June 11, 1940. J. GELB 2,204,079

ARC LAMP

Filed Oct. 21, 1936 3 Sheets-Sheet 1

Fig. 1.

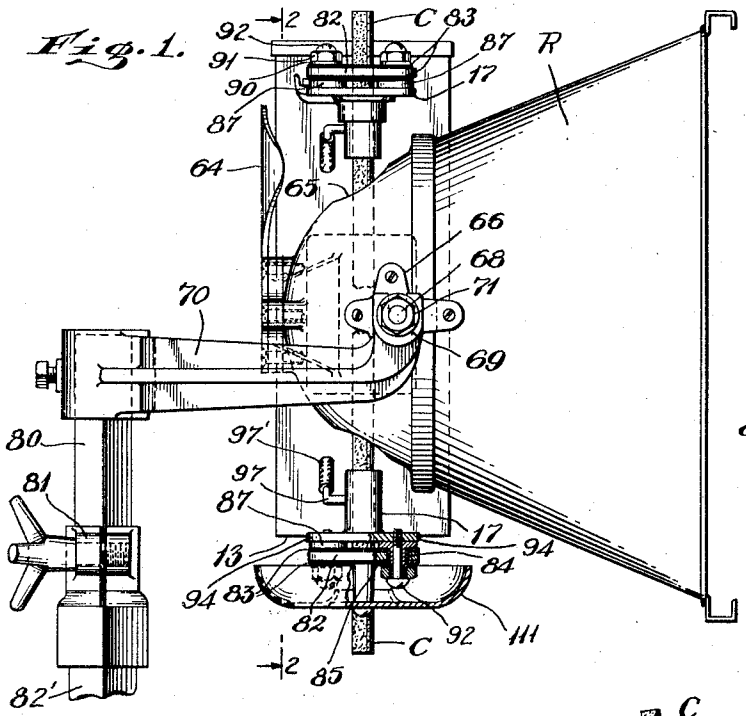

Fig. 1A.

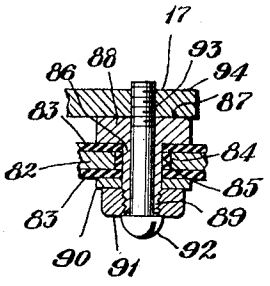

Fig. 2.

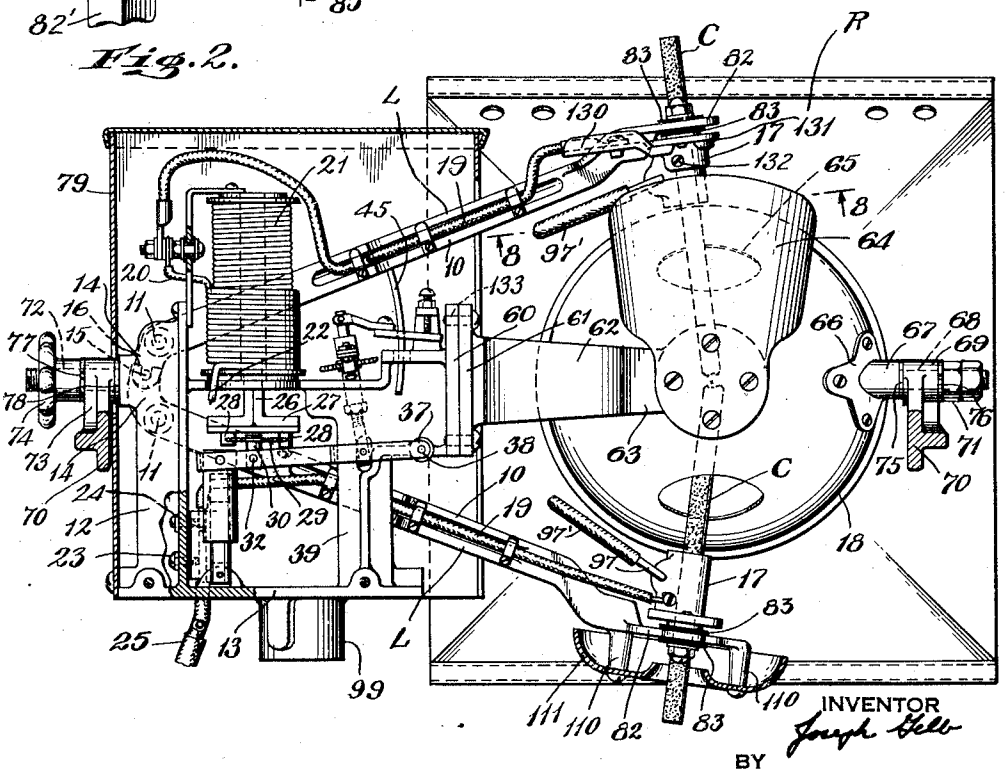

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Fig. 3.

