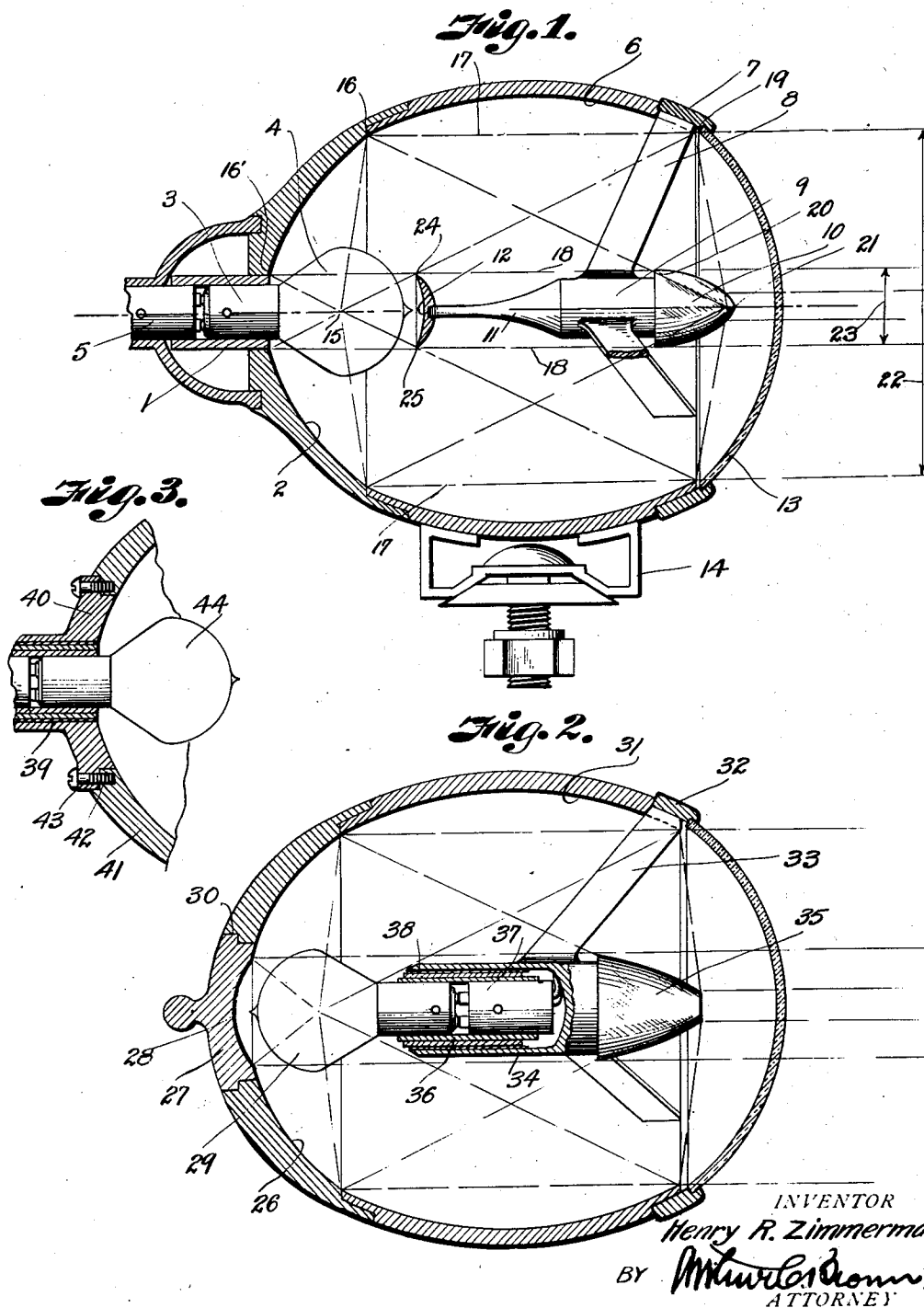


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LIGHT PROJECTING DEVICE

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LIGHT-PROJECTING DEVICE.

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This invention relates to light projecting devices and particularly to a lamp in which the rays from a light source are projected in the form of a condensed beam of great luminosity. Such lamps are more particularly adapted for use as head lights or spot lights for motor vehicles, so in order to present a comprehensive description of the preferred embodiment of my invention, I will hereinafter refer to it as a motor vehicle head light, it being understood of course that the invention is not limited to any particular use.

