

644609

COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1952
APPLICATION FOR A STANDARD PATENT

Minnesota Mining and Manufacturing Company, incorporated in Delaware, of 3M Center, Saint Paul, Minnesota 55144-1000, UNITED STATES OF AMERICA, hereby apply for the grant of a standard patent for an invention entitled:

Light Fixture for Externally Illuminated Sign

which is described in the accompanying complete specification.

Details of basic application(s):-

<u>Basic Applic. No:</u>	<u>Country:</u>	<u>Application Date:</u>
429,178	US	30 October 1989

The address for service is:-

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DATED this EIGHTEENTH day of OCTOBER 1990

Minnesota Mining and Manufacturing Company

By:



Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS
OUR REF: 144371
S&F CODE: 58400

DECLARATION IN SUPPORT OF A
CONVENTION APPLICATION FOR A PATENTAUSTRALIA
CONVENTION
STANDARD
& PETTY PATENT
DECLARATION
SFP 4In support of the Convention Application made for a
patent for an invention entitled: Light Fixture for File No. 44673 AUS 5A

Title of Invention

Externally Illuminated Sign

Full name(s) and
address(es) of
Declarant(s)

I/We Donald Miller Sell, Chief Patent Counsel

of Minnesota Mining and Manufacturing Company
3M Center, Saint Paul, Minnesota 55144-1000
United States of America

do solemnly and sincerely declare as follows:-

Full name(s) of
Applicant(s)1. ~~I am/We are the applicant(s) for the patent-~~*(or, in the case of an application by a body corporate)*1. I am/~~We are~~ authorised by MINNESOTA MINING AND MANUFACTURING COMPANYthe applicant(s) for the patent to make this declaration on
its/~~their~~ behalf.2. The basic application(s) as defined by Section 141 of the
Act was/~~were~~ made

Basic Country(ies)

in United States of America

Priority Date(s)

on 30 October 1989

Basic Applicant(s)

by Harry Bauer Anderson, Sanford Cobb, Jr.
and David Lee WortmanFull name(s) and
address(es) of
inventor(s)3. ~~I am/We are the actual inventor(s) of the invention referred-~~
~~to in the basic application(s)~~*(or where a person other than the inventor is the applicant)*3. Harry Bauer Anderson, Sanford Cobb, Jr.
and David Lee Wortmancare
of Minnesota Mining and Manufacturing Company
3M Center, Saint Paul, Minnesota 55144-1000
United States of America

(respectively)

~~is/are~~ the actual inventor(s) of the invention and the facts upon
which the applicant(s) ~~is/are~~ entitled to make the application are
as follows:

The said Company is the assignee of the actual inventors.

Set out how Applicant(s)
derive title from actual
inventor(s) e.g. The
Applicant(s) is/are the
assignee(s) of the
invention from the
inventor(s)4. The basic application(s) referred to in paragraph 2 of this
Declaration was/~~were~~ the first application(s) made in a Convention
country in respect of the invention(s) the subject of the application.Declared at Saint Paul,
Minnesota this 12th day of September 19 90
U.S.A.Donald M. Sell
Donald M. Sell, Chief Patent Counsel



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LIGHT FIXTURE FOR EXTERNALLY ILLUMINATED SIGN
- International Patent Classification(s)
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- (71) Applicant(s)
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- (56) Prior Art Documents
US 4850665
US 4615579
US 4071750
- (57) Claim

1. A light fixture for providing light to an externally illuminated sign, said light fixture comprising:

a light source adapted to produce a partially collimated beam of light;

a housing having an axis, said housing and said light source being positioned such that said partially collimated beam of light is directed into said housing along said housing axis, said housing having a first section occupying a first portion of its perimeter and a second section occupying a second portion of its perimeter said first section being a light guide means and said second section having a first surface interior to said housing and a second surface exterior to said housing, said first surface having light extraction structures thereon, said light extraction structures being for extracting light from said beam of partially collimated light and directing it toward said second surface, said second surface having a Fresnel lens formed thereon.

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FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE:

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Complete Specification Lodged:

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Related Art:

Name and Address
of Applicant:

Minnesota Mining and Manufacturing Company
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Sydney, New South Wales, 2000, Australia

Complete Specification for the invention entitled:

Light Fixture for Externally Illuminated Sign

The following statement is a full description of this invention, including the best method of performing it known to me/us

S 017955 191090

- 1 -

Light Fixture For Externally Illuminated Sign
Background of the Invention

Outdoor signs often must be lighted so that they
5 will be visible at night. For example, it is desirable
that advertising signs be visible after dark and it may be
critical that traffic signs be visible. Various schemes of
internally and externally illuminating such signs have been
used. When external illumination is used, the most common
10 method is to align a row of spotlights along either the
bottom or the top of the sign. Those spotlights are
positioned to direct light toward the sign. This provides
several disadvantages, most notably the lack of uniformity
of illumination. The sign will receive more light close to
15 the spotlight than it will in other regions. A system
providing uniform lighting would be desirable.

