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LIGHT PROJECTION.

APPLICATION FILED NOV. 1, 1916.

1,302,924. Patented May 6, 1919.

Fig. 1.

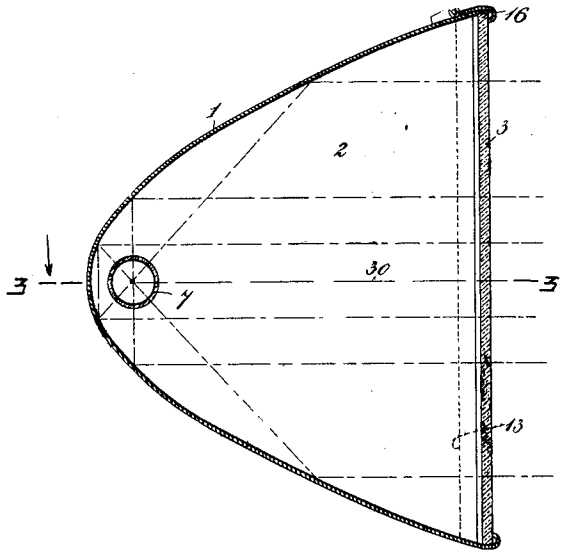


Fig. 2.

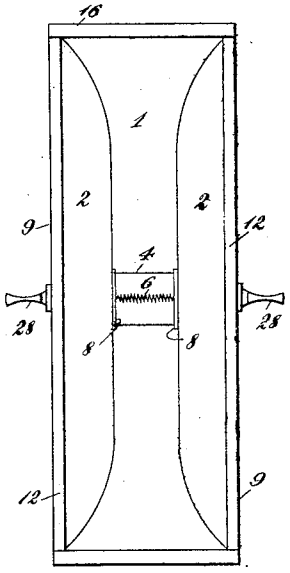


Fig. 3.

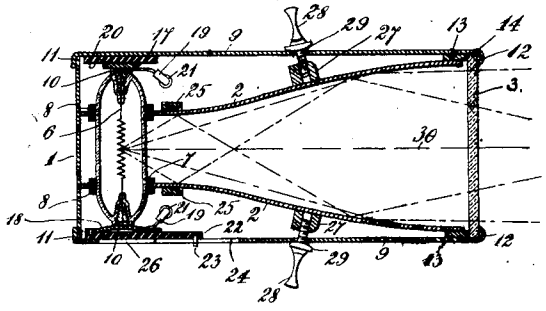


Fig. 4.

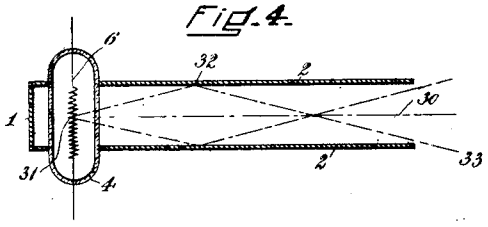
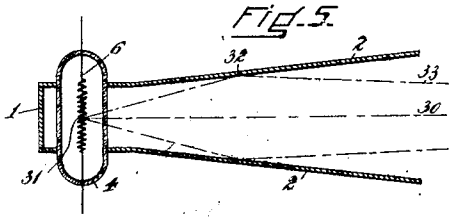


Fig. 5.



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LIGHT PROJECTION.

1,302,924. Specification of Letters Patent. Patented May 6, 1919.

Application filed November 1, 1916. Serial No. 129,001.

To all whom it may concern:

Be it known that we, HERBERT P. HOLLNAGEL and OLIVER E. CONKLIN, citizens of the United States, and residents, respectively, of West Newton, in the county of Middlesex, and Boston, in the county of Suffolk, both in the State of Massachusetts, have invented new and useful Improvements in Light Projections, of which the following is a specification.

This invention relates to a method of producing a concentrated beam of light and to apparatus, for practising the method. More particularly the invention relates to a headlight for automobiles and the like which is adapted to produce a concentrated horizontal beam of light without producing objectionable upward glare.

The invention involves apparatus for producing a beam of light the vertical spread of which is small, thereby affording penetrating power and at the same time avoiding upward glare by keeping substantially all the dazzling rays below the level of vision, and the lateral spread of which can be regulated without substantial change in the vertical spread, thereby affording a convenient method of suiting individual tastes. A cardinal feature of the invention consists in the use of separate reflectors to control the lateral and the vertical spread of the beam, respectively, and, in the preferred embodiment of the invention, this is accomplished by means of a cylindrical reflector which controls the vertical spread and vertically disposed reflecting sides positioned sufficiently close together to control the lateral spread.

