United States Patent [19]

Camp

[11] **3,743,780**

[45] **July 3, 1973**

[54] **BOILING CHAMBER FOR STEAM GENERATOR**

[76] Inventor: **Nat Camp,** 395 Westchester Avenue, Port Chester, N.Y. 10573

[22] Filed: **May 1, 1972**

[21] Appl. No.: **249,189**

[52] **U.S. Cl.** **219/288,** 21/119, 128/192, 219/273, 219/275, 219/289, 239/135, 239/394

[51] **Int. Cl.** **H05b 3/60,** F22b 1/30

[58] **Field of Search** 219/271–276, 284–295; 128/186, 192; 21/117–119; 239/135, 394, 436

[56] **References Cited**

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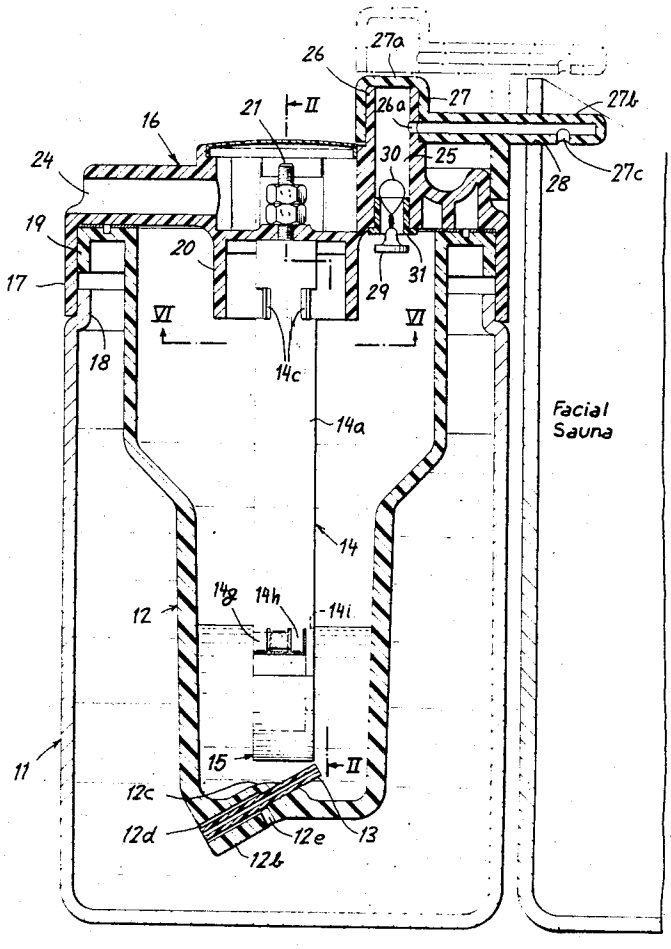
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Primary Examiner—A. Bartis
Attorney—Karl F. Ross

[57] **ABSTRACT**

A boiling chamber in the form of a generally cylindrical upright container, communicating at its bottom with a water tank through a restricted inlet, has a pair of vertical electrodes suspended from its top which is formed as a detachable lid. A central mounting ring on that lid has two diametrically opposite segmental cutouts engaged by respective pairs of locator rigs on the electrode shanks which terminate in transverse tabs screwed onto the lid within the ring. A nozzle assembly on the lid includes a fixed sleeve, in line with a vertical outlet aperture adjacent the outer periphery of the mounting ring, and a movable sleeve coaxially engaging the latter; the movable sleeve may carry a laterally projecting discharge tube, serving to extend the nozzle to an adjacent vessel such as a facial sauna, or may be provided with two or more ports of different diameters selectively alignable with an orifice of the fixed sleeve to establish passages of different widths for the escaping steam. The entrance end of the vertical outlet aperture is partly obstructed by a splash shield loosely seated therein to intercept droplets of water entrained by the evolving steam. Different shapes for the active lower extremities of the electrodes are described; in one embodiment, they include a generally J-shaped vertical extremity and a generally U-shaped horizontal extremity spacedly nested in the former.

