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N E W Z E A L A N D

"THE PATENTS, DESIGNS AND TRADEMARKS ACT 1921-22".

COMPLETE SPECIFICATION

"AN IMPROVED ELECTRICAL IMMERSION HEATER"

I, PETER DAYSH DAVEY, of 57 Carlton Mill Road, Merivale, Christchurch, in the Dominion of New Zealand, a subject of the King of Great Britain, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :-

THIS INVENTION relates to electrical immersion heaters and more particularly to electrical immersion heaters which utilize the conductivity of liquid for their operation.

It is known that co-axial electrodes in water heaters and particularly for use with such a heater for immersion in a vessel of liquid including a system through which water flows are common to the art in connection with electric immersion heaters.

The objects of this invention are to provide an improved electrical immersion heater which is very rapid in raising liquid temperatures when in use and which will not when in use undergo any ill effects if the liquid in which it is placed should evaporate entirely or the liquid supply is cut off; but will operate again immediately further liquid is provided for the heater.

According to this invention the improved heater comprises a central electrode, circular electrodes arranged concentrically about the central electrode, means for holding the circular electrodes so that they vibrate and an electrical connection from one side of a source of alternating current to the central electrode and to electrodes alternate from the central electrode, and an electrical connection from the other side of a source of alternating current to the circular electrode adjacent the central electrode and to circular electrodes alternate from the circular electrode adjacent the central electrode.

Further the invention comprises a casing having holed ends and a side or sides separating the ends, a central electrode holding the ends and sides together, grooves in the inner surfaces of the ends loosely retaining electrodes therein an electrical connection from one side of a source of alternating current to the central electrode and to circular electrodes alternate from the central electrode, and an

electrical connection from the other side of a source of alternating current to the circular electrode adjacent the central electrode and to circular electrodes alternate from the circular electrode adjacent the central electrode.

The invention will now be further described with reference to the accompanying drawings, in which :-

Figure 1 is a schematical representation of the circuit arrangement used in all forms of the invention,

Figure 2 is a side elevational view of one form of the invention adapted for use as a portable immersion heater,

Figure 3 is a plan view of Figure 1,

Figure 4 is a cross section on line A-A of Figure 3, while

Figure 5 is a diagrammatical view in longitudinal section of the immersion heater affixed in a water heating system.

In accordance with the present invention the improved heater as schematically represented in Figure 1 has a central electrode 1 surrounded by a second electrode 2 spaced therefrom and which, in turn, is surrounded by a third electrode 3 spaced therefrom, the space 4 between the second electrode 2 and central electrode 1 and the space 5 between the second electrode 2 and third electrode 3 are equal, and the first and third electrodes 1,3 are in electrical connection with one another. When a heater having such circuit arrangement is immersed in a liquid and the second electrode 2 is connected with a terminal 6 of a source of alternating current and the first and third electrodes 1, 3 are connected with a terminal 7 to said source, the current passing through the electrodes 2, 1 and 3 and the liquid heats the liquid very rapidly.

As illustrated any desired number of electrodes, concentric with the electrode 1 can be used and spaced apart,

provided an earthed electrode 8 as a safety factor.

The heater may be used by mere immersion in a bulk of liquid, see Figures 2,3 and 4, or it may be interposed in a conduit through which liquid flows, e.g. a water pipe, see Figure 5.

The size of the gaps or spaces such as 4,5 between the electrodes 1, 2 or 3 controls the speed of heating, the smaller the gap or spaces such as 4,5 the greater is the speed of heating, hence, if the heater be interposed in a water pipe or the like, see Figure 5, the gap or space such as 4, 5 must be determined according to the desired temperature and flow-volume.

In the simplest form of the invention, the central electrode 1 is a brass rod of circular cross section and the second and third electrodes 2, 3 are also of brass and are tubular and co-axial with said rod 1, the third electrode 3 is electrically connected with the first electrode 1 by a brass strip or wire 9 integral with, or secured to, the third electrode,3, and the second electrode 2 has a brass strip or wire 10a spaced from said strip or wire 9 sufficiently to prevent sparking if the circuit remains closed after all the liquid has evaporated, or said strips or wires 9, 10a can be electrically insulated from each other . The electrodes may be plated brass.

