June 25, 1929. J. F. RAYNOLDS 1,718,256

HEADLIGHT REFLECTOR

Filed April 25, 1927 2 Sheets-Sheet 1

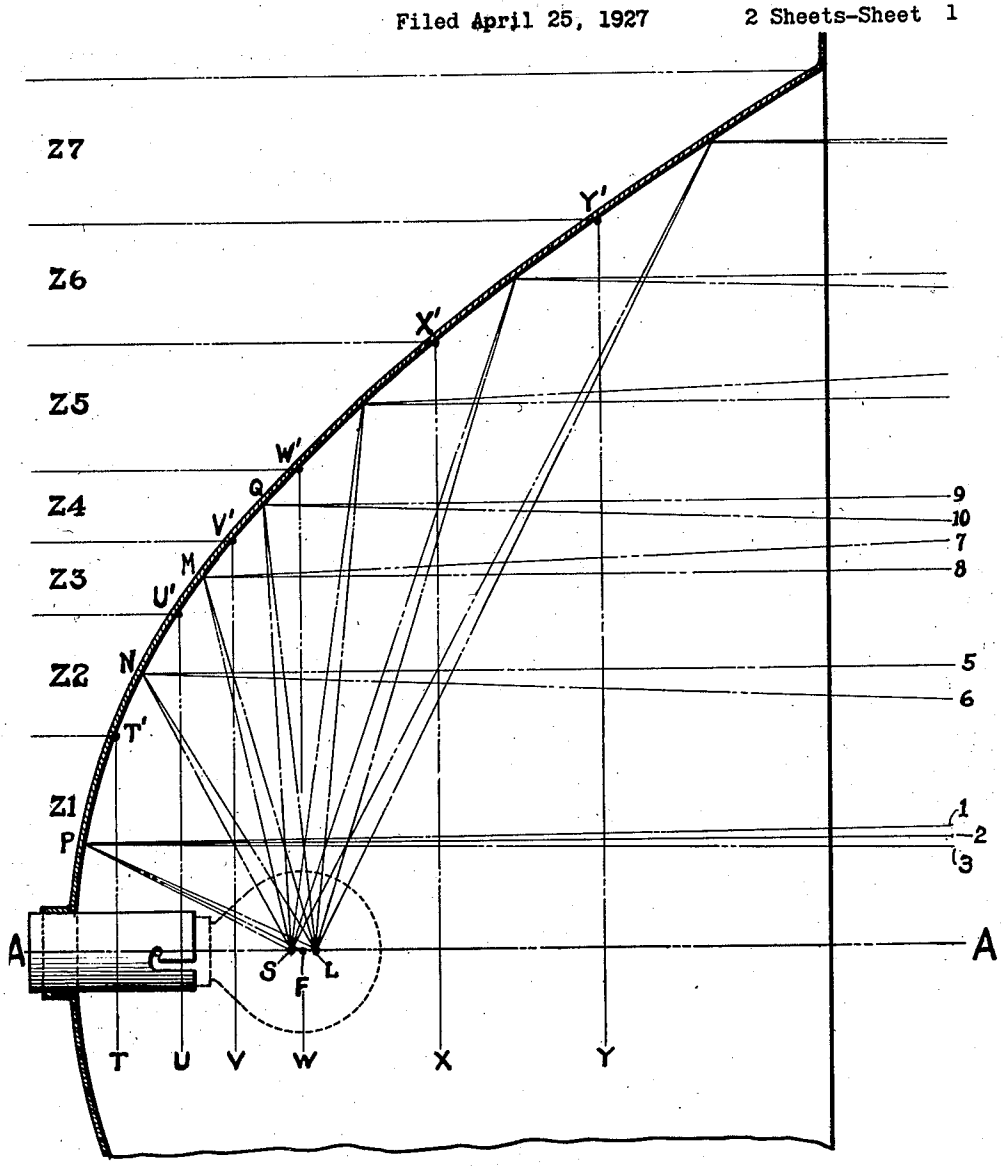


FIG. 1

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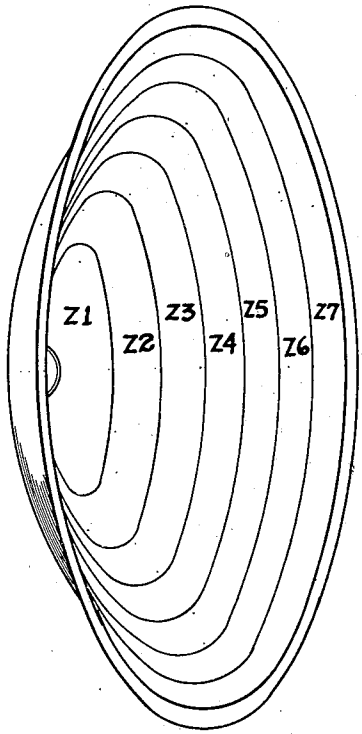


