

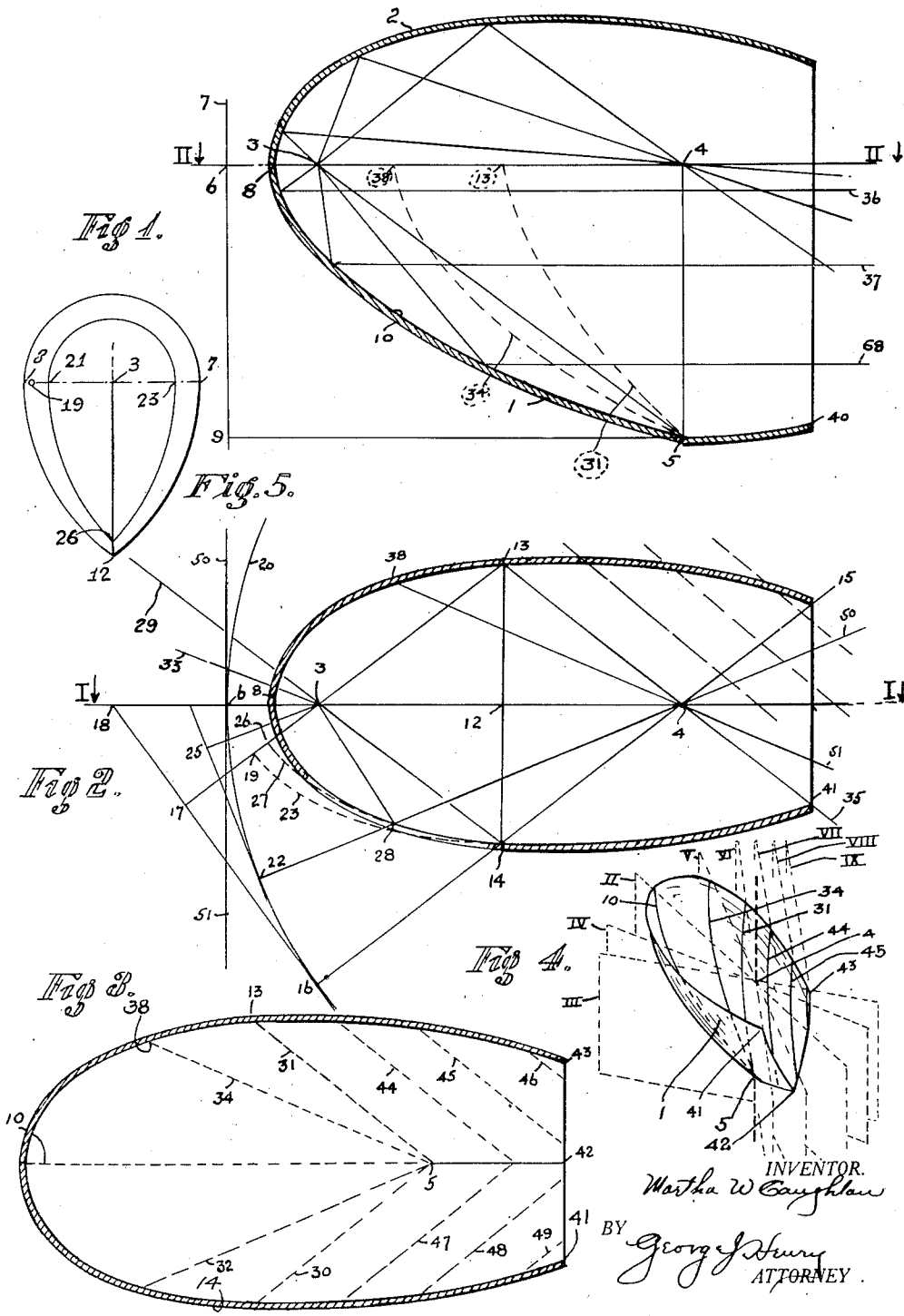
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REFLECTING SURFACE

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REFLECTING SURFACE

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My invention has for its object a reflector upon which the rays from a single source of illumination are reflected but once and are thereby projected forward as a beam of most intense central illumination with reduced side illumination, and every ray of which beam will be below a horizontal plane through a common focal point of the reflector or light source.

A further object is, in a headlight of the character described, a reflector wherein a relatively large portion of the rays emanating from a light source located at a common focal point, are reflected below and parallel with the horizontal plane and wherein the remaining rays emanating from the lamp are directed downward and over an area below said plane; and all are within a predetermined angle of divergence.

