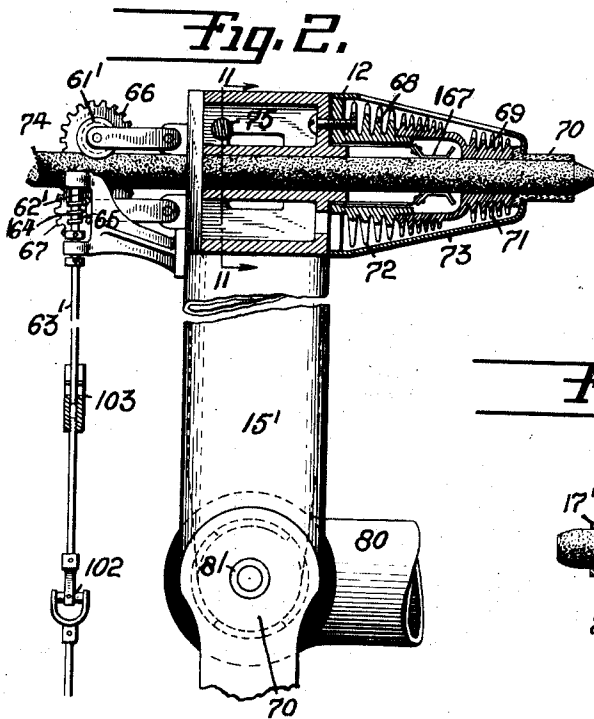
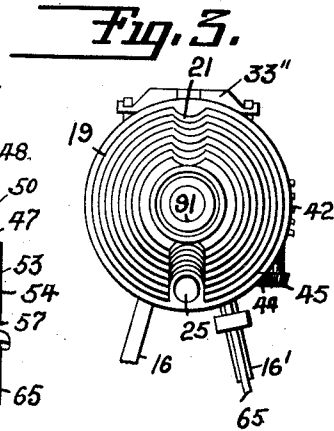
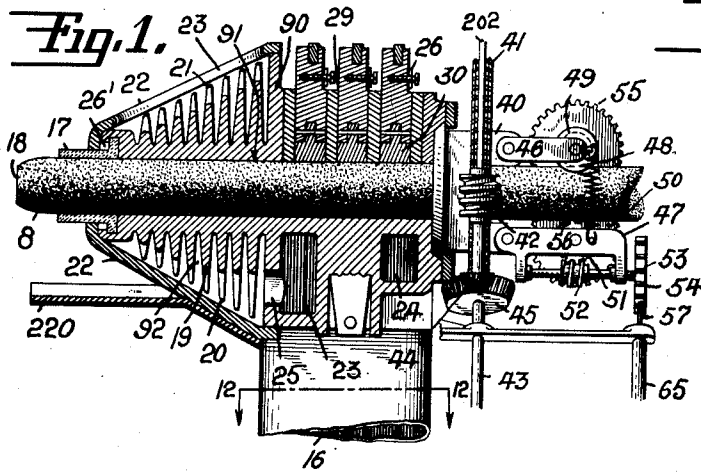


E. A. SPERRY.  
ELECTRODE HOLDER FOR SEARCH LIGHTS.  
APPLICATION FILED MAR. 13, 1918.

1,282,133.

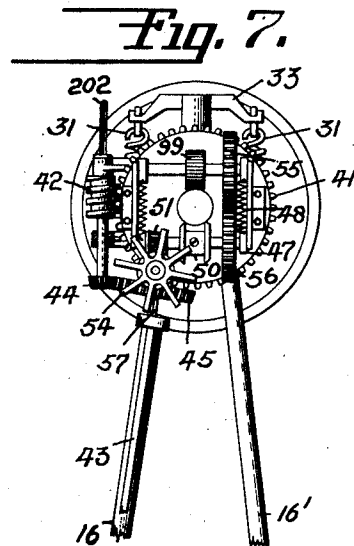
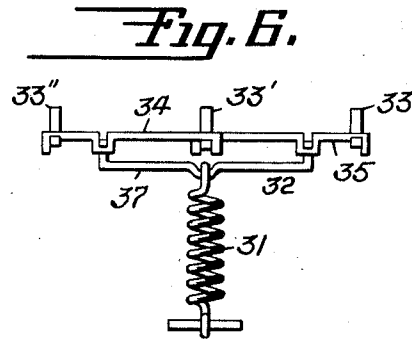
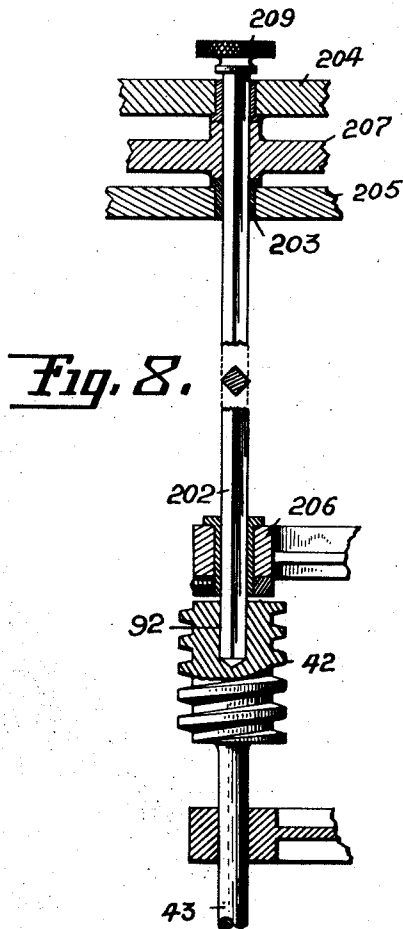
Patented Oct. 22, 1918.  
3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

