No. 749,998. PATENTED JAN. 19, 1904.

D. McF. MOORE.

ELECTRIC TUBE LAMP.

APPLICATION FILED JAN. 22, 1903.

NO MODEL.

FIG. 1.

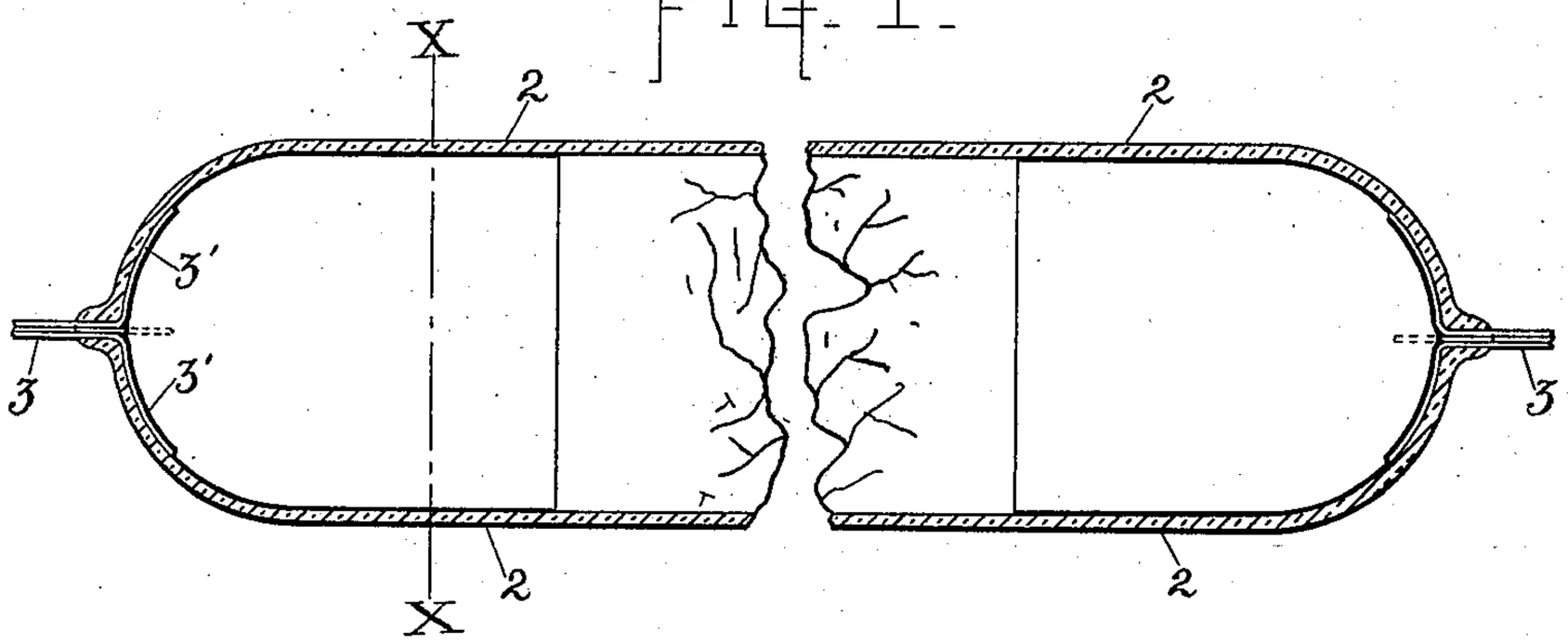


FIG. 2.

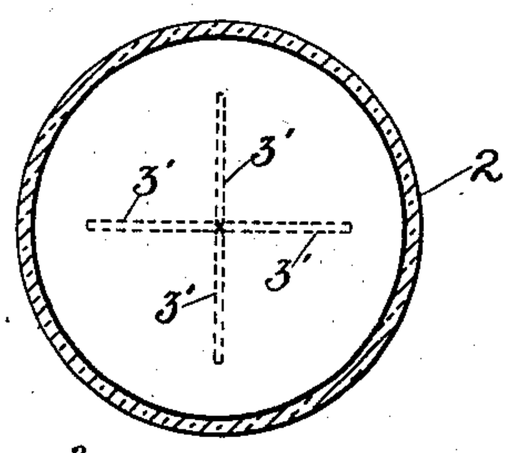


FIG. 3.

