Dec. 11, 1934. R. P. GLENN 1,984,262

BOILER

Filed Feb. 21, 1934 2 Sheets-Sheet 1

Fig. 1.

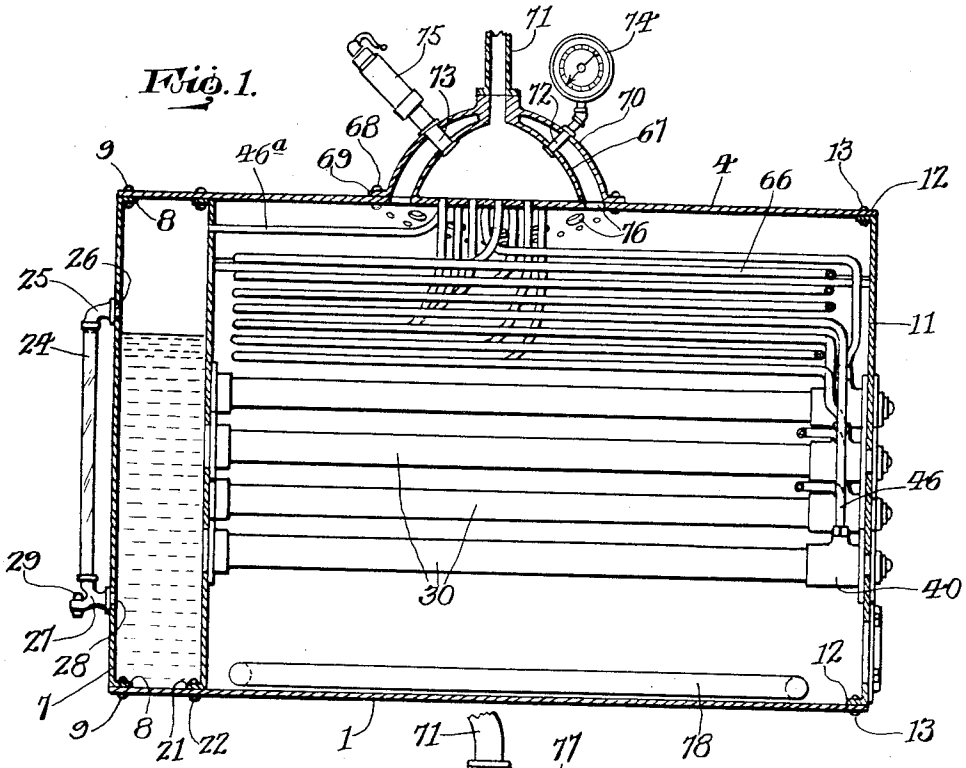
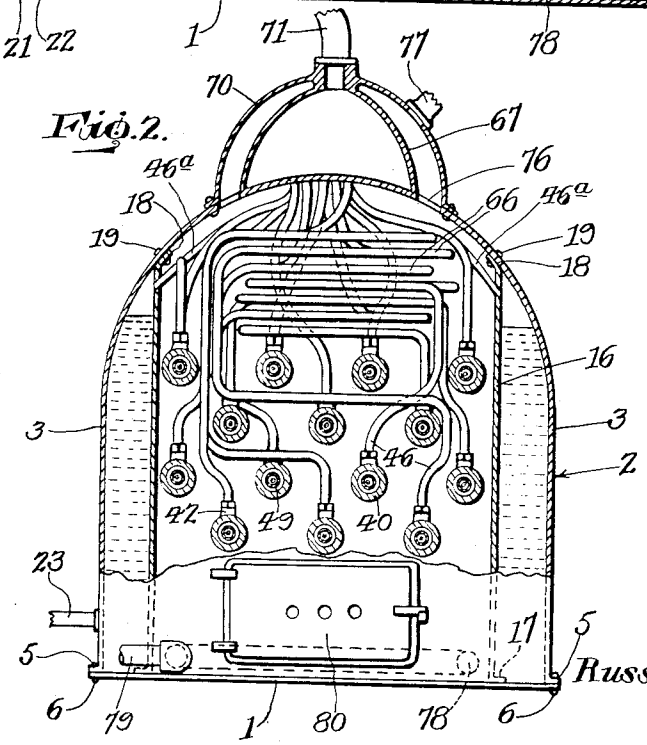


Fig. 2.