*Fig. 9.*

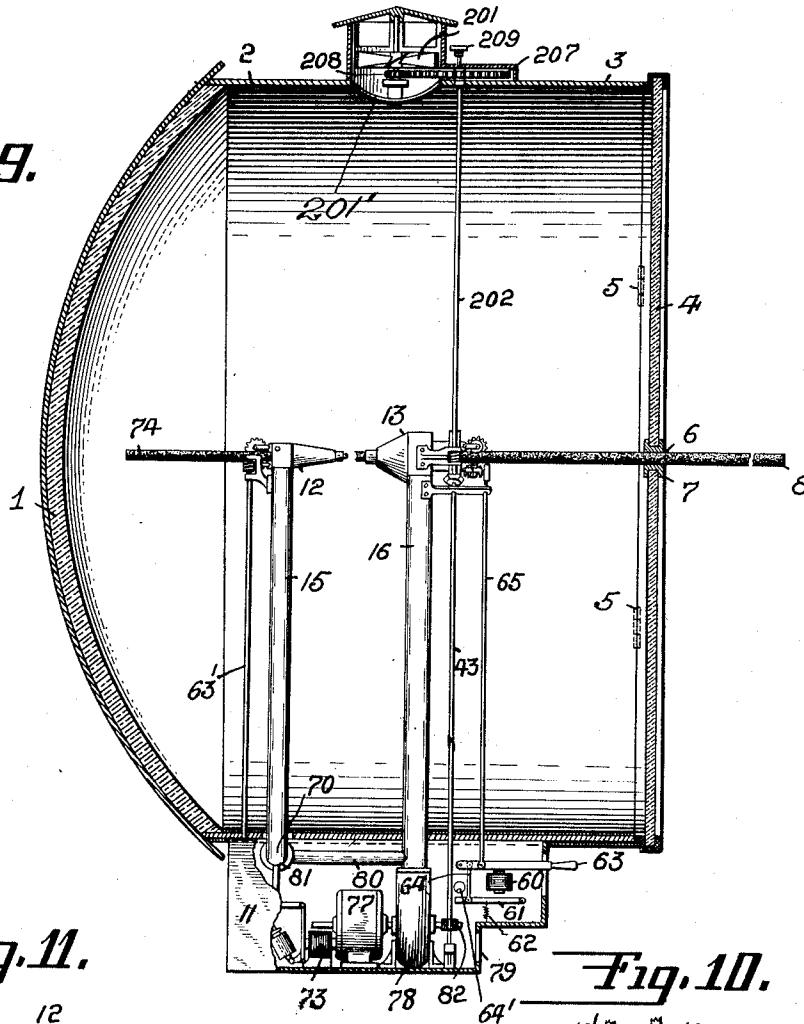


*Fig. 11.*

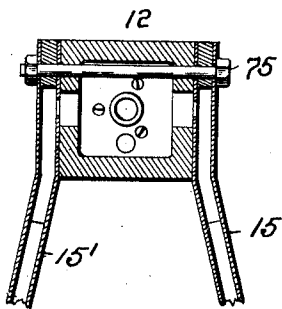


*Fig. 10.*

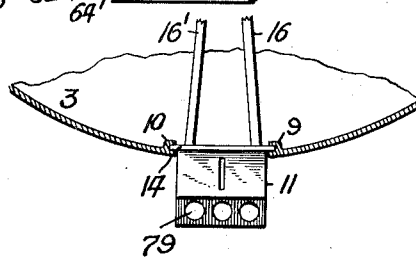
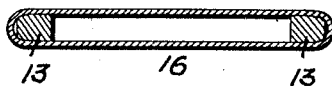


*Fig. 12.*



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# UNITED STATES PATENT OFFICE.

