UNITED STATES PATENT OFFICE.

JOHANNES SCHILLING, OF HALENSEE, NEAR BERLIN, GERMANY.

FILAMENT FOR ELECTRIC INCANDESCENT LAMPS.

No. 917,159. Specification of Letters Patent. Patented April 6, 1909.

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To all whom it may concern:

Be it known that I, JOHANNES SCHILLING, a subject of the King of Prussia, and resident of Halensee, near Berlin, Kingdom of Prussia, Germany, have invented new and useful Improvements in the Manufacture of Filaments for Electric Incandescent Lamps, of which the following is a full, clear, and exact description.

This invention relates to the production of metallic filaments for incandescent electric lamps. In manufacturing such filaments an illuminant in the form of a highly refractory metal or metal oxid in the powdered state is mixed with a binding agent to form a paste. By the well-known squirting process this paste is then formed into filaments. After drying and hardening the filaments are heated in presence of hydrogen or some such reducing agent to drive off the binding agent. Driving off the binding agent in this way is apt to produce a brittle filament owing to the molecular structure of the filaments so formed.

According to the present invention a binding agent is employed in which the constituents are easily volatilized off or driven off by heating. This binding agent is sulfid of ammonia, the ordinary sulfid of ammonia of commerce being available.

In carrying the invention into effect the refractory metals such as niobium, tantalum, molybdenum, tungsten, uranium, titanium, thorium and zirconium or their oxids in the powdered state are mixed with a solution of sulfid of ammonia; a 10% solution may be used and the mixture may be in the proportion of 70 parts by weight of the powdered metal or metal oxid to 30 parts by weight of the solution. The object is in any case to produce a paste which (by the well known process) may be squirted into filaments of the desired diameter. In practice for incandescent lamps a filament having a diameter of $\frac{1}{100}$ of a millimeter when squirted suffices. Trials made with this filament after squirting have shown that the squirted filament is only slightly inferior in conductivity to the pure metal which has been employed in its manufacture. A current of about 220 volts is then led through the filament in the squirted state and the filament is in this way rendered incandescent so that the volatile constituents of the sulfid of ammonia, which as is well known is very easily decomposed by heat, are soon driven off and the sulfur compounds formed when the current is first passed through are also driven off. The sulfid of ammonia used for mechanically holding the powdered metal or metal oxid together, is therefore completely driven off by mere application of heat without the presence of a reducing agent. The remaining metallic particles are by the heat welded together to form the metallic filament.

If desired the process described above may be altered as regards the preparation of the pasty mixture. Thus there may be employed for the mixture, in addition to the pulverized metal or metal oxid and to the sulfid of ammonia solution a conductor of the second class, that is to say, a conductor whose coefficient of conductivity increases when the temperature is increased, or in other words, a conductor having a negative temperature coefficient; such conductors are for example, magnesium oxid, zirconium oxid, and thorium oxid. These conductors of the second class are of course also added in the state of a powder. The proportions for a suitable mixture are 90 parts by weight of the highly refractory metal powder to 10 parts of the conductor of the second class also in powdered form.

Whether the powdered illuminant consists exclusively of metals of the class specified, such as tungsten, or whether such powdered illuminant consists of a mixture of said metals and of conductors having a negative temperature coefficient, the generic feature of my invention is the same, to wit; the treatment of the powdered illuminant with a solution of sulfid of ammonia.

I claim:—

1. A process for producing a metallic filament for electric incandescent lamps and the like which consists in mixing a finely powdered illuminant with a solution of sulfid of ammonia as a binding agent and so as to form a paste, forming said paste into a filament and heating said filament to drive off the constituents of the binding agent.

2. A process for producing a metallic filament consisting in mixing a finely powdered

refractory body and a finely powdered conductor having a negative temperature coefficient with a solution of sulfid of ammonia so as to form a paste, forming said paste into a filament and passing a current gradually through said filament to drive off the constituents of the sulfid of ammonia.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHANNES SCHILLING.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.