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RUDOLF FREIHERR VON BROCKDORFF

ELECTRODE FOR LIQUID RESISTANCES

Filed March 28, 1921

Fig. 1.

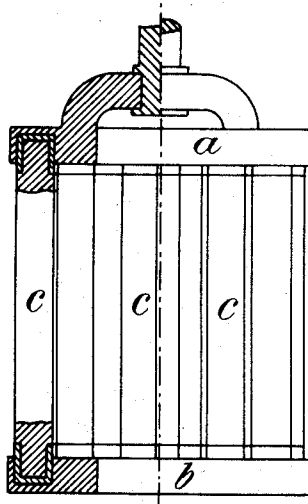


Fig. 3.

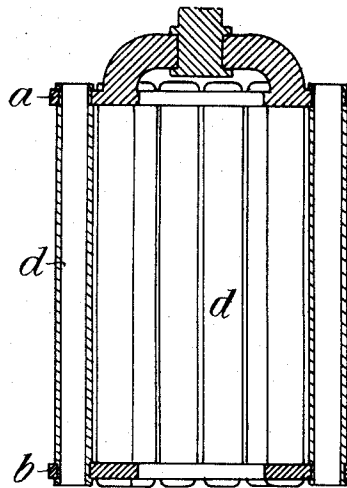


Fig. 2.

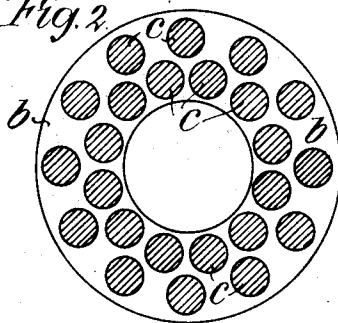


Fig. 4.

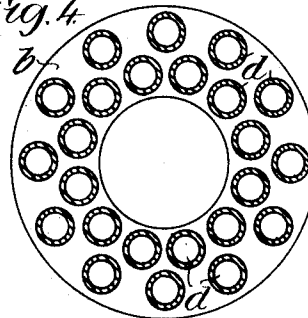


Fig. 5.

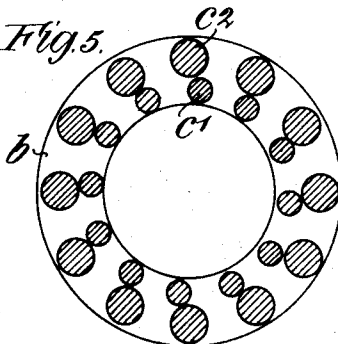
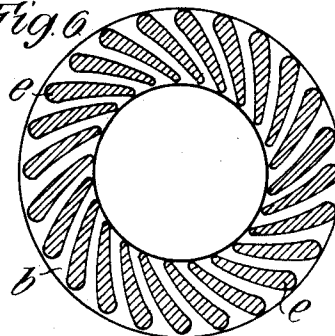


Fig. 6.



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UNITED STATES PATENT OFFICE.

RUDOLF FREIHERR VON BROCKDORFF, OF MUNICH, GERMANY.

ELECTRODE FOR LIQUID RESISTANCES.

Application filed March 28, 1921. Serial No. 456,127.

To all whom it may concern:

Be it known that I, RUDOLF FREIHERR VON BROCKDORFF, a citizen of the German Republic, residing at Munich, Germany, have
 5 invented certain new and useful Improvements in Electrodes for Liquid Resistances, of which the following is a specification.

This invention relates to electric liquid resistances or liquid heaters of the type in
 10 which the liquid forms a resistance to the passage of current therethrough and in which one or more electrodes are immersed in the liquid.

The present invention has for its object
 15 to provide a construction of electrode in which obstruction to the flow of the water or like liquid is minimized while avoiding rapid wear or deterioration of the electrode and the possibility of a concentration of potential at points on the electrode, such concentration of potential leading easily to the
 20 formation of sparks.

A further object of the invention is to ensure that the current discharge from the
 25 electrode is uniformly distributed and to provide the electrode with a large surface exposed to the liquid.

According to this invention the electrode consists of two annular bodies or rings,
 30 which are superposed at a certain distance apart and connected the one with the other by rods. The liquid rises through the lower ring into the cage-like receptacle formed by the rods and flows off wholly or partly in a
 35 lateral direction through the spaces between said rods. The rods may be staggered with regard to one another or they may be of such shape that they form vanes or blades which effect intimate inter-mixing of the water
 40 without appreciable skin friction. The rods may be solid or tubular. In the latter case part of the water will flow through the tubular rods.

In order that the invention may be clearly
 45 understood I will proceed to describe the same with reference to the examples of construction shown in the accompanying drawing, wherein:—

Fig. 1 is, on the left hand side, a section
 50 and on the right hand side an elevation of the improved electrode.

Fig. 2 is a cross section of the same.

Fig. 3 is a longitudinal section showing
 55 a second form of construction.

Fig. 4 is a cross section of Fig. 3.

Figs. 5 and 6 are cross sections of a third

and fourth form of construction—respectively.

