UNITED STATES PATENT OFFICE.

CHARLES CLAMOND, OF PARIS, FRANCE.

REFRACTORY MANTLE AND PROCESS OF MAKING SAME.

SPECIFICATION forming part of Letters Patent No. 684,192, dated October 8, 1901.

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To all whom it may concern:

Be it known that I, CHARLES CLAMOND, a citizen of the Republic of France, and a resident of Paris, France, have invented certain new and useful Improvements in Refractory Mantles and in the Process of Making the Same, of which the following is a specification.

My invention has reference to improvements in refractory mantles for incandescent gas-lighting and to the process of making the same, the object being to improve the mantle in several important particulars.

Modern refractory mantles for incandescent gas-lighting are ordinarily made by impregnating a cotton fabric with oxid of thorium, to which a small percentage of an excitant, oxid of cerium, is added. The fabric is then burned away and there is left behind a skeleton of oxid of thorium, with a slight admixture of oxid of cerium. This skeleton is then formed and seasoned by the action thereon of a blowing Bunsen flame. The mantle thus obtained is characterized by extreme fragility when cold, due to the lack of cohesion of the particles of which it is composed, so that the mantle is liable to break under the faintest mechanical impact, such as drafts of air, vibrations of the fixture on which it is mounted, and the like. In addition to this extreme fragility when cold the ordinary modern mantle attains great flexibility when hot and incandescent—that is to say, it becomes soft and is liable to become irregularly deformed by its own weight. It has a tendency to collapse. Another defect of the ordinary incandescent mantle is that by continued use it shrinks in size, and thereby parts of it are withdrawn from the most favorable zone of the flame. In consequence thereof a considerable portion of the mantle does not exhibit the high degree of incandescence which it would if all its parts remained in the initial position relative to the most favorable zone of the flame. Finally, in the ordinary thorium mantle the excitant oxid, oxid of cerium, is progressively lost. It is driven off mechanically, and there being only a small percentage of it mixed with the thorium the light emitted by the mantle diminishes gradually and turns more and more greenish. It has been found that after one hundred hours of use the light is diminished by as much as thirty per cent. of the light emitted by the mantle when new.

My improved mantle is remarkably free of the defects of the thorium mantle above set forth. It is far stronger than the thorium mantle, so that it is not liable to be destroyed under conditions which prove fatal to the latter. It is not perceptibly softened by incandescence and retains its original regular shape; nor does it perceptibly shrink in size even after long-continued use.

The most valuable characteristic of my improved mantle, however, is that the excitant is not progressively lost, so that the light emitted after one thousand hours of continued use is not sensibly fainter than the light emitted when the mantle is new. In addition to all this the light emitted by my improved mantle is not greenish at any time, whether new or after hundreds and even a thousand hours of continued use. The light has a peculiarly pleasing golden hue, which it retains, so far as I can determine, indefinitely.

The advantages here enumerated I secure by making the skeleton of the incandescent mantle of a new substance which I have discovered—namely, of the double oxid of zinc and thorium—and as a means for rendering this refractory skeleton luminous I use any of the known excitants, such as cerium; but I may also use iron or others, either singly or combined. This double oxid of zinc and thorium is more refractory than thorium alone, and it is of course far more refractory than zinc alone; but while decidedly the best effects in accordance with my invention are produced when the refractory base of the mantle is wholly composed of the double oxid of zinc and thorium some of the advantages due to the use of this double oxid are also secured when the same is mixed with the oxid of thorium.

The mode of manufacturing my improved incandescent mantle is as follows: I prepare a bath consisting of a solution in water of a soluble salt of thorium and a soluble salt of zinc. Preferably, but not necessarily, the nitrates of thorium and zinc are used in such proportions that their oxids are in the proportion of their atomic weights—that is to say, 3.28 parts of oxid of thorium and one part of

oxid of zinc. To this solution is added as an excitant for the refractory mantle a small percentage of cerium salt or iron salt, or both, cerium and iron together being preferred. The cotton fabric which serves as the temporary support for the refractory body of the mantle is then dipped into the solution, so as to be thoroughly impregnated therewith, and is then dried and burned off in the usual and well-known manner. At the stage thus reached the zinc and thorium oxids are merely mixed on the mantle and are not chemically combined. To effect the chemical combination—namely, the production of the double oxid of zinc-thorium—the mantle is exposed to the action of an oxidizing-flame, and under the influence of the same the thorium and zinc gradually enter into chemical combination. The accomplishment of this chemical combination becomes evident at once by the high incandescence which the mantle assumes. Practically this process is performed by suspending the mantle-hood over a Bunsen flame, the reducing portion of which is marked by a central greenish cone, having its base at the burner-opening and the oxidizing portion of which is marked by the bluish rather colorless envelop. The hood is lowered down upon the flame until the oxidizing portion is within the hood. In this position the latter is left until the lower edge of the hood becomes brilliant and shining. Then the hood is lowered further down toward the burner, since now the reducing portion of the flame can do no harm to the part of the mantle which has already become luminous, this part having now been converted from a mere mixture of zinc oxid and thorium oxid into the new chemical compound, the double oxid of zinc and thorium. This conversion of the mixture into the chemical combination progresses upwardly, and after a little while the whole mantle is composed of this double oxid with the admixture of the excitant, cerium or iron, or both. If before the chemical combination is effected the mantle should be exposed to the reducing portion of the Bunsen flame, the oxid of zinc would be reduced to metallic zinc and the latter would be volatilized. Under the action of the oxidizing portion of the flame, however, the chemical combination of the two oxids is effected and the zinc cannot be driven off any more by the reducing portion of the flame. The mantle is then shaped into form by a blowing-flame in the well-known manner, this being known in the art as the "seasoning" process.

