

CERTIFICATE OF TRANSLATION ACCURACY

I, Dwaine Palmer, declare:

1. I am well versed in both the Japanese and English languages and have over 21 years of experience translating Japanese technical documents into English.
2. The following translation from Japanese into English is accurate and complete to the best of my knowledge.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and accurate.

Statements made herein are to the best of my knowledge true and are based on information that I believe to be true and further these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the patent application in the United States of America or any patent issuing thereon.

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(54) [TITLE OF THE INVENTION]

SURFACE LIGHT SOURCE DEVICE

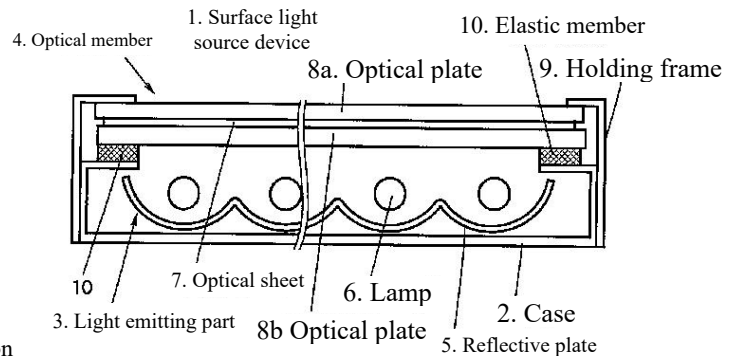
(57) ABSTRACT

[PROBLEM]

To suppress bending deformation and thermal deformation of an optical sheet incorporated in a surface light source device.

[RESOLUTION MEANS]

A surface light source device 1 includes a housing 2, a light emitting part 3, and an optical member 4. The housing 2 has an open surface in front of a flat space. The light emitting part 3 is arranged in a flat space, and emits light from the light source toward the front open surface. The optical member 4 is mounted on the open surface of the housing 2, transmits light source light, and converts this light into illumination light having a desired surface luminance distribution. The optical member 4 has a composite structure composed of an optical sheet 7 that is relatively thin and flexible and is stretchable by heat, and a pair of optical plates 8a, 8b that are relatively thick and rigid, interposed between the optical sheets 7 from the front and back.



What is claimed is:

- [Claim 1] A surface light source device, comprising:
a housing provided with an open surface in front of a flat space;
a light emitting part provided in the flat space, that emits light source light toward the front open surface; and
an optical member mounted on the open surface, that transmits light source light, and converts the light into illumination light having a desired surface luminance distribution;
wherein
the optical member has a composite structure composed of an optical sheet that is relatively thin and flexible and is stretchable by heat, and a pair of optical plates that are relatively thick and rigid, interposed between the optical sheets from the front and back.
- [Claim 2] The surface light source device according to claim 1, wherein the optical sheet is a prism sheet in which micropisms are arranged at a prescribed pitch, refracts and transmits the light source light and converts the light into illumination light having a desired front surface luminance distribution.
- [Claim 3] The surface light source device according to claim 1, wherein at least one side of the pair of optical plates is a light diffusing plate, which diffuses and transmits the light source light, and converts the light into illumination light having a uniform surface luminance distribution.
- [Claim 4] The surface light source device according to claim 1, wherein at least one side of the pair of optical plates is a transparent plate, which transmits the light source light without conversion, and maintains the surface luminance distribution of the illumination light.
- [Claim 5] The surface light source device according to claim 4, wherein an antireflection film is formed on the surface of the transparent plate to prevent reflection of external light.
- [Claim 6] The surface light source device according to claim 1, wherein the optical member has an integrated composite structure in which the optical sheet is held by a pair of optical plates from the front and rear in a stretchable state, and the pair of optical plates are adhered together.
- [Claim 7] The surface light source device according to claim 1, wherein the housing is provided with an elastic member that fixes the periphery of the optical member having a composite structure to the open surface of the housing while compressing the optical member from the front and rear, the elastic force is optimized, and the expansion and contraction deformation of the optical sheet included in the composite structure due to heat is not hindered.
- [Claim 8] The surface light source device according to Claim 1, wherein light emitting part includes a reflector provided so as to face the open surface of the housing, and a lamp provided directly below the open surface and directly above the reflector.
- [Claim 9] The surface light source device according to claim 1, wherein the light emitting part includes a lamp provided on an outer side of the open surface of the housing, and a light guide plate that guides the light source light emitted from the lamp to the open surface, and the optical member also uses the light guide plate as an optical plate positioned on the rear side.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[TECHNOLOGICAL FIELD OF THE PRESENT

INVENTION]The present invention relates to a surface light source device used for a backlight or the like provided on the rear surface of a transmissive liquid crystal panel. More specifically, the present invention relates to a mounting structure for an optical member such as a light diffusing plate and a micropism sheet

incorporated in the surface light source device.

