N. S. KEITH.

ELECTRIC LIGHT.

No. 246,517. Patented Aug. 30, 1881.

Fig. 1.

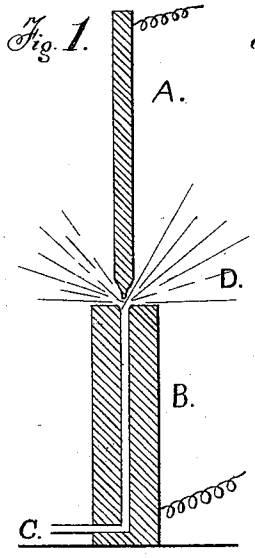



Fig. 2.

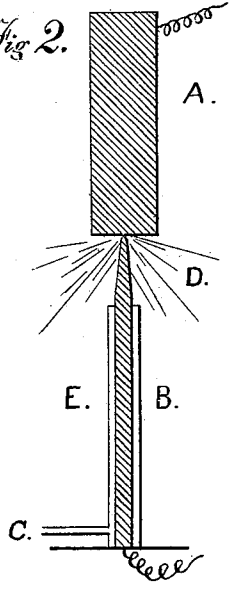



Fig. 3.

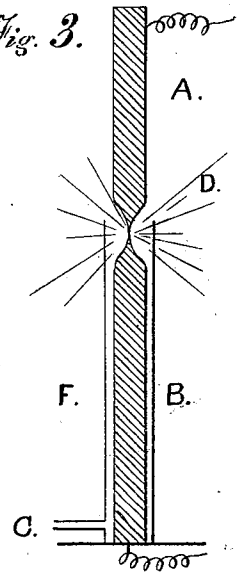



Fig. 7.

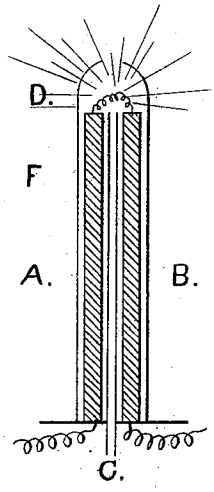



Fig. 6.

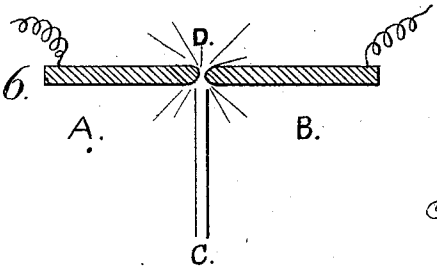



Fig. 8.

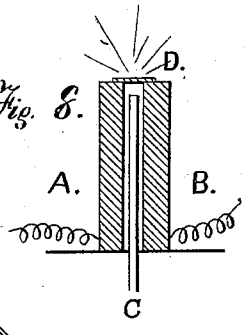



Fig. 4.

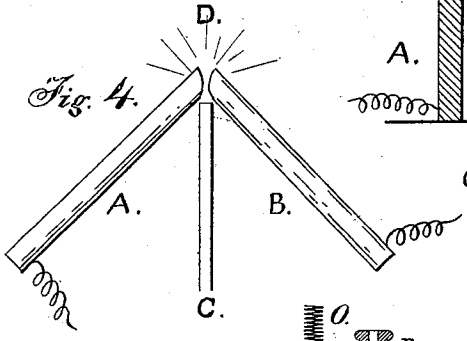



Fig. 5.

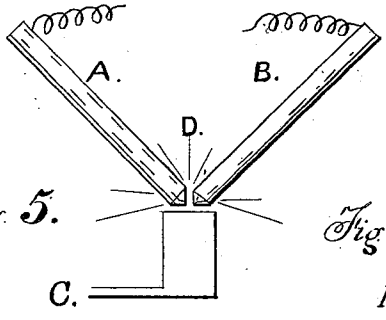



Fig. 9.

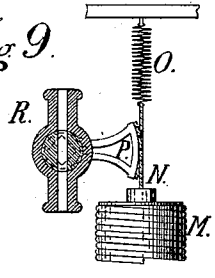
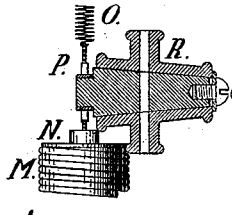



Fig. 10.




Witnesses:

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W. Hart Smith

Inventor:

N. S. Keith

N. PETERS. Photo-Lithographer. Washington. D. C.

# UNITED STATES PATENT OFFICE.

NATHANIEL S. KEITH, OF NEW YORK, N. Y., ASSIGNOR TO THE FULLER ELECTRICAL COMPANY, OF SAME PLACE.

## ELECTRIC LIGHT.

SPECIFICATION forming part of Letters Patent No. 246,517, dated August 30, 1881.

Application filed December 2, 1878.

*To all whom it may concern:*

Be it known that I, NATHANIEL SHEPARD KEITH, of the city, county, and State of New York, have made a new and useful invention for the improvement of Electric Lights, of which the following is a specification.

Prior to my invention there were two systems of producing electric lights. One was operated by causing an electric current to pervade the space between the ends of two solid electrodes of carbon, the electric action forming the light by heating to a high degree the atoms of carbon carried across the space from the positive to the negative electrode. The other was operated by causing an electric current to pervade a strip of metal or carbon which connected the electrodes, but which was made small enough for the electric current to heat it as highly as possible without fusing or vaporizing it. There are various modifications of the two systems, such as placing the electrodes in a vacuum or in gases which are not supporters of combustion, but the principle modifications have been and are mechanical.

