United States Patent

[11] 3,590,786

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[21] Appl. No. **12,296**

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[54] **ROTARY BOILER**
17 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **122/11**

[51] **Int. Cl.** **F22b 5/00**

[50] **Field of Search** 122/11, 12

[56] **References Cited**

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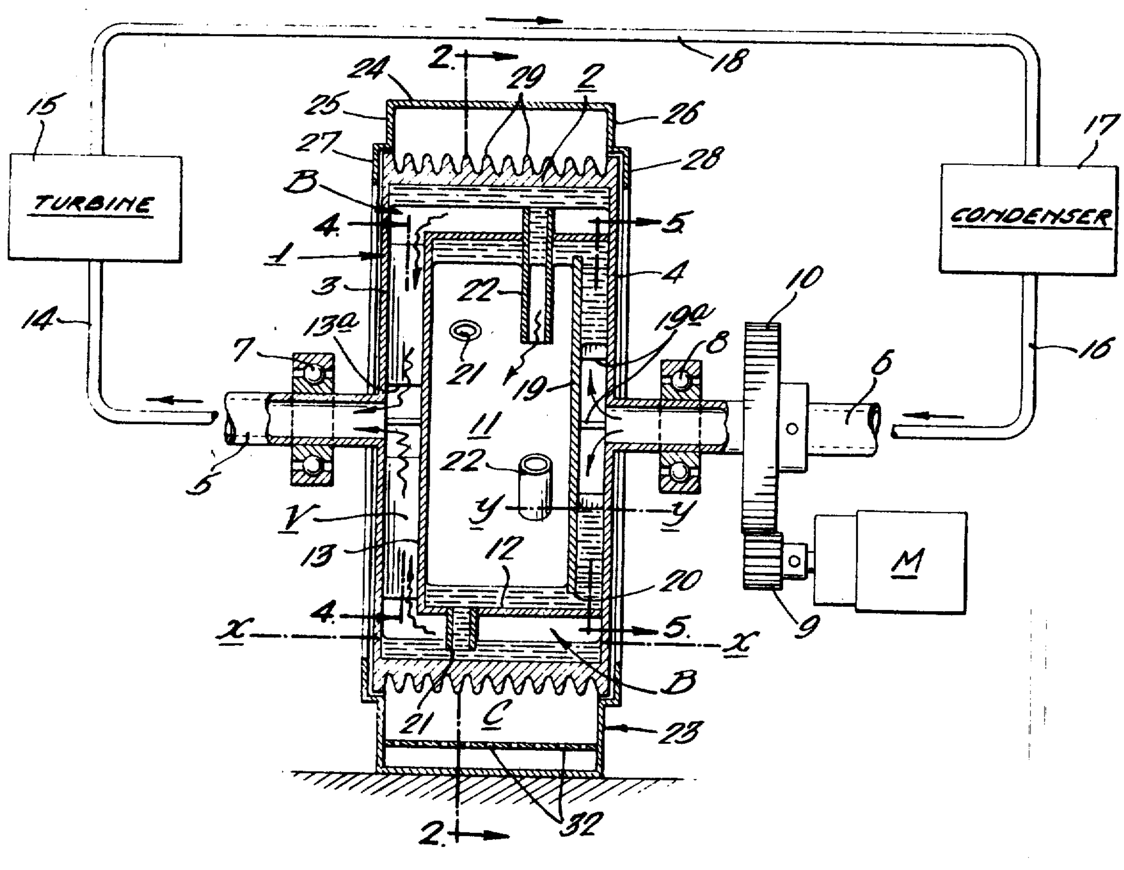
ABSTRACT: A rotary boiler comprising an outer annular boiler chamber and an inner cylindrical liquid supply chamber coaxially arranged to rotate together about a common axis. The boiler is rotated at a predetermined speed to maintain an annular body of liquid of uniform radial depth circumferentially about the inner peripheral surface of the boiler chamber and a similar annular body of liquid in the supply chamber. Radially extending feed conduits are provided to supply liquid from the inner chamber to the boiler chamber. Liquid flow through the feed conduits from the supply chamber to the boiler chamber is controlled by radially extending sensor conduits that interconnect said chambers and function in cooperation with the feed conduits automatically to maintain the radial depth of the annular body of liquid in the boiler chamber at the desired predetermined level during operation of the boiler.



