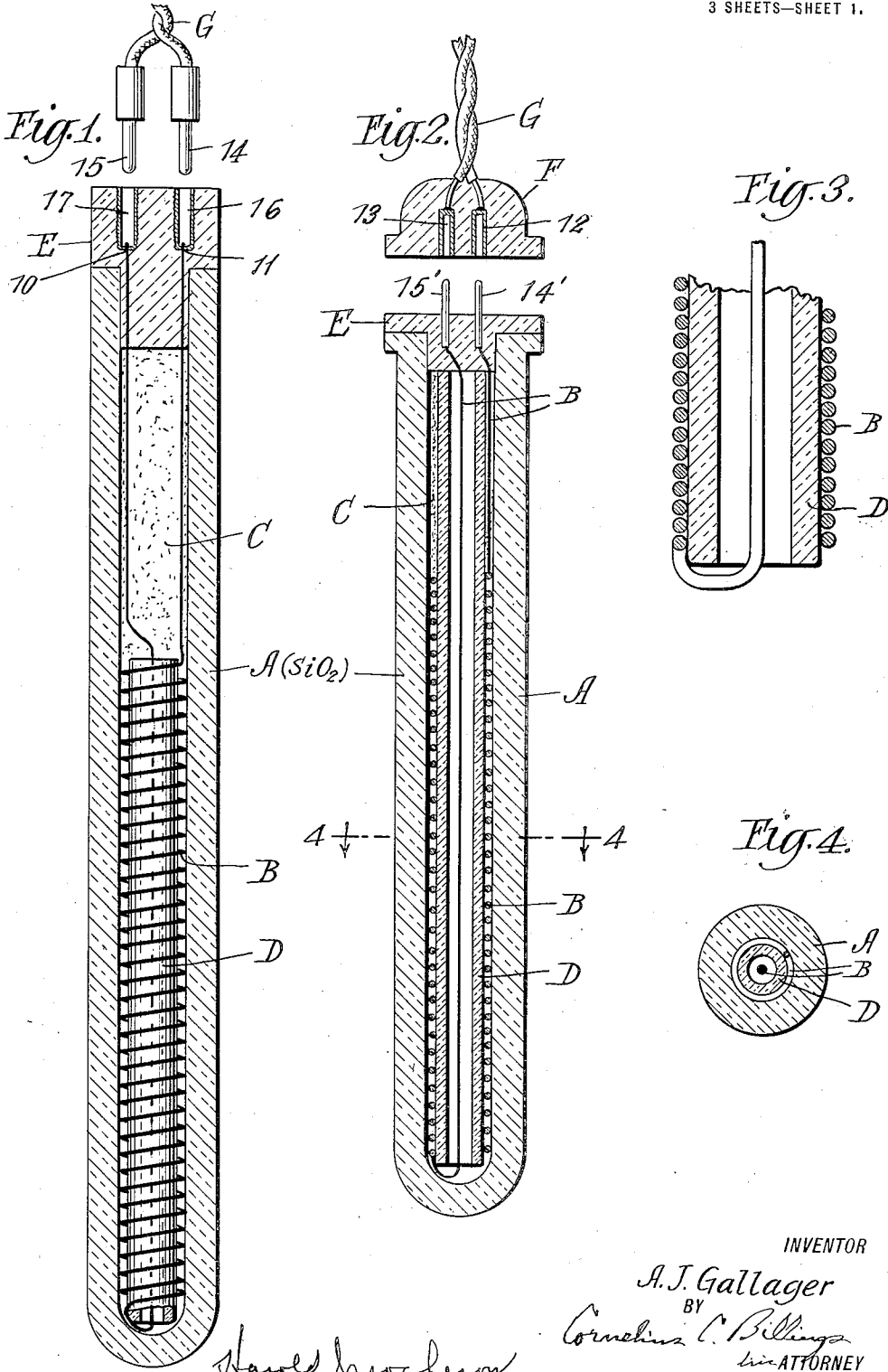


A. J. GALLAGER.
ELECTRICAL IMMERSION HEATER.
APPLICATION FILED OCT. 18, 1919.

1,365,978.