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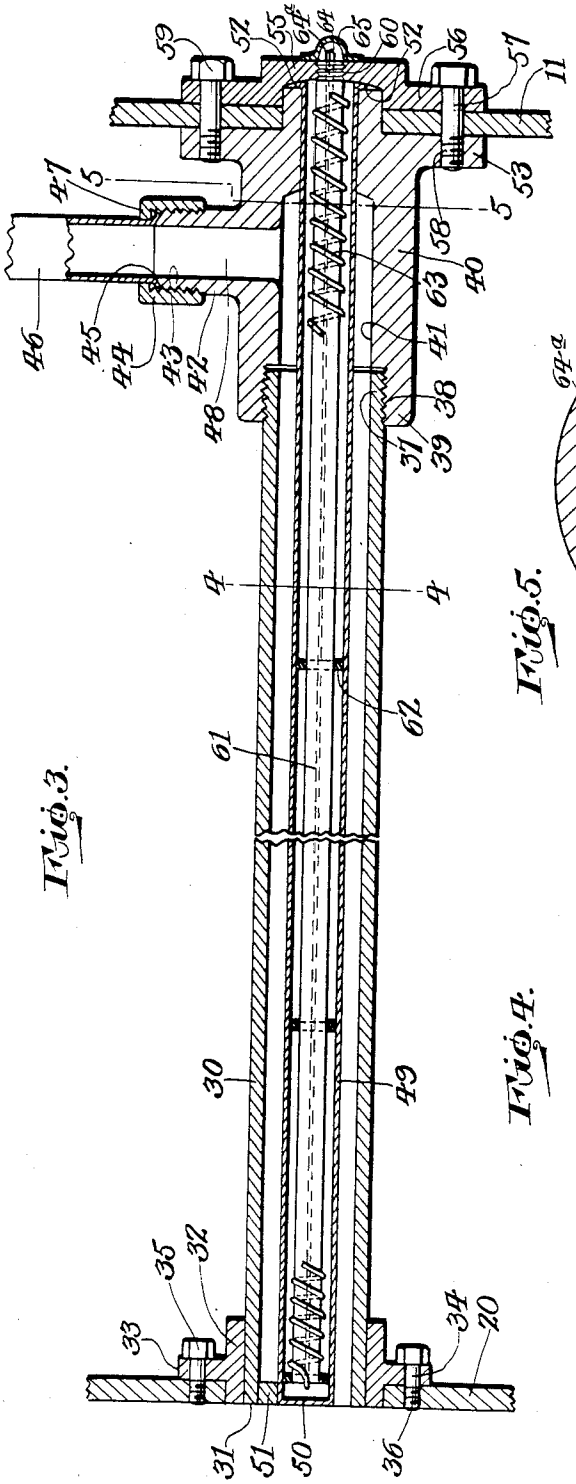


Fig. 3.

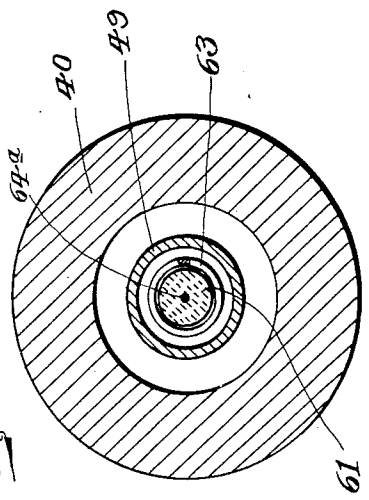


Fig. 5.

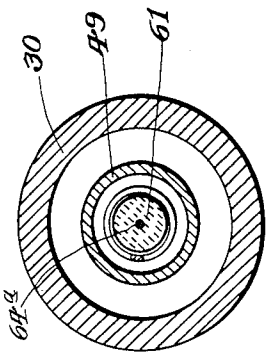


Fig. 4.

