April 9, 1940. M. COHU ET AL 2,196,548

HIGHWAY LIGHTING APPARATUS

Filed Nov. 19, 1936 3 Sheets-Sheet 1

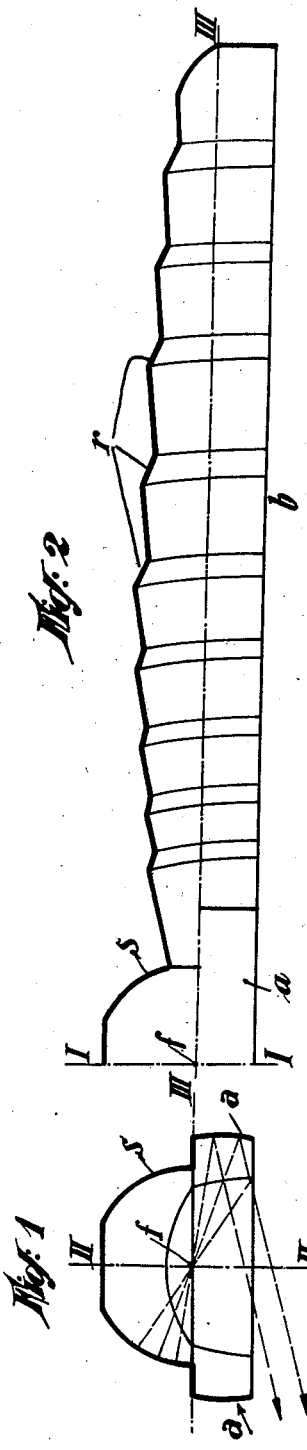

Fig. 2

Fig. 1

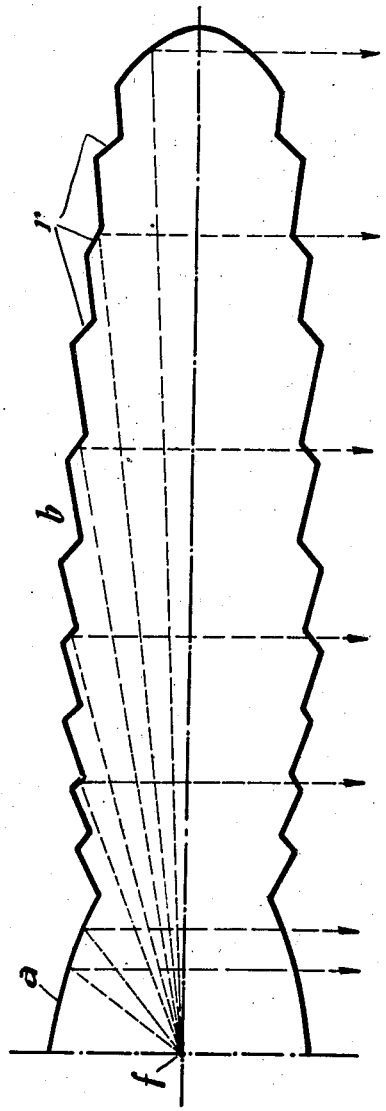

Fig. 3

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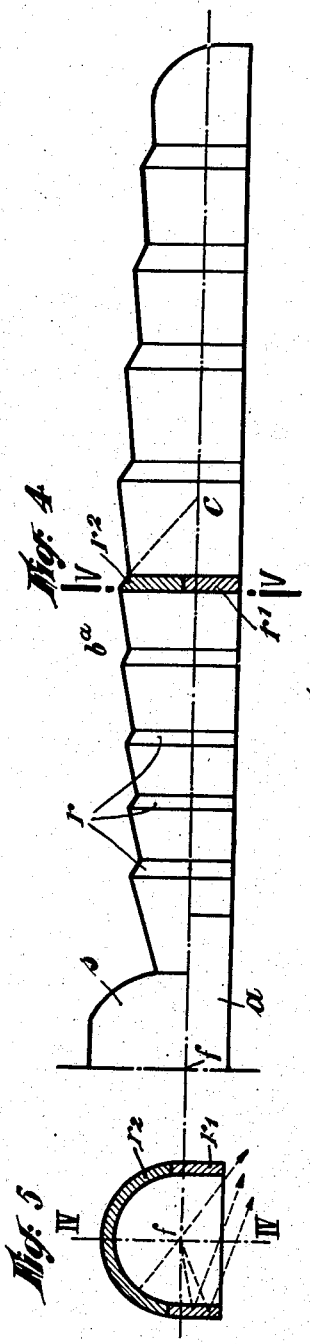

