

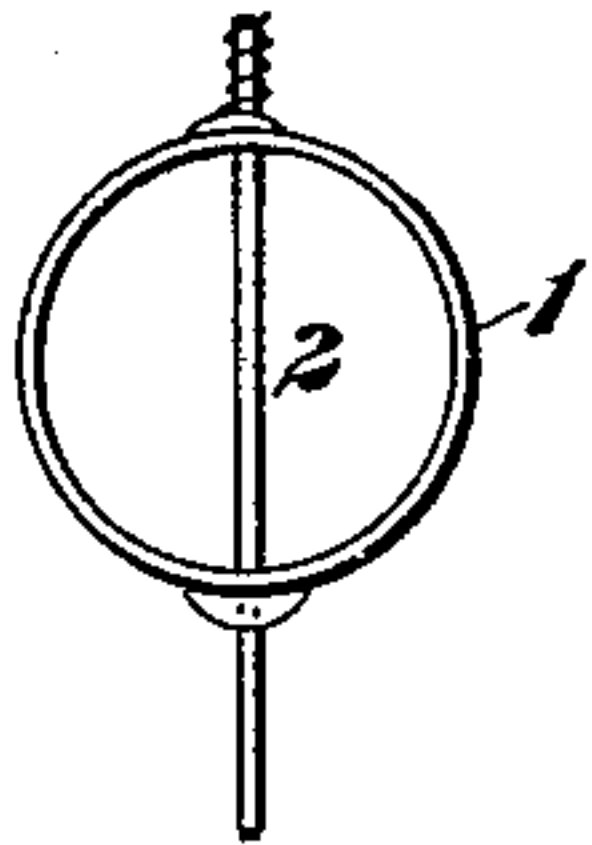
No. 652,504.

Patented June 26, 1900.

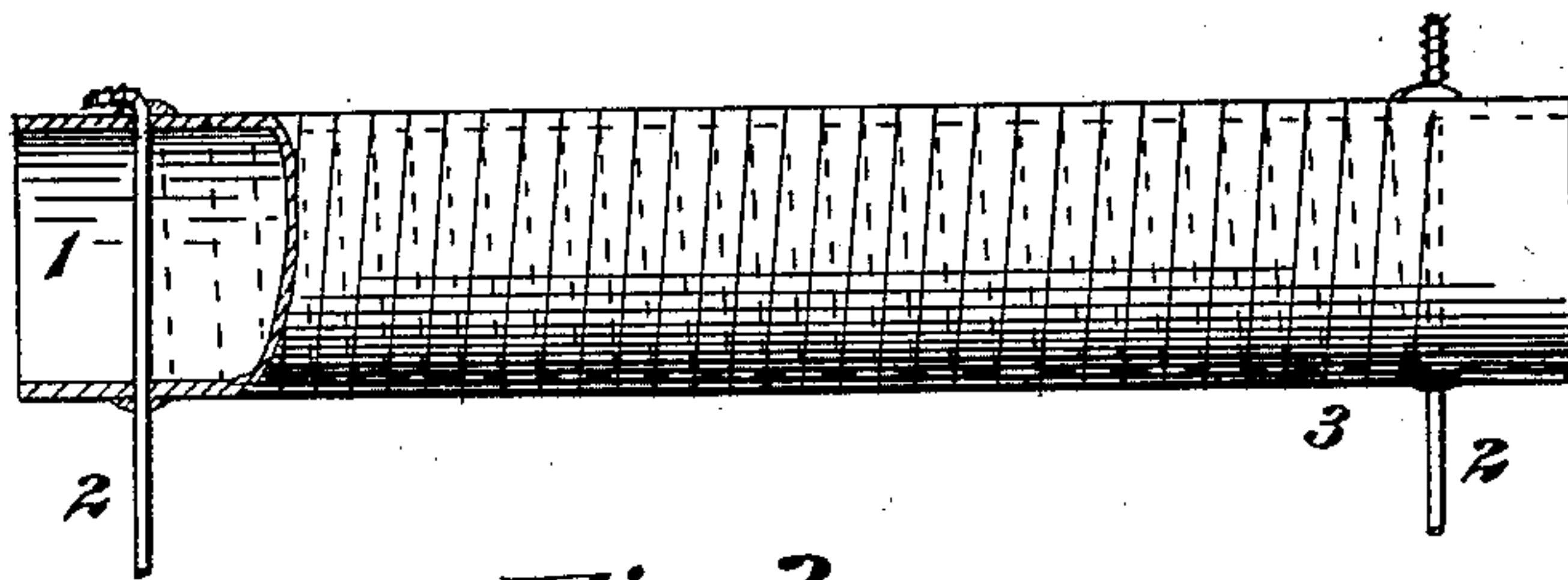
E. BENNETT.  
ELECTRIC HEATER.  
(Application filed Dec. 7, 1899.)

