(No Model.)

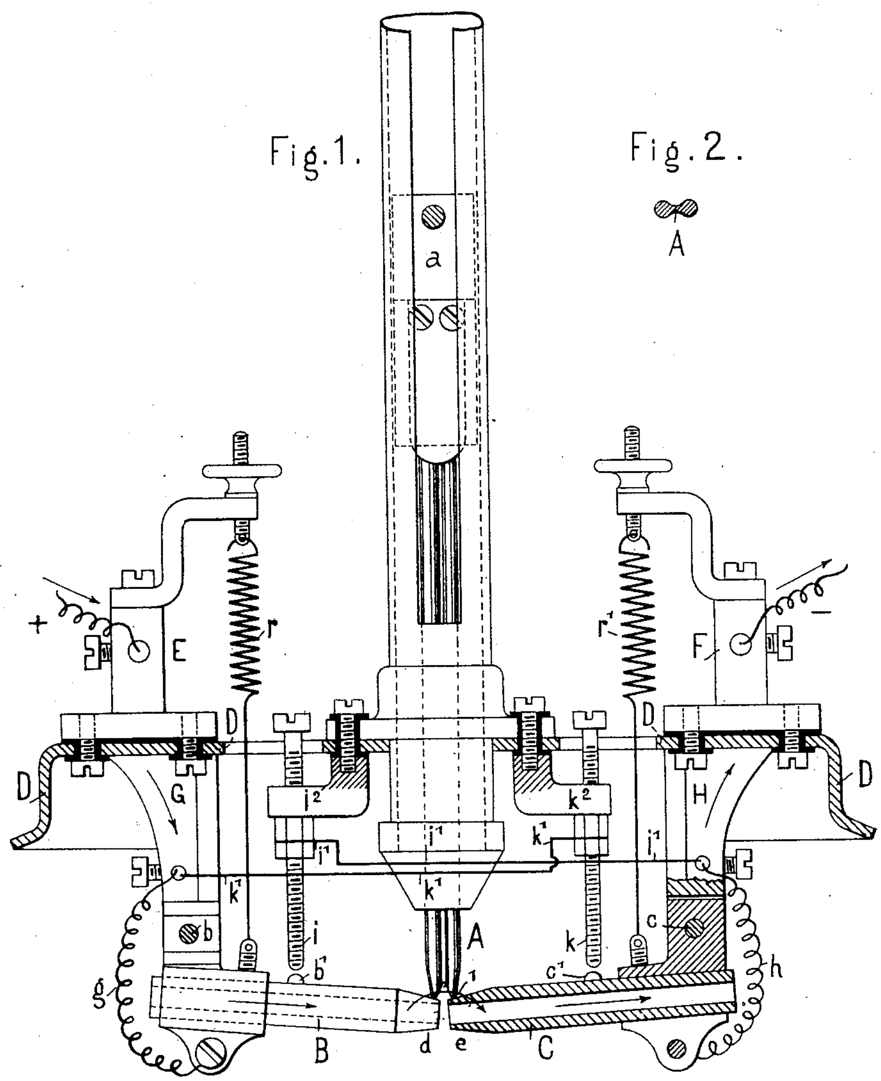
3 Sheets—Sheet 1.

H. PIEPER, Fils.

ARC LAMP.

No. 423,807.

Patented Mar. 18, 1890.



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by Marcellus Bailey
his Attorney

