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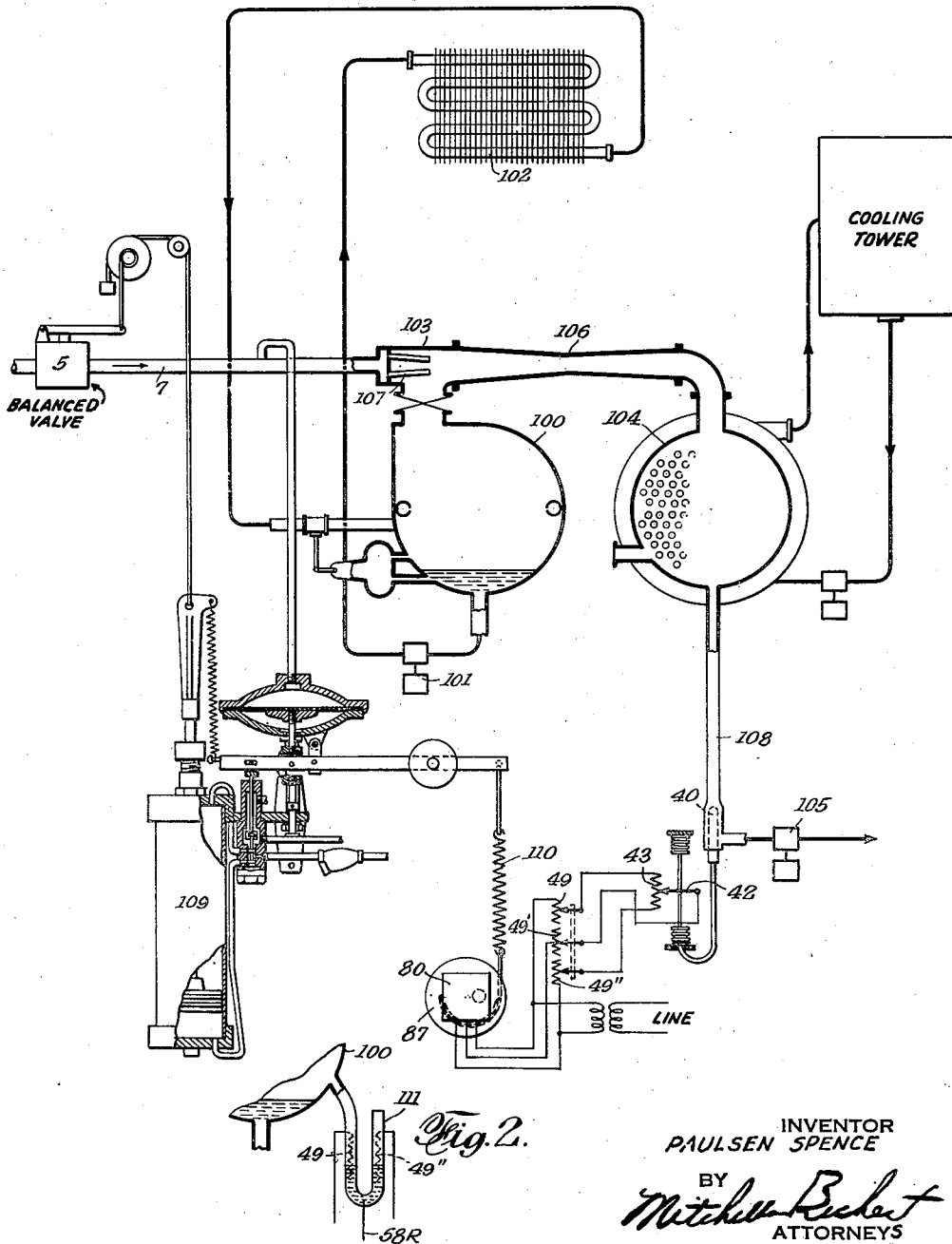
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2,314,524

COOLING SYSTEM

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Fig. 1.



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COOLING SYSTEM

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10 Claims. (Cl. 62—2)

My invention relates to a cooling system, and this application is a continuation in part of my co-pending application, Serial No. 47,778, filed November 1, 1935.

It is an object of the invention to provide improved means for controlling a cooling system.

It is another object to provide improved means for controlling the supply of steam to a steam jet ejector employed in connection with the cooling system.

Another object is to provide a cooling system with improved automatic means for maintaining a cooling effect as desired.

