(No Model.) 2 Sheets—Sheet 1.

E. A. EDWARDS.

ELECTRIC ARC LIGHT.

No. 541,603. Patented June 25, 1895.

Fig. 1.

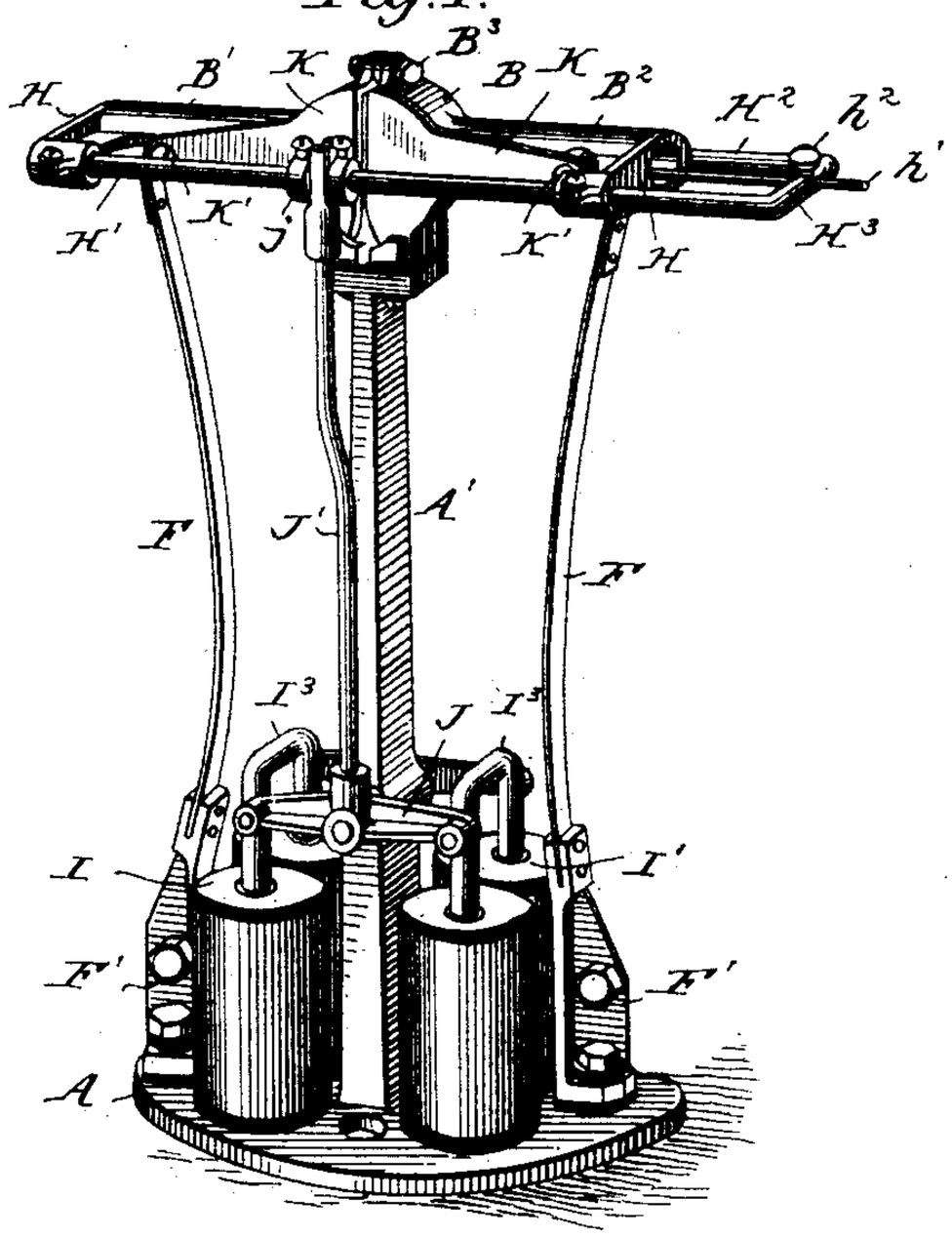


Fig. 4.

