July 9, 1957 L. SUKACEV 2,798,494

DEVICES FOR TRANSFERRING THERMO-ELECTRIC POWER EFFECTS TO THE SKIN OF A HUMAN

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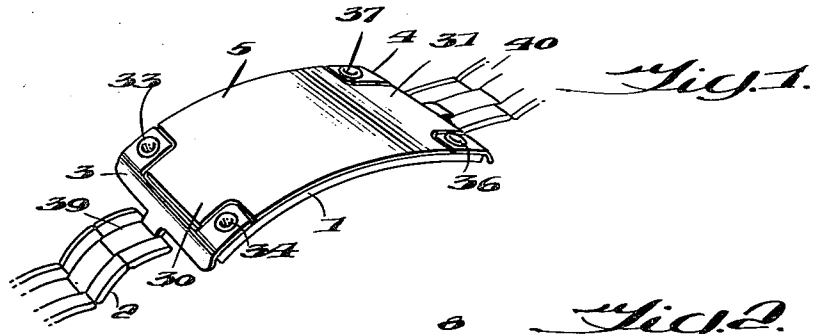


Fig. 1.

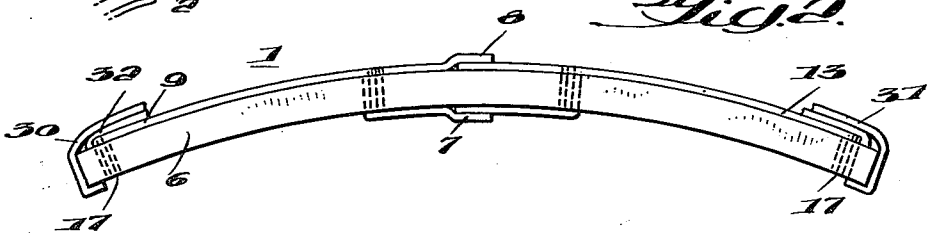


Fig. 2.

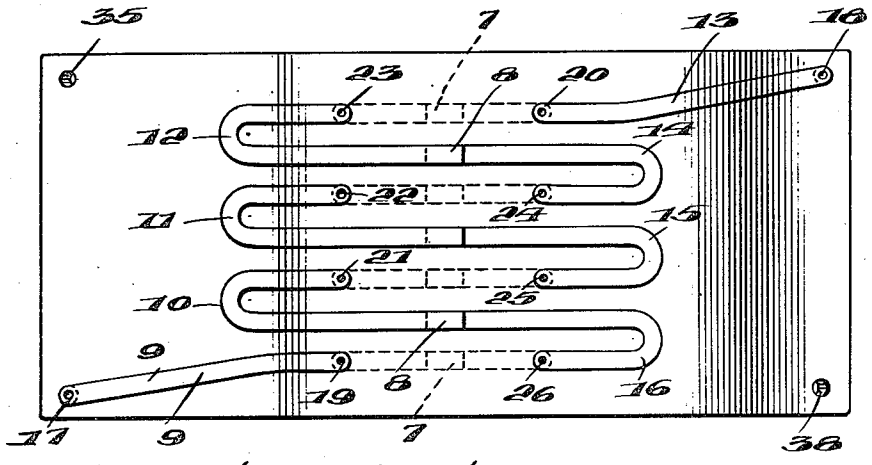


Fig. 3.

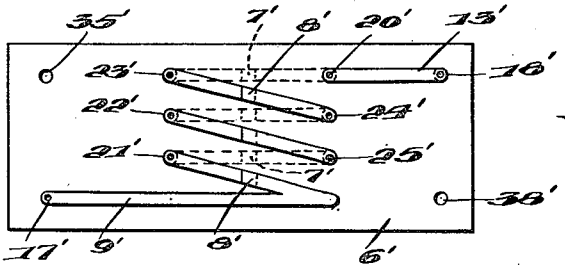


Fig. 4.

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DEVICES FOR TRANSFERRING THERMOELECTRIC POWER EFFECTS TO THE SKIN OF A HUMAN

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1 Claim. (Cl. 128—379)

The present invention relates to improvements in devices of the type employed in transferring thermo-electric power effects to the skin of a human.