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## ELECTRODE-HOLDER FOR SEARCH-LIGHTS.

1,282,133.

Specification of Letters Patent.

Patented Oct. 22, 1918.

Original application filed April 16, 1915, Serial No. 21,661. Divided and this application filed March 13, 1918. Serial No. 222,208.

*To all whom it may concern:*

Be it known that I, ELMER A. SPERRY, a citizen of the United States of America, residing at 1505 Albermarle road, Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electrode-Holders for Search-Lights, of which the following is a specification.

This invention relates to high power search-lights, its object being to improve the method of operating the electrodes and the apparatus therefor so that a greatly increased candle-powder is obtained. While I propose to use in my searchlight the very latest developments in arc-sustaining and light emitting materials, such as thin, cored, flaming arc carbons, my invention does not lie in the electrodes *per se* but in the combination of such electrodes with my improved apparatus for burning the same.

For operating the electrodes of search-lights at the high current density and with the heavy currents which I propose to use, I have found the existing types of holders and other mechanical features of the standard searchlight utterly unsuited. The main object of my invention is to devise a practicable means by which the heavy current is handled within the lamp without loss or damage to the electrodes and whereby the operating conditions of the arc are improved, so that continuous, efficient burning may be secured. I have found that the principal causes of lack of brilliancy and loss of candle power in such lights are first, the loss of the heat of the crater by conduction and radiation; second, the vaporization and oxidation of the carbon farther back of the crater of the positive carbon than a predetermined amount; third, loss of electrical energy through the resistance of the carbon, and fourth, the spreading of the arc to the sides of the carbon, which is for the most part due to said vaporization and oxidation. For searchlights, the only effective light is that which issues from the crater itself or the immediate vicinity thereof. In other words, high intrinsic brilliancy at the crater is the condition most desired. The intrinsic brilliancy may be said to depend on at least four important factors—first, the electrical energy supplied to the electrode; second, the reduction of the loss due to electrical resistance within the electrode; third, the confin-

ing of the arc to the immediate vicinity of the crater, and fourth, the elimination as far as possible of the loss of heat energy due to conduction of heat back through the electrode.

It is not often realized that of the energy converted to heat at the crater only 40% is radiated (as crater emanations) from the crater as heat and light, while the remaining 60% is lost by conduction back through the carbon whence it is dissipated at lower temperature by heat radiation and convection due to air currents. It is the purpose of this invention to increase the per cent. of the energy converted into useful radiations at the crater, to decrease the conduction and convection losses and to reduce arcing from the sides of the electrode, thus materially increasing the intrinsic brilliancy. To accomplish this I run the positive carbon at high current density, surround it for some distance back of the crater with a refractory sleeve adapted to shield or insulate the electrode from air currents, and introduce current close to the arc which last is rendered possible by cooling the electrode between the point of current introduction and said sleeve. The sleeve need not and preferably does not, however, extend to the end of the electrode but stops a short distance from it so that a limited but very desirable spindling of the electrode may take place.

According to the preferred form of my invention the said sleeve, the cooling means and the current introducing means all form a part of the electrode holder, within which the electrode is both fed and rotated.

Another object of my invention is to improve the general construction of search-lights. Further objects will appear as the invention is described in detail.

In the drawings in which are illustrated several forms that the invention may assume:

Figure 1 is a sectional elevation of the holder for the positive electrode;

Fig. 2 is a corresponding sectional elevation of the negative holder;

Fig. 3 is a front view on a smaller scale of the positive electrode holder with the outer covering or shield removed;

Fig. 4 is a plan view on a reduced scale of the positive holder;

Fig. 5 is a sectional elevation of a modified form of electrode holder;

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Fig. 6 is a detail showing the method of applying pressure to the brushes in the positive holder;

Fig. 7 is a rear elevation of the positive holder;

Fig. 8 is a detail thereof;

Fig. 9 is an elevation of the interior of the searchlight drum;

Fig. 10 is a detail showing the manner in which the box supporting the lamp mechanism is supported within the drum;

Fig. 11 is a section on line 11—11 of Fig. 2;

Fig. 12 is a cross section of one of the standards supporting the holders, on line 12—12, Fig. 1.

