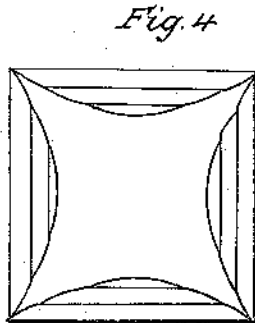
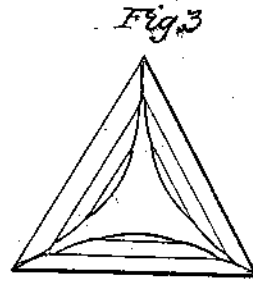
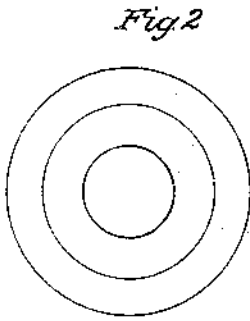
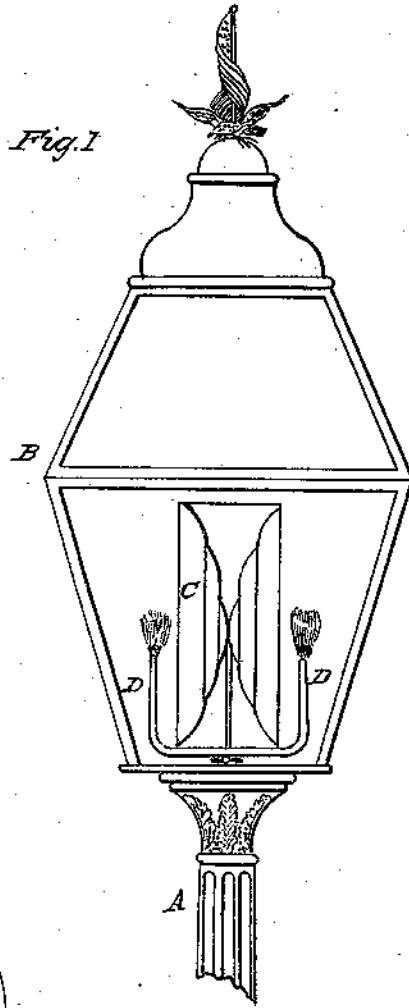


H. & J. SANGSTER.  
Street Lamp.

No. 7,904.

Patented Jan'y 14, 1851.



# UNITED STATES PATENT OFFICE.

HUGH SANGSTER AND JAMES SANGSTER, OF BUFFALO, NEW YORK.

## REFLECTOR FOR STREET-LAMPS.

Specification of Letters Patent No. 7,904, dated January 14, 1851.

*To all whom it may concern:*

Be it known that we, HUGH SANGSTER and JAMES SANGSTER, of Buffalo, in the county of Erie and State of New York, have invented a new and Improved Street-Lamp; and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon.

Our invention consists in a lamp which is provided with a double, triple, or quadruple concave reflector, placed between two or more burners, the number of burners corresponding with the number of faces of the reflector; and in making each face of the reflector of a number of concave rings concentric in outline as hereinafter described and shown.

Figure 1 is a side elevation of the lamp showing the construction and arrangement of the parts, the reflector being shown in vertical section. Fig. 2 shows one of the faces of the reflector, and Figs. 3 and 4 show horizontal sections of the triple and quadruple reflectors, all the sections being made by a plane passing through the center of each face.

A, (Fig. 1) is the upper part of the lamp post, and B, is the outside frame which are made in the usual form.

C is a vertical section of the reflector which may be made of tin plate, or tinned

copper or any other substance which can be formed with facility and is otherwise suitable for reflectors.

The general form of the faces of this reflector is a concave, but the concavity of the radiating surface, and consequently the effect of the light is increased by making the faces in concave rings in the manner shown in the drawings, to which reference is had for the form of the faces of the reflector. This form of reflector secures nearly or quite all the advantages peculiar to reflectors with concave indentations in the face, while at the same time they can be made much cheaper and can be cleaned with greater facility by turning them in a lathe.

The faces of the reflector are fastened to each other by a metallic rim and the reflector is supported on a rod *n*, and the burners D, D, are so made as to bring the light of each opposite the center of that face of the reflector to which it belongs.

What we claim as our invention and desire to secure by Letters Patent is—

Making the faces of the reflector in concave rings substantially in the manner and for the purposes herein set forth.

HUGH SANGSTER.  
JAMES SANGSTER.

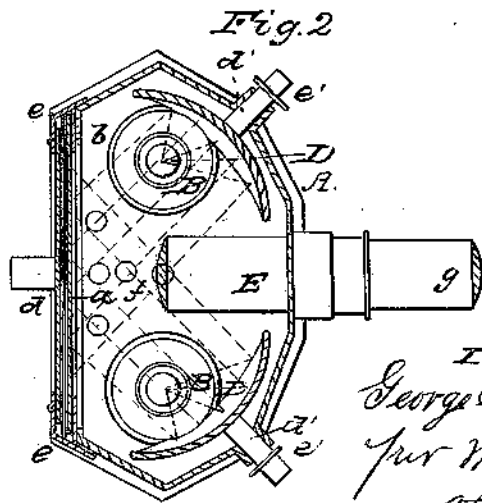
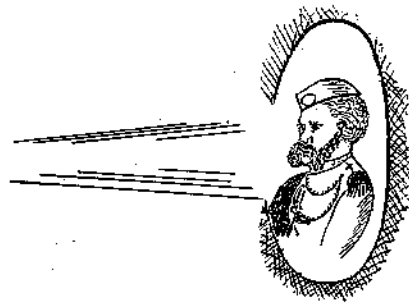
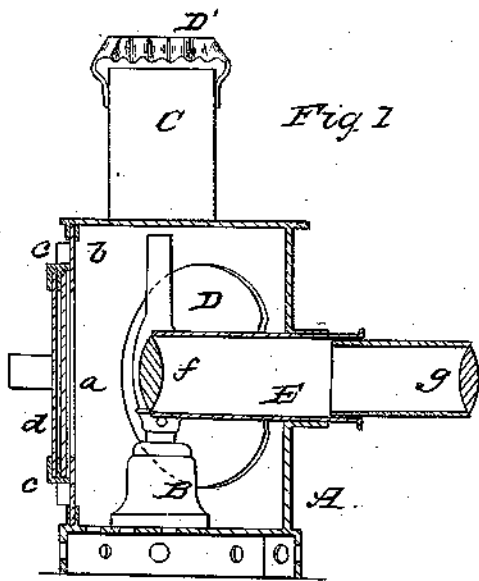
Witnesses:

THOMAS P. HOW,  
HENRY F. WILLSON.

G. SIBBALD.  
 Magic Lantern.

No. 42,412.

Patented April 19, 1864.



*Witnesses*  
*Jacobus*  
*Henry Morris*

*Inventor*  
*George Sibbald*  
*per Munn & Co*  
*Attorneys*

# UNITED STATES PATENT OFFICE.

GEORGE SIBBALD, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN MAGIC-LANTERNS.

Specification forming part of Letters Patent No. 42,412, dated April 19, 1864.

*To all whom it may concern:*

Be it known that I, GEORGE SIBBALD, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Magic-Lanterns; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a longitudinal vertical section of my invention. Fig. 2 is a horizontal section of the same.

Similar letters of reference in both views indicate corresponding parts.

This invention consists in a magic-lantern producing an image on a screen outside the lantern by the reflection of a picture of any desired description placed in the interior of the lantern and exposed to the rays of light obtained from one or more lamps or other artificial sources of light; also, in a picture-holder fitted into the side of a magic-lantern opposite the lens-tube, in combination with one or more lamps and reflectors in such a manner that the light obtained by the lamp or lamps, and increased in intensity by the action of the reflector or reflectors, illuminates the picture in the holder sufficiently to give a distinct and plain image of greater or smaller dimensions, according to the size of the instrument and of the lenses, and opaque pictures made on paper, porcelain, or any other suitable material, can be exhibited in the magic-lantern with excellent effect.

The invention relates, further, to the peculiar manner of adjusting the lens-tube in relation to the picture or picture-holder; also, to the peculiar manner of inserting the reflectors so that they can be adjusted according to the nature of the picture and of the light or lights used; finally, to the attachment to the picture-holder of hinged wings for the purpose of perfectly inclosing the light after the picture has been adjusted in the lantern.

To enable others skilled in the art to make and use my invention, I will proceed to describe it.

A represents a lantern made of sheet metal or any other suitable material, and of any convenient size or shape. One side of the lantern is made flat and provided with a square or oblong aperture, *a*, the edges of which form

grooved guides for the slide *b*. This slide is also provided with an aperture, somewhat smaller than the aperture *a* in the side of the box, and grooved flanges *c*, secured to its outer surface, form the guides for the solid plate *d* or slide *b*. This slide *b* and plate *d* together form the picture-holder, the pictures being placed, one after the other, on the inside of the grooved flanges *c*, between the slide *b* and plate *d*, as clearly shown in the drawings. For the sake of convenience, the pictures ought to be made somewhat larger than the aperture in the slide *b*, or pasted on card-board or other rigid material, cut in the proper size.

The plate *d* is provided with two wings, *e*, hinged to its ends, so that they can be turned out in order to introduce a picture or remove the plate, or that they can be turned into the position shown in Fig. 2 of the drawings, for the purpose of preventing the light escaping from the interior of the lantern into the room.

The interior of the lantern *A* is occupied by two (more or less) lamps, *B*, which may be arranged to burn oil or other liquid of any desired description, provided they produce light enough to produce the desired effect. According to my present experience, ordinary coal-oil or kerosene lamps answer the purpose, the size of these lamps, of course, being accommodated to the size of the lantern. In order to make room for the chimneys of these lamps, two tubular projections, *C*, are secured to the top of the lantern, right over the lamps, and these tubes are covered by caps *D'*, which are turned down over their edges and leave an open space all around to prevent the escape of light without obstructing the egress of the products of combustion. The lamps may be confined in suitable sockets formed by cylindrical flanges secured to the bottom of the lantern, and in this case they will be introduced through the aperture *a* in the side, or they may be introduced from the bottom and fastened in any suitable manner.

Said lamps are arranged as close to the picture-holder as may be practicable without overheating or changing the pictures and the rays of light emitted from said lamps are concentrated on the picture by the action of two or more reflectors, *D*, which are secured to the interior of the lantern opposite the picture-holder, as clearly shown in Fig. 2 of the drawings. Each of these reflectors is provided with

a stem, *d'*, projecting from the center of its back through a tubular socket in the side of the lantern, so that by pushing said stems in or drawing them out the reflectors can be adjusted from the outside, according to the nature of the lights and various pictures to be exhibited in the lantern.

Flanges *e'*, which are secured to the stems outside the sockets, prevent the reflectors being pushed in any farther than desirable, and injury to the lamp chimneys, if the reflectors should be pushed against them, or to the reflectors, if they should be brought too close to the flames, is avoided.

*E* is the lens-tube, which is constructed on the principle of a telescope, so that it can be elongated at pleasure. This lens-tube is provided with a lens, *f*, at or close to its inner end, and with another lens, *g*, near to its outer end. These lenses may be finished with more or less care, according to the price at which the various instruments are to be sold, and they are arranged in relation to each other according to the well known optical rules.

The inner end of the lens-tube projects into the interior of the lantern to such a distance that the lens *f* is protected from the direct rays of light emanating from the flames of the lamps, and that said lens is brought close to the picture in the picture-holder. The light concentrated on said pictures directly from the flames and by the reflectors *D*, combined with the action of the inner lens, *f*, produces an image in the lens-tube and by adjusting the outer lens, *g*, in the proper focus this image is enlarged and thrown on a screen or wall at a certain distance from the lantern. The image thus produced shows all the colors of the original picture with a beautiful effect.

My lantern can be used for pictures of any description, but it is particularly adapted for such pictures the surface of which is dull and not covered with glass. Oil paintings coated with glossy varnish, or photographs coated with albumen or other glossy material, do not produce so good an effect as plain photographic pictures not varnished, or lithographs, wood-cuts, or engravings printed from steel or copper plates, or pictures of any description with a dull or non-reflecting surface.

In using my instrument great care must be taken to have the lights properly adjusted

and to keep the lamp chimneys, reflectors, and lenses perfectly clean, and after the picture has been adjusted the room in which the exhibition is to be taken place ought to be perfectly darkened and all escape of light from the interior of the lantern must be prevented.

The pictures to be exhibited may either be arranged on single cards or boards, or they may be placed on an endless apron or on a long strip of canvas running over rollers which are secured to suitable arbors on both ends of the picture-holder. By imparting a rotary motion to these rollers or to one of them the pictures are brought one after the other opposite the lens-tube in the proper position to be exhibited.

If desired, the lantern can be made large enough to admit the operator in its interior, and by doing so the effect of the exhibition can be considerably improved.

What I claim as new, and desire to secure by Letters Patent, is—

1. A magic-lantern producing on a screen outside the lantern by reflection an image of a picture of any desired description placed in the lantern, substantially in the manner herein specified.

2. The picture-holder *b c d*, or its equivalent, arranged in that side of a magic lantern, *A*, opposite the lens tube *E*, in combination with one or more lamps, *B*, and reflectors *D*; constructed and operating in the manner and for the purpose substantially as herein shown and described.

3. Extending the lens-tube *E* far enough in the interior of the lantern so that the lens *f*, at its inner end is not exposed to the direct rays of light emanating from the flames of the lamps *B*, as and for the purpose specified.

4. The stems *a'*, projecting from the backs of the reflectors *D*, and provided with flanges *e'*, in combination with the lantern *A*, constructed and operating in the manner and for the purpose substantially as set forth.

5. The hinged wings *e*, in combination with the plate *d* and slide *a*, constructed and operating substantially as and for the purpose described.

GEO. SIBBALD.

Witnesses:

W. W. DOUGHERTY,  
J. L. LAFFITT.

A. J. McDOWELL & D. T. BATES.

Street-Lamp.

No. 129,846.

Patented July 23, 1872.

Fig 1.

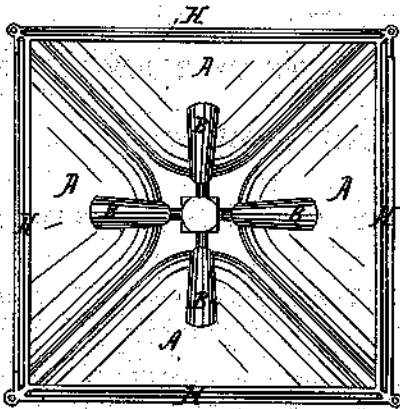


Fig 2.

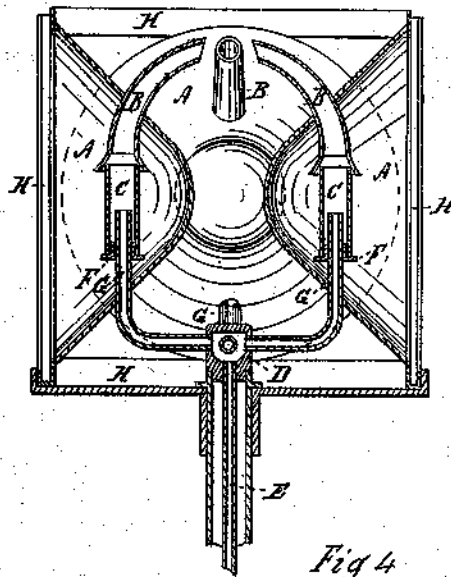


Fig 3.

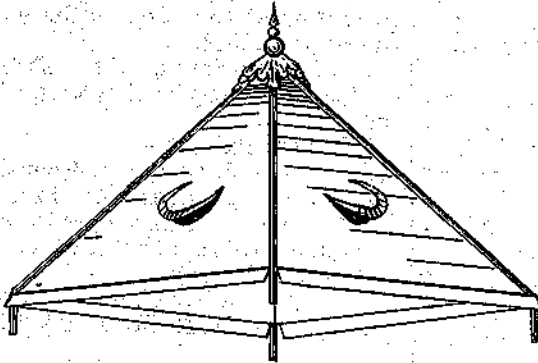
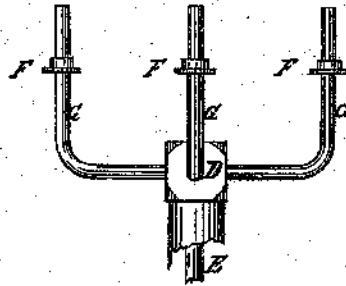


Fig 4.



Witnesses.

John Bell  
Ch. Hilgenberg

Inventor.

Andrew J. McDowell  
Daniel T. Bates

# UNITED STATES PATENT OFFICE.

ANDREW J. McDOWELL AND DANIEL T. BATES, OF RICHMOND, INDIANA.

## IMPROVEMENT IN STREET-LAMPS.

Specification forming part of Letters Patent No. 129,516, dated July 23, 1872.

Specification describing certain Improvements in Reflecting Street-Lamps, invented by ANDREW J. McDOWELL and DANIEL T. BATES, of Richmond, county of Wayne and State of Indiana.

Our invention relates to the combination of a series of burners with a like number of reflectors and tubes, to constitute a street-lamp that shall give an increased amount of light with the same amount of gas or fluid, as the case may be.

Figure 1 is a plan or top view. Fig. 2 is a vertical section, showing the burners as connected with the chimneys and tubes. Fig. 3 is a view of the top of the lamp. Fig. 4 is a view of the burners.

A A are the reflectors. B B are the tubes, extending upward from the chimneys C C in curved form, in order to bring their extremities near together, that all the burners may be lighted at once as readily as a single burner. D is a head, to which the burners G G are attached, and is screwed onto the top of the lamp-post E. F are collars or disks attached to the burners G, and supporting the chimneys C in connection with the curved tubes B. H is the frame of the lamp.

This lamp may be used with any of the burning fluids or material by constructing the burners in such form as is adapted to the kind of

fluid or material to be used. It may also be constructed with two reflectors, burners, tubes, &c., to be used to light up alleys and such places as do not require more reflectors. It is intended to use no more gas or other material in this lamp than in a lamp with a single burner, the amount of gas or other material being divided into two or more parts, according to the number of reflectors used. It is especially adapted to light small towns or villages where gas is not used. This lamp is as readily lighted as a lamp with a single burner by simply extending the lighter up on the inside of the lamp to the extremities of the curved tubes.

We do not claim any of the above-described devices separately, as they have all been used; but

What we claim is—

The device shown in Fig. 4, consisting of the head D having two or more burners, in combination with the reflectors A, chimneys C, and curved tubes B, substantially as and for the purpose described.

ANDREW J. McDOWELL.  
DANIEL T. BATES.

Witnesses:

JOHN BELL,  
CH. HILGENBERG.

J. STEPHENSON.  
Street-Car.

No. 161,566.

Patented March 30, 1875.

FIG. 1.

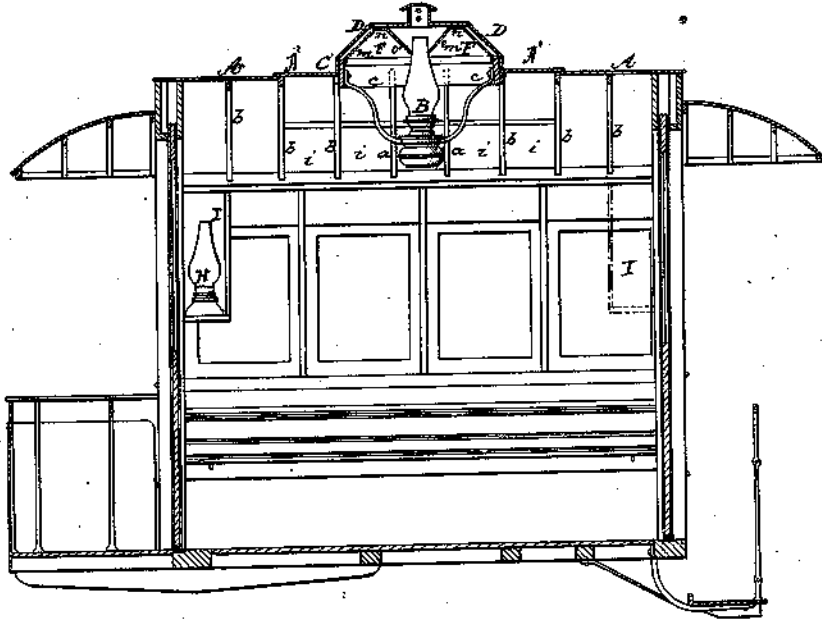
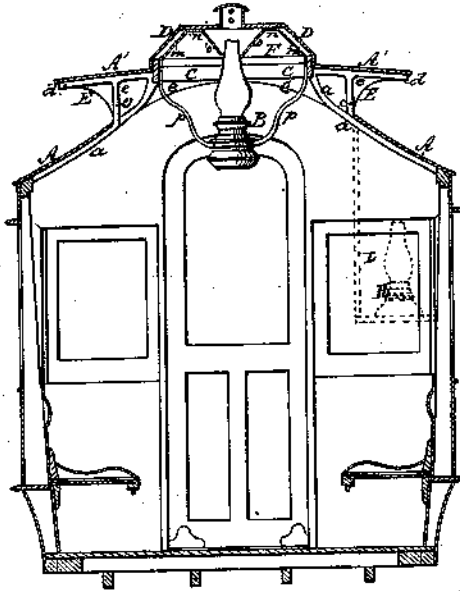


FIG. 11.



WITNESSES:

*D. G. Stuart*  
*J. Knight*

INVENTOR:

*John Stephenson*  
per. *D. Hannay*  
Attorney



# UNITED STATES PATENT OFFICE.

JOHN STEPHENSON, OF NEW YORK, N. Y.

## IMPROVEMENT IN STREET-CARS.

Specification forming part of Letters Patent No. 161,566, dated March 30, 1875; application filed March 2, 1875.

