UNITED STATES PATENT OFFICE.

JOHN ALLEN HEANY, OF YORK, PENNSYLVANIA.

MANUFACTURE OF LUMINANT FOR ELECTRIC LAMPS.

No. 839,585. Specification of Letters Patent. Patented Dec. 25, 1906.

Original application filed December 29, 1904, Serial No. 238,769. Divided and this application filed November 27, 1906. Serial No. 345,406.

To all whom it may concern:

Be it known that I, JOHN ALLEN HEANY, a citizen of the United States, residing at York, in the county of York and State of Pennsylvania, have invented certain new and useful Improvements in the Manufacture of Luminants for Electric Lamps, of which the following is a specification.

This invention relates to the manufacture of luminants for electric lamps made of very pure refractory metals, such as tungsten, titanium, zirconium, &c., or alloys of two or more of such metals, or of pure chromium, molybdenum, thorium, manganese, or alloys of such metals.

My luminants have properties heretofore unattainable, such as being ductile and capable of standing a much higher temperature than any form of carbon or the carbids of such metals and are more efficient than any hitherto-known metallic filaments. They can withstand a much higher temperature and also convert the heat into light-waves, and thereby have the properties of selective radiation. I utilize these metals or osmium, cerium, niobium, tantalium, and vanadium or boron and silicon either singly or mixed in a powdered form, as some of these powdered metals can be obtained by known processes more or less pure, or I can employ the pure oxids, hydrids, nitrids, or metals in a very fine powder or in a colloidal state of the oxid or colloidal suspension of the pure metal and with the dry powder use a lubricant or binder, such as water or paraffin, to form or shape them. They are then baked in an oven to drive out the paraffin or water, and in case the oxid is used the filament is reduced in pure hydrogen by external heat to the metal. The preliminary baking does not oxidize the metal, but merely strengthens it, and during this operation the binder is dissipated, leaving the filament formed of a refractory substance, strong, durable, and of good conductivity. The body is now heated by an electric current in a vacuum to drive out the hydrogen and to sinter or alloy the particles. If the filament is too large or rough, it may be rolled or drawn to the desired shape.

This application is a division of my previous application, filed December 29, 1904, Serial No. 238,769, and is directed particularly to the production of an alloy of tungsten and titanium or an alloy of tungsten with some other metal.

It is well known in the art that when two metals in a finely-divided condition are mixed with each other and heated under certain conditions they form alloys, and it is also believed by some that alloys generally melt at a lower temperature than either of the component metals; but I have discovered that certain alloys of these above-mentioned metals in various proportions are very stable at high temperatures and appear to have the properties of selective radiation in a vacuum. The resistivity, flexibility, strength, and shiny surface of these alloys can be regulated by the proportions of the constituents and by certain manipulation.

As an illustration of a suitable process finely-powdered pure titanium nitrid, which may be made by passing pure ammonia-gas over heated pure titanium dioxid, is mixed with an equal volume of pure tungsten trioxid, which is also finely powdered and squirted through a suitable die, there being added a small amount of paraffin or water to act as a lubricant, and the filament is then baked to drive out the lubricant. The filament is now heated by external heat, such as a gas-flame, in a porcelain tube, through which an abundant supply of pure hydrogen is flowing for several hours, and the tungsten trioxid is by this treatment reduced to the metal, which remains mixed with the titanium nitrid. The filament, after cooling, is removed from the tube through which the hydrogen is passing and mounted on the stem of the lamp. The bulb of the lamp is now exhausted and the filament is glowed at a bright temperature, care being taken that no vaporized oil arises from the pump into the bulb in order to prevent the formation of a carbid. By the action of the electrical current, which produces a very high temperature, the titanium nitrid is dissociated and the nitrogen is pumped off while the titanium alloys with the tungsten. The filament shrinks both in cross-section and in length, and there results a dense shiny durable alloy filament of pure titanium and tungsten.

Another method consists of mixing titanium dioxid with tungsten trioxid and forming the mass into filaments by squirting through a die, there being added a small

amount of water or paraffin, then driving out the water or paraffin by gently heating, and then reducing the filament, which now is composed exclusively of the two oxids mentioned in the tube by hydrogen, whereby the tungsten trioxid is reduced to metal and the titanium is either converted into the metal or the suboxid, or a mixture of the two, and then the filament is treated in a vacuum by an electric current, as above specified for the nitrid and metal filament.