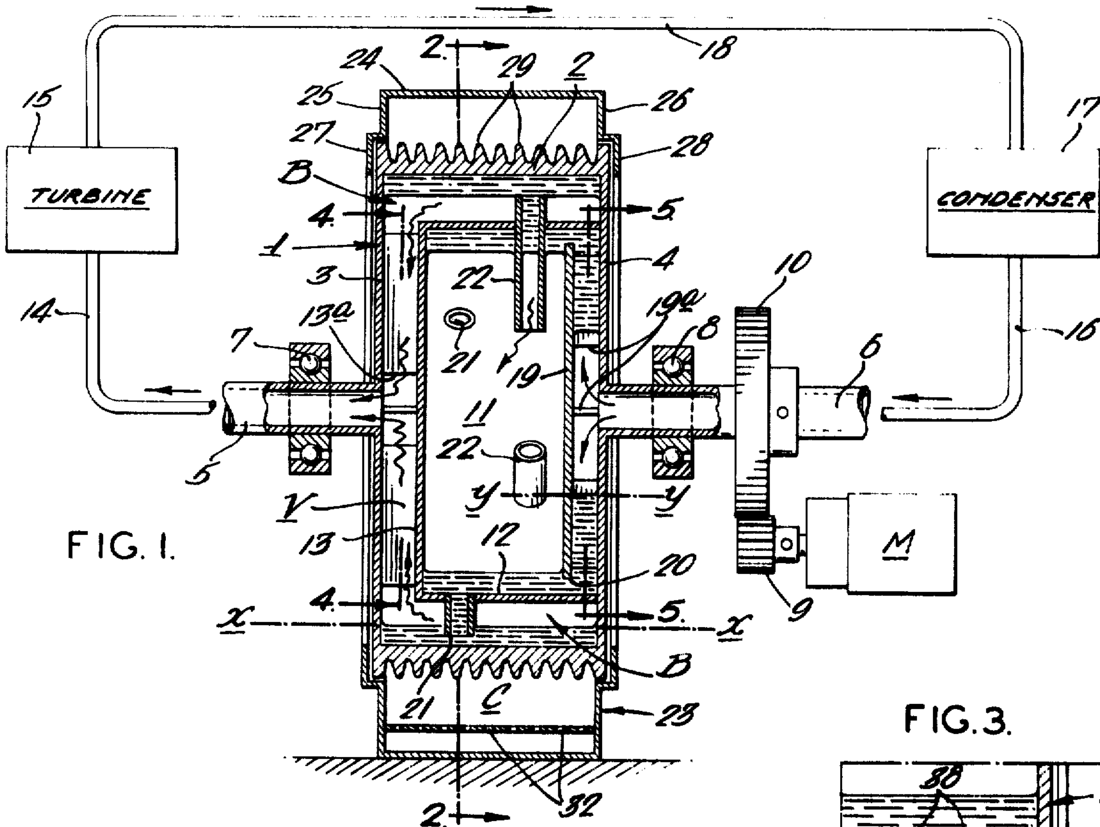


FIG. 1.

FIG. 3.

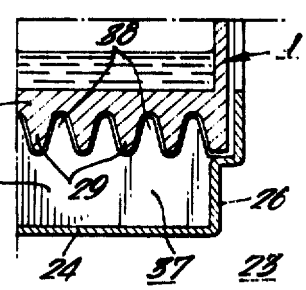


FIG. 2.

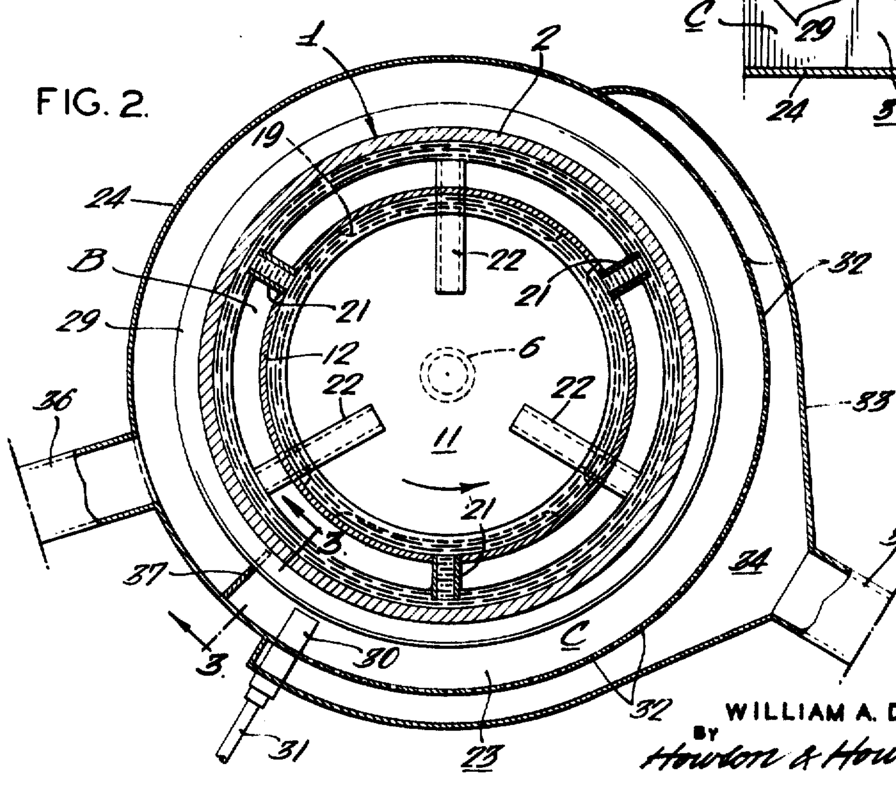


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FIG. 4.

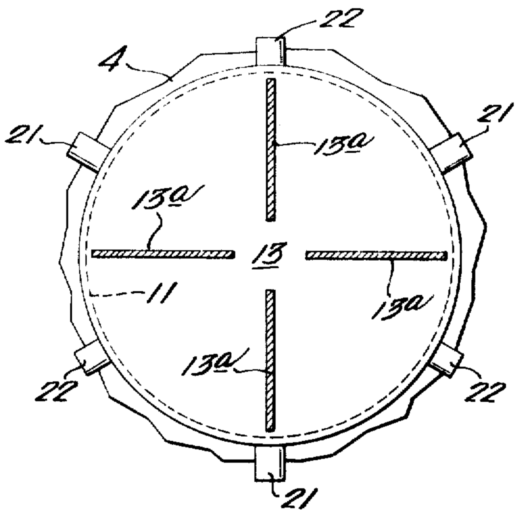


FIG. 5.

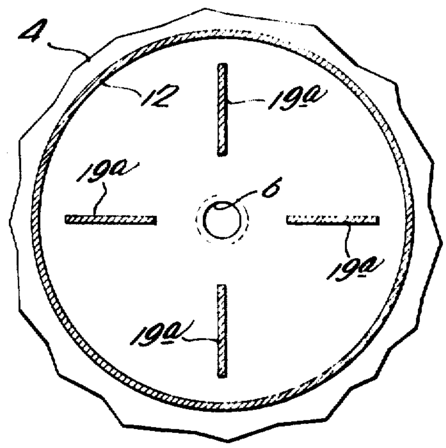


FIG. 8.