As an example, suitable sizes of the parts may be a brass rod for central electrode 1 of $\frac{1}{4}$" diameter with tubular brass second and third electrodes 2,3 1/32" thick and spaced $\frac{1}{4}$" from one another, the gap or space 4 between the second and first electrodes also being $\frac{1}{4}$". The assemblage may be $1\frac{1}{2}$" in height and the second electrode 2 may be spaced from the strip or wire 9 which connects the first and third electrodes 1,3 about $\frac{1}{8}$".

As applied to a portable immersion heater for a bulk of liquid, the form of the invention as illustrated in Figure 5, 2, 3 and 4 has a casing made up of ends 10,11 which

have holes 12, 13 giving ingress and egress for liquid being treated, and thus to provide for the convective movement of liquid as it is heated, and also made up of sides 14 which separate the ends 10,11. The central electrode 1 such as a brass rod is utilized to hold the casing together by screws 15, 16 countersunk into the ends 10,11, see Figure 4. The ends 10,11 and side 14 are made of electrical insulating material such as porcelain. The inner surfaces of the ends 10,11 have oppositely positioned grooves 17 and the grooves 17 are concentrically spaced on said surfaces. The spacings of the grooves 17 are arranged to give desired spacing to electrodes such as 1,2,3 as set forth above. The grooves 17 are also arranged to accommodate the ends of the electrodes such as 2,3 so that the latter are loosely retained in the grooves 17 and are free to move from side to side therein as electric current passes from liquid in the spaces between the electrodes. In this form of the invention an earthed electrode 8 is fastened round the outside of the side 14 as a safety means in the event of an electrical fault developing in the heater. Various methods can be employed satisfactorily in effecting and maintaining an electrical connection and in one example the electrodes may be separate and retained in place with rubber blocks, the resiliency of the rubber allowing a small movement of oscillation to take place. In this case contact may be maintained by brass strips clamped between the rubber blocks and the electrodes. Flexible retaining grooves may be used where connections may be made with stranded copper wire crimped and/or soldered to the rims of the electrodes.

As indicated in Figure 3 the electrical connections as described above are incorporated in the end 10, the earth connection 8 being illustrated in Figures 2 and 4. When a heater made according to this form of the invention is immersed in liquid in a vessel it will be found that the liquid in its immediate neighbourhood boils very rapidly and convection currents are set up through the concentric elect-

trodes and through the holes 12 and 13, thus enabling the whole bulk of the liquid to be heated speedily.

In another form of the invention as illustrated in Figure 5, the immersion heater is interposed axially in the length of a water pipe and will be found to heat adequately a sufficient flow of water passing through the water pipe. In this form of the invention, as referenced in Figure 5, a conduit 18 leading from a controlled source of water supply is widened to form a casing 19 which contains the end plates 10, 11 with holes 12, 13 and the electrodes 1,2,3 or a multiple thereof as previously described. The electrical connections may be from terminals 6,7 in the casing 19 and electrically wired to the respective electrodes as described before herein. After passing through the holes 12, 13 heated water emerges into a narrow conduit again and masses through the conduit to a faucet.

In as much as there is no flow of electric current when there is no liquid to complete the circuit it follows that the heater cannot burn out if, through negligence, all the liquid is allowed to evaporate, or the source of liquid supply to a conduit in which the immersion heater is affixed is cut off.

HAVING NOW particularly described and ascertained the nature of my said invention and the manner in which it is to be performed, I declare that what I claim is :-

1. An electrical immersion heater for increasing the temperature of liquids comprising a central electrode, circular electrodes arranged concentrically about the central electrode, means for holding the circular electrodes so that they can vibrate, and an electrical connection from one side of a source of alternating current to the central electrode and to electrodes alternate from the central electrode, and an electrical connection from the other side of a source of alternating current to the circular electrode adjacent the central electrode and to circular electrodes alternate from the circular electrode adjacent the central electrode.

2. An electrical immersion heater for increasing the temperature of liquids as claimed in Claim 1 wherein an electrical earth connection surrounds the concentrically arranged electrodes.

3. An electrical immersion heater for increasing the temperature of liquids, comprising a casing through which liquid can pass, a central electrode held in the casing, circular electrodes concentrically arranged around the central electrode and held loosely in the casing, and connections from a source of alternating current connected alternately to the electrode in the casing.

