(No Model.)

T. A. EDISON.

MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS.

No. 411,019. Patented Sept. 17, 1889.

Fig. 1.

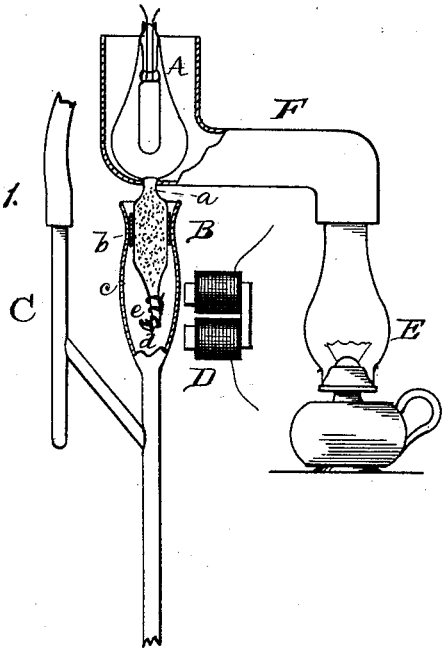


Fig. 2.

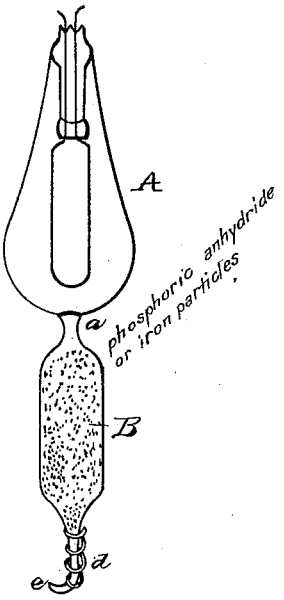


Fig. 3.

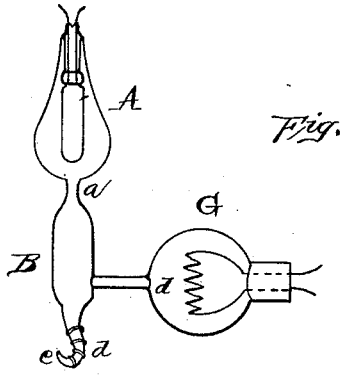
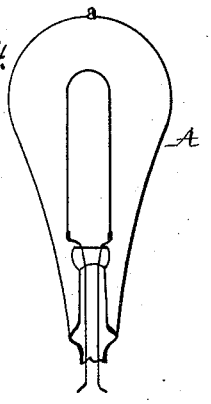


Fig. 4.



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MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 411,019, dated September 17, 1889.

Application filed July 29, 1886. Serial No. 209,501. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in the Manufacture of Incandescent Electric Lamps, (Case No. 671,) of which the following is a specification.

The object of my invention is to produce high vacuums in the inclosing-globes of incandescing electric lamps, and especially to rid such globes of the watery vapor which adheres to the inner surface of the glass.

In carrying out my invention I connect with the exhaust-tube of the lamp a glass receptacle in which I have placed an absorbent of moisture, such as phosphoric anhydride, or a material like iron, which, when heated, decomposes water and takes up its oxygen. The lower end of this glass receptacle is drawn out into a hooked tube and sealed by the fusion of the glass, so that the lamp and receptacle form together an air-tight chamber. Upon the hooked end I hang a small coil of several turns of iron wire.

When phosphoric anhydride is used in the attached receptacle, I prefer to coat pieces of glass with that material and to place such pieces in the receptacle. I then place the lamp and receptacle in a suitable chamber and heat the same to from 600° to 800° Fahrenheit. The vapor is thus driven from the glass, and is absorbed by the phosphoric anhydride, from which it cannot afterward be removed even by heating. The whole is then attached to the Sprengel vacuum-pump, preferably by placing a rubber band covered with vaseline around the attached receptacle and inserting the same in the cup of the pump. I now apply a magnet outside the tube of the pump, and by its attraction for the iron wire hung on the glass hook I break off this hook, leaving an opening into the receptacle. The pump being now put in operation, the lamp is exhausted, any vapor which may have remained being absorbed by the material through which the air must pass. The lamp is preferably heated externally while it is being exhausted by means of a heating-lamp having a chimney surrounding the electric lamp. After the exhaustion is completed, the neck between the lamp and the attached receptacle is sealed off, there being a contraction in the neck for this purpose.

When particles of iron are placed in the attached receptacle, the lamp is placed in the chamber and heated as before to 600° or 800°, while the attached receptacle projects from said chamber and is separately heated to a much higher temperature, so that the iron is brought to a red heat and the vapor is thus decomposed, its oxygen combining with the heated iron, while its hydrogen remains to be drawn off by the pump after the end of the receptacle is broken off by the magnet, as already explained. Instead of this, a spiral of iron wire may be placed in the attached receptacle, or in another globe connected therewith, and provided with circuit-connections, so it may be brought to incandescence by an electric current, whereupon it acts to decompose the vapors in the same way as the iron particles above mentioned.

