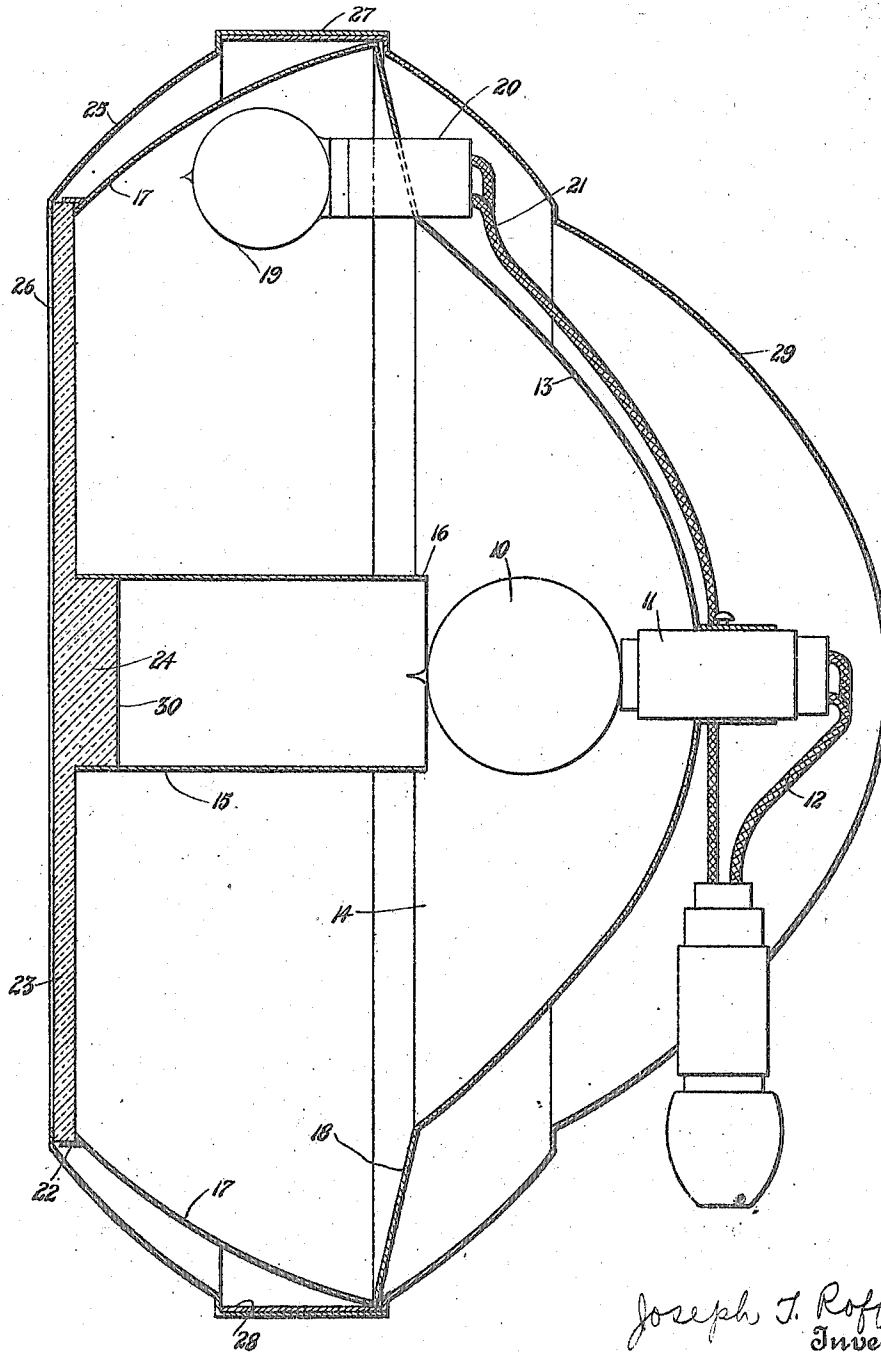


J. T. ROFFY.
ILLUMINATING APPARATUS.
APPLICATION FILED DEC. 1, 1915.

1,270,972.

Patented July 2, 1918.



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UNITED STATES PATENT OFFICE.

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ILLUMINATING APPARATUS.

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To all whom it may concern:

Be it known that I, JOSEPH T. ROFFY, a subject of the Emperor of Austria-Hungary, residing in Pittsburgh, county of Allegheny, State of Pennsylvania, have invented certain new and useful Improvements in Illuminating Apparatus, of which the following is a specification.

