

- [54] **SUIT FOR KEEPING WARMTH IN WATER** 2,579,383 12/1951 Goodsmi..... 219/211
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[51] Int. Cl. **H05b 3/04**

[58] Field of Search 219/211, 527-529;
 128/379, 402; 2/211 R, 211 A

[56] **References Cited**

UNITED STATES PATENTS

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[57] **ABSTRACT**

A suit for keeping warm in water, comprising basic warming materials, consisting of a chest and abdomen contact part and a back contact part, in which one or more of plate-like heating units are enveloped, back and face, and perfectly sealed within water-proof sheets, having electrical insulation. The contact parts are secured together by connecting pieces, both ends of which are sewn in or bonded with the edges on both ends of the basic materials. Water-proof electric wires connect the enveloped plate-like heating units with each other, and a lead wire connects the water-proof electric wire with an electric source for generating heat to keep warm.

10 Claims, 5 Drawing Figures

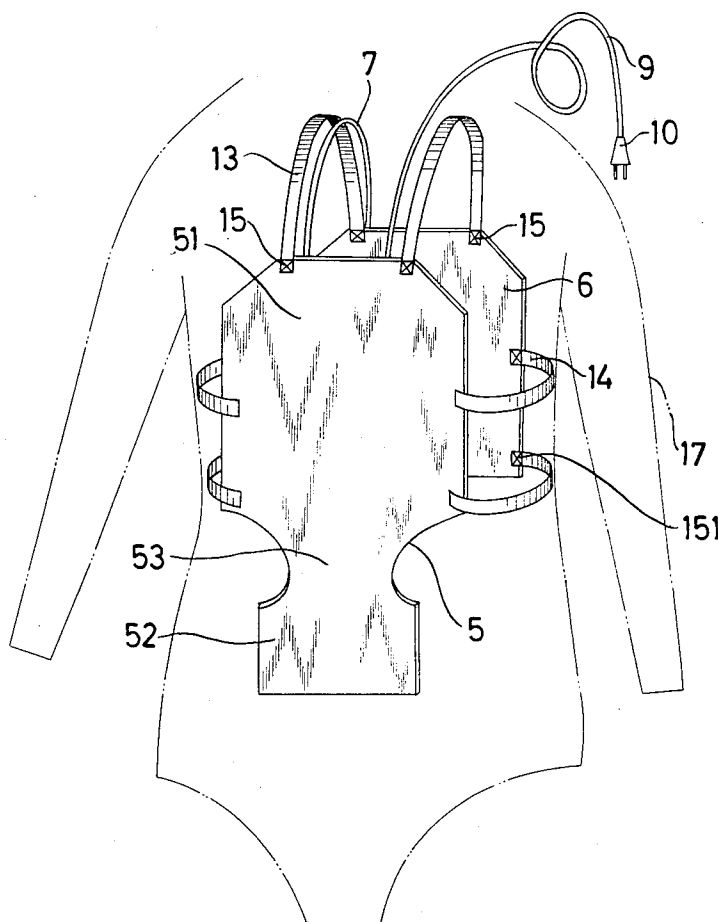


FIG. 1

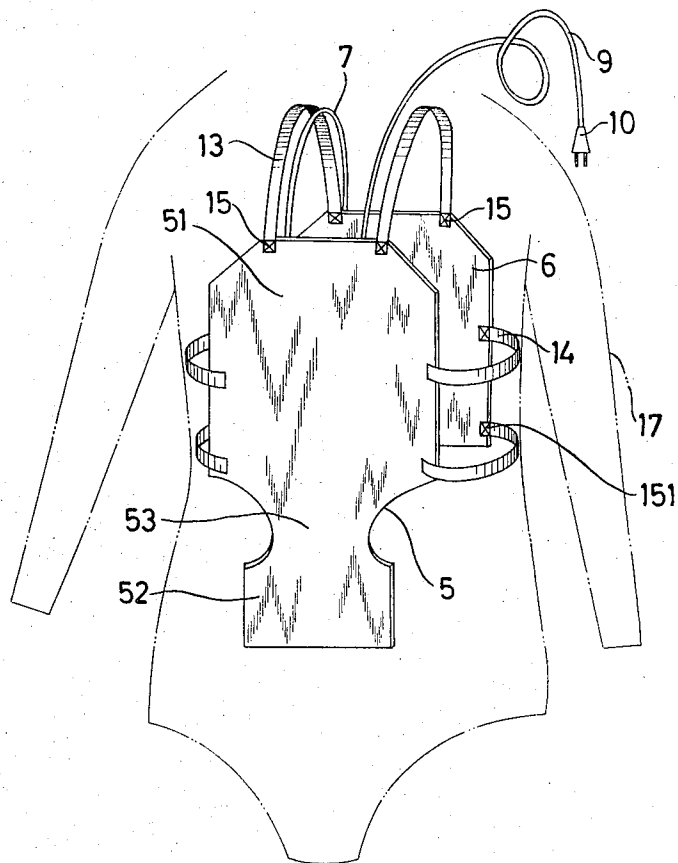


FIG. 2

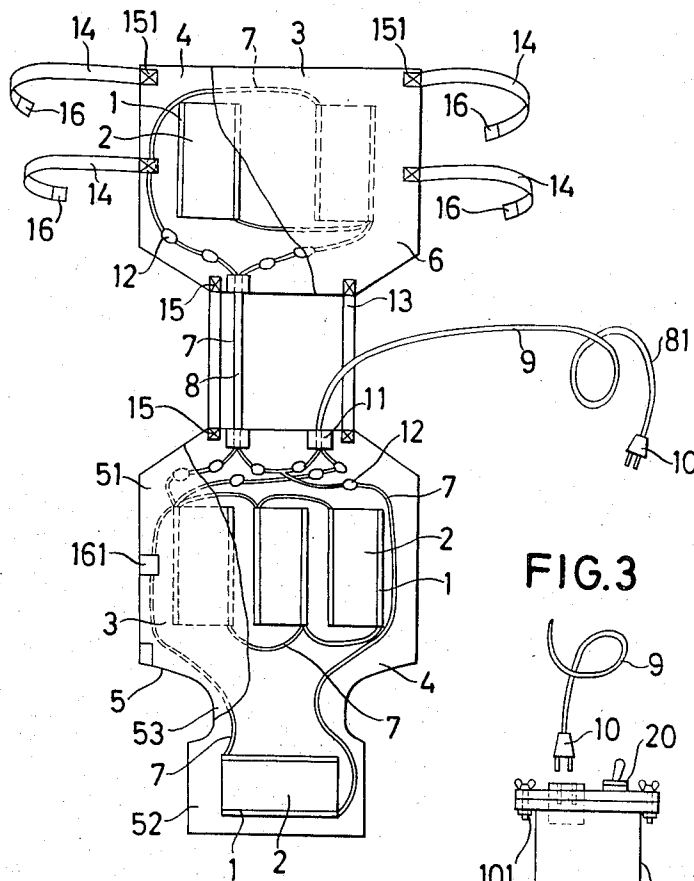


FIG. 3

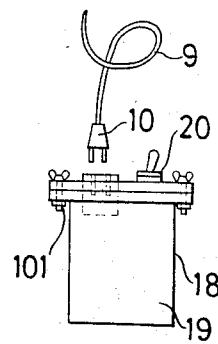


FIG. 4

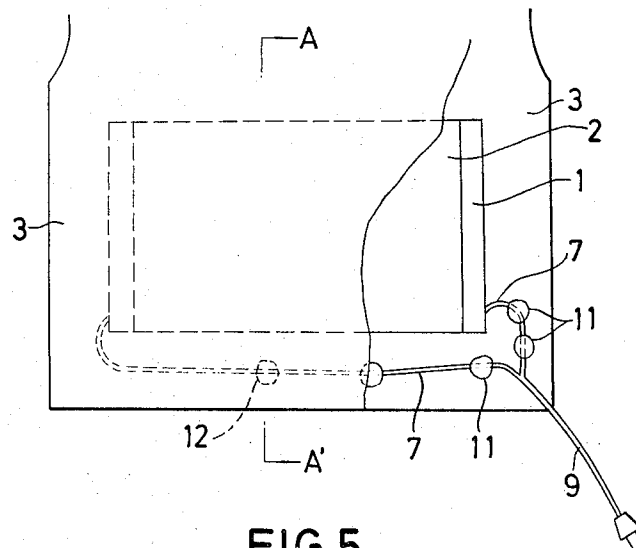
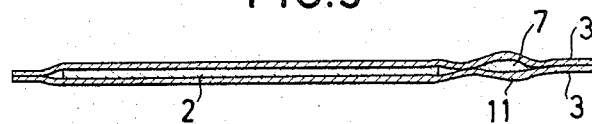


FIG. 5



SUIT FOR KEEPING WARMTH IN WATER

BACKGROUND OF THE INVENTION

The present invention relates to a means for keeping a person warm in water, comprising basic warming materials, in which a plate-like heating unit is enveloped on its back and face in a perfectly sealed condition within insulating water—proof sheets, and connecting pieces for the basic material; and particularly, a suit for keeping a person warm in water, which contacts respectively, the chest and abdomen and the back of the upper half of a human body with the basic warming material and its connecting piece, and the suit can be put on inside a wet suit to be worn at the time of underwater swimming.

