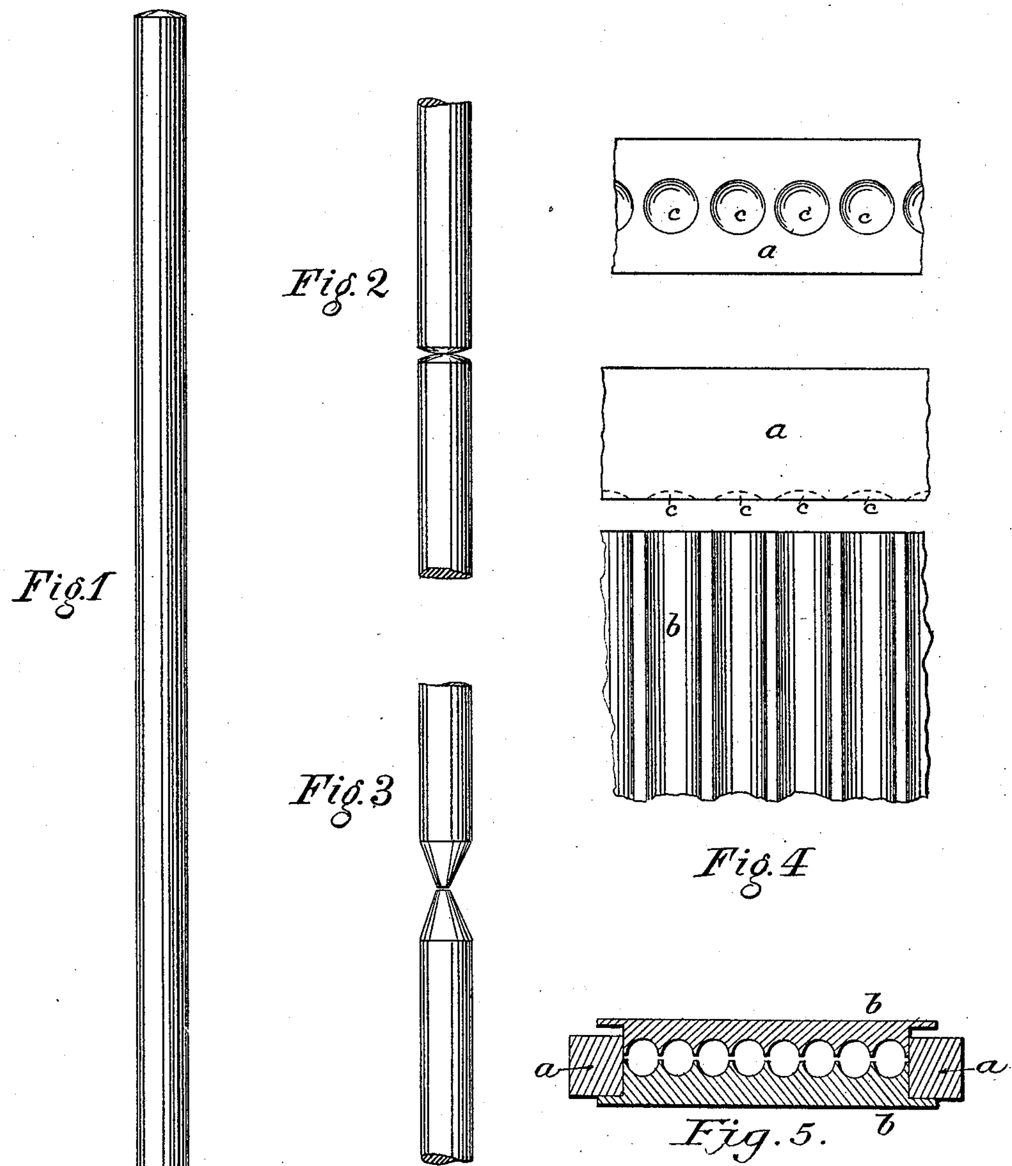
(No Model.)

W. H. LAWRENCE.

CARBON FOR ELECTRIC ARC LAMPS.

No. 454,873. Patented June 30, 1891.



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WASHINGTON H. LAWRENCE, OF CLEVELAND, OHIO.

CARBON FOR ELECTRIC-ARC LAMPS.

SPECIFICATION forming part of Letters Patent No. 454,873, dated June 30, 1891.

Application filed April 9, 1887. Serial No. 234,300. (No model.)

To all whom it may concern:

Be it known that I, WASHINGTON H. LAWRENCE, a citizen of the United States, residing in the city of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Electric-Arc-Light Carbons; and I hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in the form of the carbon itself and in mechanism for producing the special form employed, the object of the invention being, by means of the improved shape of the end of the carbon, to secure a more efficient operation of the electrode, a steadier arc, and a cheaper construction, as well as a generally improved article; and it consists in the special form of the carbon and the construction and combination of the mold-plates and frame to produce the results hereinafter particularly described.

