March 22, 1927.

C. E. GODLEY

1,621,585

LAMP

Filed May 19, 1922

3 Sheets-Sheet 1

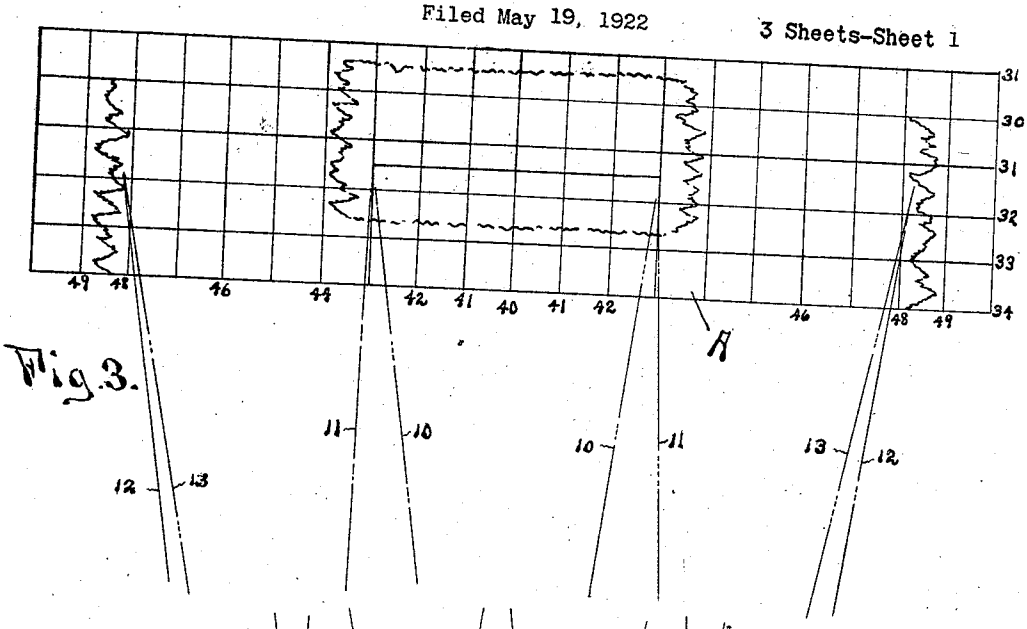


Fig. 3.

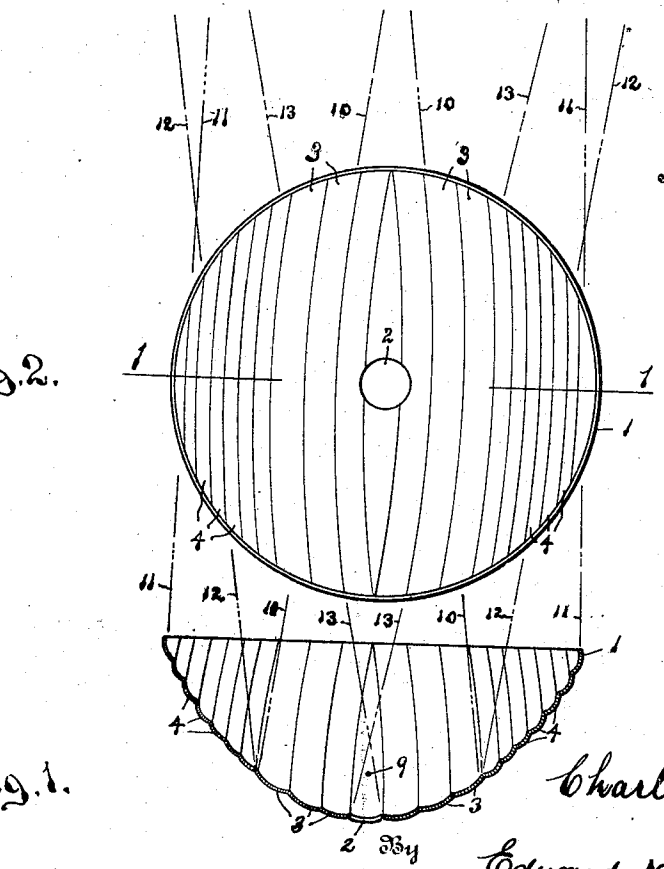


Fig. 2.

Fig. 1.

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Fig.5.

