(No Model.)

2 Sheets—Sheet 1.

E. A. EDWARDS.

ELECTRIC ARC LAMP.

No. 485,537. Patented Nov. 1, 1892.

Fig. 1.

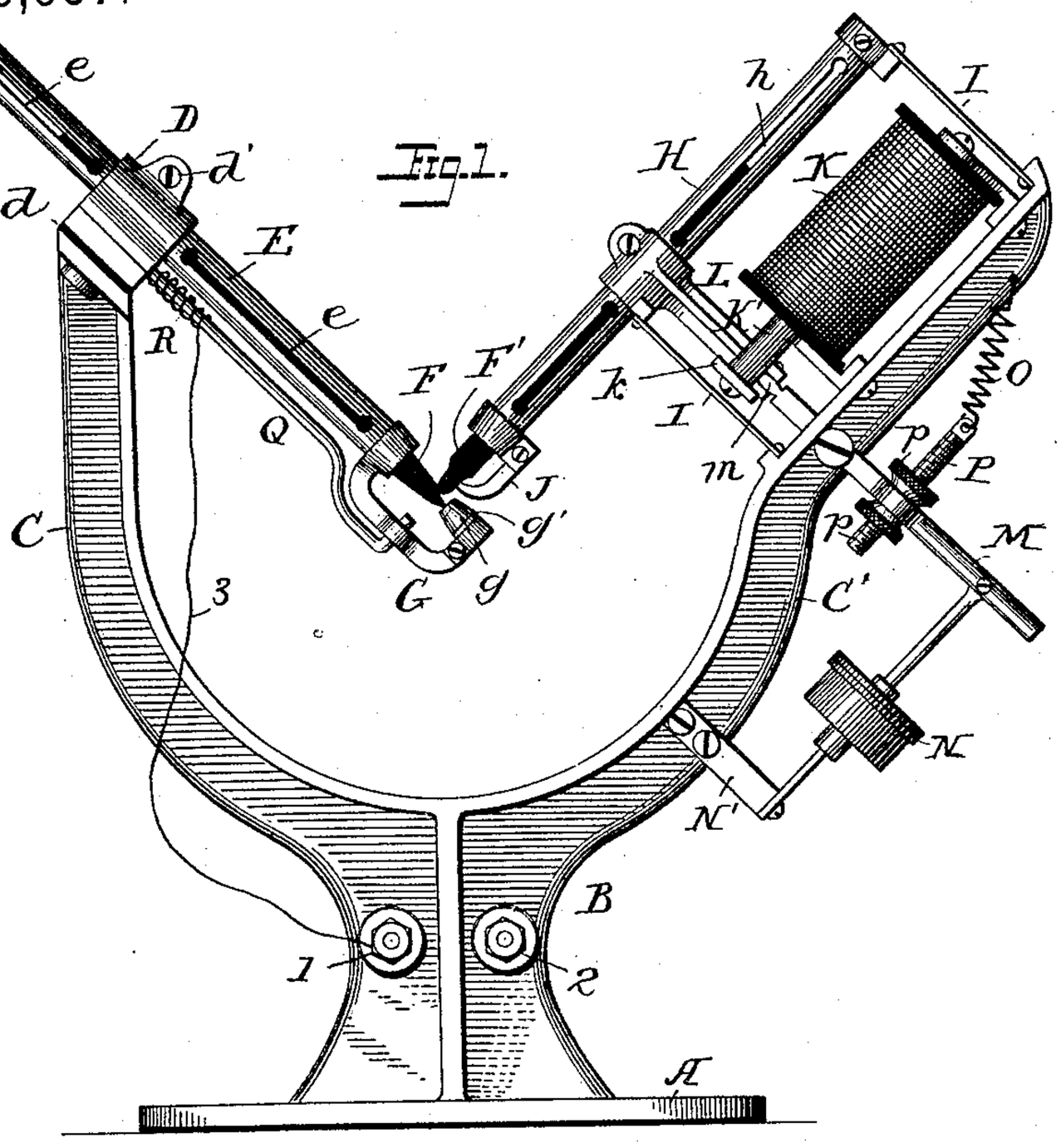
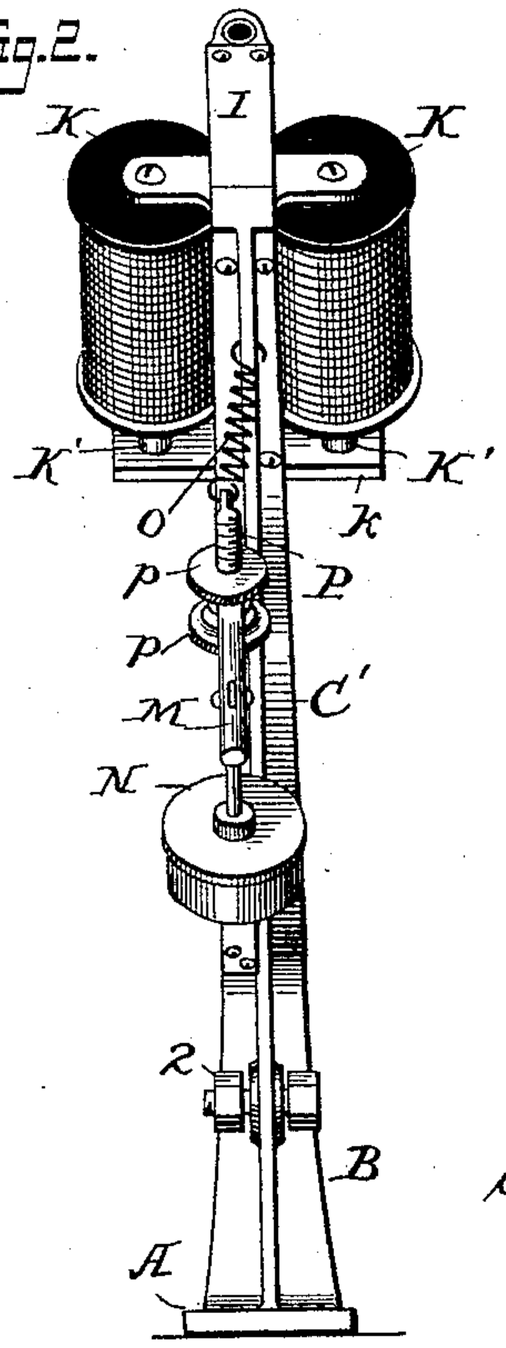


