E. J. OVINGTON.

ELECTRICAL RESISTANCE DEVICE.

APPLICATION FILED APR. 26, 1910.

1,052,843.

Patented Feb. 11, 1913.

2 SHEETS—SHEET 1.

Fig. 2

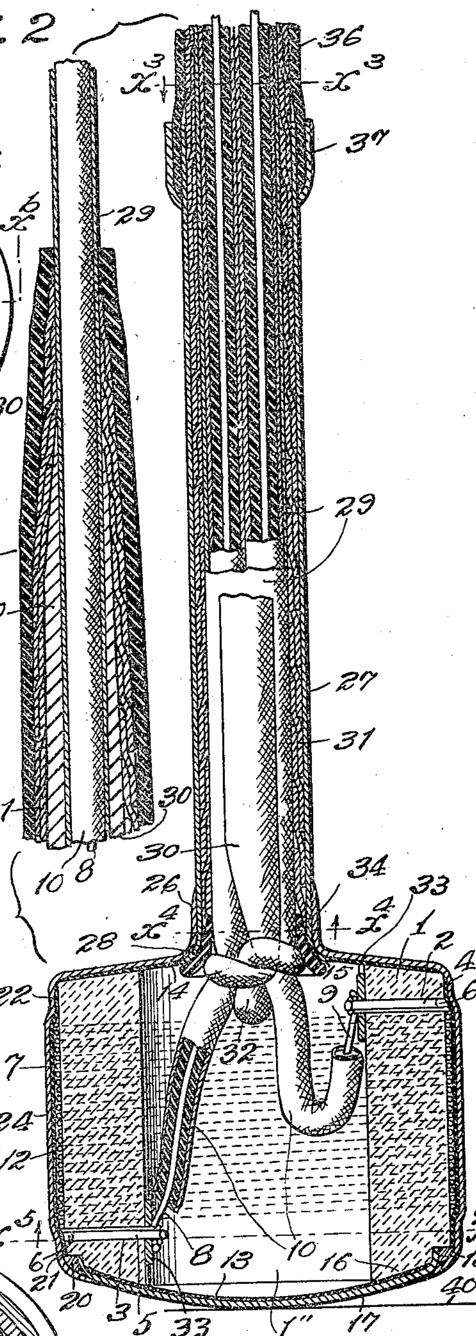


Fig. 3

Fig. 1

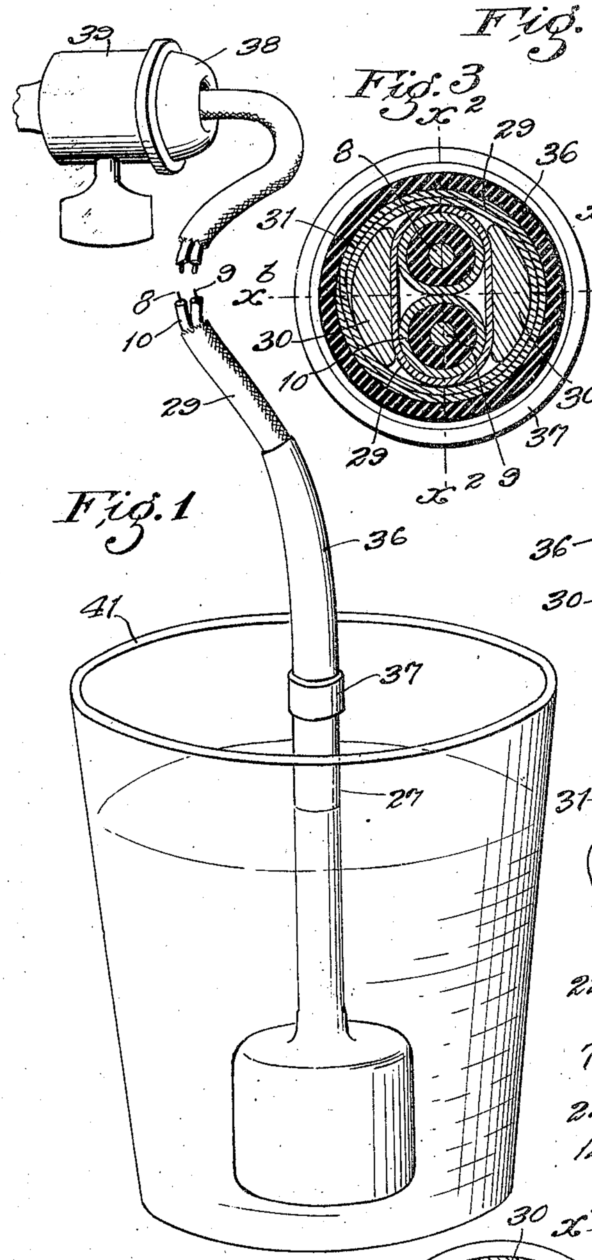
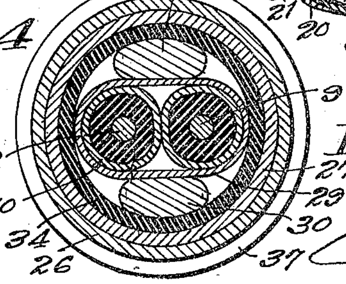