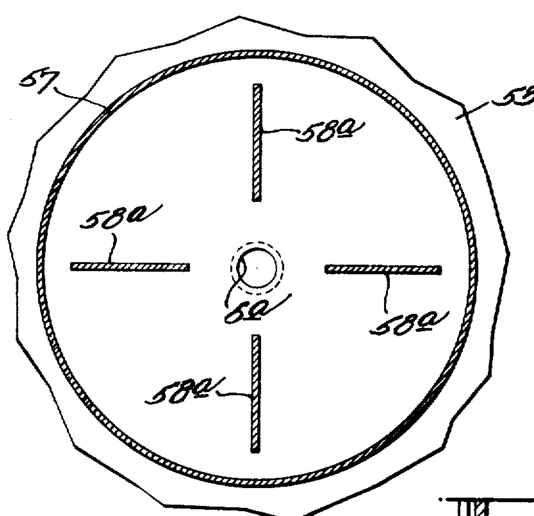
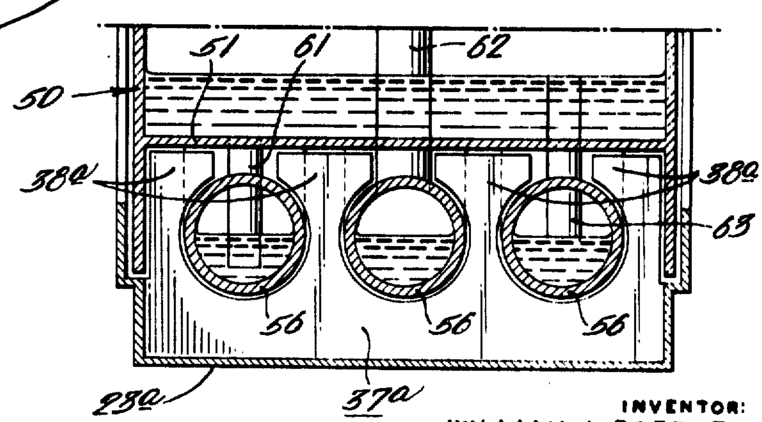


FIG. 9.



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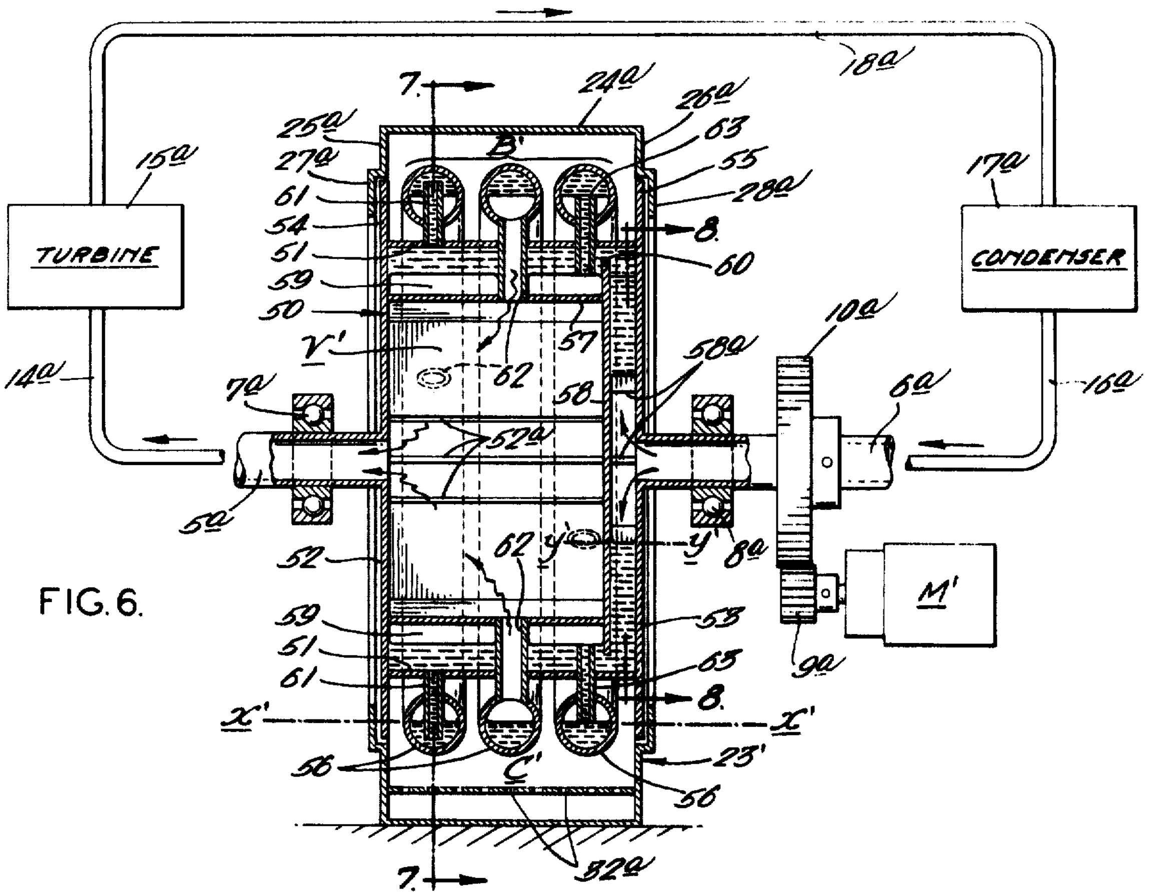

FIG. 6.

