



TRANSLATION CERTIFICATION

Date: May 24, 2024

To whom it may concern:

I, Frank McGee, a translator fluent in the Japanese and English languages, on behalf of Morningside, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

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(54) [Title of the Invention] Lighting Device for Vehicle Display Unit

(57) [Abstract]

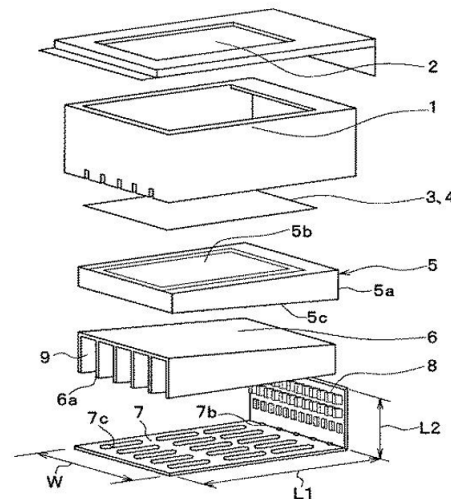
[Problem]

To extend the service life of light-emitting diodes by suppressing thermal degradation of the diodes through improved heat dissipation of the printed wiring board, and to enable the use of inexpensive vertical light-emitting diodes while reducing the size of the lighting device.

[Solution]

In a lighting device in which light from light emitting diodes 8 arranged opposite a side edge 5a of a light guide plate 5 is emitted as illuminating light from the surface of the light guide plate 5, a metallic wiring board based on a metallic board 71 is used as the printed wiring board 7 on which the light emitting diodes 8 are mounted, and the wiring board 7 is bent so that it extends from the portion facing the backside of the light guide plate 5 to the portion facing the side edge 5a. By improving the thermal conductivity of the wiring board 7 by using a metallic wiring board, and by bending the wiring board 7 as described above, a large heat dissipating area can be secured for the wiring board 7 while reducing the size of the lighting device, and inexpensive vertical light-emitting diodes can be used.

[Selected Drawing] Fig. 1



5: Light guide plate
5a: Side edge
7: Printed wiring board
8: Light emitting diode
71: Metal plate

[Claims]

[Claim 1]

A lighting device for a vehicle display unit provided with a light guide plate (5), light emitting diodes (8) arranged opposite a side edge (5a) of the light guide plate (5), and a printed wiring board (7) on which the light emitting diodes (8) are mounted, light incident from the light emitting diodes (8) on the side edge (5a) of the light guide plate (5) exiting the surface of the light guide plate (5) as illuminating light, the lighting device for a vehicle display unit characterized in that the printed wiring board (7) is a metal-based wiring board based on a metal plate (71), and the printed wiring board (7) is bent so as to extend from a portion opposite the side edge (5a) of the light guide plate (5) to a portion opposite the backside of the light guide plate (5).

[Claim 2]

The lighting device for a vehicle display unit according to claim 1, wherein the light emitting diodes (8) are arranged in a plurality of rows perpendicular to the light guide plate (5).

[Claim 3]

The lighting device for a vehicle display unit according to claim 1 or 2, wherein a bent portion (7a) of the printed wiring board (7) is provided with one of a through hole (7b), a notch (7d), and a recess.

[Claim 4]

The lighting device for a vehicle display unit according to any one of claims 1 to 3, wherein a heat dissipation space (9) is formed between the printed wiring board (7) and the light guide plate (5).

[Claim 5]

The lighting device for a vehicle display unit according to claim 4, wherein the backside of the light guide plate (5) is provided with a reflector (6) that reflects light incident from the side edge (5a) toward the surface of the light guide plate (5), and the heat dissipation space (9) is formed between the reflector (6) and the printed wiring board (7).

[Claim 6]

The lighting device for a vehicle display unit according to claim 5, wherein a plurality of ventilation holes (7c) are formed in the portion of the printed wiring board (7) that faces the backside of the light guide plate (5).

[Claim 7]

The lighting device for a vehicle display unit according to any one of claims 1 to 6, wherein the metal plate (71) is made of aluminum.

[Claim 8]

The lighting device for a vehicle display unit according to any one of claims 1 to 7, wherein the printed wiring board (7) is composed of a flexible printed wiring board (72) bonded to the metal plate (71).

