

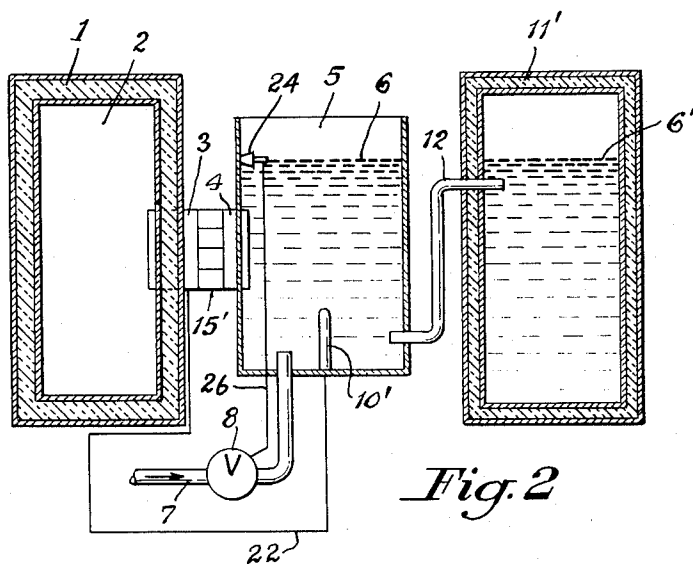
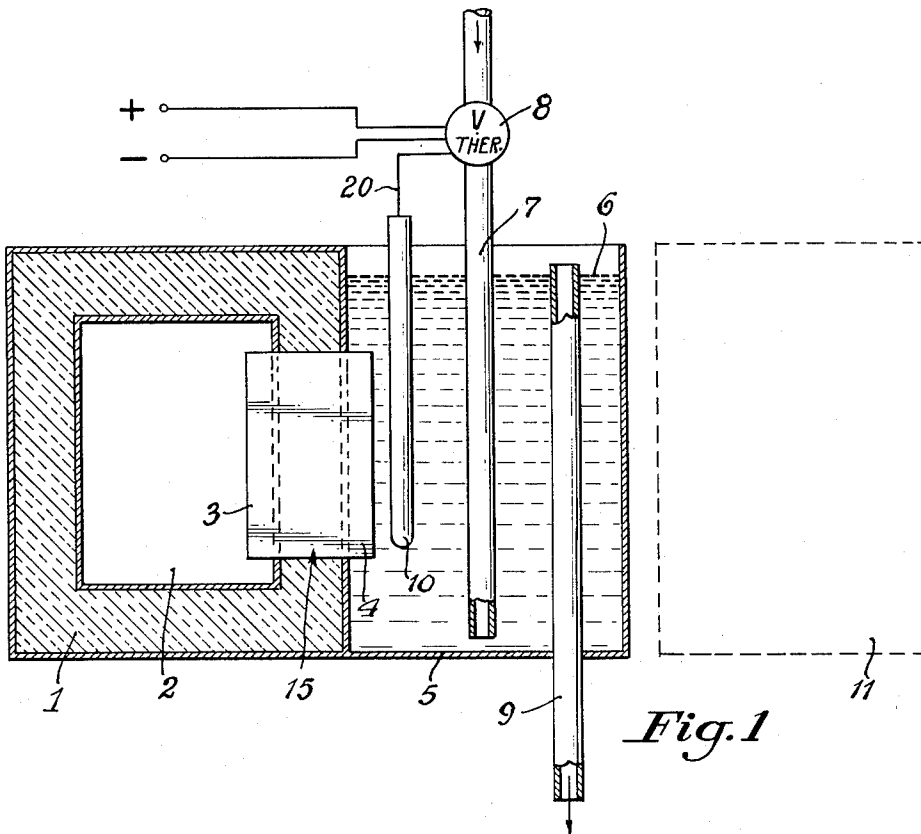
July 7, 1964

