(No Model.) 2 Sheets—Sheet 1.

O. A. MOSES.

INCANDESCENT ELECTRIC LAMP.

No. 324,038. Patented Aug. 11, 1885.

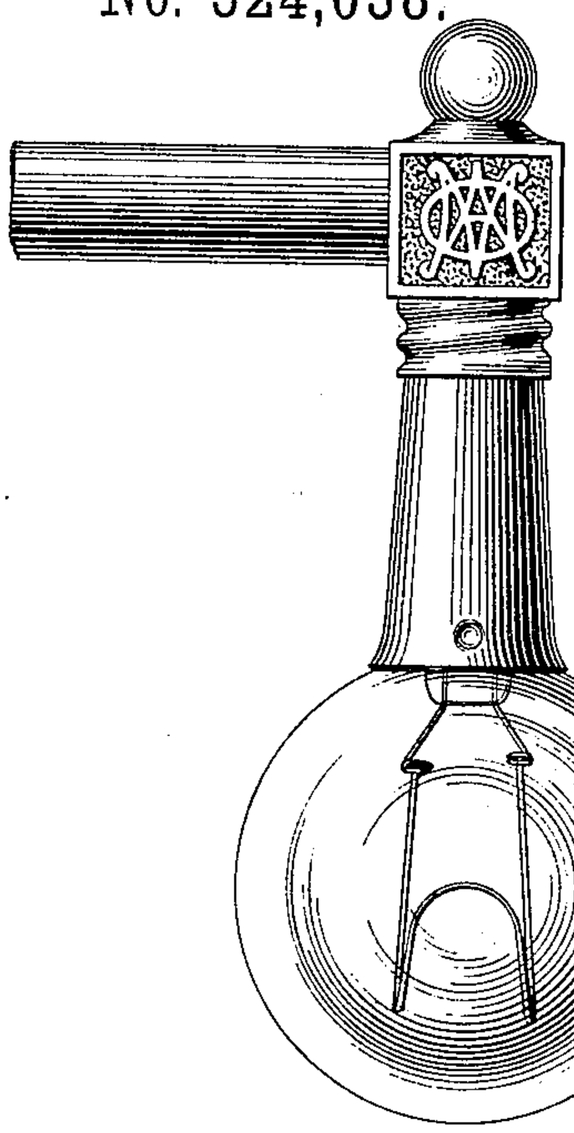


Fig. 1.

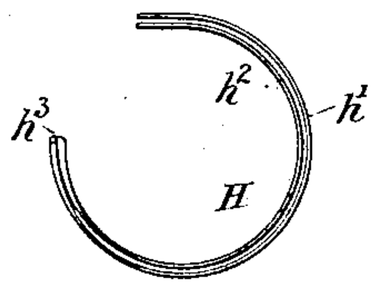


Fig. 2.

Fig. 4ª.

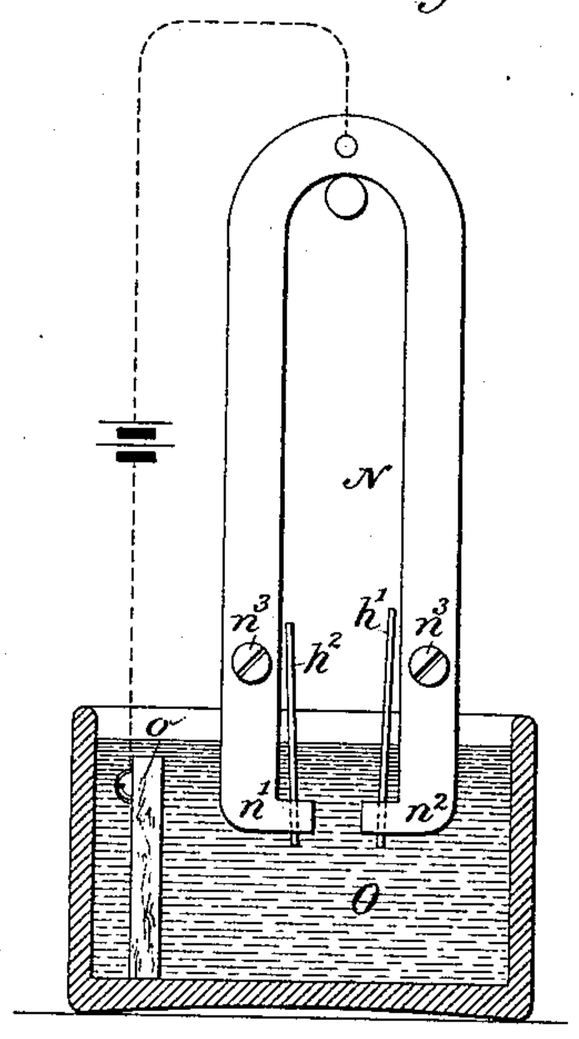
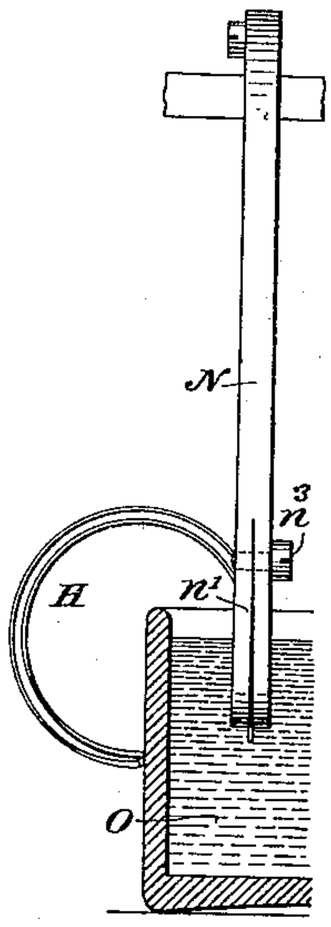


