Light fixture for a storage aisle, particularly a warehouse aisle. A lamp is provided with a reflector generally overlying it and wrapped around two sides of the lamp region. An underlying lens, together with the lamp and reflector, distributes light uniformly over the sides of the aisle, while avoiding glare, and preferably limiting illumination of the aisle floor.

4 Claims, 8 Drawing Figures
LIGHT FIXTURE FOR A STORAGE AISLE

BACKGROUND AND NATURE OF THE INVENTION

The aisles of warehouses present a lighting problem which is not readily solved by the use of conventional lamp units developed for general or industrial purposes. It has not been possible, thus far, to illuminate such aisles efficiently and at the same time to provide a comfortable visual environment for an operator who places and removes merchandise in shelf areas constituting vertical sides of the aisle. The side walls of the aisle, presenting for example, the vertical surfaces of cartons, must generally be illuminated by overhead, light diffusing luminaires, providing enough light for easy perception of labels and merchandise, throughout these surfaces, from the eye level of an average person standing in the aisle. The light intensity, observed by such a person, must enable him readily to read the labels and to examine the merchandise, in all parts of the aisle, without undue effort in stooping down, climbing up, or straining his eyesight, also when working in areas between luminaires. Excessive glare must also be eliminated, from the viewpoint of a person standing in the aisle and looking at side areas thereof, including those close to overhead lamps, and also from the viewpoint of a person looking along the aisle. A lens problem is provided by the floor of the aisle, which must generally be lighted only to a level that allows safe movement of people and equipment on it.

Somewhat similar requirements exist in the aisles between library stacks and, more broadly, in storage aisles where goods or data are displayed in generally vertical surface areas, locally lighted from above. The problems are aggravated when the aisles have a high proportion of height to width, and when the attendant must read small print on the parcels or books.

It is an object of this invention to provide an improved luminaire for proper illumination of storage aisles, particularly warehouse aisles, and thereby to solve the indicated problems.

For this purpose the invention provides a new combination of reflector and lens means for a lamp, advantageously of the incandescent type. The new unit provides high photometric as well as refractive efficiency, along with excellent visual comfort in areas of the indicated type, by the use of reflector and lens means specially disposed in relation to the lamp, and to one another, as will now be described.

DRAWINGS

FIG. 1 is a sectional view of a simple and preferred embodiment of the invention, the view being taken along lines 1—1 in FIG. 4;

FIG. 2 is a schematic, fragmentary, sectional view of the same unit, taken along lines 2—2 in FIG. 1 and showing certain ray traces;

FIG. 3 is a section generally similar to FIG. 2 but showing other ray traces;

FIG. 4 is a partial bottom view of the new unit;

FIG. 5 is a schematic side view of the unit, mounted in a storage aisle;

FIG. 6 is a plan view of the same aisle structure taken along lines 6—6 in FIG. 5; and

FIGS. 7 and 8 are polar diagrams of intensity of illumination, taken in different planes which are shown in FIG. 6 at 7—7 and 8—8.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

As shown in FIG. 1, the luminaire comprises a lamp 10 with a special reflector 11 and lens 12. Reflector 11 is wrapped down around the lamp region on the sides thereof, as best shown in FIG. 2 at 13, 14, but not on the ends thereof, which are shown in FIG. 1 at 15, 16. Lens or refractor 12 is made of glass or acrylic plastic or the like. It has the general shape of a circular pan, consisting of a flat circular bottom 17 and an upstanding side wall 18 the surface of which forms an inverted frustoconical surface. The height of this side wall of the lens varies, being relatively high at ends 15, 16 of the reflector space and being partly wrapped around this space (FIG. 1), where the edge of the reflector is relatively high. The side wall of the lens is lower on the sides (FIGS. 2 and 3), where the edge of the reflector is wrapped down to a relatively low position.

Socket 20 of lamp 10 is suitably incorporated in reflector end wall structure 21, for example by welding the outside wall of the socket to this structure. The lamp desirably has a light source L of thin tubular shape, as is provided by a clear mercury arc lamp tube, a high pressure sodium arc tube, or an axially coiled filament.

The relatively high wall portions 18 of lens 12, FIG. 1, receive and pass only direct light from light source L in lamp 10. The relatively lower portions 22 of the lens, FIGS. 2 and 3, receive and pass light from the lamp and also from lower reflector portions 23 facing the same. Lens bottom 17 also receives light from the lamp direct and from overlying portions of the reflector, and directs this light, advantageously with the aid of prisms 24, 25, 26, as will be described presently.

As shown in FIG. 2, reflector 11 has elliptical sections 27—28 and 27—29, intersecting at an obtuse angle 27 and overlying lamp 10, to focus light from light source L in the lamp to a point P slightly below the lens and near the axis A of the lamp. On the other hand, light from L, reflected by lower, parabolic sections 28—13 and 29—14 of the reflector, is directed in form of a bundle B of parallel rays. Each side 27—13 and 27—14 of the reflector throws this light towards the opposite wall of the aisle, through reflector portions on the two sides of an elongated center section which has prisms 24 parallel to light source L. In FIG. 4, the outer boundaries of the reflected focused light are shown by dash-dot lines. These also are in substance the inner boundaries of the reflected parallel light.

