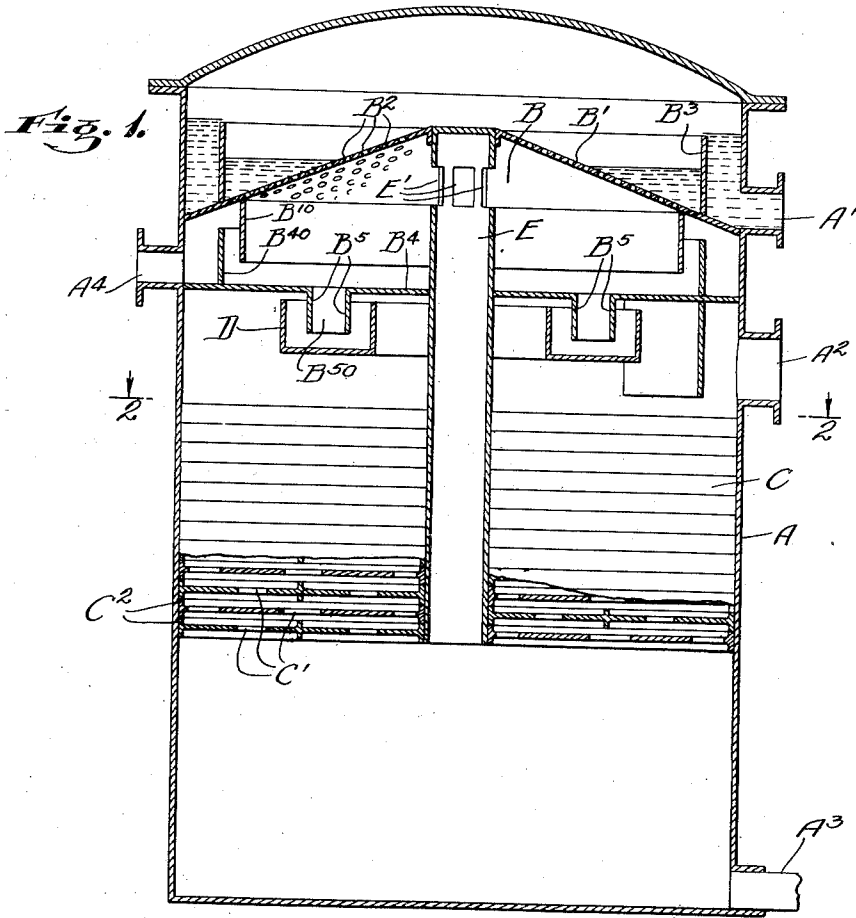
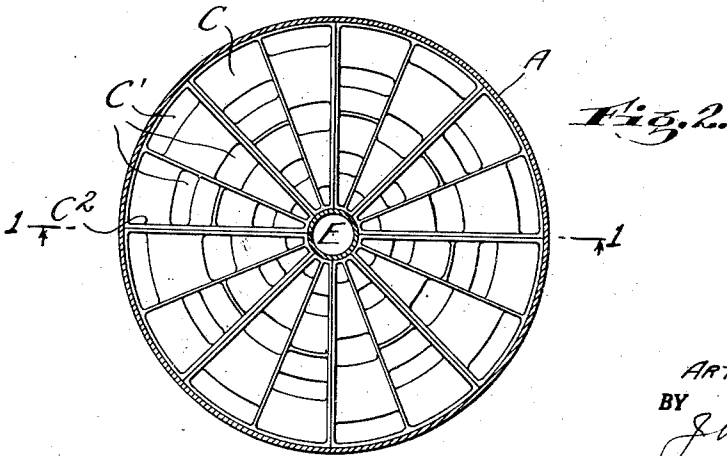


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DEAERATING APPARATUS
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DEAERATING APPARATUS

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1 Claim. (Cl. 183—2.5)

The general object of the present invention is to provide improved means for heating and deaerating or degasifying water, by exposing the latter to contact with steam. A more specific object of my invention is to improve, and in particular to increase the capacity, of water heating and deaerating apparatus of the type in which the water, after first being heated approximately to the temperature of the steam, is passed downward over deaerating trays arranged in a tray stack comprising passages for the flow of steam which contacts with the water passing down over the trays and completes its deaeration.

