No. 661,107. Patented Nov. 6, 1900.

J. F. SANDERS.

CARBON PENCIL OR ELECTRODE FOR ELECTRIC LIGHTS.

(Application filed Sept. 25, 1899.)

(No Model.)

Fig. 1.

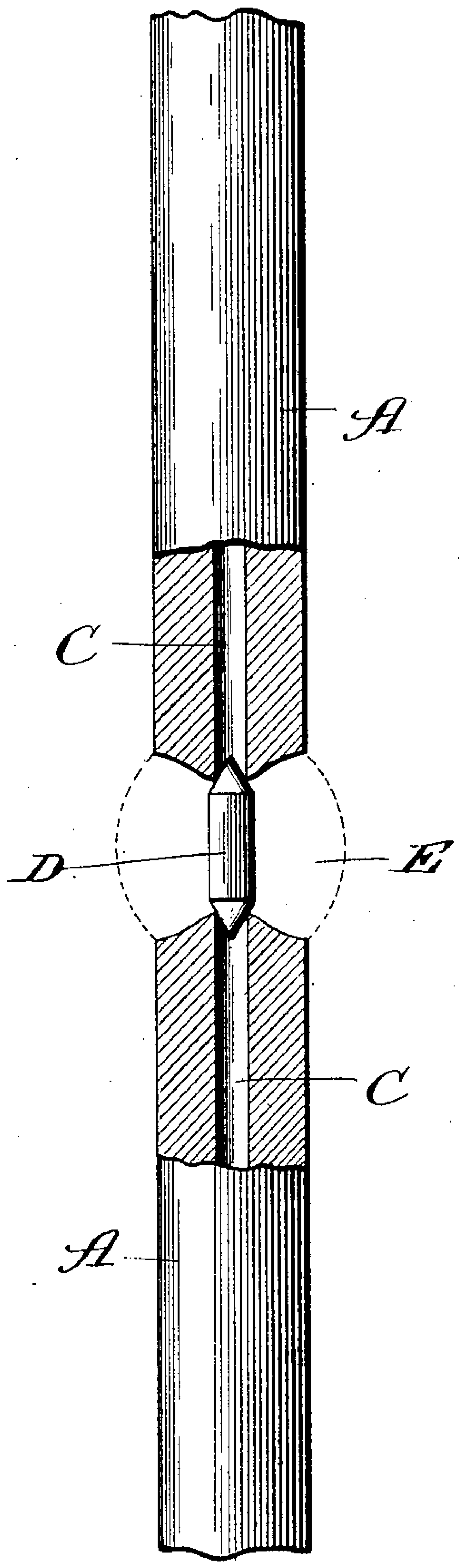


Fig. 2.

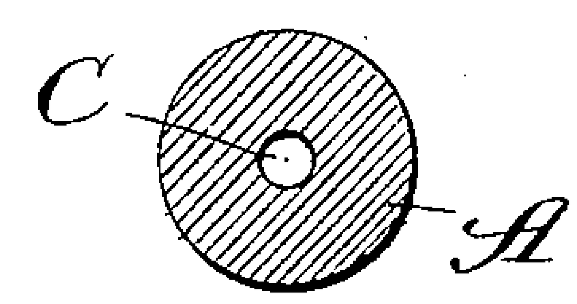
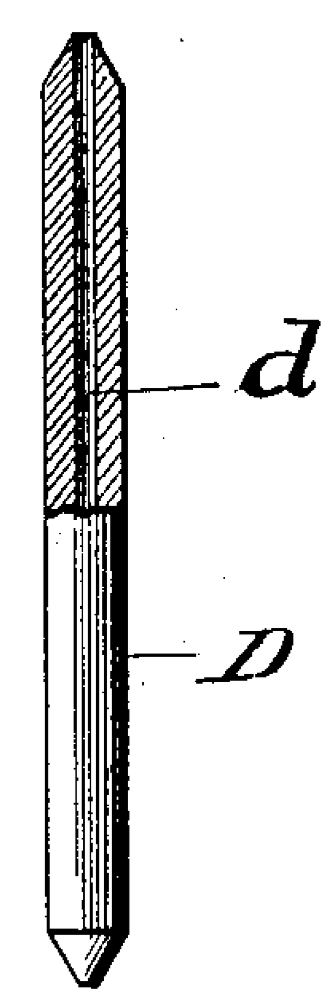


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN F. SANDERS, OF CHICAGO, ILLINOIS, ASSIGNOR TO HARRY BROWN, OF SAME PLACE.

