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THERMAL POTENTIAL PRODUCING CELL

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FIG.1.

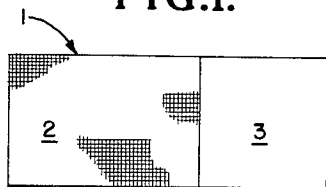


FIG.2.

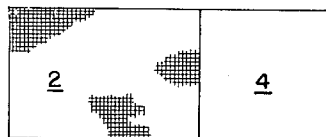
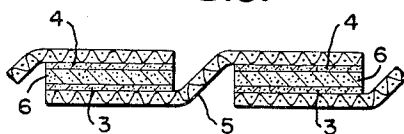


FIG.3.



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THERMAL POTENTIAL PRODUCING CELL

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3 Claims. (Cl. 136—90)

This invention relates to thermal cell systems and methods of making the same and has particular reference to certain new and useful improvements in the anode and cathode employed therewith.

The thermal cells to which the invention relates are electrochemical power supplies based upon electrolytes of various inorganic salts which remain solid and non-conducting at all storage temperatures. When the cell is heated to an elevated temperature, the electrolyte fuses and becomes conducting and electrical energy may then be withdrawn from the system. The invention contemplates a new and improved anode and cathode which are pressed firmly against the electrolyte on opposite sides thereof respectively and which remain in contact therewith at all times under the conditions of use.

Heretofore it has been the practice to provide a cathode essentially comprising a coating formed by solidifying a fusion of B_2O_3 and V_2O_5 on a cathode metal, said B_2O_3 comprising at least about 5 percent by weight of the combined weight of the coating of B_2O_3 and V_2O_5 ; and an anode essentially comprising pressed powdered metal selected from the group consisting of magnesium and calcium. The cathode metal may be one selected from the group consisting of Ni, Ag, Cu and stainless steel. The best results heretofore have been obtained where the percentage of B_2O_3 and the fuse coating on the cathode contains from about 16 to about 20 percent by weight of the combined weight of the B_2O_3 and V_2O_5 components of such coating, and where the cathode consists of a thin perforated strip of stainless steel having a very thin coating on the surface thereof exposed to and in contact with the electrolyte. Coatings of the order of 0.002" to 0.006" have been found to be very useful.

One of the objects of the present invention is the provision of a new and improved cathode for a thermal cell.

Another of the objects is the provision of a new and improved anode for a thermal cell.

Still another of the objects is the provision of an anode-cathode element for a multi-unit thermal cell which is simple in construction, reliable in operation, and which possesses the qualities of ruggedness and low first cost.

Various other objects, advantages and improvements will be apparent from the following description taken in connection with the single sheet of drawing in which:

FIG. 1 is a view of an anode element suitable for use with the present invention;

FIG. 2 is a view of the cathode element; and

FIG. 3 is a view of the anode and cathode elements of FIGS. 1 and 2 when employed with a multi-unit cell.

Referring now to the drawing for a more complete understanding of the invention and more particularly to FIG. 1 thereof, there is shown thereon an anode indicated generally by the numeral 1 and comprising a steel wire screen 2 having compressed therein a quantity of powdered magnesium indicated at 3 over a portion of the length thereof.

On FIG. 2 is shown the cathode element of the present invention comprising a steel wire screen 2 having a quantity of powdered V_2O_5 pressed into the meshes thereof forming the cathode element and indicated by the numeral 4. Whereas the wire screen has been described as being composed of steel, it will be understood that

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other material suitable for the purpose may be employed such, for example, as copper, nickel or stainless steel, if desired. Furthermore, if desired, the powdered magnesium comprising the active anode element of FIG. 1 may be employed with the same screen as the powdered V_2O_5 pressed therein and comprising the cathode element, it being merely necessary to arrange the anode and cathode elements on opposite ends and opposite sides of the screen.

