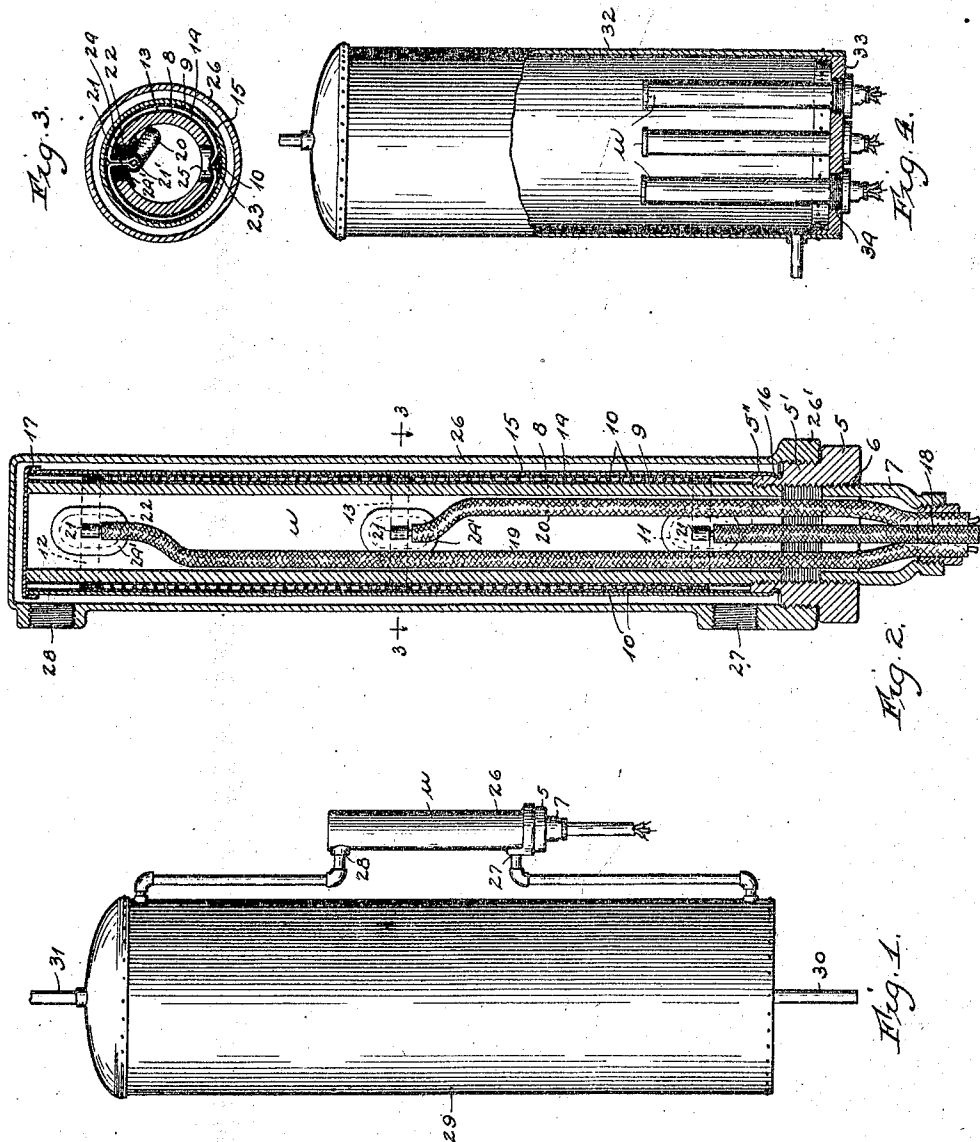


E. H. RUCKLE & E. J. KENNEDY.
WATER HEATER.

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1,122,423.

Patented Dec. 29, 1914.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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WATER-HEATER.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, EDWARD H. RUCKLE and EDWIN J. KENNEDY, both citizens of the United States, and residents of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Water-Heaters, of which the following is a specification.

Our invention relates to water heaters and particularly to electrical heaters adaptable for application in circulatory water heaters or systems to efficiently heat the water.