It is one of the advantages of this reflector shape that it counteracts direct passage of lamplight to adjacent top sides of the aisle, which due to their proximity to the lamp, require much less of the total illumination than the bare source would give them.

On the other hand, the elongate center section of lens 12, having prisms 24, as shown in FIG. 3, redirects the direct, central lamp rays R, which would normally fall on the floor of the aisle, into two beams directed toward somewhat higher regions, to aid in illuminating the lower sides of the aisle. This center section of the lens deals with direct lamplight, as the light from the elliptical and parabolic reflector sections does not reach this center section of the lamp. As shown in broken lines, the effect is enhanced by the provision of prisms 24 on this center section, extending along the aisle. These arrangements not only direct the light into the
most useful regions, but also eliminate direct lamp glare toward a person standing in the aisle and looking up towards the light. The light is directed across the aisle (plane 7—7 in FIG. 6) in a way which distributes the light in this plane efficiently, as indicated by diagram 7. It provides two high intensity beams B1, B2, having sharp cut-off on their sides and providing very low intensity in the region R on the vertical axis.

Between luminaires, as indicated by plane 8—8 in FIG. 6 and diagram 8, the distribution of candlepower is basically similar, and similarly advantageous, although unavoidable, somewhat lower illumination is obtained in lower parts of the illuminated plane. Of course, dependent upon considerations of economy and efficiency, floor F of the aisle, FIG. 5, can be located at any desired level, relative to the diagrams of FIG. 7 and 8.

The distribution of light along the aisle and the achievement of a suitable system of light beams of the type analyzed in FIG. 8, is promoted by providing lens bottom 17, on both sides of central part 24, with lightspreading prisms 25, 26 arranged to spread the basic cross-wise distribution of light along the sides of the aisle, that is, along axis 1—1. By contrast, central part 24 has prisms, extending at right angles to prisms 25, 26, to throw the incident light onto lower parts of the sidewalks of the aisle, rather than on the floor. For somewhat related reasons, prisms in the general location and orientation of those on part 24, may also extend upwardly over sidewall 18 of the lens as FIG. 4 shows at 24'.

It will be noted by persons skilled in this art that the new luminaire operates in a way very different from conventional practice. Conventional illumination of the aisle, with intensities comparable to those shown in FIGS. 7 and 8, could be obtained only by the use of narrow-beam high-bay symmetrical luminaires, spaced at fairly close distances along the aisle, in order to realize enough light intensity at eye level and assure getting the desired, vertical foot candles. Since the distribution from such luminaires is generally circular, they would produce a scalloped light effect along the upper level of the aisle, with bright arc-shaped patterns directly opposite the luminaires and V-shaped dark patches therebetween. Incidentally, they would over-illuminate the floor. All these conditions are greatly improved by the light distribution according to FIGS. 7 and 8, obtained by the new luminaire.

If use were made of long fluorescent luminaires or the like, oriented along the aisle, the scalloped light patterns could be avoided, but excessive floor lighting would still be present, vertical light distribution would still be inadequate, and glare would still be a problem. In all these respects, the new light fixture is superior to conventional fluorescent as well as other lamps, in its distributed light efficiency and provision of visual comfort.

I claim:

1. A luminaire for illuminating the floor and walls of a storage aisle comprising an elongated light source the axis of which is parallel to the axis of the aisle to be illuminated, a reflector having first and second halves with each half having an upper portion substantially above said light source and a lower portion extending from said upper portion on the side of and below said light source, a refractor underlying said light source and having first and second refracting portions, said first portion of said refractor being comprised of parallel rows of prisms substantially parallel to said axis of said light source and symmetrically located on either side of said axis, said second portion being comprised of prisms for spreading light along the axis of said light source, said upper portion of each said refractor half reflecting light rays to converge at a point below said refractor, substantially all of said converging rays passing through said second portion of said refractor, and, said lower portions of each said refractor half reflecting light in parallel beams, substantially all of the light in said parallel beams passing only through said second portion of said refractor, and said parallel rows of prisms in said first portion of said refractor elevating direct light incident thereon.

2. A luminaire as claimed in claim 1 in which said first and second halves of said reflector are symmetrical about the axis of said light source.

3. A luminaire as claimed in claim 1 in which the prisms of said first portion of said refractor on each side of said line parallel to said axis of said light source elevate and direct light to a corresponding side of said luminaire, respectively.

4. A luminaire as claimed in claim 1 in which said refractor includes side and bottom walls, said side wall being secured to and extending downwardly from the bottom of said lower portion of said reflector.