Underwater swimming has been used for a long time for underwater operations, such as harbour public works, rescues of persons in a disaster by water, or the like. In recent years, in addition to the underwater operations such as the underwater works and the rescues of persons in a disaster by water, sports in water areas, along the sea shore, lakes, rivers, etc., have been becoming popular. A wet suit of rubber film is always used in order to prevent a human body during the underwater swimming from getting cold or being damaged in contact to such as rocks. However, even if the wet suit is put on, the human body becomes extremely cold and threatened with an outbreak of cramps of muscles or functional disorders of internal organs, when the underwater swimming is continued for a long period of time at the low temperatures of the winter season. Accordingly, the underwater swimming in the winter season is quite troublesome in a long-continued underwater work and also unsuitable from a sporting point of view, because the above-mentioned disorders are apt to take place very often.

Of course, in order to eliminate the above-mentioned disorders, there has been hitherto used in practice a variety of warming means, used together with a wet suit. But when a plate-like heating unit is used as the heating element of an electric heater for keeping warmth, it is usual that the inlet of a lead wire is arranged in an exposed condition on the outer end portion is apt to be soaked with water at the arranged place in danger of an electric leakage. There is a well-known technique used in order to avoid the above danger, a holding press metal, having wedge-like blades so constructed on both sides as to be gradually thinner towards both ends, is used as an inlet of a lead wire. However, the part to be fitted with the inlet is arranged like a conventional one in an exposed condition on the outer end portion and particularly, is liable to receive the action of bending and deflection and the pressure of such as shocks. Therefore, the holding press metal is jacketed with the protecting tube of the lead wire. But, the jacketed part becomes bulky and takes such a make as apt to receive shocks, so that undesirable results may be produced.

It is the object of the present invention to eliminate the above-mentioned defects and to provide a suit for keeping a person warm in water, which allows a safe and comfortable movement.

It is another object of the present invention to provide a suit for keeping warm in water, composed separately from a wet suit to be put on in the interior of the same, so that it is not influenced at all by the swimming movement of a human body, however the wet suit is expanded and contracted, unlike a conventional warming

means, which is built in a wet suit, made of elastic rubber film and liable to be damaged by the flexible action of the wet suit and also, gets out of order by an electric leakage due to permeation of water into the heating element.

It is further another object of the present invention to provide a suit for keeping warm in water, which is so put on as to be in contact with the upper half part of a human body, particularly, the chest and abdomen and the back; in case of diving with a wet suit, put on over the suit, water being permeated through the gap into the inside of the wet suit to compose a thin layer of water between the warming suit and the human body, the suit for keeping warm in water being charged with electricity to heat the whole face of the plate-like heating units, so that the thin layer of water, surrounding the human body, is heated to form a thin layer of warm water; thus, the whole part of the human body is kept warm; without being troubled by the above-mentioned disorders, caused by staying in water for by the long time or a cold water temperatures of the winter season, the underwater swimming being able to be enjoyed as a sport even in the winter season, while a high degree of safety is guaranteed to persons, working at underwater work and rescue work for a long period of time.

The suit for keeping warm in water according to the present invention may be connected to a base such as a depot-ship, a land-station or a marine-station by means of a cable along a life line and an air-hose instead of being provided with a battery.

The suit for keeping warm in water, according to the present invention, is constructed with a basic material, in which a plate-like heating unit is especially enveloped and sealed with insulating water-proof sheets, so that even if the inlet of a lead wire is soaked with water by any chance during underwater swimming, water cannot permeate into the interior of the basic material, composing the suit for keeping warm. It is insulated in a good condition, so that electric leakage never takes place.

