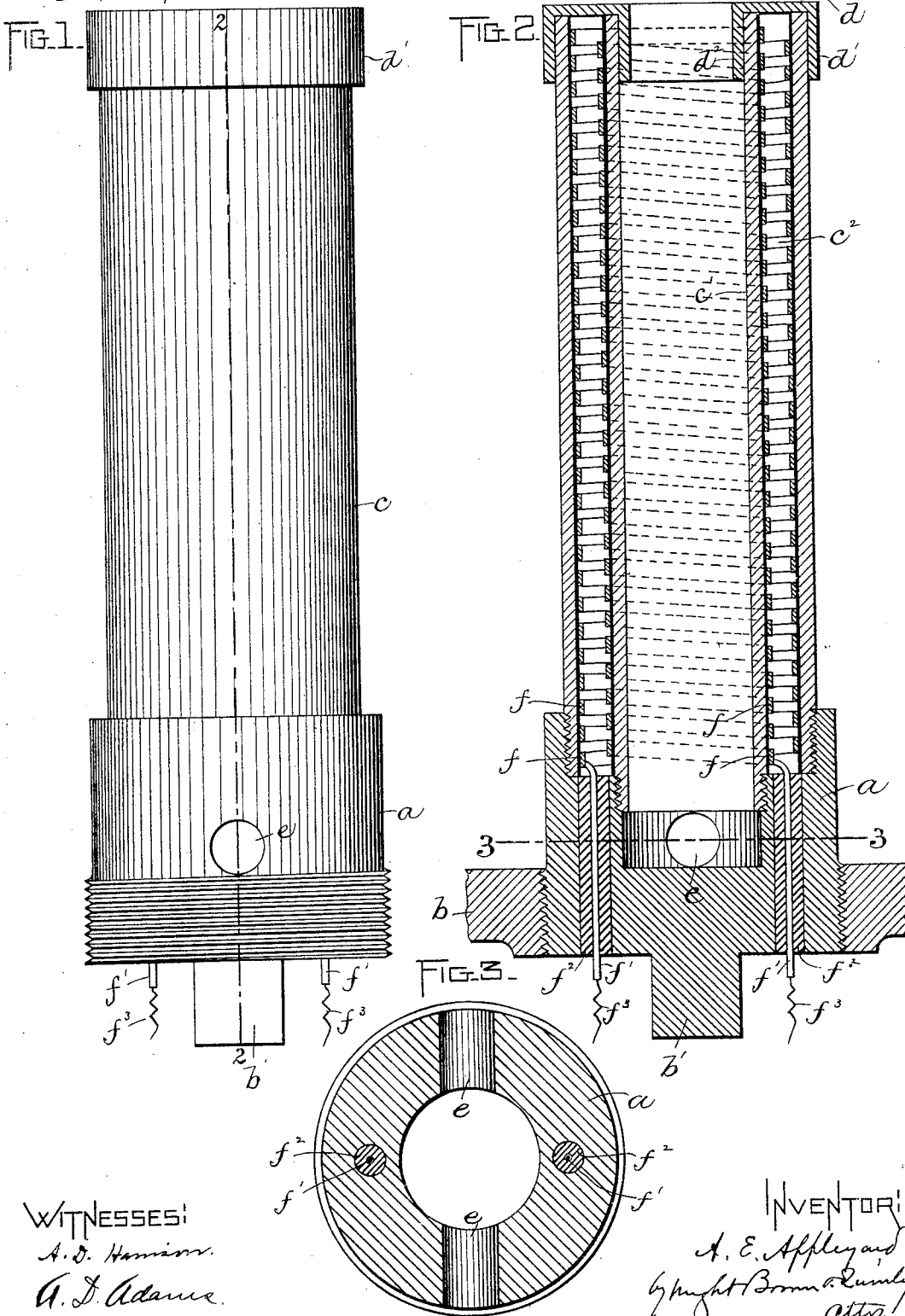


(No Model.)

A. E. APPLEYARD.  
ELECTRIC HEATING APPARATUS.

No. 571,257.

Patented Nov. 10, 1896.



WITNESSES:  
A. D. Harrison.  
A. J. Adams.

INVENTOR:  
A. E. Appleyard  
by Knight, Brown & Rumley  
attys.

# UNITED STATES PATENT OFFICE.

ARTHUR E. APLEYARD, OF NATICK, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NATIONAL ELECTRIC HEATING COMPANY, OF MANCHESTER, NEW HAMPSHIRE.

## ELECTRIC HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 571,257, dated November 10, 1896.

Application filed January 30, 1896. Serial No. 577,380. (No model.)

*To all whom it may concern:*

Be it known that I, ARTHUR E. APLEYARD, of Natick, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Electric Heating Apparatus, of which the following is a specification.

This invention relates to an electrical heating apparatus comprising an electrical resistance contained in a space or chamber between an outer and an inner tube located within a water receptacle or boiler, the resistance being included in an electric circuit and imparting heat to said tubes, which are in contact with the water in the receptacle, as shown in Letters Patent of the United States No. 483,759, dated October 4, 1893.

The present invention has for its object to include the tubes, the resistance, and the conductors which extend therefrom in a single structure which is attachable to and removable from the water receptacle or boiler as a whole, so that the heater is at once made operative by the act of applying it to the boiler and can be removed as a whole from the boiler for repairs.

