

Sept. 2, 1941.

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2,254,917

COOLING SYSTEM FOR ELECTRIC DEVICES

Filed June 28, 1940

Fig. 1.

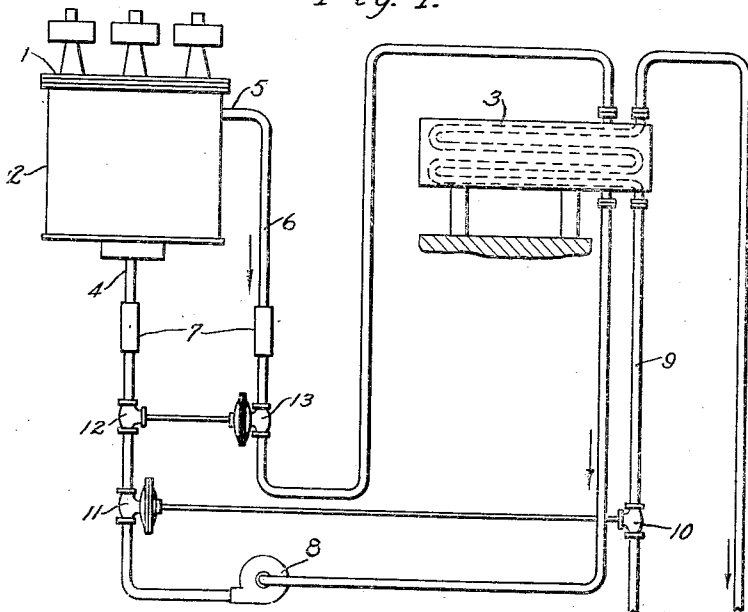
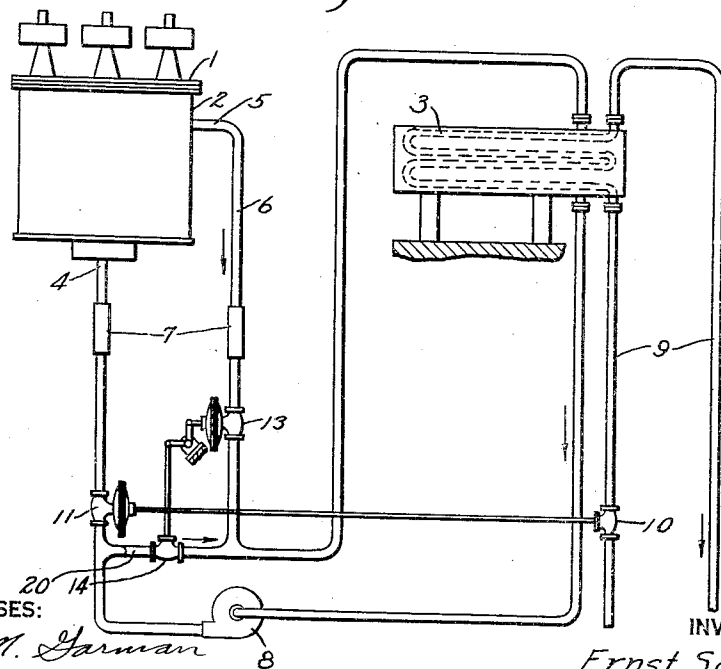


Fig. 2.



WITNESSES:

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2,254,917

COOLING SYSTEM FOR ELECTRIC DEVICES

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Application June 28, 1940, Serial No. 343,006
In Germany August 23, 1939

3 Claims. (Cl. 257—2)

My invention relates to a vapor electric device and particularly to a cooling system for such a device.

In the operation of vapor electric devices, it has heretofore been proposed to provide a cooling system in which the cooling fluid is recirculated through the cooling element of the vapor electric device and a suitable heat exchanger. Usually the supply of cooling fluid to the heat exchanger has been automatically regulated in response to the temperature of the vapor electric device so that the same temperature relation is secured independent of the loading of the vapor electric device.

In prior art construction of which I am aware, it has been customary to maintain a constant flow or a constant volume of recirculating cooling fluid and to control the flow of auxiliary cooling fluid to the heat exchanger in response to the thermal condition of the vapor electric device. The control of the cooling fluid to the exchange device is usually determined by means of thermo-sensitive devices such as thermostats or thermo-contactors placed either in the inlet or outlet for the cooling fluid to the vapor electric device. If the thermo-sensitive device is placed in the inlet to the cooling element, the flow of auxiliary cooling fluid to the heat exchanger will be controlled by the inlet temperature and at light loads the temperature differential between the inlet and outlet of the cooling element would be small resulting in cold operation of the vapor electric device as well as waste of cooling water supplied to the heat exchanger. On the other hand, if the thermo-sensitive device is placed at the outlet of the vapor electric cooling system, the control of the cooling fluid to the heat exchanger will be such that the inlet temperature to the vapor electric device will be too high, resulting in difficulties in operation of the vapor electric device.