[0002]

[CONVENTIONAL TECHNOLOGY]

Liquid crystal panels and the like have attracted attention as a large flat displays to replace CRTs, and are currently being actively developed. Liquid crystal panels are not self-luminous, but display images by modulating external light, and are broadly classified as being a transmissive type or a reflective type. With the transmissive type, a backlight must be attached to the back surface of the liquid crystal panel. A surface light source device having a flat shape has been conventionally used as the backlight.

[0003] FIG. 6 illustrates an example of a conventional surface light source device. (A) is a cross-sectional view, (B) is a plan view, and (C) is an enlarged view of the C portion shown in (A). As illustrated, a conventional surface light source device 1 includes: a housing 2 provided with an open surface in front of a flat space; a light emitting part 3 provided in the flat space, that emits light from a light source light toward the front open surface; and an optical member 4 mounted on the open surface, that transmits light from the light source, and converts the light into illumination light having a desired surface luminance distribution. The illustrated conventional example is a so-called direct type, and the light emitting part 3 includes: a reflective plate 5 facing the open surface of the housing 2, and a lamp 6 such as a fluorescent tube or the like, provided thereon. Furthermore, as illustrated in (C), the optical member 4 provides an optical sheet 7 which is relatively thin, has flexibility, and stretchability due to heat, and superimposes a single optical plate 8 which is relatively thick and rigid, and supports the optical sheet 7 from behind. The optical sheet 7 is, for example, a prism sheet in which micropisms are formed at a constant pitch, and the optical plate 8 is, for example, a light diffusing plate in which diffusing fine particles are dispersed in an acrylic resin plate. As illustrated in (A), the optical member 4 in which the optical sheet 7 and the optical plate 8 are stacked is attached to the open surface of the housing 2 via a holding frame 9. As illustrated in (B), the portion of the optical member 4 exposed from the holding frame 9 constitutes the light emitting surface 11 of the surface light source device 1. As illustrated in (C), the peripheral edge part of the optical member 4 is inserted into a gap provided between the holding frame 9 and the housing 2. The optical member 4 thermally expands and deforms due to radiant heat or the like from the lamp 6. Therefore, some clearances X and Y are provided between the holding frame 9 and the peripheral part of the optical member 4.

[0004]

[PROBLEMS TO BE SOLVED BY THE INVENTION]

Conventional flat displays are still predominantly small, and the size of the surface light source device that serves as the backlight is also small. Therefore, an important characteristic required of the backlight is to reduce the thickness and weight of the surface light source device. Therefore, the optical member 4 is a sheet-like or plate-like member. Since the area is relatively small, the amount of expansion of the sheet material and the plate material due to heat is small, and in order to further reduce the thickness, a method of holding the optical member 4 has a relatively simple structure, as illustrated in FIG. 6. However, in a surface light source device corresponding to a large flat display with a 25 inch size or the like, the structure illustrated in FIG. 6 causes various problems. For example, as illustrated in FIG. 7, when the surface light source device 1 is vertically oriented and combined with a flat display (not shown), the relatively thin and flexible optical sheet 7 cannot stand on its own against gravity, and bending deformation occurs.

The bending deformation of the optical sheet 7 adversely affects the surface luminance distribution of the illumination light. Although FIG. 7 illustrates the surface light source device provided horizontally, as described above, a state in which the device is vertically oriented for use is shown. As illustrated in FIG. 8, in order to prevent bending deformation of the optical sheet 7, a structure in which the peripheral edge part of the optical member 4 is supported and secured so as to be interposed between the holding frame 9 and the housing 2 is also conceivable. Thereby, tension can be applied so that the optical sheet 7 does not bend. However, the optical sheet 7 is thermally stretchable, and when heated from the lamp 6 side, the sheet thermally expands and wrinkles. The wrinkles also adversely affect the surface luminance distribution of illumination light.

[0005]

[MEANS FOR SOLVING THE PROBLEM] In order to solve the aforementioned problems of the conventional technology, the following measures have been taken. In other words, the basic configuration of the surface light source device of the present invention, provides:

a housing provided with an open surface in front of a flat space; a light emitting part provided in the flat space, that emits light from a light source light toward the front open surface; and an optical member mounted on the open surface, that transmits light from the light source, and converts the light into illumination light having a desired surface luminance distribution. A characteristic matter is that the optical member has a composite structure composed of an optical sheet that is relatively thin and flexible and is stretchable by heat, and a pair of optical plates that are relatively thick and rigid, interposed between the optical sheets from the front and back. For example, the optical sheet is a prism sheet in which micropisms are arranged at a prescribed pitch, refracts and transmits the light source light and converts the light into illumination light having a desired front surface luminance distribution. Furthermore, at least one side of the pair of optical plates is a light diffusing plate, which diffuses and transmits the light source light, and converts the light into illumination light having a uniform surface luminance distribution. Alternatively, at least one side of the pair of optical plates may be a transparent plate, which transmits the light source light without conversion, and maintains the surface luminance distribution of the illumination light. In this case, an antireflection film may be formed on the surface of the transparent plate to prevent reflection of external light. As one embodiment, the optical member has an integrated composite structure in which the optical sheet is held by a pair of optical plates from the front and rear in a stretchable state, and the pair of optical plates are adhered together. Preferably, the housing is provided with an elastic member that fixes the periphery of the optical member having a composite structure to the open surface of the housing while compressing the optical member from the front and rear, the elastic force is optimized, and the expansion and contraction deformation of the optical sheet included in the composite structure due to heat is not hindered. Furthermore, the light emitting part includes a reflector provided so as to face the open surface of the housing, and a lamp provided directly below the open surface and directly above the reflector. Alternatively, the light emitting part includes a lamp provided outside of the open surface of the housing, and a light guide plate that guides the light source light emitted from the lamp to the open surface. In this case, the optical member can also serve as the light guide plate as an optical plate located on the rear side.

