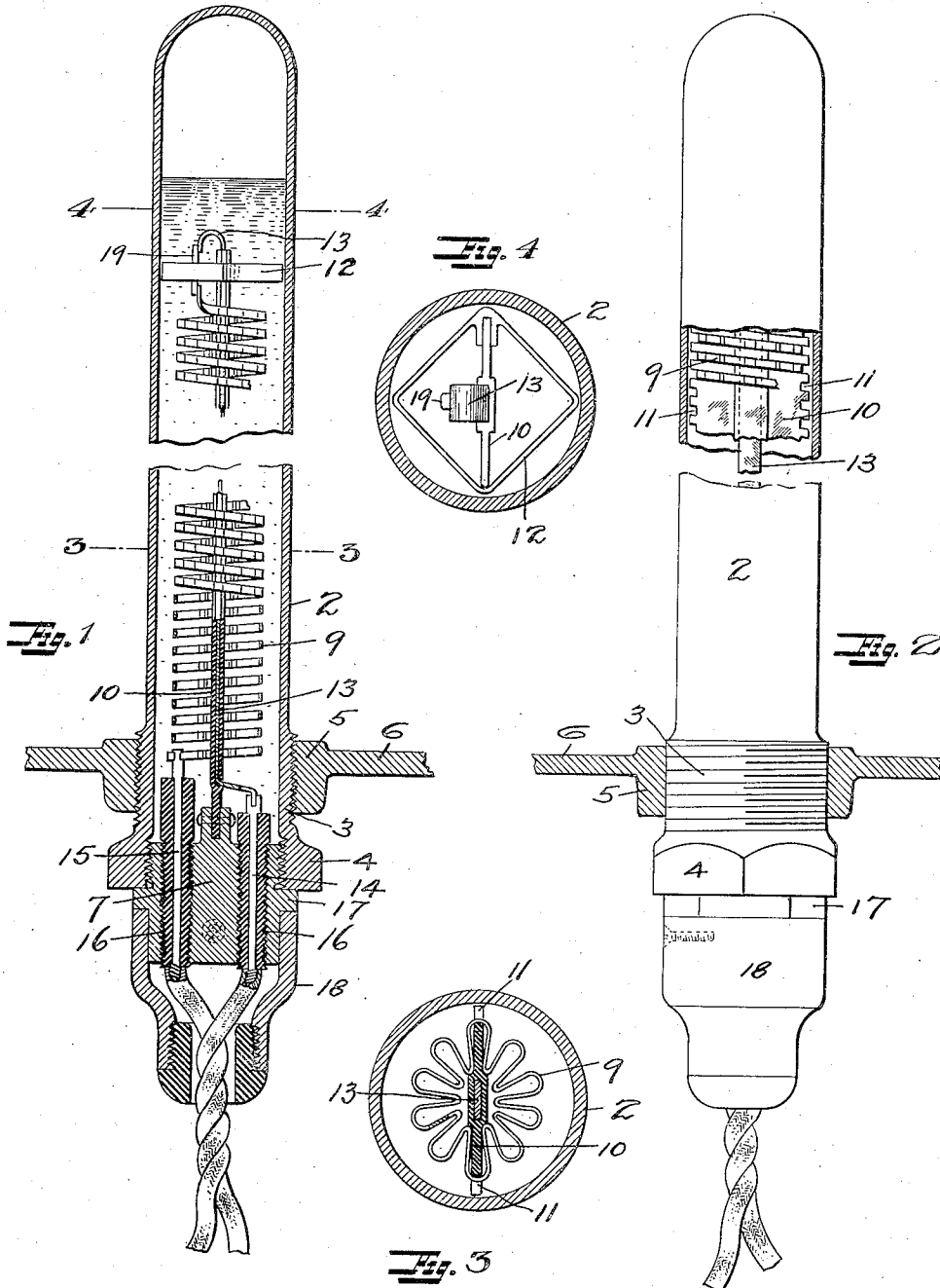


R. E. FRICKEY,
ELECTRIC HEATING UNIT,
APPLICATION FILED FEB. 26, 1916.

1,238,124.

Patented Aug. 28, 1917.



WITNESSES:

J. B. Gardner

INVENTOR.

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HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

ROYAL E. FRICKEY, OF REDDING, CALIFORNIA.

ELECTRIC HEATING UNIT.

1,238,124.

Specification of Letters Patent. Patented Aug. 28, 1917.

Application filed February 26, 1916. Serial No. 80,622.

To all whom it may concern:

Be it known that I, ROYAL E. FRICKEY, a citizen of the United States, and a resident of Redding, Shasta county, State of California, have invented a certain new and useful Electric Heating Unit, of which the following is a specification.

The invention relates to devices which are adapted to be submerged in the water or other liquid to be heated.

An object of the invention is to provide a heating unit having a low temperature gradient between the heating element and the fluid to be heated, and also to provide a heating element which is protected from oxidation.

Another object of the invention is to provide a submersible electric heating unit comprising a unitary structure.