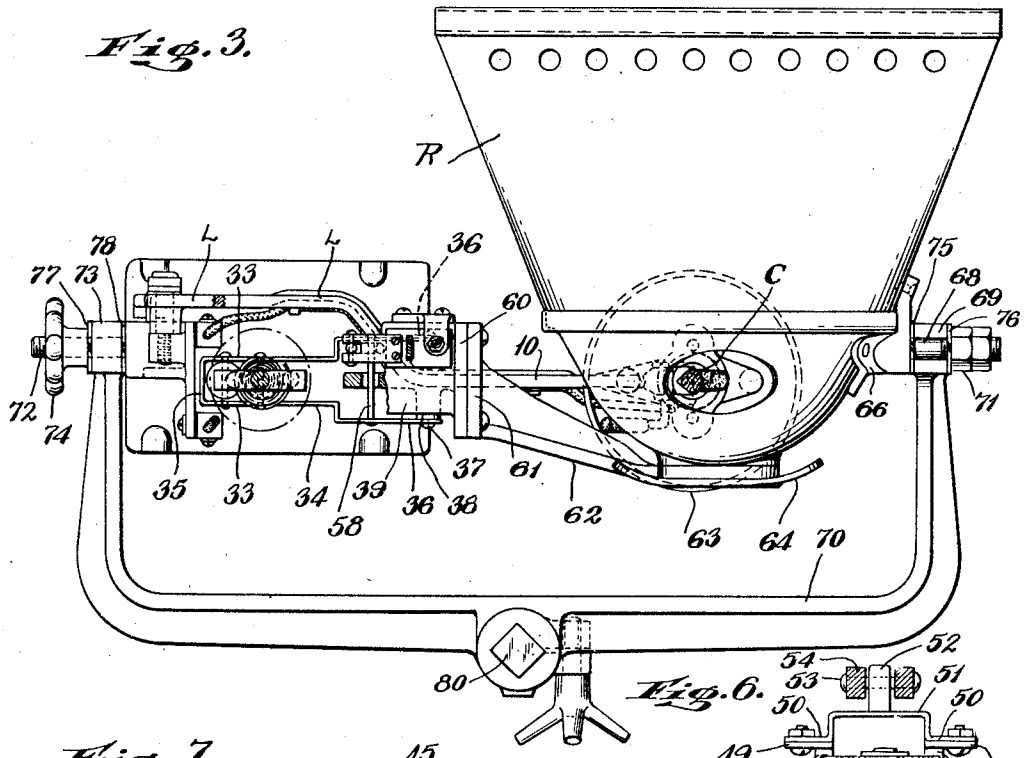


Fig. 6.

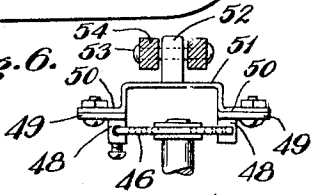


Fig. 7.

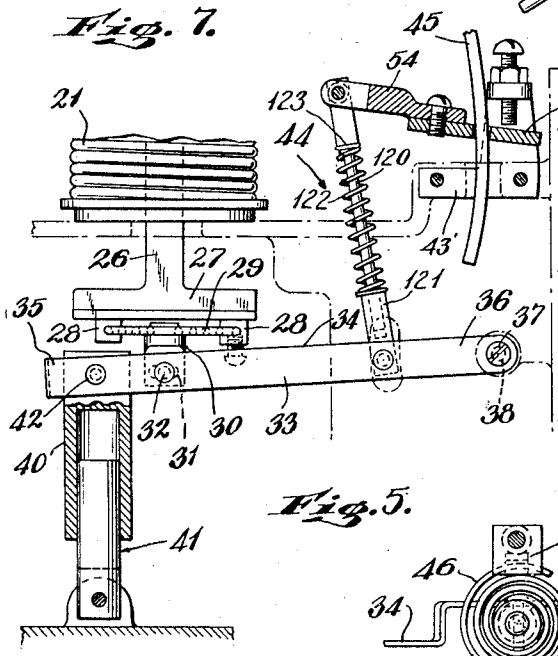


Fig. 4.

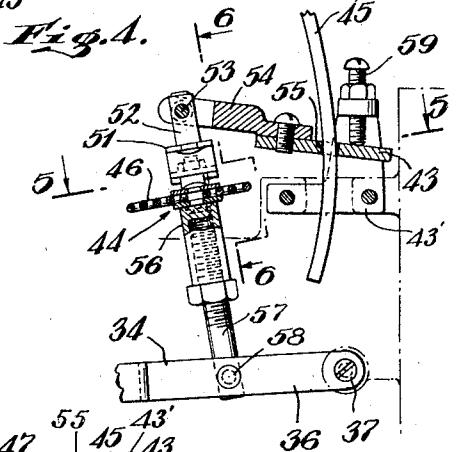
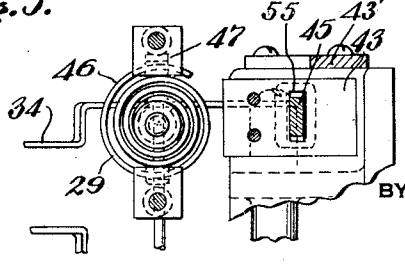


Fig. 5.



Joseph Gelb
INVENTOR

BY

ATTORNEY

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Fig. 8.

