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(54) **DISPLAY DEVICE AND METHOD OF ASSEMBLING THE DISPLAY DEVICE**

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(57) **ABSTRACT**

A display device includes: a reflection plate; plural light sources disposed above the reflection plate; an optical member disposed above the plural light sources; a support member disposed standing on a bottom surface of the reflection plate; a frame member that houses the reflection plate and the light sources; and a display panel disposed above the optical member. The support member includes: a standing support portion that is disposed standing on and supports the reflection plate; an optical member support portion that supports the optical member; and a leg portion that protrudes downward of the reflection plate and the frame member and is bent in a direction along the standing support member.

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Related U.S. Application Data

(63) Continuation of application No. 11/480,519, filed on Jul. 5, 2006, now Pat. No. 7,489,372.

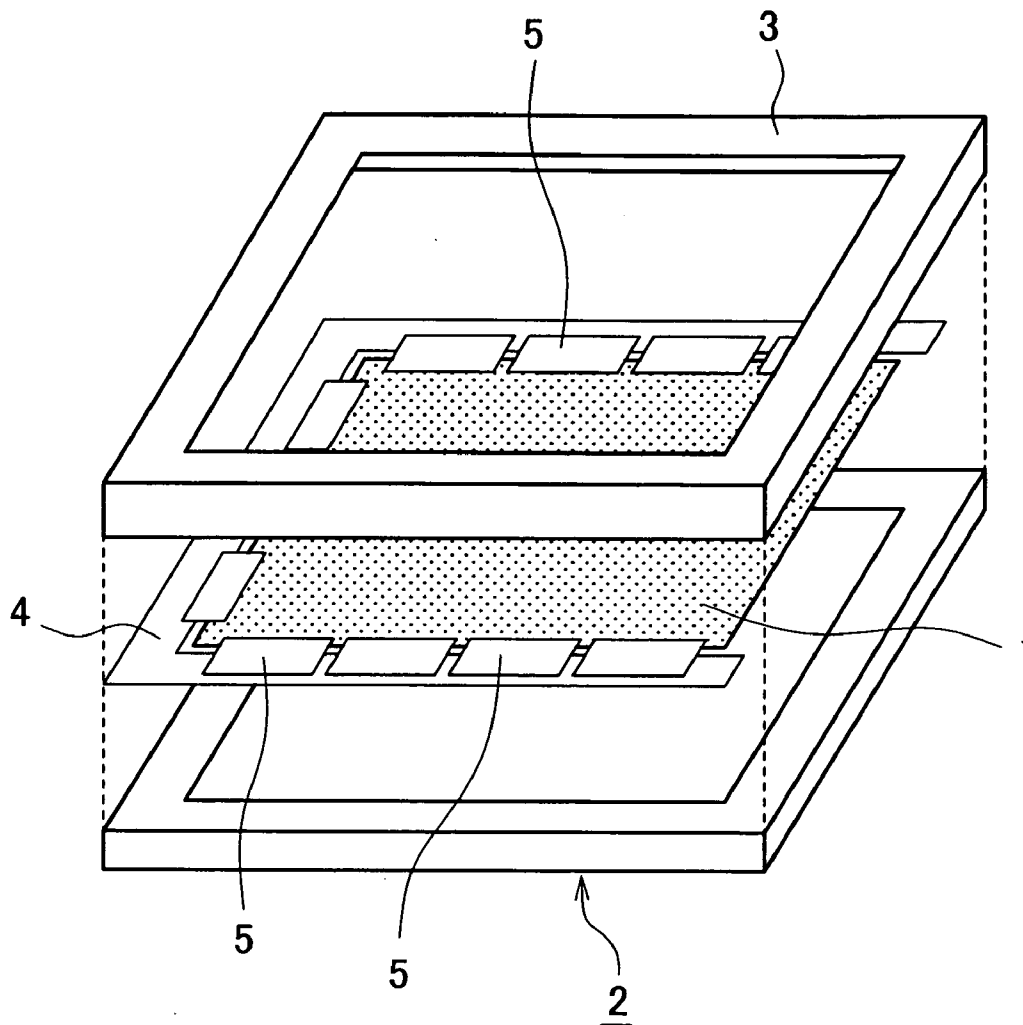


FIG. 1

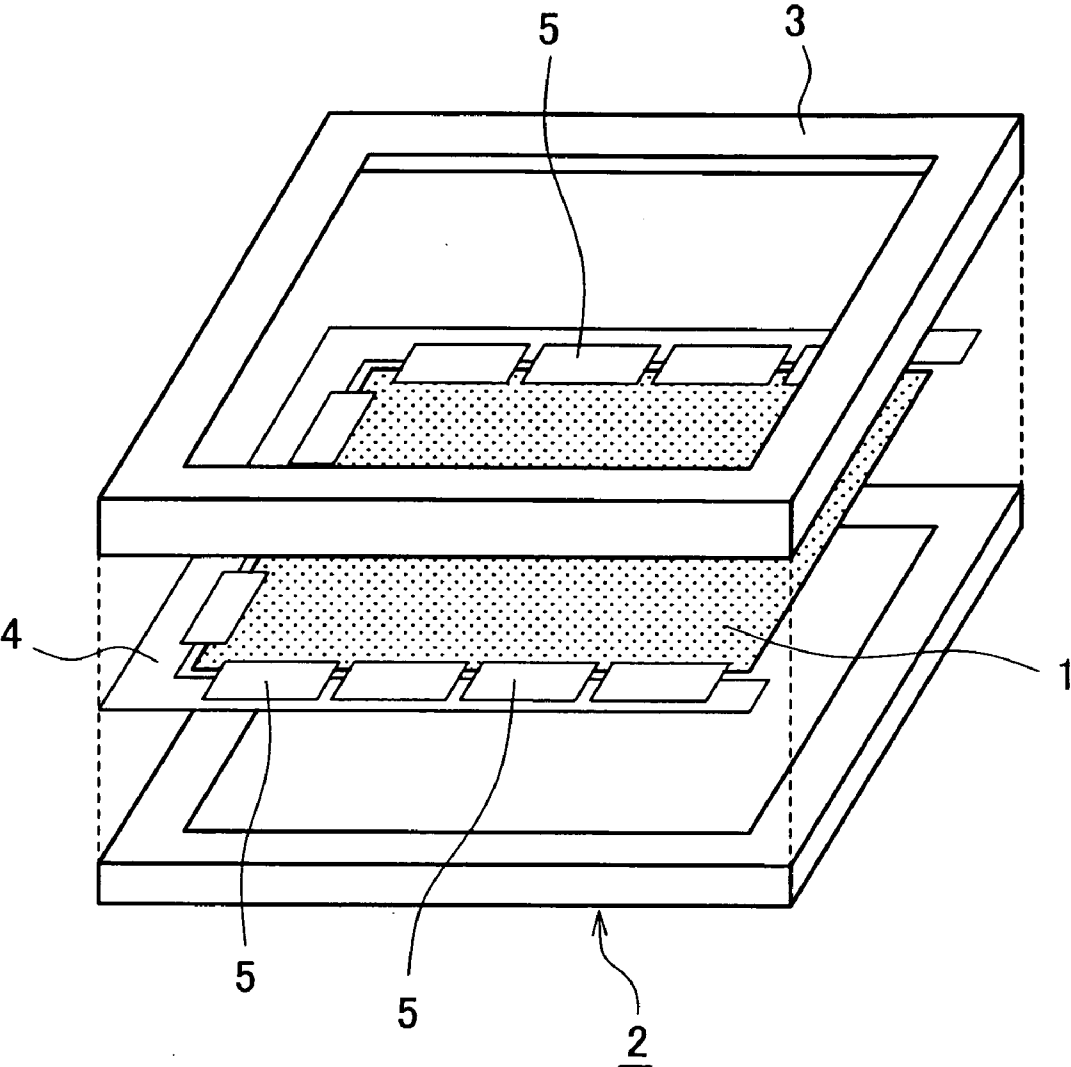


FIG. 2