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UNITED STATES PATENT OFFICE

1,984,262

BOILER

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Application February 21, 1934, Serial No. 712,398

9 Claims. (Cl. 219—38)

This invention relates in general to boilers for generating steam or the like, and more particularly has reference to a novel arrangement of boiler parts and to novel means for heating the water to generate steam.

It is an object of this invention to provide a boiler arrangement in which the maximum amount of heat provided will be transmitted to the water and steam and thus made available for the purpose of accomplishing useful work. It is a further object to provide a boiler having more than one type of heating apparatus for heating the water and producing steam, and in which one of said types of heating apparatus will supply heat to the water and steam from the outside of tubes provided for the same, and in which another type of heating apparatus will supply heat to the water within a tube from the interior of such body of water.

It is a further object of this invention to provide a tube and heating apparatus for a boiler of this type in which the water within the tube may be heated from the interior thereof so as to produce a large amount of steam in a comparatively short time with a minimum loss of heat energy. It is an object to provide an electrical heating unit for supplying the heat to the interior of said tube, and that the various parts may be so formed and assembled that the electrical unit cannot come in contact with the water being heated or with any metallic part which might short circuit the heating element or otherwise cause damage. Another object is to provide an arrangement of water and heater tubes and to provide a fitting which will permit of said tubes forming a water chamber therebetween and which will permit steam generated to escape from said chamber through suitable tubes provided for the purpose, yet which will permit said electric heating element to be reached or removed without the necessity for draining the tube or any part thereof. Also, means is to be provided for maintaining the heating element in its proper position within the tube, which means shall also serve to assist in sealing the various parts together and in supporting the water heater or boiler tube from one of the outer walls of the boiler.

With the above and other objects in view, this invention consists of various parts and combinations thereof, one embodiment of which is illustrated in the accompanying drawings and described in the following specification.

In the drawings:

Figure 1 is a vertical longitudinal cross section of a boiler constructed in accordance with this invention.

Figure 2 is a vertical transverse section of the same structure.

Figure 3 is a vertical cross section of one of the steam generator tubes employed in the boiler illustrated in Figures 1 and 2.

Figure 4 is a sectional view taken along the line 4—4 of Figure 3.

Figure 5 is a sectional view taken along the line 5—5 of Figure 3.

With reference first to Figures 1 and 2, it is noted that the boiler comprises a base plate 1 to the sides of which are secured the opposite edges of a plate 2. This plate 2 is formed with a pair of substantially upright sides 3 and with a curved upper portion 4 forming the top of the boiler. The opposite edges of the plate 2 are formed with outwardly turned marginal portions 5 which are secured by means of rivets 6 or the like to the opposite side edges of the base plate 1. A plate 7 forms one of the end walls of the boiler and is provided with inturned marginal portions 8 which are secured by means of rivets 9 or the like to one of the end edges of the base plate 1 and to one of the arched edges of the plate 2. The other end wall is formed of a plate 11 having inturned marginal portions 12 secured to the end edge of the base plate 1 and to the other arched edge of the plate 2 by means of rivets 13 or the like.

The side walls of the boiler are made double by means of plates 16 which are disposed upright within the boiler at a position parallel to but spaced from the upright side portions 3 of the plate 2. The lower edge of these plates 16 are bent to form the marginal portions 17 which are secured to the base plate 1, and the upper edges of the plates 16 are bent to form marginal portions 18 secured by means of rivets 19 or the like to the curved top portion 4 of the plate 2. One of the end walls of the boiler is likewise made double by means of a plate 20 disposed parallel to and spaced from the plate 7 and having a marginal flange 21 secured by means of rivets 22 or the like to the base plate 1 and to the plate 2 along its curved upper portion 4. This marginal flange is also secured to the rear edges of the plates 16 in a similar manner. It will be seen that by the construction just set forth the firebox of the boiler illustrated is provided with double walls on three sides thereof, the space between said walls being available for use as a water jacket or reservoir.