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

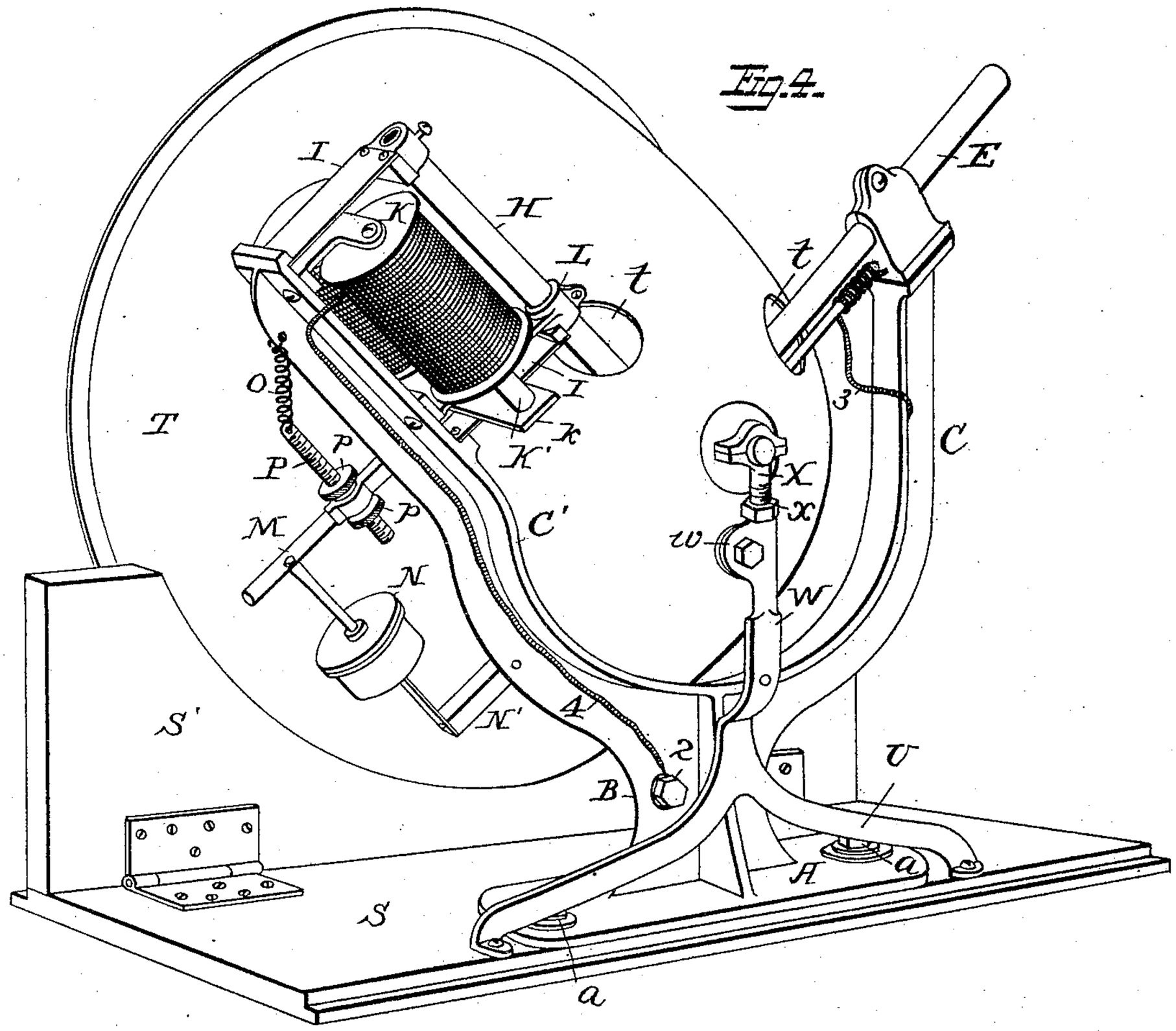
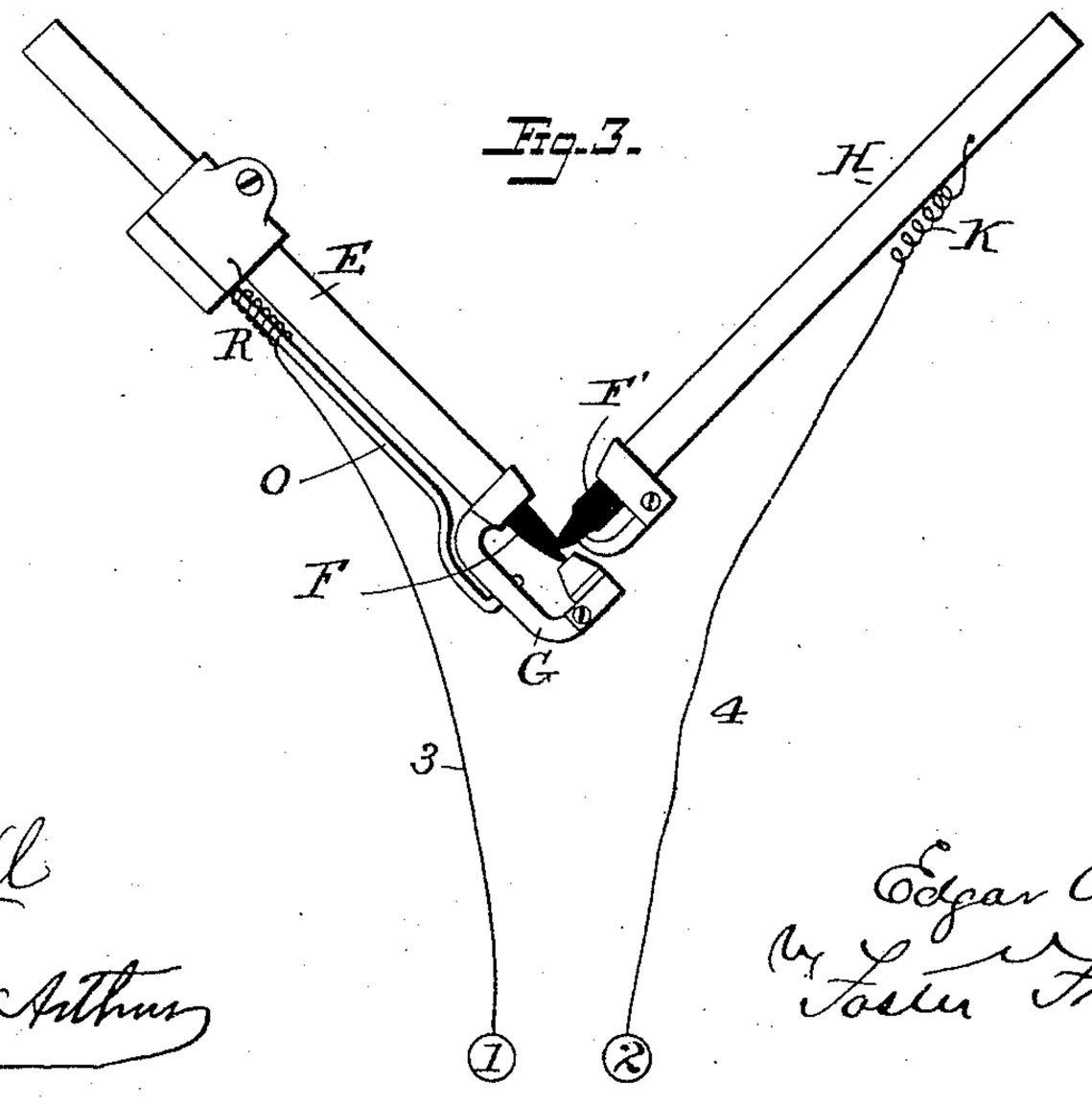


