

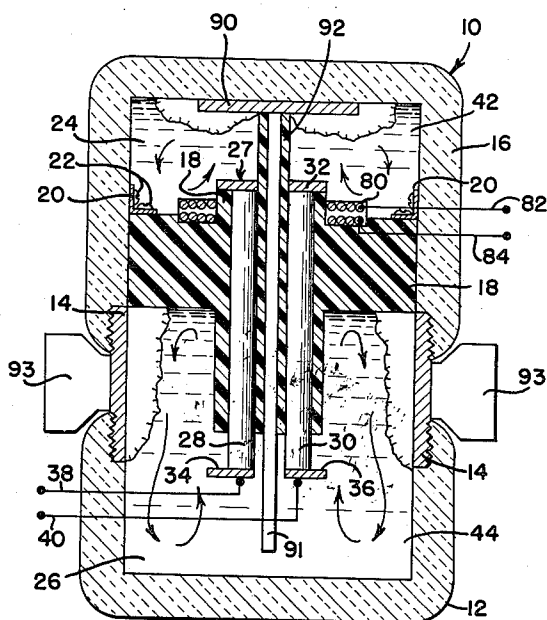
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CONSTANT ENERGY SOURCE

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CONSTANT ENERGY SOURCE

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Original application Oct. 30, 1957, Ser. No. 693,308, now Patent No. 2,952,724, dated Sept. 13, 1960. Divided and this application June 27, 1960, Ser. No. 39,065
4 Claims. (Cl. 136—4)

This invention relates to constant energy sources, and more particularly to sources in which a constant electrical potential is available from a thermoelectric generator, and this application is a division of my application Serial No. 693,308, filed October 30, 1957, now Patent No. 2,952,724.

In order for a thermoelectric generator to provide a source of constant electrical energy, it is necessary that a fixed temperature differential be maintained between the hot and cold thermojunctions thereof. This, of course, can be accomplished by maintaining the hot and cold thermojunctions at predetermined fixed temperatures, but heretofore no satisfactory means has been available for maintaining such fixed temperatures. Common temperature controlling means operate on the principle of correcting for any departure from the predetermined temperature and for this reason cannot maintain a constant temperature. In certain applications the maintenance of a predetermined temperature level depends upon continuous energization of the temperature controlling means at a constant value, and any variation in the energizing current, however small, results in departure of the temperature from the desired level.

With the above in mind, it is a general object of the present invention to provide apparatus affording a constant energy source and having embodied therein a thermoelectric generator and electroresponsive means for maintaining the thermojunctions of said generator at a constant temperature differential despite slight variations in the energizing current supplied to said electroresponsive means.

Another object of the invention is to provide apparatus of the aforementioned character wherein the means for maintaining the thermojunctions of the generator at a constant temperature differential comprises two constant temperature baths or media with which said thermojunctions are thermally associated and which undergo a change of physical state at predetermined temperatures at which it is desired to maintain the associated generator thermojunctions, said means also including heat transfer means operable when energized to maintain a portion of each of said media in one physical state, for example solid, and the remainder in the other physical state, for example liquid, such that said media and hence said thermojunctions are maintained constant at the transformation temperature of said media.

Still another object of the invention is to provide apparatus of the class described wherein both media are of such a character that the transformation temperatures thereof are above ambient but are substantially disparate, there being a single heat supplying means operatively associated with both of said media to effect liquefaction of a portion of each of said media.

Another object of the invention is to provide apparatus as aforesaid wherein the heat transfer means includes a thermoelectric heat pump having semi-metallic thermoelements.

Other objects and advantages of the invention will become apparent as the description proceeds, reference being had to the accompanying drawing illustrating the invention and wherein:

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The FIGURE is a vertical sectional view of one form of apparatus constructed in accordance with the principles of the present invention.

The embodiment of the invention shown in the drawing comprises a container 10 having a cup-shaped lower member 12 formed of material of low thermal conductivity, such as rubber or synthetic resins, and a sleeve member 14 formed of material of relatively high thermal conductivity, for example metal, sealingly threaded into said base member and provided with cooling fins 93. An inverted cup-shaped container portion 16 is sealingly threaded onto sleeve member 14, and a partition wall 18 formed of material of low electrical and thermal conductivity divides the interior of container 10 into chambers 24 and 26, there being means such as brackets 20 and screws 22 which retain said partition wall in the operative position shown.

Embedded within partition wall 18 is a thermoelectric generator 27 comprising P and N type thermoelements 28 and 30 respectively, thermojunction member 32, and thermojunction and terminal members 34 and 36. Thermoelements 28 and 30 may, for example be made of the semi-metallic compositions disclosed in U.S. Patent No. 2,811,570 or Patent No. 2,811,571. Lead wires 38 and 40 are connected to the members 34 and 36 respectively, and a heating coil 80 surrounds an extended portion 18a of the partition 18 adjacent the thermojunction member 32 and is connected to a source of alternating current (not shown) by means of lead wires 82 and 84.