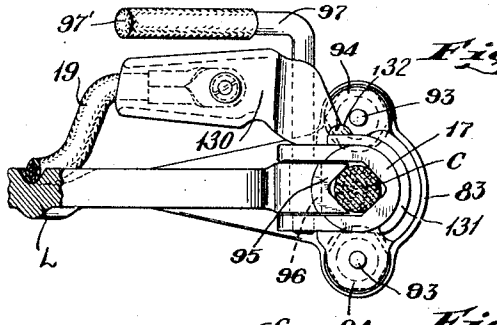


Fig. 9.

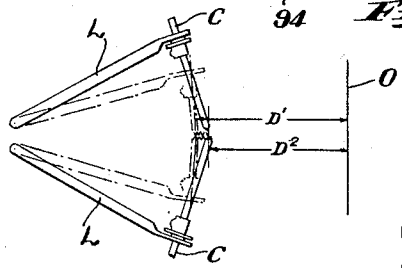


Fig. 10.

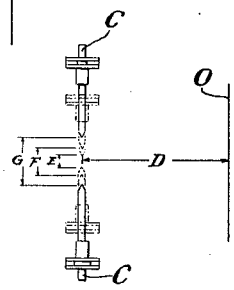


Fig. 11.

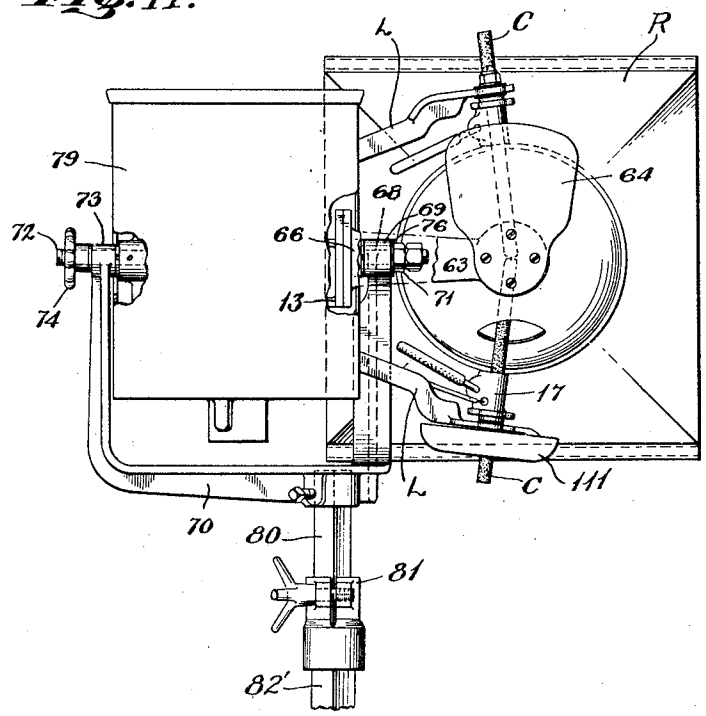


Fig. 12.

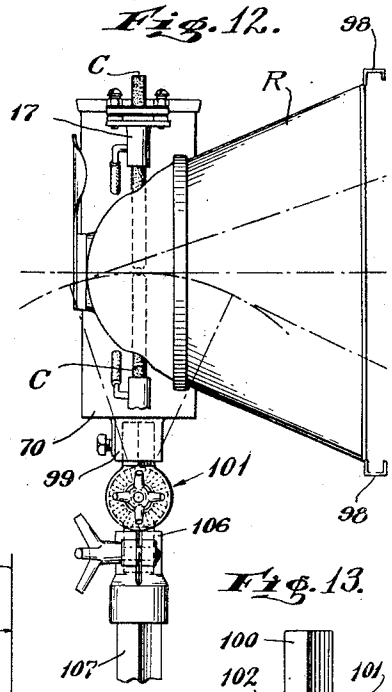
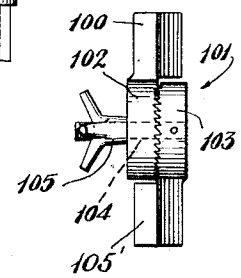


Fig. 13.



Joseph Gelb
INVENTOR

BY

ATTORNEY

Patented June 11, 1940

2,204,079

UNITED STATES PATENT OFFICE

2,204,079

ARC LAMP

Joseph Gelb, New York, N. Y.

Application October 21, 1936, Serial No. 106,732

12 Claims. (Cl. 176—51)

The invention which forms the subject matter of the present application is an improvement in an arc lamp utilized for photographing purposes. In lamps of the character referred to, carbon electrodes are employed. In these types of lamps and so far as I am aware, the distance between the arc or light source and the object illuminated increased in proportion to the wear of the poles of the electrodes, correspondingly causing an appreciable decrease in light intensity with a corresponding decrease in overall efficiency. According to the invention, the cooperating electrodes are so disposed in respect to the companion reflector that they are continuously in one common plane disposed substantially at a constant distance from the object to be illuminated. Hence it is one object of the invention to provide a serviceable and improved arc lamp wherein the forward plane of the reflector laterally overhangs a tiltable, settable, and compact electrically controlled device comprising operating mechanism adapted to actuate electrodes holding means to produce the arc between the poles of the electrodes, thus providing an arrangement in which the light source is disposed at substantially the same distance from the object to be illuminated without materially lowering the intensity of the light projected onto the object even though appreciable wear has taken place in the poles of the electrodes.