(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

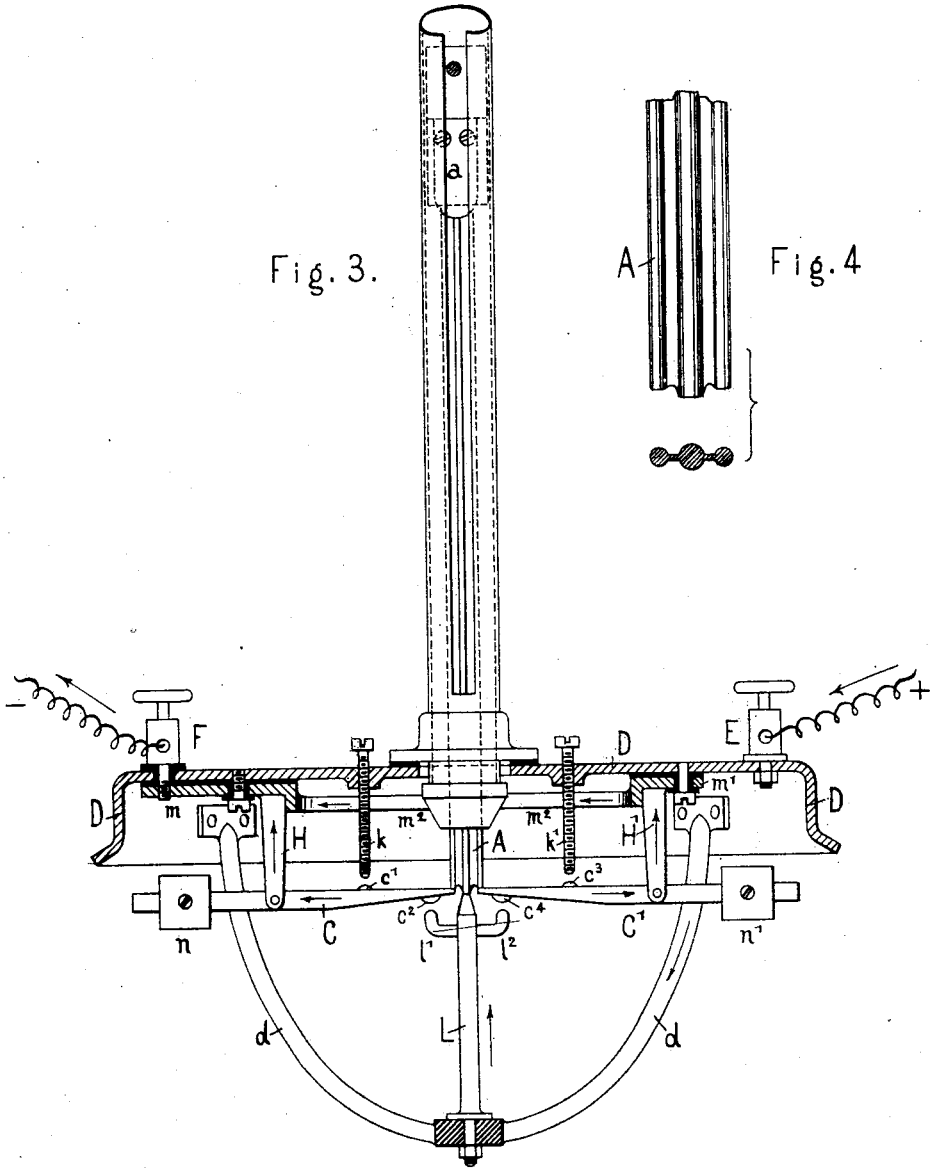

Fig. 4

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 5.

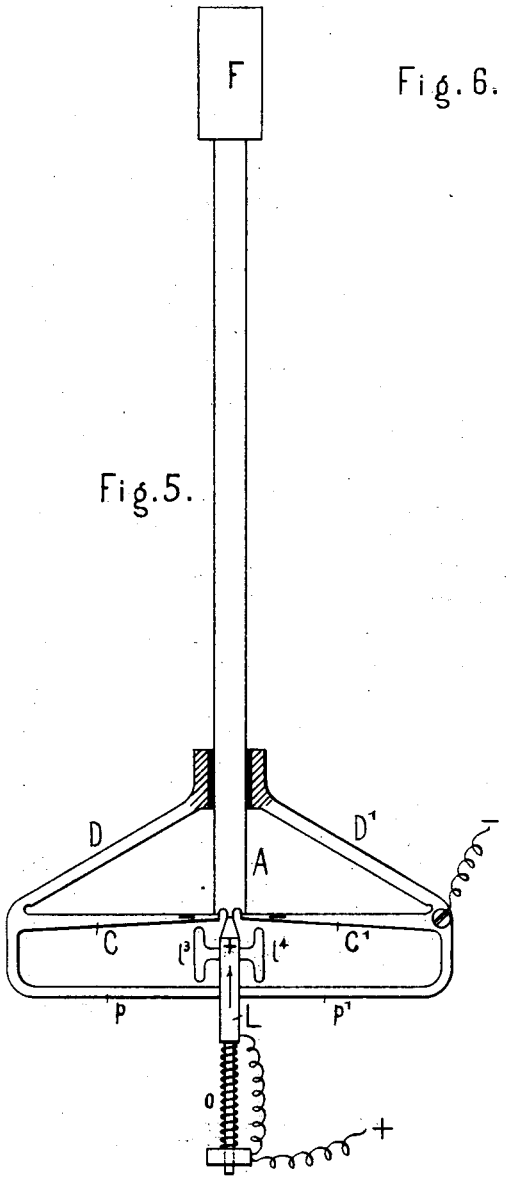


Fig. 6.

