

UNITED STATES PATENT OFFICE.

HANS KUŽEL, OF BADEN, NEAR VIENNA, AUSTRIA-HUNGARY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PROCESS OF MANUFACTURING INCANDESCENT-LAMP FILAMENTS.

1,030,666.

Specification of Letters Patent.

Patented June 25, 1912.

No Drawing. Application filed December 15, 1905, Serial No. 291,909. Renewed March 19, 1912. Serial No. 684,813.

To all whom it may concern:

Be it known that I, HANS KUŽEL, a subject of the Emperor of Germany, residing at Baden, near Vienna, Empire of Austria-Hungary, have invented an Improved Process of Manufacturing Incandescent-Lamp Filaments, of which the following is a full, clear, and exact description.

My invention relates to a process of manufacturing electric incandescent lamps.

The object of my invention is to produce such filaments of refractory metalloids other than carbon, viz: boron or silicon or both, with or without the addition of metals melting at very high temperatures such as chromium, manganese, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, titanium, thorium, zirconium, platinum, osmium and iridium, but without using any agglomerant and more particularly any organic carbonaceous agglomerant. In some cases I incorporate into the filaments nitrogen compounds of the said metalloids.

In carrying out my invention I proceed as follows:—I take the metalloid or a mixture of metalloids to be used, viz. boron or silicon, in the colloidal state, and I add thereto, if desired, one or more of the above named metals melting at very high temperatures, in the colloidal state, and further, if desired, one or more of the said metalloids or metals in a finely powdered solid state, but without the addition of any agglomerant, and then I bring the whole into the form of a plastic mass, by removing from the colloid or colloids used such of their imbibition liquid as may be required, by any of the known methods. When mixtures of colloids or of colloids and dry powders have to be used, I first mix the colloids while in a state of solution, for instance the dissolved sols, and I uniformly suspend in such mixture the powders, if any are to be used, and then the colloids are thickened by evaporation or gelatinized by heat or all are precipitated by electrolytes, whereby an intimate mixture of the constituents is insured and the plastic mass above referred to is obtained. To the colloids of the said metalloids I add in some cases the nitrogen compounds of the said metalloids in a colloidal state or I may add such nitrogen compounds in dry pulverulent state to the

said colloids, preferably in the manner above set forth. I then bring the plastic mass thus obtained into the desired shape of threads by any known or preferred method, and then dry such threads and finally heat them to a white heat in the absence of gases capable of attacking the constituents used, for instance *in vacuo* or in an inert gas, such as hydrogen. By such heating, the substance of the threads is re-converted into the ordinary or crystalline state, with the result that filaments ready for use are obtained, which consist of the constituent elements of the plastic masses used, the electric resistance of those filaments being higher than that of metal filaments.

The filaments obtained by this process have a remarkable tensile strength and are homogeneous throughout and elastic, the same as the filaments described in my prior application of January 5th, 1905, Serial No. 239,637. No agglomerants, and particularly no carbonaceous agglomerants having been made use of, the production of carbids is avoided, which might at a red or white heat enter into reaction with the nitrogen compounds used, evolving nitrogen and cyanogen, whereby the resistance of the filaments would be gradually diminished and pressure would be gradually set up in the bulb originally evacuated.

A preferable method of heating, by which the dried threads made of the plastic masses above referred to are reconverted into the ordinary or crystalline state, consists in heating such threads to more than 60° centigrade to render them conductive, and then heating them gradually to a higher temperature by passing through them an electric current in the absence of gases, which attack the substance, preferably *in vacuo*, and finally heating them to a white heat.

I do not claim in this case incandescent lamp filaments consisting of tungsten with a refractory metalloid or specifically, silicon, for they form the subject of my application Serial No. 296,885.

I do not claim in this case broadly the colloidal process of making incandescent lamp filaments, as that forms a subject of my application for patent above mentioned, Serial No. 239,637, but

I claim as my invention:

1. A process of manufacturing an incan-

- descent lamp filament, consisting in making a mixture of colloidal material with material in a finely powdered state, the mixture containing a described metalloid, working the mixture into a plastic mass, bringing the mass to the desired wire-like shape, drying the latter and heating it to a white heat in the absence of gases capable of attacking the same.
2. A process of manufacturing an incandescent lamp filament, consisting in making a mixture of colloidal material with material in a finely powdered state, the mixture containing a described metalloid and a nitrogen compound as described, working the mixture into a plastic mass, bringing the mass to the desired wire-like shape, drying the latter and heating it to a white heat in the absence of gases capable of attacking the same.
3. A process of manufacturing an incandescent lamp filament, consisting in making a mixture of colloidal material with material in a finely powdered state, the mixture

containing the described two metalloids, working the mixture into a plastic mass, bringing the mass to the desired wire-like shape, drying the latter and heating it to a white heat in the absence of gases capable of attacking the same.

4. A process of manufacturing an incandescent lamp filament, consisting in making a mixture of colloidal material with material in a finely powdered state, the mixture containing a described metalloid and a metal melting at a very high temperature, working the mixture into a plastic mass, bringing the mass to the desired wire-like shape, drying the latter and heating it to a white heat in the absence of gases capable of attacking the same.

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

HANS KUŽEL.

Witnesses:

T. GEORGE HARDY,
ALVESTO S. HOGUE.