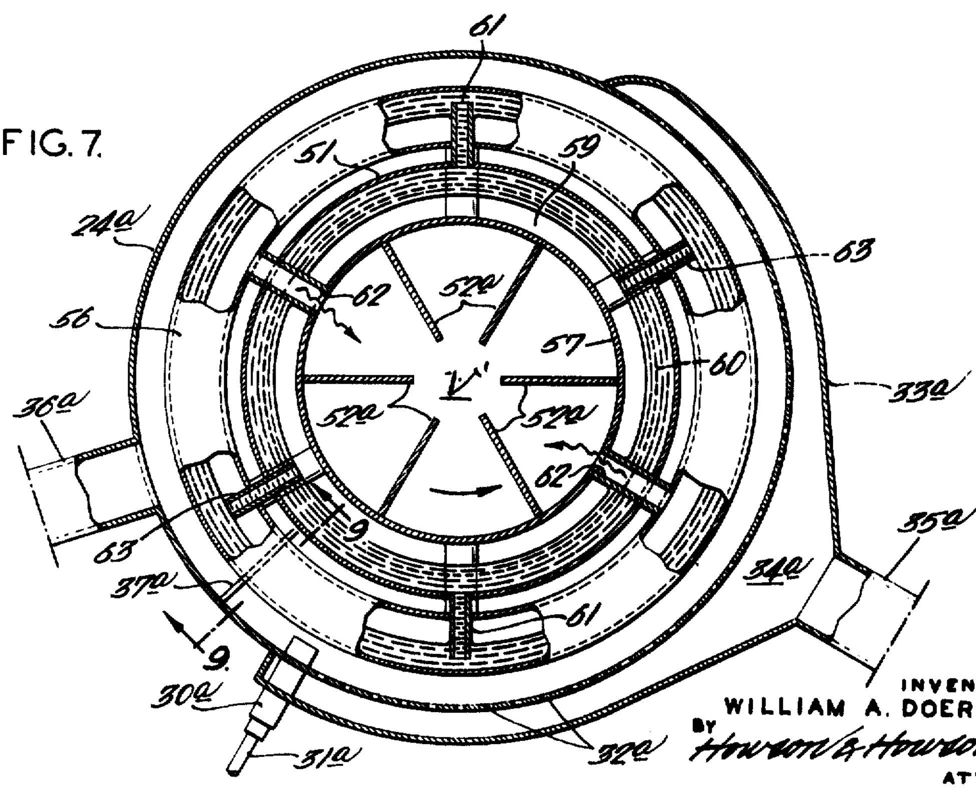

FIG. 7.

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ROTARY BOILER

The present invention relates to rotating boilers, and more particularly to rotating boilers of novel construction including novel means for maintaining the annular body of liquid in the boiler at the desired predetermined radial depth during operation of the boiler.

Rotating boilers are known in the art of vapor generation and have been demonstrated to provide a number of advantages over conventional boilers. For example, the high centrifugal acceleration in such a boiler produces a sharp stable interface between the liquid and vapor during boiling which is essentially cylindrical and concentric with the cylindrical heated boiler surface. Such a boiler produces a high-quality vapor with steady flow of both vapor and liquid and the boiler operates independent of gravity field and orientation. Also, the high rotational speeds customarily employed in rotating boilers permit heat fluxes well above the peak boiling level for normal gravity.

With the foregoing in mind, an object of the present invention is to provide a rotating boiler of novel design and construction which is operable to provide optimum beneficial utilization of the aforesaid advantages.

Another object of the invention is to provide a rotating boiler as set forth having novel means for automatically controlling and maintaining the radial depth of the annular body of liquid in the boiler chamber at the desired predetermined level.

Another object of the present invention is to provide a rotating boiler having novel liquid level control means as set forth which is efficient and foolproof in operation and of highly simplified construction devoid of moving parts.

A further object of the invention is to provide a rotating boiler construction as set forth which, among other uses, is especially suited and adapted for use, for example, in high-performance Rankine cycle power systems, Stirling engines, refrigeration, and for supplying vapors for heat exchange or chemical reaction elsewhere.

These and other objects of the invention and the various features and details of the construction and operation thereof are hereinafter set forth and shown in the accompanying drawings, in which:

FIG. 1 is a sectional view taken diametrically through a rotary boiler embodying the present invention and showing the same schematically in a Rankine cycle power generation system including a turbine and a condenser;

FIG. 2 is a sectional view taken on line 2–2, of FIG. 1;

FIG. 3 is a fragmentary view on line 3–3, FIG. 2;

FIG. 4 is a fragmentary sectional view on line 4–4, FIG. 1;

FIG. 5 is an enlarged fragmentary sectional view on line 5–5, FIG. 1;

FIG. 6 is a view similar to FIG. 1 showing a modified construction of the rotary boiler;

FIG. 7 is a sectional view taken on line 7–7, FIG. 6;

FIG. 8 is a fragmentary sectional view on line 8–8, FIG. 6, and

FIG. 9 is an enlarged sectional view on line 9–9, FIG. 7.

Referring now to the drawings, and more particularly to FIGS. 1 and 2 thereof, a rotary boiler constructed according to the present invention comprises an outer cylindrical casing 1 having a continuous circumferentially extending cylindrical wall 2 and sidewalls 3 and 4, respectively. Fixedly secured to and extending coaxially outward from the casing sidewalls 3 and 4 are tubular shaft members 5 and 6, respectively, by means of which the boiler casing 1 is rotatably mounted in bearings 7 and 8. The boiler may be rotationally driven at the desired speed by means of an electric motor M driving a gear 9 which in turn drives a gear 10 mounted on the shaft 6.

