

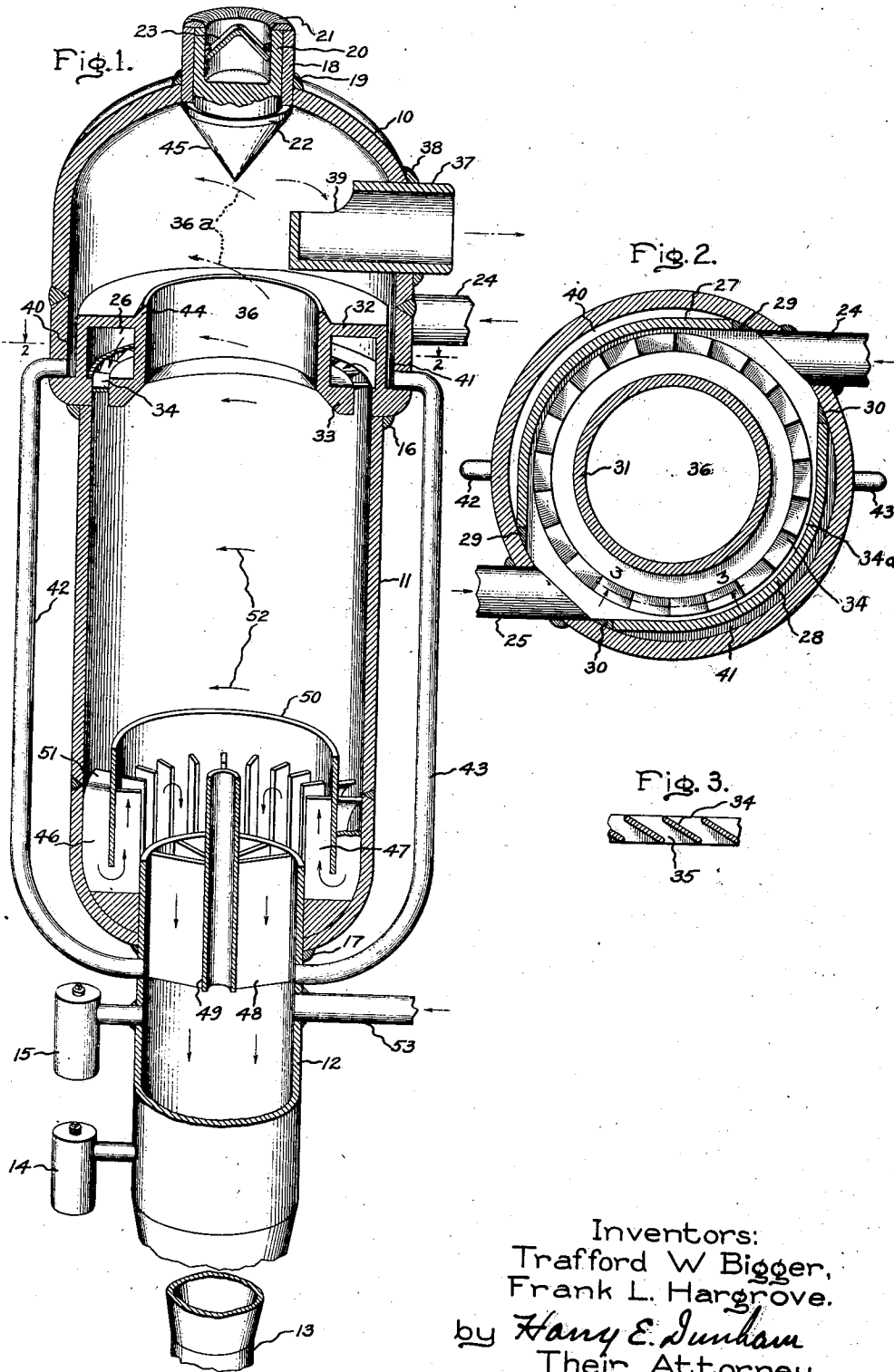
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BOILER DRUM

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BOILER DRUM

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1 Claim. (Cl. 183—83)

The present invention relates to boiler drums for receiving heated liquid or liquid and vapor mixtures and effecting partial conversion of the liquid into vapor and separation of the vapor thus formed from the remaining liquid. Such drums are used in connection with forced circulation and flash-type boilers in which liquid is heated within heating elements at pressures high enough to prevent evaporation of the liquid within these elements. The liquid is discharged from such heating elements into a drum at reduced pressure whereby it is at least partly converted into vapor, the vapor being discharged from the drum to a consumer and the remaining liquid being recirculated through the heating elements.

