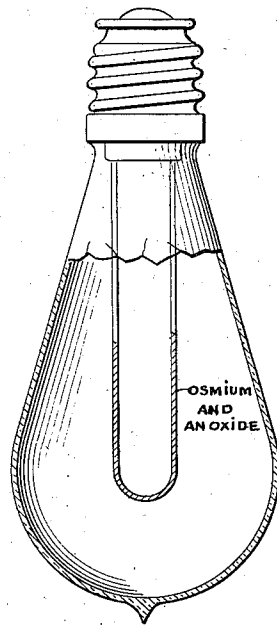


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MANUFACTURE OF ELECTRIC FILAMENTS.
APPLICATION FILED AUG. 9, 1898.

1,086,428.

Patented Feb. 10, 1914.



Witnesses:

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MANUFACTURE OF ELECTRIC FILAMENTS.

1,086,428.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, Dr. CARL AUER VON WELSBACH, a subject of the Emperor of Austria-Hungary, residing at Vienna, Austria-Hungary, have invented or discovered a certain new and useful Improvement in the Manufacture of Electric Filaments, of which the following is a specification.

My invention relates to certain new and useful improvements in and relating to the manufacture of incandescents, that is electrically conducting bodies which in the form of filaments, or the like, are adapted to be traversed by an electric current and to convert the electric energy into light.

In carrying out my invention, I obtain as the final product an incandescent comprising a mixture of a metal and a metallic oxid in such condition that it will remain substantially stable under the ordinary conditions to which it is subjected when traversed by the electric current. The metal employed is of such character as not to melt or volatilize at the temperature to which the incandescent is brought by the passage of the electric current and the metallic oxid employed is of such a character as to practically retain its oxygen rather than give it up in whole or in part to the metallic constituent of the filament. I find that a mixture well adapted for this purpose is one consisting substantially of osmium and thoria prepared in accordance with the processes hereinafter set forth, these particular ingredients possessing the peculiar properties indicated to a very high degree, particularly because of the fact that thoria even at very high temperatures to which it would be subjected has no tendency to volatilization.

By means of my invention, I produce an electric incandescent consisting of a mixture of a metal and an oxid of the character referred to, and which will remain stable, or substantially stable when brought, by the passage of the electric current, to the incandescing temperature required for effective lighting and whose particles coalesce to such an extent as to enable the incandescent to be made up in the form of elastic filaments and the like, capable of withstanding not only the usual shocks and jars incident to handling and use, but also of resisting the tendency to disintegration due to static conditions. I prefer, in practice, to employ the metal osmium or a suitable salt or salts

there-of, such as the sulfid, in combination with thoria. However ruthenium or rhodium or their suitable salts either in whole or part may be used in place of the osmium and the thoria may be replaced in whole or part by zirconia—hereafter to be understood as included within the term “rare earths” or the yttrite earths. I will proceed to describe a method of practically utilizing my preferred mixture of osmium and thoria in the production of an incandescent electric filament. The osmium chosen is preferably in the pure state, or allowed with such small percentage of platinum, ruthenium, or other like metal, sometimes associated with it, as will not materially lower its point of fusion. I first prepare a mixture of osmium (or a suitable compound thereof); thoroxid, or other thorium compound capable under the influence of heat of producing thoroxid, and a substance which operates something after the fashion of a binder or support and which under the influence of heat resolves itself practically into carbon. To this end, I prepare a mixture somewhat analogous to a paste and consisting of, generally stated, osmium, thoroxid and sugar, or instead of sugar I may employ collodion or flour paste, or generally any binding material which under the influences of heat will resolve itself practically into carbon. I use the osmium and thoroxid in a very finely divided condition. The described mixture containing osmium, thoroxid and carbonaceous binder is shaped or otherwise formed into filaments, or the like, for example, by forcing the mixture through a die or in any other suitable manner to give it the desired form. When collodion is employed, it will be necessary to denitrate the filament, after its passage through the die or after it has been otherwise formed. The presence of the thoria in the paste adds materially to the plasticity of the mass, and consequently to the facility with which the filamentary bodies can be formed therefrom.

Without intending to limit myself to proportions, I may state that a paste suitable for the manufacture of filaments of osmium and thoroxid may be prepared by mixing three parts by weight of finely-divided metallic osmium with one part by weight of powdered thoroxid and a suitable quantity of sugar with sufficient water to cause the ingredients to assume a stiff pasty con-

dition. The quantity of osmium used must be sufficient to form a conductor for the voltage used and as little binding material used as will hold the particles together during the manufacture of the filament. The thus produced unfinished filament consisting of a mixture substantially of osmium, thoroxid and carbonaceous matter capable upon the application of heat of resolving itself practically into carbon, is then subjected to dry distillation by the application of heat which resolves the organic matter into carbon and drives off any volatile constituents present, so that the filament now comprises a mixture of carbon, thoroxid and osmium. The carbon is then removed from the mixture by subjecting the incomplete filament to the influence of a moderate heat obtained by an electric current in an atmosphere of gases capable of taking up or removing the carbon without oxidizing the osmium or deoxidizing the thoroxid. Such an atmosphere should contain carbonic acid or water vapor to take up the carbon, but, as these gases would attack the osmium more or less, the atmosphere should contain a reducing gas, such, for instance, as hydrogen, carbon-monoxid, or hydro-carbons; the simplest composition of such an atmosphere would be hydrogen containing water vapor or carbonic acid, or a mixture of carbon-monoxid and carbonic acid. Such gases may be derived, for instance, from the mixture of gases and vapors incident to the incomplete combustion of illuminating gas procured by the ignition thereof at the base of air feed openings of a Bunsen burner, the said mixture of gases and vapors being collected from the burner tube.

