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# DISPLAY APPARATUS


## Abstract

A display apparatus includes a reflective sheet, a light source substrate on the reflective sheet and including a first light source substrate and a second light source substrate, and a plurality of light sources including a plurality of first light sources on the first light source substrate and a plurality of second light sources on the second light source substrate. A first distance between a first light source of the plurality of first light sources and a second light source of the plurality of second light sources is greater than or equal to two times a second distance and less than or equal to four times the second distance. The second distance is a distance between adjacent first light sources of the plurality of first light sources.



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## Background/Summary

CROSS REFERENCE TO RELATED APPLICATION(S) [0001] This application is a continuation of International Application No. PCT/KR2024/020940, filed on Dec. 23, 2024, in the Korean Intellectual Property Receiving Office, which is based on and claims priority to Korean Patent Application No. 10-2024-0020687, filed on Feb. 13, 2024, and Korean Patent Application No. 10-2024-0047669, filed on Apr. 8, 2024 in the Korean Intellectual Property Office, the disclosures of which are incorporated by reference herein in their entireties.

BACKGROUND
1. Field
[0002] The present disclosure relates to a display apparatus including a reflective sheet.
2. Description of Related Art
[0003] A display apparatus is a type of output device that converts acquired or stored electrical information into visual information and displays the converted visual information to a user, and is used in various fields such as homes and businesses.
[0004] Display apparatuses include monitor devices connected to personal computers or server computers, portable computer devices, navigation terminal devices, general television devices, Internet Protocol television (IPTV) devices, portable terminal devices such as smart phones, tablet PCs, personal digital assistants (PDAs), and cellular phones, various display apparatuses used in industrial settings to play back images such as advertisements and movies, or various types of audio/video systems.
[0005] A display apparatus includes a light source module to convert electrical information into visual information, and the light source module includes a plurality of light sources to independently emit light.
[0006] Each of the plurality of light sources includes, for example, a light emitting diode (LED) or an organic light emitting diode (OLED). For example, the light emitting diode or the organic light emitting diode may be mounted on a circuit board or substrate.
SUMMARY
[0007] Provided is a display apparatus which may have improved ease of assembly.
[0008] Further, provided is a display apparatus which may have improved brightness.
[0009] Further, provided is a display apparatus which may have reduced material costs.
[0010] Technical tasks to be achieved in this document are not limited to the technical tasks mentioned above, and other technical tasks not mentioned will be clearly understood by those skilled in the art from the description below.
[0011] A display apparatus according to an aspect of the present disclosure includes a reflective sheet, a light source substrate on the reflective sheet and including a first light source substrate and a second light source substrate, and a plurality of light sources including a plurality of first light sources on the first light source substrate and a plurality of second light sources on the second light source substrate. A first distance between a first light source of the plurality of first light sources

and a second light source of the plurality of second light sources is greater than or equal to two times a second distance and less than or equal to four times the second distance. The second distance is a distance between adjacent first light sources of the plurality of first light sources.
[0012] A display apparatus according to an aspect of the present disclosure includes a bottom chassis, a reflective sheet disposed in front of the bottom chassis, a first light source substrate disposed in front of the reflective sheet, a second light source substrate disposed in front of the reflective sheet and arranged in an up-down direction with the first light source substrate, a plurality of first light sources mounted on the first light source substrate, and a plurality of second light sources mounted on the second light source substrate. A closest first distance among distances between one of the plurality of first light sources and one of the plurality of second light sources is set to be two times to four times a second distance between the plurality of first light sources.

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## Description

BRIEF DESCRIPTION OF DRAWINGS
[0013] FIG. **1** illustrates a display apparatus according to an embodiment of the present disclosure.
[0014] FIG. **2** is an exploded view of the display apparatus according to an embodiment of the present disclosure.
[0015] FIG. **3** is an enlarged cross-sectional view illustrating a configuration of a portion of a display module of the display apparatus according to an embodiment of the present disclosure.
[0016] FIG. **4** illustrates the inside of the display apparatus according to an embodiment of the present disclosure.
[0017] FIG. **5** is an exploded view illustrating a configuration of a part of the display apparatus according to an embodiment of the present disclosure.
[0018] FIG. **6** is a front view of the part of the display apparatus according to an embodiment of the present disclosure.
[0019] FIG. **7** is an enlarged view of a portion A shown in FIG. **6** according to an embodiment of the present disclosure.
[0020] FIG. **8** illustrates a state in which a third light source substrate in FIG. **7** is separated from a connector according to an embodiment of the present disclosure.
[0021] FIG. **9** schematically illustrates an optical profile of one light source among a plurality of light sources of a light source module of the display apparatus according to an embodiment of the present disclosure.
[0022] FIG. **10** is an enlarged view of a portion B shown in FIG. **6** according to an embodiment of the present disclosure.
DETAILED DESCRIPTION
[0023] The embodiments described in the present disclosure and the configurations shown in the drawings are only examples of preferred embodiments of the present disclosure, and various modifications may be made at the time of filing of the present disclosure to replace the embodiments and drawings of the present specification.
[0024] Like reference numbers or signs in the various drawings of the present disclosure represent parts or components that perform substantially the same functions.
[0025] The singular form of a noun corresponding to an item may include one item or a plurality of items, unless the relevant context clearly dictates otherwise.
[0026] In this document, each of phrases such as “A or B,” “at least one of A and B,” “at least one of A or B,” “A, B or C,” “at least one of A, B and C,” and “at least one of A, B, or C” may include any one of the items listed together in the corresponding one of the phrases, or all possible combinations thereof.
[0027] The terms “unit,” “module,” and “member” may be implemented as hardware or software.

Depending on embodiments, a plurality of “units,” “modules,” and “members” may be implemented as one component, or one “unit,” “module,” and “member” may include a plurality of components.

[0028] The terms used in this specification are for the purpose of describing the embodiments and are not intended to restrict and/or to limit the present disclosure. For example, the singular expressions herein may include plural expressions, unless the context clearly dictates otherwise. Also, the terms “comprises” and “has” in this specification are intended to indicate that there are features, numbers, steps, operations, components, parts, or combinations thereof described in the specification, and do not exclude the presence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

[0029] It will be understood that, although terms including ordinal numbers, such as “first,” “second,” etc., used in this specification may be used to describe various components, these components should not be limited by these terms, and the terms are only used to distinguish one from another component. For example, without departing from the scope of the present disclosure, a first component may be referred to as a second component, and similarly, the second component may also be referred to as a first component. The term “and/or” includes any combination of a plurality of related items or any one of a plurality of related items.

[0030] When any (e.g., a first) component is referred to as being “coupled” or “connected” to another (e.g., a second) component with or without the terms “functionally” or “communicatively”, this means that the any component may be connected to the other component directly (e.g., by a wire), wirelessly, or through a third component.