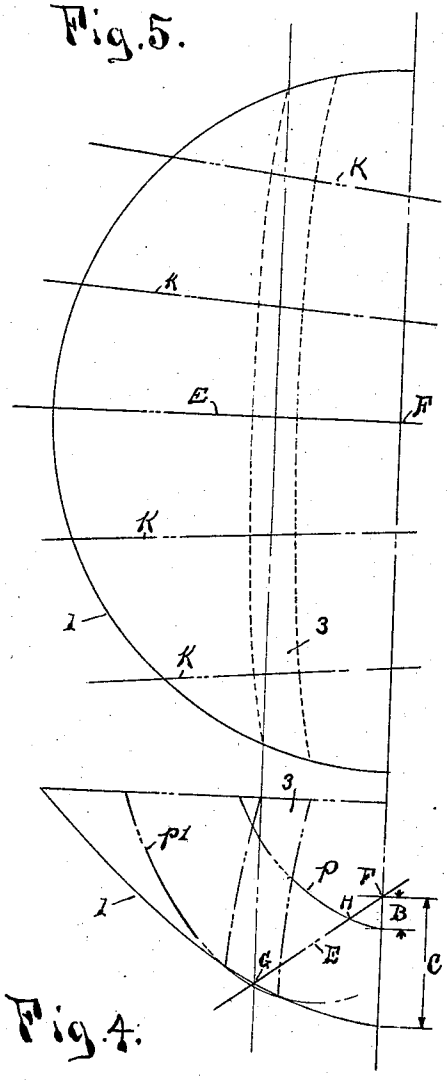


Fig.4.

Fig.7.

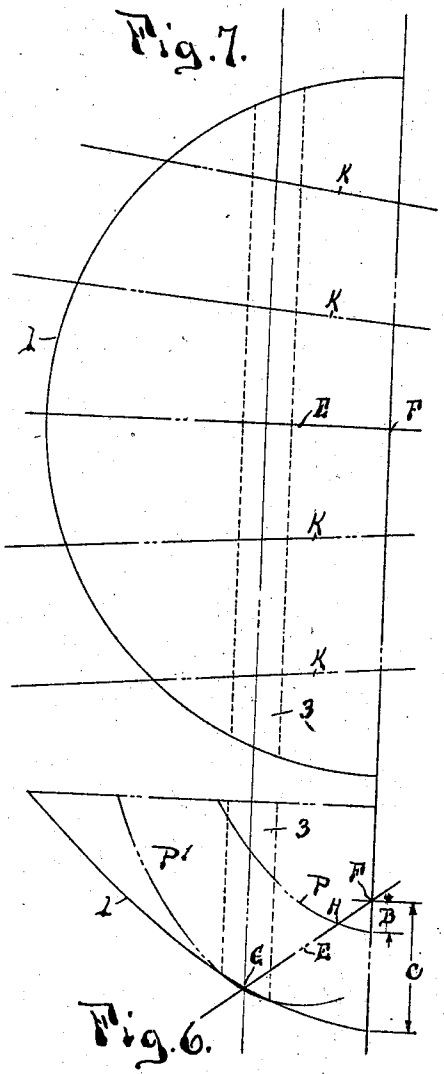


Fig.6.

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Fig. 10.

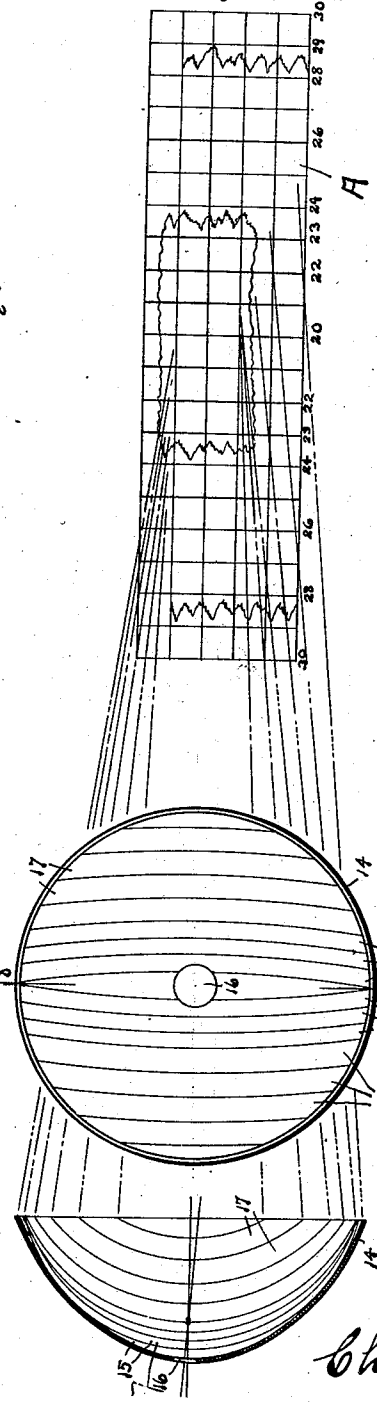


Fig. 9.