Among the important objects of the invention are to provide an improved electrical heater unit which can be readily and inexpensively manufactured; to provide a unit which can be used alone for heating by radiation and which can be used for insertion in a liquid to rapidly heat such liquid; to produce a unit of such shape that it can be readily included in a circulatory system to present maximum heating surface with minimum current expenditure; to provide such arrangement that a unit can be quickly and readily inserted and supported in a liquid containing or conducting receptacle and which can be quickly detached for inspection or repairs; to provide improved arrangement which will enable one or more units to be quickly inserted or withdrawn from a liquid receptacle or passageway; and in general to provide improved construction and arrangement for devices of the character referred to.

On the accompanying sheet of drawings the various features of our invention are clearly shown, Figure 1 being an elevational view showing a heating unit applied to a water tank, Fig. 2 being an enlarged vertical diametral sectional view of a heating unit and a receiving receptacle therefor, Fig. 3 being a sectional view on plane 3-3, Fig. 2, and Fig. 4 being a vertical diametral sectional view showing the arrangement of a plurality of heater units in a tank.

Referring to Figs. 2 and 3, the unit *u* comprises a supporting base or block 5 having a central threaded bore 6 for receiving a nipple 7, the block having intermediate section 5' threaded externally and the inner reduced section or flange 5". Threaded at its lower end into the section 5" of the block 5 is a tube 8 which may be of metal if desired and which forms a main support for the current conductors and insulating ma-

terial. As shown, the tube 8 is incased by a sleeve or layer 9 of insulating material, as for example mica, and spirally wound over this insulation is the resistance wire 10. Encircling the tube 8 over the insulation 9 are the metal bands 11 and 12 forming the main terminals for the resistance winding. As shown, an intermediate terminal band 13 surrounds the tube and is connected with the resistance winding intermediate its main terminals. Surrounding the terminal bands and the resistance winding is a second layer or sleeve 14 of insulating material such as mica, the two insulating sleeves thoroughly insulating the windings from the tube 8 and from the exterior. In order that the unit may be inserted into a fluid a water-proof casing 15 is applied over the insulating sleeve 14, and this casing is preferably a tube of non-corrosive metal such as copper and surrounds the flange 5" of the supporting block 5, this flange at its base having the annular pocket 16 into which the lower end of the tube may be compressed to form a water-tight fit. At its outer end the tube 15 is closed by the cap 17 which is preferably brazed thereto.

The terminal leads 18, 19 and 20 for the respective terminal bands 11, 12 and 13 are arranged at the interior of the tube 8 and extend outwardly therefrom through the nipple 7 to connect with suitable current arranging and controlling mechanism (not shown). The detailed arrangement of the terminal bands and the manner in which the leads connect therewith is clearly shown in Fig. 3. A section of each band intermediate its ends is folded together to form a radial extension 21 for projecting through a suitable opening 22 in the tube 8 to the tube interior, the end of the extension being expanded to form a sleeve 21' for receiving the end of the respective lead 20. The ends of each band are secured together by seaming or folding to receive and secure in such folding the winding 10 as indicated at 23. To insulate the bands from the tube 8 when such tube is of electrically conductive material, each opening 22 is provided with a filler or bushing 24 of insulating material, as for example rubber or mica, and the inner end 24' of the filler is preferably expanded to engage against the inner side of the tube 8. Directly opposite each opening 22 the tube has an opening 25 for accommodating the

seamed or folded together ends of the band. When a band is to be applied it is first bent midway and its ends brought together, and then after the bend is expanded to form the terminal sleeve 21' the band is inserted ends foremost through the opening 25 and through the filler 22 until the sleeve 21' abuts against the inner side of the filler. The bands are then carried in opposite directions around the tube 8 and folded or seamed together opposite the opening 25 as indicated at 23, the resistance wire being inserted in the fold or seam. The insulating sleeve 9 and the fillers or bushings 24, 24' will insulate the bands from the tube 8 and the bands will hold the insulating bushings or fillers in place. During application of the terminal bands the ends of the current leads are secured in the sleeve 21'. The outer insulating sleeve 14 is then applied and the tube 15 then slipped thereover and secured at its lower end to block 5 and sealed at its upper end by the cap 17. The outer end of nipple 7 may be threaded for receiving conduit through which the current supply wires lead.

