(No Model.)

O. A. MOSES.

MOLD FOR MAKING INCANDESCENTS.

No. 321,309. Patented June 30, 1885.

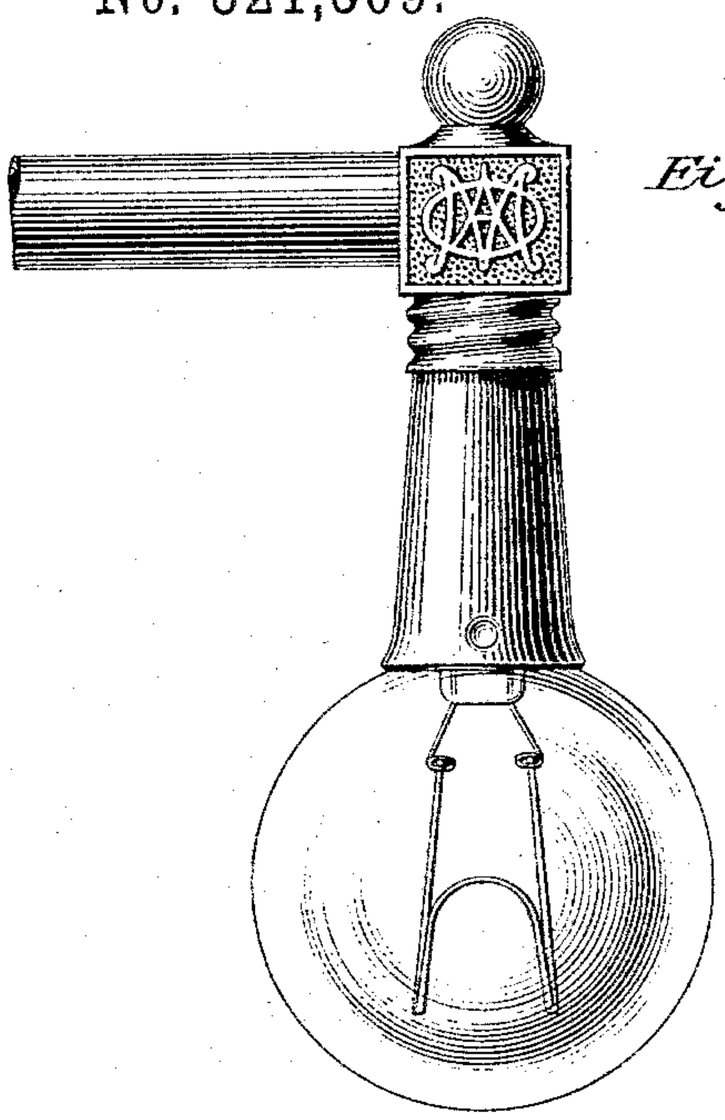


Fig. 1.

Fig. 2.

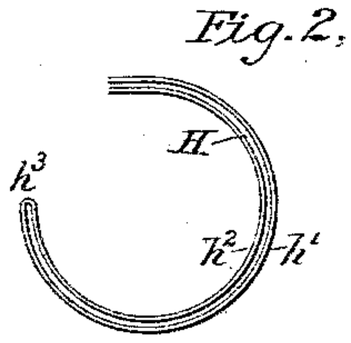


Fig. 5.

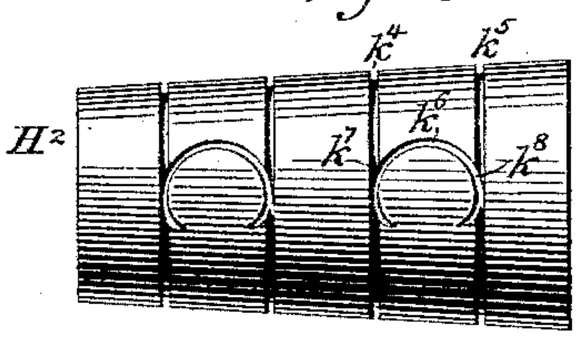


Fig. 3.

