UNITED STATES PATENT OFFICE.

OSKAR KNÖFLER, OF CHARLOTTENBURG, GERMANY.

GAS-INCANDESCENT.

SPECIFICATION forming part of Letters Patent No. 593,106, dated November 2, 1897.

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To all whom it may concern:

Be it known that I, OSKAR KNÖFLER, of Charlottenburg, Prussia, Germany, have invented new and useful Improvements in the Manufacture of Gas-Incandescents, of which the following is a full, clear, and exact description.

My invention relates to the manufacture of gas-incandescents such as are used in the Auer von Welsbach lamps. These lamps are provided with refractory bodies or "mantles" adapted to produce light by incandescence, and it is required of these mantles that they should combine a maximum of surface with a minimum of weight. The process which hitherto has been employed almost exclusively for the manufacture of such incandescents or refractory mantles is that described by Auer von Welsbach in his Patents No. 409,531, dated August 20, 1889, and No. 399,174, dated March 5, 1889. According to this usual process porous fibers or threads of a combustible material, such as cotton, &c., being ordinarily in the form of a hose-like tissue, are impregnated with solutions or emulsions of suitable metallic oxids or salts, particularly oxids or salts of the so-called "metals" of the rare earths. The fibers are then dried and burned, the earths remaining as a continuous body, whose shape is the same as that of the original cotton tissue. It has been found in practice that mantles of sufficient strength will be obtained only when solutions of the above-named salts are employed. The cotton threads which are employed exclusively in practice as a temporary support for the salts consist of short fibers twisted together, and since the texture of the finished mantle closely resembles that of the cotton support it follows that the said mantle consists of crossed threads connected to each other merely by being twisted together. It will therefore be apparent that considerable improvement would be effected as to strength and durability of the mantles by producing threads having incorporated therewith a substance or salt which is to be brought to incandescence. This I have accomplished in the following manner: It is well known that Chardonnet recently has indicated a process whereby threads and textile fabrics may be produced from inorganic cellulose—that is, from collodion—whereas previously such threads or fabrics have been made only from organic, vegetable, or animal fibers. Chardonnet produced artificial silk by forcing a highly-concentrated solution of collodion out of capillary tubes, so as to form threads of the said solution. These threads he allows to pass through water, whereby the alcohol and ether are extracted and the thread is "fixed." The thread can then be spooled directly without any danger of the threads sticking together.

My improved process for the manufacture of gas-incandescents is somewhat similar to the above process. I employ a collodion solution, to which, however, I add the appropriate salts, preferably dissolved in alcohol, these salts, as will be well understood, containing the oxids or salts which later on constitute the refractory mantle. Compounds which are not soluble in alcohol may be mixed with the collodion in a state of fine division, thereby forming a kind of emulsion. To this emulsion or mixture of collodion with an inorganic substance may be added, if required, organic substances, either solid or dissolved, such as sugar, camphor, and the like. The mixture is forced out of capillary tubes either by pressure or by creating a suction at the outlets of the tubes, and the threads which are produced by this operation are either dried in warm air or fixed by passing them through water. I may also employ as a fixing liquid petroleum-ether, benzol, toluol, sulfureted carbon, or, in general, liquids having the property of extracting or dissolving the alcohol and ether without dissolving the inorganic salts contained in the threads. In this manner I obtain threads which can be spooled, spun, or woven without further preparation.

It will be obvious that fixing with water is the simplest and cheapest method. In order to prevent the solution of the salts from being washed out from the threads, I add to the fixing-water an alkali, preferably aqua-ammonia, these substances forming a coating of hydrated oxid on the threads and thereby strengthening them. These threads or textile fabrics made therefrom are very readily combustible unless organic substances, such as camphor or sugar and the like, have been added thereto, and for this reason there is

some difficulty in obtaining satisfactory durable mantles. In order to avoid this, it is necessary to denitrate the threads prior to combustion. The usual denitrating agents which are employed in an aqueous solution are not readily available in the present case, since the water would also extract a part of the inorganic salts incorporated with the thread. This difficulty may be overcome by adding to the fixing solution (benzin, benzol, &c.) a small quantity of formaldehyde, (hydroxylamin,) sulfureted ammonium, and the like, so that fixing and denitrating will be accomplished simultaneously. It is, however, preferable to provide for a prolonged action of the denitrating liquid and to leave the threads in the denitrating liquid for the appropriate length of time either in their original condition or after they have been spun or woven. I have found that the best results are obtained by performing the denitration subsequently with the aid of sulfureted alkalies, particularly sulfureted ammonium dissolved in water or in diluted alcohol, the latter being preferable. Even threads of comparatively considerable thickness can be completely denitrated with this solution within a half-hour.

The mantles constructed out of such denitrated artificial threads or tissues offer many advantages over the usual ones. They are exceedingly strong and durable, and the threads are more flexible than those used ordinarily, so that it is easier to give the mantle any shape desired. Another advantage is that they do not contain inorganic substances liable to impair the power of light emission, as in the mantles manufactured according to the Welsbach method.

I have found that cotton mantles made according to the Welsbach process, even when they are washed with muriatic acid, contain about one-half per cent. of ashes before they are impregnated, these substances diminishing the illuminating power of the mantle and, moreover, impairing its stability. The radical difference between my process and that of Welsbach will be apparent. Welsbach employs threads or fabrics made of natural fibrous materials and impregnates them with the inorganic refractory substances, whereas I produce artificial threads from a mass which contains the appropriate salts or substances incorporated therewith. The threads employed or produced by me contain no organized matter, and these threads I employ for spinning or weaving the mantles therefrom.

As an inorganic salt to be added to the collodion I may employ any soluble or insoluble salt which upon combustion of the threads will leave an oxid of sufficient refractory qualities which will not be volatile and which will emit a powerful light when incandescent. The most durable threads are produced by the employment of salts soluble in alcohol, and particularly nitrates, such as nitrate of thorium. I have also employed the mixture of collodion and an appropriate salt to produce a refractory oxid for the production of mantles in other shapes than that of threads or tissues. In this case the addition of camphor is of advantage. I have found, however, that these bodies will undergo a considerable change of formation by combustion and will not yield continuous mantles of equal quality to those made out of threads.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The process of obtaining threads of collodion for incandescent lighting, consisting in making a nitrocellulose or guncotton solution, adding thereto rare metal earth, and eliminating the solvent of the solution by an alkaline agent substantially as described.

2. The herein-described method of producing gas-incandescents, which consists in fixing the threads by water to which has been added a substance, preferably an alkali, producing with the salts contained in the threads, an insoluble compound, and thereby at the same time strengthening the threads, substantially as described.

3. The herein-described method of producing gas-incandescents, which consists in mixing a solution containing collodion with appropriate substances to produce incandescent refractory bodies, and then fixing the product obtained by passing it through a liquid such as benzin, benzol or the like, which is a solvent for alcohol and ether, but will not dissolve the salts or substances which are to form the refractory mantle, substantially as described.

4. The herein-described method of producing gas-incandescents, which consists in mixing a solution containing collodion with appropriate substances to produce incandescent refractory bodies, and then fixing the product thus obtained in a liquid consisting of a solvent for alcohol and ether, and a reducing agent for denitrating the product, substantially as described.

5. In a process of manufacturing gas-incandescents from a solution containing collodion mixed with suitable salts adapted to be converted into refractory oxids, the herein-described process of denitrating a solid body obtained from the said mixture, which consists in treating the said product with an alkaline-reducing agent such as sulfureted ammonium, substantially as described.

OSKAR KNÖFLER.

Witnesses:
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