15 Claims, 11 Drawing Figures



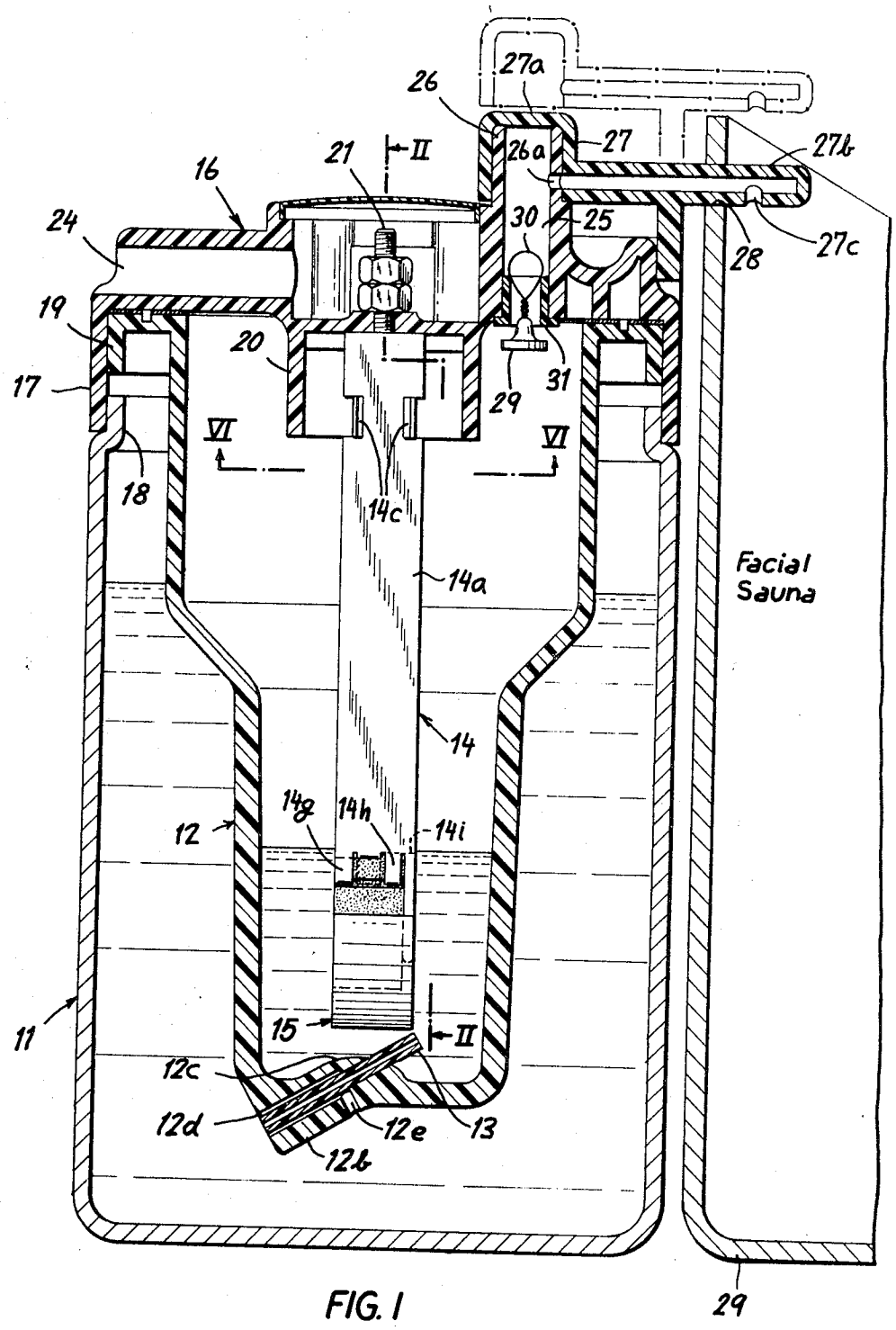

27a
26
27
27b
26a
21
II
16
30
25
24
28
27c
19
20
31
29
17
VI
VI
18
14c
14a
Facial
Sauna
14
14g
14h
14i
12
11
15
II
12c
12d
12e
13
12b
29