[0031] When any component is referred to as being “connected,” “coupled,” “supported” or “in contact” with another component, this includes a case in which the components are indirectly connected, coupled, supported, or in contact with each other through a third component as well as directly connected, coupled, supported, or in contact with each other.

[0032] When any component is referred to as being located “on” or “over” another component, this includes not only a case in which any component is in contact with another component but also a case in which another component is present between the two components.

[0033] The terms “up-down direction,” “front-rear direction,” etc., used in the description below are defined based on the drawing, and the shape and position of each component are not limited by these terms. For example, the terms “front” and “rear” below may each be defined based on an X direction shown in the drawings. The terms “front” and “rear” below may each be defined based on a Z direction shown in the drawings. The terms “left direction” and “right direction” below may each be defined based on a Y direction shown in the drawings. The term “vertical direction” below may refer to a Z direction shown in the drawings, and the term “horizontal direction” below may refer to a Y direction shown in the drawings.

[0034] Hereinafter, embodiments according to the present disclosure will be described in detail with reference to the accompanying drawings.

[0035] FIG. **1** illustrates a display apparatus according to an embodiment of the present disclosure.

[0036] Referring to FIG. **1**, a display apparatus **1** according to an embodiment of the present disclosure is a device capable of processing an image signal received from the outside and visually displaying the processed image. FIG. **1** illustrates a case in which the display apparatus **1** is a television (TV), but is not limited thereto. For example, the display apparatus **1** may be implemented in various forms such as a monitor, which is a type of computer output device, a portable multimedia device, a portable communication device, etc., and the form of the display apparatus **1** is not limited as long as the display apparatus is a device that visually displays an image.

[0037] In addition, the display apparatus **1** may be a large display apparatus (large format display, LFD) installed outdoors, such as on a building rooftop and at a bus stop. Herein, the outdoors is not necessarily limited to outdoors, and the display apparatus **1** according to an embodiment of the

present disclosure may be installed in any indoor location where many people may come and go, such as a subway station, a shopping mall, a movie theater, a company, and a store.

[0038] FIG. **1** illustrates an example in which the display apparatus **1** is a flat display apparatus having a flat screen, but is not limited thereto, and the display apparatus according to the present disclosure may be applied to a curved display apparatus or a bendable or flexible display apparatus capable of being changed between a flat state and a curved state. In addition, the configuration according to the present disclosure may be applied to display apparatuses of various shapes regardless of a screen size or ratio of the display apparatus.

[0039] The display apparatus **1** may receive content including video signals and audio signals from various content sources, and output video and audio corresponding to the video signals and audio signals. For example, the display apparatus **1** may receive content data via a broadcast receiving antenna or a wired cable, receive content data from a content playback device, or receive content data from a content provision server of a content provider.

[0040] The display apparatus **1** may display images corresponding to video data and output sounds corresponding to audio data. For example, the display apparatus **1** may restore a plurality of image frames included in the video data and continuously display the plurality of image frames. In addition, the display apparatus **1** may restore audio signals included in the audio data and continuously output sounds according to the audio signals.

[0041] As illustrated in FIG. **1**, the display apparatus **1** may include a main body **11** and a screen **12** displaying an image I.

[0042] The display apparatus **1** may be installed in a standing manner on an indoor or outdoor floor or furniture, or in a wall-mounted manner on a wall or inside a wall. As an example, the display apparatus **1** may include support legs **19** provided at a lower portion of the main body **11** so that the display apparatus may be installed in a standing manner on an indoor or outdoor floor or furniture.

[0043] The main body **11** may form an outer shape of the display apparatus **1**. Inside the main body **11**, components for performing various functions, such as the display apparatus **1** displaying the image I, may be provided.

[0044] The display apparatus **1** may be configured to display the image I. For example, the screen **12** may be formed in a front surface of the main body **11**, and the display apparatus **1** may display the image I through the screen **12**. For example, the screen **12** may display a still image or a moving image. In addition, the screen **12** may display a two-dimensional flat image or a three-dimensional stereoscopic image using a parallax between two eyes of the user.

[0045] A plurality of pixels P may be formed on the screen **12**. The image I displayed on the screen **12** may be formed by light emitted by each of the plurality of pixels P. For example, the image I on the screen **12** may be formed by combining light emitted from the plurality of pixels P like a mosaic.

[0046] The plurality of pixels P may each emit light of various brightness and various colors. For example, each of the plurality of pixels P may include sub-pixels PR, PG, and PB, and the sub-pixels PR, PG, and PB may include the red sub-pixel PR capable of emitting red light, the green sub-pixel PG capable of emitting green light, and the blue sub-pixel PB capable of emitting blue light. For example, red light may represent light with a wavelength from about 620 nm (nanometer, one billionth of a meter) to 750 nm, green light may represent light with a wavelength from about 495 nm to 570 nm, and blue light may represent light with a wavelength from about 450 nm to 495 nm.

[0047] By combining the light emitted from the red sub-pixel PR, the green sub-pixel PG, and the blue sub-pixel PB, the plurality of pixels P may each emit light of various brightness and various colors.

[0048] FIG. **2** is an exploded view of the display apparatus according to an embodiment of the present disclosure.

[0049] Referring to FIG. **2**, various components for generating the image I on the screen **12** may be

provided inside the main body **11** of the display apparatus **1** according to an embodiment of the present disclosure.

[0050] For example, the display apparatus **1** may include a display panel **20**. The display panel **20** may be provided in the main body **11**. The display panel **20** may be configured to display the image I. The screen **12** illustrated in FIG. **1** may be formed on a front surface of the display panel **20**.

[0051] As an example, the display panel **20** may have a substantially rectangular shape. For instance, the display panel **20** may have a shape in which a length of a horizontal side and a length of a vertical side are different from each other. That is, the display panel **20** may be configured to have a long side and a short side. The display panel **20** may be provided in a rectangular plate shape. However, the present disclosure is not limited thereto, and the display panel **20** may be provided in a square plate shape with the long side and the short side having almost the same length.

[0052] The display panel **20** may be provided in various sizes. A ratio between the long side and the short side of the display panel **20** is not limited to general cases such as 16:9 and 4:3, but may be provided as an arbitrary ratio.

[0053] In the display apparatus **1** according to an embodiment of the present disclosure, the display panel **20** may be configured as a panel of a light-receiving/emitting display type, such as a liquid crystal display (LCD).

[0054] A cable **20***a* to transmit image data to the display panel **20**, and a display driver integrated circuit (DDI) **30** (hereinafter referred to as a 'driver IC') to process digital image data to output analog image signals may be provided on one side of the display panel **20**.

[0055] The cable **20***a* may electrically connect between a control assembly **50**/power assembly **60** and the driver IC **30**, and also electrically connect between the driver IC **30** and the display panel **20**. The cable **20***a* may include a flexible flat cable capable of being bent, a film cable, or the like.

[0056] The driver IC **30** may receive image data and power from the control assembly **50**/power assembly **60** via the cable **20***a*, and transmit image data and driving current to the display panel **20** via the cable **20***a*.

