

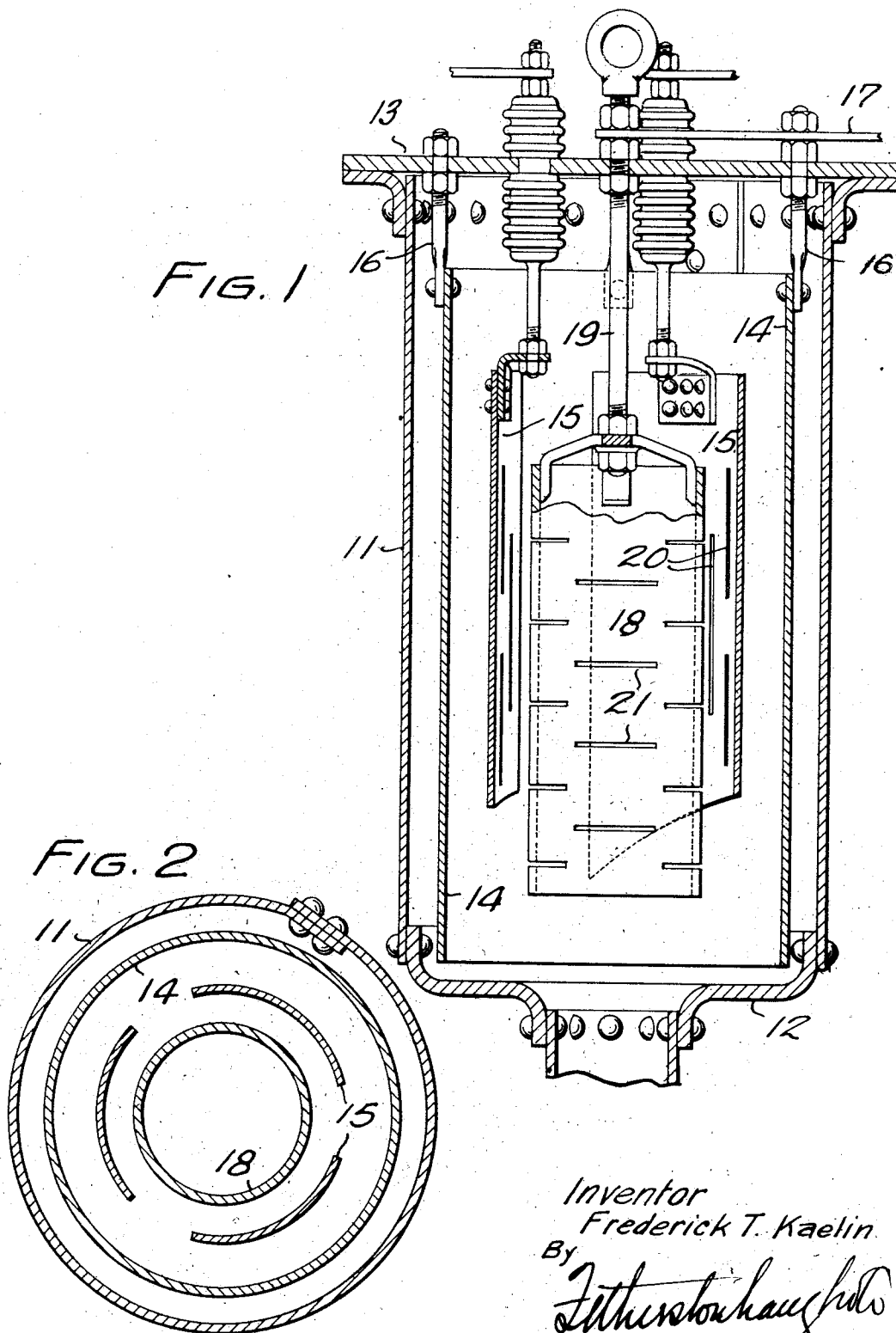
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ELECTRIC BOILER CONSTRUCTION

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UNITED STATES PATENT OFFICE.

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ELECTRIC-BOILER CONSTRUCTION.