These objects I attain by providing a reflector having a light source located at a common focal point, the lower surface of said reflector being formed of differential elements of successive and varying paraboloids of revolution and whose upper portion is formed by rotating about an axis of symmetry through said focus, the figure formed by the intersection of the lower portion of the reflector with a horizontal plane through said axis.

Referring to the drawing.

Fig. 1 is a vertical longitudinal section through one form of the reflector of my invention, and passing through the common focus, and on the line I—I of Fig. 2.

Fig. 2 is a horizontal section through the reflector of Fig. 1 and taken on the line II—II thereof, and passing through the common focus.

Figs. 1 and 2 show the mathematical construction and proof of operativeness of the reflector of my invention.

Fig. 3 is similar to Fig. 2 but showing the lower reflecting surface in plan and with lines shown thereon to indicate certain of the selected elements or chains of points selected from the family of paraboloids of revolution, and which collectively produce the said surface.

Fig. 4 is a reduced perspective of the lower

half of the reflector of Figs. 1, 2 and 3 showing in dotted lines the pencil of planes and in full curved lines the intersection of said planes with their respective paraboloids and therefore they are all parabolas, and the sum of such infinite numbers of parabolas forms the principal portion of my reflector surface.

Fig. 5 is a front view of a completed lamp employing my invention.

Throughout the figures similar numerals refer to identical parts.

A horizontal plane through the axis of symmetry is shown at I—I.

A vertical plane through the axis of symmetry is shown at II—II.

Other vertical planes are shown at III—IV—V—VI—VII—VIII—IX. All of these vertical planes pencil about the vertical axis 4, 5.

The numeral 1 indicates generally the lower portion of my reflector and the numeral 2 the upper portion thereof.

At 3 is a common focus which is also the light source employed with my reflector.

The construction of my surface is based on the mathematical fact that there can be constructed a family of paraboloids, with a common focus 3, whose axes revolve in a horizontal plane about that focus as a pivot, and all whose surfaces pass through a common point 5. As that point is necessarily at a fixed distance 3, 5, from the common focus 3, it is also at the same perpendicular distance 4, 6=5, 9 from the directrix of each paraboloid of the family. The directrix planes of the family are therefore all tangent to a right circular cylinder whose axis is the perpendicular 4, 5 from the axis of symmetry 3, 4 to the common point 5, and whose radius is the distance 5, 9, from the foot of that perpendicular to the directrix 7, 9 and which is also the distance 3, 5, of the common point from the common focus.

Let 8 be the vertex and 8—4 the axis of one paraboloid and 50, 51 the trace of its directrix plane on the horizontal plane I—I and 7, 9 its trace on the vertical plane of symmetry II—II. With the focus (the light source) at 3, I select a convenient point 4 on the axis and drop a perpendicular 4, 5 and let 3, 5 100

equal 4, 6. Then 5 is on the surface of the paraboloid, since 3, 5 equals 4, 6 equals 5, 9 which satisfies the mathematical law of the parabola. Since 3, 5 is constant for all of the family of paraboloids, whose focus is 3 and which pass through 5, the length 4, 6 is also constant for all, and the directrix planes for all must be tangent to a right circular cylinder having a radius equal to 4, 6, and an axis at 4, 5.

Let the circular arc 20, 6, 22, 16 be the trace of that cylinder in the horizontal plane I—I.

Cut the first named paraboloid by a vertical plane II—II through the axis 4, 6. The parabola 10 will result, and is the center rear line of my reflector. Now revolve the paraboloidal axis in the horizontal plane I—I on the pivot 3 to any position as 3—17 to represent the axis of any one of the family of paraboloids. (Fig. 2) and revolve a plane on 4—5 as an axis, into a position parallel to 3—17; this new plane III will cut the paraboloid in a parabola 30, congruent to the generating parabola of that paraboloid, and is also an element of the surface of my reflector.

Now 4—16 equals 4—6 being the radii of the cylinder, and 3—14 equals 14—16 (distance of point 14 from the focus and from the directrix.)

In similar manner rotate the paraboloidal axis in a horizontal plane about 3, and rotate a plane on 4, 5 as an axis, such that the plane and the axis of its corresponding paraboloid are always parallel. Let 38 be any such point in the horizontal plane where such revolving plane cuts its corresponding paraboloid. Then 34 will be the parabola cut on the surface of the paraboloid, and will be one of the elements on the reflector surface.