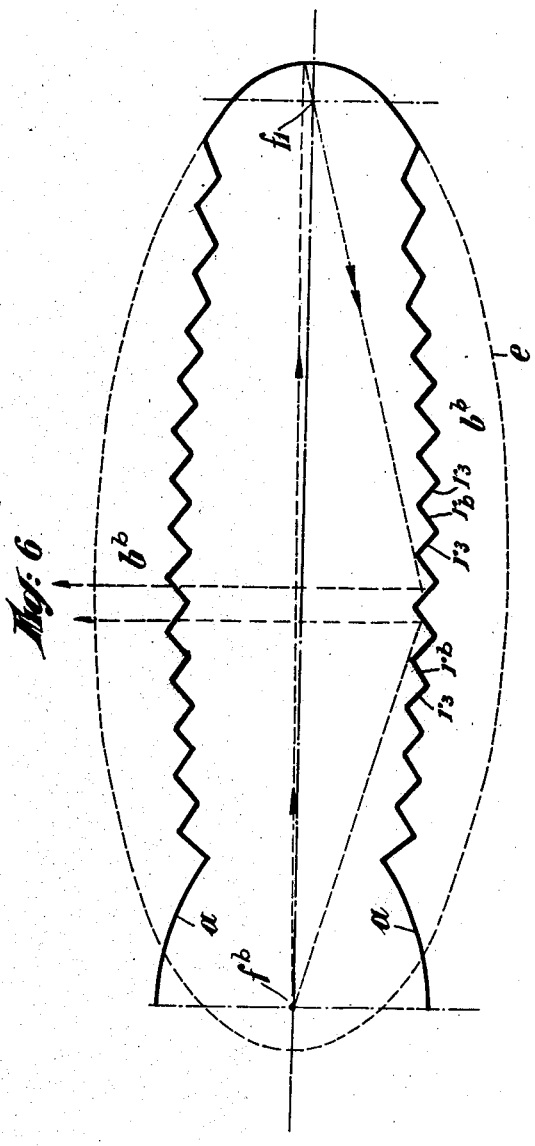

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HIGHWAY LIGHTING APPARATUS

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Fig. 7

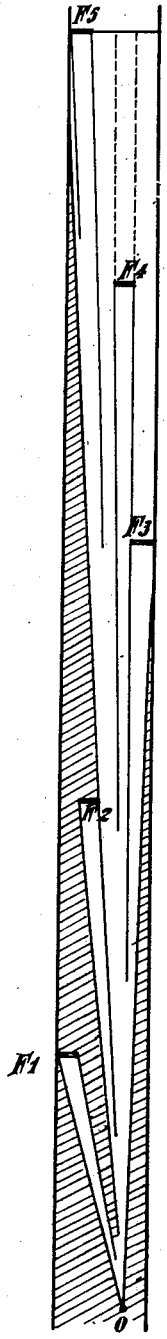


Fig. 8

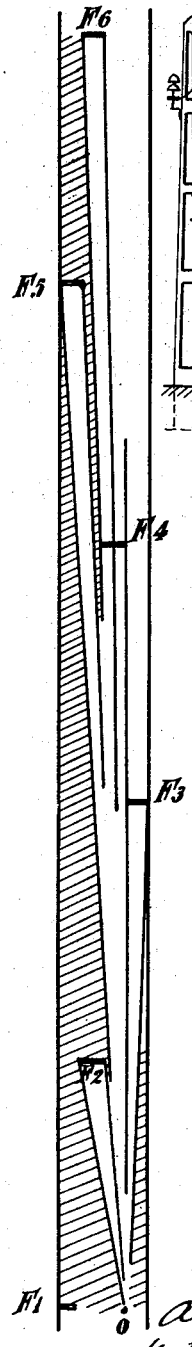
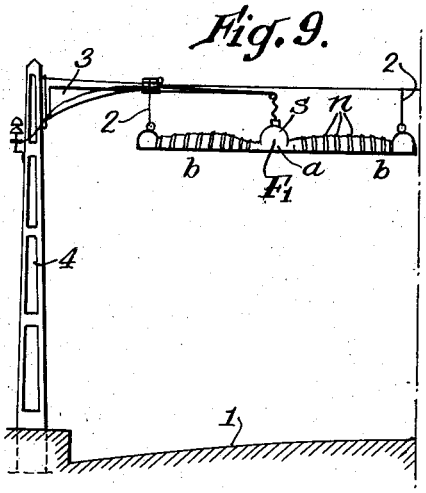


Fig. 9.



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UNITED STATES PATENT OFFICE

2,196,548

HIGHWAY LIGHTING APPARATUS

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Application November 19, 1936, Serial No. 111,736
In France November 25, 1935

5 Claims. (Cl. 240—25)

The present invention relates to lighting apparatus for roads, streets and the like.

The object of the invention is to provide an apparatus of this kind which permits of seeing in a satisfactory manner during nighttime obstacles and other objects present on the surface of the road, especially when said surface is wet and has a low diffusing power.

The apparatus according to the present invention consists, on the one hand, of a light source, incandescence lamp, gas mantle, low or high pressure discharge luminescent tube, etc., and, on the other hand, of reflecting surfaces intended to distribute the light in directions parallel to the axial plane of the roadway (this expression "axial plane" is intended to mean a plane, generally a vertical plane, passing through the axis of the roadway). These surfaces perform two chief functions:

a. The central mirror structure returns to a great distance the light flux emitted by the lamp, in directions close to the axis of the road, in such manner as to create a certain uniformity of illumination which also permits of obtaining a sufficiently uniform brilliancy in the case of a roadway surface that diffuses in a suitable manner.

For instance according to a preferred embodiment, the light flux directed by means of said central surface or surfaces will be limited between two vertical planes located on either side of the axial vertical plane of the roadway and making each an angle of 50–60° with said axial vertical plane.

