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O. M. THOWLESS.

ILLUMINANT FOR INCANDESCENT ELECTRIC LAMPS.

APPLICATION FILED AUG. 13, 1903.

Fig. 1.

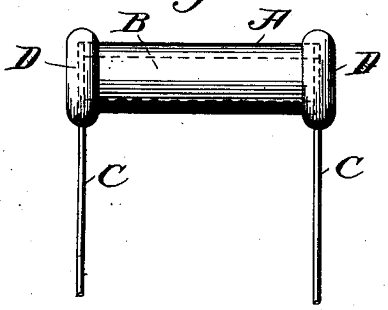


Fig. 3.

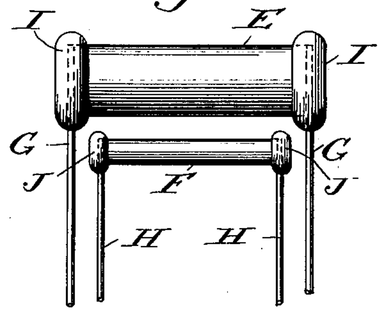


Fig. 2.

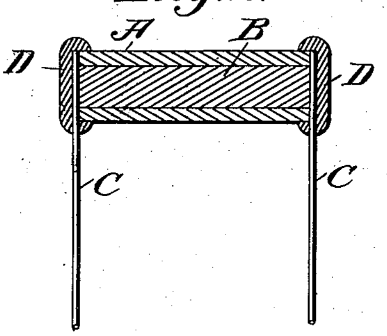
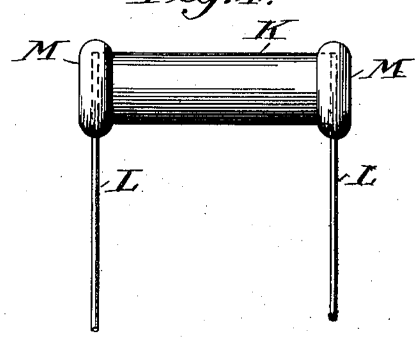


Fig. 4.



Witnesses:

Inventor:
Orlando M. Thowless.

UNITED STATES PATENT OFFICE.

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ILLUMINANT FOR INCANDESCENT ELECTRIC LAMPS.

No. 844,213. Specification of Letters Patent. Patented Feb. 12, 1907.

Application filed August 13, 1903. Serial No. 169,344.

To all whom it may concern:

Be it known that I, ORLANDO M. THOWLESS, a subject of the King of Great Britain, residing at Newark, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Illuminants for Incandescent Electric Lamps, of which the following is a specification.

My invention relates to a new and improved incandescent electric lamp and to methods connected therewith.

The object of my invention is to provide an incandescent electric light which will consume less electrical energy than the present attenuated carbon filament and give a purer and brighter light.

My improved illuminant consists of a rod or strip of material which at ordinary temperatures is a non-conductor of electricity, but when heated to a proper temperature will become sufficiently conductive to permit the passage of an electric current, thereby keeping it in an incandescent condition, (even when the original source of heat is removed.)

It also consists of the heating apparatus used therewith.

In drawings, Figure 1 shows a front view of rod containing composite core, with wires connected to both core and rod. A represents the normally non-conducting rod; B, the composite core; C, the connecting-wires, and D the cement.

Fig. 2 is a cross-section of Fig. 1, wherein like letters represent like parts.

Fig. 3 shows a front view of solid rod, without core, having heating-body. E is the solid luminant; F, the solid heating-body; G, the connecting-wires to the luminant; H, the connecting-wires to the heating-body; I, the cement on the luminant, and J the cement on the heating-body.

Fig. 4 is a front view of the solid rod without heating-body. K represents the luminant, L the connecting-wires, and M the cement.

The composition of the material forming the rod or strip which is to be used as the light-giving body must be of such a nature that it will be normally non-conductive, but capable of becoming conductive when heated. Such substances as magnesia, lime, or zirconia do not have the quality of becoming conductive when heated, but any one of these, or a mixture of them, or any of the rare earths or earthy oxids—such as thoria, the oxid of yttrium, the oxid of cerium, the oxid of erbium, or a mixture of them—can be made available for this purpose, if a small amount of flux—such as borax, borax-glass, cryolite, or similar material—be added to them, for rods made of such materials, if subjected to a vitrification by the aid of a very high heat, will become conductive when properly heated.

