H. E. COHEN.

ELECTRIC BOILER.

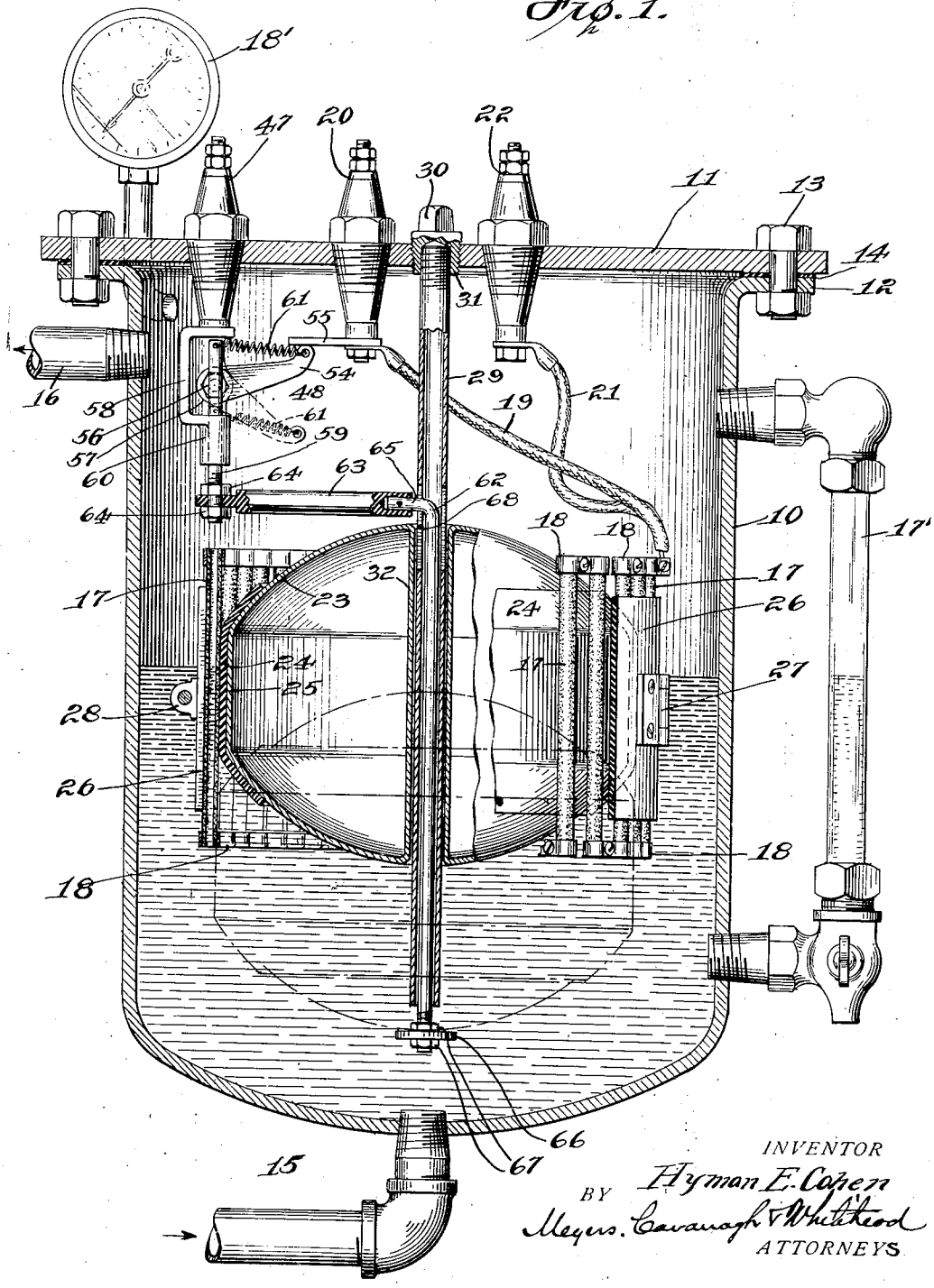
APPLICATION FILED MAR. 4, 1922.

1,420,693.

Patented June 27, 1922.

2 SHEETS—SHEET 1.

Fig. 1.