Fig. 8.

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Patented Mar. 22, 1927. 1,621,585

UNITED STATES PATENT OFFICE.

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LAMP.

Application filed May 19, 1922. Serial No. 562,065.

This invention relates to the construction of the reflectors of projecting lamps for vehicles of the type shown in my application Ser. No. 559,204, filed May 8th, 1922, and has the same object, that 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.

This present invention employs a simple reflector for vehicle lamps of a substantially parabolic type, and deforms the reflector so that different portions thereof will project beams whose cross-sections are similar in shape but different in size, so that the larger beam or beams will afford a general road illumination of considerable spread while the more concentrated beam or beams will light a narrower stretch of road for a considerable distance ahead of the vehicle.

This deformed reflector projects beams of greater width than height, and is suitable for considerable variations both in the spread of the beams and in their relative intensity.

A reflector of this character can be made at approximately the same cost as an ordinary paraboloidal reflector of the same dimensions and the deformations do not interfere with the usual machine polishing of the reflecting surfaces. An ordinary paraboloidal reflector is divided into a series of panels which extend transversely to the direction in which the beam is to be expanded, each of these panels having its longitudinal medial portion disposed rearwardly of the general paraboloidal form of the reflector, the lateral edges of the reflector remaining in this original paraboloidal surface. The depths of the concavities of the cross-sections or the widths of the panels may be varied according to the desired spread of the projected beam, and the relation of the central lines of the panels to the vertical plane passing through the axis of the reflector may be varied according to the directions in which the beam is to be expanded.

The cross-sections of any panel on a line radial to the inner edge of the panel is the same as a horizontal cross-section of the same width of a predetermining parabola having the same focal point and focal axis but less focal distance than the reflector, the center of this cross-section of the determining parabola being in a line connecting the focal points of the parabola and the center of the said cross-section of the panel. This is true in reflectors the sides of whose panels are all parallel and vertical and in reflectors divided into curved or irregular panels, so long as the cross-sections of these panels are tilted into the planes in which light is to be spread. If the central lines of the panels of a reflector having a horizontal axis were all in vertical planes, the beams of the reflector would be expanded from circular to elliptical cross-sections with the major axis horizontal. But if the panels are curved slightly toward or away from a vertical plane, the beam is changed in cross section substantially to that of a horizontal rectangle.

These panels may all be of the same width or of different widths, the spread of light being determined by the focal length of the determining parabola, varying substantially inversely with such length.

Panels having paraboloidal sections project rays which diverge equally from the axis of the reflector, the rays of each panel covering substantially a predetermined field of light.

In the accompanying drawing, Fig. 1 is a horizontal section of a reflector embodying the present invention on the line 1—1 of Fig. 2. Fig. 2 is a front elevation of the reflector. Fig. 3 is a diagram illustrating the effect of the light rays projected by the reflector shown in Figs. 1 and 2. Figs. 4, 5, 6, and 7 are diagrams showing the process for determining the proper cross-sections of the paraboloidal panels. Fig. 8 is a vertical section of a reflector on the line 8—8 of Fig. 9. Fig. 9 is a front elevation of the reflector. Fig. 10 is a diagram illustrating the effect of the light rays projected by the reflector shown in Fig. 8.

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

Fig. 2 is a front elevation of a reflector embodying this invention, but Figs. 1 and 3 are to be taken together, the observer being supposed to be stationed at the bottom of the sheet looking at the diagram Fig. 3, which, being in a vertical plane, receives the rays of light from the reflector 1. This reflector is generally parabolic in form. If a light bulb could be made with a filament having substantially no dimensions and if

this filament were 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 having a somewhat indefinite surface.

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 the central aperture 2 of the reflector in Figs. 1 and 2 being wider than those farther away although these widths may be reversed. Each of these panels is substantially in a vertical plane, as shown in Fig. 2, those on each side of the center of the reflector being parallel to each other, but all of the panels are preferably curved slightly in order to effect the projection of diffused light toward the corners of the main projected field.