A. KÜCKENS ETAL
METHOD AND MEANS FOR MOUNTING AND
CONTROLLING Peltier ELEMENTS

3,139,734

Filed March 16, 1962

2 Sheets-Sheet 1



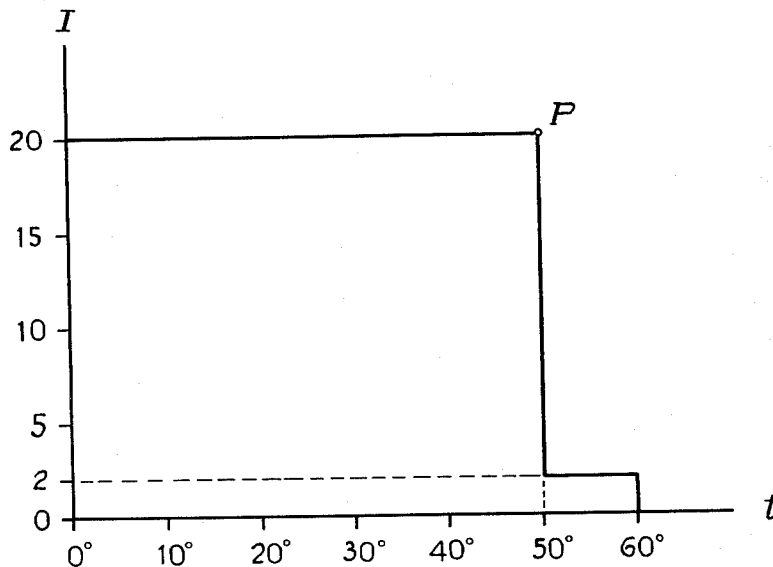
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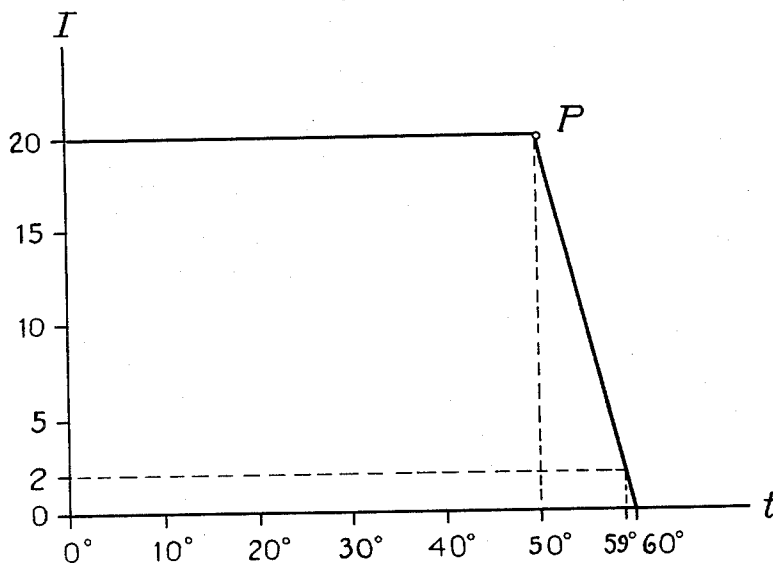
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I = CURRENT IN AMPERE THROUGH PELTIERE ELEMENTS
 t = TEMPERATURE OF WATER SIDE IN CENTIGRADE
 P = STARTING POINT OF THERMOSTAT CHANGE

Fig. 3



I = CURRENT IN AMPERE THROUGH PELTIERE ELEMENTS
 t = TEMPERATURE OF WATER SIDE IN CENTIGRADE
 P = STARTING POINT OF CONTROL

Fig. 4

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METHOD AND MEANS FOR MOUNTING AND CONTROLLING PELTIER ELEMENTS

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2 Claims. (Cl. 62—3)

This invention relates to a method and means for mounting and control of Peltier elements.

In practical use of Peltier elements it is at present feasible to achieve a temperature difference of between 50 and 60° C. With constant current supply the Peltier element has a tendency to continuously displace this temperature range upwardly. In other words, if in an installation intended to have a temperature of 0° C. on the cold side and a temperature of maximum 60° C. on the warm side, the last mentioned temperature should increase to, e.g., 100° C., the temperature on the cold side might rise to 40° C.