Patented Jan. 18, 1921.
3 SHEETS—SHEET 1.



INVENTOR

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BY

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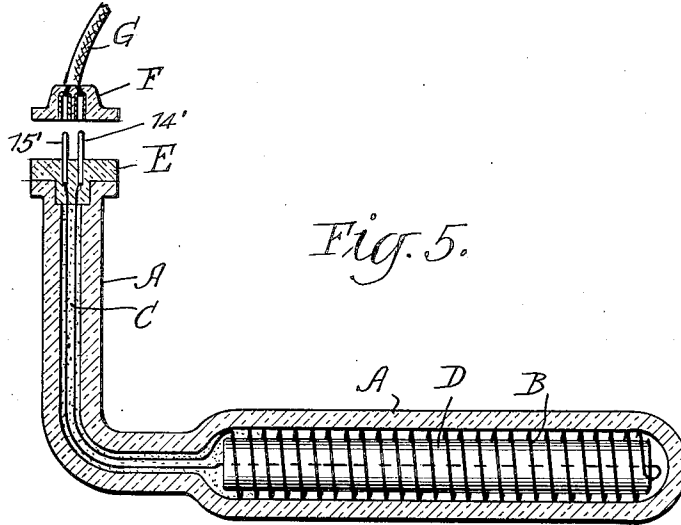


Fig. 5.

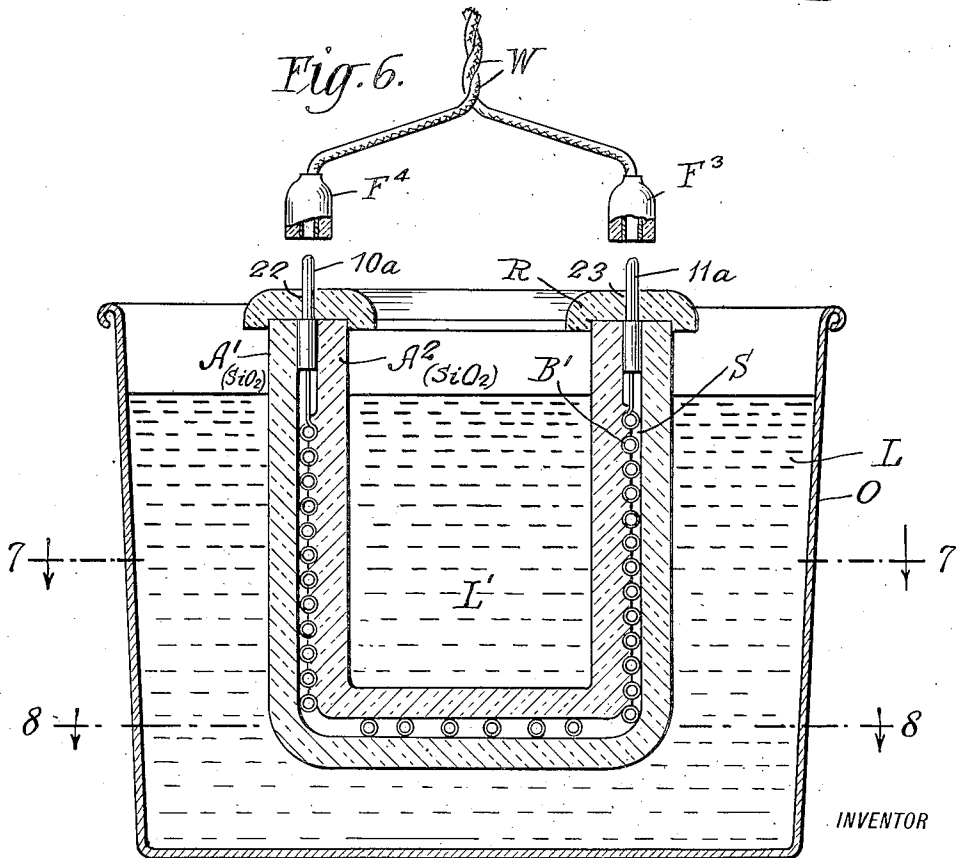


Fig. 6.

