United States Patent

Hall et al.

[15] **3,638,619**

[45] **Feb. 1, 1972**

[54] THERMOSTATICALLY CONTROLLED LIQUID-HEATING TANK

[72] Inventors: **Henry B. Hall**, Hamilton, Mass.; **Norman W. Hill**, Rochester, N.H.

[73] Assignee: **International Telephone and Telegraph Corporation**, Nutley, N.J.

[22] Filed: **June 17, 1970**

[21] Appl. No.: **47,054**

[52] **U.S. Cl.** .....**122/13 A, 219/306, 219/309**

[51] **Int. Cl.**.....**F22b 5/00**

[58] **Field of Search** 122/13; 219/306, 308, 309, 219/328, 331

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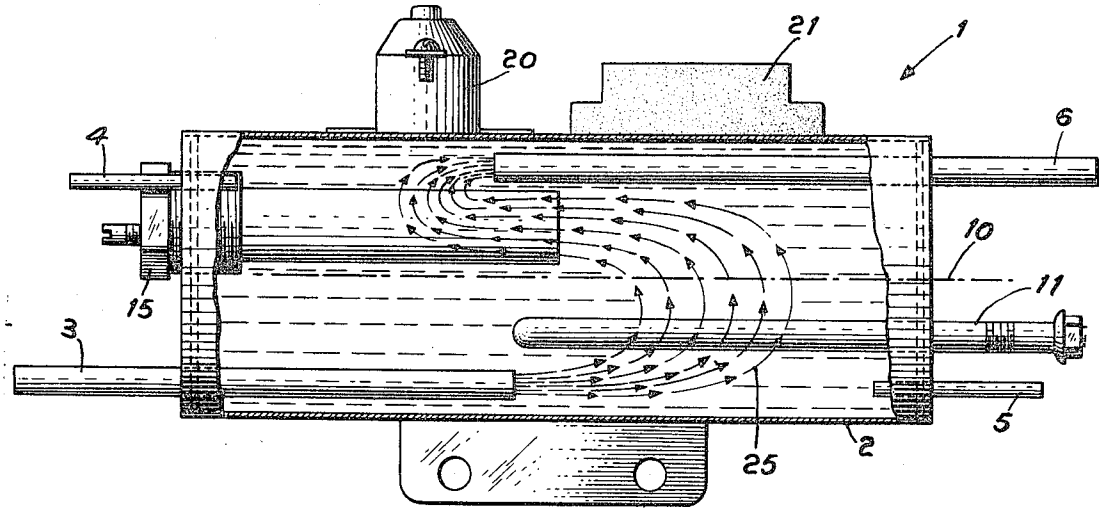
Primary Examiner—Kenneth W. Sprague

Attorney—C. Cornell Remsen, Jr., Walter J. Baum, Paul W. Hemminger, Charles L. Johnson, Jr., Philip M. Bolton, Isidore Togut, Edward Goldberg and Menotti J. Lombardi, Jr.

[57] **ABSTRACT**

An apparatus for heating a liquid for use in medical, dental and other services comprising a receptacle for heating the liquid, thermostatic means for determining the temperature of the liquid as it exits from the receptacle, inlet and outlet means for said receptacle, said inlet and outlet means extending into the interior of the receptacle for some distance. The thermostatic control means are located adjacent the outlet means, and the heater means for the liquid are disposed adjacent the inlet means.

6 Claims, 2 Drawing Figures



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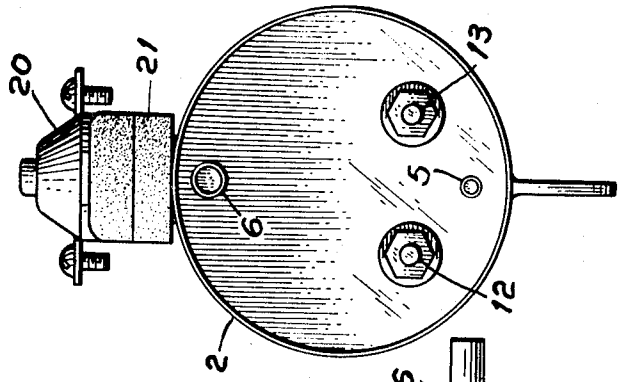


