

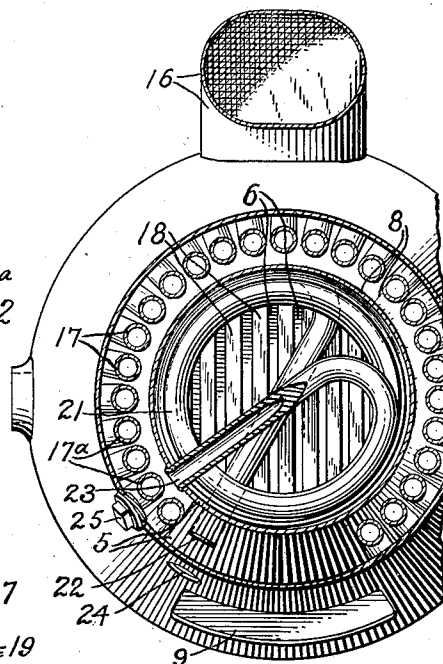
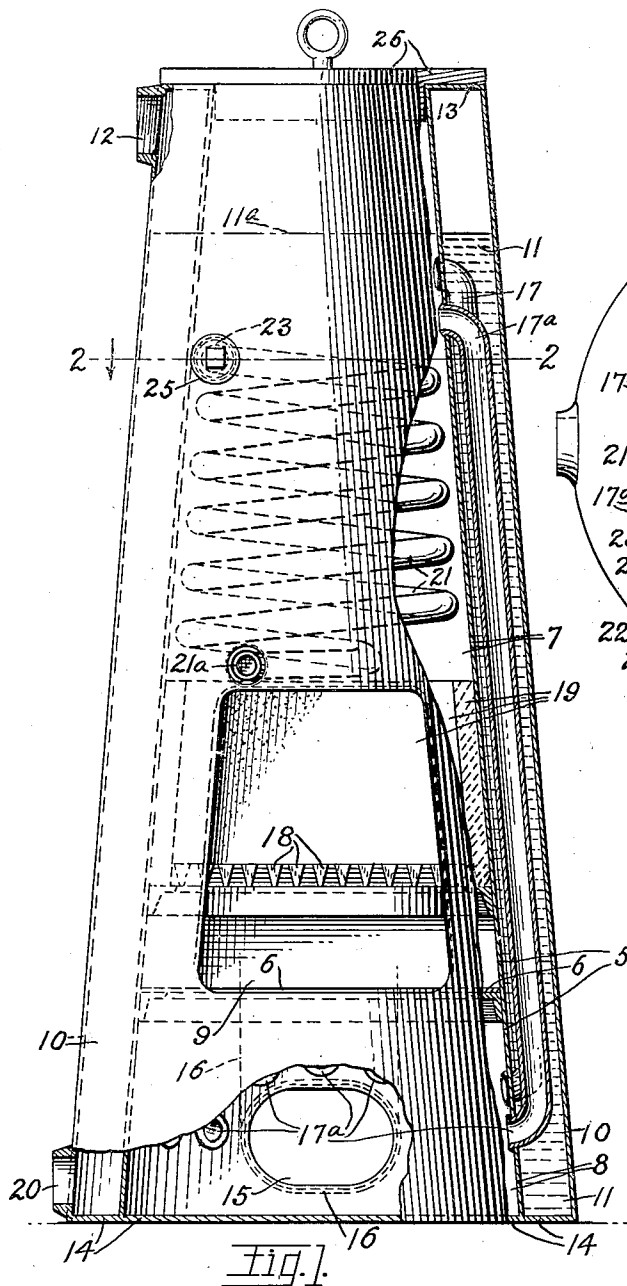
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DIRECT TOP STRATA-OF-LIQUID HEATER

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DIRECT TOP STRATA-OF-LIQUID HEATER

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7 Claims. (Cl. 122—182)

This invention relates to liquid heaters, and specifically, to a new type of heater which may be described briefly as an instantaneous vaporizer, or a direct top strata-of-liquid heater, this latter being given as the title to distinguish it from previously known heaters where the highest temperature of the heat-applying means is directed to the lower strata of liquid and where the whole volume of liquid must be heated before a steam or vapor attains a useful pressure on top of the liquid.