INVENTOR

Hyman E. Cohen

BY

Meyer, Cavanagh & Whitehead

ATTORNEYS

H. E. COHEN.

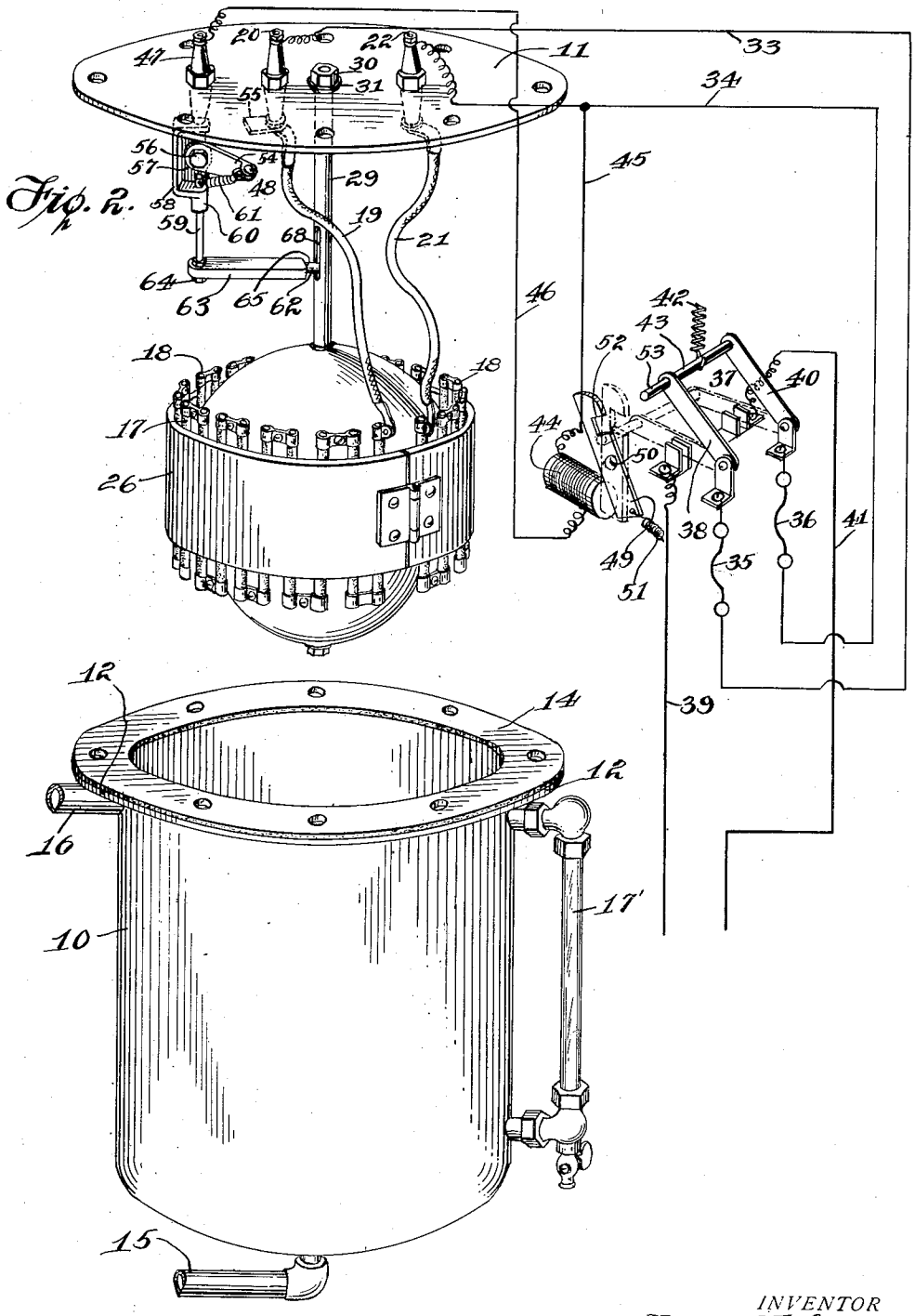
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2 SHEETS—SHEET 2.

Fig. 2.



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ATTORNEYS

UNITED STATES PATENT OFFICE.

HYMAN E. COHEN, OF SYRACUSE, NEW YORK.

ELECTRIC BOILER.

1,420,693. Specification of Letters Patent. Patented June 27, 1922.

Application filed March 4, 1922. Serial No. 540,968.