Fig. 4ᵇ.



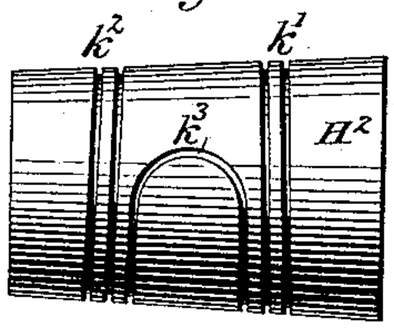


Fig. 3.

Fig. 4.

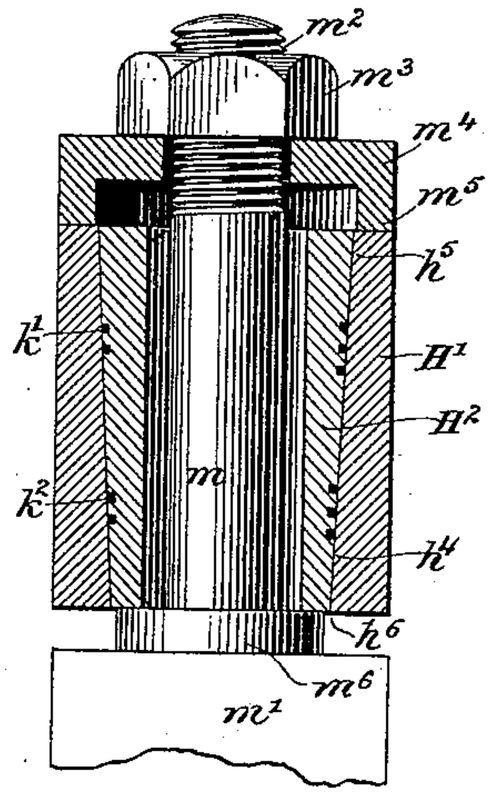


Fig. 5.

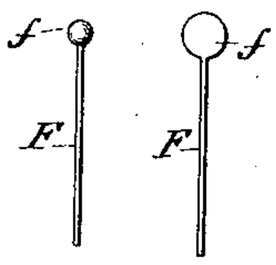


Fig. 6

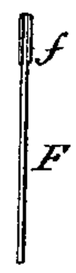


Fig. 7

Witnesses

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By his Attorneys

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(No Model.) 2 Sheets—Sheet 2.

O. A. MOSES.

INCANDESCENT ELECTRIC LAMP.

No. 324,038. Patented Aug. 11, 1885.