### CASE G<sup>7</sup>.

*To all whom it may concern:*

Be it known that I, JOHN STEPHENSON, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Street-Cars; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings and to the letters of reference marked thereon, which form a part of this specification, in which—

Figure 1 represents a vertical longitudinal section of a car-body having my improvement applied thereto, and Fig. 2 a vertical transverse section of the same.

For some purposes a lamp located in the center of the car-roof is desirable, and, therefore, portions of the roof have been elevated, in order that the lamp may be above the heads of the passengers. This elevation of roof, for various causes, is sometimes inadmissible, as, for instance, the door-lintel of the car-house may not be sufficiently high, or other difficulties may exist. I relieve such embarrassment by making in the center of the roof an aperture or well-hole of sufficient size, in which to place the lamp, and that in such manner that the lower portion only will lie beneath the plane of the roof, and the upper portion above the roof.

I am aware that cars have heretofore been made with lantern-tops—*i. e.*, with a portion of the roof elevated above the remainder—and such elevated portion provided with transparent walls, through which the light from the central lamp was transmitted, so as to form a signal, and by which lamp, thus centrally arranged, the car was lighted. Such construction in itself I do not claim; but, inasmuch as experience has proven that the location of the lamp in a central position is in itself insufficient to afford all the desired illumination, and as it is desirable to have the car well lighted that passengers may be enabled to read, and that pickpockets and other wrong-doers may be observed and detected, I have, therefore, combined with the central lamp a reflector of peculiar construction, and

also a lamp or lamps at one or both ends of the car. The latter lamp, besides illuminating the interior of the car, may also be used to make the night-signals.

To enable others skilled in the art to make, construct, and use my invention, I will now proceed to describe it in detail, omitting a particular description of such parts of a car as may not be necessary to give a full understanding of the present improvement.

The body of the car may be of the ordinary construction, with the exception of the roof A, which is modified by cutting an opening or well-hole through it of circular or other suitable shape. This well-hole is strengthened by a correspondingly-shaped frame-piece, C, the upper or outer edge of which is provided with a close-fitting dome-shaped roof or cover, D, made of wood or metal, as may be desired. In putting the well-hole roof D on, it is deemed advisable to bring its lower edge down to the roof, so as to close the joint between the latter and the frame-piece C, it being then secured to either or both, as deemed best.

The frame-piece C may be secured to the upper portion of the rafters with which it is brought in contact in any suitable and proper manner. The two central rafters for this purpose, and for the purpose of making room for the central lamp B, are cut away, or rather are formed differently from the other rafters *b*, their upper ends being bent or curved slightly outward, and their inner face slightly cut away, so as to furnish a shoulder or support to the under side of the frame-piece C.

In the drawing, my improvement is shown in connection with a car-body provided with a roof, A, and a supplementary roof, A', the latter being arranged in a plane, but the thickness of itself above the plane of the ridge or highest portion of roof A. This is done with the view of providing ventilation for the car and seats for outside passengers. For these or either of these purposes the supplementary roof A' is given but little pitch, while the main roof A has a steep inclination or pitch, as shown in Fig. 2.

In constructing the car for the supplementary roof A', the roof A or ceiling proper is left open or cut away along the line of the car for

a distance corresponding to the intended length of the roof A', the width of the opening being made less than that of the roof A'. Over the opening in the ceiling, thus left, is erected and secured a frame, E, for the support of the supplementary roof A', said frame consisting of two end-supporting pieces, e, and a series of auxiliary rafters, d, and stays c, all properly secured to the roof A and its supporting-rafters. The space between the under side of roof A' and the upper side of roof A is left uncovered, thereby leaving an open communication through the upper ends of rafters a and b between the interior of the car and the outer atmosphere for ventilating purposes.

By reference to Fig. 2 it will be seen that the outer edges of roof A' are made to project sufficiently far over the opening in roof A to prevent ingress to water in stormy and rainy weather. The supplementary roof A' thus erected on roof A, the lamp well-hole is cut and its frame C and roof D applied thereto in the same way as before described in applying it to roof A direct.

The lamp-opening and its cover D having been constructed and applied as before described, a reflector, F, is then arranged on the under side of the dome or cover D, and secured in any suitable manner to the latter, or to the frame G. This reflector is of peculiar construction, it being formed with two reflecting-surfaces set at reverse angles to each other and to the plane of the horizon, and these connected together at their upper edges by another reflecting-surface set in a horizontal plane; the whole forming a double circular reflector arranged in a plane above the flame of the lamp B. Through the central portion of reflector F the upper end of the lamp-chimney is projected, so as to discharge its products of combustion into the open air through a short chimney, h, arranged in the top of dome D, or through any other channel provided therein or elsewhere for their escape—as for instance, through a space or spaces left between the back of the reflector and inside of the dome, and these suitably conducted into the ventilating-openings i beneath the supplementary roof A'; but for some reasons the chimney is preferred. The angular surface m of reflector F reflects the light downward over the central portion of the car, as does the horizontal part n, while the other angular surface o reflects downward and outward toward the sides and ends of the cars, forming at once a concentrating as well as a dispersing reflector, thereby causing the light from the central lamp to pervade the car as far as such an arrangement is capable of doing. The central lamp B is supported by means of

a spider-frame, p, secured to the frame-piece C. This spider-frame is so constructed and arranged as to suspend the lamp above the lower marginal line of the roof A proper, and so that the top of the flame will be just a little below the plane of the under side of said roof A, while the chimney is made to project slightly above it. This construction of the roof admits of the use of a central lamp under the most favorable circumstances, and renders this class of car little if any more objectionable than a car in which no dome or central lamp is used. The ventilating-openings i may in winter be fitted with removable frames covered with a transparent medium, and these may be so applied as to be capable of being wholly or only partially opened or shut, as occasion may require. In addition to the central lamp B a lamp or lamps, H, are arranged at either or both ends of the car, a suitable chamber, I, for the purpose, being provided for each one used. For a large car, one at each end, as a rule, will be sufficient; but two may be used, if desired. For a single-horse car one lamp, H, in addition to the central one, will, as a rule, be found sufficient, although others may be used. In either case, I prefer to arrange the lamp H at the driver's end, so as to give him sufficient light to enable him to properly perform his various duties. This arrangement also enables that lamp to act as a signal-lamp, a suitable transparency being provided for the purpose as the outer cover to its chamber.

Having described my invention, what I claim as new is—

1. A street-car roof having a central opening combined with a lamp partly beneath and partly above the plane of the roof, substantially as and for the purpose set forth.
2. A street-car roof in combination with a lamp near its center, and with a reflector above the point for the flame of the lamp, consisting of two inclined surfaces, m and o, for casting light in reverse directions, substantially as and for the purpose set forth.
3. In a street-car, the combination of a lamp near the center of its roof, and a lamp or lamps located in one or both ends of the car, to serve the double purpose of a signal and of illuminating the interior of the car, substantially as set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JOHN STEPHENSON.

Witnesses:

WM. JOHN WALKER,  
JOHN SMITH.

J. FORREST.  
Self-Lighting Lamps for Light-Houses.

No. 204,806.

Patented June 11, 1878.

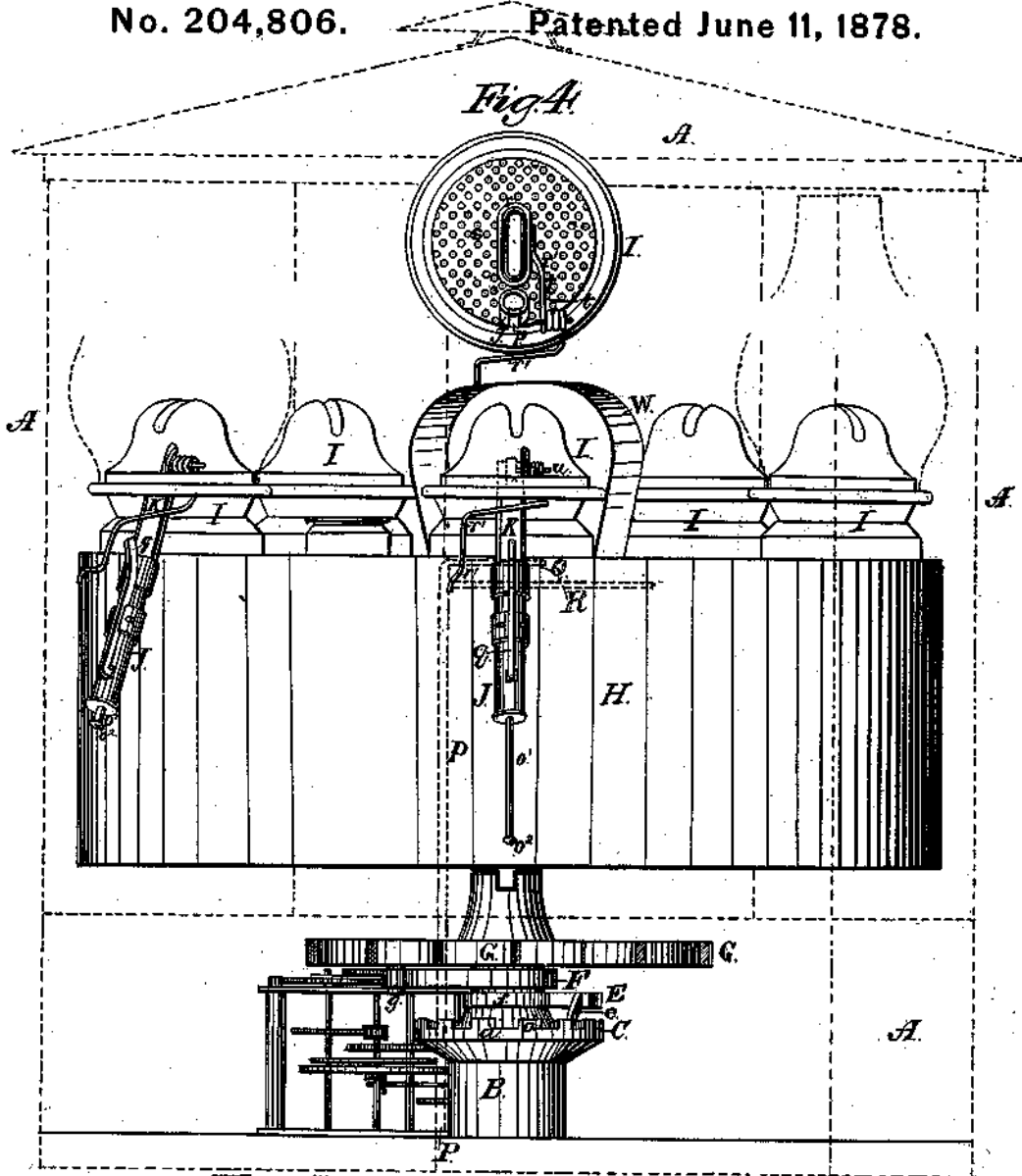


Fig. 1.

Attest:  
G. P. Brock  
D. Y. Stuart

Inventor:  
Joseph Forrest  
per  
C. Hannay  
Attorney.

J. FORREST.  
Self-Lighting Lamps for Light-Houses.

No. 204,806.

Patented June 11, 1878.

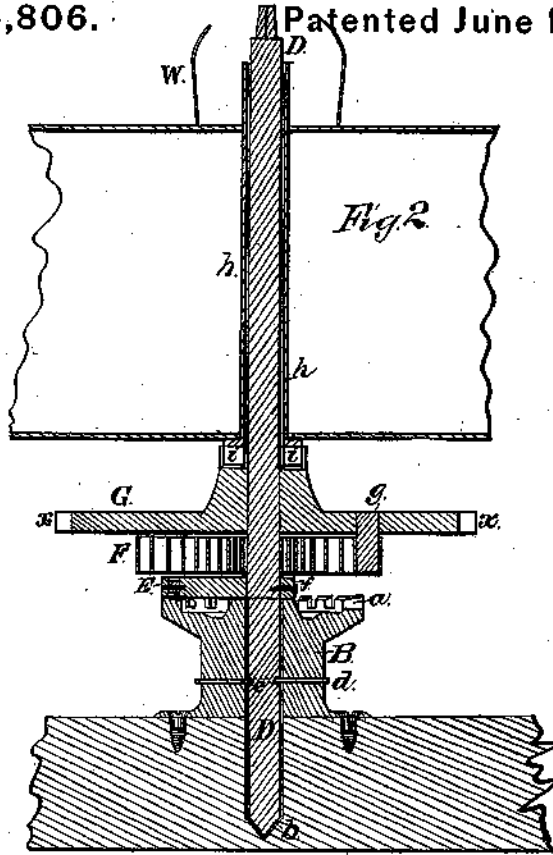
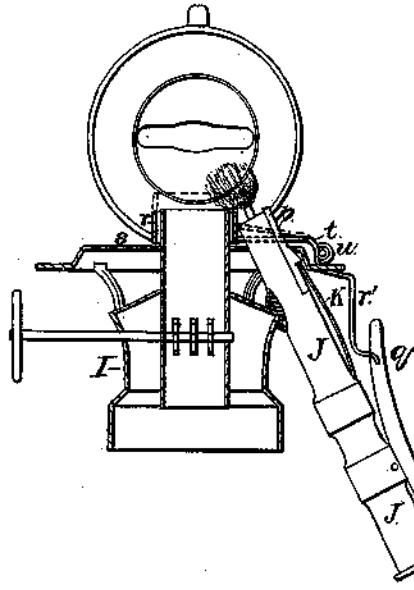


Fig 3.



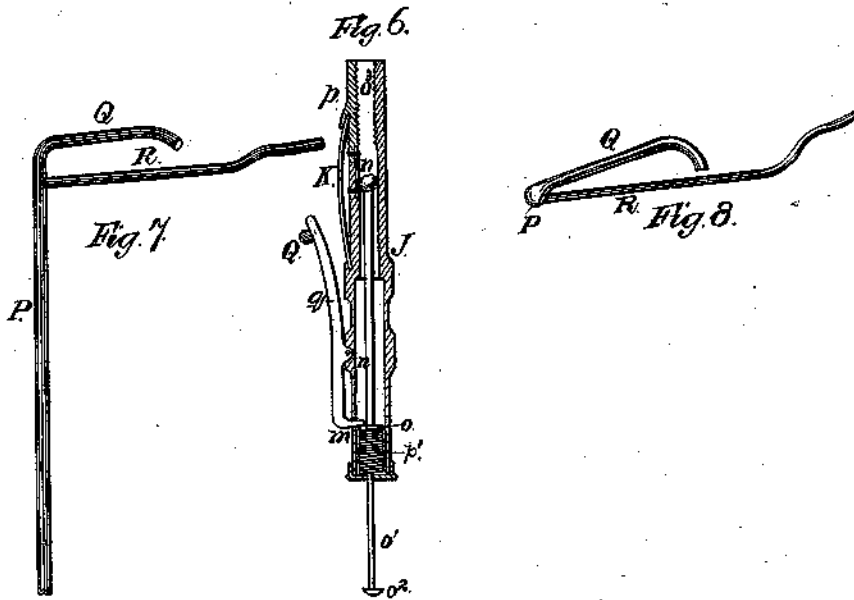
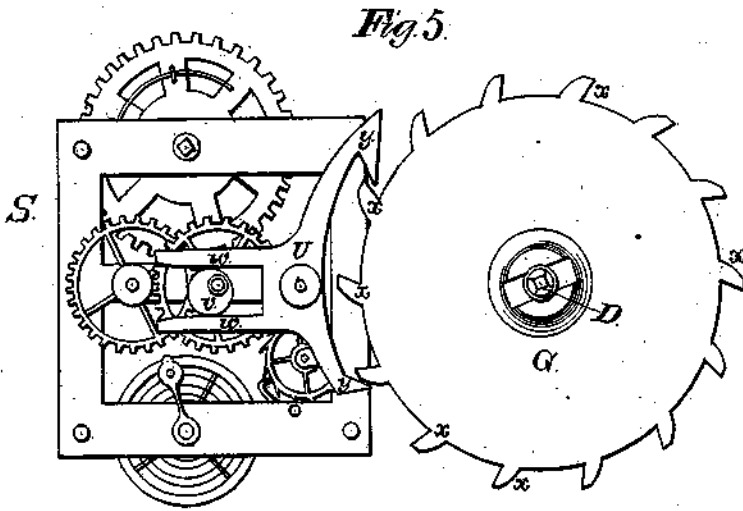
Attest:  
*F. B. Brock*  
*D. G. Stuart*

Inventor:  
*Joseph Forrest*  
 per  
*C. Hannay*  
 Attorney.

J. FORREST.  
Self-Lighting Lamps for Light-Houses.

No. 204,806.

Patented June 11, 1878



*Attest:*  
*G. B. Brock.*  
*D. G. Stuart*

*Inventor:*  
*Joseph Forrest*  
*per* *P. Hannay*  
*Attorney.*

# UNITED STATES PATENT OFFICE.

JOSEPH FORREST, OF OAKVILLE, MARYLAND.

## IMPROVEMENT IN SELF-LIGHTING LAMPS FOR LIGHT-HOUSES.

Specification forming part of Letters Patent No. 204,806, dated June 11, 1878; application filed May 14, 1878.

*To all whom it may concern:*

Be it known that I, JOSEPH FORREST, of Oakville, in the county of St. Mary's and State of Maryland, have invented certain new and useful Improvements in Self-Lighting and Self-Extinguishing Revolving Lamps for Light-Houses, Buoys, Wharves, &c.; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification, in which—

Figure 1 represents a side elevation of the lamp-reservoir, lamps, and actuating devices for revolving the lamp, with the lantern-frame and the lamp-chimneys shown in dotted lines. Fig. 2 represents a section taken vertically through the reservoir and spindle on which the lamps revolve, and also through the stop-plate and devices for revolving the lamps on the stop device being released, to show details of construction, the oil-reservoir being broken off. Fig. 3 represents a partial vertical section taken through one of the lamp-tops, the cone or burner being thrown back or raised, and, like the lighting device, shown in elevation. Fig. 4 represents a plan of the lamp-top, with its cone or burner removed to illustrate the details of the extinguishing device. Fig. 5 represents a plan of the clock-movement, releasing device, and stop device through which an intermittent revolving motion is imparted to the lamps. Fig. 6 represents a detached sectional view of the lamp-lighting device, taken longitudinally through its center to show its details and construction. Figs. 7 and 8 represent a side elevation and plan of the cam devices for releasing the plunger of the lighting devices and for operating the lamp-extinguishers.

My invention relates to a self-lighting lamp for use on buoys, piers, wharves, light-houses, and other places, so as to dispense with the daily attentions of an attendant.

My invention consists, first, in combining a series of lamps with a time-movement, whereby it is made to perform a partial revolution at stated intervals, and for purposes hereinafter to be described; second, in combining,

with each of a series of lamps having an intermittent revolving motion, a self-lighting device put in action by said motion and suitable devices for that purpose; third, in combining, with each of a series of lamps having an intermittent revolving motion, an extinguishing device put in action by said motion and a suitable device for that purpose.

In the drawing, A represents an open frame or lantern, of suitable construction, in which the lamps are mounted, and which may also be of any suitable shape, such as round or polygonal, and the sides of which are covered in any suitable way with panes of glass to exclude the wind. On the bottom of this lantern-frame is secured a short stud, B, on which is formed or otherwise secured a stationary ratchet-disk, C, provided with a series of teeth or notches, *a*.

Standard B is provided with a tubular opening through its center for the reception of a spindle or stem, D, and which rests in a step, *b*, formed in the lantern-bottom, or, if desired, it may be formed in the lower part of the standard B.

A circular groove, *c*, is formed at the lower end of spindle D around its periphery, for the reception of a pin, *d*, which passes through the stud B and lies in the groove *c* of the spindle D, and thereby, while holding the latter in place, leaves it free to turn or revolve in its bearing in the stud, for a purpose to be hereinafter described.

On spindle D, immediately above stud B and its ratchet-disk C, is rigidly secured, in any suitable and known way, an arm, E, to the outer end of which is pivoted a drop-pawl, *e*, and which is intended to engage with the teeth *a* of the stationary ratchet-disk C, for a purpose to be hereinafter described.

In the drawings, arm E is represented as being formed on a collar, *f*, and the latter mounted on and secured to the spindle by a set-screw.

Immediately above the collar *f* and arm E is arranged a strong spiral spring, F, the inner end of which is secured to the spindle D, and the outer one to a wrist pin or stud, *g*, secured to the under side of the toothed release-disk G, and which latter is also mounted upon and rigidly secured to spindle D. The hub

of disk G is raised above its face in cone form, and on its upper side is provided with one or more notches for the reception of one or more lugs or detents, *i*, formed on the lower end of the tubular portion *h* of the oil-reservoir, and which thereby connects the oil-reservoir and lamps with the release mechanism and spindle.

On the stem or spindle D is mounted the oil-reservoir H, and which for this purpose has a tube, *h*, running through its center, and secured, respectively at its upper and lower end, to the top and bottom of the reservoir, with an air and water tight joint. Through this tube the spindle passes, and is made to fit it snugly, but without binding. Into the top of this reservoir H is fitted in the usual manner the lamp-tops I, and which may be of any suitable construction, whether for burning with or without a chimney; but a chimney-lamp is preferred. To each of these lamp-tops (see Figs. 3, 4, and 6) is secured a lighting apparatus, J, of any approved or suitable construction, in such manner that the open end is within convenient distance of the wick, in order to light it when the match-light is struck. For this purpose the upper end of the lighter J passes into the lamp-shell underneath the cone or burner. A lighter suitable for the purpose is shown in section in Fig. 6, in which J represents an elongated cylindrical metal case, soldered or otherwise made fast to the lamp-top, as shown in Fig. 3. Into the lower end of this case is arranged a plunger, *o*, carrying a stem, *o*<sup>1</sup>, and knob or button *o*<sup>2</sup>. Around stem *o*<sup>1</sup>, between the plunger and end of the case, is arranged a spiral spring, *p*<sup>1</sup>, and which imparts motion to the plunger when the latter is released from the pivoted lock-stop *q*. Lock-stop *q* consists of a bent lever, pivoted to the side of the case J, and having a bent end, *m*, which is made to protrude into the interior of the case J through an opening formed in its side for that purpose.

