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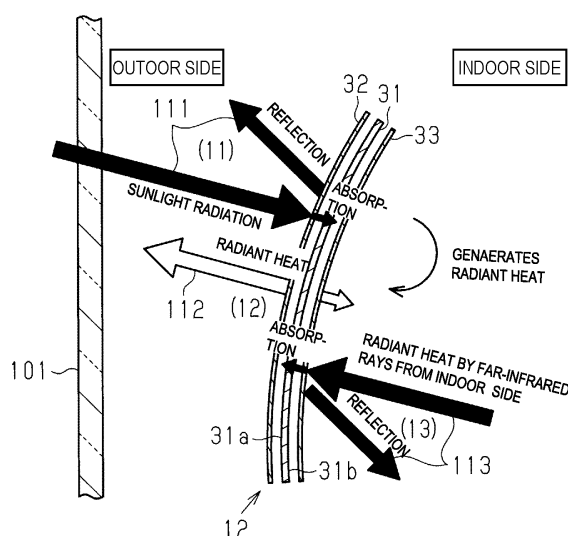
(54) **SUNSHINE SHIELDING DEVICE AND SLAT**

(57) Provided is a sunshine shielding device capable of reducing the thickness of a shielding material that reflects heat rays.

The horizontal blind includes a head box that hangs a lift cords and slats 12 that moves up and down by raising and lowering the lift cord. The slat 12 includes: a base

31 having a convex surface 31a and a concave surface 31b; an infrared reflection layer 33 that reflects infrared rays on the concave surface 31b of the base 31; and a sunlight reflection layer 32 that reflects sunlight on the convex surface 31a. The infrared reflection layer 33 is formed by thermal transfer.

FIG. 5



Description

Technical Field

[0001] The present invention relates to a sunshine shielding device and a slat each provided with a shielding member that reflects infrared rays.

Background Art

[0002] PTL 1 discloses a horizontal blind as a sunshine shielding device. This horizontal blind has a function of reflecting heat rays. A sunlight reflection layer and an infrared reflection layer are processed on a base formed of a transparent film, and the base is adhered to the surface of a synthetic resin substrate serving as a shielding member.

Citation List

Patent Literature

[0003] PTL 1: Japanese Examined Utility Model Application Publication No. 04-22705

Summary of Invention

Technical Problem

[0004] Even with this type of horizontal blind, the slats are required to be thinner. In the horizontal blind of PTL 1, it is difficult to further reduce the thickness of the slat and further reduce the weight of the entire horizontal blind because the infrared reflection layer is adhered to the slat via a base formed of a transparent film.

[0005] In addition, a reduction in the thickness of the shielding member is required not only for the horizontal blind but also for a sunshine shielding device such as a vertical blind, a pleated screen, or a roll screen, since the reduction leads to a reduction in the overall weight.

[0006] The present invention has been made to solve the above problems. An object of the present invention is to provide a sunshine shielding device and a slat capable of reducing the thickness of a shielding member that reflects infrared rays.

Solution to Problem

[0007] The sunshine shielding device for solving the above problem comprising a shielding member supported by the support member, wherein the shielding member includes a base and an infrared reflection layer that reflects infrared rays; and the infrared reflection layer is provided via an adhesive layer or directly on one surface of the base.

[0008] The sunshine shielding device for solving the above problem comprising a shielding member supported by the support member, wherein

the shielding member includes a base and an infrared-low-emission layer on one surface of the base, the infrared-low-emission layer being lower in infrared emission than the base.

[0009] In the sunshine shielding device, the support member rotatably supports the shielding member; and the shielding member is configured such that the one surface and the other surface opposite to the one surface selectively face the indoor side by its rotation.

[0010] In the sunshine shielding device, when the infrared reflection layer is provided on the one surface via the adhesive layer, the infrared reflection layer may be provided by thermal transfer.

[0011] In the sunshine shielding device, when the infrared reflection layer is provided directly on the one surface, the infrared reflection layer may be configured by applying paint containing an infrared reflection material.

[0012] In the sunshine shielding device, a sunlight reflection layer that reflects sunlight and can be colored is provided on the other surface opposite to the one surface of the base.

[0013] In the sunshine shielding device, an antifouling layer may be provided on a surface of the sunlight reflection layer.

[0014] In the sunshine shielding device, the base has opposing surfaces formed of a convex surface and a concave surface; and the one surface is the concave surface.

[0015] In the sunshine shielding device, the shielding member may be a slat; and the base may be made of a metal plate.

[0016] The slat for solving the above problem comprising:

a base;
an infrared reflection layer that reflects infrared rays on one surface of the base; and
a sunlight reflection layer that reflects sunlight on the other surface opposite to the one surface of the base, wherein
the infrared reflection layer is provided on the one surface via an adhesive layer or directly on the one surface.

Advantageous Effects of Invention

[0017] According to this invention, the sunshine shielding device and the slat which enabled the thickness reduction of the shielding material which reflects infrared rays can be provided.

Brief Description of Drawings

[0018]

FIG. 1 is a front view of a horizontal blind in one embodiment.

FIG. 2 is a perspective view of a main part of a horizontal blind in one embodiment.

FIG. 3 is a sectional view of a main part of a slat used for a horizontal blind in one embodiment.

FIG. 4 is a schematic view of a room in which a horizontal blind according to one embodiment is used.

FIG. 5 is a sectional view of the slat at the normal closed state.

FIG. 6 is a sectional view of the slat at the reverse closed state.

FIG. 7 is a sectional view of a main part of a slat according to a second embodiment.

