W. H. FOX.

WATER HEATER.

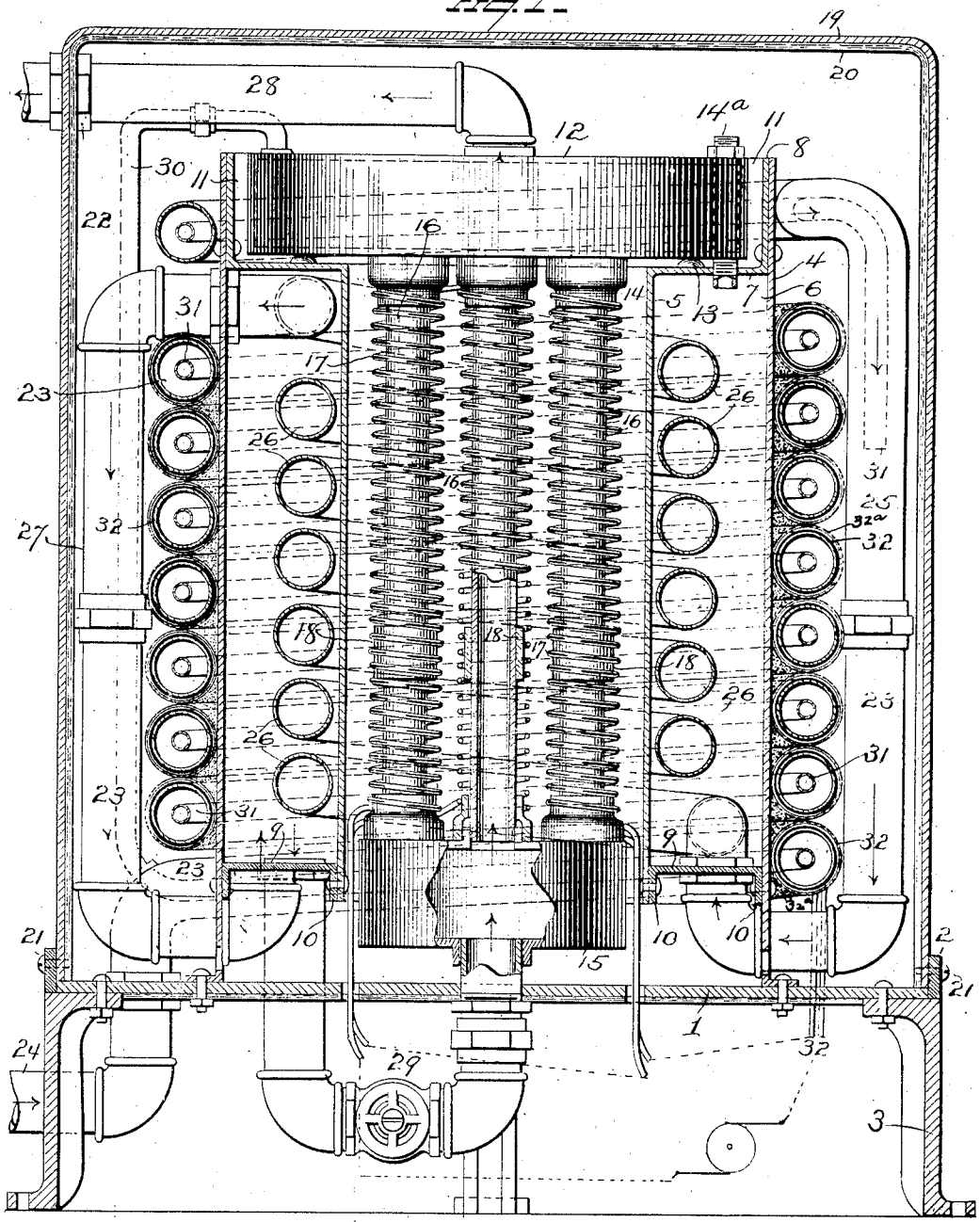
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1,027,831.