It is another object to provide a cooling system including vacuum inducing means with control means directly influenced by or actuated in proportion to the degree of vacuum in the system.

Other objects and various features of novelty and invention will be hereinafter set forth or will become apparent to those skilled in the art.

In the drawing which shows, for illustrative purposes only, preferred forms of the invention:

Fig. 1 is a more or less diagrammatic or schematic view of a cooling system embodying my invention; and

Fig. 2 is a fragmentary view illustrating a slight modification.

Certain features of my invention may be employed in the control of a cooling system. One known type of cooling system now employed comprises a cold tank 100 for refrigerant, which may be water. From the cold tank cold water is circulated by means of a pump 101 through an air cooler 102 and may then be returned to the cold tank. The cold tank is maintained under reduced pressure so as to vaporize a part of the water and thus reduce the temperature of the remaining water. The vacuum is maintained in the cold tank by means of a steam jet air pump or so called booster ejector 103 and a suitable type of condenser, such as a surface condenser 104 and an ordinary type of condensate pump 105 for removal of air and condensate. The steam jet air pump or booster ejector comprises a Venturi type of tube 106 with steam jets 107 discharging thereinto and the steam jets serve to carry off the water vapor evaporated from the refrigerant or water in the cold tank 100 and the combined steam jets and water vapor are then condensed in the surface condenser. Such apparatus is now known.

The application of my present invention is to the control of the steam jets 107 of the booster ejector. When the vacuum in the cold tank 100 is low larger quantities of steam must be supplied to the booster ejector and when the vacuum in the cold tank rises the quantity of steam supplied may be progressively reduced and such reduction is not in general directly proportional to the increase in

vacuum but is substantially along the lines of a square root curve.

One novel application of my invention to the control of steam to the booster ejector comprises controlling the steam in accordance with the temperature of the condensate in the condenser. It is known or may be assumed that a low temperature of condensate indicates a high vacuum and a high temperature of condensate indicates a low vacuum. Therefore I control steam jets 107 to the booster ejector in accordance with the condensate temperature. In the condensate line 108 I interpose a thermostat 40, which actuates a control potentiometer blade, such as 42, movable over a potentiometer resistance, such as 43. The potentiometer blade and resistances are connected to a reversible motor 80 of the type disclosed in the parent application aforesaid, which in turn operates means, such as the cam plate 87, for controlling the loading of a valve, or may control the pilot valve of a hydraulically actuated piston motor 109 for controlling a balanced valve 5 in the steam line 7 leading to the booster ejector. The motor 80 is preferably a well known "Modutrol" motor manufactured by Minneapolis-Honeywell Company. The hydraulic motor 109 is preferably of the type disclosed in my Patent No. 2,211,300, August 13, 1940. The valve or pilot may be loaded, as by means of a chain, in proper cases and in the case of the pilot valve for the hydraulic motor or where substantial pressures are involved the valve or its pilot may be loaded, as by winding up or stressing a spring 110 by means such as the cam plate 87 disclosed. As set forth in the parent application the cam is preferably designed as a spiral so as to load the spring in accordance with the requirements. In addition to the thermostatic control just mentioned the motor may be further controlled by resistances 49, 49', 49'' interposed in the three lines, which resistances may be varied manually or otherwise.

Thus, in accordance with such an application of my invention the quantity of steam supplied to the booster ejector is varied in accordance with the requirements, that is, when the vacuum is high the quantity of steam supplied to the jets is reduced and vice versa.

Another method employing substantially the same apparatus as disclosed but not dependent upon the temperature of the condensate but rather directly upon the extent of the vacuum in either the cold tank or the condenser, may comprise a U-tube 111 connected to the vacuum space at one end and open to the atmosphere at the other end and containing mercury. In each leg of the U-tube is a resistance corresponding to the resistance 49, 49' of the motor heretofore described. The connection 58R to the blade 42 directly contacts the mercury. Therefore, when the vacuum is increased the mercury will rise in

one leg and lower in the other and one of the resistances will be reduced while the other is increased and the motor will be appropriately rotated so as to reduce or increase the quantity of steam supplied to the booster ejector in accordance with the requirements.