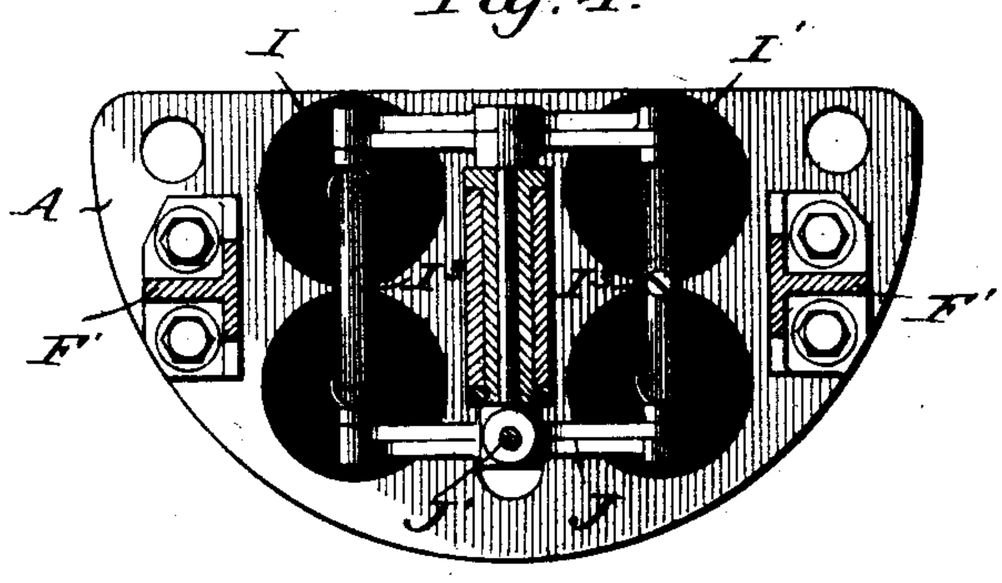
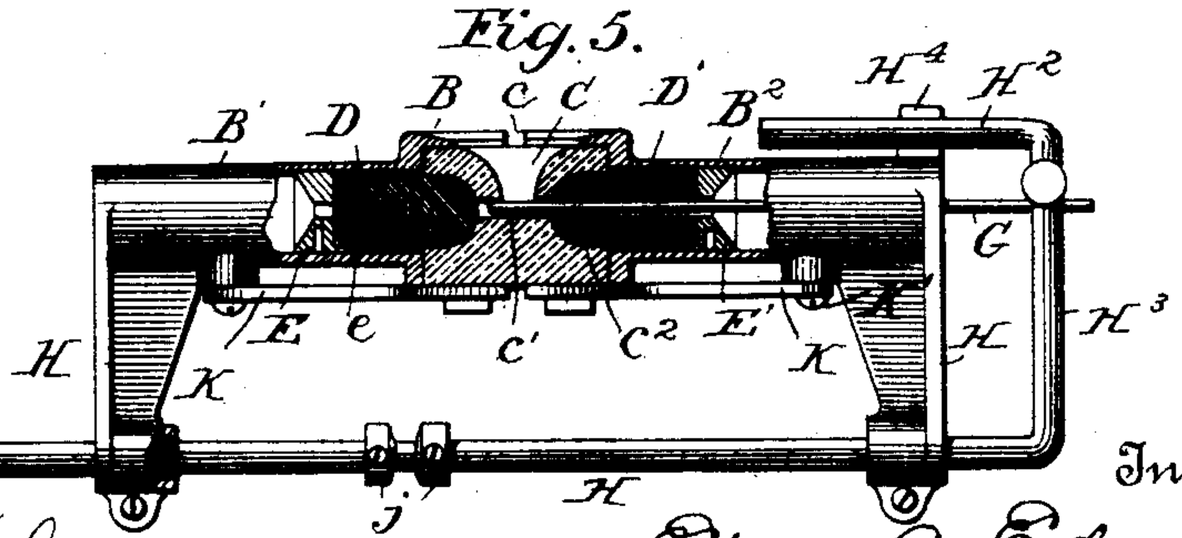