My invention relates in general to lamps for lighting and more specifically to an apparatus in which the radiation from the lamp or illuminating source is treated for the production of a definite limited field of illumination. In another sense the invention relates to improvements in the efficiency of illumination. A further feature of the invention is an improved arrangement of primary and secondary illuminating sources whereby a certain advantageous combination of two interchangeable fields of illumination may be secured.

The objects of the invention include the production of a parallel beam of light from a source which is concealed from direct observation, whereby the source is visible in but one direction or line. Another object is to provide for increased economy of illumination by transmitting from the apparatus only that portion of the illumination which is desired and restoring to the source so far as possible, the radiation of light and heat which is not represented in the desired flux of light. A further object is to provide an apparatus in which a selection of the quantity and direction of illumination from a plurality of sources may be made. Other advantages and objects of the invention will be apparent from a consideration of an embodiment of the invention illustrated in the accompanying drawing and referred to in detail hereinafter.

Said drawing represents a central vertical section of an automobile head-light which embodies the invention.

Referring now in detail to said drawing, 10 indicates the illuminating source, preferably an electric incandescent lamp and more specifically one of the type known as gas-filled, in which inert gases, such as for example nitrogen and argon, are employed within the bulb to oppose the vapor tension of the filament material. The lamp 10 is mounted in a socket 11 suitably, and connected by cable 12 with a source of electric current.

Associated with the illuminating source 10 is a concave reflector 13 which may for example be substantially parabolic and so located with respect to the center of the luminous source as to transmit the light therefrom in the form of a distinct parallel-beam. The reflector 13 terminates at such distance from the illuminating source 10 as not to sacrifice the clear limitation of the beam to a parallel condition, this condition prescribing about a 52° angle of incidence as the extreme. This termination of the parallel-beam reflector is indicated by the line 14 in the drawing. Adjacent the tip of the lamp 10 and in axial alinement therewith, I employ a tube 15 of opaque material such as for example, drawn copper tubing. This tube may have a diameter approximately equal to that of the lamp bulb and it will be observed that its inner end or edge 16 defines with the terminal edge 14 of the reflector 13, an annular opening through which a parallel-beam of light from reflector 13 is delivered. In order to obscure the direct rays which might otherwise escape through this annular space, from lamp 10, I provide a second reflector 17 of spherical curvature, the center of curvature being the center of lamp 10. This obscuring reflector 17 thus directs back to the illuminating source any light and heat which passes directly through the annular space defined by the circles 14 and 16. For convenience of construction, the reflectors 13 and 17 may constitute parts of a unitary sheet metal drawing, these parts being united by a frusto-conical portion 18 which performs no direct optical function in the apparatus. It serves however as a convenient mounting for a lamp 19 which fits into socket 20 and is connected by means of cable 21 with a suitable source of electric current. The location of lamp 19 above the central horizontal plane of the reflector 13 and beneath the spherical reflecting surface 17 provides for a secondary illumination of less candle power, which may be employed alternately to the primary illumination and which will be confined to the emission of light in a generally downward direction as required for example in many city ordinances. The obscuring and reflecting surface 17 will prevent direct observation of secondary source 19, except below a predetermined level.

Surrounding the forward edge of reflector 17, I provide a ring or band 22 within which may be conveniently mounted, a glass disk 23 formed with an axial stud or post 24 for the reception of the above mentioned tube 15. The ring 22 may for example be secured to the reflector 19 by means of solder or otherwise. To retain the glass disk 23 in its place, a cover 25 having a central light aperture 26 commensurate with the parallel-beam of light, is employed. This cover 25 is provided with a cylindrical portion 27 which slides upon a similar cylindrical portion 28 of a sheet metal rear wall member 29. The inner face 30 of the stud 24 may be frosted or rendered opaque to prevent the transmission of direct light from the source 10. With the apparatus described it will be apparent that light from source 10 is transmitted to the exterior of the apparatus only in the form of a parallel-beam coming from the reflector 13. In the case of aeroplanes or other aerial machines, the use of a vertical beam of light will prevent the location of the machine in space by triangulation as the light is visible only in one direction. At the same time, in the case of automobile head-lights, the apparatus provides a concentrated illumination within the immediate path while returning to the source the heat and light not represented in such illumination whereby an important gain in economy is attained. In the case of incandescent lamps, the energy thus returned in the form of heat, represents a considerable saving and aids materially in the maintenance of the desired filament temperature. In the metallic filament lamps, the positive temperature coefficient will cause this restored heat to show a drop in current consumption. If a gas-filled lamp be employed, the energy returned represents an important item in the reduction of heat loss arising from the conductivity of the inclosed gas. In this latter respect the invention will thus be seen to provide an important improvement in the use of gas filled lamps, residing in the return to the lamp of light and heat energy not represented in the useful illumination.