By this construction, on drawing the plunger *o* down by the stem *o*<sup>1</sup> below the bent end *m* of the lever *q*, and then pressing it in above the plunger, the latter will be held in that position until released by pressing the lever inward toward the casing. In this position the spring *p*<sup>1</sup> is held in a compressed position, so that when the plunger is released from lock-stop *q* the plunger *o* is forced rapidly forward, pushing before it the match *n*, and igniting it by causing its end which carries the fulminate to chafe against the roughened surfaces *o*<sup>3</sup> formed on the inside of the upper end of the casing. That the match may be easily inserted, one side of the upper end of the casing J is slotted, and into it is fitted an internally-roughened spring-bar, *p*, the lower end of which is flexibly secured, as by a spring-plate, to the casing J at the lower end of the notch or slot. (See Fig. 6.)

K represents a spring, the lower end of which is secured to casing J, and the upper attached in any suitable way to the roughened

bar *p*. This spring serves to press the bar *p* inward against the match to yield the necessary friction for its ignition, and at the same time yields to allow bar *p* to be drawn back far enough to yield a free passage for the match on being inserted to prepare the lighter for its work, as shown in Fig. 6.

*r* represents an extinguisher, consisting of a short section of a tube, which is made to surround the wick-tube, and is about the same length as that portion of the wick-tube which stands above the air-screen *s*. (See Fig. 3.) To the side of this tube is secured a bent wire rod or lever, *t*, in which is formed a short coil, through which the straight end of a hooked or bent stud, *u*, passes, the lower end of which is secured to the lamp-top. This pin forms the pivot on which the lever *t* turns. The outer end of this lever *t* then passes down through the top plate of the shell of the lamp-top, and is then again bent downward and outward, as shown in Fig. 3, to form a lever, *r*<sup>1</sup>, by which to raise the tube *r* and extinguish the flame.

P, Figs. 1, 7, and 8, represents a standard rigidly secured to the frame of the apparatus, which carries at its upper end two cam-rods, Q R.

Cam-rod Q is intended to operate on the lock-lever *q* of the lighting apparatus, forcing its upper end in, and thereby releasing the plunger *o*, which, through the action of the spring *p*<sup>1</sup>, is then driven forward, and, in so doing, ignites the match, and the latter the lamp. Cam-rod R is intended to act on the lower end of the lever *r*<sup>1</sup>, the other end, *t*, of which carries the extinguisher *r*.

Various modes of raising the extinguisher may be used, as by a rigid arm moving over a stationary cam-face; or, instead of a tubular extinguisher, a hinged cap-extinguisher may be used, and operated in the same way as that illustrated for the tubular one.

In Fig. 5 is illustrated the release mechanism. S represents a time-movement, which may either be an eight-day or two-week movement.

Upon the spindle which usually carries the hour-hand is secured an eccentric, *v*, and which is arranged between two arms, *w w*, of the escapement U, which is pivoted to the frame of the clock-movement. At the side of the clock-movement thus constructed is arranged the standard B and spindle D in such manner that the teeth *x* of the release-disk G will project between the detents *y* of the escapement-lever U, as shown in Fig. 5.

Thus arranged the disk G will be provided with teeth according to the number of lamps to be used in the apparatus. As a rule, I prefer to provide it with seven lamp-burners, one for each night of the week. When thus constructed the disk G will carry fourteen teeth, and the ratchet-disk U the same number, two teeth for each twenty-four hours, for the reason that the eccentric *v* of the clock-spindle performs one revolution every twelve hours,

and therefore releases a tooth, *x*, of the disk every twelve hours, whereupon the spring *F*, acting on disk *G*, causes it to perform a part of a revolution equal to one-fourteenth of the whole, carrying with it, through the teeth *i i* on the lower end of the tube *h* of the oil-reservoir, the latter and lamps.

Now, let us suppose that the lamps are so set that the release of disk *G* shall take place at six o'clock in the evening and six o'clock in the morning; then the first tooth released would allow the lamps to be forced around just sufficiently far to cause the cam-rod *Q* to compress lever *g* of the lighting apparatus *J*, thereby releasing plunger *o* and match *n*, igniting the latter, and, in so doing, that lamp. Then, at the end of the next twelve hours, the next tooth of wheel *G* would be released, thereby causing the lamps to perform another one-fourteenth of a revolution, or just half the distance between the lamps, thereby bringing the lower end of the lever *r' t* in contact with the cam-rod *R*, and by this means raising the short tube *r* and extinguishing the lamp. Here the extinguisher is held until the next tooth is released and the next lamp is brought into position and lighted, and so on until the end of the week, when all have been lighted and extinguished, after which the attendant comes and removes the lamps and reservoir, and replaces it with another, or else refills and trims, and places new matches in each lighter, and then replaces it for another week's work.

*W* represents the handle for removing the

lamps from the lantern, the top of which may be made removable for that purpose, suitable fastenings being used for keeping it in its position. Each lamp, if desired, may be provided with a separate oil-reservoir. Spring *F*, which moves the lamps, is wound up weekly by applying a suitable key to the top of spindle *D* and turning it in the proper direction, the ratchet *C*, arm *E*, and pawl *e* holding it in place when wound.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of one or more lamps and intermediate mechanism, substantially as described, with a time-movement, whereby an intermittent revolving motion at regulated intervals apart is imparted to the lamp, for the purposes set forth.

2. The combination, with each of a series of lamps having an intermittent revolving motion, of an extinguishing device, substantially as set forth.

3. The combination, with each of a series of lamps having an intermittent revolving motion, of a self-lighting device, substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JOSEPH FORREST.

Witnesses:

D. G. STUART,  
JOS. N. YOUNG.

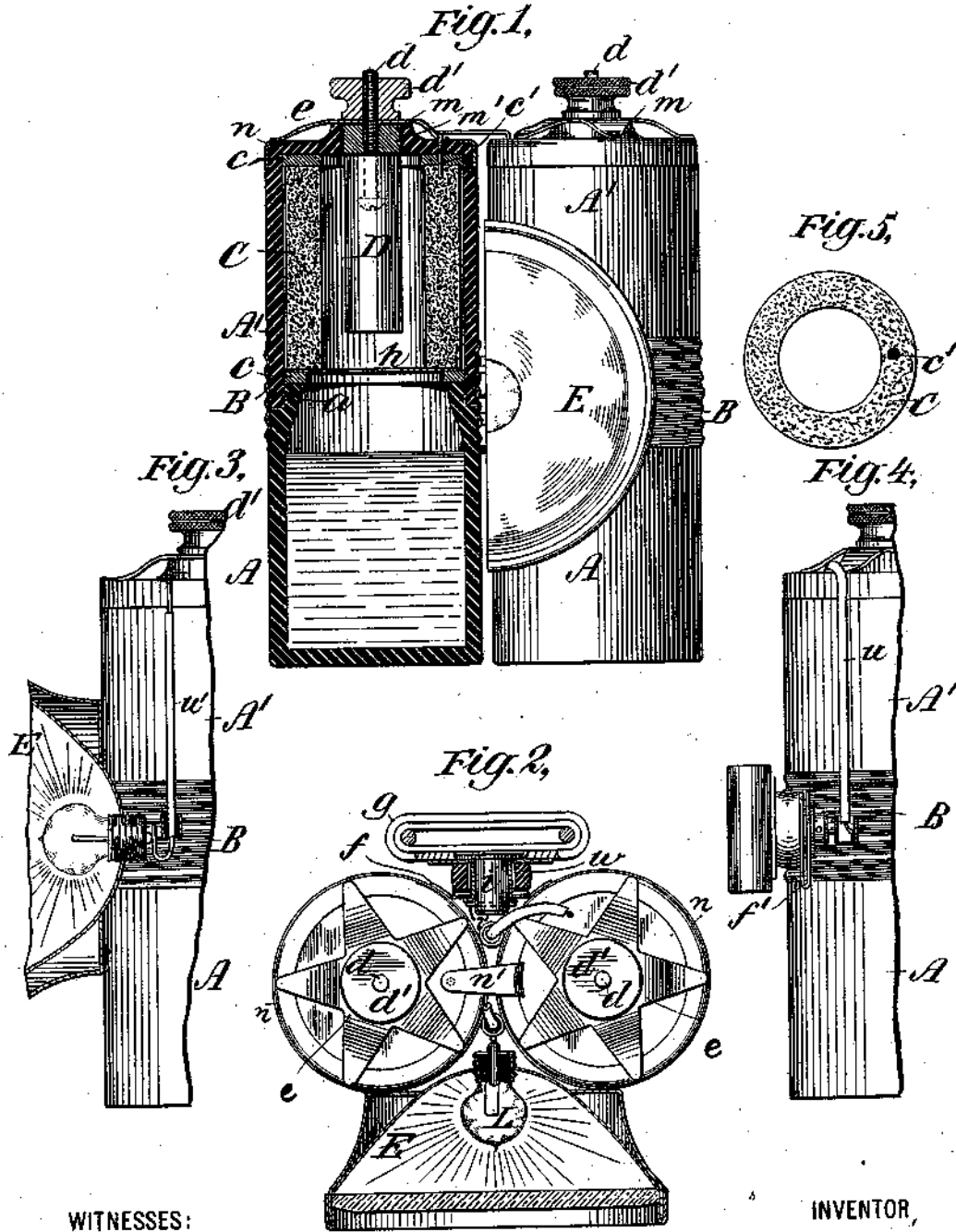


(No Model.)

R. R. MOFFATT.  
PRIMARY BATTERY.

No. 581,426.

Patented Apr. 27, 1897.



WITNESSES:

*N. N. Haywood*  
*L. A. Schaefer*

INVENTOR,

*Richard R. Moffatt.*

# UNITED STATES PATENT OFFICE.

RICHARD R. MOFFATT, OF BROOKLYN, NEW YORK, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE VICE VERSA ELECTRIC LAMP COMPANY.

## PRIMARY BATTERY.

SPECIFICATION forming part of Letters Patent No. 581,426, dated April 27, 1897.

Application filed September 1, 1896. Serial No. 604,516. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD R. MOFFATT, a citizen of the United States, residing in the city of Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Primary Batteries, of which the following is a specification, reference being had to the accompanying drawings.

The invention relates most particularly to portable electric batteries in which the electrodes may be immersed in or removed from the exciting fluid of the battery by simply turning, tilting, or reversing the battery-case.

My present improvements are particularly applicable to such batteries, adapting them for special purposes, such as producing light in hand-lamps, miners' lamps, bicycle-lamps, &c., the chief aim of the invention being to simplify construction, to facilitate charging and renewing the electrodes, also to combine strength, lightness, and efficiency.

To this end, in carrying out my improvement in preferred form I use two or more independent cells of cylindrical or other shapes, made from hard rubber or other suitable material. Each cell is preferably composed of two parts, which are connected by means of a coupling-ring, that firmly joins the parts and effectually prevents their separation or becoming loose by expansion or contraction in the operation of the battery. I find this method of connecting the parts of the cell together well adapted to prevent their separation or loosening due to the unequal contraction or expansion arising from the heat developed in the use of the battery. Each cell is provided in one of its parts with removable electrodes, in the present instance consisting of a tubular carbon and a cylindrical zinc, the latter being arranged to be withdrawn without parting the cell, while the carbon can be readily removed by simply unscrewing one of the parts of the cell from the coupling-ring.

A supporting frame or case for holding the cells in position is made by metallicly joining the coupling-rings with a connection, means or handle on one side, and if the battery is used to run a lamp a reflector, in which is mounted an ordinary electric incandescent

lamp, upon the other side, the frame or case forming part of the electric circuit.

In the annexed drawings, Figure 1 is a part view of a battery embracing my invention, showing part in elevation and part in section. Fig. 2 illustrates a plan or top view of the same. Fig. 3 is a side view through the center of battery, showing the reflector in section, also circuit connections. Fig. 4 is a similar view showing circuit connections, also means for holding and reversing battery. Fig. 5 shows a plan or top view of carbon electrodes.

Similar letters of reference in the several figures indicate like or corresponding parts.

Referring to the drawings, A and A' indicate the two parts of a battery-cell, preferably made of hard rubber. They are connected together and held in position by a metallic screw coupling-ring B. In the upper part A' of the cell is a carbon tube C, held firmly in place by means of the neck projection or shoulder a, that forms an integral part of cell-case. Suitable elastic packing-rings c c are placed between the carbon tube and cell to prevent leakage of fluid or gas.

D is a zinc electrode, from one end of which extends a metal screw d, upon which is a thumb-nut d' and a contact-washer e. An elastic rubber disk m encircles the screw and serves to close the opening m' in the top of cell A', and to firmly hold and secure the zinc in position by being expanded laterally with pressure upon the sides of opening m' when compressed between the zinc D and the washer e by means of the screw-nut d'. A metallic wire or contact-pin c' extends from the carbon C through the washer c and the cell A', as shown.

E is a metallic reflector which, together with a back or support piece f, is metallicly connected to the coupling-rings B B and forms a case or frame that rigidly supports and holds the battery-cells.

L is an incandescent lamp mounted in an ordinary manner within the reflector.

g is a rubber-lined socket for attaching the battery to a bicycle-hook. It is provided with a swivel i, that engages with the back piece f, a securing-pin i', passing through the swivel,

together with an elastic washer *w*, or a metal spring *f'* firmly holds the parts together and properly checks the operation in reversing the battery, so that it will always be in correct position. A check-groove in the back piece *f*, engaging with the securing-pin *i'* through the tension of the elastic washer *w*, or the spring-piece *f'*, or both, as shown, effectually holds the battery in position when reversed.

A metallic fixture or ring *n* is secured upon the top of cell *A'* and forms part of the electric circuit. One of these has a projecting portion *n'*, that extends over to the carbon connecting-pin *c'* in the other cell. (See Fig. 2.)

The washer *e* is provided with multiple contact points or fingers, which extend outward, preferably in star shape, and engage by spring-pressure with the circuit fixture or ring *n*, thus insuring a perfect metallic contact when the zinc has been removed and replaced.

*u* is a circuit-wire connection between ring *n* and frame.

*w* is an insulated circuit-wire to lamp, as shown in Fig. 3.

A thin perforated disk or diaphragm *h* is placed between the parts of the cell *A* and *A'*, as shown, to prevent fluid from being thrown from one part of cell to the other when the battery is carried.

In the operation of my invention the zincs are removed from the cells by simply unscrewing the nut and withdrawing them. The charge of battery-fluid is then inserted, filling the lower part of each cell. The zincs are replaced and firmly secured by means of screw-nut *d'*, and the battery is ready for use. To light the lamp, it is only necessary to reverse the position of the battery by turning it upon its swivel, when the fluid within the cells is brought into contact with the carbon and zinc, instantly generating electric energy, when, the circuit being closed, the current passing through the lamp-filament produces light. To stop the action, the battery is reversed in like manner to starting. Then the fluid passes away from the electrodes and the current ceases.

It is obviously not necessary that the cells should be cylindrical in form throughout, as the lower part could advantageously be angular in shape, with cylindrical neck for screw-couplings.

I claim—

1. A primary battery comprising a metal frame having a plurality of openings and a plurality of independent battery vessels, each consisting of two cups having rims secured in the openings of said frame, substantially as set forth.

2. A primary battery comprising a metal frame having a plurality of threaded open-

ings and a plurality of independent battery vessels, each consisting of two cups having threaded rims secured in the openings of said frame, substantially as set forth.

3. The combination of a primary battery comprising a metal frame having one or more openings and corresponding battery vessels, each consisting of two cups having rims secured in the openings of said frame, an electrical translating device, and electrical connections of which the frame is a part between said device and the battery, substantially as set forth.

4. A primary battery comprising a metal frame with a plurality of openings therein, and a plurality of battery vessels in said openings, each vessel consisting of two cups with rims secured in the openings, one of which cups contains battery electrodes, substantially as set forth.

5. A primary battery comprising a metal frame having a plurality of openings and a plurality of independent battery vessels, each consisting of two cups having rims secured in the openings of said frame, an incandescent lamp and reflector secured to the frame on one side, a swivel device on the other side for reversing the battery, and suitable electric conductors connecting the battery elements with the incandescent lamp, substantially as set forth.

6. The combination in a battery-cell, of two parts connected together by a coupling-ring, zinc and carbon electrodes located in one of said parts, the other of said parts, having a neck, or shoulder, holding the carbon electrode in position when the parts are coupled together, substantially as specified.

7. A primary battery-cell composed of two parts coupled together by a screw, one part containing a zinc, and a carbon lining that is held in place by means of a neck or shoulder, a perforated disk and elastic washers *c, c*, between the neck or shoulder and the carbon electrode substantially as and for the purpose specified.

8. In a portable primary battery, the combination of a cell comprising separable parts, *A, A'*, a metallic screw coupling-ring *B* connecting the parts, a neck or shoulder formed upon one of the parts, a tubular carbon *C* located in the other part, and elastic rubber washers *c, c*, forming a tight joint between the parts of the battery, substantially as and for the purpose set forth.

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

RICHARD R. MOFFATT.

Witnesses:

PIERSON L. WELLS,  
L. A. SCHAEFER.

Nov. 28, 1933.

F. A. BERG

1,937,379

HIGH INTENSITY MULTIPLE ARC PROJECTION LAMP MACHINE

Filed Dec. 7, 1929

4 Sheets-Sheet 1

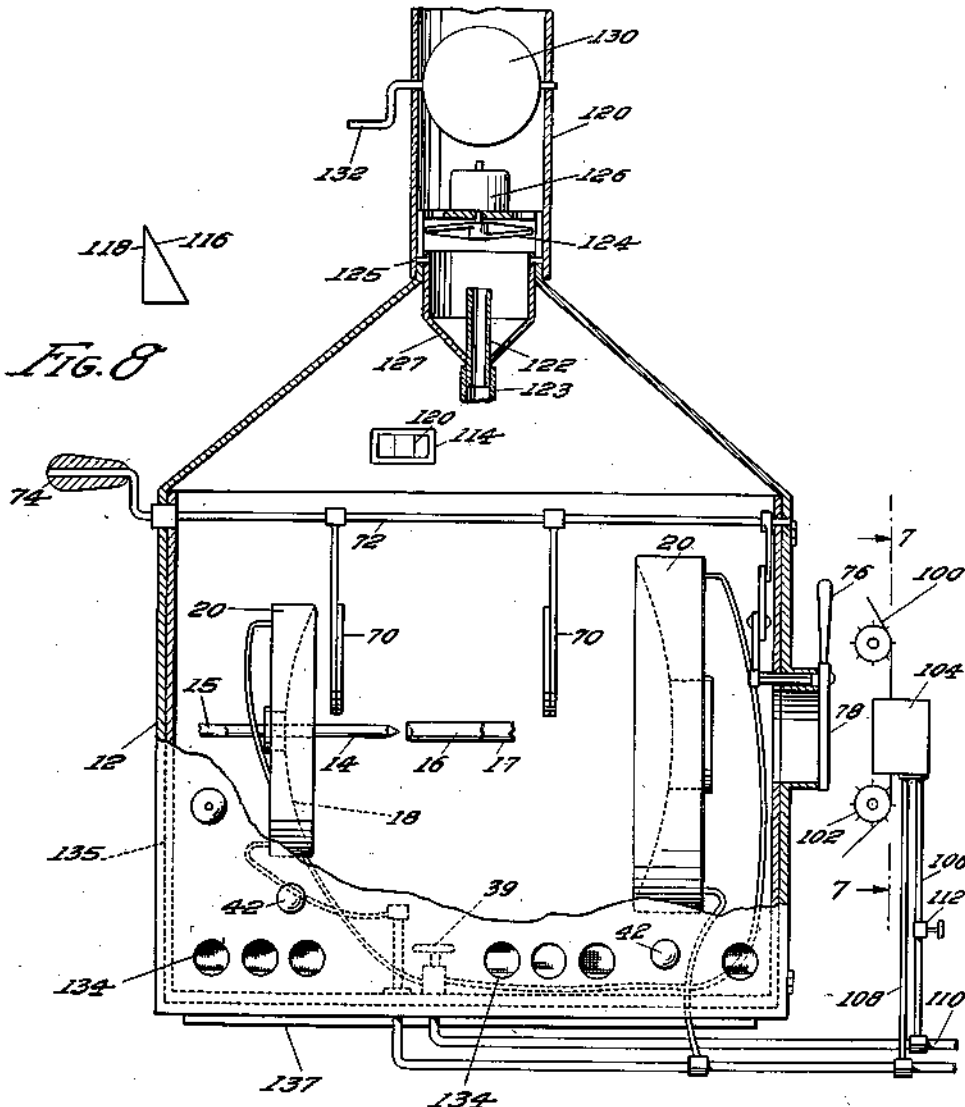


FIG. 8

FIG. 1

FREDERICK A. BERG  
INVENTOR

PER *Albert J. Pike*  
ATTORNEY

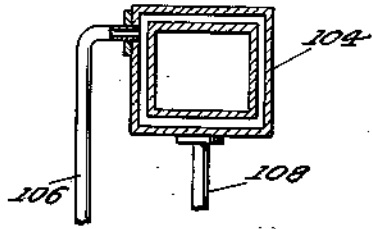


FIG. 7

Nov. 28, 1933.