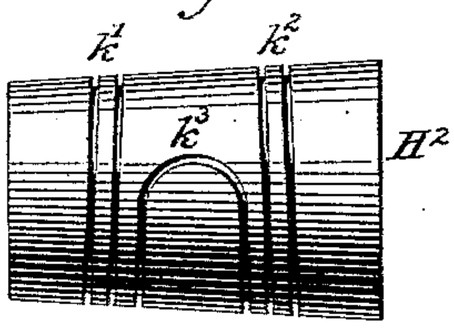
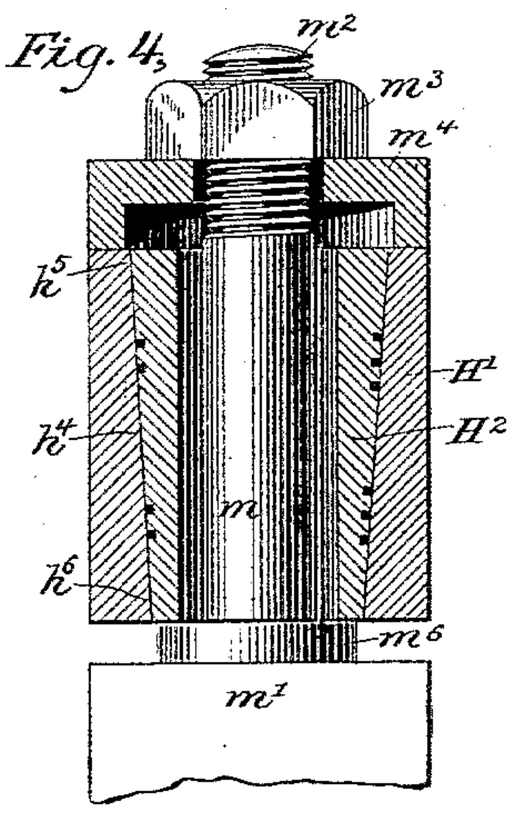


Fig. 4.



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MOLD FOR MAKING INCANDESCENTS.

SPECIFICATION forming part of Letters Patent No. 321,309, dated June 30, 1885.

Application filed August 13, 1884. (No model.)

To all whom it may concern:

Be it known that I, OTTO A. MOSES, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Incandescent Electric Lamps, of which the following is a specification.

This invention relates to the class of electric lamps in which the conducting strip, wire, or filament of carbon, hydrocarbon, or other suitable refractory substance is inclosed within a transparent air-tight globe or chamber from which the air is exhausted, and which may or may not be filled with a non-oxidizing gas or vapor.

The invention claimed in this application relates, particularly, to the form and construction of the molds employed for manufacturing the filaments, and to the method of employing the same.

The form of carbon which it is preferable to employ consists of a carbonized filament formed in the shape of two incomplete circles having, preferably, slightly different diameters and united with each other by a curved continuation of the filament. The circles of different diameters serve a special purpose in preventing a continued movement of the filament when the lamp is jarred by breaking up the vibrations into ones of smaller amplitude. The form of the filament is also of especial advantage for producing and radiating as equal an amount of light as possible from a given length of conductor, and that, too, within as small an area of containing-globe as possible.

In the accompanying drawings, Figure 1 illustrates a complete lamp, together with its holder. Fig. 2 is a side view of the incandescing filament. Figs. 3 and 4 and 5 illustrate the mold employed for carbonizing the filament and the method of removing the filaments therefrom.

Referring to Figs. 1, 2, 3, and 4, a description will first be given of the incandescing filament and the process of forming and manufacturing the same.