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

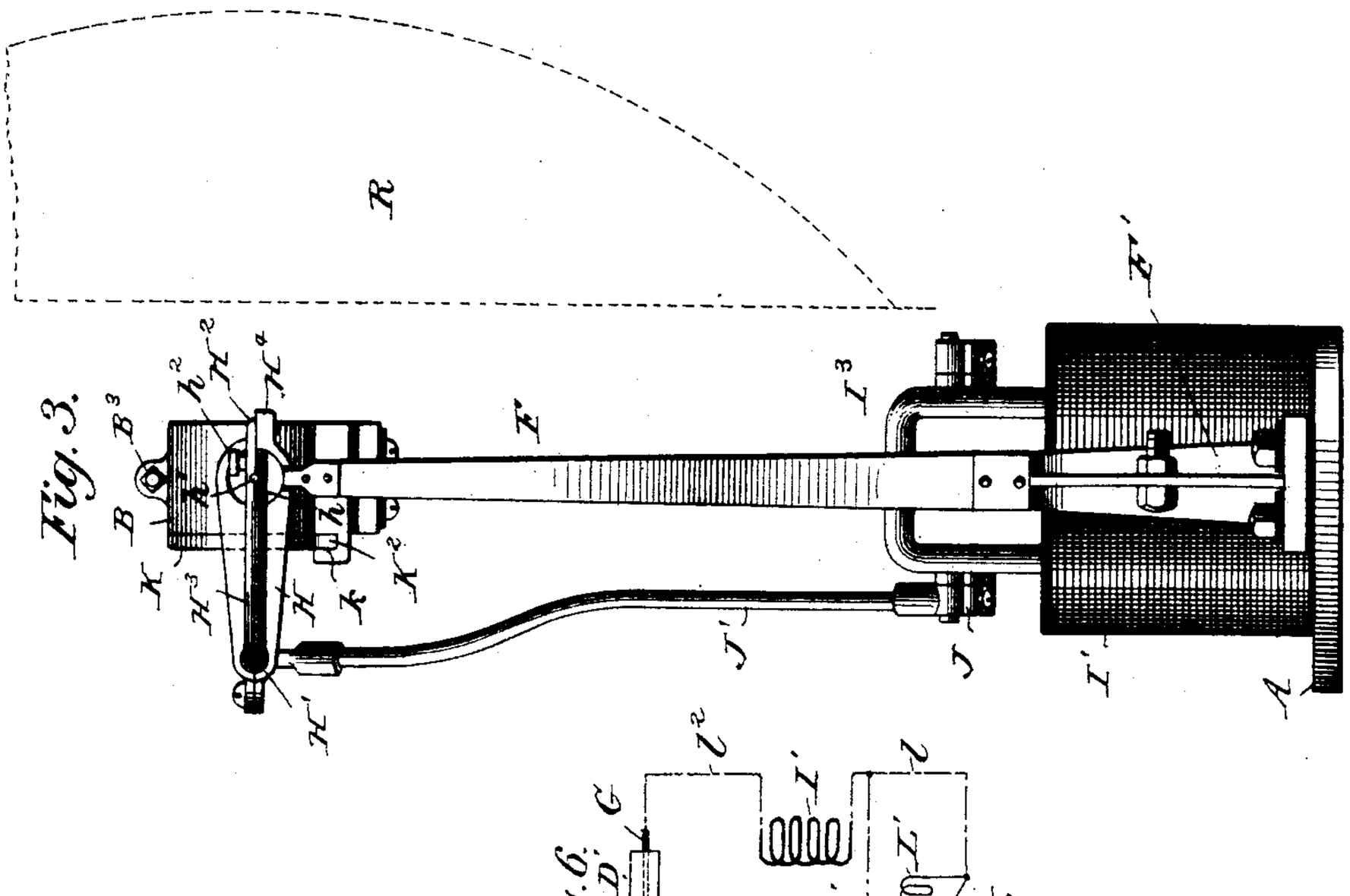


Fig. 6.