[0006] With the present invention, two optical plates having the same dimensions or larger dimensions than the optical sheet are

used to interpose and hold the entire surface of the optical sheet from the front and rear (front and back). As a result, it is possible to prevent the optical sheet from becoming wrinkled due to the heat generated by the light source part. The optical plate interposing the optical sheet is not simply a part for holding, but can also use a light diffusing plate with various diffusion coefficients, or a transparent plate made of acrylic or the like with an anti-reflection film on the outer surface, as a component that satisfies the optical properties required of a surface light source device. In some cases, the two optical plates interposing the optical sheet may be adhered to each other using heat-resistant adhesive tape or an adhesive, or the optical sheet may be packed inside the two optical sheets to form an integrated component. In this manner, when the optical part is incorporated into the surface light source device, there is no need to handle the optical sheet alone, which facilitates the assembly process. Depending on the size of the surface light source device, the materials of the optical sheets and optical plates, the difference in the coefficient of thermal expansion between the two, and the like, the force with which the optical sheets are interposed between the two optical plates may be adjusted using elastic members, such as springs, cushions, or the like.

[0007]

[PREFERRED EMBODIMENTS OF THE INVENTION] A preferred embodiment of the present invention is described below in detail, with reference to the following diagrams. FIG. 1 is a schematic cross-sectional view illustrating a first embodiment of a surface light source device according to the present invention. As illustrated, the surface light source device 1 includes a housing 2, a light emitting part 3, and an optical member 4. The housing 2 has an open surface in front of the flat space. The light emitting part 3 is arranged in a flat space, and emits light from the light source toward the front open surface. The optical member 4 is mounted on the open surface of the housing 2 by the holding frame 9, transmits light source light, and converts this light into illumination light having a desired surface luminance distribution. A characteristic matter is that the optical member 4 has a composite structure composed of an optical sheet 7 that is relatively thin and flexible and is stretchable by heat, and a pair of optical plates 8a, 8b that are relatively thick and rigid, interposed between the optical sheets 7 from the front and back. For example, the optical sheet 7 is a prism sheet in which micropisms are arranged at a prescribed pitch, refracts and transmits the light source light and converts the light into illumination light having a desired front surface luminance distribution. Furthermore, at least one side of the pair of optical plates 8a, 8b is a light diffusing plate, which diffuses and transmits the light source light, and converts the light into illumination light having a uniform surface luminance distribution. In some cases, at least one side of the pair of optical plates 8a, 8b may be a transparent plate. In this case, the transparent plate transmits the light source light without conversion, and maintains the surface luminance distribution of the illumination light. Furthermore, when a transparent plate is used as the front optical plate 8a, the antireflection film may be formed on the surface thereof in order to prevent reflection of external light. The present embodiment is a so-called direct type backlight, and the light emitting part 3 includes a reflective plate 5 provided across from the opening surface of the housing 2, and a lamp 6 including a plurality of fluorescent tubes or the like provided directly below the open surface of the housing 2 and directly above the reflective plate 5. Furthermore, an elastic member 10 is interposed between the housing 2 and the optical member 4. The elastic member 10 is

secured to the open surface of the housing 2 together with the holding frame 9, while pressing the periphery of the optical member 4 having a composite structure from the front and back. The elastic member 10 is composed of a spring or a cushion, and optimizes the elastic force such that the optical sheet 7 included in the middle of the composite structure of the optical member 4 does not interfere with the expansion and contraction deformation due to heat.

[0008]