[0057] The cable **20***a* and the driver IC **30** may be implemented as a single package, such as a film cable, a chip on film (COF), and a tape carrier packet (TCP). In other words, the driver IC **30** may be disposed on the cable **20***a*. However, the present disclosure is not limited thereto, and the driver IC **30** may be disposed on the display panel **20**.

[0058] A detailed description of a structure of the display panel **20** will be described later.

[0059] The display apparatus **1** may include a backlight unit **100** configured to irradiate light toward the display panel **20**. The backlight unit **100** may be provided in the main body **11**. The backlight unit **100** may be disposed at the rear of the display panel **20** to radiate light toward the front where the display panel **20** is located. In detail, the backlight unit **100** may be configured as a surface light source. The display panel **20** may block or pass light emitted from the backlight unit **100**.

[0060] The backlight unit **100** may include a point light source emitting monochromatic light or white light, and may be configured to refract, reflect, and scatter light in order to convert light emitted from the point light source into uniform surface light. The backlight unit **100** may emit uniform surface light toward the front by refracting, reflecting, and scattering light emitted from the point light source.

[0061] As illustrated in FIG. **2**, the backlight unit **100** may include a light source module **110**. The light source module **110** may generate and emit light. For example, the light source module **110** may be configured to emit monochromatic light or white light.

[0062] The light source module **110** may include a plurality of light sources **116**, **117**, and **118** configured to irradiate light and light source substrates **111**, **112**, and **113** on which the plurality of light sources **116**, **117**, and **118** is mounted (see FIG. **4**, etc.).

[0063] A detailed description of the light source module **110** will be provided later.

[0064] As illustrated in FIG. **2**, the backlight unit **100** may include a reflective sheet **120** configured to reflect light. The reflective sheet **120** may reflect light forward or in a direction close to the front.
[0065] For example, the light source module **110** (e.g., the light sources **116**, **117**, and **118** of the light source module **110**, see FIG. **4**) may emit light in various directions in front of the reflective sheet **120**. The light emitted from the light source module **110** may be emitted not only toward a diffuser plate **130**, which will be described later, but also toward the reflective sheet **120** from the light source module **110**, and the reflective sheet **120** may reflect the light emitted toward the reflective sheet **120** toward the diffuser plate **130**.
[0066] According to an embodiment, while the light emitted from the light source module **110** passes through various objects such as the diffuser plate **130** and an optical sheet **140**, a portion of the light may be reflected from surfaces such as the diffuser plate **130** and the optical sheet **140**, and the reflective sheet **120** may reflect this light back forward.
[0067] As illustrated in FIG. **2**, the backlight unit **100** may include the diffuser plate **130** configured to uniformly diffuse light. The diffuser plate **130** may be provided in front of the light source module **110** and the reflective sheet **120**. The diffuser plate **130** may evenly disperse the light emitted from the light source module **110** and then emit the evenly dispersed light forward.
[0068] As illustrated in FIG. **2**, the backlight unit **100** may include the optical sheet **140** configured to further improve the brightness and uniformity of brightness of emitted light. The optical sheet **140** may be configured to refract and scatter light emitted from a front surface of the diffuser plate **130**. For example, the optical sheet **140** may include various types of sheets, such as a diffusion sheet, a prism sheet, a reflective polarizing sheet, and a quantum dot sheet.
[0069] The diffuser plate **130** and the optical sheet **140** may be referred to as optical members **130** and **140**.
[0070] The display apparatus **1** may include the control assembly **50** configured to control operations of the backlight unit **100** and the display panel **20**, and the power assembly **60** configured to supply power to the backlight unit **100** and the display panel **20**. The control assembly **50** and the power assembly **60** may be provided in the main body **11**.
[0071] As an example, the control assembly **50** may include a control circuit configured to control the operations of the display panel **20** and the backlight unit **100**. The control circuit may process image data received from an external content source, transmit the image data to the display panel **20**, and transmit dimming data to the backlight unit **100**.
[0072] As an example, the power assembly **60** may supply power to the display panel **20** and the backlight unit **100** such that the backlight unit **100** outputs surface light and the display panel **20** blocks or passes light from the backlight unit **100**.
[0073] The control assembly **50** and the power assembly **60** may be implemented with a printed circuit board and various circuits mounted on the printed circuit board. For example, a power circuit may include capacitors, coils, resistors, processors, etc., and a power circuit board on which these are mounted. Additionally, the control circuit may include memory, a processor, and a control circuit board on which these are mounted.
[0074] The display apparatus **1** may include a display case configured to support various components of the main body **11** of the display apparatus **1**. In other words, various components of the main body **11** may be accommodated inside the display case. The display case may form the outer shape of the display apparatus **1**.
[0075] As an example, the display case may support the display panel **20**. As an example, the display case may support the backlight unit **100**. As an example, the display case may support the control assembly **50**. As an example, the display case may support the power assembly **60**.
[0076] As an example, the display apparatus **1** may include a top chassis **13**. The top chassis **13** may be configured to support the front surface or side surfaces of the display panel **20**. As an example, the top chassis **13** may be provided in the shape of a substantially square frame.
[0077] The top chassis **13** may support the front surface of the display panel **20** by forming a bezel

disposed to face the front of the display apparatus **1**. However, in a case in which the display apparatus **1** is a bezel-less type display apparatus with a very narrow or no bezel, the top chassis **13** may be configured to support only the side surface of the display panel **20**. In some examples, in a case in which a bottom chassis **15** supports the side surface of the display panel **20**, the display apparatus **1** may not include the top chassis **13**.

[0078] As an example, the display apparatus **1** may include the bottom chassis **15**. The bottom chassis **15** may cover the rear of the display panel **20**. The bottom chassis **15** may be coupled to the rear of the top chassis **13**. The bottom chassis **15** may support various components of the display apparatus **1**, such as the backlight unit **100**, the control assembly **50**, and the power assembly **60**.

[0079] The bottom chassis **15** may be formed to have the shape of a substantially flat plate, but is not limited thereto. The bottom chassis **15** may be composed of a material with high thermal conductivity to dissipate heat generated from a light source **1100** to the outside. As an example, the bottom chassis **15** may be composed of a metal material such as aluminum or SUS, or a plastic material such as ABS.

[0080] As an example, the display apparatus **1** may include a middle mold **14**. The middle mold **14** may be disposed between the top chassis **13** and the bottom chassis **15**. For example, the middle mold **14** may support at least some components of the backlight unit **100**.

[0081] As an example, the display apparatus **1** may include a rear cover **16**. The rear cover **16** may be disposed at the rear of the bottom chassis **15** and may cover the bottom chassis **15** and various components mounted on the rear of the bottom chassis **15** (for example, the control assembly **50**, the power assembly **60**, etc.).