b. The lateral mirror elements located on either side of the central surfaces will act upon the light flux emitted by the lamp in directions transverse to the axis of the road (as a rule, this flux is badly utilized or remains unemployed in many of the apparatus used at the present time) in such manner as to direct this flux also in directions substantially parallel to the axis of the road so that these lateral surfaces correspond to the creation of further bright bands on the surface of the roadway.

The central and lateral elements of the mirror consist of reflecting surfaces such as obtained with polished metals (silver-plated, chromium-plated, etc.) silvered glass, or prismatic glass systems acting either by refraction or by total reflection.

The apparatus according to the present invention will have an elongated shape in a direction at right angles to the axis of the road.

They will be arranged in staggered relationship to one another in the transverse direction of the road in such manner that the wide luminous bands they produce are juxtaposed.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 shows a mirror according to the invention in section by a plane parallel to the axis of the roadway to be illuminated;

Fig. 2 is a section of the same mirror on the line II—II of Fig. 1, that is to say in a plane at right angles to the axis of the roadway;

Fig. 3 shows a section of the mirror by a horizontal plane containing line III—III;

Fig. 4 is a view similar to Fig. 2, showing a modification;

Fig. 5 is a section of this modification on the line V—V of Fig. 4;

Fig. 6 is a plan view of another modification;

Figs. 7 and 8 are explanatory views illustrating the use of mirrors according to the invention for the illumination of a roadway; and

Fig. 9 represents a mirror according to the present invention shown in projection on the vertical plane perpendicular to the axis of the highway.