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Fig. 7.

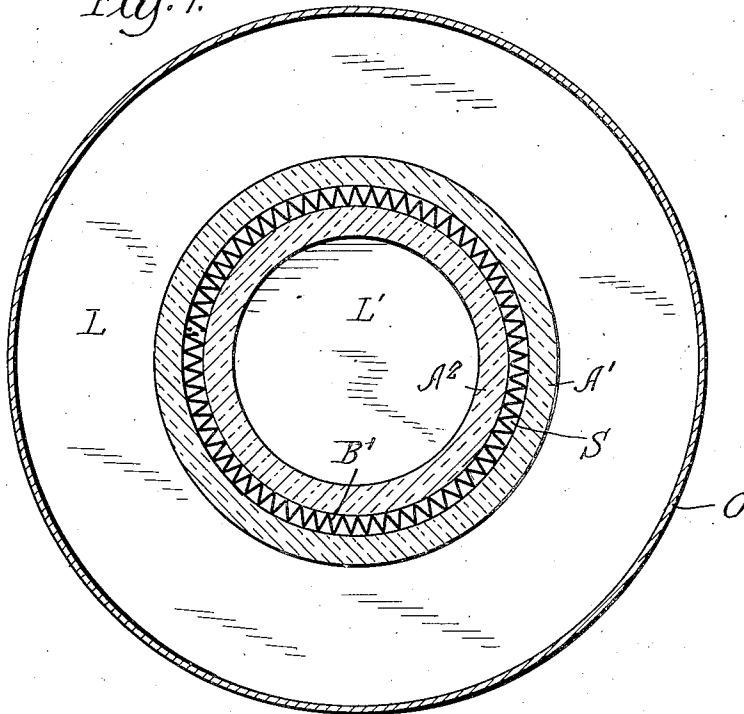
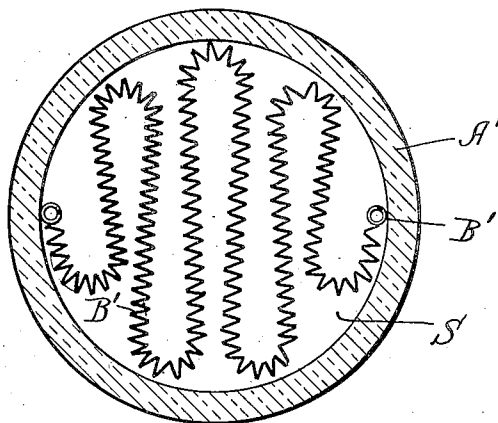


Fig. 8.



St. Louis

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UNITED STATES PATENT OFFICE.

ALBERT J. GALLAGER, OF NEW YORK, N. Y.

ELECTRICAL IMMERSION-HEATER.

1,365,978.

Specification of Letters Patent.

Patented Jan. 18, 1921.

Application filed October 18, 1919. Serial No. 331,628.

To all whom it may concern:

Be it known that I, ALBERT J. GALLAGER, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Electrical Immersion-Heaters, of which the following is a specification.

My invention relates to electrical heating devices particularly adapted to be immersed in liquids and solutions of all kinds for the purpose of heating the same.

The principal object of my invention is to provide an electrical immersion heater which with the exception of the electric heating circuits is composed of non-corrosive insulating material.

Another object of my invention is to provide an electrical immersion heater wherein the heating element is in direct contact with a wall of substantially pure fused silica, fused quartz or "vitreosil," and which latter material transmits the heat generated by the heating element to the fluid or plastic material to be heated.