In Fig. 9, 1 represents the reflector or projector of the searchlight 2, while the drum is shown at 3 and the front window at 4. The front window is preferably made so that it may be swung open on hinges 5 or may otherwise be removed to permit the withdrawing of the lamp mechanism. The window is shown as provided with an opening 6 near the center thereof which is reinforced by a thimble 7 through which the positive electrode 8 may project and which serves to support the outer end of the electrode. The drum is preferably provided with guideways 9 and 10 adjacent the bottom thereof. In these guideways the control box 11 which supports the electrode holders 12 and 13 is adapted to slide. For this purpose the box is shown as provided with flanges 14 which fit into said guideways. It will readily be seen that by opening the front door the control box together with the electrode holders may be readily removed. While in Fig. 9 the holders are shown as axially positioned, this arrangement may be obviously varied within fairly wide limits without affecting the operation of the invention described and claimed herein.

Instead of securing the electrodes to their holders and moving the holders bodily to effect the feeding of the electrodes, as has heretofore been the standard practice in searchlights, I prefer to make at least one and preferably both holders stationary during the normal burning of the arc and to feed the electrodes through their holders and also to rotate at least one of the electrodes within the holder.

The holders 12 and 13 for the electrodes are preferably supported from the control box 11 on hollow legs or standards 15 and 16 which preferably also serve to introduce a supply of cooling fluid to the holders, as hereinafter described, and to lead in current to the electrodes. Pairs of standards 15 and 15' and 16 and 16' are shown as provided for each holder. The holder 13 preferably comprises a metallic body portion 90 which is secured to the upper ends of the legs 16 and 16'. The said holder is provided with

an axial bore 91 for the electrode and serves to perform a variety of functions. Adjacent the forward end thereof is secured a refractory heat-resisting sleeve 17 adapted to insulate or shield the electrode from the air. Said sleeve is preferably made of quartz or the like and is shown as extending fairly close to the arcing face 18 of the electrode, but spaced a predetermined distance therefrom. The sleeve preferably forms an extension from the holder, being clamped thereto at its forward end, as hereinafter explained. This sleeve performs several important functions, among which is that it maintains that portion of the electrode which it surrounds at white incandescence by reducing radiation and shielding it from heat abstracting air currents. It also shields the electrode from vaporization and oxidation, which at this temperature would cause too great spindling of the electrode. The metallic holder also assists in performing the last named function, being joined to the sleeve. The action of the arc flame and heat on the projecting portion of the electrode is to cause it to taper to a more or less degree and hence to reduce the size of the light source, or in other words, the size of the positive crater. As is well known in searchlights, the smaller the light source secured the greater the intensity and brilliancy of the beam, so that by permitting this predetermined tapering to occur the size of the light source is appreciably reduced and the efficiency of the light increased for a given size of the positive electrode. By feeding the electrode through the holder, the length of the tapering section is kept constant, while the rotation of the electrode causes equal spindling on all sides.

As above remarked, however, only a comparatively slight spindling is allowed to take place, *i. e.*, the crater area should not be materially less than 80% of the cross sectional area. As the loss of heat from a crater by conduction depends on the cross-section of the carbon, and as in ordinary arcs such great spindling takes place that it is necessary to employ an electrode of at least twice the size of the crater, it will be seen that the sleeve permits me to reduce conduction losses by employing a small electrode.

Back of the sleeve the holder is formed in such manner as to permit the circulation therethrough or thereover of a cooling fluid such as air and to dissipate heat at a rapid rate thereto. For this purpose the holder is shown as provided with a plurality of heat-radiating fins or ribs 19 having cut-away portions 20—21 adjacent their tops and bottoms to permit the free intake and egress of the air. The holder preferably tapers toward the arc. The ribs so provided are preferably entirely inclosed by an outer member