Communicating with this water jacket through the walls 3 thereof or in some other similar position is a water supply pipe 23 for supplying water to the reservoir. There is also provided a water glass indicator 24 coupled to the water reservoir at its upper end by means of an elbow 25 passing through the wall 7 at 26, and coupled at its lower end to the reservoir by means of a fitting 27 passing through the wall 7 at 28. The fitting 27 may if desired be provided with a pet-cock or the like 29.

Communicating with the reservoir through the

wall 20 and extending from such wall to the opposite outer wall 11 are a plurality of steam generator tubes 30. These are preferably arranged in staggered relation with respect to each other as indicated in Figure 2 for a purpose which will hereinafter be described. With reference more particularly to Figures 3, 4 and 5 of the drawings, it will be seen that the ends 31 of the steam generator tubes are provided with fittings for securing them to the inner wall 20 of the boiler These fittings consist of a collar portion 32 snugly surrounding the end of the generator tubes and having a radially projecting flange 33 at a position spaced axially from the end of the tube and adapted to receive the screws 34 or the like. These screws 34 are provided with heads 35 so that they may be turned with a wrench or similar tool, and are provided with threaded ends for the purpose of threadedly engaging the wall 20 as indicated at 36.

The opposite end 37 of the tube 30 is threaded at 38 to receive the internally threaded end 39 of the fitting 40. This fitting is provided with an axial bore, one portion of which is of a relatively small diameter and the other portion of which is of a relatively large diameter. The portion 41 which is of relatively large diameter is of substantially the same size as the inner diameter of the tube 30, and when the fitting 40 is in place on the end of the tube 30, this portion of larger diameter forms a continuation of the inner walls of the tube 30. This fitting also has a laterally projecting portion 42 threaded on its outer end 43 for the purpose of receiving the coupling nut 44. This coupling nut 44 is adapted to couple to the end of the lateral extension 42 the end 45 of a steam transfer tube 46. The end 45 of the steam transfer tube is flared outwardly so as to engage the end of the lateral extension 42, and the coupling nut 44 is provided with an inwardly extending flange 47 for the purpose of engaging the flared portion 45 of the tube 46 and clamping said flared portion against the end of the lateral extension 42. It is noteworthy that this lateral extension is provided with a bore 48 which is of substantially the same diameter as the inner diameter of the tube 46 and which forms a continuation thereof. It is also worthy of note that this bore 48 communicates with the upper side of the larger portion 41 of the axial bore in this fitting.

Mounted within the steam generator tube 30 and substantially concentric therewith is a second tube 49 preferably of somewhat thinner construction than the tube 30 and closed at its end 50. The end 50 of the tube 49 is supported by means of a semi-circular support member 51 joining the upper side of the tube 49 to the upper side of the tube 30. At its opposite end, the tube 49 passes through the smaller portion of the axial bore in the fitting 40 and is snugly engaged thereby. The outer end of the tube 49 is flared outwardly at 52 against the outer end of the fitting 40.

At a position spaced from its outer end, the fitting 40 is provided with a radially projecting annular flange 53, and the portion outwardly of said flange is formed to extend through an opening provided for the purpose in the support wall 11. For the purpose of holding the flared portion 52 of the tube 49 in close engagement with the end of the fitting 40, there is provided a cap member 55 for engaging this flared portion 52. This cap member 55 is formed to fit around the outer end of the fitting 40 and is provided with a radially extending flange portion 56 corresponding in size and location to the flange 53 on the fitting 40, with the exception that the flange 56 is located on the outside of the wall 11 whereas the flange 53 is located on the inside of this wall. The flange 56 is perforated to receive bolts 57 which pass therethrough and through corresponding perforations in the plate 11 to threadedly engage the flange 53 at 58. The outer ends of these bolts or screws are provided with heads 59 for the purpose of receiving a wrench or the like.