[Claim 9]

The lighting device for a vehicle display unit according to claim 8, wherein the region of the printed wiring board (7) from the portion facing the backside of the light guide plate (5) to the bent portion (7a) is formed solely from a metal plate (71) with the flexible printed wiring board (72) eliminated.

[Claim 10]

The lighting device for a vehicle display unit according to claim 8, wherein bonding of the flexible printed wiring board (72) to the metal plate (71) is eliminated in the region of the printed wiring board (7) from the portion facing the backside of the light guide plate (5) to the bent portion (7a).

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a lighting device for a vehicle display unit.

[0002]

[Prior Art]

A lighting device is known in the art in which light-emitting diodes are arranged opposite a side edge of a light guide plate, and light incident from the light-emitting diodes onto the side edge of the light guide plate is outputted from the surface of the light guide plate as illuminating light (see, for example, Patent Document 1).

[0003]

Fig. 5 shows a lighting device similar to the one in the patent document above that the present inventors studied as a prototype, in which light-emitting diodes 8 are mounted on a printed wiring board 7. A glass epoxy-based wiring board is used as the printed wiring board 7, and the printed wiring board 7 is arranged

so that it is parallel to the light guide plate 5. As shown in Fig. 6, which is a cross-sectional view of Fig. 5, the light emitting diodes 8 are parallel light emitting diodes that emit light in a direction parallel to the mounting surface on the printed wiring board 7.

[0004]

[Patent Document 1]

JP 2003-004492 A

[0005]

[Problem to Be Solved by the Invention]

If the heat generated by the emission of light is not dissipated efficiently, thermal degradation will be accelerated and the service life of the light emitting diodes 8 will be shortened. However, the printed wiring board 7 in the prototype study mentioned above has poor thermal conductivity because of its glass epoxy base. Therefore, it is disadvantageous in terms of heat dissipation and cannot extend the service life of the light emitting diodes 8.

[0006]

In cases where vertical light-emitting diodes, which are less expensive than parallel light-emitting diodes, are used, the glass epoxy-based printed wiring board 7 is rigid and cannot be bent, so the printed wiring board 7 must be placed perpendicular to the light guide plate 5 as shown in Fig. 7.

[0007]

From the standpoint of reducing the size of the lighting device, there is a limit to how much the length dimension L2 of the printed wiring board 7 can be increased in the vertical direction of the light guide plate 5 (vertical direction in Fig. 7), so the area ($W \times L2$) of the printed wiring board 7 must be reduced. Therefore, the heat dissipation area is not sufficient compared to the heat dissipation area ($W \times L1$) of the printed wiring board 7 shown in Fig. 5 and Fig. 6, and thermal degradation of the light emitting diodes 8 is further accelerated.

[0008]

In view of the above, it is an object of the present invention to suppress thermal degradation of light-emitting diodes and extend their service life by improving the heat dissipating properties of the printed wiring board, thereby making it possible to use inexpensive vertical light-emitting diodes while also suppressing any increase in the size of the lighting device.

[0009]

[Means for Solving the Problem]

In order to achieve this object, the invention according to claim 1 is a lighting device for a vehicle display unit provided with a light guide plate (5), light emitting diodes (8) arranged opposite a side edge (5a) of the light guide plate (5), and a printed wiring board (7) on which the light emitting diodes (8) are mounted, light incident from the light emitting diodes (8) on the side edge (5a) of the light guide plate (5) exiting the surface of the light guide plate (5) as illuminating light, the lighting device for a vehicle display unit characterized in that the printed wiring board (7) is a metal-based wiring board based on a metal plate (71), and the printed wiring board (7) is bent so as to extend from a portion opposite the side edge (5a) of the light guide plate (5) to a portion opposite the backside of the light guide plate (5).

[0010]

Because a metallic wiring board is used as the printed wiring board (7), the thermal conductivity of the printed wiring board (7) can be improved compared to that of a glass epoxy-based wiring board.

[0011]

By bending the printed wiring board (7) as described above, a heat dissipating area can be secured for the printed wiring board (7) while reducing the size of the lighting device, and inexpensive vertical light-emitting diodes (8) can be used.

