July 22, 1924. 1,502,453

W. H. WOOD

HEADLIGHT

Filed May 11, 1921

Fig. 1.

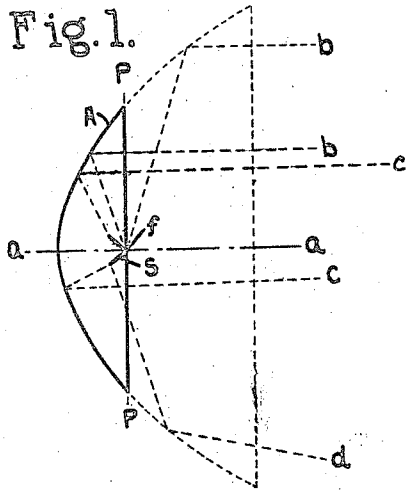


Fig. 2.

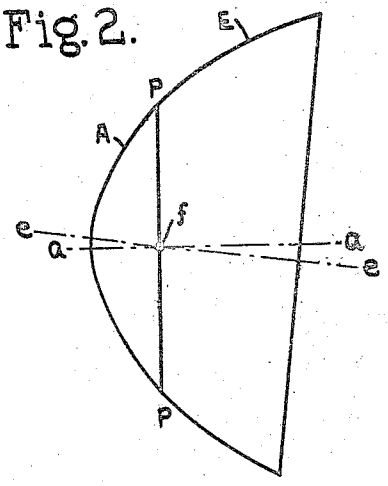


Fig. 3.

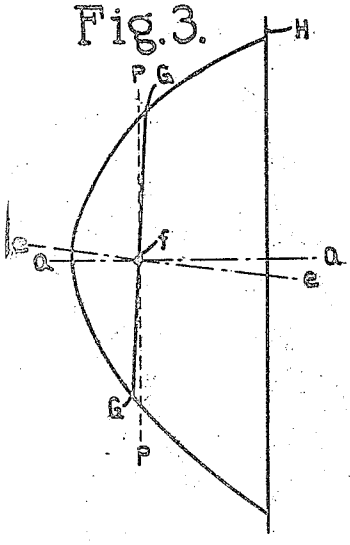


Fig. 4.

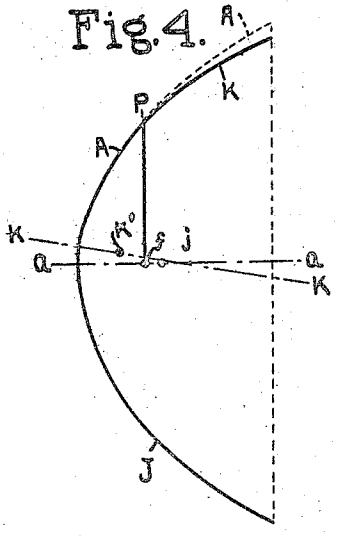


Fig. 5.

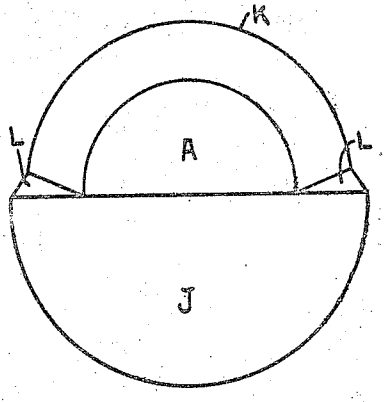


Fig. 6.

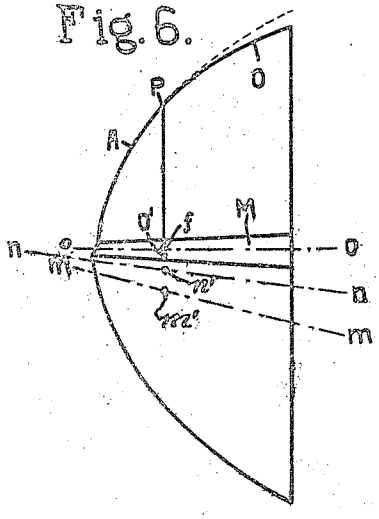
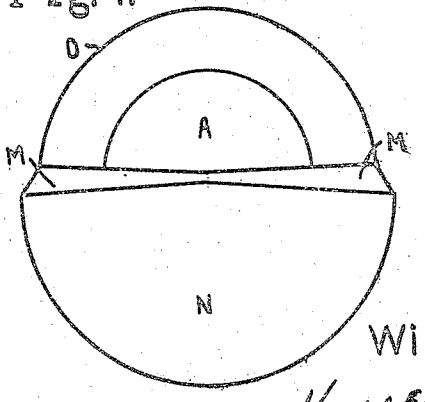


Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM H. WOOD, OF SOUTH EUCLID, OHIO.