Referring to Figures 1 and 2 *a* is an upper ring of conducting material, provided with
 60 a suitable spider *f* which supports the ring on and connects it to a conductor *g*, by which the electrode is supplied with current. The reference character *b* denotes a lower
 65 ring and *c* are the rods of circular cross section which connect the two rings *a* and *b*. These rods *c* are arranged in two circles as shown in Figure 2, the rods of the outer circle being opposite the intervals between
 70 the rods of the inner circle. As can be seen especially from Fig. 2 the water flows through the lower ring *b* into the electrode the inner space of which is of substantially
 75 uniform cross-sectional area throughout so that the flow of the water is not impeded. The inner edge of the ring *b* may be so
 80 shaped as to be of substantially the same cross-sectional area as the inner space of the electrode and thus minimize impedance to the flow of the water.

The rods *c* are preferably made of graphite as this material is not liable to a chemical transformation so that variations of the surface of the electrode are avoided, these being
 85 particularly onerous with continuous current although occurring also with alternating current. This is particularly important in connection with small ohmic resistances where the resistance at the point of discharge forms a considerable part of the total re-
 90 sistance.

According to the second form of construction shown in Figures 3 and 4 the rods *d*
 95 which connect the rings *a* and *b* are tubular and open at the upper and at the lower ends. In this case the liquid flows not only upward through the electrode and from the electrode
 100 in lateral direction outward but also in through the tubular rods *d*.

In the two forms of construction herein-
 105 before described the water which flows out laterally from the electrode is effectively broken up owing to the staggered arrangement of the rods *c* and *d* shown by the cross sections Figures 2 and 4.

The form of construction shown in Figure 5 differs from the forms of construction which have already been described with reference to Figures 1-4 merely in that the rods
 110 *c'* of the inner circle are of smaller cross section than the rods *c*² of the outer circle and that the rods *c*² are not exactly opposite

the intervals between the rods c' of the inner circle. Sufficient eddying of the water is however ensured in this form of construction by the different sizes of the rods and by their position.

According to Figure 6 the rods e have the shape of blades between which long curved channels are formed.

The rods c' , c^2 and e may of course be also tubular.

In all the forms of construction, which could of course be further modified, baffles or like devices may be arranged either around or above the electrode in order to compel the liquid to flow in determined directions within the complete unit, e. g. within the liquid resistance unit.

In all the forms of construction it is further possible to provide different forms of cross section for the passages for the liquid formed by the rods c , d , e within the electrode and to provide for efficient breaking up of the water without any appreciable skin friction. The individual water particles come into closest proximity to the rods which carry the current so that voltage variations do not occur by the liquid enclosed in the electrode. The entire transformation of energy can be transferred to baffles or the like arranged outside the electrode as hereinbefore mentioned.

The form of construction comprising the tubular rods will be used preferably where outer baffles or like devices are provided both outside the rods and above the same.

It is evident that the circular cross section of the electrode rods used for all forms of construction shown by way of example is not a characteristic feature of the invention.

I claim:—

1. An immersion electrode for liquid resistances comprising in combination, a pair of vertically spaced conducting rings, and a plurality of conducting rods supported between and electrically connected to said rings, said rods and rings forming a cage whereby liquid being heated will flow upward through the lower ring and radially outward between the rods.

2. An immersion electrode for liquid resistances comprising in combination, a pair of vertically spaced conducting rings, and a plurality of conducting rods supported between and electrically connected to said rings, the rods being adapted to impart a whirling motion to liquid flowing outward between them.

3. An immersion electrode for liquid resistances comprising in combination, a pair

of vertically spaced conducting rings, and a plurality of conducting rods supported between and electrically connected to said rings, the rods being arranged in staggered relation and forming with the rings a cage whereby liquid being heated will flow upward through the lower ring and radially outward between the rods.

4. An immersion electrode for liquid resistances comprising in combination, a pair of vertically spaced conducting rings, a plurality of series of conducting rods supported by and electrically connected to said rings, the rods of each series being of a different size from those of the other series, said rods and rings forming a cage whereby liquid being heated will flow upward through the lower ring and radially outward between the rods.

5. An immersion electrode for liquid resistances comprising in combination, a pair of vertically spaced conducting rings, and a plurality of tubular conducting rods supported between and electrically connected to said rings, said rods and rings forming a cage whereby liquid being heated will flow upward through the lower ring and radially outward between the rods.

6. An immersion electrode for liquid resistances comprising in combination, a pair of vertically spaced conducting rings, and a plurality of tubular conducting rods supported between and electrically connected to said rings, the rods being arranged in staggered relation and forming with the rings a cage whereby liquid being heated will flow upward through the lower ring and radially outward between the rods.

7. An immersion electrode for liquid resistances comprising in combination, a pair of vertically spaced conducting rings, and a plurality of conducting vanes supported between and electrically connected to said rings, the vanes being adapted to impart a whirling motion to liquid flowing outward between them.

8. An immersion electrode for liquid resistances comprising in combination, a pair of vertically spaced conducting rings, a plurality of conducting rods supported between and electrically connected to said rings, and means for supporting the upper ring and connecting it to a source of current.

In testimony whereof I affix my signature in presence of two witnesses.

RUDOLF FREIHERR von BROCKDORFF.

Witnesses:

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A. DE OLEA.