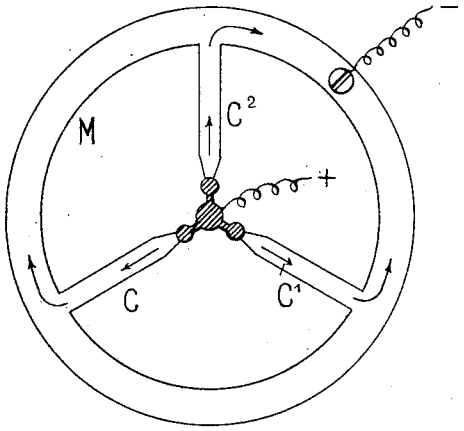


Fig. 7.

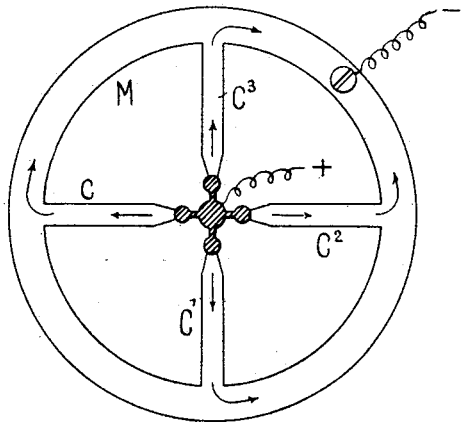
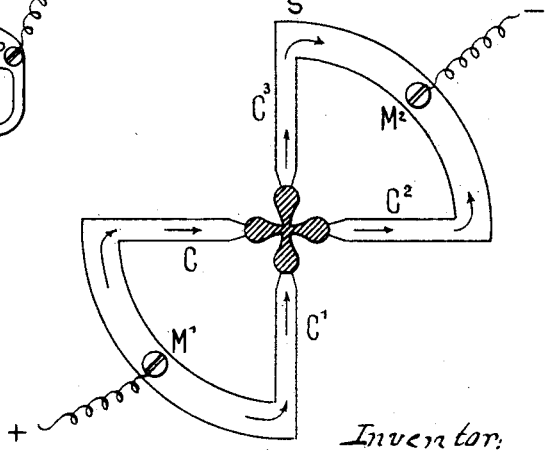


Fig. 8.



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UNITED STATES PATENT OFFICE.

HENRI PIEPER, FILS, OF LIEGE, BELGIUM.

ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 423,807, dated March 18, 1890.

Application filed September 21, 1889. Serial No. 324,611. (No model.) Patented in Belgium March 15, 1889, No. 85,408, and in France March 23, 1889, No. 196,916.

To all whom it may concern:

Be it known that I, HENRI PIEPER, Fils, a subject of the King of Belgium, residing at Liege, Kingdom of Belgium, have invented new and useful Improvements in Electric Lamps, (for which Letters Patent have been granted in France, March 23, 1889, No. 196,916, and in Belgium, March 15, 1889, No. 85,408,) whereof the following is a specification.

My invention relates to electric lamps in which the light is produced by means of an electric circuit, a carbon rod, and two or more electrodes being in contact with one end surface of the said rod, so that when the electrodes are excited the current will pass transversely through the carbon—*i. e.*, vertically to its length.

The improvements are as follows: First, one or more of the electrodes is or are arranged to be capable of moving with its point or their points of contact lengthwise to the carbon, and it is or they are pressed (each separately, if more than one is movable) against the carbon, in order to keep the latter in certain contact with the electrodes in case it should not burn away uniformly at all its points of contact; second, the electrodes, or any of them, are made in the form of tubes open at both ends and placed at an incline, so that a current of air will pass through them when they become heated by the carbon, the said air-current preventing the electrodes from being heated excessively; third, the lamp having a movable electrode or electrodes is provided with means for switching it out of circuit automatically, without interruption of the current when the carbon is consumed, or if any portion of the same should break, the said means consisting in contact-surfaces on the movable electrode or electrodes and other contact-surfaces arranged opposite thereto, and each of which is conductively connected to the pole of the lamp, being of different denomination than that to which the corresponding movable electrode is connected.

