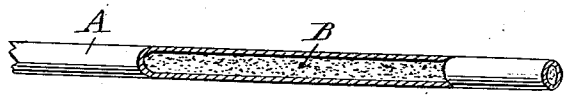
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GLOWER FOR ELECTRICAL INCANDESCENT LAMPS.

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GLOWER FOR ELECTRICAL INCANDESCENT LAMPS.

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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 certain new and useful Improvements in Glowers for Electrical Incandescent Lamps, of which the following is a specification.

My invention relates to glowers or illuminants for electrical incandescent lamps, and more particularly to filamentary glowers, although tubes, rods or other forms may be made for the purpose, the said glowers being made from finely powdered materials and when finished shall be conductive and luminous under the action of a suitable electric current.

The object of this invention is to produce glowers which shall be more regular and even in their light-emitting qualities than those at present in use and be stronger and well adapted for commercial purposes.

One form of this invention consists in basic filaments made from refractory metals such as tungsten, titanium or molybdenum, all of which I have used for basic filaments and on these I have deposited tungsten in some cases and titanium in others.

Another form consists in filaments having a high specific resistance as compared with solid metal filaments, so that shorter and thicker glowers may be used than those made entirely of metal, and on this form of filament a coating of refractory metal is deposited of the same nature of one or more metals such as disclosed for the first form above mentioned. In this form the powders forming the filament can be so changed and arranged as to enable the maker to control and plan any resistance for them at a given length and cross-section, this being accomplished by adding a varying quantity of refractory resistance material to the metal powders hereinbefore mentioned. The refractory resistance material I have used for the above purpose is oxid of thorium, zirconium, yttrium, magnesium or aluminum.

In regard to the plan of controlling the resistance it should be understood that where metallic powder and oxid (for instance) are mixed together and made into filaments, the larger the amount of oxid added to a given amount of metal powder the higher will be the resistance and this can be increased to any degree by the addition of more of the oxid powder for the same dimensions of the glower.

As an illustration of my invention and to show how it is carried into effect I will give here one form of refractory metal powder, also one form of resistance material with one of refractory metal, with the methods of making the same into filaments. For example, tungsten in fine powder and in a high degree of purity is intimately mixed with a binding material and formed into a paste. This binding material may be such as paraffin. The paste is then squirted through a small hole in a die, under proper pressure, into filamentary form, having a thread-like appearance. This is cut into lengths and shaped into filaments proper for lamps. These filaments are then placed in an oven wherein the temperature is gradually raised until all the paraffin is driven out and is dissipated. They are given a heat sufficient to frit the metal particles together and when cooled are mounted between terminals under a bell-jar and after the bell-jar has been exhausted of air a coating of refractory metal is given to them. This may be accomplished by depositing metal on the filament from the vapor of halogen or other salts of metals in the presence of hydrogen or other suitable reducing gas, by means of an electric current traversing the filament and raising it to a temperature sufficient to produce the deposition of the metal.

In case tungsten is the metal which is to be deposited on the basic filament, a salt of tungsten, such as the pentachlorid, WCl_5 or the hexachlorid, WCl_6, is prepared and placed in a receptacle connected with the bell-jar and heated to a vaporizing temperature. A filament is placed in the bell-jar and connected with electrical terminals, the bell-jar is exhausted of air, the vapor of tungsten salt is mixed with the pure dry hydrogen or other reducing gas and the mixed vapors are allowed to enter the bell-jar. A proper current, sufficient to raise the filament to a temperature high enough to cause the vapors to decompose, is made to traverse the filament which results in a deposit of tungsten upon the filament. While it may be better, in most cases, to deposit the

same metal as used in the filament, yet any of the highly refractory metals may be used for the deposit. Generally this deposition should be made after the filaments have received the high fritting temperature. In all cases it will be found that if a very high temperature is given to the filaments, after the binding substance has been removed, a filament of closer grain will be obtained. The high temperature may be given by means of an electric current *in vacuo* or in an atmosphere of inert gas.