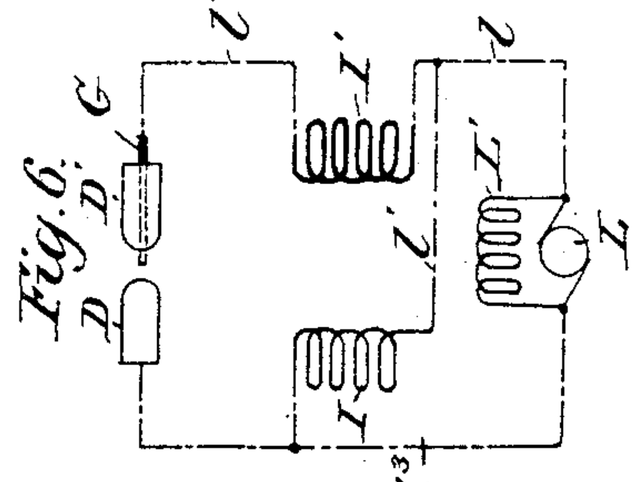
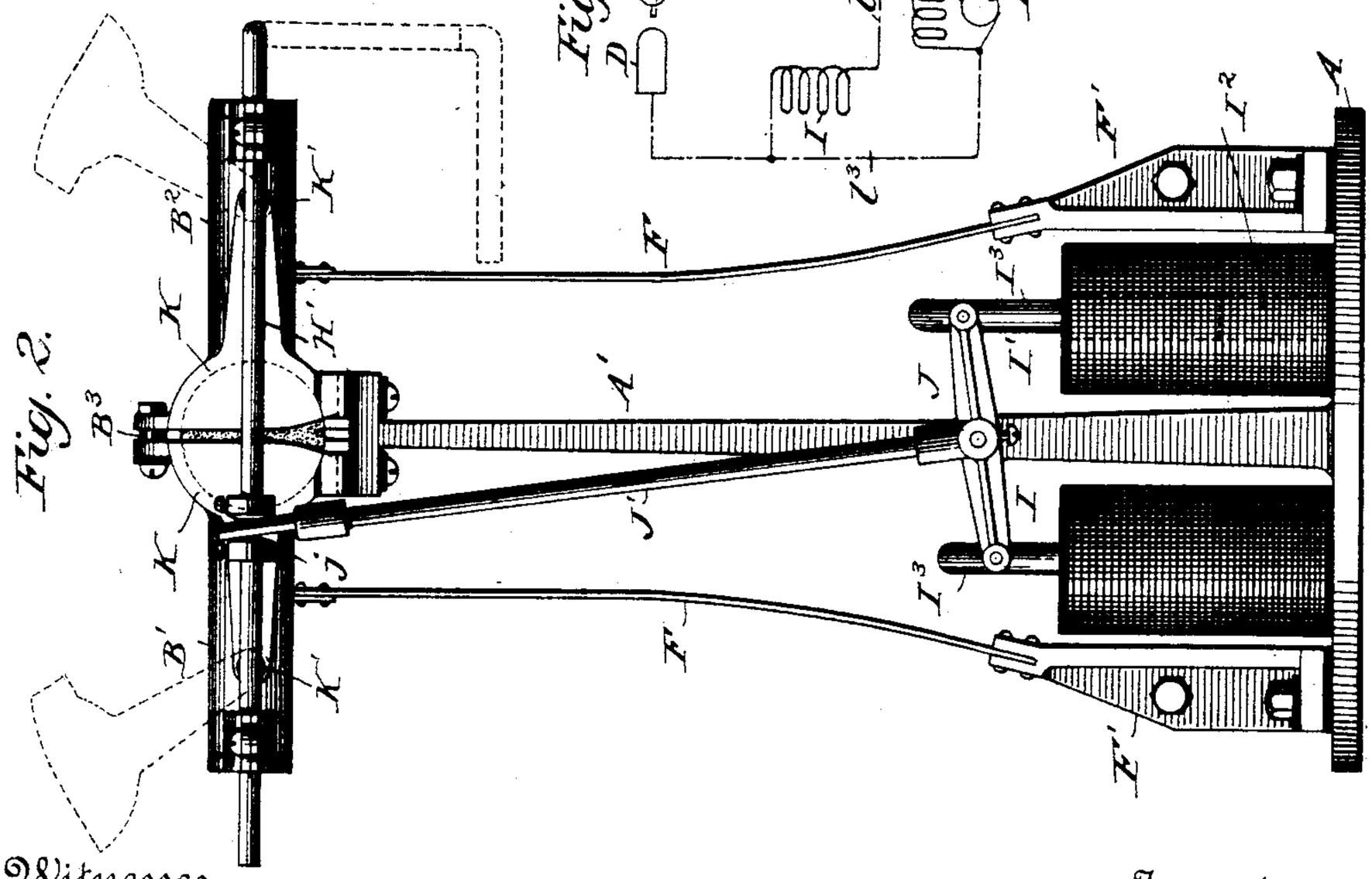