In the annexed drawings, Figure 1 is a sectional elevation of a lamp having two electrodes and comprising my improvements. Fig. 2 is a section of the carbon rod used in the same. Fig. 3 is a sectional view of a lamp with three electrodes, the central one being vertical and stationary, the lateral ones horizontal and movable. Fig. 4 shows in elevation and in section the carbon rod for this lamp drawn to a larger scale. Fig. 5 is a skeleton view of a lamp with three electrodes, whereof the central one is vertical and movable, while the lateral ones are horizontal and stationary. Figs. 6 and 7 are plans of modifications of the latter, comprising, respectively, three and four horizontal and stationary electrodes. Fig. 8 represents in plan an arrangement with two combined pairs of electrodes, which are all horizontal.

In Fig. 1, A is the carbon, and B C are the two electrodes. These are pivoted at *b* and *c* to the respective posts G and H, which are fixed to the plate D, but insulated therefrom. The post G is provided with the binding-screw E and the post H with the binding-screw F. The electrodes are drawn by springs *r* and *r'* against the end of the carbon rod, which in turn presses by gravity or, in addition thereto, by means of a weight *a*, against the latter. A current introduced at E will consequently pass through the post G and the electrode B to the carbon A, and after having traversed the carbon, as indicated by the arrow 1, it flows through the electrode C and the post H to the binding-screw F, the carbon being in consequence caused to become incandescent at its end.

In order to avoid the transmission of the current through the pivots *b* and *c*, it is advantageous to connect the posts G and H with the respective electrodes B C by means of wires *g h*. If with this arrangement the carbon is consumed unequally at its points of contact with the electrodes, so that it becomes on one side shorter than on the other, the electrode which is opposite to the point of greatest consumption will rise at its contact-making end, and thus remain in contact with the carbon, in whichsoever position the opposite electrode may be at the time. By these means the formation of sparks and the consequent burning of the electrodes, heretofore a great inconvenience in lamps of this kind, is completely avoided.

For the purpose of keeping the ends *d e* of

the electrodes cool, the said electrodes are perforated throughout their length, so that they form tubes, and they are arranged to be normally somewhat inclined upward from their point of contact. In consequence, as soon as the electrodes become hot an air-current will arise in the perforation, which produces refrigeration.

In view of causing the lamp to be switched out of circuit automatically it is provided with the contact-screws i k, carried by the respective insulated brackets i^2 k^2, and the ends whereof are opposite to the contact-points b' c' of the electrodes and so adjusted that either electrode on rising to a certain extent will touch the corresponding screw. The screw i, being above the positive electrode B, is connected by a wire i' with the post H, and through the same with the negative pole of the lamp, while from the other screw k a wire k' is conducted to the post G, which is in connection with the positive pole. As long as the lamp is burning the carbon keeps the electrodes out of contact with the screws i and k; but if one of the carbon parts—for instance, the part bearing on the electrode C—should break on a considerable length the spring r' puts the said electrode in contact with the screw k, the current passes from the binding-screw E through the post G, the wire k', the screw k, the electrode C, and the post H to the screw F, the lamp being consequently switched out of circuit. If the other part of the carbon breaks, the wire i' and the screw i cause the switching out. A like effect is brought about by either shunt, or by both together, if the carbon is consumed or checked in its descent.

The carbon rod A is made at the sides thicker than in the middle, as shown by Fig. 2. The said sides, which are in contact with the electrodes when the lamp is burning, consequently present less resistance to the current than the intermediate part, the carbon becomes uniformly incandescent upon the entire portion acted upon by the current, and a light of greater power is produced than by a carbon having uniform resistance transversely. A like effect may be obtained if the carbon rod is composed of three strips of carbons, the outer ones whereof are more conductive than the middle one, and in this case the rod may be made of equal thickness at the sides and in the middle.

The lamp represented by Fig. 3 has the stationary electrode L and the two movable electrodes C C′, which are pressed against the carbon by weights n n'. The electrode L is supported by and conductively connected to the plate D by the bows d, while the electrodes C C′ are pivoted to the respective posts H and H′, which are screwed, by means of flanges m m', to the plate D, with interposition of insulating material, and connected together by a conductive bar m^2.

To the plate D is conductively attached the binding-screw E, and to the flange m the binding-screw F, which is insulated from the plate D. A current entering at E will consequently pass through the plate D, the bows d, and the electrode L to the central part of the carbon, which rests on the said electrode. At this point the current will divide into two branches, one passing through the left-hand portion of the carbon, the electrode C, and the post H to the binding-screw F, while the other branch passes through the right-hand portion of the carbon, the electrode C′, the post H′, and the bar m^2 to the flange m, and ultimately also to the screw F. The carbon will consequently be exposed to the current in a similar manner as in the first case, except that each half thereof is acted upon by a branch of the said current, the purpose thereof being to attain a better utilization of the current, especially in lamps which are to have great lighting-power.