In manufacturing my mantle it is not necessary that the excitant be added to the impregnating-bath, since I have found that it is practicable to add this excitant by spraying it onto the mantle after the double oxid of zinc and thorium has been formed. It is, however, generally preferable to add the excitant to the original impregnating-bath.

It will be seen from the preceding description that one part of my invention consists of a refractory mantle for incandescent gas-lighting of which the double oxid of zinc and thorium is a constituent and which is excited by any of the known excitants—such as cerium or iron, or both. In its best form the refractory base of my improved mantle consists wholly of the double oxid of zinc and thorium; but the advantages of my invention are in a measure also secured by a mixture of the double oxid of zinc and thorium with the oxid of thorium. This means that it is not absolutely necessary that the impregnating-bath be prepared with the nitrates of zinc and thorium in proportion to their atomic weights. Deviations from this proportion are admissible—that is to say, I may use either zinc in excess or thorium in excess. In each case there will be formed under the effects of the oxidizing-flame the double oxid of zinc and thorium; but when the oxid of thorium is in excess there will result a mixture of oxid of thorium with the double oxid of zinc and thorium, while when oxid of zinc is in excess the fact that this excess is not reduced and driven off by the flame indicates that zinc and thorium may combine in different proportions.

When the oxids of zinc and thorium are used in proportion to their chemical equivalents, I have found that the percentage of cerium to be used varies with the degree of concentration of the impregnating fluid. With a concentrated fluid it may be as low as 0.4 per cent., while with a diluted fluid it may be above two per cent.

In the foregoing description I have spoken of the substance which results from the action of an oxidizing-flame upon the mixture of zinc oxid and thorium oxid as a chemical combination—namely, as a double oxid of zinc and thorium. Now, while I believe that in my process the oxids of zinc and thorium do actually combine chemically and form a double oxid, yet the scope of my invention is not dependent upon the correctness of my views. Consequently I wish it to be understood that in my appended claims the terms "double oxid of zinc and thorium" are used to designate the union of zinc oxid and thorium oxid irrespective of the true character of such union—that is to say, whether such union is a true chemical combination or is a union of another kind. It is the thing described which I designate by the terms "double oxid of zinc and thorium," and I do not undertake to circumscribe the scope of my invention by any theory.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. A refractory mantle for incandescent gas-lighting containing, as a constituent, the double oxid of zinc and thorium, and an excitant or excitants, substantially as described.

2. A refractory mantle for incandescent gas-

lighting containing, as a constituent, the double oxid of zinc and thorium, and oxid of cerium as an excitant, substantially as described.

3. A refractory mantle for incandescent gas-lighting containing, as a constituent, the double oxid of zinc and thorium, and the oxids of cerium and iron as excitants, substantially as described.

4. A refractory mantle for incandescent gas-lighting composed of the double oxid of zinc and thorium and an excitant or excitants, substantially as described.

5. A refractory mantle for incandescent gas-lighting composed of the double oxid of zinc and thorium and oxid of cerium as an excitant, substantially as described.

6. A refractory mantle for incandescent gas-lighting composed of the double oxid of zinc and thorium and the oxids of cerium and iron as excitants, substantially as described.

7. A refractory mantle for incandescent gas-lighting composed of a double oxid of zinc and thorium, with either of the two oxids in excess, and an excitant or excitants, substantially as described.

8. A refractory mantle for incandescent gas-lighting composed of a double oxid of zinc and thorium with either of the two oxids in excess, and the oxid of cerium as an excitant, substantially as described.

9. A refractory mantle for incandescent gas-lighting composed of a double oxid of zinc and thorium with either of the two oxids in excess, and the oxids of cerium and iron as excitants, substantially as described.

10. The process of making a refractory mantle for incandescent gas-lighting, which consists in subjecting a skeleton composed of oxid of zinc and oxid of thorium to the action of an oxidizing-flame, substantially as described.

11. The process of making refractory mantles for incandescent gas-lighting, which consists in placing a skeleton composed of oxid of zinc and oxid of thorium over a Bunsen flame and lowering the skeleton gradually in such manner that the oxidizing portion of the flame, to the exclusion of the reducing portion thereof, acts upon successive portions of the skeleton until these portions become brilliantly luminous, substantially as described.

12. The process of making refractory mantles for incandescent gas-lighting, which consists in impregnating a combustible mantle fabric with a solution of zinc thorium and cerium salts; then drying the mantle and burning off the combustible fabric, and then exposing the remaining skeleton to the action of an oxidizing-flame, substantially as described.

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

CHARLES CLAMOND.

Witnesses:
EDOUARD SUDEE,
EDWARD P. MACLEAN.