Sept. 13, 1932. E. S. HUMPHREYS 1,877,242

ARC LAMP

Filed Oct. 24, 1928 2 Sheets-Sheet 1

Fig. 2.

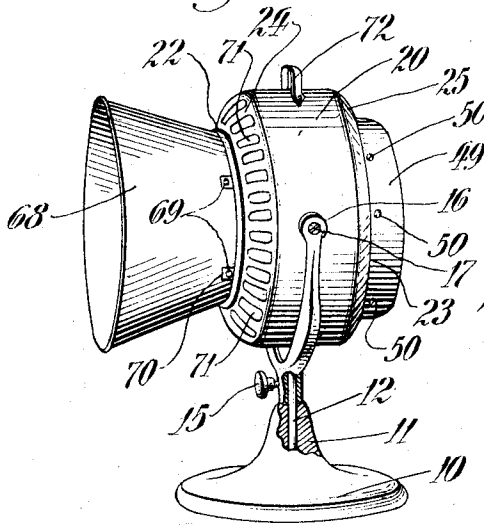
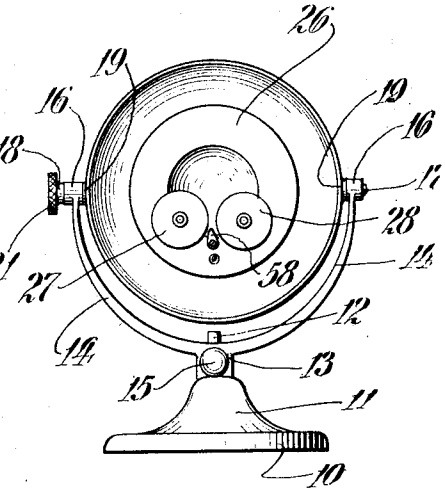


Fig. 1.



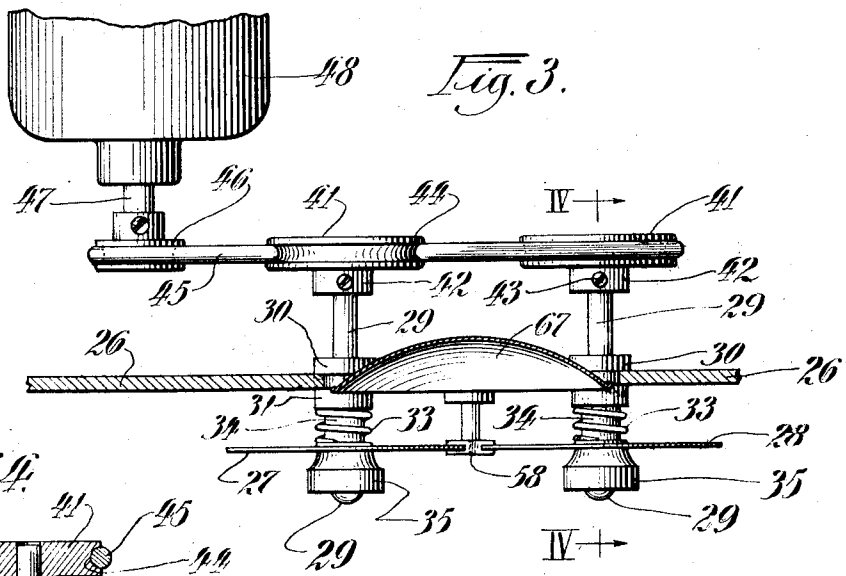


Fig. 3.

Fig. 4.

