Dec. 4, 1934. F. A. BENFORD 1,983,337

SEARCHLIGHT

Filed April 29, 1932

Fig. 1.

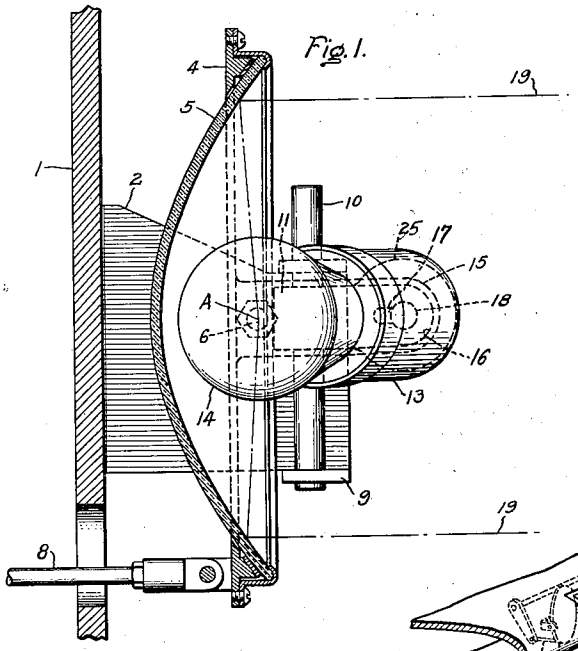


Fig. 4.

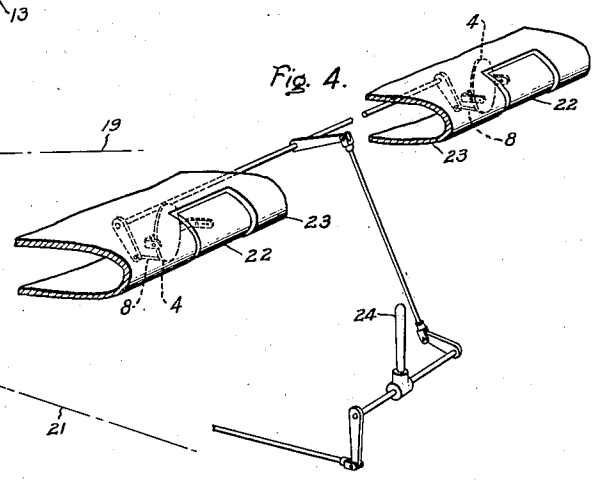


Fig. 2.

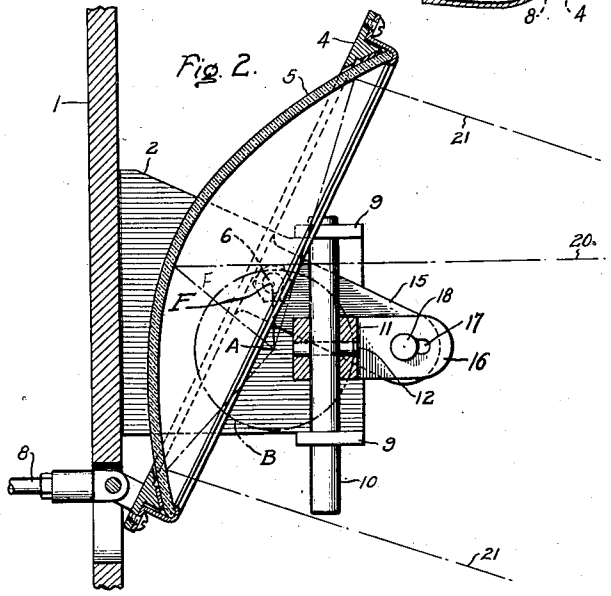


Fig. 3.

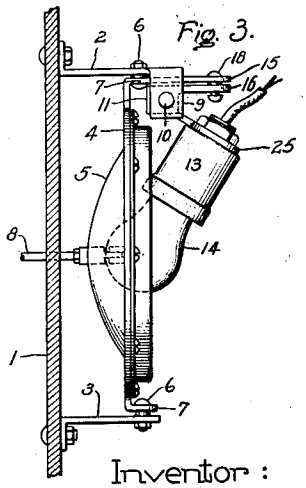
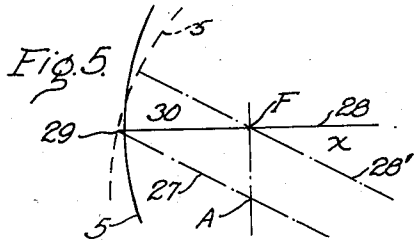


Fig. 5.