FIG. 8 is a sectional view of a main part of a slat according to a third embodiment.

Description of Embodiments

[0019] Hereinafter, a horizontal blind in one embodiment will be described with reference to the drawings.

[First Embodiment]

[0020] As shown in Figs. 1 and 2, a horizontal blind 10 includes a head box 11 attached to an attachment portion such as a ceiling, a window frame, a curtain box, and the like, and multiple slats 12 as a shielding member for shielding sunlight radiation. The horizontal blind 10 includes three ladder cords 13 as a support member hung from the head box 11, a bottom rail 14 located below the lowermost slat 12, and first and second lift cords 15a, 15b hung from the head box 11 and end of which are connected to the bottom rail 14. Further, the first lift cords 15a and the ladder cords 13 are arranged at each of both ends in the longitudinal direction of the slats 12, and the second lift cords 15b and the ladder cord 13 are arranged at an intermediate part in the longitudinal direction of the slats 12.

[0021] The slats 12 are formed in an elongated rectangular thin plate shape, and the lower surface, which is one surface, is formed of an arc-shaped concave surface, and the upper surface, which is the other surface, is formed of an arc-shaped convex surface. The multiple slats 12 are arranged along a vertical direction that is the height direction of the horizontal blind 10, and are supported by ladder cords 13 hung from the head box 11 so as to be tilt-adjustable. The bottom rail 14 having substantially the same length as the slat 12 is disposed below the lowermost slat 12.

[0022] The bottom rail 14 functions as a weight member when maintaining a state in which the multiple slats 12 are lowered, and is formed of a metal material such as SECC (electrolytic zinc-coated carbon steel sheets).

The bottom rail 14 functions as a weight member when maintaining a state in which the multiple slats 12 are lowered, and is formed of a metal material such as SECC (electro-galvanized zinc plated steel). The bottom rail 14 has substantially the same length in the longitudinal direction and the width in the short direction as the slats 12, and when the bottom rail 14 is raised, the multiple slats 12 are stacked on the bottom rail 14. The ladder cord 13 is connected to the bottom rail 14. Further, the bottom rail 14 is connected to the first and second lift cords 15a, 15b drawn out of the head box 11, and is hung from the head box 11 by the first and second lift cords 15a, 15b.

[0023] In each of the multiple slats 12 constituting the slat group, a through hole 21 is arranged at both ends in the longitudinal direction of the slats 12 and at the center in the front-rear direction, i.e. the short direction. The through hole 21 has a rectangular shape with the long side in the short direction. The second lift cords 15b are disposed at the center in the longitudinal direction of the slats 12, along the opposing side edges of the slat 12 in the front-rear direction. The slats 12 does not have a through hole required for inserting the second lift cords 15b. At the center in the longitudinal direction of the slats 12, the above-described through-hole is not formed, so that high light-shielding properties can be obtained.

[0024] A tilt pole 18 as an operation unit for raising and lowering the bottom rail 14 and an equalizer 19 provided at the tip of the tilt pole 18 are arranged near one end of the head box 11 in the longitudinal direction. When the tilt pole 18 is rotated left and right, the slats 12 are tilted by raising and lowering the warp cords of the ladder cords 13 in opposite directions based on the rotation. The tilt pole 18 rotates the slat 12 by being rotated left and right, and can switch between a fully closed state and a fully opened state. The equalizer 19 can raise the bottom rail 14 and the slat 12 by being pulled downward, and can stop the raising of the bottom rail 14 and the slat 12 halfway by being stopped. As the bottom rail 14 is raised, the multiple slats 12 are stacked on the bottom rail 14 in order from a position near the bottom rail 14. When the slats 12 are to be lowered, the equalizer 19 is slightly pulled downward and loosened. When the bottom rail 14 are to be stopped halfway, the equalizer 19 is pulled again. As the bottom rail 14 descends, each of the multiple slats 12 also descends.

[0025] The ladder cord 13 includes a pair of warp cords 13a extending in the height direction of the horizontal blind 10 and weft cords 13b arranged between the warp cords 13a. The weft cords 13b supports each slat 12. Among the three ladder cords 13, the warp cord 13a of the ladder cord 13 along the second lift cord 15b has a pico 13c through which the second lift cord 15b is inserted. The pico 13c is an annular body formed by pulling out a thread from the warp cord 13a, and the second lift cord 15b is inserted therethrough.

[0026] As shown in Fig. 3, the slat 12 includes a base 31, a sunlight reflection layer 32 provided on a convex

surface 31a of the base 31, and an infrared reflection layer 33 provided on a concave surface 31b of the base 31.

[0027] The base 31 is formed of a synthetic resin plate, a metal plate of aluminum, stainless steel, or the like, and is formed of a light-shielding material. Further, the base 31 may be formed of flameproof material, or may be formed of a wooden board. The base 31 has an arcuate cross section and has opposing surfaces formed of the convex surface 31a and the concave surface 31b. The convex surface 31a faces the outdoor side and the concave surface 31b faces the indoor side when the slat 12 is at the normal closed state. At the normal closed state, when viewed from the outdoor side, the upper slat 12 is arranged so as to overlap the lower slat in the vertically adjacent pair of slats 12. This makes it difficult for sunlight radiation to enter the room through the gap between the pair of slats 12. Here, aluminum is used for the base 31. The base 31 is provided with a primer layer 35 serving as a base for an adhesive layer 34 of the infrared reflection layer 33.

