(No Model.)

C. W. HAZELTINE.

ELECTRODE FOR ARC LAMPS.

No. 487,220. Patented Nov. 29, 1892.

Fig. 1.

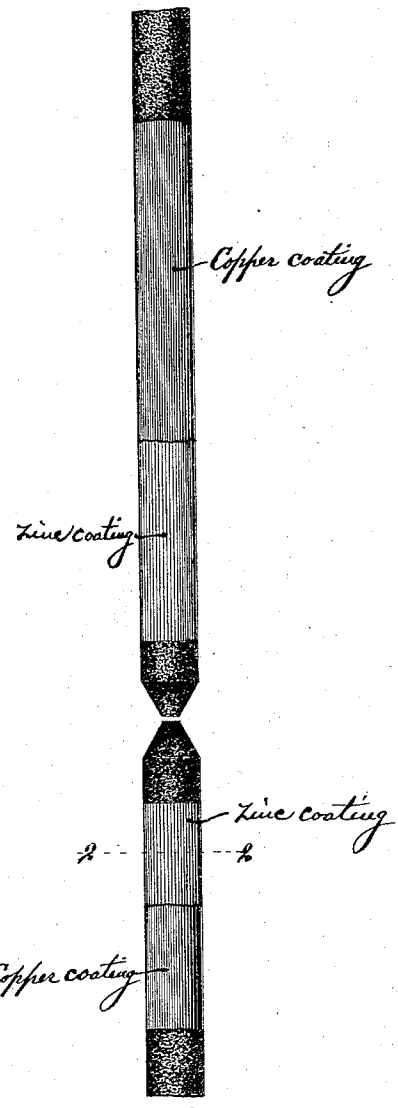
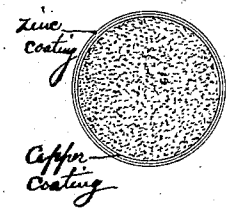


Fig. 2.



Witnesses:
Charles Pickles,
George L. Neuhoff.

Inventor:
Chas W. Hazeltine
By Fowler & Fowler
Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES W. HAZELTINE, OF ST. LOUIS, MISSOURI, ASSIGNOR TO THE HAZELTINE ELECTRIC COMPANY, OF SAME PLACE.

ELECTRODE FOR ARC LAMPS.

SPECIFICATION forming part of Letters Patent No. 487,220, dated November 29, 1892.

Application filed May 6, 1892. Serial No. 432,005. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. HAZELTINE, a citizen of the United States, residing at St. Louis, in the State of Missouri, have discovered and invented a certain new and useful Means for Prolonging the Life of Electrodes in Arc Lamps, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

The primary object of my invention is to effect a substantial saving of carbon in the electrodes of arc lamps.

The invention has also for its object to effect a saving of labor in the trimming of arc lamps.

Various devices have been recently proposed for prolonging the life of carbons or electrodes in arc lamps to such an extent as to double or materially prolong the life of the carbons and enable a single-arc lamp, if necessary or desirable, to burn all night or to perform the functions of a double-arc lamp and to effect a material saving in carbon and in labor in trimming. In my patent, No. 437,901, of October 7, 1890, I have described a device for such purpose which accommodates itself to the shifting of the arc, this being the first instance of such a device.

My present invention or discovery and the means I have devised for carrying it into effect dispenses with the use of a device or means which is independent of the carbons and accomplishes the same result—namely, a saving in labor in trimming and a substantial saving of carbon or the doubling of or materially prolonging the life of the carbons in electric-arc lamps, so as to enable a single-arc lamp, if necessary or desirable, to burn all night, and thus accomplish, if necessary or desirable, the results attained by a double-arc lamp. By a series of experiments I have ascertained that by suitably coating the electrodes or carbons of an electric-arc lamp a great saving of carbon can be effected and the carbons may be made to burn substantially twice as long as or much longer than when uncoated or coated in the ways already known in the art.

To best carry out the objects of my invention the carbons are first given a coating of copper, which should be very thin and about the same as the ordinary copper coating with which carbons are now usually provided. After coating the carbons with copper a coating of zinc, preferably somewhat heavier, is put over the copper.

In the accompanying drawings I have illustrated two carbons provided with the best kind of protective covering so far devised by me.