The primary object of the invention is to provide a lamp with reflectors so arranged that the light rays will be collected and condensed to provide a beam of relatively small cross section but great intensity, the reflectors serving to so direct the light rays that practically all of the available light will be utilized and directed into a single beam without liability of spilling some of the light rays which would blind pedestrians, drivers of on-coming cars and the like.

One of the disadvantages of the ordinary head light is that light rays are spilled over a relatively wide angle. That is the reason it is dangerous to pedestrians and drivers of on-coming vehicles, but obviously if the light rays are directed into a well defined sharp beam, the beam of light from the lamp will illuminate the road far in advance of the lamp, with greater intensity than where the angle is wide and since the beam of light can be directed upon the ground below the line of vision of pedestrians and below the line of vision of drivers of on-coming vehicles, it will be obvious that the lamp may throw a beam of greater intensity without endangering persons who are not occupants of the motor vehicle on which the lamp is installed.

This invention makes use of the characteristics of a concave parabolical reflector and those of a concave ellipsoidal reflector and also those of a convex parabolical reflecting surface, which latter can be shown to be such that light rays traveling from external sources toward the focal point would, upon striking such surface, be reflected into parallelism. It proposes to accomplish the desired result by means of a reflector encompassing a desired amount of the available light rays and directing such rays against another reflecting surface from which they are redirected in a secondary reflection into

a beam. Such double reflection can be desirably accomplished by means of a concave ellipsoidal reflector in suitable combination with a convex parabolical reflector having its axis in alignment with the major axis of the ellipsoidal reflector and the two reflectors being located in a suitable relation. These two reflectors are inter-dependent mates forming a light-directing unit. This unit may include a third light-directing means for the purpose of usefully directing such rays as would not otherwise add to the intensity of the beam. The duties of this third means can be performed by a reflector of a concave spherical character arranged to return such rays to the light source. This unit comprises the inter-dependent reflecting mates one of which redirects the rays before the point of convergence is reached, the inter-supporting member and when desired for increasing the efficiency, the third reflector. Another new feature in the invention disclosed consists of the combination of a concave parabolical reflector for projecting a beam with a light-directing unit comprising a concave ellipsoidal reflector having an inter-dependent light-directing means for projecting an additional beam which is made coincident with the first beam. This combined arrangement is the preferred construction because the concave parabolical reflector would direct a large portion of the light into the beam with one reflection which would be more efficient than if all the light were to pass through a secondary reflection.

There are various novel features in connection with my invention which will be elaborated upon hereinafter, reference being had to the accompanying drawings, in which

Fig. 1 is a vertical, longitudinal, sectional view through a lamp constructed in accordance with my invention.

Fig. 2 is a vertical, longitudinal, sectional view through a slightly modified form of my invention, and

Fig. 3 is a sectional view through a modified form of bulb socket.

Referring now to the drawings by numerals of reference,

In Fig. 1, 1 designates a bulb socket located at the vertex of a parabolic reflector member 2 and adapted to receive the bulb stem 3 of the bulb 4 which constitutes the light source. The bulb stem 3 is adapted to

contact with a plug 5 in the usual manner, the plug being the connector for supplying current to the bulb as will be well understood. The parabolic reflector member 2 is
 5 connected at its forward edge to an ellipsoidal reflector member 6 which in turn carries at its forward edge the ring 7 of a spider, the spider arms 8 constituting supports for a stem 9 on the forward end of which is a
 10 convex reflector 10, the inner constricted portion 11 of the stem carrying a spherical concave reflector 12 in front of the light source to reflect the rays from the light source back to such source.

15 The ring 7 may carry a spherical transparent cover 13 of glass or similar material. The element 13 however is not a lens, but merely a cover to protect the lamp bulb and the reflectors from dirt, dust and from the
 20 elements. The lamp casing is provided with a bracket 14 which may be of any suitable construction so that it is adapted to fasten the lamp to a suitable support.