In order to avoid such an increase above a maximum temperature on the warm side of a Peltier element it is necessary to provide for transmission of heat to some medium from the element. Certain difficulties are encountered in this connection. One possibility would be to greatly enlarge the heat transmission surface of the warm side by adding a pack of laminae. This involves, however, considerable costs which as a rule are not economically practicable.

Another possible solution would be to bring the warm side of the element in contact with a cooling medium, such as water. Such a medium would have to be circulated in order to transport sufficient amounts of heat, and this would involve the use of a pump aggregate, a source of running water with attendant loss of heat, or a closed water circuit with means for continuously cooling the water. In either case, and regardless of whether air or water cooling is employed, a portion of the produced heat energy would be unnecessarily wasted, whereby the economical efficiency of the Peltier element would be jeopardized, particularly in the case of high wattage output.

The ideal solution would appear to be a combination with a hot water system capable of operating the cooling means and at the same time of delivering hot water. However, a water filled container which is sufficiently large to absorb the continuously supplied heat calories cannot be used when it also must deliver hot water of, for instance, up to 100° C.

The present invention provides the solution of all these problems.

An object of the invention is to provide a method and means whereby the warm side of the Peltier element is not connected directly to a hot water vessel but rather with an uninsulated buffer vessel which is so dimensioned that it for long periods can absorb the freed heat calories. Directly to this buffer vessel an insulated hot water battery may be connected which receives the preheated water from the buffer vessel. Thereby the heat calories freed from the Peltier element can be usefully utilized.

The problem which may arise in connection with such an installation is that due to insufficient hot water consumption from the hot water battery the heat calories in the buffer vessel may accumulate to such an extent that the temperature on the cold side of the Peltier element rises unduly.

Therefore, it is another object of the invention to provide means, e.g., thermostat controlled means, whereby

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the buffer vessel upon reaching a predetermined temperature is emptied and filled with fresh water.

A further object of the invention is to provide means whereby upon reaching a predetermined temperature in the buffer vessel a current restriction for the Peltier element occurs in such a way that the amount of supplied heat calories no longer is sufficient to bring the buffer vessel to the maximum temperature since said vessel is not insulated and also, e.g., through direct or indirect enlargement of its transmission surfaces, including the evaporation surface of the water, dissipates more heat calories than supplied from the warm side of the thus throttled Peltier element.

The invention is described below with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic elevational view, partly in section, of one embodiment of the invention,

FIG. 2 is a similar view of another embodiment, and

FIGS. 3 and 4 are diagrams illustrating two different forms of the inventive method.

In FIG. 1 an insulated container 1 forms a cooling chamber 2 into which the cold side 3 of a Peltier element, or battery, 15 extends through one of the walls of the container 1. The warm side 4 of the Peltier element 15 is located in a vessel 5 which is filled with water up to the level 6. A water supply pipe 7 extends into the vessel 5 from above and contains a valve 8, e.g., an electrically operated valve, which controls the connection of the pipe 7 with a water supply system. An outlet pipe 9 extends into the vessel 5 to form an overflow means, and the vessel 5 is provided with a thermostat 10 which through a connection indicated at 20 controls the opening and closing of the valve 8 in a known manner. Means (not shown) are provided for connecting the Peltier element 15 to a suitable power net.

When through the action of the Peltier element 15 the temperature of the water in the vessel 5 exceeds a predetermined value, the thermostat 10 causes the valve 8 to open so that fresh water is supplied to the vessel 5 through the pipe 7. As indicated, this fresh water will enter the vessel 5 adjacent the bottom thereof and thus cause the warm water thereabove to be discharged through the overflow pipe 9. When the water temperature has been sufficiently lowered, the thermostat causes the valve 8 to close. The vessel 5 may, of course, be provided with a suitable outlet valve (not shown) for use in emptying the same when required.

In FIG. 1 a hot water battery 11 is shown in dashed lines. This hot water battery may be any kind of heat exchanger, a hot water boiler, or other similar device. If suitable connections (not shown) with the vessel 5 are provided, and if the hot water consumption in said battery 11 is continuous and of sufficient magnitude, the fresh water supply procedure described above is, of course, superfluous. It would be required only if and when the output from said battery 11 becomes insufficient or too irregular for the amount of heat calories in the vessel 5.