The infinite number of such parabolas so formed constitute the principal reflecting portion of my reflector lower surface.

In detail the manner of construction is as follows:

Select a point 4 in the plane I—I and a second point 5 below 4, such that 4, 5 is at right angles to 3, 4. Choose a point 6 on the line 3, 4 produced, and midway between 3 and 6 a point 8. Through the point 8 as a vertex, conceive a paraboloid whose directrix is 7, 9, and whose focus is 3, it will cut the plane II in the parabola 10. See Figs. 1 and 4.

By the law of the parabola every point thereon will be equi-distant from the focus and from the directrix. Such a parabola will therefore pass through the point 5, the distance 3, 5 being equal to 4, 6 equal to 5, 9. This parabola, a single element from the aforesaid paraboloid will be the central element 10 of my lower reflecting surface—see Figs. 3 and 4.

Midway between 3 and 4 at 12, draw the line 13, 14, see Fig. 2, and with 4 as a center describe the circular arc 20—6—22—16; and continue 4, 14 to 16. Continue 13, 3 to 17 on

the line 16, 18, at right angles to 13, 17 and at right angles to 4, 16.

The line 16, 18 is tangent at 16 to said arc 20.

At 19 midway between 3, 17 construct a paraboloid of revolution whose focus is 3, and whose trace is 23 and the trace of whose directrix plane is 18, 16.

The vertical plane through the axis 4, 5 and the point 14 will cut from the paraboloid whose trace is 23 the single parabolic line projected in plan as 30 of Fig. 3.

From any other point 22 on the said arc 20 draw the line 22, 4 and parallel thereto through 3, draw 3, 25. Through the center 26 construct the paraboloid of revolution whose trace is 27 on the axis 3, 25.

On 22, 4 lay off the point 28 equi-distant from 3 and 22. It will lie upon the paraboloidal surface whose trace is 27.

In like manner consider an infinite number of paraboloids of revolution all having the common focus 3 and all lying upon axes in the horizontal plane I—I, that is the plane of Fig. 2, and between the lines 3, 17 and 3, 29. The directrix planes of all of said paraboloids are to be tangent to the curve 20—6—22—16.

Now, through the line 4, 5 as an axis pass a pencil of planes II, III, IV, V, VI, etc.—see Fig. 4. Note particularly that the plane I—I of the paraboloidal axes is at right angles to the axis of the said pencil of planes.

The plane II will cut the paraboloid whose axis is 4, 6 in the parabola 10.

The plane III will cut the paraboloid whose trace is 23 and whose axis is 3, 17 in the parabola 30 and plane IV will cut the paraboloid whose trace is 27 and whose axis is 3, 25 in the parabola 32. All of these several parabolas will appear as straight lines in plan Fig. 3.

The planes V and VI will likewise cut the paraboloids whose axes are 3, 33 and 3, 29 in the parabolas 34 and 31 respectively.

There will therefore be cut from this infinite number of paraboloids by the infinite number of planes whose axis is 4, 5, an infinite number of parabolas as 10, 30, 31, 32 and 34, see Figs. 3 and 4.

The lower surface of the reflector to the left of the line 13, 14 of Fig. 2 will be made up of such an infinite number of parabolas all of which will have the common focus 3 because they are elements of corresponding paraboloids whose focii coincide at 3.

Every ray of light emanating from 3 will therefore be reflected upon said surface portion in straight lines parallel with the plane I—I and all of such rays will emerge as an illuminating beam between the lines 15 and 35 and will all pass through the vertical line 4, 5, and some of these will appear as 50, 51, 15, 41 of Fig. 2 and as rays 36, 37, 68 of Fig. 1.

The lower surface of the reflector to the right of line 13, 14 of Fig. 2, and below the horizontal plane, I—I and bounded by 14—5—42—41 is a segment of a single paraboloid of revolution whose trace is 23; and the forward portion of the reflector surface bounded by 13—5—42—43 is likewise a segment of the surface from the paraboloid of revolution whose axis is 14, 29.

If now other planes as VII, VIII, IX, parallel to the plane VI—see Figs. 3 and 4—be caused to cut the last named surface they will likewise cut parabolas 44, 45, 46 respectively; and on the opposite side of plane II similar parabolas will be cut at 47, 48, 49 by symmetrical planes parallel to plane III from symmetrical paraboloids, see Fig. 3.

As before, all the parabolas 44 to 49 inclusive being elements of paraboloids whose common focus is 3 will likewise reflect rays of light originating at the focus 3, below and parallel to the horizontal plane I—I.