The apparatus of the present invention comprises an improved arrangement of thermocouples for application to the body of a patient. The thermocouples are preferably affixed to an insulating support comprising, for instance, a plate preferably of thermoplastic material that can be shaped to fit snugly against a surface, or member of a body to which the device is applied so that the hot junctions of an associated thermopile are efficiently heated. In certain arrangements, a thermopile is combined with an insulating plate in such manner that it is reversible and that either side may be placed against a skin surface, thereby heating junctions for generation of an electric current. The plate and combined thermopile may serve as a unitary insert that is replaceable. A cover for ornamental or other purpose may be provided which does not interfere with the thermo-electric effects produced.

Further features and details of the invention will be apparent from the following description, when read in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view of a fragment showing the application of a thermopile insert in a bracelet;

Fig. 2 is an enlargement of an elevational view looking towards one edge of the thermopile insert with added parts of Fig. 1 for purposes of illustration;

Fig. 3 is a plan view of only the upper side of the insert shown in Fig. 2; and

Fig. 4 is a plan view of one side of a modified insert.

In Fig. 1, a thermopile unit or insert 1 is shown, by way of example, combined in a bracelet comprising an extensible metal band 2, connectors 3 and 4 to which the opposite ends of the band are respectively attached, removably, if desired, when placed on the wrist, and a cover 5 affixed to one side of the insert 1 in a congruent manner.

A thermopile unit or insert 1 for use in an instrument in the present invention comprises, as shown in detail in Figs. 2 and 3, an insulating base 6 and a continuous strip of metals for forming a plurality of thermocouples 7 and 8 in a thermopile. The strip consists of alternate lengths of different metals or metal-containing substances that form thermocouples when associated in a manner well understood in thermoelectricity. Every other section in the strip may be copper, for instance, and the intermediate sections may be nickel. Copper and zinc, iron and constantan, or antimony and bismuth, are further examples of metallic substances that may be so combined.

The strip with its sections electrically connected end to end, and the ends of the sections overlapping at 7 and 8, is so arranged and supported on the surface of the base 6 that the overlaps 7 are on one side and the overlaps 8 are on the other side of the base. Several of each of these overlaps are shown in alignment across the opposite sides of the base 6. The sections 9, 10, 11, and 12 of the strip placed toward one end of the base may be of one metal, copper for instance, and the

sections 13, 14, 15 and 16 of the strip placed toward the other end of the base may be of another metal, nickel for instance. End sections 9 and 13, on the upper face of the base 6, extend from a terminal 17 and 18, respectively, near opposite ends of the base, to and through an opening 19 and 20, respectively, to the lower face of the base and then to an overlap 7 where they connect with the end of a next adjoining section, 16 and 12 respectively. The sections 10, 11 and 12 extend from an overlap 8 on the upper surface of the base 6, to and through an opening 21, 22, and 23, respectively, and then to an overlap 7 on the lower side of the base where they connect with the end of the next adjoining section 15, 14, and 13, respectively. The sections 14, 15, and 16 extend from an overlap 8 on the upper side of the base to and through openings 24, 25 and 26, respectively, and then to an overlap 7 on the lower side of the base where, as indicated above, they connect with sections 11, 10, and 9, respectively.

In Fig. 3, the openings 19, 21, 22, 23 are shown in alignment to one side of the line of overlaps 7 and 8, and the openings 20, 24, 25 and 26 are shown in alignment to the other side of the line of these overlaps. The arrangement, as shown, makes it convenient to apply the metal sections to the base by electrolytic processes, wherein one end of the base 6 with properly distributed shielding means, may be inserted in a suitable bath to provide plating of the metal in sections 9, 10, 11 and 12 of the strip, and then the other end of the base with the shielding means may be inserted in a bath to provide plating of the other metal in sections 13, 14, 15, and 16 of the strip and to form the overlaps 7 and 8 serving as the couples.