Fig. 3.



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UNITED STATES PATENT OFFICE.

EDGAR A. EDWARDS, OF CINCINNATI, OHIO.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 485,537, dated November 1, 1892.

Application filed November 25, 1891. Serial No. 413,024. (No model.)

To all whom it may concern:

Be it known that I, EDGAR A. EDWARDS, a citizen of the United States, residing at Cincinnati, Hamilton county, State of Ohio, have invented certain new and useful Improvements in Focusing Electric-Arc Lamps, of which the following is a specification.

My invention relates to electric lamps, and more particularly to that class of electric-arc lamps in which the arc can be maintained in a single position for the purpose of focusing the light in order that it may be projected in any desired direction by means of suitable reflectors arranged in connection with the lamp; and it has for its object to provide a simple, cheap, and effective lamp which is capable of withstanding shocks and jars without derangement and which shall be specially adapted to be used on railway-trains as a head-light for the engine or other purposes; and to this end my invention consists in a lamp embodying the various features of construction and arrangement substantially such as are hereinafter more particularly pointed out.

Referring to the accompanying drawings, Figure 1 is a front elevation of the preferred embodiment of my invention. Fig. 2 is a side view of the same. Fig. 3 is a diagram of the circuits. Fig. 4 is a rear perspective view showing the lamp in position in connection with the reflector.