The invention further comprehends as an object, the provision of a novel arc lamp wherein the operating mechanism which controls the performance of the electrodes and the reflector for directing the light from the electrodes are bodily and swingably sustained on frame which comprises a yoke having bearing means for rotatably supporting trunnions carried by the reflector and the means which supports the operating mechanism.

The invention has as a further object the provision of electrically controlled means for actuating a pair of balanced bell crank levers pivotally carried by the supporting means of the operating mechanism, the arrangement being such that even though the supporting means and the reflector are tilted relative to the rearwardly disposed yoke, the electrodes of the electrode holders carried by the bell crank levers may be readily separated if closed, and readily closed if separated.

The invention has as a further important object the provision of bodily tiltable and settable means journalled to forwardly projecting bearings of the rearwardly disposed yoke, the tiltable means having pivotally supporting interconnected bell crank levers so disposed that their weights are balanced and uniformally distributed to provide a relatively negligible load to a retractible armature of the electrically controlled means thus permitting easy separation or approach of the carbon electrodes.

The invention has as another object the provision of an improved arc lamp having means at the rear thereof to shield the arc flame thereof and thus protect the operator from needless eye strain.

The invention has as a further object the provision of improved shock absorbing means interposed between the armature of the solenoid of the electrically controlled means to dampen the electrical and/or mechanical vibrations. Another object of the invention is realized in interposing, between the clutch which controls the movement of the balanced bell crank levers and a loop tiltably actuated by the armature, vibration dampening means in the form of a relatively flat spiral spring.

The invention has as another important object the provision of an improved arc lamp in which the bell crank levers are at all times in balance regardless of the angle tilt of the settable and tiltable supporting unit, hence providing a substantially uniform although relatively negligible load on the armature of the solenoid which controls the separation of the bell crank levers and with these levers in continuous balance sensitive control thereof is maintained.

The invention accordingly comprises features of construction, combination of elements, and arrangement of parts exemplified in the embodiments hereinafter specifically pointed out in the appended claims.

For a clearer understanding of the invention and how all of the other features, advantages, and objects thereof are accomplished and carried into effect, attention is directed to the embodiments shown in the accompanying drawings in which:

Fig. 1 is a side elevational view of the improved arc lamp according to my invention.

Fig. 2 is a rear view of the lamp taken on the line 2—2 of Fig. 1.

Fig. 3 is a plan view of Fig. 1, shown partly in section.

Fig. 4 is an enlarged detail view of the clutch control mechanism shown in Fig. 2.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4.

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 4.

Fig. 7 is an enlarged detail view illustrating a modified form of shock absorbing means interposed between the clutch or brake and the swingable loop controlled by the armature of the solenoid.

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 2.

Fig. 9 is a schematic showing illustrating several positions of a pair of electrodes during the process of wear thereof as in the case of arc lamps of the type well known in the art, the copy board being indicated at O.

Fig. 10 is a schematic view showing several positions of the electrodes during periods of wear in the arc lamp according to my invention, the copy board being indicated at O.

Fig. 11 is a rear view of a lamp according to the invention shown supported on a modified form of mounting.

Fig. 12 is a side elevational view showing an arc lamp according to the invention supported by a modified form of mounting, a dot-and-dash line representing a normal central horizontal axis for the reflector of the lamp and dotted lines above and below the same showing the movement of said axial plane when the reflector is tilted.

Fig. 13 is a front view of the swivelled joint shown in Fig. 12.

Fig. 14 is a sectional view of an insulated connection between a balanced lever and its carbon holder.

In arc lamps of the prior art and in so far as I am aware, the distance betweer the light source and the object varies proportionately to the wear of the carbon electrodes. In this connection attention is directed to Fig. 9 wherein the terminals or poles of the carbon electrodes C before any wear thereof are at a distance D^2 from the object O and this distance progressively increases as the wear of the poles increase until the poles of electrodes are almost in vertical alinement, say for the sake of example, at a distance D^1 from the object O. Where this distance is varied, the intensity of the light emanating from the electrodes is decreased, thus reducing the efficiency of the lamp.

According to the invention the electrodes are so disposed that regardless of wear of the poles thereof, the distance between the object and these poles is substantially constant. In this connection attention is directed to Fig. 10. In this view preparatory to wear the poles of the electrodes are separated by a distance, say equivalent to gap E. After wear the gap approaches a size designated F. Further wear increases the size of the gap to the distance G. However, at all times, irrespective of wear, the electrodes are in the same plane and substantially parallel to the object O. Or in other words the distance between the poles of the electrodes and the object is maintained substantially constant. Hence the light intensity striking the object is substantially the same.

For accomplishing this purpose it will be noted that the reflector R is arranged at one side or laterally of the pair of bell crank levers L. The long arms 10 of the opposing bell crank levers L are pivoted on the spaced fulcrum pins 11 attached to the standard 12 of the bracket or supporting means generally designated 13. The short arms 14 are interconnected by a pin and fork connection characterized by pin 15 extending from one of the arms 14 and the fork 16 straddling pin 15 and extending from the adjacent short arm 14 of the opposing bell crank lever.