Fig. 2.



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UNITED STATES PATENT OFFICE.

EDGAR A. EDWARDS, OF CINCINNATI, OHIO.

ELECTRIC-ARC LIGHT.

SPECIFICATION forming part of Letters Patent No. 541,603, dated June 25, 1895.

Application filed September 19, 1894. Serial No. 523,483. (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, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Electric Lights, of which the following is a specification.

My invention relates to electric lights, and more especially to that class which are generally known as incandescent arc lamps, and while the lamp may be used for many and various purposes, it is designed and embodied in a form which is adapted particularly for electric head-light purposes

The object of the invention is to provide a simple mechanism which can be not only readily made, but easily and quickly operated and adjusted by comparatively unskilled persons; which shall be light and at the same time strong, and the parts shall be so proportioned and arranged as to interfere as little as possible with the distribution or projection of the light-rays; which shall give a steady, continuous light, of great illuminating power; and which shall produce this light in the best way for projecting it in straight or parallel rays for search-light or electric head-light purposes, and to these and other ends which might be mentioned, my invention consists in the various features of construction and arrangement of parts, having the mode of operation substantially as hereinafter more particularly set forth.

Referring to the accompanying drawings, Figure 1 is a perspective of the lamp. Fig. 2 is a rear elevation of the lamp. Fig. 3 is a side view of the lamp. Fig. 4 is a part transverse horizontal section and part plan view of the lamp. Fig. 5 is a plan view of the top portion of the lamp, partly in section; and Fig. 6 is a diagram of the circuits.

While it will be understood that various features of my invention may be modified and changed to adapt them for various uses, and they may be used separately or in combination, as shown, or in combination with other equivalent parts, without departing from the general principles of my invention, in the present instance I have shown the invention as embodied in a form well adapted for search-light and more especially for electric head-light purposes, and as the requirements of such lamps are now well understood, without setting them forth in detail, I will now proceed to describe the invention and illustrate how I have met all the requirements in a practical and effective, although simple, embodiment of the invention.

For head-light purposes, it is well known the lamp should be as light as possible, and still have sufficient rigidity to withstand the shocks and jolts incident to its use for such purposes, and as the lamp is usually used with the reflector indicated at R, in dotted lines, Fig. 3, which concentrates and projects the rays of light practically horizontal beyond the rear of the lamp, it is, of course, desirable that the lamp shall interfere the least possible amount with such projection of the rays.

The frame of the lamp comprises a base-plate A, from which rises a standard A′, which is made relatively thin in cross-section in the line of projection of the rays to interfere as little as possible therewith, and which serves as a support for the housing for the light-giving elements. This housing comprises generally a central portion B, with two laterally extending tubes B′, B^2, and these are arranged to support the carbons and the refractory material.

Mounted in the central portion B, of the housing is a mass or body of refractory material C, of generally cylindrical shape, having one side recessed, as at *c*, the surface of the recess being preferably curved, as indicated, and this recess communicates with a passage *c*′, longitudinally through the block. Each end of the block is also recessed, as at c^2, to receive the adjacent ends of the carbons D, D′, and these recesses are preferably curved to conform with the outline of the recess *c*, with their centers in line with each other and in line with the opening or passage *c*′.