An additional problem is particularly acute in
the case of overhead signs commonly used on multilane
highways. Replacement of light sources commonly requires
20 that traffic be diverted or stopped so that a worker can
reach the light source to be replaced. A system with which
the actual light source can be located beyond the traffic
carrying portion of the highway would be advantageous.

25 Summary of the Invention

According to the invention, a light fixture
includes a housing having an axis and a light source for
directing light into the housing along the housing axis. A
30 first section of the housing occupies a first portion of
the housing's perimeter and comprises a light guide
material. A second section of the housing occupies a
second section of the housing perimeter and has light
extraction structures internal to the housing and a Fresnel
35 lens external to the housing.

Brief Description of the Drawings

Figure 1 is a view of a light fixture according to the invention;

Figure 2 is first a cross sectional view of a light extraction film used in the invention;

5 Figure 3 is a second cross sectional view of a light extraction film used in the invention;

Figure 4 is a cross sectional view of an alternative light extraction film for use in the invention; and

10 Figure 5 is a schematic representation of a light fixture according to the invention in operation.

Detailed Description of a

Preferred Embodiment

In the preferred embodiment of the present invention a light guide confines a beam of light to travel along one edge of a sign. An
15 extractor removes light from the light guide and directs it toward the sign. Associated with the extractor is a Fresnel lens for shaping the output characteristics of the illuminator.

Figure 1 shows an illuminator of the present invention. The illuminator includes a light source 10, providing a partially collimated
20 beam of light. A housing in the form of a tube, that is preferably a right circular cylinder, although other shapes may be used, receives light from the light source. Part of the circumference of the illuminator is made up of a light guide material 12 while the remainder is an extractor 16. As shown, the light guide section 12 makes u 270
25 degrees of the circumference while the remaining 90 degrees is extractor portion 16. The relative amounts of the circumference occupied by each of these portions, however, is implementation dependent and must be determined on a case by case basis. Furthermore light source 10 could be separated from extractor 16 by a



light guide of material similar to that of light guide portion 12. The primary reason for doing this would be to locate the light source in a more convenient position for replacing bulbs or lighting elements. This is particularly
5 useful in the case of overhead signs since the light conduit can carry the light from the edge of a highway to the extractor adjacent the sign.

Light guide material 12 has running along its external surface a plurality of linear prisms such as prism
10 14. In a preferred embodiment these prisms are right angled isosceles prisms, although that is not required. These prisms serve to confine light traveling along the illuminator to remain in the illuminator by means of total internal reflection. The light guide material may, for
15 example, be Scotch Optical Lighting Film, a product commercially available from 3M and described in United States Patent Application Serial Number 218,087 filed July 12, 1988, now United States Patent 4,906,070. Light
20 extractor portion 16 has an inner surface 18 and an outer surface 20. The nature of these structures will be more fully described in accordance with Figures 2, 3 and 4.

Figure 2 shows a cross section of extraction film 16 perpendicular to the axis of the tube. Extraction film 16 is of a transparent material, preferably a transparent
25 polymeric material. Preferred polymers are polycarbonates and acrylics. As may be seen there are a plurality of structures such as structure 22 and structure 24 on surface 20. These structures are the linear elements of a Fresnel lens. Each element has an axis that runs parallel to the
30 direction of the housing axis. The nature of the Fresnel lens formed by the structures on surface 20 will depend upon the desired output light beam. Typically the desire is to provide relative constant illumination over the surface of a sign. Thus a Fresnel lens should be designed
35 to provide output that would appear uniform over the sign.

Figure 3 is a cross section of film 16 parallel to the axis of the tube. As shown in Figure 3, side 18 of

film 16 has a plurality of triangular prisms lying thereon. Each prism has an axis that is perpendicular to the housing axis. For these purposes, the axis will be considered perpendicular to the housing axis when the tube is round, because the tangent to the axis is perpendicular at all points. As shown, the prisms are isosceles triangles, but that is not required. The use of isosceles prisms is preferred, however, because they will work equally well with light from either direction. Therefore the light fixture may be illuminated at both ends to provide both more light and greater uniformity. The operation of the prisms as light extractors may be understood with reference to prism 26. Prism 26 has two sides 28 and 30. In operation, light enters prism 26 through one of the two sides, for example, side 28, and crosses the prism striking side 30. At 30 the light undergoes total internal reflection and is reflected through film 16 and out through surface 20 where, in combination with the light traveling through the remainder of the film, it forms the desired shaped beam.