Mounted coaxially within the boiler casing 1 for rotation therewith is an inner cylindrical chamber 11 that is defined by a continuous circumferential wall 12, the aforesaid casing sidewall 4 and an oppositely spaced sidewall 13. As best shown in FIG. 1 the diameter of the inner chamber 11 is less than the diameter of the boiler casing 1 so that the cylindrical wall 12 of the inner chamber is spaced a predetermined distance radially inward from the casing wall 2 and defines therebetween an annular boiler chamber B. Also, the inner chamber wall 13 is spaced a predetermined distance from the adjacent casing wall 3. The space thus defined between the cylindrical wall 12 of the inner chamber and the wall 2 of the casing and between the chamber sidewall 13 and casing sidewall 3 defines a vaporizing chamber V within the rotating boiler casing 1. The chamber V is in open communication with the tubular shaft 5 so that vapor generated in the boiler chamber B and collecting in the chamber V, as hereinafter described, is discharged from the rotating casing 1 through said shaft 5 and a conduit 14, for example, to a turbine 15. Radial vanes 13*a* are provided in the chamber V between the walls 3 and 13 as shown in FIG. 4 to transfer rotational energy in the vapors back to the linear exit system as the vapors leave the boiler through the tubular shaft 5.

In similar manner the interior of the inner chamber 11 is in open communication with the tubular shaft 6 through which boiler feed liquid is admitted to the chamber 11, for example, in the form of liquid condensate, through a pipe 16 from a condenser 17 having its inlet connected by a conduit 18 to the exhaust of the turbine 15. Spaced inwardly from the tubular shaft 6 and from the boiler casing wall 4 is an imperforate baffle 19 which is disposed perpendicular to the rotational axis of the boiler casing. This baffle 19 has a diameter slightly less than the diameter of the chamber wall 12 so that the peripheral edge 20 of the baffle 19 is spaced from the inner surface of the chamber wall 12 to permit the flow of boiler feed liquid from the shaft 6 about the peripheral edge 20 of the baffle 19 into the main portion of the chamber 11. Moreover, and as shown in the drawing, the spacing of the baffle edge 20 from the chamber wall 12 is less than the radial height or depth of the annular body of boiler feed liquid maintained in the chamber 11. Radial vanes 19*a* are provided between the baffle 19 and casing wall 4 as shown in FIG. 5 to impart rotational movement to the feed liquid as it flows from the inlet shaft 6 to the periphery of the liquid chamber 11.

The boiler casing 1 is driven by the motor M at a predetermined speed of rotation calculated to create the centrifugal force necessary to maintain the selected boiler feed liquid uniformly distributed circumferentially about the boiler chamber B in contact with the inner surface of the casing wall 2, and to provide the desired boiler (vapor) pressure correlated to the radial length of the leg of feed liquid between the baffle 19 and casing wall 4. The interface between the liquid and vapor in the chamber B is highly stable and is essentially cylindrical and concentric with the axis of rotation of the boiler. Similarly, the boiler feed liquid in the chamber 11 is uniformly distributed circumferentially about the inner surface of the cylindrical chamber wall 12.

The radial vanes 13*a* and 19*a* are desirable in a boiler of the present type to control radial flow of the liquid and vapor fluids for proper and efficient operation of the boiler. In this connection, the work W required to pump a unit weight of liquid condensate into the boiler is:

$$W=(V^2/2g)\,(R_2^2-R_1^2)$$

where v is the boiler angular velocity, g is the acceleration of gravity, R_1 is the radius from the rotational axis of the boiler to the liquid level line y shown in FIG. 1, and R_2 is the radius from said rotational axis to the liquid level line x in FIG. 1. The pressure increase between the condenser 17 and the chamber V is:

$$(P_2-P_1)=$$

where d is the density of the feed liquid. The work done on the vanes 13*a* in the chamber V as the vapor travels radially inwardly of the boiler is always equal to or greater than the pump work W if friction is neglected. Thus without the vanes not only is no work recovered from the inwardly flowing vapor but the pressure drop is much greater than it is with the vanes present.

A particular feature of the present invention resides in the construction and arrangement provided for supplying boiler feed liquid from the chamber 11 to the boiler chamber B and for automatically maintaining the liquid level in the vaporizing chamber at the desired radial height or depth, for example, as indicated at x in the drawings.

Referring again to FIGS. 1 and 2 the boiler feed liquid is supplied from the chamber 11 to the boiler chamber B by means of a plurality of radially disposed feed conduits 21 mounted in the cylindrical chamber wall 12 and equally spaced circumferentially thereabout to insure rotational balance in the boiler. As shown, the radial inner ends of the conduits 21 are disposed flush with the inner surface of the chamber wall 12 and the radial outer ends of said conduits 21 are spaced inwardly from the inner surface of the casing wall 2 but extend or terminate below or beyond the liquid surface level x so that the outer ends of said conduits 21 are immersed in and covered by the annular body of liquid maintained uniformly about the inner surface of the boiler casing wall 2 by rotation of the boiler.

The body of liquid in the boiler chamber B of the casing 1 is maintained at the desired predetermined level x by means of a plurality of radial sensor tubes or conduits 22 also mounted in the circumferential wall 12 of the inner chamber 11. As in the case of the liquid supply conduits 21, the sensor conduits 22 are equally spaced circumferentially with respect to each other and the conduits 21 to insure rotational balance in the boiler. It is important to note that the radial outer ends of the conduits 22 are disposed at the radius of the desired predetermined surface level x of the body of liquid in the boiler chamber B. The inner ends of the conduits 22 are open to the interior of the chamber 11 and extend radially inwardly to a point substantially spaced from the surface of the annular body of liquid about the inner periphery of the chamber 11.