It is well known that in the use of focusing arc lamps it is necessary that the arc should be maintained in as nearly an absolute position as possible in order that the best results may be obtained. While this is a comparatively-simple problem in the use of focusing arc lamps when the lamps are fixed upon a solid base, it is a much more difficult problem when the base is not so fixed, and especially when such a lamp is used, for instance, to furnish illumination for a locomotive head-light, as the engine is subjected to a great deal of movement, and as a consequence the lamp must be so constructed and adjusted as to be able to sustain the shocks and jars due to the movements of the engine without danger of deranging the operative parts of the lamp or interfering with their adjustment. Furthermore, when the lamps are so used on locomotives it is necessary to make them of suitable dimension and shape, so as to occupy but little space and to accommodate the parts to the reflector and reflector-case, and it is primarily with this object in view that I have produced the lamp which I am about to describe, and while it is intended more especially for such use it is evident that the principles of construction and arrangement set forth may be applied for other purposes and embodied in other devices by those skilled in the art and without departing from the spirit of the invention. The lamp comprises a suitable base A, upon which is mounted the support B for the operative parts of the device, and this support is bifurcated, so as to provide two arms C C′, which furnish the means for supporting the electrodes and operative mechanism. This support and base may be of any material suitable for the purpose; but I preferably make use of metal having flanges and ribs to produce a practically-rigid support with the least weight of material.

Upon one of the arms, as C, I mount a socket D, preferably insulated from the arm by insulating material *d*, and this socket is provided with means for clamping it, as a set-screw *d′*. Mounted in this socket is the electrode-holder E, which in the present instance consists of a tube, preferably of brass, having slots *e* in its sides and serving as a guide for the electrode F, which slides within the tube, while the slots furnish a means of determining at a glance the length of the electrode contained in the holder.

Mounted on one end of the electrode-holder is a bracket G, preferably U-shaped and carrying on one of its arms a stop-piece *g*, preferably made of copper and insulated from the bracket by some insulating material *g′*, preferably of refractory material, as soapstone and the like. This stop receives the end of the electrode F, which is usually tapered, and serves to support it and hold it in a fixed position with relation to the other electrode about to be described, and at the same time said electrode as it is disintegrated gradually feeds, in the present instance by gravity, so as to maintain continuous contact between its end and the stop. Mounted upon the other arm C′ of the support is the elec-

trode-holder H, having a construction similar to the other holder, being provided with slots *h*. This electrode-holder must be arranged so that it can move with relation to its complementary holder—as, for instance, in establishing the arc—and in order to accomplish this I support this holder in the present instance upon flat flexible or spring-like arms I I, the ends of which are respectively secured to the electrode-holder and to the arm C′ of the support. This construction, it will be seen, will allow of a movement of the electrode-holder in a plane passing through the arm and holder, but will prevent any lateral movement of the holder outside of that plane. The electrode-holder H is provided with means which will retain the electrode F′ within the holder and cause them to move together, and I have shown in the present instance one or more fingers J, which is preferably of copper or other refractory material, secured to the end of the holder and bearing on the electrode near its point, and it will be seen that whatever movements are imparted to the electrode-holder will be transmitted to the electrode, so that the two will move in unison. The normal position of the electrodes when no current is passing is with their points or end portions in contact, and I have shown the electrodes arranged at substantially right angles to each other, as I have found from experience that not only does this arrangement furnish a convenient form for use with parabolic or other reflectors, but that the arc formed between the electrodes can be adjusted and maintained in the focal point of the reflector, so that the greatest amount of light will be distributed in the desired direction, as in this arrangement the electrodes and their supports are so disposed as to interfere in the least possible manner with the projection of the light-rays.

In order to establish the arc and maintain it when the lamp is in operation, I provide a magnet K, which is shown in the form of a pair of solenoids mounted on the arm C′, and the cores K′ are connected by a heel-piece *k*, and to this heel-piece is connected a bar L, which is shown as clamped to the electrode-holder H, so that any movement in the cores of the solenoids will be imparted positively to the electrode-holder. In order to prevent too sudden movements in the electrode-holder, due to changes or makes or breaks in the circuit of the magnet, and also to aid in withstanding the shocks and jars to which the lamp may be subjected, I provide a lever M, which is pivotally mounted in the frame and connected to the bar L by a rocking joint *m*, and to the free end of this lever is attached one member of the dash-pot N or equivalent retarding device, the other member being secured to the arm C′, as by a bracket N′. To further regulate and control the movements of the electrodes, I provide a spring O, which may be secured to the arm C′ and which is connected by means of an adjusting-screw P to the lever M, suitable jam-nuts *p* being provided to secure the screw in proper adjustment and to regulate the tension of the spring in its action on the lever M.