In the drawings, Figure 1 represents an electric-arc-light carbon made according to my invention. Fig. 2 shows the ends of two such carbons placed in contact, as when inserted in an arc lamp. Fig. 3 represents the points of two ordinary carbons in the same position. Fig. 4 represents a portion of the frame and a portion of one of the plates of a carbon-mold, showing the method of forming carbons embodying my improvement, the upper view showing the inner face of the frame with the recesses, and the middle view showing the top of the frame in its relation to the plates. Fig. 5 is a cross-section of the mold-plates and frame in the position in which they are placed in use.

Electric-arc-light carbons are now almost universally formed in molds composed of two similar fluted plates surrounded by a hinged or jointed frame analogous to that of a glass mold capable of being locked firmly around the plates and strong enough to withstand the enormous pressure necessary to consolidate the pulverized carbon into the form of a rod or pencil. The frame heretofore employed was smooth and flat on its inner face, and when locked around the plates holds the lower plate immovably, with its flutings uppermost, while the upper plate, placed with its flutings downward, although tightly held, is yet capable of being forced, under the powerful hydraulic pressure employed, into contact with the lower plate.

a, Fig. 4, represents a portion of the frame, and *b* a portion of one of the mold-plates, showing the fluted face by which the carbon rods are formed.

For many years arc-light carbons were formed only as straight rods of square or cylindrical section and with flat ends, which were afterward pointed by cutting or grinding, and this is still the method employed by nearly all manufacturers. Some attempts were made a number of years ago to mold carbons with ends of a conical shape more or less acute, but with very limited success, and have generally been abandoned. The molds employed have almost invariably been composed of fluted plates with their flutings triangular or semicircular in cross-section, according as the carbon was to be square or cylindrical in section, the flutings being closed at their ends by the flat inner face of the inclosing frame when the carbons were to be molded without points, and being contracted at their ends to a more or less complete conical form when the carbons were to be pointed in the molding.

Among the many difficulties encountered in the endeavor to mold pointed carbons were, the liability of the material at the point to receive less pressure in proportion than the rest of the rod, and hence to be softer and more liable to break in removal from the mold and in subsequent handling; the great difficulty of removing the carbons from the mold, owing to the fact that they had to be lifted up at one end to start them from the mold, which operation bent them more or less, as well as tended to break the points; the increased necessity for a critically-exact regulation of the amount of material filled into the molds, its distribution in the molds, the degree of heating, and the amount of pressure employed, since, in the sheet of carbons formed in the mold, each is joined to the other by a web of hard-pressed carbon at the line between the flutings, and in breaking them apart, unless the above-mentioned requirements were very exactly met, many of the carbons were spoiled by chipping or breaking, and the points, being softer or more fragile than the body of the carbon, suffered most in this respect. Another great point of difficulty arose from the fact that if any of the carbon mixture adhered to either mold-plate when the carbons were removed, unless it was completely cleaned off the next carbons pressed in the same plates were certain to stick, and since the conical points required the sheet of carbons to be lifted out of the flutings before they could be removed, such sticking would spoil many of the carbons, whereas when the flutings of the plates were straight and without contraction, as when the carbons were molded unpointed, the sheet of pressed carbons could be removed by pushing it endwise along the flutings, and breakage in removal was almost wholly avoided. It was, however, found to be a necessity that the mold-plates should be carefully and thoroughly cleaned of all dust or adhering particles of carbon before each filling. Otherwise the carbons when pressed adhered so strongly to the plates as to prevent lifting them out or pushing them free without causing much scaling and breakage of the carbons, and a moderate amount of breakage would more than counterbalance the cost of subsequent pointing of the flat-ended carbons by grinding. The proper cleaning of the mold-plates, when the flutings were contracted at the end, was found vastly more difficult and expensive than when the flutings were straight throughout, and to be most difficult at the points, where the necessity for it was greatest. For all these and other reasons it became and is important to have the flutings of the mold-plates straight and free from contractions, shoulders, or corners, so that they may be easily and perfectly cleaned and kept smooth and polished to prevent sticking of the carbons and to enable them to be removed by sliding, as above described, without bending them, which cannot be done when the flutings of the mold-plates are contracted at either end.

The foregoing explains the almost uniform practice of making the carbon rods in cylindrical form and pointing them after they are finished, besides which it has not been found possible to mold the carbons with conical points without leaving a web or seam on the points at the line of junction of the molds, and such web prevents a sufficiently perfect contact of the points to enable the current to pass and start the lamp; also, in using carbons with truncated conical ends the arc is not immediately localized when the current is turned on, owing to the flat portion of the point forming a field over which the arc shifts until the cup or crater is developed in the positive carbon, and an unpleasant flickering of the light is the result. In trimming the lamps the conical pointed carbons are liable, by jarring or from other causes, to slip past each other before the lamp is lighted, and in case they do so slip past each other, they usually wedge fast against each other so that the upper carbon cannot lift and the current continues passing without causing the lamp to light. I avoid these objections by forming the carbon with the ends in the form of a spheroid of low curvature, as shown in Fig. 1, and both ends are formed alike, so that either may be used to form the arc. When these carbons are used the contact is perfect, owing to absence of seam, slipping past is impossible, and the arc is instantly formed at the point of contact and remains there while the crater forms around it and maintains the arc in the same spot, wholly preventing flickering, and the light burns steadily from the instant the current is turned on.

