

UNITED STATES PATENT OFFICE.

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GAS-INCANDESCENT.

SPECIFICATION forming part of Letters Patent No. 409,528, dated August 20, 1889.

Application filed March 31, 1888. Serial No. 269,198. (No specimens.) Patented in France November 4, 1885, No. 172,064; in Belgium November 4, 1885, No. 70,739, and September 9, 1886, No. 74,502; in Italy February 23, 1886, XXXVIII, 310, and October 13, 1886, XL, 415; in England March 13, 1886, No. 3,592; in Austria-Hungary April 9, 1886, No. 44,989 and No. 5,176; in Sweden April 14, 1886, No. 687; in Germany April 29, 1886, No. 41,945; in Finland July 10, 1886, No. 261; in Norway August 25, 1886, No. 88; in Portugal April 6, 1887, No. 1,127, and in Russia December 31, 1887, No. 12,505.

To all whom it may concern:

Be it known that I, CARL AUER VON WELSBACH, a subject of the Emperor of Austria-Hungary, residing at Vienna, Austria-Hungary, have invented new and useful Improvements in Gas-Incandescents, (for which I have obtained Letters Patent in Great Britain, dated March 13, 1886, No. 3,592; Sweden, dated April 14, 1886, No. 687; Norway, dated August 25, 1886, No. 88; Finland, dated July 10, 1886, No. 261; France, by certificate of addition, dated April 22, 1886, No. 172,064; Belgium, by patent of addition, dated September 9, 1886, No. 74,502; Portugal, by patent dated April 6, 1887, No. 1,127; Russia, dated December 31, 1887, No. 12,505; Italy, by patent of addition, dated October 13, 1886, Vol. XL, No. 415; Germany, dated April 29, 1886, No. 41,945; Austria-Hungary, applied April 9, 1886, No. 44,989 and No. 5,176, granted March 28, 1888,) of which the following is a specification.

This invention relates to improvements in the manufacture of incandescent gas-lighting devices of the character set forth in Letters Patent No. 359,524, granted to me March 15, 1887, in which I have described an incandescing burner or mantle made of light network fabric or threads—such as cotton—impregnated with a solution of the salts of the rarer metals which produce earthy oxides, and then exposed to heat, so that the material of the foundation fabric will be consumed, leaving a skeleton hood, cap, or frame, consisting of the incombustible and infusible earthy oxides resulting from the decomposition of the salts employed for impregnating the fabric.

My present invention consists particularly in certain novel combinations of the rarer metals or refractory earths in the form of solutions of their salts, for the purpose of producing a brilliant white light by incandescence.

It is an important fact that the illuminating-power of the rarer metals or their earthy oxides is greatly increased by the addition of

thorium oxide. In the production of a white light the maximum degree of illumination is obtained by a mixture of thorium oxide, zirconium oxide, and lanthanum oxide. The white thorium oxide combines at the heat of incandescence with the white lanthanum oxide to form a body which, when cold, is of a dark-red brown color. In this combination the lanthanum oxide can no longer be distinguished by certain properties that otherwise characterize it. The incandescence body obtained is perfectly durable, while lanthanum oxide without sufficient addition of thorium oxide crumbles away after a few hours.

For the purpose of producing a white light I have found the following compounds to be very satisfactory.

1. Thorium oxide, (ThO_2) thirty per cent., zirconium oxide, (ZrO_2) thirty per cent., and lanthanum oxide, (La_2O_3) forty per cent. This mixture gives out a brilliant and intense white light, and a mantle or hood formed therefrom is pliable when incandescent.

2. Thorium oxide, forty per cent., lanthanum oxide, forty per cent., and magnesium oxide, (MgO) twenty per cent. This is also pliable when heated.

3. Thorium oxide, thirty per cent., zirconium oxide, thirty per cent., and yttrium oxide, (Y_2O_3) forty per cent. This body gives a yellowish-white light.