The cap member 55 is provided centrally thereof with a threaded opening 60 for the purpose of receiving the end of a rod 61. This rod 61 is of substantially the same length as the tube 49 and is adapted to extend from the cap member to within a relatively small distance from the closed end 50 of the tube 49. This rod 61 is supported at intervals throughout its length by means of rings 62 of some suitable insulating material such as bakelite or the like and serves as a support for a coil of electric resistance wire 63. This coil of resistance wire is shown in Figure 3 as extending only part of the distance along the rod 61, but in reality is broken away only for the purpose of illustration and the coil extends throughout substantially the entire length of the rod 61. The rod 61 itself may be formed of any suitable insulating material, or if it is found more expedient to insulate the coil it may be formed of a non-insulating material. Connection to the coil may be made through the end of the rod 61 which is threaded into the cap 55. Such a connection is illustrated at 64 and 64*a* and may be protected by means of a guard 65 of the nature illustrated.

Referring again to Figures 1 and 2, it will be seen that the steam transfer tubes 46 leading up from the respective fittings 40 are formed with horizontally arranged coils disposed above the steam generator tubes 30, these coils being designated by the numeral 66. The upper ends of these tubes above the coils 66, as well as the upper ends of the steam transfer tubes 46*a* leading from the top of the water reservoir, pass through the lower wall of and communicate with the interior of a steam dome 67. These tubes are welded or otherwise suitably secured to the bottom wall of the steam dome 67. The outer walls of this steam dome 67 are double, and the steam dome itself is preferably made of one piece secured to the curved upper wall 4 of the boiler by means of rivets 68 or the like passing through the flange 69 provided on the outer wall 70 of the steam dome. The steam outlet main 71 leads from the upper end of the steam dome for the purpose of conducting the steam supplied by the boiler to the point at which it is to be used. Passing through the double walls of the steam dome are the conduits 72 and 73 connected respectively to the customary pressure indicator 74 and cut off valve or safety valve 75. The curved upper wall 4 of the boiler is provided with a series of perforations or openings 76 connecting the interior of the boiler proper with the space between the double wall of the steam dome thus allowing hot gases from the boiler to pass into the space between the walls of the steam dome. The flue for the boiler is arranged to lead from one side of the steam dome adjacent its upper end and to allow the hot gases to escape from the space between the double walls of the steam dome. This flue is indicated in Figure 2 at 77.

In addition to the electrical heating device

within the tube 49 for heating the water within the steam generator tubes from within, there is provided a burner 78 within the bottom of the firebox below the steam generator tubes 30 by which liquid fuel may be burned. Fuel is supplied to burner 78 by means of a supply pipe 79. A door 80 is also provided in the front wall of the firebox, through which door access may be had to the interior of the boiler. It will be appreciated of course that any other form of fuel burner may be provided if so desired, but that by such arrangement the steam generator tubes may be heated both from the inside and from the outside thus increasing the efficiency and capacity of the boiler.

It is believed that the operation of the above described boiler will be clearly apparent from the description which has been given. The water is supplied through the water intake pipe 23 in any conventional manner until the proper level shows on the water glass indicator 24. At this point, the water level is above the level of the steam generator tubes 30 and the water chamber which is between the walls of the tubes 30 and the wall of the tube 49 will be filled with water. Upon heat being supplied to these steam generator tubes either from the outside or from the inside or from both outside and inside, the steam will be generated within these tubes. The support member 51 previously described will also serve as a baffle to prevent such steam generated within the generator tubes from passing back into the water reservoir, and the steam will naturally pass out of the water chamber by way of the laterally extending bore 48 in the fitting 40 and the steam transfer tubes 46 leading therefrom. The steam will then be passed through the coils 66 above the steam generator tubes during which time it will be prevented from condensing by virtue of the fact that these coils lie in the path of any hot gases arising either from the steam generator tubes themselves or from the burner 78 positioned in the bottom portion of the boiler. From the coils 66, the steam will pass upward into the steam dome 67 and thence out through the steam main 71 to the point at which it is to be used. The hot gases from the boiler passing up through the openings 76 and into the hollow space between the double walls of the steam dome will serve further to prevent condensation of and to add heat to the steam.

