UNITED STATES PATENT OFFICE.

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INCANDESCENT GAS-MANTLE AND ART OF MAKING SAME.

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To all whom it may concern:

Be it known that I, ALEXANDER P. WHITE, a citizen of the United States, residence and post-office address Caldwell, New Jersey, have invented certain new and useful Improvements in Incandescent Gas-Mantles and Art of Making Same, of which the following is a specification.

As is well known, these devices, composed of the salts of refractory earths, are suspended over the flame of a Bunsen gas burner, the heat of which causes them to incandesce and emit light.

My invention relates to a new method for the production of such mantles whereby I combine certain of the rare earth salts in such a manner that the resultant mantle is more durable than those made in the ordinary way. They are also of a high illuminating power and the tendency to shrink is practically eliminated.

The ordinary method of making gas mantles consists in impregnating a cotton web with a solution of thorium and cerium generally in the form of nitrates. After the webs are dried, the cotton thread is burned out, and the skeleton of oxids thus formed is shaped over a Bunsen flame and then prepared for the market, by being dipped into a collodion solution which forms a protecting coating.

A full and clear description of the manner of carrying out my invention is as follows: I take equal parts by weight of thorium nitrate and distilled water, and into the solution thus made (which is a fifty per cent. solution of thorium nitrate), I immerse a web of the well known form used in this art, but preferably one made by knitting threads of lustra-cellulose, commonly known as artificial silk. Cotton and ramie webs are also available but I prefer the lustra-cellulose, because this material leaves practically no residue upon being burned, in the process of forming the skeleton of the refractory earths. If lustra-cellulose be used, the web should remain in the solution at say 70° Fahrenheit, not less than fifteen minutes and preferably not more than thirty minutes. Upon being taken from the solution it is passed, after the manner of the cotton webs, through squeezing rolls of hard rubber or other suitable material, to press out the excess of solution, according to the desired weight of the mantle. I prefer when using lustra-cellulose to make the weight of the fifty per cent. solution held in each web, double the weight of the web so that upon drying out, the web will contain about equal quantity in weight of the salts and lustra-cellulose. In the case of cotton it is not important to so determine the quantity, and in either case the strength of the solution may be varied considerably. After the web is impregnated it is allowed to dry, the drying being accelerated if desired by placing the wet webs in a chamber in which the temperature is raised to not more than 160° Fahrenheit.

When dried I treat the web with hydrogen peroxid for the purpose of denitrating the thorium salts; for if the web be burned out while containing the nitrates, the resultant deflagration caused by the presence of the nitric acid injures the delicate skeleton fabric. If burned in this form while containing only thorium nitrate, the mantle would give practically no light, as pure thorium oxid which would result upon burning has alone little light emitting power and if the excitant be introduced before the treatment with the peroxid, the peroxid apparently carries away the excitant by solution, or destroys it as an excitant, and apparently leaving the thorium alone in a hydrated state. The excitant may be provided by dipping the web saturated with thorium nitrate in a solution of cerium nitrate or uranium nitrate and a good light may be so produced, but it will be found that the cerium or uranium nitrates when introduced in this manner, will pass away by volatilization after the mantle is burned in service for a few hours. The light giving power will steadily diminish until the mantle is practically valueless for light. According to my invention, however, the essential excitant is introduced by passing the web after the peroxid of hydrogen treatment, into a solution containing about one per cent. of uranium nitrate, or one and one half per cent. of cerium nitrate and five per cent. of nitrate of thorium. When the web is subsequently burned after drying, the resultant oxid will retain and hold the excitant in the mantle, thus providing the essential

light-giving combination. Of course other nitrates may be used in this step to provide an excitant without departing from the spirit of my invention. It will be seen that when the web reaches the burning off stage, it contains so small an amount of nitrate that the deflagration consequent upon burning out the threads is not violent enough to cause serious damage.