In the drawings, reference character *a* designates elements of reflecting surfaces constituting the central part of the mirror and which includes lower surfaces *a* consisting of portions of paraboloids and a spherical upper surface S, so as to recuperate an important portion of the flux. The center of the sphere and the focus of the paraboloids are located at *f* on the light source close to the plane separating surfaces *a* and S from each other.

b is one of the two lateral elements of the mirror. Each of these two lateral surfaces, only one of which is shown in Figs. 2 and 3, is constituted in this example by juxtaposed separate mirrors *r* of suitable curvature and direction.

In the modification of Figs. 4 and 5, the elementary mirrors which constitute the lateral parts b^a include each:

1. a lower part r^1 consisting of an element of a paraboloid having its focus on the light source and the axis of which is located in the vertical plane parallel to the axis of the road passing through said source;

2. an upper part r^2 consisting of a portion of a cone (a cone of revolution for instance) having

its apex at c on the axis passing through the light source.

The parabolic lower portion r^1 returns the light rays parallelly to its axis, whereas the upper part r^2 ensures a relatively wide dispersion of the reflected rays.

The modification shown in Fig. 6 of the drawings is particularly advantageous because it permits a very good recuperation of the light rays emitted by the source in a direction transverse to the axis of the roadway. The lateral parts b^b of the mirror are provided, at their ends, with a portion of an elliptic mirror e one of the focuses of which coincides with the light source located at f^b, while the other focus is at f_1. Between the portions of paraboloids r^b having their focus at f^b as above explained, are provided other portions of paraboloids r_3 having their focuses at f_1 and the axes of which are in the vertical plane passing through f_1 and parallel to the axis of the road. The light rays issued from f^b and striking paraboloids r^b are reflected as above toward the axis of the road. The light rays that do not strike the paraboloids r^b strike ellipsoid e and are reflected by passing through f_1, after which they strike paraboloids r_3 which reflect them parallelly to the axial plane of the road.

Of course the ellipsoid has been given only as an example of a suitable reflecting surface arranged so that the focus f^1 of paraboloids r_3 is placed on the image of the source given by said surface.

The apparatus that have been just described give, by reflection upon roadways which are little diffusing or moist, wide bright bands, themselves constituted by the juxtaposition of the bands corresponding to the central and lateral reflecting surfaces, which are of smaller size. The width of the apparatus, and therefore that of the bands, may, by way of example, be about two meters.

In order to obtain a uniformly bright appearance of the roadway, the present invention includes a particular arrangement of the apparatus which will juxtapose the bright bands for the various possible positions of the observers. It will be advantageous, according to the present invention, to abandon the old arrangements of the apparatus all in axial or lateral position, and to combine these arrangements, and also eventually to place said apparatus in intermediate positions between the axis and the sides of the road.

By way of example, Figs. 7 and 8 show a possible arrangement of the apparatus. In these figures we have shown in a diagrammatic manner the light bands created on a rectilinear and plane road by apparatus F_1, F_2, F_3, F_4 . . . . as seen by an observer moving along the road. Fig. 7 corresponds to a position of the observer, and Fig. 8 to another position. It will be noted that, from a certain distance of the observer, the light bands cover the whole area of the road. The cross-hatched portions in Figs. 7 and 8 show the zones that are not covered by luminous bands and for which the object, located at a small distance, will be made visible by the contrasts existing between its own parts. If the visibility of the objects is considered as insufficient in these zones, it is possible to make use of apparatus of larger size or to associate several of these apparatus in such manner that they constitute a continuous line.

As illustrated in Figure 9 the mirror is preferably placed so that its larger axis is perpendicular to the longitudinal axis of the highway. It may be suspended, for example, by chains 2 from a cable 3 stretched across the highway and secured at each end to the poles or standards 4.

The present invention is especially applicable to the illumination of towns, suburbs, streets, roads of any importance whatever, covered passages, bridges, etc. It involves the eventual replacement of sources of small size, such as the filament of an incandescent lamp by sources of great length, such as incandescence tubular lamps and elongated luminescent tubes, and also by discontinuous sources formed, for instance, by the juxtaposition of a plurality of lamps of small or mean power.