With apparatus as thus far described the control will be subject to variations in atmospheric pressure. However, with a barometric type U-tube (Fig. 2) closed at its free end, the control will be unaffected by barometric changes. In order to render the control shown in Fig. 1 immune to changes in atmospheric pressure the Sylphon or bellows actuator for the potentiometer blade may be counterbalanced by a similar Sylphon or bellows. The counterbalancing Sylphon preferably has the air evacuated therefrom so it will be unaffected by temperature changes and subject only to changes in atmospheric air pressures. The Sylphon or bellows actuator for the potentiometer blade may also be rendered immune to external pressure conditions by enclosing the bellows and potentiometer apparatus as a unit inside of some evacuated chamber, so that the external pressure conditions will operate only on this chamber and not on the bellows. In this latter system no counterbalancing evacuated bellows would be needed.

While the invention has been described in considerable detail and various modifications shown it is to be understood that other modifications and various changes, omissions and additions may be made, all within the scope of the invention as defined in the appended claims.

I claim:

1. In a device of the character indicated, a chamber to be evacuated, a steam ejector for evacuating said chamber, a condenser for condensing steam and vapors from said steam jet ejector, a valve for controlling the admission of steam to said steam jet ejector, and means actuated in proportion to the vacuum in said chamber for controlling said valve, said means including means for moving said valve to vary the quantity of steam admitted thereby by increments substantially along a square root curve for equal increments of vacuum change.

2. In a device of the character indicated, a chamber to be evacuated, a steam jet ejector for evacuating said chamber, a condenser for condensing steam and vapors from said ejector, thermostatic means actuated by the temperature of the condensate from said condenser, a valve for controlling the supply of steam to said ejector, and means controlled by said thermostatic means for controlling said valve, said means including means for moving said valve to vary the quantity of steam admitted thereby by increments substantially along a square root curve for equal increments of change of said thermostatic means.

3. In a device of the character indicated, a chamber to be evacuated, a steam jet ejector for evacuating said chamber, a valve for controlling the supply of steam to said ejector, and means controlled by the pressure in said chamber for controlling said valve, said means including means for moving said valve to vary the quantity of steam admitted thereby by increments substantially along a square root curve for equal increments of pressure change in said chamber.

4. In a system including a condenser, means

for discharging steam thereto and means for controlling the supply of steam in accordance with the vacuum in said condenser, comprising a thermostatic member exposed to the temperature of the condensate in said condenser, a valve for controlling the supply of steam, and means actuated by said thermostatic member for controlling the actuation of said valve, said means including means for moving said valve to vary the quantity of steam admitted thereby by increments substantially along a square root curve for equal increments of change for said thermostatic member.

5. In a system including a condenser, a valve for controlling the supply of steam thereto, and means for controlling said valve in accordance with the vacuum in said condenser, comprising movable contact means operable in accordance with changes in the vacuum in said condenser, and means controlled by said movable contact means for controlling said valve, said means including means for moving said valve to vary the quantity of steam admitted thereby by increments substantially along a square root curve for equal increments of vacuum change.

6. In a system including a condenser, a valve for controlling the supply of steam to said condenser, a motor for controlling the actuation of said valve, a three-wire potentiometer system for controlling said motor, and means acting as a control of said three-wire potentiometer system and influenced in its action by the extent of vacuum in said condenser whereby said steam valve may be controlled in accordance with the requirements of the vacuum in said condenser, said valve control means including means for moving said valve to vary the quantity of steam admitted thereby by increments substantially along a square root curve for equal increments in vacuum change.

7. In the combination defined in claim 6, said last mentioned means including a spiral cam.

8. In a system of the character indicated, a chamber to be evacuated, a steam ejector for evacuating said chamber, a condenser for condensing steam and vapors from said ejector and chamber, steam supply means to said ejector, means actuated in proportion to change in vacuum in said chamber, and mechanism controlled by said last mentioned means to vary the supply of steam to said ejector by increments along substantially a square root curve for equal increments of change in said means actuated in proportion to change in vacuum.

9. In a system of the character indicated, a chamber to be evacuated, a steam ejector for evacuating said chamber, a condenser for condensing steam and vapors from said ejector and chamber, a main valve for controlling the supply of steam to said ejector, pilot valve means for controlling the actuation of said main valve, loading means for said pilot valve, means for loading said pilot valve, said pilot means and means for loading the same including means for moving said valve to vary the quantity of steam admitted thereby by increments substantially along a square root curve for equal increments in change of vacuum in said chamber.

10. In the combination defined in claim 9, said load varying means including a motor and spiral cam means operated thereby.

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