A lamp for vehicle use, such as automobiles, which is subject to high speeds in open country and moderate speeds in crowded thoroughfares within city limits, must be of reasonable size, and provided with two independently controlled light sources, one of comparatively large candle power for fast driving on country roads and the other of more moderate candle power and preferably concealed to provide a diffused light immediately in front of the vehicle embracing a large area and devoid of glare to other users of the road, for moderate speed and crowded thoroughfares. The high speed lighting calls for a powerful and penetrat-

ing central beam projecting parallel or slightly inclined toward the road and devoid of rays of light that are at an angle to the projected beam and which interfere with vision, such as the direct candle power of the light source, or rays that diverge at an angle to the main projected beam, due to spherical aberration in the present form of short focus parabolic type of reflectors. A concave reflector, whether spherical or parabolic will handle a light flux, generally speaking, in proportion to the angle of light it embraces of the light source. Therefore if we assume a given aperture, the shorter the focus of the reflector becomes, the greater will be the light flux. The spherical aberration of the reflector, however, is greater with a short focus. Desiring visibility and penetration of the light at a distance, I seek to provide for a relatively long focus, and do so without sacrifice to the smallness and compact shape of the lamp. A longer focus reflector, although of reduced size of aperture to maintain compactness, may still be preferable although it embraces less total light flux than a reflector of the same aperture and shorter focus. In accordance with this desire to avoid spherical aberration, I employ a reflector of the concave variety having a relatively long focus and embracing the light source between the normals approximately 30 degrees and 105 degrees. I choose 30 degrees because at that angle the spherical candle power of the light source will be reflected by the parabolic beyond the diameter of the globe, that is the return light will not be obscured by the globe of the light source itself. I choose 105 degrees for the other normal, which is the opening of the reflector, because at that point the angle of incidence to the tangent forming the parabolic is $52\frac{1}{2}$ degrees. Smaller angles of incidence are of problematical value and we may well call $52\frac{1}{2}$ degrees the critical angle for the present type of parabolic or spherical reflectors. A reflector of this type will handle approximately 50% of the spherical light of the light source. It is known that the high efficiency of the gas filled bulbs is due mainly to the higher melting and evaporating points of matter under pressure in contrast to those in vacuum. It is also known that a gas filled bulb by convection and radiation carries heat away from the filament, which tends to negative current economy. I find that the conservation of that portion of radiant heat and light that would pass into space beyond the aperture or opening of the concave reflector if re-focused or returned upon the light source materially raises the operating temperature of the filament which having a positive temperature coefficient tends to current economy and greater brilliancy for the beam projected by the concave reflector.

In accordance with this I place a portion of a spherical reflector between the normals of 105 degrees and 135 degrees and mount an opaque tube in front of the light source embracing 45 degrees of the candle power. In all these angular considerations the axis of the reflecting surfaces is used as the base line, the light source located on the axis as point of focus for the main reflector, center of curvature to the heat reflector, and angle of normal intercepted by the opaque tube. Having this additional means of economy in heat and light which would otherwise pass into space beyond the parallel-beam, I am thus able to economically reduce the aperture of the parabolic reflector. The front orifice of the spherical mirror by which the light and heat are reflected back to the source is preferably equal in diameter to the aperture of the main or parallel-beam reflector. The axial opaque tube which is placed in front of the light source represents in optical effect a screen for intercepting the central cone of light defined by the center of light source and forward orifice of the return reflector, and while the tube has certain specific advantages such as the obscuring of the bright spot which would otherwise be visible in the surface of the main reflector, still this tube must in a broad sense be regarded as merely a central or axial screen for shutting out a cone of light having its base at the opening or front orifice of the return reflector, and might even be a reflector.

The small lamp or secondary illuminating source which is placed in the annular pocket behind the return reflector is concealed from direct observation above a given level and the light from this source will be diffused in front of the car although the source itself will not be visible. Having the source itself invisible to the other users of the road, I am able to employ higher candle power for this secondary source without inconvenience to others and thus have the advantage of ample illumination without its usually attendant objectionable glare in the eyes of those facing the lamp.