The main object or purpose of this invention is to direct the heat from the furnace or other heat-applying means immediately to the top strata of water or other liquid, so the heating and vaporizing or steam generating begins at the top, and such vapor or steam generating begins instantaneously or immediately upon heat arising from a fire or electric heater in the heating chamber.

Another object is to provide draft-producing means in open communication with a chamber under the imperforate bottom of the heating chamber, and to surround these chambers with an outer liquid-containing chamber into which the heat is conducted through a heat-conducting wall which is heat-insulated around its lower part so that the upper part only is initially heated so as to initially heat the upper strata of liquid, also to provide down-coming pipes in open communication with the heating chamber and with the chamber having the draft-producing means therein, so that the high-heated air or products of combustion pass direct from the heating chamber into the down-coming pipes which have their main parts in the liquid, and so the highest temperature in the down-coming pipes is at the tops of the latter and thereby supplements the high-heat that is conducted directly through the wall, the draft-producing means thus cooperating with the down-coming pipes by drawing the high-heated air or fluid downward through these pipes.

Another object is to further supplement the heat-conducting means, above described, by provision of a heat-conducting liquid-circulating coil in the heating chamber, over the heat-applying means, and in open communication with the liquid-containing chamber at relatively low and high points, so that the liquid is immediately heated by conduction through this coil, and so the highly heated liquid in the coil rises and is discharged into the liquid-containing chamber or outer container.

Another object is to provide, in a liquid heater or boiler, a liquid container that tapers from its

bottom to its top, so there is a gradual and considerable reduction of liquid per unit-depth from bottom to top, and so the heat applied at the top will more quickly generate steam or vapor than if more liquid were at the top; and further, to provide numerous and closely grouped down-coming fire-tubes or hot-fluid-conduits in the liquid container so as to displace a very considerable part of the liquid and present large heat-conducting surfaces against the liquid and thereby substantially immediately starting the top strata of liquid to vaporize while the lower strata of liquid is yet cold or relatively cool.

Another object is to connect the down-coming tubes with an air-cooling or fluid-cooling chamber (under the heat-applying means and non-communicating therewith except as through the down-coming tubes), this chamber being in open communication with the lower ends of the down-coming tubes, also in open communication with the draft-stack, and surrounded by the lower end of the liquid container, the latter having at its bottom an inlet for the relatively cold or cool liquid from a water-supply or other liquid-supply source; this correlation of features establishing and maintaining a heat-exchange which tends to cool the exhaust air or product of combustion before it enters the stack, and to pre-warm the water so as to effect maximum efficiency, while the draft-stack draws the heated air or combustion product from the heat-applying means down through the down-coming fire-tubes and into the heat-exchange receptacle or chamber.

Another object of the invention is to provide under and away from the fire-tubes, or heat-conducting and water-heating tubes, a wide and deep base-chamber which serves as an ample sump for accumulation of mud or other sediment that may settle in the water being heated, so the heat-conducting tubes are unencumbered by said sediment; and so the sediment can be cleaned out through the water inlet (at the bottom) when the inlet-pipe has been disconnected so as to gain access through said water inlet.

Another object is to provide this type of water-heater or boiler with water-heating tubes that are substantially vertical from end to end, so that there is substantially no horizontal or level part within the water-chamber or liquid container to accumulate sediment, except the level bottom of the base-chamber; so the maximum heating efficiency remains substantially unchanged.

Another object is to provide the heating chamber with an unfastened and easily removable cover that is normally held in place by gravity and by

suction of the draft-stack, and which, when removed, permits of easy access to the interior of the heating chamber, and therethrough to the fire-tubes, so access to the interior of the latter can be had for cleaning out carbon or other accumulations.

Other objects and important features are pointed out or implied in the following details of description, in connection with the accompanying drawing in which:

Fig. 1 is a view partly in front elevation and partly in central vertical section, some (but not all) of the invisible parts being shown in dotted lines; and

Fig. 2 is a horizontal sectional view taken along the line 2—2 of Fig. 1, the down-coming tubes being omitted, but their respective positions (at the sectional plane) being indicated by broken line circles.