Disposed in the upper end of the chamber 24 is a heat conducting plate 90 of material, such as metal, having good thermal conductivity. The plate 90 is supported by a heat conducting rod 91 integral therewith and extending downwardly therefrom through the thermojunction member 32 and partition 18, terminating in the lower portion of the chamber 26. The rod 91 is also of material of good thermal conductivity. The partition 18 has a tubular extension 92 extending through a suitable opening in thermojunction member 32 and surrounding and insulating the portion of the rod 91 within the chamber 24.

Within chamber 24 is a fill 42 in intimate contact with heating coil 80, thermojunction member 32 of generator 27, and heat conducting plate 90. Within chamber 26 is a fill 44 in intimate contact with thermojunction and terminal members 34 and 36 and with the lower end portion of the heat conducting rod 91. Fill 42 is transformable from one to another physical phase or state, for example from solid to liquid, at a temperature somewhat above the temperature of the ambient atmosphere. A relatively high melting point paraffin is an example of one material which meets the above requirement. The fill 44 is also transformable from one to another physical phase or state, for example from solid to liquid, at a temperature somewhat above ambient temperature, which transformation temperature is preferably substantially below the transformation temperature of the fill 42. A relatively low melting point paraffin is an example of a material which is satisfactory for use as the fill 42.

The embodiment of the invention shown in the drawing operates as follows:

Energization of the heater coil 80 supplies heat to the fill 42 raising the temperature thereof above ambient. A portion of the heat supplied to the fill 42 flows by conduction through plate 90 and rod 91 to the fill 44, and a minor portion of said heat may flow to the fill 44 by conduction through the thermoelements 28 and 30. A certain amount of heat may also be lost from the fill 42 by conduction through the container member 12.

The heater coil 80 and the energizing current supplied thereto through the conductors 82 and 84 are of such a character that continuous current flow through said coil

maintains a portion of the fill 42 transformed to the liquid phase, while the remainder thereof stays in the solid phase in which it normally occurs at ambient temperature. A state of equilibrium is eventually reached wherein the amount of heat delivered to fill 42 by continuous current flow through heating coil 80, is equal to the amount of heat lost from fill 42 to the fill 44 and to the ambient atmosphere. This thermal equilibrium preferably occurs in fill 42 when approximately one-half of said fill is in the liquid phase or state and the remainder is in the solid state or phase.

Since heat conducting plate 90 and rod 91 afford the principal means for transferring heat from fill 42 to fill 44, and sleeve 14 with its fins 93 affords means for conducting heat from fill 44 to the surrounding environment, proper selection of the material used as fill or medium 44 results in the utilization of the heat flow from fill 42 into fill 44 to maintain fill 44 at its transformation temperature. By proper selection of the structural elements and of fill 44 the heat flow to the fill 44 from fill 42 can be made substantially equal to that lost from fill 44 to the atmosphere, and a state of thermal equilibrium is reached wherein approximately one-half of said fill is transformed to the liquid phase or state while the remainder thereof stays in the solid state in which it normally occurs at ambient temperature.

Thus, by continuous current flow through heating coil 80, the heat content of each of fills 42 and 44 is so stabilized that each of said fills is approximately fifty percent in each of two physical states or phases. Under these conditions, if the energizing current supplied to the heating coil 80 should vary so as to vary the quantity of heat per unit time delivered from said coil to fill 42, or the environmental temperature should change to vary the quantity of heat transferred to the environment, the ratio of the two physical states or phases of each of the fills 42 and 44 varies accordingly until a new state of equilibrium is reached. Because advantage is taken of the latent heat of transformation of the fills 42 and 44, such variation in the energization of coil 80 and/or in environmental temperature does not in any way vary the temperatures of said fills which remain constant at their respective transformation temperatures.

By virtue of the intimate contact between thermojunction member 32 and fill 42 thermojunctions thereat are also maintained at the transformation temperature of said fill. In like manner, the intimate contact of the thermojunction and terminal members 34 and 36 with fill 44 insures that the thermojunctions thereat are maintained at the transformation temperature of fill 44. Thus, the thermojunctions at the opposite ends of the thermoelements 28 and 30 are maintained constant at predetermined specific and substantially different temperatures, and this, of course, causes generator 27 to provide a constant electrical output potential at the conductors 38 and 40 in the manner of a standard cell.

Although a specific embodiment of the invention has been shown and described, it is with full awareness that many changes and modifications therein are possible without departing from the spirit of the invention. All of such changes are contemplated as may come within the scope of the appended claims.