CARBON PENCIL OR ELECTRODE FOR ELECTRIC LIGHTS.

SPECIFICATION forming part of Letters Patent No. 661,107, dated November 6, 1900.

Application filed September 25, 1899. Serial No. 731,564. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. SANDERS, a citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in Carbon Pencils or Electrodes for Electric Lights, of which the following is a specification.

The object of my invention is to make carbon pencils that will produce an arc-light and burn in end-to-end contact; and my invention consists in the features and details of construction hereinafter described and claimed.

In the drawings, Figure 1 shows a carbon pencil provided with an axial longitudinal hole or hollow through it embodying my invention. Fig. 2 is a plan view of the same, and Fig. 3 shows a side elevation of a special resistance-electrode hereinafter described.

In the drawings, A is the carbon.

C is the axial hole or hollow.

D is the resistance electrode or tip, and E is the arc-globe.

For the purpose of giving an intelligible description of my invention I believe it necessary to describe in the first place the method of forming or constructing carbon pencils and in the next the uses and applications to which they can be put and the difference between ordinary arc-lights and that produced by my contact carbon pencils.

In making my improved carbon pencils it is advisable, not to say essential, to select pure lampblack, as the ashes, silicate of lime, &c., resulting from coke are detrimental and may, if existing in large quantities in the carbon pencils, even defeat the purpose in view. I mix with this lampblack a sufficient quantity of tar, pitch, or other binding material to saturate it and form it into a pasty mass. This mass is now subjected to a low heat under exclusion of air, which heat is gradually increased until the volatile (hydrocarbon) matter has been expelled from it. The resulting mass is now pulverized and again mixed with tar or pitch or similar substance, as before, and again subjected to a low heat, the air being excluded from it and the heat gradually increased, as before. This process may be repeated several times until the resulting mass has become a solid hard body, in which the pores are reduced to a minimum and which is now a good conductor of electric currents. This mass is again pulverized and mixed with from, say, five to ten per cent. of a salt of magnesium or bismuth, or both, if desired, according to the light to be produced, and again sufficient tar, pitch, &c., is added to saturate the whole mass, which is then thoroughly mixed to form a homogeneous mass and then subjected to a gentle heat, gradually increased until the more volatile ingredients have been expelled from it. The tar, pitch, &c., thus treated at first expands; but when a certain quantity of the volatile ingredients have been expelled the mass begins to contract. At this point it is removed from the fire to cool. The attendant or operator will from his observations come to readily recognize the point or time when the mass should be removed from the heat and permitted to cool, so as to make the best quality of carbon pencil. When sufficiently cooled, the mass is again reduced to a powdery condition and as such poured into hot molds, where it is subjected to a high degree of pressure, and so shaped in pencils adapted for the use of electric lights. While the pulverized mass is in the hot molds and under pressure, the remaining tar, pitch, &c., becomes again soft and sticky, so as to cause the particles to adhere to one another and not to the molds and to remain after being cooled in the form and shape into which they had been pressed.

In the act of forming the carbon pencils I adopt the necessary measures required to make them hollow, as shown in the drawings. The hole or hollow passes through the pencils longitudinally and axially and is preferably made of a diameter from one thirty-second part to three-sixteenths part of an inch in diameter. To provide this hole, an iron or steel rod may be employed, about which the carbon material is molded, and which may be withdrawn when the carbon pencils have been molded into the desired form.