It is well known that in an ordinary arc lamp the arc itself moves from point to point at the ends of the electrodes as they disintegrate, and while in the ordinary lamp this changing or "jumping," as it is sometimes called, is immaterial in a focusing-lamp it interferes with the steadiness of the arc and the uniform projection of the rays of light therefrom. In order to overcome this difficulty and to aid in maintaining the arc in the focal point, I provide a magnet Q, which is arranged in a position to attract the electric arc and to confine it as nearly as possible to one position, and while this may be accomplished in various ways I have shown the magnet as consisting of a bar secured to the clamping piece or socket D and having its bent end extending through the yoke G, adjacent to the focal point of the carbons, and while this may be a permanent magnet I have found that under the influence of the heat from the arc the magnetism is impaired or even vitiated, and I therefore provide the magnet Q with a coil R, which is connected in the circuit of the lamp, so as to energize the magnet continuously when the lamp is in operation.

As before intimated, it is necessary that the arc should be accurately adjusted in the focal point of the reflector, and while the construction heretofore described is well adapted for that purpose I find it advantageous to adjustably mount the reflector, so that the lamp and reflector may be accurately adjusted with relation to each other.

In Fig. 4 I have shown a simple and effective means of carrying out this part of the invention. In this construction S may be the sliding board of an ordinary head-light, having a hinged support S′, adapted to receive the rim of the reflector T, which is shown as a parabolic reflector. Mounted on this sliding board is a support U, having a vertical standard W, provided with a hole *x* to receive the screw X, which is attached to the rear end of the reflector. This standard is split and is provided with ears *w*, and the screw-bolt X is provided with a nut *x*, by means of which the reflector may be nicely adjusted on the standard, and then the ears *w* are secured in position by a suitable bolt to clamp the screw and hold it firmly in position. In this way I am enabled to accurately adjust the reflector vertically and hold it in position. The reflector is provided with openings *t*, through which the electrodes of the lamp and their holders are passed, so that the arc may be brought into the focal point, and in order to adjust this arc laterally I attach the support A of the lamp to the sliding board S by means of bolts *a*, passing through enlarged bolt-holes in the base of the support, and in this way it will be seen I can readily adjust the lamp laterally and longitudinally with rela-

tion to the reflector, while the latter is vertically adjusted by the means before described with relation to the lamp, and when the parts are once accurately adjusted they are held in position against the shocks and jars to which they are subjected. Furthermore, by attaching the lamp and the reflector to the sliding board they may both be removed from their position in the head-light case without disturbing the adjustment, or they can be adjusted before or after they are placed in the head-light case.

The circuits of the lamp are illustrated diagrammatically in Fig. 3, in which 1 indicates the plus binding-post, and 2 the negative binding-post, which are secured to the frame, but insulated therefrom. From the plus binding-post a conductor 3 leads to the magnet R, and from thence the current passes to the electrode-holder E, from whence it passes directly to the electrode F through the point of contact of the electrodes F and F′ to the electrode-holder H, and thence to the coils of the magnet K and to the negative binding-post by the wire 4.

The operation of the lamp will be readily understood by those skilled in the art and need not be described in detail, it being understood that in the normal position with no current on the electrodes are in contact; but when the circuit is closed the magnet K is energized, attracting its cores and moving the electrode-holder H, so as to establish the arc, the flat springs I causing the same to move in a direction substantially parallel to the flattened portion of the arm C′, the dash-pot and springs preventing a too rapid movement, and also serving to aid the cores in holding the electrodes in proper position. At the same time the magnet Q is energized and attracts the electric arc, as before indicated, and I find that the lamp burns with great steadiness and regularity. It will be understood, of course, that as the resistance of the arc increases through the disintegration of the electrodes the carbons approach each other through the action of gravity, there being little or no movement in the movable-carbon holder, the feeding depending upon the movements of the electrodes by gravity, while the magnets K operate to regulate and maintain them at a proper distance apart.