The invention consists in an electric heating apparatus comprising a screw-threaded holder or base formed as a plug adapted to be detachably inserted in an orifice in a casing or support, two concentric tubes secured to the inner portion of said holder and separated from each other by an annular space, an electrical resistance in said space, and insulated conductors connected with the resistance and extending through the holder, the said tubes, resistance, and conductors being supported entirely by the holder, which detachably secures said parts to the casing or support.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a side elevation of an electric heater embodying my invention. Fig. 2 represents a longitudinal section on the line 2 2 of Fig. 1, showing a part of the water receptacle or boiler to which it is attached. Fig. 3 represents a section on line 3 3 of Fig. 2.

The same letters of reference indicate the same parts in all the figures.

In the drawings, *a* represents a base or holder formed as a plug, having on the outer portion of its periphery a screw-thread *a'*, by which the holder may be quickly and detachably secured to one of the walls *b* of a water receptacle or boiler, said wall having a screw-threaded orifice formed to engage the thread *a'*, so that when the plug is screwed into the orifice of the boiler a water-tight connection is formed. The outer end of the plug is provided with a squared shank or projection *b'*, adapted to be engaged by a wrench, so that the plug may be conveniently rotated to insert and remove it.

The plug or holder is formed to project some distance into the interior of the water receptacle or boiler, its inner portion being recessed and provided with internal screw-threads to engage an outer tube *c* and an inner tube *c'*, said tubes being screw-threaded at their inner ends to engage the threads in the recessed portion of the holder *a*. The tubes are separated by an annular space or chamber *c<sup>2</sup>*, which is made water-tight by the screw-thread connection of the inner ends of the tubes to the holder *a* and by a suitable annular cap *d*, applied to the outer ends of the tubes, the cap having flanges *d'* *d<sup>2</sup>*, which are screwed or otherwise secured to the outer ends of the tubes. The ends of the inner tube *c'* are connected with the interior of the boiler through a passage *e*, formed in the holder *a* and communicating with the inner end of the tube *c'*, and the central opening in the cap *d*, connecting the outer end of said tube with the interior of the boiler, provision being thus made for a circulation of water through the inner tube.

In the annular space *c<sup>2</sup>* is placed an electrical resistance, which is preferably a platinum wire *f*, wound to form an inner and an outer helix, both being parts of the same wire, the outer helix being close to or in contact with the tube *c*, while the inner helix is close to or in contact with the inner tube *c'*. The ends of the resistance *f* are electrically connected with conductors *f'* *f'*, which pass through insulators *f<sup>2</sup>* *f<sup>2</sup>*, located in longitudinal passages extending from the recessed inner portion to the outer portion of the holder

*a*, the said insulators and the passages through which they pass communicating only with the inner end of the resistance-space *c*<sup>2</sup>, there being therefore no opportunity for the access  
 5 of water to said conductors nor for its escape through the openings through which the conductors pass. The conductors *f'* *f'* project outside of the outer end of the holder *a*, where they may be conveniently connected  
 10 with the circuit-wires *f*<sup>3</sup> *f*<sup>3</sup>.

The resistance *f* may be composed of a wire which is of ribbon-like form, as set forth in the patent above-mentioned, or it may be of any other suitable form and material.

15 The surfaces of the tubes *c* *c'* adjacent to the resistance may be provided with coatings of insulating material, as described in said patent.

It will be seen that the holder *a*, the outer  
 20 and inner tubes forming an annular space or chamber, the resistance within said chamber, and the conductors passing from the chamber through the holder to the outer portion thereof constitute an electric heating appliance or at-  
 25 tachment which is a complete structure in itself, so that when its parts have been assembled the heater can be applied to or removed from a water receptacle or boiler as a whole, only one opening in the boiler being  
 30 required for the heater, although in practice several heaters will usually be placed in one boiler, which will have a separate orifice for each heater. The heater can therefore be  
 35 readily removed for repairs, and, if necessary, without discontinuing the use of the boiler, it being feasible to quickly withdraw one holder and insert another in its place without a very considerable escape of water from the boiler.

40 It will be seen that by this improvement I avoid all necessity for a plurality of separate joints, stuffing-boxes, &c., in connection with each heater, a single orifice in the boiler accommodating the heater and conductors *f'* *f'*.  
 45 Hence the construction is extremely simple as

compared with that shown in the patent above mentioned, its advantages being obvious.

I claim—

1. An electric heating apparatus comprising a holder or base formed as a plug and provided with means whereby it may be detachably inserted in an orifice in a casing or support, two concentric tubes secured to the inner portion of said holder and separated  
 55 from each other by an annular space, the outer tube having a diameter less than that of the plug an electrical resistance in said space, liquid-passages at both ends of the inner tube to the space outside of the outer tube and insulated conductors connected  
 60 with the resistance and extending through the holder, the said tubes, resistance, and conductors being supported entirely by the holder, which detachably secures said parts to the casing or support.

2. An electric heating apparatus comprising a screw-threaded holder or base formed as a screw-threaded plug adapted to be inserted in an orifice in a water-receptacle, two concentric tubes detachably secured to the  
 70 inner portion of the holder and separated by an annular space, the inner tube being open at the end away from the holder, and a port or passage through the walls of the device connecting the space in the inner tube with  
 75 the space outside of the outer tube whereby water in the boiler is permitted to circulate through the inner tube, an electrical resistance located in said space, and insulated conductors connected with said resistance and  
 80 extending through the holder.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 25th day of January, A. D. 1896.

ARTHUR E. APPELEYARD.

Witnesses:

A. D. HARRISON,  
 A. D. ADAMS.