Light rays emanating from substantially
 25 the focal point 15 strike the concave parabolic reflecting surface embraced in the fields 16 and 16' and are reflected substantially parallel to and within the zone indicated by lines 17 and 18 running from 16 to 19
 30 and from 16' to 20 respectively. Light rays emanating from local point 15, which is common to both the parabolic reflector 2 and the ellipsoidal reflector 6, and striking the ellipsoidal surface 6 are reflected in converg-
 35 ing rays toward the focal point 21 which is common to both the ellipsoidal reflector 6 and the convex reflector 10, but before reaching the focal point 21 the rays are intercepted by the convex parabolical reflector
 40 10 and by it reflected in parallelism into a beam substantially parallel to and within the zone defined by the lines 18, it being understood of course that the lines 17 and the lines 18 are indicative of cylindrical
 45 light zones so that a preponderance of rays reflected from the surface of the parabolic convex reflector 10 are concentrated in a pencil-like cone, and within the cylindrical beam defined by the circular series of lines 17.

50 The beam will have a cross sectional diameter equal to the diameter line 22 and it will be a sharply defined cylindrical beam and the core will have a diameter equal to the line 23 of greater intensity than the major
 55 portion of the beam, the intensity of the entire beam being due to the fact that it is formed from a relatively large angle of light directed into a beam of relatively small cross section.

60 Light rays emanating substantially at the focal point 15 and within the angle 24, 15 and 25 formed by the center of the light source 15 and the periphery of the concave reflector 12 would ordinarily be largely stray
 65 rays but the concave spherical reflector 12

with its focus at 15 intercepts these rays and reflects them back substantially to the focal point 15 where they in part return heat to the light source, which will add to the incandescence of the light filament, and in
 70 part strike the surface of the light filament and by it be reflected within the useful angle described by lines running from 15 to 16' and 15 to 19, and in part pass through the
 75 interstices of the light filament so that in some forms of the invention they would strike largely within a useful angle of light. By this arrangement described, about all the light rays not available for use will be those
 80 subtended by the bulb stem 3 or those subtended by the opening in the parabolical reflector member which accommodates the lamp socket. Therefore in a commercial sense, substantially all of the available light
 85 rays will be directed into the beam.

The form of the parabolic reflector and the ellipsoidal reflector can be changed to increase or diminish the diameter or cross section of the beam and the intensity of the center of the beam so I do not wish to be
 90 limited to any particular form of parabolic reflector or ellipsoidal reflector, the invention residing rather in the broad combination of elements than in any particular dimensions or form of any of the parts,
 95 it being apparent however that the parabolical convex reflector 10 is in advance of the parabolic reflector 2 and the ellipsoidal reflector 6 so that light rays projected from the ellipsoidal reflector will be re-reflected
 100 in straight stream lines parallel to the axes of both parabolic reflectors, parallel to the long axis of the ellipsoidal reflector and parallel to the axis of the concave spherical reflector.
 105

It will be apparent from the description thus far that I have provided a novel form of lamp in which a concave parabolical reflector is so associated with the light source
 110 in front of it as to direct forwardly into a cylindrical beam such rays as are encompassed by it. To this reflector unit I have added a combination of co-operating reflectors forming a second unit for the purpose
 115 of collecting and directing into a beam such available light rays as are not encompassed by the first unit. The first unit and the second unit are joined into a related whole by
 120 having the focal point of the first unit to coincide substantially with a suitable one of the focal points of the second unit and having the two units in suitable alignment. The projected beam from the first unit and
 125 that from the second unit are made to substantially coincide and be concentric to form a single beam of greater intensity than either of them singly. It is apparent that the beam projected by the second unit is composed of rays which would be otherwise stray rays if the first unit only were used

in the headlight. It is evident that the second unit comprises a concave reflector of ellipsoidal characteristics whose rearward focal point coincides substantially with the light source, a convex parabolical reflector whose focal point coincides substantially with the forward focal point of the ellipsoidal reflector and whose vertex end is toward the direction in which the beam of light is projected and whose axis is in alignment with the major axis of the ellipsoidal reflector, a concave spherical reflector in front of the light source, and a member centrally located for supporting the reflectors in their proper relative positions. It is also apparent that the second unit can be designed to encompass and direct into a beam substantially all of the available rays of light emanating from the light source and thus the first unit may be entirely omitted, which arrangement would merely be another embodiment of my invention. It is evident that a condensed sharply defined beam as described can be better directed below the line of vision of other vehicle drivers and be more intense than where a wide angle of light flux is emitted from a headlight.