To all whom it may concern:

Be it known that I, HYMAN E. COHEN, a citizen of the United States, and resident of Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Electric Boilers, of which the following is a specification.

This invention relates to an electric boiler and more particularly to an electric steam boiler embodying my electrical steam generator disclosed in my copending application Serial Number 416,399, filed October 12, 1920; and has special reference to the provision of a boiler of this nature which may be operated with a maximum of surety, safety and facility.

In the steam generator forming the subject matter of my above mentioned copending application one or more electrical heating elements in the form of resistance tubes is or are arranged in a boiler and disposed therein with an end or the ends of the tube or tubes exposed above the water level, the said tubes when electrically heated, as by passing a current therethrough, effecting the segregation of water within the tube, the heating of the said segregated water and the expulsion of the same from the top end of the tube in the form of generated steam. These tubes in one form of my invention are arranged to be floated in the boiler for following the changing liquid level therein to the end of maintaining the upper ends of the tubes exposed above the water level a constant predetermined amount. A prime desideratum of my present invention comprehends the provision of a boiler construction in which the electrical resistance tubes are floated in a manner to render the operation of the same in practice safe, dependable and secure.

I have found after considerable experimentation that in order to obtain an efficient floating construction in the steam boiler, which is usually subjected to considerable pressure during steam generation, that such factors as the character of the float, the mounting of the float and movement of the same in the boiler casing are considerations of prime importance. It is very desirable, for example, that the float be freely movable in the boiler casing without let or hindrance so that the rise and fall of the float may be assured during changes in the liquid level of the boiler. Moreover, the construction of the float should be such as to withstand the heavy pressure to which it is subjected in practice. Furthermore, the electrical resistance elements must be so mounted on the float and associated with the boiler casing as to prevent the same from making contact with the boiler casing to minimize grounding troubles and also to prevent the same from moving transversely in the casing to reduce the liability or tendency of grounding or largely modifying the resistance between the said electrical heating elements and the boiler casing. A principal object of the present invention therefore comprehends the provision of a construction in which the float and the tubular elements thereon are efficiently supported within the casing and movable therein to prevent undesirable binding and jamming of the parts and to permit the free rise and fall of the float with the construction such as to minimize or prevent any grounding tendency of the electrical heating elements.

Another important desideratum of my present invention comprehends a construction of the type referred to in which the electrical elements are protected against "burn outs" and in which needless consumption of energy is prevented when the water in the boiler falls below a predetermined level.

I have found it highly desirable where an absolutely safe and dependable boiler is desired to provide an automatic cut-out means operable by movement of the float in the boiler, the construction and arrangement being such that when the float following the water level falls below a predetermined height, the circuit to the electrical heating elements is opened or cut out to prevent the wastage of current and to prevent the burning out of the electrical heating elements. A further principal object of the invention therefore comprehends the provision of a cutout means of this nature which is efficiently associated in a simple manner with the floating apparatus.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in the elements and their relation one to the other, as herein-

after particularly described and sought to be defined in the claims, reference being had to the accompanying drawings which show a preferred embodiment of my invention and in which:

Figure 1 is a cross sectional view of my boiler showing the floating equipment therein, and

Figure 2 is a perspective and diagrammatic view thereof showing the floating equipment removed from the boiler casing and the control circuits therefor.

Referring now more in detail to the drawings, the electric boiler of my invention comprises the preferably cylindrical casing or shell 10, the said casing being provided with the closure 11 adapted to be attached to the casing structure as by being bolted to a top flange 12 of the boiler casing as by means of the spacedly arranged bolts 13, the suitable gasket 14 being interposed between the closure and the casing flange for obtaining an effective seal between these parts. Connected to the bottom of the casing shell 10 there is provided the water inlet piping 15 and connected to the side wall of the boiler casing 10 adjacent its top there is provided the steam outlet piping 16. The boiler may be further provided with the usual water gauge 17′ and the pressure gauge 18′. The casing or shell 10 is intended for the reception of a suitable supply of water and for heating this water for steam generation I provide a plurality of electrical resistance elements in the form of carbon tubes, as disclosed in my above mentioned copending application, the said carbon tubes functioning to segregate portions of the water in the boiler shell and to heat the same substantially instantly for generation of steam. The resistance tubes preferably comprise a plurality of tubular elements 17 arranged in series and connected by means of a plurality of connectors 18, these tubular elements being connected to any source of electrical supply, one end of the series of tubes being to this end electrically connected by means of a conductor 19 to a binding post 20 attached to the boiler closure 11 and suitably insulated therefrom, the other terminal of the series of tubes 17 being connected by means of a conductor 21 to a second binding post 22 carried by the boiler closure 11 and suitably insulated therefrom, the binding posts 20 and 22 being intended for connection to a suitable source of supply, as will be made clearer hereinafter. Upon energization or closing of the circuit to the heating units 17 the water segregated thereby is instantly heated and transformed into steam which issues from the top ends of the tubes in a continuous fountain formation. The tubes 17 are preferably arranged within the boiler casing with the top ends thereof exposed above the water level to the end of effecting efficient steam generation, and where a constant characteristic of steam is desired, it is preferred to maintain the exposed ends of the tubes in constant and predetermined relation with respect to the water level and for this purpose these tubes are floated within the boiler to follow the changing liquid level therein.

