HEAT-EXCHANGE EVAPORATOR APPARATUS

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Application November 24, 1953, Serial No. 394,121

Claims priority, application France November 24, 1952
5 Claims. (Cl. 122—33)

The present invention relates to heat-exchange-evaporator apparatus, that is to say apparatus adapted to generate steam or the vapour of some other liquid by the use of a heating medium (intermediate fluid) delivered from some suitable type of heat generator.

It is the object of the invention to provide exchange-evaporator apparatus wherein the liquid to be evaporated (usually water) is propelled through the apparatus with a high flow velocity along or across tubes conveying the heating fluid, without requiring the costly production of any external force to produce the displacement of the liquid.

It is another object of the invention to provide exchange-evaporator apparatus wherein the exchange of heat between the heater fluid and the liquid to be vaporized will be highly uniform, and one which will instantaneously generate dry vapour at high pressures at a controllable rate.

A further object of the invention is the provision of an exchange-evaporator unit all the external components of which may be readily dismantled in order to uncover both ends of the tubing circulating the heater fluid and the liquid to be vaporized, for purposes of cleaning and repair and other servicing operations.

The above and further objects, features and advantages of the invention will appear from the ensuing description made with reference to the accompanying drawings, given by way of illustration but not of limitation, wherein:

Fig. 1 is a view partly in elevation and partly in vertical section illustrating one practical embodiment of the invention; and

Fig. 2 is a cross section on the line 2—2 of Fig. 1.

The apparatus shown comprises a vertically extending central tube 1 for the intake of heater fluid, said tube being provided at its lower or inlet end with a flange 2 or other suitable connector and having its upper end sealed with an end plate 3 preferably though not necessarily of the domed construction shown. Mounted within tube 1 are a plurality of tubes 4 (Fig. 2) the upper ends of which project through end plate 3 and are secured thereto as by welding or expansion. The lower ends of tubes 4 extend through the wall of the tube 1 and are secured thereto as by welding or expansion, and project into an outlet chamber 5 provided with a connector flange 6. The tubes 4 have their lower ends above the point where they are led out through the tube wall of tube 1, formed with expansion bends as illustrated at 7.

The tube 1 adjacent its top is formed with apertures 8 for connection therewith of corresponding tubes 9. The tubes 9 extend vertically downwards and have their lower ends projecting through an annular plate 10 into a chamber 11 having a number of apertures such as 12 formed in its wall for connection through headers 13 to a discharge conduit 14.

The chamber 11 comprises the space defined between annular plate 10 in which the lower ends of tubes 9 are secured through any suitable means capable of providing a good seal, and a removably mounted plate 15 secured as by bolts (not shown) over the flange 16 of a skirt portion 17 extending downwardly from an outer under-flange 18, said under-flange being bolted to an upper flange 19 formed at the base of a bell member or casing 20. Retained between flanges 18 and 19 is the annular plate 10. As shown, the removable plate 15 is likewise bolted to the lower surface of a flange 21 extending around the lower end of a smaller skirt 22 surrounding and welded to the tubular body 1 for receiving purposes.

The fixed bell-member 20 is fitted with a steam pressure-gauge connection 23 and two water-level connections 24.

The liquid to be vaporized, e. g. water, enters through a conduit 25 provided with a connector flange 26 at its lower end, the conduit 25 extending upwards into the tubular body 1 and having its upper end led out through the wall of said body just above the annular plate 10. The outer upper end of conduit 25 opens into a movable bell member 27 surrounding the tubes 9, the vertical dimension of the movable bell 27 being so predetermined that, when said bell is allowed to rest through suitable bosses or the like such as 28 depending from its upper end surface, upon the end or top plate 3 of tubular body 1, a gap 29 will be present between the lower end of the bell 27 and the upper surface of annular plate 10, to provide communication between the interior of the movable bell and the annular space 11 present between the fixed bell 20 and the movable bell 27. It should be noted however that the bell member 27 is provided with a baffle plate 30 adjacent the outlet opening of conduit 25 in order to eliminate the effect of back pressure created by the discharge of liquid out of conduit 25 and prevent said liquid from flowing directly into the annular space 11. The bell member 27 at its upper end is formed with pressure-equalizing apertures 33 for equalizing the steam pressures in the two bell members 20 and 27.

The interior of movable bell member 27 further communicates with the space 31 through apertures 34 formed slightly below the level of the lower one of the water-level take-off connections 24.

To facilitate assembly, the annular plate 10 may be provided with securing lugs 35 projecting radially beyond the flanges 18 and 19.