The principal objects of the invention are to provide a method of and means for projecting a concentrated beam of light horizontally without projecting dazzling light upwardly; to obtain, by reflecting a portion of the light a plurality of times, a more perfect control of the beam than is possible where it is attempted to regulate the spread of the beam by a single reflection; to provide a headlight having, instead of a point focus, a focal region of at least one substantial dimension, whereby a light source of relatively large size may be employed and still be maintained substantially in the focus of the reflector so as to obtain a concentrated beam of light; and to provide apparatus which may, when space is limited, be of greatly reduced size and yet be capable of projecting as strong a beam of light as prior apparatus of much larger size, owing to the relatively large light source and consequent relatively limited reflecting surface, although obviously a proportionate increase in intensity may be obtained by employing a reflecting surface of the ordinary extent.

Other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of the apparatus;

Fig. 2 is a front elevation of the apparatus;

Fig. 3 is a horizontal transverse section on the line 3—3 of Fig. 1;

Fig. 4 is a vertical longitudinal section of a portion of the apparatus showing the effect of parallel end reflecting members; and

Fig. 5 is a horizontal longitudinal section showing the effect of flaring the reflecting end members outwardly.

The main reflecting surface 1 consists of a parabolic cylinder, the contour of which is generated by moving a straight line along a parabola but in a different plane and always parallel to itself, its plane sections all being parabolas, although the invention is in no wise limited to a parabolic cylinder inasmuch as some of the objects of the invention may be obtained when employing cylindrical reflectors of cross sections other than parabolas, for example, hyperbolas or ellipses.

At or near the ends of the cylindrical reflector 1 are vertically disposed reflecting end-members 2, which meet the cylindrical reflecting surface throughout their entire outline, except at their forward portions where they meet the transparent front cover 3. These end-members may either be flat and parallel or they may be flared outwardly throughout their forward portion as hereinafter more fully described. Moreover, the end-members may either be secured to the cylindrical reflector throughout that portion of their outlines which contact with the cylindrical reflector or they may be rigidly mounted at their rearward portions so

as to swing about vertical axes which may constitute either pivotal axes or they may comprise axes of rotation resulting from the flexing of the end-members.

The light source preferably comprises a cylindrical lamp bulb 4 having a rectilinear helical filament disposed substantially concentrically with respect to the lamp bulb, and being secured at the opposite ends of the bulb to metallic contact members 10 mounted on the respective ends of the bulb. Openings 7 are provided in the end-members 2 concentrically with the focal line of the cylindrical reflector 1, and when the lamp bulb is mounted in these openings, the rectilinear light source is disposed substantially in the focal line of the cylindrical reflector 1.

In manufacturing a tubular incandescent lamp bulb it is difficult to position the filament exactly concentrically with respect to the outer surface of the cylindrical bulb. For this reason and for the further reason that mounting means, more substantial than glass, should be disposed between the end-members and the glass bulb, sleeves 8, preferably formed of a suitable hard rubber compound, are mounted on the cylindrical lamp bulb at the proper positions to contact with the end-members 2 when the lamp bulb is properly positioned in the apparatus.

The preferred method of forming the mounting sleeves 8 on the bulb 4 comprises first securing the sleeves to the bulb at the proper positions, as for example, by means of a suitable glue, and then turning the sleeves so that their outer surfaces are exactly concentric with the rectilinear filament 6. A suitable means of turning the sleeves 8 comprises mounting the central portion of the bulb in a padded chuck, accurately centering the bulb so that the rotating filament has no lateral movement, and turning the sleeves to the proper size by means of a small machine tool which exerts a very light pressure upon the lamp bulb. When this method is employed, the lamp bulb is automatically positioned with the incandescent filament accurately in the focal line of the cylindrical reflector by merely inserting the lamp within the openings 7 in the end-members 2.

The cylindrical reflector 1 is preferably made of relatively heavy material so that a housing for the apparatus other than end-walls 9 is unnecessary. The end-walls are preferably provided with in-turned flanges 11 which accurately fit over the ends of the cylindrical reflector 1, and which fit over the front glass cover as indicated at 12. Vertical members 13 are preferably secured to the inside of the end-walls at such a position as to provide vertical slots 14 for the front cover 3. A narrow hinge cover 16 is pivotally mounted on the cylindrical reflector so that it may be swung out of alinement with the slots 14 while the front cover 3 is being inserted, and which may be swung downwardly to fit over the front cover and the slots 14 after the cover has been inserted.