Fig. 4



Witnesses

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2 SHEETS—SHEET 2.

Fig. 5.

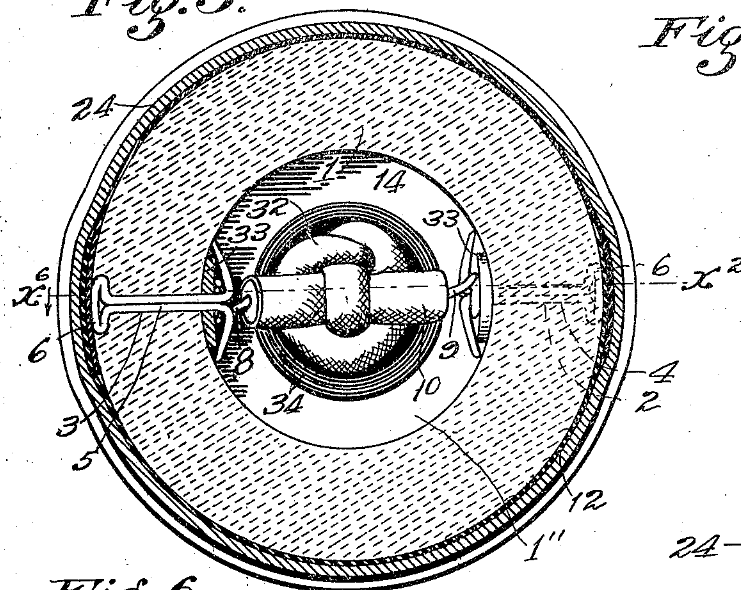


Fig. 8

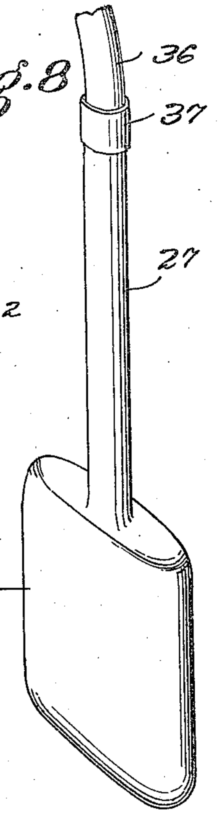


Fig. 6

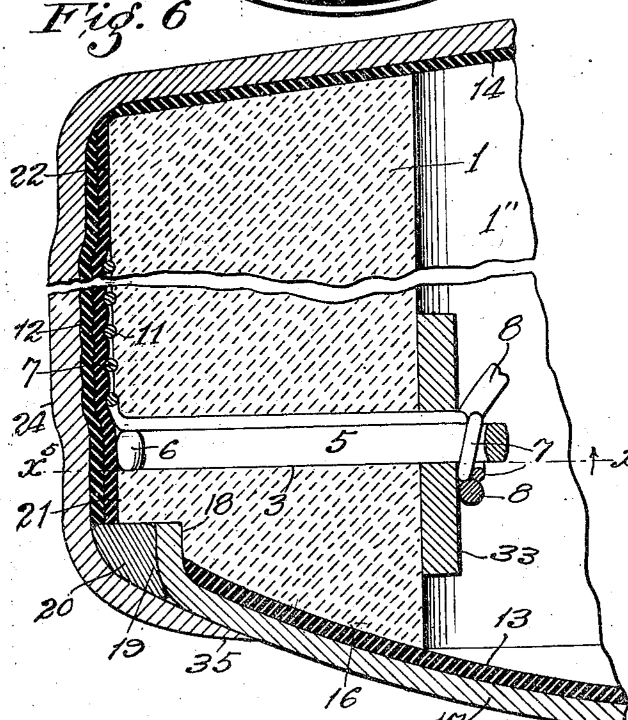
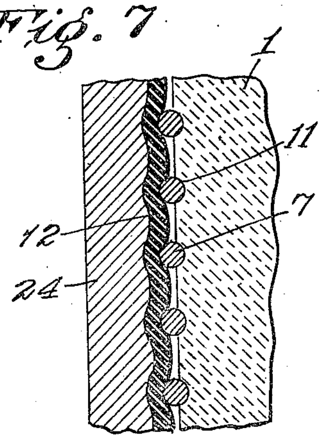