FIG. 1

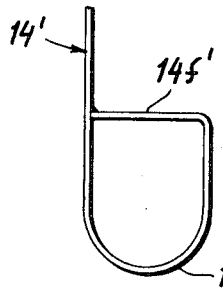

14'
14f'
14d

FIG. 2A

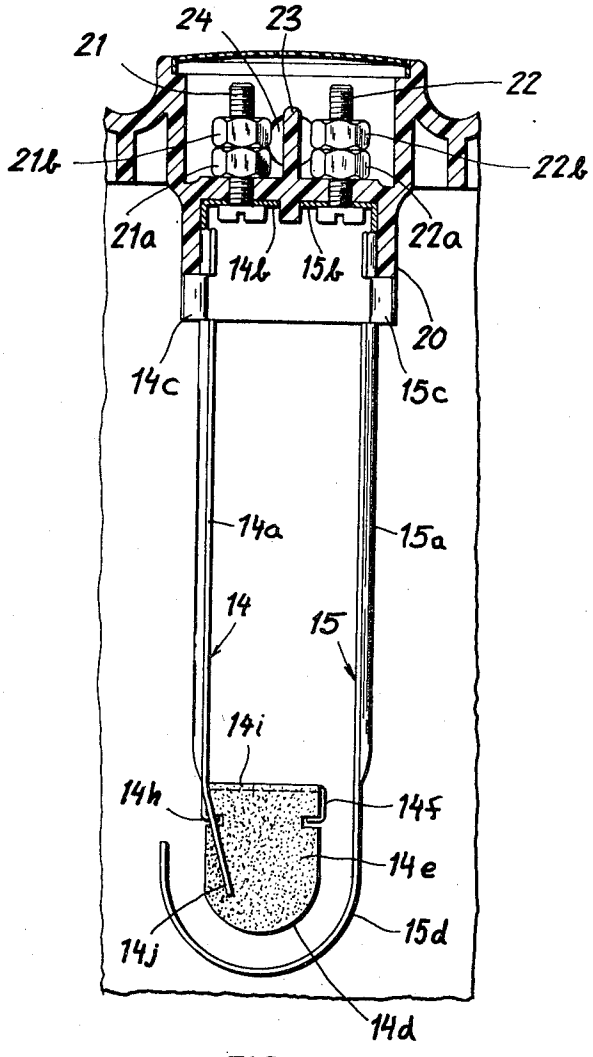

24
23
21
22
21b
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14b
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20
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14i
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14f
14e
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14j
14d

