Dec. 22, 1942. H. BECK 2,305,757

ELECTRIC SEARCHLIGHT

Filed Sept. 11, 1940 2 Sheets-Sheet 1

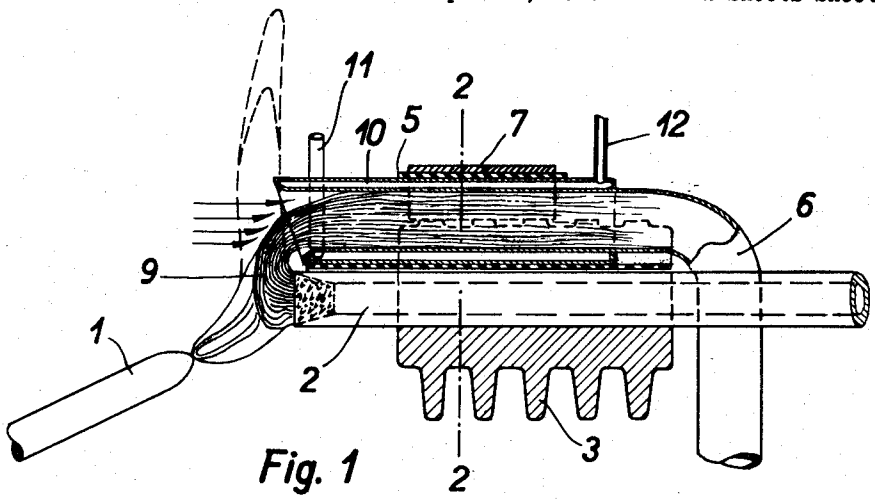


Fig. 1

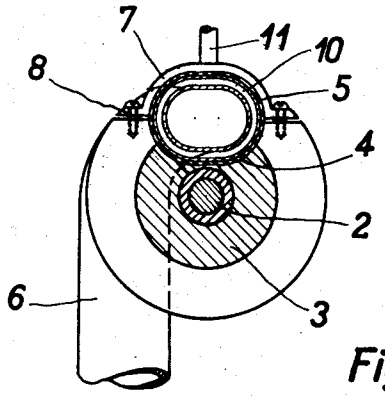


Fig. 2

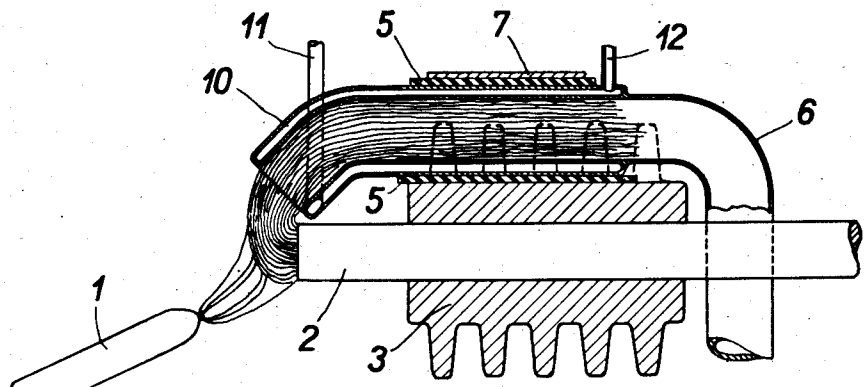


Fig. 3

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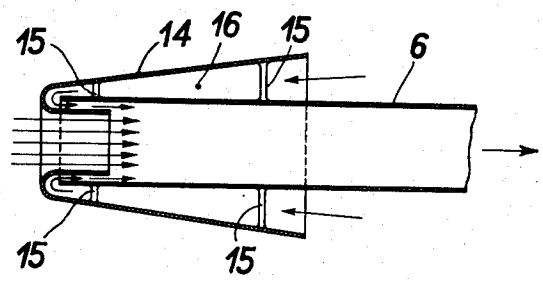