The object of the invention is to provide an improved construction of boiler drums of the type above specified to attain a better separation of liquid from vapor. Complete separation of liquid particles from the vapor to be discharged from the drum is important, especially in connection with boilers such as mercury boilers using operating liquids other than water because liquid particles entrained in the vapor are injurious when impinging on machine elements, for instance the blading of a mercury vapor turbine.

For a consideration of what we believe to be novel and our invention, attention is directed to the following description and the claim appended thereto in connection with the accompanying drawing.

In the drawing, Fig. 1 represents a front view of a mercury boiler drum embodying our invention; Fig. 2 is a section along the line 2—2 of Fig. 1; and Fig. 3 is a section along the line 3—3 of Fig. 2.

The mercury boiler drum comprises an outer body having an upper portion or dome 10, an intermediate cylindrical portion 11 and a lower portion 12. The upper portion 10 is larger in diameter than the intermediate portion 11, whereas the lower portion 12 is considerably smaller in diameter than the intermediate portion. In the present example the lower portion 12 has a diameter of the order of about one-half of the diameter of the intermediate portion 11 and the lower end of the lower portion 12 is tapered downward, ending in a conduit connection 13 from which liquid is discharged from the drum and conducted to a heating element, not shown. The small diameter and the tapering of the lower portion 12 reduce the liquid space therein to a minimum. This is desirable in mercury boilers due to the high cost of mercury. A definite liquid level is normally maintained in the lower

portion 12. To this end it is connected to chambers 14 and 15 forming parts of a level-indicating device, not shown, the level being normally maintained at a point intermediate the connections to the chambers 14 and 15. The dome 10 is secured to the intermediate portion 11 by a weld 16, and the intermediate portion 11 and the lower portion 12 are united by another weld 17. The dome 10 has a central opening closed by means of a ring 18 secured to the dome by a weld 19 and a cylinder member 20 disposed within the ring 18 and secured thereto at its upper end by a weld 21. The cylinder 20 has a flanged bottom 22 engaging the lower end of the sleeve 18. This arrangement permits access to the interior of the drum for the purpose of inspection after removal of the weld 21 and lowering of the cylinder member 20. During lowering, the cylinder member 20 may be held by means including a handle 23 secured to the interior of the member 20. The liquid to be converted into vapor is conducted to the drum by means of two conduits 24 and 25 connected to diametrically opposite points of the dome. The liquid thus conducted to the dome is received by an annular inlet chamber 26 having an outer wall formed by two curved sheets or walls 27 and 28 secured to the drum by welds 29 and 30 respectively. The chamber 26 has an inner cylindrical wall 31 connected to the outer wall 27, 28 by a top 32 and a bottom 33. The bottom 33 includes an annular row of partitions 34 forming a plurality of nozzles 35 through which liquid is discharged from the chamber 26 into the space defined by the intermediate drum portion 11. The conduits 24, 25 discharge tangentially towards the inner surfaces of the curved sheets 27 and 28 so that the liquid discharged from the conduits assumes at once a circular path within the chamber 26. The outer edges of the partitions 34 are spaced from the inner surfaces of the curved walls 27 and 28 of the inlet chamber 26 to form a continuous space 34a for receiving liquid from the inlet conduits 24 and 25 and for facilitating distribution of the liquid to the nozzles 35. The body of liquid contained in said space 34a also acts as a cushion to absorb some of the impact energy of the liquid entering the chamber through the inlet conduits 24 and 25. The liquid is discharged from the chamber 26, as stated above, through the row of nozzles 35 which are arranged so as to cause the liquid to follow a helical path downward along the inner surface of the intermediate portion 11. The length of the helical path is preferably a multiple of 360 angular degrees. The liquid is at least