or casing 22 which fits thereover so that a hollow interior chamber 92 is formed. Said casing is provided with a slot at 23 adjacent the top thereof which preferably tapers away from the arc from which the cooling air escapes in an upward direction. The air coming up through the hollow legs 15 and 16 enters the holder through the openings 23 and 24 and passes from the body of the holder out toward the ribs through opening or openings 25. The sleeve 17 is fastened to the holder and shield 22 by an air-tight joint 26' so that no gas or air is allowed to escape toward the arc. By employing an intensive cooling means as described for the electrode holder, I am enabled to introduce current to the electrode much closer to the arc than otherwise, since according to my invention the electrode in the drum is run at such high current density and such enormous crater temperatures are reached that the heat of an uncooled electrode near the arc would be sufficient to seriously damage any brushes employed to introduce current to the electrode. By my invention I am also enabled to greatly reduce the size of the electrode holder, which would otherwise be necessary to dissipate the large amount of heat generated. I thereby gain the advantage of compactness and also cut off a minimum amount of light from the searchlight beam. This effect is further increased by tapering the ribs toward the arc as described. By employing this cooling means I am enabled to place the brushes 26 on the holder immediately back of the cooling ribs, thereby reducing the resistance losses in the electrode and securing a compact structure.

One construction for the brushes is as follows: The holder is provided near its top with an oval or elongated aperture at 27 leading down to the electrode. In the said aperture is fitted a block 28 having a plurality of holes 29 therein. In the said holes are fitted the brushes 26, proper. Each brush is shown as provided with a detachable wearing block 30 for making contact with the rotating electrode. Pressure is applied to the brushes by means of a pair of springs 31 which act through a system of equalizing links 32 upon the ends of cross pieces 33, 33' and 33'' mounted in slots at the top of the blocks. The equalizing links (see Fig. 6) preferably comprise a pair of links 34 and 35, each of which has its inner end supported on the central piece 33' and extends in opposite directions to the corresponding outer piece 33 or 33''. The springs 31 are secured to the center of the equalizing bar 37 which has its ends supported by links 34 and 35, the points of connection being such that equal pressure is exerted on all brushes.

As above stated I prefer to rotate and feed the positive electrode through its holder.

While the specific mechanism for effecting this purpose forms no part of this invention, being claimed in my copending application for "improvements in searchlights", Serial No. 21,661, filed April 16, 1915, of which this present case is a division, I have illustrated and will briefly describe the mechanism more completely set forth and claimed in said application.

Journalled upon said body portion 90 is a rotatable member 40 upon which is mounted a worm wheel 41. Said wheel is rotated by means of a worm 42 rotated from the shaft 43 extending without the drum through gears 44 and 45. Pivotaly mounted on the face of said member or gear is a pair of brackets 46 and 47 which are normally pulled together by a spring 48. The brackets carry the feed rollers 49 and 50 on the electrode. The rollers are rotated by means of worm wheel 51 mounted upon the shaft of the roller 50 and worm 52 on the shaft 53 of the gear or star wheel 54. Motion may be transmitted to the feed roller 49 through spur gears 55 and 56 mounted on the shafts of the rollers respectively. It may be readily seen that as the member 40 revolves, the feed rollers and gears will be carried around with it and thereby rotate the electrode, and also that the star wheel 54 will be revolved in a planetary fashion about the electrode but will not be rotated upon its own axis. To effect the feed of the electrode a stop pin 57 is provided which may be adjusted into or out of the path of the star wheel. The position of the stop may be automatically controlled by the position of the arcing face of the electrode as disclosed in said other application; or it may be adjusted by hand. The automatic means is diagrammatically represented in Fig. 9 by an electro-magnet 60 which operates to draw the pivoted armature 61 against the action of the spring 62 thereby raising the lever 63 through the link 64 and also the rod 65 of which the said stop means is an extension.

It will be readily seen that upon excitation of the magnet 60, which may be effected in any manner such as by the voltage across the arc or the position of the electrode with respect to a thermostat, the stop may be pushed into the path of the star wheel and the feeding of the electrode effected; and also that the stop may be pushed out of the path of the star wheel by the action of spring 62 so that the feeding will stop. It will also be apparent that the stop may be placed in the path of the star wheel by raising the handle 63 or by an adjustment of the cam 64'.

The construction of the negative holder 12 as shown is similar to that of the positive holder, so that only the points of difference need be mentioned. The feeding mechanism is simplified, as I do not find it necessary