The annular body of liquid in the boiler chamber B may be heated to the required boiling temperature to vaporize the same, for example, by the combustion of a suitable fuel-air mixture in a combustion box 23 such as shown in the drawings. The combustion box 23 is a stationary structure of annular configuration that circumscribes the rotatable boiler casing 1 and comprises a radially spaced circumferentially wall 24 and spaced apart annular sidewalls 25 and 26, the latter having offset inner flange portions 27 and 28 that closely overlie the peripheral edge portions of the opposite sidewalls 3 and 4 of the boiler casing 1. The combustion box 23 defines an annular combustion chamber C surrounding the casing 1 and the outer surface of the casing peripheral wall 2 is provided with a plurality of circumferentially extending radial fins or ribs 29 to provide maximum efficiency of heat transfer from the combustion chamber C to the annular body of liquid in the boiler casing 1 to heat the liquid to the desired boiling temperature.

Fuel for combustion in the chamber C is discharged tangentially into said chamber from a nozzle 30 to which the fuel is supplied at the required rate and pressure by a pipe 31, and air for mixture with the fuel is discharged into the combustion chamber C through a plurality of ports 32 in a substantial segment of the peripheral wall 24 of the combustion chamber C. The ports 32 are enclosed within a hood structure 33 that defines a plenum chamber 34 into which the air is supplied through a duct 35 from a pump or fan (not shown) at the pressure and volume required for efficient combustion of the fuel to heat the liquid in the boiler casing to the desired temperature. Combustion of the fuel-air mixture extends substantially about the entire circumference of the rotating boiler and the residual products and gases of combustion are discharged through an outlet or exhaust duct 36. A stationary baffle 37 having projecting portions 38 for complementary interfitting cooperation with the fins or ribs 29 on the rotating boiler casing 1 is mounted transversely of the combustion chamber C intermediate the fuel nozzle 30 and outlet duct 36, as shown in FIG. 3, to prevent recirculation of the combustion gases through the combustion chamber.

In operation, with the motor M driving the boiler casing 1 at desired speed of rotation and the annular body of liquid in the boiler chamber B heated to the desired boiling temperature by combustion of the fuel-air mixture in the chamber C, the vapor produced by the boiling liquid collects in the chamber V and is discharged therefrom through the shaft 6 and conduit 14 to the turbine 15 which is rotationally driven thereby in the customary manner.

As the liquid in the boiler chamber B is converted to vapor as described, the height or depth of the annular liquid body in the boiler decreases thus lowering or radially displacing the surface level thereof outwardly from the desired predetermined level x shown in the drawing with the result that the radial outer ends of the sensor conduits 22 are uncovered and opened to the vapor atmosphere in the boiler chamber B. Uncovering or opening of the outer ends of the sensor conduits 22 allows the liquid in said conduits 22 to flow into the boiler chamber and permit some of the vapor under pressure in the chamber B to flow inwardly through the conduits 22 into the chamber 11, thus increasing the pressure in said chamber and thereby causing liquid in said chamber 11 to flow outwardly through the feed conduits 21 and replenish the body of liquid in the boiler chamber B until the surface level thereof is restored to predetermined level x. Return of the liquid surface to the level x closes the outer ends of the sensor conduits 22 and stops further flow of liquid through the feed conduits 21 to the boiler casing until the surface level of the liquid is again displaced as described to again open the outer ends of the sensor conduits 22.

This interplay between fluctuations of the surface level of the liquid to open and close the outer ends of the sensor conduits 22 and the flow of liquid through the feed conduits 21 to replenish the liquid in the boiler and restore the surface to the desired level, is substantially continuous so that the surface level of the liquid in the boiler casing 1 is automatically maintained at all times during operation of the boiler substantially continuously at the line x shown in the drawings. The radial depth or thickness of the annular body of liquid in the boiler chamber B is determined by and equal to the radial distance between the outer ends of the sensor conduits 22 and the inner surface of the casing wall 2, and therefore the radial depth of the annular body of liquid in the boiler chamber B and hence the radial position of the surface level line x shown in FIG. 1, can be predetermined and controlled as desired by changing the space or gap between the outer ends of the sensor conduits 22 and the inner surface of the casing wall 2.

The boiler feed liquid in the chamber 11 is replenished by liquid supplied thereto through the shaft 6, in the present instance in the form of liquid condensate from the condenser 17. The spent vapor discharged from the exhaust of the turbine 15 is conducted by the pipe 18 to the condenser 17 where it is condensed to liquid form and returned through pipe 16 to the inlet shaft 6 and chamber 11.

Another embodiment of the invention is shown in FIGS. 6, 7, 8 and 9 of the accompanying drawings. This form of the invention is generally similar in construction to the embodiment previously described but differs therefrom in certain details of construction and arrangement hereinafter described. Referring to FIGS. 6 and 7, a rotary casing 50 is provided comprising a circumferential wall 51 and spaced opposing sidewalls 52 and 53 the latter having radial flanges 54 and 55 extending outwardly beyond the wall 51 and defining therebetween a space in which is mounted an outer boiler chamber B' comprising a plurality of annular toroidal boiler sections 56. Each of the annular toroidal boiler sections 56 is of tubular construction, circular in cross section, and they are disposed in spaced relation to each other and to the wall 51 of the rotary casing 50 as shown.

As in the first embodiment, the casing 50 is provided with axially projecting tubular shaft members 5a and 6a, respectively, by means of which the casing 50 is rotatably mounted in bearings 7a and 8a. The casing 50 is rotationally driven at the desired speed by an electric motor M' driving a gear 9a which in turn drives a gear 10a on said shaft 6a.

Formed centrally within the casing 50 coaxially thereof is a vapor chamber V' that is defined by a cylindrical wall member 57, the casing wall 52 and an oppositely spaced wall member 58. The chamber V' is in open communication with the tubular shaft 5a so that vapor generated in the boiler sections 56 and admitted to said chamber V' is discharged therefrom through said shaft 5a and a conduit 14a, for example, to a turbine 15a. Radial vanes 52a are provided in the vapor chamber V' as shown in said FIGS. 6 and 7, and these vanes function the same as the vanes 13a previously described.

