

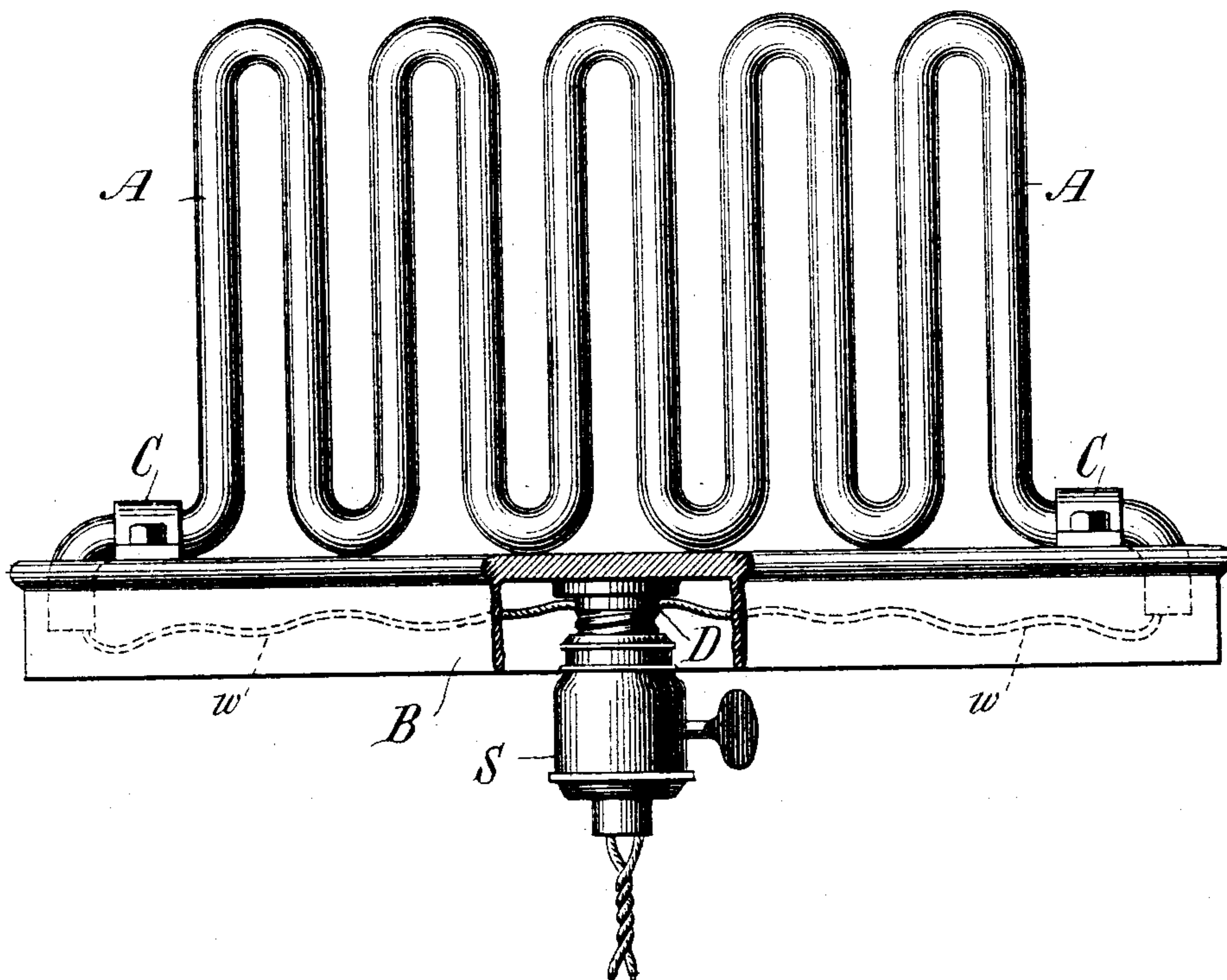
(No Model.)