to rotate the negative electrode; hence the feeding rollers 61' and 62' may be rotated directly from the drive shaft 63' as by means of a worm on the drive shaft, and worm wheel 65 on the shaft of the roller 62'. Gears 66 and 67 transmit motion to the upper roller as before. An added change is made possible in the negative holder due to the different conditions presented in the two cases. With the positive electrode the greatest amount of heat seems to be generated at the crater face and is carried back by conduction. The problem of introducing current close to the arcing face of the positive electrode therefore resolves itself mainly into the dissipation of the crater heat far enough from the crater so as not to materially lessen the crater temperature. It is partly to maintain this crater temperature that the refractory sleeve is employed. With the negative electrode, on the other hand, which is much smaller in diameter, the heating effect is mainly due to the resistance of the electrode, the current density being sufficient to maintain it at white heat. It is a matter therefore of even more importance in the case of the negative electrode to introduce the current very close to the arcing face and to keep the brushes as cool as possible. Accordingly, the spring pressed brushes 167 which are employed for insuring good contact with the electrode are positioned forwardly of a portion of the cooling ribs 68, another portion of the cooling ribs 69 being placed in front of the brushes and in contact with the electrode. A protective sleeve 70 may also be used for the negative electrode for the purpose of preventing too rapid spindling thereof. The negative holder is shown as made up of a plurality of detachable sections 71, 72, and 73 so as to give ready access to the brushes. In order that the negative electrode 74 may be inserted in the holder the latter is pivotally secured to the legs 15 and 15' (see Fig. 11) by means of a bolt 75 on which it may be swung upwardly. Besides placing the holder in a position in which the electrode may be inserted, this upward movement will disengage the worm wheel 65 from the worm 164 thus allowing the feed rollers to rotate easily when inserting the carbon.

While neither holder is moved for bringing about the feeding of the carbons, I prefer to move the negative holder substantially axially for striking the arc. To permit of this, I pivotally mount the legs 15 on pivot 70, located outside of the searchlight, and provide means for oscillating the holder about this pivot to strike the arc as explained in said other application, the arc striking magnet being at 73.

In the control box is mounted a single motor 77, which furnishes power for all of

the various purposes that may be found necessary. For furnishing a continuous supply of cooling medium to the holders and within the drum a fan blower 78 or other means for creating a pressure difference between the two ends of the passage leading through the hollow legs and the holders is mounted in said box and is driven by said motor preferably by coupling it directly thereto. The supply of air may be drawn through holes 79 in the box and is forced by the blower up through legs 15 and 16, a cross pipe 80 being provided to lead the air across to legs 15 which are hinged thereto at point 81. Motor 77 also supplies power for rotating and feeding the positive carbon through the long shaft 43, which may be rotated from the motor shaft by worm gearing 82. In order that the least amount of shadow may be thrown by the transmission mechanism both shafts 43 and 65 are placed in line with one of legs 16 or 16'. Said legs are preferably placed in line with and parallel to legs 15. Within box 11 is also placed the mechanism for feeding the negative carbon as described in said other application.

Shaft 63' is provided with a universal joint 102, and slidable coupling 103, in order to permit oscillation of holder 12 about pivot 70. Also said shaft should be mounted in line with one of legs 15 or 15'.

On account of the intense heat of my type of arc lamp, and the consequent danger of damaging the reflector, and also on account of the fumes generated by a flaming arc which condense on and dim the reflector, I prefer to equip my searchlight with an exhaust fan 201, at the exhaust opening 201' which may be at the top of the casing 2 (Fig. 9). For rotating the fan, a slender squared shaft 202 may be employed, which normally fits loosely in a squared opening 92 in worm 42 (Fig. 8). Sleeves 203 are provided in the bearings 204, 205 and 206 for the shaft, so as to permit rotation thereof. A gear 207 is slidably but non-rotatably mounted on the shaft 202, and drives the fan 201 through pinion 208. Shaft 202 may be moved longitudinally by means of finger piece 209, so as to disengage it from shaft 43 when it is desired to remove the holder 13.

In Fig. 5, a slightly modified form of holder 13' is shown, the principal difference being in the method of securing the refractory sleeve 17' to the holder. In this case the sleeve 17' is made with a flaring end 214, which is clamped between the conical end of holder 13', and the cone-shaped shield 22', said shield being drawn into close engagement therewith by a spring 215. Packing rings 216 may be provided to insure a tight fit. Also in this figure, the shield 20' is shown as made up of a metallic base 218.

coated with a protective insulating material 219, to shield the metal and the holder from the intense radiation of the arc.

The holder 13 is also made use of to cut off at least the major portion of the direct rays from the negative carbon which are regarded as objectionable. To supplement this action, a small shield 220 may be provided to more effectively cut off all rays from a predetermined arc such as those that would shine on the deck of the vessel.