As already stated, the heating fluid is delivered into the apparatus through tube 1, while the liquid (e. g. water) to be vaporized is delivered through the conduit 25, and the apparatus operates as follows:

The heater fluid rises through tube 1, issues out of the tube through the apertures 8 and flows back through tubes 9 into chamber 11, whence it is returned to the heat generator through the apertures 12, headers 13 and discharge pipe 14.

The water entering through conduit 25 issues out therefrom above the level or annular plate 19 into the space defined between tube 1 and movable bell 27 which space houses the tubes 9. The bubbles of steam formed in the water on contact thereof with the surface of tubes 9 rise and carry the water up with them, so that the water level in movable bell 27 will be higher than that in fixed bell 20, i. e. within the space 31 defined between the two bells. In this way a circulation is created with the water flowing downwards through space 31 and upwards through space 29. Such circulation is made possible owing to the presence of the space 29 and of the apertures 34. It is to be noted that the arrangement described, in that it increases the counter-flow velocity of the water, results in an increase of the thermal exchange factor.

The steam separating from the liquid water at the free surface of the latter rises up into the top of the bell 27 while still remaining in contact with the tubular body 1 and tubes 9 which are hotter than the steam, and then flows down through the tubes 4 surrounded by the heater.
2,820,487

fluid which is hotter than the steam generated, and thereupon passes into the steam outlet chamber 5 whence it is discharged for utilization.

In order to limit the upward rise of the movable bell 27, the outer or fixed bell is provided with a limiting stop or boss 36.

It will be understood that various modifications may be made in the structural details disclosed without exceeding the scope of the present invention.

What I claim is:

1. In liquid vaporizing apparatus, an outer vertical container having a sealed base and top, an inner vertical container with walls spaced from the walls of the outer container and defining an annular space therewith, a tubular member extending through said base upwards into said inner container and having a top adjacent and spaced from the top of said inner container, means for connecting the lower end of said tubular member with a source of heater fluid, a plurality of tubes connecting with said tubular member adjacent the top thereof and extending downwardly in the inner container and through said base for discharging heater fluid out of said tubular member back to said source, inlet means for said liquid opening into a lowermost point of said inner container adjacent said tubes, aperture means in the inner container wall at the base thereof and at an intermediate level thereof for permitting a continuous circulation of said liquid up within the inner container and down through said annular space and back into the inner container, means for discharging vapour of said fluid from the top of said inner container said inner container comprising a bell member vertically movable within the outer container, and cooperating stop means on the top end wall of said bell member and on the top surfaces of said outer container and said tubular member for limiting the vertical displacements of said bell member to a predetermined limited amount.

2. In a liquid vaporizing apparatus, in combination, a casing including a stationary bell and a bottom, a vertical tubular body for conducting a heating medium disposed in said casing and extending through said bottom to the exterior of said casing, inflow means for said heating medium connected to said vertical tubular body, a movable bell suspended in said casing and defining on its interior with the external surface of said tubular body an inner space and defining on its exterior with the internal surface of said stationary bell an outer space, a plurality of tubes for conducting the heating medium arranged outside said tubular body in said inner space, each tube connected with its upper end of said body and intercommunicating with said body whereby in said tubes the heating medium will flow downwardly and each tube being with its other end sealed in said bottom, said movable bell including a wall having apertures establishing a communication between said inner and outer spaces, said inner and outer spaces holding liquid to be heated flowing downwardly in said outer space, and flowing upwardly in said inner space within said movable bell heated by said tubes and generating vapor and collecting the vapor in the top part inside said movable bell, and a conduit opening into said top part of said movable bell and operable for conducting the vapor from said movable bell.

3. An apparatus as claimed in claim 2, a baffle plate arranged at the lower end of said movable bell, said baffle plate restricting near said lower end intercommunication between said inner and outer spaces thereby restraining the liquid from directly entering said outer space between said movable and stationary bells.

4. An apparatus as claimed in claim 2, said aperture arranged in said wall of said movable bell being arranged below the lower liquid level in the apparatus.

5. An apparatus as claimed in claim 2, said conduit being arranged within said tubular body carrying said heating medium.

References Cited in the file of this patent

UNITED STATES PATENTS

1,948,539 Nosack ----------------- Feb. 27, 1934
1,993,674 Larsen ------------------ Mar. 5, 1935
2,229,554 Cummings ---------------- Jan. 21, 1941
2,291,872 Brantly ------------------ Aug. 4, 1942