No. 620,308. Patented Feb. 28, 1899.

W. S. HADAWAY, Jr.

INCANDESCENT ARC LIGHT.

(Application filed Feb. 16, 1898.)

(No Model.)

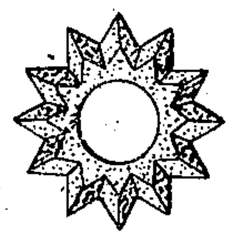

Fig. 8.

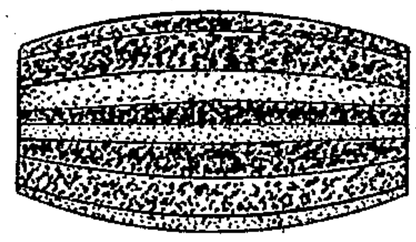

Fig. 7.

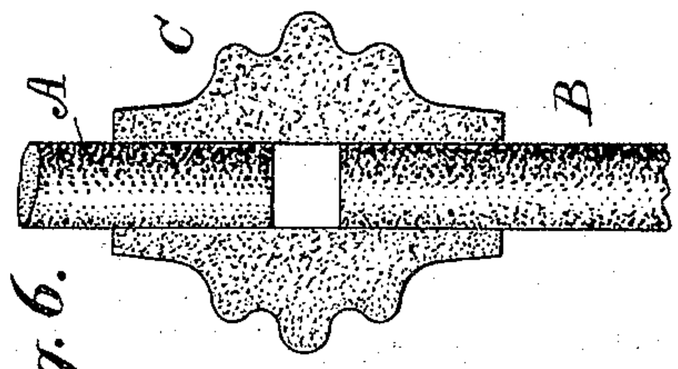

Fig. 6.

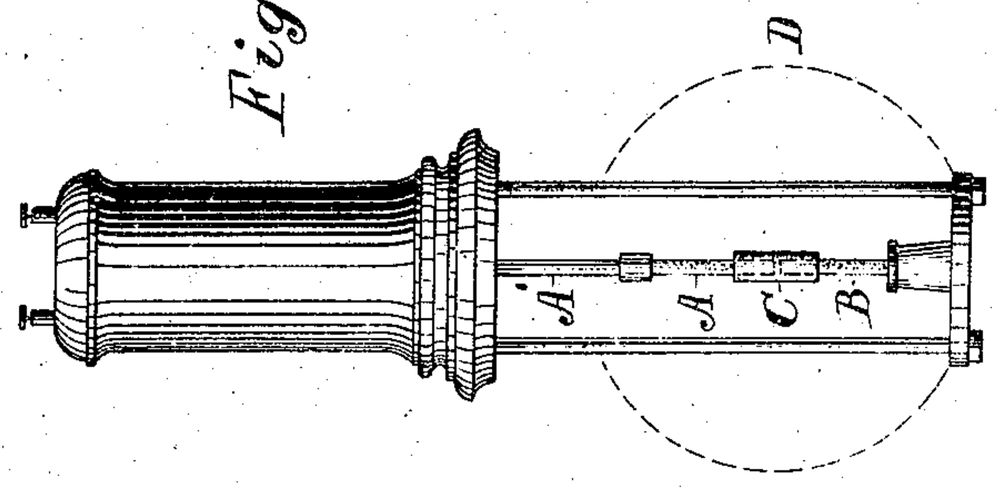

Fig. 4.

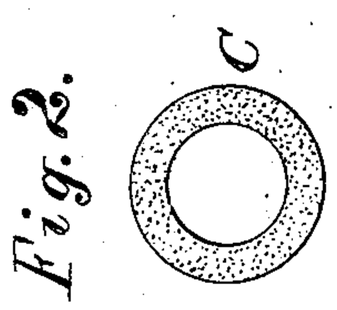

Fig. 2.

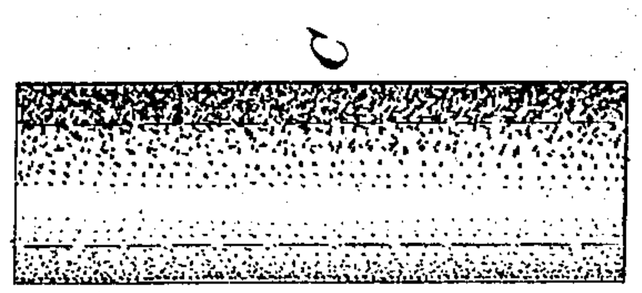

Fig. 3.

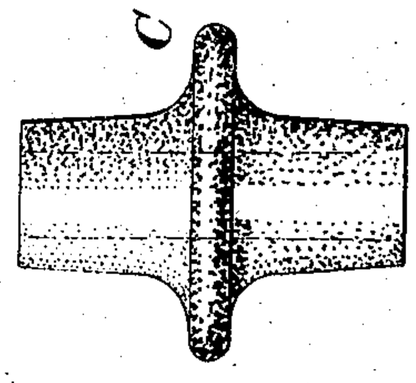

Fig. 5.