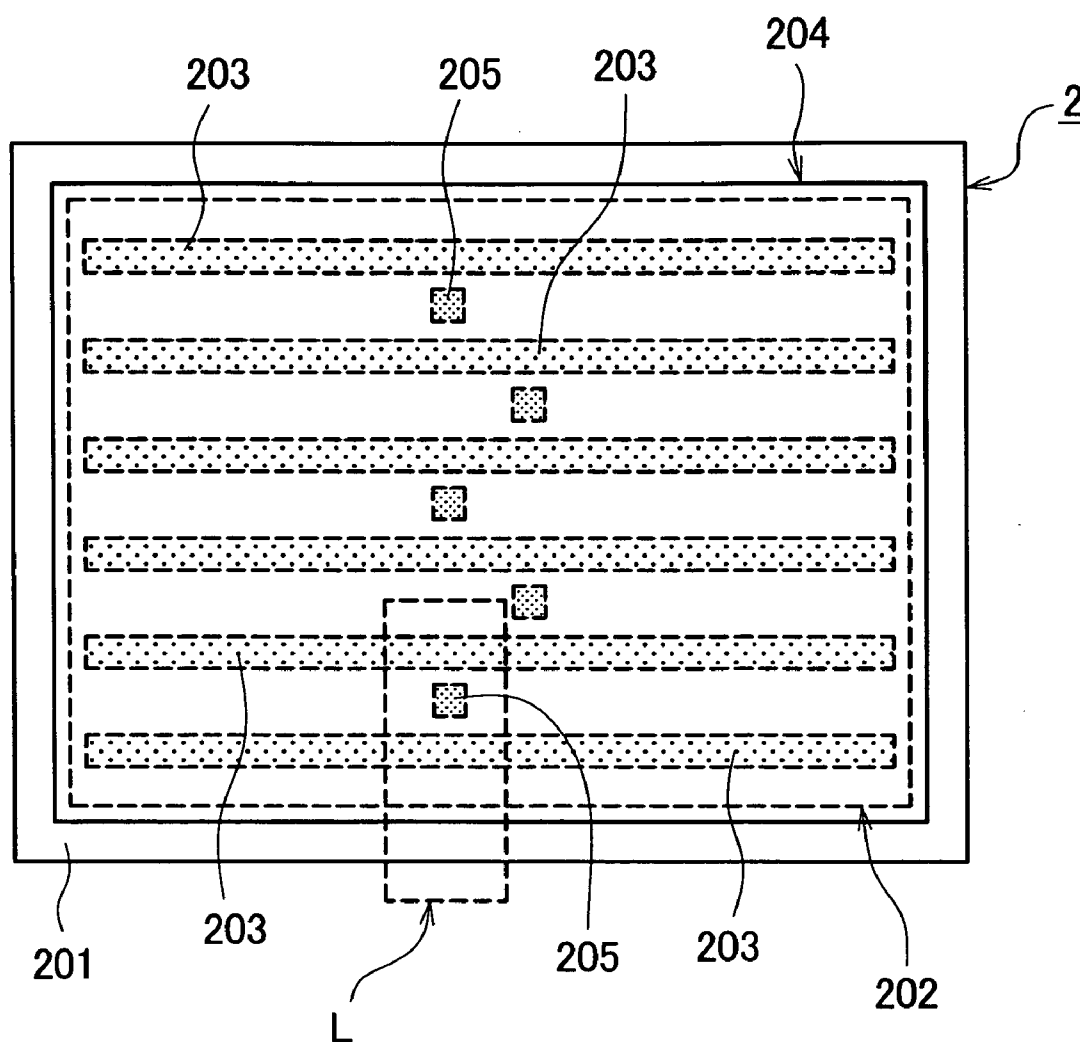


FIG. 3

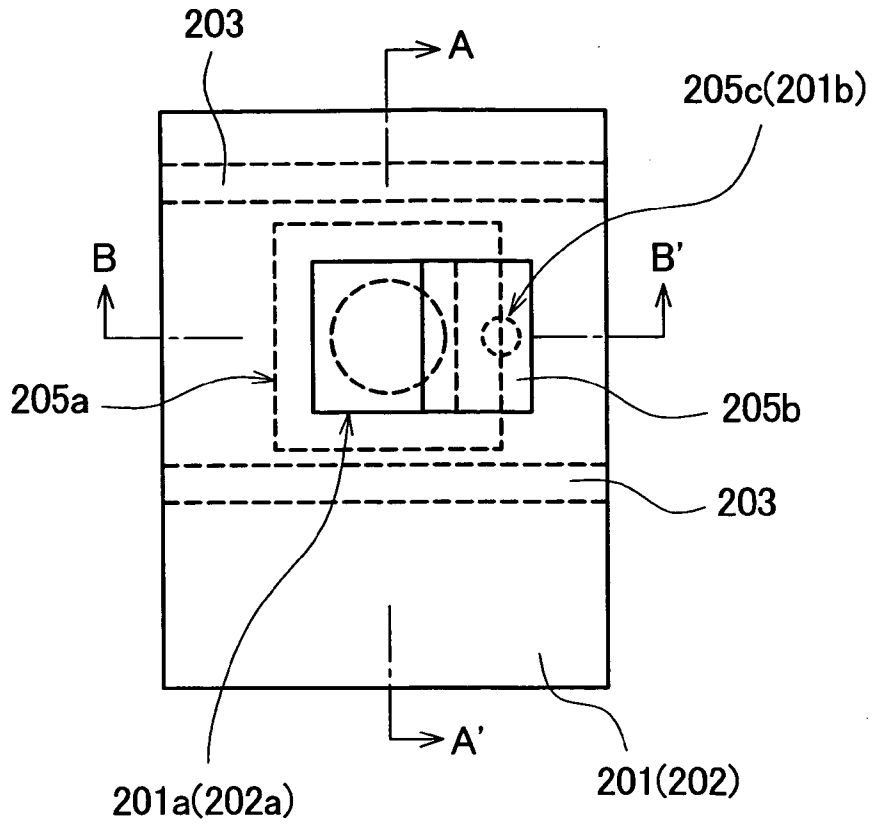


FIG. 4

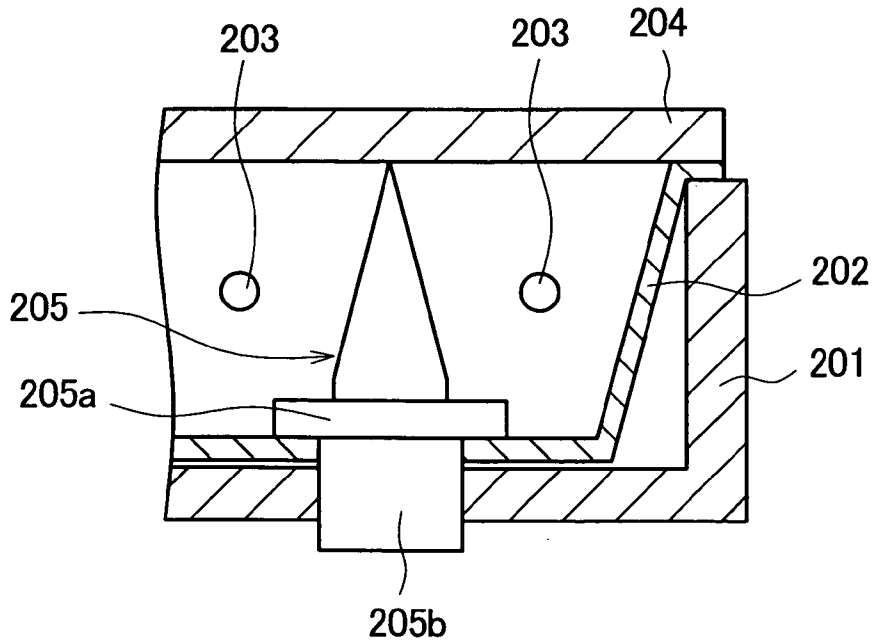


FIG. 5

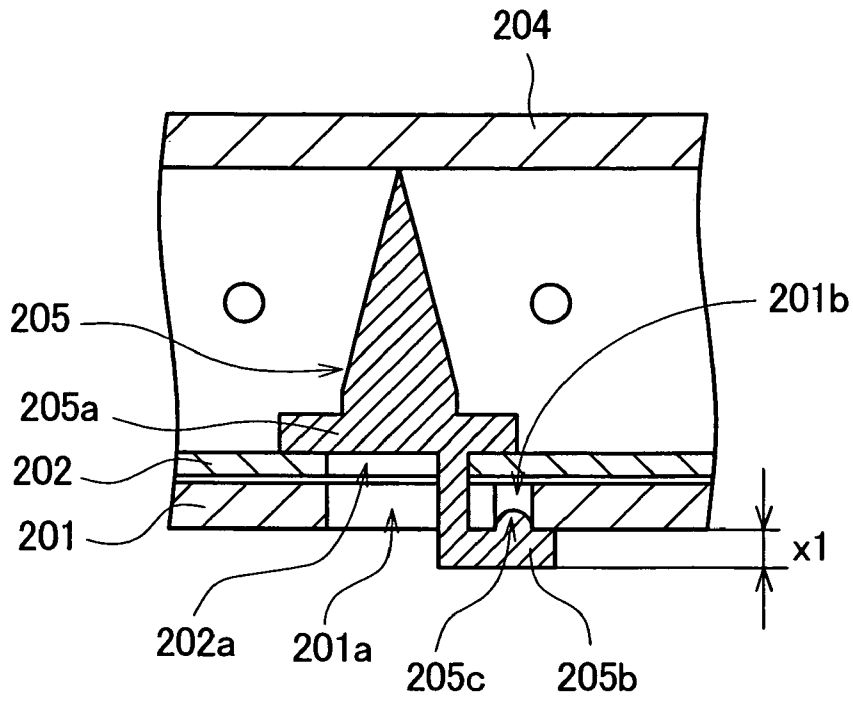


FIG. 6

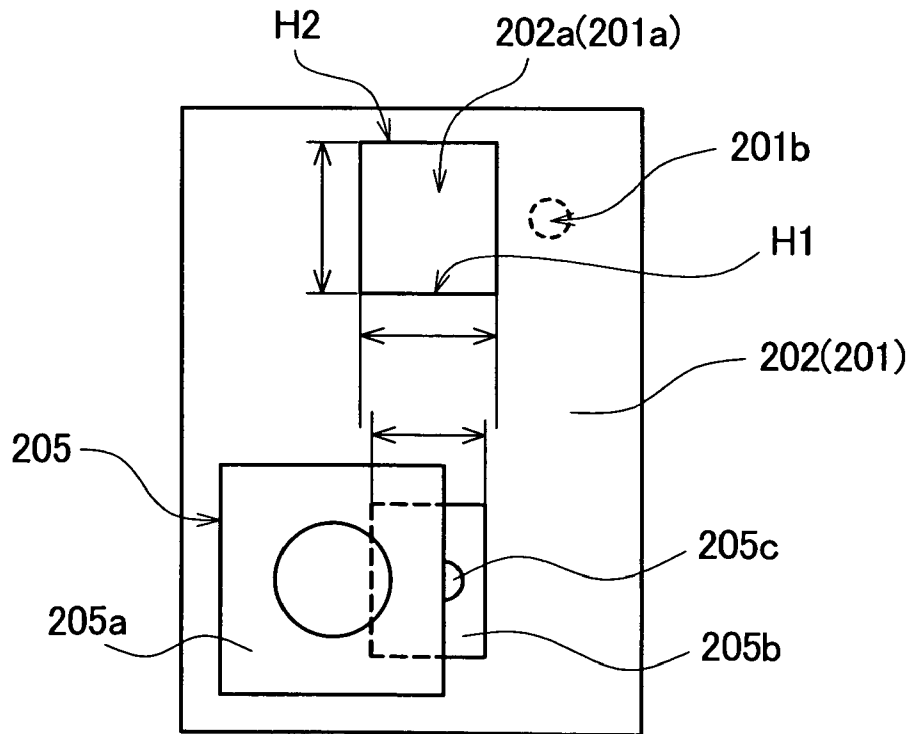


FIG. 7

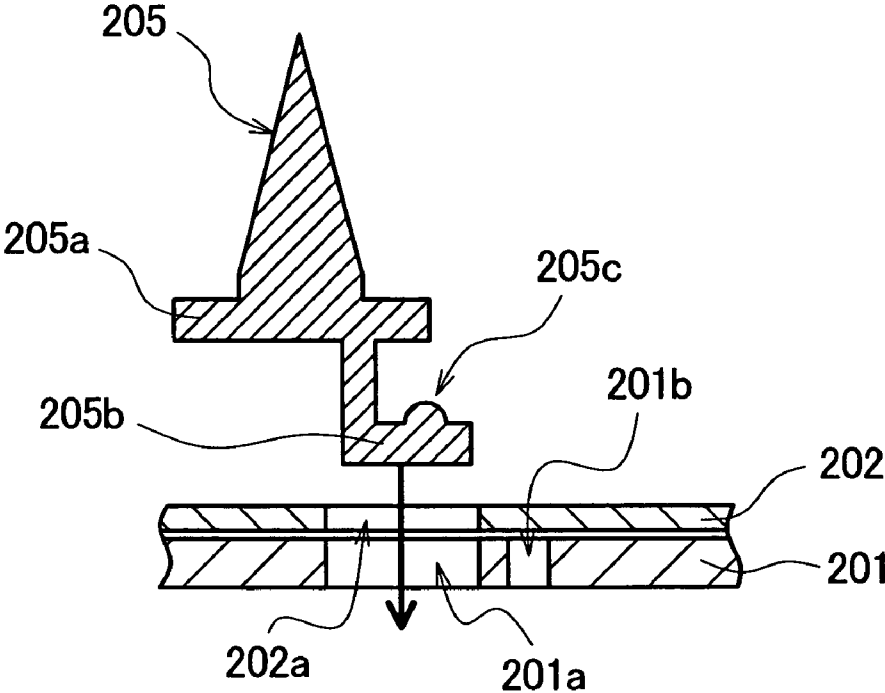


FIG. 8

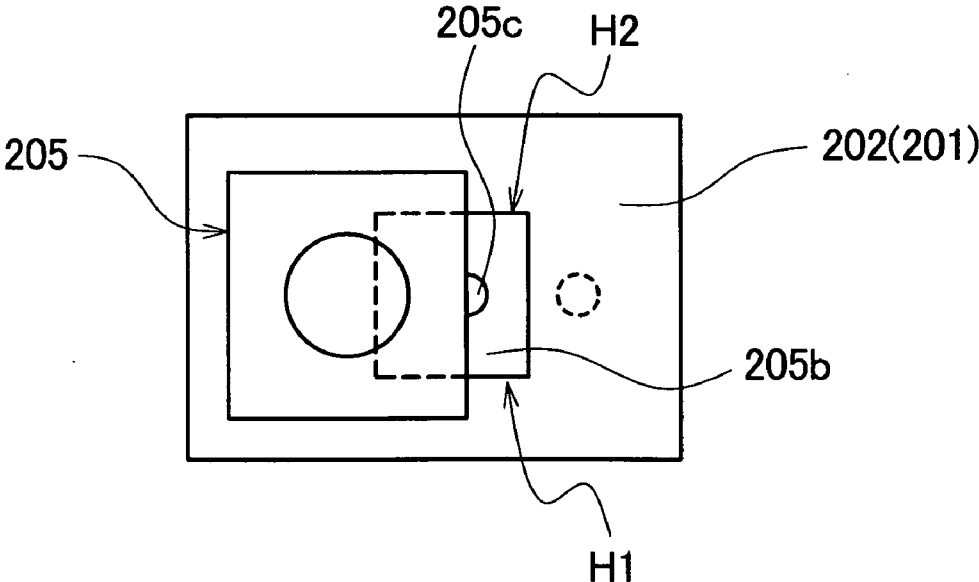


FIG. 9

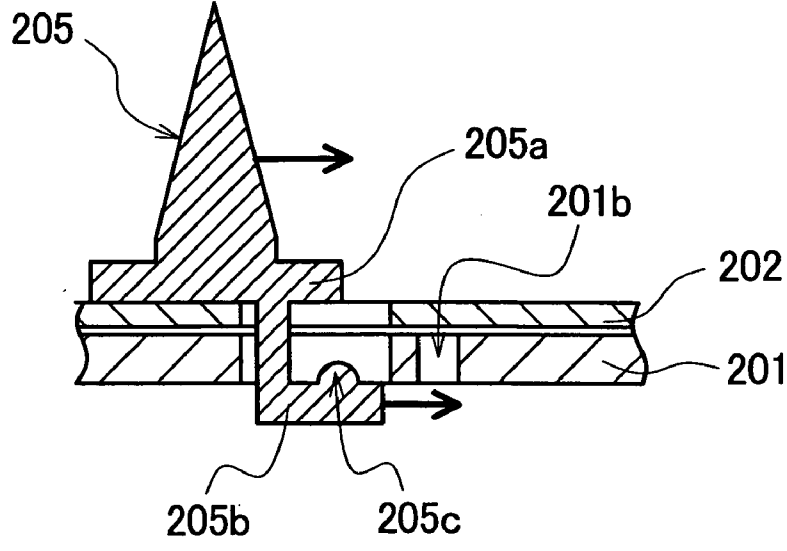


FIG. 10