Patented May 28, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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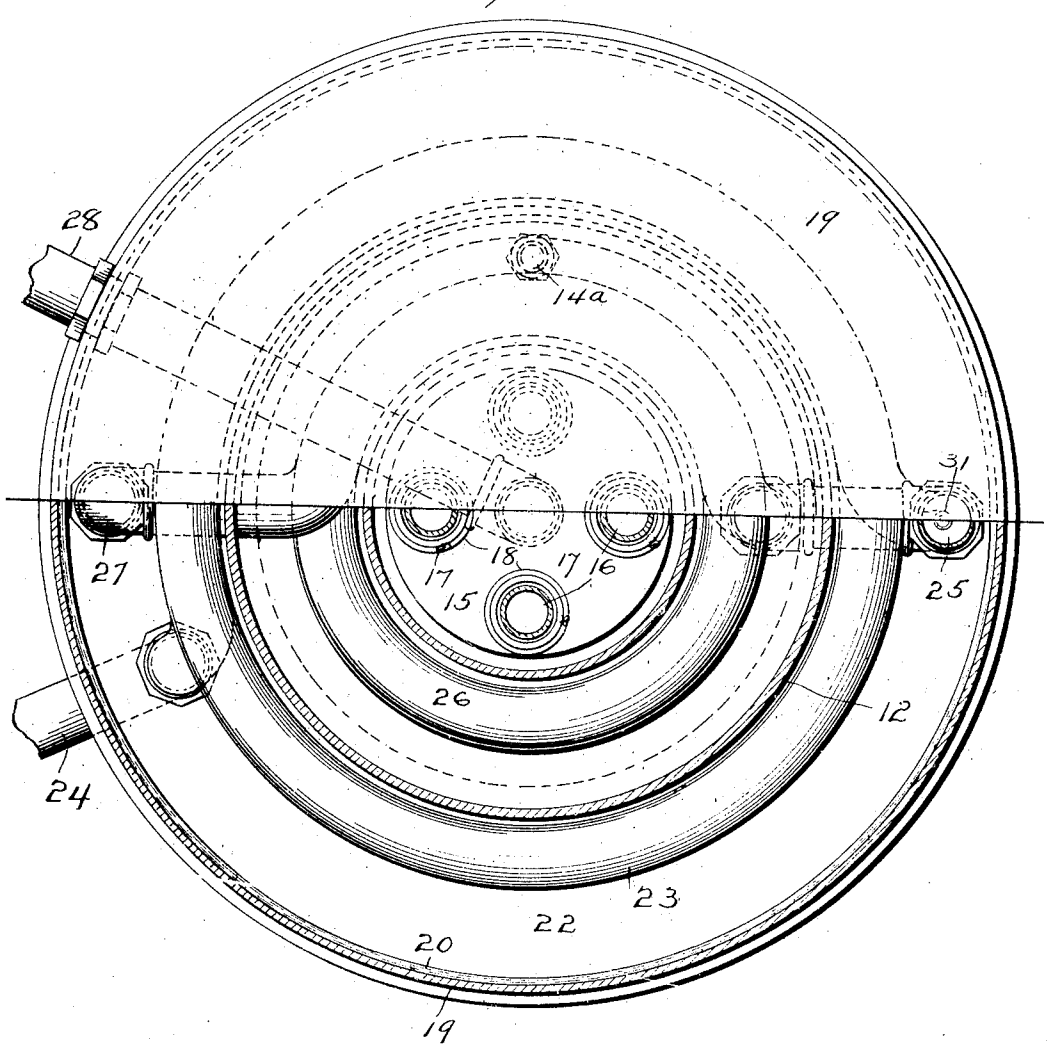
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3 SHEETS—SHEET 2.

Fig. 2.