The diameter of the cylindrical wall 57 is less than the diameter of the casing cylindrical wall 51 and is spaced inwardly therefrom to define therebetween an annular boiler liquid feed chamber 59. As shown, the wall member 58 is spaced inwardly from the casing wall 53 and has a diameter slightly less than the cylindrical casing wall 51 terminating in a peripheral edge 60 that is spaced inwardly from the casing wall 51. Thus the annular boiler liquid feed chamber 59 is in open communication with the tubular shaft 6a through which boiler feed liquid is supplied to said chamber 59, for example, in the form of liquid condensate, through a pipe 16a from a condenser 17a that has its inlet connected by a conduit 18a to the exhaust of the turbine 15a. It is to be noted that, similar to the baffle 19 in the first embodiment of the invention, the diameter of the wall 58 is such that the spacing of the peripheral edge 60 thereof from the casing wall 51 is less than the radial depth or height of the annular body of boiler feed liquid maintained in the chamber 59. Also, radial vanes 58a are provided in the feed liquid leg between the wall 58 and casing wall 53 as shown in FIG. 8 to impart rotational movement to the feed liquid similar to the vanes 19a previously described.

Boiler feed liquid is supplied from the chamber 59 to each of the toroidal tubular boiler sections 56 by means of feed conduits 61 mounted in the cylindrical wall 51 and extending inwardly of the boiler section 56. In the embodiment shown in FIGS. 6 and 7, a plurality of such conduits 61 is provided for each boiler section 56 and these conduits 61 are equally spaced circumferentially to insure rotational balance in the boiler. The radial inner ends of the feed conduits 61 are disposed flush with the inner surface of the chamber wall 51 and the radial outer ends of said conduits are spaced inwardly from the wall of the boiler sections 56, but extend or terminate below or beyond the liquid surface level x' so that the outer ends of said conduits are immersed in and closed by the annular body of liquid maintained about the inner surface of the boiler sections by rotation of the casing 50.

Vapor generated in each of the toroidal boiler sections 56 by boiling the liquid therein is discharged into the chamber V' through vapor conduits 62 constructed and arranged as shown in FIGS. 6 and 7 of the drawings. A plurality of such conduits 62 is provided for each boiler section 56 and, like the conduits 61, the said conduits are equally spaced circumferentially of the casing 50 with respect to one another to insure rotational balance in the boiler. The body of liquid in each of the toroidal boiler sections 56 is maintained at the desired predetermined level x' by sensor tubes or conduits 63 constructed and arranged as shown, a plurality of such tubes being provided for each boiler section and equally spaced circumferentially relative to the other conduits to insure rotational balance. As in the case of the sensor tubes 22 in the first embodiment, the radial outer ends of the conduits 63 are disposed at the radius of the desired predetermined liquid surface level x' and their inner ends are open to the interior of the liquid feed chamber 59 inwardly beyond the surface level of the annular body of liquid therein.

The annular body of liquid in each toroidal boiler section 56 may be heated to the required boiling temperature to generate vapor in the same manner as shown and described with respect to the first embodiment of the invention. Accordingly, it is not necessary to repeat the description of the combustion system shown in FIGS. 6 and 7 and the parts thereof which are identical to parts shown and described with reference to FIGS. 1, 2 and 3 have been given corresponding reference numbers with the addition thereto of the letter a.

Operation of the embodiment of the invention shown in FIGS. 6, 7, 8 and 9 is essentially the same as previously described for the first embodiment and need not be repeated. Suffice it to state that the feed conduits 61 and sensor conduits 63 function in the same manner as the conduits 21 and 22 of the first embodiment automatically to maintain the surface of the body of liquid in each boiler section 56 at the desired level x' shown in FIG. 3. Also to determine the work W required to pump a unit weight of liquid condensate into the boiler of this embodiment use may be made of the formula previously set forth herein where R_1 is the radius from the rotational axis of the boiler to the liquid level y' shown in FIG. 6 of the drawing and R_2 is the radius from said rotational axis to the liquid level line x' in said FIG. 6.

An important feature of a rotating boiler of the type described is the ability of such a boiler to produce high-quality vapor. The centrifugal force resulting from rotation of the boiler and the fluid therein acts to enhance the separation of entrained liquid droplets from the exiting vapor in the chambers V and V'. This feature is especially important in the case of rotary boilers used in applications where the entrainment of liquid in the exiting vapors is undesirable, such as in driving a turbine.

While certain embodiments of the present invention have been illustrated and described, it is not intended to limit the invention to such disclosures and changes and modifications may be made and incorporated as desired within the scope of the claims.

I claim:

1. A rotary boiler comprising
a structure defining an annular boiler chamber,
means mounting said structure for rotation about the axis of said annular boiler chamber,
means providing a cylindrical liquid supply chamber coaxially inwardly of the annular boiler chamber and rotatable therewith about said axis,
means to admit liquid to said supply chamber,
first conduit means providing for flow of liquid from the supply chamber to said boiler chamber,
drive means operable to rotate the boiler and liquid supply chambers about said axis at a predetermined speed to provide and maintain an annular body of liquid of uniform radial depth continuously about the inner peripheral surface of each of said boiler and liquid supply chambers and provide the desired vapor pressure in said boiler,
and means comprising second conduit means communicating between said supply chamber and boiler chamber and cooperable with said first mentioned conduit means to control and maintain the radial depth of the liquid body in the boiler chamber substantially constant and at the desired predetermined surface level.

2. A rotary boiler as claimed in claim 1 wherein
the first conduit means comprises at least one radially extending conduit having its inner end opening to the liquid body in the supply chamber and its outer end opening disposed radially outwardly of the desired predetermined surface level of the liquid body in said boiler chamber and immersed therein.