The unit as described above forms a rigid structure which can be readily handled and which on account of its long cylindrical shape is particularly adapted for insertion in fluid containing vessels or tanks or in a pipe or passageway forming part of a circulatory water heating system. As shown in Figs. 1 and 2 a unit is inserted in a pipe-like tank or water conductor 26 and is detachably secured therein by engagement in its lower flanged end 26' of the threaded intermediate section 5' of the unit supporting block 5, the tank having an inlet 27 at its lower end for cold water or other liquid, and having the outlet 28 at its upper end. It will be noted that the inner diameter of the casing 26 is only slightly larger than the external diameter of the unit. Liquid entering at the inlet 27 will therefore flow upwardly toward the outlet as a comparatively thin film about the unit, and close to the heating wires, being separated therefrom only by a thin layer of insulating material and by the copper sealing sheath, the copper being, however, a very good conductor and distributor of heat. Fluid entering at the lower end of the heater structure is therefore quickly heated on its way to the outlet at the top. The water container 26 in Fig. 2 could be looped directly in a water supply pipe, or the inlet end could be connected with a water supply outlet and a faucet applied in the outlet at the top so that when the faucet is opened the water heated during transit through the structure will be delivered.

In Fig. 1 I have shown the structure of Fig. 2 associated with a hot water tank 29, the inlet 27 of the casing 26 being connected

with the lower end of the tank and the outlet 28 being connected with the top of the tank, there being then circulation downwardly through the tank and upwardly through the heater, the tank having a water supply inlet 30 and a hot water outlet 31.

Each heater unit may be incased in a water container or number of heater units may be arranged in a common container. As shown in Fig. 4 the water container 32 has a bottom plate 33 provided with a plurality of threaded openings 34 in which the heater units *u* may be inserted and secured to extend upwardly into the container to heat the water therein or flowing there-through. Such container can be a separate tank or may be a tank secured to the side of a stove.

We do not, of course, desire to be limited to the precise constructions and arrangements herein shown and described as modifications might be possible which could still come within the scope of the invention, and

We claim as follows:

1. In an electrical heater unit, the combination of a supporting block; a supporting tube extending from said block, a resistance winding on said tube insulated therefrom, terminal bands surrounding and insulated from said tube and connected with said winding, extensions from said bands to the interior of said tube, and current circuit leads extending into said tube and connected with said extensions.

2. In an electrical heater unit, the combination of a supporting block, a supporting tube extending from said block, a resistance winding on said tube insulated therefrom, terminal bands surrounding and insulated from said tube and connected with said winding, extensions from said bands to the interior of said tube, current circuit leads extending into said tube and connected with said extensions, and a water tight shell extending from said block and inclosing said tube and said winding and bands thereon.

3. The combination with an electrical heating unit comprising a supporting tube, resistance winding on said tube insulated therefrom, electrical conductors extending into the interior of the tube and connected with said windings and insulated from said tube, a sheath inclosing said tube and said windings thereon, of a water container, said unit being adapted to be detachably inserted into said container and said container being of only slightly greater diameter than said unit and having inlet and outlet openings adapted for connection with water supply or circulating conductors.

4. In an electrical heater unit, the combination of a supporting tube, a resistance winding on said tube, sheet metal terminal bands surrounding said tube and connected

with said winding, each band being looped and said tube having openings through which the loops extend to the interior thereof, and current circuit leads extending into
5 said tube and secured in said loops to be thus connected with the terminal bands.

10 5. In an electrical heater unit, the combination of a supporting block, a tube extending from said block, a resistance winding on the exterior of said tube, terminal bands surrounding said tube and connected with said winding, extensions from said bands to the interior of the tube, current conductors within the tube connecting with

said extensions, a water-tight shell inclos- 15
ing said tube and the windings and terminal bands thereon, and a water container extending from said block concentric with said shell and having inlet and outlet openings.

In witness whereof, we hereunto subscribe 20
our names this 13th day of February, A. D.,
1914.

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Witnesses:

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