Each part will be explained below. The lamp 6 is made of a fluorescent tube or the like, and serves as a light source. The reflective plate 5 reflects the light source light generated by the lamp 6 toward the front. The lower optical plate 8b is a light diffusing plate, and is a plate material in which diffusing fine particles are dispersed in acrylic resin. The direct light source light from the lamp 6 and the indirect light source light from the reflective plate 5 are diffused to eliminate luminance unevenness such that the area directly above each lamp 6 appears bright and the space between adjacent lamps 6 appears dark. The optical sheet 7 is a prism sheet, and serves to collect the light source light diffused outside the viewing angle by the lower optical plate 8b toward the front, in order to increase the front brightness. The upper optical plate 8a also is a light diffusing plate, and is used to suppress the glare of the optical sheet 7 and to alleviate a sudden decrease in luminance from a certain viewing angle due to the optical sheet 7. The diffusing plate used as the upper optical plate 8a has a relatively low diffusing function compared to the diffusing plate used as the lower optical plate 8b. The pair of optical plates 8a, 8b are rigid, self-supporting in shape, and thick enough to form a flat surface. For example, with the surface light source device 1 corresponding to a flat display having a 25-inch screen size (approximately 550 mm × 320 mm), the thickness of the optical plates 8a and 8b is approximately 2 mm to 3 mm. The optical plate 8a on the front side, the optical sheet 7 in the middle, and the optical plate 8b on the rear side are superimposed as illustrated in the figure, and interposed between the housing 2 and the holding frame 9 via the elastic member 10 with a relatively weak elastic force. At this time, the optical sheet 7 is interposed between the front and rear optical plates 8a, 8b having flat surfaces, respectively, and is held without bending deformation.

Furthermore, when thermal expansion occurs due to heat generated during use, the optical plates 8a, 8b extend in a planar direction within the holding frame 9. The optical sheet 7 extends along the gap between the front and rear optical plates 8a, 8b. At that time, by optimizing the elastic force of the elastic member 10, the optical sheet 7 expands and contracts while being interposed between the optical plates 8a, 8b. Thereby, the difference in the coefficient of thermal expansion between the optical sheet 7 and the optical plates 8a, 8b can be absorbed. For example, with a surface light source device 1 corresponding to a 25-inch screen, if the optical plates 8a, 8b are made of acrylic resin and the optical sheet 7 is made of polyester resin and has a thickness of approximately 0.15 mm, the elastic member 10 has a thickness of 1 mm to 2 mm and a hardness of approximately 30 to 60 degrees, and is interposed between the housing 2 and the optical member 4 in a state of being compressed to 0.3 to 0.5 mm. As a result, the optical sheet 7 can be held without slack, even in the large-sized surface light source device 1, and the generation of wrinkles due to heat generation in the optical sheet 7 can be suppressed.

[0009]FIG. 2 is a schematic cross-sectional view illustrating the second embodiment of a surface light source device 1 according to the present invention. Parts corresponding to those of the first

embodiment shown in FIG. 1 are denoted by corresponding reference numerals for easy understanding. The present embodiment is a so-called side edge type backlight. In other words, the light emitting part 3 includes a lamp 6 provided outside of the open surface of the housing 2, and a light guide plate 8c that guides the light source light emitted from the lamp 6 to the open surface. In this case, the optical member 4 also serves as the light guide plate 8c as an optical plate located on the rear side. In other words, in this embodiment, the middle optical sheet 7 is interposed between the front optical plate 8a and the rear light guide plate (optical plate) 8c. As described above, depending on the directivity of the illumination light required for the surface light source device 1, a prism sheet is used as the optical sheet 7, in order to achieve a large amount of light being directed to the front by emphasizing the front surface luminance. In this case, a transparent plate made of acrylic resin, polycarbonate resin, or the like may be used as the front optical plate 8a instead of the light diffusing plate. With the side edge type surface light source device 1, the lamp 6 is housed in the reflecting mirror 5a, and the reflecting surface 5b is formed under the light guide plate 8c.

[0010]FIG. 3 is a schematic diagram showing a third embodiment of the surface light source device 1 according to the present invention, showing only the configuration of the optical member 4, which is an essential part. With the optical member 4, the middle optical sheet 7 is held in a stretchable state by a pair of optical plates 8a, 8b from the front and back, and the pair of optical plates 8a, 8b are adhered to each other with a heat-resistant adhesive tape 11 or the like, to create an integrated composite structure. In other words, the optical member has a structure in which an optical sheet 7 such as a prism sheet is packed between optical plates 8a, 8b such as a light diffusion plate.

Herein, the optical plates 8a, 8b are assumed to have the same coefficient of thermal expansion, and the size of the gap between these plates is such that the optical sheet 7 does not bend, and can be expanded and contracted by heat. This eliminates the need to handle the optical sheet 7 alone when assembling the surface light source device 1. Furthermore, in a flat display set, when replacing the surface light source device of the backlight due to a burnt out lamp or the like, the work can be performed without touching the optical sheet which is easily damaged.

[0011]

FIG. 4 illustrates a specific configuration of a prism sheet used as an example of the optical sheet. In FIG. 4, (A) shows the cross-sectional shape of the prism sheet, (B) shows the planar shape, and (C) shows the enlarged cross-sectional structure. As illustrated, the prism sheet 70 has an anisotropic structure in which microprisms 71 extending in stripes are arranged at a prescribed pitch P along the direction orthogonal to the stripes. The thickness T of the prism sheet 70 is, for example, approximately one hundred and several ten μm . The prism sheet 70 is overlapped on the optical plate (light diffusing plate) 8b positioned on the lamp side. Emitted light U from the lamp (not shown) is converted into almost completely diffuse light V by the diffusing optical plate 8b. This completely diffused light V is condensed by the refractive action and total reflection action of the microprism 71, and converted into illumination light W having directivity. The illumination light W is condensed only in the direction perpendicular to the stripes of the microprisms 71, and is not condensed in the direction parallel to the stripes. The condensing angle (viewing angle) θ is, for example, approximately 60° to 70°.