FIG. 2

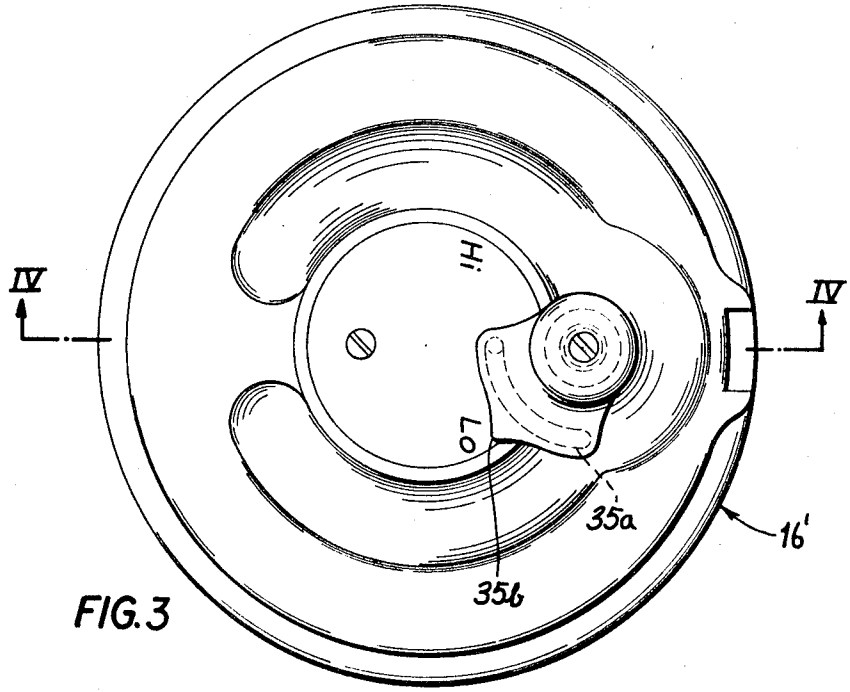


FIG. 3

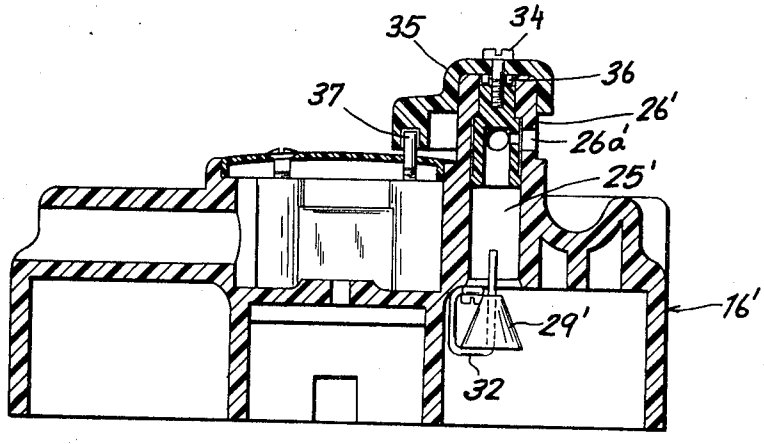


FIG. 4

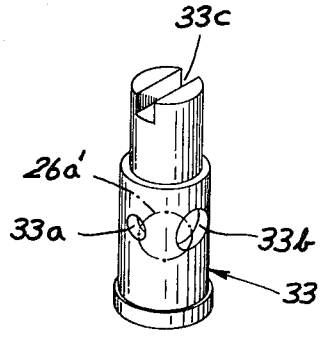


FIG. 5

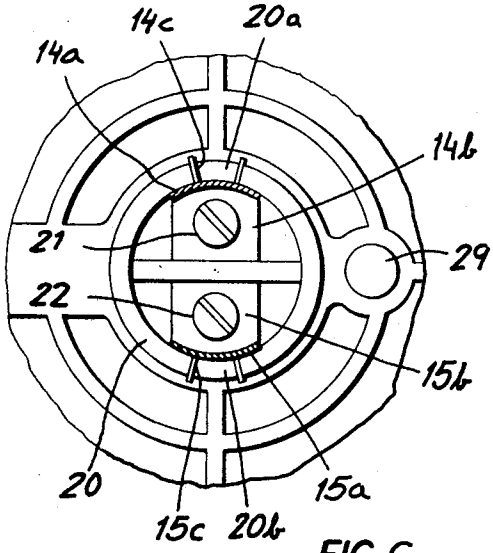


FIG. 6

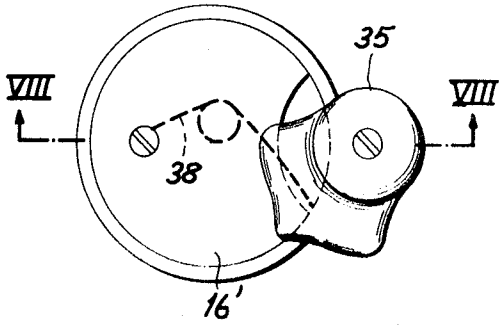


FIG. 7

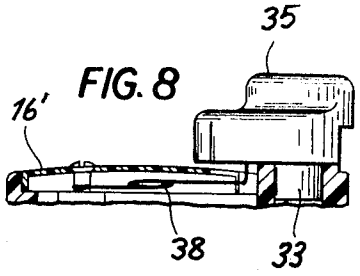


FIG. 8

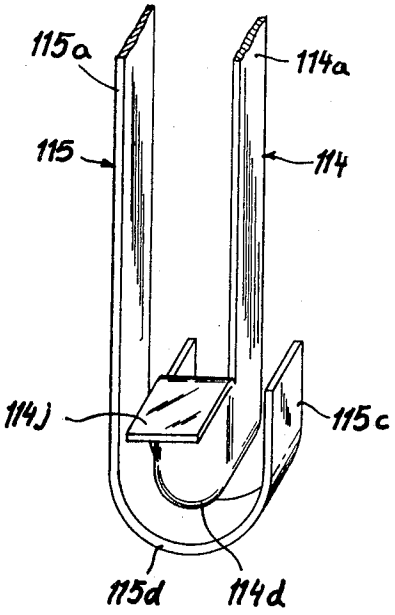


FIG. 9

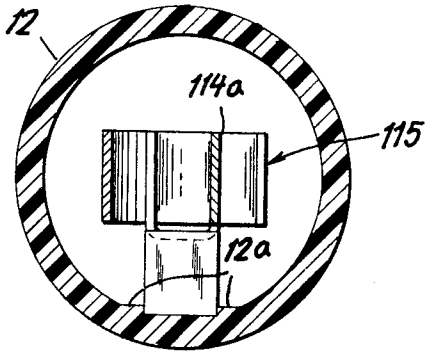


FIG. 10

BOILING CHAMBER FOR STEAM GENERATOR

My present invention relates to a boiling chamber for a steam generator of the general type disclosed in my prior U.S. Pat. No. 3,619,559.

Such a steam generator includes a boiling chamber in the general form of an upright cylinder which communicates at its bottom with a water tank through a restricted inlet, specifically a capillary tube, and has an outlet at its top for the discharge for the evolving steam. From the top of this tube, advantageously constituted by a detachable lid, two sheet-metal electrode hang down into a body of water which occupies the lower part of the boiling chamber, the water level being mainly determined by the boiling rate and the degree of obstruction of the outlet which leads to a preferably adjustable discharge nozzle; owing to presence of the capillary tube, the pressure head of the water in the tank does not significantly affect that level. In order to stabilize the liquid volume with the chamber, the lower extremities of the electrodes are broadened so as to increase the current flow in that range and, consequently, to magnify the reduction in boiling rate due to a drop in the water level.