[0028] The sunlight reflection layer 32 reflects sunlight from visible light to near-infrared light (wavelength of about 380 nm to 2500 nm). The sunlight reflection layer 32 is formed by applying and drying a thermal barrier coating material (painting material) containing sunlight reflecting constituent such as aluminum using a coating device such as a roller coater. As an example, the sunlight reflection layer 32 is formed on the convex surface 31a of the base 31 so that the film thickness is about 10 μm . Further, the thermal barrier coating material includes a coloring material such as a pigment, and by changing the coloring material, the convex surface of the slat 12 can be colored in various colors. The sunlight reflection layer 32 is provided on the convex surface 31a facing the outdoor side at the normal closed state in which the amount of sunlight radiation entering the room can be reduced, so that more sunlight can be reflected outside the room.

[0029] The infrared reflection layer 33 is a layer that reflects most of the infrared rays, particularly far-infrared rays (wavelength: about 10 μm to 20 μm). Also, the infrared reflection layer 33 is, in other words, the infrared-low-emission layer in which infrared emission, especially far-infrared emission is lower than the base 31. Here, the emission is lower than the aluminum of the base 31. In addition, the infrared reflection layer 33 transmits sunlight, for example. The infrared reflection layer 33 is made of, for example, a metal thin film containing silver or metal oxide (such as zinc oxide or tin oxide), and is made of, for example, Low-E (Low Emissivity). The infrared reflection layer 33 is adhered to the base 31 by an adhesive layer 34. As an example, the infrared reflection layer 33 is provided on the concave surface 31b of the base 31 by thermal transfer.

[0030] The sheet for providing the infrared reflection layer 33 on the concave surface 31b is a thermal transfer sheet, the release sheet is provided with a release layer.

The infrared reflection layer 33 is provided on the release layer, and the adhesive layer 34 is provided on the infrared reflection layer 33. Then, the adhesive layer 34 is adhered to the concave surface 31b. After that, the thermal transfer sheet is pressed against the concave surface 31b and further heated, so that the infrared reflection layer 33 is fixed to the concave surface 31b by the adhesive layer 34. After that, the release sheet is released from the infrared reflection layer 33 at the location of the release layer. The infrared reflection layer 33 is a metal thin film and has a thickness that allows the ground color of the base 31 to slightly pass through. As a result, the color of the surface can be changed by changing the ground color of the concave surface 31b. As an example, the adhesive layer 34 for adhering the infrared reflection layer 33 is formed to have a thickness of about 10 μm to 20 μm .

[0031] The slat 12 as described above is manufactured by providing the sunlight reflection layer 32 on the convex surface 31a of the base 31 and then thermally transferring the adhesive layer 34 and the infrared reflection layer 33 to the concave surface 31b.

[0032] Next, the operation of the horizontal blind 10 configured as described above will be described.

[0033] The horizontal blind 10 is attached to a window frame of an attaching target such that the bottom rail 14 is positioned below the lower frame of the window frame when the bottom rail 14 is lowered. When the equalizer 19 is pulled down to raise the slats 12 and the bottom rail 14, the bottom rail 14 of the horizontal blind 10 is raised so that the multiple slats 12 are stacked on the bottom rail 14 in order from a position near the bottom rail 14. When lowering the slats 12 and the bottom rail 14, the equalizer 19 is slightly pulled down so that the bottom rail 14 can descend, and as the bottom rail 14 descends, each of the multiple slats also descends. In addition, each slat 12 is tilted at the normal closed state or the reverse closed state according to the rotation direction by rotating the tilt pole 18.

[0034] As shown in Fig. 4, the environment near the building is as follows during the daytime. Sunlight radiation 111 such as sunlight enters the room 100 through the window glass 101, and a part thereof is reflected by the window glass 101 (1). The sunlight radiation 111 is partially absorbed by the window glass 101, but most of the sunlight radiation 111 passes through the window glass 101 and reflected by the slats 103 of the horizontal blind 102, then is again emitted out of the room 100 through the window glass 101 (2). Here, in Fig. 4, the horizontal blind 102 is a conventional horizontal blind in which a sunlight reflection layer is provided only on one surface of the slats 103. Part of the sunlight radiation 111 transmitted through the window glass 101 is absorbed by the slats 103 and converted into thermal energy, thereby warming the slats 103 (3). Further, a part of the sunlight radiation 111 passes through the gap between the slats 103 (4). The slats 103 heated by the sunlight radiation emit radiant heat by far-infrared rays (5). Normally, the

inside of the room 100 is conditioned by an air conditioner or the like. However, when the air between the window glass 101 and the horizontal blind 102 is heated, convection occurs due to the temperature difference between the space and the room space, and as a result, convection heat flows into the room (6). That is, the space inside the horizontal blind 102 of the room 100 is heated by the sunlight radiation (4) passing through the gap between the slats 103, the radiant heat from the slat 103 by far-infrared rays (5), and the convective heat (6) between the window glass 101 and the horizontal blind 102.

[0035] As shown in Fig. 5, in the daytime in summer or the like, it is preferable that the horizontal blind 10 to which the present invention is applied is in a state in which the slats 12 are lowered and tilted at the normal closed state. This is because the slats 12 are less likely to allow sunlight to enter the room from the gap between the adjacent slats 12 tilted at the normal closed state than tilted at the reverse closed state. In Figs. 5 and 6, the illustration of the adhesive layer 34 and the primer layer 35 is omitted.