HEADLIGHT.

Application filed May 11, 1921. Serial No. 468,639.

To all whom it may concern:

Be it known that I, WILLIAM H. WOOD, a citizen of the United States, residing at South Euclid, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Headlights, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to headlights for automobiles and like vehicles and has for its general object the provision of a reflector of simple form by which the light rays can be controlled in such wise as to use the largest possible proportion of them beneficially without causing such an upwardly projected glare as to dazzle or confuse meeting travellers. From a commercial standpoint it is imperative that the device be one that can be drawn in dies and polished by machinery in the same way that plain parabolic reflectors are polished; that the dies be of simple and rugged construction so as to be kept in order easily; that the rays emitted by a V-shaped filament be controlled as effectively as those produced by the older types of filament; and that the use of special lenses or glasses be dispensed with. All these requirements are met by my invention.

The essence of my invention resides in inclining downwardly the axis of a greater or smaller proportion of the reflecting surface which lies forward of the light source, while retaining horizontal the axis of a greater or smaller proportion of such surface which lies at the rear of such light source. The basic optical theory is as follows:

Assuming a paraboloid reflector and a light source consisting of a geometrical point, if that light source coincide with the focal point all rays falling on the reflector will be reflected forwardly parallel with the parabolic axis; if the source be moved to a position on the axis forward of such focal point, all rays falling on the reflector will be converged; and if the source be moved to a position on the reflector-axis at the rear of the focal point all rays falling on the reflector will be diverged. However no practical light source is known which even approximates the dimensions of a geometrical point, but all sources exhibit a decided extension laterally of the axis as well as longitudinally thereof. The commonest present-day source is an incandescent filament having a V shape, mounted in a horizontal position symmetrically of the reflector-axis and having its apex located substantially at the focal point with the legs thereof extending toward the vertex of the reflector and also diverging laterally; and it is this divergence which has entailed more difficulty in light-control than any other single element.

This difficulty arises largely from the fact that if a light source be shifted laterally of the axis of a plain paraboloid reflector, all rays which fall thereon inside a given point are thrown to the opposite side of the reflector axis while all rays which fall on this reflector outside the point are thrown to the same side on which the source is located, this point being determined by the intersection with the reflecting surface of a straight line which passes through the focal point and through this particular light source. Assuming that the light rays are emitted equally in all directions, which owing to the constructional details of the lamp is not strictly true although approximately so, one half of all the light emitted by the source is reflected inside the parameter and this constitutes about five-sixths of all the rays which are reflected, owing to the large open front of the reflector; but the rays reflected by the part of the reflector located in front of the parameter are almost completely responsible for the objectionable glare so often observed.

My invention, therefore, involves such an inclination of the surface of the parts forward of this given point as will overcome this objectionable feature, while retaining the horizontal position of the axis of some or all of the parts at the rear of this point so as to retain their beneficial effect. For purposes of convenience of definition I have defined this point as being approximately at the parameter, and while this is not strictly accurate scientifically it is sufficient practically since no objectionable glare ever arises inside the true parameter. By the expression "approximately at the parameter" I mean anywhere inside that region, although the break between the different portions may fall anywhere within a considerable area thus generally defined.

Experiments readily show that a plain paraboloid reflector produces its worst glare when used with a V shaped filament and

that the most objectionable part of this glare comes from the portion of the reflector which lies forward of the parameter. It has been suggested to leave this part off completely, indeed this is exactly what was done in the gas and oil lamps which preceded these incandescent bulbs, but such a construction at the present day is considered neither artistic, economical, nor mechanically practical. Certain manufacturers in order to approximate this condition have made their reflectors very large and shallow, bringing the bulb so far forward as to necessitate convex lenses; and these do indeed help, although the lenses are expensive and exposed to breakage, and less of the light is used.