[0012]

As explained above, the present invention can suppress thermal degradation of the light emitting diodes (8) by improving the heat dissipating properties of the printed wiring board (7), thereby extending the service life of the light emitting diodes (8), and enabling the use of inexpensive vertical light emitting diodes while suppressing any increase in the size of the lighting device.

[0013]

In the lighting device of the prototype study shown in Fig. 5 and Fig. 6, in which the printed wiring board (7) was arranged so as to be parallel to the light guide plate (5), it was difficult to increase the luminance of the illuminating light because a plurality of light emitting diodes (8) could not be arranged in a row in the direction perpendicular to the light guide plate (5).

[0014]

In contrast, in the present invention, in which the printed wiring board (7) is bent as described above, a plurality of light emitting diodes (8) can be arranged in the portion of the printed wiring board (7) opposite the side edge (5a) in a line perpendicular to the light guide plate (5), as described in claim 2, and the brightness of the illuminating light can be easily increased.

[0015]

As the number of light emitting diodes (8) increases, the heat dissipating properties of the printed wiring board (7) must improve. Therefore, the present invention, which has good heat dissipating properties, can be used in lighting devices with a large number of light emitting diodes (8).

[0016]

In the invention according to claim 3, a bent portion (7a) of the printed wiring board (7) is provided with one of a through hole (7b), a notch (7d), and a recess to make it easier to bend the printed wiring board (7).

[0017]

In the invention according to claim 4, a heat dissipation space (9) is formed between the printed wiring board (7) and the light guide plate (5). Here, the air in the heat dissipation space (9) can be made to circulate by natural or forced convection to further improve the heat dissipating properties of the printed wiring board (7).

[0018]

In the invention according to claim 5, when the backside of the light guide plate (5) is provided with a reflector (6) that reflects light incident from the side edge (5a) toward the surface of the light guide plate (5), the heat dissipation space (9) is formed between the reflector (6) and the printed wiring board (7).

[0019]

In the invention according to claim 6, a plurality of ventilation holes (7c) are formed in the portion of the printed wiring board (7) that faces the backside of the light guide plate (5). Ventilation holes (7c) can be formed so that air can flow through, which further improves the heat dissipating properties of the printed wiring board (7).

[0020]

Examples of materials that can be used for the metal plate (71) include aluminum, copper, and iron. If the metal plate (71) is made of aluminum, as in the invention described in claim 7, it is advantageous with respect to heat dissipating properties.

[0021]

The "metal-based printed wiring boards" of the present invention include, of course, the well-known metal-based printed wiring boards, metal core printed wiring boards, and enamel printed wiring boards, but also include printed wiring boards (7) consisting of a flexible printed wiring board (72) bonded to a metal plate (71), as in the invention described in claim 8.

[0022]

When embodying the invention described in claim 8, the flexible printed wiring board (72) should be provided at least on the portion of the printed wiring board (7) that is opposite the side edge (5a) of the light guide plate (5).

[0023]

Here, if the flexible printed wiring board (72) is to be provided on the entire surface of the printed wiring board (7), electronic components other than the light emitting diodes (8) can be mounted on the portion of the flexible printed wiring board (72) that faces the back side of the light guide plate (5). However, in this example, the portion of the flexible printed wiring board (72) corresponding to the bent portion (7a) may be damaged when bent.

[0024]

In the invention according to claim 9, the region of the printed wiring board (7) from the portion facing the backside of the light guide plate (5) to the bent portion (7a) is formed solely from a metal plate (71) with the flexible printed wiring board (72) eliminated.

[0025]

This avoids damage due to the bending of the flexible printed wiring board (72) described above. In addition, the portion of the printed wiring board (7) that faces the back side of the light guide plate (5) exposes the metal plate (71), which further improves the heat dissipating properties of the printed wiring board (7).

[0026]

In the invention according to claim 10, bonding of the flexible printed wiring board (72) to the metal plate (71) is eliminated in the region of the printed wiring board (7) from the portion facing the backside of the light guide plate (5) to the bent portion (7a).

[0027]

This can suppress damage caused by bending of the flexible printed wiring board (72) as described above and improve the heat dissipating properties of the printed wiring board (7) compared to when the flexible printed wiring board (72) is bonded in all regions. Electronic components other than the light sources (8) can be mounted on the portion of the printed wiring board 7 that faces the back side 5c of the light guide plate 5, allowing for more effective use of the space on the back side of the light guide plate 5.