[0082] In some examples, the display case of the display apparatus **1** according to the present disclosure may not include some of the top chassis, the middle mold, the bottom chassis, and the rear cover.

[0083] The configuration of the display apparatus **1** described above with reference to FIG. **2** is only an example for explaining the display apparatus according to the present disclosure, and the present disclosure is not limited thereto. The display apparatus according to the present disclosure may be configured to include various configurations for performing a function of providing images through a screen.

[0084] FIG. **3** is an enlarged view of a portion of a cross-section of the display panel of the display apparatus according to an embodiment of the present disclosure.

[0085] Referring to FIG. **3**, the display panel **20** included in the display apparatus **1** according to an embodiment of the present disclosure may be configured as a liquid crystal display (LCD) panel to block or pass light emitted from the backlight unit **100**. The image I may be formed in front of the display panel **20** by the operation of the display panel **20** blocking or passing light emitted from the backlight unit **100**.

[0086] The front surface of the display panel **20** may form the screen **12** of the display apparatus **1** described above. The plurality of pixels P may be provided on the display panel **20**. The plurality of pixels P provided on the display panel **20** may each independently block or pass light from the backlight unit **100**, and the light passed by the plurality of pixels P may form the image I displayed on the screen **12**.

[0087] For example, as illustrated in FIG. **3**, the display panel **20** may include a first polarizing film **21**, a first transparent substrate **22**, a pixel electrode **23**, a thin film transistor **24**, a liquid crystal layer **25**, a common electrode **26**, a color filter **27**, a second transparent substrate **28**, and a second polarizing film **29**.

[0088] The first transparent substrate **22** and the second transparent substrate **28** may fix and support the pixel electrode **23**, the thin film transistor **24**, the liquid crystal layer **25**, the common electrode **26**, and the color filter **27**. These first and second transparent substrates **22** and **28** may be composed of reinforced glass or transparent resin.

[0089] The first polarizing film **21** and the second polarizing film **29** may be provided on outer

sides of the first and second transparent substrates **22** and **28**.

[0090] The first polarizing film **21** and the second polarizing film **29** may each pass specific light and block other light. For example, the first polarizing film **21** may pass light having a magnetic field oscillating in a first direction and block other light. Also, the second polarizing film **29** may pass light having a magnetic field oscillating in a second direction and block other light. In this case, the first direction and the second direction may be orthogonal to each other. Accordingly, a polarization direction of the light passed through the first polarizing film **21** and an oscillation direction of the light passed through the second polarizing film **29** may be orthogonal to each other. As a result, generally, light may not pass through the first polarizing film **21** and the second polarizing film **29** simultaneously.

[0091] The color filter **27** may be provided on an inner side of the second transparent substrate **28**.

[0092] The color filter **27** may include, for example, a red filter **27**R to pass red light, a green filter **27**G to pass green light, and a blue filter **27**B to pass blue light, and the red filter **27**R, the green filter **27**G, and the blue filter **27**B may be arranged side by side with each other. A region in which the color filter **27** is formed may correspond to the pixel P described above. A region in which the red filter **27**R is formed may correspond to the red subpixel PR, a region in which the green filter **27**G is formed may correspond to the green subpixel PG, and a region in which the blue filter **27**B is formed may correspond to the blue subpixel PB.

[0093] The pixel electrode **23** may be provided on an inner side of the first transparent substrate **22**, and the common electrode **26** may be provided on the inner side of the second transparent substrate **28**.

[0094] The pixel electrode **23** and the common electrode **26** may be composed of a metal material conducting electricity, and may generate an electric field for changing the arrangement of a liquid crystal molecules **25***a* constituting the liquid crystal layer **25**, which will be described later.

[0095] The pixel electrode **23** and the common electrode **26** may be composed of a transparent material and may pass light incident from the outside. For example, the pixel electrode **23** and the common electrode **26** may be composed of indium tin oxide (ITO), indium zinc oxide (IZO), silver nanowire, carbon nanotube (CNT), graphene, or 3,4-ethylenedioxythiophene (PEDOT). The thin film transistor (TFT) **24** may be provided on the inner side of the first transparent substrate **22**.

[0096] The thin film transistor **24** may pass or block the current flowing to the pixel electrode **23**. For example, an electric field may be generated or removed between the pixel electrode **23** and the common electrode **26** depending on whether the thin film transistor **24** is turned on (closed) or turned off (opened).

[0097] The thin film transistor **24** may be composed of poly-silicon, and may be formed through a semiconductor process such as lithography, deposition, or ion implantation process.

[0098] The liquid crystal layer **25** may be formed between the pixel electrode **23** and the common electrode **26**. The liquid crystal layer **25** may be filled by the liquid crystal molecules **25***a*.

[0099] Liquid crystals represent an intermediate state between a solid (crystal) and a liquid. Most of liquid crystal materials are organic compounds, a molecular shape thereof is in the shape of a long and thin rod, and the arrangement of molecules thereof may appear irregular in some directions, but may take the form of regular crystals in other directions. As a result, liquid crystals may have both the fluidity of a liquid and the optical anisotropy of a crystal (solid).

[0100] Also, liquid crystals may exhibit optical properties depending on changes in the electric field. For example, liquid crystals may change a direction of the molecular arrangement making up the liquid crystals depending on change in the electric field. When an electric field is generated in the liquid crystal layer **25**, the liquid crystal molecules **25***a* of the liquid crystal layer **25** may be arranged according to the direction of the electric field, and when an electric field is not generated in the liquid crystal layer **25**, the liquid crystal molecules **25***a* may be arranged irregularly or arranged along an alignment layer. As a result, the optical properties of the liquid crystal layer **25** may vary depending on the presence or absence of an electric field passing through the liquid