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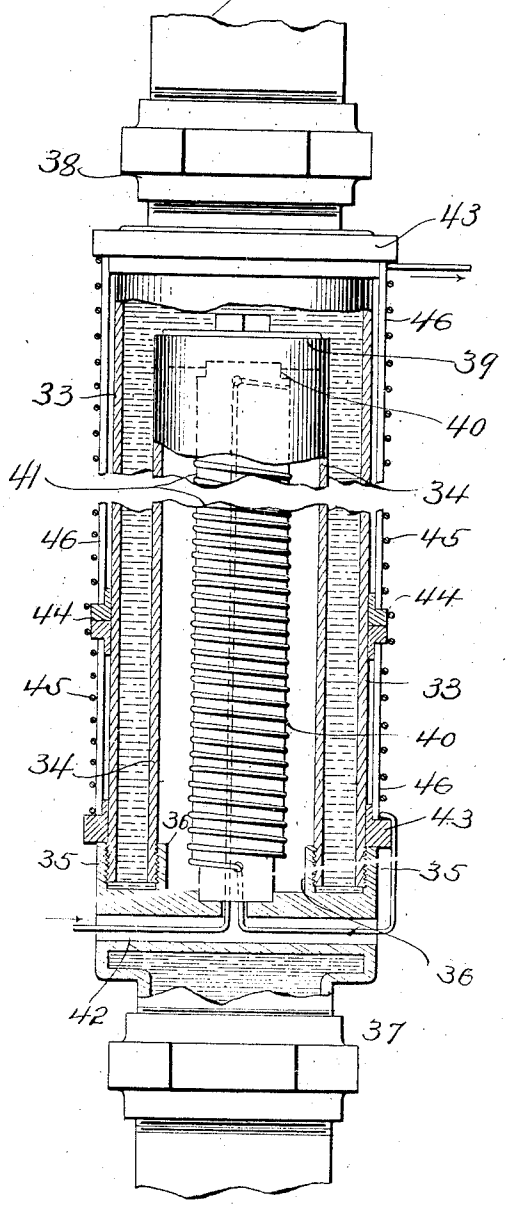
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM H. FOX, OF MINNEAPOLIS, MINNESOTA.

WATER-HEATER.

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Application filed November 5, 1910. Serial No. 590,931.

To all whom it may concern:

Be it known that I, WILLIAM H. FOX, of Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Water-Heaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in water heaters and more particularly to such as are adapted to utilize electrical heating means,—one object of the invention being to provide a water heater capable of use in street cars and other places, and to so construct the heater that the temperature of the water can be raised to a maximum degree with the expenditure of a minimum amount of heat energy.

A further object is to so construct the apparatus that the heat energy developed will be economically utilized in heating the water.

A further object is to so construct an electric water heater that a minimum amount of electrical energy can be employed to cause effectual heating of the water, and so that the circulation of the water will be such that the full heat energy developed shall be utilized in the heating of the water.

With these and other objects in view the invention consists in certain novel features of construction and combinations of parts as hereinafter set forth and pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional view of a heater embodying my improvements; Fig. 2 is a view partly in plan and partly in horizontal section of the same, and Fig. 3 is a view of a modification.

1 represents a suitable base member at the peripheral edge of which, an upturned flange or ring 2 is located and said base is supported upon suitable legs 3. Upon the base member 1 the lower flanged end of an outer boiler shell 4 is secured. An inner boiler shell 5 is spaced a suitable distance from and within the boiler shell 4,—the space between said boiler shells constituting the boiler of the apparatus. The upper end of this annular boiler chamber 6 is closed by means of a top wall 7 integral with the upper end of the boiler shell 5 and at the free edge of this top wall, an upwardly projecting flange 8 is provided which is secured to the upper portion of the outer boiler shell 4. The bottom of the boiler chamber is closed by a base wall 9, the edges of which are provided with flanges 10 secured to the boiler shells 4 and 5. The upper annular boiler plate or wall 7 and the annular flange 8 at the outer edge thereof coöperate to form a chamber 11 in which a dome 12 (preferably of cast iron) is located. This dome is spaced from the walls of the chamber 11 and is supported above the top plates or walls 7 of the boiler by means of lugs 13,—thus forming air spaces around and under the dome, which air spaces communicate with the chamber 14 within the annular boiler. The dome is secured to the boiler top 7 by means of tubular bolts 14^a which also serve as air vents to permit the complete filling of the boiler. At the bottom of the annular chamber 14, a hollow base head 15 (preferably of cast iron) is located and supported slightly above the base member 1 of the heater. The hollow base head 15 is connected with the dome 12 by means of a plurality of tubes 16 (preferably of copper),—the lower ends of said tubes communicating with the head 15 and the upper ends with the dome 12 so as to conduct water from said head 15 to the dome 12 as hereinafter explained.

The heating elements comprise electrical coils 17 encircling the several tubes 16 and suitably insulated and mechanically separated from the latter by means of short sleeves 18 of porcelain or other suitable material. Electrical energy will be supplied to these coils from any convenient source of electrical supply.