C. J. REED.  
ELECTRIC HEATER.

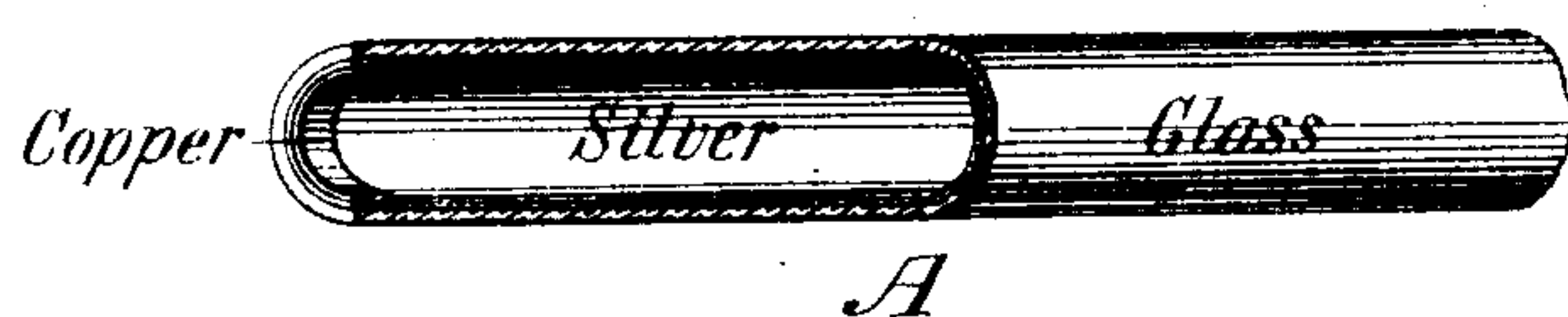
No. 540,073.

Patented May 28, 1895.

*Fig. 1,*



*Fig. 2,*



Witnesses  
*C. E. Ashley*  
*A. P. Chabier*

Inventor  
*Charles J. Reed*  
By his Attorney  
*Charles J. Kintner*



# UNITED STATES PATENT OFFICE.

CHARLES J. REED, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY  
DIRECT AND MESNE ASSIGNMENTS, TO THE REED ELECTRIC COM-  
PANY, OF SAME PLACE.

## ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 540,073, dated May 28, 1895.

Application filed June 5, 1894. Serial No. 513,561. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES J. REED, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have made a new and useful Invention in Electric Heaters, of which the following is a specification.

My invention relates to improvements in that type of electric heaters in which heat is developed by currents of electricity passed through high resistances, and its object is, to devise a heater of this type which shall possess high resistance properties and correspondingly high heat radiating qualities.

To this end, my invention constitutes an electrical heater constructed by forming a film-like conducting substance upon the inner wall of a non-conducting tube whereby the radiating effects of such conducting film may be utilized to the greatest advantage and the conducting material which constitutes the current carrying conductor be wholly protected, the tubes used by me for sustaining said conducting film being preferably of glass, porcelain or the like.

My invention will be fully understood by referring to the accompanying drawings, in which—

Figure 1 is a side elevational view illustrating the application of my improvement in the simple form of a radiator, while Fig. 2 is a perspective view, partly broken away, of a glass tube, illustrating the manner of constructing my improved heating apparatus.

B represents the base of a heater, preferably of metal, and A a heat radiating tube either of glass or porcelain, or analogous non-conducting material, said tube being disposed in a similar manner to well known forms of heat radiating tubes and attached to the base B by yokes or eyes C.

D represents the conducting or neck portion of a socket, analogous in all respects to well known forms of incandescent lighting sockets, and S the stationary part of said socket, a key being provided, as shown, for connecting the current feeders in circuit with the conductors *ww* which are secured at their inner ends to the conducting portions of the socket in the usual manner, their outer ends being con-

nected to the inner surface and lower ends of the tube A, said inner surface being, as shown in Fig. 2, a thin coating or film of silver and electro-plated with copper at the lower ends.

