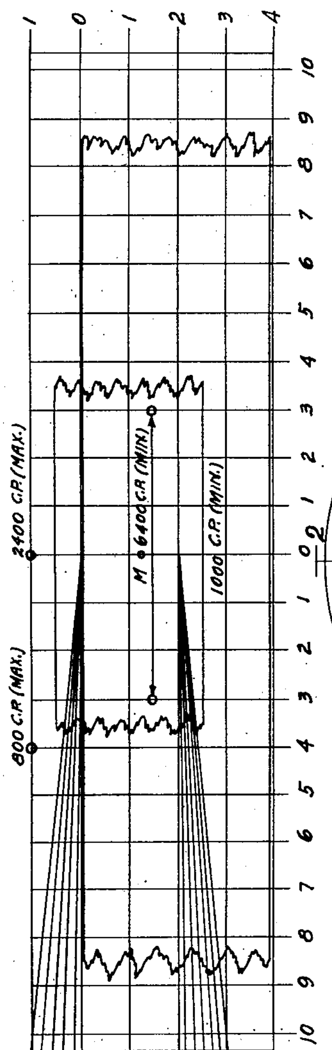
Dec. 22, 1925. 1,566,590

C. E. GODLEY

REFLECTOR

Original Filed May 8. 1922 2 Sheets-Sheet 1

Fig. 3



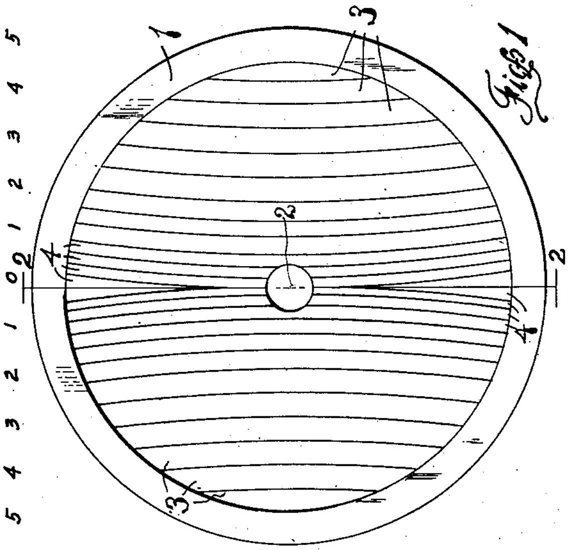


Fig. 1

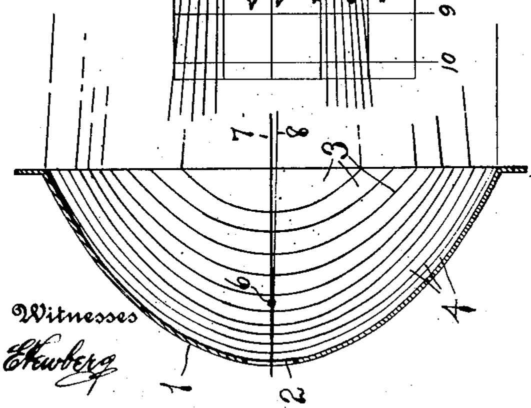


Fig. 2

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Charles E. Godley

Witnesses

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Attorney

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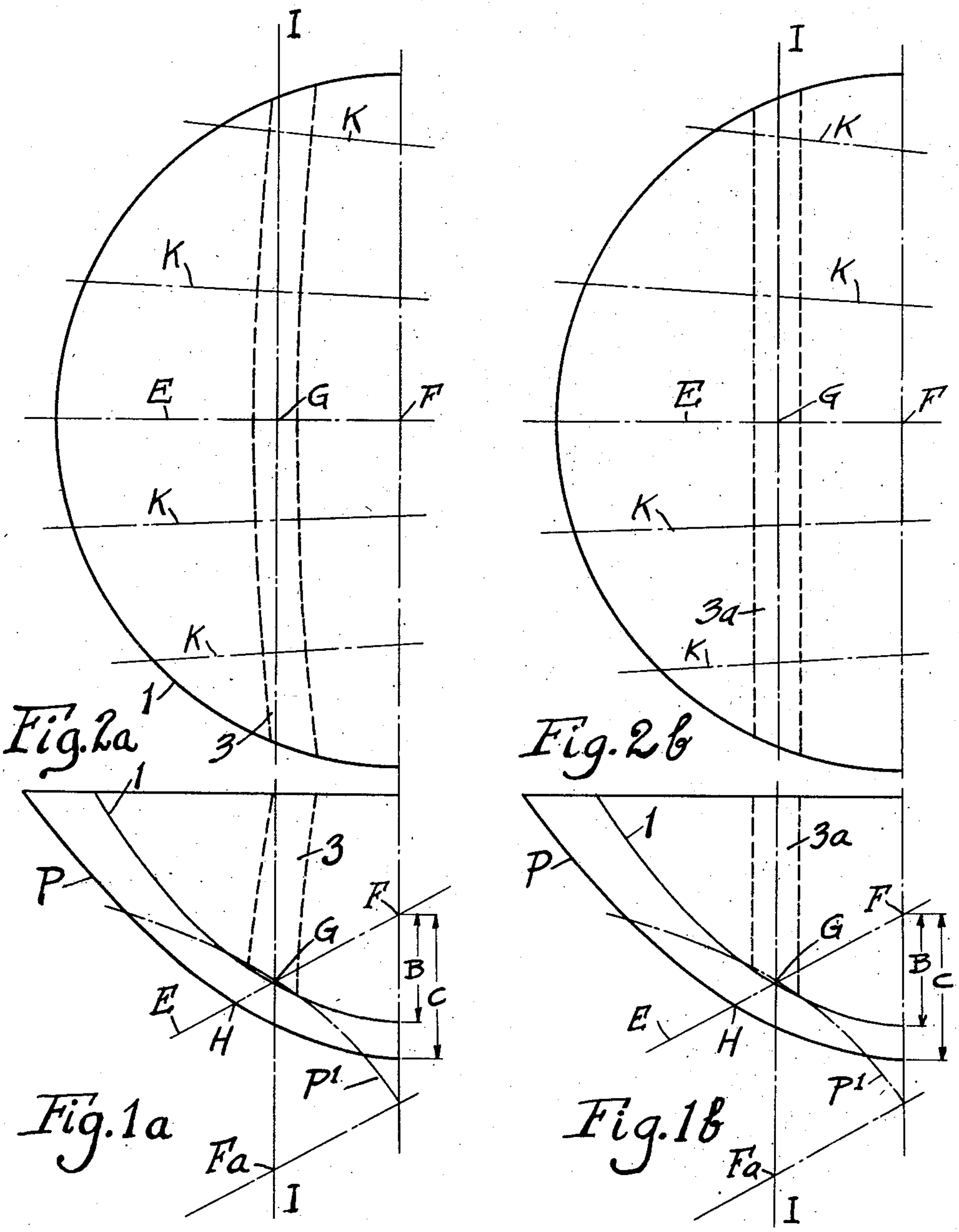

Fig. 2a

Fig. 1a

Fig. 2b

Fig. 1b

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Patented Dec. 22, 1925. **1,566,590**

UNITED STATES PATENT OFFICE.

CHARLES E. GODLEY, OF DETROIT, MICHIGAN, ASSIGNOR TO EDMUNDS AND JONES CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF NEW YORK.

REFLECTOR.

Original application filed May 8, 1922, Serial No. 559,204. Divided and this application filed May 3, 1924. Serial No. 710,770.

To all whom it may concern:

Be it known that I, CHARLES E. GODLEY, a citizen of the United States, and residing at Detroit, in the county of Wayne and State of Michigan, have invented a new and Improved Reflector, of which the following is a specification.

This invention relates to the construction of the reflectors of projecting lamps, especially the headlamps of motor vehicles of the types shown in my co-pending application, Ser. No. 559,204, filed May 8, 1922, of which this is a division, and its object is to so divide the reflector into sections that the rays of light will be projected upon a clearly defined limited area and in part concentrated upon a restricted portion of such area.