FIG. 3

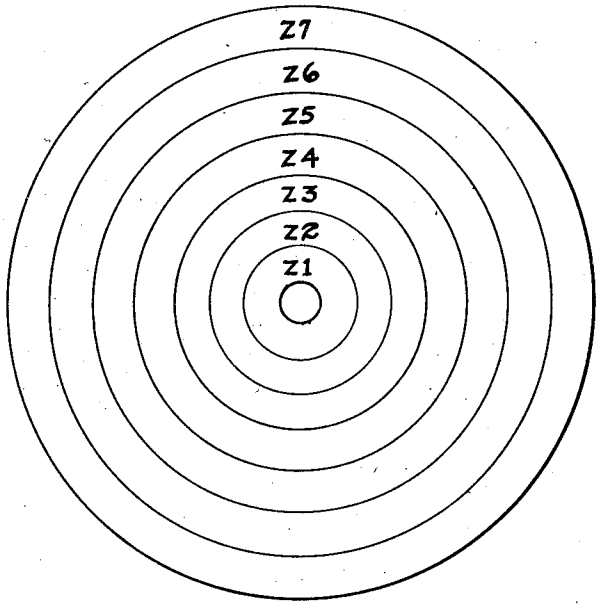


FIG. 2

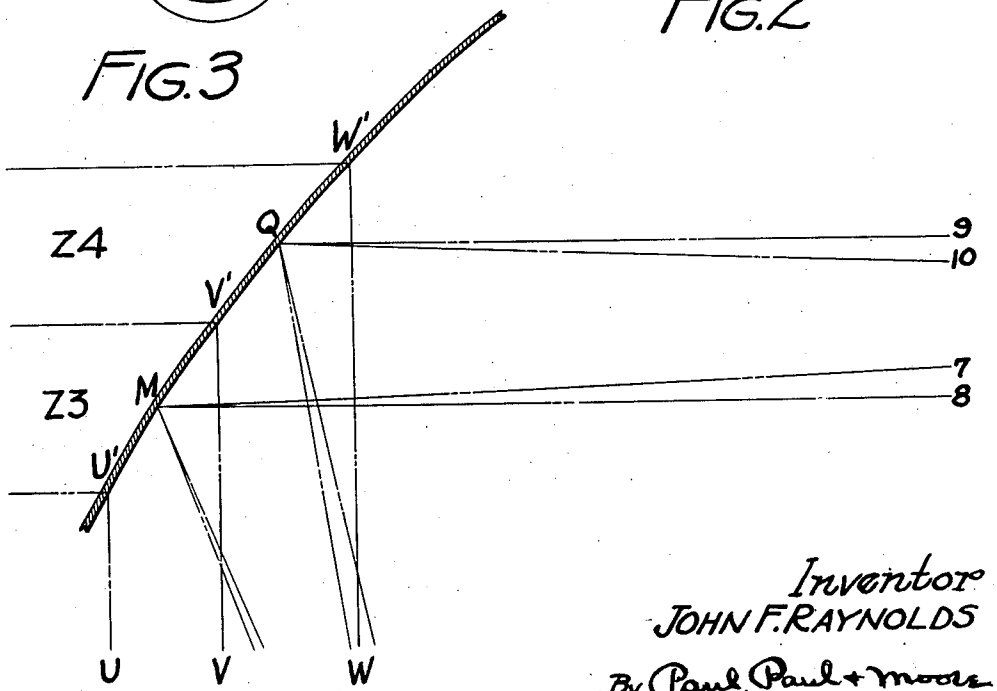


FIG. 4

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Patented June 25, 1929. 1,718,256

UNITED STATES PATENT OFFICE.

