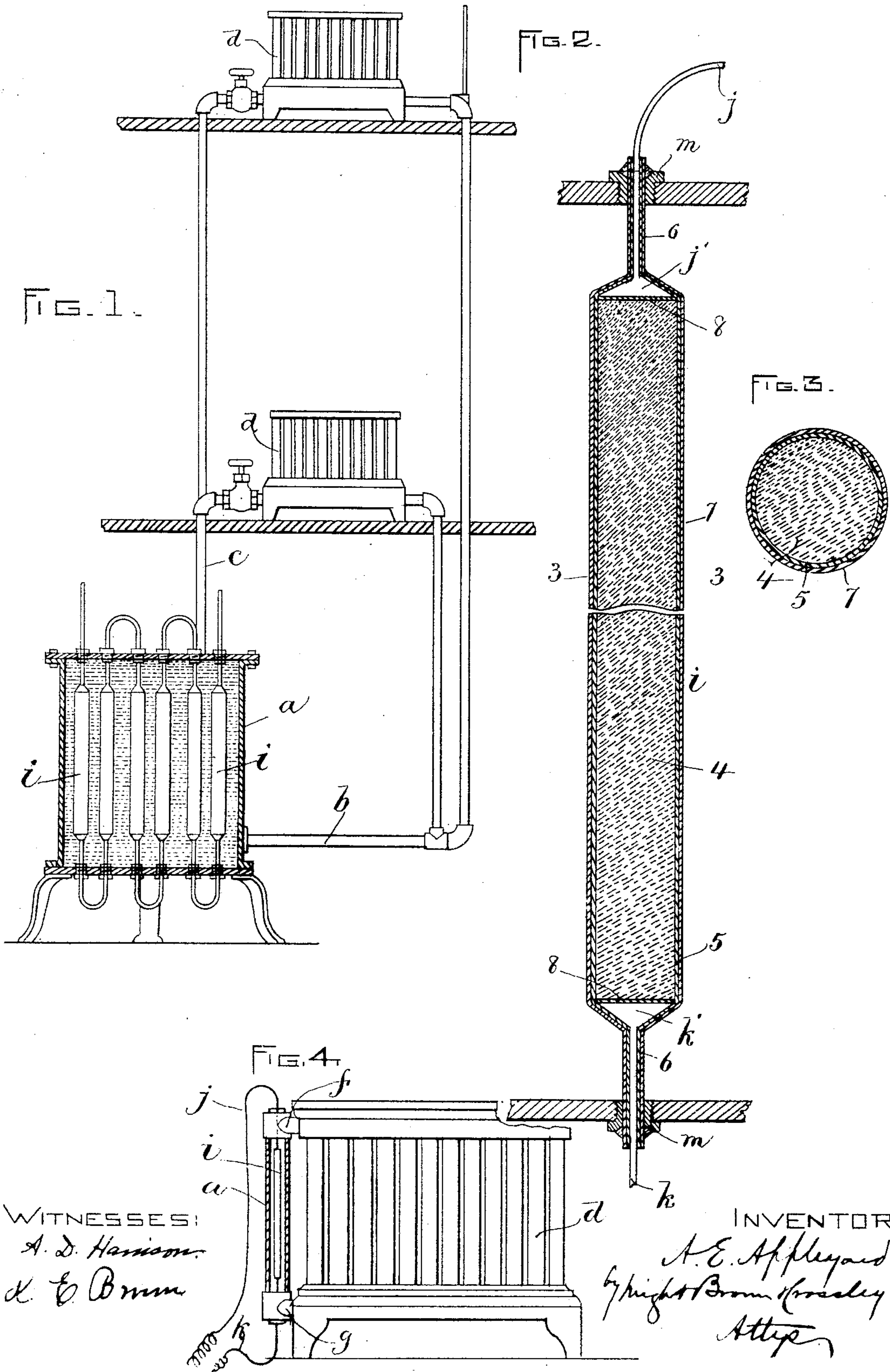


(No Model.)

A. E. APPLEYARD.
ELECTRIC HEATING APPARATUS.

No. 516,071.

Patented Mar. 6, 1894.



UNITED STATES PATENT OFFICE.

ARTHUR E. APPELYARD, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO H. J. FOLSOM, OF SAME PLACE.

ELECTRIC HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 516,071, dated March 6, 1894.

Application filed January 16, 1893. Serial No. 458,444. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR E. APPELYARD, of Boston, in the county of Suffolk 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 principally to the construction of an electrical resistance adapted to radiate heat by electrical energy, and particularly adapted for water heating, and it consists in the improvements which I will now proceed to describe.