SUMMARY OF THE INVENTION

The suit for keeping warm in water according to the present invention comprises that one or more of flexible plate-like heating units, both ends of which are electrodes, a connecting electric wire, arranged between said plate-like heating units, and a water-proof sealer, penetrated by said connecting electric wire, are enveloped on the back and face by an electric insulating water-proof sheet to compose a perfectly sealed basic material; the suit consisting of a chest and abdomen contact panel and a back contact panel, which are composed of said basic materials, connected by flexible connecting bands and shoulder bands.

The insulating water-proof sheet in accordance with the present invention is made by the use of suitable materials, such as rubber cloth, rubber sheets, plastic leather, plastic sheets, etc.

It is preferable that the plate-like heating unit is made of flexible cloth, for example, strong heat-resisting cloth, applied with conductive paint, or blended cloth of heat-resisting non-conductive fibre, such as glass fibre, with a heating wire, such as a nichrome wire. Both ends of the plate-like heating unit are sewn with metallic fine wires or metallic foil to form an electrode. The basic material comprises that by the use of the above-mentioned insulating water-proof sheet, the plate-like

heating unit and the connecting electric wire are enveloped from back and face and sealed in a perfect closely contacted condition with a heat-resisting adhesive agent or by such a method as a high-frequency deposition. According to the present invention, one or more sheets of the basic material may be connected permanently or detachably by a connecting band. For said connecting band, there is used a cord or a narrow band, consisting of such suitable flexible raw materials, as rubber woven cloth, rubber yarn or ordinary woven cloth and yarn, knitted cloth, plastic leather, plastic sheets, rubber cloth or rubber sheets. From the above-mentioned basic material, composed of an insulating water-proof sheet, said water-proof sheet may be partly extended to be a connecting band, which is made in such a shape as to bridge more than two basic materials, so that said basic materials are permanently connected. But, when the basic materials are connected by other connecting bands, they are detachably connected by such a method as sewing, tacking, adhesion, welding, etc. or by the use of fastenings, such as hooks, buttons, magic fasteners or the like.

The electric wire to be connected with a heating element, composing the plate-like heating unit according to the present invention, is arranged to pass through the water-proof sealer in the inner part, held between the insulating water-proof sheets.

When the suit for keeping warmth in water according to the present invention is in use, the basic materials, corresponding respectively to the chest and abdomen contact panel and the back contact panel, are attached to the necessary parts of the human body to be warmed. The basic materials are contacted to the body by the connecting band, attached to each contact panel, so as not to be removed from the necessary parts during the swimming or working movement. Then, a wet suit is put over the suit for keeping warmth in water. Thus, before diving, the plate-like heating unit is heated by a charge of electricity from an electric source.

According to the present invention, the plate-like heating unit is used in the suit for keeping warm in water, so that the suit can be made extremely thin. When a wet suit is put on over it after it has been put on, any oppressive sensation or sense of uncomfortableness is not felt on the body. Accordingly, the basic material is always in close contact with the necessary parts of the human body even in case of a free swimming movement. And besides, after the wet suit is put on, the figure is not spoiled in appearance.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawing shows an embodiment of a suit for keeping warm in water according to the present invention, in which FIG. 1 is a perspective view, showing the condition of the same when worn under a wet suit in case of underwater swimming; FIG. 2, a plan, partly in section of the above; FIG. 3, a side view, showing an example of an electric source, connected with a plate-like heating unit, of which the basic body is composed; FIG. 4, a plan, showing a plate-like heating unit partly in section; and FIG. 5, an enlarged view, showing the cross section along the line A-A' of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 2, a plurality of plate-like heating

units 2 are prepared with electrodes 1, which are composed of highly flexible ribbon wires, sewn with conductive metallic fine yarns and are attached on the ends of both sides. Said plate-like heating units 2 are enveloped on the back and face in one piece with insulating water-proof sheets 3 and 4 and sealed by the use of a heat-resisting adhesive agent. The thus-obtained basic materials compose a chest and abdomen contact panel and a back contact panel.

Said chest and abdomen contact panel 5 consist of a chest protector 51, an abdomen protector 52 and a binder 53, binding said chest protector 51 and said abdomen protector 52.