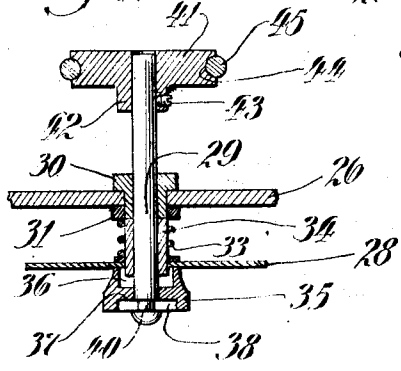


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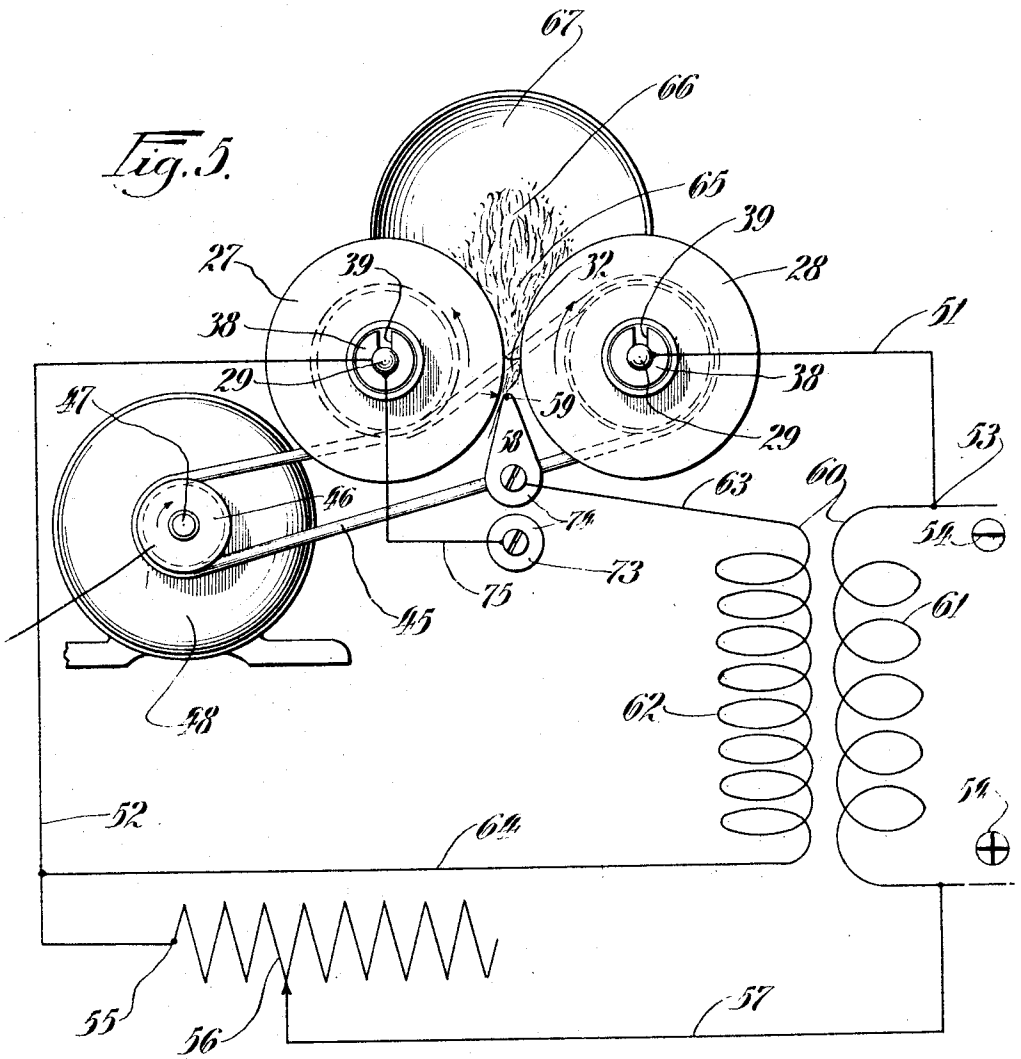
Fig. 5.



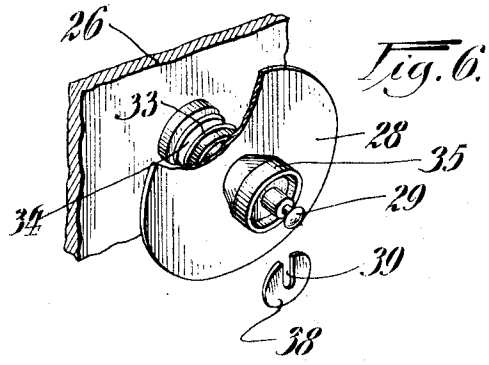


Fig. 6.