Of the accompanying drawings forming part of this specification, Figure 1 represents a sectional elevation of a water receptacle having a plurality of electrical resistances constructed in accordance with my invention, the same being connected electrically in a series, the receptacle being shown connected with a series of radiators. Fig. 2 represents a longitudinal section of one of the resistances. Fig. 3 represents a section on line 3—3, Fig. 2. Fig. 4 represents a side elevation of a radiator, showing in section a water receptacle connected with the radiator and provided with one of my improved resistances.

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

In the drawings which show water heating apparatus embodying my invention—a represents a water receptacle, which may be an independent structure, and connected by pipes *b c* with one or more radiators *d*, as shown in Fig. 1, or may be made as a structural part of a radiator, as shown in Fig. 4, and connected with the radiator by top and bottom connections *f g*.

In the receptacle *a* I place one or more electrical resistances *i*, each of which is constructed as follows: I take a rod 4 of carbon, preferably of cylindrical form, and provide the same with a continuous coating 5 of insulating material such as porcelain or enamel. With the ends of the rod 4 are electrically connected conducting wires *j k*, on the inner ends of which are formed heads or enlargements *j' k'*, said wires and their heads being integral and preferably made of copper or other suitable conducting material. The object of the heads *j' k'* is to furnish large areas

of contacting surface between the wires and the rod 4, the heads *j' k'* being preferably of about the same diameter as the rod. The said heads *j' k'* may bear directly upon the ends of the rod, but I prefer to interpose between the said heads and the ends of the rod layers 8 8 of copper, as shown in Fig. 2 formed by the electro deposition upon the ends of the rod, said layers extending continuously across the ends of the rod and being soldered to the heads *j' k'*. The wires *j k* extend through the walls of the receptacle *a*, perforated screw-threaded plugs or bushings *m m* being preferably provided, through which said wires may pass.

The insulating coating 5 is preferably formed to cover the heads *j' k'* and those portions of the wires *j k* which are within the receptacle *a* in case the resistance 4 does not extend through the walls of the receptacle.

7 represents an external metallic shell closely fitting the exterior of the insulating coating 5 and covering all parts of said insulating coating that are within the receptacle *a*. Said metallic shell is made seamless, and is formed by the electro-deposition of copper or other suitable metal upon the surfaces to be protected by the coating, the insulating coating 5 when made of enamel or the like being prepared to receive the electro deposit by means of a suitable covering applied to its outer surface and of such nature that copper may be electrically deposited upon it. I prefer to make said shell 7 of such thickness that it will afford substantial protection for the insulating coating, preventing liability of cracking the latter, and making the apparatus more durable. In case the wires *j k* are located partly within the casing, as shown in the drawings, the metallic shell will cover the extensions of the insulating coatings upon the wires.

I regard the employment of the continuous seamless metallic shell closely fitting the external surfaces of the insulating coating, as a feature of much importance, since it makes the resistance practically operative as a water-heating device, by preventing liability of its becoming inoperative through the cracking or breaking of the insulation.

I do not limit myself to the employment of

a carbon rod or cylinder as the resistance, and may use any other suitable material.

In the construction shown in Fig. 1, a plurality of resistances of the construction above described are connected in a series by the wires *j k*, said wires being formed in loops outside of the receptacle, so that the entire series constitutes a continuous conductor, the opposite ends of which may be connected with any suitable source of electricity, such as a dynamo.

It will be seen that the passage of a current of electricity through the series of resistances will develop heat therein, and thus heat the water and cause it to circulate through the radiators.

It is obvious that the improved resistance may be used for heating air or for other purposes without departing from the spirit of my invention. For example the metal shell may be of such external form as to adapt it for use as a soldering iron in which case the wires *j k* would both emerge from one end of the shell.

I claim—

1. An electrical resistance, comprising a core externally coated with an insulating material, and provided with a continuous, seamless electrically-deposited, metallic shell covering the insulating coating and extending over the ends of the core, as set forth.

2. An electrical resistance composed of a rod of carbon, conducting wires having enlarged heads or disks electrically connected with the ends of said rod, a continuous insulating sheath or coating enveloping the carbon rod, and an external continuous seamless electrically-deposited metallic shell covering the said insulating coating, and the enlarged heads of the conducting wires as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of January, A. D. 1893.

ARTHUR E. APPELYARD.

Witnesses:

HORACE BROWN,
A. D. HARRISON.