The operation of the searchlight is as follows: as soon as the current is turned on and adjusted through any means, magnet 73 will strike the arc, as will be readily apparent. At the same time the motor 77 is started up, and all the various functions performed thereby are set into motion. The cooling medium is forced up the legs 15 and 16 and into intimate contact with the holders 12 and 13 and rotating mechanism 40 revolves carbon 8 and also feeds it under the control of the mechanism shown in Fig. 7, which is responsive to the changes of the position of the positive crater. At the same time the exhaust fan 201 is started, which aids in ventilating and cooling the interior of the drum by assisting the blower 78 in forcing air through the drum. The streams of air issuing from slots 19 also perform an important ventilating function in that they entrain the fumes from the arc and carry them directly to the opening 201.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus, which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

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

1. In a searchlight, an electrode holder comprising means for introducing current to the electrode, a metallic portion adapted to closely fit the electrode between the point at which current is introduced to the electrode and the arc, a plurality of heat radiating ribs on said portion, and means for intensively cooling said portion by circulating a cooling medium thereover.

2. In a searchlight, means for confining the consumption of the positive electrode to the region of the tip, comprising a metallic jacket adapted to fit the electrode near its end, means on said jacket for dissipating

heat to a circulating cooling medium and means for preventing said medium from coming into direct contact with the electrode.

3. In a searchlight, an electrode holder comprising a metallic member adapted to fit the electrode, a plurality of heat radiating ribs on the forward portion thereof, a shield for inclosing said ribs, means for introducing a supply of cooling gas within said shield, and means permitting the escape of said gas at the top of said shield.

4. In a searchlight, a hollow casing adapted to surround the electrode adjacent the arc, said casing being closed at its forward end, means for causing air to flow therethrough, means for feeding the electrode through the casing, and a refractory, heat insulating sleeve, extending forwardly from the casing to within a predetermined distance of the electrode tip.

5. The herein described method of operating arc lights for projectors which consists in operating the positive electrode at high current density and excluding all gases from the end of the electrode up to a point immediately adjacent the arc, and in vigorously abstracting heat from said end by circulating a cooling medium therearound.

6. The method of operating arc lights for projectors, which consists in operating an electrode at high current density, introducing the current supply close to the arc, and in abstracting heat from the electrode between the arc and the point of application of the current by the circulation of a cooling medium.

7. In an arc light, the combination with a positive electrode, of a jacket adapted to abstract heat from the electrode, and means on said jacket causing rotation and axial movement of the electrode within the jacket.

8. In a searchlight, means for confining the arc to the tip of an electrode, comprising a heat abstracting casing adapted to surround the electrode adjacent the arc and to closely fit the same throughout the greater portion of its length, and means for supplying and circulating a cooling fluid within said casing.

9. In a searchlight, the combination with a drum, an electrode holder positioned therein having an air passage therethrough, an air duct leading from a point without the drum to said holder, and means for circulating air through said holder and duct.

10. In a searchlight, the combination with a drum, an electrode holder positioned therein having an air passage therethrough, an air duct leading from a point without the drum to said holder, and means for causing a difference in pressure to exist at the inlet of the duct from that at the outlet of the holder.

11. In a searchlight, the combination

with a drum, an electrode holder positioned therein having an air passage therethrough, an air duct leading from a point without the drum to said holder, and means for causing  
5 a difference in pressure to exist at the inlet of the duct from that at the outlet of the holder whereby air is caused to flow from without the drum through the duct and holder.

12. In a searchlight, the combination with a drum, and an electrode holder movably located therein, means for cooling said holder comprising a duct connecting said holder and a point without the drum, an air  
15 circulating device connected to said duct, the connections being such that air may be supplied thereto irrespective of the movements of the holder.

13. In a searchlight, the combination with a drum and an electrode holder pivotally located therein, means for cooling said holder comprising a duct connecting said holder and a point without the drum, an air circulating device connected to said duct  
20 and a joint in the connections between the device and the duct.

14. In a searchlight, the combination with a drum and an electrode holder movably located therein, a hollow support for said holder, a pivot therefor having a passage  
30 therethrough, and means for causing a circulation of a cooling medium through said duct to said holder.

15. In a searchlight, the combination with the drum and electrode holders, of means for ventilating the drum comprising an inlet air duct leading from a point without the drum and having an outlet adjacent an electrode holder, and means for causing air to pass  
40 through said duct, whereby a current of air is produced leading away from said holder which entrains the fumes from the arc.

16. An electrode holder for a positive electrode adapted to be operated at high current density comprising a forward heat resistive and insulating sleeve, adapted to extend close to the arc, a metallic heat abstracting section, means for circulating cooling air over said section, and means for introducing  
50 current to the electrode located adjacent said section.

