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[54] HEATER WITH COMBUSTION CHAMBER LOCATED BELOW FLUID DISTRIBUTING MEANS

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[51] **Int. Cl.** **F24h 1/10**

[58] **Field of Search** 126/359, 355, 350

[56] **References Cited**

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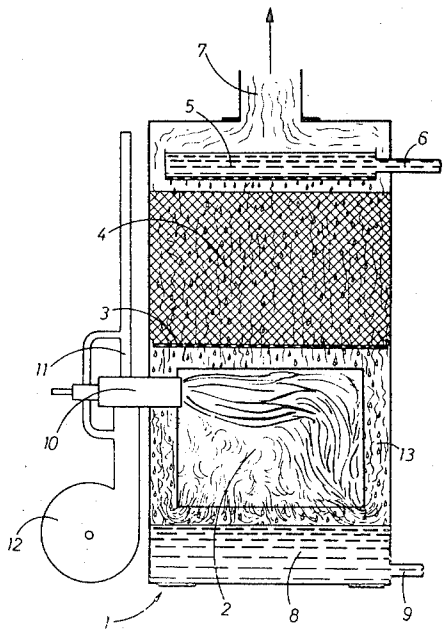
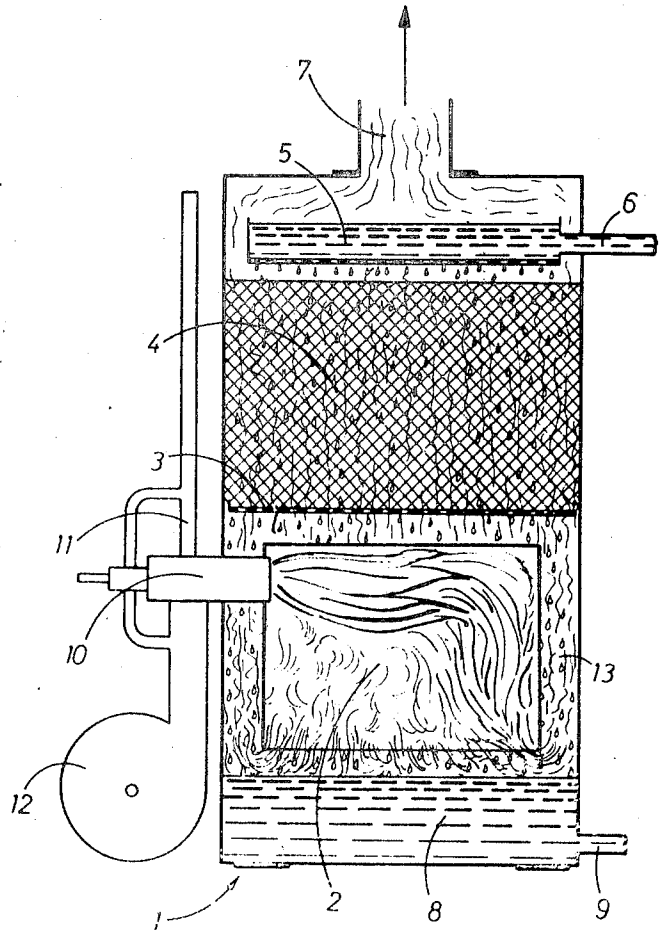
[57] **ABSTRACT**

Liquid to be heated is introduced into the top of a column and distributed in downward flow through the column. A combustion chamber is disposed within the column and has a closed top and closed side walls, and an open bottom. Combustion gases produced by a burner in the combustion chamber are constrained to flow through the open bottom of the chamber and then upwardly through an annular space between the chamber and column whereat the gases commence to contact the downflowing liquid. The spent gases are discharged at the top of the column and the heated liquid at the bottom of the column.

1 Claim, 1 Drawing Figure

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HEATER WITH COMBUSTION CHAMBER LOCATED BELOW FLUID DISTRIBUTING MEANS

The present invention relates to the provision of a heater of the type comprising, in a column, a combustion chamber situated below a space equipped with fluid-distributing means, in which space the fluids meet in countercurrent, the heated liquid descending from one end and the combustion gases rising from the other.

In known heaters of the above type, the combustion chamber is open at the top, which means that the extremely hot gases leaving these chambers do not meet the liquid to be heated until they reach the space containing the distributing elements or, at best, meet the liquid only a short distance beneath these elements. Consequently, the grid supporting the distributing elements, and the elements themselves, are subjected to rapid corrosion and scaling, caused by the extremely hot combustion products which may be at a temperature of the order of 1,000° C. Moreover, since the transfer of heat from the gases to the liquid takes place substantially within the space containing the distributing elements, this space must be quite large and takes up a great part of the column.

By the present invention there is provided heating apparatus including a combustion chamber having an opening in its underside, and an enclosed upper side, the combustion chamber enclosing a burner, there being provided means to distribute a liquid over the upper side of the combustion chamber, and means to collect the heated liquid beneath the chamber.