What is claimed as the invention is:

1. Constant output energy source means comprising, a thermoelectric generator having at least two thermojunctions, a bath comprising a first medium transformable from a solid state to a liquid state at a first predetermined temperature above a predetermined range of ambient room temperatures external to said bath, said medium being in thermal contact with one of said thermojunctions, a bath comprising a second medium transformable from a solid state to a liquid state at a second lower predetermined temperature above said range of ambient temperatures and in thermal contact with another of said thermojunctions, electrically energizable means having a heat

emitting portion in said first bath and supplying heat to said first medium in quantity sufficient to maintain a portion only of said first medium in a liquid state, means communicating between said baths and having surface portions in thermal contact with both of said media for conducting heat from said first to said second medium to cause solid phase portions of said first medium to tend to collect on the surface portion of said conducting means in contact therewith as a result of extraction of heat from said first medium through said surface portion, and heat transfer means having a heat absorbing portion in thermal contact with said second medium for transferring heat to the ambient atmosphere from said second medium in sufficient quantity to maintain a portion only of said second medium in its solid phase and deposited on said heat absorbing portion, thereby controlling the heat content of both of said media in a manner to cause each of said media to have portions in both liquid and solid phases to maintain the temperatures of said media and hence those of the associated thermojunctions constant at the transformation temperatures of said media, the constant temperature differential between said one and another thermojunction thus produced affording said generator constant output potential.

2. Constant output energy source means comprising, a thermoelectric generator having at least two thermojunctions, a bath comprising a first medium transformable from a solid state to a liquid state at a first predetermined temperature above a predetermined range of ambient room temperatures external to said bath, said medium being thermally associated with one of said thermojunctions, a bath comprising a second medium transformable from a solid state to a liquid state at a second lower predetermined temperature above said range of ambient temperatures and thermally associated with another of said thermojunctions, electrical resistance heating means in said first bath and supplying heat to said first medium in quantity sufficient to maintain a portion only of said first medium in a liquid state, heat conducting means communicating between said baths and having surfaces in thermal contact with both of said media for conducting heat from said first to said second medium to cause solid phase portions of said first medium to tend to collect on the surface of said conducting means in contact therewith as a result of extraction of heat from said first medium through said surface, and heat transfer means in thermal contact with said second medium and having heat dissipating surfaces exposed to the ambient atmosphere for transferring heat to the ambient atmosphere from said second medium in sufficient quantity to maintain a portion only of said second medium in its solid phase and deposited on said heat transfer means, thereby controlling the heat content of both of said media in a manner to cause each of said media to have portions in both liquid and solid phases to maintain the temperatures of said media and hence those of the associated thermojunctions constant at the transformation temperatures of said media, the constant temperature differential between said one and another thermojunction thus produced affording said generator constant output potential.

3. Constant output energy source means comprising, means defining an insulating container, partition means separating the interior of said container into two chambers, a thermoelectric generator extending through said partition means and having at least one thermojunction in each of said chambers, a first medium in one of said chambers transformable from a solid state to a liquid state at a first predetermined temperature above a predetermined range of ambient room temperatures external to said bath, said medium being thermally associated with said thermojunction in said one chamber, a second medium in the other of said chambers transformable from a solid state to a liquid state at a second lower predetermined temperature above said range of ambient temperatures and thermally associated with said thermo-

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junction in said other chamber, electrically energizable heating means in said first chamber for supplying heat to said first medium in quantity sufficient to maintain a portion only thereof in a liquid state, heat conducting means extending through said partition means and having a surface in said one chamber in contact with said first medium and a surface in said other chamber in contact with second medium for conducting heat from said first to said second medium, and heat transfer means extending through said container wall and having a heat absorbing portion in said other chamber in thermal contact with said second medium for transferring heat to the ambient atmosphere from said second medium in sufficient quantity to maintain a portion only of said second medium in its solid phase, thereby controlling the heat content of both of said media in a manner to cause each of said media to have portions in both liquid and solid phases to maintain the temperatures of said media and hence those of the associated thermojunctions constant at the transformation temperatures of said media, the constant temperature differential between said one and another thermojunction thus produced affording said generator constant output potential.

4. A constant output energy source means comprising, means defining an insulating container, partition means separating the interior of said container into two chambers, a thermoelectric generator extending through said partition means and having at least one thermojunction in each of said chambers, a first medium in one of said chambers transformable from a solid state to a liquid state at a first predetermined temperature above a predetermined range of ambient room temperatures external to said bath, said medium being thermally associated with said ther-

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mojunction in said one chamber, a second medium in the other of said chambers transformable from a solid state to a liquid state at a second lower predetermined temperature above said range of ambient temperatures and thermally associated with said thermojunction in said other chamber, electrical resistance heating means in said first chamber for supplying heat to said first medium in quantity sufficient to maintain a portion only thereof in a liquid state, heat conducting means extending through said partition means and having a surface in said one chamber in contact with said first medium and a surface in said other chamber in contact with said second medium for conducting heat from said first to said second medium, and heat transfer means extending through said container wall and having a heat absorbing portion in said other chamber in thermal contact with said second medium and heat dissipating means external to said container for transferring heat to the ambient atmosphere from said second medium in sufficient quantity to maintain a portion only of said second medium in its solid phase, thereby controlling the heat content of both of said media in a manner to cause each of said media to have portions in both liquid and solid phases to maintain the temperatures of said media and hence those of the associated thermojunctions constant at the transformation temperatures of said media, the constant temperature differential between said one and another thermojunction thus produced affording said generator constant output potential.

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