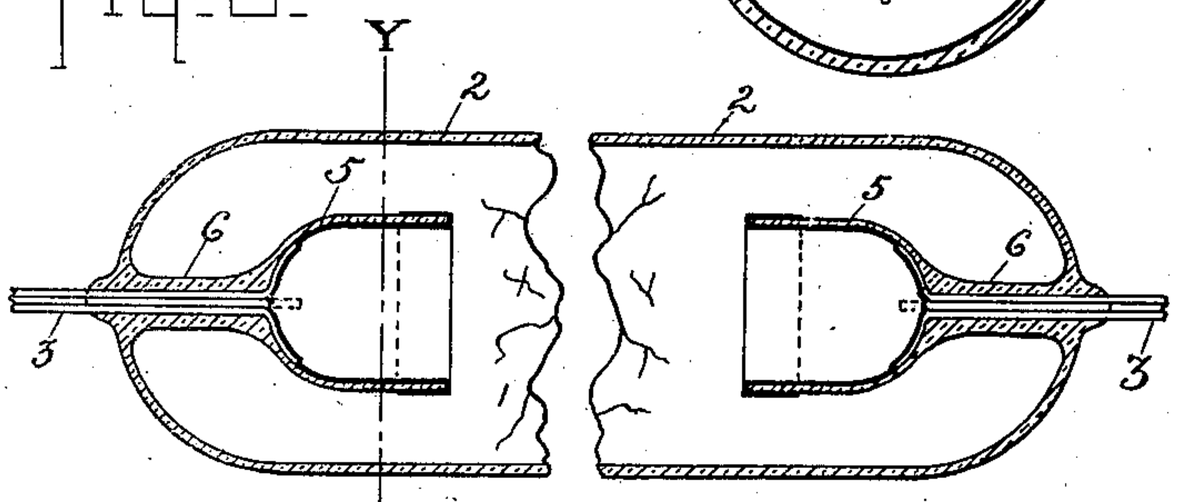
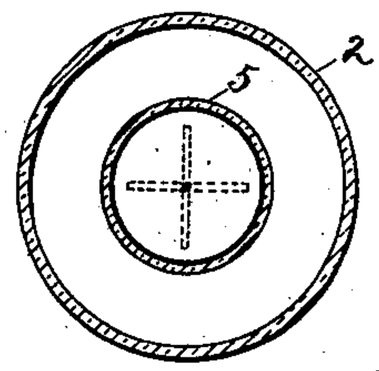


FIG. 4.



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No. 749,998. Patented January 19, 1904.

UNITED STATES PATENT OFFICE.

DANIEL McFARLAN MOORE, OF NEWARK, NEW JERSEY.

ELECTRIC TUBE-LAMP.

SPECIFICATION forming part of Letters Patent No. 749,998, dated January 19, 1904.

Application filed January 22, 1903. Serial No. 140,189. (No model.)

To all whom it may concern:

Be it known that I, DANIEL MCFARLAN MOORE, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric Tube-Lamps, of which the following is a specification.

My invention relates to that class of electric lamps wherein a body of gas contained in a suitable inclosure is rendered luminous by the passage of electric currents by conductive action from one to the other of two electrodes, both in direct conducting connection with the body of gas.

My present invention is mainly designed to improve the efficiency and operation of lamps of this character, which in practice have heretofore been usually constructed with electrodes consisting of conducting-caps applied to the exterior surfaces of the translucent tube or receptacle containing the gas and out of contact with said gas, or otherwise operated so that the transfer of energy to the contents of the gas-containing receptacle shall be by condenser action.