F. A. BERG

1,937,379

HIGH INTENSITY MULTIPLE ARC PROJECTION LAMP MACHINE

Filed Dec. 7, 1929

4 Sheets-Sheet 2

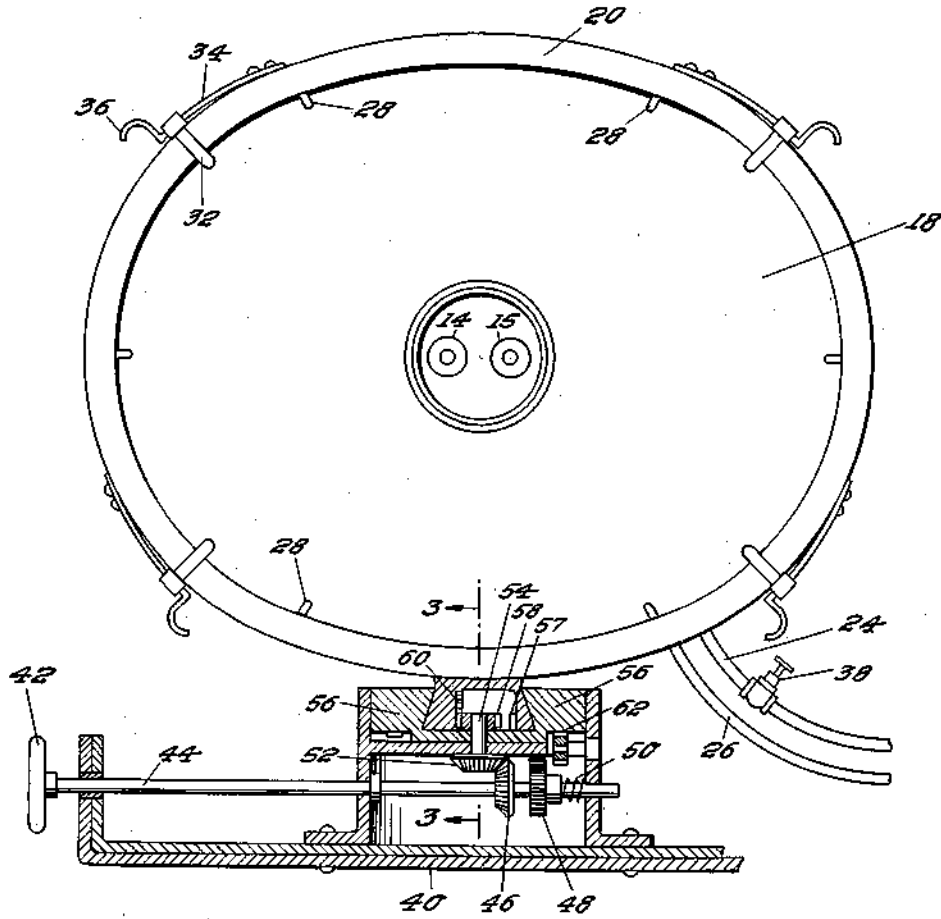


FIG. 2

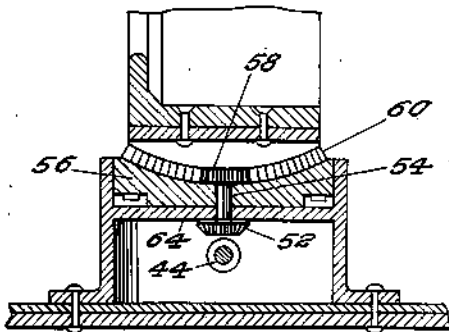


FIG. 3

FREDERICK A. BERG  
INVENTOR

PER

*Albert J. Fike*  
ATTORNEY

Nov. 28, 1933.

F. A. BERG

1,937,379

HIGH INTENSITY MULTIPLE ARC PROJECTION LAMP MACHINE

Filed Dec. 7, 1929

4 Sheets-Sheet 3

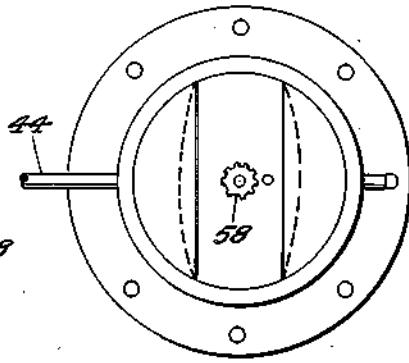
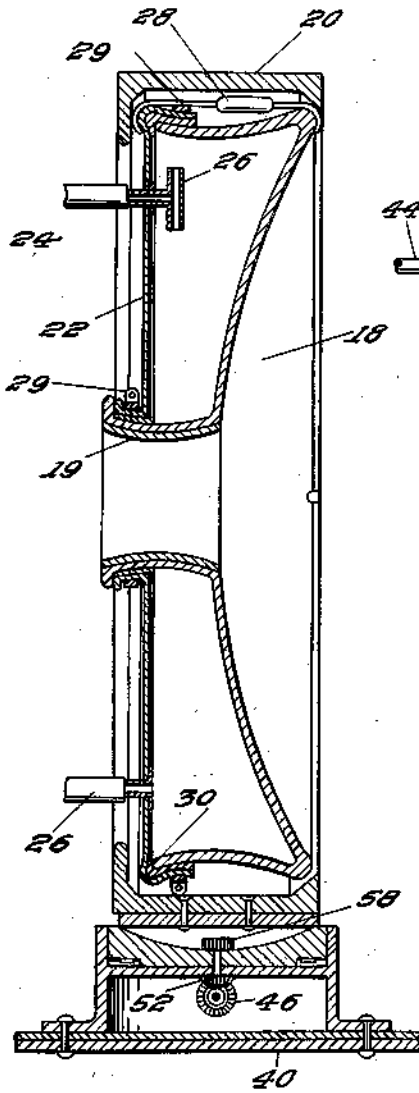


FIG. 5

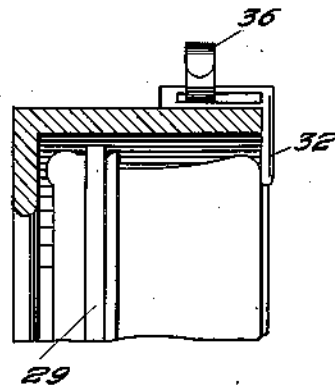


FIG. 6

FIG. 4

FREDERICK A. BERG  
INVENTOR

PER

Albert J. Fike  
ATTORNEY.

Nov. 28, 1933.

F. A. BERG

1,937,379

HIGH INTENSITY MULTIPLE ARC PROJECTION LAMP MACHINE

Filed Dec. 7, 1929

4 Sheets-Sheet 4

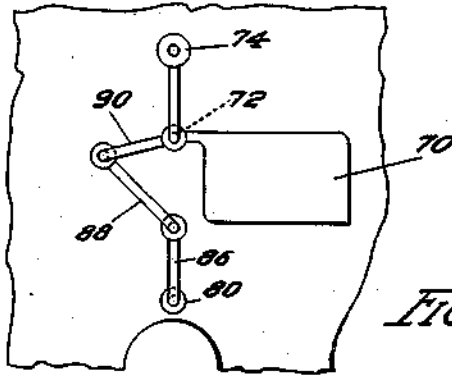


FIG. 9

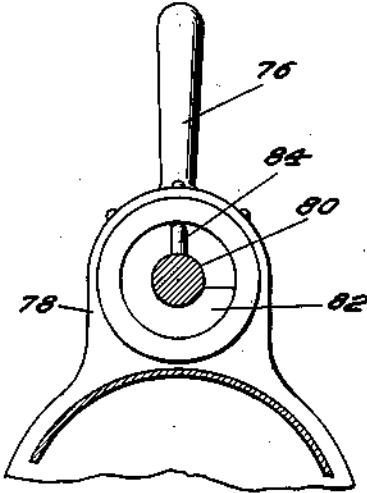


FIG. 11

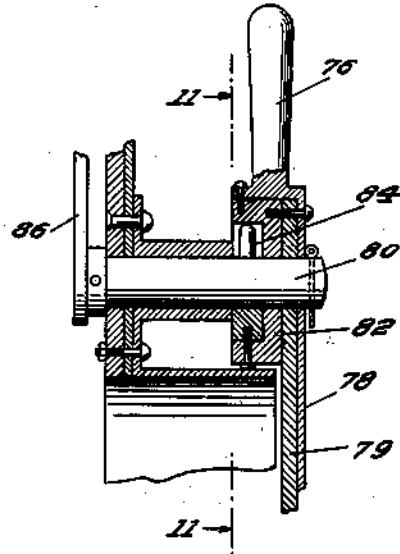


FIG. 10

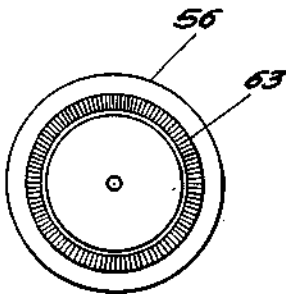


FIG. 13

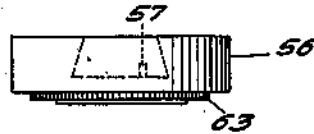


FIG. 12

FREDERICK A. BERG  
INVENTOR

PER

*Albert F. Bibe*

ATTORNEY

# UNITED STATES PATENT OFFICE

1,937,379

## HIGH INTENSITY MULTIPLE ARC PROJECTION LAMP MACHINE

Frederick A. Berg, Chicago, Ill.

Application December 7, 1929. Serial No. 412,309

24 Claims. (Cl. 88-24)

This invention relates to an improved multiple high intensity hydraulic projection lamp machine and has for one of its principal objects the provision of a multiple arc construction for motion picture projection whereby a high intensity light can be passed through the film for better projection work.

One of the important objects of this invention is to provide a hydraulic cooling system in conjunction with a high intensity lighting arrangement for motion picture projection machines whereby the film will be automatically cooled upon its passage through the machine, thus eliminating danger of overheating, warping of the film, fire or spontaneous combustion.

Still another important object of this invention is the provision in a motion picture projection lamp of means for automatically and continuously exhausting and cleaning the same so that particles of dust and carbon will be removed from the interior thereof and not allowed to accumulate on the reflectors, lens, and the like in the lamp housing.

Another and still further important object of the invention is the provision in a motion picture projection apparatus of a system of elliptical mirrors in conjunction with a multiple arc construction whereby the light from a plurality of arcs can be concentrated and focused upon the film aperture together with a special means of adjusting such mirrors and also cooling the same to insure against cracking from the intense heat developed.

Other and further important objects of the invention will be apparent from the disclosures in the accompanying drawings and following specification.

The invention, in a preferred form, is illustrated in the drawings and hereinafter more fully described.

In the drawings:

Figure 1 is a side elevation of the improved projection apparatus of this invention, parts being broken away to show the interior thereof.

Figure 2 is a front elevation of one of the novel mirrors used in the device.

Figure 3 is a detail view of the mirror support.

Figure 4 is a side elevation of the mirror.

Figure 5 is a top plan view of the mirror support, the mirror being removed.

Figure 6 is a detail view of the mirror housing construction.

Figure 7 is a front plan view of the film aperture.

Figure 8 is a side detail view of the optical prism

for inspecting the condition of the multiple arc.

Figure 9 is a detail view of the operating means for the mirror dampers or protectors.

Figure 10 shows the operating handle for the dampers in side elevation.

Figure 11 is a sectional view taken on the line 11-11 of Figure 10.

Figure 12 is an end view of the mirror base.

Figure 13 is a bottom view thereof.

As shown in the drawings:

The reference numeral 12 indicates generally the casing of the improved motion picture projection machine of this invention having a multiple arc therein composed of positive carbons 14 and 15, and negative carbons 16 and 17. Obviously, a plurality of arcs may be employed if desired, providing a multiple high intensity light.

In order that the multiple arc may function properly, the reflecting mirrors are made elliptically oval as illustrated at 18 and 20 respectively, each of the arcs being positioned at one of the foci of the smaller mirror. This arrangement is best illustrated in Figure 2.

Each mirror is composed of some highly reflective material such as silver, glass, or the like, and as best shown in Figures 2 and 4, has a central opening for the introduction of the carbons for the arcs, and each mirror is built into a frame 20 having a back 22, leaving a hollow space for the passage of circulating cooling water or fluid which is introduced through an inlet pipe 24 having a T-shaped inlet spout as shown at 26 so that all parts of the mirror will be effectively cooled, and the water is forced out through an outlet pipe 26 let into the lower portion of the mirror housing.

In order to insure a tight construction, a number of turnbuckles 28 is spaced around the periphery of the mirror, and locking bands 29 encircle the periphery of the mirror housing and also the casing around the central opening. In this way, a water-tight joint can be made between the rear edge 30 of the mirror plate and the corresponding face of the back 22. The interior of each central opening is lined with insulating material 19, such as asbestos or the like.

The mirror may be readily removed from the frame 20, it being held in position by means of a plurality of locking pins 32, each of these pins being positioned upon a spring-impelled clamping element 34 which has as its outer end an operating handle 36. A suitable stop cock 38 is provided on the inlet pipe 24 for controlling the flow of water, and a master valve is provided at 39.



Each mirror is adjustably mounted on a base plate 40, the mounting including means for rotating the mirror about its central vertical axis and also for tilting the same forwardly or rearwardly as desired to obtain a proper focusing of the light rays. Both of these operations are accomplished by a single operating handle 42 outside the lamp housing mounted on a shaft 44 which in turn has positioned thereon a bevel gear 46 and a plain gear 48. A helical spring 50 normally impels the shaft 44 forwardly so that the bevel-gear 46 is normally in mesh with the corresponding bevel-gear 52. This gear 52 is positioned upon a supporting shaft 54 mounted in a plate 64 and upon the upper end of this shaft 54 is another gear which meshes with a rack 60 integral with the mirror support 56 whereby the mirror may be rotated about its vertical axis. The position of the handle 42 with respect to the lamp housing is best shown in Figure 1.

Upon operating the handle 42 inwardly against the pressure of the spring 50, the gear 48 is caused to mesh with a pinion 62 also mounted in the plate 64. This gear 62 is always in mesh with a circular rack 63 which is integral with and forms part of the bottom of the mirror support or base 56 as best shown in Figures 12 and 13. Obviously, a rotation of the handle 42 will impart a corresponding rotation of the mirror support 56 about its central axis 54, thereby rotating the mirror about its central vertical axis. A pin 57 is provided for retaining the mirror support 56 in its proper position, particularly with respect to the meshing of the gear 54 with the rack 60 which, as will be noted from an inspection of Figure 3 is curved upwardly, thereby providing for a forward and rearward tilting motion of the gear itself upon a rotation of the mirrors 46, 52, and 58. The relation of the parts 56 and 60 is such that a frictional sliding fit is provided which maintains this support in desired adjusted position at all times, and without any possibility of becoming loose or displaced. Further the V-shaped support cannot be forced upwardly upon operation of the gear 58.

In this way, the mirror is tilted forwardly or rearwardly at the will of the operator, and when set in this position will remain so even though the operating handle 42 is later used for rotating the mirror about its vertical axis.

Positioned before the upper part of each of the mirrors and between it and the arc is a damper or protecting plate 70 which prevents sparks and molten carbon from metal or the like from striking the surface of the mirror when the arc is struck. These dampers are preferably composed of mica or some other suitable material, and are supported from the rod 72 which passes longitudinally through the casing 12 of the machine. The rod may be rotated by means of an operating handle 74 which is of considerable weight so that it will serve as a counterweight to retain the dampers in a withdrawn position when the device is in operation. The dampers can also be operated simultaneously with the opening of the passage for the light rays through the forward face of the housing, this being accomplished by means of an operating handle 76 which shifts a plate 78 to one side. The plate 78 has an insulating backing 79 of asbestos or the like. This plate when shifted to one side allows passage of the light rays out through the forward opening in the casing. The handle 76 and the plate 78 comprises a unitary

construction, and are loosely mounted upon a shaft 80, the handle and plate assembly also comprising a cam element 82 which forms a part thereof and which also comprises a portion of a bearing support for this assembly on the shaft 80. The handle 76 is heavy enough to provide a counterbalance for the weight of the upright dampers. A pin 84 is fixed in the shaft 80 and from an inspection of Figure 11, it will be seen that a rotation of the counter weighted handle 76 with its cam element 82 will move the pin 84 in a clockwise direction, thereby turning the shaft 80. Into the rear end of the shaft 80 is fixed a link 86 which in turn is pivotally mounted to a connecting rod 80, this being in turn pivoted to a further link 90 which is fixed to the shaft 72 upon which the damper or protector plates 70 are mounted. Obviously, a 90° movement of the handle 76 will produce a corresponding 90° upward movement of the dampers 70 and also a corresponding downward motion of the handle 74 which is counter-weighted so as to remain in its downward position, thereby retaining the dampers 70 in their withdrawn position. The plate 78 can then be shifted to cover the aperture in the protector without again moving the dampers 70, if this is desired.

The entire interior of the housing is lined with asbestos or other suitable heat and fire insulating material as shown at 135.

Again the housing as a whole can be adjusted to and from the film aperture plate 104, by sliding the housing on its supporting rails 137. This is for the purpose of properly focusing the light rays at their point of passage through the film, and after an original focusing has been accomplished by adjustment of the elliptical mirrors.

The film is illustrated at 100 in Figure 1 and passes over the usual sprockets 102 before the usual aperture formed in a plate 104, as best shown in Figure 7.

This plate is made hollow and has passages therein for the circulation of cooling water which enters at the top inlet pipe 106 and is forced outwardly at the bottom through the outlet pipe 108. The inlet pipe 106 is connected to the main supply pipe 110 which leads circulating water to the mirrors and is also fitted with a stop cock 112 whereby the flow of water through the aperture plate can be regulated.

In the top of the housing 12 is an opening fitted with an optical prism 114 having its rear face covered with silver or other reflecting element as shown at 116 in Figure 8, and this prism is set at such an angle that the condition of the arcs 14—17 can be readily inspected. The forward face of the prism 118 is frosted and is provided with two hair lines 120 so that the location of the arcs can be accurately determined and positioned without the necessity of gaining access to the interior of the apparatus, the carbons themselves being controlled and manipulated by the ordinary operating handle not shown.

In the top of the housing is fitted a ventilating shaft 120 which has at its lower end a Venturi or other restricted tube 122 so that a considerable current of air may be drawn there-through by means of a fan 124 operated by motor 126. The upper edge of the Venturi tube is above the lower level of the housing 120 leaving a space for the collection and retaining of dust carbon particles and the like which are drawn through the Venturi tube 122 but which are too heavy to be forced out past the fan. A

damper is provided in the shaft as illustrated at 130, this being operated by means of a handle 132 and a series of inlet vents for air is provided in the lower portion of the housing 12 as illustrated at 134. A flexible hose 123 is attached to the lower end of the tube 122, whereby the interior of the housing may be thoroughly suction-cleaned, the tube being of a length sufficient to reach all corners of the housing.

10 A pair of locking pins 125 is provided whereby the housing 127 supporting the tube 122 and hose 123 may be removed for disposal of accumulated dust or dirt, also when in operation.

15 It will be evident that herein is provided a multiple arc high intensity hydraulic optical system for projection machines which in addition to providing an amount of available light at least double that of the present system will automatically provide for the dissipation of the heat necessarily involved in this additionally high intensity projection. This is accomplished by means of the novel hydraulic system incorporated into the apparatus which also includes an automatic cooling of the film itself as it passes the light aperture.

20 This cooling is further accentuated by the action of the automatic ventilating and blower system incorporated into the construction.

25 I am aware that many changes may be made, and numerous details of construction varied throughout a wide range without departing from the spirit of this invention, and I therefore do not purpose limiting the patent granted hereon otherwise than as necessitated by the prior art.

I claim as my invention:

35 1. A high intensity multiple arc projection lamp machine including a plurality of aligned opposed reflector mirrors of elliptical shape, and arcs positioned at each of the focal points of said mirrors, each mirror having an opening therein for passage of light rays.

40 2. A high intensity multiple arc projection machine including a plurality of aligned opposed reflector mirrors of oval elliptical shape, an arc being positioned at each of the focal points of one of the mirrors, each of the mirrors provided with a central opening, one for the positioning of the carbons, and the other for the passage of light rays therethrough.

50 3. A high intensity multiple arc projection lamp machine including a plurality of hydraulic cooled aligned opposed mirrors, and means for adjusting said mirrors, both tilttable and rotatable, said means comprising a single operating handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tilttable movement of the reflector mirrors and the plain gear accomplishing rotation thereof.

60 4. A high intensity multiple arc projection machine including a plurality of mirrors, and means for adjusting said mirrors, both tilttable and rotatable, said means comprising a single operating handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tilttable movement of the mirror and the plain gear accomplishing rotation thereof, the bevel-gear normally meshing with a corresponding bevel-gear mounted on a shaft in the mirror base, a pinion on the other end of the shaft, and a rack in the mirror support in mesh with the pinion.

70 5. A high intensity multiple arc projection machine including a plurality of mirrors, and means for adjusting said mirrors, both tilttable and rotatable, said means comprising a single operating

80 handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tilttable movement of the mirror and the plain gear accomplishing rotation thereof, the bevel-gear normally meshing with a corresponding bevel-gear mounted on a shaft in the mirror base, a pinion on the other end of the shaft, and a rack in the mirror support in mesh with the pinion, the said rack being curved upwardly along an arc having its center in the center of the mirror.

90 6. A high intensity multiple arc projection machine including a plurality of mirrors, and means for adjusting said mirrors, both tilttable and rotatable, said means comprising a single operating handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tilttable movement of the mirror and the plain gear accomplishing rotation thereof, the plain gear adapted to be meshed with a similar plain gear mounted in the mirror base upon an inward movement of the handle, said second-named gear in mesh with a circular rack integral with the mirror support frictionally held in place.

7. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors and means for automatically cooling said mirrors.

8. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors and means for cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of water.

9. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors, at least one of the mirrors having an opening therein for the passage of light rays reflected from the other mirrors, and means for automatically cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of fluid, and casings behind the mirror and forming part thereof for the reception of said cooling fluid.

10. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors, at least one of the mirrors having an opening therein for the passage of light rays reflected from the other mirrors, and means for automatically cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of water, and casings behind the mirror and forming part thereof for the reception of said cooling water, said casings comprising metal boxes, and a system of turnbuckles and clamps for removably mounting the mirror face in said boxes.

11. In a motion picture lamp projector, a plurality of adjustable oval elliptical mirrors having aligned openings in their centers the reflecting surfaces of said mirrors being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture.

12. In a motion picture lamp projector, a plurality of elliptical mirrors having aligned openings in their centers the reflecting surfaces of

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150

- said members being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plate, and means connected with said operating means for automatically protecting the mirrors from sparks.
13. In a motion picture projector, a plurality of elliptical mirrors having aligned openings in their centers the reflecting surfaces of said mirrors being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plate, and means connected with said operating means for automatically protecting the mirrors from sparks, said means comprising a shaft extending longitudinally of the casing above the mirrors, a plurality of dampers on the shaft, and connections between the plate operating means and the shaft.
14. In a motion picture projector, a plurality of elliptical mirrors having aligned openings in their centers the reflecting surfaces of said mirrors being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plates, and means connected with said operating means for automatically protecting the mirrors from sparks, said means comprising a shaft extending longitudinally of the casing above the mirrors, a plurality of dampers on the shaft, and connections between the plate operating means and the shaft, together with means for independently operating the dampers.
15. In a motion picture projector, a plurality of arcs, a plurality of reflectors for the arcs, said reflectors comprising opposed aligned elliptical mirrors, having their reflecting surfaces facing each other and means for automatically and continuously disposing of carbon particles from the arcs, said means comprising a ventilating and suction system.
16. A motion picture projector including a plurality of aligned opposed mirrors, a high intensity arc comprising a plurality of light sources, said light sources being focused and positioned through an opening in one of the mirrors, and the light from both mirrors passing through an opening in the other mirror forwardly out of the projector, a film aperture before said projector opening and means common to the mirrors and the film aperture for fluid cooling the same and means for adjusting the projector with relation to the film aperture.
17. A motion picture projector including a plurality of water-cooled aligned opposed mirrors, a high intensity arc comprising a plurality of light sources, and a water-cooled film aperture, and a common source of cooling liquid for the mirrors and the film aperture.
18. A high intensity multiple arc projection machine including a plurality of aligned opposed mirrors and means for adjusting said mirrors, both tiltable and rotatable, said means comprising a single operating handle, a bevel-gear and a plain gear on the handle, said bevel-gear accomplishing tiltable movement of the mirror and the plain gear accomplishing rotation thereof, the plain gear meshing with a similar plain gear mounted in the mirror base, said second-named gear in mesh with a circular rack integral with the mirror support, and additional means for slightly adjusting both mirrors simultaneously.
19. A high intensity multiple arc projection machine including a plurality of aligned opposed mirrors, and means for automatically cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of water, and casings behind the mirror and forming part thereof for the reception of said cooling water, said casings comprising metal boxes, and a system of turnbuckles, clamps, and bands for removably mounting the mirror face in said boxes.
20. In a motion picture projector, a plurality of elliptical aligned opposed mirrors having openings in their centers, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, and an insulating lining in each of said openings.
21. In a motion picture projector, a plurality of elliptical aligned opposed mirrors having openings in their centers, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plate, and means connected with said operating means for automatically protecting the mirrors from sparks, said means comprising a shaft extending longitudinally of the casing above the mirrors, a plurality of dampers on the shaft, and connections between the plate operating means and the shaft, together with means for independently operating the dampers.
22. A high intensity multiple arc projector machine including aligned opposed mirrors and a film aperture, hydraulic cooling means for the mirrors and aperture, and a combination cooling and dust removing system in the projector housing.
23. A motion picture projection lamp, comprising in combination, a pair of carbon arcs, carbons for the arcs, a pair of elliptical mirrors for reflecting the rays from the arcs forwardly through the film aperture of the machine, and means for mounting the carbons for reducing light interference between the mirrors.
24. A motion picture projection lamp, comprising in combination, a pair of carbon arcs, carbons for the arcs, a pair of water-cooled elliptical mirrors for reflecting the rays from the arcs forwardly through the film aperture of the machine, and means for mounting the carbons for reducing light interference between the mirrors.

FREDERICK A. BERG. 140

June 29, 1937.

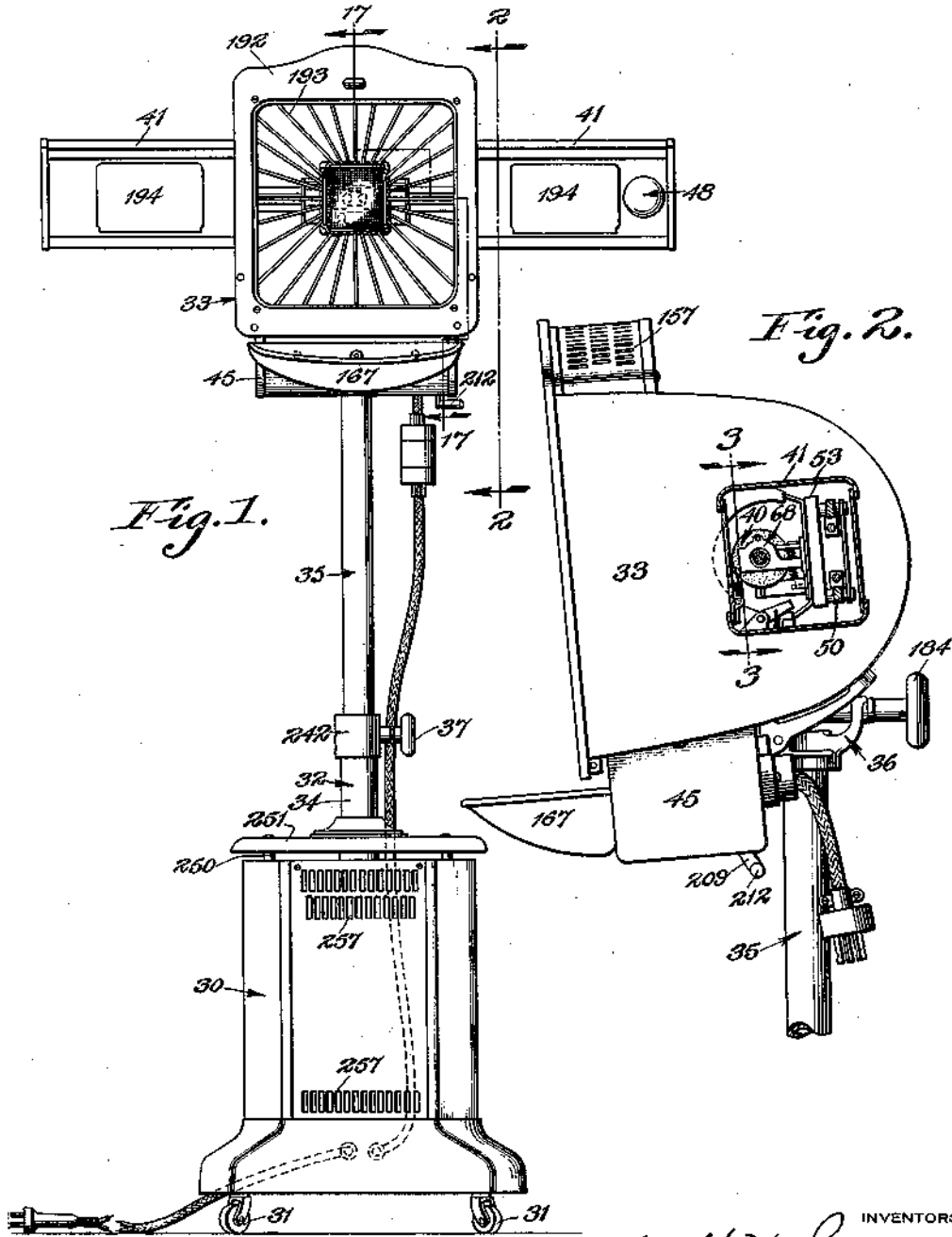
J. G. H. LIEBEL ET AL

2,085,536

ARC LAMP

Filed Jan. 5, 1931

9 Sheets-Sheet 1



INVENTORS  
*John L. H. Liebel*  
*Edwin S. Flursheim*  
BY  
*Wood & Wood* ATTORNEYS





June 29, 1937.

J. G. H. LIEBEL ET AL

2,085,536

ARC LAMP

Filed Jan. 5, 1931

9 Sheets—Sheet 4

Fig. 13.

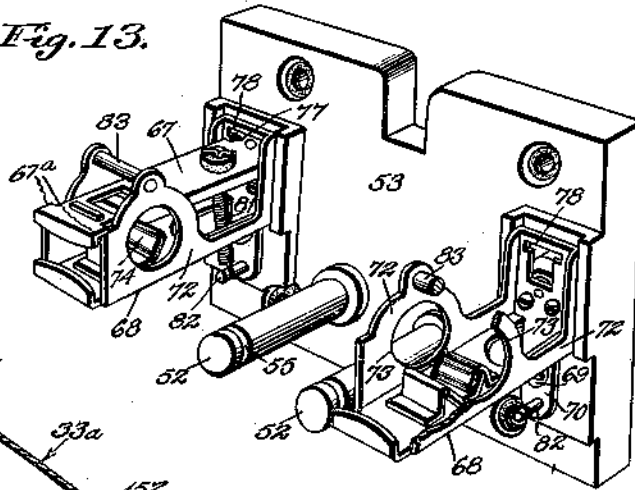


Fig. 14.

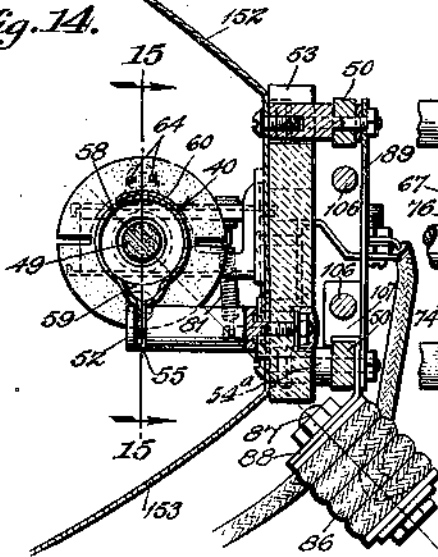


Fig. 15.

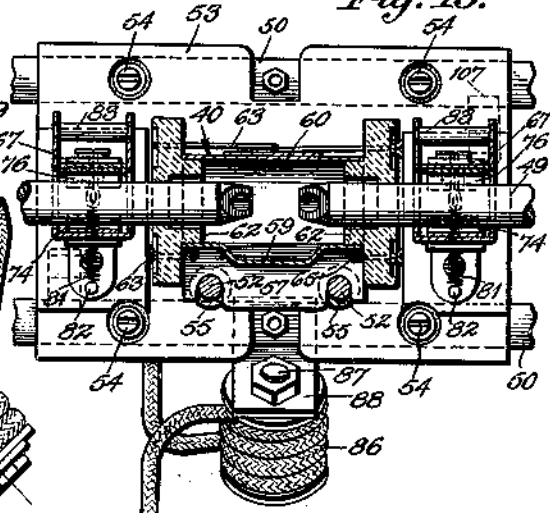
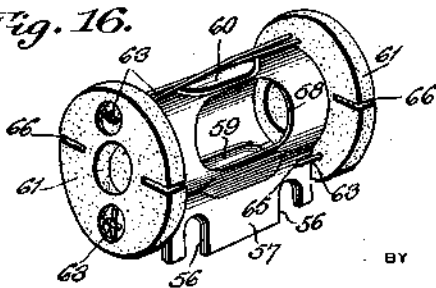


Fig. 16.



BY

INVENTORS  
John G. H. Liebel  
Edwin S. Flansheim

Word & Word ATTORNEYS





June 29, 1937.

J. G. H. LIEBEL ET AL

2,085,536

ARC LAMP

Filed Jan. 5, 1931

9 Sheets-Sheet 6

Fig. 20.

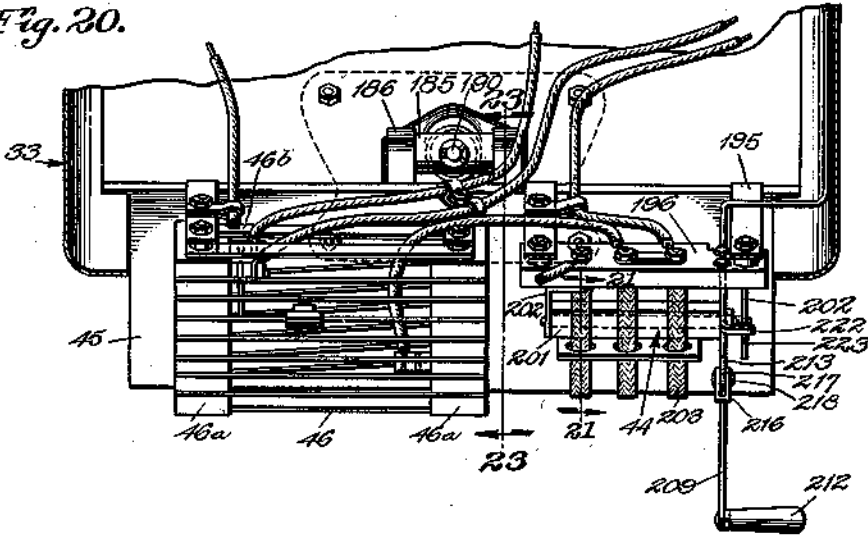


Fig. 21.

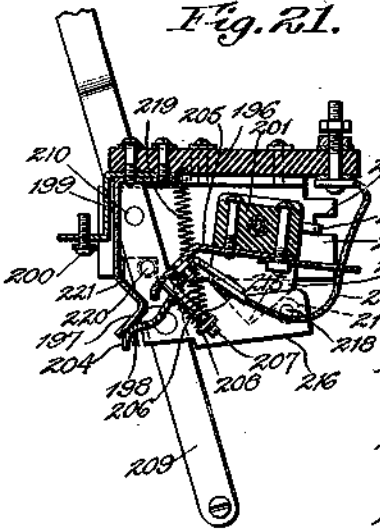
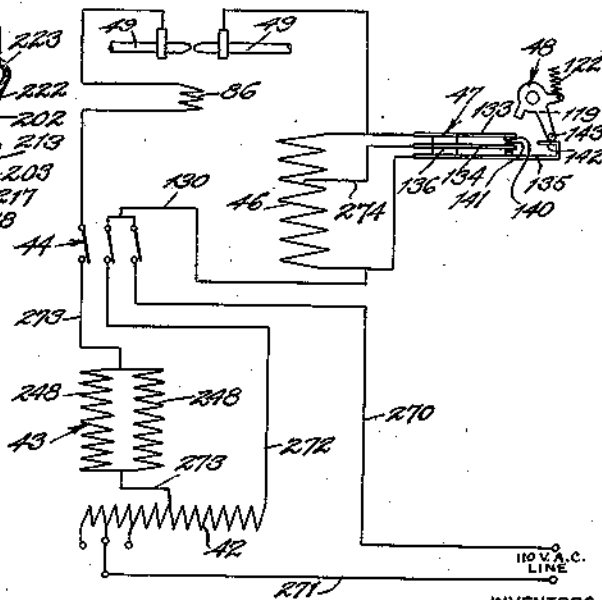


Fig. 22.



INVENTORS

John G. H. Liebel  
Edwin S. Florsheim

BY

Wood & Wood ATTORNEYS



June 29, 1937.

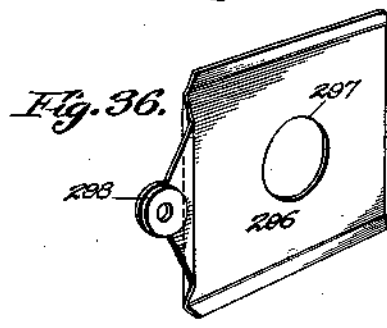
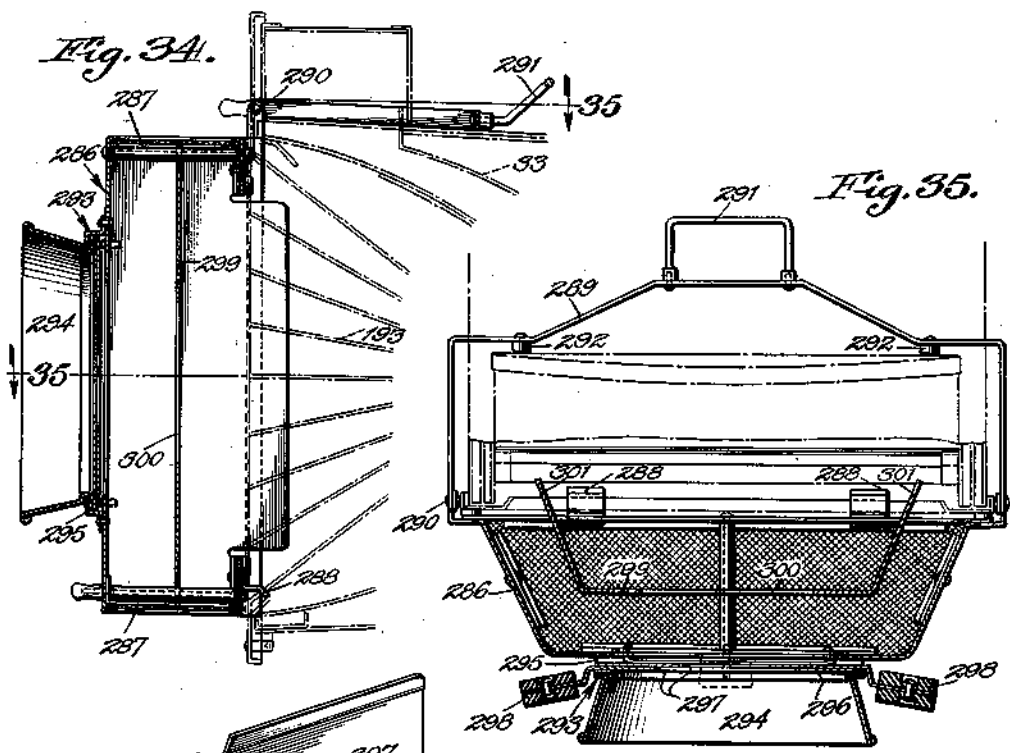
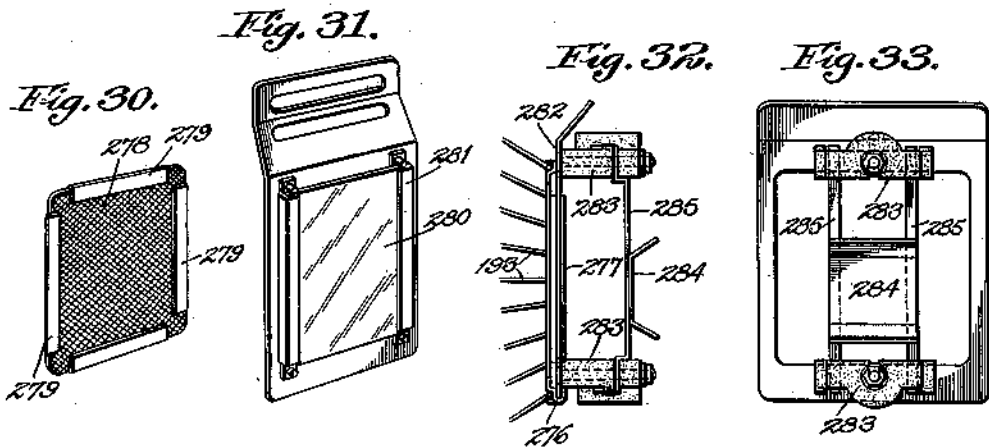
J. G. H. LIEBEL ET AL

2,085,536

ARC LAMP

Filed Jan. 5, 1931

9 Sheets—Sheet 8



INVENTORS  
John G. H. Liebel  
Edwin S. Florsheim  
BY  
Mark & Wood ATTORNEYS

June 29, 1937.

J. G. H. LIEBEL ET AL

2,085,536

ARC LAMP

Filed Jan. 5, 1931

9 Sheets—Sheet 9

Fig. 37.

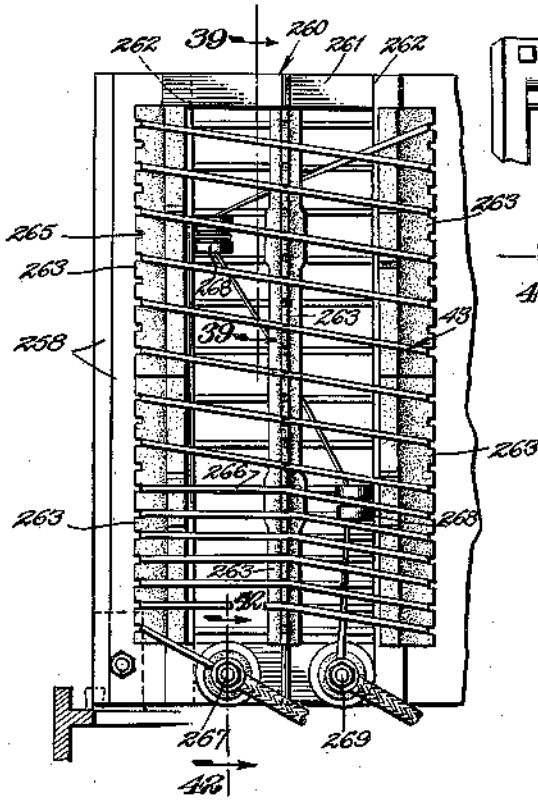


Fig. 38.