An outer inclosing shell 19, having a lining 20 of asbestos, is secured by means of removable screws or bolts 21 to the upturned flange or ring 2 of the base member 1 and this inclosing shell coöperates with the boiler in a manner to form an annular heating chamber 22. A coil of pipe 23 surrounds the boiler within the heating chamber 22 and the lower end of this coil communicates with an in-take pipe 24 which receives water from any suitable source of supply. The upper end of the coil 23 communicates with the upper end of a vertical pipe 25 located within the heating chamber 22 and preferably covered with asbestos. The lower end of the pipe 25 is provided with suitable couplings which are connected with the lower end of a coil 26 located within the boiler

chamber 6 and encircling the inner boiler shell 5. The upper end of the coil 26 is connected with the upper end of a vertical pipe 27 (preferably covered with asbestos) located within the heating chamber 22 and connected at its lower end by means of suitable couplings with the bottom of the boiler chamber 6. An outlet pipe 28 communicates at one end with the dome 12 and extends out through the wall of the inclosing casing 19.

A small auxiliary heating pipe 30 (preferably covered with asbestos) communicates at its upper end with the dome 12 and the lower end of this pipe enters the lower portion of the coil 23. The pipe 30 is extended through the coil 23 and forms an auxiliary heating coil 31, the free end of the latter extending into the vertical pipe 25, in the upper portion of which, said auxiliary heating coil 31 discharges. The high temperature of the water flowing through the auxiliary heating pipes 30—31 increases the temperature of the water in the coil 23 and pipe 25, and said pipes 30—31 also provide means of relief for any possible surplus pressure of the water in the boiler chamber 6 and heating tubes 16, and insure a positive circulation of water throughout the heater.

The coil 23 is covered with suitable insulating material and then wound with a heating coil 32 included in series with the heating coils 17. The heating coil is covered by a suitable insulating cement 32^a.

When water is first introduced into the apparatus through the pipe 24, it will flow through the coil 23 in the heating chamber 22 and then, by way of pipe 25 to the inner coil 26; through the latter to the pipe 27 and from the latter to the boiler chamber 6,—filling said chamber so that the inner coil 26 shall be submerged. From the boiler chamber 6, the water will flow, through a pipe 28 (having a valve 29) to the hollow base head 15 and from the latter, upwardly through the tubes 16 to the dome 12 and from said dome, through the pipe 28 to a point of consumption or utilization, a portion of the heated water flowing from the dome through the auxiliary heating pipes 30—31 as before explained. During the operation of the heater, the water flowing through the coil 23 will absorb heat from the heating chamber 22 and from the internal coil 31 so that when this water reaches the submerged coil 26, it will have a temperature approximating to that in the submerged coil. After the water has passed through the coils and entered the boiler chamber, it will flow from the latter to the head 15 and from said head through the heating tubes 16 to the dome 12. It will be observed that the area of the service pipe 28 (and the auxiliary heating pipe 30) which communicates with the dome is less than the combined areas of the heating tubes 16. The flow through the heating tubes will therefore be retarded and the rapidity of the circulation of the water correspondingly increased and the maintenance of the temperature of the water at a high degree will be enhanced.

When the system is once heated, it requires very little heating energy to maintain a necessary and steady temperature and therefore the heating element and energy necessary to operate it can be reduced to a minimum. The apparatus is economical in operation as all of the heat created by the heating coils, the water and the metal is preserved and utilized and hence the operation can be maintained at very low consumption of electric energy.

In the modification shown in Fig. 3, I employ outer and inner tubes 33, 34 spaced apart and screwed at their lower end to flanges 35—36 of a hollow head 37 to be coupled to a pipe leading to the boiler chamber 6 or to a base head such as shown in Fig. 1. The upper end of the tube 33 is connected with a coupling 38 and the upper end of the inner tube 34 may be closed by a cap 39. The coupling 38 is adapted to communicate with the dome 12. Located within the inner tube 34 and supported by the head 37, is a post 40 of porcelain or other insulating material. Around this post is a heating coil 41, the leading-in-wires for which, pass through sleeves 42 formed in the head 37. Collars 43 of insulating material are located at or near respective ends of the tube 33 and similar collars 44 are located intermediate to the ends of said tube. These collars support insulating standards 46, and the latter serve to separate a coil 45 surrounding the tube, from actual contact therewith,—said coil 45 being connected in circuit with the coil 41.