According to the invention the distribution of load on the bell crank levers is substantially the same regardless of the angle of tilt of the reflector or in other words, these bell crank levers are always in balance as far as load is concerned, permitting the poles of the carbons to readily come together or to readily separate when desired. With the prior art devices difficulty has been experienced in the matter of controlling the electrodes carried by the bell crank levers when the reflector was tilted from its normal position. If the reflector was tilted downwardly, the poles of the electrodes come together fairly rapidly because of the irregular distribution of forces or load on the bell crank levers. It was therefore difficult to open the electrodes when desired. If on the other hand, the reflector be tilted upwardly, the electrodes widely separated, because of the irregular distribution of load upon the bell crank levers, and therefore difficulty was experienced in properly positioning or moving these levers towards each other to set the electrodes the required distance apart. In either case because of the irregular distribution of forces acting on the bell crank levers due to tilting of the supporting means, an increased load was added to the armature of the electrically controlled means of the operating mechanism, consequently resulting in either holding the poles closed or widely open, and with this added load applied to the armature and in the event that an arc flame would be developed, the light emanated thereby would be of varying intensity.

By mounting the crank levers in the manner shown, the distribution of forces applied to these levers whether the reflector and the supporting means 13 be tilted or whether not tilted, is substantially the same, that is, the distribution of these load forces on these bell crank levers substantially neutralize each other and consequently these levers may be considered as balanced. It follows therefore that an appreciable less load is applied to the retractible armature of the electrical control means hereinafter more particularly set forth, thus providing more sensitivity in the matter of actuating these levers.

It will be observed that each of the bell crank levers is provided with a hollow holder 17 each sustaining a carbon electrode C electrically connected to cables 19 attached to the long arms 10 of the bell crank levers as shown in Fig. 2. The upper cable 19 is electrically connected to one end 20 of solenoid 21. The other end 22 of the solenoid is electrically connected to the binding post 23 while the lower cable 19 is connected to the binding post 24. These binding posts 23 and 24 are suitably connected to a source of electrical potential by means of conduit 25. It is apparent therefore that the winding of the solenoid, the cables and the electrodes are in series in the same circuit.

Depending from shoe 27 of the retractible armature 26 are the spaced apertured posts 28 through which the outer convolution of a relatively flat spirally coiled stabilizing and shock absorbing spring 29 is threaded. In one form (Fig. 7), the inner convolution of spring 29 is fixedly retained on centrally arranged stud 30 which includes slot 31 through which the shank of pin 32 projects. This pin is also threaded through spaced sides 33 of loop 34 and serves as fulcrum means for pivotally sustaining the loop 34. The terminals 36 of loop 34 are pivotally connected at 37 to

bearings 38 overhanging standard 39 of bracket or supporting means 13.

Closed end 35 of the pivoted loop 34 straddles the slidable cylinder 40 of the dash pot generally denoted 41 and is pivotally connected to this cylinder by a transverse pin 42. If therefore the solenoid is energized the core thereof attracts the armature 26, causing closed end 35 of loop 34 to rise by reason of the yieldable although shock absorbing connection between the armature and the pivoted loop 34. It also follows that the cylinder 40 of the dash pot is raised at this time by loop 34 since the latter is pivotally connected to cylinder 40 by fulcrum pin 42.

Interposed between the clutch 43 and the hinged loop 34 is an elastic and shock absorbing connection generally denoted 44. In the form according to Figs. 4 and 7 this connection operates to displace clutch 43 to actuate or raise arcuate arm 45 attached to and depending from the long arm 19 of the upper bell crank lever L. More particularly, however, in the form according to Fig. 4, the elastic connection 44 is also formed by a coiled and relatively flat spring 46 which has its outer convolution threaded in and retained by depending apertured posts 48 of the spaced plates 49 attached to laterally extending arms 50 of a channel or inverted U shaped member 51 to which is fastened the centrally arranged post 52 carrying fulcrum pin 53 pivotally sustaining the bifurcated end of arm 54 to which clutch or brake 43 is attached.

Clutch 43 is provided with slot 55 having faces disposed at an incline in respect to the curved faces of the arcuate arm 45; the elastic connection 44 being such that when loop 34 is pivotally displaced, clutch 43 is actuated through the cooperating bushing 56 having its upper end fixedly fastened to the inner convolution of coiled spring 46 and post 57 adjustably connected to the bushing 56 and pivotally carried by fulcrum pin 58 interconnecting the sides of loop 34. When the solenoid is energized clutch 43 first slightly moves relative to the arcuate arm 45 and subsequently the inclined faces of opening 55 grip the arcuate depending arm 45, causing the latter to be elevated and consequently the long arms of the bell crank are separated, the limit of separation being controlled by the adjustable screw 59 which serves as a stop.

Appropriately fastened to transverse plate 60 of the standard 39 is a plate 61 having integral therewith the offset arm 62 provided with curved portion 63 to which is fixedly attached the upwardly extending and slightly concaved shield or flame protector 64 extending above and spaced from the electrode receiving opening 65 in the upper part of the reflector R to protect the operator from the glare of the arc or flame created between the poles of the electrodes L.