The filament H is constructed from a single piece of cane, bamboo, parchmentized paper, thread, woody fiber, or other suitable carbonaceous material by being subjected, in a suitable mold, to a very high temperature. The form of the filament which is preferred may be described as a long loop, bent upon itself so as to form two incomplete circles, the one of which, h', is preferably of greater diameter than the other, h^2. The curved end h^3 of the loop unites the two incomplete circles with each other, and is at right angles to them. It may here be observed that an especial advantage is derived from having the two circles of the loop of different diameters, namely—that is, neither circle intercepts the path of the other when the lamp is viewed from one side, but the light emitted from each circle is radiated independently of the other. Such a filament is preferably formed by means of a mold of the character illustrated in Figs. 3 and 4. This mold, which is preferably formed of nickle, or some form of iron, steel, or carbon, or hydrocarbon, consists of an outer case, H', and an inner section, H^2. The case H' has a central bore, h^4, of greater diameter at one extremity, h^5, than at the other, h^6. Within the bore h^4 it is designed that the section H^2, constituting a stopper or a plug, shall be inserted. The section H^2 of the mold tapers at the same angle as the bore h^4 of the portion H'. The two conical contact-surfaces of the sections H' and H^2 are ground smooth, for the purpose of making the joint as perfect as possible. Upon the surface of the section H' there are cut two spiral grooves, k' and k^2, joined at their inner ends, as shown at k^3, by a curved continuation of the grooves. The portion k^3 of the mold is preferably cut under slightly, for the purpose of preventing the filament from slipping out of the groove. The spiral grooves starting from the portion k^3 pass outward toward the respective ends of the section H^2 of the molds. It is not essential, however, that the grooves should in all instances be spiral, as they may be made parallel. It is designed that the filament to be carbonized shall be laid in this groove, being wound about the plug H^2. The plug or section H^2 is then inserted within the section H' and driven tightly into place. The mold is then placed in a suitable kiln with the smaller end of the taper bore downward, and while in the kiln it is subjected to a sufficient heat to effect the carbonization of the filament.

It is essential that the mold should be per-

fectly tight during the process of carbonization, and this is one of the objects of tapering the bore h^4. It is evident that during the process of heating the mold the outer section, H′, will expand, causing the diameter of the bore to increase. The section H^2, however, may thereupon drop farther into the section H′ and continue to keep the joint between the two tight. The section H^2 afterward, as it becomes thoroughly heated, expands still more, and binds tightly against the inner surface of the bore. The plug H^2 is made hollow, so that the heat of the kiln may enter the same and more quickly penetrate the filament which is now being carbonized.

The filament, after it has been placed in the groove of the mold, may with advantage be covered and held in position by means of a thread wound about the same and covering it more or less. Such a thread not only serves to hold the filament in position, but also serves to prevent the filament from being converted into carbonic oxide or carbonic-acid gas in the event that any oxygen should be present. In Fig. 5 there is illustrated a mold especially adapted to permit such a thread to be applied. In this mold grooves are made for two filaments, and, instead of being spiral in form, they are made in the form of complete circles, the grooves k^4 and k^5 being respectively intended to receive the two limbs of the filament, while the portion k^6 serves to connect the same. At points k^7 and k^8 slight depressions are made for the purpose of permitting the thread to pass across the filament.

It is well-known that during the process of carbonizing the filaments shrink a considerable portion of their lengths. It is desirable that they should be maintained under tension throughout their lengths during the time such shrinkage takes place. The pressure of the filament against the sides of the groove in which it is placed secures precisely this result, and a tension is placed upon the same throughout its length, although a similar result could be obtained by fastening the end or ends of the filament before and during carbonization.

It may be found desirable in some instances to cover the filament after it has been placed in the mold with carbonaceous material for the purpose of more thoroughly protecting it from any oxygen which may gain access thereto. This may be accomplished by covering the filament, as already stated, with a thread wrapped about in the groove, or coating it with some substance easily applied and melted or distilled away, like wax or paraffine.

In practice it is found that when the molds are of iron more or less of the carbon of the filament will enter into the iron, forming steel throughout the immediate surfaces of the grooves. For the purpose of avoiding such destruction of the filaments, the molds may be made of carbon or of some other metal than iron or nickel; but it is preferred to make them of iron and to electroplate or otherwise coat the surfaces of the grooves with nickel. This may be readily accomplished by any of the well-known methods of electroplating or surface-coating.