In a preferred electrode configuration disclosed and claimed in my above-identified patent, these lower extremities are in the form of nested J's whose shorter legs define the upper and lower limits of the range of level variation.

An object of my present invention is to provide an improved mounting for a pair of such electrodes inside a boiling chamber of the character set forth, designed to maintain them in a predetermined relative position with accurate spacing of their electrically effective lower extremities.

A related object is to provide an electrode configuration affording greater resistance to corrosion in order to extend the service life of the electrode assembly and to prevent internal short circuits.

It is also an object of my present invention to provide simple means in the outlet of the boiling chamber for varying the effective width of the nozzle and for preventing "spitting" due to the entrainment of droplets by the exiting steam.

In accordance with an important feature of my invention, the generally cylindrical boiling chamber is provided at its top with a mounting ring substantially centered on the cylinder axis and formed with a pair of diametrically opposite cutouts open toward the chamber bottom, the shank of each electrode terminating at its free end in a transverse tab secured to the chamber top within the ring adjacent a respective cutout; two outwardly diverging locator ribs on each shank bear upon opposite edges of the cutout to hold the electrode in its assigned position.

The chamber outlet, leading directly to the nozzle, advantageously is a vertical aperture in the lid close to the outer periphery of the central mounting ring whose presence, therefore, partly shields the entrance end of that aperture from splashing water. In order to provide additional protection against entry of liquid into that aperture, I prefer to install therein a splash shield in the form of an upwardly tapering body mounted for substantially unrestricted movement below the entrance end and extending partly into same. When struck from below by water particles, this body rises and momentarily obstructs the outlet to keep the liquid within the chamber.

The nozzle communicating with this aperture advantageously comprises, pursuant to a further feature of my invention, a fixed sleeve rigid with the lid in line with the outlet aperture and engaged by a movable sleeve. The latter may be provided with at least two peripherally spaced ports of different diameters selectively alignable with an oriface in the fixed sleeve for establishing alternate passages of different widths for the escaping steam. With a view to positively indexing the nozzle in either of its operating positions, I prefer to anchor the movable sleeve to the chamber top through a toggle spring or its equivalent. This movable sleeve may also be formed integral with a discharge tube extending laterally from its port to facilitate the delivery of the output of the steam generator into an adjoining vessel such as a facial sauna.

While the use of J-shaped electrode extremities as claimed in may prior patent is generally satisfactory, I have now found that especially the inner J is subject to considerable corrosion upon prolonged use; this is believed due to the fact that the current density is higher at the inner J than at the outer J. Such corrosion eventually results in a break-up of the inner J at its bight and may cause a fragment thereof to drop onto the bight of the outer J while being still partly connected with its own shank so that the electrodes are short-circuited. In order to avoid such short circuits, and to prolong the useful life of the unit, still another feature of my invention provides for a bridging of the active portions of the inner electrode by a conductive support remote from the outer electrode so that the exposed end of the inner electrode remains connected with its shank even if some intervening potions are eaten away. This can be accomplished, for example, by bending the shorter leg of the inner J back toward the stem and attaching it to same; the resulting loop can also be replaced by a solid conductor of similar outline which need not be metallic but can be made of carbon.

In a particularly advantageous mode of realization of such an electrode assembly, the lower extremity of one (preferably the inner) electrode has the general shape of a horizontal "U" attached by one leg thereof to its shank, this U-shaped extremity lying on a level with the short leg of the J-shaped extremity of the other electrode. The bight of the "U," which does not confront any part of the "J" and therefore does not participate in the generation of current, not only serves as a conductive support for the second leg of the "U" but also is available as a means for further stabilizing the electrode position by directly engaging the surrounding chamber wall.

The above and other features of my invention will be described in detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is an axial sectional view of a steam generator including a boiling chamber according to my invention;

FIG. 2 is a fragmentary cross-sectional view taken on the line II — II of FIG. 1;

FIG. 2A is a fragmentary view similar to FIG. 2, illustrating a modified electrode;

FIG. 3 is a top view of a modification of the lid of the boiling chamber shown in FIG. 1;

FIG. 4 is a cross-sectional view taken on the line IV — IV of FIG. 3;

FIG. 5 is a perspective view of part of a nozzle assem-

bly included in the steam generator of FIGS. 3 and 4;

FIG. 6 is a bottom view of the lid of the boiling chamber taken on the line VI — VI of FIG. 1;

FIG. 7 is a view similar to FIG. 3, illustrating another modification;

FIG. 8 is a cross-sectional view taken on the line VIII — VIII of FIG. 7;

FIG. 9 is a perspective view of the working extremities of a pair of modified electrodes for a steam generator as shown in FIG. 1; and

FIG. 10 is a cross-sectional top view of the lower part of the boiling chamber of FIG. 1 equipped with the electrode assembly of FIG. 9.