Fig. 7



Witnesses

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UNITED STATES PATENT OFFICE.

EDWARD J. OVINGTON, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SIMPLEX ELECTRIC HEATING COMPANY, OF CAMBRIDGE, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

ELECTRICAL-RESISTANCE DEVICE.

1,052,843. Specification of Letters Patent. **Patented Feb. 11, 1913.**

Application filed April 26, 1910. Serial No. 557,818.

To all whom it may concern:

Be it known that I, Edward J. Ovington, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Electrical-Resistance Device, of which the following is a specification.

This invention relates to an electrical resistance device adapted to rapidly radiate heat generated in the same by the electrical current and in its practical application is adapted for various forms of heating devices for various uses.

One object of the invention is to provide a resistance device which is especially adapted to become highly heated and to impart its heat to surrounding materials or objects without sustaining injury to itself.

Another object of the invention is to provide a superior immersion electrical heater giving a mechanical and thermal bond between the resistance element and the external shell, and which heater will not be liable to burn out from the heat produced by the current even though non-immersed while the electrical current is on so that it will not be incapacitated though allowed to remain in a vessel with the current turned on after the liquid has all been evaporated by boiling.

A further object is to produce the most intimate contact between the cover or shell and the resistance element by producing a shrinking tension within the metal itself, whereby the use of devices extraneous to the cover, for causing the cover to press tightly against the resistance element, is obviated, and the means for producing the tension is self-contained within the cover, that is to say, the fiber or grain of the metal of which the cover or shell is composed is given a sustained strain by spinning it into shape, which results in a sustained shrinking tension bringing the inner surface of the shell into tight contact with the resistance element and excluding the air from between them, thereby attaining a high degree of heat conductivity from the resistance element to the shell.

Other objects and advantages will appear from the subjoined specification and claims.

My invention comprises a support, an electrical resistance element disposed on the support and having an uneven surface, a heat conducting electrical insulating sheet disposed on and conforming to the uneven surface of the resistance element, and an external heat conducting metal shell having thermal contact with the resistance element disposed about the insulator and conforming on the face which is in contact with the insulation to said uneven surface.

The invention may be carried out in various forms and in the accompanying drawings I have shown an embodiment thereof which at the present I deem most effective.

The accompanying drawings illustrate the invention in the preferred form.

Figure 1 is a perspective view of an immersion heater constructed in accordance with this invention and ready for use to heat a glass of water. Fig. 2 is a broken sectional view of the heater shown in Fig. 1. The upper part of the handle is shifted and turned half way around from the body. In Fig. 3, line x^2, indicates the plane of section of the main body, and line x^b, indicates the plane of section of the upper part of the handle. Fig. 3 is an enlarged cross section of the handle on line x^3, Fig. 2, looking down. Fig. 4 is an enlarged cross section on line x^4, Fig. 2, looking up. Fig. 5 is an enlarged section on line x^5, Figs. 2 and 6, looking up. Fig. 6 is an enlarged fragmental section on line x^2—x^6, Fig. 5. The head and body of the low resistance pieces are intact. Fig. 7 is a magnified sectional detail of fragments of the shell, insulation, resistance and core as held together at a point where the insulation is not lapped. Fig. 8 is a perspective view of a heater corresponding to the heaters shown in Figs. 1 to 5 and being oval in cross section.