Another object of the invention is to provide means within the heating unit for automatically opening the electric circuit when the temperature therein reaches a certain predetermined maximum.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full that form of the invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one specific form of my invention, but it is to be understood that I do not limit myself to such form, since the invention may be embodied in a multiplicity of forms, each being a species of my said invention.

Referring to said drawings:

Figure 1 is a longitudinal section of one form of heater of my invention, part thereof being broken away to reduce the size of the figure.

Fig. 2 is an elevation of the heater of my invention taken at right angles to Fig. 1, the inclosing tube being partly broken away to disclose the heating element.

Fig. 3 is a cross section on an enlarged scale taken on the line 3—3 Fig. 1.

Fig. 4 is a cross section on an enlarged scale taken on the line 4—4 Fig. 1.

The heater of my invention comprises a unitary structure which may be readily applied to any tank or receptacle, the liquid content whereof it is desirable to heat. The heater comprises a sealed metallic container or tube 2 provided on its end with a reduc-

tion nipple 3 and an integral nut 4 for screwing the tube to a firm seat in a tapped boss 5 in the wall 6 of a tank or other receptacle. Screwed tightly into the nipple 3 and closing the outer end of the tube is a perforated metallic plug 7, on which the heating element is mounted.

The heating element comprises a fluted coil or helix of flat thin wire 9 which is supported on a strip 10 of suitable insulating material such as mica, the insulator being preferably provided with indentations 11 along its edges in which the successive convolutions of the heating coil are embedded. The insulator is but slightly narrower in width than the internal diameter of the tube 2, so that it acts to center the heating coil in the tube. By forming the heating element of flat thin wire, a much greater area of surface is obtained than with a round wire of the same cross section. The lower end of the insulator 10 is secured in a slot in the plug 7 and attached to the upper end is a guard or spacer 12 which contacts with the tube, holding the heating coil centrally and out of contact with the tube. The upper end of the heating coil is connected to a substantially stiff metallic bar or strip 13 which extends downward through the insulation strip 10 and serves as a support therefor when mica or other flexible material is employed for the insulator 10, and also constitutes the electric conductor. The conductor 13 is offset at its lower end and is rigidly connected to a boss formed on the end of the feed conductor 14. The lower end of the heating coil is connected to the feed conductor 15. The conductors 14 and 15 are tightly embedded in insulating material 16, which is either cast into or screwed into the perforated plug 7, forming a sealed joint therewith. The metallic plug 7 is provided with a flange 17 for the engagement of a wrench and when screwed into place the flange bears against the nut 4. Secured to the plug 7 and bearing against the flange 17 is a cap 18 through which the conductors 14—15 pass, the conductors being suitably insulated.

Heretofore heating elements which have been inclosed in metallic tubes have usually been wrapped with mica or other comparable insulating material, to insulate them from the inclosing tube, but the electrical insulating material is also an efficient heat insulator, resulting in a steep tem-

perature gradient between the heating element and the inclosing tube. In accordance with my invention, I partially fill the tube with an electric insulating material or substance which is fluid at the temperature of operation of the heater. The material which I prefer to employ is oil of the proper characteristics, but the use of oil is not essential and any other suitable substance may be employed. By employing such medium, which is in direct contact with the heating wires and with the walls of the tube, the heat is conveyed to the tube by convection with a low temperature drop between the heating element and the tube. Sufficient of the fluid material is placed in the tube to submerge the heating element, thereby protecting it from oxidation, and the tube is preferably only partially filled to allow an air space so that increase in volume due to increase in temperature will not materially increase the pressure within the tube. Since the heat is rapidly transferred from the heating element to the tube by convection and on account of the large surface of the heating element in contact with the fluid, there is a small temperature drop between the maximum temperature at the heating element and the minimum temperature at the tube.

The heating unit is preferably arranged in the tank containing the liquid to be heated, in a vertical position, but it may be employed in any desired position.

Means are also provided for automatically

opening the electric circuit should the temperature within the tube exceed a certain predetermined maximum. Arranged in the electric circuit within the tube and preferably at the upper end thereof, is a metallic fuse 19 which melts at the predetermined temperature. This fuse is preferably interposed between the wire 9 and the supporting conductor 13. When destroyed, this fuse may be renewed by removing the plug and the heating element from the tube.

I claim:

1. An electric heating unit comprising a sealed tube, a plug closing the lower end of said tube, a strip of insulating material mounted on said plug and provided with indentations along its edges, a resistance wire wound on said strip and seated in said indentations and a filling of fluid electric insulating material in said tube.

2. An electric heating unit comprising a sealed tube, an electric heating element in said tube, a circuit for the heating element, a fuse in said circuit and tube adapted to be melted by the increase in temperature in the tube to a certain predetermined degree and a filling of fluid insulating material in which said element is submerged.

In testimony whereof, I have hereunto set my hand at Redding, California, this 18th day of February 1916.

ROYAL E. FRICKEY.

In presence of—

HENRY G. HILL.

ANNA A. BROWN.