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To all whom it may concern:

Be it known that I, FREDERICK T. KAELIN, a subject of the King of Great Britain, and resident of the city of Montreal, in the Province of Quebec and Dominion of Canada, have invented certain new and useful Improvements in Electric-Boiler Constructions, of which the following is a full, clear, and exact description.

10 This invention relates to improvements in the construction of boilers or vessels for use in the electric generation of steam or in other cases in which an electric discharge takes place within a vessel, and the object of the invention is to provide a vessel so constructed as to escape or resist destruction by the action or passage of electric current.

15 Another object is to provide for the free circulation of liquid in such a vessel and to avoid as largely as possible interference with liquid movements in the vessel by elements therein, such as electrodes.

20 Still another object is to provide for operation of devices of this character with a maximum of efficiency and without danger to the apparatus.

25 Dealing, for the sake of explanation, with an electric boiler, it may be pointed out that the arrangement of electrodes within the boiler can be such that the discharge is between electrodes and the shell of the boiler or between the electrodes themselves. Even if the discharge is intended to be only between electrodes, there is a certain amount of discharge between the electrodes and the shell. If, therefore, the shell has internal projections, the discharge will localize at these points and, on account of the frequent high current densities, the boiler is in grave danger of being weakened by the current tearing away small particles of metal in a manner similar to that which obtains when an arc is formed. Such action is hereinafter referred to by the term "electrolysis" which however must not be confused with electrochemical action, commonly termed "electrolytic action." This electrolysis is seemingly unavoidable and occurs when the shell of the boiler is not intended to be used as the ground electrode.

30 This invention aims primarily to provide a vessel of such construction that the shell thereof, which is subjected to mechanical stresses, will be protected from weakening by electrolysis. This result is obtained in

part by the construction of the vessel itself but largely by the provision of a protective inner shell spaced from the outer and suitably grounded and designed to serve as an electrode.

In the drawings which illustrate one embodiment of the invention;—

Fig. 1 is a vertical sectional view of a vessel designed to be used as a boiler for the generation of steam by electric current.

Fig. 2 is a cross sectional view of the same.

Referring more particularly to the drawings, 11 designates an outer cylindrical shell provided with lower and upper heads 12 and 13 of any suitable form connected to the shell in any suitable way. The practical considerations of boiler making render it substantially impossible to produce an inner surface free from projections without resorting to costly methods of manufacture. According to this invention, the outer shell is constructed in any desired way without regard to the internal projections such as rivet heads, plate edges at seams and the like which may result. The boiler is provided with an inner cylindrical shell 14 disposed concentrically of the outer shell 11 and preferably of open ended construction. This shell extends considerably above and below the electrodes 15, so that no discharge will take place between the electrodes and the outer shell owing to the interposition of the inner shell. This inner shell is formed with a perfectly smooth inner surface and it will be readily understood that as the shell is not subjected to mechanical stresses and is open ended that this result may be easily accomplished by electric or otherwise welding a bent-up plate or by employing large diameter seamless tubing. This inner shell is supported in any suitable way, for example, by straps 16 and is preferably provided with a grounding connection 17 connected directly to it, so that reliance is not placed upon the outer shell as an electric conductor. The electrodes may be of any suitable form and number. In the form shown the electrodes are three in number for connection to a three phase circuit but it will be understood that a greater or lesser number of electrodes may be employed. As illustrated, the electrodes are disposed symmetrically within the boiler and around a ground electrode 18 which is in the form of a tubular body open at both

ends and suspended by a ground connection 19. It will be understood that the inner shell 14 serves also as a ground electrode and, owing to the greater surface which it presents to the electrodes 15 as compared with the surface of the ground electrode 18, the electrodes 15 are placed nearer to the electrode 18 than to the shell 14, in order to approximately equalize resistances on the opposite sides of the electrodes 15. This also serves in a measure to equalize steam generation on both sides of the electrodes 15 and to prolong the life of the electrodes.