Fig. 2

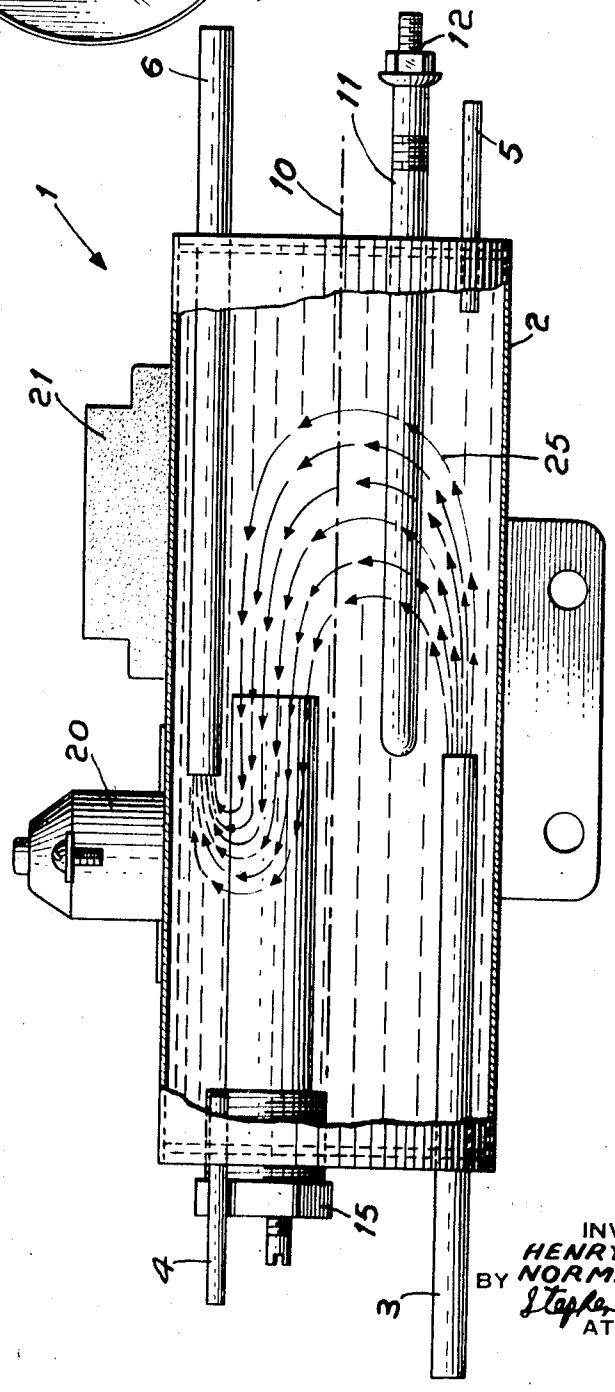


Fig. 1

INVENTORS
HENRY B. HALL
NORMAN W. HILL
BY Stephen A. Young
ATTORNEY

THERMOSTATICALLY CONTROLLED LIQUID-HEATING TANK

BACKGROUND OF THE INVENTION

This invention relates to an improvement in liquid-heating apparatus for such applications as medical and dental warm-water tanks, aircraft wash-water tanks, vending machine water tanks and similar applications, and, more particularly to an improved apparatus which is more efficient, economical to operate, and is a more compact apparatus than those now in use.