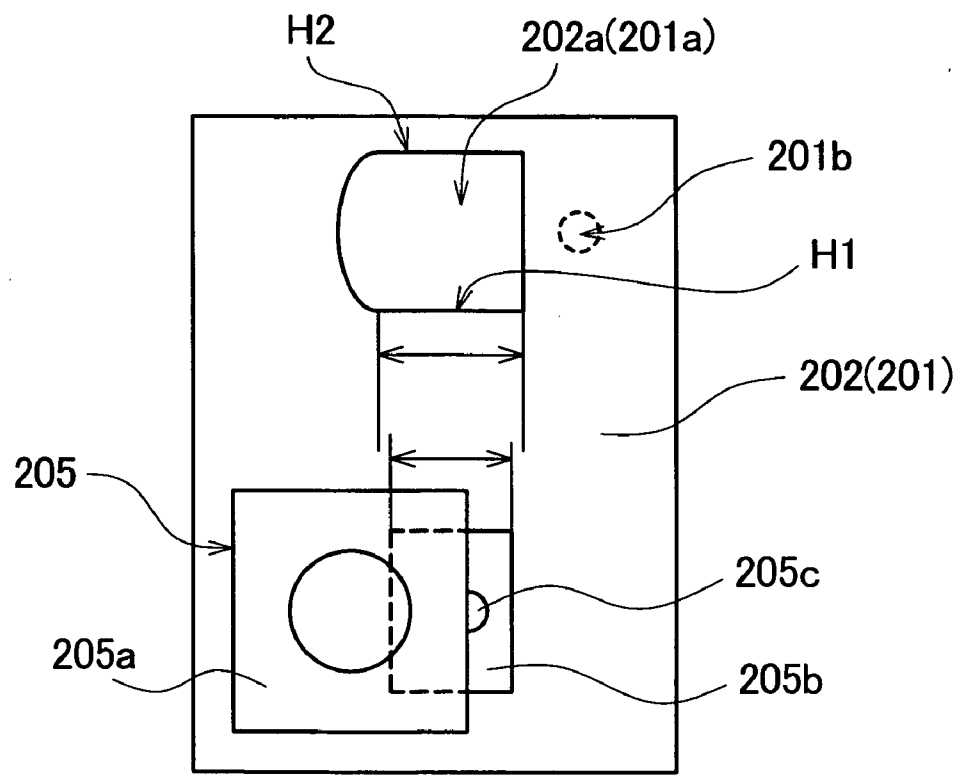


FIG. 11

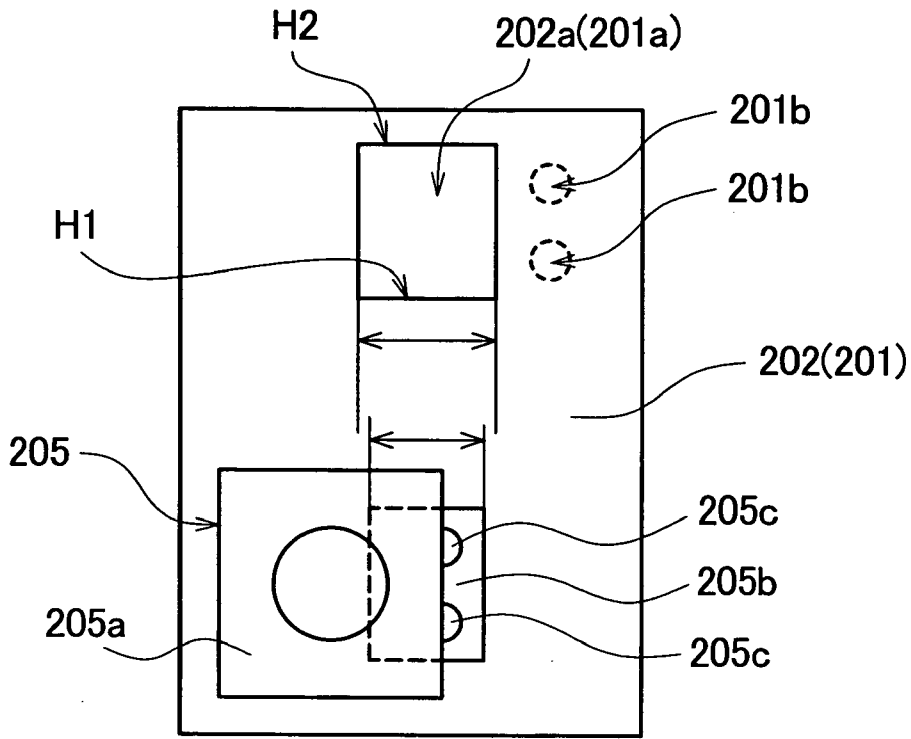


FIG. 12

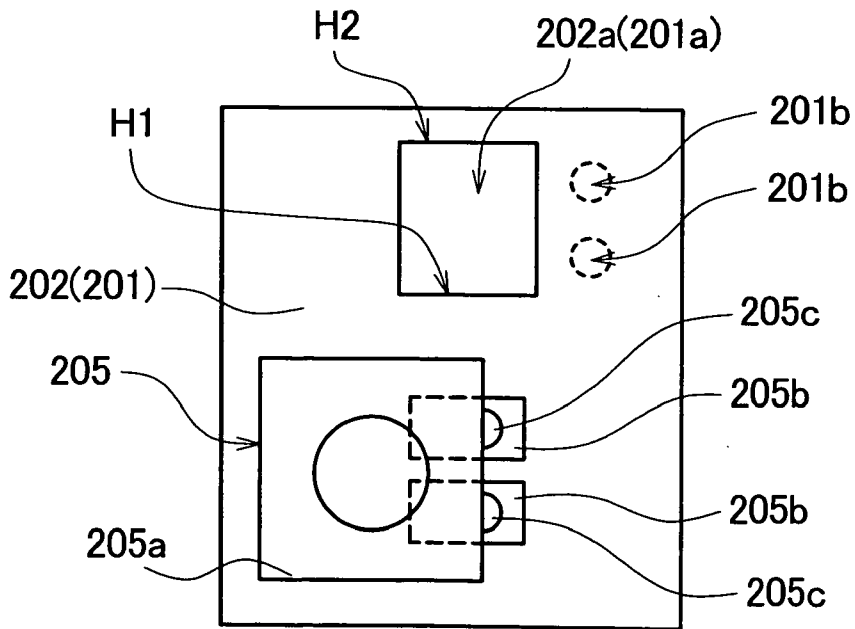


FIG. 13

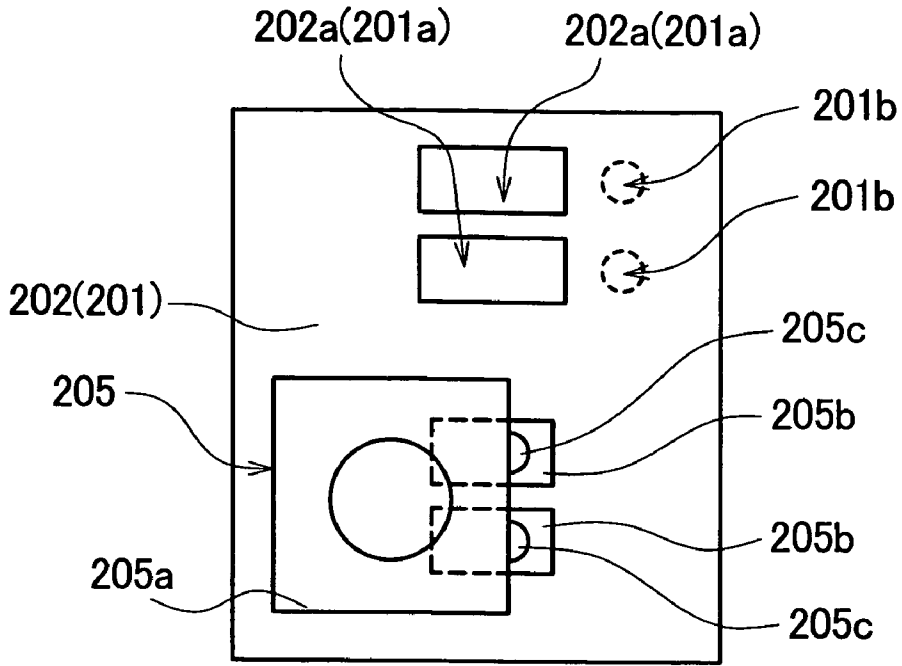


FIG. 14

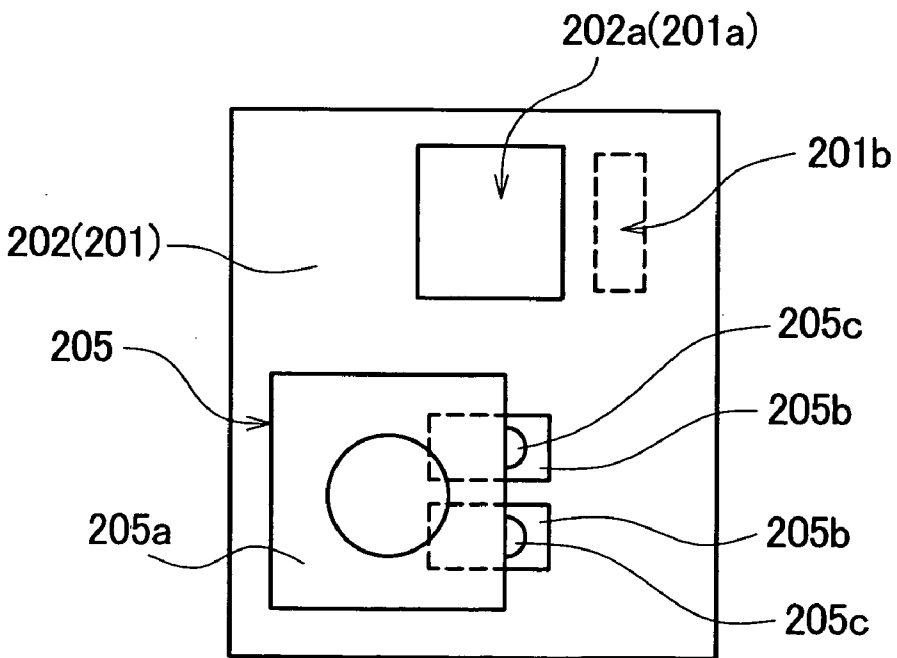


FIG. 15

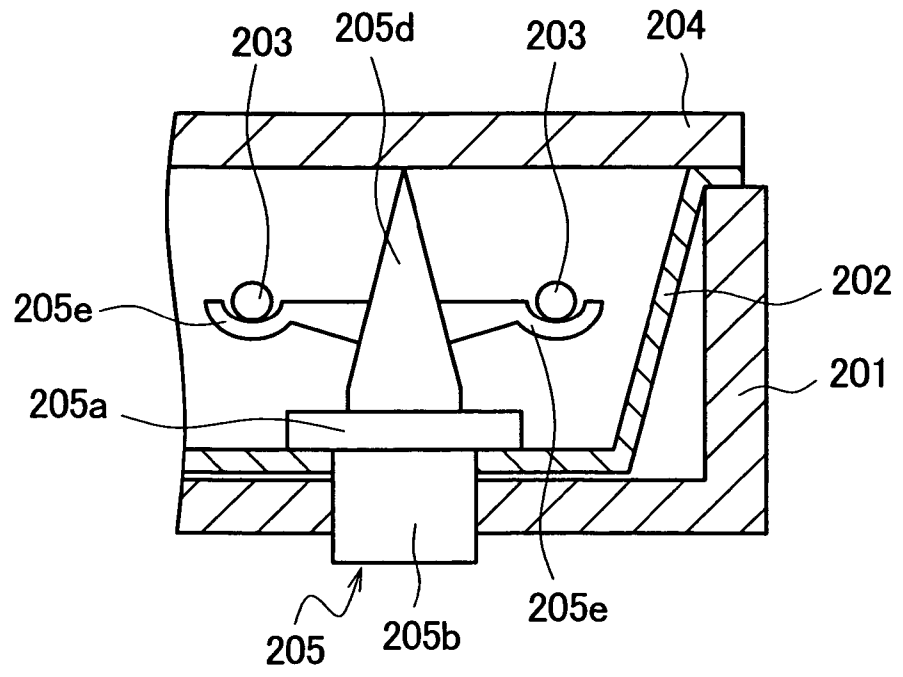


FIG. 16

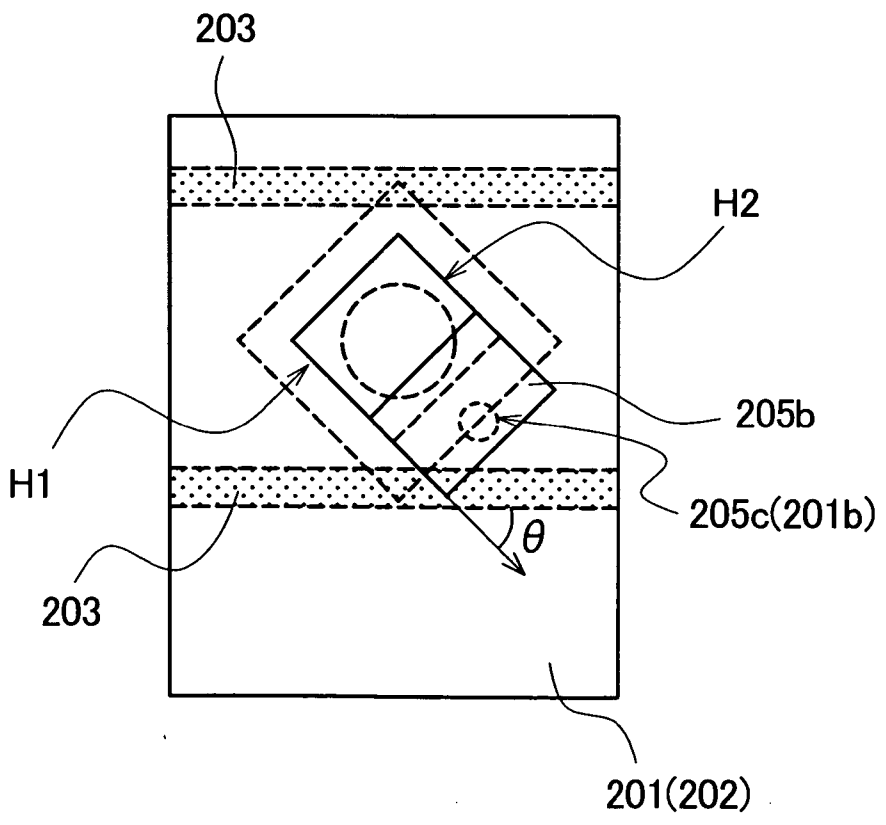
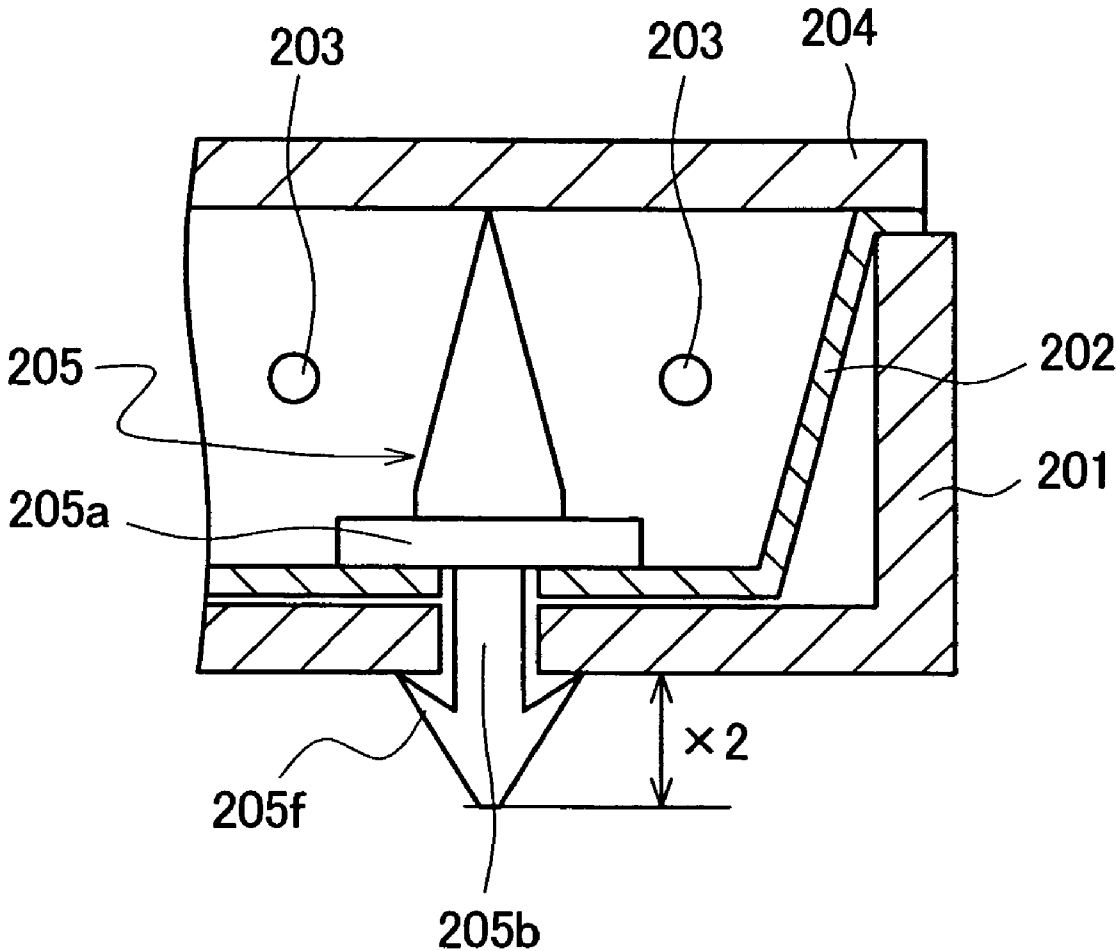