According to my invention, these difficulties are suppressed by providing two thermo-sensitive devices and controlling both the amount of recirculated cooling fluid and the amount of cooling fluid supplied to the heat exchanger. I propose to make the flow of cooling fluid to the heat exchanger dependent upon the temperature of the cooling fluid at the inlet of the cooling element for the vapor electric device and control the quantity of recirculated water by means of a thermo-sensitive device responsive to the temperature of the cooling fluid at the outlet of the cooling element of the vapor electric devices. The two thermo-sensitive devices are automatically set so that the in-flow temperature and the

out-flow temperature are maintained substantially constant independent of the electric loading of the discharge device.

It is, therefore, an object of my invention to provide a cooling system which will maintain the inlet and outlet temperatures of the cooling fluid substantially constant regardless of the load condition of the vapor electric device.

It is a further object of my invention to provide a cooling system using a minimum quantity of new water in the heat exchange device.

Further objects and advantages of my invention will be apparent from the following detailed description taken in connection with the accompanying drawing, in which:

Figure 1 is a schematic illustration of a vapor electric device according to my invention; and

Fig. 2 is a similar illustration of a modification according to my invention.

In an illustrative embodiment of my invention according to Figure 1, a vapor electric device 1 is provided with a suitable cooling element 2 which may be either a water jacket or a cooling coil applied to the container of the device 1. A suitable heat exchanger 3 is connected to inlet connection 4 and outlet connection 5 of the cooling element of the vapor electric device by means of suitable piping 6 which is preferably provided with suitable insulating sections 7 in order to prevent circulating currents between the vapor electric device 1 and the heat exchange device 3.

A suitable pump 8 is provided in this system to circulate the cooling fluid such as water between the vapor electric device 1 and the heat exchanger 3. A suitable source of cooling fluid herein illustrated as a source of new water 9 is connected to the heat exchange device 3 and a suitable control valve 10 is supplied in the inlet of the new water of the heat exchange device 3. This control valve 10 is operated by the suitable thermo-sensitive device 11 placed in the inlet 4 to the cooling element 2 of the vapor electric device 1. A suitable control valve 12 is also placed in the recirculating system, and this control valve 12 is controlled by means of a thermo-sensitive device 13 responsive to the outlet temperature of the cooling element 2 of the vapor electric device 1.

The operation of this form of my invention supplies new cooling fluid to the heat exchange device 3 sufficient to maintain the inlet temperature in the cooling element 2 of the vapor electric device 1 at a predetermined value, and the amount or volume of fluid circulated in the recirculating system will be dependent upon the outlet tem-

perature of the cooling element 2 of the vapor electric device 1, and consequently dependent on the electrical load in the vapor electric device 1.

In the modification of my invention according to Fig. 2, the pump 8 operates at a constant pressure or volume and the circulation through the cooling element 2 is controlled by a bypass 20 in shunt with the element 2. The temperature responsive device 13 controls a bypass valve 14 which controls the amount of water passing through the shunt 20. As the outlet water from the cooling element 2 decreases in temperature, the thermo-sensitive device opens the valve 14 and increases the flow in the shunt 20 so that a smaller flow occurs in the cooler 2 and the temperature rises. If the temperature in the outlet 5 rises, the thermo-sensitive element 13 closes the valve 14 to decrease the flow in shunt 20 and increases the flow through the cooler 2.

The inlet temperature at 4 is controlled by thermo-sensitive element 11 and valve 10 in the same manner as explained above.

While, for purposes of illustration, I have shown and described specific embodiments of my invention, it will be apparent that changes and modifications can be made therein without departing from the true spirit of my invention or the scope of the appended claims.

I claim as my invention:

1. A cooling system comprising a cooling element, a heat exchanger, closed connections between said cooling element and said heat exchanger, a pump for circulating cooling fluid between said cooling element and said heat exchanger, a supply connection for supplying cooling fluid to said heat exchanger, a control valve in said supply connection, a thermal responsive device in the inlet connection of said cooling ele-

ment for operating said control valve, a second control valve in the connection between the cooling element and the heat exchanger and a thermal responsive element in the outlet of said cooling element for controlling said second control valve.

2. A cooling system for a vapor electric device comprising a cooling element for said device, a heat exchanger, means for circulating cooling fluid between said cooling element and said heat exchanger, means responsive to the outlet temperature of the fluid from the cooling element for determining the amount of cooling fluid circulated between said cooling element and said heat exchanger, a source of cooling fluid for said heat exchanger and means responsive to the temperature of the cooling fluid entering the cooling element for determining the flow of cooling fluid from said source to said heat exchanger.

3. A cooling system for a vapor electric device comprising a cooling element for said device, inlet and outlet connections for said cooling element, a heat exchanger connected to said inlet and outlet connections, pumping means for circulating cooling fluid between said cooling element and said heat exchanger, a by-pass connected between the inlet and outlet connections to said cooling element, a throttle valve in said by-pass, a thermal element responsive to the temperature of the fluid in the outlet connection for controlling the throttle valve, a connection for supplying cooling fluid to said heat exchanger, a control valve in said connection and a thermal element responsive to the temperature of the fluid in the inlet connection to the cooling element for operating said control valve.

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