In the foregoing example a glower is described made of metal only. For the higher resistance the mode of procedure is as follows: Metal powder, such as tungsten, is intimately mixed with a powder such as oxid of zirconium, aluminum or other oxid and this mixture is formed into a paste with a binding substance such as paraffin. The paste is then forced through a fine hole into a filamentary form, having a thread-like appearance. This is cut into proper lengths and shaped into filaments suitable for lamps. The binding substance is eliminated by heat and a high temperature is caused to act upon the filaments until all the particles are closely united together in a manner similar to fritting or welding. The filaments then receive a deposit of refractory metal to reduce their resistance to commercial requirements and to make the filament uniform in its light-giving qualities.

Another method of making the high resistance filament is to form a paste of metal powder with a solution of a salt which, under the action of heat, will become changed to an oxid. For instance, nitrate of aluminum dissolved in water and somewhat concentrated will form a jelly-like mass. This is mixed with the metal powder and, in this condition, serves as a binding substance. The mass is then forced through a die-hole, formed into filaments and the nitrate of aluminum changed into oxid of aluminum by means of heat. This may be performed in a bell-jar under the action of an exhaust pump while the filament is raised to a high temperature by means of an electric current. The filament may then be coated with the refractory metal in the manner previously set forth.

In some cases it will be desirable to form the basic filament of a ductile metal such as tantalum, molybdenum and the like even if the methods of forming such metals into ductile wires may be expensive. Also, tungsten may be drawn into wire by working it at a rather high temperature, therefore it is contemplated in this invention to make such wire and while it is in a heated condition to shape it into the form desired and then deposit a coating of refractory metal thereon. Molybdenum, tantalum and other wires may be made into filaments and covered with tungsten or other metal, as a coating of this nature equalizes the surfaces and protects metals which have a low vapor density.

I show in the accompanying drawing an enlarged view of a portion of the finished filament, a part of which is shown broken away to display its construction. In this drawing the coating is represented as A, and the basic filament as B.

Having thus described my invention I claim:

1. The method of making glowers for electrical incandescent lamps which consists in subjecting filaments composed of metallic particles and a vaporizable binding material to a gradually rising temperature until the binding material is eliminated therefrom and the metallic particles are fritted together, then bringing them to a high temperature while they are in close contact with mixed vapors of hexachlorid of tungsten and dry hydrogen and depositing on them a resistance equalizing flashing of tungsten.

2. The method of making glowers for electrical incandescent lamps which consists in raising metal filaments to a temperature above the softening point of platinum, bringing them while in such heated condition into close contact with mixed vapors of hexachlorid of tungsten and dry hydrogen and causing a resistance equalizing flashing of tungsten to form on the filaments.

3. In the manufacture of glowers for electrical incandescent lamps the steps which consist in vaporizing hexachlorid of tungsten, mixing it with dry hydrogen, admitting the mixture into an exhausted vessel containing a refractory metal filament connected with electrical terminals and raising the filament to a high temperature to the extent that it receives a resistance equalizing flashing of tungsten.

4. In the manufacture of glowers for electrical incandescent lamps the steps which consist in vaporizing hexachlorid of tungsten, mixing the vapor with dry hydrogen and admitting the mixture into an air-exhausted vessel containing a refractory metal filament raised to a high temperature.

5. In the manufacture of glowers for electrical incandescent lamps the steps which consist in raising filaments to a high temperature in an atmosphere composed of the vapor of hexachlorid of tungsten and dry hydrogen, decomposing the mixed vapors and depositing a coating of tungsten on the heated filaments.

6. In the manufacture of glowers for electrical incandescent lamps the steps which consist in subjecting filaments to an elevated temperature in an atmosphere composed of a mixture of the vapor of hexachlorid of tungsten and a reducing gas, decomposing the mixed vapor and gas and depositing on the filaments a flashing of tungsten.

7. In the manufacture of glowers for elec-rical incandescent lamps the steps which onsist in subjecting filaments to an elevated emperature in an atmosphere composed of nixed vapor of hexachlorid of tungsten and lry hydrogen and depositing on them a oating of tungsten.

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

ORLANDO M. THOWLESS.

Witnesses:

ARTHUR J. THOWLESS,

HERBERT L. THOWLESS.