FIG. 17



DISPLAY DEVICE AND METHOD OF ASSEMBLING THE DISPLAY DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation application of U.S. application Ser. No. 11/480,519 filed on Jul. 5, 2006. Priority is claimed based on U.S. application Ser. No. 11/480,519 filed on Jul. 5, 2006, which claims priority to Japanese application 2005-199860 filed on Jul. 8, 2005, all of which is hereby incorporated by reference into this application.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a display device and a method of assembling the display device, and more particularly to technology effectively applied to a display device which includes support members that are disposed standing on a reflection plate and support an optical member disposed above the reflection plate.

[0004] 2. Description of the Related Art

[0005] Conventionally, among display devices, there is a display device where light sources (a backlight unit) are disposed under (behind) a display panel, such as in a liquid crystal display device, for example.

[0006] The backlight unit is one where, for example, light sources such as cold-cathode fluorescent tubes are disposed above (in front of) a reflection plate, and where an optical member such as a light diffusion plate or an optical sheet is disposed above the light sources. A display panel is disposed above (in front of) the optical member.

[0007] Further, at this time, support members that support the optical member are disposed standing on the bottom surface of the reflection plate (e.g., see JP-A-7-64084).

[0008] In the backlight (lighting device) disclosed in JP-A-7-64084, an auxiliary reflection portion that protrudes inward in a chevron-like shape is integrally coupled at a width-direction intermediate portion of the bottom surface of the reflection plate and between a pair of fluorescent lamps. Part of the auxiliary reflective portion is formed as a planar surface, and the support member is disposed standing on this planar surface.

[0009] However, when the chevron-shaped auxiliary reflection portion and the planar surface are disposed on the bottom surface of the reflection portion, as in the reflection portion of the backlight disclosed in JP-A-7-64084, it is conceivable for there to be the problem that it becomes easy for the reflection portion to twist and bend such that the uniformity ratio of reflection light drops.

[0010] Thus, in recent years, a method has been proposed where, as shown in FIG. 17 for example, the bottom surface of a reflection plate 202 is made planar, holes through which a leg portion 205b of a support member 205 passes are disposed in the reflection plate 202 and in a frame member 201, and a pawl 205f of the leg portion 205b of the support member 205 catches on the frame member 201.

[0011] However, in the case of the method shown in FIG. 17, there has been the problem that when the support member 205 is to be attached, it is difficult to align the hole in the reflection plate 202 and the leg portion 205b of the support member 205, and the workability has been poor.

[0012] Further, in the case of the method shown in FIG. 17, it is easy for the problem of the pawl 205f of the support

member 205 breaking and becoming extraneous, or that the support member 205 cannot be fixed, to arise.

[0013] Further, in the case of the method shown in FIG. 17, a protruding height x2 of the leg portion 205b of the support member 205 becomes large. For this reason, there is the problem that the attachment height becomes high when a circuit board including a circuit such as a timing controller is attached in the region where the leg portion 205b of the support member 205 protrudes, for example.

SUMMARY OF THE INVENTION

[0014] It is an object of the present invention to provide technology capable of improving workability when support members are to be attached to a reflection plate.

[0015] It is another object of the present invention to provide technology capable of reducing damage to the support members when the support members are to be attached to the reflection plate.

[0016] It is still another object of the present invention to provide technology capable of reducing the protruding height of leg portions of the support members when the support members are to be attached to the reflection plate.

[0017] These and other objects and novel characteristics of the present invention will become apparent from the description of this specification and the attached drawings.

[0018] The invention disclosed in this application can be described as follows.

[0019] A first aspect of the present invention provides a display device comprising: a reflection plate; plural light sources disposed above the reflection plate; an optical member disposed above the plural light sources; a support member disposed standing on a bottom surface of the reflection plate; a frame member that houses the reflection plate and the light sources; and a display panel disposed above the optical member, wherein the support member includes a standing support portion that is disposed standing on and supported by the reflection plate, an optical member support portion that supports the optical member, and a leg portion that protrudes downward of the reflection plate and the frame member and is bent in a direction along the standing support member.

[0020] In the first aspect, the reflection plate may include a hole through which the leg portion of the support member passes, and the hole in the reflection plate may include two sides parallel to the direction in which the leg portion of the support member is bent.

[0021] Further, in the first aspect, the frame member may include a second hole in the vicinity of a first hole through which the leg portion of the support member passes, and the leg portion of the support member may include a protrusion that protrudes into the second hole.

[0022] Moreover, in the first aspect, the leg portion of the support member may protrude outward of the standing support portion.

[0023] Further still, in the first aspect, the support member may include, on a side surface of the optical member support portion, a light source support portion that supports the light sources.

[0024] A second aspect of the present invention provides a method of assembling a display device where a reflection plate is disposed on a frame member, a support member is disposed standing on and supported by the reflection plate, and then a light source and an optical member are disposed above the reflection plate, the method comprising: inserting, into holes disposed in the frame member and the reflection

plate, a leg portion of the support member that protrudes downward of a standing support portion disposed standing on and supported by the reflection plate and is bent in a direction along the standing support portion; and sliding the support member in the direction in which the leg portion is bent such that the frame member and the reflection plate are fitted between and supported by the standing support portion and the leg portion.

[0025] In the second aspect, the method may further comprise disposing a second hole in the vicinity of a first hole in the frame member through which the leg portion of the support member passes, and fitting a protrusion of the leg portion of the support member into the second hole to fix the support member.

[0026] As described above, in the display device of the present invention, the leg portion of the support member is bent in the direction along the standing support portion. At this time, the support member is disposed standing on and supported by the reflection plate by the method of the second aspect, and the reflection plate and the frame member are fitted between and fixed by the standing support portion and the leg portion. For this reason, damage to the leg portion can be reduced in comparison to a support member that fixes with the pawl shown in FIG. 17. Further, the protruding height of the leg portion can also be reduced.