Thus, by stacking the prism sheet 70 on the light diffusing optical plate 8b, it is possible to obtain an anisotropic surface light source device that emits condensed illumination light in only one direction. The surface light source device is suitable for backlighting a liquid crystal panel having a so-called blind structure.

[0012]

FIG. 5 is an exploded perspective view illustrating an example of a flat display using the surface light source device of the present invention as a backlight. This flat display includes a frame 81, a display unit 82, a surface light source device 1 used as a backlight unit, and a chassis 83. Furthermore, a pair of speakers 84 and 85, a shield cover 86 and a rear cover 87 are also included. The frame 81 is positioned on the front side of the flat display set, and is open in a window part 88. The display unit 82 has a flat shape and includes a transmissive blind-structured liquid crystal panel, which is incorporated in the frame 81 from the rear, and aligned with the window 88 to form a screen. The chassis 83 is positioned on the rear side of the flat display set and engages with the frame 81 with the display unit 82 interposed therebetween, to form a flat storage space 89 on the rear side of the display unit 82. As described above, the surface light source device 1 is assembled in advance using the housing 2 having a flat shape, can be detachably inserted into the storage space 89, and illuminates the transmissive display unit 82 from the back. As described above, an optical member having a composite structure is attached to the open surface of the housing 2 of the surface light source device 1.

[0013]

Finally, with reference to FIG. 9, an example of a liquid crystal panel having a blind structure incorporated in the display unit 82 shown in FIG. 5 will be described. This liquid crystal panel has a plasma address type and has a flat panel structure containing a liquid crystal cell 101, a plasma cell 102, and a common intermediate substrate 103 interposed therebetween. The middle substrate 103 is made of an ultra-thin plate glass or the like, and is called a microsheet. The plasma cell 102 is composed of a lower substrate 104 made of glass or the like bonded to an intermediate substrate 103, and an ionizable gas is sealed in the gap between the two substrates. Striped discharge electrodes 105 are formed on the inner surface of the lower substrate 104. The discharge electrodes 105 can be printed and fired on the flat glass substrate 104 by screen printing or the like, and can provide excellent productivity and workability, and can be miniaturized. A partition wall 106 is formed in parallel with the discharge electrode 105 to divide the gap filled with the ionizable gas in order to form a discharge channel 107. The partition wall 106 can also be printed and baked by a screen printing method, and the top portion is in contact with one side of the intermediate substrate 103. As described above, in the plasma-addressed liquid crystal panel, the discharge channels 107 separated by the barrier ribs 106 are arranged in stripes, resulting in a so-called blind structure. The striped discharge electrodes 105 alternately function as anodes A and cathodes K to generate plasma discharge therebetween. Note that the middle substrate 103 and the lower substrate 104 are bonded to each other by a glass frit 108 or the like.

[0014]

On the other hand, the liquid crystal cell 101 is constructed using a transparent upper substrate 109. The upper substrate 109 is adhered to the other surface of the middle substrate 103 with a prescribed

gap by using a sealing material 110 or the like, and the gap is filled with liquid crystal 111. A signal electrode 112 made of a transparent conductive film is formed on the inner surface of the upper substrate 109. The signal electrode 112 is perpendicular to the striped discharge electrode 105. Matrix-shaped pixels are defined at the intersections of the signal electrodes 112 and the discharge channels 107.

[0015]

In the plasma-addressed liquid crystal panel having such a structure, the row discharge channels 107 in which plasma discharge is performed are sequentially switched by line and scanned, while at the same time, synchronous to the scanning, an image signal is applied to the column signal electrodes 112 on the side of the liquid crystal cell 101 to drive the display. When plasma discharge occurs in the discharge channel 107, the inside becomes substantially uniform at the anode potential, and pixel selection is performed for each row. In other words, the discharge channel 107 functions as a sampling switch. When an image signal is applied to each pixel with the plasma sampling switch turned ON, sampling is performed and the light transmittance of the pixel can be controlled. The image signal is held in the pixel without conversion even after the plasma sampling switch is turned OFF. When a transmissive liquid crystal panel having such a structure is illuminated from behind using the surface light source device according to the present invention, a clear image is projected forward.

[0016]

[EFFECT OF THE INVENTION]

As described above, the present invention uses a composite structure including a relatively thin optical sheet having flexibility and stretchability due to heat, and a relatively thick and rigid optical sheet interposed between a pair of optical plates from the front and rear, as the optical member to be mounted on the open surface of the surface light source device. With such a configuration, even if the surface light source device is enlarged, the optical sheet does not bend due to its own weight, or wrinkles due to thermal expansion will not occur.