In the drawings accompanying and forming part of this application I have shown a few physical structures, embodying the idea of my invention, together with certain diagrammatic views illustrating the principles involved in my method of light control. In these drawings Fig. 1 is a horizontal section illustrating diagrammatically the course of rays arising at different parts of a V shaped filament and reflected by different parts of a paraboloid reflector, the portion of the reflector forward of the parameter being shown in dotted lines; Fig. 2 is a diagrammatic view illustrating one mode of curing the objections indicated in Fig. 1; Fig. 3 illustrates a practical reflector embodying this principle; Fig. 4 is a diagrammatic view illustrating the principle of my invention as applied to a composite reflector; Fig. 5 is a face view of the reflector shown in Fig. 4; Fig. 6 is a diagrammatic view showing another modification of my invention; and Fig. 7 is a face view of the reflector shown in Fig. 6.

In Fig. 1, A represents a plain paraboloid reflector having an axis *a*—*a*, a parameter *p*—*p*, and a focal point *f*, while S represents a V-shaped light source symmetrically located relatively to such axis with its apex coinciding with the focal point. All rays arising at *f* are reflected parallel to the axis as shown at *b*, *b*, no matter which side of the parameter they fall; all rays arising at the extremities of the source are diverged or converged depending upon whether they fall upon the reflector outside or inside the straight line which intersects both the focus and the point of origin. However the deflection is comparatively slight as to the rays which fall inside the parameter as shown at *c* and very pronounced as to those rays which fall outside the parameter as shown at *d*. Indeed the action is really even more marked than can be shown on any drawing, since a drawing is confined to two dimensions while the action really occurs in three dimensions, thus giving rise to a cross-fire of rays producing a very objectionable glare, though this is confined almost entirely to the forward part of the reflector as any one can verify by taking two reflectors and blackening the portion of one outside the parameter and the portion of the other inside the parameter and comparing their operation.

The simplest way to remedy this is to cut off the portion forward of the parameter and to substitute therefor a portion E whose axis *e*, *e*, is inclined downwardly a sufficient amount so that substantially all the stray beams are confined at or beneath a horizontal plane as shown in Fig. 3. This portion E can be either a portion of the same original paraboloid or can be a different paraboloid. An excellent light can be produced in this way, the rays reflected by the heel-portion A constituting a concentrated distance beam and the rays reflected by the forward portion E constituting a diffused beam for near lighting and for curb illumination. The inclination can well be made somewhat lateral toward the curb side as well as downward. The only care requisite is to avoid such an extreme inclination as to separate the two beams and produce a dark region between them, or to produce such a lop-sided condition as might be difficult to draw or polish.

The simplest way to produce such a reflector is to sever a plain paraboloid reflector upon a transverse plane G, G passing through or near the focal point and making an angle with the parametral plane equal to one half the desired angle between the axes of the front and rear portion. The severed portions are then rotated 180° relatively to each other and fastened together again, and the forward portion cut off at right angles to the axis of the heel portion, thus producing the reflector shown in Fig. 3. A better way is to apply this process to the dies, thus enabling the reflectors to be drawn in one piece in the same way as the common paraboloid reflector, the mouth being provided with an integral outturned rim H. Such a reflector can be polished in automatic machinery and costs no more than the cheapest.

In this embodiment the two reflector portions have a common focal point which is located upon the lamp axis, though such an arrangement is not necessary since by suitably choosing the size of the forward portion and the point and angle of severing the same its axis can be caused to intersect the axis of the heel portion at other point, and its focal point to lie either ahead of or behind the focal point of the heel portion, thus enabling the direction and character of the light beam to be varied independently of the inclination of the axis and a smaller amount of inclination employed. Some inclination is always essential according to this invention, and such inclination always

results in an elliptical section at the point of junction. It is necessary that the ellipses of the forward and rearward portions be substantially equal but this can easily be accomplished by a suitable choice of sizes and angles.

It is not necessary to my invention that either portion of the reflector constitute a complete surface of revolution, but either can be made of a plurality of segments so long as certain segments of each portion possess the relation herein defined, and I will now describe the application of my inventive idea to such a condition. In the embodiment shown in Figs. 4 and 5, A represents a segment of a paraboloid and *a—a* its axis which coincides with the lamp axis. No part of this segment extends materially forward of the parameter P nor below the horizontal plane which contains the axis *a—a*, but its vertex merges with the vertex of a semi-paraboloid J of larger size whose axis is substantially parallel and coincident with the axis *a—a*. However its greater size causes its focal point *j* to fall sufficiently far forward of the focal point *f* of the segment A so that this fact alone creates a sufficient downward divergence of the rays which fall thereon to overcome any glaring tendency they might otherwise possess.