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Patented Dec. 4, 1934 1,983,337

UNITED STATES PATENT OFFICE

1,983,337

SEARCHLIGHT

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Application April 29, 1932, Serial No. 608,245

3 Claims. (Cl. 240—7.7)

The present invention relates to searchlights and has for its object to provide an improved construction and arrangement in a searchlight whereby it may be adjusted to vary the depth of the beam without disturbing unduly the direction of one edge, for example, the top edge, of the beam; in other words, the searchlight can be adjusted to vary the depth of the beam while maintaining in one selected direction a substantially parallel beam.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

According to my invention, I utilize a parabolic mirror or reflector and mount it so that it can be rotated about a horizontal transverse axis through the focal point, and in connection with the mirror I provide a lamp so mounted and arranged with respect to the mirror that when the mirror is rotated the lamp, with regard to the optical axis of the mirror is moved vertically downward. With this arrangement, for every position of the lamp, there is a section of the mirror reflecting a substantially parallel to the horizontal beam, while the remaining sections of the mirror give a flaring beam that is in all parts to one side of the parallel beam.

In the drawing, Fig. 1 is a vertical sectional view of a searchlight embodying the invention, it being a searchlight well adapted to be mounted in the wing of an airplane; Fig. 2 is a sectional view similar to Fig. 1, but showing the reflector adjusted to a different position; Fig. 3 is a top plan view of the construction shown in Figs. 1 and 2; Fig. 4 is a diagrammatic perspective view illustrating the manner in which the searchlight may be applied to the wings of an airplane to form landing lights therefor; and Fig. 5 is a diagram indicating the relative movement of the light source with respect to the mirror surface as obtained with the mechanism illustrated.

Referring to the drawing, 1 indicates a base which in the case of airplane landing lights may be a part of an airplane wing. Mounted on base 1 are spaced brackets 2 and 3. Pivotally mounted between brackets 2 and 3 is a frame 4 to which is attached a parabolic mirror or reflector 5. The pivots for the frame may be of any suitable construction, being shown in the present instance as studs 6 projecting through ears 7 on frame 4. Connected to the edge of frame 4 is a rod 8 by means of which the frame and mirror may be turned on pivots 6.

Bracket 2 is provided with spaced ears 9 having openings in which a pin 10 is adapted to slide. Fastened to pin 10 is a block 11, it being fixed to the pin by means of a transverse rivet 12. Carried by block 11 is an arm 15 to which is attached a lamp socket 13 for the lamp bulb 14. With this arrangement the lamp bulb 14 can be adjusted by moving pin 10 through the openings in ears 9 since block 11 is rigidly fastened to the pin and the lamp bulb is carried by the block.

The pin 10 and block 11 are connected to the reflector so that when the reflector is turned the pin and block are moved vertically as shown in Figs. 1 and 2, thus adjusting the lamp bulb 14. To this end there is provided on frame 4 a projecting arm 15 having a pin 18 solidly attached to it and projecting into slot 17 in an ear 16 which projects from block 11. With this arrangement, it will be seen that when the reflector is turned on its pivots 6, arm 15 will move to raise and lower block 11 and pin 10, thus moving the lamp bulb 14 relatively to the reflector. In Figs. 1 and 2, A indicates the center of the light source, and in Fig. 2 the dotted circle B indicates the outline of lamp bulb 14.

With the reflector and lamp bulb in the relative positions shown in Fig. 1, the light rays are all directed in a horizontal beam thereby producing a relatively narrow beam of greater intensity. This is due to the fact, as is known in the art, that the center A of the light source coincides with the focal point F of the mirror. The direction of the light rays are indicated by the dot and dash lines 19. When the reflector and lamp bulb are adjusted relatively to each other, the reflector is rotated about an axis extending through studs 6 and through the focal point F. The lamp is moved along a vertical line F—A (see Fig. 5) due to the movement of pin 10 in its bearings. The path of movement of the point A is, therefore, a vertical line also extending through the focal point of the mirror. The depth of the beam is thereby gradually increased but due to the relative movement which takes place, there is always a section of the mirror which reflects a substantially parallel beam. When the mirror is rotated, about the axis transverse the focal point, the axis 28 (see Fig. 5) of the mirror and therefore the beam is rotated. In Fig. 5 a maximum rotation of angle X is assumed for the purposes of this description. In order to maintain a section of the beam parallel to the original direction, it is necessary to lower the light source A until the line 27, drawn between the light source A and the intersection 29 of the mirror and the axis 28, is parallel to the axis 28', or the new position of

the axis 28. The portion of the mirror at the intersection 29 reflects rays which are parallel to the original position of axis 28.