4. Thorium oxide, sixty per cent., and magnesium oxide, forty per cent. This body is pliable when incandescent.

5. Thorium oxide, sixty per cent., magnesium oxide, twenty per cent., and aluminium oxide, (Al_2O_3) twenty per cent. This body vitrifies more than the others, but is pliable when incandescent. It may be stated generally that magnesia and alumina compounds have not the same degree of durability which so greatly distinguishes the other compounds above named.

Some of the bodies above mentioned are more or less applicable in their natural combined condition, as in the earths. Yttrium, for instance, may be replaced by the ytterite

earths, (gadolinite.) Strictly speaking, pure yttrium oxide is not applicable to advantage for use in incandescence bodies, as only by the most careful treatment a small residue of 5 terbium oxide can be extracted from it. Foremost in the series of ytterite earths is scandium oxide, owing to the basic nature of certain compounds. Scandium oxide and zirconium oxide give a beautiful intense white 10 light, and the incandescent effect of this combination is considerably increased, in a similar manner to yttrium oxide, by the addition of thorium oxide. This is distinguished by extraordinary brilliancy and refractory prop- 15 erty. In the series of ytterite earths the compounds of terbium oxide are important on account of the frequency of their occurrence. Terbium oxide and zirconium oxide give a very intense and nearly white light. I will 20 here also mention samarium oxide, which stands between ytterite and cerite earths, to the latter of which belongs lanthanum. The combination of samarium oxide with zirconium oxide and thorium oxide gives an intense 25 white light. A less perfect white light may be produced by the use of thorium oxide alone, or a mixture of thorium oxide and lanthanum oxide. In these compounds named, from which zirconium is omitted, it will be 30 understood that thorium oxide can be partly replaced by zirconium oxide. With such bodies containing zirconium oxide the light is more of a whitish hue.

All the above-named bodies may be mixed 35 together in varying proportions, according to the brilliancy and color of light desired and the required durability of mantle to be made. There is practically no limit to the variations of proportions in which the above-named 40 bodies can be successfully employed together for incandescent purposes, and I therefore do not confine myself to any exact formula, though I prefer those above stated.

In preparing the impregnating solution or 45 solutions with which to saturate the mantle-forming fabric, I prefer to employ the selected minerals or metallic substances in the form of a nitrate or acetate of the oxides, though it is obvious that a number of different salts 50 may be employed. In fact any salt may be used in which the acid can be easily decom-

posed and driven off by heat. After the fabric has been thoroughly impregnated and dried and formed into the desired hood shape, it only remains to expose it to a sufficient de- 55 gree of heat to consume the foundation fabric, drive off the acid of the salt, and leave the mantle composed of earthy oxides only.

Owing to its incandescing and strengthening properties thorium is of great value in 60 the manufacture of the skeleton-like hood or mantle. By reason of the pliability of thorium oxide when hot a mantle made from a compound in which thorium is contained can be more readily manipulated and shaped dur- 65 ing the process of manufacture, and the mantle, when finished, is prevented from shrinking. Thorium, when used alone, is apt to render the mantle brittle, and it is therefore best to combine it with other refractory earths, 70 such as are herein named. Zirconium oxide is also pliant, though not to the same degree as thorium, and it does not become so incandescent. If used alone, it shrinks out of shape when exposed to intense heat. Lanthanum 75 oxide, while possessing very valuable incandescent properties, is not strong enough when used alone to make mantles. The value of zirconium and lanthanum is greatly increased by combining them with thorium oxide. 80 Yttrium oxide and other rare oxides, hereinbefore named, I employ principally to impart color to the light.

What I claim as my invention is—

1. An incandescent burner for gas, consist- 85 ing of a skeleton hood or frame composed of a compound containing thorium and zirconium, substantially as described.

2. An incandescent burner for gas, consist- 90 ing of a skeleton hood or frame composed of a compound containing thorium, zirconium, and lanthanum, substantially as described.

3. An incandescent burner for gas, consist- ing of a skeleton hood or frame composed of 95 a compound of thorium, zirconium, and an ytterite earth, substantially as described.

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

CARL AUER VON WELSBACH.

Witnesses:

FRED WILLIAMS,

EDMUND JUSSEN.