Secured to the reflector R is a spider 66 having an overhanging portion 67 provided with a fixed shaft or trunnion 68 journalled in bearing 69 of the U shaped yoke 70. To prevent side thrust of shaft 68, rotatable locking and clamping members 71 are utilized and split resilient metal washers 75 and 76 serve as friction means cooperating with bearing 69 to hold the trunnion 68 in a set position after having been rotated to tilt the reflector.

Extending laterally of bracket 13 and secured thereto is the shaft 72 which is rotatably sustained or journalled in bearing 73 of the yoke 70 and an adjustable hand wheel 74 is threadably connected to shaft 72. Hand wheel 74 cooperates with resilient and split metal washer 77 to preclude shifting of trunnion or shaft 72 in bearing 73. Split washer 78 interposed between the upper part of bracket 12 and bearing 73 in cooperation with split washer 77 serve to hold shaft 72 in a set position after the reflector has been tilted as is well understood.

The operating mechanism for actuating the bell crank levers shown in Fig. 2 is disposed in a casing or housing 79 which is secured to and surrounds the supporting means 13 and only a portion of the bell crank levers overhang a side wall of the casing. The operating mechanism within casing 79 together with the reflector R may be considered for purposes of specification as a unitary device rotatably sustained in bearings 69 and 73 by means for the trunnions 68 and 72. Accordingly this unitary device may be readily tilted bodily relative to yoke 70. After rotation to a desired position, the unitary device will be held in such set position due to the holding action of the split washers 75, 76, 77 and 78 against bearings 69 and 73.

As shown in Fig. 1, yoke 70 is attached to column 80 disconnectably associated with the adjustable coupling 81 secured to pedestal or post 82' of a suitable tripod not shown. For purposes of specification yoke 70 together with column 80 may be considered as the frame for sustaining the unitary tiltable device between the arms of the yoke.

Each of the carbon holders 17 although secured to a bell crank lever is also insulated therefrom and in this connection, it will be noted that terminals 82 (Figs. 1, 2 and 14) of each of the bell crank levers has attached to opposite faces thereof, layers of mica 83. Each terminal 82 also includes spaced openings 84 each lined by an annular sleeve of mica 85, thus forming an insulated interconnection between the spaced layers of mica 83.

Closely disposed within and surrounded by the mica sleeve 85 is the hollow shank 86 of a bushing 87 having its annular head 88 abutting the layer of mica 83 interposed between head 88 and terminal 82. Surrounding the exteriorly threaded part 89 of shank 86 is metal washer 90 and a clamping nut 91 is utilized to abut the latter. From the foregoing, it is apparent that by adjusting nut 91, the spaced layers of mica 83 are firmly clamped against terminal 82 of its respective bell crank lever to insulate bushing 87 therefrom.

Within the bore of each bushing 87 is arranged a set screw 92 having its shank 93 threadably interconnected to a lug 94 of the base of electrode holder 17, and for each terminal 82 of the bell crank levers there are two bushings 87 of the type shown in Fig. 14 and each insulated as shown and connected to its respective terminal 82.

With the present arrangement, it will be appreciated that a carbon holder 17 may be readily disconnected from its bell crank lever by merely actuating set screws 92 in the proper direction without however disturbing or removing the bushings 87 or the layers of mica 83 or the insulated sleeves 85. This is an important feature of the invention since the carbon holders may be quickly removed from or attached to the bell crank levers.

Each of the carbon holders 17 is provided with a tiltable jaw 95 adapted to be actuated by eccentric 96 of the rotatable manipulator or crank 97. If the crank be rotated in one direction,

the electrode C is held in a clamped position by the tiltable jaw 95. If the crank be rotated in an opposite direction, the tiltable jaw 95 releases from the electrode permitting the latter to be adjusted relative to its holder 17.

If desired the tiltable reflector may be provided with spaced channeled members or tracks 98 to removably hold a light diffusing plate (not shown).

In the form according to Fig. 3 the sides of yoke 70 straddle the unitary device comprising the operating mechanism for actuating the bell crank levers and the reflector. According to Fig. 11, yoke 70 of the frame merely straddles housing 79 containing the operating mechanism for the bell crank levers while the reflector is arranged to overhang one side or the yoke 70. In this connection spider 66 is secured to the bracket 13 and the trunnion 68 of spider 66 is rotatably sustained in bearing 69. In other aspects, the embodiment shown in Fig. 11 is along the lines of the construction disclosed in connection with Fig. 2 in which nipple 99 depending from bracket 13 if desired may be non-rotatably mounted on column 80 (Fig. 1) in cases where it is desired to eliminate yoke 70.

In the form according to Fig. 12, yoke 70 includes depending nipple 99 mounted on extension 100 of the swivel joint 101 comprising serrated jaws 102 and 103. Specifically jaw 102 is rotatably sustained on the fixed fulcrum pin 104 carried by fixed jaw 103. A manipulator 105 is utilized to hold jaw 102 interlocked with jaw 103 or after the extension 100 has been tilted upon tilting of the reflector. Jaw 103 has an extension 105' removably disposed in coupling 106 fixed to pedestal 107 of a tripod (not shown). By unloosening manipulator 105 reflector R may be tilted and thereafter it can be conveniently locked in its set position.