In a general manner, while we have, in the above description, disclosed what we deem to be practical and efficient embodiments of the present invention, it should be well understood that we do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What we claim is:

1. An illuminating apparatus for a roadway which comprises, in combination, a light source and a composite mirror of elongated shape having its length at right angles to the axis of the roadway and including a central structure comprising at least two reflecting paraboloid mirror surfaces having both of their respective focuses on said source and their respective axes in a vertical plane passing through said source and parallel to the axis of the roadway, said axes being inclined and passing through the opposite ends, in the direction of the roadway axis, of the field to be illuminated, and two lateral mirror structures located on either side of said central mirror structure along a line at right angles to the vertical plane in question and including each a series of parallel vertical steps arranged to reflect light rays from the source parallelly to said vertical plane.

2. An illuminating apparatus for a roadway which comprises, in combination, a light source and a composite mirror of elongated shape having its length at right angles to the axis of the roadway and including a central structure comprising at least two reflecting paraboloid mirror surfaces having both of their respective focuses on said source and their respective axes in a vertical plane passing through said source and parallel to the axis of said roadway, said axes being inclined and passing through the opposite ends, in the direction of the roadway axis, of the field to be illuminated, said central structure being limited by two planes passing through said source and making an angle of at most 60° with said vertical plane and on either side thereof, respectively, and two lateral mirror structures located on either side of said central structure along a line at right angles to said vertical plane, each of said lateral mirror structures including a series of parallel vertical steps arranged to reflect light rays from said source parallelly to said vertical plane.

3. An illuminating apparatus for a roadway which comprises, in combination, a light source and a composite mirror of elongated shape having its length at right angles to the axis of the roadway and including a central structure which comprises at least two reflecting paraboloid mirror surfaces having both of their respective focuses on said source and their respective axes in a vertical plane passing through said source

and parallel to the axis of said roadway, said axes passing through the opposite ends, in the direction of said roadway, of the field to be illuminated, said central structure being limited by two planes passing through said source and making with said vertical plane and on either side thereof an angle of at most 60°, and two lateral mirror structures located on either side of said central structure along a line at right angles to said plane, each of said lateral mirror structures including a series of parallel vertical steps, each step including at least two reflecting surfaces in the form of portions of paraboloids having their focuses on said source and their respective axes parallel to said vertical plane but oblique with respect to a horizontal plane.

4. An illuminating apparatus for a roadway which comprises, in combination, a light source and a composite mirror of elongated shape having its length at right angles to the axis of the roadway and including a central structure which comprises at least two reflecting paraboloid mirror surfaces having both of their respective focuses on said source and their respective axes in a vertical plane passing through said source and parallel to the axis of said roadway, said axes passing through the opposite ends, in the direction of said roadway, of the field to be illuminated, said central structure being limited by two planes passing through said source and making with said vertical plane and on either side thereof an angle of at most 60°, two lateral mirror structures located on either side of said central structure in a direction at right angles to said vertical plane, and a reflecting surface at the outer end of each of said lateral mirror structures adapted to give an image of said source, said lateral mirror structures including parabolic elements having their focuses on said image and adapted to reflect the light rays from said image to a remote point of said roadway, parallelly to said first mentioned vertical plane.

5. An illuminating system for a roadway which comprises, in combination, a plurality of illuminating apparatus comprising each a light source and a composite mirror of elongated shape having its length at right angles to the axis of the roadway and including a central structure comprising at least two reflecting parabolic mirror surfaces having both of their respective focuses on said source and their respective axes in a vertical plane passing through said source and parallel to the axis of the roadway, said axes passing through opposite ends, in the direction of the roadway axis, of the field to be illuminated, and two lateral mirror structures located on either side of said central structure along a line passing through said source and at right angles to said plane, each of said lateral mirror structures including a series of parallel vertical steps arranged to reflect light rays from said source into directions parallel to said plane, said plurality of apparatus being arranged in staggered relationship on the road in such manner that the respective light bands emitted by said apparatus are substantially juxtaposed to one another on the surface of the roadway.

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