[0027] Further, when the hole including parallel two sides is disposed in the reflection plate, not only is the support member slid along the parallel two sides when the display device is assembled by the method of the second aspect, but the workability of the assembly is improved.

[0028] Further, when the second hole is disposed in the frame member and the display device is assembled, the support member can be easily fixed.

[0029] Further, when the leg portion of the support member protrudes outward of the standing support portion, it becomes easier to align the direction of the support member with the hole in the reflection plate when the support member is to be attached to the reflection plate, and the workability is improved.

[0030] Further, at this time, the support member may also include the light source support portion that supports the light source.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] An embodiment of the present invention will be described below based on the following figures, wherein:

[0032] FIG. 1 is a schematic diagram showing the general configuration of a display device of the embodiment according to the invention, and is a perspective view showing the schematic configuration of the display device;

[0033] FIG. 2 is a schematic diagram showing the general configuration of the display device of the embodiment according to the invention, and is a front view showing a configural example of a backlight unit;

[0034] FIG. 3 is a schematic diagram showing the general configuration of the display device of the embodiment according to the invention, and is a bottom view of a region L shown in FIG. 2;

[0035] FIG. 4 is a schematic diagram showing the general configuration of the display device of the embodiment according to the invention, and is a cross-sectional view along line A-A' shown in FIG. 3;

[0036] FIG. 5 is a schematic diagram showing the general configuration of the display device of the embodiment according to the invention, and is a cross-sectional view along line B-B' shown in FIG. 3;

[0037] FIG. 6 is a schematic diagram for describing a method of assembling the display device of the embodiment, and is a diagram describing a method of inserting a leg portion of a support member;

[0038] FIG. 7 is a schematic diagram for describing the method of assembling the display device of the embodiment, and is a side sectional view of FIG. 6;

[0039] FIG. 8 is a schematic diagram for describing the method of assembling the display device of the embodiment, and is a diagram describing a method of fixing the support member;

[0040] FIG. 9 is a schematic diagram for describing the method of assembling the display device of the embodiment, and is a side sectional view of FIG. 8;

[0041] FIG. 10 is a schematic diagram for describing a modification of the embodiment;

[0042] FIG. 11 is a schematic diagram for describing a modification of the embodiment;

[0043] FIG. 12 is a schematic diagram for describing a modification of the embodiment;

[0044] FIG. 13 is a schematic diagram for describing a modification of the embodiment;

[0045] FIG. 14 is a schematic diagram for describing a modification of the embodiment;

[0046] FIG. 15 is a schematic diagram for describing a modification of the embodiment;

[0047] FIG. 16 is a schematic diagram for describing a modification of the embodiment; and

[0048] FIG. 17 is a schematic diagram for describing a conventional method of fixing a support member.

DETAILED DESCRIPTION OF THE INVENTION

[0049] The present invention will be described in detail below together with an embodiment with reference to the drawings.

[0050] It will be noted that, in all of the drawings for describing the embodiment, the same reference numerals will be given to members having the same functions, and redundant description thereof will be omitted.

[0051] In the display device of the invention, by making a shape that the leg portion of the support member which is disposed standing on the reflection plate is bent in a direction along the standing support of the support member, the damage upon attachment is prevented and further the protruding height is reduced. Also, by sliding and fixing the support member, the workability upon attachment is improved.

[0052] FIGS. 1 to 5 are schematic diagrams showing the general configuration of a display device of an embodiment according to the present invention. FIG. 1 is a perspective view showing the general configuration of the display device, FIG. 2 is a front view showing a configural example of a backlight unit, FIG. 3 is a bottom view of a region L shown in FIG. 2, FIG. 4 is a cross-sectional view along line A-A' shown in FIG. 3, and FIG. 5 is a cross-sectional view along line B-B' shown in FIG. 3. It will be noted that FIGS. 4 and 5 are diagrams where up and down have been reversed.

[0053] In FIG. 1, 1 is a display panel, 2 is a backlight unit, 3 is a frame member (upper frame), 4 is a printed circuit board, and 5 are semiconductor packages. Further, in FIGS. 2 to 5, 201 is a frame member (lower frame), 201a are holes

through which leg portions of support members pass, **201b** are holes into which protrusions of the leg portions fit, **202** is a reflection plate, **202a** are holes through which the leg portions of the support members pass, **203** are light sources, **204** is an optical member, **205** are the support members, **205a** are standing support portions of the support members **205**, **205b** are the leg portions of the support members **205**, and **205c** are the protrusions of the leg portions **205b**.

[0054] As shown in FIG. 1, the display device of the present embodiment includes the display panel **1**, the backlight unit **2** disposed under (behind) the display panel **1**, and the frame member (upper frame) **3** that integrally supports the display panel **1** and the backlight unit **2**. Further, the printed circuit board **4** is disposed on the outer peripheral portion of the display panel **1**, and wires of the display panel **1** and wires of the printed circuit board **4** are electrically connected via the semiconductor packages **5**, which comprise a tape carrier package (TCP) on which a driver IC is mounted or a chip on film (COF), for example. Further, although it is not shown, the printed circuit board **4** is electrically connected to another circuit board including a circuit such as a timing controller, for example.

[0055] The display panel **1** is a transmissive display panel, such as a liquid crystal display panel, and presents images and video by transmitting the light from the backlight unit **2**.

[0056] Further, the backlight unit **2** is a sub-unit where the light sources are disposed behind the display panel **1**. For example, as shown in FIGS. 2 to 5, the reflection plate **202** is housed in the frame member (lower frame) **201**, and the light sources **203**, which comprise cold-cathode fluorescent tubes, for example, are plurally disposed above (in front of) the reflection plate **202**. Further, an optical member **204** such as a light diffusion plate or an optical sheet is disposed above the light sources **203**.

[0057] Further, at this time, the support members **205** that support the optical member **204** are disposed standing on the reflection plate **202**. The support members **205** are for preventing the optical member **204** from bending or warping. For example, as shown in FIG. 2, the support members **205** are disposed standing on plural places on the reflection plate **202**.

[0058] Further, in the display device of the present embodiment, the support members **205** include the leg portions **205b** that are disposed on the rear sides of the standing support portions **205a** contacting the reflection plate **202**, pass through the holes **202a** and **201a** in the reflection plate **202** and the lower frame **201**, and have shapes that are bent in the direction along the standing support portions **205a**. Additionally, the support members **205** are disposed standing on and supported by the reflection plate **202** as a result of the reflection plate **202** and the lower frame **201** being fitted between the standing support portions **205a** and the leg portions **205b**.

[0059] Further, at this time, the second holes **201b** are disposed in the lower frame **201** in the vicinity of the first holes **201a** through which the leg portions **205b** of the support members **205** pass. Additionally, the protrusions **205c** that fit into the second holes **201b** are disposed on the leg portions **205b** of the support members **205**.

[0060] FIGS. 6 to 9 are schematic diagrams for describing a method of assembling the display device of the present embodiment. FIG. 6 is a diagram describing a method of inserting the leg portions **205b** of the support members **205**, FIG. 7 is a side sectional view of FIG. 6, FIG. 8 is a diagram describing a method of fixing the support members **205**, and FIG. 9 is a side sectional view of FIG. 8.

[0061] When the display device of the present embodiment is to be assembled, first, the reflection plate **202** is disposed on the lower frame **201**, and the support members **205** are disposed standing. At this time, as shown in FIGS. 6 and 7, the holes **201a** and **202a**, which are larger than the outer shapes of the leg portions **205b** of the support members **205** and are smaller than the outer shapes of the standing support portions **205a**, are formed in the lower frame **201** and the reflection plate **202**. Further, at this time, the holes (second holes) **201b**, into which the protrusions **205c** of the leg portions **205b** fit, are formed in the lower frame **201**. Additionally, the leg portions **205b** of the support members **205** are inserted into the holes **201a** and **202a** in the lower frame **201** and the reflection plate **202**.

[0062] Further, as shown in FIG. 6, for example, the holes formed in the lower frame **201** and the reflection plate **202**—that is, the holes **201a** and **202a** into which the leg portions **205b** of the support members **205** are inserted—are rectangular holes having two sides H1 and H2 that are parallel to the direction facing the second holes **201b** in the lower frame **201**.