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Patented Sept. 13, 1932 1,877,242

UNITED STATES PATENT OFFICE

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ARC LAMP

Application filed October 24, 1928. Serial No. 314,602.

This invention relates to arc lamps and more particularly to ultra-violet ray generating devices, although features thereof may be employed with equal advantage for other purposes.

It contemplates more especially the production of an instantaneously efficient ultra-violet light attendant with minimum heat generation, and without excessive wear requiring frequent adjustment and replacement.

Arc producing lights of known construction are inefficient and create excessive wear on the generating parts. In addition such produce a concentrated arc of restricted area which is attendant with substantial heat generation, an undesirable feature not only to the ray receiving surface but also to the electrodes which soon deteriorate thereunder.

Moreover known ultra-violet ray generating devices are expensive and/or inefficient, lack expansive ray concentration, and require frequent adjustment in order to be operable for any extended period. In operation, they create excessive heat very low in ultra-violet ray generation, and much time and energy is consumed in initiating efficient ray production responsive to commencing the operation thereof.

Owing to the high voltage required to initiate arcing across spaced electrodes necessary for expansive ray generation and the excessive year incident to the production thereof, low voltage producing arcs are very advantageous over extended arc activity. Now, then, the wear incident to extended use enlarges the air gaps to the extent that the electrical apparatus windings are endangered in that the insulation therebetween fails to prevent arcing or short circuiting therein when the electrode defining gap resists arcing in excess of the insulation between the transformer windings.

One object of the present invention is to simplify the construction and impove the operation of devices of the character mentioned.

Another object is the provision of a ray generating device possessing increased electrical and mechanical efficiency.

Still another object is to provide novel means for producing a highly concentrated arc of increased expanse attended with minimum heat generation.

A further object is the production of an instantaneously efficient ray generating arc possessing increased expanse without resort to excessive voltages or expensive generating devices.

A still further object is to provide novel means capable of expansive ray generation with increased electrical efficiency and safety minimizing physical deterioration thereof.

Still a further object is the provision of a flaring ray generating arc of considerable expanse initiated by a high potential and continued with a considerably decreased potential, thereby increasing the electrical and physical efficiencies thereof.

Other objects and advantages will appear from the following description of an illustrated embodiment of the present invention.

In the drawings:

Figure 1 is a view in elevation of an arc lamp embodying features of the present invention.

Figure 2 is a perspective view of the lamp disclosed in Figure 1.

Figure 3 is a fragmentary sectional plan view of the ray generating instrumentalities employed in connection with the device disclosed in Figure 1.

Figure 4 is a sectional view taken substantially along line IV—IV of Figure 3.

Figure 5 is an enlarged detail view in elevation of the instrumentalities shown in Figure 3, an electrical circuit being conventionally shown in association therewith to effect the operation thereof.

Figure 6 is a perspective view of the mechanism disclosed in Figure 4.

The structure selected for illustration comprises a base 10 which has a central elevated boss 11 to receive a standard 12 axially therethrough for fixed joinder therewith in any suitable manner. A shank 13 having semicircular furcations 14 integrally or otherwise associated therewith, is bored to slidably receive the standard 12 therethrough. A threaded stud 15 projects through the shank 13 to selectively engage the standard 12 so as to enable rotary and vertical adjustment with respect thereto.

The furcations 14 terminate in circular bosses 16 along a diametral horizontal line thereof, they being bored to receive studs 17 and 18 for threaded engagement with aligned bosses 19 formed on a cylindrical drum casing 20 to effect the adjustable support thereof. As shown, the stud 18 terminates in a knurled knob 21 to afford manual adjustment of the casing 20 in a circular path transverse to the adjustment enabled by the stud 15 engageable with the reduced openings 22 and 23 axially therethrough, these being defined by arcuate end rims 24 and 25 constituting end extensions of the casing 20.

In order to enable the support of the ray generating instrumentalities, a plate 26 is fixed within the casing 20 intermediate the openings 22 and 23 for access on either side thereof. A pair of electrodes 27 and 28, in this instance two, preferably composed of high quality steel are mounted on spaced shafts 29 journalled in insulator bushings 30. The bushings 30 are fixed in suitable collars 31 provided in the plate 26, thereby insulating the shafts 29 therefrom. In the present embodiment, the electrodes 27 and 28 constitute circular discs mounted on the shafts 29 to define an air gap 32 therebetween.