In the present embodiment, said binder 53 is made narrow, as compared with the chest protector 51 and the abdomen protector 52. Three sheets of the plate-like heating unit 2 are uprightly arranged in parallel in the chest protector 51, while one sheet of the plate-like heating unit 2 is flatly arranged in the abdomen protector 52. Two sheets of plate-like heating unit 2 are uprightly arranged in parallel in the back contact panel 6. The plate-like heating units 2 are respectively connected in parallel with each other by connecting electric wires 7. The connecting electric wires 7 are made slightly longer than the interval of the adjoining plate-like heating units, so that they are arranged in an arc, and similarly to the plate-like heating units 2, are enveloped on the back and face in insulating water-proof sheets 3 and 4 and sealed with a heat-resisting adhesive agent. The connecting electric wire 7, connecting the chest and abdomen contact panel 5 and the back contact panel 6, is bonded to a shoulder band through an insulating water-proof coated pipe 8 lest the movement should be disturbed. The connecting electric wire 7 is a ribbon wire, having a good property against bending. The lead wire 9 for the plate-like heating unit 2 is connected at one of the end parts with a water-proof cord connector 10, and at the other end part is led into the chest and abdomen contact panel 5 to be connected with the plate-like heating unit 2. The lead-in wire 9 is covered by an insulating water-proof coated pipe 81 at least on the part, exposed outside the chest and abdomen contact panel 5. The connecting electric wire 7 and the lead-in wire 9 are made at the respective lead-in holes so as to pass to the chest and abdomen contact panel 5 and the back contact panel 6 through a water-proof sealer 11, such as rubber, stuck to and held between the insulating water-proof sheets 3 and 4. The connecting electric wire 7 and the lead-in wire 9, led into the respective contact panels 5 and 6 for the chest and abdomen and the back, are made to pass at several points through a water-proof sealer 12, such as rubber. The chest and abdomen contact panel 5 and the back contact panel 6 are sewn together 15 by two cloth-made shoulder connecting bands 13. Both sides of the chest and abdomen contact panel 5 and the back contact panel 6 are respectively connected detachably by a connecting band 14 to be fastened to the flank. This band 14 is made with a band-shaped piece of rubber woven cloth, having a good flexibility. One end of the band 14 is sewn 151 with both sides of the back contact panel 6, while the other is attached with a magic fastener 16. The paired magic fastener 161 is attached to both sides of the chest and abdomen contact panel 5. By the engagement of the magic fasteners 16 and 161, the connecting band 14 to be fastened to the

flank can connect both sides of the contact panels 5 and 6 for the chest and abdomen and the back.

The suit for keeping warm in water is first put on and a wet suit 17 is put on over it. Then, such as a cylinder for inhalation is put on the shoulder. A 12V colloidal battery is used for an electric source 18 of the suit for keeping warm in water. The battery is built in a perfectly water-proof box 19, say, a case of aluminium ingot, soaked with synthetic resins. This case 19 can be attached to the above-mentioned cylinder or such as a weight belt. The lead wire, connected with the above-mentioned battery, is connected with a water-proof cord connector 101 through a water-proof switch 20, attached to the case 19. The water-proof cord connector 10, connected with one end of the lead-in wire 9, is paired with the cord connector 101. Both 10 and 101 are fitted to each other, whereby the electric source 18 is connected with the suit for keeping warm in water.

Electricity is consumed by the plate-like heating units 2, respectively at 12W for three sheets, arranged in parallel in the chest protector 51, at 4W for one sheet, arranged in the abdomen protector 52 and at 8W for two sheets, arranged in parallel in the back contact panel 6. The total amount of the consumed electricity becomes 24W. As the result, the superficial temperature reaches 45° C in air. Water, heated by the suit for keeping warmth in water, shows about 25° C in water at the water temperature of 4° C. This is the best temperature, suitable for a human body. The cold human body can be suitably warmed up when electricity is intermittently charged by a switch even in air. The binder 53 of the chest protector 51 and the abdomen protector 52, composing the chest and abdomen contact panel 5, is made narrower than both of the above-mentioned protectors 51 and 52, and the plate-like heating units 2 are not built in, so that the abdomen of a human body is not oppressed and can be easily bent.

The respective contact panels 5 and 6 for the chest and abdomen and the back are connected by the flexible connecting bands 14 at both sides of the flank of a human body to be closely contacted with the human body and do not separate from the body by the flexible action of the connecting bands 14 even when a swimming movement is carried out. There is no fear of damage because both contact panels 5 and 6 themselves are not elongated. The connecting electric wires 7, held between and inserted into the respective contact panels 5 and 6 for the chest and abdomen and the back, are made of ribbon wires, so that they do not break when bent.

The connecting electric wire 7 and the lead-in wire 9 are arranged to pass through the water-proof sealer 11 and the water-proof sealer 12, applied in two or three layers, at the lead-in entrance and the interior of the respective contact panels 5 and 6 for the chest and abdomen and the back. Therefore, water cannot pass along these electric wires to penetrate into the enveloped plate-like heating units 2.