Mounted in the laterally extending tubes B′, B^2, of the housing are the carbon-holders E, E′, which may be of any suitable construction, but are shown as having flanges or spring fingers *e*, to receive and hold the carbons D, D′. These carbon-holders E, E′, may be moved or controlled by different devices, so as to properly feed the carbons toward the block of refractory material as they are consumed, but in the present instance I have shown for this purpose the spring arms F, F,

which are shown as mounted in stand supports F′, F′, mounted on but insulated from the base-plate A. The upper ends of these spring arms are formed so as to properly engage the carbon-holders and move them toward each other under the tension of the springs. It will be observed by reference to Figs. 2 and 3 that these spring arms are broader than they are thick, and that they present their narrow edges to the rays of light as they are projected by the reflector, so that they interfere in the least possible way with the light-rays. By making the springs of relatively considerable length a practically uniform pressure or tension is exerted on the carbons in forcing them forward to their operative position. It will be seen, however, that they exert their greatest pressure when new or relatively long carbons are used, and as will be seen hereinafter, it is preferable to trim or adjust all the parts of the lamp at one time by substituting a fresh block of refractory material at the same time that the burned carbons are replaced by new ones, and under these conditions, the block of refractory material can best withstand the pressure from the carbons at either side, but after it has been used a considerable time, it deteriorates more or less and is more liable to fracture under excessive pressure, and this arrangement of springs enables me to take advantage of this and exert the least pressure at the time when it is most desirable, and the greatest pressure at the time when it is most effective, so the result is that under all conditions the carbons are held properly in place so as to establish a uniform length of arc.

In a lamp of this character, having a practically inclosed arc, and where the carbons are maintained in fixed relations to each other, it is necessary to provide some means of starting the arc, or to provide what is technically known as an arc-starter or re-lighter, and I have shown in the present instance one of the carbons, as D′, perforated at or near its center, through which is moved a rod G, of carbon or other similar conducting material. Normally, the re-lighter carbon is withdrawn within the opening in the carbon D′, but some means must be provided for moving it so that it will make contact with the opposite carbon D, at the proper time to start the lamp into operation. While various means may be used for this purpose, in a lamp of this character, it is also desirable to have these means interfere as little as possible with the projection of the light-rays, and I have shown the housing as provided with brackets or arms H, extending rearward therefrom, and mounted in these brackets is a horizontal rod H′, one end of which is insulated from one of the brackets, as indicated. This rod H′ slides freely in the brackets, and is bent at one end to a practically U shape, having a bent end H^2, and a connecting portion H^3. This bent end H^2, is preferably supported on the projection H^4, of the housing, and in order that it may slide thereon with little or no friction, as well as for other purposes, I preferably make the bent portion of a half round rod, or in other words, provide the rod at this part with a flat face, as indicated in Fig. 3. This also enables me to utilize the intermediate portion H^3, as a clamp for the re-lighter G, and it will be seen that by simply sawing or slitting the rod, as at *h*, a socket *h′* for the re-lighter is formed, in which it can be adjusted and clamped by any suitable means, as a set screw h^2. This rod H′, can be swung over into the position indicated in dotted lines, Fig. 2, when the lamp is being re-trimmed, as hereinafter set forth.

In order that the re-lighter and the rod by which it is carried may be automatically moved at the proper time, I provide two electro-magnets or solenoids I, I′, one of which, as I, is arranged in a shunt circuit from the main or feeding circuit of the generator, and is of relatively high resistance, while the other, I′, is of relatively low resistance, and is arranged in the main circuit of the generator, including the electrodes or carbons of the lamp. The cores or armatures of these magnets are properly adjusted and are connected in the present instance to a cross-arm J, which is pivoted to the standard A′, and to which is attached an upwardly extending arm J′, the end of which in the present instance is bifurcated so as to embrace the rod H′, and is confined in relation thereto by tappets *j*, secured to said rod. These tappets, of course, can be adjusted in any position to suit, but the parts are preferably so arranged that under normal conditions when the re-lighter is withdrawn, the upright arm J will be parallel to the standard A′, so as not to cut off or interfere with the light-rays.