The hollow non-combustible insulating core 1 may be made of any suitable material, such as porcelain or some well known equivalent thereof, said core having a central, longitudinal bore 1″, and is provided near opposite ends with transverse perforations 2 and 3 to receive low resistant conducting pieces 4 and 5 which are preferably split pins in the nature of cotter pins provided at their outer ends with heads 6 which are embedded in the material of the core, and are practically flush with the exterior of the core that forms the support for the resistance element 7 which is disposed about the exterior surface of the core and the terminals of which are connected with the conducting pieces 4 and 5 respectively. Within the cavity of the core are disposed the lead wires 8 and 9 which are surrounded with heat proof insulation 10 and are brought together at one end of the cavity of the core and extend thence from said core.

The resistance element shown, is a cylindrical wire of high resistance material well known in the art, and is wound tightly around the core in the form of a coil, the convolutions of which are spaced apart. Preferably the core is provided with an external spiral groove 11 in which the resistance coil is seated. Said groove is of less depth than the diameter of the wire so that the resistance forms an uneven surface on the outside of the core. Disposed over said core and resistance is a yielding flexible electrical insulating resistance cover 12 of noncombustible heat conducting material which is preferably thin sheet mica, well known in the art. Said mica is made to conform to the irregularities of the uneven exterior surface of the resistance.

Disposed at the ends of the core are two electrical insulating sheets 13 and 14, one of said sheets 14 being provided with a central perforation 15 through which the insulated leads or conductors 8 and 9 are led. The end of the core opposite that from which the conductors are led is rounded or beveled as indicated at 16, and a concavo-convex sheet metal cap 17 is fitted against the mica sheet 13 and the rounded or bevel end of the core is provided with a peripheral gain 18 in which the rim of the concavo-convex sheet metal cap 17 is seated. Said rim is preferably bent to conform to the gain and thus provide an annular recess 19 to receive a resilient heat-resisting, waterproof packing 20, which may be of graphited asbestos.

Plain or ungrooved necks 21 and 22 are provided at the ends of the core beyond the perforations 2 and 3 through which the conducting pieces 4 and 5 extend. An external heat conducting metallic shell casing or envelop 24 is disposed around the core and over the perforated mica sheet 14 and is provided with a tubular neck 26 to receive a tubular handle 27 which passes through and is brazed in the neck 26 and is provided interiorly of the shell with a flaring end 28 to fit against the inside of the shell.

The method of producing the resistance device shown in the drawings is as follows: The insulating core 1, which in this instance forms a support for the resistance element 7, is molded or otherwise produced in the form of a body having preferably an exteriorly curved cross-sectional form and being of the desired length which is somewhat greater than the length of the space or face thereof on which the resistance is to be disposed. Said support may be externally grooved by machinery or by a process of molding the groove being spiral to seat a resistance coil formed of a suitable wire 7. The insulated leads 8 and 9 are insheathed in a braid 29 to form a conducting cord, well known in the art, and are bundled together with an asbestos packing cord 30 disposed on each side of the sheath. The bundle is then bound together by tape 31 wound thereon thus forming a cable. The asbestos cord is preferably bent to form a knot around the insulated leads 8 and 9 as indicated at 32 in Fig. 2. When this has been done the leads are ready for connection with the low resistance conductor pieces.

One terminal of the resistance wire 7 is applied to the core by inserting the same with a cotter pin 4 from the outside of the core through to the inside of the core, and the resistance wire is then wound on the core from such cotter pin toward the other perforation through which it is passed with another cotter pin and drawn tight. Then washers 33 are passed over the cotter pins and the inwardly extending ends of the resistance wire, which ends are then wrapped around the pin. Loops are formed on the ends of the leads 8 and 9 and are placed around the inwardly projecting ends of the cotter pins and against the washers, and the limbs of the cotter pins are then spread apart and bent over the loops, the resistance wire and the washers, and are firmly pressed against the same. Then the cord with its tape winding is passed through a tapering collar 34 of heat-resisting and electrical non-conducting material, such as porcelain. The end insulating sheet 14 is then inserted into the shell and the side insulation, which in the form shown consists of one or more thin sheets of mica, is then inserted into the shell. These form a lining at the top of the shell and entirely around the interior thereof. Preferably, two sheets of mica are employed to encircle the core and their ends are lapped at opposite sides of the shell. The cable is then inserted through the shell 24, the orifice 15 and the handle 27, and is drawn tightly therethrough to bring the collar 34 and the knot of asbestos packing firmly into place and then the core 1 is pressed tightly into the lined shell, care being taken that the conducting pieces 4 and 5 are brought opposite the lap joints of the mica sheets so that a double thickness of mica insulation will occur between said conducting pieces and the shell. Then the mica cap 13 is inserted against the end of the core and the metal cap or end piece 17, which is of the same material as the shell and is bent at its edges to conform to the gain 18, is inserted into the shell and against the core. Then the shell is inserted into the chuck of a lathe, not shown, the cord and the handle being inserted through the bore of the chuck and spindle of the lathe, and for convenience disposed in such a way as to allow the shell and core to be rotated without entangling the cord. This may be done by rolling the cord into a loose ball and inserting it into a receptacle attached to the back end of the lathe spindle. The workman will then clamp the core and metal shell between the lathe centers and will then proceed with a suitable tool to spin the shell, so as to compress said shell, the mica and the resistance tightly about the core. This method or process results in conforming the shape of the mica lining and the inner surface of said metal shell to the outer uneven surface formed by said resistance, and also results in forcing the parts into tight, intimate, interlocking contact, and in increasing the heat-receiving surface of the metal shell. The unevenness of surface of the metal shell and the mica lining tends also to hold the resistance and to prevent the same from shifting to any great extent. Said method also produces a contracting strain which tends to maintain very close thermal contact between the resistance producing the heat, and the metal shell which is to impart the heat.