In the construction of my improved form of heater, I deposit a thin coating or film of metal by any well known depositing process, such as is well understood for instance in the art of silvering mirrors. A silver solution is first prepared by dissolving ten grams of nitrate of silver in one hundred grams of water. To this, I add one hundred and sixty grams of caustic soda solution prepared by dissolving twenty grams of caustic soda in five hundred grams of water. I then add ammoniacal hydrate enough to re-dissolve the precipitate until it becomes nearly clear. I then add enough water to make twelve hundred cubic centimeters. I now prepare a reduction solution by boiling twenty-five grams of white sugar in two hundred grams of water and add, while boiling, 1.33 grams of nitric acid, the boiling continuing preferably about twenty minutes. When cold, I add fifty grams of alcohol and water enough to make five hundred cubic centimeters. I now proceed in the process of silvering by mixing one hundred parts of the above described silver solution with ten or twelve parts of the above described reduction solution, and then fill the tube A with this solution, allowing it to stand a sufficient time for the silver to deposit on the inner surface of the tube. The thickness of this deposit, and hence its conductivity, will depend of course upon the proportions of the solution and the length of time it is allowed to stand in the tube.

The above named process of silvering glass and analogous surfaces is well known in the art of mirror making and constitutes no part of my invention, the same being described here for the purpose of illustrating the manner of constructing my novel form of heater.

After the interior of the tube has been thus silvered or coated with a thin conducting deposit, I alternately immerse the ends of the tube in an electro-plating bath and deposit thereon an additional surface of copper as shown in Fig. 2, this process of electro-plating being also well understood by those skilled



in that art. By thus plating the inner ends of the tube, I afford a simple and efficient means of attaching the outer ends of the conductors *w* by soldering, as will be well understood by those skilled in the art.

While I have shown my invention arranged in the form of a radiator, it is to be understood that it may be used in many well known ways. To illustrate, it might be arranged for use in connection with flat-irons, water heating vessels, and in fact in any place where heating implements are now used in the art of electric heating. Nor do I limit myself to the use of my improvement for electric heaters as the invention obviously has an analogous use in rheostats or in any place in the electrical art where it is desired to furnish a conductor of high resistance in the nature of a thin conducting film located upon the inner surface of a non-conducting tube, and my claims are designed to be of such scope as to include all such structures wherever used in the electrical art. I am aware of United States patents to John V. Capek, No. 395,950, granted January 8, 1889, No. 424,921, granted April 1, 1890, and No. 449,036, granted March 24, 1891, and I make no claim hereinafter broad enough to include any structure shown or described in said patents, my claims being directed to an electrical heater or electrical conductor of a tubular form in which the conducting material constitutes a coating or lining on the inside of a tube and which is therefore fully protected from outside abrasure or from contact by the user which might render it dangerous when in use.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. An electric heater consisting of a heat radiating tube having a conducting lining attached to its inner surface, the opposite ends of said conducting lining being connected to current conductors.

2. An electric heater consisting of a non-conducting tube having an interior coating of conducting material which coating is attached at its opposite ends to current conductors.

3. An electric heater consisting of a glass tube having a thin conducting film of silver deposited on its inner surface, said film being connected at the opposite end of the tube to conductors which lead to a source of current supply.

4. An electric heater consisting of a non-conducting tube having a thin film or coating of silver attached to its inner surface, said film being connected at its opposite ends to conductors leading to a source of current supply.

5. An electric heater consisting of a non-conducting tube bent in zigzag form after the manner of an ordinary radiator and coated on its inner side with a thin conducting film, the opposite ends of which film are connected to a source of electrical energy.

6. An electric heater consisting of a glass tube having a thin film or coating of silver on its inner surface, the opposite ends of which are connected to a source of electrical energy, said tube being bent back and forth upon itself in the form of an ordinary radiator, substantially as described.

CHARLES J. REED.

Witnesses:

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EDWARD EVERETT.