Aug. 18, 1925. 1,550,164

J. HEINRICH

ELECTRICALLY HEATED STEAM BOILER

Filed Oct. 27, 1922

Fig. 1.

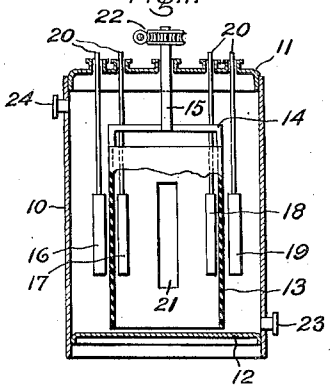


Fig. 3.

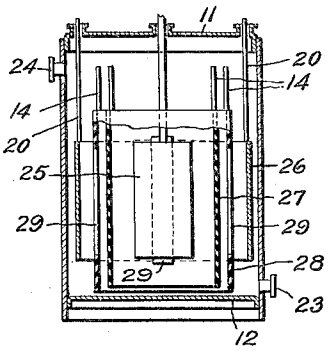


Fig. 2.

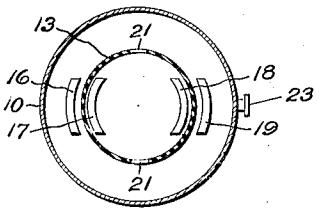


Fig. 4.

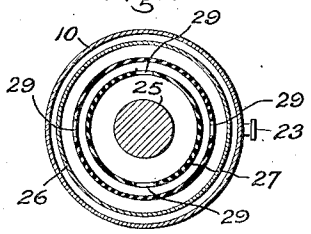


Fig. 5.

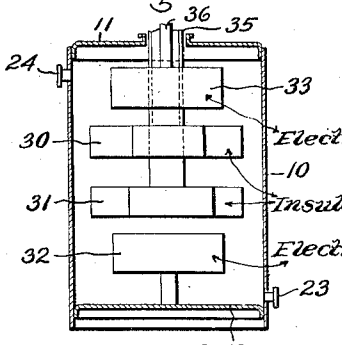


Fig. 7.

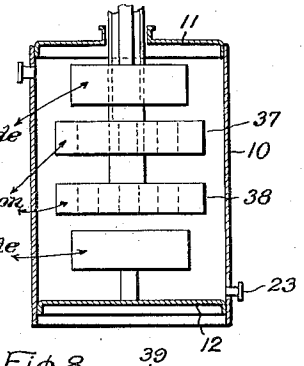


Fig. 6.

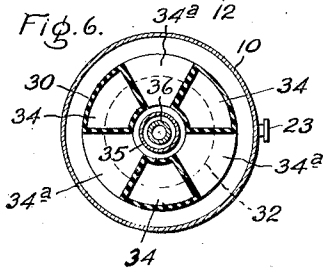
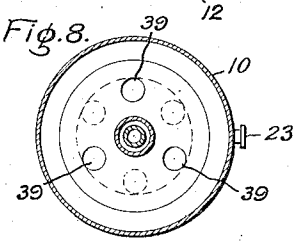


Fig. 8.



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Johann Heinrich
by Albert G. Davis
His Attorney.

Patented Aug. 18, 1925. 1,550,164

UNITED STATES PATENT OFFICE.

JOHANN HEINRICH, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRICALLY-HEATED STEAM BOILER.

Application filed October 27, 1922. Serial No. 597,266.

To all whom it may concern:

Be it known that I, JOHANN HEINRICH, a citizen of the German Republic, residing at Berlin, Pankow, Kreuzstrasse 18, Germany, have invented certain new and useful Improvements in Electrically-Heated Steam Boilers, of which the following is a specification.

The present invention relates to steam boilers in which a current of electricity flowing from one electrode to another is caused to give up heat energy to the fluid in which they are immersed. As commonly constructed the electrodes are surrounded by relatively long insulating tubes through which the fluid to be heated flows. The regulation of the output of such boilers is obtained by changing the resistance of the fluid column through which the current flows. To accomplish this the tubes and electrodes are moved axially one with respect to the other. When the boiler is operated on high potential circuits these tubes have to be very long and their manufacture is extremely difficult and complicated. These long tubes are also objectionable because the boiler shell has to be correspondingly long to contain them, and thus for a given output the boiler as a whole becomes unduly large.