Heretofore, in apparatus of said type, the steam flow passages through the stack of deaerating trays and the means for producing the steam flow therethrough, have been of such character as to make the steam flow counter to, or crosswise of, the water flow. In distinction from such prior apparatus, the present invention is characterized by the provision of means for causing a steam flow parallel to the water flow through the ports and flow passages of the stack of deaerating trays.

By making the direction of steam flow through the deaerating tray stack parallel to, instead of counter to, or crosswise of, the water flow, I obtain the advantage that the steam flow assists, instead of bucking or deflecting the water flow. In consequence, with the parallel flow of steam and water, the steam flow does not interfere with the proper distribution of the water flow, or tend to produce the local concentrations of water which are experienced when the steam flow is counter to, or crosswise of the water flow.

The improved distribution of water flow which the invention thus makes possible, reduces the amount of deaerating tray surface required for a given deaerating effect and permits of a closer spacing of the deaerating trays than is otherwise possible, and thereby increases the amount of water which can be subjected to a given deaerating effect in its passage through a deaerating tray stack of given volume.

The flow of the steam in parallel with rather than counter to, or crosswise of the water flow through the deaerating tray stack, involves no significant reduction in the scrubbing action of the steam on the water, since in practice the steam velocity in any event is so much higher than the water velocity, that the latter can be disregarded from this point of view. While with the parallel flow of steam and water, all the air liberated from the water in its passage over the deaerating trays, is in admixture with the steam in contact with the water at the bottom of the tray stack, the amount of air thus admixed with the steam is so relatively small as not to significantly diminish the capacity of the steam to effect the degree of deaeration required in practice in such apparatus. By passing the steam which has passed

through the deaerating tray stack, into contact with the water passing through the water preheating means and thereby preheating the water approximately to the temperature of the steam, I retain the advantage, characteristic of the prior type of apparatus referred to, of reducing to a practical minimum the amount of steam which must be vented from the apparatus to carry off the air liberated in the preheating means and in the passage of the water over the deaerating trays, while at the same time insuring a large volume of steam flow over the deaerating trays.

The various features of novelty which characterize my invention are pointed out with particularity in the claim annexed to and forming a part of this specification. For a better understanding of my invention, however, and the advantages possessed by it, reference should be had to the accompanying drawing and descriptive matter, in which I have illustrated and described preferred forms of my invention.

Of the drawing:

Fig. 1 is an elevation in section on the line 1—1 of Fig. 2; and

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

In the embodiment of my invention illustrated in the drawing, A represents the tank or shell of a deaerating water heater formed with a water inlet A', a steam inlet A², an outlet A³ for the treated water, and a vent A⁴, for the discharge of the vent mixture including the air separated from the water in the deaerating heater and the steam supplied to, but not condensed therein.

The water entering the heater through the inlet A', is initially heated in the upper portion of the tank A, by suitable heating means. The heating means shown comprises a heating chamber B through which the water is passed, and from which it is discharged onto a stack or bank of deaerating trays C. As shown, the top wall B' of the heating chamber B is conical, and is formed with perforations B² through which the water drips or rains down into the chamber B. An uprising flange B³ surrounds the perforated portion of the latter, and is spaced away from the surrounding portion of the wall of the tank A to provide a water distributing channel receiving water through the inlet A', and from which the water flows over the top of the flange B³ onto the perforated portion of the wall B'. The flange B³ thus forms a means for distributing the water supplied through the inlet A' over the plate B'.

The bottom wall B⁴ of the chamber B is formed with a water outlet B⁵⁰, and with depending flanges B⁵ at the margin of the outlet. The flanges B⁵ extend downward into a trough D over the inner and outer edges of which the water overflows onto the trays C. The trough

D and flanges B⁵ provide a water seal effective to prevent air or steam flow through the water outlet B⁵⁰. The vent A⁴ opens from the chamber B, and overlapping baffles B¹⁰ and B⁴⁰ carried by the top and bottom walls B' and B⁴, respectively, of the chamber B, may be provided as shown, to distribute the flow of the vent mixture out of the chamber B proper, and to reduce the tendency of that vent mixture to carry with it objectionable amounts of entrained water.

