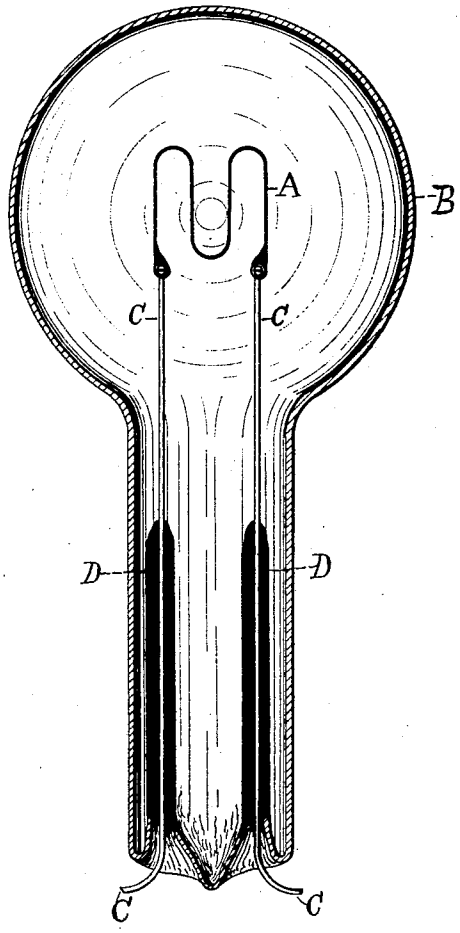
(Model.)

J. V. NICHOLS.

Electric Lamp.

No. 236,833. Patented Jan. 18, 1881.



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JOSEPH V. NICHOLS, OF BROOKLYN, ASSIGNOR TO THE UNITED STATES ELECTRIC LIGHTING COMPANY, OF NEW YORK, N. Y.

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 236,833, dated January 18, 1881.

Application filed October 18, 1880. (Model.)

To all whom it may concern:

Be it known that I, JOSEPH V. NICHOLS, of the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Electric Lamps, of which the following is a specification, reference being had to the accompanying drawing, which forms a part hereof.

My invention relates to the class of electric lamps known as "incandescent" lamps, in which light is produced by the incandescence of a continuous conductor of low conductivity, forming a part of the electrical circuit of the lamp. When the conductor is made of carbon, which has been found to be the most available material for that purpose, it is essential that it should be effectually protected, when highly heated, from all access of oxygen, as it readily oxidizes at high temperatures, and the incandescent part of the lamp has usually been inclosed in a glass globe from which the air has been exhausted or excluded. Various devices have been used for making perfectly-tight joints about the conducting-wires; but sealing the glass of the globe directly to the conducting-wires has proved more effective and convenient for this purpose than other constructions. Platinum has been considered the only available material of which to make the conducting-wires in lamps so constructed, as the coefficients of expansion of other metals differ considerably from that of glass, and glass, moreover, does not readily adhere to them. The firm adhesion of the glass to the metal is obviously essential to a perfect joint, and, as the lamp undergoes very considerable changes of temperature in use, any inequality in the coefficient of expansion of the parts tends to separate them at the joint or to crack the glass about the wires, and even with a metal of the same coefficient of expansion as the glass there is a considerable tendency to the formation of cracks in the glass about the wires, on account of the low thermal conductivity of glass. The platinum wire, becoming heated by conduction from the incandescent carbon, expands rapidly, while the adjacent glass, conducting the heat received from the platinum very feebly, expands slowly, and the glass is temporarily subjected to a strain, which tends to crack it. The use of platinum for conducting-wires in such lamps is, moreover, objectionable for other reasons. Its electrical conductivity is comparatively low, and, as the leading-wires have to be made quite small when sealed into the glass, they are more or less heated by their resistance to the current, and this aggravates the tendency to crack the glass due to the expansion caused by the heat received from the carbon. This metal, moreover, as is well known, has a remarkable capacity for absorbing gases, and oxygen thus occluded in the conducting-wires is probably, to some extent, given off again within the globe when the wires become heated, to the injury of the incandescent carbon, and the expensiveness of platinum also adds considerably to the cost of the lamp.

It is obviously extremely desirable to use for conducting-wires a metal free from these objections, such as copper, and to construct the globe in such a manner as to avoid the tendency to the formation of cracks about the wires.

I have found that by forming the base of the glass globe, or that part which immediately surrounds the conducting-wires, of a composition made by mixing various metallic substances with silica and potash, the adhesion of the parts may be increased and the tendency to crack diminished, and that when proper proportions are used the composition or cement so formed will readily adhere both to glass and to copper, and will not crack when the parts are subjected to changes of temperature. The composition so formed is apparently metallo-vitreous in its nature, being, in fact, neither metal nor glass, but possessing for certain purposes the properties of both. I find that a serviceable cement of this kind is formed by thoroughly mixing and fusing together fifty-eight parts, by weight, of oxide of lead, seventeen parts of silica, ten of oxide of iron, ten of oxide of copper, and five of potash or soda. It is not essential to use exactly the ingredients named, or to combine them in precisely the proportions indicated; but it is essential that the cement should be rich in metallic constituents, and at the same time contain sufficient silica to insure perfect adhesion to the glass of the globe. I prefer to use the cement for only

a small part of the base of the globe immediately adjacent to the conducting-wires, and to form the main part of the globe of glass.

The conducting-wires are made preferably of copper, on account of its high electrical conductivity and its cheapness; but other metals may be used, if desirable.

The absence of cracks in the base of a lamp so constructed is probably due to the assimilation of the cement to the metal of the wires both as regards its coefficient of expansion and as regards its thermal conductivity, and to its being more tough and elastic than glass. The heating of the conducting-wires by the current is also largely avoided by constructing them of metal of high electrical conductivity.

In the drawing I have shown a lamp constructed in accordance with my invention.

A is the incandescent conductor. B is a glass globe inclosing the conductor. C C are conducting-wires, of copper. D D are tubes, made of cement such as I have described, fused and sealed to the conducting-wires at their upper ends and to the glass of the globe at their lower ends, so that the base of the globe is hermetically sealed about the conducting-wires. The tube of cement should be joined to the wire when both are at a white heat, so as to remove all oxide from the surface of the metal and insure perfect adhesion between the parts.

By way of additional precaution, a second joint may be made between the tube and the wire a short distance below the upper end of the tube.

The air may be exhausted from the globe in the usual way, so as to leave as perfect a vacuum as practicable; or the air may be replaced with a rarefied atmosphere of hydrocarbon vapor or gas.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in an electric lamp, of a glass globe inclosing an incandescent conductor in a vacuum with conducting-wires connected with said conductor, and metallo-vitreous cement interposed between the glass of the globe and the conducting-wires and united to both by fusion, substantially as described.

2. In an electric lamp, a glass globe inclosing the incandescent or light-giving part in a vacuum, in combination with conducting-wires of copper or other metal of high conductivity and metallo-vitreous cement interposed between the glass of the globe and the conducting-wires and united to both by fusion, substantially as described.

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