Helical springs 33 envelope sleeves 34 on the shafts 29 intermediate the bushings 30 and the discs 27—28 which are slidable thereon. To retain the discs 27—28 in position for movement in unison with the shafts 29, a cap 35 having a cavity 36 to receive the collar 34 therein is slipped on the extremities of each of the shafts 29 to engage the discs 27 and 28, there being a countersunk face 37 in the caps 35 to receive a washer 38 therein. The washer 38 is provided with a radial slit 39 therein for reception by an annular groove 40 in proximity to the extremities of the shafts 29. With the reception of the washer 39 in the annular groove 40 to the extent of being co-axial therewith, the washer 38 is received in the countersunk face 37 of the cap 35, thereby precluding accidental removal thereof to frictionally engage the discs 27—28 owing to the resilient urge of the springs 33. It will be noted that this arrangement affords instant removal of the discs 27—28 for replacement purposes.

It has been found desirable to rotate the electrode discs 27—28 in opposite directions designated by the arrows (Figure 5), and to this end the shafts 29 are provided with pulleys 41 of fibre or other insulating material, the hubs 42 thereof being provided with the customary set screws 43 which effect rotation of the pulleys 41 in unison with the shafts 29. The pulleys are formed with annular grooves 44 in the periphery thereof to frictionally engage an endless flexible belt 45 of twisted metallic strands, leather or other suitable material. The belt 45 is so geared to each of the pulleys 41 to drive them in opposite directions when harnessed to a pulley 46 secured in the usual manner to the armature shaft 47 of a power source, in this instance an electrical motor 48 which is fixed to the interior of the casing 20 in any suitable manner rearwardly of the partition casing plate 26. A casing closure 49 is secured to the rim flange of the rear opening 23 of the casing 20 by means of fasteners 50, thereby rendering the instrumentalities within the casing 20 rearwardly of the partition plate 26 readily accessible.

The electrodes 27 and 28 have a low electrical voltage or potential impressed therebetween, such being insufficient to normally arc across the gap 32. To this end, electrical conductors 51 and 52 are in constant contact with the rotating shafts 29 through the medium of slip rings or other expedients of standard construction, and the terminal 53 of the conductor 51 contacts with one terminal of a plug leading to a source of electrical energy 54 receivable from a 110 volt, A. C., lighting circuit. The terminal 55 of the conductor 52 is connected to an impedance coil 56 which is electrically connected by a wire 57 to the other terminal of the plug leading to the source of electrical energy 54, thereby shorting the electrodes 27 and 28 through the impedance 56 which limits the current of the low voltage arc subsequent to its establishment between the electrodes in a manner which will more fully appear hereinafter.

To initiate continued arcing with instantaneous efficiency and minimum wear on the instrumentalities, a pilot electrode 58 is positioned or fixed more proximate to one of the movable electrodes 27—28, in this instance electrode 27, than the gap 32 existing between the electrodes 27 and 28. In fact electrode 58 may be positioned within $\frac{1}{32}''$ of the electrode 27 to define a minute gap 59. Primary or initial arcing is established therebetween owing to the impression of a comparatively high voltage or potential between the electrodes 27 and 58. For this purpose a transformer 60 having the low side 61 thereof connected to the electrical energy source 54, steps up the potential to approximately 3,000 volts taken from the high side 62 thereof.

The pilot electrode 58 is connected thereto

by a conductor 63 while a wire 64 leading therefrom to terminate in the conductor 52 which leads to the movable electrode 27, thereby creating primary arcing between the gap 59 while the disc electrodes 27 and 28 revolve in opposite directions (see arrows—Figure 5) to carry the continued primary arcs therebetween. As a consequence, secondary arcing is initiated between the electrodes 27 and 28 in that the primary arcs decrease the resistance occasioned by the gap 32, since such is projected therein by the rotation of the discs 27—28 and the resulting heat currents.