As shown, tank A is circular in horizontal cross section, though, as those skilled in the art will understand, that shape is not essential, and the tank might be square or oblong in cross section. When the tank is circular, as shown, the trays C are advantageously of sector-like shape. As shown, each tray C comprises a horizontally disposed plate-like body formed with distributed ports C' for the downflow of water and steam, and with vertical projections C² which space the body portions of the trays of one tier or level away from the corresponding plate-like bodies of the trays C of the adjacent tiers or levels. Preferably, the ports C' in each tray section at any intermediate tray stack level, are staggered with respect to the corresponding parts in the tray sections immediately below and above.

The steam admitted through the inlet A² to the space within the tank between the chamber B and the stack of trays C, passes downward through the ports C' in the trays to the underside of the tray stack. The steam thus coming to the space in the tank below the tray C, along with any air liberated from the water in its passage over the trays C, is passed into the heating chamber B through a conduit E. As shown, the conduit E is centrally disposed in the tank E and is open at its lower end and closed at its upper end. In its upper portion, however, the conduit E is formed with discharge ports E', through which the steam and air rising through the conduit E pass radially outward into the chamber B.

In practice, a deaerating water heater of the type shown is ordinarily provided with means responsive to the water level in the lower portion of the tank A for regulating the supply of water through the inlet A' and with overflow provisions, which need not be illustrated or described, as such features are well known in the art and constitute no part of the present invention. In practice, also a vent condenser will ordinarily be employed to receive the discharge through the vent A⁴ in order, as is customary in the art, to recover available heat from the vent mixture and to reduce the load on the air pump or other air exhaust device necessarily acting on the outlet A⁴ when the vapor pressure within the chamber B does not exceed the pressure of the atmosphere.

In operation the water entering the heating and deaerating tank A of the inlet A' is heated to, or nearly to, the temperature of the steam by the water heating means in the upper portion of the tank, shown as comprising the chamber B in which the streams of water entering the orifices B' come into contact with the vapor mixture entering the chamber B through the conduit E. The water passing out of the chamber B is distributed by the trough D onto the top of the stack of trays C, and passes downward through the flow passages formed by the tray ports C' and the spaces between the tray bodies. The retardation of the water down-

flow by the trays and the water spreading action of the latter insure a desirable extent and intimacy of contact with the water by the steam supplied through the inlet A² and passing through the same tray ports and spaces between the superposed tray bodies to which the down-flowing water passes.

Such portion of the steam supplied through the port A² will be condensed and give up its heat to the water as may be necessary to bring the water to the full temperature of the steam before the water leaves the bottom of the tray stack. The steam not condensed by contact with the water along with the air liberated from the water passing over the trays C, after leaving the tray bank passes through the conduit E and ports E' into the chamber B, wherein the major portion of the entering steam is condensed and gives up its heat to the water passing through that chamber. The uncondensed residue of the steam, along with all of the liberated air entering the chamber in admixture with the steam coming to the chamber B, escapes through the vent A⁴.

The passage of water to be heated and deaerated and the steam for heating and deaerating it in the same direction through the same flow passages in a deaerating tray stack possesses decided advantages over a counterflow of steam and water through the same passages, or over a flow of the steam through the intertray spaces in a general direction crosswise to the water flow, in that with the parallel flow of the steam and water, the steam does not have the tendency to interfere with the proper water distribution. When the steam flows counter to the water it tends to retard and thereby to thicken the streams of water flow and tends to sweep the water along with it, and thus results in undesirable concentrations of the water in localized portions of the apparatus.

While in accordance with the provisions of the statutes, I have illustrated and described the best forms of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the forms of the apparatus disclosed without departing from the spirit of my invention, as set forth in the appended claim, and that certain features of my invention may sometimes be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim and desire to secure by Letters Patent, is:

Water heating and deaerating apparatus comprising in combination, means for preheating the water, a stack of deaerating trays receiving preheated water from said means and through which said water flows in broken and divided streams, means for causing steam to flow through said tray stack with a direction of flow therein generally parallel to that of the water flow through said stack, said trays providing flow paths dividing the steam and water flow through the stack into divided downflow streams in each of which the steam comes into close contact with the water, means for passing the steam which has passed through said tray stack, into contact with the water passing through said preheating means to thereby preheat the water, and means for discharging uncondensed steam and liberated air from said preheating means.

ARTHUR E. KITTREDGE.