It has been found that prisms having included angles in the range of 59 to 79 degrees are preferred, with a particularly preferred value of 69 degrees.

As previously explained, the nature of the output beam will be shaped by the Fresnel lens on surface 20. This shaping, however, only affects the distribution of the light in the direction perpendicular to the original beam. In the direction parallel to the beam the distribution is controlled by the extraction structures on surface 18. If, as shown in Figure 3, the structures are all triangles having the same included angle, the light will emerge collimated in the direction parallel to the original light beam. As shown in Figure 4, film 16' has a plurality of isosceles triangles having varying included angles provided thereon. Typically these will be in a repeating series. As may be seen in Figure 4, prisms 32, 33, 34, 35 and 36 each have different included angles. The sequence then

begins again with prism 32' and 33' having equal included angles to prisms 32 and 33 respectively. The number of prisms in the sequence to be repeated is not fixed, but will be determined by the requirements of a particular design. For example, in one extraction film manufactured for a test a series of seven prisms was utilized. These prisms had included angles of 78.5 degrees, 63.5 degrees, 71.0 degrees, 76.0 degrees, 66.0 degrees, 73.5 degrees, and 68.5 degrees. After one group of such prisms, the pattern repeats. The advantage of varying the prism angles in this manner is light is spread out over a wider range of angles in the direction parallel to the original beam rather than collimated, as occurs when a single included angle is used.

Figure 5 illustrates how the illuminator of the present invention works in practice. As may be seen, it runs parallel to one edge, in this case the bottom edge, 40, of a sign 42. Extractor 16 has a top edge 44, bottom edge 46 and a center 48. The Fresnel lens on exterior side 20 of extractor 16 is designed such that light passing through top edge 44 of extractor 16 will strike the sign 42 at its top edge 50. Similarly light traveling through bottom edge 46 of extractor 16 will strike sign 42 at its bottom 40 and light traveling through extractor 16 at center 48 will strike sign 42 at its center 52. The effect of this is to provide more uniform lighting over the entire sign. Additional correction could be made to further increase the uniformity of illumination, but the design shown in Figure 5 has been shown to provide no worse than a two to one ratio in light intensity between the brightest and dimmest parts of the sign, a value well within acceptable limits.

The claims defining the invention are as follows:

1. A light fixture for providing light to an externally illuminated sign, said light fixture comprising:

5 a light source adapted to produce a partially collimated beam of light;

a housing having an axis, said housing and said light source being positioned such that said partially collimated beam of light is directed into said housing along said housing axis, said housing having a first section occupying a first portion of its perimeter and a second section occupying a second portion of its perimeter said first section being a light guide means and said second section having a first surface interior to said housing and a second surface exterior to said housing, said first surface having light extraction structures thereon, said light extraction structures being for extracting light from said beam of partially collimated light and directing it toward said second surface, said second surface having a Fresnel lens formed thereon.

2. The light fixture of claim 1 wherein said first section of said housing has an external surface, said external surface having a plurality of linear right angled isosceles prisms thereon, each of said prisms having an axis, said axes of said prisms running parallel to said housing axis.

3. The light fixture of claim 2 wherein said light extraction structures comprise a plurality of triangular prisms on said first surface, said each of said prisms having an axis, said axes of said prisms running perpendicular to said housing axis.

4. The light fixture of claim 3 wherein said prisms having included angles in the range of 59 to 79.

5. The light fixture of claim 4 wherein said Fresnel lens comprises a plurality of linear structures on



said external surface of said second section of said housing, each of said linear structures having an axis, said axes of said linear structures running parallel to said housing axis.

5 6. The light fixture of Claim 4 wherein said Fresnel lens produces a light distribution such that the ratio between the light intensity received at any point on the sign and that received at any other point is no greater than two to one.

10 7. The light fixture of Claim 3 wherein said prisms are divided into repeating groups wherein said prisms of a group have varying included angles.

15 8. The light fixture of Claim 1 wherein said light extraction structures comprise a plurality of triangular prisms on said first surface, each of said prisms having a axis, said axes of said prisms running perpendicular to said housing axis.

20 9. The light fixture of Claim 1 wherein said Fresnel lens comprises a plurality of linear structures on said external surface of said second section of said housing, each of said linear structures having an axis, said axes of said linear structures running parallel to said housing axis.

