No. 702,791. Patented June 17, 1902.

W. E. GOLDSBOROUGH.

ELECTRIC ARC LAMP REFLECTOR SHADE.

(Application filed Sept. 18, 1900.)

(No Model.)

Fig. 1.

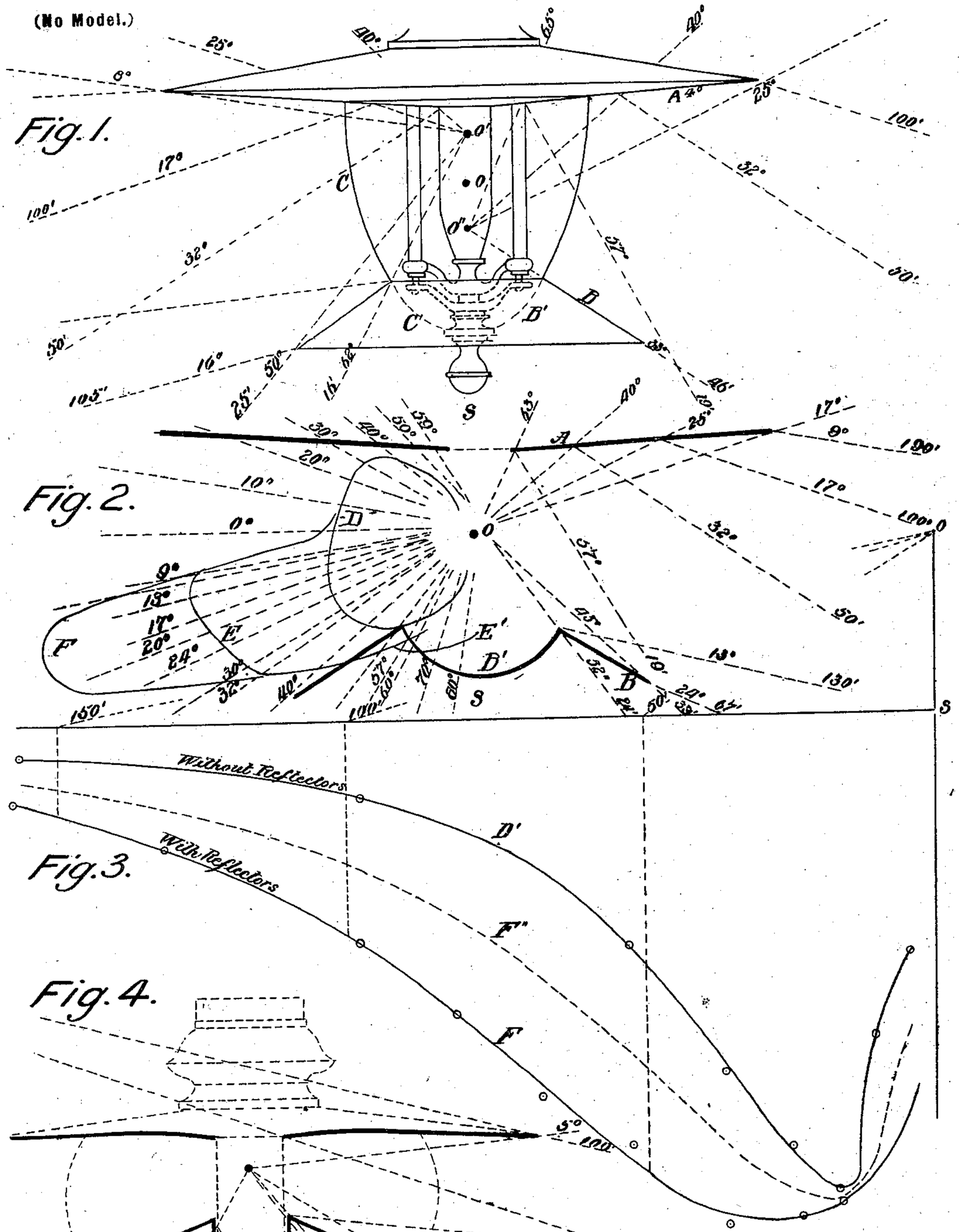

Fig. 2.

Fig. 3.

Fig. 4.

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ELECTRIC-ARC-LAMP REFLECTOR-SHADE.

SPECIFICATION forming part of Letters Patent No. 702,791, dated June 17, 1902.

Application filed September 18, 1900. Serial No. 30,436. (No model.)

To all whom it may concern:

Be it known that I, WINDER ELWELL GOLDSBOROUGH, a citizen of the United States, residing at Lafayette, in the county of Tippecanoe and State of Indiana, have invented certain new and useful Improvements in Electric-Arc-Lamp Reflector-Shades; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The purpose is to increase the quantity of light falling upon objects at a distance from a lamp above what it would normally be without appreciably diminishing the intensity of the illumination on objects immediately under or near the lamp.