Referring to the drawing in detail, in which, similar reference numerals refer to similar parts in the several views, the invention is described in detail as follows:

At 5, I show an inner upwardly tapered or converging wall or duplex receptacle, the same being in the form of a hollow truncated cone and provided with an imperforate partition 6 which divides it into an upper receptacle or container 7 and a lower receptacle or container 8. The upper container is provided with a door-way 9 which is normally closed by a door or doors (not shown) which may be hinged or otherwise secured in place by means not shown. This doorway also extends through an outer wall 10 which is spaced from the wall 8 to provide a water-chamber or liquid-container in which the liquid is indicated at 11, the top thereof being indicated by a broken line at 11a, and the space above the liquid being for steam or vapor which arises from the liquid and passes out through a port 12 which may be connected to a tubular connection (not shown) that may comprise a part of either a means for utilizing steam or hot vapor or hot water; and of course, when utilizing hot water, the water-level is raised so as to permit it to flow through the port 12. The upper and lower ends of the liquid-chamber are closed by plates 13 and 14, respectively; and the plate 14 also constitutes a floor or bottom of the lower container 8. This lower container has a draft-opening 15 in open communication with an elbow of a draft-stack or draft-producing means 16 that may extend up to any desired height so as to draw the warm air or combustion product from the container 8 which may also be termed a heat-exchange chamber, for a reason that is hereinafter shown.

The inner container 7 and lower container 8 have openings in which are fitted the upper and lower ends, respectively of numerous down-coming fire-tubes or water-heating pipes 17 and 17a the distinction between these pipes being in their location, viz., the pipes 17 being higher than the pipes 17a, so these pipes can be closely grouped without too closely grouping the holes through which their ends are fitted and secured. By thus closely grouping the down-coming tubes in the liquid 11, a large part of the liquid is displaced by the heat-conducting tubes, so the maximum efficiency is obtained in heating the water (or other liquid) in the minimum of time.

As one heat applying means, I show a coal-grate at 18, in the heating chamber or container 7; but it is to be understood that the heating is not confined to coal or to any kind of fuel, for an electric heater (not shown) may replace the heating

means here disclosed; but when fuel is used, its grate or other support is spaced above the imperforate bottom 6 to provide a proper draught through the doorway 9; and when an electric heater is used, it heats air that is drawn down through the tubes 17 and 17a and imparts heat to the liquid through conduction of these tubes. A refractory lining 19 is provided to insulate the heating chamber from the intermediate part of the liquid-chamber, so only the upper part of the latter exposes heat-conducting material to the heat that arises from the heat-applying means, and so the upper strata of water is initially and very quickly heated while the lower strata remains relatively cool, especially so because the inlet-port 20 supplies cold or cool liquid that passes around the heat-exchanging chamber 8; and, as the most of the heat is absorbed by the upper strata of liquid, a comparatively low temperature of the lower parts of the down-coming tubes imparts but little heat or warmth to the lower strata of the liquid; but the residue of heat from the bottoms of the down-coming tubes, entering the chamber 8, is conducted through the wall 5 into the relatively cold water or liquid, and thereby pre-warms the liquid, thus effecting maximum efficiency.

To provide a supplemental means for conducting heat from the heat-applying means to the liquid's upper strata, a pipe-coil 21 has its lower end over the heat-applying means and in open communication with the liquid container, as indicated at 22, while its upper end 23 is in open communication with the same liquid container at a higher level, so a circulation of the liquid through this coil is set up in consequence of the heat surrounding this coil, as in other liquid circulating devices, and the highly heated liquid from this coil is discharged at the top of the liquid, either as steam, vapor, gas or super-hot fluid.

Openings 24 are provided in the outer wall, opposite to the ends of the coil 21, and these openings are normally closed by plugs 25, only one of which is here shown. These openings permit the user to have access to the ends of the coil for any necessary purpose.

A cover 25 is seated on the primarily open upper end of the heating chamber, and is removable for permitting the user to have access to the interior of the heating chamber for any necessary purpose.

It is not my intention to limit my patent protection to the specific details of construction and arrangement or combination here shown and described, for the invention is susceptible of numerous changes within the scope of the inventive ideas disclosed.