The lower arm of the bell crank levers L is provided with depending projections 110 to which is secured the dish shaped bowl 111 through which the lower electrode extends and which serves as means for conveniently manipulating its bell crank lever.

In operation the solenoid is first energized and hence its armature is attracted. Loop 34 is therefore tilted relative to its fulcrum means 37. Cylinder 40 of the dash pot is raised and through the medium of the shock absorbing means 44, clutch 43 is raised. Thus arcuate arm 45 is gripped and elevated, causing the self closing or counter balancing bell crank levers L to separate. The stop 59 limits displacement of clutch 43 and therefore the poles of the electrodes are set to a position to provide a predetermined arc gap.

During use the poles of the electrodes wear, consequently increasing the size of the arc gap. However during use, the armature gradually drops or slips due to reduction of the magnetic strength of the solenoid and therefore the distance of the gap is maintained substantially constant until the clutch 43 in lowering abuts block 43' at which time, clutch 43 releases arcuate arm 43 momentarily, and the self closing bell crank levers move towards each other, thus decreasing the size of the arc gap, thereby reducing the internal resistance of the circuit and the solenoid is reenergized. It follows that the armature is again fully attracted, the poles of the electrodes are again separated to form the predetermined size arc gap. This cycle of operation periodically is repeated and although the arcing poles wear away, the arc gap is held substantially constant and although the poles wear, the electrodes are continuously sustained in one plane substantially a constant distance from the object illuminated.

By the expressions "balanced", "self closing" or "counter balanced" is meant, that the load on the bell crank levers is uniformly distributed even though they are moved and set in a tilted plane relative to the vertical plane containing the horizontal axis of the bearings of the yoke.

In the form according to Fig. 7, the shock absorbing or vibration dampening means 44 comprises a shiftable rod 120 having its upper portion pivoted to arm 54 while its lower portion is slidably disposed in the bore of socket 121 pivotally carried on the hinged loop 34. Encircling rod 120 is the spring 122 which abuts shoulder 123 at the upper part of rod 120. This spring also abuts the upper part of socket 121. In operation, vibrations set up in rod 120, are dampened by spring 121, although when loop 34 is raised, arm 54 elevates clutch 43, since socket 121 is elevated and consequently rod 120 is raised.

Briefly recapitulating, the several advantages of the present invention, it is apparent that even or uniform lighting is obtained since the reflector is so arranged that the electrodes are always disposed in one plane at a constant distance from the object to be illuminated even though the poles of the electrodes have worn. This is accomplished by arranging the reflector so that its transverse vertical axis is at all times substantially normal to the path of movement of the bell crank levers. By such an arrangement, the load of the lamp on these bell crank levers is uniformly distributed even though the bracket or supporting means 13 carrying these levers is in a tilted relation relative to the frame.

By providing a shield at the back of the reflector at one side of upper opening thereof, the operator is protected from the flame of the arc.

As another advantage, it is apparent, that in the event a carbon holder burns out, it may be quickly removed and replaced and because of the ease with which these replacements may be made a skilled operator is not needed.

By securing an asbestos casing or covering 97' to crank 97, protection is obtained against heat and shock, and by the provision of a seat 130 to which the lead of the upper cable 19 is connected, this cable is protected from the flame within the reflector. This seat 130 is a metal casting comprising an offset arcuate portion 131 fastened to the associated carbon holder 17 by a set screw 132.

According to the invention offset arm 62 sustaining the reflector may be disconnected from plate 60 of bracket 13 by removing screws 133. Hence the reflector may be readily dismantled.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be devised without further departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In combination, a frame comprising a yoke having forwardly extending arms, trunnions journalled in said arms, a unitary device carrying said trunnions and comprising: a reflector for housing opposed electrodes and including an opening, balanced pivoted means carrying said electrodes and adapted to move the electrodes

within a single path intersecting the reflector transversely thereof, and electrically controlled means for separating said electrodes; means for holding said device in a tilted position relative to said frame, and a flame protecting shield disposed adjacent said opening.

2. In an arc lamp, a reflector having an opening, a flame protector at the rear of said opening, opposed electrodes within said reflector, balanced and interconnected levers having terminals disposed at the rear of reflector and arms extending laterally of said reflector, electrode holders carried by said arms, and electrically controlled means for actuating said levers within a single path intersecting the reflector transversely thereof.

3. In an arc lamp, a reflector having alined openings, holders at the rear of said reflector and removably received in said openings, electrodes carried by said holders, balanced and pivoted bell crank levers having terminal portions carrying said holders, said levers having vertically spaced arms extending laterally of said reflector and having interconnecting portions, one of said levers having depending arcuate means, a clutch, and electrically controlled means for actuating said clutch to move said arms apart and separate said electrodes, the movement of the electrodes being in a single path intersecting the reflector transversely thereof.