[0036] In this case, the sunlight reflection layer 32 located on the convex surface 31a faces the direction of the window glass 101, and the infrared reflection layer 33 located on the concave surface 31b faces the indoor side. The surface of the slats 12 on the side of the window glass 101 (outdoor side) is provided with the sunlight reflection layer 32 and has a high sunlight reflectance, and can reflect most of the sunlight radiation 111, and thus suppresses a temperature rise of the slats 12 (11). The slats 12 are heated by part of the sunlight radiation 111 and emit radiant heat 112, but most of the radiant heat is emitted to the window glass 101 side (outdoor side) due to the presence of the infrared reflection layer 33 and emission of the radiant heat to the indoor side is suppressed (12). Further, a room 100 whose temperature is close to room temperature (about 25°C) emits radiant heat 113 by far-infrared rays, but the infrared reflection layer 33 reflects this radiant heat 113 to prevent the heat in the room from escaping outside (13).

[0037] As shown in Fig. 6, in a daytime in winter or the like, it is preferable that the horizontal blind 10 is in a state in which the slats 12 are lowered and tilted at the reverse closed state. In this case, the infrared reflection layer 33 located on the concave surface 31b faces the direction of the window glass 101, and the sunlight reflection layer 32 located on the convex surface 31a faces the indoor side. Most of the sunlight radiation 111 from the window glass 101 can pass through the infrared reflection layer 33 to heat the slats 12, and thus the slats 12 can emit the radiant heat 114 to the indoor side through the sunlight reflection layer 32 to warm the room (14). At this time, the infrared reflection layer 33 suppresses the radiant heat 114 from being emitted to the outdoor side.

[0038] However, the state shown in Fig. 5 is preferable when there is no sunshine due to cloudiness in the daytime in winter or at night. This is because far-infrared rays emitted from the room can be reflected by the infrared

reflection layer 33 facing the indoor side, and the escape of indoor heat to the outside can be suppressed (13).

[0039] The horizontal blind 10 as described above can obtain the effects listed below.

(1) Since the infrared reflection layer 33 is provided on the concave surface 31b of the base 31 via the adhesive layer 34, the slats 12 can be made thinner than the slats in the prior art that adhere the film provided with an infrared reflection layer 33 to the base 31. Accordingly, the weight of the slats 12 and the weight of the horizontal blind 10 can be reduced. In addition, as the weight of the slats 12 is reduced, the operation force for raising and lowering the slats 12 is reduced, and in this respect, the operability can be improved. Further, in the horizontal blind 10 can reduce the folding dimension when the bottom rail 14 is raised in the direction of the head box 11. Thereby, the design of the horizontal blind 10 can be improved.

(2) Since the infrared reflection layer 33 is provided by thermal transfer, production efficiency can be improved. As a comparative example, when the infrared reflection layer 33 is provided with paint, the drying time of the paint is required. However, when the infrared reflection layer 33 is provided by thermal transfer, the time corresponding to the drying time of the paint can be reduced, and the production efficiency can be improved.

[Second Embodiment]

[0040] As shown in Fig. 7, the slats 12 may be provided with an antifouling layer 36 on the sunlight reflection layer 32. The antifouling layer 36 may be formed by coating a fluororesin, or may be provided with titanium oxide on the upper layer of the underlayer. This can prevent the sunlight reflection layer 32 from being soiled.

[0041] Further, the slats 12 may be provided with a protection layer 37 on the infrared reflection layer 33. The protection layer 37 may be an antioxidant layer for preventing the infrared reflection layer 33 from being oxidized, or may be a hard coat layer having a function of preventing damage. The protection layer 37 is, for example, a release layer of a thermal transfer sheet. Also, the protection layer 37 may be configured by further coating paint on the upper layer of the release layer.

[Third Embodiment]

[0042] As shown in Fig. 8, the infrared reflection layer 33 of the slats 12 may be configured by directly applying and drying a coating material (paint) containing an infrared reflection material to the concave surface 31b by using a coating device such as a roller coater, instead of by the thermal transfer. In this case, the adhesive layer 34 can be omitted, and the slats 12 can be made thinner and lighter. Further, the primer layer 35 may be omitted,

or may be made of a material suitable for paint. Also, in the case of paint, a coloring material can be mixed, and the degree of freedom in designing the infrared reflection layer 33 can be increased.

[0043] The above-described horizontal blind 10 can be further modified and implemented as described below.

- The infrared reflection layer 33 has a metallic luster because it is made of a metal thin film. Then, when the infrared reflection layer 33 faces the room, the circumstances of the room is reflected on the surface of the slats 12. Therefore, the surface of the infrared reflection layer 33 may be performed a diffuse reflection processing such as matte processing and the surface may be a non-directional matte surface as a diffuse reflection processing surface. The diffuse reflection processing may be performed on the infrared reflection layer 33, or on the protection layer 37 in the second embodiment. Thereby, the design of the horizontal blind 10 is improved, and the horizontal blind 10 can be easily used.
- The sunlight reflection layer 32 is not limited to the configuration where a heat-shielding coating material (paint) is applied and provided. As an example, a film provided with the sunlight reflection layer 32 may be adhered to the base 31.
- The infrared reflection layer 33 is not limited to the configuration provided by the thermal transfer if provided on the base 31 via the adhesive layer 34.
- The slat 12 may be a flat plate having flat surfaces on both sides instead of a configuration having a convex surface and a concave surface.
- The slats 12 may be provided with a sunlight reflection layer 32 on a concave surface and an infrared reflection layer 33 on a convex surface.
- The shielding member such as the slats 12 only needs to have the infrared reflection layer 33 on one surface, and the sunlight reflection layer 32 on the other surface may be omitted.
- The metal thin film of the infrared reflection layer 33 may be formed directly on the base 31 by a sputtering method or a CVD method.
- As a lifting and lowering member, a lift tape may be used in addition to the lift cord. Also, the ladder code may be a ladder tape.
- The horizontal blind can also be applied to an electric horizontal blind system. The electric blind system includes an electric blind that moves up and down and tilts the slat 12 electrically using a motor or the like as a drive source, a sensor that is installed outdoors or the like to detect sunlight radiation, and a control device for controlling the tilting and lifting/lowering operation of the slats 12. The control device can perform switching settings such as summer and winter. The control device performs control to tilt the slats 12 as shown in Fig. 5 during the daytime in summer or the like (when the sensor detects sunlight radiation in summer). On the other hand, the control