[0028]

The numbers in parentheses in each of the above means are examples corresponding to the specific means described in the embodiments below.

[0029]

[Embodiment of the Invention]

Embodiments of the present invention are described below with reference to the drawings.

[0030]

(First Embodiment)

The present embodiment of the lighting device of the present invention is applied to a lighting device for a display unit installed in the instrument panel of a vehicle, and the lighting device functions as a backlight for the liquid crystal display panel 2 described later. Examples of display units include speedometers, tachometers, and other gauges, as well as display units for navigation devices.

[0031]

Fig. 1 shows an exploded perspective view of the display unit in the present embodiment, which consists of a cover 1, liquid crystal panel 2, optical sheet 3, diffusion sheet 4, light guide plate 5, reflector 6, printed wiring board 7, and light emitting diodes 8. The lighting device consists at least of a light guide plate 5, a printed wiring board 7, and light emitting diodes 8.

[0032]

The liquid crystal display panel 2 is supported on the cabin interior side of the cover 1 (the upper portion in Fig. 1), and an STN common in the art is used. Then, below the liquid crystal display panel 2, are stacked an optical sheet 3, diffusion sheet 4, light guide plate 5, reflector 6, and printed wiring board 7 in order, all of which are built into and held in place by the cover 1.

[0033]

The optical sheet 3 reflects incident light perpendicular to the sheet surface from the back side of the sheet surface (bottom side in Fig. 1) and does not transmit it, while light incident from a specific direction is refracted in the direction perpendicular to the sheet surface and transmitted to the front side of the sheet surface. The optical sheet 3 is composed of two optical sheets laminated together, and the two optical sheets are arranged so that the specific directions are oriented 90 degrees to each other.

[0034]

The diffusion sheet 4 diffuses light incident from the back side (bottom side in Fig. 1) of the diffusion sheet 4 and transmits it to the front side (top side in Fig. 1), so that light with uniform and even luminance is emitted from the entire surface of the diffusion sheet 4 toward the liquid crystal display panel 2.

[0035]

The light guide plate 5 guides light entering from a side edge 5a into the interior and outputs it as illuminating light from the surface 5b of the light guide plate. In the present embodiment, light is incident from only one of the four side edges 5a, but when embodying the invention, light may be incident from the opposing surface as well.

[0036]

The reflector 6 is positioned in close contact with the back side 5c of the light guide plate 5 to reflect light that is about to leak from the back side 5c of the light guide plate 5 toward the surface 5b of the light guide plate 5, thereby improving the brightness of the illuminating light for the liquid crystal display panel 2.

[0037]

Fig. 2 is a cross-sectional view of Fig. 1 showing the light guide plate 5, reflector plate 6, printed wiring board 7, and light emitting diodes 8. As shown in Fig. 2, the printed wiring board 7 is a metal-based wiring board in which the metal plate 71 occupies more than half the thickness of the wiring board 7.

[0038]

The metallic wiring board 7 in the present embodiment consists of a flexible printed wiring board 72 bonded to a metallic plate 71. The flexible printed wiring board 72 and the metal plate 71 may be made to adhere to each other by bonding them with an adhesive, or by thermocompressing the insulating layer of the flexible printed wiring board 72 to the metal plate 71.

[0039]

Examples of materials that can be used for the metal plate 71 include aluminum, copper, and iron. In the present embodiment, aluminum is used because of its advantageous properties in terms of heat dissipating properties and bendability. The flexible printed wiring board 72 may be any type common in the art, for example, an insulating film such as polyimide film or polyester film with a printed conductor pattern.

[0040]

The printed wiring board 7 configured in the manner described above is bent so that it extends from the portion facing the side edge 5a of the light guide plate 5 to the portion facing the back side 5c of the light guide plate 5. A plurality of through holes 7b are arranged side by side in the bent portion 7a of the printed wiring board 7 in the bending direction (perpendicular to the surface of the paper in Fig. 2) to make it easier to bend the printed wiring board 7.