The method of obtaining the exact curvatures of the various panels is illustrated in Figs. 4 and 5. The paraboloidal reflector which is to be provided with a panel 3 is indicated by the character 1, while the determining parabola is indicated by the character P. The reflector and the determining parabola have the common focal point F, and their respective focal distances are indicated by the lines C and B. The line E passes from the focal point F through the determining parabola at H and through the middle G of the panel 3 at the point where the curvature of this panel is to be determined. A section of the parabola P with the point H as a center and of the width of the panel 3 at G is then plotted as shown in Fig. 4, the continuation of the parabola when thus plotted being indicated by the line P. 1.

The remainder of the panel 3 is similarly determined and the result is, that a reflector thus constructed widens the beam of light to give it a cross section which is substantially rectangular with its upper and lower borders substantially parallel to the plane of the line E in Fig. 5. 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.

Where the panels are at any other angle to the vertical plane of the reflector or parallel thereto, the same process for determining the curvature of the panels composing the reflector may be followed, as indicated in Figs. 6 and 7. This is true no matter at what angle the line E (Fig. 7) crosses the side edges of the panels.

Each of the panels presents a transversely concave surface toward the plane of the open end of the reflector and the curvature of each panel at every point in its length is desirably the same as a horizontal cross section of the determining parabola taken in a line passing through the focal points F and placed so as to coincide with the normal reflector at the edge of each panel and tilted into the planes in which the light is to be spread.

In Fig. 3, the diagram A shows the proportionate illumination of a field by means of a reflector of this character, the field being divided as shown into one hundred squares.

With the source of illumination at the focal point 9, Fig. 1, some of the reflected light rays are projected by the wide and deeply concave panels 3 over a surface extending substantially from one vertical line 48 to the other, and from horizontal line 30 to line 34, and if the panels 4 were coated with a non-reflecting material, it would be observed that the illumination of this area is remarkably uniform. Its side borders are not as clearly defined as its upper and lower limits but are still clearly distinguishable. These rays are indicated as being limited by the lines 12 and 13.

The side panels 4 are narrower than the middle panels 3 and their transverse curvatures are much less, so that the light reflected by these side panels is diffused to a much less extent, as indicated by the lines 10 and 11, for the reason that the narrower panels approach more closely to the true paraboloidal reflector surface. For example, I have found that with the panels proportioned as in Fig. 2, these side panels will project light on about the middle one-fourth of the field illuminated by rays projected by panels 3. The result is that at any desired testing distance, the field or chart shown in Fig. 3 can be illuminated by any combinations of beams of light, that is, more or less concentration or more or less diffused light, to the extent of spreading the beam candle power of the normal parabolic reflector over the respective field areas. This is accomplished by varying the proportionate width of the sections or panels for the different fields of light. It is not my intention to limit myself to only two beams of light, one within the other, as it may be advantageous to throw more light onto some other point on the roadway which can easily be accomplished by altering the panels and sections so as to project two or more separate beams of light. Also it is not my intention to limit myself to the extent that the tops of the separate beams of light shall coincide at any particular distance, as it may be desirable at some time to have them coincide at a less or greater distance from the reflector, so the angle of the axis of the two or more sections of the panels may vary in degree.

It will be observed in Fig. 3 that the upper edge of the area of intense illumination caused by the panels 4 is between the hori-

zontal line 30 and the line 31 above, which is above the upper edge of the illumination caused by the panels 3. This is produced by tilting that portion of the reflector which embodies the panels 3 on the focal axis of the reflector as a center, as indicated in Figs. 8 and 9, through an angle sufficient to make these upper beam edges differ, which in this instance means an angle of about one degree. This causes the point of most intense illumination of the field shown in Fig. 3 to be just below the upper horizontal line 31 instead of having the intensified field central of the less brightly lighted field.

Figs. 8, 9, and 10 show a reflector 14 having narrow panels 15 near the central opening 16 and wider panels 17 on the outside thereof. The rays reflected by the narrower panels 15 are concentrated on the space between the lines 23. It will be apparent that in this case, as in that shown in Figs. 1, 2 and 3, the wider panels diffuse the light over the entire area of illumination of the diagram A between the lines 28. But because of the shallower curvatures of the narrow panels 15 the illumination is more closely confined to the space between the lines 23 than in the reflector shown in Fig. 2, wherein the wider central panels, because of their greater curvature, diffuse the light laterally beyond the lines 48 to a considerable extent.