After the shell has been spun onto the core, the workman may, by a suitable tool, trim the projecting edge of the shell into the beveled form which is seen at 35, and then the resilient packing 20 will be inserted into the recess 19.

At the outset, those parts of the inner surface of the projecting portion of the shell 24 and of the outer surface of the shell cap 17, which is to contact therewith, will be tinned so that when sufficient heat occurs between said contacting surfaces, such surfaces will become soldered together.

When the shell cap 17 and mica 13 have been brought into place as stated, the workman will then spin the projecting bevel edge of the shell down onto the shell cap, tightly compressing the resilient packing 20, shell cap 17 and the insulated cap 13 tightly against the end of the core. As a result of this operation the concavo-convex cap 17 is firmly held in convex form externally and the spun shell 24 and the shell cap are sealed together.

The spun metal shell around the necks at the ends of the core at each side of the resistance element holds the mica tightly against the core and thus tends to hold the resistance firmly in place and provides insulation to prevent leakage of current from the resistance.

The joint between the handle 27 and the conducting core may be covered by a tubular sheath 36 held in place on the handle by a band 37.

To complete the device the leads may be provided with an electrical connection 38 for attachment to a fixture 39, the current is turned on the resistance becomes quickly heated and heat is rapidly transmitted through the portion of the shell adjacent thereto. The heat thus evolved by the resistance raises the temperature of the spun shell body 24 and the shell cap 17 at the tinned lap, (adjacent 35 in Fig. 6) sufficiently to effect the soldering of the joint between the shell and the cap. After the shell and cap have thus been soldered together, the same, together with the handle are suitably cleaned, polished and otherwise prepared for market in any well-known manner.

In practical use the convex form of the cap 17 enables the device when it rests on a flat surface 40 to be supported by a very small area at that portion of the cap which is farthest from the source of heat and when the immersion heater, shown in Figs. 1 and 2, is left at rest in the glass or other vessel 41 containing liquid, the evolved heat is most effectively applied to raise the temperature of the liquid; and the tendency to heat the vessel is minimized.

By reason of the convexity of the bottom surface of the heater, steam or air bubbles which are formed thereon, will pass upward and laterally to the sides of the heater, thus preventing overheating of the bottom of the heater and of the adjacent portions of the water containing vessel.

I claim:—

1. A resistance device comprising a resistance element, a support therefor projecting beyond the resistance element to form necks, a shell around said resistance and its support and an insulating lining in the shell and around the support and resistance, said insulating lining being crimped and conforming to the necks and to the uneven surface formed by the resistance, and the inner surface of the shell conforming to the crimped lining and practically conforming to said uneven surface, said shell, insulation, resistance and support being in tight thermal contact.

2. An electrical heater comprising a hollow insulated core having a general circular form in cross-section, low resistant electrical conducting pieces extending through the material of the core from the bore to the outside surface of said core, the outer ends being flush with said surface, an electrical resistance disposed on the outside surface of said core and connected at its terminals with said conductors, heat conducting electrical insulation around the core and said resistance, an external heat-conducting shell of metal closely conforming to the outer surface of the resistance element, and in tight thermal contact therewith through the elec-

trical insulation, and means for conducting the terminals connected to the low-resistant electrical conducting pieces through said shell.