device performs control to tilt the slats 12 as shown in Fig. 6 during the daytime in winter or the like (when sunlight radiation is detected in winter). When the slats 12 are applied to the electric blind system, the tilt control of the slats 12 can be automatically performed according to the sunlight radiation, and the energy-saving effect can be enhanced.

- The present invention may be applied to vertical slats of a vertical blind. In this case, an infrared reflection layer may be provided on at least one surface of the vertical slat which is a shielding member hung from the support member in the head box.
- Further, the present invention may be applied to a roll screen or a pleated screen. In this case, a screen such as a cloth serving as a shielding member is moved up and down by a support member hanging down from the head box. At this time, an infrared reflection layer may be provided on one surface of the screen. The screen preferably has a flameproofing performance.
- In addition, the slats can be applied to a louver or the like assembled in parallel with a gap in a frame as a support member.
- The sunshine shielding device such as a horizontal blind may be disposed between the inner window and the outer window. Further, it may be disposed inside the translucent partition.

Reference Signs List

[0044]

10:	horizontal blind,
11:	head box,
12:	slat,
13:	ladder cord,
13a:	warp cord,
13b:	weft cord,
13c:	pico,
14:	bottom rail,
15a:	first lift cord,
15b:	second lift cord,
18:	tilt pole,
19:	equalizer,
21:	through hole,
31:	base,
31a:	convex surface,
31b:	concave surface,
32:	sunlight reflection layer,
33:	infrared reflection layer,
34:	adhesive layer,
35:	primer layer,
36:	antifouling layer,
37:	protection layer,
100:	room,
101:	window glass,
102:	horizontal blind,
103:	slat,

- 111: sunlight radiation,
 112: radiant heat,
 113: radiant heat,
 114: radiant heat

Claims

1. A sunshine shielding device comprising a shielding member supported by the support member, wherein:

the shielding member includes a base and an infrared reflection layer that reflects infrared rays; and
 the infrared reflection layer is provided via an adhesive layer or directly on one surface of the base.

2. A sunshine shielding device comprising a shielding member supported by the support member, wherein the shielding member includes a base and an infrared-low-emission layer on one surface of the base, the infrared-low-emission layer being lower in infrared emission than the base.

3. The sunshine shielding device according to Claim 1 or 2, wherein:

the support member rotatably supports the shielding member; and
 the shielding member is configured such that the one surface and the other surface opposite to the one surface selectively face an indoor side by its rotation.

4. The sunshine shielding device according to Claim 1, wherein the surface on the infrared reflection layer side has a diffuse reflection processing surface.

5. The sunshine shielding device according to Claim 1 or 4, wherein
 the infrared reflection layer is provided on the one surface via the adhesive layer, and the infrared reflection layer is provided by thermal transfer.

6. The sunshine shielding device according to Claim 1 or 4, wherein
 the infrared reflection layer is provided directly on the one surface, and the infrared reflection layer is configured by applying paint containing an infrared reflection material.

7. The sunshine shielding device according to any one of Claims 1 to 3, wherein
 a sunlight reflection layer that reflects sunlight and can be colored is provided on the other surface opposite to the one surface of the base.

8. The sunshine shielding device according to Claim 7, wherein
 an antifouling layer is provided on a surface of the sunlight reflection layer.

9. The sunshine shielding device according to Claim 7 or 8, wherein:
 the base has opposing surfaces formed of a convex surface and a concave surface; and
 the one surface is the concave surface.

10. The sunshine shielding device according to any one of Claims 1 to 9, wherein:

the shielding member is a slat; and
 the base is made of a metal plate.

11. A slat comprising:

a base;
 an infrared reflection layer that reflects infrared rays on one surface of the base; and
 a sunlight reflection layer that reflects sunlight on the other surface opposite to the one surface of the base, wherein
 the infrared reflection layer is provided on the one surface via an adhesive layer or directly on the one surface.