Fig. 4

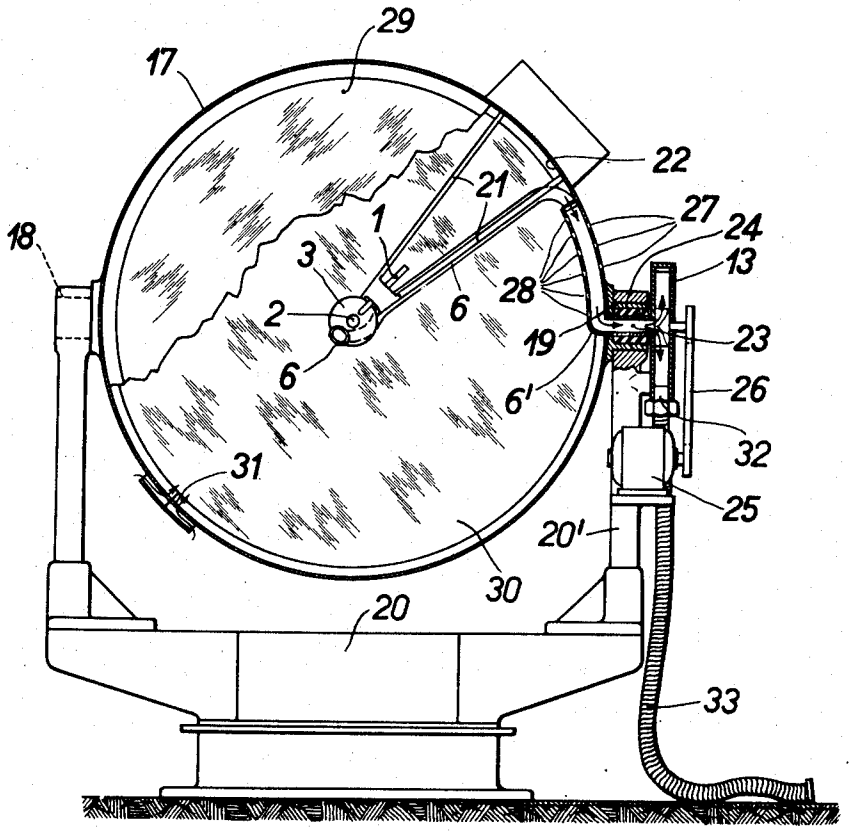


Fig. 5

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UNITED STATES PATENT OFFICE

2,305,757

ELECTRIC SEARCHLIGHT

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Application September 11, 1940, Serial No. 356,349
In Germany July 19, 1935

3 Claims. (Cl. 176—41)

High intensity arc-lamp searchlights are known to embody two drawbacks when in operation. One of these drawbacks is occasioned by the emitted beam of light being accompanied on the outside by a tunic of intense adventitious light which is produced by a relatively large flame of the arc outside of the crater and which causes an undesirable illumination of the foreground impairing observation. The other drawback lies in the fact that the electrode—which contains luminous agents—produces vapors deposited on the reflector and front glass usually in the form of a white precipitate and considerably reduces the illuminating performance of the searchlight when in operation for a length of time, particularly the light-beam is turned in an upward direction.

