UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN CARBONS FOR ELECTRIC LIGHTS.

Specification forming part of Letters Patent No. **211,262**, dated January 7, 1879; application filed October 15, 1878.

To all whom it may concern:

Be it known that we, WILLIAM EDWARD SAWYER, of the city, county, and State of New York, and ALBON MAN, of Brooklyn, county of Kings, and State aforesaid, have jointly invented certain Improvements in Carbons for Electric Lights; and we do hereby declare the following to be a description of the same, and of the manner and process of making, constructing, and using them, in such full, clear, concise, and exact terms as will enable any person skilled in the arts or science to which it appertains, or with which it is most nearly connected, to make, construct, and use the same, reference being had to certain Letters Patent of the United States heretofore granted to us for certain inventions hereunto appertaining, and to which especial reference will hereinafter be made.

Our invention is, first, of a novel process of preparing the illuminating part of an electric lamp, consisting of electrically heating the same while it is surrounded by a carbon liquid; secondly, of a new article of manufacture, consisting of an improved illuminating-conductor for electric lamps, composed of consolidated carbon created by electric action; thirdly, of a novel process of preparing the illuminating part of an electric lamp, consisting of first heating the same by means of the electric current while immersed in a carbon liquid, and of subsequently, when the globe containing it is charged with nitrogen gas, and before the flow of such gas through the lamp has ceased, and before the lamp is finally sealed, heating its illuminating part by means of the electric current to drive out impurities or occluded gases.

In Letters Patent of the United States No. 205,144, granted to us, we have shown and described an electric lamp in which a pencil of carbon is heated to incandescence in a nitrogen or other carbon preservative atmosphere. One of the principal obstacles to successful electric lighting by incandescence is the dissociated character of nearly all obtainable carbon. In most of such carbon there is danger of fracture as well as of the establishment of the voltaic arc; and, furthermore, the carbon, unless specially prepared by our process, naturally occludes sufficient air or oxygen to render its consumption a mere question of time, since, as fully set forth in the Letters Patent referred to, the least quantity of oxygen in a sealed lamp is sufficient to combust an indefinite quantity of carbon.

As is well known, carbon suitable for electric lighting by the voltaic arc is naturally produced in gas-retorts; but generally the rods of carbon used in the "regulator-lamps," so called, are molded from the powdered material. Neither the one nor the other quality of carbon is suitable for electric lighting by incandescence. In both there is a lack of homogeneity. The pencil is not sufficiently hard and dense, because in the first place the heat required to produce the proper character of carbon is as high as 7,000° Fahrenheit, and such a temperature is not obtainable in the retort, and in the second place the mechanical subdivisions of the material and the pressure necessary to produce the perfect article are practically unattainable. Carbons of the ordinary sort, when heated by the electric current, exhibit points and lines of unequal brilliancy. Carbons prepared by our process, when so heated, glow with a uniform brilliancy throughout.

We have found that a pencil of carbon immersed in a hydrocarbon liquid, and heated to an extremely high temperature by the voltaic current, is not itself attacked, but decomposes the surrounding matter, the carbon of which enters and fills up its pores to an extent impossible except with matter in a very attenuated state, and deposits a perfectly-homogeneous layer, generally of a bright-gray color, upon the exterior surface. As the carbon increases in size more current is required to maintain its temperature, and if the current is gradually increased, in accordance with the demand for it, there is appearingly no limit to the increase in mass of the homogeneous exterior deposit. Carbon pencils may be cut from this deposit, or the original pencil with its coating may be used in the lamps.

In this process it would seem that the carbon is never in contact with the liquid in which it is immersed, but surrounded by a carbonic gas of a very high temperature.

Naphtha, turpentine, bees-wax, balsam, and most oils, if pure, operate satisfactorily. Almost any hydrocarbon, in fact, will answer.

We do not confine ourselves to the treat-

ment of carbon alone, since it is obvious that many infusible substances non-conductors of electricity may be heated in hydrocarbon liquids so as to render them conductors of electricity—as, for instance, a tube of lime inclosing a pencil of carbon, through which the electric current is caused to circulate.

In the Letters Patent hereinbefore referred to we have described a method of charging a sealed globe with pure nitrogen gas. We will suppose that the pencil of carbon, held between two carbon pieces of greater mass than that of the pencil, as shown in the said Letters Patent, is immersed in the hydrocarbon liquid and heated in the manner already described. Being then cleansed in alcohol, the pencil and its holders, without having been disturbed, are placed in the globe, in which they are to be hermetically sealed. The globe is charged with pure nitrogen, and then, while still allowing pure nitrogen to flow into and out of the globe, we heat the carbon to incandescence, thus driving out all impurities and occluded gases, which are carried out of the lamp by the current of nitrogen. With this operation the preparation of the carbon is completed, and the lamp, now being hermetically sealed, as described in the Letters Patent referred to, is ready for use.

In concluding this description we will point out that the preparation and treatment of the carbon must take place in carbon liquid before it is put in the lamp, for if the carbon pencil be put in the globe of the lamp and hydrocarbon gas be present, part of the deposit resulting from its decomposition adheres to the globe of the lamp, making it black, and if the process be long continued the globe becomes so thickly coated as to obstruct the light absolutely; and that part of the carbon deposited upon the pencil-burner, or part of it, at least, instead of uniting with, consolidating, and purifying the pencil, collects in a sooty mass around its upper part, like a "thief" on the wick of a tallow candle, the effect of which is to greatly impair the light and to practically destroy the lamp. The lamp becomes inoperative, also, for the additional reason that the carbon gas being deposited leaves the hydrogen, in which the pencil is soon consumed; but the carbon prepared by our process before it is put in the lamp does not blacken the inner surface of the globe of a lamp charged with nitrogen when heated by the current to drive out occult gases during the ingress and egress of the nitrogen, because in that case there is no carbon gas present, and, of course, no deposit; and we desire, also, to point out the fact that the consolidated homogeneous carbon of our invention may be produced by the electroplating process, as well as by the electrical heating of a conductor in a carbon gas or liquid. The cathode, composed either of solid carbon or of an infusible refractory substance, coated with plumbago or graphite, is immersed in a carbon liquid and connected with one pole of the battery. The other pole of the battery is connected with the anode, composed of solid carbon, also immersed in the liquid. The passage of the current decomposes the liquid and deposits a homogeneous layer of carbon upon the cathode.

We do not intend to lay any claim to the treatment of a carbon burner after it is made and placed in the globe or illuminating chamber of the lamp, nor as a mere incident of the operation of the lamp as a part of the invention making the subject-matter of this application. We disclaim the treatment of the carbon in that way; but

What we do claim herein as new, and desire to secure by Letters Patent, is—

1. The method of preparing carbon to be used in the production of electric light, consisting of electrically heating it while surrounded or saturated with or by a carbon liquid.

2. The herein-described method of preparing the illuminating part of an electric lamp, consisting in first obtaining a solid deposit of carbon by electric action before it is put in the lamp, as set forth, and subsequently, when the globe containing it is charged with nitrogen gas, before the flow of the nitrogen through the lamp has ceased, and before the lamp is finally sealed, heating the illuminating part by means of the electric current, in order to expel impurities and occluded gases.

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Witnesses:
AMOS BROADNAX,
THOMAS SAULT.