17. An electrode holder for a positive electrode adapted to be operated at high current density comprising a forward heat resistive and insulating sleeve adapted to extend close to the arc, a metallic heat abstracting section, means for circulating air over said section, and means also located adjacent said section for feeding the electrode through the  
60 holder.

18. In a searchlight, an electrode holder comprising a metallic member adapted to fit the electrode, a plurality of heat radiating ribs on the forward portion thereof, an inclosure for said ribs, and means for introduc-

ing a supply of air within said inclosure, said inclosure being provided with an opening to permit the escape of said air.

19. In a searchlight, an electrode holder including a hollow portion having an interior and exterior wall and a central aperture through the interior wall for an electrode, ribs on said interior wall, and means for introducing a supply of air within said portion.

20. In a searchlight, an electrode holder including a hollow portion having an interior and exterior wall and a central aperture through the interior wall for an electrode, ribs on said interior wall tapering in diameter toward the arc, an opening in said exterior wall tapering away from the arc, and means for introducing a supply of air within said portion.

21. In a searchlight, a metallic jacket adapted to fit the electrode adjacent its end, heat dissipating ribs thereon, a forwardly extending refractory and insulating sleeve, and means for blowing air over said ribs.

22. In a searchlight, a metallic jacket adapted to fit the electrode adjacent its end, heat dissipating ribs thereon, a forwardly extending, refractory and insulating sleeve, means for blowing air over said ribs, and means for preventing said air from disturbing the arc.

23. The herein described method of producing a high power arc between carbonaceous electrodes which consists in introducing current to the positive electrode at a comparatively short distance from its arcing end, in cooling that portion of the electrode immediately adjacent said point of current introduction and in preventing the loss of heat from and the oxidation of said electrode within a zone adjacent said arcing end and between it and said cooled portion.

24. The herein described method of producing a high power arc between carbonaceous electrodes which consists in introducing current to the positive electrode at a comparatively short distance from its arcing end, in cooling that portion of the electrode immediately adjacent said point of current introduction and in preventing the loss of heat from and the oxidation of said electrode within a zone adjacent but spaced from said arcing end and between it and said cooled portion.

25. The herein described method of operating arc lights for projectors, which consists in operating a carbonaceous electrode at high current density, jacketing the electrode between the point where it receives current and the arc, circulating a cooling medium therearound and causing relative movement between the jacket and the electrode.

26. In a searchlight, an electrode holder including a hollow portion having an interior and exterior wall and a central aper-

ture through the interior wall for an electrode, ribs on said interior wall tapering in diameter toward the arc, and means for introducing a supply of air within said portion.

27. In a searchlight, an electrode holder of comparatively small diameter including means on the holder for feeding an electrode therethrough and heat dissipating means on the holder which are located between the arc and said feeding means and which taper toward the arc.

28. In a searchlight, a drum, a pair of arc electrodes within said drum, said drum being provided with an exhaust port and means for introducing into said drum a current of air directed away from the arc but toward said exhaust port.

29. A searchlight comprising a drum, an electrode, a hollow support for said electrode and means for injecting outside air into said drum through said support.

30. A searchlight comprising a drum, an electrode, an electrode holder provided with an air passage, a hollow support for said holder and means for injecting outside air into said drum through said support and holder.

31. In a searchlight, the combination with a drum, an electrode holder positioned therein, means without the drum for furnishing a continuous supply of gaseous cooling medium to said holder, and a support for said holder, said support also constituting a duct for leading the cooling medium from said means to said holder.

32. In a searchlight, the combination with

a drum, an electrode holder positioned therein, means without the drum for furnishing a continuous supply of cooling medium to said holder, a support for said holder, said support also constituting a duct for leading the cooling medium from said means to said holder, and means also located without the drum for feeding the electrode through said holder.

33. In a searchlight, the combination with a pair of electrode holders, driven means connected to each holder for feeding the electrodes, an air circulating device for cooling either holder, a source of power, and means connecting said power source with each of said driven means and with said device.

34. In a searchlight, an electrode holder comprising a metallic portion adapted to closely fit the electrode between the point at which current is introduced to the electrode and the arc, a chamber around said portion, means for feeding the electrode through the holder, a blower for circulating air through said chamber, and a motor for operating both said blower and said feeding means.

35. In a searchlight, the combination with an electrode holder, of driven means mounted on the holder for both feeding and rotating the electrode through and within the holder, an air circulating device for cooling said holder, a source of power and means connecting said power source with said means and said device.

In testimony whereof I have affixed my signature.

ELMER A. SPERRY.