The steam generator shown in FIG. 1 comprises an outer housing 11 forming a water tank or reservoir from which water may enter the bottom of a generally cylindrical boiling chamber 12, suspended within that reservoir, through a capillary tube 13 (e.g. of Teflon) which extends into the chamber at an angle of about 30° to the horizontal; this angle could be increased to about 60°. The discharge end of tube 13 lies just below the lower extremities of a pair of electrodes 14 and 15 suspended from a lid 16 which constitutes the top of boiling chamber 12; lid 16 has a rim 17 removably embracing a neck 18 of vessel 11 and a peripheral flange 19 of cylinder 12 overlying that neck. Lid 16 is further formed integral with a depending ring 20 which is centered on the cylinder axis of chamber 12 and serves as a mounting for the electrodes 14 and 15.

Each electrode 14, 15 comprises a generally flat sheet-metal shank 14*a*, 15*a* terminating at the top in a transverse tab 14*b*, 15*b* which is secured to the lid 16 inside ring 20 by screws 21, 22; these tabs and screws are mutually separated by a nonconductive partition 23 molded integral with lid 16 from synthetic resin.

A passage 24 in lid 16 serves for the insertion of wires conductively secured to screws 21 and 22 with the aid of clamping nuts 21*a*, 22*a* and retaining nuts 21*b*, 22*b*.

Shanks 14*a* and 15*a*, which are slightly convex with a radius of curvature substantially corresponding to that of ring 20, are each provided with a pair of locator ribs 14*c*, 15*c*, which are stamped out from the shanks and, as best seen in FIG. 6, diverge outwardly therefrom. These ribs are received in respective segmental cutouts 20*a*, 20*b* of ring 20 which are downwardly open to facilitate insertion of the ribs from below, the ribs then coming to rest against opposite edges of the cutout so as to define the position of the corresponding electrodes 14, 15 independently of the mounting screws 21, 22. The electrode shanks 14*a* and 15*a* thus embraced extend parallel to each other to the water level within boiler 12 and terminate below that level in a pair of lower extremities 14*d*, 15*d* generally similar to the J-shaped terminations disclosed and claimed in my prior U.S. Pat. No. 3,619,559. In contradistinction to the prior disclosure, however, the inner J has a solid bight portion constituted by a carbon block 14 *e* engaged by prongs 14*f*, 14*g*, 14*h* integral with shank 14*a*, this block having a raised ledge 14*i* engaging the prong 14*h*; another prong 14j is bent out of the plane of shank 14*a* to hold the block 14*e* in position. Thus, electrode 14 has inactive portions (such as the top of block 14*e* or prong 14*f*) conductively interconnecting its active portions which confront the various parts of the extremity 15*d* of electrode 15.

As illustrated in FIG. 2A, a modified electrode 14′ may have a J-shaped extremity 14*d*′ connected with its shank by an inactive bridge piece 14*f*′ which may be soldered or otherwise fastened to that shank. The loop formed by the extremity 14*d*′ is of the same general outline as the carbon block 14*e* of FIG. 2.

Lid 16 has a vertical aperture 25 serving as an outlet for the generated steam, the aperture lying close to the outer periphery of ring 20 and communicating with the interior of a fixed sleeve 26 coaxially surrounded by a movable sleeve 27. Sleeve 27 forms a cap 27*a* overlying the top of sleeve 26; a laterally extended tube 27*b* integral with sleeve 27 is in line with an orifice 26*a* of sleeve 26 and has a port 27*c* for the discharge of the steam. Tube 27*b* may be inserted into a hole 28 of a vessel 29 juxtaposed with tank 11 to serve as a facial sauna.

As further illustrated in FIG. 1, a splash shield 29 is partly inserted into the entrance end of aperture 25 in which it is loosely held with the aid of a looped wire 30 bearing upon a bushing 31 press-fitted into that aperture. Shield 29 has an upwardly tapering body and lies normally far enough below the bushing 31 to let steam pass substantially unobstructedly through aperture 25 and nozzle tube 27*b*. If, however, water entrained upwardly by the rising steam strikes the underside of body 29, the latter is thrust into the sleeve to block the passage temporarily.