It has heretofore been proposed in the device known as the "Geisler" tube to render the gaseous contents of a translucent envelop luminous by passing electric currents through them; but such tubes have also been inefficient and unsuitable for commercial usage, mainly because it has been impossible to use them with electric energy of sufficient volume and potential, owing to the tendency of the so-called "electric discharge" to seek the point nearest the point of sealing, where it will melt down the glass or other seal and finally destroy the lamp. Moreover, the length of the tube in such lamps has been limited and their life has been frail and the character of the light unstable and unsatisfactory in appearance, owing to the presence of striations. This latter undesirable quality has also been more or less a characteristic of lamps wherein the electrodes consist of exterior caps.

The object of my present invention is to improve the efficiency of lamps wherein the illuminating agent consists of a gas having its tension suitable or adjustable to the character of the particular gas employed and to further permit lamps to be built with tubes of very great length. It is not to be understood, however, that I limit myself in my present application to any particular length of tube, as my invention would be useful with tubes of comparatively short length, constituting, as it were, light units in contradistinction to a long tube, by which the light is distributed or diffused over the whole area or space to be illuminated.

A further object of my invention is to provide an electrode which is alike suitable for use as a positive and as a negative electrode, and which may therefore be employed for both electrodes of a lamp operated by alternating currents. The form of electrode which I have devised is, however, applicable to lamps operated by continuous currents and is suited for use therein either as the positive or the negative electrode in combination with any properly-constructed opposite electrode.

My present invention consists, essentially, of an electrode for a lamp of the character before described, composed of a coating or film of a conducting material spread out upon the surfaces within the tube or envelop containing the gas and in proper union with a leading-in wire or wires sealed in the wall of the gas-containing receptacle. Such material may be of any desired conducting character, although by preference I employ some form of carbon, preferably graphite. The surface to which said electrode is applied may be the wall of the gas-containing envelop or may be the surface of a supplemental piece of material mounted suitably within the envelop or inclosure. In any case it is in direct contact with the gaseous contents and forms, in effect, an expansion or extension of the leading-in wire to give an electrode of large area. By thus using an electrode of large area I find in practice that the light is much more stable, while, moreover, the tendency of the discharge to attack any particular point and produce destructive effects is practically eliminated.

My invention consists, further, of an improved internal electrode for an electric gas-lamp consisting, essentially, of a thin layer of graphite adherent upon suitable non-conduct-

ing surfaces, but united electrically with the leading-in wire.

In the accompanying drawings, Figure 1 represents, in longitudinal section, a lamp embodying my invention, the central portion of the lamp being removed or broken out. Said section represents a length of tubing of indefinite or any desired length. Fig. 2 is a cross-section through the lamp on the line *x x*, Fig. 1. Fig. 3 represents in longitudinal section a lamp of modified form; and Fig. 4 is a cross-section of the same on the line *y y*, Fig. 3.

2 indicates the translucent tube ordinarily employed for electric gas-lamps and made as usual of glass.

3 indicates the leading-in wire sealed in the end of the tube. The internal electrode appears as a coating of graphite, which adheres to the inner surfaces of the tube and to the conductor, which is located within the envelop or tube, but in electrical union with the leading-in wire. When graphite is employed, it may be applied by making up a mixture out of graphite and a suitable drier, like alcohol, said mixture being of such consistency as to flow easily, and then to pour the same into the interior of the tube, which has been previously provided with its sealed leading-in wire. The internal part of the leading-in wire may be separated into a number of arms 3′, which should lie against the interior surfaces and may, if desired, be the individual wires of a bundle of wires constituting said leading-in wire 3.

The paint or adherent material having been introduced the tube is moved about until the inner surfaces are thoroughly covered with adherent mixture, which will adhere to and be in union obviously with both the glass and the ends 3′. The superfluous material may be poured out from the tube and the surfaces cleaned by wiping to secure a coated surface of the desired extent. After drying the end section of tubing to which the internal coating has been thus applied it may be united to another section of tubing to make up the lamp. This form of electrode gives a large interior surface of conducting material which is in good electrical union with the leading-in wire, and in practice I find that it may be used with heavy currents and with little tendency to rupture of the seal, since the discharge is spread out over a large or extended area and does not tend to pass to the leading-in wire at any particular point.