As heretofore stated, a principal object of my present invention relates to the provision of a boiler construction in which the floated heating elements are arranged and mounted for efficient movement and operation in the boiler, the floating equipment being adapted to rise and fall with the changing liquid level with facility and surety. For the purpose of withstanding the high pressures attainable in the boiler during steam generation I have found it very desirable to provide the hollow substantially ball shaped metallic float 23 and to the float I attach the resistance elements 17, the latter being preferably arranged circumferentially or peripherally on the said float. A very convenient means of attaching the resistance elements to the float comprises the provision of a resilient and insulating sheath such as a rubber covering 24 stretched over the flattened side walls 25 of the float, the series of connected tubes 17 being arranged about this rubber sheath and a clamping band 26 made of any suitable insulating material being provided for clamping the heating elements 17 against the rubber covering 24, the said clamping band 26 preferably comprising two semi-circular sections hinged together by means of the hinging element 27, the other ends of these semi-circular sections being adapted to be drawn together by means of a clamp 28, the provision of this means effecting a secure attachment of the tubes 17 on the float 23. For obtaining a float which will readily respond and rise and fall with the changing liquid level in the boiler while minimizing grounding tendencies, I have found it very suitable to provide a rectilinear guiding means for the float, the guiding means conveniently comprising a preferably hollow stem 29 carried by the boiler closure 11 as by being threadedly received by a plug 30 which in turn is threadedly attached to the boiler closure 11 as at 31, the said hollow stem 29 slidably receiving the float 23 and the heating elements carried thereby, the said float 23 being preferably provided with a central sleeve-like integral portion 32 of a diameter to be freely received by the hollow stem 29. The stem 29 is preferably arranged centrally of the cylindrical shell 10 and the float and its attached resistance tubes are thus preferably movable centrally of the boiler. With the provision of this construction the floating equipment is efficiently guided for movement within the boiler casing for obtaining a dependable operation thereof.

For the purpose of obtaining a safe and "fool-proof" construction to prevent the needless consumption of energy and to prevent the burning out of the heating elements when the water in the boiler is or falls below a predetermined level, I have found it desirable to provide means for controlling the energization of the circuit to the heating elements depending upon the position of the floating equipment in the boiler. Referring now to Figure 2 of the drawings, the circuit to the heating elements may comprise the conductors 33 and 34 connecting the binding posts 20 and 22 through fuses 35 and 36, if desired, to a main control switch 37, the conductor 33 being connected through the bar 38 of the said switch to line 39 leading to a source of supply, the conductor 34 being connected through the other bar 40 of the switch to the other line 41 leading to the source of supply. The switch 37 is normally maintained in open position and to this end this switch is spring controlled, a spring 42 being provided anchored to the transverse insulating bar 43 of the switch 37 for maintaining the said switch in the normally open position as indicated in full lines in figure 2 of the drawings. For controlling the circuit to the heating elements, the switch 37 is controlled so that operability of the said switch is prevented under the abnormal boiler conditions presented when the liquid therein falls below a predetermined level.