In the embodiment of the invention shown in FIG. 2 the arrangement of the container 1 with its cooling chamber 2, the buffer vessel 5, and the Peltier element 15' with its cold side 3 and warm side 4 is substantially similar to that of FIG. 1. The location of the supply pipe 7 with its valve 8 is changed as shown, and the thermostat 10' is also differently disposed.

An insulated hot water tank 11' is connected with the vessel 5 by means of a pipe 12, and through this arrangement it is obvious that the water level 6' in the tank 11' will be substantially equal to the water level 6 in the vessel 5. It will be noted that the vessel 5 in this case has no overflow pipe corresponding to the pipe 9 in FIG. 1. On the other hand, there is an operative connection, indi-

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cated at 22, of well known kind between the thermostat 10' and the electrical power supply to the Peltier element 15 for a purpose which will be explained below. There may, of course, also be separate heating means for bringing the preheated water supplied to the tank 11' from the vessel 5 to a desired high temperature.

In operation, hot water is occasionally withdrawn from the tank 11' as required for one purpose or another, and only a sufficient amount of fresh water to replace said withdrawn amount is automatically supplied through the pipe 7 and valve 8 as, e.g., under the control of a water level contact means 24 in vessel 5 with a connection 26 to the valve 8. It is obvious, therefore, that in the case of insufficient withdrawal from the tank 11' the water temperature in the vessel 5 will tend to increase.

If the thermostat 10' were connected to the power supply for the Peltier element in such a way as to shut off said power supply when a predetermined temperature, e.g., 60° C., is exceeded in the vessel 5, then the cooling effect in the chamber 2 and the heating effect in vessel 5 would both be interrupted. The Peltier element 15' is heat conducting and thus the result would be that the temperature in the chamber 2, e.g., 0° C., would gradually increase while the temperature in the vessel 5 would decrease. The desired cooling effect in the container 1 would be lost.

In one form of the present invention the connection between the thermostat 10' and the power supply is so arranged that at a certain temperature of the water in the vessel 5 below the predetermined maximum temperature the thermostat 10' causes the normal power supply to be interrupted and replaced by a reduced power supply. The effect of such a change is diagrammatically illustrated in FIG. 3 in which the current (I) in amperes is indicated on the vertical axis while the temperature (t) in degrees centigrade (° C.) is marked on the horizontal axis.

In the example illustrated in said FIG. 3 the thermostat 10' switches to the reduced power supply at a water temperature in the vessel 5 of 50° C., thus causing the current to drop from 20 amperes to 2 amperes. The reduced current should be chosen so as to produce a heating effect which renders the heat supply over the Peltier element to the vessel 5 equal to or less than the heat loss from said vessel 5. Heat transfer to the cooling chamber 2 will thus be prevented.

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FIG. 4 illustrates how the same result can be achieved without the aid of a thermostat controlled power source. In this case, a temperature sensitive resistance is disposed in the vessel 5 and connected in the circuit. In the example illustrated, the resistance is adapted to begin its action at 50° C. and then gradually reduce the heat supply to zero at 60° C. This zero point will, however, not be reached since the gradual throttling of the heat supply over the Peltier element prevents it, as there is a continuous loss of heat from the vessel 5 through its wall and from the water surface. Accordingly, the cooling effect in the chamber 2 is preserved in this case also.

Modifications within the scope and spirit of the invention will occur to those skilled in the art.

What we claim is:

1. In cooling means utilizing the Peltier effect, means defining a cooling chamber, means defining a substantially uninsulated water container, a power supplied Peltier element connected with its cold side to said cooling chamber and having its warm side in direct metallic heat conductive connection with said water container, means defining a hot water tank, means connecting said hot water tank with said water container so as to maintain substantially the same water level in said container and tank whereby water is withdrawn from said water container when water is tapped from said hot water tank, and heat sensitive means associated with said water container to automatically cause reduction of the power supply to the Peltier element when the temperature in the water container rises toward a predetermined value whereby total interruption of the cooling effect of the Peltier element in the cooling chamber is prevented regardless of the rate of water tapping from the hot water tank.

2. Cooling means as set forth in claim 1, in which said heat sensitive means comprises a thermostat.

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