The invention consists in the novel construction and combination of parts of an electric-arc-lamp reflector-shade and in the method of increasing the quantity of light falling upon objects at a distance from the source of light, all as will be hereinafter fully described and claimed.

In the accompanying drawings, forming a part of this specification, and in which like letters of reference indicate corresponding parts, I have illustrated several ways of carrying my invention into effect, it being understood that the forms of apparatus herein shown may be departed from and still be within the scope of my invention, and in these drawings—

Figure 1 is a view in elevation, exhibiting a non-focusing arc-lamp provided with my improvements. Fig. 2 is a diagrammatic view exhibiting the light distribution under certain conditions of use of my reflector. Fig. 3 is a diagrammatic view exhibiting certain surface-illumination curves derived from the apparatus shown in Fig. 2; and Fig. 4 is a focusing form of lamp, in which the lower reflector is placed on the inside of an inclosing globe, as opposed to the form shown in Fig. 1, wherein the reflectors are on the outside of the globe.

Referring to the drawings and to Figs. 1 and 2 thereof, A designates a reflector placed above the arc, and B a reflector placed below the arc. The reflector A is to be of high reflecting power, as nearly totally reflecting as possible, and for ordinary purposes a good porcelain-lined metal reflector will suffice. The reflector A, as here shown, has its reflecting-surface pitched at an angle of four degrees with the horizontal, and is therefore an inverted truncated cone, the apex of which is situated at a suitable height above the mid-burning point O of the arc. The reflector B, which is also a truncated cone, serves a double purpose and should be made of translucent material. As here shown, it has a pitch that makes an angle of thirty-three degrees with the horizontal. The surface of the reflector should be dense, highly reflecting, and opaque to light. The apex of the conical surface of the reflector B must be at a suitable distance below the mid-arc position O. The spherical portion B′ of the reflector B performs the function of a light-diffusing globe, illuminating the ground immediately under the lamp, and its center may be situated at any preferred distance below the mid-arc position O and should be translucent to the extent of not cutting off more than twenty per cent. of the light falling upon it. The lower reflector B can be made of porcelain, the conical portion being relatively thick and the spherical portion relatively thin. This reflector may be placed either on the inside or the outside of a clear glass outer inclosing globe C, Figs. 1 and 4. Where located within the inclosing globe, the truncated portion B′ of the reflector should fit snugly against the surface C′ of the inclosing globe, as shown in Fig. 4.

The reflectors are especially designed to give as nearly as possible the same distribution of light, whether the arc be burning at the top-arc position O′, the mid-arc position O, or bottom-arc position O″.

As shown in Figs. 1 and 2, whatever may be the position of the arc the light between the angles twenty-five degrees and forty degrees above the horizontal is always reflected so as to be distributed evenly on the ground between points fifty and one hundred feet from the point immediately under the lamp. By referring to the curve D in Fig. 2, which represents the illumination-curve of a good alternating-current arc-lamp, it will be seen that the strong upper light is placed in a uniformly good position.

The left-hand half of Fig. 1 shows the general distribution of the light when the arc is at top-arc position—say about two inches, more or less, above the mid-arc position O. The inner portion of the upper reflector illuminates the ground between points fifty and one hundred feet from the point immediately under the lamp. The outer portion of the upper reflector and the conical surface of the lower reflector illuminate points at one hundred feet or more from immediately under the lamp and beyond. The glow or spherical surface B′ of the reflector B takes the light below 62.5 degrees, more or less, and illuminates the ground under the lamp, while the direct light from the arc strikes the ground twenty-five feet, more or less, from under the lamp. Further, as the light from the arc makes a relatively abrupt angle with the slant surface of the lower reflector a fair proportion of the light passes through the reflecting-surface to the ground. When, therefore, the arc is in the top-arc position, there is a good diffused light under the lamp and a greatly-increased illumination at points upward of one hundred feet from the lamp.

When the arc is burning some distance below the mid-arc position, or at O″, the distribution of the light indicated on the right-hand side of Fig. 1 obtains. The outer portion of the lower reflector throws light to points one hundred feet, more or less, from under the lamp. The slant surface B of the lower reflector has no function when the arc is burning at the bottom-arc position, but will not cast a sharply-defined shadow, owing to the reflected light from the upper reflector and the strong glow-light from the lower-reflector surface B′, which catches all the light from the arc below thirty-three degrees. With the arc burning at O″ a very strong light is secured at one hundred feet from under the lamp or base-point S, practically as strong in reflected light as when the arc is as its top-arc position O′, owing to the fact that the light between twenty-five degrees and forty degrees above the horizontal is reflected from a larger and relatively more efficient part of the upper reflector. With the arc at O″ all the light between the horizontal and twenty-five degrees above the horizontal escapes reflection.