The present invention has for its object to improve boilers of the electrode type described, and this is accomplished by so constructing and arranging the parts that the resistance of the fluid column is changed by relative rotary motion of the insulating body or tube and electrode as distinguished from axial movement thereof. By reason of this arrangement the tubes can be made relatively short and hence easy to manufacture and the boiler shell for a given output materially shortened.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the accompanying drawing which illustrates certain of the embodiments of my invention, Fig. 1 is a vertical section of one of my improved boilers; Fig. 2 is a cross section of the same; Fig. 3 is a vertical section of a modified construction; Fig. 4 is a cross section of the same; Fig. 5 is a vertical section of a further modification; Fig. 6 is a cross section of the same; Fig. 7 is a vertical section of a further modification and Fig. 8 is a cross section of the same.

Referring first to Figs. 1 and 2, the boiler shell comprises a cylindrical portion 10 and upper and lower heads 11 and 12. These parts may be of any suitable metal and preferably follow standard boiler construction as to strength, union of parts, etc. Located within the shell is a relatively short, vertically-disposed body or tube 13 made of good insulating material which will stand up under the effects of heat and hot fluid, in this case water. To the upper end of the tube is secured a bridge piece 14, and the latter is suspended from the lower end of a spindle 15 that extends upwardly through the head 11. This spindle is packed pressure-tight where it passes through the head but as this is unessential to an understanding of the invention, the details of the packing are omitted. The electrodes, of which there are four in this case, are arranged in pairs, 16 and 17 forming one pair and 18 and 19 forming the other pair, and current flows from one electrode of a pair to the other of said pair. The electrodes which have the same, or substantially the same, potential are located within the insulating tube and the others outside. Due to this arrangement all tendency for the current of electricity to flow across the tube is prevented. The electrodes are all stationary and are suspended by rods 20 which also form conductors to carry current to and from them. These rods where they pass through the head should be well insulated, but as the insulators form no part of the present invention the details are omitted. The electrodes have considerable length and width so as to provide suitable cross-sectional area for the dissipation of heat, and when viewed in plan form segments of circles, the axes of which coincide with that of the insulating body of tube 13. The tube 13 is provided with suitable slots or openings 21 in its wall through which fluid is free to flow, there being two slots or openings in the present illustration, and said tube is supported a short distance above the bottom wall of the shell so as to permit free access of the fluid to the inside thereof.

The practical effect of the slots 21 is to divide the insulating tube into two parts but for mechanical reasons it is preferable to unite the parts of the tube either above or

below the slots, and generally at both places.

Water or other fluid is supplied to the boiler through the inlet 23 by a suitable feed pump, not shown, and steam is taken from the boiler through the outlet 24. The water should be maintained at a level sufficient to cover the electrodes.

As the parts now stand the resistance of the current carrying fluid column is at the maximum and hence the heating effect of the current is at the minimum. By rotating the insulating tube 13 through the bridge 14 and spindle 15 as for example by the worm wheel and worm 22, the resistance of said column is decreased. This is due to the fact that such turning movement moves the openings 20 in the tube closer to one side of the electrodes than the other and hence the length of the fluid columns through which the current must flow in passing from one electrode in each pair to the other is decreased. As the amount of the resistance decreases the heating effect is increased because of the greater flow of current.

In the modification illustrated in Figs. 3 and 4, the electrodes are circular, 25 indicating the central stationary electrode and 26 the outer. Between the electrodes is a body of insulating material comprising two concentric insulating tubes 27 and 28, each of which is provided with slots or openings through which the fluid columns flow. As shown each tube has two slots or openings 29 which extend lengthwise and are angularly displaced by 180°. It will be noted from Fig. 4 that the slots or openings in one tube are angularly displaced from those in the other tube by 90°. The effect of this is to cause the fluid to flow in a sort of zigzag path and hence the resistance to flow of current can be made greater than with the more simple construction shown in Figs. 1 and 2. Each tube is supported by a bridge piece 14 as before, only portions of which are shown, and through said pieces the tubes can be rotated relatively to each other and hence the resistance of the fluid column may be varied. The electrodes are supported in a manner similar to that illustrated in Fig. 1.