(No Model.)

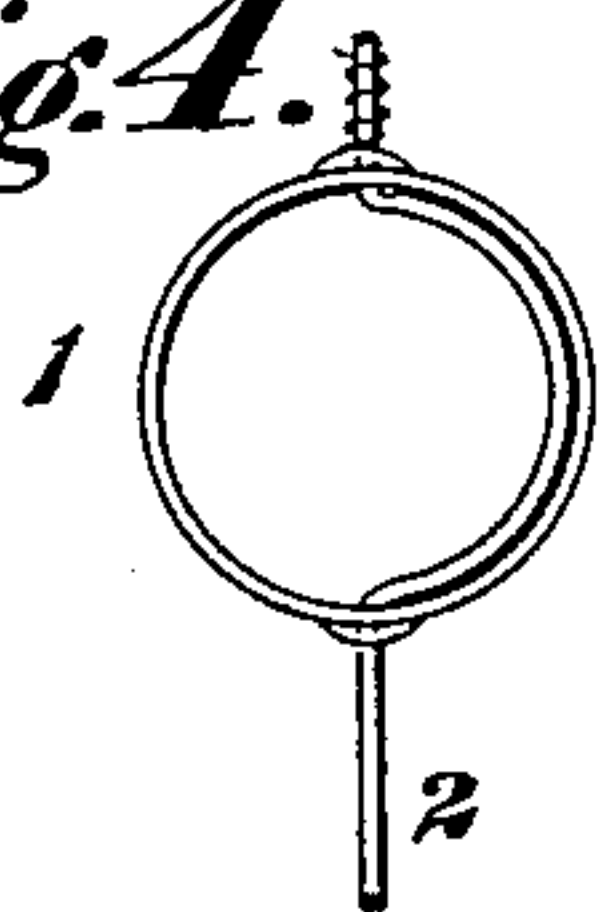
*Fig. 2.*



*Fig. 1.*



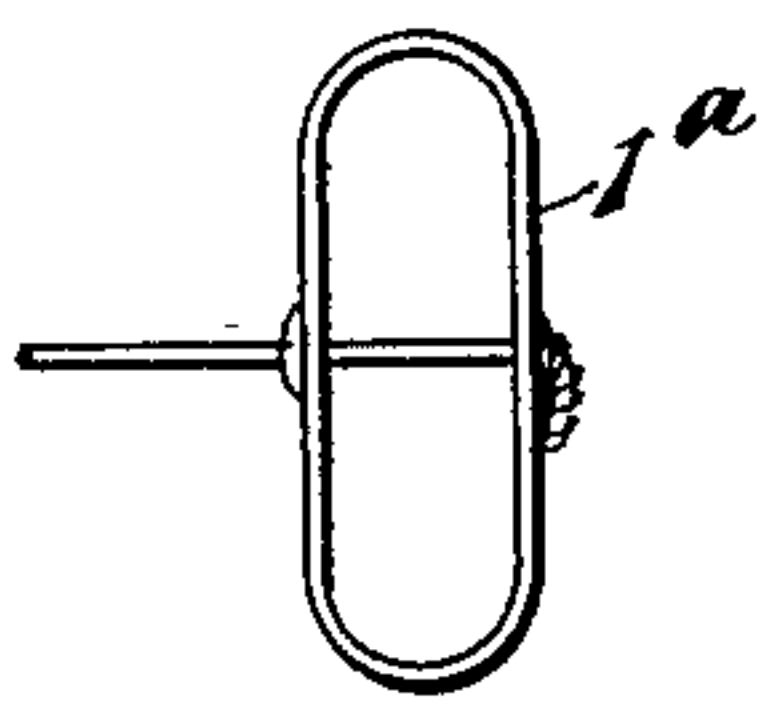
*Fig. 4.*



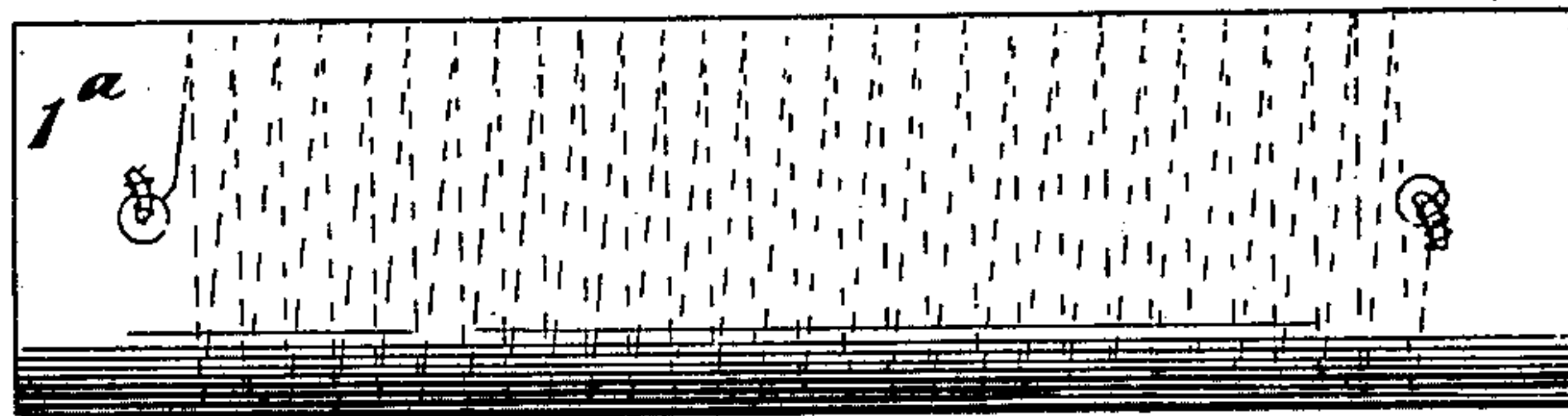
*Fig. 3.*



*Fig. 6.*



*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

EDWARD BENNETT, OF JEANNETTE, PENNSYLVANIA, ASSIGNOR TO GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

## ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 652,504, dated June 26, 1900.

Application filed December 7, 1899. Serial No. 739,545. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD BENNETT, a citizen of the United States, residing at Jeannette, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Electric Heaters, (Case No. 852,) of which the following is a specification.

My invention relates to electric heaters, and has particular reference to devices employed in connection with electric lamps of the class in which the glowers are non-conductors of electricity when cold, but become luminous conductors when heated to the proper temperature.

The object of my invention is to provide a heater for use in raising the lamp-glowers to a proper temperature which shall be simple and inexpensive in construction and effective in operation and one which shall be less liable to injury in process of construction and in use than the devices heretofore employed for performing the same function.

It has been proposed prior to my invention to wind the heater-wire in a helical coil on the surface of a tube of insulating refractory material and to fasten the ends of such wire to terminal wires of larger size. The means heretofore employed for fastening the terminal wires to the tube comprised notches cut in the tube near its ends, the terminal wires being wound about the tube in such notches and their free ends twisted together. It was found in practice that the notches cut in the tube weakened it very materially and the twisting of the terminal wires together was liable to result in breaking either them or the tube or both. The bending and twisting of the terminal wires also frequently loosened the heater-wire from the surface of the tube and left it exposed, so that it was fused by the first rush of current when the heater was put into use.