In vessels designed to contain liquids and where the level of the liquid changes frequently, it has been found that there may be a tendency to local changes of level. In order to overcome any tendency in this direction due to unequal evaporation of water on opposite sides of the electrode, but chiefly to permit circulation of water which in a device of this character usually enters at the centre of the bottom, the electrodes are, according to this invention, provided with slots 20 disposed parallel with the direction of current flow in the electrodes. These slots give communication between the annular spaces around and within the electrodes. If a central or ground electrode 18 is used, as shown in the drawings, it will be obvious that there is no consumption of water within this electrode, whereas there is a considerable and constant consumption outside. In order to keep the water levels inside and outside this electrode approximately constant, especially on account of inflowing water entering the electrode 18, it may be provided with slots 21. As the current flow in such an element is not as clearly defined as in the electrodes 15, the slots may be disposed circumferentially as shown. This is especially advisable where more than one electrode 15 is disposed in the vessel, since the current flow in the ground electrode 18 is then in a substantially circumferential direction, from one electrode 15 to another, through the member 18. Obviously the inner shell 14 should not be slotted as this would expose the outer shell 11 to the destructive electrolysis which it is particularly desired to avoid.

While the invention has been described as applied to a steam boiler, it will be understood that it is not limited to such use but pertains to all classes of vessels where it is desired to protect a shell under mechanical load from electrolysis.

Having thus described my invention what I claim is:—

1. In apparatus for heating liquids, a vessel having the walls thereof in contact with the liquid to be heated, means within the vessel for effecting electric discharge through the liquid to be heated, and a protective shell interposed between the vessel

walls and the electric discharge means to prevent discharge between such means and the vessel walls and to prevent mechanical weakening of the walls by reason of any such discharge.

2. In apparatus for heating liquids by electric discharge, a vessel having the walls thereof in contact with the liquid to be heated, means for effecting electric discharge through the liquid including an electrode and a member interposed between said electrode and the vessel walls, the said member having the same polarity as the vessel, whereby no electric discharge will occur between the vessel walls and said member but electric discharge may occur between the electrode and said member.

3. In apparatus for electrically heating liquids, a grounded vessel having the walls thereof in contact with the liquid to be heated, means for effecting electric discharge through the liquid to be heated, and a grounded member interposed between such electric discharge means and the shell, whereby any electric discharge which would take place between the discharge means and vessel with destructive effect on the latter will take place between the discharge means and said member without destructive effect upon the vessel walls.

4. In apparatus for electrically heating liquids, a vessel having the walls thereof subject to mechanical stress such as by internal pressure, electric discharge means in such vessel, and a protective member not subject to mechanical stress interposed between the discharge means and the vessel walls and electrically connected with the vessel walls, whereby any electric discharge between such discharge means and the vessel will occur between the discharge means and protective member.

5. In apparatus for electrically heating liquids, a vessel adapted to contain such liquids and to withstand mechanical stress such as by internal pressure, electric heating means within the vessel, said vessel comprising a mechanical stress resisting shell and a lining electrically connected to the vessel and interposed between the vessel proper and the electric heating means, whereby any discharge between the vessel and the heating means will occur between said lining and the heating means and will relieve the mechanically loaded portions of the vessel of electric stress and protect the same from any detrimental action due to such discharge.

6. In apparatus for electrically heating liquids, a vessel adapted to contain the liquids and to resist mechanical stress, the said vessel having internal projections such as seams and rivets, electric heating means disposed within the vessel and a shell interposed between the heating device and the vessel electrically connected to the vessel

- and covering the internal projections thereof and presenting to the heating device a smooth surface, whereby in the event of discharge between the vessel and heating device localizing of such discharge upon the internal projections of the vessel proper will be prevented and uniform current density will obtain at the surface of said protective shell.
- 10 7. In apparatus for heating liquids by passage of an electric current through the liquid between the vessel containing the liquid and an electrode within the vessel, means to prevent destruction or mechanical weakening of the vessel by reason of such discharge comprising a shell electrically connected to the vessel and interposed between the vessel and the electrode, whereby the discharge will occur between the electrode and said shell. 20
8. A device according to claim 7, in which the shell is under no mechanical load such as may obtain in the vessel proper.
9. A device according to claim 7, in which the shell is spaced from the vessel and covers any internal projections thereof such as seams and rivets. 25
10. A device according to claim 7, in which the shell comprises a smooth surface disposed in such relation to the electrode as to obtain uniform current density at the surface of such shell. 30
- In witness whereof, I have hereunto set my hand.

FREDERICK T. KAELIN.