As shown, the secondary arcing 65 is in continuity with the primary arcing in the gap 59, thereby increasing the expanse thereof. The movement of the electrodes 27—28 and the air currents occasioned thereby, creates a flaring arc 66 which emanates increased rays with much expanse. These ultra-violet rays are directed in a predetermined path by a concave reflector 67 which is positioned centrally of the plate 26 for secural thereto rearwardly of the discs 27 and 28. A frusto-conical ray director 68 is secured to the forward opening 22 of the casing 20 by means of fasteners 69 projecting through brackets 70 formed integral with the casing. The ray generating electrodes are self-ventilated owing to the movement thereof, and the heat is disseminated with the assistance of elongated openings 71 provided in circumferential spaced relation on the arcuate rim 24 of the casing 20. A strap handle 72 is secured to the casing 20 at the top thereof to facilitate the positioning and carrying thereof with the instrumentalities secured therein.

Obviously, the extended and continued use of the device will cause peripheral wear on the electrodes 27 and 28; therefore they are rendered readily replaceable by virtue of the novel retaining expedient described hereinabove. In order that the attendant or user thereof may not continue the operation thereof when the gaps 32 and 59 have become too large and there is strong possibility of short-circuiting the winding 62 of the transformer 60, a safety electrode 73 is fixed to the plate 26 and insulated therefrom in any appropriate manner. The electrode 73 is secured a fixed distance from the pilot electrode 58 so that the arcs will bridge the gap 74 therebetween when the gap 59 has exceeded safety limits of operation, since the gap 74 is impressed with the potential of the high side 62 of the transformer 60 through a wire 75. Arcing in the gap 74 signallizes that the electrodes 27 and 28 require replacement, thereby permitting a layman to use the device with utmost safety.

Various changes may be made in the embodiment of the invention herein specifically described without departing from or sacrificing any advantages thereof as defined in the appended claims.

I claim:

1. In an ultra violet ray generating device, the combination with spaced electrodes for producing primary arcing at a predetermined potential, of another electrode spaced from said first electrodes to produce secondary arcing at a lower potential effecting ultra violet ray generation, said secondary arcing being initiated by said primary arcing in continuity therewith, and means for creating a flaring therapeutic arc of considerable expanse between said electrodes.

2. In an ultra violet ray generating therapeutic device, the combination with electrodes having a high potential impressed therebetween to create primary arcing, and another electrode spaced therefrom with a considerably lower potential impressed between it and one of said first electrodes to create secondary arcing in continuity therewith, and means for moving said electrodes to create a flaring arc of considerable expanse therebetween for therapeutic treatment.

3. In an ultra violet ray generating therapeutic device, the combination with spaced electrodes for producing primary arcing at a predetermined potential, of a rotary electrode spaced from said other electrodes to produce secondary arcing at a lower potential, said secondary arcing being initiated by said primary arcing in continuity therewith, and means for rotating said electrodes to produce a flaring ultra violet ray arc of considerable expanse for therapeutic treatment.

4. In an ultra violet ray generating therapeutic device, the combination with relatively movable electrodes having a potential impressed therebetween of a magnitude insufficient to initiate arcing, of pilot electrode in proximity to one of said electrodes, means for impressing a potential between said pilot and first named electrodes, said potential being sufficient to initiate primary arcing in the path of said relatively movable electrodes and means for rotating said movable electrodes for effecting secondary expansive arcing in continuity with said primary arcing.

5. In an ultra violet ray generating therapeutic device, the combination with relatively movable metallic disc electrodes having a potential impressed therebetween of a magnitude insufficient to initiate arcing, of a pilot electrode in proximity to one of said disc electrodes with a potential impressed therebetween sufficient to initiate primary arcing in the path of said relatively movable electrodes, and means for moving said electrodes to effect secondary expansive arcing in continuity therewith for ultra violet ray generation.

6. In an ultra violet ray generating therapeutic device, the combination with rela-

tively movable disc electrodes having a potential impressed therebetween of a magnitude insufficient to initiate arcing, of a pilot electrode in proximity to one of said disc electrodes with a potential impressed therebetween sufficient to initiate primary arcing in the path of said relatively movable electrodes for effecting secondary arcing in continuity therewith, and a normally inoperative safety electrode spaced from said pilot electrode with a potential impressed therebetween for avoiding short circuiting of the potential impressing circuit when the primary arc gap becomes excessive.