In order to avoid the difficulties and objections specified above, I have devised the heater shown in the accompanying drawings, in which—

Figure 1 is a side elevation of one form of heater-tube, showing the terminal wires in position and the heater-wire before the outer

coating is applied. Fig. 2 is an end elevation of the heater shown in Fig. 1. Figs. 3 and 4 are respectively a side and an end elevation of the form of heater shown in Figs. 1 and 2 with the heater-wire covered and embodying a slightly-modified arrangement of terminal wires. Figs. 5 and 6 are respectively a plan view and an end elevation of a heater having the modified form of tube.

Referring particularly to Figs. 1 to 4, inclusive, the tube 1 is molded from talcum or other suitable insulating refractory material and subsequently baked. Before being baked, however, holes slightly larger than the terminal wire to be employed are punched through the tube near each end. The terminal wires 2 are threaded through the holes, and a small quantity of suitable paste is then applied to each hole around the wire. The tube is then baked until it becomes sufficiently hard for the purpose for which it is to be employed. In the baking operation the paste applied to the apertures becomes fused and seals the terminal wires securely in position. The heater-wire 3 is then wound about the tube 1 as a helical coil and its ends attached to the ends of the terminal wires 2, projecting from one side of the tube.

In case the heater is to be employed in a high-voltage circuit and the heater-wire is consequently small in cross-section the ends of the wire may be attached to the terminal wires by wrapping them around the ends of the latter, as indicated in Figs. 2 and 4, and at the right hand in Figs. 1 and 3, after which the projecting ends of the terminal wires may be bent over against the surface of the tube, as indicated at the left in Figs. 1 and 3. In case the heater is to be employed in low-voltage circuits carrying relatively-large currents the heater-wire is fused to the lead-wire at the start, and at the completion of the winding it is twisted around the other lead-wire and fused to it and then bent down to the surface of the tube. This construction is rendered necessary in order to avoid the destruction of the heater-wire by reason of the poor contact which would be made by merely twisting the same around the terminal wire.



In case the tube is to be applied to a spindle or mandrel for the purpose of winding the heater-wire thereon the portion of the terminal wire that is inside the tube may be bent to conform to the inner surface of the tube, as is indicated in Fig. 4.

I have found that economy of material and improved heating effects may be secured by flattening the heater-tube substantially as indicated in Figs. 5 and 6. This flattened tube 1<sup>a</sup> is formed in substantially the same manner as the tube already described. The application of the terminal and heater wires is also made in the same manner as that already described.

Whatever may be the form of the heater it will preferably be provided with a coating 4 of non-conducting refractory material of sufficient thickness to cover and embed the heater-wire.

I desire it to be understood that the composition, size, and arrangement of the several parts of the heater may be varied from what is shown without departing from my invention and that the heater is not necessarily restricted to use in connection with electric lamps.

I claim as my invention—

1. An electric heater comprising a tube of insulating, refractory material, terminal wires projecting through perforations adjacent to the ends of the tube and fused therein, and a heater-wire helically coiled around the tube

and having its ends joined to the terminal wires, substantially as described.

2. An electric heater comprising a tube of insulating, refractory material having apertures adjacent to its ends, terminal wires projecting through said apertures and fused therein, and a heater-wire helically coiled around the tube and having each end joined to a projecting end of a terminal wire, substantially as described.

3. An electric heater for electric lamps of the type described comprising a flattened tube of insulating, refractory material provided with terminal wires projecting through and fused into openings in said tube and having a coiled heater-wire joined to the terminal wires, substantially as described.

4. An electric heater comprising a tube of insulating, refractory material of approximately-elliptical cross-section and having apertures adjacent to its ends, terminal wires projecting through and fused into said apertures, and a heater-wire coiled around the tube and joined at its ends to the terminal wire, substantially as described.

In testimony whereof I have hereunto subscribed my name this 5th day of December, 1899.

EDWARD BENNETT.

Witnesses:

H. A. CROOKS,  
WESLEY G. CARR.