When the arc is burning in the mid-arc position, the distribution shown at the right-hand side of Fig. 2 obtains. The reflected light from the upper reflector is distributed between points nineteen and one hundred and ninety feet, more or less, from the base-point S. The reflected light from the lower reflector is distributed over the ground between points sixty-seven and one hundred and thirty feet, more or less, from the base-point S, while the diffused light from the spherical surface widely illuminates the ground beneath the lamp.

The combined glow-light and the reflected light from the upper reflector (see curve E, Fig. 2, the light between which and the curve D does not have to pass through the reflector-shade B) will in this case also prevent any defined shadow from the outer edge of the lower reflector.

Referring to the left-hand side of Fig. 2, D is the curve of light distribution from the lamp with a clear outer globe. Placing the upper reflector on the lamp and assuming total reflection of the light incident upon it, the lower part of the curve is extended to E. Placing the lower reflector-shade on the lamp and assuming total reflection from the conical surface, the curve is still further extended to F. The curve F represents a limiting maximum when the arc is in mid-arc position.

In Fig. 3 the surface-illumination curves are shown, which are derived from the curves D and F of Fig. 2. The ordinates of the curve D′ are derived from the distribution-curve D, supposing the lamp to be hung thirty feet above the ground, and is plotted in candle-feet units. The ordinates of curve F′ are derived from the curve F, and the curve F′ shows at a glance the great gain in even illumination under the lamp by using the reflectors, supposing one hundred per cent. of the light incident upon the reflectors is reflected. This is, of course, a condition which can never be commercially attained. The curve F′ can, however, be modified to suit any practical condition by reducing the length of those parts of the ordinates which are intercepted between F′ and D′ by the reflecting efficiency of the reflectors. If it be assumed as low even as fifty per cent., the resulting illumination-curve will be the dotted curve between the curves D′ and F′, and this dotted curve marks a great gain over conditions which obtain without the reflectors.

The chief difficulty has been so to adjust the reflecting-surfaces that they will be practically equally effective without reference to the varying positions taken by the arc. If, as is shown in Fig. 4, a focusing-lamp is used, an almost perfect distribution can be effected.

It is evident that my invention is susceptible of modification, and I do not, therefore, desire to limit myself to details.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination with a non-focusing source of light, of a reflector, the reflecting-surface of which is disposed with reference to the light source so as to receive the light-rays emanating therefrom within given angles to the horizontal, and uniformly to reflect the same to points within given limits, irrespective of the vertical shifting of the light source, substantially as described.

2. The combination with a non-focusing source of light, of a reflector, the reflecting-surface of which is disposed at an angle of approximately four degrees to the horizontal and so arranged relative to the light source that it will receive the light-rays emanating

therefrom, within given angles to the horizontal, and uniformly reflect the same to points on the ground within given limits, irrespective of the vertical shifting of the light source, substantially as described.

3. The combination with a non-focusing source of light, of a reflector, the reflecting-surface of which is so disposed with reference to the light source that it will receive the light-rays emanating therefrom between the angles of twenty-five degrees and forty degrees to the horizontal and uniformly reflect the same to points on the ground between fifty feet and one hundred feet distant, irrespective of the shifting of the light source within the usual limits, substantially as described.

4. The combination with a non-focusing source of light, of reflecting-surfaces arranged at such an angle as uniformly to receive the light-rays emanating from the light source within given angles to the horizontal and to reflect the same within given limits, irrespective of the shifting of the light source within a vertical plane, substantially as described.

5. A reflector formed with a reflecting-surface adapted to direct light-rays in a downward and outward direction, and having a central opening, the said opening being provided with a covering of translucent material, whereby light-rays from above may be diffused to points beneath the reflector, substantially as described.

6. The combination with a source of light, of a reflecting-surface so arranged relative to the light source as to distribute the strongest light-rays to points distant, and having a central opening covered with a translucent medium, whereby a portion of the light-rays will be evenly diffused, thus reducing the intensity of any shadow of the reflecting-surface, substantially as described.

7. The combination with a source of light, of an upper and lower reflecting-surface, the upper reflecting-surface being so arranged with relation to the light source as to reflect the strongest upper light-rays to points distant and the weaker light-rays to points comparatively near, the lower reflecting-surface being so arranged relative to the light source as to reflect the strongest lower light-rays to points distant, and having a central opening covered with a translucent medium, whereby the light-rays from above will be evenly diffused to points more immediately beneath, and means for supporting such reflecting-surface relative to the light, all coöperating to effect a reflection and concentration of the light-rays within given limits and to reduce the intensity of any shadows from parts of the apparatus, substantially as described.

In testimony whereof I affix my signature in the presence of two subscribing witnesses.

WINDER ELWELL GOLDSBOROUGH.

Witnesses:
R. A. WHITE,
BERTHA I. BUSCHMAN.