Fig. 8,

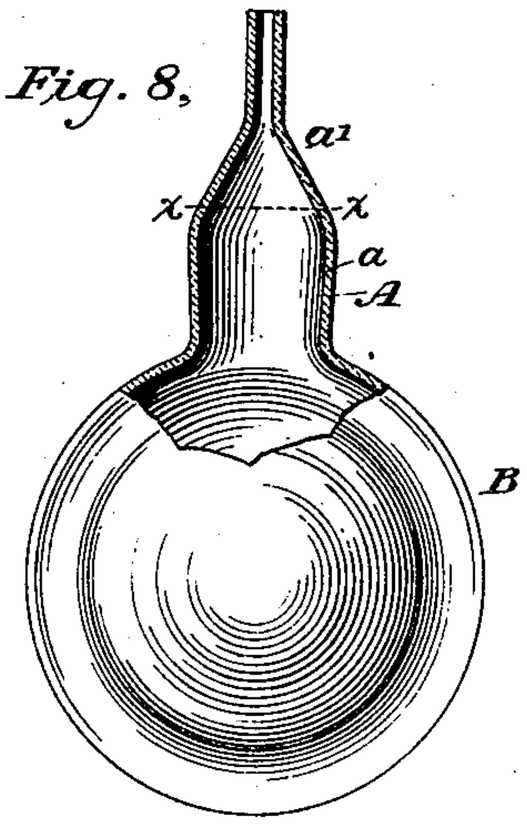

Fig. 9,

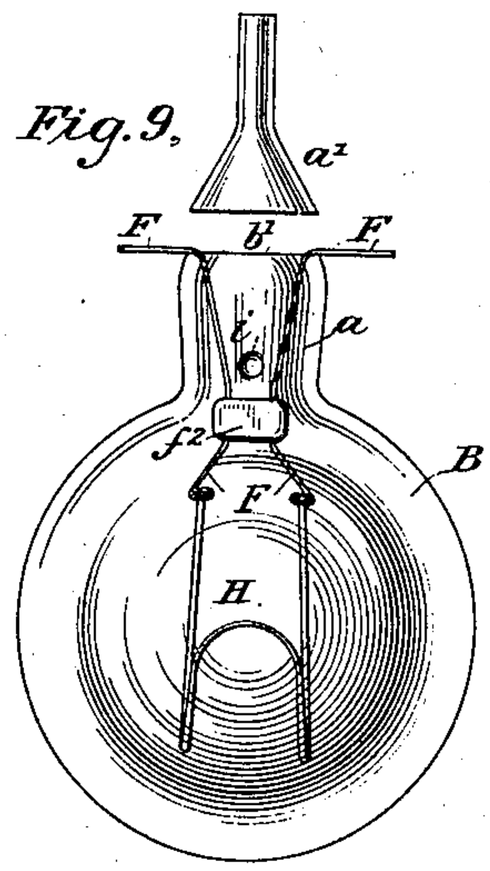

Fig. 10,

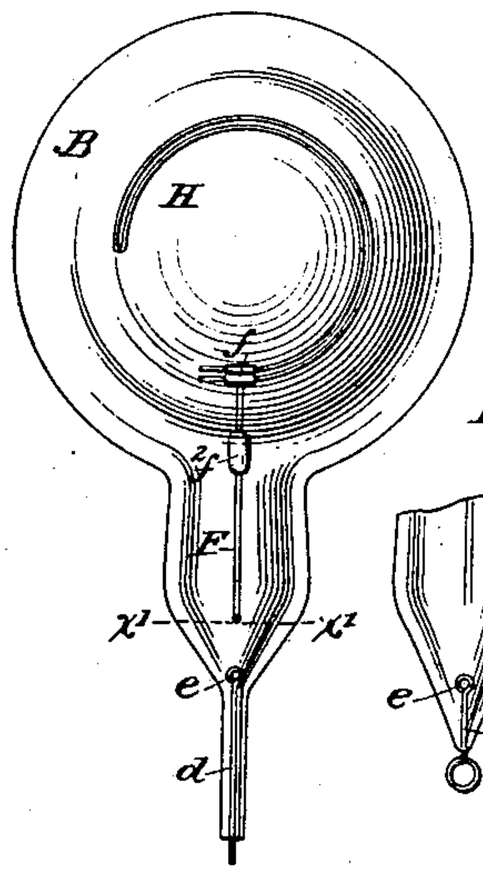

Fig. 10a

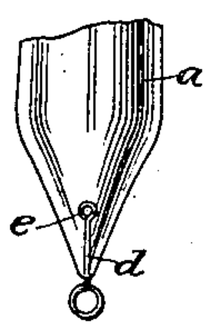

Fig. 11,

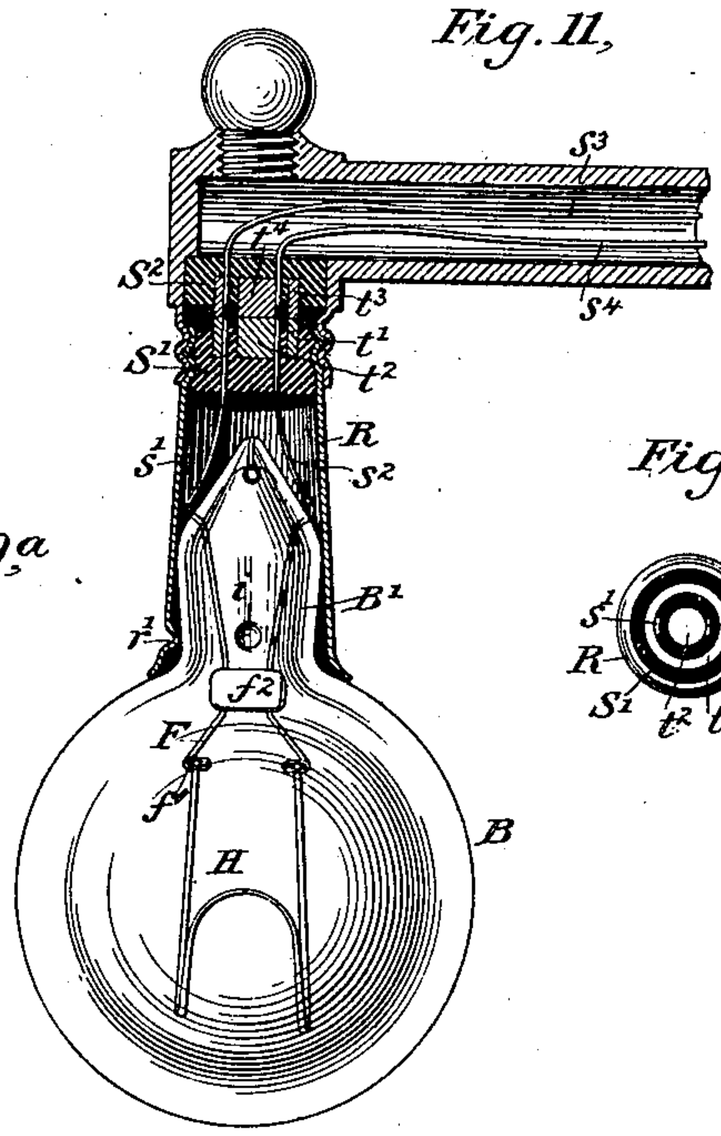

Fig. 12,

Witnesses

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UNITED STATES PATENT OFFICE.

OTTO A. MOSES, OF NEW YORK, N. Y.

INCANDESCENT ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 324,038, dated August 11, 1885.

Application filed July 30, 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 New York, in the 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 particularly claimed in this application relates, particularly, to the method of manufacturing the inclosing-globe, the method or process of securing the supporting-conductors and causing them to enter through the walls of the chamber or globe, and to the process of closing the globe itself after the air has become exhausted therefrom.

In the construction of inclosing-globes for incandescent lights it is desirable that the globe itself should be so formed that it will not be liable to crack or break when unevenly heated by the current employed for rendering the filament incandescent, that it shall be of uniform thickness, and offer as little opportunity as possible for the formation of rings or shadows by refraction, and that the entire process of shaping, exhausting, and sealing the globe or vacuum-chamber should be simple and effective. For this purpose it is desirable that the several elements comprised in the lamp—namely, the globe, the incandescing filament, its supporting-conductors, and the supporting-cup, in connection with which the completed lamp is to be employed—should be each adapted in form and construction to the other parts. In setting forth this invention, therefore, a complete description will be given of the process of forming and manufacturing all these several parts of the lamp, together with the description of the formation of the globe and process of exhausting and closing the same.