25 10. The light fixture of Claim 9 wherein said Fresnel lens produces a light distribution such that the ratio between the light intensity received at any point on the sign and that received at any other point is no greater than two to one.

30 11. A light fixture, substantially as described herein with reference to Figs. 1, 2, 3 and 5 or Figs. 1, 4 and 5 of the accompanying drawings.

DATED this EIGHTEENTH day of OCTOBER 1990
Minnesota Mining and Manufacturing Company
Patent Attorneys for the Applicant
SPRUSON & FERGUSON

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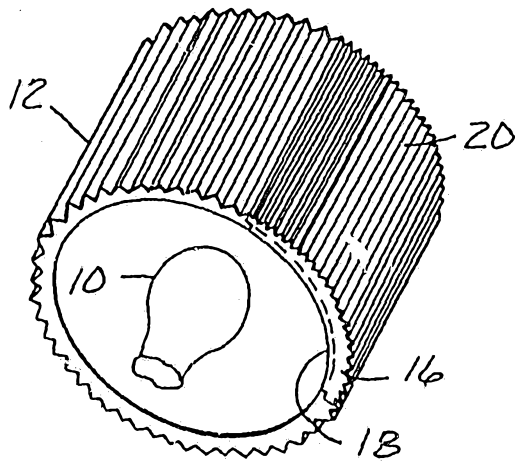


Fig. 1

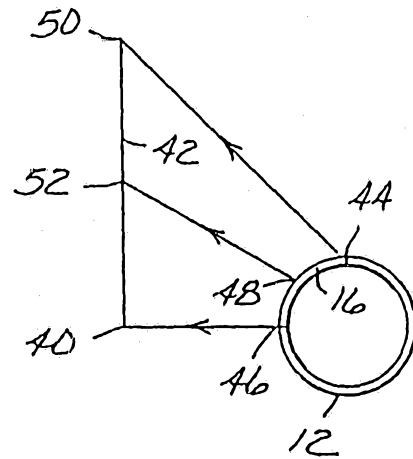


Fig. 5

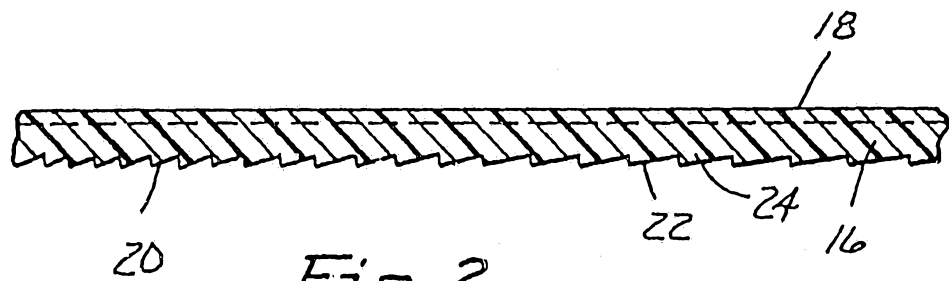


Fig. 2

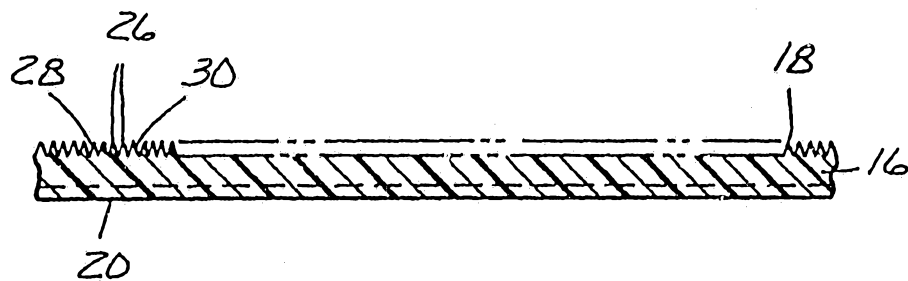


Fig. 3

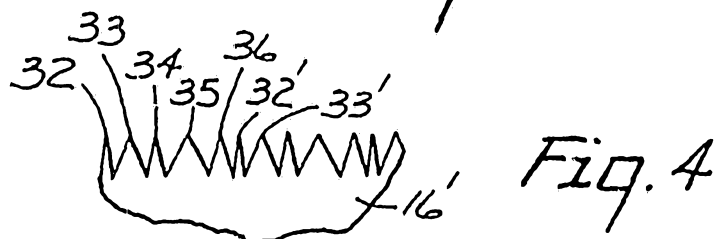


Fig. 4