Opposite to the points or contact-surfaces c' c^3 of the electrodes C C′ are arranged the screws k k', screwed through the plate D, so as to be in conductive connection therewith, and opposite to the points or contact-surfaces c^2 and c^4 of the said electrodes the electrode L is provided with the arms l' l^2, the screws k k' and the arms l' l^2 being adjusted at a small distance from the respective contact-surfaces of the electrodes C C′, when these are in their normal position. The result attained by this arrangement is this: If the left-hand corner of the carbon should break, the electrode C will be brought into contact with the screw k by means of the weight n. The entire current will consequently pass from the plate D through the parts k C H m to the binding-screw F, the lamp being thereby switched out of circuit. A like effect is produced by means of the electrode C′ and the screw k' if the right-hand corner of the carbon should break. If the central part of the carbon should from any reason become too short, the carbon will press the electrodes C C′ into contact with the arms l' l^2 of the electrode L, whereby the lamp is also short-circuited. When, finally, the carbon is consumed, both electrodes C and C′ will touch against the screws k k', and thus produce the short circuit.

As shown by Fig. 4, the carbon rod for this lamp has a thick strip in the middle, designed to receive the current from the electrode L, and a thick strip or bead at each side from which the two branch currents pass to the electrodes C C′, the purpose of this form being the same as that set forth relatively to the form of the carbon of the lamp described above; but in this case, also, the lower resistance of the portions of the carbon rod being in contact with the electrodes may be attained by making the central and the lateral strips of any kind of carbon which is in a higher degree conductive than the carbon of which the intermediate portions are formed.

The lamp represented in a skeleton view by Fig. 5 differs substantially from the foregoing

one only in this that the electrode L is made movable and pressed by a spring *o* against the central portion of the carbon rod A, while the electrodes C C′ are stationary. The means for short-circuiting the lamp when the carbon is consumed, or if a portion thereof breaks, consist in the arms *p p′*, extending from the electrodes C and C′ downward and toward the electrode L, and in the arms l^3 l^4, fixed to the latter. The co-operation of these parts will be obvious from the foregoing description.

Although in this lamp but one of the three electrodes is movable, the consumption of carbon is quite regular, because as soon as the consumption begins to become less on one side the resistance opposed to the current at this side increases and a greater portion of the current passes over to the other side, the consumption being thereby equalized again immediately.

It is evident that instead of two electrodes C C′, Figs. 3 and 4, there may be three or more, provided the carbon rod be made with as many strips of low resistance as there are electrodes. Thus Fig. 6 shows in plan three electrodes C C′ C^2, connected together by a ring M, and a carbon rod composed of a thick central strip and three ribs with thick strips or beads at their outer edges. Fig. 7 is a plan of four electrodes C C′ C^2 C^3, connected together by a ring M, the carbon being made with four ribs. Fig. 8 finally shows in plan four electrodes connected in pairs to the positive and the negative pole, the electrodes C and C′ being united by the annular segment M′, to which is attached the positive conductor, and the electrodes C^2 C^3 by the segment M^2, connected with the negative conductor. The carbon in this case forms a cross, with thick strips or beads at the outer edges, but without such strip in the middle, as there is no central electrode.

I claim as my invention—

1. In an electric lamp, the combination of a carbon rod, an electric circuit, two or more electrodes in contact with one end surface of said rod, one or more of the said electrodes being movable with its or their contact point or points lengthwise to the rod, and means for pressing the movable electrode or electrodes against the surface of the same, substantially as described.

2. In an electric lamp, the combination of a carbon rod, an electric circuit, and two or more electrodes in contact with one end of the said rod, one or more of the said electrodes being tubular and inclined upward from their points of contact with the carbon, substantially as specified.

3. In an electric lamp, the combination of a carbon rod, an electric circuit, two or more electrodes in contact with one end of the said rod, one or more of the said electrodes being movable, means for pressing the movable electrode or electrodes against the carbon rod, contact-surfaces on the movable electrode or electrodes, other contact-surfaces arranged opposite thereto, and each of which is conductively connected to the pole of the lamp, being of different denomination than that to which the corresponding movable electrode is connected, substantially as hereinbefore set forth.

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

HENRI PIEPER, FILS.

Witnesses:
WM. S. PRESTON,
J. GROTT.