This may be better understood when bearing in mind the fact that each point on a parabola has conjugate foci. It has been shown that the path of the foci conjugate to the main focal point is a parabola having a focal length one-half that of the first parabola or mirror surface and that this path may be found by laying off on the parallels, which intersect the mirror, distances equal to the distances between the focal point and the intersecting points of the respective parallels, so that in Fig. 5 the line 27 is one of the parallels and the distance from A to the mirror should be approximately equal to the distance 30, between the point 29 and F, the focal point.

The distance 30 between the points F and 29 and the distance 27 between points A and 29 are not equal, since the distance 27 is the hypotenuse and the distance 30 is a leg of the same triangle. Fig. 5 illustrates the maximum angle to which it is necessary to turn the light beam for landing purposes. The light source A is moved by the mechanism to approximate the correct path according to the theory set forth above, that is, in such manner that the center of the light source will be approximately in the conjugate focal path of the reflector and therefore the upper edge of the beam remains stationary. A slight increase in the distance 27 over the distance 30 is obtained by the apparatus above described. This is practically negligible, however, since the light source is located along the proper line for maintaining the upper edge of the beam in its original position, and the increase of the distance over what it should be, in order to be absolutely accurate, results merely in a slight spreading of the light beam and does not interfere with the main distribution of the light rays. In Fig. 2 the parallel beam is indicated by the dot and dash line 20 and the angular portion of the beam is indicated by the dot and dash lines 21.

A construction embodying my invention is especially well adapted for wing landing lights for an airplane and in Fig. 4 this application of my invention is illustrated diagrammatically. As there shown, the frames 4, mounted behind transparent sections 22 in the wings 23 of an airplane, are connected by suitable links and levers to a control handle 24 of the airplane, this being a handle which is moved to alter the angle of the stabilizing fins when it is desired to depress the tail of the airplane for landing. With this arrangement, during normal flying, the landing lights give a parallel beam straight ahead, but when the airplane is being landed, the movement of the lever to alter an angle of the stabilizing fins automatically adjusts the landing lights so that while maintaining a straight parallel beam at the same time the beam is increased in depth to light up the ground below and ahead of the airplane.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best manner for carrying it out, but I desire to have it understood that the apparatus disclosed is only illustrative and that the invention may be carried out with such modifications as come within the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination with an airplane having a landing control lever and a landing light comprising a parabolic reflector and a light source, of means for adjusting the reflector and light source relatively to each other to cause the light source to move in front of the reflector in a path at right angles to the normal position of the beam axis from said reflector, and means connecting said adjusting means to said control lever.

2. In an airplane, the combination of a landing control lever, a landing light normally directing a beam directly forward of said airplane and means operable for spreading the light beam downwardly for landing purposes while maintaining the upper edge of said beam in its original position including a parabolic reflector operable by said landing control lever to rotate about a transverse axis through its focal point, and linkage mechanism between the reflector and lamp mounting whereby the lamp is moved below the focal point of said reflector and at right angles to the normal position of the light beam axis.

3. In an airplane, the combination of a landing control lever, a landing light normally directing a beam directly forward of said airplane and means operable for spreading the light beam downwardly for landing purposes while maintaining the upper edge of said beam in its original position including a parabolic reflector operable by said landing control lever to rotate about a transverse axis through its focal point, a linkage mechanism connected between the reflector and the lamp mounting whereby the lamp is moved below the focal point of said reflector at right angles to the normal position of the light beam axis, the distance that the lamp is moved from the focal point being the length of a leg of the triangle formed between the focal point of the reflector, the point of intersection of the reflector and the beam axis in its original position and a hypotenuse parallel to the beam axis in its new position.

FRANK A. BENFORD.