The globe is constructed of a single piece of glass, which is preferably blown into a mold, whereby all the lamps are rendered uniform in size, and, contrary to the usual custom, they are formed entirely spherical, and with a smooth surface at the lower end—that is to say, opposite to the neck—where it is usually customary to form a slight projection for the purpose of attaching a tube and exhausting the air after the conductors have been secured in place. This is rendered unnecessary, for the reason that by this invention the globe is exhausted and closed at the end at or near which the conductors enter. The neck of the globe is afterward narrowed or diminished in size, and it is cut or broken off, by a suitable tool, near the bulb or globe. The conducting-filament, which will be hereinafter described, is then inserted within the globe, and the conducting-wires leading to the same are suspended across the edge of the neck of the globe. By means of a blow-pipe the glass is then heated about the conducting-wires, which are preferably of platinum. The wires, by reason of their own weight, sink into the glass as it becomes softened, and the glass closes above them. If, however, this action should not take place quickly enough a little particle of glass is fused upon the exposed platinum wire resting on the globe, for the purpose of holding the conductors and the filament firmly during the subsequent manipulations. The portion of the neck which was at first cut off is then placed against the neck from which it was removed and the two are welded together by means of a blow-pipe, the two parts occupying the same relative positions as those they originally held. A platinum or other suitable metallic stopper is then inserted within the neck formed of the two sections which have been thus welded together into a whole tube, and the tube is then preferably drawn to a diameter that will prevent the stopper from falling out; or it may be curved at an angle for the same purpose. The air is then exhausted from the globe and the glass is softened around the stopper at the lowest possible temperature, and caused to be compressed against the same. While the surrounding atmosphere is compressing the softened glass around the pin or stopper, the glass neck is elongated to still further insure the close fitting of the pin to the neck of the tube which joins the lamp to the air-pump. In the sides of the neck there are preferably formed slight depressions, which afford points for the holder

to grasp the lamp and retain it in its proper position.

The form of carbon which it is preferable to employ in this globe 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.

The supporting conducting-wires for the filament are united thereto by means of a peculiar form of clamp which is formed at the end of each wire. This clamp is made by forming an enlargement at one end and then causing the enlargement to be flattened into a disk. The disks are doubled, preferably in the axis of the wire, so that two lips are formed, which are intended to receive the filament between them. The lips are then together bent out laterally, so that they project from the wire at right angles. One of these conducting-wires is applied to each extremity of the filament, and they are preferably so arranged that the lips of the clamps are turned in toward each other, so as to make use of the resilience of the carbon loop in case of a defective clamping.

For the purpose of handling the delicate filaments with facility in introducing the ends into the clamps, and for rendering the connection between the ends of the filament and supporting-conductors as perfect as possible, the ends of the filament are preferably coated with metal by electrolysis before they are applied to the clamps. The metallic coatings may then be forcibly brought into intimate contact with the clamps by compression without crushing the ends of the filament contained therein. They may afterward be soldered to the clamps, if it is desired. A suitable bridge-piece of glass preferably unites the supporting-conductors with each other, for the purpose of stiffening the same and preventing the filament from being displaced.

In a patent issued to me December 30, 1884, there is described a method of sealing a vacuum-chamber in some respects resembling that described herein. In the patent referred to, however, the evacuating-opening is closed not by a platinum plug alone, but by such a plug sealed in or soldered to the glass by a sealing of lead or other readily-fusible metal between the platinum and the glass. Such a sealing unites chemically with both the stopper and the glass. I have found, however, that the sealing of lead or other fusible metal may be dispensed with, and an independent metallic stopper employed for closing the opening—that is to say, a platinum stopper alone without any sealing metal.

The operation of coating the ends of the filament with copper, as well as the details of the construction of the lamp and holder, will be described in connection with the accompanying drawings, in which—

Figure 1 illustrates a complete lamp together with its holder. Fig. 2 is a side view of the incandescing filament. Figs. 3 and 4 illustrate the mold employed for carbonizing the filament and the method of removing the filaments therefrom. Figs. 4^a and 4^b illustrate the apparatus employed for coating the ends of the filament. Figs. 5, 6, and 7 illustrate the construction of and the method of manufacturing the supporting-conductors. Fig. 8 illustrates the form of the globe before the filament has been inserted, and Fig. 9 illustrates the method of inserting the conducting-wires after the section of the neck of the globe has been removed. Fig. 10 illustrates the process of closing the globe. Fig. 10^a shows a method of employing the protruding end of the stopper. Figs. 11 and 12 illustrate certain details in the form and construction of the holder.

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, 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 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 nickel or some form of iron, steel, or carbon, 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 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 tapered 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 perfectly 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 being carbonized.

It is well known that during the process of carbonizing, the filaments shrink a considerable portion of their length. It is desirable that they should be maintained under an even 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 an even tension is placed upon the same throughout its length, although a similar result could be obtained by fastening the 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 with a thread wrapped about it in the groove, or coating it with some substance easily applied and melted or distilled away, like wax or paraffine.

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 mold 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.