It follows from the above construction that every ray of light originating at 3 and reflected from the entire lower surface of my reflector will reflect said ray in a horizontal plane below the plane I—I and through the line 4, 5 and that the aggregate of these rays will be a beam between the lines 15 and 35 of Fig. 2.

The upper half of the reflector above the horizontal plane I—I is formed by rotating one-half of the section shown in Fig. 2, through 180° about the axis 4, 6—see Fig. 1; and by the above analysis it will be seen that every ray of light originating at 3 and reflected by the upper portion of my reflector above the plane I—I will issue from the reflector below the horizontal plane I—I.

The illumination produced by my reflector will then be entirely below the horizontal plane and between the lines 15 and 35 and with the greatest intensity directly in front thereof.

I claim:

1. A compound reflecting surface having a common focus for all reflecting elements thereon at which focus a source of light is located, the said surface below a horizontal plane through said focus consisting of two rear parts symmetrical about a longitudinal vertical plane through said focus, the portion of each of said parts adjacent to said focus formed of elements from the surfaces of successive increasing paraboloids having the said common focus and whose axes all lie in said horizontal plane and also consisting of two forward parts symmetrical about said vertical plane and each comprising a surface portion from the greatest of said paraboloids.

2. A compound reflecting surface having a common focus for all reflecting elements thereon at which focus a source of light is located, the said surface below a horizontal

plane through said focus consisting of two rear parts symmetrical about a longitudinal vertical plane through said focus, the portion of each of said parts adjacent to said focus formed of elements from the surfaces of successive increasing paraboloids having the said common focus and whose axes all lie in said horizontal plane and also consisting of two forward parts symmetrical about said vertical plane and each comprising a surface portion from the greatest of said paraboloids, the smaller of said paraboloids having an axis lying also in said vertical plane.

3. A compound reflecting surface having a common focus for all reflecting elements thereon at which focus a source of light is located, the said surface below a horizontal plane through said focus consisting of two rear parts symmetrical about a longitudinal vertical plane through said focus, the portion of each of said parts adjacent to said focus formed of elements from the surfaces of successive increasing paraboloids having the said common focus and whose axes all lie in said horizontal plane and also consisting of two forward parts symmetrical about said vertical plane and each comprising a surface portion from the greatest of said paraboloids, the smaller of said paraboloids having an axis lying also in said vertical plane, and all of said axes lying within a predetermined angle.

4. A compound reflecting surface having a common focus for all reflecting elements thereon at which focus a source of light is located, the said surface below a horizontal plane through said focus consisting of two rear parts symmetrical about a longitudinal vertical plane through said focus, the portion of each of said parts adjacent to said focus formed of elements from the surfaces of successive increasing paraboloids having the said common focus and whose axes all lie in said horizontal plane and also consisting of two forward parts symmetrical about said vertical plane and each comprising a surface portion from the greatest of said paraboloids, and the said surface above said horizontal plane generated by rotating the intersection of said lower surface with said horizontal plane about the line of intersection of said horizontal and said vertical planes.

5. A compound reflecting surface having a common focus for all reflecting elements thereon at which focus a source of light is located, the said surface below a horizontal plane through said focus consisting of two rear parts symmetrical about a longitudinal vertical plane through said focus, the portion of each of said parts adjacent to said focus formed of elements from the surfaces of successive increasing paraboloids having the said common focus and whose axes all lie in said horizontal plane and also consisting of

two forward parts symmetrical about said vertical plane and each comprising a surface portion from the greatest of said paraboloids, the smaller of said paraboloids having an axis lying also in said vertical plane and the said surface above said horizontal plane generated by rotating the intersection of said lower surface with said horizontal plane about the line of intersection of said horizontal and said vertical planes.

6. A compound reflecting surface having a common focus for all reflecting elements thereon at which focus a source of light is located, the said surface below a horizontal plane through said focus consisting of two rear parts symmetrical about a longitudinal vertical plane through said focus, the portion of each of said parts adjacent to said focus formed of elements from the surfaces of successive increasing paraboloids having the said common focus and whose axes all lie in said horizontal plane and also consisting of two forward parts symmetrical about said vertical plane and each comprising a surface portion from the greatest of said paraboloids, the smaller of said paraboloids having an axis lying also in said vertical plane, and all of said axes lying within a predetermined angle, and the said surface above said horizontal plane generated by rotating the intersection of said lower surface with said horizontal plane about the line of intersection of said horizontal and said vertical planes.

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