To prevent the occurrence of said precipitate suggestions were already made to the effect that the vapors be conducted directly into the open air by means of a duct located either above or below the arc and provided with an exhaustor for increasing the ventilating pull. The duct is at the same time to eliminate the adventitious light. In the case of the horizontal arcs or of arcs curving downwards and where the hot air current makes the end of the arc-flame leap upwards, attempts also were made to influence the arc-flame by means of a duct equipped with exhaustor in a way causing the leaping end of the flame to be deviated and redirected by the pull into its natural drawn-out position. In doing so, however, only small wind-velocities could be employed owing to the susceptibility of the arc to wind-influences in the direction in which the flame deviated, and in which, by the way, the suction devices were installed. The searchlight being required to operate in any position and the suction device having had, in certain positions, to counteract the natural thermal buoyancy, while in other positions again the pull was supported by the natural buoyancy, interferences were occasioned by the pull having been either too weak or too strong depending upon the position the searchlight occupied. While the pull to remove the vapors from the searchlight-housing was insufficient in the first instance, an unfavorable influence was exerted upon the arc in the second. What proved to be of particular disadvantage in these devices was that owing to the permissible wind-velocity being so low the cross sections of the ventilating ducts had to be rather large. The devices in question accordingly represented considerable umbral bodies in the light reflected by the mirror and reduced the illuminating performance of the searchlight. In order now to so locate and screen-off the arc-flame as to cut out most of the undesired adventitious light and at the same time to as much as possible prevent the device itself from forming any interfering shadows and furthermore, in order that all vapors and gases be removed an exhaustor is provided for whose ventilating duct, according to the invention, is disposed on the side of the positive electrode. The said duct runs alongside and terminates closely near the burning end of the electrode where the axis of its terminal cross section so intersects the arc-flame at an angle and through which duct a gas current flows at such a velocity that, already near its foot at the positive electrode, the flame is deflected from its normal direction and pulled as a whole into the ventilating duct. The action of the latter will prove particularly effective if carried up to the end of the positive electrode in such a manner that it extends parallelly alongside of the electrode. Alternatively, it is also possible to so bend the terminal of the duct facing the flame that its axis intersects the axis of the positive electrode at an angle of about 45°. The positive electrode of high intensity arc lamp searchlights being in most instances surrounded by an electrode-head it will be expedient to correspondingly provide same with a recess or a boring so as bring the duct as closely up to the lower part of the flame as possible. The greatest part of the light-arc now lies within the duct this impeding the emission of its light and the formation accordingly of the said adventitious light. Simultaneously with the light-arc being in this manner pulled away near the crater an increase is occasioned in the specific brightness of the crater-light and the light steadied.

It will furthermore be of advantage to artificially cool that terminal of the duct facing the light-arc by surrounding the said terminal with a hollow space taking the cooling agent. In this manner the pull exerted upon the arc-flame is substantially assisted in that the extremely hot gases of the light-arc experience a sudden and effective cooling-down in the cooled section of the duct resulting in a reduction of their volume. This process again exerts a sucking action upon the adjacent hot gases, thus resulting in the flame being voraciously swallowed up and deflected from its direction, while the gases and vapors are at the same time pulled out of the searchlight-housing. For air-cooling a tube should suitably be provided at the respective point of the duct where the cooling-off is to take effect, the said tube to be concentric to the duct and attached throughout its entire length at a certain distance away from the jacket of the duct whose terminal facing the flame is so bent towards the inside that it protrudes into the interior of the duct and that it permits to pull into the duct the cool air from the other end of the tube through a hollow space formed by the said tube.

Also, when high current intensities are used, it will be of advantage to artificially cool either the whole duct or part of same on account of

the hot exhaust gases making the exhaustor become very hot thus reducing its performance. For this reason it is of particular advantage to provide air inlets at various points in the duct for the purpose of introducing fresh air which effectively reduces the temperature of the exhaust gases thus cooling down the duct and the exhaustor and maintaining an even performance. An arrangement of this kind permitting, as previously mentioned, of the exhaust gases being pulled into the duct at a high current velocity the necessary suction volume requires but a small cross section for the duct, so that there will be no difficulty in situating such a duct behind those respective parts of the lamp producing shadows per se and conduct it to the exhaustor through one of the pivots of the searchlight-housing. In addition to the above, the high current velocity in the duct is of advantage in that the sublimation-products of the vapors are not deposited therein beyond a certain thickness. The high suction velocity permitted by the said arrangement affords a further advantage in that the light-arc retains its form and perfect burning qualities in any position the lamp may occupy.

A constructional example of the invention is illustrated by Figs. 1 to 5 of the accompanying drawings as follows:

Fig. 1 a view partly in section showing the attachment of the duct to the electrode-head of the anode of the searchlight,

Fig. 2 a cross section of the electrode-head along the sectional line 2—2 of Fig. 1,

Fig. 3 a further constructional example of the terminal of the duct facing the arc-flame,

Fig. 4 one terminal of the duct facing the arc-flame, provided with an air-cooling contrivance,

Fig. 5 diagrammetric view of the total arrangement of the searchlight;

In Fig. 1 the cathode is referred to as 1 and the anode as 2, the latter being disposed in electrode-head 3. The electrode-head is provided with a recess 4 running parallel to the axis of the anode and, embedded in an electric insulation 5 in the said recess and reaching up closely to the end of the anode, lies the terminal of a duct 6. By means of a bearing cover 7 attached to the electrode-head 3 with the aid of screws 8, the terminal of the duct is connected with the electrode-head, as shown in Fig. 2. That respective terminal of the duct facing the arc-flame 9 consists of double walls forming a receptacle 10 for the cooling agent and being provided with an inlet 11 and an outlet 12 for the said cooling agent. The other end of the duct 6 leads to an exhaustor 13 as shown in Fig. 5.