Another object of my invention is to so form and construct the heater that it is adapted for heating liquids in containers of various styles and shapes.

Other objects will appear from the subjoined specification and claims.

Referring to the drawings;

Figure 1 is a longitudinal sectional view with parts in elevation, of one form of my improved heater.

Fig. 2 is a cross sectional view of another embodiment of my invention.

Fig. 3 is a fragmentary view in section of one end of the heating coil to show more clearly the special winding of the heating element.

Fig. 4 is a section on line 4—4 of Fig. 2.

Fig. 5 is a vertical section with parts in elevation of another form of my improved heater.

Fig. 6 is a vertical section, partly in elevation, showing the construction, in use, of another embodiment of my invention.

Fig. 7 is a section on line 7—7 of Fig. 6.

Fig. 8 is a section on line 8—8 of Fig. 6.

In the drawings in which the same reference characters refer to like parts:

In Fig. 1 A is the heat conducting medium

consisting of a tube closed at one end and open at the other, illustrating the conducting wall of fused silica, fused quartz or "vitreosil," B the heating element in the form of a coil of wire hereinafter described, and C a packing of insulating material consisting preferably of asbestos. D is an insulating tube of clay or other suitable electrical insulating material to support the heating element and provide for a lead for the wire at one end of the coil. E is a cap of any suitable insulating material for retaining the terminals 10 and 11 of the heating element and which acts also as a stopper for the closed tube of fused silica or fused quartz. The cap E is provided with receptacles 16 and 17 to receive the plugs 14 and 15 which form the terminals of the electrical conducting cord G, so as to make proper electrical connection in a manner well known in the art.

Other forms of connectors are shown in Figs. 2 and 5 in which F is a socket or connector made of suitable insulating material and provided with receptacles 12 and 13 in the base, to receive the terminals 14' and 15' of the heating element B. In Fig. 6 single insulated socketed connections F³ and F⁴ fit over the terminal posts 10^a and 11^a, as clearly shown.

The construction of the improved heater is very simple and will now be briefly described so that anyone skilled in the art may readily construct and use the same.

The heat conducting tube A is made of substantially pure fused silica (SiO₂), fused quartz or "vitreosil," the latter being the trade name of one form of these materials, and which may readily be worked by molding or by blowing into any desired shape; some particularly suitable shapes being shown in Figs. 1, 2, 5 and 6. In practice I have found a tube substantially one half inch in diameter to be a practical structure, the diameter of the interior of the tube being substantially one quarter of an inch, and the thickness of the sides substantially one eighth of an inch, though it is to be understood, of course, that my invention is not to be in any way restricted to these measurements.

Referring more particularly to Fig. 1, the heating element B is shown wound in the

form of a coil upon a hollow tube D of insulating material which supports the coil and also affords a lead through its center for the wire of the coil passing to one of the terminals. The heating element is shaped in the form of a closely wound coil since this construction permits the maximum dissipation of heat in a minimum amount of space. A mass of asbestos or other insulating packing C is placed between the upper end of the tube D and lower end of the connector E which also acts as a plug for the tube D.

In Fig. 1 the insulating connector and plug E containing one pair of terminals, is closely fitted to the open end of the tube of fused silica, as clearly shown. This connector plug E may be of various shapes and provided either with projecting terminals or with receptacles fitted in the sockets therein, as clearly shown in the several figures of the drawing.

In Figs. 1 and 2 the heating element B is shown as having a more or less open winding for the purpose of clearness in illustration, but the coil is in fact closely wound so that the turns thereof are very near to each other though not touching, the actual winding structure being more clearly shown in Fig. 3.

The tube of fused silica or fused quartz may be either straight so that it may assume a vertical position in a container (not shown) of liquid to be heated or it may be shaped in the form of an angle so that it may more readily heat liquid in a shallow container (Fig. 5).