Metallic contacts 17 and 18 are mounted on the inside of the housing 9 in alinement with the metallic terminals 10 of the lamp bulb. These terminals are preferably prevented from making metallic contact with the housing 9 by means of insulating plates 20 and 22, and are connected to the source of electrical supply by means of conductors 19 leading out of the casing through openings 21. The metallic terminal 18 is preferably mounted on the insulating plate 22 which is mounted in longitudinal guides and which has a handle 23 projecting outwardly through a slot 24 in the end-member 9, so that the plate and contact terminal may be moved forwardly to such extent that the lamp bulb may be passed through the opening 26 in the housing 9. The contact terminal 18 is bowed inwardly at its middle portion to such an extent that when a lamp bulb is inserted and the door 22 is moved into closed position, the spring contact terminal 18 is flexed in such manner as to maintain the lamp bulb in fixed longitudinal position with its terminals 10 in contact with the supply terminals 17 and 18.

The end reflecting members 2 are provided with internally threaded sockets 27 mounted on the central portions of their outer surfaces. These sockets 27 coöperate with thumb screws 28 which project through openings 29 in the housing 9 whereby the flare of the end-members 2 may be regulated. Vertical stops 25 are preferably positioned on the outside of the end-members 2 immediately in front of the lamp bulb 4 to cause the end-members to flex at the proper places.

All rays of light radiating to the cylindrical reflector 1 from the rectilinear filament 6, which is disposed substantially in the line focus of the cylindrical reflector, are reflected in parallelism with the plane of symmetry containing the line focus, and if the apparatus be positioned with this plane disposed horizontally, all the rays reflected from the parabolic reflector 1 will leave the reflector in a horizontal direction. In the absence of the reflecting end-members 2 much of this light would be laterally reflected, thus forming a fan-shaped beam, but by positioning the end-members sufficiently close together, the rays which are reflected laterally from the reflector 1 are again reflected by the end-members, so that their direction may be controlled. If the reflecting end-members 2 are flat and perpendicular to the focal axis of the cylindrical reflector, the rays which are reflected from the end-members, either before or after hav-

ing been reflected from the reflector, are projected horizontally notwithstanding the double reflection. Thus the flat beam of light produced by the cylindrical reflector is not sacrificed by the reflection from the end-members no matter how close together the end-members are brought.

By introducing a flare in the end-members 2, all rays striking these members are rendered less oblique to the focal axis than when the members are parallel to the axis 30, and by varying the shape and slope of the flare, the lateral spread of the fan-shaped beam can be varied through a wide range as will be evident from an inspection of Figs. 3, 4 and 5. When the members 2 are in the parallel position shown in Fig. 4, they do not affect the obliquity of any of the rays projected by the apparatus for the reason that the angle which any incident ray, such as ray 31—32, makes with the axis 30, is equal to the angle which the reflected ray 32—33 makes with the same line. However, when the sides are rotated about vertical axes disposed at their rearward portions, the reflected ray 32—33 is rotated twice as much as the reflecting member 2, and therefore becomes less oblique to the axis 30 by the angle through which it is rotated. The effect of the flare therefore is to increase the intensity of the rays directly ahead and at the same time to reduce the lateral spread of the beam. Recognizing that opinions differ widely as to the proper amount of lateral spread of the projecting beam, we do not prefer that form of headlight having either of the arrangements shown in Figs. 4 and 5 exclusively, nor do we prefer any reflector having rigid sides, but our preferred form is that shown in Figs. 1, 2 and 3 in which the reflecting end-members 2 are flexible, so that their outward flare may be regulated as described.

The principal difference between the action of this head light and the ordinary paraboloidal headlight consists in that, while it is attempted to direct all of the rays efficiently by means of a single reflection in the paraboloidal reflector, in our improved headlight the rays from a rectilinear source of light are first made substantially horizontal by the cylindrical reflector, part of the rays are then directly projected along the axis of the reflector without further deflection, but most of the rays, which are laterally oblique to the axis 30, undergo a reflection from the reflectors 2. As before mentioned, the reflection by the end-members 2 does not increase the vertical spread of the beam even though the sides are flared, so long as they are vertical and so long as the rays striking them are approximately horizontal, but it does control the lateral spread of the beam. Thus, most of the rays undergo two reflections, one of which renders them substantially horizontal, and the other of which controls their lateral spread.

While the rectilinear light source has been described as being positioned exactly along the focal line of the cylindrical reflector, it has been found that a filament formed of small wire will sag somewhat when disposed in a horizontal position, and we therefore propose either to position the lamp so that the ends of the filament are slightly above the focal line or to provide means for supporting the filament throughout its central portion.

While the end-members 2 substantially meet the cylindrical reflector 1 throughout the major portion of their outlines, as stated above, it is evident that some clearance must be allowed throughout portions of their outlines where the end-members 2 are mounted to swing or flex laterally within the reflector.

In the particular application of the invention herein described the primary reflector 1 is shown as of the form adapted to give little if any spread in a vertical direction, but it is to be understood that the curvature of this reflector may be varied in whole or in part in such manner as to afford suitable distribution of light throughout the near and intermediate portions of the roadway.