4. An electrical immersion heater for increasing the temperature of liquids comprising a casing capable of passing liquid axially therethrough, and through the ends of the casing, and a side or sides separating the ends, a central electrode holding the ends and sides together and loosely retaining circular electrodes concentrically about the central electrode, an electrical connection from one side of a source of alternating current to the central electrode and to circular electrodes alternate from the central electrode, and an electrical connection from the other side

of a source of alternating current to the circular electrode adjacent the central electrode and to circular electrodes alternate from the circular electrode adjacent the central electrode.

5. An electrical immersion heater for increasing the temperature of liquids comprising a casing having holed ends and a side or sides separating the ends, so that liquid passes axially through the casing, means holding the casing together, a central electrode held in the casing, circular electrodes arranged concentrically about the central electrode and retained loosely in the casing, an electrical connection from one side of a source of alternating current to the control electrode and to circular electrodes alternate from the central electrode, and an electrical connection from the other side of a source of alternating current to the circular electrode adjacent the central electrode and to circular electrodes alternate from the circular electrode adjacent the central electrode.

6. An electrical immersion heater for increasing the temperature of liquids comprising a casing having holed ends and a side or sides separating the ends, a central electrode holding the ends together, grooves in the inner surfaces of the ends loosely retaining electrodes therein so that they can vibrate, an electrical connection from one side of a source of alternating current to the central electrode and to circular electrodes alternate from the central electrode, and an electrical connection from the other side of a source of alternating current to the circular electrode adjacent the central electrode and to circular electrodes alternate from the circular electrode adjacent the central electrode.

7. An electrical immersion heater for increasing the temperature of liquids as claimed in Claims 2, 3 4, 5 or 6 wherein an earthing electrode surrounds a casing containing heating electrodes substantially as described.

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8. An electrical immersion heater for increasing the temperature of liquids, having an electrical circuit substantially as herein described with reference to Figure 1 of the drawings.

9. An electrical immersion heater for increasing the temperature of liquids, constructed arranged and operated substantially as described with reference to Figures 2, 3 and 4.

10. An electrical immersion heater for increasing the temperature of liquids constructed arranged and operated substantially as described with reference to Figure 5.

DATED the 10th day of December 1945.

Baldwin, Son & Carey

ATTORNEYS FOR THE APPLICANT

TRUE COPY

Baldwin, Son & Carey

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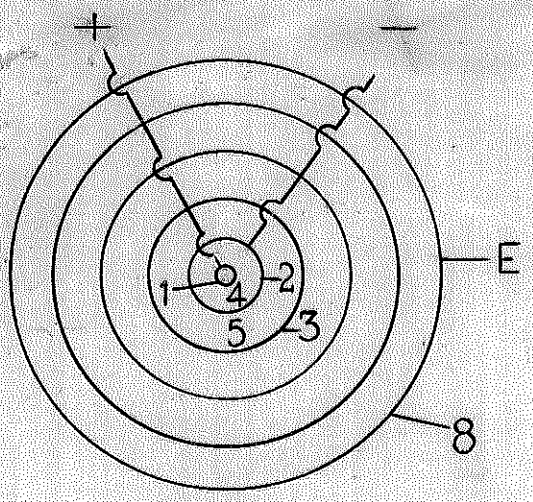