The strip may assume any desired conformation to provide decorative effects and to provide extra length on the upper side of the unit to permit cooling before the heat conducted from the lower side reaches the cold junctions, or overlaps 8. The strip is preferably placed so that it, including the terminals 17 and 18, is within an area spaced from the edges of the base 6, thereby obtaining the benefit of the insulating effect of the base and preventing contact of the strip with metallic means that may be attached at the edges. For instance, the cover 5 may be placed over the top surface of the thermopile unit 1 and its reduced ends 30 and 31 may be bent over the end edges of the base 6, as partly shown diagrammatically by way of illustration in Fig. 2, and clamped in place. If the cover is metal, insulation 32, illustrated in part, is provided between it and the thermopile strip. The connectors 3 and 4, preferably of metal, may be attached to the ends of the unit, as shown, by screws, while avoiding contact with the cover 5. Screws 33 and 34 attach the connector 3 to the base 6 respectively at the opening 35, and at the terminal 17 where electrical connection is made to one end of the thermopile strip. Screws 36 and 37 attach the connector 4 to the base respectively at the opening 38, and at the terminal 18 where electrical connection is made with the other end of the strip. The ends 39 and 40 of the band 2, attached to the connectors 3 and 4 and intermediately insulated from each other, serve as leads for conducting generated current through a person's wrist.

In Fig. 4, the perforations 21', 22', 23', and 20', 24', 25' in an insulating base 6' corresponding to perforations in the insulating base 6 shown in Fig. 3, assume substantially the same position relative to the overlaps 7' and 8' that similar perforations do with respect to overlaps 7 and 8, but the sections in the strip in the unit shown in Fig. 4 pass more directly from the perforations to the overlaps 8. In this form the lines of perforations may be sufficiently spaced from the line of overlaps to permit any desired heat radiation.

The modification shown in Fig. 4 is particularly useful when the thermopile unit is to be not only replaceable but reversible, that is, either side may be conveniently applied to a heat-radiating surface. In this case either section 9' connected to terminal 17', or section 13' connected to terminal 18' may be insulated. Perforations 35' and 38' with the terminals 17' and 18' at adjacent ends of the base 6' serve for attachment of connectors, such as 3 and 4, for the ends of a band such as 2.

The base 6, shown curved, and base 6' shown flat, may be a flexible or rigid sheet or plate of any suitable dimensions and of any suitable heat and electricity insulating, or dielectric material. If desired, it may be shaped or bent to conform with the contour of the surface to which the device is applied. Plastic compositions, preferably thermoplastic, such as Lucite or Vinylite, or thermosetting plastic or resin materials properly hardened may be used in the base. The sections in the thermopile strip may be attached to the base by other methods than by electrolysis, as by adhesion or by molding a preformed strip in place. The insert device described, lends itself especially to convenient attachment even by metallic means to decorative metallic coverings or articles of wear, with no danger of electrical contact with such coverings.

The present invention includes features by way of improvements in devices described in copending applications Serial No. 367,188, filed July 10, 1953, Serial No. 396,293 filed December 4, 1953, and Serial No. 435,391, filed June 9, 1954.

While there are hereinabove disclosed but limited illustrations of embodiments of features of the present invention, it is possible to provide still other embodiments without departing from the inventive concept herein disclosed, and it is desired therefore that only such limitations be imposed on the appended claim as are stated therein.

What is claimed is:

In a device for transferring to the skin thermoelectric power effects resulting from the heat of the human body, a plate consisting of thermoplastic, heat-insulating material, either surface of which plate can be selectively shaped to conform with the contour of an external integument of the body, a thin metallic strip affixed flatly against the plate and shapable to conform with the contour of the plate surface, the said strip passing repeatedly through the plate from one side to the other and consisting of a plurality of alternate lengths of dissimilar metals joined end to end by an overlap and forming a junction at each overlap, and each said length lying partly on one side of the plate and partly on the other, and the overlaps along said strip being alternately on one side and on the other side of said plate and spaced from each other, providing a plurality of junctions spaced apart on each side of said plate, a terminal in the plate at each end of the said strip, and a connecting conductor element attached to each said terminal.

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