It will be appreciated that by the above described construction a means has been provided for carrying out all of the objects and advantages of this invention, but that the same is by way of illustration and example only and is not to be considered as in any way limiting the spirit or the scope of this invention. These are to be limited only by the prior art and by the terms of the appended claims. In this connection it will be further appreciated that various changes may be made in the details of construction and arrangement of parts of this invention without departing from the scope thereof as defined in the appended claims.

What I claim is:—

1. In a steam boiler, a firebox having double walls on three sides thereof forming a water reservoir, a plurality of steam generator tubes disposed substantially in a horizontal position within said firebox, each of said tubes communicating at one end with said water reservoir below the normal water level therein and being secured at the other end to an outer wall of the firebox, a plurality of steam transfer tubes arranged in the firebox in substantially horizontal coils above said steam generator tubes, a double walled steam dome above said firebox, each of said steam transfer tubes having one end extending downwardly and communicating with the upper side of one of said steam generator tubes and having its other end communicating with said steam dome, the space between the double walls of said steam dome being in communication with said firebox to receive hot gases therefrom, a flue communicating with said space between said double walls of the steam dome, a steam main communicating with the uppermost portion of said steam dome, and waterproof electric heating elements disposed concentrically within and extending longitudinally throughout substantially the entire length of said steam generator tubes respectively.

2. In a steam boiler, a firebox having double walls on three sides thereof forming a water reservoir, a plurality of steam generator tubes disposed substantially in a horizontal position within said firebox, each of said tubes communicating at one end with said water reservoir below the normal water level therein and being secured at the other end to an outer wall of the firebox, a plurality of steam transfer tubes arranged in the firebox in substantially horizontal coils above said steam generator tubes, a double walled steam dome above said firebox, each of said steam transfer tubes having one end extending downwardly and communicating with the upper side of one of said steam generator tubes and having its other end communicating with said steam dome, the space between the double walls of said steam dome being in communication with said firebox to receive hot gases therefrom, a flue communicating with said space between said double walls of the steam dome, a steam main communicating with the uppermost portion of said steam dome, said steam generator tubes being of larger cross section than said steam transfer tubes, and waterproof electric heating elements disposed within and extending longitudinally throughout substantially the entire length of said steam generator tubes respectively.

3. In a steam boiler, a firebox having double walls forming a water reservoir, a plurality of steam generator tubes disposed substantially in a horizontal position within said firebox, each of said tubes communicating at one end with said water reservoir below the normal water level therein and being secured at the other end to an outer wall of the firebox, a plurality of steam transfer tubes arranged in the firebox above said steam generator tubes, each of said steam transfer tubes having one end extending downwardly and communicating with the upper side of one of said steam generator tubes, said steam generator tubes being of larger cross section than said steam transfer tubes, waterproof electric heating elements disposed within and extending longitudinally of said steam generator tubes respectively to heat the water in said steam generator tubes from the interior thereof, and means within said firebox below said steam generator tubes to supply heat to said steam generator and steam transfer tubes from the exterior thereof.

4. In an electrical water heater, a pair of horizontally disposed concentric tubes spaced one from the other and forming between them a water chamber provided with an inlet at one end thereof, the inner of said tubes at its end adjacent the inlet and extending beyond the opposite end of the outer tube, a fitting coupled to said opposite end of the outer tube, said fitting having an

axial bore and a laterally extending bore, said axial bore having a part of substantially the same inner diameter as said outer tube and forming a continuation of said water chamber, and a part of a reduced diameter to snugly embrace said inner tube and forming an annular head for said water chamber, said laterally extending bore communicating with the top wall of said continuation of the water chamber and forming an outlet therefor, and an electric heating element disposed within and extending longitudinally of said inner tube.

5. In an electrical water heater, a pair of horizontally disposed concentric tubes spaced one from the other and forming between them a water chamber provided with an inlet at one end thereof, the inner of said tubes at its end adjacent the inlet and extending beyond the opposite end of the outer tube, a fitting coupled to said opposite end of the outer tube, said fitting having an axial bore and a laterally extending bore, said axial bore having a part of substantially the same inner diameter as said outer tube and forming a continuation of said water chamber, and a part of a reduced diameter to snugly embrace said inner tube and forming an annular head for said water chamber, said laterally extending bore communicating with the top wall of said continuation of the water chamber and forming an outlet therefor, the end of said inner tube being flared outwardly at the outer end of said axial bore, a cap member for clamping said flared end against the end of said fitting, and an electric heating element carried by said cap and disposed within and extending longitudinally of said inner tube.