For controlling the switch 37 to control the operability thereof, there is preferably provided a second circuit controlled by the movement and the position of the floating equipment within the boiler. Still referring to Figure 2, this circuit includes a solenoid or electro-magnet 44, one terminal of which is connected to the conductor 34 by means of the conductor 45, the other terminal of which is connected by means of a conductor 46 to a third binding post 47 carried by the boiler closure 11 and suitably insulated therefrom, the binding post 47 being in turn connected to a cutout switch generally designated as 48 adapted for cooperative association with the binding post 20, as will be described presently, for closing the circuit to the conductor 33. This circuit including the solenoid 44 is therefore arranged in parallel with the heating elements across the lines 33 and 34, energization or deenergization of the solenoid 44 being therefore under the control of the main switch 37. The solenoid 44 is arranged for operating an armature locking element 49, the latter being pivotally mounted as at 50 and normally urged to inoperative position by means of a spring 51 anchored thereto. The armature 49 may be suitably notched as at 52 to cooperate with a locking pin or stud 53 forming part of or attached to the switch 37. With the provision of this construction it will be evident that upon energization of electro-magnet or solenoid 44 the armature locking element 49 will be moved to cooperate with the locking stud 53 for the purpose of locking the switch 37 in closed position in the event that the said switch is moved to the said closed position, the switch being maintained in closed position during continued energization of the magnet 44. It will be further apparent that in the operation of the boiler, if the magnet 44 is deenergized, the lock armature 49 will be moved by the spring 51 to inoperative position for unlocking the switch 37 and the spring 42 will move the said switch 37 to open position for opening the circuit to the heating elements.

For effecting the desired control of the armature 49 by the electro-magnet 44, the cut-out switch generally designated as 48 hereinbefore mentioned is provided. The switch 48 comprises a movable switch or contact arm 54 movable into and out of engagement with a stationary contact arm 55, the movable arm 54 being rockably mounted about a pivot 56 provided in an upstanding bearing 57 formed preferably integrally with a bracket 58, which is connected mechanically and electrically to the binding post 47, the stationary contact arm 55 being in turn attached for electrical connection to the binding post 20. For moving the contact arm 54 into and out of operative engagement with the contact arm 55 there is provided a rod 59 slidably movable in an apertured boss 60 forming part of the bracket 58 and connecting the rod 59 and the switch arm 54 there is provided a tension spring 61, one end of which is anchored to the end of the arm 54, the other end of which is anchored to the rod 59, as will be clear from a consideration of Figures 1 and 2 of the drawings. The rod 59 is adapted for sliding movement in the boss bearing 60 and when the rod is moved to its uppermost position the spring 61 will exert tension upon the arm 54 for moving the same into the contacting position as shown in Figure 1 of the drawings. When the rod 56 is moved to descended position as indicated in dotted lines in Figure 1 and as shown in Figure 2 of the drawings, the spring 61 exerts tension upon the arm 54 for snapping the same out of contacting position, thus opening the circuit to the electro-magnet 44. The position, therefore, of the rod 59 controls the operability of the magnet 44 and therefore the operability of the main switch 37.

For controlling the operation of the cut-out switch 48 the rod 59 is arranged to be operated by the movement of the float 23 and controlled by the position thereof. To this end the rod 59 is connected to a rod 62 preferably arranged for sliding movement

within the hollow stem 29, an insulating rod or bar 63 being provided for connecting the rod 59 to the rod 62, one end of the bar 63 being adjustably attached to the rod 59 as by means of the adjustable locking nuts 64, the other end of the insulating bar 63 being attached to the rod 62 as by receiving an outwardly turned portion 65 thereof. The rod 62 is provided at its bottom end with a stop disk 66 which may be adjusted on the rod 62 by means of the adjustable lock nuts 67, the adjustment being provided for varying the region in which the cut-out switch 48 is to be operated by the floating equipment. With the provision of this construction it will be seen that as the floating equipment descends with the fall in the liquid level the bottom portion of the float 23 when the float reaches the position as indicated in dotted lines in Figure 1 of the drawings, will engage the stop disk 66 and will move the rod 62 in the hollow stem 29, a suitable slot 68 being provided in the side wall of the stem for permitting this motion, movement of the rod 62 effecting, as will be obvious, the descent of the rod 59 and the movement of the switch arm 54 to open position as indicated in dotted lines in Figure 1. With the parts arranged in this manner the switch 37 will be automatically opened and when the switch 37 is manually closed the said switch will not be maintained closed under this abnormal boiler condition. It will be further apparent that when a supply of water is admitted to the boiler casing 10 the floating equipment will rise to the position shown in Figure 1 of the drawings, and in rising to the desired level the upper portion of the float 23 will engage the insulating bar 63 for moving the contact arm 54 to close the circuit controlled thereby. When the tank or boiler shell is thus filled to the desired height, the electro-magnet 44 is conditioned for energization when the switch 37 is closed, the locking means for the said switch being thus rendered operable. The stop disk 66, besides functioning for being engaged by the float 23 for operating the switch 48, also functions as a stop element to prevent movement of the float 23 from the stem 29, this construction providing the attachment of the complete floating equipment and the cut-out switch to the boiler closure 11, removal of the boiler closure as shown in Figure 2 of the drawings being effective for removing the entire floating equipment and associated parts for purposes of inspection or repair.