Lamps equipped with the well known parabolic reflectors cannot produce this effect for when such lamps are so positioned that the concentrated light properly illuminates the roadway sufficiently far in advance to permit the driver to avoid obstructions, the roadway nearer the vehicle is left dark, or too much light is projected upward and sidewise where it is liable to blind oncoming drivers and pedestrians.

These objections are overcome by deforming a reflector of substantially paraboloidal shape so that different portions thereof will project beams whose cross-sections are similar in shape but different in size, and so that the larger and milder beam will afford a general road illumination of considerable spread while the more concentrated beam will afford a driving light illuminating a narrower stretch of road for a considerable distance ahead of the vehicle.

My invention therefore consists in deforming a substantially parabolic reflector so that it will project beams of greater width than height and in a reflector of this character which can be manufactured at approximately the same cost as an ordinary paraboloidal reflector and in which the special deformations will not interfere with the usual machine polishing of the reflecting surface.

I employ a reflector of generally paraboloidal form and subdivide it into a series of panels extending transversely of the direction in which the beam is to be expanded, each of the panels having its longitudinal medial position disposed forwardly of the general paraboloidal form of the reflector farther than its lateral edges. I vary the depth of the convexity of the cross-section or the width of the panels according to the desired spread of the projected beam, and vary the relation of the central lines of the panels to the vertical plane passing through the focal axis of the reflector according to the directions in which the beam is to be expanded.

The cross-section of each panel on a line radial to the inner edge of said panel is the same as a horizontal cross-section of the same width of a determining parabola, the center of this cross-section of the determining parabola being in a line passing through the focal center of both bodies and through substantially the middle of said cross-section of said panel, but reversed. This rule holds with reflectors having panels, all of whose sides are parallel and vertical and with reflectors divided into panels of irregular form so long as the cross sections of these panels are tilted into the planes in which the light is to be spread. For example, if the central lines of the panels in a headlight reflector having a horizontal axis were all in vertical planes, the beam of the reflector would be expanded from circular to elliptical cross-sections with the major axis of the ellipses horizontal. If the ends of such generally upright panels curve slightly toward or away from a vertical plane, the beam will be changed in cross-section substantially to that of a horizontal rectangle.

While such alterations in beam sections can be accomplished by means of panels of varying transverse sections, I prefer to convex each panel forwardly in the relative transverse sections of a parabola of slightly longer focus than the normal parabolic reflector for the greater distribution, and transverse sections of a parabola of a much longer focus for the more concentrated light. By using the longer-focus transverse sections, the panels can be of any predetermined width, the spread of light being determined by the focal length of the parabola used in determining the transverse sections of the panels.

By using transverse parabolic sections in the panels I find that the light rays reflected from each panel diverge equally from the axis of the reflector, the rays from each panel covering substantially the anticipated field of light of the different sections.

I have also found that if the convexity of each panel is just the reverse of the normal parabolic section for the same portion of the reflector, using narrower panels for greater concentration and wider panels for the more diffused light, that the width of panels are determined by the width of spread desired in the projected fields.

In the accompanying drawings Fig. 1 is a front elevation of a reflector embodying the present invention. Fig. 2 is a section on the line 2—2 of Fig. 1. Fig. 3 is a diagram illustrating the light rays projected by the reflector. Figs. 1ª, 2ª, 1ᵇ and 2ᵇ are diagrams showing the method for determining the proper cross sections of the paraboloidal panels.

Similar reference characters refer to like parts throughout the several views.

The reflector 1 is generally parabolic in form. If a light bulb could be made with a filament with substantially no dimensions and this filament mounted at the focus of the reflector, then this reflector, if a perfect parabola, would project a beam of light of the diameter of the reflector. The filaments of light bulbs are, however, of considerable size so that the light projected is in the form of a cone whose surface is somewhat indefinite.