My invention is intended to be used in addition to and in conjunction with these two systems, and the only resemblance it bears to others is in the fact that I use vapors and gases, but of an entirely different character and in a different manner. While in these other modifications non-combustible gases are used in air-tight glasses without renewal, I use combustible gases and vapors which are continually supplied, not only for combustion but also in such properly-regulated quantities as to cover the electric burner with a deposit of carbon, thus protecting it from oxidation, the amount of deposit being controlled so as to further properly compensate for the waste caused by electric action. In both systems the carbon used is gradually oxidized and carried off as carbonic-acid gas by combination with the air admitted to contact with it, or, if in vacuum or gases, is gradually vaporized. When platinum and the like refractory metals are used they are either gradually disintegrated or melted and vaporized at some time when too strong a current of electricity is used.

My invention overcomes these defects, as by it the heated substances are exposed to vapors or gases, such as illuminating-gas and gases and vapors from other hydrocarbons, such as naphtha, benzine, kerosene, and oils, during which exposure carbon is set free in such manner as to protect the heated substances from contact with air and is itself burned continuously. This decomposition of hydrocarbon vapors and gases takes place when they are highly heated—say to a bright red heat and above—a portion of the carbon constituent being freed. If properly-heated substances be exposed to such vapors or gases they become covered with a deposit of carbon, and if very highly heated the deposit assumes that form of carbon which is called "graphite."

I have found, in actual practice with electric lights, that when the heated electrodes and the heated substances composing them or connecting them are in contact with hydrocarbon vapors or gases they become covered with a deposit of carbon, which protects them from oxidation or combustion, as the carbon thus deposited and the gases and vapors themselves in burning appropriate the oxygen which would otherwise combine with the carbon of the electrodes. This burning of the vapors and gases adds to the heat and consequently to the light. As the flow of vapor or gas may be accurately and automatically regulated, the deposited carbon may be increased or diminished in amount, so as to cause the unconnected electrodes to grow each toward the other or recede; and in case of connected electrodes, the size of the connection may be increased or diminished by increased or diminished deposit of carbon to suit the electric current used. The advantage of this is obvious to the electrician, for as he will see that, in case when by waste the electrodes become too far apart, an increased flow of gas or vapor will cause them to grow and thus approach each other, or if too close a diminished flow will allow them to recede. He will also see that, when in case of connected electrodes the connection gets overheated, an increased flow of gas or vapor will both increase its size and conductivity by reason of the deposit of carbon which takes place on it, and when too large, a diminished flow of gas or vapor will allow it to diminish in size by oxidation of the deposited carbon; so that in

both these cases the changes in the current of electricity caused by the changes in electrical resistance which result from these changes in size and form of the electrodes and connections will operate an automatic electro-magnetic regulator placed in the electric circuit for the purpose of controlling the supply of gas or vapor.

In putting my invention into practice I have used various forms of apparatus, some of which, for sake of illustration, I will proceed to describe. Reference is made to the accompanying drawings, like letters in all referring to like parts.

A and B are the electrodes. C is the tube or conductor for the gases or vapors. D is the place of light, the electric-light arc, where the gas or vapor is decomposed. E is a continuation and enlargement of the gas-tube for inclosing the electrodes in Figs. 2 and 5. F is a glass tube or chimney for inclosing the electrodes in Figs. 3, 7, and 8.

The vapor or gas passes through a tubulature in one of the electrodes in Fig. 1. The electrodes may touch each other in some cases, such as when it is desirable to produce the light by incandescence of one of the electrodes in the neighborhood of the junction, as in Fig. 2, and in similar cases where the electrodes are joined at D by small strips, pencils, or wires of the same or other material, as in Figs. 3, 7, and 8. The electrodes in Fig. 5 should be revolved, the axis being the center line of their length. Each of these devices has the flow of gas or vapor regulated by a stop cock or valve, which is opened and closed automatically by an electro-magnetic movement placed in the electric circuit used for the light. This is made so that the stop-cock is closed when the circuit is open, and is open when the circuit is closed. It is also so arranged that too strong a current either partially or wholly closes the stop-cock, so that the flow of gas or vapor is regulated to suit the current of electricity pervading the electric-light arc.

Figs. 9 and 10 show two views of an automatic device for controlling the flow of the gas or vapor.

M is an axial magnet, the coils of which are in the circuit of which the light-arc is a part. The core N moves up or down in obedience to changes in the current caused by variations in the resistance of the light-arc in the well-known manner. The spring O serves to adjust this motion to the requirements of the case. When no current exists the spring pulls the lever P upward and closes the passage through the cock R, so that no gas or vapor can flow. A current causes a downward movement of the core N by magnetic attraction, opens the passage, and allows the flow of gas or vapor. Too strong a current, such as would be caused by too low a resistance at the light-arc, pulls the core and lever far enough to close the passage and stop the flow of gas or vapor.

I claim—

The mode of protecting electrodes and materials used in the electric-light arc from oxidation or combustion by providing other combustible material thereat, and by changing the size and electric resistance thereof, the same consisting in conjoining properly-regulated quantities of one or more hydrocarbon vapors or gases with the heated electrodes and materials, so that by the reactions which take place carbon is freed and part thereof is deposited upon the heated electrodes and materials.

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Witnesses:
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W. HART SMITH.