FIG. 1

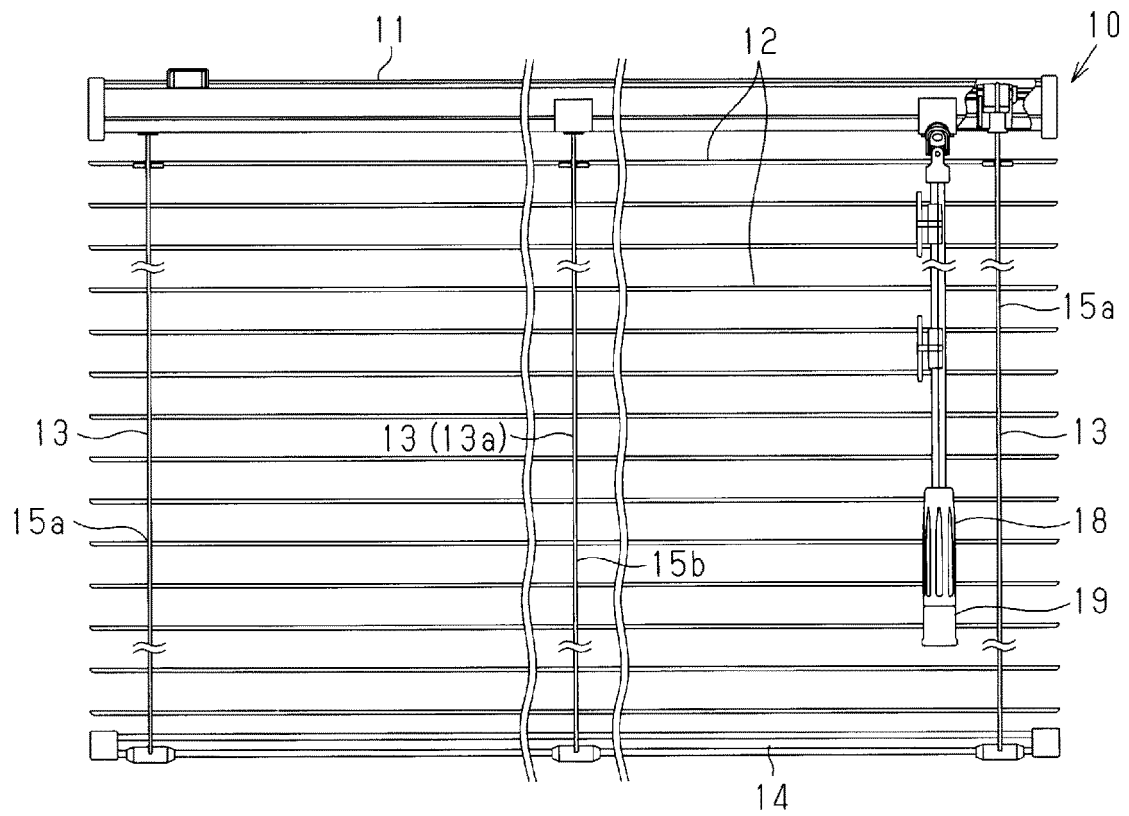


FIG. 2

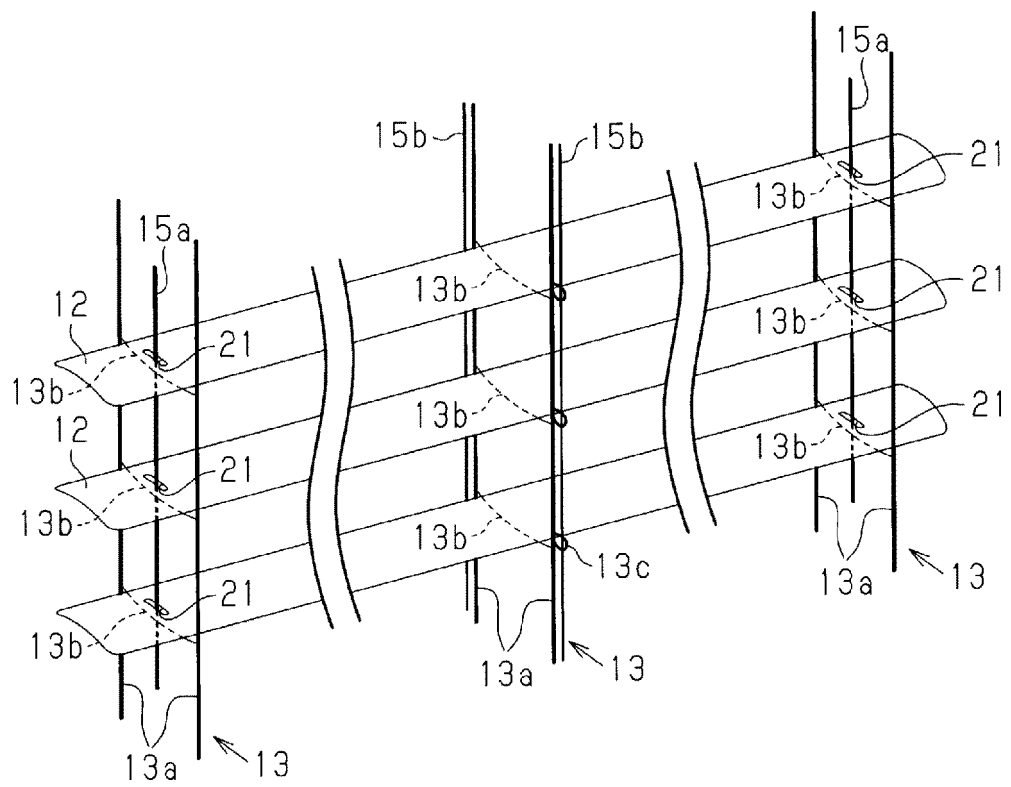


FIG. 3

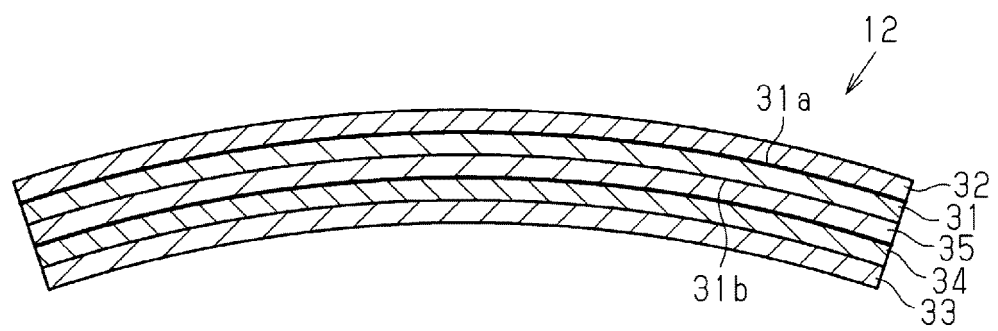


FIG. 4

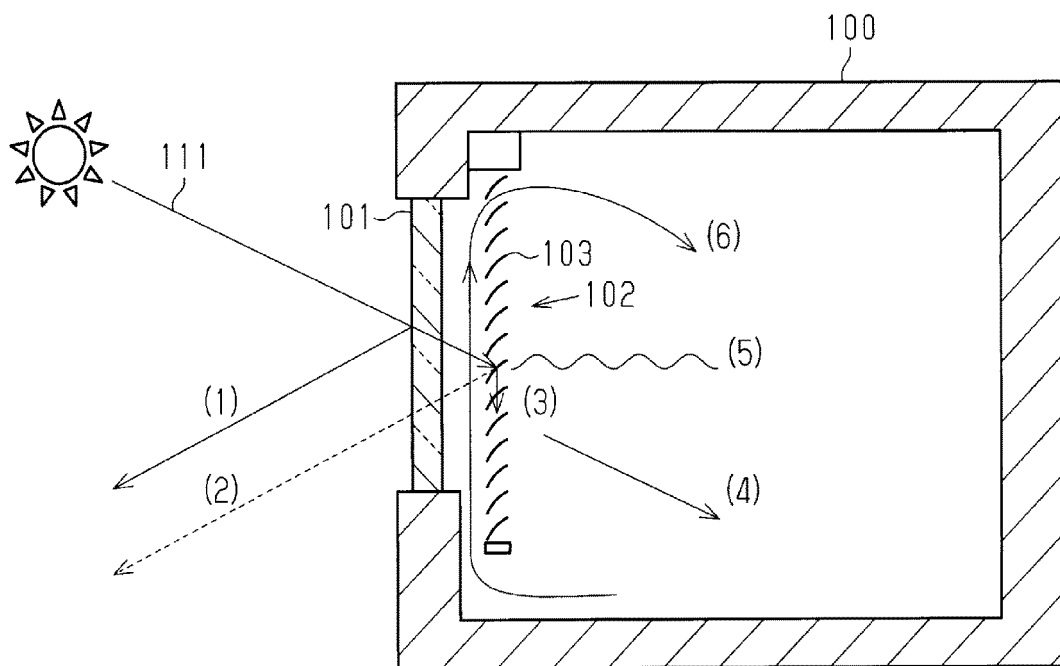


FIG. 5

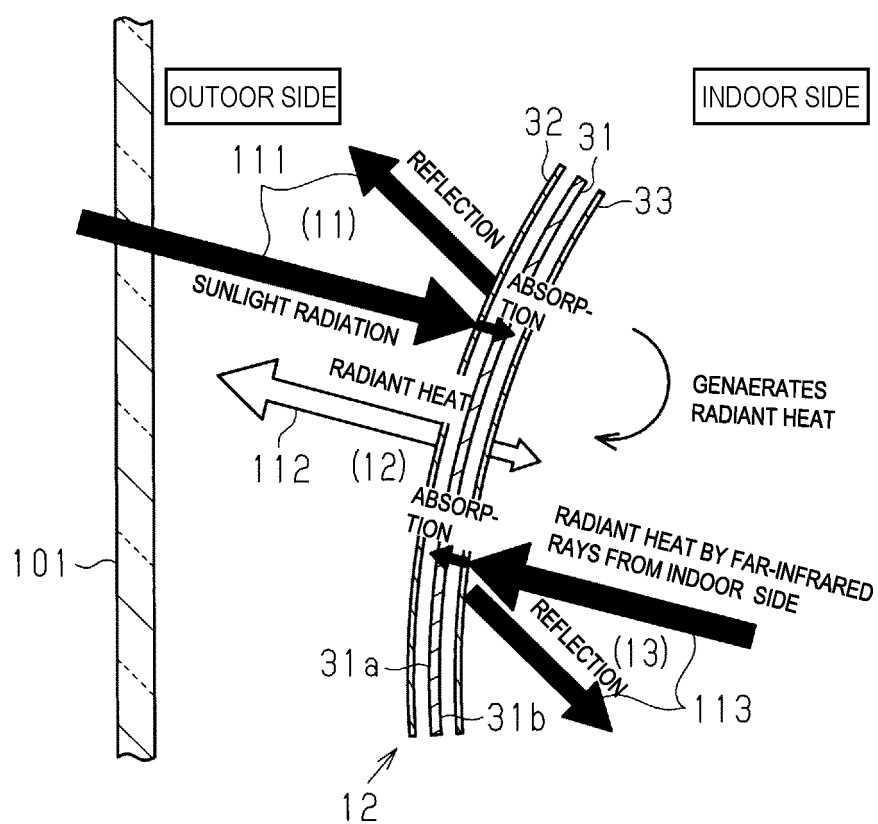


FIG. 6

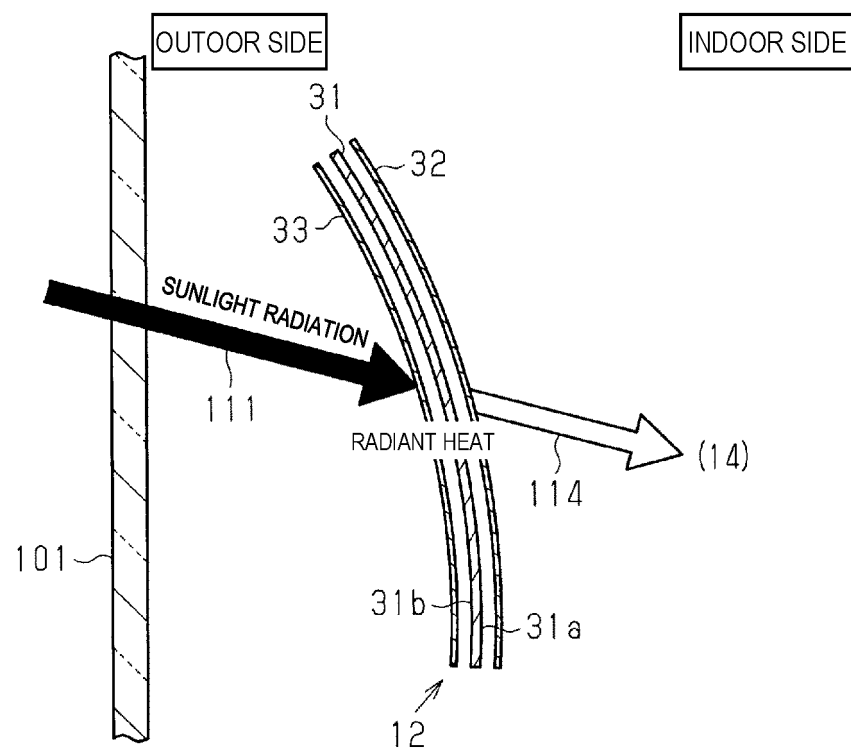


FIG. 7

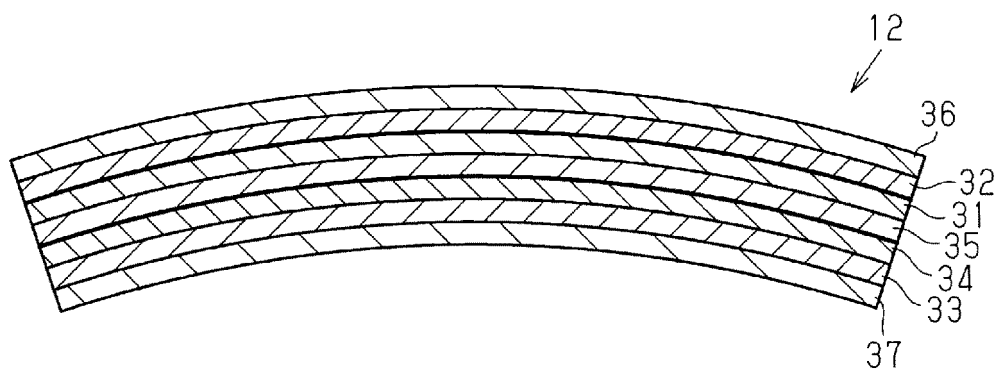
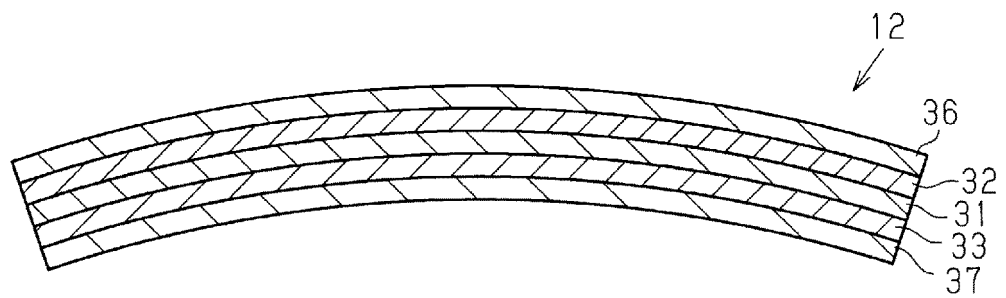


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/032140

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. E06B9/24(2006.01)i, E06B9/386(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. E06B9/24, E06B9/386

