June 23, 1942. H. G. ALM 2,287,221

LIGHTING FIXTURE

Filed Aug. 5, 1939 2 Sheets-Sheet 1

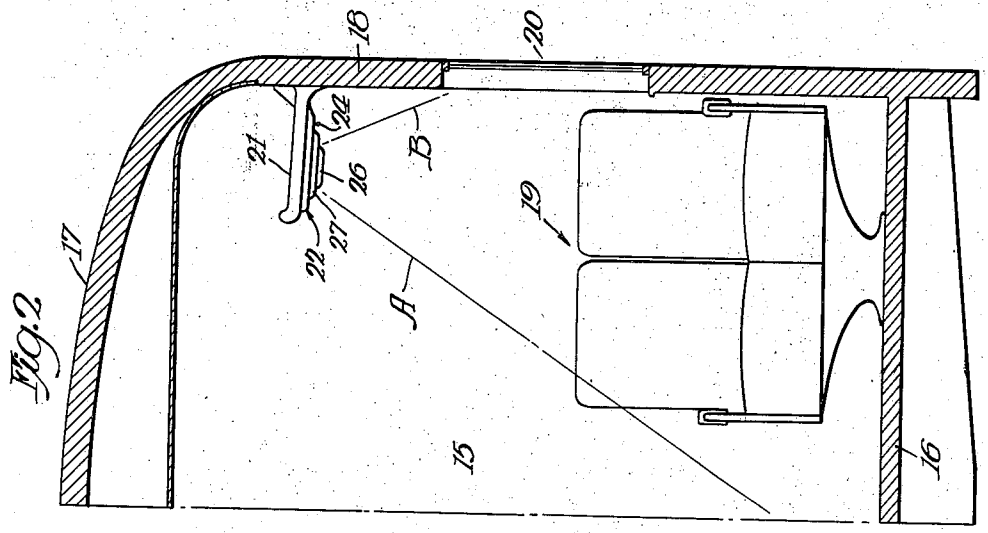


Fig. 2

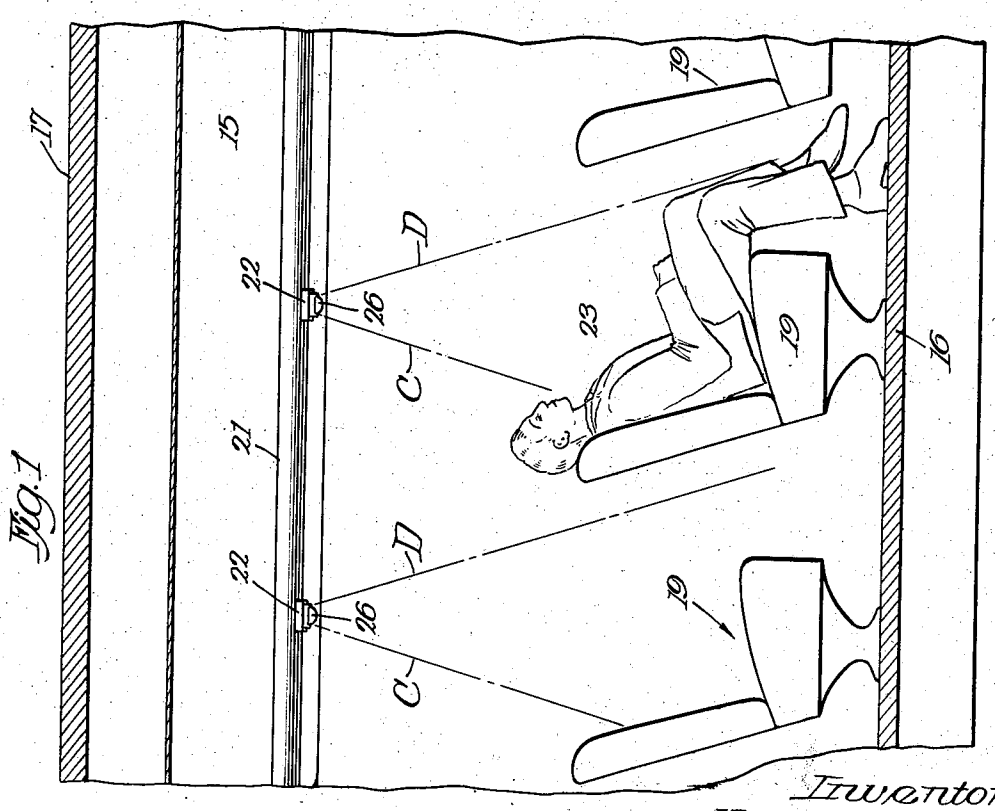


Fig. 1

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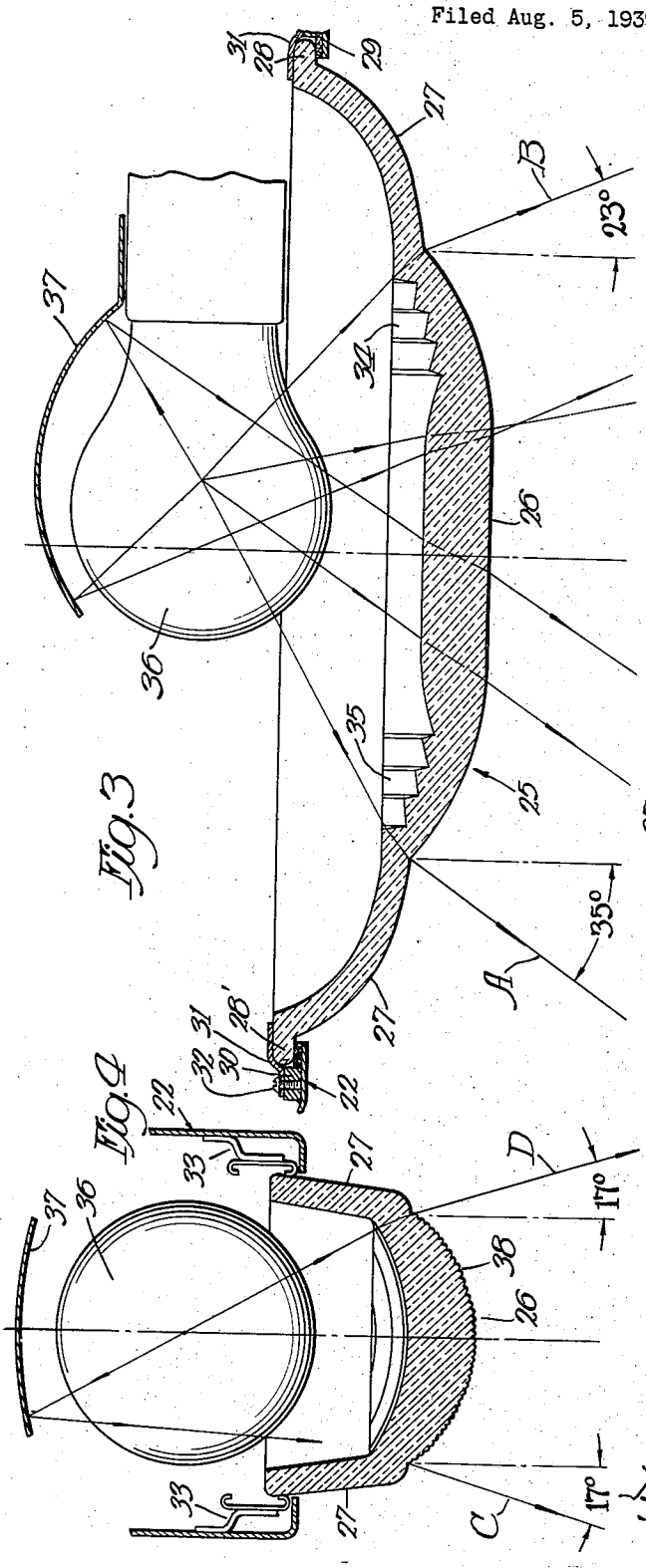


Fig. 3

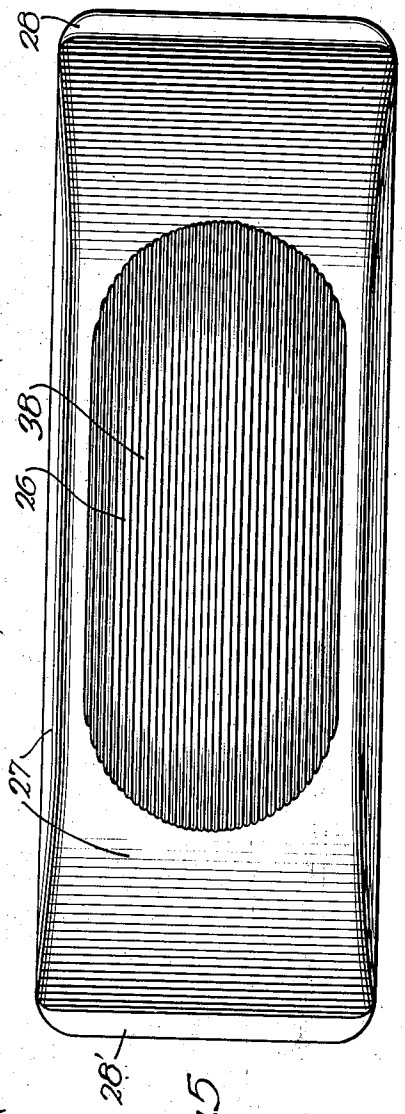


Fig. 5

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LIGHTING FIXTURE

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Application August 5, 1939, Serial No. 288,543

5 Claims. (Cl. 240—106.1)

Travel comfort is uppermost in the minds of builders of modern passenger cars and busses, and consequently every possible attempt is being made to improve riding conditions and to add facilities which will increase the comforts of the passenger. Air conditioning has become widely used, particularly in railway passenger cars, and there are many other features which a few years ago were considered deluxe and were installed only on very special trains.