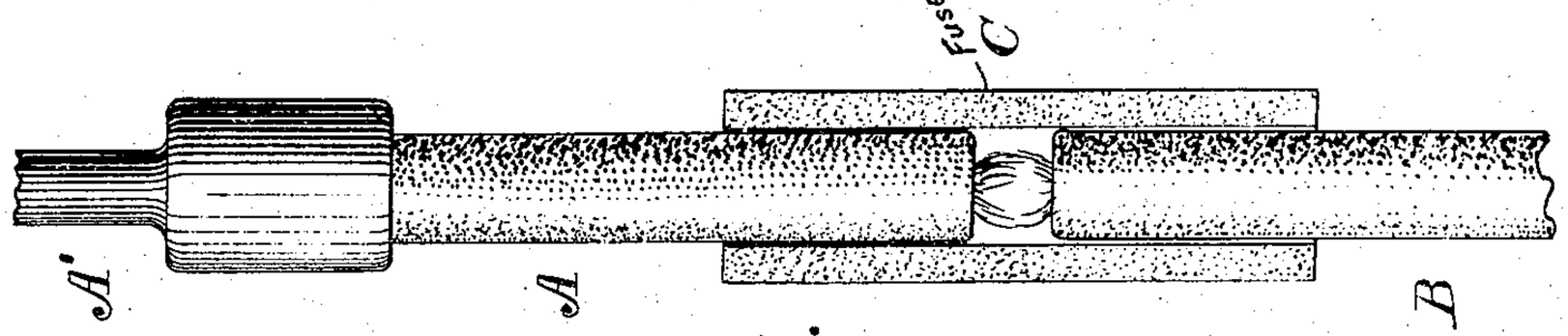

Fig. 1.

Attest:
L. Lee.
Edm. F. Kinsley

Inventor.
William S. Hadaway, Jr.,
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UNITED STATES PATENT OFFICE.

WILLIAM S. HADAWAY, JR., OF NEW YORK, N. Y.

INCANDESCENT ARC-LIGHT.

SPECIFICATION forming part of Letters Patent No. 620,308, dated February 28, 1899.

Application filed February 16, 1898. Serial No. 670,511. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM S. HADAWAY, Jr., a citizen of the United States, residing at New York, county of New York, State of New York, have invented certain new and useful Improvements in Incandescent Arc-Lights, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The present invention is based upon the discovery that an unperforated sleeve with a bore fitted closely to the carbon electrodes can be made of such material as to be rendered incandescent by the arc and without essential change or disintegration by the heat to which it is subjected. Such sleeve is made of crystallized magnesia which has been fused in the electric arc and which is thus reduced to a condition of the highest density, so that it is no longer subject to appreciable expansion and contraction by changes of temperature. With such material the sleeve requires no casing of metal or analogous substance to sustain it about the electrodes, but is of sufficient strength and durability to be supported wholly by the electrodes, and no obstruction thus exists about the sleeve to prevent the diffusion of the light therefrom. Incidentally the use of such incandescent sleeve operates to reduce the brilliancy of the light and to increase its diffusion, while the circular form of the sleeve and the absence of any metallic casing permits the diffusion of the light uniformly upon all sides of the arc. In constructing the sleeve of crystallized magnesia the material is first fused by the electric arc, and the resulting crystals are then ground to powder and mixed in a plastic mass with magnesium chlorid, the mixture being then molded under heavy pressure into the required shape.

With cylindrical electrodes like the carbon pencils in ordinary use the sleeve is made of tubular form, with bore adapted to permit the adjustment of one of the pencils within the sleeve to maintain the arc. The sleeve is preferably secured by a tight joint to one of the electrodes and fitted movably to the other with as little clearance as possible, so as to exclude air from the arc. With this construction the space between the carbons is when the lamp is in operation filled with gases of a high temperature, which offer far less resistance to the arc than the atmosphere, and the carbons may thus be separated to a greater degree and an arc of greater length be maintained.

The heat of the arc operates upon the encircling sleeve to raise the material of the same to incandescence, and the lamp thus produces a light which is derived in part from the incandescence of the sleeve and in part from the arc whose light is transmitted through the walls of the shell.

When the sleeve is attached to the upper carbon and movable upon the lower carbon, the heated gases between the carbons are wholly prevented from escaping, as they are of much less density than the atmosphere, which therefore tends to push them upward. As they cannot escape upwardly, the air is prevented from entering and circulating about the arc or reducing its temperature. A temperature is thus easily maintained which heats the sleeve to incandescence and produces a light combining the qualities of the open arc and incandescent filament.

An extended surface may be produced upon the sleeve by ribbing or corrugating the same longitudinally or transversely.