Various other proportions of the ingredients may be employed, and I have found that excellent results may be obtained by using in place of the tungsten trioxid pure finely-divided tungsten up to as high as ninety-five per cent. mixed with five per cent. of titanium powder or powdered titanium nitrid, or mixed with other refractory metal or metallic substance. The conductivity, strength, and efficiency vary with the alloys of different metals, and good results may be obtained with a comparatively large percentage of tungsten alloyed with any of the above-named metals.

Having thus described the nature and object of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A filament for incandescent lamps consisting exclusively of a metallic alloy of tungsten and titanium in a dense shiny coherent state and homogeneous throughout.

2. A filament for electric incandescent lamps comprising an alloy of tungsten and a metal which is stable and capable of being incandescent at a temperature at which platinum volatilizes, said filament having a high point of fusion and being electrically conductive, and being stable at an efficiency at which a carbon filament, or a filament containing metallic oxid will rapidly disintegrate, and being dense and homogeneous and having a shiny metallic surface.

3. The process which consists of forming a filament composed exclusively of a compound of tungsten and a compound of titanium and reducing both compounds to their respective pure metals, removing the non-metallic component elements and alloying said pure metals, and shrinking said filament into a dense homogeneous shiny metallic alloy filament.

JOHN ALLEN HEANY.

Witnesses:
HENRY E. EVERDING,
ROY C. MINGLE.

Order of Cancelation of Letters Patent No. 839,585.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., *September 18, 1912.*

By a decree of the United States District Court for the Eastern District of Pennsylvania, a copy of which decree is recorded in Liber G 90, page 94 of the Assignment Records of the United States Patent Office, patent No. 839,585, granted to John Allen Heany, was canceled.

EDWARD B. MOORE,
Commissioner.

(*Official Gazette*, September 24, 1912.)

amount of water or paraffin, then driving out the water or paraffin by gently heating, and then reducing the filament, which now is composed exclusively of the two oxids mentioned in the tube by hydrogen, whereby the tungsten trioxid is reduced to metal and the titanium is either converted into the metal or the suboxid, or a mixture of the two, and then the filament is treated in a vacuum by an electric current, as above specified for the nitrid and metal filament.

Various other proportions of the ingredients may be employed, and I have found that excellent results may be obtained by using in place of the tungsten trioxid pure finely-divided tungsten up to as high as ninety-five per cent. mixed with five per cent. of titanium powder or powdered titanium nitrid, or mixed with other refractory metal or metallic substance. The conductivity, strength, and efficiency vary with the alloys of different metals, and good results may be obtained with a comparatively large percentage of tungsten alloyed with any of the above-named metals.

Having thus described the nature and object of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A filament for incandescent lamps consisting exclusively of a metallic alloy of tungsten and titanium in a dense shiny coherent state and homogeneous throughout.

2. A filament for electric incandescent lamps comprising an alloy of tungsten and a metal which is stable and capable of being incandescent at a temperature at which platinum volatilizes, said filament having a high point of fusion and being electrically conductive, and being stable at an efficiency at which a carbon filament, or a filament containing metallic oxid will rapidly disintegrate, and being dense and homogeneous and having a shiny metallic surface.

3. The process which consists of forming a filament composed exclusively of a compound of tungsten and a compound of titanium and reducing both compounds to their respective pure metals, removing the non-metallic component elements and alloying said pure metals, and shrinking said filament into a dense homogeneous shiny metallic alloy filament.

JOHN ALLEN HEANY.

Witnesses:
HENRY E. EVERDING,
ROY C. MINGLE.

Order of Cancelation of Letters Patent No. 839,585.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., *September 18, 1912.*

By a decree of the United States District Court for the Eastern District of Pennsylvania, a copy of which decree is recorded in Liber G 90, page 94 of the Assignment Records of the United States Patent Office, patent No. 839,585, granted to John Allen Heany, was canceled.

EDWARD B. MOORE,
Commissioner.

(*Official Gazette*, September 24, 1912.)

Order of Cancelation of Letters Patent No. 839,585.

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., *September 18, 1912.*

By a decree of the United States District Court for the Eastern District of Pennsylvania, a copy of which decree is recorded in Liber G 90, page 94 of the Assignment Records of the United States Patent Office, patent No. 839,585, granted to John Allen Heany, was canceled.

EDWARD B. MOORE,
Commissioner.

(*Official Gazette*, September 24, 1912.)