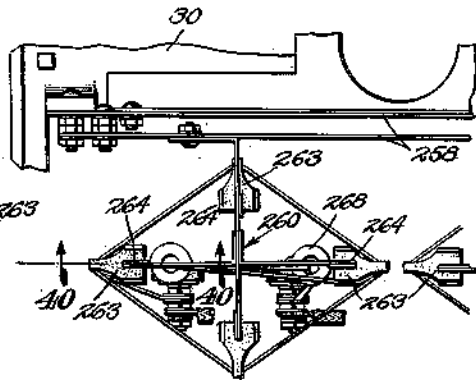


Fig. 39.

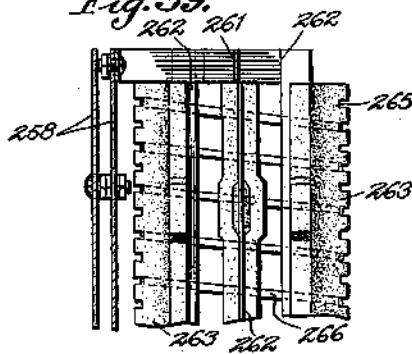


Fig. 40.

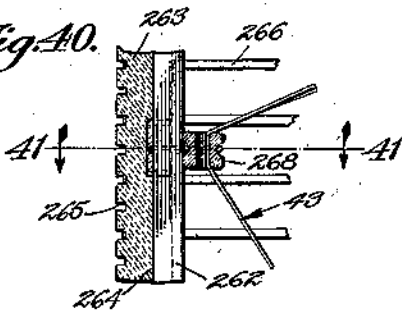


Fig. 41.

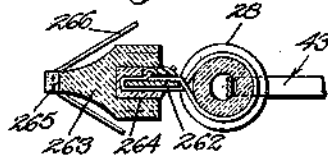
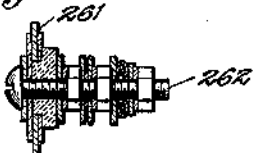


Fig. 42.



INVENTORS

John G. H. Liebel  
Edwin J. Florsheim

BY

Ward & Wood ATTORNEYS

# UNITED STATES PATENT OFFICE

2,085,536

## ARC LAMP

John G. H. Liebel and Edwin S. Flarsheim, Cincinnati, Ohio, assignors to The Liebel-Flarsheim Company, Cincinnati, Ohio, a corporation of Ohio

Application January 5, 1931, Serial No. 506,531

10 Claims. (Cl. 176-117)

This invention relates to arc lamps for therapeutic treatments adapted to provide ultra-violet and infra-red radiation as well as visible light. The particular type therapeutic lamp to which this invention is directed, comprises, two electrodes, usually of carbon, with which is associated coring or other material adapted to vaporize in the high heat of the arc between the electrodes and thus produce a luminous flame or vapor about the arc.

The problems to which this invention is addressed arise primarily in connection with a lamp of the type disclosed in the co-pending application of Jacquélet & Liebel, Serial Number 323,413, filed December 3, 1928 now issued into Patent No. 1,935,294, November 14, 1933. The arc lamp disclosed in this application comprises two electrodes mounted with their ends spaced, a housing surrounding the spaced electrode ends, and an aperture in the housing so related to said electrodes that the luminous flame or vapor surrounding the arc substantially exclude the oxygen of the atmosphere from the interior of the housing, thus eliminating smoke and fumes and retarding the consumption of the electrodes so that they need not be adjusted or reset during the course of a treatment.

Transparencies are not used to cover the aperture for the reasons that the more available are opaque to ultra-violet radiation, and that films tend to form over all transparencies thereby filtering out valuable therapeutic radiation. The housing surrounds the arc so closely that the housing becomes heated to incandescence by the arc and thus becomes itself a source of infra-red radiation.

The above mentioned application further points out that it is preferable to mount the electrodes horizontally with their longitudinal axes aligned, to dispose the aperture in the housing laterally, to throw a beam horizontally or horizontally and downwardly, and to fix the arc in the zone of the aperture by means of a magnetic field. The application also discloses that it is preferable practice to configurate the ends of the carbon electrodes within the housing so that each electrode has a surface partially facing the opposite electrode and partially facing the aperture. This provides a desirable beam of radiation.

While the lamp of the type described is susceptible to useful operation with just the few elements mentioned, still a therapeutic treatment lamp adapted for use in hospitals, clinics and physicians' offices, must be relatively simple, ex-

traordinarily reliable, and so constructed that it is impossible for either patient or operator to come to harm.

The present inventors have taken up the problems of producing a safe, convenient and economical therapeutic lamp with these elements, and have determined that it is at present commercially expedient to use relatively long carbon electrodes which can be operated for a number of hours without replacement, and further, that it is desirable to replace the protective housing with a new housing when the electrodes are renewed in order that the user of the lamp be relieved of the nuisance and burden of cleaning periodically the slag of the electrode cores from the inside of the housing.

In order to provide a therapeutic lamp suitable for the purposes specified, the inventors have proportioned and arranged the elements described, and associated with them other elements, mechanism, and devices to provide a lamp possessed of the following features:

1. A reflector is so disposed about the housing in relation to its emission aperture as to direct a beam of infra-red radiation in the direction of beam of ultra-violet radiation so that both fall upon the patient. This not only has valuable therapeutic effect, but keeps the patient warm and comfortable during the course of the treatment.

2. The housing is mounted within this reflector without the use of nuts, bolts, screws, or movable parts which might adhere, so that the housing can be removed by the user without difficulty and without the use of any tools. Inasmuch as the lamp housing becomes incandescent in operation, there is a tendency for the housing to heat the support for the housing whatever it may be. On this account, the support for the housing is placed at the bottom of the housing which is the coolest part of the housing, and the heat of the housing therefore has a minimum tendency to deteriorate the supports with which the housing is slidably engaged. Moreover, the slideway so disposed constitutes a rigid member which is the coolest part of the housing and therefore tends to support the entire housing when it is in a state of incandescence.

3. Electrical connection is made to the electrodes adjacent to the housing, as distinguished from at the far ends of the electrodes, so as to avoid the electrical potential drop which would be incidental to the passage of current through the long carbon electrodes.

4. This connection is a sliding connection which permits the electrodes to be manipulated from the ends by appropriate mechanism there disposed. (There are great difficulties in providing sliding connections capable of transmitting as much as twenty or thirty amperes without appreciable loss or sparking.)

5. Means is provided for shielding the above described electrical connections from the heat radiating from the housing.

6. As stated, the electrodes preferably used in this lamp are angular on the ends, disposed within the housing so that each electrode end is provided with a surface partially facing the other electrode and partially facing the aperture in the housing. In order that the user shall not insert the electrodes in the housing facing in the wrong direction, the opposite ends of the electrodes by which they are held in appropriate holders, are asymmetrically configured in such wise that the electrode will not fit in its holder unless the configured opposite end of the electrode within the housing is facing the aperture.

7. Mechanism is provided so that the user may turn a handle to bring the electrode ends together within the housing, and so that as this manually operable member is released, the electrodes will be automatically separated the desired and predetermined distance considered suitable for the initial arc. This mechanism is so located that it is protected from heat by the reflector.

8. When the electrode ends are in contact or when these ends are but slightly spaced, the flow of current is greater than when the proper gap is established. A starting resistance is therefore provided and is so associated with the mechanism for automatically spacing the electrode ends, that this resistance is placed in series with the electrodes when the electrode ends are touching or are but slightly spaced, but is cut out when the desired gap is established. In view of the fact that the circuit is substantially short circuit when the carbons are touching, it is considered advisable to employ two starting resistances which are cut out as the gap is established, one after the other automatically by the mechanism by which the initial gap is predetermined.

9. Inasmuch as the underwriters' regulations require some sort of screen to be interposed between the arc and the patient, it is deemed advantageous to provide a screen holder disposed in the proximity of the arc chamber, said screen holder adapted to have inserted in it not only the conventional screen, but likewise filtering transparencies as substitutes for the screen or special radiator members adapted to absorb the heat from the arc and emit large quantities of infra-red radiation to the exclusion of the ultra-violet radiation.

10. Also, it is desirable in some cases to localize the treatment and for this purpose an accessory device is provided which is designed to reduce the infra-red beam of radiation without minimizing the ultra-violet beam of radiation.

11. Since it is necessary to have access to the interior of the lamp mechanism for the purpose of changing arc chambers or electrodes, inspection, and the like, the lamp is provided with a series of connected doors. The screen holder is attached to the central door and the side doors provide access to the wings on either side of the lamp casing proper, in which is housed the electrode adjusting mechanism and some of the electrical mechanism. A safety switch is associated with this door mechanism in order that the cur-

rent be automatically turned off as the doors are opened so that it is impossible for the operator to receive an accidental shock by attempting to adjust the mechanism.

12. In view of the fact that no electrode feeding mechanism is used or recommended, it is desirable to provide electrical means which tends to stabilize the wattage consumed in the arc in the face of a gap of constantly varying length. The therapeutic radiation is essentially a function of wattage; therefore a positive temperature coefficient ballast is provided which insures substantially the same wattage when the arc is initiated, and twenty or twenty-five minutes later just prior to the time when the arc extinguishes itself due to the increasing length of the gap between the electrodes.

13. The arc chamber becomes incandescent in operation and emits large quantities of heat which are directed upon the patient by the reflector. Nevertheless, the reflector tends to become very hot over a period of prolonged use. Therefore, a live air passageway is provided between the reflector and the outer lamp casing, the passageway terminating forwardly and above the reflector in what may be termed the stack at the top of the lamp casing so that a draft is created both behind the reflector to cool it and upwardly across the front of the reflector so that any vaporous products of combustion however minor which may be formed by the arc, are drawn upwardly into the stack.

It will, therefore, be observed that the object of this invention is not only to provide a therapeutic arc lamp which is safe, convenient, and economical, but is also to provide mechanism operative for accomplishing the above outlined advantages.

Further objects and certain advantages will be more fully apparent from a description of the accompanying drawings, in which:

Figure 1 is a front elevation of the arc lamp complete with stand.

Figure 2 is a sectional view of the lamp taken on line 2—2, Figure 1.

Figure 3 is a fragmentary vertical sectional view of the lamp taken on line 3—3, Figure 2, showing the carbon electrodes and adjusting means, the carbon electrodes being shown properly adjusted for providing the necessary gap.

Figure 4 is a sectional view taken similar to Figure 3 but on an enlarged scale, showing the arc chamber casing and the electrode mounting in one wing of the lamp casing, the tips of the electrodes being shown in contact preparatory to starting and switch controlling the starting resistance shown fully opened for cutting off the direct electrical connections to the electrodes and throwing in the starting resistance.

Figure 5 is a sectional view taken on line 5—5, Figure 4, showing the mounting and construction of the adjusting shaft for translating the electrodes.

Figure 6 is a sectional view taken on line 6—6, Figure 5.

Figure 7 is a sectional view taken on line 7—7, Figure 4, illustrating an electrode carriage.

Figure 8 is a side elevation of the body of a carriage.

Figure 9 is a sectional view taken on line 9—9, Figure 8.

Figure 10 is an enlarged horizontal sectional view taken on line 10—10, Figure 4, detailing the mounting of an electrode.

Figure 11 is a sectional view taken on line 11—11, Figure 4.

11—11. Figure 10, showing details of carbon electrode brush and support and its mounting in the lamp casing.

Figure 12 is a sectional view taken on line 12—12, Figure 11, showing the means permitting pivoting of the brush on its support element.

Figure 13 is a perspective view of the arc chamber casing and electrode brush holders and supports assembled on their support panel.

Figure 14 is a sectional view taken on line 14—14, Figure 4, showing the arc chamber casing in cross section and illustrating the magnet used for controlling the arc.

Figure 15 is a sectional view taken on line 15—15, Figure 14, showing the electrodes properly spaced.

Figure 16 is a perspective view of the arc chamber casing or housing.

Figure 17 is a sectional view taken on line 17—17, Figure 1, showing the details of construction of the lamp casing and the cooperating connections between the doors and the starter switch, with the starter switch shown in "on" position.

Figure 18 is a fragmentary sectional view taken similar to Figure 17 but showing only the lower portion of the lamp casing to illustrate the action of the door and connecting levers in automatically throwing the switch to "off" position.

Figure 19 is a perspective view of the door in one of the wings, looking toward the same from inside the wing of the casing.

Figure 20 is a sectional view taken on line 20—20, Figure 17, showing the starting resistance and main switch in the lower chamber of the casing.

Figure 21 is a sectional view taken on line 21—21, Figure 20, detailing the main switch.

Figure 22 is a diagram of the electrical circuit of the lamp.

Figure 23 is a sectional view taken on line 23—23, Figure 20.

Figure 24 is a vertical sectional view taken through the post and base of the lamp stand for showing the electrical units on the base, a fragmentary rear portion of the lamp casing being included for illustrating the connecting bracket.

Figure 25 is a sectional view taken on line 25—25, Figure 24.

Figure 26 is a perspective view of the split clamping bushing.

Figure 27 is a sectional view taken on line 27—27, Figure 24.

Figure 28 is a sectional view taken on line 28—28, Figure 24.

Figure 29 is a detail sectional view of the lower end of the column.

Figure 30 is a perspective view of the screen insert mounted in the door immediately in front of the arc.

Figure 31 is a perspective view of a filtering device adapted for use in place of the protective screen.

Figure 32 is a rear view of a blind adapted to be mounted in the door immediately in front of the arc for blocking the ultra-violet rays when it is desired to use infra-red only.

Figure 33 is a side elevation of the device shown in Figure 32.

Figure 34 is a vertical sectional view of an appliance adapted to be mounted over the door for blocking out a portion of the ultra-violet rays for local treatment, the door and frame to which

the device is attached being shown in dotted lines.

Figure 35 is a sectional view taken on line 35—35, Figure 34, further detailing the local treatment device.

Figure 36 is a perspective view of one of the slides used in the local treatment device.

Figure 37 is a front elevation of one of the ballast units.

Figure 38 is a plan view thereof including fragmentary portions of the base member and the attachment means for the ballast unit.

Figure 39 is a vertical sectional view on line 39—39 Figure 37, of the upper portion of a ballast unit.

Figure 40 is a sectional view taken on line 40—40 of Figure 38.

Figure 41 is a sectional view taken on line 41—41 of Figure 40.

Figure 42 is a detail sectional view taken on line 42—42 of Figure 37.

The machine is generally illustrated in Figure 1 and comprises a base 30 mounted on casters 31. A standard 32 is mounted centrally of the base for supporting the lamp casing 33 on its upper end. The standard or post 32 is telescopical, consisting of two sections, one 34 rigidly mounted on the base and the other 35 directly supporting the lamp casing on the upper end by means of an adjustable bracket 36, the adjustable bracket permitting vertical swinging adjustment or tilting of the lamp casing. The telescopical sections of the post are maintained in set position by means of a knob 37 and screw 38 (see Figures 24 and 25) acting against a split clamping bushing 39. Suitable means is included in the post for counterbalancing the weight of the lamp casing and is contained mechanism for ease in raising or lowering the same relative to the base. The mounting of the lamp casing on the post is of a design also permitting rotative movement of the lamp casing relative to the post.

The lamp casing 33 includes a main chamber in which a reflector 33<sup>a</sup> is mounted and in which the arc chamber 40 is disposed, this chamber being open toward a forward end and containing devices for controlling and selectively utilizing the rays or beams developed by the arc.

The adjustment means for the carbon electrodes as well as the electrodes themselves are extended into and mounted in laterally extending wing portions 41 of the lamp casing. The electrical apparatus for the lamp includes a transformer 42 and electrical ballast 43 mounted directly on the base 30, surrounding the lower end of the standard or post, a main switch 44 mounted in a lower chamber extension 45 of the lamp casing and electrically connected to the transformer and ballast by flexible connections, a resistance 46 mounted in the lamp casing extension 45 and a control switch 47 for the resistance mounted in one of the wings and actuated by the manually actuated means 48 adjustably moving the carbon electrodes 49—49.

The arc chamber casing 40 is mounted in the central chamber of the lamp casing in alignment with the wing portions and is supported on vertically spaced rails 50—50 which extend longitudinally through the lamp casing between the outer ends of the respective wings, these rails functioning as guide rails for the outer movable supports or carriages 51—51 for the carbon electrodes extending into the wings.

The arc chamber casing 40 is supported on studs 52—52 extending out from and fixed to a

panel or block 53 of refractory material such as porcelain or any other material providing insulating properties. This panel or support block is secured to the rails by means of screws 54 extending through the panel and rails for receiving nuts on the rear sides of the rails and spacer sleeves 54<sup>a</sup> disposed between the rails and block or panel 53 for spacing the panel from the rails.

The support block 53 also includes the forwardly extending studs 52—52 which are secured in spaced relation in horizontal plane by any conventional means such as casting in the material or a shouldered and bolted arrangement as shown. The outer ends of the studs are provided with deep annular grooves 55. The arc chamber casing (see Figure 16) is formed of a strip of refractory metal such as chrome nickel. This strip is formed into a cylinder and the joined ends are disposed radially and spot-welded together. Slots 56 are provided in the radial fin 57 thus formed, permitting the casing to be engaged downwardly upon and about the studs, the slots of the studs permitting the casing to be fitted into the annular grooves 55 in the studs for a solid support.

Prior to the formation of the strip into cylindrical form, a port hole 58 of oval form is punched in the material, this port hole being disposed toward the front of the arc chamber casing as mounted in the lamp casing and being longitudinally disposed relative to the axis of the cylinder. The slots engaging the support studs are also formed in the strip prior to formation into cylindrical shape. Also, there are depressions formed in the metal which, when brought together, provide a pocket 59 at the base of the chamber directly below the arc, functioning as an ash receiver space into which the solid products of combustion are deposited as they drop from the tips of the carbon electrodes.

The small piece of metal 60 which is punched out of the port hole is spot-welded onto the top of the chamber, providing additional metal on the upper side of the chamber and serving as a means for conducting away to the other portions of the chamber, the excessive heat which would otherwise develop in the upper end and rapidly deteriorate the material of the chamber casing at this point. The addition of the piece of metal increases the life of the chamber to an extent providing a safe margin of life for the chamber over the life of a pair of carbon electrodes.

It is to be noted at this point that after a pair of electrodes have been consumed, due to the simplicity of mounting and construction of the arc chamber, the entire chamber may be removed and thrown away in preference to spending time and energy in cleaning the same. The radiating fin 57 constituting the attaching portion of the chamber, is of considerable length and as much metal is left therein as is possible, excluding the necessary slots, in order that the extension besides acting as the support, may function as a heat radiating fin, rapidly dissipating the heat at this point and preventing undue damage to the support pins.

Discs or bushings 61, generally formed of refractory clay, are secured on the respective ends of the cylinder. These discs include circular bosses 62 extending into and accurately fitting the interior diameter of the casing so as to permit ready axial alignment of the discs and cylindrical casing. The discs include central apertures through which the carbon electrodes extend

into the interior of the arc casing. These end closures or bushings are drawn together on the casing by means of refractory or chrome nickel wires 63 extended between small apertures 64 in the discs. The upper connecting wire extends directly between the discs, whereas the lower wires are extended through apertures 65 in the radiating fin and outwardly through the apertures in the discs where they are wound together.

In order to prevent cracking and crumbling of the discs, due to expansion and contraction strains, radial slots 66 are provided therein extending in from the periphery of the discs.

The discs are of relatively great diameter as compared with the diameter of the arc casing for the purpose of protecting, against the heat emanating from the arc, the carbon electrodes beyond the casing and the brushes 67 and holders or electrode supports 68 providing the electrical connections to the respective carbons close to each side of the arc chamber. The long carbon electrodes are supported at each end, the brushes and electrical connection including the necessary support at the inner ends, and the guided carriages 51 being provided at the outer ends, the necessary adjustment movement being imparted to the electrodes through these carriages and appropriate motion transmitting mechanism.

Each brush holder and electrode support at a respective side of the arc casing or chamber is attached to the block 53 of refractory insulating material by means of screws 69. The parts of each brush and holder are of stamped construction and the holder or support 68 includes a rear attaching flange 70 a base flange 71, extending horizontally outwardly under the particular electrode, side flanges 72—72 extending upwardly from each side of the base flange, which side flanges 72—72 are provided with apertures 73, traversed by the electrode, of greater diameter than the electrode and entirely clear thereof. The parts of the brush and holder are of silver in order that the electric conductivity of the parts will be maintained despite long use due to the fact that the metal yields electrically conductive oxides. The electrodes are supported on specially constructed electrical contact seats 74 mounted on the base flange.

Each seat is generally channel-shaped, extending longitudinally beneath the carbons, the carbon resting in the channel and the channel having inclined side walls with arc-shaped seats snugly fitting the contour of the electrodes and outwardly flared end edges 75 for eliminating shearing or scraping of the electrodes as they are slid through the brushes. The channel includes side flange extensions 76 which are suitably bent and silver-soldered in place in the base flange for positive electrical connection of the seat thereto. The brush 67 of each support is pivotally attached to the support at its inner end and includes an inverted contact seat 76<sup>a</sup> of the same structure as the seat 74 on the support. The brush 67 is formed of a stamped strip of metal extending longitudinally of the holder at right angles to the electrode and having the contact seat 76<sup>a</sup> attached on the lower side of its outer end. The inner end of the brush plate has its side edges adjacently slotted as at 77, this end, in the process of assembly, being inserted through a slot 78 of slightly greater cross sectional dimension than the plate, the end then being free after slight insertion to be moved downwardly, causing the slots to fit about the side edges of a downward slot continuation of the slot 78.



A contact point 79 on the underside of the inserted brush end thereupon engages upon another contact point 80 secured on the inside surface of the attaching flange 70 of the holder, the refractory block being cut away to provide the necessary clearance for these contacts. The engagement of these two contact points provides the electrical connection at this point and also permits an easy rocking movement therebetween during the raising and lowering of the brush when the electrode is being inserted between the seats.