The next step in the process of manufacture is that of electroplating the ends of the filament. The metal which it is usually preferble to employ for this purpose is copper; but other metals may be employed. For this purpose an apparatus of the character illustrated in Figs. 4^a and 4^b is employed. This apparatus consists of a clamp, N, having its ends split or cut apart, as shown at *n′* and n^2, and provided with set-screws n^3 n^3. The ends of the filament are respectively placed in the ends *n′* and n^2 of the clamp, and securely held in position by means of the clamping or set screws n^3. The entire clamp is thus suspended in any suitable manner with the ends in an electroplating-bath, as shown at O, the curved or bent portion of the filament extending outside of the bath, as shown in the drawings. Any suitable process of electroplating may then be employed. In the drawings, I have shown a battery having one pole connected with the clamp N by a wire or supporting rod, and the other with a copper electrode, *o*. Owing to the form of the contact which exists between the metallic suspending-clamp N and the ends of the filament, only a short time is required to completely coat the ends of the filament with copper. After this is accomplished the filament may be removed from the bath, and may be very conveniently handled by taking hold of the copper-plated ends. The ends will bear a very considerable pressure when thus coated, whereas they are very easily fractured when not so coated. The portions of the filament which were held by the clamps may, if it is so desired, be cut off, the filament having in the first place been made of such length as to allow of such portions being removed. By so cutting off the ends of the filament the extremities are left bare—that is to say, not covered by the metal. This is of especial advantage, because during the process of curing the filament, the fluids contained therein tend to be driven and to collect at the cooler portions—that is to say, near the ends

which are in contact with the support. Now, if the ends were completely covered, the fluids would be confined in the carbon surrounded by the metal, but the extremities being open they readily escape therethrough.

The next step in the process of manufacturing the lamp consists in clamping the ends of the electrodes into the supporting-conductors for the same. Each of these conductors is made in a manner which will be described in connection with Figs. 5, 6, and 7. At the end of a piece of platinum wire, F, there is fused a globule or ball, *f*. This ball is either hammered or compressed into a flat disk. The two halves of the disk are bent toward each other, in the manner shown in Fig. 6, along the line of the wire F, and they are then bent over, as shown in Fig. 7. The two semicircular sections or lips are then clasped upon the metal-coated end of the filament to which it is applied, and, if it is so desired, they may be soldered thereto in any convenient manner. The two conducting-wires are secured to each other by means of a bridge, f^2, of glass. This bridge consists merely of a small section of glass tube having the conducting-wires inserted through it and let into its respective sides by softening the glass or by molding the glass about the wires. The bridge-piece may be applied either before or after the filament has been clamped to the wires.

The filament and the conducting-wires having been prepared in this manner they are placed within the globe. The diameter, however, of the curve of the filament is preferably made somewhat greater than the diameter of the opening into the globe, for the purpose of giving to the lamp a capacity for giving light as great as possible, and for rendering the size of the globe as small as possible relatively to the length of the filament. It is therefore necessary to first insert the loop h^3 of the filament into the globe and to spring the entire filament in by slightly bending the double loop during the process. When, however, the loop is once within the globe it resumes its normal shape and form.

Referring now to the form and method of constructing the vacuum-chamber and of closing the same, A represents a cylindrical glass tube, at the end of which is a bulb, B, which is preferably formed by blowing into a suitable mold. The bulb B is made of the size which it is desired that the lamp shall have. Instead of blowing it in a mold, however, it may be blown directly on the punty from the metal in the glass-maker's crucible, or from a tube of any diameter. The globe, it will be particularly noticed, is thus formed without any projection at the side opposite the tube A, but with an entirely smooth surface. The tube or neck is then narrowed toward the contraction where it is to be finally closed. The globe is placed in a lathe, and a portion of the neck or tube A is cut off at a point on the curved part, which is of less diameter than the neck, as indicated, along the line *x x* in Fig. 8, leaving a short neck about one-half of an inch in length. Before the section of the neck is cut off, however, a mark is preferably put upon the same to indicate the positions which the two pieces originally occupied, so that the portion *a'* of the neck or tube can be reapplied to the portion *a* after the filament and conductors have been inserted in the globe B. The carbon filament, the form and manufacture of which have already been described, is then inserted within the bulb or globe B, the portion h^3 being first inserted through the neck *a*, and the filament being then bent in such a manner as to allow its entire length to be pushed forward into the interior of the globe. The flexibility of the filament will permit this to be accomplished, although it would not be possible to bend the two sides of the curved filament toward each other sufficiently to permit the filament to be inserted in a flattened form. This method of insertion is also applicable to other forms of filaments. After the filament is within the globe it will immediately resume its previous form. After the filament H is placed within the globe the conducting-wires F F, which sustain the same, are caused to rest across the edge *b'* of the neck *a* of the globe B in the manner indicated in Fig. 9, and the latter is, by means of a blow-pipe, or in any other suitable manner, heated sufficiently to soften the glass around the conducting-wires and to allow them to sink by their own weight into the edge of the neck, forming slight depressions. The glass, however, will close over the conductors, thus completely embedding them in the neck of the globe and securing a tight joint; or a small piece of glass may be added to each conductor for that purpose, if necessary.