JOHN F. RAYNOLDS, OF MINNEAPOLIS, MINNESOTA.

HEADLIGHT REFLECTOR.

Application filed April 25, 1927. Serial No. 186,406.

This invention relates to improvements in concave reflectors adapted for projecting a beam of light of relatively high concentration or intensity, and more particularly relates to reflectors adapted for use in headlights of motor vehicles.

The present forms of light projecting apparatus are more or less unsatisfactory in practical use because they require that the incandescent bulb be accurately focused, i. e., it must be located so that the center of the lighted filament is at the focal point of the reflector.

Since the present allowable commercial variation in the light-center length of headlight bulbs is plus or minus 3/64″, it is clear that if the reflecting surface is designed, as is common practice, for one geometric focal point having location but no dimensions, it will be necessary to adjust or focus each bulb that is used in a given reflector.

This invention is designed to eliminate the necessity of axial adjustment of the bulb, by providing in conjunction with a suitable prismatic lens or cover glass, a desirable, legal, practically constant beam of light with any bulb, the dimensions of which conform to commercial variation allowances as above mentioned. In practice the bulb may be inserted in a suitable fixed socket which fits an aperture in the vertex of the reflector and holds the bulb with its filament in the axis of the reflector, the center of mass of the filament lying within the compensating limits of the reflector as shown below. Thus, the usual axial focusing mechanism is eliminated, and it becomes simpler to retain a satisfactory light beam which, of course, may be modified in shape and direction by a suitable prismatic lens or cover glass.

The particular object of the present invention, therefore, is to provide an improved reflector for headlights, designed in such a manner that it will not be necessary to axially adjust the light bulb with respect to the reflector to focus the lamp.

Other objects of the invention will appear from the following description and accompanying drawings and will be pointed out in the annexed claims.

In the accompanying drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the accompanying drawings forming part of this specification;

Figure 1 is a vertical sectional view of the upper half of my improved reflector, showing the various zones and the direction of the rays of reflected light from the respective zones;

Figure 2 is a front elevation of a whole reflector as constructed from Figure 1;

Figure 3 is a perspective view of a reflector having the various zones indicated; and

Figure 4 is a diagrammatic view showing on an enlarged scale, a portion of the reflector surface.

The novel reflector featured in this invention has its reflecting surface divided into a plurality of concentric circular zones, which I have marked on the drawings as Z^1, Z^2, Z^3, Z^4, Z^5, Z^6, and Z^7. The center or innermost zone Z^1 includes the vertex of the reflector, and has its outer edge terminating in an imaginary plane perpendicular to the axis A—A of the reflector, as indicated by T—T′ in Figure 1. F represents the focal point of the center zone Z^1. All of the zones illustrated in Figure 1 are sections of paraboloids of revolution, each section being bounded by planes perpendicular to the common axis A—A of all the paraboloids, as for instance U—U′, V—V′, W—W′, X—X′, and Y—Y′.

The center zone Z^1, in Figure 1, has been arbitrarily chosen with its focus at point F and a focal length of approximately 1¼ inches. The second zone Z^2 has its focus at point S, and the focal length is determined so that the curve contains point T′, and joins the curve of the center zone Z^1 to make a continuous, practically smooth surface. The third zone Z^3 similarly has its focal length located so that the curve contains U′, but the focal point for this zone is located at point L. Points S and L lie substantially in the axis A—A at suitable distances respectively inside and outside point F. Similarly, the 4th zone has its focus at S, the 5th zone at L, and so on in alternation, each focal length being located so as to make the ends of adjacent zones coincide, thus avoiding

actual steps or offsets in the reflecting surface. In Figure 4, the zones are shown exaggerated to more clearly illustrate the zoning of the reflector surface.