Present apparatuses for heating water, for instance, medical and dental equipment, consist of, usually, a brass tank having a liquid supply line and two connections for circulation to and from point of use. The point of use in dental work, for instance, could be a syringe which is used by the dentist to spray liquid into the mouth of the patient on whom he is operating for cavities and such. Of course, the water which is sprayed into the patient's mouth is not returned to the tank, but during the time that the syringe is not being used the water circulates through a pipe from the tank to the syringe and then through another pipe from the syringe back to the tank. The total length of both these lines may be in the neighborhood of 6 ft. or more and, thus, provides an ambient for cooling the water as it flows through the lines. The tank would have an internal heater such as an electric immersion heater inside the tank which is controlled by a surface-mounted thermostat; that is, the thermostat is mounted on the outside surface of the tank. As the liquid temperature drops, or the liquid is drawn off for use, and a makeup liquid enters the tank, tank temperature drops. This temperature reduction is sensed by the thermostat which energizes the heater until the tank temperature reaches the high limit of the thermostat which then opens the heater circuit. However, the surface-mounted thermostat has an inherent thermal lag as the tank surface must experience a temperature change before the thermostat will operate. The surface sensing of temperature is inherently subject to ambient variations such as the airflow in the room where the tank is located, and the tank surface also sees the system temperature as well. The difference between the system temperature and the ambient temperature in the case of dental use may be about 25° F., or the difference between the desired water temperature of 105° F. and the ambient or room temperature of 80° F. These temperature figures are given for purposes of illustration, and the specific temperatures given are for dental use; it being understood that for other applications the temperature figures would be different and, therefore, the differences between system temperature and ambient temperature would also vary.

Other drawbacks of present apparatus are that the liquid connections, or pipe connections, to the tank are of a fitting type requiring wrenches because, usually, pipe threads are drilled into the tank and pipe threadings are then screwed into the tank to effectuate connections to the outside inlet and outlet means. Furthermore, no backup over temperature protection is provided. If the thermostat fails, then the apparatus will be subjected to overheating. Additional objections to present apparatus designs are that the materials used are not of maximum corrosion resistance and that the wiring connections and thermostat heater and ground are made independently requiring a multitude of connections.

Accordingly, an object of the present invention is to provide an improved apparatus for heating liquid.

Another object of this invention is to provide an improved liquid-heating apparatus which is more responsive to temperature changes within the tank holding the liquid.

A further object of this invention is to provide an improved liquid-heating apparatus which will more effectively and efficiently intermix the incoming feed liquid with the liquid within the tank.

SUMMARY OF THE INVENTION

These and other objects which will become apparent by reference to the following detailed description taken in conjunction with the accompanying drawing and the appended claims are achieved by the apparatus of this invention which comprises a receptacle for liquid, inlet and outlet means extending for some distance into the interior of the receptacle, heater means disposed adjacent the inlet means and temperature-sensing means disposed adjacent the outlet means.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings show the apparatus of this invention and comprise:

FIG. 1, which is a front elevation view of the improved apparatus in partial cross section and

FIG. 2, which is a side elevation of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGS. 1 and 2 there is shown the liquid-heating apparatus 1 of this invention which comprises a tank or receptacle 2 shown in partial cross section. On the left-hand side of this tank 2 there is shown an inlet tube 3 which extends for some distance exteriorally of the tank and extends for a longer distance into the interior of the tank 2. Above the inlet tube 3 is an outlet tube 4 which also extends for a short distance outside the tank and extends into the interior of the tank. It may be considered that the outlet tube 4 would be connected to a dental syringe if used for that purpose. On the opposite side of the tank is a second inlet tube 5 extending outside the tank for a distance and projecting into the tank interior, and above the inlet tube 5 is a second outlet tube 6 also projecting outside the tank and extending into the interior of the tank. It may be observed that the two inlet tubes are on one side of the axis 10 of the tank 2 and the two outlet tubes 4 and 6 are on the opposite side of axis 10. However, the relative displacement of inlet and outlet tubes may be varied as required for different applications and the disposition of the inlet and outlet tubes in FIGS. 1 and 2 are for illustration and not limited to that arrangement. An electric immersion heater 11 is disposed inside the tank 2 with connecting terminals 12 and 13 protruding from the tank. This type of electrical immersion heater is manufactured by a number of companies and is readily available. It should be noted that the electrical immersion heater is disposed adjacent inlet tubes 3 and 5 for reasons which will be explained later. A thermostat control 15 is located on the opposite side of the tank extending inwardly thereof. It should be noted in this case that the thermostat control 15 is disposed adjacent outlet tubes 4 and 6 and is, therefore, in a position to sense the temperature of the outflowing liquid as it leaves the tank. This thermostat control may be of the type manufactured by ITT Vulcan Electric, located at Danvers, Mass. A typical thermostat control of this type bears the catalog number 1C1B2-S105; however, this is adduced as an example only and it is to be understood that any suitable thermostat control for this purpose of the appropriate kind can be used and is not limited to the example given. There is also provided on the outside of the tank 2 and fastened securely thereto, such as by welding or any other suitable means, a high-limit thermostat 20. The thermostat 20 is shown adjacent to the outlet tubes 4 and 6 locations. The purpose of the thermostat 20 is to provide an over-temperature thermostat switch for backup protection, so that if the thermostat control 15 should fail the thermostat 20 would then prevent the temperature from rising above a desired point. The heater, thermostat 15 and thermostat 20 are series connected to effectuate this result.