After the parabola has been formed and polished, it is placed between proper dies and its surface is deformed so as to be divided into panels 3 and 4, those next to central aperture 2 of the reflector in Figures 1 and 2 being narrower than those farther away.

Each of these panels has substantially parallel sides and these sides are convex toward the central opening 2. I have shown the lateral curvatures of these panels to be substantially uniform but this is not necessary as the curvature of the ends of these panels is sufficient to project light toward the corners of the main projected field so that instead of a circular field of light, this reflector projects a substantially rectangular field.

The desired width of the panels being fixed, the exact cross-sections of the panels may be determined after the manner shown in Figures 1ª to 2ᵇ inclusive. For any given portion of the panel 3 shown in Figure 2ª, I first determine the center G of the cross-section of the corresponding part of the original or true paraboloidal surface 1, as shown in Figure 1ª. I then draw a line from this point G to the focus F of the true parabolic surface portion and also plot the corresponding portion of a determining parabola P. The focal length of the reflector 1 is indicated by the line B and that of the parabola P by the line C. The point H at which the focal line F G intersects the determining parabola P indicates the central point of a small section of the parabola P which has the proper curvature for the desired panel cross-section. If this determining parabola is of greater focal length than the parabola 1 (which is part of the true paraboloidal surface from which the reflector is to be formed and which it will still approach rather closely when finished) this curvature is reversed as shown in Figures 1ª and 1ᵇ.

Cross-sections of the panel 3 at other points are similarly determined, each being taken radially to the inner edge of the panel as shown by the lines K in Figure 2ª. This insures a panel which effects an unusually uniform distribution of light. Owing to the resulting uniform density of the projected beam and of the beam-widening effect due to the edgewise curving of the panels, they cooperate in projecting a beam of approximately rectangular cross-section with its upper and lower borders substantially parallel to the plane of the line 3 in Fig. 2ª. The lines K indicate how the rays of light are deflected up and down so as to proceed along lines substantially at right angles to the border lines of the panels at the points of reflection.

Each of the panels presents a transversely convex surface toward the plane of the open end of the reflector and the curvature of such panel at every point in its length is desirably the same as a horizontal cross-section of the determining reflector taken in a line passing through the focal points of both reflectors, reversed and placed so as to coincide with the normal paraboloidal reflector surface at the edges of each panel and tilted into the planes in which the light is to be spread. The curvature of each panel is therefore greatest at the horizontal diameter of the reflector.

This parabolic transverse curvature of the several panels enables me to determine the exact field to be illuminated by the rays reflected by each panel, and the rays of the light from each panel are projected so as to fall evenly upon the entire predetermined field of illumination, that is, illuminate evenly the field on both sides of the axis of the reflector. The angle of diffusion therefore of the rays reflected by any particular panel depends upon the focal length of the determining parabola and upon the width of the panel. Where the focal length of the determining parabola is short and the curvature of the panel is greater, the beams from that panel will be diffused over a greater area than where the focal length is greater, but the diffusion is accurately controlled, which is impossible with panels which are circular or elliptical in cross-section.

Referring again to Figs. 1 and 2, it will be noticed that each of the panels is of substantially even width throughout its length and that the upper and lower ends of the panels curve away from the vertical central plane of the reflector. The projected field will be approximately rectangular because the upper ends of the panels will skew the rays projected by them so that these rays will fill out the lower corners of the illuminated field while the lower ends of these panels will project rays to fill out the upper corners of this field. This results in a field of illumination which is practically rectangular.

The panels nearer the central opening of the reflector are made narrower in proportion to their depth than those farther away which results in the rays projected by the comparatively more shallow panels being concentrated on a more limited field than those projected by the comparatively deeper panels. This variation in transverse curvature of the panels may be gradual or abrupt. The central portion of the illuminated field will therefore be brighter than the outer portions and this area of more intense illumination may be moved up or down in the field of milder illumination by tilting the general focal axis of the outer more shallow panels. The outer portions of the reflector approach more nearly a true parabola and the light projected thereby is therefore more concentrated. I prefer to tilt these panels about one degree upward so that the area of intense illumination will be positioned at the upper portion of the less intense but larger field.