One method of making my new illuminant, containing a means of heating the normally non-conducting material of which it is made, is to form a composite rod made of a mixture of conducting and non-conducting material and cover it partially or completely, with the exception of the parts necessary for connection with the source of current, with a body of material which, though normally non-conductive, possesses the property of illuminating readily when heated and subjected to the action of an electric current. The composite rod is made of a mixture of conducting and non-conducting material—such as magnesia, alumina, thoria, or other oxid—and conductors, such as conducting metallic oxids, all in a state of fine subdivision. When the illuminant is thus prepared, there is formed a rod of normally non-conducting material on the outside which is capable of becoming a conductor when heated, having a core composed of a mixture of conducting and non-conducting material. This illuminant is attached to wires and an electric current sent through the inner body, when heat will be developed therein and communicated to the external body to such an extent that it becomes a conductor of electricity and incandescent.

The inner body of composite material I shall hereinafter call the "heating-body," and that term will apply to all bodies hereinafter mentioned as the body which supplies the heat to the normally non-conducting illuminant.

The non-conducting portion of the heating-body above referred to as being made of composite material should be formed of one or more of the class of oxids which are non-conductive at all temperatures at which the illuminant is operated, as the reason for using non-conductors at practically all temperatures is to make the heating-body of a higher electrical resistance than it would be if made of carbon and yet have it remain a conductor of electricity to the desired extent.

Good results may be obtained with a heating-body composed of eighty parts of a conductor, such as a conducting metallic oxid, and twenty parts of a non-conductor, such as magnesia; but these proportions may be varied to suit different voltages and different candle-power.

In place of manually mixing the non-conducting and conducting materials for the heating-body I may employ in some instances a mixture ready-prepared and simply form it into the shape desired. These prepared mixtures may be carbids—such, for instance, as carbid of silicon, carbid of boron, or other carbids possessing the proper qualities requisite for the heating-body—or I may form the materials for the heating-body into a plastic state and force them through holes to form a heating-body of uniform diameter.

Having prepared the heating-body, I surround it wholly or partially with a body or combination of materials which when cold are non-conductors of electricity, but which when heated become conductors and incandescent when traversed by a proper electric current. Nearly all the earths and earthy oxids if mixed with some flux—such as borax, borax-glass, cryolite, or similar material—are capable of being changed from non-conductors to conductors of electricity if said oxid or oxids and flux are vitrified into a substantially non-porous and solid body by the agency of a very high heat, such as an oxyhydrogen flame, and when cold and in this dense form are by the aid of a gentle heat available for the purpose of an illuminant. It is difficult to form rods without some binding material, so the flux can be used as a binder, thereby serving a twofold purpose—viz., combining with the oxids to make them capable of becoming conductors under the action of heat and also acting as a mechanical binder to hold and join the particles of the material together. The luminant portion need not be in contact with the heating-body; but care should be taken that proper electric connections be made with both separate portions.