The brush is urged downwardly against the carbon electrode by means of a coil spring 81 under tension between a stud 82 extending from the extreme lower end of the attaching flange of the holder and having its upper end flexibly connected to the brush, the material of the base flange of the holder being cut away to entirely clear the centrally disposed spring for free movement thereof. The connection of the spring to the brush is by means of a headed bushing 81<sup>a</sup> of electrical and heat insulating material hung in an opening in the brush and a clip 81<sup>b</sup> attached to the spring and extended through the bushing and spread above the bushing (see Figure 11). The spring is located so as to provide for the necessary free cooling by means of cool air passing through the slot and the open sides of the support.

Immediately above the brush a cross pin 83 is provided joining the side flanges for stabilizing the holder and preventing undue upward movement of the brush. The brush is limited in downward movement by virtue of the engagement of lateral flanges 67<sup>a</sup> with the upper edges of the support to prevent collapse against the lower contact and inability to enter the carbon between the contact. A flexible electrical connector 84 is electrically connected to the electrode brush and support by means of a terminal 85 held in position against the back of the support block by means of the screw 69 which secures the holder in position.

The electrode brush support 68 is attached on a raised portion of the panel 53. The attaching wall includes an extension extending below the raised portion and therefore spaced from the panel. A special connection is provided at this point to the terminal clip providing the electrical connection between the clip and the brush holder. A sleeve 69<sup>a</sup> extends through a bore in the panel. The inner end of the sleeve abuts the attaching wall of the support and the outer end is threaded through the terminal clip.

A screw 69 attaches the extension of the support to the sleeve and a nut 69<sup>b</sup> is engaged upon the screw threads of the sleeve against the outer face of the clip for locking the sleeve to the terminal clip. The sleeve is headed at its inner end in order that it will be locked in position in the panel after the terminal clip and nut are in place.

As has been disclosed in the co-pending Jacqueslet & Liebel Patent No. 1,935,294 issued November 14, 1933, the arc is fixed in the zone of the aperture by means of a magnetic field. This magnetic field is provided by the arrangement of a coil of wire 86 directly behind and below the arc chamber, the coil being wound on an axis which is radially disposed relative to the chamber approximately at a 45° angle from horizontal plane. For this purpose a core 87 is supported at the angle described, on a clip 88 which is hung from the lower longitudinally disposed guide rail

50. Suitable nuts and washers are provided and arranged on each end of the core for securing the coil of wire between the washers. The flow of current through this coil of wire, which is connected in series with the arc, creates the magnetic field.

The longitudinally disposed guide rails 50--50 are reinforced and definitely spaced at a central point by means of a strap 89 bolted in position for connecting the same. The longitudinally disposed rails which function as guides for the carriages which support the outer ends of the respective electrodes, are mounted in the casing by means of screws 90 extending through spacer sleeves. The respective carriages are of the same construction so that the description will be confined to a particular carriage mounted in one of the wings.

The carriage body or main element 91 is of T-shape, the outer edge of the head of the T being slotted for clearance purposes. The respective tips of the head of the T are transversely slotted as at 92 for sliding engagement with the respective rails, the carriage being mounted outwardly at right angles from the rails and carries an element 93 directly supporting the electrode end, the latter element being attached to and insulated from the carriage body. These parts 91, 93, are bolted together and inserts of insulation are provided between the respective parts as well as between the heads of the bolts and about the bolts where they traverse the carriage body. The electrical connections to the electrodes are made, as has been described, entirely adjacent the inner or burning ends and the carriages are insulated from the framework for preventing electrical connection of any sort at the outer ends.

The support element 93 has an offset outer end and a slot 94 is formed extending downwardly from the upper edge of the support element. The slot is located in the inclined portion of the plate at the offset. Therefore, the respective side edges of the slot are not aligned.

The carbon electrodes include transverse notches 95 on opposite sides thereof. These notches are not aligned and each carbon electrode is adapted to fit in the slot of its support or holder with the notches thereof fitting about and registering with the respective disaligned side edges of the slot in the holder. It will, therefore, be appreciated that due to this asymmetrical arrangement of the notches in the electrode, and slot edges in the holder, the electrode can be placed in only one position in the holder. This is done for the purpose of maintaining a definite relation of adjacent angular ends of the electrodes within the arc chamber.

Each electrode inner end is provided with a surface partially facing the opposite electrode and partially facing the aperture in the housing. This angular arrangement of the electrode ends is provided for the purpose of insuring a more efficient burning of the electrodes when they are initially used, the angular arrangement representing the shape of the ends which results after a short period of burning.

In order to prevent upward displacement of the outer end of each electrode a spring-urged clip 96 is provided, this clip being hinged on the electrode carriage on a pin 97 extending transversely relative to the electrode and beneath the same, the pin being fixed to a downwardly extended flange of the carriage element 93. The

clip is of plate structure including a pair of ears 98 traversed by the pin for mounting the clip and has its upper swinging end provided with an offset portion 99 horizontally disposed and engaging the top surface of the electrode. A coil spring 100 is wound about the support pin or hinge stud and has its ends respectively attached to the holder and the clip for urging the clip into position relative to the electrode. An upward extension 101 of the clip is included for purposes of manipulation.

A common transmission means is provided for uniformly moving both electrodes by translating the carriages along the rails, moving the same toward each other or away from each other as desired. For this purpose a sprocket wheel 102 is mounted in each wing at the extreme end thereof, the sprockets being disposed between the rails with their axes disposed transversely to the common vertical plane of the rails. The sprockets include trunnions 103 which are journalled in spaced vertically disposed straps 104 mounted on studs 105 extending from the respective sides of the rails. A semi-rigid, semi-flexible endless transmission chain extends around and between the respective sprockets. This chain is formed partially of conventional sprocket chain links and partially of rods.

Each carriage has a rod 106 rigidly fixed thereto extending parallel with and between the rails, the inner ends of the respective rods being slidably journalled in journal blocks 107 fixed to the rails directly behind the support block supporting the arc chamber. The purpose of these rods is to stabilize the carriages and prevent rocking thereof on the rails.

One of the rods extends from the upper portion of its carriage in alignment with the run of chain at the upper side of the sprocket and the other is disposed in alignment with the lower run of the chain. The outer end of each rod carried by a respective carriage is connected to the other carriage by means of sections 108 of sprocket chain links extending about the respective sprockets, these chain links passing through the clearances defined by notches 109 in the heads of the carriages.

The connections of the runs of chain to the ends of the rods are adjustable and consist of studs 110 screwed into the ends of the rod and a cross pin 111 disposed through the heads of the studs and adjacent chain links.

One of the connections of the chains to the carriages is adjustable, this being for the purpose of definitely applying tension to the chain at all times for eliminating slack. In the instance of this connection, a U-shaped bracket 112 is provided having one of its ears slidably mounted on a rod and engaged against a compression spring 113 coiled about the rod between the ear and a carriage, and having the other ear at the opposite or outer side of the carriage connected to the adjacent run of chain by means of a stud 114 mounted on the latter ear and a cross pin 115 extended through the stud and the end links of the chain.

The transmission means is actuated by means of a knob 116 fixed to a trunnion of one of the sprockets, the knob being disposed at the outside of the casing wing. The knob may be formed of bakelite cast about a metal sleeve 117. The metal sleeve is attached to the trunnion of the sprocket by means of set screws 118. The knob is in direct positive connection with the sprocket at all times.

A means is provided in conjunction with the manipulating means, for adjusting the electrodes, whereby the electrodes may be brought together and then definitely spaced a predetermined amount upon release of the knob at any time, thus rendering the accurate and efficient spacing of the electrodes an automatic operation. For this purpose, a motion limiting plate 119 is loosely mounted on a trunnion of the sprocket. This plate is of segmental form including a slot 120 in its outer edge providing abutment extensions 121 engaging the respective sides of one of the studs 105, as the knob is swung in respective directions. The amount of sprocket rotative movement allowed between alternate abutment of the respective extensions 121 with the stud permits movement of the electrodes to an extent providing the definite spacing required. The motion limiting element 119 is definitely and normally held in the position accomplishing the spaced position of the electrode ends by means of a spring 122 under tension between a lug 123 on the circumferential edge of the segment and a stud 124 mounted on the upper end of one of the straps supporting the sprocket.

The motion limiting plate 119 or space governing device is in rotative connection with the sprocket by means of a slip device. At each side of the plate structure of the motion limiting device and about the trunnion of the sprocket, a friction disc 125 is disposed and rotatively attached to the motion limiting or driving plate. Against each friction disc a pressure or driving washer 126 is disposed. These washers 126 are rotatively connected to the trunnion. The assembled parts, including the swinging plate element 119 are urged along the trunnion against the hub of the sprocket by means of a coil spring 126<sup>a</sup> under compression about the trunnion. An adjustable means is provided for maintaining the spring under compression, this means consisting of a nut 127 in screw-threaded engagement with the trunnion engaged against a washer 128 directly abutting the adjacent end of the spring.

It will be apparent that as it becomes necessary to readjust the spacing of the electrodes within the arc chamber, the operator turns the transmission knob to bring the ends of the electrodes together. This movement is possibly due to the slip connection between the spacing plate 119 and the sprocket. If it should happen that the ends of the electrodes are widely separated, the limit plate only moves with the sprocket until its particular abutment arm strikes the stud constituting the stop, whereupon it is held stationary and rotation of the knob is continued to bring the electrode ends together.

The moment the operator allows the knob to return, the governing plate is acted upon by the spring 122 and rotates the sprocket due to the friction connection thereto to swing the plate against its normal stop whereupon the electrodes are properly spaced. The spring which returns the governing device back to normal abutment, easily rotates the sprockets and moves the transmission without disturbing the slip device, since the carriages and electrodes move freely.

A switch 47 is associated with the electrode translating means for controlling a resistance in the electrical connections which extend to the electrodes, this resistance being necessary for lowering the amperage because of the fact that the flow of current is greater when the electrode ends are in contact or when these ends are but

slightly spaced, than when the proper gap has been established.

After the main switch has been thrown in for permitting the introduction of current to the electrodes, the knob is turned to bring the carbon electrode ends into contact where they are held for a few seconds, whereupon the knob is allowed to return slowly and evenly to normal running position with the carbons properly spaced. During this release operation the switch mentioned is operated. When the carbons meet, the wiring is such that the resistance is in series with the electrodes (see wiring diagram). The electrical flow is substantially short circuited when the carbons are touching and as the spacing takes place, the starting resistance is cut out in two sections one after the other automatically by the mechanism of the switch controlled by the means which governs the appropriate spacing or gap between the electrodes. The resistance mentioned is entirely in series with the electrodes when the electrode ends are touching or are but slightly spaced, and is entirely cut out when the desired gap is established. Therefore, the switch is of multi-blade construction employing a series of contacts. It will be noted from the wiring diagram that one of the leads namely 130, extending from the main switch 46 includes the resistance 46 and connects directly to the particular electrode. The current must flow through this lead, via the resistance 46 when the electrodes are touching since the switch contacts are all disengaged at this time.

There are three switch blades 133, 134, 135 mounted on a support block 136 of insulating material attached to the lower guide rail, there being a block of insulation between each switch blade. The bolts 137 binding the parts together are properly insulated from the metal blades. The upper blade 133 which is electrically connected directly to the particular electrode, is adjusted by means of a set screw 138 extending through a block of insulating material 139 extending out over the blade, the adjusting screw flexing the blade downwardly the desired amount for spacing it relative to the parallel intermediate blade 134, a contact point 140 being provided at the outer end of the upper blade 133 for efficient electrical contact with the similar contact 141 of the intermediate blade.

The lowermost blade 135 or the one first actuated by separating movement of the electrodes, includes an upwardly flanged outer end including a horizontal flange 142 which is engaged by a roller 143 of insulating material mounted on the swinging electrode space governing plate, this roller depressing the lower blade 135 when the electrodes are in contact and permitting flexing of the blades 133, 134 resulting in spacing of all the contact points of the blades. The intermediate blade 134 is limited in its downward flexing movement, when released by depression of the lower blade, by means of a rigid support blade 144 extending out therebeneath. In the first phase of release of the lower blade, due to upward swing of the roller, the lower blade 135 contacts the intermediate blade 134. The lower blade is directly connected to the electrical supply and the electrical connection therefore proceeds directly to the intermediate blade 134, short circuiting a portion of the resistance. This blade 134 is connected to one of the intermediate coils of the resistance and therefore the current must pass through a portion of the resistance only, rather than through the entire resistance

which was previously true when the electrodes were in direct contact.

Upon continued separation of the electrodes and release of the lower blade which is strong enough to move the intermediate and upper blades, the intermediate blade still contacting the lower blade contacts the upper blade 133 and it thereby occurs that the current passes directly from the main line to the electrode entirely excluding the resistance. The resistance coil 46 is wound about porcelain supports 46<sup>a</sup> hung on cross straps 46<sup>b</sup> in the lower chamber of the lamp casing.

The reflector 33<sup>a</sup> previously mentioned is provided for the purpose of directing the infrared or heat rays emanating from the incandescent arc chamber casing 40 forwardly through the opening in the front of the lamp casing. The reflector is formed of a sheet of material providing a vertical rear wall 151 and forwardly curved upper and lower walls 152, 153. End plates 154 are secured to the mentioned sheet of material for closing the ends of the reflector and covering the various parts located within the casing for operating the doors and switches of the lamp. The end plates are cut away as at 155 to provide ample clearance for the electrodes extending from the interior of the reflector into the wings of the casing.

The reflector 33<sup>a</sup> is best illustrated in Figure 17, this view also bringing out the arrangement of the reflector relative to the main casing for providing a passageway 156 producing the necessary draft to carry off the excess heat produced by the arc. The draft takes place upwardly through the switch and resistance casing 45 thence between the walls of the reflector and the main casing and forwardly above the reflector into a stack 157 mounted on the top of the main casing.

The top of the stack is perforated for permitting escape of the heat, the perforations providing the necessary outlet for producing the draft. A strip of wire mesh 158 is inserted in the stack on the underside of the top thereof for enhancing the appearance of the lamp and closing the interior of the stack against vision.

As a further aid to proper circuit for the draft, a baffle plate 159 is mounted across the upper confines of the main casing providing an insulating space 160 and preventing overheating of the upper surface of the casing.

The upper end of the upper curved wall of the reflector terminates short of the forward edge of the main casing as at 161 for the purpose of permitting the escape of convection heat from the interior of the reflector upwardly through the stack.

A deflector strip 162 is attached along the extreme forward upper edge of the reflector opening for directing the convection heat rising along the upper curved wall in the manner described above.

The composite design of the reflector and the aperture in the reflector upper wall in combination with the stack and screen results in condensation in the stack of any slight vapor products which may arise from the arc.

Provision is also made for the convenient disposal of any ashes or solid products of combustion dropping from the tips of the electrodes into the reflector in that the lower curved wall of the reflector also terminates slightly short of the forward edge of the main casing as at 163 and is flanged downwardly at a more abrupt

angle than that of the curved wall. The downwardly extending lip or flange 164 rests along the rear flange of a channel piece 165 secured along the lower edge of the opening in the main casing, the channel strip including an elongated slot 166 in its base web. Just below the slot and in position for efficiently receiving the matter falling through the slot, an elongated receptacle 167 of dish or tray form is bolted to the casing.

The main lamp casing containing the arc chamber casing and the various mechanisms described is rotatably mounted on the standard or post to permit substantially a full 360° of movement. The same bracket which rotatably mounts the lamp on the post also includes a manually operable adjusting means for tilting the lamp in a vertical plane for directing the ultra-violet rays and heat rays as desired by the operator.

The bracket providing the rotative and tilting movement for the head consists of two main elements 168, 169. One of these elements, namely the upper 168, is of general arcuate form to fit the contour of the back of the lamp casing and is bolted thereto. The other element, namely 169, is of circular form and includes an upwardly extending journal arm 170 and a downwardly extending stud 171 which extends into the upper section of the post. The stud 171 is journaled in a sleeve 172 fixed in the upper end of the upper section, the sleeve including a head 173 resting upon the upper edge of the section. A set screw 174 extended through the section of the post and the sleeve maintains the sleeve against displacement.

The inner end of the screw 174 also extends into an annular groove 175 in the stud for the purpose of permitting rotative movement of the stud in the sleeve and preventing upward or axial displacement of the stud. A circumferential flange 176 extends downwardly from the body of the bracket element for the purpose of housing the connection.

A disc or washer 177 is mounted within the housed portion of the bracket element and in position of assembly is disposed between the head of the sleeve and the bracket element. This disc or washer is formed of a material resisting a too free rotative motion between the parts and is inserted for the purpose of sustaining the thrust. For the reason that there are flexible electrical connections extending from the base of the machine to the head, a means is provided for limiting the rotative movement of the head in one direction to approximately 360°, thereby eliminating the possibility of the flexible electrical connections becoming entangled about the post. This limitation of movement is accomplished by means of a pin 178 extending radially from the head of the bushing and constituting a fixed stop and abutted, after approximately 360° of rotative movement of the lamp casing in either direction, by a boss 179 cast within the housed portion of the journal element.

The upper element of the bracket is fixed to the lower element in such fashion that they rotate unitarily. The connection between these parts is a pivoted one, the pivotal movement taking place on a horizontal axis. A pivot pin 180 is fixed between a pair of ears 181 cast at opposite sides on the upper surface of the circular bracket element 169. The upper bracket element 168 includes a pair of downwardly extended ears 75 traversed by the pivot pin 180. This upper

bracket element 168 including the lamp casing mounted thereon is swung on the pivot pin by means of an adjusting screw rod 183 journaled in the bearing arm 170 of the lower element and carrying a knob 184 on its outer end and having a screw-threaded inner end engaged diametrically through a rod 185 which is rotatively mounted in a horizontal plane parallel to the pivot pin 180 joining the elements of the bracket. This rod or rock shaft 185 is mounted in a pair of spaced ears 186 cast as a part of the upper element. The adjusting screw is loosely rotatively mounted within the journal arm of the bracket and is maintained against axial displacement by means of a sleeve 187 screwed onto the rod and fixed in position on the rod abutting the inner face of the journal arm in opposition to the hub of the knob 184 abutting the opposite side.

A coil spring 188 is mounted under compression, about the screw and sleeve, between the rock shaft 185 and the journal arm 170 for the purpose of eliminating any lost motion in the rock-shaft. A housing sleeve 189 is disposed about the spring. A nut 190 is held in place on the extreme inner end of the screw by means of a cotter pin 191 for the purpose of limiting forward tilting movement of the lamp casing or head as well as preventing total disconnection of the adjusting means and the rock shaft.

As has been previously disclosed, a main switch is mounted in the lower chamber of the main lamp casing. This switch is included for the purpose of controlling the application of electrical current to the head of the machine, the switch being inserted in the electrical circuit between the transformer and the brushes or the electrodes. To prevent physical contact with the arc or its casing and the surrounding parts, a door 192 is provided in the opening of the reflector, this door including a grill 193 of the proper mesh for preventing insertion of the hand and yet permitting efficient passage of the infrared and ultra-violet rays produced by the arc. The main control switch is manually thrown either to on or off position. As an additional safety feature, the grill door 192 and the switch are interconnected by cooperating linkage which is effective for throwing the switch to off position as the door is opened in the event that the operator has neglected to cut off the power. A small door 194 is provided in each wing of the casing, these doors being opened and closed by means of connections extending to the main door 192 in the opening of the reflector.

The main switch is detailed in Figure 21 and is shown in position within the machine in Figures 17 and 18. The switch is hung on a pair of straps 195 disposed across the opening between the switch chamber and the main lamp casing. A panel 196 of insulating material supports the parts of the switch, the panel being bolted directly to the straps. The switch includes three sets of contacts for the respective leads extending from the base into the head. These leads are suitably connected to the resistance and the electrodes and the resistance control switch in the head as will be more fully apparent from the description of the wiring diagram which will follow hereinafter.

The stationary contacts 197 of the switch depend from the panel of insulating material and include turned contact ends disposed opposite to the movable contacts 198 of the switch. The respective leads extending from the base are con-

5 nected to these stationary contacts by means of  
terminal clips 199 and screws 200. The movable  
contacts 198 component to the stationary con-  
tacts are mounted on a rock element 201 of in-  
sulating material pivotally mounted in end brack-  
ets 202 attached at each end of the panel of in-  
sulating material. The leads extending from the  
switch into the head are connected to the panel  
and then to swinging contacts 198 by flexible con-  
nectors 203 of conventional design. The swing-  
ing contacts 198 are in two pieces, the actual  
contact sections 204 to which the flexible leads  
203 connect being yieldingly mounted relative to  
the sections which attach the contacts to the  
15 rock element.

The contact sections 204 are L-shaped, each  
flexible connection being to one arm of a par-  
ticular L-shaped contact section and the outer  
end of the other arm being suitably contoured  
20 to contact the opposing stationary contact. These  
elements are designed to rock on the shoulders  
of studs 205 on the stationary sections traversing  
the contact sections substantially at the juncture  
of the arms thereof. The flexibly mounted con-  
tacts 204 are urged against the respective fixed  
sections by means of springs 206 under compression  
between stud 207 extended from the fixed sections  
through the flexibly mounted elements and provid-  
ing heads 208 between which heads and the flexibly  
mounted elements the springs 206 are disposed  
under compression. Therefore, it occurs that the  
contact of the moving contacts with the stationary  
contacts is a yielding one induced by spring pres-  
sure due to the fact that the throw of the mov-  
ing switch elements is such as to compress the  
springs.

The operating means for the switch is of a  
design readily described as a "snap" switch me-  
chanism. The main operating lever 209 is ful-  
crumed on one of the side brackets of the switch  
by means of a pivot pin 210 of the bracket. The  
lower end of this lever extends below the cas-  
ing through a slot 211 therein and carries a knob  
212 conveniently accessible for manual operation  
of the lever.