crystal layer **25**.
[0101] The structure of the display panel **20** described above with reference to FIG. **3** is only an example of a structure that a display panel of a display apparatus according to the present disclosure may have, and the present disclosure is not limited thereto.
[0102] FIG. **4** illustrates the inside of the display apparatus according to an embodiment of the present disclosure. FIG. **5** is an exploded view illustrating a configuration of a part of the display apparatus according to an embodiment of the present disclosure. FIG. **6** is a front view of the part of the display apparatus according to an embodiment of the present disclosure. FIG. **7** is an enlarged view of a portion A shown in FIG. **6**. FIG. **8** illustrates a state in which a third light source substrate in FIG. **7** is separated from a connector.
[0103] Referring to FIGS. **4** and **5**, the display apparatus **1** according to an embodiment of the present disclosure may include the reflective sheet **120** and the light source module **110** disposed on the reflective sheet **120**. As an example, the light source module **110** may be positioned in front of the reflective sheet **120**.
[0104] The display apparatus **1** according to an embodiment of the present disclosure may be configured such that the reflective sheet **120** is disposed in front of the bottom chassis **15** and the light source module **110** is disposed in front of the reflective sheet **120**.
[0105] The light source module **110** of the display apparatus **1** according to an embodiment of the present disclosure may include the light source substrates **111**, **112**, and **113** arranged in front of the reflective sheet **120**. The light source substrates **111**, **112**, and **113** of the light source module **110** may be positioned in front of the reflective sheet **120**.
[0106] As an example, the light source module **110** may include the first light source substrate **111** and the second light source substrate **112** positioned below the first light source substrate **111**. The second light source substrate **112** may be arranged parallel to the first light source substrate **111**. The first light source substrate **111** and the second light source substrate **112** may be arranged in an up-down direction. The second light source substrate **112** may be disposed to be spaced apart from the first light source substrate **111**.
[0107] As an example, the light source module **110** may include the third light source substrate **113** connected to the first light source substrate **111**. The third light source substrate **113** may be electrically connected to the first light source substrate **111**. The first light source substrate **111** and the third light source substrate **113** may be arranged in a left-right direction.
[0108] The display apparatus **1** according to an embodiment of the present disclosure may further include additional light source substrates, without being limited to the first light source substrate **111**, the second light source substrate **112**, and the third light source substrate **113**.
[0109] The light source module **110** of the display apparatus **1** according to an embodiment of the present disclosure may include a plurality of the first light sources **116** mounted on the first light source substrate **111**. As an example, the first light source substrate **111** may have a bar shape extending in the left-right direction, and the plurality of first light sources **116** may be arranged in the left-right direction on the first light source substrate **111**. The plurality of first light sources **116** may be spaced apart from each other on the first light source substrate **111**.
[0110] The light source module **110** of the display apparatus **1** according to an embodiment of the present disclosure may include a plurality of the second light sources **117** mounted on the second light source substrate **112**. As an example, the second light source substrate **112** may have a bar shape extending in the left-right direction, and the plurality of second light sources **117** may be arranged in the left-right direction on the second light source substrate **112**. The plurality of second light sources **117** may be spaced apart from each other on the second light source substrate **112**.
[0111] The light source module **110** of the display apparatus **1** according to an embodiment of the present disclosure may include a plurality of the third light sources **118** mounted on the third light source substrate **113**. As an example, the third light source substrate **113** may have a bar shape extending in the left-right direction, and the plurality of third light sources **118** may be arranged in

the left-right direction on the third light source substrate **113**. The plurality of third light sources **118** may be spaced apart from each other on the third light source substrate **113**.

[0112] The display apparatus **1** according to an embodiment of the present disclosure may further include additional light sources, without being limited to the plurality of first light sources **116**, the plurality of second light sources **117**, and the plurality of third light sources **118**.

[0113] The reflective sheet **120** of the display apparatus **1** according to an embodiment of the present disclosure may be positioned at the rear of the light source module **110**. The reflective sheet **120** may include a seating portion **121** on which the light source module **110** is seated, and an edge portion **122** provided along an edge of the seating portion **121**.

[0114] The edge portion **122** may be formed to be inclined with respect to the seating portion **121**. For example, the edge portion **122** may be inclined with respect to the seating portion **121** so that the reflective sheet **120** may correspond to the shape of the bottom chassis **15**. The reflective sheet **120** may be formed concavely to correspond to the shape of the bottom chassis **15** as a front surface of the bottom chassis **15** is formed concavely to accommodate the light source module **110**. Accordingly, the edge portion **122** may be inclined with respect to the seating portion **121** to form a concave shape together with the seating portion **121**.

[0115] The edge portion **122** of the reflective sheet **120** may be formed to reduce brightness. Because the brightness at the edge portion **122** may be higher than the brightness at the seating portion **121** as the reflective sheet **120** has a concave shape, the display apparatus **1** according to an embodiment of the present disclosure may have a configuration for reducing brightness in the edge portion **122** in order to uniform brightness. For example, the display apparatus **1** may be configured to reduce brightness by applying black ink to the edge portion **122**.

[0116] The display apparatus **1** according to an embodiment of the present disclosure may include a supporter **150** configured to maintain a distance between the plurality of light sources **116**, **117**, and **118** of the light source module **110** and the optical members **130** and **140**. The supporter **150** may be disposed on the reflective sheet **120**. The supporter **150** may be disposed between the reflective sheet **120** and the optical members **130** and **140**. The supporter **150** may support components disposed in front of the light source module **110**. As an example, the supporter **150** may support the diffuser plate **130** and/or the optical sheet **140**. The supporter **150** may extend from the reflective sheet **120**. For example, the supporter **150** may extend between the reflective sheet **120** and the diffuser plate **130**.

[0117] The supporter **150** may be configured to maintain optical characteristics of the display apparatus **1** by maintaining an optical distance (OD) between the plurality of light sources **116**, **117**, and **118** of the light source module **110** and the optical members **130** and **140**. For example, the supporter **150** may be configured to have a length capable of maintaining optical characteristics of the backlight unit **100**.

[0118] Referring to FIGS. **6** to **8**, the display apparatus **1** according to an embodiment of the present disclosure may be configured such that a first distance y between any one of the plurality of first light sources **116** mounted on the first light source substrate **111** and any one of the plurality of second light sources **117** mounted on the second light source substrate **112** is different from a second distance x between the plurality of first light sources **116** mounted on the first light source substrate **111**. For example, the first distance y may include the closest distance among distances between one of the plurality of first light sources **116** mounted on the first light source substrate **111** and one of the plurality of second light sources **117** mounted on the second light source substrate **112**.

[0119] The display apparatus **1** according to an embodiment of the present disclosure may be configured such that the first distance y is greater than or equal to two times the second distance x and less than or equal to four times the second distance x. For example, in a case in which the first distance y is set to be less than two times the second distance x, the reflectance of the reflective sheet **120** may be higher than the reflectance of the light source substrates **111**, **112**, and **113**, so that

the light source substrates **111**, **112**, and **113** may be viewed on the screen **12**. For example, in a case in which the first distance y is set to be greater than four times the second distance x, there may be insufficient light to drive the display apparatus **1**.

[0120] Because the display apparatus **1** according to an embodiment of the present disclosure is configured such that the first distance y is greater than or equal to two times the second distance x and less than or equal to four times the second distance x, more light may be provided to the light source substrates **111**, **112**, and **113**, and therefore, the uniformity of an image displayed on the screen **12** may be improved even though the reflectance of the light source substrates **111**, **112**, and **113** is lower than the reflectance of the reflective sheet **120**.

[0121] The display apparatus **1** according to an embodiment of the present disclosure may include a substrate connector **115** to connect the first light source substrate **111** and the third light source substrate **113**. For example, the first light source substrate **111** may be connected to one side of the substrate connector **115**, and the third light source substrate **113** may be connected to the opposite side of the one side of the substrate connector **115**. As an example, the opposite side of one side of the first light source substrate **111** connected to the substrate connector **115** may be electrically connected to the control assembly **50** and/or the power assembly **60**, and the third light source substrate **113** may be electrically connected to the control assembly **50** and/or the power assembly **60** by being connected to the first light source substrate **111** through the substrate connector **115**.