Another method of making my illuminant is as follows: I take one or more of the refractory oxids and after reducing the same to powder incorporate therewith a small quantity of some easily-fusible material, like borax, borax-glass, cryolite, fluor-spar, or some other substance having the same general characteristics, form it into a putty-like mass by the aid of borax-water, or a solution of soluble glass, or some other similar substance to act as a binder, so that the materials may be made into a workable mixture. It is desirable that no carbonaceous material be used as a binder, so that no substance such as starch, dextrin, glue, gelatin, or other like material should be used, as it would be found necessary to burn these substances out of the rods, and this would destroy the homogeneity of the same and make them more or less porous. So I prefer to use substances which do not leave the rods in a spongy state after heating. When the mixed materials are in a putty-like condition, I shape the mass into rods or filaments, or if it is to be used with the composite core, as previously described, I form it into hollow cylinders and then fill the hollow part with the composite heating material. In case it is desired to use it without the composite core I simply employ the solid rods or filaments and proceed to bake and treat them with heat, so that they will have a close grain and be homogeneous throughout. The baking and heating may be done in various ways; but a good way is to slowly dry the rods at a comparatively low temperature until all the moisture is removed. Then give them a heat equal to the oxyhydrogen flame, or to that of high incandescence, in an electric circuit. This latter I accomplish by spreading along the rod in a narrow thread-like form a small quantity of graphite-paste or some other similar conductor. The graphite is dried and forms what I will term a "bridge." The rod, with the bridge, is placed between two wires or clamps capable of carrying an electric current and a proper electric current sent through the graphite bridge. The bridge will last long enough, even in the air, to heat up the rod, when the latter by reason of the heat developed from the bridge will itself become conductive and will in a sense become vitrified. The bridge will be dissipated; but as it has served its purpose this does not signify. When the rod has been thus treated, it is ready to be mounted and used as an illuminant and will be found to be a non-conductor at ordinary temperatures, but a conductor when heated. The heating may be done by placing near it a source of heat sufficient to perform this work. One way of doing this is by using a conductor which can be acted upon by the same current that serves to light up the rod. For instance, a rod made of carbid of silicon ground to a powder and formed into a rod can be placed close to the luminant rod and connected with the electric current, which will light up the carbid-of-silicon rod, and this transmitting its heat to the luminant rod will cause that also to become a conductor and incandescent. The carbid rod may then be cut out of the circuit, so that no current passes through it; but the other rod will still continue to give light as long as it remains in connection with the current.

Other materials may be used for the same purpose as the carbid of silicon; but in all cases where the rod is to be lighted in air a material should be used capable of withstanding destruction or be of such cheap material and of convenient form that it may be readily replaced. For instance, a match may be used for the heating-body in place of the carbid-heater, or some other form of heater may be used, such as a magnesium rod or ribbon, which could be burned near the luminant rod, either by lighting it with a taper or by sending an electric current through it.

It is to be understood that proper connecting-wires are to be attached to both heater and illuminant and preferably cemented thereto. A cement for the luminant may be made of the same material as the rod itself; but a larger amount of the flux material may be used to make a good working cement.

The term "non-porous" as used in the claims does not mean that the glower has no pores, as all material is porous—that is, there is a certain distance between the molecules—but the term "non-porous" in this case means that the glower is very dense, solid, and homogeneous and does not have cracks or perceptible openings, as would obviously be the case if a carbonizable binder was employed, as the carbon would be oxidized by the air when heated and the remaining refractory oxids would be left as a skeleton of crumbling structure, which would not conduct an appreciable electric current even at a high temperature. It is not sufficient to merely mix a flux or binder with the metallic oxid and attempt to use them in the manner disclosed in British Patent No. 6,135 of 1898, but they must be subjected to the vitrifying process at a high temperature, as disclosed in my specification, in order to be operative.

Having thus described my invention, what I claim is—

1. In an incandescent electric lamp, a current-carrying glower, normally non-conductive, but a good conductor when properly heated, consisting of a combination of normally non-conductive materials and a binding substance for holding the materials together while the glower is being made, remaining entirely unchanged as an integral part of the same, and possessing the further properties of making the glower structurally solid and non-porous, and enabling it to be readily made conductive when heated.

2. In an incandescent electric lamp, a current-carrying glower, normally non-conductive, but a good conductor when properly heated, consisting of a combination of refractory material and a binding substance mixed and vitrified therewith, said substance remaining entirely unchanged by the vitrification and having conducting-wires attached to the ends of the glower by means of cement made of like material as that of the glower.

3. In an incandescent electric lamp, a current-carrying glower, normally non-conductive throughout, but a good conductor when properly heated, made of rare earths and a vitrifiable binding substance mixed and vitrified therewith, having connecting-wires attached thereto, combined with means for heating it to a conductive temperature.

4. In an incandescent electric lamp, a dense, non-porous current-carrying glower composed of a mixture of rare earths and flux vitrified therewith.

5. In an incandescent electric lamp, a dense, non-porous current-carrying glower comprising a mixture of rare earths and flux vitrified therewith.

6. In an incandescent electric lamp, a structurally-solid, non-porous vitrified and homogeneous current-carrying glower, which is practically an insulator at ordinary temperatures, but a relatively good conductor when properly heated.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ORLANDO M. THOWLESS.

Witnesses:
JOHN C. PENNIE,
EDWIN S. CLARKSON.