The next step in the process consists in replacing the section *a'* of the tube A upon the neck *a* of the globe. The marks which were applied before the section was cut off or removed serve to guide the workman in replacing the latter in the precise position which it at first occupied. By means of a blow-pipe, or in any other suitable manner, the two portions of the glass are then welded together along the line *x' x'*, as shown in Fig. 10, and the lamp resumes its former shape, the filament H and the conductors F having been inserted. It will be understood, moreover, that the two portions of the globe are entirely homogeneous, and that the disadvantage of having glass of different thicknesses or different qualities in the lamp is entirely avoided. A platinum stopper, *d*, having at one end a loop or head, *e*, is then inserted within the narrowed opening of the globe or neck, and the tube is narrowed sufficiently to prevent this stopper from falling out. The lamp is then applied to an air-pump, by means of which the air is exhausted from the chamber. When the vacuum has been formed in the chamber B, the neck of the globe is closed about the platinum stopper *d*, thus forming a tight joint. It is not found necessary in so closing the globe to

form a temporary sealing at some distance below the point where the globe is permanently closed, as is usually customary in other forms of lamp, but the lamp may be closed once for all while still upon the air-pump; and it may be further observed that since the point of closing is at the end of the globe which enters the holder it may be made at such a distance from the globe as may be desired, whereas in a lamp which is sealed at the other extremity of the globe it is necessary to form the final seal as close to the globe as possible. For convenience, however, in shaping the glass around the pin, it may in some instances be preferred to first seal the lamp at a second lower contraction to permit the final closing to be done at the glass-blower's table instead of on the pump. After the lamp has been closed the neck formed or extending below the point of closure may be readily broken off or removed. The unnecessary portion of the platinum stopper may, by means of any suitable tools, then be cut off and ground down even with the glass tube; or the neck may be drawn down to a beak, and then only the stopper is required to be cut off.

It is well known that platinum, when cooled, sends out gases which are occluded in the metal while it is heated, and for the purpose of preventing such gases from escaping from the stopper into the glass or the globe, it is advisable to conduct the process of closing the glass around the stopper at as low a temperature as possible, or it may sometimes be preferred to coat the latter with a thin film of glass preparatory to inserting it within the globe. By reason of this film of glass gases would not be given off which were occluded before the closing of the globe. The glass as it is closed about the stopper enters the pores at the surface of the platinum stopper and forms a tight joint without forming any chemical union therewith. Such a film of glass is preferably applied by first inserting the platinum wire into a tightly-fitting glass tube, then placing the same in a suitable chamber and exhausting the air therefrom. While thus in a vacuum the platinum wire is heated to incandescence. The gases are thus driven out from the platinum and the glass then enters the pores of the platinum by reason of the capillary attraction, and in this manner a very close mechanical union is formed between the two materials. The vacuum-chamber may, if it is so desired, be allowed to suddenly fill with air while the platinum is still heated, and the glass will then be brought under a pressure which insures that it will permeate the pores of the platinum.

It is important to apply the coating of glass in a vacuum for the reason that when treated in open air it is found impracticable to produce a coated wire free from occluded gases, for the reason that the occluded gases on being heated tend to separate the glass from the wire, but if the glass and the wire be surrounded during the heating by a vacuum, these gases escape into the vacuum, and thus a coated wire freed from occluded gases is produced.

Not only may the platinum stopper be thus treated, but the conductors leading to the filament may also be treated in the same manner.

The platinum stopper may, instead of being cut off at the end of the beak, be allowed to protrude, and then it may be bent into a loop, as shown in Fig. 10ª, for the purpose of affording a convenient means of hanging the lamp.