When the magnet or solenoid I, is energized, it will be seen that the lever J, J′, is moved to a position to bring the re-lighter into contact with the carbon D, and thereby furnish a path for the current to start the arc, and as soon as this is completed, the magnet or solenoid I′, is energized by the main current of the lamp, and the magnets are so adjusted with relation to the current that they will normally hold the lever in its central position, with the re-lighter withdrawn from the carbon. While, of course, the magnets could be accurately balanced so that this would be accomplished, I preferably provide in the core of the main electro-magnet a stop, shown in the form of a block I^2, so that the core I^3, will be drawn into the magnet or solenoid, and will normally rest on the stop, and in this way the magnet coils need not be so accurately adjusted, it only being necessary that under operative conditions the attractive force of the coils of the magnet I′ will predominate slightly over that of the magnet or solenoid I.

In order that the lamp can be readily re-trimmed and the refractory block C, removed and replaced by a fresh one, when necessary,

the rear of the central portion of the housing B, is closed by the covers K, K, which are shown as pivotally mounted, as at K′, and as resting in a slot or recess *k*, in the lip K^2, of the housing, they resting there by gravity. It may be remarked that the housing is really made up of two complementary right and left portions, which are adjustably united, but insulated from each other, as by means of a screw or bolt B^3.

Such being the preferred construction or embodiment of my invention for the purpose indicated, I will now explain briefly some of the advantages of this construction and how it may be manipulated.

Preferably I use carbons having a life approximately equal to the life of the block of refractory material, so that whenever the lamp requires re-trimming all the wearing parts may be replaced at one and the same operation. In order to do this speedily and conveniently, the operator first removes the re-lighter G from the arm H′, and swings the arm over to the position shown in Fig. 2. The covers K, are then raised to the position shown in said figure, and the carbon-holders are then withdrawn in any convenient way, as by bending the spring G outward to withdraw the carbon-holder from its respective tube, which tube is slotted at its under side, as clearly shown in Fig. 3. After both of the carbons are removed, the refractory block may be lifted out of its chamber and a fresh one supplied. Then the fresh carbons are inserted in the respective tubes, the doors are closed and the re-lighter adjusted, and the lamp is ready for operation. All these operations are exceedingly simple and can be quickly and easily performed by an unskilled person, and the parts necessarily assume their proper positions without requiring any delicate adjustment or handling.

In operating lamps of this character, it has generally been considered necessary to utilize a series-wound dynamo or generator, as when a shunt-wound generator is used, it was impracticable, if not impossible, to get it properly excited to furnish the desired current. In the diagram, Fig. 6, I have roughly illustrated an arrangement of circuits wherein a shunt-wound generator can be used in connection with my lamp, and it is unnecessary to set forth the advantages of such use, as they are well known to those skilled in the art. In said diagram, L, represents the armature of the generator, and L′, the shunt-wound field-magnet coils. From one of the brushes of the generator the conductor *l*, leads to the lamp, where it is divided into branches *l′*, l^2, and in the branch *l* are included the coils of the magnet I, which are of high resistance, and form the shunt of the light circuit, the other end of the coils of this magnet being connected to the other lead or conductor l^3. The main conductor l^2, includes the coils of the magnet I′, which are of comparatively low resistance, and also includes the carbons D, D′, and incidentally, of course, the re-lighter G. The normal condition is that the main circuit is broken between the carbons, and when the shunt-wound generator is started, it is necessary to have a sufficient amount of resistance in the circuit in order that it may build itself up, or be properly self-exciting, and it will be seen that the high resistance shunt magnet I, is normally included in the circuit of the generator. As soon as a sufficient current is produced in this shunt circuit, the magnet or solenoid I is energized to operate the lever J, J′, and cause the re-lighter G, to form an electrical connection between the carbons D, D′. This, of course, closes the main circuit of the generator through the carbons and coils of the magnet or solenoid I′, and as soon as this is done, the re-lighter is retracted to its normal position, and the arc established. It will thus be seen that in the normal working, both the shunt and main branches of the working circuit are included in the circuit of the generator, the starting maguet being in the shunt, and the main magnet I′ and the carbons or electrodes being in the main branch. The shunt-wound generator will then operate in its well-known way as a self-regulating generator, and I am enabled to utilize this feature of the generator, as well as to take advantage of the well-known electrical advantages of using such a generator in the way of economy of operation.