The upper end of the main lever 209 is adapted  
to be engaged and moved by the linkage between  
the main door and the doors in the wings when  
the switch is in on position. A cam element 213  
is fixed to the rock shaft. The cam element in-  
cludes angularly related lower edges 214 and an  
intermediately disposed point 215 constituting  
dead center for the switch. A link 216 is pivoted  
55 to the main control lever beneath its fulcrum.  
This link is formed of a longitudinally folded  
strip of material straddling the lever at its at-  
tached end and having a roller 217 mounted be-  
tween spaced overlap portions at the opposite end  
to the pivot. This roller is mounted on a stud  
218 disposed in the respective sides of the link  
and is maintained in engagement with the lower  
inclined edges of the cam by means of a spring  
219 attached under tension between an interme-  
diate point of the link and the body of the switch.  
Therefore, it occurs, since both the inclined sur-  
faces of the cam are angularly disposed rela-  
tive to the link, that the moment the roller is  
drawn past the tip or juncture of the inclined  
surfaces, the spring acts to throw the lever quick-  
ly to the particular side. Movement is thereby  
imparted to the cam due to the direction of thrust  
thereon, the inclined edges being disposed in such  
70 fashion that engagement against these edges in-

duces movement of the swinging contacts in re-  
verse directions.

Swinging movement of the main operating le-  
ver is limited by means of the engagement of a  
pin 220 extending from one side thereof with the  
5 respective ends of a slot 221 formed in the end  
bracket of the switch. It is also provided that  
rocking movement of the swinging contacts is  
limited due to provision of a lateral extension  
222 on the cam extending into another slot 223  
10 in the end bracket of the switch for engaging  
the respective ends of this slot. This latter slot  
is of a sufficient length to permit yielding of  
the contact sections of the movable contacts in  
the making and breaking of the electrical con-  
15 nections.

When the switch is in on position, the upper  
end of the operating lever is swung into the path  
of movement of the linkage between the doors as  
the doors are moved to open position. All of the  
20 doors are hinged along their lower edges so that  
their movements are in the same direction. The  
doors move through arcs which correspond sub-  
stantially.

The hinge rods 224 for the wing doors are  
journalled in the walls of the wings and rolled  
lower edges 225 of the doors are fixed about the  
hinge rods by means of screws 226. The inner  
ends 227 of these hinge rods 224 are extended at  
an angle forwardly or upwardly of the machine  
and are pivotally connected to sectional links 228  
joining the same to brackets 229 fixed to the inner  
face of the main door at the front of the re-  
flector. The links are sectional for the purpose  
of permitting flexibility in the linkage during the  
movements of the main door and the wing doors.  
The opening movements of the wing doors do  
not start until the main door has been partially  
opened for a reason which will be described later.

The flat sections 230, 231 of the links are piv-  
otally attached in adjacent planes by means of  
pivot pins 232. The section 230 of each link  
connected to the hinge rod 224 of the particular  
inner door includes an extension 230<sup>a</sup> beyond the  
pivot pin. Each forwardly disposed section 231  
45 also includes a U-extension 233 beyond the pivot  
point. A spring 234 disposed under tension con-  
nects the respective extensions of each link. The  
sections of the links move relatively during the  
initial opening movement of the main door, this  
50 relative movement occurring until the springs 234  
have been active for engaging the adjacently dis-  
posed extensions of the sections of each link  
whereupon the links move as a unit for rocking  
the hinge pins of the wing doors and opening  
55 these doors.

During the described initial phase of move-  
ment, the sections 230 of the links connected  
to the hinge rods of the wing doors merely pivot  
on the pivot connections and it is only when  
60 contact has been established between connec-  
tions that the links are active for swinging the  
wing doors into open position. As shown in  
Figures 17 and 18 of the drawings, the upper end  
of the main switch control lever fits into a guide-  
65 way formed of a strip 235<sup>a</sup> which is secured to  
the link by abutment pins 235. The inner pin  
235 is engaged by the lever when the switch is  
in closed or on position and when the doors are  
closed. During the initial phase of movement  
70 of the main door, the main switch control lever  
is automatically swung on its fulcrum by the  
aforesaid contact between the lever 209 and pin  
235 and as the roller 217 in the link thereof passes  
the tip between the inclined cam edges, the switch  
75

snaps into open or off position. Opening movements of the doors are limited to approximately horizontal position due to the contact of the links with abutments 236 secured on the respective inner sides of the lamp casing.

The coil springs 234 under tension in the linkages joining the main door with the wing doors become effective after the wing doors have been closed and the main door is about half closed for imparting a resistance to closing movement of the door for a portion of the remaining closing movement and a final closing impetus. The action of the springs for these results is due to the fact that after the door is half closed and the side doors are entirely closed, the sections of each link begin to move relatively. The first effect produced by this relative movement is to resist closing movement of the door due to the fact that the sections of the links are moving in a direction on their pivots for tensioning the springs. After the pivotal connections 232 and 237 of the linkages to the door have passed below a certain plane, the relative swinging movements of the sections are reversed, and the spring tension is effective for imparting a final closing movement to the door.

Inasmuch as the head of the lamp containing all the mechanisms described is quite heavy, it is necessary to provide a means for counteracting the tendency of the sections to rapidly telescope under the weight, thereby aiding in raising the head during adjusting maneuvers.

A counterbalance spring 238 is inserted in the post against the sleeve at the top of the upper or outer section of the post and is compressed at its lower end against a disc 239 located in the lower end of the lower section. The disc is held in position against downward displacement by means of a pair of abutment lugs 240 drawn against the inner sides of the post at diametrically opposite sides by means of screws 241. The compression force of the spring is sufficient to approximately counter-act the weight of the lamp so that it is relatively easy to raise the same for telescoping movement of the sections and adjustments in the height of the lamp.

The sections are splined together by means of a groove in the flange 246 at the lower end of the inner tube slidably engaging the seam of the outer tube whereby the tubes are free to telescope and are held against rotation.

For the purpose of securing the sections in any adjusted position, a sleeve 242 is fixed on the top of the lower section, this sleeve carrying the adjusting knob 37 including a screw 38 entered into a radial boss thereof. The clamping or binding sleeve or bushing 39 is mounted between the respective sections 34, 35, adjacent the clamping knob, the clamping sleeve being of split construction and including a friction lining 243. Pressures are imparted to the sleeve 39 by means of the knob screw-threaded into the outer collar through a floating pin 244 slidably disposed in a bushing 245 radially fixed in the outer sleeve, the respective ends of the floating pin engaged by the screw 38 and engaged against the clamping sleeve.

Since the clamping pressure is exerted at the upper end of the sleeve, the lower end is split longitudinally and partially circumferentially as at 245 about midway of the sleeve to permit the lower end of the sleeve to flex freely. To compensate for the spacing of the sections, caused by the clamping sleeve at the upper end of the lower section for preventing swaying of the lower

end of the inner section, an annular flange 246 is outwardly turned on the extreme lower end of this section for engaging the wall of the outer section.

Inasmuch as the inner section of the post is of a diameter somewhat smaller than the outer section to provide the clearance therebetween for the binding sleeve 39, the coil spring 238 as disposed within the inner section would have a tendency to be displaced laterally at the lower end as the upper section is telescoped upwardly. For this reason a spring housing sleeve or tube 238<sup>a</sup> is provided within the inner section, this sleeve 238<sup>a</sup> being stationary by virtue of its attachment to the disc which supports the lower end of the spring by means of lugs 238<sup>b</sup> struck outward from the lower edge of the tube and extended through openings in the disc in which the lugs are clinched.

The outer or lower section is supported in a boss 247 formed centrally of the base, the screws 241 supporting the abutment lugs 240 traversing the sleeve and boss for the purpose of holding the lower section in position in the base.

The autotransformer 42, which is mounted at one side of the post and upon the base, is of conventional structure. At the opposite side of the post from the transformer, two coils 248, 248 are supported, which coils constitute the ballast 43 which maintains even wattage despite increase in the width of the arc gap. These electrical elements 42, 43, mounted on the base are enclosed in a casing or housing. This casing consists of a top plate 249 surrounding the lower section of the post and supported on four rods 250. A false top 251 is mounted above the main top of the casing also being supported on the rods 250 which extend through the top plate. This false top is spaced from the top plate 249 by means of spacer sleeves 252 inserted on the rods between the respective tops. Nuts 253 are provided on these rods for securing the respective tops in fixed spaced position and the rods in the base. The false top is provided for preventing physical contact with the main top of the casing which may become hot and for suitably embellishing the machine.

The sides of the casing are removably attached and are arranged in two pieces, one of which, namely 254, includes three sides of the casing and the other, namely 255, the remaining one side. A rim 256 around the outer edge of the base maintains the side walls of the casing against outward displacement when they have been assembled. These sides are attached together and to the top of the casing by means of screws. Series of ventilating holes 257 at the top and the bottom of the casing are provided in the side walls for permitting the escape of the heat created by the electrical units in the base. The base is also apertured to permit air draft from under the base upwardly through the casing and outwardly through the perforations in the casing.

A pair of spaced baffle plates 258 is mounted between the transformer and the ballast coils to permit an air draft between these electrical units via the space between the plates. Immediately over and across the ballast coils a heat deflector element 259 is provided for diverting the convection heat, the element being of slightly irregular V-shape and secured against the underside of the top of the casing. The inwardly disposed wall of this element is of greater area than the outwardly disposed wall and the heat diverting point 259<sup>a</sup> is disposed toward the out-



side whereby about three-fourths of the convection heat is deflected toward the inner side and the remainder toward the adjacent outer casing wall. This prevents crowding of the heat into the one side toward which the deflector is generally disposed.

In operating an electric arc, some type of ballast must be incorporated in the supply circuit to the arc. This is because of the fact that the volt ampere characteristics of the arc are such that the voltage across the arc decreases as the current is increased. This characteristic, as is well known, would lead to unstable operation unless ballast is provided in the supply circuit to the arc. The particular design of the ballast is such that with a minimum amount of energy consumed in the ballast a practically constant amount of energy is delivered in the arc throughout its burning time, due to the automatic change in the resistance of the ballast with differences in current. These differences in current are due, first, to the natural instability of the arc and secondly, to the difference in resistance of the arc path, due to the consumption of the electrodes, resulting in a greater spacing between their tips.

The results obtained in the present ballast are primarily due to the use of a ballast wire material having a high coefficient of resistance change with changing temperature, the resistance change being positive with regard to increase in temperature. Equally important, however, is the proper proportioning of the ballast wire cross sections and the design of the frame supporting it, to insure proper and uniform radiation of heat. To insure the quick response of the ballast unit with changes in current, which necessitates the immediate balance being established between the amount of energy developed in the ballast and that radiated, the physical mass of the ballast, which determines, of course the thermal inertia of the ballast, must be kept as low as possible. If this is not done, the current in the arc will tend to swing higher or lower than is permissible before the ballast can accommodate itself to the changed condition. Under these circumstances it would be necessary to use a ballast of greater fundamental resistance in order to properly stabilize the arc and this would mean a larger consumption of energy in the ballast than is desirable.

By using two flat ribbon resistance conductors in parallel and by proportioning the cross section of these conductors so that the width is approximately ten times the thickness (.090 x .010 inch) and by supporting these wires on a properly designed frame, a highly responsive ballast is obtained, in which the physical mass of the ballast wire material is very low and the heat radiating surface quite large in proportion.

The design of the supporting frame is such that uniform free radiation is provided with a minimum amount of supporting contact to the wire. Increasing the amount of supporting contact to the wire is detrimental in that it does not allow the wire as a whole to change temperature in accord with the change in resistance, but tends to flatten out the resistance voltage curve of the ballast and furthermore introduces thermal inertia effect.

In the range of temperature through which the ballast is designed to operate, a decrease of fifteen percent in the current flowing through the ballast arc circuit will result in a decrease in resistance of the ballast of approximately thirty

percent. Thus it will be seen that as the current in the arc tends to fall off and does fall off somewhat, due to the increased electrode spacing, the resistance of the ballast and therefore the amount of energy consumed in the ballast, decreases so that the output in volt amperes at the arc remains practically constant.

As stated, two coils are provided for the ballast. Each of these coils is supported on a spider of cross form in end view, the spider frame being of relatively light material. The spider is supported on the adjacent one of the baffle plates between the ballast and the transformer. The spider frame is formed of spaced crosses having their tips joined by strips of metal. Upon each longitudinal outer edge of the spider formed by the strips, a support element of heat and electrical insulating material is mounted, the support element including a slot in its inner edge engaged over the edge of the spider and having a series of transverse notches in its outer edge. The coil of the ballast of ribbon wire is wound about the spider, the wires being engaged in the transverse slots or notches. The wire coiled about the spider initially extends from a terminal mounted on the lower cross of the support and its upper end is returned to the base being threaded through porcelain eyelets mounted on the strips interiorly of the coil and attached to a terminal on the lower cross.

The support elements are tapered to relatively sharp longitudinal edges to provide a minimum wire contact and are of material which is the best suitable for non-conductivity of heat in order that the support does not interfere with the heat changes normally taking place in the wire coils.

It is believed that the arrangement of the ballast coils as related to the circuit will be fully apparent from the wiring diagram. The wiring circuit is illustrated in Figure 22. Alternating current is used and two incoming leads are provided. One of these leads, namely, extends directly to the three contact main switch mounted on the lamp casing. The other lead, namely, extends to the transformer and from the transformer two leads extend to the remaining two contacts of the main switch.

The ballast coils are inserted in the lead containing the ballast coils extends through the magnet controlling the arc and thence to one of the electrodes. The other two leads, namely, from the transformer and the other main line, are connected at the main switch and extend as a single lead to the lower blade of the starting resistance control switch in the wing of the lamp casing also being connected to one end of the resistance coil. The other end of the resistance coil is connected to the upper blade of the switch and to the other electrode, whereas the intermediate blade of the switch is connected to an intermediate coil of the resistance by a wire.

Under normal running conditions, the current passes directly to the electrodes through the two leads, the starting resistance being cut out or shunted. The operation of the starting switch will be understood from the previous description.

In the operation of the lamp, it is necessary in complying with certain regulations prescribed by the underwriters to provide a screen in front of the arc so that the operator cannot contact the same. The grill of the door consists of wires

193, disposed radially of the arc, attached at their outer ends in the frame of the door and terminating in front of the arc at their inner ends and carrying a frame 276. This frame includes guides 277 along the lower and side edges on its rear side so that the screen 278, which is bound by a metal frame 279, may be slid downwardly into the guides.

In some instances, it is desirable to use a filtering instrumentality in place of the screen for decreasing the intensity of the rays as in cases where slow treatment is desired. In this case, a transparency 280 is used bound by a frame strip 281 readily slid into position as described.

In other cases it is desirable to utilize only the infra-red rays. In these cases a blind is provided for cutting off the ultra-violet rays which flow through the port in front of the arc chamber casing. To accomplish this, a metal frame 282 is provided fitting in the guides of the grill frame 276 and including a pair of spaced support brackets 283 of refractory material, for heat insulating and electrical purposes, extending from the rear side and supporting a plate 284 which, when the device is inserted, is disposed directly in front of the port hole of the arc chamber casing. This plate is mounted on cross straps 285 extending between the brackets. The plate 284 thus mounted becomes extremely hot and adds to the infra-red radiation.

In still other cases it is desirable to localize the rays as in the case of intensified treatment where the part to be treated is placed very close to the arc. For this purpose, an accessory 286 is hung over the door of the machine. This accessory consists of a main casing opening at the front and rear and having wire mesh 287 at the top and bottom for permitting cooling and for aesthetic purposes. This casing is readily attached over the door of the machine by means of a pair of hooks 288 at the lower edge of the casing adapted to hook over the lower portion of the door frame and a clamping device 289 at the upper end of the casing pivotally attached thereto as at 290 and including a handle 291 for swinging the same into clamping position over the stack. This clamp is formed of strip metal bent to encircle the stack and having bakelite buttons 292 thereon engaging the back of the stack. The ultra-violet ray control is provided in the front opening of the casing.

An element 293 including a flared mouth-piece 294 is attached to the face of the casing for providing a laterally disposed slideway 295 over the front opening thereof. Any number of slides 296 may be provided containing openings 297 of varying sizes which may be readily slid into position within the slideway for permitting the egress of a prescribed amount of ultra-violet rays. These slides include handles 298 at their outer ends for convenient manipulation. A plate 299 is mounted across and within the casing including an opening 300 of a size which is non-interfering with the rays passing through the light control opening in any particular slide. This plate having rearwardly extending wings 301 at each side spaced inwardly from the sides of the casing whereby a draft is induced upwardly through the casing for aiding in ventilating and cooling the lamp casing. The plate 299 serves as a baffle for the forward wall of the accessory and becomes extremely hot due to the infra-red rays. It is rapidly cooled however by the air circulating upwardly through the casing. This

accessory localizes the treatment and reduces the beam of infra-red radiation without minimizing the beam of ultra-violet rays.

Having described our invention, we desire to be limited only by the ensuing claims:

1. A therapeutic arc lamp, comprising, a reflector, a supporting member secured to said reflector, a removable housing having a slideway connected therewith, said slideway engaging the supporting member, electrodes located in said housing and guide supports on said supporting member for the ends of the electrodes opposite to the ends within the housing so that the said supports and the electrodes in combination stabilize and position the housing within the reflector, but the housing may be removed from the reflector if the electrodes are withdrawn.

2. In a therapeutic arc lamp, the combination comprising, an arc housing, electrodes removably located in said housing, the housing closely associated with said electrodes so as to become incandescent when an arc is established between said electrodes, brushes contacting said electrodes at points adjacent to those at which they enter the housing, refractory flanges transversely projecting from said housing adjacent to the points of entrance of the electrode, said refractory flanges protecting the brushes from the heat of the housing when an arc is established, and heat radiating holders for said brushes adjacent said flanges.

3. A therapeutic arc lamp, comprising, a reflector, a supporting member extending outwardly from said reflector, a housing having a slideway connected therewith, said slideway engaging the supporting member so that the housing is slidable vertically, electrodes entering said housing, supports for the ends of the electrodes opposite to the ends within the housing so that the support and the electrodes in combination stabilize and position the housing within the reflector, but the housing may be removed from the reflector if the electrodes are withdrawn, and mechanism for adjusting said holders to position the electrodes within the housing, said mechanism protected by the reflector from the heat about the arc and housing.

4. A therapeutic arc lamp, comprising, a housing, electrodes adapted to enter into said housing, brushes contacting said electrodes at points adjacent to those at which they enter the housing, and means adapted to protect the brushes from the heat of the housing, said means comprising flanges of refractory material transversely projecting from the housing at the portions thereof adjacent the points of entrance of said electrodes.

5. A therapeutic arc lamp, comprising, a reflector, a plurality of posts extending horizontally outwardly from said reflector, a housing provided with slots engaging said posts so that the housing is movable vertically on said posts, horizontally disposed electrodes entering said housing, and supports for the ends of the electrodes opposite to the ends within the housing so that the posts and the electrodes in combination stabilize and position the housing within the reflector, but the housing may be removed from the reflector if the electrodes are withdrawn.

6. The method of providing a therapeutic arc which comprises establishing an arc between a pair of spaced electrodes, said arc of sufficient power to erode said electrodes and provide a beam of radiation of therapeutic value, partially housing said electrodes for controlling the arc



whereby the ratio of electrode erosion and intensity of the therapeutic beam are co-related so that the arc operates for a period sufficient to consummate a complete treatment but extinguishes itself by reason of its increasing length prior to the time that a serious overdosage to the patient could be caused by the beam resulting from the electrode eroding arc.

7. In an arc lamp, a pair of electrodes, means for establishing an arc between said electrodes, a housing surrounding said electrode ends so closely as to be raised to incandescence upon arcing of the electrodes, a heat radiant fin having slots therein depending from said housing, and a support for said housing with which the fin thereof is detachably engaged in resting relation.

8. In a therapeutic arc lamp, the combination comprising, a casing having a reflector therein and spaced therefrom to provide an air duct, an apertured housing removably mounted in said reflector, electrodes disposed within said housing, said housing so closely associated with said electrodes as to become incandescent when an arc has been established between the electrodes, the duct between said casing and said reflector comprising a passageway for a current of air to cool said reflector.

9. A therapeutic arc lamp, comprising, a reflector, an apertured electrode housing mounted within said reflector so as to be disengageable and removable therefrom, electrodes disposed within said housing and related in position therein for emission of ultra-violet rays from the aperture thereof, said housing heatable to incandescence as a source of infra-red rays upon arcing between

the electrodes, said reflector positioned to project the infra-red ray radiation into the same general path taken by the ultra-violet rays, refractory flanges on said housing radially slotted at points about the peripheries thereof, electrode supports adjacent said refractory flanges slidably sustaining said electrodes enabling the establishment of arcing between the electrodes upon contact and spacing thereof, and mechanical means associated with said electrodes operable from a point outside the reflector, and shielded from the heat by the reflector for causing contact of the electrodes, the establishment of arcing, and adjustment of the length of the arc.

10. In a therapeutic lamp, the combination comprising, arc electrodes, a housing surrounding said electrode ends so closely as to be raised to incandescence when an arc is established between the ends of the electrodes, said housing having an aperture substantially central of the ends of the electrodes therein, and a depending fin having slots therein, supports with which the slots of the fin are relatively loosely engageable to constitute a standard for said housing whereby the same is removable therefrom, refractory flanges transversely projecting from said housing thereof at the opposite ends, and a reflector disposed about said housing, said reflector sustaining said support with which said housing is removably associated, said housing prevented from tilting through engagement of the electrodes and the apertures in the end refractory flanges.

JOHN G. H. LIEBEL.  
EDWIN S. FLARSHEIM.