In Figs. 6, 7 and 8 I have shown an electrical heater embodying the basic principle of my invention but of different mechanical construction from those shown in the other figures of the drawing. In this case the tubes or cups constituting containers are formed of fused silica and these containers are marked respectively A' and A². The container A' is of such size and has such dimensions that the container A² nicely fits therein leaving a space S between the tube or cup in which the heating element B' is placed. The heating element B' is in the form of a helical coil and this coil is laid in the bottom of the container A' in the manner of a grid shown in Fig. 8, each end of the coil passing between the sides of the two containers A' and A², being guided and held in place by means of suitable grooves in the surface of the inner cup A². The leads from each end extend up into and form electrical contacts respectively with the terminal posts 10^a and 11^a, passing through holes 22 and 23, in a ring of insulating material R forming a binding cap fitting over the upper edges of the containers A' and A², as clearly shown in the drawings, thereby effectually holding the containers together and forming a suitable support for the terminals. The electrical connection is made

in a manner well known in the art by means of the socketed terminals F³ and F⁴ connected to the conducting wires W.

The special use for which this particular construction is adapted is clearly shown in Fig. 6, wherein a body of liquid L in a container O may be heated and at the same time another body of liquid L', which is placed within the inner tube or cup A² of fused silica, may also be heated, thus enabling the heating of the two separated bodies of liquid at the same time.

So far as I am aware, I am the first to construct an electrical immersion heater, the walls of which forming the heat conducting medium are made of substantially pure fused silica, fused quartz or "vitreosil," the heating coil being in direct contact with the walls of fused silica and transmits its heat through these walls to the liquid, fluid or other material to be heated, and I wish to lay claim broadly to this construction.

By means of this construction the medium directly transmitting heat to the fluid or material to be heated is not liable to electric short circuits and grounds, neither is it liable to a possible electrolytic reaction in the solution itself as would be the case with metallic immersion heaters. Furthermore, by means of the construction hereinabove described, I have invented and produced an electrical immersion heater which is practically non-corrosive and is affected chemically only by hydrofluoric acid and hot concentrated alkaline solutions, and consequently my invention has a wide range of use.

The absence of metal in my construction enables it to be used commercially for heating oils, acids, weak alkaline and other chemical solutions, for sterilization and varied medical purposes, for home uses, namely, for heating water both in large and small quantities, and for heating liquid foods of all kinds. In the latter instance the wall of fused silica or fused quartz is glazed or satin finished, thus avoiding any possibility of contamination. Foods can thus be heated without a metallic taste being imparted to them or without subjecting them to the chance of being poisoned, which is a danger that exists where metallic substances are used.

The fact that the fused silica has an approximate softening point from 1500 degrees C. to 1600 degrees C. is a factor which gives great value to this material for the use described. The substantially high melting point for material of this kind enables the heating element to be placed in direct contact with the wall thereof and enables the heater to be operated at a very much higher heat rate. The fused silica is also valuable for the purposes described in view of the fact that it has practically a negligible coefficient of expansion and it can be heated

to a glowing state and plunged into a cold fluid without cracking. Fused silica is mechanically strong which is another desirable factor.

5 The heating coil itself while an essential part of the heater can be formed in various shapes depending upon the type of the construction of the heater and may consist of any of the commercial alloys or metals, com-
10 monly used for that purpose such as platinum, tungsten, molybdenum for very high temperatures, and carbon, nickel, nickel chromium alloys, or "Excello" wire when lower temperatures only are desired. The
15 material used would obviously depend upon the operating temperature and the particular use for which the heater is designed.

As changes of construction could be made within the scope of my invention, it is intended that all matter contained in the above
20 description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention what I claim as new and desire to secure by Let-
25 ters Patent is:

1. An electrical immersion heater which with the exception of the electrical heating circuits is entirely constructed with non-
30 metallic non-corrosive insulating material.