At the same time, the trend in railroad and bus transportation has been toward increased speed of operation. This fact, together with the addition of the many power consuming devices, such as air conditioning, has placed a rather great burden upon the available power of the train, and consequently necessitates conserving energy wherever possible. The electric light load itself is a considerable item, particularly today where people have become more or less light conscious due to the advancements made and the publicity given by lighting engineers. In order to reduce to a minimum this electric light load, it is necessary to make as efficient as possible the lighting fixtures that are employed in cars and busses. High efficiency means proper control of light distribution with the least amount of power input, and, of course, this problem must be considered along with the question of proper design and cost of the fixtures.

The foregoing constitute some of the principal objects of the present invention and, in addition it is intended that this new lighting fixture will control the light within very definite bounds to minimize glare and thus add to passenger comfort.

Various other objects and advantages will become apparent as the disclosure proceeds and the description is read in conjunction with the accompanying drawings, in which

Fig. 1 is a longitudinal sectional view of a portion of a car taken substantially along the car center line and showing the relative positions of the lights and the seats;

Fig. 2 is a transverse sectional view of the portion of the car shown in Fig. 1 showing the relationship of the light with respect to two seats;

Fig. 3 is a vertical sectional view through the globe of the lighting fixture taken lengthwise of the globe and showing the source of light asymmetrically placed with respect to one symmetrical axis of the globe;

Fig. 4 is a transverse sectional view of the fixture globe shown in Fig. 3; and

Fig. 5 is a bottom plan view of the fixture.

Obviously, certain modifications can be made in the lighting fixture as shown without departing from the invention, as it is understood that the particular embodiment selected is for the purpose of disclosing the invention in compliance with section 4888 of the revised statutes.

Referring to Figs. 1 and 2, the invention is shown as applied to a railway car body **15** having a floor **16**, roof **17**, and side walls, one of which is shown at **18** in Fig. 2. Seats are generally indicated at **19** and windows **20** (Fig. 2) are positioned along the car side wall in the usual manner. The baggage rack **21** is disposed above the seats and is fixed to the car wall in some suitable fashion, and, for the purpose of disclosure, the lighting fixture generally indicated at **22** is attached directly to the baggage rack.

As indicated in Fig. 1, the lighting fixtures **22** are carefully spaced with respect to the seats so that the beam of light from each light source is directed onto the reading plane of the passenger seated below, and this beam is so limited that, when the passenger **23** is in the reclining position, as shown in Fig. 1, his eyes are out of the direct beam of light issuing from the corresponding light fixture. Also, the light beam from the fixture directly behind a passenger falls short of any portion of the seat occupied by the passenger.

Referring to Fig. 2, lighting fixture **22** limits the beam of light substantially within the width of the seat **19** with only small portions of the beam striking the side wall **18** and the floor in the aisle between the rows of seats.

The function of the lighting fixture forming the subject matter of the present invention is to concentrate the light within limited bounds. Each of the baggage rack lighting fixtures as shown is provided with a switch **24** so that the occupants of each pair of seats may have the light on or off.

As shown in Figs. 3–5, inclusive, the globe **25** of the lighting fixture is bowl shaped having a central light collecting lens portion **26** surrounded by a light diffusing portion **27**. Horizontally extending flanges **28** and **28'** are provided along the narrow ends of the fixture which fit into the brackets **29** and **30**, respectively, on the baggage rack. A clamp **31** is screwed to bracket **30** by machine screws **32**, and this clamp is removable so that the globe can be removed from the baggage rack. Along both of the longitudinal sides of the globe, spring clip arrangements, generally

indicated at 33, engage the edges of the globe to securely hold the globe in place.

The lens on its outer surface may best be described as a surface of revolution generated by revolving about an axis a line lying in a single plane and made up of a straight line terminating at each end in an arc bending toward the axis of revolution.

The shape of the inner surface of the lens is best defined as a surface of revolution generated by revolving about an axis a line lying in a single plane and made up of a central portion of substantially arcuate form with the arc opening away from the axis of revolution and a plurality of steps extending beyond the ends of the central portion and lying on the circumference of a circle, the curvature of which is toward the axis of revolution. The central portion of the line may be a true arc or a straight line terminating at both ends in arcs so that the entire central portion is substantially an arc. The dimension and slope of the step treads and risers depend upon the desired light distribution. The step portions form a series of prisms 34 and 35 extending transversely across the collecting lens portion at opposite ends respectively.