The operation and use of my electric boiler will, in the main, be apparent from the above detailed description thereof. It will be apparent that when the boiler is suitably supplied with water to the desired height, the main control switch 37 when manually closed will be maintained closed for connecting the heating tubes 17 to a source of current supply, heating of the tubes effecting the generation of steam in the chamber above the water supply, the steam moving through the outlet 16 for use in other apparatus. As the liquid supply becomes exhausted the floating tubes 17 move downwardly in the boiler casing suitably guided to obtain facile operation and to eliminate grounding tendencies, a predetermined amount of the upper ends of the tubes being maintained above the water level. When the water level falls below a predetermined minimum the cut-out switch 48 will be operated to de-energize the magnet 44 for unlocking the switch 37 and for effecting the opening of the circuit to the heating elements, a safe and dependable operation being thereby provided.

While I have shown my device in the preferred form, it will be obvious that many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims.

I claim:

1. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, heating elements carried by the float and means for guiding the float in its movement in the boiler, the said means comprising a stem slidably receiving the said float.

2. In an electric boiler, a boiler casing, a hollow metallic float movable therein and adapted to follow the changing liquid level in the boiler, electrical heating elements insulatably carried by the float and means for guiding the float in its movement in the boiler, the said means comprising a stem connected to the boiler casing, the said stem slidably receiving the said float.

3. In an electric boiler and steam generator, a casing, a float movable therein and adapted to follow the changing liquid level in the boiler, tubular electrical heating elements carried by the float and movable therewith, the arrangement being such that the upper ends of the tubular elements are exposed above the water level and means for guiding the float in its movement in the boiler with the said tube ends maintained above the water level, the said means comprising a centrally located stationarily mounted stem receiving the said float for free slidable movement thereon.

4. In an electric boiler, a boiler casing including a boiler closure therefor, a float movable within the casing and adapted to follow the changing liquid level in the boiler, heating elements carried by the float and means for guiding the float in its movement in the boiler, the said means comprising a stem carried by the said closure and slidably receiving the said float and means

for limiting the movement of the float on the stem, the construction being such that the float and the stem are removable as a unit with the boiler closure.

5. In an electric boiler, a boiler closure, a stem carried thereby, a float slidably movable on the stem and heating elements carried by the float.

6. In an electric boiler, a boiler closure, a stem carried thereby and located centrally thereof, a hollow metallic float slidably movable on the said stem and a plurality of electrical heating tubes carried by the float for movement therewith.

7. In an electric boiler, a heating apparatus adapted for following the changing liquid level in the boiler, the said heating apparatus comprising a hollow substantially ball shaped float and a series of tubular electrical resistance elements mounted on the float and arranged circumferentially thereon.

8. In an electric boiler, a heating apparatus adapted to follow the changing liquid level in the boiler comprising a metallic float, a plurality of tubular electrical resistance elements carried by the float and arranged peripherally thereof and means for supporting the tubular elements on the float, the said means comprising a resilient sheath interposed between the float and the heating elements and a peripheral clamping band arranged externally to the heating elements for clamping the same in position on the float.

9. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the said boiler, heating elements carried by the float, an electrical circuit therefor and provisions for controlling the said circuit to the heating elements including switch means controlled by the movement of the float.

10. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the said boiler, heating elements carried by the float, an electrical circuit therefor and provisions for controlling the said circuit to the heating elements controlled by the movement of the float.

11. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, tubular electrical resistance heating elements carried by the float adapted for connection to an electrical circuit and provisions for controlling the said circuit to the heating elements controlled by the movement of the said float.