In these modifications the light is diffused laterally upwardly and downwardly into the planes of the tilted cross sections of the panels, having a tendency toward squaring the corners.

From the above described illustrations it will be obvious that the various features of my invention may be carried out in many different embodiments, and that the widths and cross sections of the panels constituting reflectors according to my invention may be varied to produce the desired reshaping of the normal beams from those produced by the general type or reflector employed, according to the desired extent of the intensifying or plural beam effect and according to the relative desired position of the different beams. I therefore do not wish to be limited to the particular details of construction and arrangement here disclosed, which obviously might be varied within the scope of the following claims in a great many ways without departing from the spirit of my invention. Neither do I wish to be limited to the use of such reflectors for vehicle headlights, as they might be employed with equal advantage for other purposes, such as show window lights and so called flood lights.

I claim:—

1. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels having parallel sides and the panels of each group being parallel to each other, each panel being transversely concave relative to 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, the adjacent edges of the two inner panels of the two groups being curved apart at the center of the reflector.

2. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels having parallel sides and the panels of each group being parallel to each other, each panel being transversely concave relative to 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, the adjacent edges of the two inner panels of the two groups being curved apart at the center of the reflector, the panels of each group constituting inner and outer sections, and the panels of one section being wider than the other and adapted 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 having parallel sides and the panels of each group being parallel to each other, each panel being transversely concave relative to 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, the adjacent edges of the two inner panels of the two groups being curved apart at the center of the reflector, the panels of each group constituting inner and outer sections and the general focal axis of the inner sections being at an angle to the general focal axis of the outer sections but in the same vertical plane.

4. A paraboloidal reflector whose reflecting surface is scored to form panels which are all concave in cross section relative to the general focus of the reflector, the transverse curvature of each portion of each panel being the same as that of the general curve at that point of a parabola of less focal distance.

5. A substantially paraboloidal reflector composed of panels of different widths, all extending in the general direction of one plane and all having their longitudinal medial portions disposed back of the true paraboloidal surface, the ends of the said panels all being bowed relatively to the said plane, the panels on one side of a vertical plane being symmetrical with those on the other side of said plane.

6. A substantially paraboloidal reflector composed of panels of different widths, all extending in the general direction of a vertical meridional plane and all having their longitudinal medial portions disposed back of the true paraboloidal surface, the ends of the said panels all being bowed relative

to the said plane, the wider panels having their focal axis at an angle to that of the narrower panels.

7. A light concentrating reflector having a horizontal axis and having its reflecting surface scored to form panels which are all concave relative to the general focus of the reflector, the transverse curvature of each portion of each panel being the same as that of the curve of a determining parabola having the same focal point and focal axis as the reflector at a point of intersection of the determining parabola and a line from said focus passing through said portion of the panel.

8. A light concentrating reflector having a horizontal axis and having its reflecting surface scored to form panels which are all concave relative to the general focus of the reflector, the transverse curvature of each portion of each panel being the same as that of the curve of a determining parabola, having the same focal point and focal axis as but less focal distance than the reflector at a point of intersection of the determining parabola and a line from said focus passing through said portion of the panel, such line of curvature being tilted into the plane in which the light is to be spread.

9. A reflector having its reflecting surface scored to produce panels which are concave relative to the general focus of the reflector, the cross section of any panel on a line radial to the inner edge of any panel being the same as a horizontal cross section of the same width of a determining parabola having the same focal point and focal axis, but less focal distance, the center of this cross section of the determining reflector being a line passing through the focal centers of both the reflector and parabola and through substantially the middle of said cross section of said panel.

10. A paraboloidal reflector composed of a group of panels on each side of the center of the reflector, the panels having parallel sides and the panels of each group being parallel to each other, each panel having a concave transverse section relative to the mouth of the reflector and such transverse curvatures at each point being the same as that of the general curve of a shorter focused parabola at the corresponding point, the adjacent edges of the two inner panels of the two groups being curved apart at the center of the reflector, the panels of each group constituting inner and outer sections and the general focal axis of the inner sections being at an angle to the general focal axis of the outer sections.

11. A light concentrating reflector having a horizontal axis and having its reflecting surface scored to form panels all having concave transverse sections relative to the mouth of the reflector, the transverse curvature of each portion of each panel, taken along the plane in which the light is to be spread, corresponding to that portion of a shorter focused determining parabola which portion is at the same angular displacement from the focal axis.

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