[0041]

A heat dissipation space 9 is formed between the portion of the printed wiring board 7 that faces the back side 5c of the light guide plate 5 (corresponding to L4 in Fig. 1) and the reflector 6. The reflector 6 has a plurality of ribs 6a extending inside the heat dissipation space 9 toward the printed wiring board 7. By bringing these ribs 6a into contact with the printed wiring board 7, the printed wiring board 7 and reflector 6 are kept from bending and becoming deformed.

[0042]

A plurality of ventilation holes 7c are formed in the portion of the printed wiring board 7 that faces the back side 5c of the light guide plate 5. These ventilation holes 7c are arranged so as not to interfere with the edge surfaces of the ribs 6a.

[0043]

The light emitting diodes 8 are positioned opposite the side edge 5a of the light guide plate 5, and are arranged in a plurality of lines perpendicular to the light guide plate 5 (vertical direction in Fig. 2), as well as in a plurality of lines perpendicular to the surface of the paper in Fig. 2. The light emitting diodes 8 are surface mounted on the portion of the printed wiring board 7 that faces the side edge 5a of the light guide plate 5. The light emitting diodes 8 are vertical light emitting diodes that emit light in the direction perpendicular to the mounting surface on the printed wiring board 7.

[0044]

Next, to explain the operations of the display unit and lighting device with the configuration described above, when the light emitting diodes 8 are driven by a drive circuit (not shown), the light emitted from the light emitting diodes 8 enters the side edge 5a of the light guide plate 5 and is guided into the light guide plate 5. The light is then emitted from the surface 5b of the light guide plate 5 as illuminating light toward the diffusion sheet 4. Light that is about to leak from the back side 5c of the light guide plate 5 is reflected by the reflector 6 toward the surface 5b. The light then passes through the diffusion sheet 4, optical sheet 3, and liquid crystal display panel 2, and is emitted from the liquid crystal display panel 2 as predetermined display image light.

[0045]

If the heat generated by the emission of light is not dissipated efficiently, thermal degradation will accelerate and the service life of the light emitting diodes 8 will be shortened. Because the lighting device in the present embodiment is located inside the cabin, the ambient temperature of the light-emitting diodes 8 can reach about 70°C, so there is need for improved heat dissipating properties. Also, because multiple rows of light-emitting diodes 8 are provided in this device to increase the brightness of the displayed image light, heat dissipating properties must be improved.

[0046]

In response, the present embodiment uses a metallic wiring board for the printed wiring board 7, so the heat of the light emitting diodes 8 is easily dissipated by the printed wiring board 7. In this way, thermal degradation of the light emitting diodes 8 can be suppressed to extend the service life of the light emitting diodes 8.

[0047]

More specifically, the heat of the light emitting diodes 8 is transferred to the metal plate 71 via the flexible printed wiring board 72 of the printed wiring board 7, and because the flexible printed wiring board 72 is very thin and the flexible printed wiring board 72 is in close contact with the metal plate 71, heat is efficiently transferred to the metal plate 71. Because the metal plate 71 has high thermal conductivity, heat is efficiently conducted inside the metal plate 71. As a result, the heat dissipation by the printed wiring board 7 can be increased.

[0048]

Also, because the printed wiring board 7 is bent in the present embodiment so that it extends from the portion facing the back side 5c of the light guide plate 5 to the portion facing the side edge 5a, the heat dissipation area ($W \times (L1 + L2)$) of the printed wiring board 7 can be kept large while suppressing any increase in the size of the lighting device due to the extension of the printed wiring board 7 in the direction perpendicular to the light guide plate 5. In addition, by bending the printed wiring board 7 as described above, inexpensive vertical light-emitting diodes can be used as the light-emitting diodes 8.

[0049]

Here, the clearance between the side edge 5a of the light guide plate 5 and the light emitting diodes 8 should be as small as possible to improve the amount of light incident on the side edge 5a. However, if the clearance is too small, the light guide plate 5 may expand thermally and the side edge 5a may hit the light emitting diodes 8. In a device using parallel light-emitting diodes 8 as shown in Fig. 6, if the light guide plate 5 hits as described above, shear stress is generated in the soldered portions of the light-emitting diodes 8, which can easily lead to damage to the soldered portions.