In the drawings, Figure 1 is an elevation of two carbons provided with suitable coatings and illustrating the zinc coating broken away on each carbon at some distance from the arc, so as to show the copper coating beneath the same. Fig. 2 is a transverse section on an enlarged scale, taken on the plane of the line 2 2 of Fig. 1.

The electrodes may be coated in any suitable manner, either by mechanically coating them or by electroplating them; but it is preferable to electroplate the coatings upon the carbons. I have found a protective covering for carbons to answer well the purpose of doubling the life of the carbons when made as follows: A ten-ampère current of a plating-dynamo is used for fifteen minutes for the copper coating and twenty minutes for the zinc coating, sulphate of copper and sulphate of zinc being used as the electrolyte, respectively. The copper coating is of about the same thickness as the ordinary copper coating now used on carbons. The zinc coating, as would be indicated by the time given, is somewhat thicker. The same thickness of coatings may be plated upon the carbons by varying the solution, the current, or the time. I do not wish to limit my invention to any of these details. The thickness of the coating or coatings may be varied without departing from my invention.

I am unable to state definitely the reason or theory on which my present invention depends; but from experiments made I am of the opinion that the heat developed by the arc turns the zinc into oxide of zinc, (zinc-white,) which seems to permeate the copper coating, closing up the pores thereof and preventing access of cold air to the heated part

of the carbon, thus preventing oxidation and wasting at the points. If an ordinary copper-coated carbon be examined under a magnifying-glass, it will be found to be very thinly coated with copper and to cover the carbon here and there only, leaving large pores or interstices in the copper covering. In other words, the carbon is not completely covered with copper, but is only partially protected. If the coating of copper be made thicker, so as to completely cover and protect the carbon, then the functions of the carbon will be interfered with in the manner to be hereinafter set forth.

Another theory on which my invention may depend, and perhaps the correct one, is that the zinc oxide referred to covers the copper plating and protects the copper plating rather than the carbon itself from the air, and thus prevents the oxidation of such plating, and in this way prevents the copper from burning off above the arc—that is to say, the zinc coating holds the copper on the carbon clear down to a point in immediate proximity to the arc. The oxide of zinc, although infusible, is light and fluffy and is readily dissipated, either forming a slight deposit in the globe or being carried off in the atmosphere. Zinc being more fusible than copper is well adapted for a coating for the purpose set forth. If a heavy coating of copper or zinc alone should be applied to a carbon, such coating will not eat away from the arc, but will in time envelop the arc and will then run off in balls and be liable to break the globe of the lamp. The heated carbon near the end seems to disintegrate a single coating of zinc or copper, no matter how heavy, and the air penetrates and oxidizes the carbon inside of the shell formed by the coating at the ends of the carbons. There seems to be a limit to which an arc-lamp carbon can be successfully coated with any single metal, this limit being that the covering shall not be so thick as to envelop or interfere with the arc or run off in balls or give rise to dense fumes and smoke and injuriously affect the light. When a single coating of copper is applied to a carbon, so as to keep out of the way of the arc, but about one hour is added to the life of the carbon, while with the copper-zinc coating an ordinary copper-coated eight-hour carbon will burn about fourteen and one-half hours, giving an all-night run and making a single-arc lamp equivalent to the double-arc lamp as now used. I have experimented with various coatings, but have gotten the best results with the zinc-copper coatings.

I have found the following coatings for carbons to give fairly-good results, namely: iron and zinc; zinc and iron; iron and copper; iron, copper, and zinc; zinc, iron, and copper; brass and zinc; copper and metallic paint; copper, zinc, and mercury; copper and fire-clay; copper and adamant plaster. The substance first mentioned in each case is the one which is placed directly upon the carbon and the others are used in the order mentioned. A coating of brass electro-deposited upon the carbons covered by a coating of zinc electro-plated thereon gives the next best result to the copper and zinc. The objection to a brass-zinc coating is that it is difficult to electro-plate with brass. The composition of the brass coating cannot be accurately determined beforehand, owing to the varying behavior in electro plating brass under apparently unvarying conditions. The zinc oxide which forms by the heat of the arc when a zinc coating is employed over a copper coating, as referred to above, is highly infusible, and when the pores of the copper coating are covered with it the coatings remain on the carbons clear down to the incandescent ends of the same, so that the carbons burn with blunt points and a large crater, the same as is now the case when burned with the electrode-shield applied thereto, as set forth in my patent previously referred to. This coating does not hang down into the arc, but wastes away at the incandescent ends of the carbons, so that the burning of the same is unobstructed.