In practice I mount the incomplete filament in a suitable container such as an incandescent lamp bulb filled with the described gas and then apply the electric current for the elimination of the carbon and the consolidation and cementation of the particles into a dense, compact and coherent filament of osmium and thoria, using for that purpose in some instances a current of one hundred volts, and developing a heat at which platinum would volatilize. If the proportion of oxid is increased the voltage must be increased, as for instance, if the mixture is one of equal parts of osmium and thorium I use in its manufacture a current of three hundred volts. However the quantity of metal must be sufficient to act as a conductor of the current after the elimination of the carbon.

Features of my metal-oxid filaments are that they are free from carbon; dense, coherent and elastic and capable of withstanding very high temperature above that at which platinum volatilizes, and consequently are of great efficiency. The completed filaments are mounted and inclosed

in bulbs containing a protective gas or, preferably, in a vacuum and electrically cemented to the leading-in wires through the medium of an osmium cement as set out in an application executed and filed herewith. A small quantity of alumina may be added to the mixture from which the filaments are made. Under the heat produced by the electric current, the alumina is wholly or partially volatilized, the effect of which is to enable the particles of the metal to be more readily fused or cemented together, and a more dense, compact and elastic filament obtained, the thoria being brought to the surface of the filament to which it strongly adheres, with the appearance of an enamel-like coating. When alumina is used, a smaller quantity of thoria is used. Instead of alumina, magnesia, or like oxids of a basic character may be employed.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An incandescent filament for electric lamps, comprising a stable electrically conducting mixture of a metal of the platinum group, a metal oxid and yttrite earth, substantially as set forth.

2. The herein described process of making incandescent filaments for electric lamps, which consists in subjecting a composite body comprising carbon, a metal and a metallic oxid to dry distillation and to the action of an electric current in an atmosphere of gases which combine with and remove the carbon, but which is inert with respect to the metal and the metallic oxid, and by the action of the electric current cementing the particles into a dense coherent elastic filament substantially as set forth.

3. The herein described process of making incandescent filaments for electric lamps which consists in associating carbonaceous material, a metal and a metallic oxid, distilling off the volatile constituents of the carbonaceous matter, and finally removing the carbon by subjecting the material to the action of an electric current in an atmosphere of gases which combine with the carbon but which is inert with respect to the metal and by the action of electric current causing the particles to cohere substantially as set forth.

4. The process of making incandescent filaments for electric lamps, which consists in forming a paste containing carbonaceous matter, a metal and a metallic oxid, forming said paste into the shape of the desired incandescent, distilling off the volatile constituents of the carbonaceous matter, and then removing the carbon by subjecting the material to the action of an electric current in an atmosphere of gases which combine with the carbon but which is inert with re-

spect to the metal and by the action of the current causing the particles to cohere into a thread or wire like filament substantially as set forth.

5 5. The process of making incandescent filaments for electric lamps, which consists in forming a paste of collodion, a metal and a metallic oxid, forming the incandescent body therefrom, denitrating the collodion and subjecting the same to the action of the electric current in the presence of a gas which unites with the carbon and which will be inert to the metal.

15 6. The herein described process of making a filament for incandescent electric lamps from a paste of osmium, thoria, and a binding material, consisting in molding the paste into a suitable wire or thread like form, subjecting the same to dry distillation and eliminating the carbon by the heat of an electric current passing through the filament in the presence of a suitable gas, and by the action of the electric current causing the particles to cohere into a dense coherent and elastic incandescent filament substantially as set forth.

20 7. The herein described process of making a filament for incandescent electric lamps from a paste of osmium, thoria, alumina and a binding material, consisting in molding the paste into a suitable wire or thread like form, subjecting the same to dry distillation in a protective gas and eliminating the carbon by the heat of an electric current passing through the filament in the presence of a suitable gas, and by the action of the electric current causing the particles to co-

here into a dense coherent and elastic incandescent filament substantially as set forth.

40 8. The process of making a filament for incandescent electric lamps, which consists in forming a paste, containing rare earth, a carbonaceous binding material, and metal which fuses at a higher temperature than the fusing point of platinum, molding the paste into a suitable filamentary form, subjecting the same to dry distillation, and eliminating the carbon by the heat of an electric current passing through the filament in the presence of a suitable gas, and, by the action of the electric current, causing the particles to cohere into a dense, coherent and elastic incandescent filament; substantially as set forth.

55 9. The process of making a filament for incandescent electric lamps, which consists in forming a paste, containing rare earth, a basic oxid, a carbonaceous binding material, and a metal which fuses at a higher temperature than the fusing point of platinum, molding the paste into a suitable wire or thread-like form, subjecting the same to dry distillation, and eliminating the carbon by the heat of an electric current passing through the filament in the presence of a suitable gas, and, by the action of the electric current, causing the particles to cohere into a dense, coherent and elastic incandescent filament; substantially as set forth.

Signed this 27th day of July 1898.

DR. CARL AUER VON WELSBACH.

Witnesses:

LUDWIG HAITINGER,
Dr. ADOLF GALLIA.