The invention will be understood by reference to the annexed drawings, in which—

Figure 1 represents the carbons adjacent to the arc with the sleeve in section inclosing the space between the carbon points. Fig. 2 is an end view of the sleeve, and Fig. 3 a side elevation of the same when made of cylindrical shape. Fig. 4 is a diagram showing an arc-lamp with the sleeve fitted about the carbons and attached to the upper carbon, as represented in Fig. 1. Fig. 5 represents a sleeve with a projecting belt to increase the diffusion of light. Fig. 6 represents the carbon points with a sleeve in section about the same and having transverse corrugations. Fig. 7 is a side elevation, and Fig. 8 a plan, of a sleeve having longitudinal corrugations or ribs.

A designates the upper electrode, B the lower electrode, and C the sleeve surrounding them adjacent to the arc. The sleeve is made of sufficient length to extend the carbons within the same a suitable distance to allow for their consumption during a given period of time and is shown cemented to the upper carbon, so as to rise and fall therewith when adjusted by the carbon-rod A'.

When the arc is first established, the carbons are close together, and very little air is therefore inclosed within the sleeve, and the heated gases which are formed between the ends of the carbon tend to expel such air through the small space surrounding the lower carbon. As the temperature of the gases increases the arc may be increased in length owing to the diminution of their resistance; but such separation does not produce any admission of the air, as the gases which are generated are unable to escape.

The sleeve when formed of crystallized magnesia, as above described, may be made nearly transparent in character, so that the light from the arc is emitted freely through the same, and when the heat of the arc has rendered it incandescent the light is produced by radiation from the sleeve as well as from the arc.

When the sleeve is attached to one of the carbons, as shown in Fig. 1, the arc is advanced toward one end of the sleeve by the consumption of the carbon to which it is attached, and the point of greatest incandescence therefore travels toward one end of the sleeve during the use of the lamp. The sleeve may, however, be held stationary, if desired, and in such case the arc may be maintained within a certain part of the sleeve, where it may be ribbed transversely, as shown in Fig. 5. When such rib becomes incandescent, it throws the light in a different direction from the other portions of the sleeve. The same effect is produced in a greater degree with the construction shown in Fig. 6, where the sleeve is corrugated transversely, and the longitudinal ribs shown upon the sleeve in Figs. 7 and 8 serve to diffuse the light in a still different manner. The cylindrical sleeve is of course best adapted to be rendered incandescent at various points in its length, as its shape and diameter are uniform throughout.

It is obvious that the arc in my construction needs no globe about it to protect it from the wind or any extraneous interference, and the lamp may therefore be operated without any globe; but a globe, as indicated by the dotted circle D in Fig. 4, may be used with the lamp, if desired, the globe being made of clear glass to transmit the light or of ornamental character when such effects are desired.

It has been common heretofore to fit the ends of the carbons within a laterally-perforated block, so that the light of the arc may escape through the lateral opening, and it has also been proposed to confine an amorphous mass of zirconia about the ends of the carbons to be rendered incandescent by the arc; but in all such constructions a metallic casing has been employed to support the incandescent material, and the diffusion of the light in every direction is thus prevented.

I have discovered that magnesia crystals possess properties altogether different from calcined magnesia and other substances heretofore proposed for incandescent lighting by the arc and that it possesses the greatest density of which the substance is capable, so that it is not subject to appreciable expansion and contraction with changes of temperature and is not disintegrated or cracked when applied to the carbons about the arc. I am thus enabled to furnish a sleeve which requires no metallic casing, but which can be supported directly upon the carbons and which when heated by the arc is thus adapted to diffuse the light in all directions around such carbons. The use of this substance thus materially changes the conditions under which an incandescent envelop can be employed about the arc, and as the substance possesses great durability it is obvious that it furnishes a very cheap and effective means for increasing the durability of the carbons by the exclusion of air and of distributing the light in a more diffused manner than is possible with the naked arc.

Having thus set forth the nature of my invention, what I claim herein is—

1. In an arc-light, the combination, with electrodes of uniform cross-section, of a refractory sleeve fitted close to the same about the arc, and adapted when the light is in operation to be heated to incandescence in proximity to the arc.

2. In an arc-light, the combination, with the carbon pencils, of a refractory shell fitted close to the carbons about the arc to be heated thereby, and provided with a projection or projections to diffuse the light when the shell is incandescent.

3. In an arc-light, the combination, with the carbon pencils, of a refractory shell fitted close to the carbons about the arc to be heated thereby, and having a corrugated or roughened surface to diffuse the light when incandescent, substantially as herein set forth.

4. In an arc-light, the combination, with prismatic electrodes vertically arranged, of a refractory shell fitted close to the same about the arc, and secured to the upper electrode by a tight joint, the shell fitting movably about the lower electrode, and adapted to be heated to incandescence by the arc, substantially as set forth.

5. An unperforated sleeve, for an incandescent arc-light, formed of fused magnesia and a suitable binder, substantially as herein set forth.

6. In an arc-light, the combination, with the carbon pencils, of a tubular unperforated sleeve of fused magnesia fitted close to the pencils about the arc and adapted to be heated to incandescence by the same, substantially as herein set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM S. HADAWAY, JR.

Witnesses:
THOMAS S. CRANE,
EDWARD F. KINSEY.