[0050]

In contrast, because the device in the present embodiment uses vertical light-emitting diodes 8, even if the light guide plate 5 hits, compressive stress is generated in the soldered portions, thus reducing the risk of damage to the soldered portions compared to those in parallel light-emitting diodes 8.

[0051]

If a printed wiring board facing the back side 5c of the light guide plate 5 and a printed wiring board facing the side edge 5a are formed separately and then coupled, the heat transfer resistance in the coupled portion increases. In contrast, because a single printed wiring board 7 is bent in the device of the present embodiment, the thermal conductivity of the printed wiring board 7 can be increased.

[0052]

In the present embodiment, a heat dissipation space 9 is formed between the printed wiring board 7 and the reflector 6, so that air in the heat dissipation space 9 can be circulated by forced or natural convection using a fan or other means and further increase the heat dissipating properties of the printed wiring board 7.

[0053]

Also, in the present embodiment, a plurality of ventilation holes 7c are formed in the portion of the printed wiring board 7 that faces the back side 5c of the light guide plate 5, allowing air to flow through the ventilation holes 7c, which further improves the heat dissipating properties of the printed wiring board 7.

[0054]

(Second Embodiment)

In contrast to the first embodiment described above, in which a through hole 7b is provided in the bent portion 7a of the printed wiring board 7, in this embodiment, a notch 7d extending in the bending direction is provided in the bent portion 7a of the printed wiring board 7, as shown in Fig. 3. This makes it easier to bend the printed wiring board 7. Fig. 3 shows the printed wiring board 7 before it has been bent into a predetermined shape.

[0055]

When embodying the present invention, the same effect can be obtained by providing a recess instead of a notch 7d.

[0056]

(Third Embodiment)

In the first and second embodiments described above, the entire surface of flexible printed wiring board 72 is bonded to a metal plate 71. In contrast, in the present embodiment, as shown in Fig. 4, the region of the printed wiring board 7 from the portion facing the side edge 5a of the light guide plate 5 to the bent portion 7a (the region indicated by A1) is bonded to the metal plate 71 using an adhesive 73 as indicated by

diagonal lines in Fig. 4. In the region from the portion facing the back side of the light guide plate 5 to the bent portion 7a (the region indicated by A2), the flexible printed wiring board 72 is not bonded.

[0057]

This can suppress damage caused by bending of the flexible printed wiring board 72 better than when the flexible printed wiring board 72 is bonded in all regions, while improving the heat dissipating properties of the printed wiring board 7. Electronic components (such as resistors) 8a other than the light sources 8 can also be mounted on the portion of the printed wiring board 7 that faces the back side 5c of the light guide plate 5, allowing for effective use of the space on the back side of the light guide plate 5.

[0058]

(Other Embodiments)

In each of the embodiments described above, the flexible printed wiring board 72 is provided on the entire surface of the printed wiring board 7. However, when embodying the present invention, the region of the printed wiring board 7 from the portion facing the back side 5c of the light guide plate 5 to the bent portion 7a may be formed from a metal plate 71 only by eliminating the flexible printed wiring board 72. This avoids damage to the flexible printed wiring board 72 in the bent portion 7a. In addition, because the metal plate 71 is exposed in the portion of the printed wiring board 7 that faces the back side 5c of the light guide plate 5, the heat dissipating properties of the printed wiring board 7 can be further improved.

[0059]

When the flexible printed wiring board 72 is provided over the entire surface of the printed wiring board 7, electronic components other than the light emitting diodes 8 can be mounted in the portion of the printed wiring board 7 facing the back side 5c of the light guide plate 5.

[0060]

Although the metallic wiring board 7 in each of the embodiments described above consists of a flexible printed wiring board 72 bonded to a metallic board 71, the metallic wiring board 7 of the present invention is not limited to this example. For example, metal-based wiring boards, metal core wiring boards, enameled wiring boards, and other wiring boards known in the art may be used as the metal-based wiring board 7.

[0061]

In each of the embodiments described above, the light emitting diodes 8 were arranged in a single row with a plurality of light emitting diodes that is arranged in the direction in which the side edge 5a extends and that is perpendicular to the light guide plate 5. However, when embodying the present invention, a row of light emitting diodes 8 may simply be provided.