To form the carbon with spheroidal ends, recesses *c c* of the desired shape are formed in the inner face of the frame *a*, and located so that one of such recesses will come opposite each end of each of the flutings of the plates *b*, when the frame is put around the plates in use. The plates *b* are well cleaned, the lower one placed in the frame *a*, which is locked around it, the proper amount of carbon-dust is filled in, and being evenly distributed the top plate is applied and the mold heated and pressed in the usual manner, the pressure causing the carbon-dust to fill the recesses *c c*, and thus forming the spheroidal ends of equal density with the other portions of the carbon. When it is attempted to mold conical ends in this manner, it is invariably found that the ends differ in density from the remainder of the carbon, impairing its efficiency.

By thus molding the ends of the carbon in the form of a spheroid of low curvature I accomplish no less than ten distinct points of advantage, viz:

First. The carbons are molded ready for use, requiring no after treatment for producing or perfecting a point.

Second. The spheroidal surface which serves for a point is smooth and polished, and has no web nor any rough surface where a web was broken away.

Third. As a result of the smoothness and shape of the end, the carbons when placed in the lamp make contact at a single spot only, serving to localize the arc, but will be in such close approximation over such portion of the surface that the arc will never fail to start the instant the current is turned on, as sometimes happens when a thin web or roughness is present on the points. The certainty and freedom from sputtering with which the arc is formed by these spheroidal ends has never been attained with carbons having conical ends, or ends approaching the conical in shape.

Fourth. The rounded ends prevent the slipping past or wedging of the carbons without sacrificing the necessity of a limited point of contact.

Fifth. By reason of the low degree of curvature given to the ends the latter are homogeneous in structure and density with the body of the carbon, whereas the ends if conical will be either softer or harder than the body of the carbon, according as the deepening of the depressions gives less or the contraction of the ends of the flutings gives more pressure in proportion to that given to the body.

Sixth. By forming the shallow recesses for the ends in the frame it allows the flutings of the mold-plates to extend entirely across the plates, and to be straight and uniform throughout, in consequence of which the plates are more easily made and more easily kept bright, smooth, and clean, and the carbons are easily removed by sliding them endwise without bending.

Seventh. By reason of the low curvature of the ends and their projection from the plates when the frame is removed they are more easily and safely removed from the plates than even if they were flat-ended, as by pushing the plates containing the carbons against any flat surface all of the carbons are pushed upon at once and the whole number started from the mold without crumbling any of the ends. If the points were conical or approaching the conical in shape, they would crumble badly in the removal.

Eighth. In consequence of the ability to remove the carbons from the mold-plates by sliding instead of by lifting, the carbons when removed are already straight and true and do not require to be straightened by placing them under weights while cooling, as has always been found necessary with carbons molded with conical or similar points and which were necessarily bent in the removal from the mold.

Ninth. The low curvature of the end of the carbons requires so shallow a recess that the recesses are as easily kept clean and smooth as the plates themselves, while a deeper recess would be difficult to clean, and if conical, or nearly so, would be impossible to keep entirely clean, and deeper recesses would not give sufficient pressure to the ends, which would consequently be too soft.

Tenth. By thus forming the ends of the carbon in the frame, instead of in the plate, I am enabled to mold both ends alike without increasing the length of the rod molded, nor increasing the care or labor required to clean the molds, which are important items of advantage, since it is that part of the flutings which forms the point that gives the most trouble, and where such plates are made to mold carbons with both ends pointed the labor and expense of keeping the plates clean is doubled, while if the carbons are molded of double length and subsequently cut in two, the breakage and expense of the additional operation exceed its advantage and the benefit of a point at both ends is lost. Hence it is that attempts to mold carbons with both ends pointed were early abandoned and the effort limited to forming them with one end only pointed and the other flat. Pointed carbons, whether the points be formed in the molding or by grinding, are very liable to have their points injured by chipping or breaking in handling, and such are then useless until repointed, whereas my carbons with spheroidal ends are even less liable to be chipped than if the ends were flat, and if chipped at all it is at the edge of the spheroidal end, leaving the end still perfect in the portion with which contact is made in the lamp, and in the rare cases in which the end is so badly chipped as to be unusable the other end is available for use as the contact end.

What I claim as my invention, and desire to secure by Letters Patent, is—

A carbon rod for electric-arc lights having a compressed seamless spheroidal end, substantially as described, and for the purposes set forth.

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Witnesses:

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