Fig. 3 is a diagram showing the proportionate illumination of a field by means of a reflector of this character, the field being divided as shown into eighty squares, and the length of the sides of the squares equally approximately one degree of arc on a spherical surface whose radius is one hundred feet, the general focus of the reflector being at the center of this spherical surface. With the source of illumination at the focal point 6, Fig. 2, some of the rays of reflected light are projected by each of the narrow and deeply curved panels 4 over a surface extending from one vertical line 8 to the other and between horizontal lines 0 and 4.

The side panels 3 are wider and shallower so that the light reflected by these panels is diffused to a much less extent, both horizontally and vertically, for the reason that they approach more closely to the true parabolic reflector. Now by tilting those portions of the reflector which embody the panels 3, through an angle of about one degree, so as to swing the axis 6—7 up above the axis 6—8 of the remaining portion of the reflector, the area of most intense illumination is moved up.

Where an automobile headlight is less than four feet above the roadway, and the rays of light strike the roadway about two hundred feet from the vehicle, the width of the area of intense illumination should be that of the roadway and it may extend about one hundred feet toward the vehicle. The area of less intense illumination derived from the more convex panels will extend over this same distance and in addition thereto, extend over space on each side of the more intense field and between it and the vehicle.

The comparative widths of these panels and their curvatures relative to the central vertical plane of the reflector may all be changed by those skilled in the art without departure from the spirit of my invention as set forth in the following claims.

I claim:—

1. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector and its transverse curvature at each point being the same as that of the general curve of a parabola at that point but in the opposite direction, the edges of the panel being convex toward the general axis of the reflector.

2. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector and its transverse curvature at each point being the same as that of the general curve of a parabola at that point but in the opposite direction, the edges of the panels being convex toward the general axis of the reflector, the panels on each side of the reflector being divided into inner and outer groups, the panels of one of the groups on each side being deeper in proportion to their width than those of the other group on that side so as to produce a greater diffusion of light.

3. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector and its transverse curvature at each point being the same as that of the general curve of a parabola at that point but in the opposite direction, the edges of the panels being convex toward the general axis of the reflector, the panels on each side of the reflector being divided into inner and outer groups, and the general focal axis of the inner groups being at an angle to the general focal axis of the outer groups.

4. A paraboloidal reflector composed of a

group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector and its transverse curvature at each point being the same as that of the general curve of a parabola at that point but in the opposite direction, the edges of the panels being convex toward the general axis of the reflector, the panels on each side of the reflector being divided into inner and outer groups, the panels of the inner groups being deeper in proportion to their width than those of the outer groups, and the general focal axis of the inner groups being at an angle to the general focal axis of the outer groups but in the same plane.

5. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector, the edges of the panels being convex toward an axial plane of the reflector.

6. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector, the edges of the panels being convex toward the general axis of the reflector, the panels on each side of the reflector being divided into inner and outer groups, the panels of the inner groups being deeper in proportion to their width than those of the outer groups so as to produce a greater lateral diffusion of light.

7. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector, the edges of the panels being convex toward the general axis of the reflector, the panels on each side of the reflector being divided into inner and outer groups, and the general focal axis of the inner groups being at an angle to the general focal axis of the outer groups.

8. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being parallel to each other, each panel being transversely convex toward the general focus of the reflector, the middle portions of the panels being nearer the general vertical plane of the reflector than their ends, the panels nearer said plane being narrower and more convex in transverse cross section than those farther away from said plane.

9. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector, the edges of the panels being convex toward the general axis of the reflector, the panels of each set increasing in width as they are successively farther from said medial plane.

10. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels on each side of the center of the reflector being substantially parallel to each other, each panel being transversely convex toward the general focus of the reflector, the edges of the panels being convex toward the general axis of the reflector, the lines of juncture of adjacent panels all being in a common paraboloidal surface.

CHARLES E. GODLEY.