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is a cross-sectional view illustrating the first embodiment of a surface light source device according to the present invention. FIG. 2 is a cross-sectional view illustrating the second embodiment of a surface light source device according to the present invention. FIG. 3 is a cross-sectional view of essential components illustrating the third embodiment of a surface light source device according to the present invention. FIG. 4 is an explanatory diagram showing the structure and function of a prism sheet used in the surface light source device according to the present invention.

FIG. 5 is an exploded perspective view illustrating an example of a flat display set using the surface light source device of the present invention as a backlight.

FIG. 6 is a schematic diagram illustrating the structure of a conventional surface light source device.

FIG. 7 is an explanatory diagram illustrating the problems of a conventional surface light source device.

FIG. 8 is an explanatory diagram illustrating the problems of a conventional surface light source device.

FIG. 9 is a cross-sectional view illustrating an example of a liquid

crystal panel incorporated in the flat display set illustrated in FIG. 5.

[DESCRIPTION OF REFERENTIAL NUMERALS]

1... Surface light source device, 2... Housing, 3... Light-emitting part, 4... Optical member, 5... Reflective plate, 6... Lamp, 7... Optical sheet, 8a... Optical plate, 8b... Optical plate, 9... Holding frame, 10... Elastic member

FIG. 1

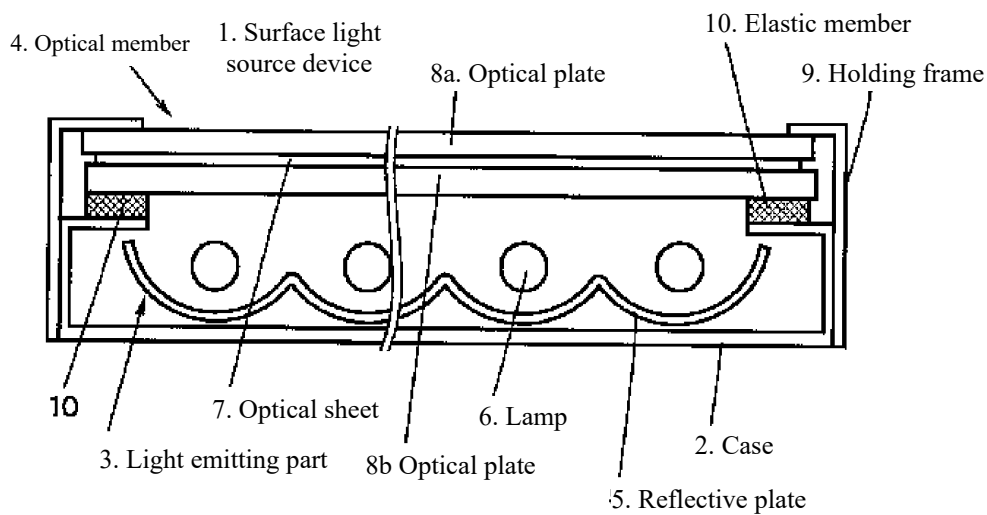


FIG. 2

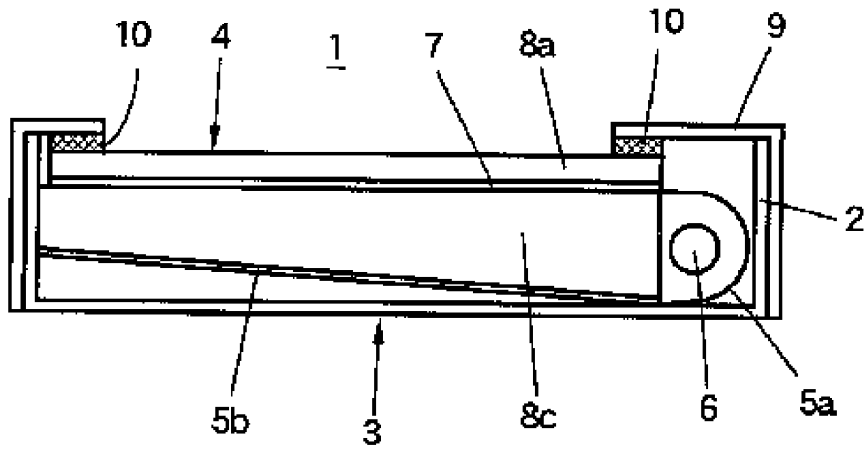


FIG. 3

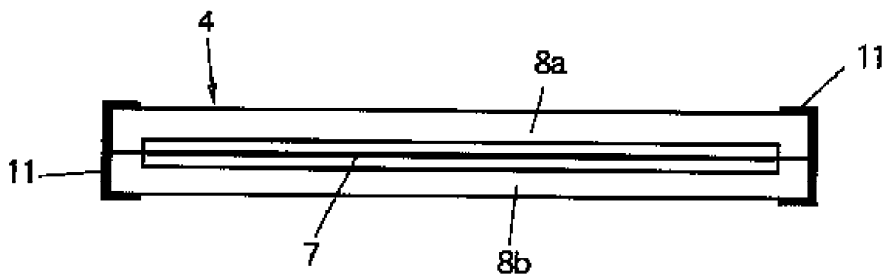


FIG. 4

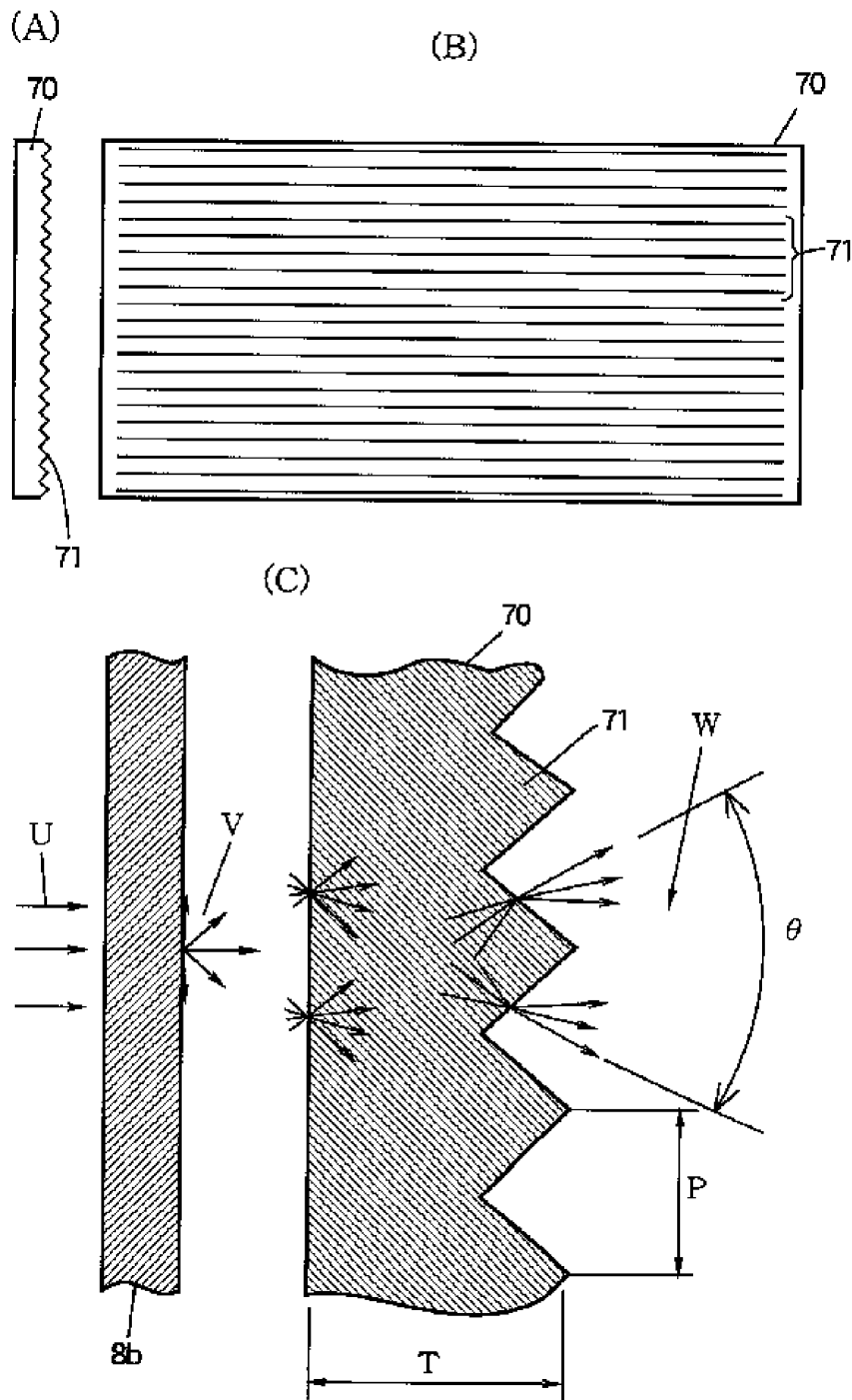


FIG. 5

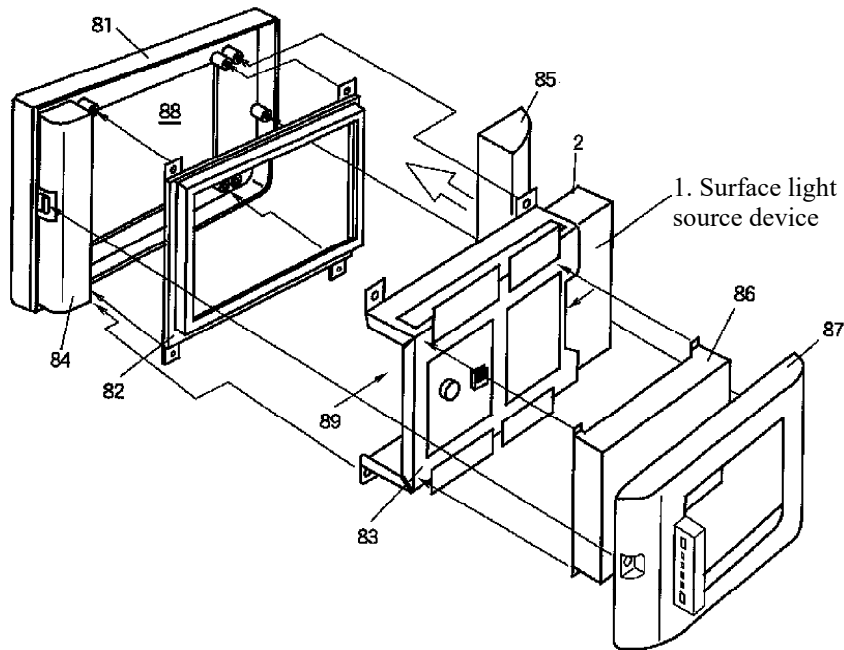


FIG. 6

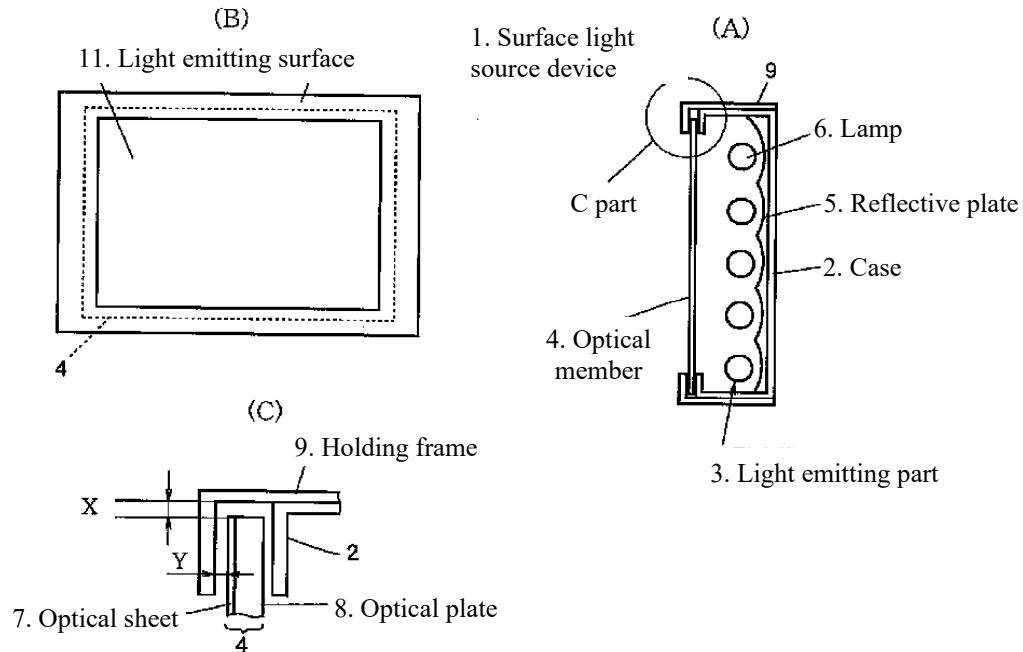


FIG. 7

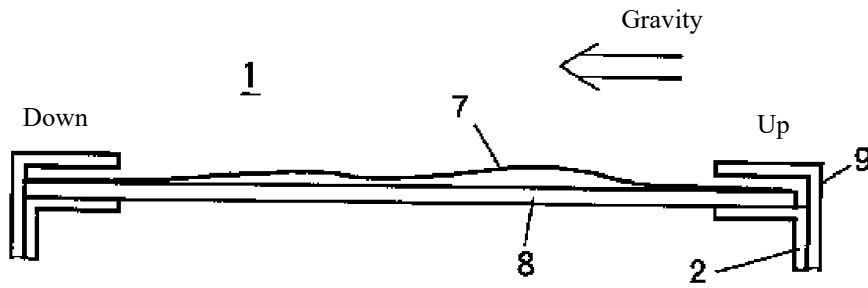


FIG. 8

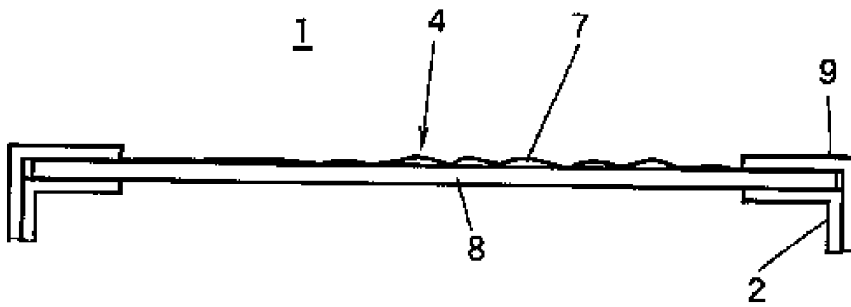


FIG. 9