3. A rotary boiler as claimed in claim 1 wherein
the second conduit means comprises at least one radially extending conduit having its inner end opening interiorly of the supply chamber inwardly from the liquid level therein and its outer end opening disposed at the desired predetermined surface level of the liquid body in the boiler chamber.

4. A rotary boiler as claimed in claim 2 wherein

the second conduit means comprises at least one radially extending conduit having its inner end opening interiorly of the supply chamber inwardly from the liquid level therein and its outer end opening disposed at the desired predetermined surface level of the liquid body in the boiler chamber.

5. A rotary boiler as claimed in claim 1 wherein

the first conduit means comprises a plurality of radially extending conduits each having its inner end opening to the liquid body in the supply chamber and its outer end opening disposed radially outwardly of the desired predetermined surface level of the liquid body in said boiler chamber and immersed therein,

said radially extending conduits being equally spaced circumferentially of the supply and boiler chambers to provide rotational balance in the boiler during rotation thereof.

6. A rotary boiler as claimed in claim 1 wherein

the second conduit means comprises a plurality of radially extending conduits each having its inner end opening interiorly of the supply chamber inwardly from the liquid level therein and its outer end opening disposed at the desired predetermined surface level of the liquid body in the boiler chamber,

said radially extending conduits being equally spaced circumferentially of the supply and boiler chambers to provide rotational balance in the boiler during rotation thereof.

7. A rotary boiler as claimed in claim 5 wherein

the second conduit means comprises a plurality of radially extending conduits each having its inner end opening to the liquid body in the supply chamber inwardly from the liquid level therein and its outer end opening disposed radially outward of the desired predetermined surface level of the liquid body in said boiler chamber and immersed therein,

said radially extending conduits being equally spaced circumferentially of the supply and boiler chambers to provide rotational balance in the boiler during rotation.

8. A rotary boiler as claimed in claim 1 wherein

means is provided to heat the liquid in the boiler chamber to the desired temperature to vaporize said liquid.

9. A rotary boiler as claimed in claim 8 wherein

a vapor chamber is provided in communication with the boiler chamber to receive the vapor generated in the boiler chamber.

10. A rotary boiler as claimed in claim 9 wherein

the means mounting the boiler chamber structure for rotation about its axis includes a pair of coaxially projecting tubular shafts at respectively opposite sides of said structure,

one of said shafts communicating with the vapor chamber and constituting an outlet for the vapor generated in the boiler chamber and the other of said shafts communicating with the supply chamber to admit liquid thereto.

11. A rotary boiler as claimed in claim 8 wherein

the means provided to heat the liquid in the boiler chamber comprises a stationary combustion box circumscribing the rotary boiler structure,

and means is provided to supply fuel and air to said box for combustion therein to heat the liquid in the boiler chamber to the desired temperature.

12. A rotary boiler as claimed in claim 1 wherein

the boiler chamber comprises a plurality of annular tubular boiler sections disposed in laterally adjacent relation and each of said boiler sections is provided with at least one of the first and second conduit means.

13. A rotary boiler as claimed in claim 12 wherein

means is provided to heat the liquid in each boiler section to the desired temperature to vaporize said liquid,

and a vapor chamber is provided having third conduit means communicating with each boiler section for the passage of vapor from said boiler sections to the vapor chamber.

14. A rotary boiler as claimed in claim 12 wherein

the first conduit means comprises at least one radially extending tube having its inner end opening to the liquid body in the supply chamber and its outer end opening disposed radially outwardly of the desired predetermined surface level of the liquid body in each boiler section and immersed therein.

15. A rotary boiler as claimed in claim 12 wherein

the second conduit means comprises at least one radially extending conduit having its inner end opening interiorly of the supply chamber inwardly from the liquid level therein and its outer end opening disposed at the desired predetermined surface level of the liquid body in each boiler section.

16. A rotary boiler comprising

a structure defining an annular boiler chamber and a vapor chamber in communication with said boiler chamber,

means mounting said structure for rotation about the axis of said annular body comprising a pair of coaxially projecting tubular shafts at opposite sides thereof,

one of said shafts communicating with said vapor chamber and constituting an outlet for the vapor generated in the boiler chamber,

means providing a cylindrical liquid supply chamber concentrically inwardly of the annular boiler chamber and rotatable therewith about said axis,

the other of said tubular shafts communicating with said supply chamber to admit liquid thereto,

first conduit means providing for flow of liquid from the supply chamber to said boiler chamber,

drive means operable to rotate the boiler and supply chambers about said axis at a predetermined speed to provide and maintain an annular body of liquid of uniform radial depth continuously about the inner peripheral surface of each of said boiler and supply chambers and provide the desired vapor pressure in said boiler,

said first conduit means comprising a plurality of radially extending feed tubes each having its inner end opening interiorly of the supply chamber inwardly from the liquid level therein and its outer end disposed radially outwardly of the surface level of the liquid body in the boiler chamber and immersed therein,

second conduit means comprising a plurality of radially extending sensor tubes each having its inner end opening interiorly of the supply chamber inwardly from the liquid level therein and its outer end opening disposed at the desired predetermined surface level of the liquid body in the boiler chamber,

said sensor tubes being operable in conjunction with said feed tubes to control and maintain the radial depth of the liquid body in the boiler chamber substantially constant and at the desired predetermined surface level,

and means to heat the liquid in the boiler chamber to the desired temperature.

17. A rotary boiler as claimed in claim 16 wherein

the means provided to heat the liquid in the boiler chamber comprises a stationary combustion box circumscribing the rotary boiler structure,

and means is provided to supply fuel and air to said box for combustion therein to heat the liquid in the boiler chamber to the desired temperature.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,590,786 Dated July 6, 1971

Inventor(x) William A. Doerner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 70 should read: $(P_2 - P_1) = dW$

Column 3, line 44; change "circumferentially" to --circumferential--.

Signed and sealed this 7th day of December 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents