No. 649,551.

Patented May 15, 1900.

J. F. SANDERS.

CARBON FOR ELECTRIC LIGHTS.

(Application filed Oct. 14, 1897. Renewed Sept. 15, 1899.)

(No Model.)

Fig. 1.

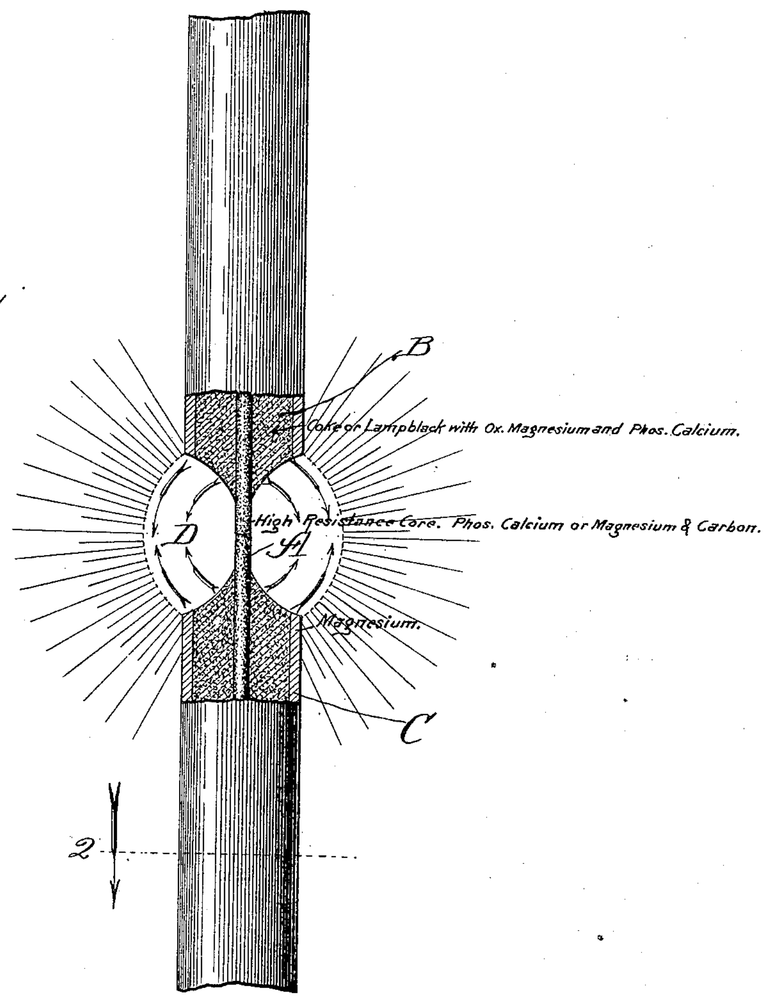
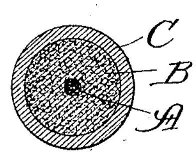


Fig. 2.



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UNITED STATES PATENT OFFICE.

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CARBON FOR ELECTRIC LIGHTS.

SPECIFICATION forming part of Letters Patent No. 649,551, dated May 15, 1900.

Application filed October 14, 1897. Renewed September 15, 1899. Serial No. 730,642. (No specimens.)

To all whom it may concern:

Be it known that I, JOHN F. SANDERS, a citizen of the United States, residing at Portland, Oregon, have invented certain new and useful Improvements in Carbons for Electric Lights, of which the following is a specification.

The object of my invention is to make carbons for electric lights which will give a steady, lasting, economical, and agreeable light with less electromotive power than is required in the existing systems of electric lighting and which will burn in end-to-end contact either with each other or with other carbons; and my invention consists in the features, details of construction, and methods of operation hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of my improved carbons with portions broken away at one side, and Fig. 2 a plan view of a transverse section taken in line 2 of Fig. 1.

For the purpose of giving an intelligible and complete understanding of my invention I have concluded to describe, in the first place, the method of constructing or forming the carbons, and, in the next place, the process and methods of their use.

In making my improved carbons I take coke, lampblack, or similar material, although I may say that I prefer to use lampblack made for the purpose. Where coke is used it should be as free as possible from the presence of silicates of lime, soda, or other substances, and where lampblack is used it should be as near as possible a perfect monoxid of carbon and well calcined before it is used. I mix with the pulverized coke, lampblack, or other material a salt of magnesium, preferably calcium oxid of magnesium, enough to constitute about one per cent. of the mass when completed. I also mix in a salt of calcium, preferably phosphate of calcium, about one per cent. The mass would thus constitute about ninety-eight per cent. of carbon, about one per cent. of the salt of magnesium, and about one per cent. of the salt of calcium. I then mix in some binding material, such as pitch, sugar, molasses, or other sticky material. The mass is then thoroughly mixed and subjected to a gentle heat to cause the parts to be thoroughly incorporated with each other. The mass on cooling constitutes a hard and brittle substance, so that it can be pulverized again. When so pulverized to a very fine powder, it is poured into hot molds, where it is subjected to a high degree of pressure and so shaped into sticks adapted for use as electric-light carbons. These sticks may be round, as illustrated in the drawings, or they may be in angular form, as square, hexagon, octagon, or other shape. While the mass is in the hot molds and under pressure the binding material becomes again soft and sticky, so as to cause the particles to adhere and remain in the shape and form into which they are pressed. After the carbons have become cool I take them and pack them into a crucible, where they are held in a vertical position by filling the interstices and the spaces between them and the crucible with pulverized coke, graphite, or similar material. The crucible is then covered with a lid, so as to exclude the air, and placed in a furnace and subjected to a gradually-increasing heat to expel any gases formed in the crucible. When this point has been reached, the furnace is permitted to cool off, and when sufficiently cool the crucible is removed and the carbons taken out.

I have found from experience that carbons thus prepared may be burned in end-to-end contact either on a direct or an alternating current. With an alternating current I have found that they give more light than on a direct current and without any noise or humming, as is the case with other carbons on an alternating current. I have found also that lamps provided with carbons made as above do not require the usual mechanism to regulate the arc and that they may therefore be made simpler, cheaper, and more durable than the lamps now in use. I have found, moreover, that carbons made as above explained require only about one-half of the electromotive force that is now required in arc-lights to produce a given amount of illumination. I have also found that in comparison with incandescent lights my carbons will give about twenty times more illumination with a given current. Moreover, I have found that the light produced by my carbons is absolutely steady so far as the eye can determine and more agreeable to the eye than any other artificial light employed at the present time.

The carbons as above made are especially applicable for use with the existing alternating electric currents. To make them equally applicable to the existing direct electric currents, so as to give them a wider range of use and utility, I provide the carbons with a core running longitudinally through the axial centers of the carbons. This core is made in such a manner and of such material that it will have a greater resistance than the surrounding body of the carbons. This resistance in the core may be produced by adding a nonconductor of the electric current—such, for example, as phosphate of magnesium, or calcium, or other suitable salts—to the lampblack or coke or material of which the core is made in such quantity as to produce the desired resistance. The core is preferably made in the same manner as I describe in reference to the carbons themselves. Where a core is intended to be used in the carbons, one half of the carbon may be molded first, with a groove or channel running longitudinally through it, into which the core may be then placed, and the other half of the carbon is then molded in the same mold and pressed onto the first half, so that the two halves, with the core running through the longitudinal center, will emerge from the mold in the form of a single solid carbon. After the carbons have thus been formed with the cores in them they are subjected to the same method of treatment as to placing them in crucibles and heating them as above described.

To describe the composition and characteristics of the carbon illustrated in the drawings, I may say that A represents the core of the carbon, B the body of the carbon, and C the coating of the carbon, formed of an illuminating metal, such as magnesium, calcium, bismuth, antimony, zinc, aluminium, nickel, &c., or an alloy of these metals or some of them. The coating is applied to the carbons by dipping them after they have been baked and while they are still warm into a benzin or other solution of magnesium, calcium, or other desired metallic carbonyl for a short time. In this manner the metal or alloy is separated from the solution and is deposited upon the outside of the carbons in a solid adhesive coating of any desired thickness; or, if preferred, the carbons may be exposed to the vapors or gases of such metallic carbonyls heated to, say, over 350° Fahrenheit, when the same deposition of metals takes place. It will be understood that the coating in whichever way applied is a good conductor of the electric current, besides being of an illuminating nature. In fact, by these coatings of magnesium or calcium metals or alloy of the same I produce a magnesium, calcium, or magnesio-calcium light in the electric light, but in a simpler, more efficient, and less expensive way than is done at the present time by burning the same metals in a hydroöxygen flame. The completed carbons will thus be formed of a core of material of poor conductivity, and the body of the carbons will be formed of a material of a greater conductivity, and the coating of the carbons will be formed of an illuminating metal of high conductivity.

In operation the carbons are arranged in place in an electric circuit, with the points of the cores preferably exposed in contact with each other, as shown in Fig. 1. The current of electricity must necessarily pass through the resistance-cores and cause them to become incandescent. As soon as incandescence is produced in the points of the cores there takes place certain chemical actions in the points of the cores. One of these actions is that the phosphate of lime or magnesium is decomposed and phosphoric acid is set free in the form of a gas, which first occupies the space between the carbon-points and the shoulders of the carbons. Now this gas is a better conductor of an electric current than the cores. Hence a part of the electric current will, in proportion to the relative resistances, pass through the phosphoric acid from the body of one carbon to the body of the other. Owing to the burning or consuming of the body portions of the carbons and of the coating more rapidly than the points of the cores, there is a constantly-enlarging space from the cores to the outer edges of the carbons, which, owing to the continuous development and extension of the phosphoric-acid gas, causes it to bulge out, as it were, and thus form what for convenience I term the "globe" D, through which the electric current passes, as indicated by the arrows. The phosphoric gases, however, are not the only gases developed when the points of the resistance-cores become incandescent, which are conductors of electric currents. There is also dioxid-of-carbon gas as well as other gases, together with particles of carbon, calcium, magnesium, &c., which are carried from the body of one carbon to the other and which while in motion undergo certain chemical changes, especially combustion, in this way producing a very strong light of great illuminating power, which light, however, is very agreeable to the eye. Owing to the presence of the phosphoric-acid gas, the light in a measure partakes of the nature of a phosphorescent light, which, in my opinion, adds to the agreeable nature of the light. There is thus formed a new kind of light from any electric light now in existence of which I have any knowledge, what may be termed a "combination" of the present arc and incandescent and the magnesium or calcium lights. This, as I understand it, forms a new system of electric lighting.

It will be seen that the resistance in the cores is of great importance and that by it the length of the "light-globe," as I have termed it, is controlled more completely than the arc is controlled in the present lamps.

It is clear that in this new light all the current must at first pass over the points of the resistance-cores and in so doing cause them to become incandescent and so produce the globe, as above explained. Moreover, it is clear that whenever the globe between the unconsumed portions of the body and coating of the carbons becomes too great, so that its resistance is greater than the resistance of the cores, the electric current is naturally and instantly compelled to again seek its passage through the cores proportionate to the difference of the resistance between the cores and the globe. As the current thus returns, as it were, to the cores the core-points are again more rapidly consumed and again more freely supply the gases, which act as conductors for the current in the globe, so that more of the current again seeks its passage through the globe than through the cores. As the body of the carbons is formed of a material of greater conductivity than the cores, the electric current will more readily pass through such material than the cores, and as the coating of the carbons is of still greater conductivity the current will more readily pass through the coating than through the body of the carbons. The difference in the degrees of conductivity in the several parts, as above explained, will cause the cores to become incandescent, while the body and coating of the carbons will remain comparatively cool. If the points of the cores were not exposed at the commencement, the more rapid consumption of the body and coating would soon cause them to become exposed and assume the relative forms shown in Fig. 1. In this way, as above explained, the passage of the current through the globe or through the cores is made self-regulating, so that practically the resistance afforded by the cores and the resistance afforded by the globe are kept constantly equalized, so that the light is maintained in a regular, steady, and unvarying condition so far as the eye can discern. The electric current, owing to the character of the different portions of the carbons, is made to regulate itself and so to dispense with all the mechanism usually employed in the arc-lamps of the present time to regulate the arc, and it does so with much greater simplicity and precision than can be secured by mechanical means. My carbons therefore require a very simple lamp and merely enough mechanism to hold them in correct position with reference to each other and to permit them to feed as they are consumed.