With the construction shown in Fig. 3, the water will pass up between the tubes 33 and 34 and be heated by the heating coil within the inner tube 34 and also by the heating coil surrounding the outer tube 33.

Various slight changes might be made in details of construction of my invention without departing from the spirit of the latter or limiting its scope and hence I do not wish to restrict myself to the precise details herein set forth.

Having fully described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a water heater, the combination with an annular boiler, a dome at one end of the boiler and a hollow head at the other end, of a tube connecting said hollow head with the dome, means for passing water around the boiler and subsequently to the boiler, means for conducting water from the boiler

to said hollow head, means for heating the water during its passage through said tube to the dome, and a service pipe connected with said dome.

2. In a water heater, the combination with an annular boiler, a dome over the same and a hollow base head, of a tube surrounded by the boiler and connecting the base head with the dome, an electrical heating coil encircling said tube, means for conducting water around the boiler and then to the boiler, means for conducting water from the boiler to the base head, and a service pipe connected with the dome.

3. In a water heater, the combination with an annular boiler, a dome at one end thereof, and a hollow head at the other end of said boiler, of a plurality of tubes surrounded by the annular boiler and connecting the base head with the dome, electrical heating coils encircling said tubes, means for circulating water around the boiler and then conducting water to the boiler, means for conducting water from the boiler to the base head, and a service pipe connected with the dome.

4. In a water heater, the combination with an annular boiler and chambered members at respective ends thereof, of a water heating tube connecting said chambered members, a coil located within the annular boiler, means for conducting water through said coil and to the annular boiler so as to submerge said coil, means for conducting water from the boiler to one of said chambered members, and a service pipe communicating with the other chambered member.

5. In a water heater, the combination with an annular boiler, water heating tubes surrounded by said boiler and chambered members connecting the ends of said tubes, of a casing coöperating with the boiler to form a heating chamber, a coil surrounding the boiler and located in said heating chamber, a coil located within the boiler, means for supplying water to the first mentioned coil, a pipe connecting the upper end of said first mentioned coil with the lower end of the coil within the boiler, a pipe connecting the upper end of the last mentioned coil with the lower end of the boiler, a connection between the lower end of the boiler and one of said chambered members, and a service pipe communicating with the other chambered member.

6. In a water heater, the combination with concentric shells forming a water chamber between them, and a dome, of water tubes within the inner shell and communicating with the dome, means connecting said tubes with the water chamber between the shells, means for heating said tubes, a coiled pipe surrounding the outer shell, a connection between said coil and the water chamber between the shells, and an auxiliary heating pipe within said coiled pipe, said auxiliary heating pipe communicating at one end with the dome and open at the other end within the connection between said coiled pipe and the water chamber.

7. In a water heater, the combination with a boiler, heating means, a dome provided with an outlet, and means for conducting water from the boiler to the dome, of a coiled pipe surrounding the boiler, a connection between one end of said coiled pipe and the boiler, and an auxiliary heating pipe within the coiled pipe, said auxiliary heating pipe communicating at one end with the dome and open at its other end within the connection between said coiled pipe and the boiler.

8. In a water heater, the combination with a boiler, a dome provided with a water outlet, means for conducting water from the boiler to the dome, and heating means, of a coiled inlet pipe surrounding the boiler, a coiled pipe located within the boiler and communicating with the latter, a pipe connection between said coiled pipes, and an auxiliary heating pipe located within the outer inlet coiled pipe, one end of said auxiliary heating coil communicating with the dome and the other end open within the pipe connection between said coiled pipes.

9. In a water heater, the combination with a boiler, a dome provided with an outlet, and means for conducting water from the boiler to the dome, of a coiled inlet pipe surrounding the boiler, means connecting said coiled pipe with the boiler, and an electrical heating coil surrounding the coiled pipe.

10. In a water heater, the combination with an annular boiler, and a dome provided with an outlet, of tubes within the chamber formed by the annular boiler and communicating with the dome, means connecting said tubes with the boiler, electrical heating coils for said tubes, a coiled inlet pipe surrounding the boiler, means connecting said coiled pipe with the boiler, and an electrical heating coil on said coiled pipe.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

WILLIAM H. FOX.

Witnesses:
THOS. W. HICKS,
H. J. FALLS.