3. An electrical immersion heater comprising an electrical resistance element, conductors attached to said element, electrical insulation around said element, a metallic shell having a cap and inclosing said element and insulation, a hollow handle forming an exit for the conductors from the shell, and packing of heat-resisting water-proof material to make the joint between the cap and the shell water-proof.

4. An electrical heater comprising a core, leads extending inside the core, electrical resistance disposed on the exterior of the core, low resistant electrical conducting pieces between the leads and the terminals of the resistance, and a shell surrounding and electrically insulated from, and in tight thermal contact with, the resistance and the outer ends of said pieces.

5. An electrical heater comprising a hollow core of a general circular form in cross-section, an electrical resistance disposed around said core, low-resistant electrical conducting pieces, extending from the interior to the outside surface of the core, the outside ends of said pieces being flush with such surface, a shell surrounding the resistance and core and in tight thermal contact with the resistance and the outer ends of said pieces, and electrical insulation between the shell and said resistance and pieces.

6. An electrical resistance device comprising a support, a coil of resistance forming an uneven surface on the support, an electrical insulating heat-conducting medium on and conforming to said surface, and a shell on said medium and conforming to said surface.

7. An electric heating device comprising a support, a coil of resistance forming an uneven surface on the support, an electrical insulating heat-conducting sheet on and conforming to said surface, and a shell on said sheet and conforming to said surface.

8. An electrical resistance unit comprising electrical resistance, arranged to form an irregular surface, an electrical insulating sheet disposed on and conformed to the irregularities of the surface and an externally smooth metal sheet conformed to and in tight contact with the irregular external surface of the insulating sheet.

9. An electrical heater comprising a core, electrical resistance disposed about the core and forming thereon a surface having projections, non-combustible heat-conducting electrical insulation on said resistance and conforming to the surface thereof over and between the projections and a metal shell practically conforming interiorly to the resistance surface and in tight thermal contact therewith through the electrical insulation.

10. An electrical resistance device, comprising a cylindrical insulated resistance element, and a cylindrical metallic shell in closs contact therewith under compression.

11. An electrical resistance device comprising electrical resistance arranged to form an irregular surface, an electrical insulating sheet disposed on and conformed to the irregularities of the surface, and an externally smooth metallic sheet conformed to and in tight contact with the irregular external surface of the insulating sheet.

12. An electrical immersion heater comprising an electrical resistance element, conductors attached to said element, electrical insulation around said element, a metallic shell having a cap and inclosing said element and insulation, a hollow handle forming an exit for the conductors from the shell, and packing of heat-resisting water-proof material to make the joint between the cap and the shell water-proof.

13. The combination with a support of electrical resistance on one side of the support, a split pin of low resistant conducting material extending through the support and having its head on the side thereof with the resistance, said pin and said resistance being in electrical contact, and a lead looped around the pin on the other side of the support, the limbs of said pin being bent apart and toward the support and against said lead.

14. An electrical immersion heater comprising a resistance on a core, insulation around the resistance; a shell around the insulation, a cap, part of which is inserted beneath the shell and a packing of heat resisting water proof material at the joint between the shell and cap making said joint water proof.

15. An electrical immersion heater comprising a core, a shell around the core, a cap a part of which is inserted between the shell and the core, and a packing of heat resisting water proof material around the core between the core and the shell and between the shell and the cap.

16. In combination with an insulated electrical resistance element, a casing therefor consisting of metal surrounding the resistance element and in a state of tension whereby it is caused to closely hug the resistance element.

17. In combination with an insulated electrical resistance element, a shell therefor consisting of metal surrounding the resistance element and in a state of constricting tension.

18. An electrical heater comprising a support, leads extending inside the support, electrical resistance disposed on the exterior of the support, low resistant electrical con-

ducting pieces between the leads and the terminals of the resistance, and a shell surrounding and electrically insulated from and in thermal contact with the resistance.

19. An electrical immersion heater, comprising a resistance element, insulation over the resistance element, a shell over the insulation, a cap joined to one edge of the shell, and a packing of heat-resisting water-proof material at the joined portions of the shell and the cap.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 21st day of April, 1910.

EDWARD J. OVINGTON.

In presence of—

JAMES R. TOWNSEND,

BELLE RICE.