Furthermore, very beautiful color effects may be produced by treating the carbons before they have been coated to different color solutions. For instance, to produce a strong red light I dip the carbons, made as above, after they have been baked and before they are coated with any metal into a solution of strontium for some minutes, so as to give this solution ample time to permeate or saturate the whole body of the carbon. They are then taken out and dried until the moisture has been expelled. These carbons can now be used as they are, or, if preferred, they may be coated with any of the metals, as already explained. To produce a blue light, the carbons may be treated, as above explained, with a solution of indium, and to produce a green light they may be treated to a solution of lithium. In like manner other solutions may be employed where other color effects are desired. In all cases, however, whatever be the color solution employed the process and mode of treatment are the same as already explained in reference to the red.

In addition to the various advantages that I have enumerated above in the description of my invention I desire to call attention to the fact that my light is particularly adapted to indoor use, owing to the fact that a large quantity of ozone is generated or produced from the combustion of the phosphoric-acid gas as I understand it.

What I regard as new, and desire to secure by Letters Patent, is—

1. As a new article of manufacture, a carbon for electric lights having a core in which a phosphoric salt forms one of the ingredients, a body composed of carbon material proper, and a coating composed of illuminating metal, substantially as described.

2. As a new article of manufacture, a carbon for electric lights having a core composed of resisting material in which a phosphoric salt forms one of the ingredients, a body composed of a material of less resistance than the core, and a coating composed of material of less resistance than the body of the carbon, substantially as described.

3. As a new article of manufacture, a carbon for electric lights having a core composed of resisting material, and a body composed of a homogeneous mass of carbon material proper and oxid of magnesium, and phosphate of calcium, substantially as described.

4. As a new article of manufacture, a carbon for electric lights having a core of resistance material in which a phosphoric salt forms one of the ingredients, substantially as described.

5. As a new article of manufacture, a carbon for electric lights having a core of resistance material in which a salt of illuminating metal comprises a component part, a body composed of carbon material proper in which a phosphoric salt forms one of the ingredients, and a coating composed of illuminating metal, substantially as described.

6. As a new article of manufacture, a carbon for electric lights having a body composed of carbon material proper and a light-giving salt having resistance qualities, and an adhesive coating composed of metallic magnesium applied directly to the carbon, substantially as described.

7. As a new article of manufacture, a carbon for electric lights having a body composed of carbon material proper and a light-giving

salt having resistance qualities, and an adhesive coating composed of an alloy of calcium and magnesium applied directly to the carbon, substantially as described.

8. As a new article of manufacture, a carbon for electric lights having a body composed of carbon material proper and a light-giving salt having resistance qualities, and an adhesive metallic coating composed of an illuminating metal applied directly to the carbon, substantially as described.

9. As a new article of manufacture, a carbon for electric lights having a core composed of resisting material, a body composed of carbon material proper and light-giving metallic salts saturated with a desired coloring salt, and a coating composed of illuminating metal, substantially as described.

10. As a new article of manufacture, a carbon for electric lights having a body composed of a homogeneous mass of carbon material proper and a phosphorescent light-giving salt, and a core formed of a light-giving salt having resistance qualities, whereby carbons may be burned in end-to-end contact, substantially as described.

11. As a new article of manufacture, a carbon for electric lights having a body of carbon material proper and a core composed of resistance material and a phosphorescent light-giving salt, whereby carbons may be burned in end-to-end contact, substantially as described.

12. As a new article of manufacture, a carbon for electric lights having a body composed of a homogeneous mass of carbon material proper and light-giving salts, a core composed of resisting material and a phosphorescent light-giving salt, and a coating composed of illuminating metal, whereby carbons may be burned in end-to-end contact, substantially as described.

13. As a new article of manufacture, a carbon for electric lights having a body composed of a homogeneous mass of carbon material proper and light-giving metallic and phosphorescent light-giving salt, and a core formed of resistance material composed of phosphate of lime and magnesia, whereby the light is made self-regulating, substantially as described.

14. As a new article of manufacture, a carbon for electric lights having a body composed of a homogeneous mass of carbon material proper and light-giving metallic salts, and a core composed of resisting material and a phosphorescent light-giving salt, whereby the arc is made self-regulating, substantially as described.

15. As a new article of manufacture, a carbon for electric lights having a body composed of a homogeneous mass of carbon material proper and light-giving metallic salts, a core composed of resisting material and a phosphorescent light-giving salt, and a coating composed of illuminating metal, whereby the arc is made self-regulating, substantially as described.

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