[Brief Description of the Drawings]

[Fig. 1] Fig. 1 is an exploded perspective view of the vehicle display in a first embodiment of the present invention.

[Fig. 2] Fig. 2 is a cross-sectional view of Fig. 1, showing the light guide plate 5, reflector 6, printed wiring board 7, and light emitting diodes 8.

[Fig. 3] Fig. 3 is a perspective view showing the printed wiring board 7 and light emitting diodes 8 in a second embodiment of the present invention, before the printed wiring board 7 is bent into a predetermined shape.

[Fig. 4] Fig. 4 is a side view of a third embodiment of the present invention, showing the printed wiring board 7 and light emitting diodes 8, etc.

[Fig. 5] Fig. 5 is an exploded perspective view of a vehicle display equipped with a lighting device that the present inventors have examined as a prototype.

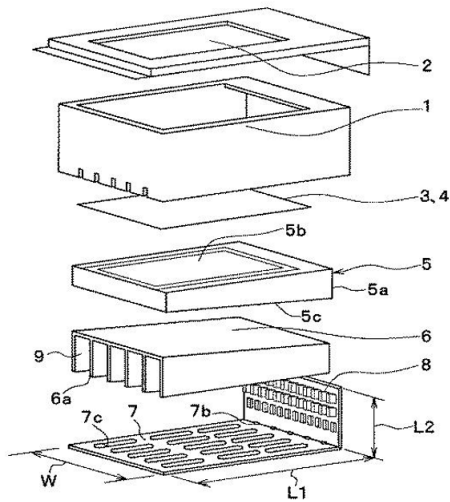
[Fig. 6] Fig. 6 is a cross-sectional view of Fig. 5, showing the light guide plate 5, reflector 6, printed wiring board 7, and light emitting diodes 8.

[Fig. 7] Fig. 7 is a cross-sectional view of the lighting device in Fig. 6, showing a change in the orientation of the printed wiring board 7.

[Reference Numbers]

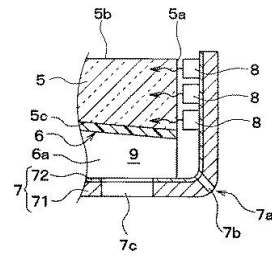
5 ... Light guide plate, 5a ... Side edge, 7 ... Printed wiring board, 8 ... Light emitting diode, 71 ... Metal plate

[Fig. 1]

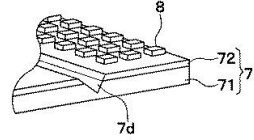


5: Light guide plate
 5a: Side edge
 7: Printed wiring board
 8: Light emitting diode
 71: Metal plate

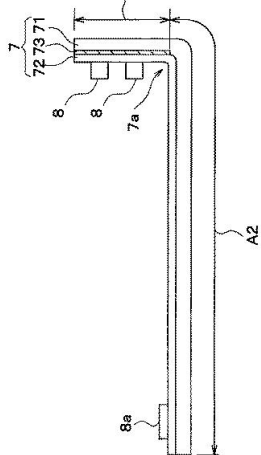
[Fig. 2]



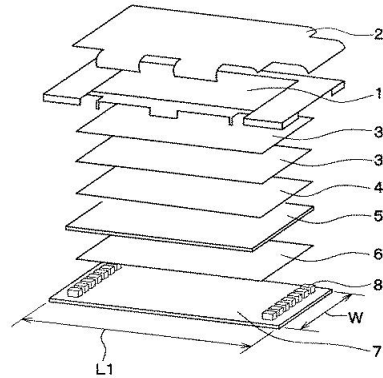
[Fig. 3]



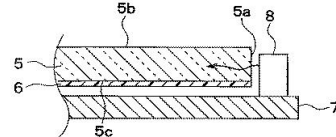
[Fig. 4]



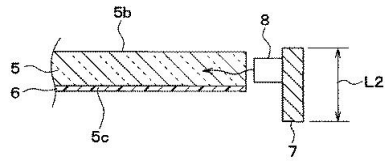
[Fig. 5]



[Fig. 6]



[Fig. 7]



Continued from the front page

F Terms (Reference) 2F074 AA02 BB06 CC02 DD02 EE02 FF01 GG06
3D044 BA22 BA27 BD01 BD13