It is desired also to call attention to the fact that the stopper may be placed at the end of the lamp opposite the neck, the usual projection being formed at that end for the purpose.

It remains now to describe the holder which it is preferable to employ for sustaining the lamp in position. Such holder is illustrated in Figs. 11 and 12. Referring to these figures, R represents a suitable calyx of the proper size for receiving the neck B′ of the lamp. In this calyx the neck is designed to fit and to be held securely by means of suitable lugs, r', which are designed to enter depressions j, formed in the sides of the neck of the lamp. These depressions are formed while the shank about the lamp is still softened by heat.

Soldered to the ends of the supporting-conductors F are suitable conducting-wires, s' and s^2, which extend to the lower end of the supporting-calyx R, and through these conductors it is designed that the connections of the lamp shall be completed. For this purpose a plug or nut, S′, is inserted at the lower extremity of the calyx R and either screwed into the same or tightly fastened in any suitable manner. In the lower ends of the nut or plug there is set a ring, t', of conducting material surrounding a disk, t^2, of like material. The disk and ring are insulated from each other, the nut itself being of insulating material. The conductor s' is soldered to the ring t', while the conductor s^2 is united with the disk t^2. The ring and the disk both preferably project a slight distance beyond the face of the nut. A second nut, S^2, is designed to be applied to the extremity of the calyx R, and this nut is provided with a ring, t^3, and disk t^4, similar to the parts t' t^2. The second nut, S^2, by being screwed into the case or calyx R, brings the two rings against each other, and likewise the two disks, thus making two perfect electrical connections. The ring t^3 and the disk t^4 are respectively provided with conductors s^3 and s^4, which are connected with the connecting-wires of the system in which the lamp is to be employed, so that either by screwing the calyx upon the nut or the latter into the calyx the lamp will be placed in circuit.

It is understood that suitable circuit-interrupting devices may be applied to the supporting-calyx, as desired. Instead of two of the depressions and lugs formed in the neck of the lamp for securing the calyx, any number may be employed, and they may be ex-

tended throughout the length of the neck, if so desired, for the purpose of preventing the lamp from being turned when in position, or the side of the neck may be flattened, if it is found desirable.

Certain other applications filed by me contain descriptions of some of the features claimed herein—viz., No. 139,125, filed July 30, 1884, and No. 140,441, filed August 13, 1884.

I claim as my invention—

1. In an incandescent electric lamp, the combination, substantially as hereinbefore set forth, of a transparent chamber having its neck formed of two sections of homogeneous glass cut apart and welded together with the metallic conductors leading through the joint thus formed, and a seal at or near the end of the neck consisting of a platinum stopper around which the glass of the neck is closed.

2. In an incandescent electric lamp, the combination, substantially as hereinbefore set forth, of an inclosing-chamber for the filament, conductors leading through the wall of the chamber, and an independent stopper of platinum closing the evacuating opening of the chamber and constituting the seal.

3. In an incandescent electric lamp, the combination, substantially as hereinbefore set forth, of the inclosing-chamber, the conductors leading into the same, and an independent metallic wire passing through the wall of the chamber, to which wire the glass of the wall is mechanically united.

4. In an incandescent electric lamp, in combination with the conductors leading to the filament, a seal consisting of an independent platinum wire passing through the walls of the chamber at the outer end of which wire there is formed a hook or loop, substantially as described.

5. In an incandescent electric lamp, a platinum wire passing through the wall of the inclosing-chamber, which wire is freed from occluded gases by being coated with a film of glass *in vacuo* before being applied to the lamp.

6. In an incandescent electric lamp, a platinum conductor freed from occluded gases and passing through the wall of the inclosing-chamber, which wire has been coated with a film of glass by being heated *in vacuo* while surrounded by glass, substantially as described.

7. In an incandescent electric lamp, an inclosing-globe for the filament, having its neck formed from two sections of the same piece of transparent material which have been cut apart for the insertion of metallic conductors and replaced after such conductors have been inserted.

8. In an incandescent electric lamp, a glass inclosing-chamber for the filament formed in two sections which are sealed or welded together under the influence of heat, and conductors leading through the walls of one section, which conductors are sunk into the edge of that section under the influence of heat, substantially as described.

In testimony whereof I have hereunto subscribed my name this 21st day of July, A. D. 1884.

OTTO A. MOSES.

Witnesses:
CARRIE E. DAVIDSON,
CHARLES A. TERRY.