(No Model.)

G. SAUTTER.

ELECTRIC LIGHT.

No. 499,473. Patented June 13, 1893.

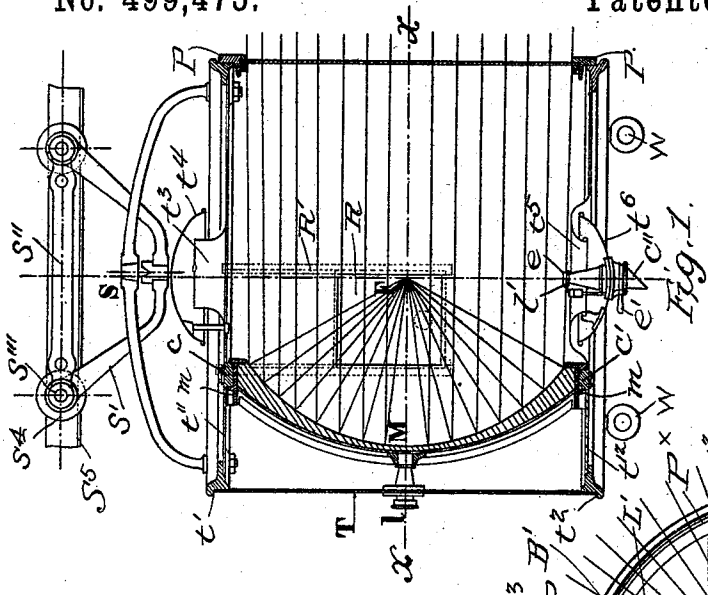

Fig. 1.

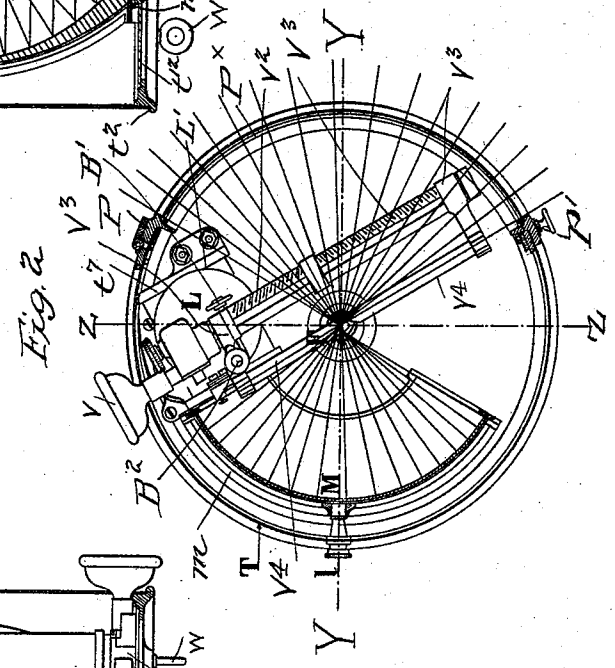

Fig. 2.

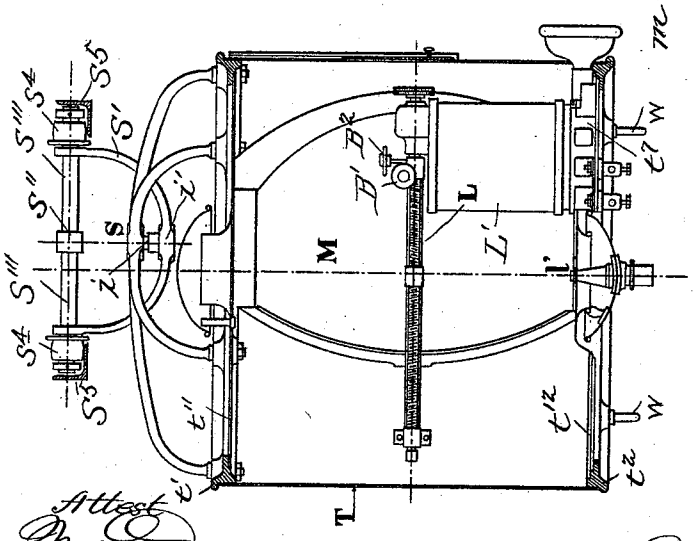

Fig. 3.