[0063] Further, at this time, it is preferable for the leg portions **205b** of the support members **205** to have a length that protrudes outward of the standing support portions **205a**. By configuring the leg portions **205b** in this manner, the leg portions **205b** can be easily aligned with and inserted into the holes **201a** and **202a** in the lower frame **201** and the reflection plate **202** using the protruding portions of the leg portions **205b**. Further, when the rectangular holes **201a** and **202a** are disposed in the lower frame **201** and the reflection plate **202**, the direction of the support members **205** can also be easily aligned by changing the lengths of the two sides H1 and H2 parallel to the direction facing the second holes **201b** and the lengths of the remaining two sides connected to the parallel two sides H1 and H2.

[0064] Additionally, as shown in FIGS. 8 and 9, when the leg portions **205b** of the support members **205** are inserted into the holes **201a** and **202a** in the lower frame **201** and the reflection plate **202**, the support members **205** are slid such that the lower frame **201** and the reflection plate **202** are fitted between and fixed by the standing support portions **205a** and the leg portions **205b** of the support members **205**. At this time, the support members **205** are fixed as a result of the protrusions **205c** of the leg portions **205b** being fitted into the second holes **201b** in the lower frame **201**. Further, at this time, the support members **205** are merely slid along the parallel two sides H1 and H2 of the holes **201a** and **202a** in the lower frame **201** and the reflection plate **202**, thereby they can also be easily fixed.

[0065] When the support members **205** are attached to the reflection plate **202** by the sequence shown in FIGS. 6 to 9, then the light sources **203** are disposed and the optical member **204** is disposed in the same manner as in conventional assembly methods. Then, the display panel **1** and the printed circuit board **4** are superposed and the upper frame **3** and the lower frame **201** are fixed.

[0066] Further, after the upper frame **3** and the lower frame **201** have been fixed, a circuit board including a circuit such as a timing controller is attached to the underside of the lower frame **201**, for example. In the display device of the present embodiment, a protruding height x1 of the leg portions **205b** of the support members **205** shown in FIG. 5, for example, is about 1 mm. On the other hand, the protruding height x2 of the conventional leg portions **205b** of the support members **205** shown in FIG. 17, for example, is about 5 mm. That is, in

the display device of the present embodiment, the protruding height $x1$ of the support members **205** can be reduced in comparison to what has conventionally been the case. For this reason, when the circuit board is attached to the region where the leg portions **205b** of the support members **205** protrude, the attachment height of the circuit board can be reduced and the display device can be made thinner as a result.

[0067] As described above, according to the display device of the present embodiment, the leg portions **205b** of the support members **205** are inserted into the holes **201a** and **202a** in the lower frame **201** and the reflection plate **202**, and then the support members **205** are slid, whereby the support members **205** can be easily fixed and the workability of attaching the support members **205** is improved.

[0068] Further, because the leg portions **205b** of the support members **205** protrude outward of the standing support portions **205a**, the directions and positions of the support members **205** can be easily aligned when the support members **205** are to be attached.

[0069] Further, because the protruding height $x1$ of the leg portions **205b** of the support members **205** can be reduced in comparison to what has conventionally been the case, the attachment height of the circuit board can be reduced when the circuit board is attached to the region where the leg portions **205b** of the support portions **205** protrude.

[0070] Further, in the support members **205** of the present embodiment, the pawls **205f** of the conventional support members **205** shown in FIG. 17 are unnecessary, and problems such as the leg portions **205b** of the support members **205** becoming chipped and extraneous or the fixing becoming insufficient are prevented.

[0071] FIGS. 10 to 16 are schematic diagrams for describing modifications of the preceding embodiment.

[0072] In the display device of the preceding embodiment, the holes **201a** and **202a** into which the leg portions **205b** of the support members **205** are inserted had rectangular shapes as shown in FIG. 6, for example. However, in the present invention, it suffices for the holes **201a** and **202a** into which the leg portions **205b** of the support members **205** are inserted to be holes having the two sides H1 and H2 parallel to the direction facing the second holes **201b** in the lower frame **201**. For this reason, as shown in FIG. 10, for example, one of the sides connected to the parallel two sides H1 and H2 may also be curved. In this case, by making the side closest to the second hole **201b** a straight line and making the side farthest from the second hole **201b** a curved line, the direction of the support members **205** can be easily aligned even when the second holes **201b** in the lower frame **201** are hidden by the reflection plate **202** and cannot be seen, as shown in FIG. 10, for example.

[0073] Further, in the preceding embodiment, each of the leg portions **205b** of the support members **205** included just one protrusion **205c**, and a single hole **201b** was disposed in the lower frame **201** in correspondence to each of the protrusions **205c**, but the present invention is not limited to this. For example, as shown in FIG. 11, each of the leg portions **205b** may include a pair of protrusions **205c**, and a pair of second holes **201b** may be disposed in the lower frame **201** in correspondence to each of the pairs of protrusions **205c**. Further, at this time, the leg portions **205b** of the support members **205** may be divided into two, as shown in FIG. 12. Further, when the leg portions **205b** of the support members **205** are divided into two, the holes **201a** and **202a** in the lower frame **201** and the reflection plate **202** may also be divided into two, as

shown in FIG. 13, for example. Further, although FIGS. 11 to 13 illustrate examples where there are pairs of the protrusions **205c** of the leg portions **205b** of the support members **205** and of the second holes **201b**, the present invention is not limited to this. There may also be three or more of each of the protrusions **205c** and the second holes **201b**.

[0074] Further, when two protrusions **205c** are disposed on each of the leg portions **205b** of the support members **205**, each of the second holes **201b** in the lower frame **201** may also comprise a single large hole **201b** that can house the two protrusions **205b**, as shown in FIG. 14, for example.

[0075] Further, although it is not shown, the protrusions **205c** of the leg portions **205b** of the support members **205** are not limited to the hemispherical shape shown in FIG. 6 but may also be rectangular parallelepiped protrusions, for example.

[0076] Further, the support members **205** are not limited to simply supporting the optical member **204**, for example, but may also be supports that also support the light sources **203**. In this case, as shown in FIG. 15, for example, light source support portions **205e** that support the light sources **203** may be disposed on the side surfaces of optical member support portions **205d** on the standing support portions **205a** of the support members **205**.

[0077] Further, in the preceding embodiment, the holes **201a** and **202a** in the lower frame **201** and the reflection plate **202** were formed such that the parallel two sides H1 and H2—or in other words, the sliding direction of the support members **205**—were parallel to the extension direction of the light sources **203**. However, the holes **201a** and **202a** are not limited to this. For example, as shown in FIG. 16, the holes **201a** and **202a** may also be holes where the sliding direction of the support members **205** is slanted θ degrees with respect to the extension direction of the light sources **203**.

[0078] The present invention has been specifically described on the basis of the preceding embodiment, but the present invention is not limited to the preceding embodiment and can be variously altered in a range that does not depart from the spirit thereof.

What is claimed is:

1. A display device comprising:
 - a display panel;
 - a backlight unit; the backlight unit including;
 - a frame member,
 - a reflection plate disposed in the frame member,
 - a plurality of light sources disposed between the reflection plate and the display panel,
 - an optical member disposed between the light sources and the display panel,
 - a support member disposed on the reflection plate, wherein the support member includes;
 - a standing support portion that is arranged in parallel to the reflection plate,
 - an optical member support portion that supports the optical member and is arranged in the perpendicular direction to the reflection plate,
 - a leg portion that penetrated the reflection plate and the frame member, and has bend portion which is bent in the direction parallel to the standing support portion,
 - a light source support portion which supports the light source is formed in the optical member support portion.

2. The display device of claim 1, wherein the reflection plate has a through hole for the leg portion to penetrate, and the through hole in the reflection plate has a first side in parallel to the direction in which the leg portion of the support member is bent and a second curved side.

3. The display device of claim 1, wherein the frame member has a first hole for the leg portion to penetrate and a second hole formed in the adjoining position to the first hole, and the leg portion has a protrusion that protrudes into the second hole.

4. The display device of claim 3, wherein two of protrusions are formed in one of the support member, two of the second hole are formed one of the support member.

5. The display device of claim 4, wherein the leg portion has a first leg portion and a second leg portion.

6. The display device of claim 3, wherein two of protrusions are formed in one of the support member, one of the second hole is formed one of the support member, and two protrusions are inserted in the one of second hole.

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