A modified splash shield of the same general structure has been shown at 29′ in FIG. 4, the frustoconical body of this shield being supported by a bent wire 32 on which it is freely slidable toward outlet aperture 25′. The modified lid 16′ shown in FIGS. 3 and 4 is rigid with an outer sleeve 26′ having an orifice 26*a*′ positioned to register with either of two discharge ports 33*a*, 33*b* (see also FIG. 5) of an inner sleeve 33. The latter is connected by a screw 34 with a cap 35 having pegs 36 projecting into a slot 33*c* at the closed top of sleeve 33; cap 35 has an arcuate slot 35*a* engaged by a stop pin 37 which rises from the upper surface of lid 16′. A point 35*b* of cap 35 indicates two rotary positions 90° apart, respectively designated Lo and Hi, in which either the small port 33*a* or the large port 33*b* registers with orifice 26*a*′ to let the steam issue at either a high or a low rate. Indexing means (not shown) may be provided to arrest the swivel cap 35 in either of these positions.

In the modified arrangement of FIGS. 7 and 8, a toggle spring 38 is anchored to the lid 16′ at one end and has its other end secured to the swivel cap 35 to bias it into either of the two operative positions described above.

In FIGS. 9 and 10 I have illustrated the lower parts of two electrodes 114 and 115 adapted to be used in the boiler 12 in lieu of the electrodes 14 (or 14′) and 15 described above, the upper ends of electrodes 114 and 115 being identical with those of the electrodes shown in FIGS. 1 and 2. Outer electrode 115 has a generally J-shaped lower extremity 115*d* merging into its shank 115*a*. The shank 114*a* of inner electrode 114 terminates in an active extremity 114*d* having the shape of a horizontal U whose upper surface is level with the top of the short leg 115*e* of the J. The bight portion of extremity 114*d* has a lug-shaped extension 114*j* through which it bears upon the inner periphery of boiling chamber 12 and is received between ribs 12*a* thereof to help immobilize the electrode 114. It will be noted that, as with the electrodes shown in the preceding Figures, the shanks 114*a* and 115*a* are widely sepa-

rated as compared with the spacing of their confronting active portions.

Naturally, the various electrodes described and illustrated may be interchangeably used with the several lid and valve structures of FIGS. 1 – 8.

As further illustrated in FIG. 1, the bottom of cylinder 12 has an outer boss 12*b* and an inner boss 12*c* accommodating the capillary tube 13; within boss 12*b* the bore 12*d* receiving this tube is widened and communicates with a transverse access hole 12*e* whereby water from tank 11 may circulate around the tube to help keep it from overheating and impeding the water flow therethrough. As the water heats up inside boss 12*b*, it leaves the bore 12*d* and gravitates to the top of the tank so that colder liquid continuously circulates through the bore to cool the outer surface of the lower end of tube 13.

I claim:

1. A boiling chamber for a steam generator, comprising:
   - a generally cylindrical upright vessel provided at its bottom with an inlet for water to be boiled, said vessel having a closed top formed with an outlet for evolving steam;
   - a mounting ring on said top within said vessel substantially centered on the cylinder axis, said ring being formed with a pair of diametrically opposite segmental cutouts open toward the bottom;
   - a pair of electrodes depending from said top within said vessel, each of said electrodes having a generally flat stem terminating at its free end in a transverse tab secured to said top within said ring adjacent a respective cutout thereof, said stem being provided with two outwardly diverging ribs bearing upon opposite edges of the respective cutout; and
   - nozzle means on said top communicating with said outlet.

2. A boiling chamber as defined in claim 1 wherein said electrodes have lower extremities integral with their stems spacedly confronting each other above said bottom, one of said extremities comprising two portions facing respective parts of the other extremity and conductive bridge means interconnecting said portions in non-confronting relationship with said other extremity.

3. A boiling chamber as defined in claim 2 wherein said other extremity is generally J-shaped, said one of said extremities forming a horizontal U received within the J of said other extremity.

4. A boiling chamber as defined in claim 3 wherein said one of said extremities is connected with the associated stem at one of the legs of the U and bears upon the inner peripheral wall of said vessel at the bight of the U.

5. A boiling chamber as defined in claim 1 wherein said outlet is a vertical aperture in said top close to the outer periphery of said ring, said nozzle means comprising a fixed sleeve rising from said top in line with said aperture and having a lateral orifice communicating therewith.

6. A boiling chamber as defined in claim 5 wherein said nozzle means comprises a movable sleeve engaging said fixed sleeve in coaxially nested relationship and having at least one port alignable with said orifice.

7. A boiling chamber as defined in claim 6 wherein said movable sleeve detachably surrounds said fixed sleeve and is integral with a laterally extending tube provided with said discharge port.

8. A boiling chamber as defined in claim 6 wherein said movable sleeve is rotatably received in said fixed sleeve and has at least two ports of different diameters selectively alignable with said orifice in different rotary positions to establish passages of different widths for escaping steam.