What I claim is—

1. In a focusing electric-arc lamp, the combination of a positive electrode and a positive refractory stop against which it normally rests, of a negative electrode and a detaining-finger bearing against said electrode, substantially as described.

2. In a focusing electric-arc lamp, the combination, with the carbon-holders arranged at an angle to each other, of a positive carbon normally resting against a fixed refractory axial stop and the negative carbon normally resting on a detaining-finger, substantially as described.

3. In a focusing electric-arc lamp, the combination, with a positive carbon normally resting on an insulated metallic stop, of a negative carbon normally resting against a detaining-finger, substantially as described.

4. In a focusing electric-arc lamp, the combination, with the positive-carbon holder, of an axial metallic stop supported thereby, but insulated therefrom, and a negative-carbon holder carrying a detaining-finger for supporting the negative carbon, substantially as described.

5. In a focusing electric-arc lamp, the combination, with the electrode-holders arranged at an angle to each other, a positive electrode normally bearing against a fixed refractory stop, a negative electrode normally bearing against a detaining-finger, a magnet, and connections for establishing and maintaining the arc, substantially as described.

6. In a focusing electric-arc lamp, the combination, with the electrode-holders arranged at an angle to each other, a positive electrode normally bearing against a fixed refractory stop, a negative electrode normally bearing against a detaining-finger, a magnet, and connections between the magnet and the negative-electrode holder for establishing and maintaining the arc, substantially as described.

7. In a focusing electric-arc lamp, the combination, with the supporting-frame, of an electrode-holder, flat spring connecting the holder to the frame, a magnet, a bar connecting the core of the magnet to the holder, a lever pivotally connected to the bar, a dash-pot connected to the lever, and an adjustable spring, also connected to the lever, substantially as described.

8. In a focusing electric-arc lamp, the combination, with an electrode normally resting on a fixed refractory stop and an electrode normally held by a detaining-finger at an angle to the first electrode, of a magnet arranged adjacent to the electrodes for directing the arc, substantially as described.

9. In a focusing electric-arc lamp, the combination of the positive electrode resting against the fixed refractory stop and a negative electrode resting against a detaining-finger and arranged at an angle to the positive electrode, of a magnet, the coils of which are included in the circuit of the lamp, the magnet being arranged in axial line with the negative electrode, substantially as described.

10. In a focusing electric-arc lamp, the combination, with the electrode-holder having a yoke supporting a stop, of another electrode-holder arranged at an angle thereto and having a detaining-finger for the electrode and a magnet supported by the yoke adjacent to the point of contact of the electrodes, substantially as described.

11. In an electric head-light, the combination, with the sliding board, of a reflector, a support mounted on the sliding board, connections to the rear end of the reflector and adjustable in said support, a lamp, also mounted on the sliding board, and electrodes mount-

ed on said arms and arranged at an angle to each other in the focal point of the reflector, substantially as described.

12. In an electric head-light, the combination, with the sliding board, of a reflector, a support mounted on the sliding board, connections to the rear end of the reflector and adjustable in said support, a lamp, also mounted on the sliding board and having bifurcated arms embracing the reflector, and electrodes mounted on said arms and arranged at an angle to each other in the focal point of the reflector, substantially as described.

13. In an electric head-light, the combination, with the sliding board, a support mounted thereon, and devices connected thereto for vertically adjusting the reflector, of a support for the lamp, having bifurcated arms and provided with means for lateral and longitudinal adjustment of the lamp, the electrodes being arranged at an angle to each other and passed through openings in the reflector and extending to the focal point thereof, whereby the lamp and the reflector may be adjusted with relation to each other, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDGAR A. EDWARDS.

Witnesses:
W. S. MCARTHUR,
F. L. FREEMAN.