Since heavy currents and currents of large potential may be used, I am enabled to make a tube of very great length and to render the whole contents thereof luminous, and I am also enabled to secure from air or other stable gas rarefied to the proper extent a very high degree of luminosity.

I prefer to use the form of carbon known as "graphite," but do not limit myself to the same, nor do I limit myself to the use of carbon in any of its forms, but might employ a metallic coating or a coating of other conducting material, though I prefer to use carbon, because it is freer from occluded gases or may be so treated as to be free from the same. This form may be used to advantage in both terminals of the lamp and is suitable for either alternating or continuous currents, although in general the lamp is best operated by alternating currents.

In Fig. 1 the coating is shown applied to the inside of the glass inclosure in which the leading-in wire is sealed. It might, however, be applied to the surfaces of a supplemental glass structure, as shown in Fig. 3, wherein 5 indicates a tubular or other form of a piece of glass supported upon a stem 6, through which the leading-in wire passes after the manner usually employed with incandescent electric lamps. The piece of glass 5 or other material may be a section of tubing having its interior surfaces coated with the carbon or other conductor, as already described, or said tube may have such carbon coating extended around over the edge of the mouth of the tube and over the whole or a part of its exterior surfaces.

As will be obvious, leading-in wires might be taken out through the side of the tube in direct union with the coating upon the exterior of the tube 5.

What I claim as my invention is—

1. In an electric lamp wherein the illuminating agent consists of a luminous gas traversed by electric currents and contained in a sealed inclosure, an internal electrode consisting essentially of a thin film of carbon applied to a non-conducting surface but in union with the leading-in wire.

2. In an electric lamp wherein the illuminating agent is a body of gas contained in a translucent envelop and wherein the energy passes by conductive action from one to the other of two electrodes both in direct contact with the gas, an internal electrode consisting essentially of a conducting coating applied to surfaces within said envelop and in direct contact with the gaseous contents.

3. In an electric lamp consisting essentially of a body of gas rendered luminous by the passage of electric currents by conductive action both to and from the body of gas, an internal electrode forming an adherent coating for surfaces within the gaseous inclosure.

4. In an electric lamp consisting essentially of a translucent inclosure for a body of gas adapted to be rendered luminous by electric currents passing by conducting action to and from the body of gas, an internal electrode consisting of an adherent coating upon the glass surfaces and consisting of a conducting material in electrical union with a leading-in wire.

5. In an electric lamp consisting essentially of a translucent envelop containing a body of gas adapted to be rendered luminous by elec-

tric currents passing by conducting action to and from the gas, an internal electrode consisting of a conducting coating applied to the interior surface of the wall for said envelop and electrically united with a suitable leading-in wire.

6. In an electric lamp consisting essentially of a glass inclosure containing a gas adapted to be rendered luminous by the passage of an electric current, an internal electrode consisting of an adherent coating of graphite in electrical union with a suitable leading-in wire.

7. In an electric lamp comprising a glass inclosure for a body of gas adapted to be rendered luminous by electric currents passing by conducting action to and from the gas, a leading-in wire extended into a thin coating of conducting material adherent to the interior surfaces of said inclosure.

8. In an electric lamp consisting essentially of a glass inclosure for a body of gas adapted to be rendered luminous by electric currents, an interior electrode consisting of a thin layer of graphite spread upon the inner surfaces of said inclosure and in electrical union or with suitable leading-in wires.

9. In an electric-lighting system, an electric lamp consisting essentially of a translucent tube or receptacle containing gas adapted to be rendered luminous by the application of electric energy, and interior electrodes at the opposite ends of said tube respectively, each said electrode consisting of an interior coating of conducting material.

Signed at New York, in the county of New York and State of New York, this 16th day of January, A. D. 1903.

DANIEL McFARLAN MOORE.

Witnesses:
J. GALLWITZ,
E. L. LAWLER.