Fig -1-

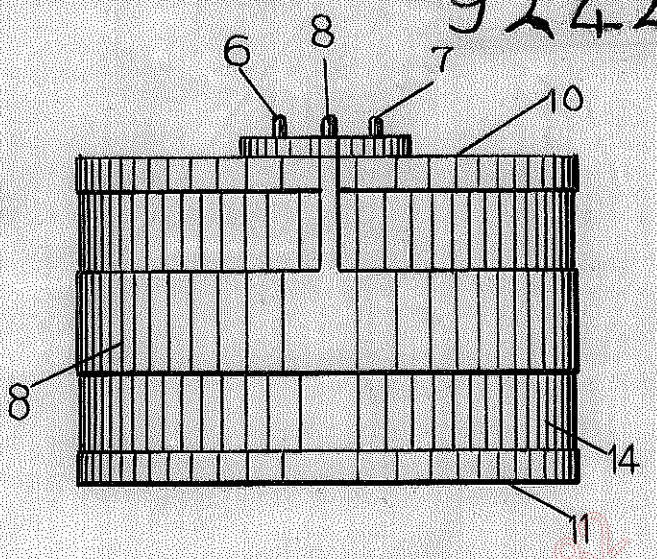

Fig -2-

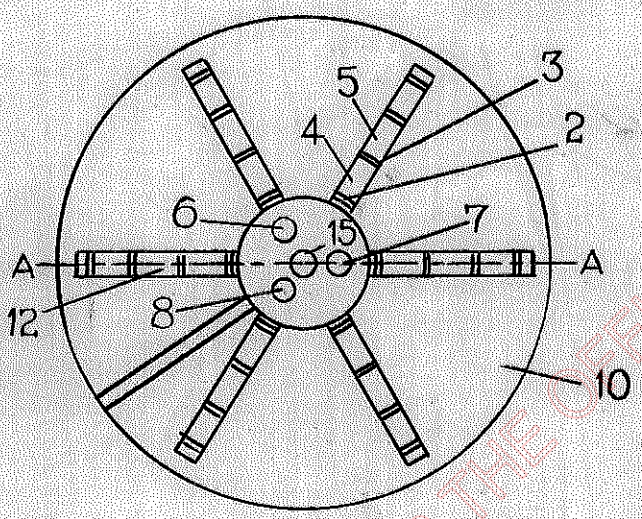

Fig 3

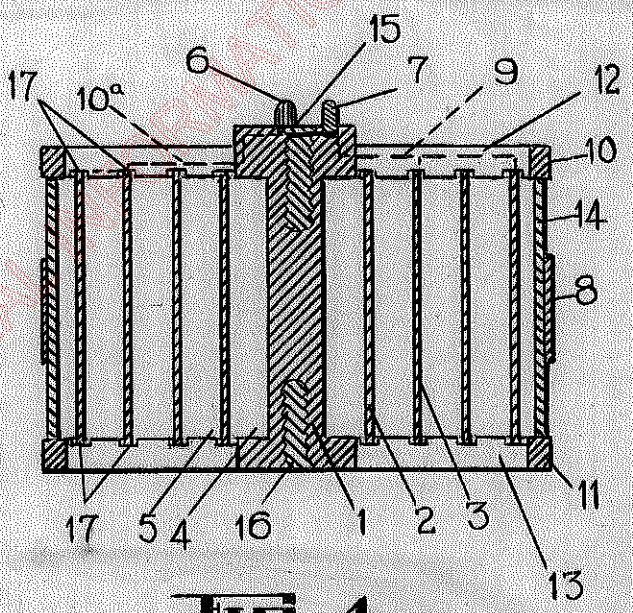

Fig 4

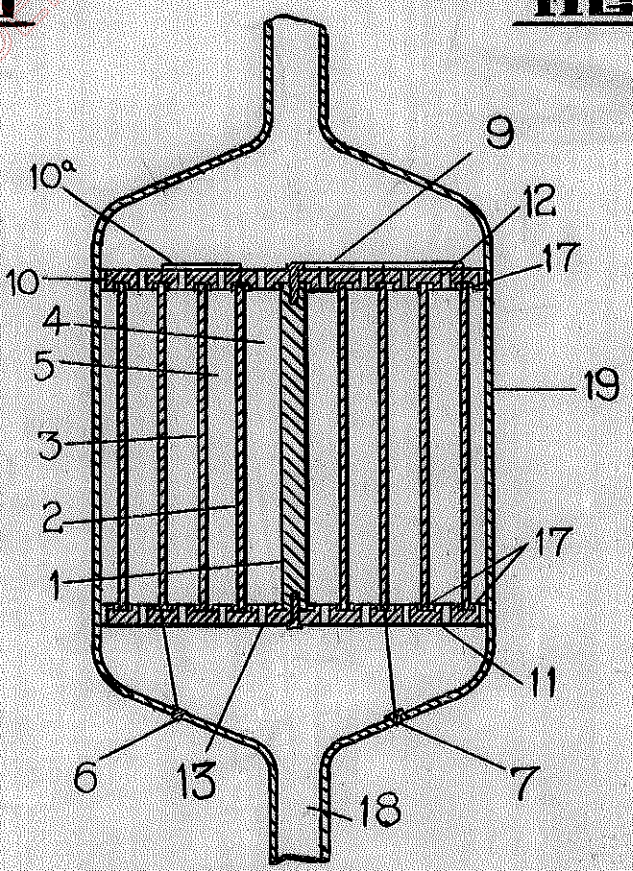

Fig -5-

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