When a sufficient number of carbon pencils have been formed, as above explained, I pack them into crucibles, in which they are held in a vertical position by packing pulverized coke, graphite, or similar material through, around, and about them, so as to surround and cover them. The crucible is then closed, so as to exclude the air and placed in a furnace and subjected to a gradually-increasing heat to expel the volatile ingredients still remaining in the carbon material and which are not desired in the finished carbon pencils. When this point has been reached, the furnace is permitted to cool off and when sufficiently cool the crucibles are removed and the carbon pencils taken out and placed in a solution of bitartrate of potassium ($KC_4H_5O_6$) or other solution until well saturated, when they are removed from the solution and dried in a temperature of 100° centigrade. When dried, they are ready for use.

I have found from experience that carbon pencils prepared as above explained may be burned in end-to-end contact, though I prefer to interpose between them a special resistance electrode or tip to hold them a desired distance apart. When burning in end-to-end contact or when burning with the resistance-electrode interposed between them, a much less intense heat is produced than in the present arc-lights.

In order to make carbon pencils that will give a good light without flaming, it is important, not to say essential, to prepare the carbon materials with a final heat at least equal to the heat produced in the light which they are to give, and the illuminating-salts to be added to the carbon material should be so selected that they are also capable of sustaining such heat in the final baking without undergoing change or reduction.

The carbon pencils made as above for the contact light remain in quiet contact while burning and require a current of from three to ten volts and from twelve to thirty-five amperes or even more. They produce a heat of from 600° to 1,000° centigrade in their light. The illuminating-salts in these carbon pencils should be selected with regard to their low fusing and reducing points. These requirements are found in the chlorid and cyanate of magnesium and the salts of bismuth and in a mixture of them all. The carbon material is prepared, as above stated, in a high degree of heat; but the final baking is carried out by heating up to the degree of heat developed in the light to be given by them. These illuminating-salts may be mixed in with the carbon material, as above stated, or they may all or any of them be added after forming and baking by saturation and absorption.

As already stated, my hollow carbon pencils may be burned in end-to-end contact, and I regard them as especially adapted for such method of use. As already said, I prefer to use them in connection with a tip or interposed piece made of resistance material, which is placed between the carbons, as shown in Fig. 1. The tip is shown detached in Fig. 3. This method of use, however, as I desire to say, is included in the term "end-to-end contact," as in this case the ends of the carbon are in contact with a piece, tip, or electrode common to both, so that there is no actual space through which the electric current is obliged to pass, as in the arc-light. As the tips or electrodes are made of resistance material they constitute a resistance-carbon—a carbon capable of being heated to a white heat without being consumed. In this way I am able to secure the advantages of both the present arc electric light and the end-to-end contact electric-arc light, as the resistance-carbons cause the formation of an arc while at the same time forming the medium of contact between the ends of the carbons. This permits me to dispense with the complicated and expensive mechanism used in present arc-light lamps for feeding and regulating carbons. The carbon pencils are only required to be arranged in the lamps so that the upper carbon rests on the upper end of the tip or resistance electrode and the lower end of the tip rests on the upper end of the lower carbon pencil, as shown in Fig. 1. By making the holes or hollows longitudinal and axial the positioning of the parts is secured, so that the upper carbon pencil shall be so arranged as to slide downward by its own weight as it burns away, and thereby maintain the same position with relation to the tip or resistance electrode and the lower carbon pencil at all times until consumed.