A covering composed of copper electro-deposited upon the carbon and protected by a coating of cadmium electro-deposited upon the copper gives good results and is the next best to the zinc-brass coating, it giving a twelve-hour run and keeping out of the way of the arc and not interfering with the lamp and the light. Cadmium, however, being more volatile than zinc, does not remain upon the carbon as effectually as zinc.

While I have described my invention as applied to carbon, I do not wish to limit it to the coating of carbons, as other substances may be used for electrodes. Neither do I wish to limit my invention to coating the electrodes or carbons with zinc and copper specifically, except where such substances are specified in my claims, for other protective covering and combinations of coatings may be made to carry out the purposes of my invention. I am not aware that carbons or electrodes have ever previously been coated in such a way as to effect a substantial saving in carbon or to make an ordinary single-arc lamp perform the duty of a double-arc lamp, or, in other words, to double or materially increase the life of the ordinary carbons in an electric-arc lamp without interfering with the lamp or the light thereof. By a single-arc lamp performing the duty of a double-arc lamp I do not necessarily mean that a single-arc lamp must burn twice as long as before or to the full length of time that a double-arc lamp will necessarily burn. If, for instance, a ten or eleven hour run with carbons of ordinary size and now in commercial use is required, this can only be gotten by employing a double-arc lamp, wherein after one set of carbons is consumed another set is automatically put in circuit to give the additional amount of time required. I include in the statement above any material additional run that is ordinarily

required of a double-arc lamp to answer such requirement.

I am aware that Letters Patent of the United States No. 196,425 were granted on October 23, 1877, to Charles F. Brush for covering carbons with various substances which increase the conductivity of the carbons and incidentally only prolong the life of the same; but this patent points out no such result as is contemplated herein, nor could any such result be accomplished by said patented invention as is herein set forth.

I am aware, also, of reissued Letters Patent No. 10,544, granted December 23, 1884, to Charles F. Brush, as a reissue of the last-mentioned patent, and the same statements just made apply with full force to what is disclosed in this reissue patent.

I am aware, also, of British Letters Patent No. 471, of 1878, to Gray, wherein nickel or iron is electro-deposited on carbons to prevent useless burning away of the carbons. The state of the art as to nickel and iron being used for such a purpose is duly acknowledged in the reissued Letters Patent of Brush alluded to above and in referring to Reynier's French patent, hereinafter mentioned, and describing nickel and iron, as well as platinum, palladium, iridium, gold, silver, copper, cobalt, chromium, and manganese for such purpose. The substances referred to will not, however, accomplish the purpose of my invention and will not give as good results as the ordinary copper coating of the Brush patent referred to.

I have also become aware since making my experiments and devising means for carrying out the discovery herein set forth of Carre's original French patent, No. 80,793, of 1867, and patent of addition to the same, and also French Patent No. 109,895, granted in 1875 to Reynier, and two additions to the same granted in 1876 and 1877, all of which French patents are referred to in the reissued patent of Brush specified above. In these French patents the result accomplished by me could not be attained, the main purpose of said French patents being merely to form a sheath, mold, or tube for the carbon in order to give it sufficient rigidity and hold the particles thereof together. In none of these French patents is suggested the idea of effecting a material saving of carbon or the doubling or materially increasing the life of the carbons without increasing their size or varying their length, so as to make a single-arc lamp perform the duty of a double-arc lamp or enable a double-arc lamp to run two nights and require trimming every other day instead of every day, as is at present required in double-arc lamps without protectors, and at the same time not interfere with the lamp and the light thereof.