6. In an electrical water heater, a pair of horizontally disposed concentric tubes spaced one from the other and forming between them a water chamber provided with an inlet at one end thereof, the inner of said tubes at its end adjacent the inlet and extending beyond the opposite end of the outer tube, a fitting coupled to said opposite end of the outer tube, said fitting having an axial bore and a laterally extending bore, said axial bore having a part of substantially the same inner diameter as said outer tube and forming a continuation of said water chamber, and a part of a reduced diameter to snugly embrace said inner tube and forming an annular head for said water chamber, said laterally extending bore communicating with the top wall of said continuation of the water chamber and forming an outlet therefor, an electric heating element disposed within and extending longitudinally of said inner tube, said fitting also having a laterally extending flange adjacent its outer end, and means for securing said flange to a support.

7. In an electrical water heater, a pair of horizontally disposed concentric tubes spaced one from the other and forming between them a water chamber provided with an inlet at one end thereof, the inner of said tubes at its end adjacent the inlet and extending beyond the opposite end of the outer tube, a fitting coupled to said opposite end of the outer tube, said fitting having an axial bore and a laterally extending bore, said axial bore having a part of substantially the same inner diameter as said outer tube and forming a continuation of said water chamber, and a part of reduced diameter to snugly embrace said inner tube and forming an annular head for said water chamber, said laterally extending bore communicating with the top wall of said continuation of the water chamber and forming an outlet therefor, an electric heating element disposed within and extending longitudinally of said inner tube, said fitting also having a laterally extending flange adjacent its outer end and having said outer end reduced and extended beyond said flange to enter and properly align the heater with an opening in a suitable support, and means for securing said flange to such support.

8. In an electrical water heater, a pair of horizontally disposed concentric tubes spaced one from the other and forming between them a water chamber provided with an inlet at one end thereof, the inner of said tubes at its end adjacent the inlet and extending beyond the opposite end of the outer tube, a fitting coupled to said opposite end of the outer tube, said fitting having an axial bore and a laterally extending bore, said axial bore having a part of substantially the same inner diameter as said outer tube and forming a continuation of said water chamber, and a part of a reduced diameter to snugly embrace said inner tube and forming an annular head for said water chamber, said laterally extending bore communicating with the top wall of said continuation of the water chamber and forming an outlet therefor, the end of said inner tube being flared outwardly at the outer end of said axial bore, a cap member for clamping said flared end against the end of said fitting, an electric heating element carried by said cap and disposed within and extending longitudinally of said inner tube, said heating element consisting of a rod carried by said cap member, and a resistance wound on said rod, and a series of spaced insulating rings surrounding said rod and spacing said heating element from the walls of said inner tube throughout its length.

9. In an electrical water heater, a pair of horizontally disposed concentric tubes spaced one from the other and forming between them a water chamber provided with an inlet at one end thereof, the inner of said tubes at its end adjacent the inlet and extending beyond the opposite end of the outer tube, a fitting coupled to said opposite end of the outer tube, said fitting having an axial bore and a laterally extending bore, said axial bore having a part of substantially the same inner diameter as said outer tube and forming a continuation of said water chamber and a part of a reduced diameter to snugly embrace said inner tube and forming an annular head for said water chamber, said laterally extending bore communicating with the top wall of said continuation of the water chamber and forming an outlet therefor, said fitting also having a laterally extending flange adjacent its outer end and having said outer end reduced and extended beyond said flange to pass through an opening in a suitable support, said inner tube being flared outwardly at said outer end of the fitting, a flanged cap member for clamping said flared end against the end of said fitting, means for passing through such support and securing said flanged cap member to said flange on the fitting with the support held between them, and an electric heating element carried by said cap and disposed within and extending longitudinally of said inner tube.

RUSSELL P. GLENN.