Light issuing from a light source 36 passes directly through the collecting lens portion or is reflected from reflector 37 through the lens, and that portion of the light which passes through the center area of the collecting lens between the two groups of prisms is concentrated on the reading plane directly below the light. Any light passing through the prism areas 34 and 35 is bent downwardly so as to concentrate all of the light from the light source within the area bounded by rays A and B, indicated in Fig. 3. The exact angularity of these lines A and B for a given globe will depend largely upon the positioning of the light source 36. As indicated in Fig. 2, the lighting fixture is placed very near the car side wall 18 so that it is necessary that the angularity of light ray A with respect to a true vertical be greater than that of light ray B. Referring again to Fig. 3, this is accomplished by positioning the light source 36 asymmetrically with respect to the transverse axis of symmetry of globe 25.

For the purpose of disclosing a specific example, the seat and baggage rack heights, as shown in Figs. 1 and 2, the depth of the baggage rack from the side wall, and their relative positions with respect to the lighting fixture are all shown to scale. For this type of installation, the angularity of light ray A with respect to the vertical should be approximately 35 degrees (Fig. 3), and the angularity of light ray B should be approximately 23 degrees. These angles, of course, are varied according to the requirements of particular installations.

The outer face of the central collecting lens portion may be serrated, as shown at 38, so that the image of the light source 36 behind the globe is destroyed after the light passes through the collecting lens portion.

The size of the collecting lens and the radii of the inner and outer surfaces with respect to the transverse axis of the globe will vary for specific installations, but, as shown, they are such that the angularity of the light beams C and D is 17 degrees from the true vertical.

Although the linear prisms 34 and 35 are indicated along only two ends of the collecting lens, it may be desirable to also place them along the other two sides. This is particularly true where it is desired to limit glare from all four sides of the fixture, as may be the case if a lighting fixture of this type were used for a center aisle light.

If desired, the inner surfaces of diffusing portions 27 of the globe may be enameled or frosted to produce the desired effect.

The term "axis plane" used in some of the claims herein means a plane passing through one of the central axis lines of the lens and disposed at right angles to the plane of the rim of the globe. There are two axis planes in the case of the lens shown, one disposed lengthwise to the lens and the other at right angles to the first plane and transversely to the lens.

I claim:

1. A lens of the class described having an outer surface defined as a surface of revolution generated by revolving about an axis a line lying in a single plane and comprising a straight line terminating at each end in an arc bending toward the axis of revolution, and an inner surface defined as a surface of revolution generated by revolving about an axis a line lying in a single plane and made up of a central portion of substantially arc form with the arc opening away from the axis of revolution, and a plurality of steps extending beyond the end of the central portion and lying on the circumference of a circle the curvature of which is toward the axis of revolution.

2. A bowl-shaped lens having curvature about two normal axes and having two of its opposite sides disposed substantially vertically and straight and the other two sides curved inwardly toward the bottom of the bowl, and a bottom portion having an outer surface defined as a surface of revolution generated by revolving about an axis spaced from and in non-intersecting relationship with the resulting surface of revolution a line lying in a single plane and made up of a straight line terminating at each end in an arc bending toward the axis of revolution, and a substantially concave inner surface having curvature about two normal axes and having a plurality of prisms on diametrically opposite sides, the projection of said prisms on the plane of the rim of the bowl constituting straight lines.

3. A bowl-shaped lens of the class described having an inner bowl-shaped surface having curvature about two normal axes and defined as a surface of revolution generated by revolving about an axis spaced from and in non-intersecting relationship with the resulting surface of revolution a line lying in a single plane and made up of a central portion of substantially arc form with the arc opening away from the axis of revolution, and a plurality of steps extending beyond the end of the central portion and lying on an arc the curvature of which is toward the axis of revolution, and an outer surface which is substantially convex.

4. A lens of the class described having an outer surface defined as a surface of revolution generated by revolving about an axis a line lying in a single plane and comprising a straight line terminating at each end in an arc bending toward the axis of revolution and an inner surface defined as a surface of revolution generated by revolving about an axis a line lying in a single plane and made up of a central portion of substantially arc form with the arc opening away from the axis of revolution and a plurality of

steps extending beyond the central portion, the steps from the end of the arc to the end of the steps approaching the axis of revolution.

5. A lens of the class described having an outer surface defined as a surface of revolution generated by revolving about an axis a line lying in a single plane and comprising a straight line terminating at each end in an arc bending toward the axis of revolution and an inner surface defined as a surface of revolution generated by revolving about an axis a line lying in a single plane and made up of a central straight line portion with the opposite ends of the straight line bending in the form of an arc away from the axis of revolution and a plurality of steps extending beyond the end of the central portion and lying on the circumference of a circle the curvature of which is toward the axis of revolution.

HENRY G. ALM.