The accompanying drawings illustrate my invention. Figure 1 represents complete apparatus for exhausting the lamp; Fig. 2, a separate view of the lamp with attached receptacle; Fig. 3, a view of a modified arrangement as above described, and Fig. 4 a view of the completed lamp.

Referring first to Figs. 1 and 2, A is an incandescent electric lamp.

B is a glass chamber or receptacle forming a continuation of the exhaust-tube of the lamp, there being a contracted neck *a* between the lamp and the receptacle. This receptacle may contain pieces of glass covered with phosphoric anhydride or other moisture absorbent; or such absorbent may be placed therein by itself, or the chamber may contain particles of clean iron or other metal with which oxygen combines when the metal is heated.

As above explained, the lamp is placed in a chamber and heated to set free its moisture; or if the receptacle B contains iron it is heated separately from the lamp to a much higher temperature. The heating may be done in a furnace or in any other suitable way. It is not thought necessary to illustrate this step of the process, since it will be readily understood. The moisture being set free of the lamp, and having been either absorbed

by the phosphoric anhydride or decomposed by the heated iron, which absorbs its oxygen and leaves its hydrogen, the lamp is attached to the Sprengel pump C, as above described, and as shown in Fig. 1, *b* being the rubber band covered with vaseline or similar material, so as to make an air-tight connection. An electro-magnet D is then brought close to the cup *c* of the pump and moved so that its attraction for the iron wire *d*, hung on the sealed hooked end *e* of the receptacle B, causes such hook to be broken off. The pump is then put in operation and the lamp is exhausted. Preferably during the process of exhaustion the electric lamp is heated by the flame of a heating-lamp E, from whose chimney a tube F, having an aperture for the exhaust-tube, extends, so as to surround the lamp. This heating drives off any moisture which may have remained in the lamp. If there is hydrogen in the globe, it is very readily removed by the pump. After the lamp is exhausted it is sealed off at *a*, and is then in the completed form shown in Fig. 4.

In the modification shown in Fig. 3 a chamber G, connected with a receptacle B, contains a spiral *d* of iron wire, which is heated to incandescence by an electric current while the lamp is being heated in the closed chamber, and also, if desired, while the lamp is being exhausted. It acts to decompose the moisture in the same way as the iron particles, as already explained.

What I claim is—

1. The herein-described method of removing moisture from the inclosing-globe of an incandescent electric lamp, which consists in hermetically sealing said globe to a sealed chamber containing a material capable of absorbing or decomposing such moisture and then externally heating said globe.

2. The herein-described method of exhausting an incandescent electric lamp, which consists in hermetically sealing the lamp to a sealed chamber containing a material capable of absorbing or decomposing such moisture, heating said lamp, and afterward withdrawing the air from said lamp.

3. The herein-described method of exhausting an incandescent electric lamp, which consists in hermetically sealing such lamp to a sealed chamber containing a material capable of absorbing or decomposing such moisture, heating the lamp, forming an opening in said receptacle, and withdrawing the air from the lamp through said opening.

4. The herein-described method of exhausting an incandescent electric lamp, which consists in hermetically sealing the lamp to a sealed chamber containing a material capable of absorbing or decomposing such moisture, heating the lamp, attaching the said receptacle to an air-exhausting apparatus, forming an opening in said receptacle, and exhausting the lamp by means of said apparatus.

5. The herein-described method of exhausting an incandescent electric lamp, which consists in hermetically sealing such lamp to a sealed chamber containing a material capable of absorbing or decomposing such moisture, heating the lamp, attaching said receptacle to an air-exhausting apparatus, forming an opening in said receptacle by the attraction of a magnet for a magnetic body attached to said receptacle, and exhausting the lamp by means of said apparatus.

6. The herein-described method of exhausting an incandescent electric lamp, which consists in hermetically sealing the lamp to a sealed chamber containing a material capable of absorbing or decomposing such moisture, heating the lamp, and then withdrawing the air from the lamp and at the same time heating it again.

7. The combination, with an incandescent electric-lamp globe, of a sealed receptacle hermetically sealed thereto containing a material capable of absorbing or decomposing moisture and having a magnetic body attached to it, substantially as and for the purpose set forth.

8. The combination, with an incandescent electric-lamp globe, of a receptacle hermetically sealed thereto containing a material capable of absorbing or decomposing moisture and having a sealed hooked end, and a coil of iron wire hung on said hooked end, substantially as and for the purpose set forth.

This specification signed and witnessed this 20th day of July, 1886.

THOS. A. EDISON.

Witnesses:
WM. PELZER,
A. W. RIDDLE.