[0122] Referring to FIGS. **5**, **7**, and **8**, the light source module **110** of the display apparatus **1** according to an embodiment of the present disclosure may be mounted on the bottom chassis **15**. The light source substrates **111**, **112**, and **113** of the light source module **110** may be detachably mounted on the bottom chassis **15**.

[0123] The bottom chassis **15** may include a module mounting protrusion **15***a* for mounting the light source module **110**. The module mounting protrusion **15***a* may protrude forward from the front surface of the bottom chassis **15**.

[0124] The reflective sheet **120** of the display apparatus **1** according to an embodiment of the present disclosure may be accommodated in the bottom chassis **15**. The reflective sheet **120** may include a first opening **126** formed to allow the module mounting protrusion **15***a* of the bottom chassis **15** to pass through. As an example, the first opening **126** may have a hole shape. When the reflective sheet **120** is mounted on the bottom chassis **15**, the module mounting protrusion **15***a* may pass through the first opening **126** and protrude further forward than the reflective sheet **120**. The first opening **126** may be formed to allow the module mounting protrusion **15***a* to pass through in order to be coupled to the light source substrates **111**, **112**, and **113**.

[0125] The light source module **110** may be mounted on the bottom chassis **15** in a state in which the reflective sheet **120** is mounted on the bottom chassis **15**. For example, in order to mount the first light source substrate **111** to the bottom chassis **15**, the first light source substrate **111** may include a first substrate mounting part **111***a*. The first substrate mounting part **111***a* may include a first passing portion **111***aa* through which the module mounting protrusion **15***a* is passable, and a first restricting portion **111***ab* capable of restricting the forward/rearward movement of the module mounting protrusion **15***a*. As the module mounting protrusion **15***a* passes through the first passing portion **111***aa* and then moves to the first restricting portion **111***ab*, the first light source substrate **111** may be mounted on the bottom chassis **15**. As the module mounting protrusion **15***a* is inserted into the first passing portion **111***aa* and then moves slidingly to the first restricting portion **111***ab*, the first light source substrate **111** may be mounted on the bottom chassis **15**.

[0126] For example, in order to mount the second light source substrate **112** to the bottom chassis **15**, the second light source substrate **112** may include a second substrate mounting part **112***a*. The second substrate mounting part **112***a* may include a second passing portion **112***aa* through which the module mounting protrusion **15***a* is passable, and a second restricting portion **112***ab* capable of restricting the forward/rearward movement of the module mounting protrusion **15***a*. As the module mounting protrusion **15***a* passes through the second passing portion **112***aa* and then moves to the

second restricting portion **112***ab*, the second light source substrate **112** may be mounted on the bottom chassis **15**. As the module mounting protrusion **15***a* is inserted into the second passing portion **112***aa* and then moves slidingly to the second restricting portion **112***ab*, the second light source substrate **112** may be mounted on the bottom chassis **15**.

[0127] For example, in order to mount the third light source substrate **113** to the bottom chassis **15**, the third light source substrate **113** may include a third substrate mounting part **113***a*. The third substrate mounting part **113***a* may include a third passing portion **113***aa* through which the module mounting protrusion **15***a* is passable, and a third restricting portion **113***ab* capable of restricting the forward/rearward movement of the module mounting protrusion **15***a*. As the module mounting protrusion **15***a* passes through the third passing portion **113***aa* and then moves to the third restricting portion **113***ab*, the third light source substrate **113** may be mounted on the bottom chassis **15**. As the module mounting protrusion **15***a* is inserted into the third passing portion **113***aa* and then moves slidingly to the third restricting portion **113***ab*, the third light source substrate **113** may be mounted on the bottom chassis **15**.

[0128] Referring to FIGS. **7** and **8**, for example, the third light source substrate **113** may be mounted on the bottom chassis **15** in the state in which the reflective sheet **120** is mounted on the bottom chassis **15**. As illustrated in FIG. **8**, the third light source substrate **113** is positioned such that the module mounting protrusion **15***a* of the bottom chassis **15** passes through the third passing portion **113***aa*. In a state in which the module mounting protrusion **15***a* is positioned to pass through the third passing portion **113***aa*, the third light source substrate **113** may move such that the module mounting protrusion **15***a* is positioned in the third restricting portion **113***ab*. As an example, the third light source substrate **113** may move in a direction of being connected to the substrate connector **115** in the state in which the module mounting protrusion **15***a* is positioned to pass through the third passing portion **113***aa*.

[0129] Referring to FIG. **7**, the third light source substrate **113** may be mounted on the bottom chassis **15** and also connected to the substrate connector **115** as the module mounting protrusion **15***a* is positioned on the third restricting portion **113***ab*.

[0130] Referring to FIG. **5**, the bottom chassis **15** may include a supporter mounting portion **15***b* so that the supporter **150** may be mounted on the bottom chassis **15**. The supporter mounting portion **15***b* may protrude forward from the front surface of the bottom chassis **15**.

[0131] Referring to FIG. **5**, the reflective sheet **120** may include a second opening **127** formed to allow the supporter mounting portion **15***b* of the bottom chassis **15** to pass through. For example, the second opening **127** may have a hole shape. When the reflective sheet **120** is mounted on the bottom chassis **15**, the supporter mounting portion **15***b* may protrude further forward than the reflective sheet **120** by passing through the second opening **127**.

[0132] In the state in which the reflective sheet **120** is mounted on the bottom chassis **15**, the supporter **150** may be mounted on the bottom chassis **15**. For example, in order to mount the supporter **150** to the bottom chassis **15**, the supporter **150** may include a supporter coupling part **151**. The supporter coupling part **151** may include a supporter passing portion **151***a* through which the supporter mounting portion **15***b* is passable and a supporter restricting portion **151***b* capable of restricting movement of the supporter mounting portion **15***b* in a front-rear direction. As the supporter mounting portion **15***b* passes the supporter passing portion **151***a* and then moves to the supporter restricting portion **151***b*, the supporter **150** may be mounted on the bottom chassis **15**.