I am aware, also, of United States Letters Patent to Atwood, No. 272,017, of February 13, 1883, and British Patents No. 3,402 of 1881 to Mignon and Rouart, No. 4,805 of 1876 to Werderman, No. 4,432 of 1877 to Rapieff, No. 783 of 1879 to Harding, and No. 277 of 1879 to Cohne. These patents do not and cannot accomplish any such result as is contemplated and actually attained by my invention. In all of said patents, except Rapieff and Cohne, the carbons are covered with material of an insulating character, and Rapieff coats his carbons, which are of an angular shape, on one or several sides with metal for the purpose of increasing the conductivity of the carbons. Cohne places his carbons in a zinc tube before baking, and the zinc is caused to be disseminated through the carbon in the process of manufacturing the same. Nearly all of said patents have for their object to produce a more intense and steadier light by causing the coating or material about the electrodes to become incandescent. In my invention, on the other hand, the carbons are preferably coated with a thin film of conducting material, and the coating is of such a nature as to cause the carbons to burn with blunt points and prevent their penciling. My coating does not run off in balls and give rise to dense fumes and smoke or injuriously affect the light and does not protrude beyond the end of the electrode, but is dissipated by the heat of the arc, so as not to interfere with the light thereof. I hereby disclaim all of the aforementioned patented devices and do not wish to be understood as claiming anything set forth in any of said patents, my invention securing results which none of the aforesaid patents can accomplish.

Having fully set forth my discovery and the means devised by me to best carry out the same, what I desire to claim and secure by Letters Patent of the United States as new is—

1. An electrode or carbon for arc lamps, provided with a covering materially increasing its life beyond the life of coated carbons of the prior art, substantially as set forth, which covering remains upon and protects the carbon to a point substantially even with the arc, thereby making the carbon burn with a blunt point and preventing substantial penciling or coning of the same at the end and saving the carbon comprised between the ordinarily-coned end and the cylindrical end of the carbon, and which covering does not flake or fuse off in pieces of material size and does not project beyond the electrode or envelop the arc, so as to interfere with the light, but is dissipated by the heat of the arc, so as not to affect the lamp and the light thereof.

2. An arc-lamp electrode or carbon provided with a protective coating by which a single-arc lamp may burn as long as a double-arc lamp provided with the same-sized uncoated carbons of the prior art and by which a double-arc lamp may perform double its duty, substantially as set forth, which coating does not flake or fuse off in pieces of material size

and does not project beyond the electrode or envelop the arc, so as to interfere with the light, but is dissipated by the heat of the arc, so as not to affect the lamp and the light thereof.

3. An arc-lamp electrode provided with a coating substantially doubling the life thereof, and which coating does not flake or fuse off in pieces of material size and does not project beyond the electrode or envelop the arc, so as to interfere with the light, but is dissipated by the heat of the arc, so as not to affect the lamp and the light thereof.

4. An arc-lamp electrode provided with a composite metallic coating increasing its conductivity and protecting it, substantially as and for the purpose described.

5. An electrode for arc lamps, provided with a protective coating composed of a plurality of metals.

6. An arc-lamp electrode or carbon provided with a metallic coating protected by a suitable outer covering of different character carried by the electrode.

7. An electrode for arc lamps, having a protective covering composed of a plurality of metallic coatings of different material, for the purpose set forth.

8. An arc-lamp electrode or carbon having an inner metallic coating protected by an outer coating of different material, which outer coating is capable of being oxidized by the heat of the arc, the oxide formed being dissipated by the heat of the arc at a point substantially even with the arc.

9. An electrode or carbon for arc lamps, provided with a plurality of metallic coatings of different materials electro-deposited thereupon, for the purpose described.

10. An electrode or carbon consisting in an ordinary copper-coated carbon provided with a suitable additional coating of different character.

11. An electrode or carbon for an arc lamp, provided with a coating of copper protected by a metallic covering of different material.

12. A protective covering for the electrodes of an arc lamp, made up of a coating of copper and zinc.

13. A protective covering for the electrodes of an arc lamp, consisting of an inner coating of copper and an outer coating of zinc.

14. A protective covering for the electrodes of an arc lamp, consisting of a coating of copper electro-deposited upon the electrodes and a second coating of zinc electro-deposited upon such copper coating.

In testimony whereof I have hereunto set my hand and affixed my seal, this 3d day of May, 1892, in the presence of the two subscribing witnesses.

CHARLES W. HAZELTINE. [L. S.]

Witnesses:
A. C. FOWLER,
THOS. G. PORTIS.