The tips or resistance electrodes may be made in various ways. Their body may be made of fire-clay or other suitable refractory material that is a non-conductor or practically a non-conductor of electricity and at the same time indestructible in high degrees of heat. When made of non-conducting material, they may be coated with a thin coat or cover of graphite or other carbon material that will permit a slight portion of the electric current to pass from one hollow carbon to the other, so as not to wholly interrupt the current. The tips or resistance electrodes will become highly heated under the electric current, so as to reach a white heat, and thus assist in producing the light or illuminating effect. They may be made also of a solid body consisting of a mixture of clay, graphite, or other suitable material, which by such mixture has both the necessary resistance and the ability to resist the destructive action of high temperatures and to become highly incandescent, or they may be made of a body composed of carbon material mixed with a resistance material and then coated with a refractory material. Where preferred, the tips or resistance electrodes may be provided with a longitudinal or axial hole *d*, as shown in Fig. 3. These resistance tips or electrodes operate to produce a steady arc-light having the desirable qualities and characteristics of both end-to-end contact and ordinary arc-lights. Furthermore, by the use of these tips or resistance electrodes the light may be changed at will to any desired candle-power simply by inserting tips of various lengths or endowed with various resistance qualities. By changing a tip for another of a different length or for one of a different resistance quality desired changes can be secured in the quality and power of the light produced. Of course with such variations corresponding variations will take place in the amount or strength of the electric current required. However, the length of the tips or resistance electrodes should always maintain a certain relation to the amount of resistance given to them. When the resistance in the tips is too great for the length of the arc, the arc will become longer than the tips, so that the carbons may burn away above and below them, permitting them to fall out, so that the light would be seriously interfered with, if not extinguished. The resistance tips or electrodes when properly made permit a much wider scope or application of the contact or end-to-end lights than can be obtained in any other way and also furnish the means of securing greater light from a given strength of current. In short, by these tips or resistance-electrodes I am enabled to adapt my light to the different existing electric currents to a much greater extent than could be done by using other kinds of carbons. The electric lamps may be connected in series or multiple or direct with alternating currents, as in the use of other kinds of carbons; but when the electric current is applied it passes from one carbon to the other through the tips or resistance-electrodes. In this way through the principle of self-regulation an absolutely steady light is obtained.

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

1. The combination of a pair of carbon pencils or electrodes for electric lights vertically positioned, each having a predetermined point of fusion, reduction and consequent combustion, and each provided with an axial longitudinal hole, and a non-fusible resistance-separator of cylindrical form interposed between the carbon pencils or electrodes and having both of its ends beveled or pointed to enter the axial hole and properly center the separator longitudinally with the pencils and having a length coincident with the required spacing between the points of the carbon pencils or electrodes for producing a resistance proportionate to the point of fusion, reduction and combustion, substantially as described.

2. The combination of a pair of carbon pencils or electrodes for electric lights vertically positioned, each having a predetermined point of fusion, reduction and consequent combustion, and each provided with an axial longitudinal hole, and a non-fusible resistance-separator of cylindrical form and of a diameter slightly greater than the axial hole in the carbon pencils and considerably less than the diameter of the carbon pencils themselves and having a length coincident with the required spacing between the points of the carbon pencils or electrodes for producing a resistance proportionate to the point of fusion, reduction and combustion, substantially as described.

3. The combination of a pair of carbon pencils or electrodes for electric lights vertically positioned, each having a predetermined point of fusion, reduction and consequent combustion, and each provided with an axial longitudinal hole, and a non-fusible resistance-separator of cylindrical form, and having greater vertical than horizontal dimensions and a length coincident with the required spacing between the points of the carbon pencils or electrodes for producing a resistance proportionate to the point of fusion, reduction and combustion, substantially as described.

4. As a new article of manufacture, a resistance-electrode for the regulation of electric-contact arc-lights, of cylindrical form, composed of a refractory and non-conductive material, and a coating of a homogeneous mixture of carbon material and a salt of magnesium, substantially as described.

5. As a new article of manufacture, a resistance-electrode for the regulation of electric-contact arc-lights, of cylindrical form, having a body composed of carbon material proper and a salt of magnesium and an axial longitudinal hole through it, substantially as described.

6. As a new article of manufacture, a resistance-electrode for the regulation of electric-contact arc-lights, of cylindrical form, having a body or core composed of carbon material proper and a resistance material and a coating composed of refractory material, substantially as described.

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