In the modification shown in Figs. 5 and 6 a body of insulation comprising disks or members 30 and 31 are arranged between the lower stationary electrode 32 and the upper electrode 33. Each of said disks is slotted or cut away to provide three hollow arms 34 with fluid passages 34ª between them, and said bodies are carried by suitable supports 35 and 36, one or both of which are adjustable. As shown the arms on the upper body are directly over the passages on the lower body so that the fluid follows a zigzag path. By rotating one disk with respect to the other from the position indicated the resistance of the column of fluid can be decreased and the current flow increased. Care should be exercised to see that the resistance of the fluid column from one electrode to another and around the disks is made greater than that of the column through the disks. This can readily be accomplished by making the disks substantially larger in diameter than the electrodes.

In Figs. 7 and 8 is shown a modification of the structure shown in Figs. 5 and 6 in which disks 37 and 38 are employed, each of which is provided with a number of holes, perforations of fluid-carrying passages 39, there being three such passages shown. Relative rotation of the disk will cause the resistance of the fluid column to be varied, and hence the output of the boiler.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with apparatus which I now consider to represent the best embodiments thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an electrically heated boiler, the combination of a fluid-containing shell, electrodes, a body of insulating material which is situated between the electrodes and defines the length of the path between the electrodes, and means for moving said insulating body to vary the length of the path between said electrodes.

2. In an electrically heated boiler, the combination of a fluid-containing shell, a pair of electrodes, a perforated body of insulating material which is situated between said electrodes and defines the length of the path between the electrodes, and means for moving the body to vary the length of the path between said electrodes.

3. In an electrically heated boiler, the combination of a pair of electrodes, a perforated body of insulation which is situated between the electrodes and defines the length of the path between them, the electrodes and body having a common axis, a fluid-containing shell which encloses the electrodes and body, and means external to the shell for rotating said body for changing the length of the path between the electrodes.

4. In an electrically heated boiler, the combination of a pair of electrodes, a perforated body of insulation which is situated between the electrodes and has the same axis, an enclosing shell which contains said electrodes, body and fluid to be vaporized, and means for moving the said body between the electrodes to vary the length of the fluid path between the electrodes.

5. In an electrically heated boiler, the combination of a fluid-containing shell, a

pair of electrodes which are supported within the shell from one of its walls, a tubular body of insulating material which is situated between the electrodes and is mounted to turn, said body having one or more slots through which fluid passes, and means for turning said body without moving it axially to change the position of the slot to vary the length of the fluid path between the electrodes.

6. In an electrically heated boiler, the combination of a fluid-containing shell, an inlet for liquid, an outlet for vapor, a pair of electrodes arranged side by side within the shell, a body of insulating material which is of cylindrical shape in cross-section and which extends between the electrodes, and a spindle for supporting and turning said body between the electrodes so as to change the length of the fluid path between them.

7. In an electrically heated boiler, the combination of a fluid-containing shell having an inlet for fluid and an outlet for steam, a cylindrical body of insulating material which is mounted within the shell for angular adjustment and electrodes also mounted within the shell and arranged in pairs, one member of each pair being located within said body and the other outside, the electrodes located within the body being subjected to substantially the same potential.

8. In an electrically heated boiler, the combination of a fluid-containing shell having an inlet for fluid and an outlet for steam, a cylindrical body of insulating material located within the shell, means for supporting the body within the shell and for changing its angular position, electrodes arranged in pairs, one member of each pair being located within said body and the other outside, the electrodes located within the body being subjected to substantially the same potential, and means for supporting the electrodes within the shell.

9. An electric heater comprising a plurality of hollow insulating members of different sizes disposed in substantial coaxial relation, one within the other, each member having an opening in its side wall, and one or more of said members being rotatable relatively to the other member or members, whereby the angular relation of the various slits may be varied, an electrode mounted within the inner hollow member and an electrode surrounding the outer hollow member.

10. An electric heater comprising a series of hollow insulating members of increasing sizes, disposed in substantial coaxial relation one within the other, each of said members having a vertically disposed slit in its side wall and one or more of said members being independently rotatable, whereby the angular relations of the slits may be varied, an electrode within the inner member and an electrode surrounding the outer member and spaced therefrom.

In witness whereof, I have hereunto set my hand this thirtieth day of September, 1922.

JOHANN HEINRICH.