For the electric source 18, a battery is built in the water-proof case 19 and the current is led through the water-proof cord connectors 10 and 101 into the suit for keeping warm in water. Therefore, underwater swimming can be performed freely with the case 19 being attached to the cylinder for inhalation, carried on the back, or to the weight belt. There is no fear of an electric leakage because a good property of water-proofness and insulation is given to all of the above-

mentioned water-proof cord connectors 10 and 101, the battery case 19, a water-proof switch 20, equipped in said case 19 for the electric source, the lead-in wire 9, the connecting electric wire 7 and the respective contact panels 5 and 6 for the chest and abdomen and the back. Rubber cloth, having layers of rubber and cloth, is used for the water-proof sheets 3 and 4 to envelop and seal the plate-like heating unit 2. The enveloped plate-like heating unit 2 is not flexible and removable. Therefore, there is no danger of damage.

The electric wire 7, connected with the plate-like heating unit 2, is arranged an arc. Therefore, there is no fear of a break in the wire even when the water-proof sheets 3 and 4 are extended.

A colloidal battery is used for the electric source 18. Therefore, there is no liquid leakage of the battery and no danger of generating hydrogen gas.

What is claimed is:

1. A suit to be worn for keeping warm in water comprising a chest and abdomen part and a back contact part separate from said chest and abdomen part, connecting bands connected permanently to said chest and abdomen part and said back contact part for securing said parts together and for securing them in place on the body of a wearer of the suit, at least one flexible plate-like heating unit located in each of said parts, a lead wire arranged for electrically connecting said heating units to one another, insulating waterproof sheets sealed together and completely enveloping said heating units, said heating units each comprising a heating element formed of a tough heatproof flexible cloth coated with an electroconductive paint, a pair of flexible electrodes each attached to said flexible cloth at spaced positions from one another, and metallic yarn for fixing electrodes to said flexible cloth.

2. A suit to be worn for keeping warm in water comprising a chest and abdomen part and a back contact part separate from said chest and abdomen part, connecting bands connected detachably to said chest and abdomen contact part and said back contact part for securing said parts together and for securing them in place on the body of a wearer of the suit, at least one flexible plate-like heating unit located in each of said parts, a lead wire arranged for electrically connecting said heating units to one another, insulating waterproof sheets sealed together and completely enveloping said heating units, heating units each comprising a heating element formed of a tough heatproof flexible cloth coated with an electroconductive paint, a pair of flexible electrodes each attached to said flexible cloth at spaced positions from one another, and metallic yarn for fixing said electrodes to said flexible cloth.

3. A suit to be worn for keeping warm in water, as set forth in claim 1, wherein said lead wires are located and sealed between said insulating waterproof sheets, said lead wires extending inwardly between the sheets from the edges thereof and waterproof sealers located between said sheets interiorly of the edges for preventing the passage of water along said lead lines inwardly from the edges of said sheets.

4. A suit to be worn for keeping warm in water, as set forth in claim 2, wherein said lead wires are located and sealed between said insulating waterproof sheets, said lead wires extending inwardly between said sheets from the edges thereof and waterproof sealers located between said sheets interiorly of the edges for preventing

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the passage of water along said lead lines inwardly from the edges of said sheets.

5. A suit to be worn for keeping warm in water, as set forth in claim 1, wherein said lead wires extending inwardly from the edges of said insulating waterproof sheets have an arc-like configuration in the plane of said heating units.

6. A suit to be worn for keeping warm in water, as set forth in claim 2, wherein said lead wires extending inwardly from the edges of said insulating waterproof sheets have an arc-like configuration in the plane of said heating units.

7. A suit to be worn for keeping warm in water, as set forth in claim 1, including a power source separate from said parts, and a second lead wire connectable to said power source and electrically connected to said lead wires within said parts.

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8. A suit to be worn for keeping warm in water, as set forth in claim 2, including a power source separate from said parts, a second lead wire connectable to said power source and electrically connected to said lead wires within said parts.

9. A suit to be worn for keeping warm in water, as set forth in claim 1, wherein a plurality of said heating units are located within each of said parts, and said lead wires electrically connect said heating units together in parallel.

10. A suit to be worn for keeping warm in water, as set forth in claim 2, wherein a plurality of said heating units are located within each of said parts, and said lead wires electrically connect said heating units together in parallel.

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