The portion K of the reflector which lies above the lamp axis and forward of the segment A is made of a paraboloid segment having its axis *k—k* inclined downwardly relatively to the axis *a—a* an amount sufficient to overcome the glaring tendency. The dotted lines indicate the amount of the displacement, and *k* indicates its focal point which is here located above the axis *a—a* and rearwardly of the parameter *p—p*, thus for numerous reasons producing a downward deflection of the rays reflected thereby, all of which are assumed to be derived from a V shaped filament located on the axis *a—a* with its apex at the point *f*. The small size and inclination of the portion K produce gaps at both sides of the reflector which are bridged by slanting wings L, L, as described and claimed in my Patents Nos. 1,235,274 and 1,235,275 issued July 31, 1917. It will be understood that I have exaggerated the displacement of the focal points in this view and that it is seldom that the focal point K will be both elevated above and brought behind the point *f*, but I have indicated this to show the scope of the adjustments possible under my invention.

In Figs. 6 and 7 I have illustrated the mode of applying the present invention to a reflector of the specific construction shown in said Patent No. 1,235,275. In these views A, as before, represents a paraboloid segment whose axis *a—a* is horizontal and coincident with the lamp axis. This segment is terminated forwardly at the parameter P, and at a point slightly above the axis merges with a section M consisting of the zone of a paraboloid whose axis *m—m* is inclined forwardly and having a focal point *m'*. The lower margin of this zone merges with a semi paraboloid segment N having an axis *n—n* also inclined downwardly but not so much as *m—m*, and having a focal point *n'*. The portion O of the reflector which lies above the lamp axis and forward of the segment A is made of a paraboloid segment whose axis is inclined downwardly as shown at *o—o* and whose margins merge with the margins of adjacent sections. This inclination is so chosen as to divert downwardly any glare-producing rays produced by the extremities of the light source. While I do not restrict myself thereto the arrangement I prefer and advocate is that wherein all the focal points *f*, *m'*, *n'*, *o'* are located in a single vertical line as shown.

It will be understood that my invention can be employed without employing segments that are, in all respects and at all places true paraboloids. An exact paraboloid is at best not easy to make, and the joining of two paraboloid segments together is sometimes attended with various minor irregularities caused by the workman's attempt to justify the joints, or even to dress the dies, which in time become slightly misshapen. Nearly all the paraboloids here described can be fitted together with theoretical accuracy, and all can be joined within practical limits; but if by choice, chance, or poor workmanship the segments vary more or less from the true geometrical terms herein employed to define them, I still assert that the same fall within the purview of my inventive idea.

In all the devices here shown it will be noted that all the paraboloid portions forward of the parameter of the portion A are inclined so as to fall beneath the imaginary surface of revolution produced by extending such portion A. In Figs. 2 and 3 this is effected by inclining the single axis *e—e;* in Figs. 4 and 5 this is effected by inclining the axis of the portion K while increasing the size of the portion J; in Figs. 6 and 7 this is effected by inclining the axes of the portions M, N and O. I do not, therefore, limit myself to any one mode of securing the relative inclination herein described, nor do I restrict myself in any wise except as specifically recited in those claims, since many changes can be made in these minor details within the scope of my invention.

Having described my invention what I claim is:

1. A one piece, sheet metal reflector for headlights, comprising, in combination a semi-paraboloid heel portion terminating substantially at its parameter, the portion of the reflector on the opposite side of the axis

being located outside the imaginary surface defined by said first portion and the remaining portion of the reflector which lies upon the same side of the axis being located inside such imaginary surface.

2. A one piece, sheet metal, reflector for headlights, comprising, in combination, a semi-paraboloid heel portion which terminates substantially at its own parameter, and a plurality of additional paraboloid portions merging with the margins thereof, and all having their axes deflected to one side of the axis of said first portion.

3. A one piece, sheet metal reflector for headlights, comprising, in combination, a semi-paraboloid heel portion which terminates substantially at its own parameter, and a plurality of additional paraboloid portions merging with the margins thereof, said additional portions having their axes deflected to one side of the axis of said first portion, and the focal points of all of said portions being arranged in a straight line which is transverse to the general axis of the reflector.

In testimony whereof, I hereunto affix my signature.

WILLIAM H. WOOD.