On FIG. 3 is shown an arrangement for a multi-unit cell [B] in which the screen is provided with anode and cathode active elements on opposite ends thereof in the manner just described. The wire screen is preferably bent along the central transverse portion thereof substantially as shown on FIG. 3 and designated by the numeral 5. The screen element 5 is thus well adapted to form a multi-unit thermal cell of the "B" type by arranging the anode and cathode end portions of a pair of screen elements 5 on opposite sides of a pellet composed of a solid fusible electrolyte substantially as shown on FIG. 3 in such manner that the voltages of the cells are additive, sufficient cells being employed in series arrangement to provide the required "B" voltage therefrom when the cells are heated to an elevated temperature sufficient to fuse the electrolyte and cause the cell to thus become conductive. The electrolyte may advantageously include the admixture of an adsolvent, therewith, which prevents or retards the flow of the electrolyte when the cell is activated without interfering with the wetting of the electrodes by the electrolyte or impairing the efficiency of the cell. The electrolyte per se forms no part of the present invention and may be of any fusible type suitable for the purpose such, for example, as the solid fusible electrolyte disclosed and claimed in the application for "Thermal Cell and Method of Making the Same," Serial No. 536,685, filed September 23, 1955, by Glenn F. Zellhoefer. The electrolyte is designated on FIG. 3 by the numeral 6.

Although the anode layer of powdered magnesium pressed into the wire screen is substantially free of a depolarizing agent, a small quantity of depolarizing material may be added thereto, if desired, without departing from the present invention.

An important aspect of the present invention resides in the use of powdered magnesium pressed into a wire screen to form an anode and the use of powdered V_2O_5 pressed into a screen for forming the cathode. In the fabrication of the anode and cathode elements of this invention, a die suitable for the purpose may be employed. A quantity of powdered magnesium is placed in the cavity of the die in such manner as to form a layer of loose powdered magnesium of a predetermined thickness, a depth of 65 mils of this loose powder having been found to be satisfactory. The wire screen is also positioned within the die in contact with the powdered magnesium and the punch at the bottom of the die is raised to apply a pressure to the powdered magnesium in the order of 50,000–60,000 p.s.i. The cathode is formed in a similar manner, it being merely necessary to substitute the powdered V_2O_5 for the powdered magnesium. This same method may be employed advantageously to produce the anode-cathode screen element of FIG. 3.

From the foregoing it will be clearly apparent that there has been provided a new and improved anode-cathode element or separate anode and cathode elements, as the case may be, in which the anode comprises a quantity of powdered magnesium pressed into a wire screen and the cathode a quantity of powdered V_2O_5 pressed into the screen, whereby the separate anode and cathode elements may be advantageously employed with a single thermal cell unit and the anode-cathode element

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may be employed with a multi-cell unit to obtain a "B" voltage therefrom when the cell is heated sufficiently to melt and fuse the electrolyte to the anode and cathode elements.

Whereas the invention has been described with reference to two embodiments thereof which give satisfactory results, it is not so limited as various changes and modifications may be made by one skilled in the art, after understanding the invention, without departing from the spirit and scope of the invention and it is intended therefore, in the appended claims, to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A multi-unit battery comprising a plurality of thermal cell units serially connected to produce a voltage greater than the voltage of any of said units when the battery is heated, each unit comprising a length of wire screen having a quantity of powdered magnesium tightly compressed into an end portion only thereof to form a thin anode and a quantity of V_2O_5 tightly compressed into the other end portion only thereof to form a thin cathode, a plurality of pellets of solid fusible electrolyte, an anode of one of said screens and a cathode of another of said screens being arranged on opposite sides of one of said pellets and in intimate contact therewith.

2. A multi-unit battery according to claim 1 in which each of said screens comprises a portion bent transverse

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to the length of the screen and disposed between the anode and cathode elements thereof in such manner that the anode element is displaced from the corresponding cathode element by a distance corresponding to the thickness of one of said pellets.

3. A multi-unit battery according to claim 2 wherein the anode and cathode elements are arranged on opposite sides of said screens between and in intimate contact with the supporting surfaces thereof and on opposite sides respectively of a medial line corresponding to a central longitudinal portion thereof.

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