It is necessary to provide some means for removing the filament from the mold after it has been completely carbonized without doing injury to it. When it is desired to remove the filament after carbonizing, the mold is dropped over a rod, *m*, (shown in Fig. 4,) which is approximately the size of the interior bore of the plug H^2. The rod is cool, and has therefore the effect of cooling the interior of the molds more rapidly than the exterior, and thus to produce a consequent contraction of the interior section, H^2. The rod *m* extends from a base, *m′*, and is constructed with a screw-thread, m^2, upon the rod designed to receive a suitable nut, m^3. This nut is employed to press against a flanged washer, m^4, which is placed upon the rod after the mold has been placed in position. The flange m^5 of the washer rests against the upper end of the mold-section H′. By turning the nut m^3 downward the washer presses the outer section, H′, of the mold downward, causing it to slip by the section H^2, the lower end of which is engaged by an annular shoulder, m^6, formed at the base of the rod *m*. A slight movement of the outer section, H′, at once separates the two sections of the mold, and the section H^2, containing the carbonized filament, may then be readily removed from the outer section without bringing the filament into contact therewith, being guided by the rod *m′*. The filament is then removed from the mold, it being sufficiently flexible to allow of its being bent or sprung outward.

It is desirable that the filament should be subjected to as high a temperature as possible before it is finally placed in the lamp, for the higher the temperature to which it is exposed the more hard, tough, and firm will it become. The temperature to which the filaments may be exposed while in the molds is limited to the capacity of the molds to resist the heat, and not themselves become melted. When, therefore, the filaments are removed from the mold, it is preferable to pack them in loose carbon powder, and while thus packed they may be subjected to as high temperature as may be desired. The carbon powder may for convenience be contained in boxes or crucibles made of carbon, clay, or other refractory material, and a large number may be treated in the same bath. They will be found to retain their shapes during this treatment, and when removed from the carbon powder will be found to be exceedingly hard and tough. The surrounding carbon powder prevents, also, the access of air to the filaments both during the process of heating and during the time the filaments are being cooled.

The core or plug H^2 may be placed in the bath of powdered carbon when the filament is first applied, the filaments being held in place by the threads, in which case the section H′ of the mold would be dispensed with. When

the core is to be used in this manner, it may with advantage be of carbon or other refractory material, though it is not necessary that it should be.

In two other applications, filed July 30, 1884, and numbered 139,124 and 139,125, respectively, there are shown and described certain of the features claimed herein.

I claim as my invention—

1. A filament-carbonizing mold consisting of a core having grooves formed in its outer surface for receiving the filaments, and a tubular inclosing-case for said core.

2. A filament-carbonizing mold consisting of a core having the shape of a frustum of a cone, and having grooves formed in its surface for receiving the filaments, and an inclosing-case for the same having a bore conforming to the outer surface of the core, substantially as described.

3. A filament-carbonizing mold consisting of a tubular core having grooves formed in its outer surface for receiving the filaments and an inclosing tubular case for said core.

4. A filament-carbonizing mold consisting of a core having grooves formed in its outer surface for receiving the filaments, which grooves are electroplated with nickel or other similar metal, and an inclosing-case for said core.

5. An iron filament-carbonizing mold constructed in two sections, in the one of which there is formed a groove for receiving the filaments, the surface of which groove is electroplated or otherwise protected with nickel, and the second of which sections covers said grooves.

6. A filament-carbonizing mold consisting of a tubular conical-shaped core having one or more grooves formed in its outer surface for receiving one or more filaments, and an inclosing-case for the same, which core has a tapering bore conforming in shape to the outer surface of said core, in combination with a post extending through said core and having a shoulder at its base for engaging one of said cores, and means, substantially such as described, for pressing the outer section of the mold over said shoulders.

7. The combination, substantially as hereinbefore set forth, of the filament-carbonizing mold consisting of the section H′ and the section H², having the grooves *k*, the rod *m*, having the screw-thread m^2, the nut m^3, turning upon said screw-thread, the washer m^4, having the flange m^5, and the shoulder m^6 at the base of the rod.

8. A filament-carbonizing mold consisting of a core having grooves formed in its outer surface for receiving the filaments, and means, substantially such as described, for inclosing and protecting the filaments during the process of carbonization.

In testimony whereof I have hereunto subscribed my name this 2d day of August, A. D. 1884.

OTTO A. MOSES.

Witnesses:

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