7. In an ultra violet ray generating therapeutic device, the combination with movable spaced discs serving as electrodes having a potential impressed therebetween, a stationary pilot electrode positioned more proximate to one of said discs than the distance therebetween, there being a potential impressed between said stationary electrode and the disc proximate thereto to initiate primary arcing, and power means operatively connected to said discs for imparting relative rotation thereto in the path of said primary arcing to establish secondary expansive arcing between said discs in continuity with said primary arcing.

8. In an ultra violet ray generating device, the combination with a frame, of rotary spaced discs on said frame a stationary electrode positioned intermediate said discs more proximate to one than the other, means for impressing a high potential between said stationary electrode and the proximate disc to initiate a primary arc therebetween, means for impressing a comparatively lower potential between said discs, and means for relatively rotating said discs to effect secondary arcing constituting expansive ray concentration in continuity with said primary arcing.

9. In an ultra violet ray lamp, the combination with a frame, of a shaft journalled in said frame, a collar on said shaft, a spring enveloping said shaft to bear against said collar, an electrode slidable on said shaft against said spring, a cap on said shaft to engage said electrode, there being an annular groove in the extremity of said shaft, and a slotted member slidable in said groove to retain said cap on said shaft against the urge of said spring.

10. In an ultra violet ray lamp, the combination with a frame, of a shaft journalled in said frame, a collar on said shaft, a spring enveloping said shaft to bear against said collar, an electrode slidable on said shaft against said spring, a cap on said shaft to engage said electrode, there being an annular groove in the extremity of said shaft, and a slotted member slidable in said groove to retain said cap on said shaft against the urge of said spring, said cap being provided with a countersunk face to receive said slotted member therein for precluding displacement thereof.

11. In an ultra violet ray lamp, the combination with a circuit connected to a source of electrical energy, a transformer in said circuit, spaced electrodes connected to the low potential side of said transformer to impress a potential therebetween, a pilot electrode spaced more proximate to one of said electrodes than the other, and electrical conductors for connecting said pilot and proximate electrode to the high potential side of said transformer for creating primary arcing therebetween serving to instigate secondary arcing between said spaced electrodes in continuity therewith.

12. In an ultra violet ray lamp, the combination with a circuit connected to a source of electrical energy, a transformer in said circuit, spaced electrodes connected to the low potential side of said transformer to impress a potential therebetween, a pilot electrode spaced more proximate to one of said electrodes than the other, electrical conductors for connecting said pilot and proximate electrode to the high potential side of said transformer for creating primary arcing therebetween, and means for imparting movement to said spaced electrodes to establish secondary arcing in continuity therewith over an extended area.

13. In an ultra violet ray lamp, the combination with a circuit connected to a source of electrical energy, a transformer in said circuit, spaced electrodes connected to the low potential side of said transformer to impress a potential therebetween, a pilot electrode spaced more proximate to one of said electrodes than the other, electrical conductors for connecting said pilot and proximate electrode to the high potential side of said transformer for creating primary arcing therebetween, and means for imparting relative rotary movement to said spaced electrodes to establish secondary arcing in continuity therewith over an extended area.

14. In an ultra violet ray lamp, the combination with a circuit connected to a source of electrical energy, a transformer in said circuit, spaced electrodes connected to the low potential side of said transformer to impress a potential therebetween, a pilot electrode spaced more proximate to one of said electrodes than the other, electrical conductors for connecting said pilot and proximate electrode to the high potential side of said transformer for creating primary arcing therebetween, an open casing enveloping said electrodes, a reflector positioned behind said electrodes, and means associated with the opening in said casing to direct the arc generated rays therethrough.

15. A method of producing efficient ray generation which consists in initiating primary arcing by impressing a high voltage be-

tween spaced electrodes, and thence continuing the arcing with a third electrode at a comparatively lower potential, and effecting disturbances in the arc to increase the expanse thereof.

16. A method of producing efficient ray generation which consists in initiating primary arcing by impressing a high voltage between spaced electrodes, thence continuing the arcing with a third electrode at a comparatively lower potential, and creating a flaring arc of much expanse by effecting movement of the arcing medium.

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