It is to be understood that such terms as horizontal, vertical, upward, downward, etc., are herein employed merely in a relative sense more conveniently to refer to relative positions and directions and that they are not employed in the absolute sense with respect to the earth's surface, although in the preferred use of our apparatus they are also accurate with reference to the earth's surface.

We claim:

1. Light projection apparatus comprising a light source, a reflector having substantially conic vertical cross sections and having relatively straight horizontal cross sections for determining the vertical spread of the projected beam, and concave reflectors for determining the horizontal spread of the projected beam.

2. Light projection apparatus comprising a reflector having substantially the contour of a parabolic cylinder, a rectilinear light source, the reflector being so positioned and the light source being so disposed along the focal line of the reflector that light is projected substantially horizontally, and reflecting surfaces for determining the lateral spread of the projected beam, the reflecting walls being flared outwardly so that at least a part of the light emanating from the central portion of the line focus will be reflected by the reflecting surfaces so as to increase the concentration of the beam throughout its central portion.

3. Light projection apparatus comprising a cylindrical parabolic reflector, reflecting

ends flaring outwardly and forwardly, a rectilinear light source centrally disposed with respect to the ends along the line focus of the cylindrical parabolic reflector, the reflecting ends being so shaped that at least a portion of the rays emanating from the central point of the light source and reflecting from the cylindrical reflector to the end reflectors are projected in parallelism with the axis of the beam.

4. Light projection apparatus comprising a substantially cylindrical reflector, a light source disposed along the focal line of the reflector, cylindrical reflecting members for determining the lateral spread of the projected beam of light, and means for varying the disposition of the reflecting members so as to regulate the lateral spread.

5. Light projection apparatus comprising a substantially cylindrical reflector, a light source disposed along the focal line of the reflector, cylindrical reflecting members for determining the lateral spread of the projected beam of light, and means for swinging the reflecting members outwardly so as to increase the concentration of the central portion of the beam.

6. Light projection apparatus comprising a substantially cylindrical reflector, a light source having a substantial dimension, the reflector being positioned with its focal line horizontal and the light source being disposed along the focal line of the reflector so that light is reflected horizontally, and vertically disposed reflecting end members for determining the lateral spread of the light, the reflecting members being so arranged that they may be flexed outwardly so as to vary the lateral spread of the beam.

7. Light projection apparatus comprising a substantially cylindrical reflector, a light source having a substantial dimension, the reflector being positioned with its focal line horizontal and the light source being disposed along the focal line of the reflector so that light is reflected horizontally, and flexible reflecting members for determining the lateral spread of the light, the members being rigidly mounted along vertical axes so that they may be flexed about these axes and thereby vary the lateral spread of the beam.

8. Light projection apparatus for producing a beam of small vertical spreading and controllable lateral spreading comprising a cylindrical reflector, a rectilinear light source in the line focus, and reflecting side members positioned so close together as to control substantially all of the relatively laterally oblique rays.

9. Light projection apparatus for producing a beam of light of small vertical spreading and controllable lateral spreading comprising a parabolic cylindrical reflector, an incandescent lamp containing a coiled filament approximately coinciding with the line focus of the reflector, and vertical reflecting sides having adjustable flares.

10. Light projection apparatus for producing a beam of small vertical spreading and controllable lateral spreading comprising a cylindrical reflector, a concentrated light source in the line focus, and laterally-controllable reflecting side members positioned so as to control most of the relatively laterally oblique rays.

11. Light projection apparatus comprising a cylindrical reflector, reflecting end-members for the cylindrical reflector flaring outwardly and forwardly, and a housing meeting the forward edges of the flared end-members and having end-walls spaced from the end-members throughout their rearward portions, the end-members and the end-walls being substantially straight vertically.

12. Light projection apparatus comprising a substantially cylindrical reflector, end reflecting members substantially fitting within the cylindrical reflector, and means for swinging the end reflecting members horizontally.

13. Light projection apparatus comprising a substantially cylindrical reflector, flexible end reflecting members substantially fitting within the cylindrical reflector, and means for adjustably flexing the end reflecting members.

14. Light projection apparatus comprising a substantially cylindrical reflector, and end reflecting members, the vertical elements of the end reflecting members being substantially straight and the horizontal elements of the end reflecting members being curved.

15. Light projection apparatus comprising a substantially cylindrical reflector, and end reflecting members, the vertical elements of the end reflecting members being substantially straight and the horizontal elements of the end reflecting members being concave.

Signed by us at Boston, Massachusetts, this 28th day of Oct., 1916.

HERBERT P. HOLLNAGEL.
OLIVER E. CONKLIN.