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UNITED STATES PATENT OFFICE.

GASTON SAUTTER, OF PARIS, FRANCE, ASSIGNOR TO SAUTTER, HARLÉ & CO., OF SAME PLACE.

ELECTRIC LIGHT.

SPECIFICATION forming part of Letters Patent No. 499,473, dated June 13, 1893.

Application filed January 5, 1892. Serial No. 417,080. (No model.) Patented in France August 11, 1891, No. 215,453.

To all whom it may concern:

Be it known that I, GASTON SAUTTER, a citizen of France, residing at Paris, France, have invented certain new and useful Improvements in Electric Lights; 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The invention has been patented in France, No. 215,453, dated August 11, 1891.

The use of projectors for the defense of ships has shown the advantages there would be in adapting these apparatus in a more rational manner to the different uses which they are called upon to fulfill. For distant objects search projectors are used, giving to the beam the maximum of concentration and placed at a certain distance above the sea. For the near defense of ships, principally at anchor or hove to, when torpedo attacks are to be feared, a class of projectors has been designed called port hole projectors, which furnish a beam spread out horizontally. In this way ships may be surrounded with a continuous luminous zone. The horizontal divergence of the beam is obtained, in these apparatus by means of an optical spreader formed of a series of lenses placed in front of the light reflector. After its passage through these lenses, the conical beam, of small angular divergence, about two degrees, spreads out into a horizontal band extending over say twelve to fifteen degrees. In order to surround the vessel with a continuous zone, without leaving a dead angle between adjacent beams it is necessary either to increase the number of projectors, or give to the lenticular spreader such large dimensions as involve great difficulties of construction and considerable loss of light.

This invention aims at obtaining the continuous zone by means of a novel arrangement of projector, having great horizontal divergence while preserving to the beam a luminous intensity independent of the divergence, whence the name adopted for this novel apparatus the divergent aplanatic projector.

The apparatus is shown in the annexed drawings in which--

Figure 1 is a vertical section of the apparatus on the line Y Y of Fig. 2. Fig. 2 is a horizontal section on the line X X of Fig. 1. Fig. 3 is a vertical section on the line $z\ z$ of Fig. 2, some of the parts being in side elevation.

M is a mirror of glass cut to a special form and silvered upon its back face; it is held in a metallic mounting m, forming a curved frame fixed by wood or metal strips $c\ c'$, upon the two foundation plates of the apparatus.

T is a cylindrical sheet iron drum, held between the angle pieces $t'\ t^2$. Upon these angle pieces are riveted the upper and lower foundation plates t^{11} and t^{12}.

At the front of the apparatus the drum is cut away and replaced by a hinged door formed of a metal frame P in which a glass $P^{\times}$ is fixed. A button p' with a latch keeps this door shut while in use.

In the upper plate t^{11}, an opening t^3 is formed for the outlet of the heated air. It is covered with a metallic cover t^4. The lower foundation t^{12} is also pierced with a hole provided with an opening t^5 and a cover t^6.

On the side of the projector a shutter R is placed sliding in a groove R' in such a manner as to allow of the hand being placed inside the apparatus.

A spy glass l for observing the carbons is placed in the axis of the projector. It passes through the drum T and receives the rays from the luminous crater. These rays pass through the mirror in the axis of the apparatus where a small unsilvered surface is left. A second spy glass l' gives at right angles the image of the crater; it is placed on the vertical axis in the lower foundation plate. A screen e moved by a button e' protects it from the fall of particles of ignited carbon. A totally reflecting prism c'' sends the image to the operator.

The horizontal carbon electric lamp L is mounted upon a slide t^7.

V' is a head which controls the threaded rods $V^2\ V^3$. This head gives to and fro movement to the slide in such a way as to bring the luminous source into the focal plane.