Now, if a lighted bulb filament is located with its center of mass at F, the center zone is in exact focus and projects a concentrated circular beam of high intensity light, the focal ray being shown by FP^2. The ray projected from the rear (or inner) end of the filament is shown by SP^1, and that from the front (or outer) end of the filament by LP^3. With relation to zone Z^2, the center of the filament will be slightly in front of the focal point S, hence the various rays reflected from this zone will converge relative to corresponding rays from the center zone, and will cross each other a short distance ahead of the reflector, producing a circular beam or spot of light, larger and of less intensity at any considerable distance, than the beam from the center zone. The rays projected from any point of zone Z^2 are shown by SN^5 and LN^6. In this case, it will be noted that line N^5 is substantially parallel to the axis A—A.

With relation to zone Z^3, however, the center of the filament is back of the focal point L, hence reflected rays from this zone will diverge more than those from any other zone, the focal point of which lies between point L and the vertex, and will therefore again produce a beam of greater diameter than that from the center zone Z^1. Zones Z^4 and Z^6 will reflect similarly to zone Z^2, and zones Z^5 and Z^7 similarly to zone Z^3. The rays projected from any point of zone Z^3 are shown by SM^7 and LM^8, and those projected from zone Z^4 are shown by SQ^9 and LQ^{10}. (See Figure 1.) In this figure, it will be noted that the rays M^8 and Q^9 are also substantially parallel to the axis A—A of the reflector. The rays M^7 and Q^{10}, however, converge, and will therefore cross each other a short distance ahead of the headlights. It is to be understood, of course, that the particular relation of the zones with respect to one another need not necessarily be followed as illustrated in the drawings, as their order may be reversed and practically the same results obtained. Also the number of zones employed may be varied, as desired, without departing from the invention. The important feature of the invention, however, is to provide a reflector having its surface divided into annular concentric zones which are arranged in such a manner that a desired light beam will be projected therefrom without the necessity of having to focus the light bulb therein.

Now it is clear that movement of the light-center along the axis, within the limits between S and L will cause the beams from one set of zones to increase in diameter while those from the other set of zones will decrease in diameter. The center zone, as illustrated in Figure 1 is the exception. Its reflected beam will increase in diameter as the light center is moved either way along the axis A—A from its focal point F, but owing to the small change in the angle of incidence of the projected rays to this zone, when the source of light varies axially, the change in diameter of the reflected beam will be less than for any other zone outside the center zone. This is shown in Figure 1 by the angles SPL and SQL, the former being the smaller angle. It is to be understood, however, that if desired, the center zone Z^1 may be designed with its focal point at either S or L instead of at the intermediate point F, provided an alternating relationship between the focal points for adjacent zones is preserved as hereinbefore described.

If the sum of the areas of zones with focus S is made approximately equal to the sum of those with focus L, we shall have roughly equal areas tending to produce a more concentrated beam, and a more divergent beam respectively, when the light center is axially removed from point F. Hence, the reflector is less sensitive to variations in the light-center length of incandescent bulbs, and may be used without means for axial adjustment of the bulb. It may be desirable to provide in a headlight with the reflector, means for adjusting the bulb perpendicular to the axis A—A, in order to secure the most desirable distribution of rays from the various portions, or if a bulb is used which contains two filaments of equal light center length arranged one above the other in parallel planes.

I claim as my invention:

1. A concave reflector, adapted for a centrally located concentrated source of light, the reflecting surface of said reflector being continuous and unbroken and composed of a plurality of zones defined by planes cutting said surface and perpendicular to the main axis thereof, each zone having a focal point lying substantially in said axis, and the focal points of adjacent zones being displaced alternately closer to and further away from the vertex of the inner zone.

2. A concave reflector, adapted for a concentrated source of light located substantially in the main axis thereof, the reflecting surface being continuous and unbroken and composed of a plurality of zones defined by planes cutting the reflecting surface perpendicular to the main axis thereof, the inner zone containing the vertex and having a single focal point in said axis, and the outer zones having their respective focal points in said axis and alternately closer to and further away from the vertex than the focal point of said inner zone.

3. A reflector having a continuous surface

composed of a plurality of sections of paraboloids of revolution, all sections having a common axis and being bounded by planes perpendicular to said axis, the radii of adjacent sections in their common bounding plane being equal, and the various paraboloids being of such focal lengths that their respective focal points lie alternately nearer to and further from the vertex of the inner section than the focal point of said inner section.

In witness whereof, I have hereunto set my hand this 22d day of April, 1927.

JOHN F. RAYNOLDS.