According to Fig. 3 the terminal of the duct 6 facing the arc-flame 9 is bent, its axis intersecting the axis of the anode at an angle of about 45°.

In Fig. 4 the front end of the duct is arranged for taking an air-cooling contrivance. For this purpose a tube 14 is throughout its whole length concentrically disposed a distance away from the jacket of the duct 6, and is supported by means of braces 15. That end of the tube facing the arc-flame 9 is so bent towards the inside that it protrudes into the interior of duct 6 and that the cooling air may be pulled from the other end of tube 14 into the duct through a conically hollow space 16 formed by the said tube.

The searchlight housing 17 is pivotally disposed in a bogie 20 by means of two pivots 18 and 19. From the electrode-head 3 the duct runs alongside of a carbon holder 21 up to the inner wall 22 of the searchlight housing 17 and, alongside the latter, proceeds from there up to a tube 23 mounted in and coaxially to the pivot 19. Connected to the tube 23 is an exhaustor 13 rigidly attached to the bearing arm 20' of bogie 20 for the pivot 19, while the tube 23 is rotatable in the housing of the exhaustor. Disposed between the tube 23 and the pivot 19 is a tube 24 of insulating material to prevent any excessive heating of the pivot and its bearing. The exhaustor 13 is actuated with the aid of an endless chain 26 driven by an electric motor 25. Also the exhaustor 13 may be rigidly connected to the pivot 19. In the flat portion 6' of the duct 6 lying against the inner wall 22 of the searchlight housing 17 a number of openings 27 are provided for to permit the entry of fresh air to the hot exhaust gases. By the provision on this part 6' of the duct 6 of openings 28 in the interior of the searchlight housing the latter is at the same time ventilated for the additional purpose of cooling the front glass 29 and the mirror 30. In this case the fresh air is permitted to so enter the housing 17 in one or several suitable places 31 that it is bound to sweep over the mirror and the front glass. Part 6' of the duct 6 lying in front of the pivot can be placed, if necessary, over a far greater section of the inner wall 22 than is shown in the drawings in order that the front glass and the mirror may be cooled to any desirable degree.

To prevent the dust blown out of exhaustor 13 from being drawn back, through the opening 31, into the searchlight housing and either be deposited there or whirl up in the projected light beam where it would produce a dazzling effect as a result of being subjected to the intense brightness of the light, provision is made either for a suitable dust-filter which is expediently placed before the outlet 32 of the exhaustor, or for a flexible metal hose 33 which is attached to the said outlet as shown in Fig. 5 and which, depending upon the direction of the wind is so placed that the wind carries the exhausted bodies outside of the range of the searchlight.

What is claimed is:

1. In an electric searchlight a high intensity arc lamp, said lamp comprising an electric holder, a pair of arc electrodes disposed on said holder, a duct placed on the side of the positive electrode, running alongside this electrode and terminating closely at its burning end, while the axis of the terminal cross section of said duct intersects the electric arc at an oblique angle, and a high power exhaustor connected to said duct.

2. In an electric searchlight a high intensity arc lamp, said lamp comprising an electric holder, a pair of arc electrodes disposed on said holder, a duct placed on the side of the positive electrode, running alongside this electrode and terminating closely at its burning end, the terminal of said duct facing the arc-flame being bent, while its axis intersects the axis of the positive electrode at an angle of about 45°, and a high power exhaustor connected to said duct.

3. In an electric searchlight according to claim 1 a cooling chamber disposed concentrically to said first named duct and provided with two connections.

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