From the above it will be seen that my lamp is composed of very few parts, all of which are of simple construction, while at the same time they are not liable to get out of order, and can withstand the shocks and jolts incident to the operation of this class of lamps. It will be further seen that it can be quickly and readily adjusted or re-trimmed as occasion requires; also that it offers the least obstruction to the projected rays of light when used in connection with the reflector for headlight or similar purposes, and which is one of the most important features, it produces a practically uniform light, there being no fluctuation, and the light-rays are concentrated upon the reflector in such a way as to be utilized to their best advantage.

What I claim is—

1. In an electric lamp, a housing having a central recess for the reception of a block of refractory material, and tubular lateral extensions for the reception of the carbons, the extensions being provided with longitudinal slots substantially as described.

2. In an electric arc lamp, the combination with the housing having a central recess and tubular lateral extensions, provided with longitudinal slots of a refractory block, and the carbon-holders arranged in the tubular extensions, and means for feeding the carbons and maintaining them in contact with the block, substantially as described.

3. In an electric lamp, the combination with

the housing having a recess for the reception of a refractory block; of the covers for closing said recess, substantially as described.

4. In an electric lamp, the combination with the housing having a recess for the reception of the refractory block, of the covers pivotally mounted on the housing and serving to retain the block in position in the recess, substantially as described.

5. In an electric lamp, the combination with the housing supporting the refractory block and carbons, of a re-lighter, a sliding and rocking rod supported by the housing and connected to the re-lighter, and means for moving the rod to adjust the re-lighter, substantially as described.

6. In an electric lamp, the combination with the housing supporting the refractory block and carbons, of a re-lighter, a bent sliding and rocking rod, the bent end of which is flattened, and means for moving the rod, substantially as described.

7. In an electric arc lamp, the combination with the housing having a central recess for the refractory material and tubular lateral extensions for the carbons, of brackets, a sliding and rocking rod mounted in said brackets the end of the rod being flattened and resting on a projection on the housing, a re-lighter attached to the rod, and means for operating the rod, substantially as described.

8. In an electric arc lamp, the combination with the housing having a central recess for the refractory material and adjustable covers therefor and having tubular lateral extensions provided with slots for the reception of the carbon-holders, of a re-lighter, a sliding rod connected to the re-lighter for operating the same, means for operating the rod, and springs connected to the carbon-holders for feeding the carbons, substantially as described.

9. In an electric lamp, the combination with the base and standard, of a housing mounted thereon and carrying the refractory block, the carbons and re-lighter, springs connected to the base and arranged to feed the carbons, and electro-magnets mounted on the base and arranged to operate the re-lighter, substantially as described.

10. In an electric lamp for head-light purposes, the combination with the reflector and with the base, of a standard presenting a narrow surface to the front, a housing extending transversely to the standard and supporting the refractory material and carbons and presenting a relatively small surface to the front, springs for feeding the carbons also presenting a narrow surface to the front, a re-lighter, and a lever for operating the same normally in the plane of the standard, whereby the lamp structure presents the least possible surface to the projection of the light-rays, substantially as described.

11. The combination with a shunt-wound generator, of an electric light provided with two electro-magnets, the one being of relatively high resistance in a shunt around the lamp and continuously in the circuit of the generator, and the other of relatively low resistance arranged in the main circuit of the lamp including the carbons, and a re-lighter operated by said electro-magnets, substantially as described.

12. In an electric lamp, the combination with the housing supporting the refractory block, the carbons, and a re-lighter device, of a lever for operating said re-lighter, two electro-magnets for operating the lever and connected in branches of the main circuit, one being of relatively high resistance, and the other of relatively low resistance, and a stop connected with the latter magnet, substantially as described.

13. In an electric arc lamp, the combination with the base and standard, of a housing for the refractory block and carbons mounted on the standard and insulated therefrom, springs for feeding the carbons mounted on stand supports connected to the base but insulated therefrom, a re-lighter connected to the housing, a sliding arm for operating the re-lighter and insulated from the housing, and electro-magnets mounted on the base and connected to operate the re-lighter, 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:
A. N. DOBSON.
F. L. FREEMAN.