What I claim as my invention is:

1. In a liquid heater, the combination of an inner container that comprises a heating chamber having heat-applying means therein and having an imperforate bottom or floor under and spaced from the heat-applying means, a second inner container under said heating chamber, means to draw exhaust fluid from said second container, an outer container having an upright wall surrounding said heating chamber and said second inner container and spaced therefrom to provide an outer chamber or liquid-chamber, and heat-conducting tubes having their main portions in said liquid-chamber so as to be surrounded by liquid in the latter while their upper ends are in open communication with the heating chamber at points above said heat-applying means and while

their lower ends are in open communication with said second inner container at points below said imperforate floor, whereby, as the draft-creating means draws fluid from said second or lower container, heated fluid from said heating chamber is drawn down through the liquid by means of said heat-conducting tubes and draft-creating means and thus imparts the heat of greatest intensity to the liquid in the upper part of said outer chamber and thereby heats the upper strata of liquid before heating the lower strata.

2. In a liquid heater, the combination of an inner container having heat-applying means therein and an imperforate floor under the heat-applying means, a second inner and lower container under said imperforate floor and provided with draft-creating means to draw exhaust fluid from said lower container, an outer container having an upwardly converging wall surrounding both the first and second said containers and spaced therefrom to provide an outer chamber for containing liquid and gradually diminishing the quantity of liquid per unit-depth from the bottom to the top of this outer chamber, and heat-conducting tubes having their main portions in said outer chamber so as to reduce the space for liquid therein while their upper ends are in open communication with the chamber that contains said heat-applying means and while their lower ends are in open communication with said lower container, for the purposes specified.

3. The combination defined by claim 2 the first said inner container having a heat-conducting wall that is tapered from its bottom to its top so as to compensate for contraction of the heated fluid as it rises from said heat-applying means and imparts its heat to the liquid through said heat-conducting wall.

4. The combination defined by claim 1, and a liquid-conducting coil which is also heat-conducting and disposed in the heating chamber above said heat-applying means and having one end in open communication with the liquid-chamber at a point near said heat-applying means and having its other end in open communication with said liquid-chamber at a point considerably above the first said end, whereby, liquid is heated and passes into the upper part of the liquid-chamber from said coil, for purposes specified.

5. The combination defined by claim 2, and a liquid-conducting coil which is also a heat-conducting coil and disposed in the heating chamber above said heat-applying means and having one

end in open communication with said liquid-chamber at a point near said heating means and having its other end in open communication with said liquid-chamber at a point considerably above the first said end, whereby, liquid is heated and passes into the upper part of the liquid-chamber from said coil, for the purposes specified.

6. The combination defined by claim 1, said outer container being provided with liquid-supplying means to conduct liquid into its lower end where it surrounds said second or lower container, whereby, the influx of liquid tends to cool the fluid before it is drawn from this lower chamber, and whereby, the residue of heat from the fluid-conducting tubes pre-warms the inflowing liquid.

7. In a liquid heater, the combination of an inner container that comprises a heating chamber having a heat-applying means therein and having an imperforate bottom or floor under and spaced from the heat applying means, a second inner container under said heating chamber, means to draw exhaust fluid from said second container, an outer container having an upright wall surrounding said heating chamber and said second inner container and spaced therefrom to provide an outer chamber or liquid-chamber, and heat-conducting tubes having their main portions in said liquid chamber so as to be surrounded by liquid in the latter while their upper ends are in open communication with said second inner container at points below said imperforate floor, whereby, as the draft-creating means draws fluid from said second or lower container, heated fluid from said heating chamber is drawn through the liquid by means of said heat-conducting tubes and draft-creating means and thus imparts the heat of greatest intensity to the liquid in the upper part of said outer chamber and thereby heats the upper strata of liquid before heating the lower strata, said outer container being provided with liquid-supplying means to conduct liquid into the lower end where it surrounds said second or lower container, whereby, the influx of liquid tends to cool the fluid before it is drawn from this lower chamber, and whereby, the residue of heat from the fluid-conducting tubes pre-warms the inflowing liquid, said liquid-chamber being provided with an outlet port that is adapted to connect with the said liquid supplying means through any appropriate tubular means, or at will of the user, to connect with any appropriate means for utilizing steam or vapor from the liquid-chamber.

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