2. An electrical immersion heater provided with a body of insulating material, a heat transmitting element consisting of sub-
35 stantially pure fused silica, fused quartz, or vitreosil, surrounding first mentioned body, and a heating element in contact with each of the adjacent walls of the first mentioned insulating body and heat transmitting element.

40 3. An electrical immersion heater consisting of independently disposed heat conducting walls of substantially pure fused silica, fused quartz or vitreosil each wall of which is in direct contact with a heating element
45 mounted between the said walls.

4. An electrical immersion heater consisting of a tube of substantially pure fused silica, a hollow rod of insulating material fitted within the tube of pure fused silica,
50 a heating coil mounted upon said rod and in direct contact with the inner wall of the tube of pure fused silica.

5. An electrical immersion heater consisting of a tube of pure fused silica, closed at
55 one end and open at the other, a cap or cover of insulating material for the open end of the tube, and an electric heating element in direct contact with the inner wall of the tube.

60 6. An electrical immersion heater with a heat conducting medium separable consisting each of which is of a pair of containers made of substantially pure fused silica, one fitting within the other, a heating coil held

between the walls of the two containers, 65 means for securing the two containers together, the heating coil being in contact with the outer surface of the inner container and the inner surface of the outer container.

7. An electrical immersion heater com- 70 prising a tube of fused silica, a heating coil disposed therein, a heat insulating packing above said coil, and a closure for said tube having terminals, to which the ends of said heating coil are attached. 75

8. An electrical immersion heater comprising a tube of fused silica, having a closed and an open end, a heating coil unit disposed in said tube near the closed end, the said tube having a portion extending at an
80 angle thereto, and a closure for the open end of said tube, having terminals to which the ends of said heating coil are attached.

9. An electrical immersion heater comprising an insulating tube, having a closed
85 and an open end, a heating coil unit disposed in said tube near the closed end, the said tube having a portion extending at an angle thereto, and a closure for the open end of said tube, having terminals to which
90 the ends of said heating coil are attached.

10. An electrical immersion heater comprising a tube of pure fused silica, having a closed and an open end, a heating coil unit comprising a clay core and a heating coil
95 wound thereon, said coil being disposed in said tube adjacent the closed end, and with the coils directly in contact with the tube, the open ended portion of said tube being bent to extend substantially at right angles
100 to said unit and having a stopper provided with terminals to which the ends of the heating coil are attached.

11. A combined electrical immersion heater and heating vessel comprising a con-
105 tainer having its outer and inner wall surfaces composed of pure fused silica, an electrical heating coil between said wall surfaces and terminals for said heating coil projecting from said vessel. 110

12. A combined electrical immersion heater and heating vessel comprising a con-
115 tainer having its outer and inner wall surfaces composed of pure fused silica, an electrical heating coil between said wall surfaces and terminals for said heating coil in the rim of said vessel.

13. A combined electrical immersion heater and heating vessel comprising an outer receptacle of pure fused silica, a heat-
120 ing coil having its convolutions in contact with the inner wall of said vessel, an inner receptacle fitting against the said convolutions, a ring connecting the rims of the two receptacles to form a single vessel, and ter-
125 minals for said coil extending through said ring.

14. A combined electrical immersion

heater and heating vessel comprising an
outer receptacle of pure fused silica, a heat-
ing unit of wire bent back and forth on the
bottom of said receptacle in the manner of
5 a grid, the free ends from said grid being
disposed in coiled form against the inner
surface of said receptacle, an inner recep-
tacle fitting against said wire, a ring con-
necting the rims of the two receptacles to

form a single vessel, and terminals for said 10
coil extending through said ring.

In witness whereof, I have hereunto set
my hand at the borough of Manhattan, city
and State of New York, this 17 day of Octo-
ber, 1919.

ALBERT J. GALLAGER.

In presence of—

ISABEL R. FLETCHER.