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 106782/1987 (Laid-open No. 11721/1989) (KAJIMA CORPORATION) 23 January 1989, page 4, line 1 to page 6, line 16, page 10, lines 1-19, fig. 1-4 (Family: none)	1-2, 4, 11 3, 5-10
Y	JP 2016-79558 A (INSTITUTE OF NATIONAL COLLEGES OF TECHNOLOGY JAPAN) 16 May 2016, paragraphs [0047]-[0048], [0059]-[0068], fig. 3-4, 7 (Family: none)	3, 9



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

17 October 2018 (17.10.2018)

Date of mailing of the international search report

30 October 2018 (30.10.2018)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/032140

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2014-224434 A (DAINIPPON PRINTING CO., LTD.) 04 December 2014, paragraphs [0020]-[0021], fig. 2-3 & US 2016/0060954 A1, paragraphs [0032]-[0034], fig. 2-3	3, 9
Y	JP 59-217887 A (KAJIMA CORPORATION) 08 December 1984, page 2, upper left column, line 6 to page 3, upper left column, line 1, fig. 1-2 (Family: none)	5
Y	JP 3-235893 A (DAINIPPON PRINTING CO., LTD.) 21 October 1991, page 2, lower left column, lines 2-6, page 3, upper right column, lines 9-16, fig. 3 (Family: none)	5, 10
Y	JP 2003-293673 A (TOSO CO., LTD.) 15 October 2003, paragraphs [0002], [0008]-[0010], fig. 1 (Family: none)	6, 10
Y	JP 2008-25142 A (HAYASHI, Ryoza) 07 February 2008, paragraph [0018] (Family: none)	7-9

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4022705 A [0003]