I claim:—

1. A lamp comprising a casing having interior reflecting surfaces comprising a paraboloid and an opposed, peripherally located spherical zone, a glazing across a base of said zone, a screen member axially located and mounted on said glazing and located substantially to cut off from said base focally originating rays and a light source disposed substantially at the focus of said paraboloid.

2. A lamp as described in claim 2 in which the screen member is a cylindrical tube.

3. Illuminating apparatus comprising, in combination, a source of light, a parallel-beam reflector cooperating therewith, a ray-

returning reflector surrounding the aperture of said parallel-beam reflector and having a forward central orifice commensurate with the parallel beam and defining with the center of said light source a central cone of projection, and an axially disposed screen in front of said source, terminating substantially at the imaginary surface of such cone of projection.

4. Illuminating apparatus as described in claim 3 wherein the screen provides a reflecting surface.

5. A lamp comprising a casing having interior reflecting surfaces comprising a concave projecting reflector and an opposed, peripherally located spherical zone, a glazing across the base of said zone and a screen mounted on the glazing having an inwardly extending portion reaching substantially to the cone defined by the light source and the base of said zone and adapted to cut off obliquely propagated direct rays from said source.

6. Illuminating apparatus comprising in combination a primary illuminating source, means associated therewith for producing a parallel beam of light, means for obscuring all but such parallel beam of light and means concealed by said obscuring means and alternative to said main illuminating source for producing an illumination.

7. Illuminating apparatus comprising in combination an illuminating source, means associated therewith for producing a parallel beam of light, a screen disposed in axial alinement with said source and adjacent the end thereof for limiting the direction of observation thereof, means for returning to the source heat and light falling between the aperture of the reflector and the edge of said screen, and an independent secondary source of light concealed behind said heat and light returning means for producing diffused light without glare.

8. Illuminating apparatus comprising in combination an illuminating source, means associated therewith for producing a parallel beam of light, an opaque tube disposed in axial alinement with said source and adjacent the end thereof for limiting the direction of observation thereof, means for returning to the source heat and light falling between the aperture of the reflector and the edge of said opaque tube, and an independent secondary source of light concealed behind said heat and light returning means for producing diffused light without glare.

9. Illuminating apparatus comprising in combination a gas-filled electric incandescent lamp, a parallel-beam reflector cooperating therewith, means for supplying current to said lamp, means for intercepting and restoring to said lamp light and heat beyond the influence of said beam reflector, and an independent secondary source of

illumination concealed behind said light and heat restoring means, for producing a diffused illumination without visible glare.

10. A vehicle lamp comprising a source of light, a concave reflector partly enveloping said source and reflecting a parallel beam therefrom, a second reflecting surface surrounding the aperture of said concave reflector for returning to said source heat and light falling beyond the angle of the aperture of the first reflector, and forming an annular pocket, and a second source of light located within said pocket and concealed by said second reflector.

11. A vehicle lamp comprising a light source, a concave projecting reflector, an opposed peripherally located return reflector for rays falling beyond the angle of the aperture of the first reflector and forming an annular pocket, a screen extending in a generally axial direction and adapted to cut off from said aperture obliquely propagated direct rays from the light source, a second source of light located within said pocket and concealed by the return reflector, said screen shielding an opposed portion of the concave reflector from rays incident from said second source.

12. A vehicle lamp comprising a source of light, a concave reflector partly enveloping said source and reflecting a parallel beam therefrom, a second reflecting surface surrounding the aperture of said concave reflector for returning to said source heat and

light falling beyond the angle of the aperture of the first reflector, and forming an annular pocket, said return reflector having a forward central orifice commensurate with the parallel beam and defining with the center of said light source a central cone of projection, an axially disposed screen in front of said source, terminating substantially at the imaginary surface of such cone of projection, and a second source of light located within said pocket and concealed by said second reflector.

13. A vehicle lamp comprising a source of light, a concave reflector partly enveloping said source and reflecting a parallel beam therefrom, a second reflecting surface surrounding the aperture of said concave reflector for returning to said source heat and light falling beyond the angle of the aperture of the first reflector, and forming an annular pocket, said return reflector having a forward central orifice commensurate with the parallel beam and defining with the center of said light source a central cone of projection, an axially disposed opaque tube in front of said source, terminating substantially at the imaginary surface of such cone of projection, and a second source of light located within said pocket and concealed by said second reflector.

JOSEPH T. ROFFY.