[0133] In the display apparatus **1** according to an embodiment of the present disclosure, because the light source module **110** and the reflective sheet **120** may be mounted on the bottom chassis **15** as the reflective sheet **120** is mounted on the bottom chassis **15** and then the light source module **110** is mounted on the bottom chassis **15**, compared to a structure in which the light source module **110** is disposed at the rear of the reflective sheet **120**, that is, a method in which the light source module **110** is mounted on the bottom chassis **15**, the reflective sheet **120** is mounted on the bottom chassis **15**, and then the reflective sheet **120** is fixed to the light source module **110**, ease of

assembly may be improved.
[0134] FIG. **9** schematically illustrates an optical profile of one light source among a plurality of light sources of a light source module of the display apparatus according to an embodiment of the present disclosure.
[0135] Hereinafter, for convenience of explanation, one of the plurality of first light sources **116** mounted on the first light source substrate **111** will be described, and the configuration of the one first light source **116** may be applied equally to the plurality of first light sources **116**, and may also be applied to the plurality of second light sources **117** and/or the plurality of third light sources **118**.
[0136] Referring to FIG. **9**, the first light source substrate **111** may be disposed in front of the reflective sheet **120**, and the first light source **116** mounted on the first light source substrate **111** may include a light emitting diode **116***a* and a light source lens **116***b* configured to cover the light emitting diode **116***a* in order to protect the light emitting diode **116***a*.
[0137] The first light source **116** disposed on the first light source substrate **111** may be set such that a width of a region having half the brightness compared to a brightest portion (front of the light-emitting diode **116***a*) in a light profile F is a maximum half-width W.
[0138] The display apparatus **1** according to an embodiment of the present disclosure may be configured such that the maximum half-width W of the first light source **116** is greater than the first distance y. For example, the maximum half-width W of the first light source **116** may be set to be greater than or equal to the first distance y and less than or equal to 1.15 times the first distance y between any one of the plurality of first light sources **116** mounted on the first light source substrate **111** and any one of the plurality of second light sources **117** mounted on the second light source substrate **112**.
[0139] As the display apparatus **1** according to an embodiment of the present disclosure is designed such that the maximum half-width W of each of the plurality of light sources **116**, **117**, and **118** mounted on the light source substrates **111**, **112**, and **113** is greater than or equal to the first distance y and less than or equal to 1.15 times the first distance y between any one of the plurality of first light sources **116** mounted on the first light source substrate **111** and any one of the plurality of second light sources **117** mounted on the second light source substrate **112**, more light may be provided to the light source substrates **111**, **112**, and **113**, and therefore the brightness may be improved.
[0140] FIG. **10** is an enlarged view of a portion B shown in FIG. **6**.
[0141] Hereinafter, for convenience of explanation, the first light source substrate **111** and some of the plurality of first light sources **116** will be described, and the configuration of some of the first light source substrate **111** and the plurality of first light sources **116** may also be applied to the second light source substrate **112** and the plurality of second light sources **117**, and may also be applied to the third light source substrate **113** and the plurality of third light sources **118**.
[0142] Referring to FIG. **10**, the display apparatus **1** according to an embodiment of the present disclosure may further include a reflector **160** to improve the reflectance of the first light source substrate **111** of the light source module **110**. As an example, the reflector **160** may include white ink. For example, the reflector **160** may include a photo solder resist (PSR). By the reflector **160**, a difference in reflectance between the first light source substrate **111** and the reflective sheet **120** may be improved.
[0143] The reflector **160** of the display apparatus **1** according to an embodiment of the present disclosure may be provided in different amounts depending on predetermined regions on the first light source substrate **111**. For example, the reflector **160** of a relatively small amount may be applied to a first region **161** adjacent to each of the plurality of first light sources **116**, and the reflector **160** of a relatively large amount may be applied to second regions **162** spaced apart from the plurality of first light sources **116**. The second regions **162** may be provided between the plurality of first light sources **116**.
[0144] As an example, the reflector **160** may be applied to the first light source substrate **111**. For

example, because the second regions **162** are spaced apart from the plurality of first light sources **116**, the second regions **162** may be relatively light-deprived compared to the first regions **161**. Therefore, the reflectance of light in the second regions **162** is improved more than the reflectance of light in the first regions **161**, so that uniformity of overall brightness of the display apparatus **1** may be improved.

[0145] A display apparatus according to an embodiment includes a reflective sheet, a light source substrate on the reflective sheet and including a first light source substrate and a second light source substrate, and a plurality of light sources including a plurality of first light sources on the first light source substrate and a plurality of second light sources on the second light source substrate. A first distance between a first light source of the plurality of first light sources and a second light source of the plurality of second light sources is greater than or equal to two times a second distance and less than or equal to four times the second distance. The second distance is a distance between adjacent first light sources of the plurality of first light sources.

[0146] The first distance may be a smallest distance among distances between one of the plurality of first light sources and one of the plurality of second light sources.

[0147] The first light source substrate and the second light source substrate may be separated in an up-down direction.

[0148] The display apparatus may further include a bottom chassis configured to accommodate the reflective sheet. The light source substrate may be configured to be mounted on the bottom chassis in a state in which the reflective sheet is mounted on the bottom chassis.

[0149] The bottom chassis may include a module mounting protrusion. The light source substrate may include a passing portion into which the module mounting protrusion is configured to be inserted, and a restricting portion configured to restrict detachment of the module mounting protrusion in a state in which the module mounting protrusion is inserted therein.

[0150] In a state in which the module mounting protrusion is inserted into the passing portion, the light source substrate may be configured to be mounted on the bottom chassis as the module mounting protrusion inserts into the restricting portion.

[0151] The reflective sheet may include an opening through which the module mounting protrusion is inserted to be coupled with the light source substrate.

[0152] The display apparatus may further include a display panel, an optical member and between the display panel and the reflective sheet, and a supporter on the reflective sheet and configured to support the optical member.

[0153] A reflectance of the light source substrate may be less than a reflectance of the reflective sheet.

[0154] A width of a region around a light source of the plurality of light sources may be based on a distance from a brightest portion of the light source to a point at which a brightness is half of a brightness of the brightest portion. The width may be greater than or equal to the first distance and less than or equal to 1.15 times the first distance.

[0155] The display apparatus may further include a reflector disposed on the light source substrate and provided in a greater amount in second regions spaced apart from the plurality of light sources than in first regions adjacent to the plurality of light sources.

[0156] The reflector may include a photo solder resist (PSR) on the light source substrate.

[0157] At least a portion of an edge of the reflective sheet may have a reduced reflectivity compared to another portion of the reflective sheet.

[0158] A distance between the plurality of second light sources may be equal to a distance between the plurality of first light sources.

[0159] The display apparatus may further include a third light source substrate arranged in a left-right direction with the first light source substrate, and a substrate connector configured to electrically connect the first light source substrate and the third light source substrate.

[0160] A display apparatus according to an embodiment includes a bottom chassis, a reflective

sheet disposed in front of the bottom chassis, a first light source substrate disposed in front of the reflective sheet, a second light source substrate disposed in front of the reflective sheet and arranged in an up-down direction with the first light source substrate, a plurality of first light sources mounted on the first light source substrate, and a plurality of second light sources mounted on the second light source substrate. A closest first distance among distances between one of the plurality of first light sources and one of the plurality of second light sources is set to be greater than or equal to two times the second distance x and less than or equal to four times a second distance x between the plurality of first light sources.

[0161] The first light source substrate and the second light source substrate may be detachably mounted on the bottom chassis when the reflective sheet is mounted on the bottom chassis.