Also mounted on the outside of the tank 2 is a terminal block 21 to which connections are made to the heater, the thermostat control 15 and the thermostat 20. This provides for a self-contained compact unit which can be easily installed by means of mounting bracket 21 and requires only three electri-

cal connections to the apparatus, one of the connections being a ground that is connected to the tank. Also it will be observed that the inlet and outlet tubes extend from the tank outwardly and, therefore, connections can be made simply, by means of a rubber tube or hose or with quick connect-and-disconnect devices. The inlet and outlet tubes can be brazed to the tank **2** to provide watertight seals. For corrosion resistance the tank **2** and the inlet and outlet tubes are preferably made of stainless steel.

The operation of this apparatus will now be described and it will be apparent how the novel design thereof provides for a vastly improved liquid-heating tank. Inlet water or liquid which is usually colder than the ambient temperature is provided by connection to tube **3**. It will be noted that the tube extends for rather a long distance inside the tank. Therefore, as the liquid flows through tube **3** before emerging into the tank interior it is being preheated by the warm water within the tank. The flow of the cooler liquid through the tank after it leaves tube **3** is as shown by the broken lines with arrows at **25**. It can be seen that this flow path provides for a much longer path and will insure a much better mixing of the preheated cold inlet water or liquid with the heated liquid inside the tank. Also the heater **11** is disposed adjacent to the inlet tube **3** so that the inlet water flowing out of tube **3** will first strike the heating element **11**, thereby being heated as soon as it enters the interior of the tank. The water is thus heated more quickly and will not tend to cool the tank water thus providing more economical operation, faster and more uniform heating. The flow path from the inside end of tube **3** to the outlet tube **4**, it will be observed, is a relatively long one so that this insures that the relatively cold water newly entering will be heated to the prevailing temperature of the liquid within the tank before it will exit through tube **4**. Also, as stated before, the thermostatic control **15** is located adjacent to exit tube **4** and, therefore, will sense the temperature of the exit fluid, thus providing a more accurate reading of the water which is transmitted to the outside. Outlet tube **6** may be considered a secondary drawout and in dental work could be used for a secondary purpose, such as filling a water cup for the patient with which to rinse his mouth.

It is to be understood that the foregoing description of specific examples of this invention is made by way of example only and is not to be considered as a limitation on its scope.

We claim:

1. A thermostatically controlled liquid-heating tank comprising:

a receptacle for holding a liquid;

inlet and outlet means for said liquid, said inlet means being located on one side of the axis of said receptacle and said outlet means being located on the other side of said axis;

heater means disposed inside said receptacle;

first thermostatic control means disposed adjacent said outlet means to sense the temperature of said liquid at said outlet means; and

second thermostatic control means disposed on the outside surface of said receptacle, said second thermostatic control means having a higher cutoff temperature than said first thermostatic control means.

2. A thermostatically controlled liquid-heating tank according to claim **1** wherein said inlet means comprises

a first inlet on one side of the receptacle and extending for some distance into the interior of said receptacle.

3. A thermostatically controlled liquid-heating tank according to claim **1** wherein said outlet means comprises

at least one outlet extending for some distance into the interior of said receptacle.

4. A thermostatically controlled liquid-heating tank according to claim **2** wherein said inlet means comprises

a second inlet on the opposite side of said receptacle extending for some distance into the interior of said receptacle.

5. A thermostatically controlled liquid-heating tank according to claim **3** wherein said outlet means comprises

a second outlet disposed on the opposite side of said tank from the side holding said first outlet means, said second outlet extending into the interior of said receptacle.

6. A thermostatically controlled liquid-heating tank according to claim **4**, wherein said heater means are disposed adjacent said first and second inlet.

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