partly evaporated on its path through the intermediate portion 11. The greater inertia of the liquid and the action of centrifugal force acting thereon cause the liquid to form a spinning cylindrical sheath or boundary layer on the surface of the intermediate portion 11, thereby forcing the vapor inward, that is, towards the central portion of the space within the intermediate drum portion 11, whence the vapor is discharged in the direction of the arrows 36a through the opening 36 defined by the inner surface of the wall 31. The vapor is conducted to a consumer, not shown, by a conduit 37 secured to the dome 10 by a weld 38 and communicating with a space within the dome through an opening 39 in an upper end portion of the conduit 37. Liquid particles remaining entrained in the vapor are substantially removed in the dome 10 as such particles impinge on the surface of the drum. This liquid is collected within grooves 40 and 41 defined between the wall of the drum and the curved sheets 27 and 28. These grooves communicate with the lower drum portion 12 by conduits 42 and 43 respectively. The provision of a separate path for conducting liquid from the dome 10 to the lower drum portion 12 is important in that it prevents liquid once separated from the vapor in the dome from again becoming mixed with the vapor. To this end, ring member 31 has an upper projection 44 so that any liquid dropping onto the top of the chamber 26 is prevented from flowing into the opening 36 and becoming entrained in the vapor flowing therethrough. To the same end, the flanged bottom 22 of the cylinder member 20 is provided with a cone-shaped surface 5. Liquid particles entrained in the vapor and impinging the surface 45 are deflected laterally to be collected in the grooves 40 and 41.

In order to permit proper level control in the lower portion 12 it is desirable to maintain a quiet liquid pool therein. Such quiet pool also assures proper level-indication. This is accomplished in accordance with our invention by the provision of means for destroying the velocity energy of the liquid in the lower space of the intermediate drum portion 11 and directing the liquid in a smooth, gentle path into the lower drum portion 12. These means form a zig-zag path for the liquid and as shown in the present instance comprise three rows of blades 46, 47, and 48. The last row of blades 48 is disposed within the upper end of the lower drum portion 12 which upper end projects into the lower end of the intermediate drum portion 11. The inner edges of the blades 48 are secured to a pipe 49 which acts as a stiffener for the blades and also as a vent, permitting vapor to be conducted from the lower drum portion 12 to the intermediate drum portion 11. The second row of blades 47 is disposed between the outer surface of the extension of the lower drum portion 12 and the inner surface of a cylindrical element 50. The first row of blades 46 is located between the outer surface of the cylindrical element 50 and the inner surface of the intermediate drum portion 11. The upper portions 51 of the first row of blades 46 are bent in the direction of flow of liquid, as indicated by arrows 52, to reduce the

impact of the liquid on the blade portions 51. The lower portions of the blades 46 are vertical. Thus, the first row of blades changes the spiral paths of the liquid into a vertical, downwardly directed path. The blades 47 and 48 are vertically arranged to further straighten and quiet the flow so that liquid discharged from the lower ends between the blades 46 is forced upward in a vertical path defined between the blades 47, whence it is discharged therefrom to flow downward through the vertical passages defined between adjacent blades 48. Thus, the three rows of blades form a zig-zag path through which the liquid flows on its passage from the intermediate drum to the pool in the lower drum portion 12. The zig-zag path is of considerable length and thereby straightens and quiets the flow of the liquid, causing the liquid to flow gently into the pool within the lower drum portion 12 without causing therein substantial disturbances of the level. The lower drum portion 12 is also connected to a conduit 53 through which liquid may be conducted to the drum, for instance, from a mercury condenser, not shown.

Having described the method of operation of our invention, together with the apparatus which we now consider to represent the best embodiment thereof, we desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What we claim as new and desire to secure by Letters Patent of the United States is:

A boiler drum including the combination of a cylindrically shaped vertically disposed drum having an upper portion, an intermediate portion and a lower portion, the diameter of the intermediate portion being smaller than that of the upper but considerably larger than that of the lower portion, an annular chamber formed within and supported on the upper portion, conduit means for conducting heated liquid to the chamber, the chamber having a bottom with a ring of nozzles for discharging fluid into the intermediate portion and for causing the fluid to flow in a helical path along the surface of the intermediate portion whereby the liquid by the action of centrifugal force is forced outward forming a layer on the surface of the intermediate portion and causing the vapor to be forced radially inward, means including a vapor discharge conduit connected to the upper drum portion and a central opening formed by the annular chamber for conducting vapor from the intermediate portion through the upper portion to a consumer, means disposed in the lower end of the intermediate portion and including an extension of the lower portion projecting into the intermediate portion and a plurality of rows of blades for directing the liquid in a vertical path into the lower portion, and means for conducting liquid particles separated from the vapor in the upper portion into the lower portion comprising grooves formed between the chamber and the wall of the upper portion and conduits between the grooves and the lower portion.

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