9. A boiling chamber as defined in claim 8, further comprising toggle means urging said movable sleeve into either of two rotary positions establishing respective passages.

10. A boiling chamber as defined in claim 5 wherein said aperture is provided with a splash shield partly obstructing its entrance end.

11. A boiling chamber as defined in claim 10 wherein said splash shield comprises an upwardly tapering body mounted for substantially unrestricted vertical move ment below said entrance end and extending partly into same.

12. A boiling chamber as defined in claim 1 wherein said inlet comprises a capillary tube entering said vessel through said bottom below said electrodes, said bottom forming a widened bore around a lower end of said tube having a lateral access hole for facilitating the circulation of water from a surrounding reservoir around said lower end.

13. A boiling chamber as defined in claim 12 wherein said tube enters said vessel at an angle ranging substantially between 30° and 60°.

14. An electrode assembly for a boiling chamber of a steam generator, comprising a first electrode with a first generally flat vertical sheet-metal stem terminating in a generally J-shaped extremity in line therewith, and a second electrode with a second generally flat vertical sheet-metal stem confronting said first stem and terminating in a generally U-shaped extremity in a plane transverse to said stems, said U-shaped extremity lying on a level with the short leg of said J-shaped extremity and spacedly confronting the latter.

15. An assembly as defined in claim 14 wherein said U-shaped extremity is nested within said J-shaped extremity and has a bight portion projecting beyond the confines of the J.

* * * * *

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,743,780 Dated 3 July 1973

Inventor(s) Nat CAMP

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

Figure 9 is to appear as shown below.

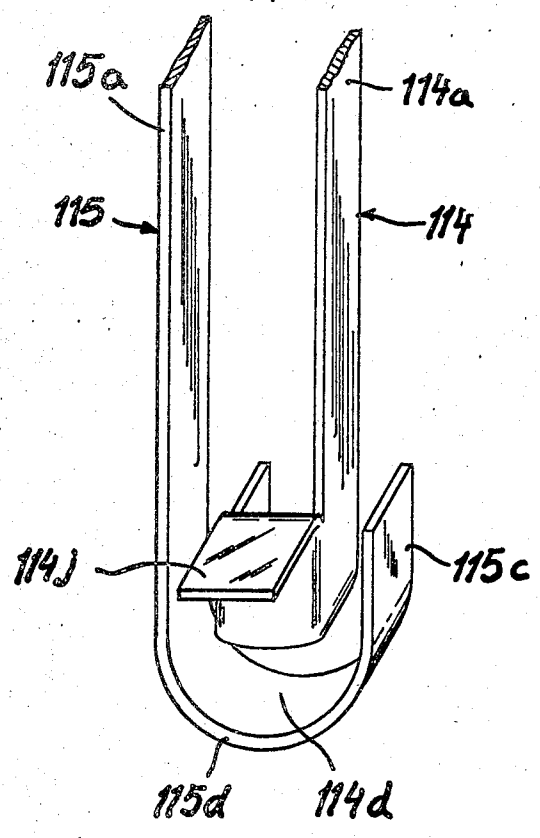


FIG. 9

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(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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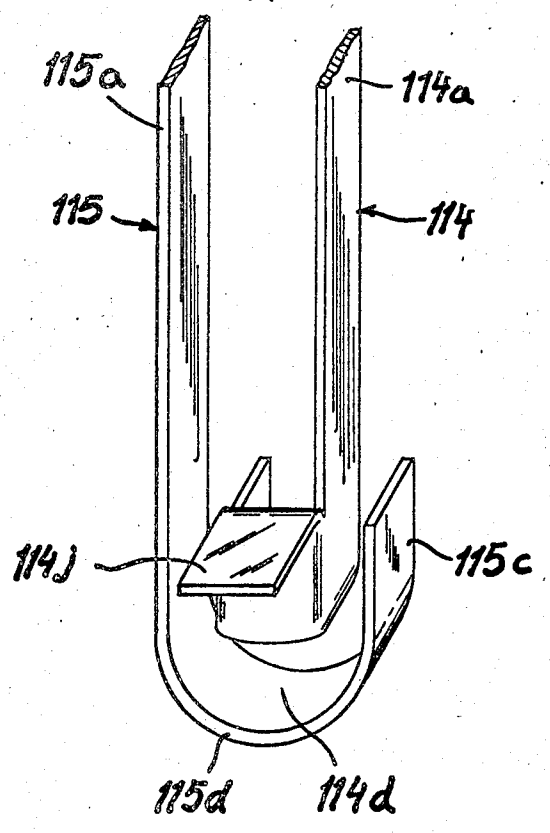


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