The percentage of the excitants may be varied as in the ordinary method of making incandescent mantle fluids. The proportion of the thorium nitrate may be varied also and, to a material degree, but, if the ordinary commercial nitrate, $Th(No_3)_4$ be used, I prefer to avoid a material increase in the proportion on account of the effect of the acid in the stronger solution, especially as some of the nitrate of thorium sold in the open market contains free nitric acid. Care should always be taken that there is no free nitric acid present. This can readily be done and very satisfactory results can be obtained by using a compound prepared by adding, when the nitrate is made, more hydrate of thorium than is sufficient to satisfy the nitric acid. In the preparation of this special compound, I note the quantity of the thorium hydrate required to satisfy a given quantity of nitric acid. I then dilute to 30 or 40 degrees (Baumé), and add to the nitrate fluid made by mixing the said hydrate with nitric acid, 10% more of the thorium hydrate, that is, 10% of the original quantity required to satisfy the acid. When the fluid is diluted as above, the second instalment of hydrate is quickly dissolved. Next the solution is diluted to the required density. When this special compound is used the webs burn out slowly and assume readily the desired form over the shaping flame and I prefer its use when the webs are to be retained for many hours after saturation.

It is very obvious that by the use of the above compound all danger of the presence of free nitric acid is removed, and that a solution of greater density can be used without evil effects from acid.

Especially in the case of mantles made with lustra cellulose the presence of the thorium nitrate in the solution employed for dipping the webs the second time to introduce the excitant serves another important purpose. When the thorium salt is denitrated by the peroxid of hydrogen, it will be found, after the cellulose threads are burned out, that the identity and original form of the many minute fibers that made up the threads are preserved in form to the extent that the individual minute fibers are reproduced in the skeleton of resultant oxid. This fact is very apparent if the structure thus formed by the oxid be examined through a magnifying glass, the many minute fibers will be seen twisted together. The lustra-cellulose leaves practically no residue upon burning and no welding effect takes place.

The fibers being twisted, make a very strong flexible fabric. The fabric is especially strong and flexible because the minute fibers are not welded or fluxed by residue from the silk as is the case when cotton is used, but are free to move in flexing. As desirable, however, as this state may be, the mantle if put on the market in this condition, has a serious drawback because when the mantle is dipped in a collodion or other suitable solution for the purpose of coating it for handling and transport, the coating solution engages the various minute fibers, causing them to fracture and break from the distorting and contracting action of the coating solution when drying, with the result that it is almost impossible to coat satisfactorily mantles so made. The application of the thorium solution in the second step corrects this fault by causing a welding effect to take place. It also provides a superficial coating which contributes to the protection from the injury from the collodion coating; and, although the mantle so treated may be less flexible, it is nevertheless more threads of either cotton or lustra-cellulose way described, and it is practically shrinkless and can be coated in a commercial way with almost any of the known coating solutions.

I have referred to the impregnating of knitted webs, but it is obvious that the threads of either cotton or lustra-cellulose may be treated in the new manner described before being knitted, and then knitted into the form necessary to produce the mantle, without departing from my invention.

What I claim is:

1. The improvement in the art of making gas mantles, which consists in impregnating a suitable fabric with a solution of thorium nitrate, treating the said impregnated fabric with hydrogen peroxid, then immersing the fabric so treated in a solution of thorium nitrate containing an excitant before burning out, for substantially the purposes described.

2. The improvement in the art of making gas mantles, which consists in impregnating the fabric with a thorium compound and subsequently acting on the compound with a hydrating agent, and before burning out further impregnating the fabric with a solution of a thorium salt containing another rare earth salt to act as an excitant.

3. As an article of manufacture, a web for making incandescent gas mantles, consisting

of threads containing denitrated salts of thorium, and coated with a thorium compound containing another salt to act as an excitant.

4. As an article of manufacture, a thread for making webs for the production of incandescent mantles containing denitrated salts of thorium, and coated with a thorium compound containing another salt to act as an excitant.

Signed this 8th day of May, 1907.

ALEXANDER P. WHITE.

Witnesses:
E. VAN ZANDT,
A. L. O'BRIEN.