UNITED STATES PATENT OFFICE.

ISIDOR KITSEE, OF PHILADELPHIA, PENNSYLVANIA.

METALLIC FILAMENT.

971,385. Specification of Letters Patent. Patented Sept. 27, 1910.

No Drawing. Application filed August 10, 1910. Serial No. 576,467.

To all whom it may concern:

Be it known that I, ISIDOR KITSEE, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Metallic Filaments, of which the following is a specification.

My invention relates to an improvement in metallic filaments.

The invention is applicable to filaments of different metals, but its advantages are more apparent when one of the so-called rare or refractory metals is employed. Of the refractory metals, tungsten, tantalum, vanadium, etc., may be used, but I will describe this, my invention, as applied to the refractory metal "tungsten."

As the first step to produce a filament according to my invention, I require that the metal should be converted into a compound of metal, and of all the compounds of metal, I prefer that the metallic particles should be converted into "phosphide." To produce the phosphide of one of the rare metals, such as tungsten, it is best that the metallic particles are heated in a crucible and then the phosphorus added in small quantities, but sufficiently to combine with the tungsten after the temperature is raised and form a phosphide. The crucible is, during this process, closed with the exception of those parts which have to be left open for the purpose of receiving the phosphorus.

After the phosphide is produced, I prefer that the different particles of this phosphide should be melted over in a crucible so as to form one solid mass; and as these phosphides are generally produced in small quantities at a time, it is best to assemble the products of these successive operations and produce therefrom with the aid of heat one ingot consisting of the phosphide of this metal. As the phosphide of—for instance—tungsten is comparatively easily fusible, the combining of the different particles of phosphide into one ingot is easily accomplished. The phosphide ingot is then made the cathode in an electrolytic apparatus through which current of electricity is sent whereby the phosphide is reconverted into the metallic state and the metallic ingot—more or less porous—remains after all the phosphorus is taken out by this electric process.

In practice, it is desirable that the phosphide ingot should be in intimate contact with a good conductor and for this reason, I introduce into the molten phosphide a conducting rod preferably formed of platinum and this platinum rod or wire should be used in the later electrolytic process as the conductor to convey the current to the phosphide electrode.

When all the phosphorus is taken out of the ingot and the ingot is converted to its metallic state, then it is subjected to a temperature high enough to produce—as is technically called—a "white" heat, but not high enough to produce an oxidation, and I have found that for this purpose the oxy-hydrogen "blow pipe" is well adapted. I would warn against the employment of any of the gaseous materials which carry with them atoms of carbon, as otherwise the metal may be contaminated and the produced filament not be as pure as required. During the time that this ingot is heated to a degree so as to "glow" or nearly glow, it is subjected to a mechanical stress with the aid of hammering and rolling, thus for two purposes:—first, to compact the porous metal; and, second, to make the mass more homogeneous and ductible. It is best to repeat this process, *i. e.* to allow, after hammering or compressing, the ingot to slowly cool and to subject the same again to hammering or rolling. When the required tenacity is reached, the ingot is hammered in a manner so as to produce a long drawn out rod. This rod, after it is cooled, is again subjected to heat but not as high a temperature as the former heat, and during the time that this rod is at a high temperature, it is subjected to the drawing out process with the aid of well known devices until the rod is drawn into a wire of the required thickness. A wire, so produced, has a ductility not present in any of the metallic filaments as produced today. This wire can be formed in the shape of a filament and then used in the same manner as carbon or metallic filaments are used today.

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

1. The process of producing a metallic filament, which consists in first converting the metallic particles into an ingot consisting of the metallic compound, then reconverting the ingot into metallic state; then subjecting the metallic ingot to pressure of

hammering and rolling during the time that said ingot is at the high temperature; repeating this process and finally drawing out the ingot into desired wire at a temperature lower than the former temperature.

2. The process of producing metallic filaments, which consists in first producing an ingot of the phosphide of the metal out of which the filament should consist, then converting said phosphide ingot into a porous metallic ingot; then subjecting said ingot to a high temperature and to mechanical stress during said temperature and finally drawing out the compacted metal into a wire of desired thickness.

3. In the production of metallic filaments, the following steps:—first, producing a compound of the metal out of which said filament should consist; second, reducing said compound of metal to metallic state; third, heating said converted metal and subjecting the same to mechanical stress during the period of heating; fourth, drawing out the metal into the desired thickness during the time that said metal is subjected to a temperature higher than the normal.

4. In the production of metallic filaments, the process, which consists, in first producing an ingot of the phosphide of the metal out of which said filament should consist; in, second, converting said phosphide into the metallic state with the aid of electrolysis; third, subjecting simultaneously the reconverted metal to heat and mechanical stress; and fourth, drawing out said metal to a wire of required thickness at a temperature higher than normal.

5. The process of producing a metallic filament which consists in first producing an ingot of the compound of the metal out of which the filament should consist, then converting said compound ingot into a porous metallic ingot, then subjecting said metallic ingot simultaneously to a high temperature and a mechanical stress and finally drawing the compacted metal into a wire of the desired thickness.

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

ISIDOR KITSEE.

Witnesses:
MARY C. SMITH,
ALVAH RITTENHOUSE.