The combustion chamber may be positioned in a column, and the means to distribute the liquid may include a distributing element or elements positioned above the combustion chamber.

The burner may be aligned horizontally in the upper portion of the combustion chamber. The distributing means may include a distributing tray positioned above the distributing element or elements.

The sole FIGURE of the accompanying drawing, given only by way of example, diagrammatically shows in side elevation view one embodiment of the invention.

The apparatus comprises, in a column **1** of a circular or rectangular cross section a combustion chamber **2** which has the shape of a bell closed on top and arranged below a grid **3** which supports distributing elements occupying the space **4**. Above this space is arranged a tray **5** having a perforated bottom into which tray is connected a conduit **6** for feeding liquid to be heated. At the top of the column is provided a pipe **7** for evacuating the cooled combustion products towards the flue, and in the lower part of the column is provided a space **8** from which the liquid when heated is discharged via a conduit **9** towards the point of utilization. Near the top of the bell **2** is arranged a burner **10** in horizontal position to which burner fuel is fed through a conduit **11**, and combustion air from a blower **12**.

Liquid introduced through the conduit **6** spreads over the tray **5** and, leaving the latter through the perforated bottom is distributed over the whole cross section of the space **4** which contains the distributing elements. The liquid meets combustion products in the space **4**, in a countercurrent flow after the latter have already been cooled to a considerable extent. After having passed through the grid **3**, part of the finely dispersed liquid descends upon the bell **2**, thereafter to trickle down through the annular space **13** thus remaining constantly in direct contact with the combustion products which are rising through the annular space **13**. The hot liquid collects in the space **8** below the combustion chamber and leaves the column through the conduit **9**.

The combustion products produced in the bell **2** have a temperature of the order of 1,000° C. when they clear the lower border of the bell, and they do so with great turbulence. The

combustion products immediately start to surrender a large part of their heat to the liquid, both by radiation and by direct contact with the liquid descending in dispersed form, so that, at a point just above the lower part of the annular space **13**, the temperature of the combustion gases will have been reduced considerably, down to a point at which they no longer cause corrosion or scaling. Because of this abrupt drop in temperature, the volume of the gases is also reduced considerably, and this enables them to rise in the annular space and in the space comprising the distributing elements without carrying with them descending liquid.

For example, in a heater having a capacitor of 160,000 cal./h., and used for heating water that enters through the conduit **6** at 10° C. to a temperature of 90° C., it was found that the temperature in the annular space **13**, a little above the lower end of this space, was of the order of 60° C. The volume of the combustion products was therefore, reduced to about one-quarter of its original volume at 1,000° C., and this allows them to reach the flue through the pipe **7** after traversing spaces **13** and **4**, which have a comparatively reduced cross section In addition, the height of space **4** may also be reduced considerably. It was found that a height of about 43 centimeters is ample to achieve a final cooling of the combustion products in this space, to a temperature not more than 2° or 3° in excess of the temperature of the cold liquid entering by the conduit **6**. The resulting thermal efficiency of the apparatus is therefore, almost equivalent to theoretical.

As in all heaters of the above type, the hot liquid is corrosive because of its direct contact with the combustion products which latter contain acid anhydride substances. In many cases it may be of advantage to use the hot liquid which leaves the heater through conduit **9** as a primary liquid which surrenders its heat to a secondary liquid in a heat exchanger of corrosion resistant material and which reenters the heater in a closed circuit through conduit **6**. The secondary liquid would then serve for transmitting the heat to a point of utilization

It should be well understood that the invention is by no means limited to the embodiment described and illustrated here by way of example and modification thereto may not constitute a departure from the scope of the invention as defined in the appended claims.

I claim:

1. Heating apparatus comprising a vertical column, a combustion chamber in the lower half portion of said column defining an annular passageway therearound between the chamber and the column, said combustion chamber having a top and side walls which are closed, and a bottom which is open, burner means disposed horizontally the combustion chamber at the upper portion thereof to discharge hot gases into said upper portion which then travel downwardly through the open bottom of said chamber and then upwardly through said annular passageway towards the top of said column, inlet means at the top of the column for supply of a liquid to be heated, the liquid flowing downwardly from said inlet means towards the bottom of the column, distribution means below said inlet means and above said combustion chamber for distributing the liquid therein, said combustion gases flowing upwardly in the distribution means and contacting the downwardly flowing distributed liquid whereby heat exchange is effected therebetween, said liquid then flowing downwardly through said annular passageway for intense heating by contact with said combustion chamber and the combustion gases flowing upwardly in the annular passageway, and means at the bottom of the column for collecting the heated liquid below the combustion chamber and for discharging said liquid from the column said distribution means comprising a grid above said combustion chamber, distributing elements on said grid, and a distributing tray above said distributing elements.

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