12. In an electric boiler, a boiler closure, a float carried by the boiler closure and adapted for movement within the boiler for following the changing liquid level therein, heating elements carried by the float, an electrical circuit therefor and provisions carried by the said closure for controlling the said circuit to the heating elements, the said provisions being controlled by movement of the said float.

13. In an electric boiler, a float movable in the boiler and adapted to follow the changing liquid level therein, electrical heating elements carried by the float, a circuit therefor, a cut-out switch movable for controlling the said circuit to the heating elements, the said switch being operated by movement of the float in the boiler.

14. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, heating elements carried by the float, means for guiding the float in its movement in the boiler comprising a stem slidably receiving the said float, an electrical circuit for the heating elements, switch means for controlling the said circuit and provisions for operating the said switch means, the said provisions being also movable on the stem and controlled by the movement of the said float.

15. In an electric boiler, a boiler closure, a float movable within the boiler and adapted to follow the changing liquid level therein, heating elements carried by the float, means for guiding the float in its movement in the boiler comprising a stem carried by the said closure and slidably receiving the said float, an electrical circuit for the heating elements, switch means also carried by the said closure for controlling the said circuit, and provisions for operating the said switch means, the said provisions being also movable on the stem and controlled by the movement of the said float.

16. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, electrical heating elements carried by the float, means for guiding the float in its movement in the boiler comprising a stem slidably receiving the said float, an electrical circuit for the heating elements, switch provisions for controlling the said circuit and means movable on the stem for operating the said provisions, the said means being movable to two positions on the said stem, the construction being such that when the float is moved to a predetermined upper level the said means will be moved to one position and when the float is moved to a predetermined lower level the said means will be moved to its other position.

17. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, electrical heating elements carried by the float, a circuit therefor, a control switch in said circuit and means for preventing operability of the said control switch under abnormal boiler conditions, the said means including provisions arranged within the cas-

ing and controlled by the position of the said float.

18. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, electrical heating elements carried by the float, a circuit therefor, a control switch in said circuit and means for preventing operability of the said control switch under abnormal boiler conditions, the said means including a second switch arranged within the casing and controlled by the position of the said float.

19. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, an electrical circuit, a switch in said circuit and means for preventing operation of the said switch under abnormal boiler conditions, the said means including provisions arranged within the casing and controlled by the position of the said float.

20. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, electrical heating elements carried by the float, a circuit therefor, a control switch in said circuit normally movable to open position, a locking means therefor for holding the switch closed under normal boiler conditions and means for controlling the operation of the said locking means for preventing operability thereof under abnormal boiler conditions, the said means including provisions arranged within the casing and controlled by the position of the said float.

21. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, electrical heating elements carried by the float, a circuit therefor, a control switch in said circuit normally movable to open position, a locking means therefor for holding the switch closed under normal boiler conditions and means for controlling the operation of the said locking means for preventing operability thereof under abnormal boiler conditions, the said means including a solenoid for actuating the locking means and a cut-out switch arranged within the casing and movable to open and closed position by movement of the said float.

22. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the boiler, heating elements carried by the float and means for rectilinearly guiding the float in its movement responsive to the changing liquid level in the boiler.

23. In an electric boiler, a boiler closure, guiding means carried thereby, a float guidedly movable on said guiding means and heating elements carried by the float.

24. In an electric boiler, a boiler closure, a guiding means carried thereby and located centrally thereof, a hollow metallic float guidedly movable on said guiding means and a plurality of electrical heating tubes carried by the float for movement therewith.

25. In an electric boiler, a boiler casing, a plurality of electrical heating elements floatingly movable within the casing, an electric circuit therefor and provisions for controlling the said circuit to the heating elements controlled by the movement of the same.

26. In an electric boiler, a boiler casing, a float movable therein and adapted to follow the changing liquid level in the said boiler, floatable heating elements associated with the float, an electrical circuit therefor and provisions for controlling the said circuit to the heating elements controlled by the movement of the float.

27. In an electric boiler, a boiler casing, floatable heating elements therein and means for guiding the said heating elements for following the changing liquid level in the boiler.

28. In an electric boiler, a boiler casing, floatable electrical heating elements therein, an electric circuit therefor and means controlled by movement of the said floating heating elements for controlling the operability of the said circuit.

Signed at New York city, in the county of New York and State of New York, this 3rd day of March, A. D. 1922.

HYMAN E. COHEN.