[0162] At least one of the plurality of first light sources or the plurality of second light sources may be configured such that a width W of a region having half the brightness compared to a brightest portion is greater than or equal to the first distance and less than or equal to 1.15 times the first distance.

[0163] The display apparatus may further include a reflector to be applied to at least one of the first light source substrate and the second light source substrate, and the reflector is provided to be applied in a larger amount in second regions spaced apart from the plurality of first light sources or the plurality of second light sources than in first regions adjacent to the plurality of first light sources or the plurality of second light sources.

[0164] A reflectance of at least one of the first light source substrate and the second light source substrate may be set to be lower than a reflectance of the reflective sheet.

[0165] According to an embodiment of the present disclosure, ease of assembly of a display apparatus can be improved because a light source module is disposed in front of a reflective sheet.

[0166] According to an embodiment of the present disclosure, the display apparatus may be configured such that distances between the plurality of light sources is set so that more light can be provided to a light source substrate than to the reflective sheet, so that the brightness can be improved.

[0167] According to an embodiment of the present disclosure, the display apparatus may be configured to use a smaller number of light source substrates compared to a case in which distances between a plurality of light sources mounted on a single substrate is the same as distances between light sources mounted on different substrates, so that material costs can be reduced.

[0168] Effects obtainable from the present disclosure are not limited to the effects mentioned above, and other effects not mentioned will be clearly understood by those skilled in the art to which the present disclosure belongs from the fallowing description.

[0169] The foregoing has illustrated and described specific embodiments. However, it should be understood by those of skilled in the art that the present disclosure is not limited to the above-described embodiments, and various changes and modifications may be made without departing from the technical idea of the present disclosure described in the following claims.

## Claims

**1**. A display apparatus comprising: a reflective sheet; a light source substrate on the reflective sheet and comprising a first light source substrate and a second light source substrate; and a plurality of light sources comprising a plurality of first light sources on the first light source substrate, and a plurality of second light sources on the second light source substrate, wherein a first distance between a first light source of the plurality of first light sources and a second light source of the plurality of second light sources is greater than or equal to two times a second distance and less than or equal to four times the second distance, and wherein the second distance is a distance between adjacent first light sources of the plurality of first light sources.

**2**. The display apparatus according to claim 1, wherein the first distance is a smallest distance

among distances between one of the plurality of first light sources and one of the plurality of second light sources.

**3**. The display apparatus according to claim 1, wherein the first light source substrate and the second light source substrate are separated in an up-down direction.

**4**. The display apparatus according to claim 1, further comprising: a bottom chassis configured to accommodate the reflective sheet, wherein the light source substrate is configured to be mounted on the bottom chassis in a state in which the reflective sheet is mounted on the bottom chassis.

**5**. The display apparatus according to claim 4, wherein the bottom chassis comprises a module mounting protrusion, and wherein the light source substrate comprises: a passing portion into which the module mounting protrusion is configured to be inserted; and a restricting portion configured to restrict detachment of the module mounting protrusion in a state in which the module mounting protrusion is inserted therein.

**6**. The display apparatus according to claim 5, wherein, in a state in which the module mounting protrusion is inserted into the passing portion, the light source substrate is configured to be mounted on the bottom chassis as the module mounting protrusion inserts into the restricting portion.

**7**. The display apparatus according to claim 5, wherein the reflective sheet comprises an opening through which the module mounting protrusion is inserted to be coupled with the light source substrate.

**8**. The display apparatus according to claim 1, further comprising: a display panel; an optical member between the display panel and the reflective sheet; and a supporter on the reflective sheet and configured to support the optical member.

**9**. The display apparatus according to claim 1, wherein a reflectance of the light source substrate is less than a reflectance of the reflective sheet.

**10**. The display apparatus according to claim 1, wherein a width of a region around a light source of the plurality of light sources is based on a distance from a brightest portion of the light source to a point at which a brightness is half of a brightness of the brightest portion, and wherein the width is greater than or equal to the first distance and less than or equal to 1.15 times the first distance.

**11**. The display apparatus according to claim 1, further comprising: a reflector on the light source substrate and provided in a greater amount in second regions spaced apart from the plurality of light sources, than in first regions adjacent to the plurality of light sources.

**12**. The display apparatus according to claim 11, wherein the reflector comprises a photo solder resist (PSR) on the light source substrate.

**13**. The display apparatus according to claim 1, wherein at least a portion of an edge of the reflective sheet has a reduced reflectivity compared to another portion of the reflective sheet.

**14**. The display apparatus according to claim 1, wherein a distance between the plurality of second light sources is equal to a distance between the plurality of first light sources.

**15**. The display apparatus according to claim 1, further comprising: a third light source substrate arranged in a left-right direction with the first light source substrate; and a substrate connector configured to electrically connect the first light source substrate and the third light source substrate.

**16**. A display apparatus comprising: a reflective sheet; a light source substrate on the reflective sheet and comprising a first light source substrate, and a second light source substrate separated from the first light source substrate by a first distance in a first direction; and a plurality of light sources provided on the light source substrate along a second direction that is different from the first direction, wherein a second distance is a distance in the second direction between adjacent light sources of the plurality of light sources, and wherein the first distance is at least two times the second distance and less than or equal to four times the second distance.

**17**. The display apparatus according to claim 16, further comprising: a bottom chassis comprising a module mounting protrusion and configured to accommodate the reflective sheet, wherein the light source substrate is configured to be mounted on the bottom chassis in a state in which the reflective

sheet is mounted on the bottom chassis, wherein the light source substrate comprises: a passing portion into which the module mounting protrusion is configured to be inserted; and a restricting portion adjacent to the passing portion and configured to restrict detachment of the module mounting protrusion in a state in which the module mounting protrusion is inserted therein, and wherein, in a state in which the module mounting protrusion is inserted into the passing portion, the light source substrate is mounted on the bottom chassis and the module mounting protrusion is inserted into to the restricting portion.

**18**. The display apparatus according to claim 16, wherein the first distance corresponds to a brightness of at least one light source of the plurality of light sources.

**19**. The display apparatus according to claim 18, wherein a width of a region around a light source of the plurality of light sources is based on a distance from a brightest portion of the light source to a point at which a brightness is half of a brightness of the brightest portion, and wherein the width is greater than or equal to the first distance and less than or equal to 1.15 times the first distance.

**20**. A display apparatus comprising: a reflective sheet comprising an opening; a bottom chassis configured to accommodate the reflective sheet and comprising a module mounting protrusion configured to insert through the opening; a light source substrate having at least one through hole through which the mounting protrusion is configured to insert to couple with the light source substrate, the light source substrate comprising a first light source substrate, and a second light source substrate separated from the first light source substrate by a first distance in a first direction; and a plurality of light sources provided on the light source substrate along a second direction that is different from the first direction, wherein a second distance is a distance in the second direction between adjacent light sources of the plurality of light sources, and wherein the first distance is greater than or equal to two times the second distance and less than or equal to four times the second distance.