These rods, whose threads are opposite in direction and of different pitch, by their movement cause the carbon holders V^5 V^5 and consequently the carbon pencils Y^4 Y^4 to advance.

B′ B^2 are buttons regulating the positions of the carbons.

Automatic action of the lamp is obtained by means of mechanism placed in the case L′ and not shown in the drawing.

The whole projector is supported by a six branched fork S, bolted to the piece *t*′. It carries at its center a pin *i* which engages in a socket *i*′ fixed on a bearer S′. This latter is attached to a slide formed of a cross bar S″ and two axes S‴ on which rollers S^4 turn and they run on a guide way S^5. The projector can thus oscillate freely in all directions.

Path of the luminous rays.—The outline of the mirror in vertical section Fig. 1 is calculated to prevent spherical aberration of the rays emanating from the point F. To obtain this property it is sufficient to take as limit of the profile, two circles whose radii are in a given relation, that is to say the inner or front side of the reflector is on a curve struck from one center while the rear side is struck from another center as shown in Fig. 1, the latter curve having the larger radius. If this profile be rotated about a vertical axis passing through F, the surface of revolution thus formed will have at all points, the property of producing a reflected pencil passing through the vertical axis at F and whose rays will be parallel to the horizontal plane. The thickness of the reflector along any given horizontal line will by this construction be the same from one edge to the other but as shown in Fig. 1 the reflector is thicker toward its upper and lower ends. There is thus obtained a luminous band, the height of which is a minimum and the breadth depends only on the horizontal aperture of the mirror. The intensity at each point of the illuminated band, is dependent on the focal distance and the power of the source, but it is independent of the angular opening of the mirror.

The mirror shown in the drawings possesses a divergence of one hundred and twenty degrees in a horizontal plane and gives a maximum concentration in the vertical plane, aberration being rigorously suppressed. One may however obtain any divergence desired by limiting the mirror to the horizontal opening. The rays no longer having to traverse the lenticular spreader, the important loss of light caused by the thickness of the glass is avoided. The circular shape of the glass door P allows the rays to traverse it normally.

The electric lamp L has its carbons horizontal. The axis of the carbons is inclined at about thirty degrees to the horizontal axis of the projector. This arrangement is necessary on account of the path of the rays, which being emitted at the point F, are all directed, after reflection on the mirror, to intersect on the vertical axis of the focus. If then the lamp were placed vertically or in an inclined position, it would eclipse all or a great proportion of the rays.

The arrangement of the lamp is that of our mixed lamps which are able to work either automatically or by hand, but the projector may be illuminated by any other kind of electric lamp or by a luminous source of any kind.

Working of the apparatus.—As soon as the lamp is got to work the exact position of the crater is regulated by means of the two spy-glasses *l* and *l*′, the heads and the buttons B′ B^2. The luminous source is thus brought exactly to the height suitable to the point F. The projector being placed in the lower part of the ship to constantly illumine the surface of the sea, it is desirable to suspend it in such a manner as to counteract the influence of the rolling and pitching movement. The free suspension S S′ is well suited for this purpose and always brings the beam back into the plane of the horizon. The eyes W W nevertheless allow the apparatus to be if necessary immovably fixed.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a reflecting lamp, the reflector having its inner face curved from top to bottom on one radius and its rear face struck from a different center with a larger radius said reflector being of general concave form corresponding to the plane formed by the revolution of the described curved profile about a vertical axis whereby the front and rear faces diverge from each other from the center to the upper and lower portions of the reflector, substantially as described.

2. In a reflecting lamp, the carbons the casing, the reflector having an aperture with a spy glass at the same, a second spy glass arranged under the carbons and at right angles to the first and extending through the casing and the screen for the latter spy glass, substantially as described whereby the front and rear faces diverge from each other from the center to the upper and lower portions of the reflector, substantially as described.

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

GASTON SAUTTER.

Witnesses:
ROBT. M. HOOPER,
G. DE MESTRAL.