In Fig. 2 I have shown a slightly modified form of my invention involving however the generic principles incorporated in the form shown in Fig. 1. The form shown in Fig. 2 differs essentially from that shown in Fig. 1 by having the spherical reflector placed rearward from the light source and by utilizing the central stem for supporting the bulb socket and appurtenant equipment as well as the convex reflector so that the lamp filament is directed rearward. There are certain advantages in the construction shown in Fig. 2 over that shown in Fig. 1, for example—a more compact arrangement can be made of the head lamp as a whole by the elimination of the external housing for the electrical connections. Also it permits of a design having a shorter distance from the light source to the vertex of the concave parabolical reflector and still allow the use of a bulb of standard dimensions. This latter feature permits the design of a smaller parabolical reflector for a given angle of light to be encompassed.

I will now proceed to describe the construction shown in Fig. 2. It consists of a parabolical reflector 26, the vertex portion of which consists of a removable plug 27 having a concave spherical reflecting surface 28 in the place of the actual parabolical vertex. The plug 27 is of sufficient diameter to permit the lamp bulb to pass through the opening which it closes and it is shouldered as at 30 so that it may be fastened by suitable screws or the like. The parabolic reflector member 26 is connected at its outer edge to an ellipsoidal reflector member 31 which carries a spider ring 32 having spider

arms 33 radiating from a central hub or stem 34 on the front end of which is a convex parabolical reflector 35 corresponding to the parabolical reflector 10 in Fig. 1. The stem 34 is provided with a lamp socket 36 having a contact plug 37 therein against which the stem 38 of the bulb 29 may contact in the usual way. Any appropriate construction of the socket will suffice, provided it is so arranged as to make electrical contact with the contact plug 37 or its equivalent when it is inserted in the position shown in Fig. 2.

It is recommended that one or more of the spider arms 33 be hollow and suitably arranged to contain the electric supply conductors and extensions for the focusing mechanism which latter is intended to be contained in the central member 34.

Having elaborately described the zones and meets and bounds of the light rays in Fig. 1 it is thought that it will be unnecessary to reiterate as applied to Fig. 2, it being sufficient to note that the construction shown in Fig. 2 provides a condensed illumination especially suited for spot lights and the like, while the construction shown in Fig. 1 is recommended for use in headlights. Fig. 2 illustrates a design in which some of the rays returned by the spherical reflector to the light source would pass through the interstices of the light filament into a useful angle; in the particular design of figure 2 these rays would strike the forward region of reflector 31 and from there be directed ultimately into the core beam.

Attention is called to the fact that in Fig. 2 the vertex region of the reflector 35 is removed so that the parabolic convex reflector is more in the nature of a truncated cone, it being not necessary for this reflector to extend forward further than where it intersects with the forwardmost boundary of the converging rays.

In Fig. 3 I have illustrated a modified form of lamp socket which is contained within a movable plug or wall portion 40 carried by and forming part of the concave parabolic reflector member 41 and it is shouldered as at 42 so it may be fastened in place by the set screws 43. The diameter of the opening which the member 40 closes is great enough to permit the lamp bulb 44 to pass through it, so when necessary the plug portion 40 can be removed, taking with it the lamp bulb 44 so that the lamp can be inspected, renewed or repaired. The construction shown in Fig. 3 might well be used in the form shown in Fig. 1, and other modifications might suggest themselves from time to time without departing from the generic features of my invention, so I wish it to be understood that I do not limit myself to any particular specific construction, but reserve the right to make such changes in

form, proportion and minor details of construction as properly come within the scope of the appended claim.

What I claim and desire to secure by Letters-Patent is:—

In a lamp, a light source, a concave parabolical reflector in rear of the light source and having its focal point substantially coinciding with the light source for directing rays into parallelism to form a beam, a concave ellipsoidal reflector having one of its focal points substantially coinciding with that of the parabolical reflector and its other focal point located forwardly on a straight line passing through the focal point and the vertex of the parabolical reflector for reflecting rays of light not encompassed

by the parabolical reflector into converging lines toward its forward focal point, and a convex parabolical reflector whose focal point coincides substantially with the forward focal point of the ellipsoidal reflector and whose vertex is directed away from the vertex of the concave parabolical reflector and so disposed with respect to the ellipsoidal reflector as to intercept the light rays received from the ellipsoidal reflector and direct them forwardly into parallelism to form a condensed beam substantially concentric with the beam projected by the concave parabolical reflector.

In testimony whereof I affix my signature.

HENRY R. ZIMMERMAN