4. In an arc lamp, a frame having forwardly projecting arms each constituting bearing means, a unitary device comprising; a reflector, balanced bell crank levers comprising arms having terminals disposed at the rear of said reflector, electrode holders carried by said terminals, electrodes adjustably sustained by said holders, said levers being vertically spaced apart and extending laterally of said reflector and having offset means operatively interconnected, an arcuate member depending from one of said arms, a clutch, electrically controlled means for operating said clutch to separate said levers, the movement of the levers being within a single path intersecting the reflector transversely thereof; trunnions carried by said device and rotatably sustained in said bearing means, and means cooperating with said bearing means and trunnions to bodily hold said device in a set but tilted relation relative to said frame.

5. In an arc lamp, a frame having forwardly projecting portions each constituting bearing means, a unitary device tiltably sustained by said bearing means and comprising a reflector, spaced pivoted and balanced bell crank levers comprising arms having terminals disposed at the rear of said reflector, electrode holders carried by said terminals and insulated therefrom, electrodes adjustably and removably sustained by said holders, said arms in part extending laterally of said reflector and having offset means operatively interconnected, a clutch, electrically controlled means for operating said clutch to separate said arms and comprising a retractible armature, a pivoted loop, and shock absorbing means interposed between said armature and loop and said loop and clutch.

6. In an arc lamp, a frame having forwardly projecting arms each constituting bearing means, a unitary device tiltably carried by said bearing means and comprising a reflector, pivoted and self counterbalanced bell crank levers having terminals disposed at the rear of said reflector, electrode holders carried by said terminals and insulated therefrom, electrodes adjustably sustained by said holders, said levers having vertically spaced arms extending laterally of said reflector and other offset arms operatively interconnected, an arcuate member depending from one of said levers, a clutch, and electrically controlled means for operating said clutch to separate said levers and comprising a retractible armature, a pivoted loop, a relatively flat spiral spring interposed between said armature and loop, and a relatively flat spiral spring interposed between said clutch and loop, the movement of said arms being within a single path intersecting the reflector transversely thereof.

7. In combination, a frame, a unitary device carried by said frame and comprising a reflector, a casing and electrical control means therein and vertically spaced movably interconnected arms operatively connected to said control means and having terminals extending laterally of said control means, the reflector being carried by said casing laterally thereof and disposed at least in part forwardly of said terminals the reflector having opposed openings, holders connected to and insulated from said terminals, and electrodes carried by said holders and projectable through said openings into said reflector, said control means upon energization thereof causing said arms to be displaced relative to each other and to maintain said electrodes, throughout the movement of said arms, in a plane substantially at right angles to the optical axis of the reflector parallel to an object disposed in front of said reflector and in said plane substantially normal to the vertical transverse axial plane of said reflector regardless of wear of said electrodes.

8. In a photographic lamp, a frame, a unitary device pivotally supported by said frame comprising control means and a reflector disposed to one side of said control means, levers operatively connected to said control means and having portions extending laterally thereof at the rear of said reflector, holders insulated from and carried by said portions, electrodes carried by said holders and projectable in said lever reflector, said portions being disposed in a plane substantially at right angles to the optical axis of said reflector, said control means actuating said levers.

9. In a photographic lamp, a frame, control means carried by said frame, a reflector disposed at one side of said frame and carried by said control means, arms pivotally sustained by said control means and including terminals projecting beyond said frame and laterally of said control means and disposed substantially normal to the transverse vertical axial plane of said reflector, electrode holders insulated from and disposed substantially normal to said terminals, and electrodes carried by said holders and disposed and movable by said arms in a plane substantially at right angles to the optical axis of the reflector.

10. In an arc lamp, a frame, a reflector sustained by said frame, balanced and pivoted bell crank levers comprising vertically spaced arms extending laterally of said reflector and having terminals, electrode holders carried by and insulated from said terminals, rectilinear electrodes sustained by said holders and continuously disposed in a plane substantially normal to the transverse axial plane of said reflector, an arcuate arm depending from one of said levers, a clutch closely but detachably surrounding said arcuate arm, electrically controlled means for operating said clutch to actuate said levers, and insulated means carried by said holders for adjustably holding said electrodes.

11. In an arc lamp, a frame, a reflector tiltably sustained by said frame, balanced and pivoted bell crank levers comprising vertically spaced arms extending laterally of said reflector and having terminals, electrode holders carried by and insulated from said terminals, rectilinear electrodes sustained by said holders and continuously disposed in a plane substantially normal to the transverse axial plane of said reflector regardless of wear of said electrodes, an arcuate arm depending from one of said levers, a clutch cooperating to detachably grip said arcuate arm, electrically controlled means for operating said clutch to actuate said levers, insulated means rotatably carried by said holders for adjustably holding said electrodes, and rotatable means for holding said reflector in a set and tilted position relative to said frame.

12. An arc lamp comprising a frame, a unitary device comprising a supplemental frame and a reflector, arms pivotally carried by the supplemental frame and disposed at the rear of said reflector, electrode holders carried by said arms, said arms being vertically spaced apart and extending laterally of said reflector, electrically controlled means including a member adapted to separate said arms, the movement of said arms being wholly within a single path intersecting the reflector transversely thereof, said means being carried by the supplemental frame, a pivotal connection between the frame and said unitary device, and means to bodily hold said device in a set but tilted relation relatively to said frame.

JOSEPH GELB.