



(11) **EP 2 716 858 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
09.04.2014 Bulletin 2014/15

(51) Int Cl.:
E06B 9/68 (2006.01) **E06B 9/322 (2006.01)**
E06B 9/323 (2006.01) **E06B 9/324 (2006.01)**

(21) Application number: **12789174.5**

(86) International application number:
PCT/JP2012/063081

(22) Date of filing: **22.05.2012**

(87) International publication number:
WO 2012/161195 (29.11.2012 Gazette 2012/48)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

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(30) Priority: **25.05.2011 JP 2011116763**

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(54) **OPERATING APPARATUS FOR SOLAR RADIATION SHIELDING DEVICE**

(57) An operation apparatus (6) for a sunlight shielding apparatus includes a pulley (15) disposed in a region adjacent to one end of a winding shaft (3), an operation cord (7) engaged with the pulley (15), and a drive mechanism configured to rotationally drive the winding shaft (3) on the basis of an operation of the operation cord (7). The drive mechanism includes: a case (10) which rotatably supports the pulley (15), is rotatable with respect to a support bracket (2a), and hangs from the support bracket (2a) by self-weight; and a transmission mechanism (16, 17, 18) disposed on the case (10) and configured to transmit rotation of the pulley (15) to the winding shaft (3).

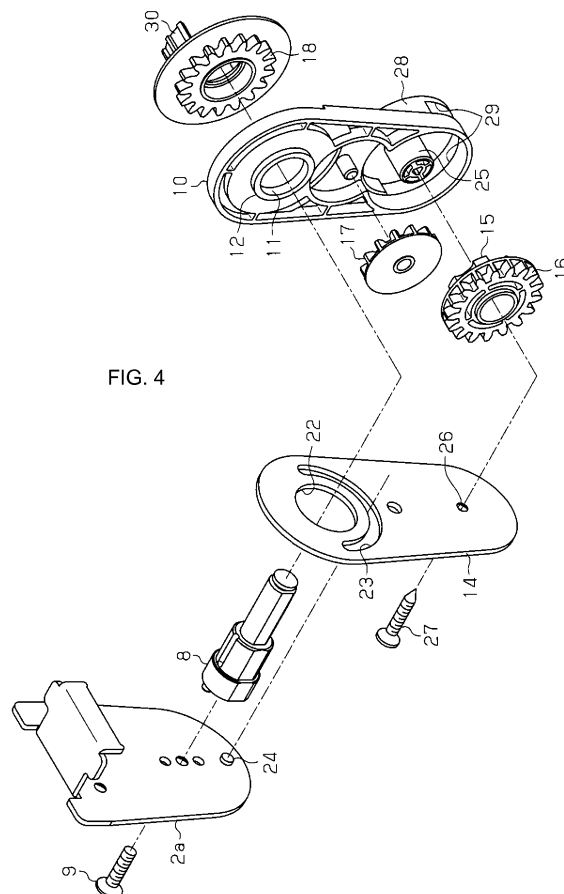


FIG. 4

Description

TECHNICAL FIELD

[0001] The present invention relates to an operation apparatus for a sunlight shielding apparatus, for example, an operation apparatus configured to raise or lower the screen of a roll blind, a pleated screen, or the fabric of a roll-up curtain.

BACKGROUND ART

[0002] In a roll blind, a winding shaft is rotatably supported between support brackets fixed to the mounting surface, and a screen is suspended from and supported by the winding shaft. By operating an operation apparatus to rotate the winding shaft in the screen winding direction, the screen is wound around the winding shaft and raised; in contrast, by operating the operation apparatus to rotate the winding shaft in the screen unwinding direction, the screen is unwound from the winding shaft and lowered.

[0003] In the operation apparatus, a pulley is rotatably supported by one of the support brackets, and an endless operation chain is engaged with the pulley. By operating the operation chain to rotate the pulley, the winding shaft rotates.

Prior Art Documents

Patent Documents

[0004]

Patent Document 1: Japanese Unexamined Patent Application Publication No. 2010-31592

Patent Document 2: Japanese Unexamined Patent Application Publication No. 2009-138326

Patent Document 3: Japanese Patent No. 2994552

Patent Document 4: Japanese Patent No. 3181841

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] In the above operation apparatus, the pulley is disposed between an end of the winding shaft and the support bracket. Accordingly, a gap corresponding to the thickness of the pulley occurs between an edge of the screen and the support bracket. Thus, when the support brackets are ceiling-mounted on the lower surface of the head of a window, there occurs a problem that a gap is formed between the edge of the screen and the window head and therefore light leaks through the gap. Particularly for a roll blind mounted on a narrow window, the ratio of this gap to the width of the screen is increased, which is undesirable in terms of appearance.

[0006] Patent Document 1 discloses an operation ap-

paratus for a roll blind where a pulley having an operation chain engaged therewith is located below a ceiling-mounted winding shaft and thus the gap between an edge of a screen and a window frame is reduced.

[0007] However, if the winding shaft of this operation apparatus is face-to-face mounted, a bracket supporting the pulley overhangs the room, which is undesirable in terms of appearance.

[0008] The same goes for an operation apparatus disclosed in Patent Document 2. If the winding shaft of an operation apparatus is face-to-face mounted, a bracket supporting a pulley overhangs the room.

[0009] Patent Document 3 discloses an operation apparatus where the operation cord pulling direction can be changed to a front-back direction. However, changing the operation cord pulling direction requires replacing the guide member.

[0010] Patent Document 4 discloses a roll blind where the pulley cover opening direction can be adjusted. However, this roll blind has a problem that adjusting the opening direction requires rotating a lock pin, thereby making the adjustment operation complicated.

[0011] An object of the present invention is to provide an operation apparatus for a sunlight shielding apparatus where the gap between the edge of the sunlight shielding material and the window frame is reduced and where overhang of the bracket over the room can be prevented without having to replace the guide member, whether the winding shaft is ceiling-mounted or face-to-face-mounted.

MEANS FOR SOLVING THE PROBLEMS

[0012] According to the present invention, a sunlight shielding apparatus includes: a winding shaft rotatably supported by a pair of support brackets fixed to a mounting surface; a sunlight shielding material configured to be raised or lowered based on rotation of the winding shaft; a pulley provided in a region adjacent to one end of the winding shaft; an operation cord engaged with the pulley; and a drive mechanism configured to rotationally drive the winding shaft on the basis of an operation of the operation cord. The drive mechanism includes: a case rotatably supporting the pulley, being rotatable with respect to the support bracket, and hanging from the support bracket by self-weight; and a transmission mechanism disposed on the case and configured to transmit rotation of the pulley to the winding shaft.

[0013] In one aspect of the present invention, the case preferably includes a synthetic resin and is rotatably supported by a spindle fixed to the support bracket, and a rotation plate including a metal plate is preferably attached to the case.

[0014] In one aspect of the present invention, the case preferably has a through hole through which the spindle can be passed and a shaft adjacent to the through hole, and the rotation plate is preferably fitted to the shaft.

[0015] In one aspect of the present invention, the pulley

and the transmission mechanism are preferably supported between the case and the rotation plate.

[0016] In one aspect of the present invention, at least one of the case and the rotation plate is preferably provided with a holder holding the case and the rotation plate on the support bracket at any angle.

[0017] In one aspect of the present invention, a base end of the case is preferably rotatably supported by the spindle fixed to the support bracket; the transmission mechanism preferably includes a plurality of spur gears; the first spur gear in the train of the spur gears is preferably formed integrally with the pulley; and the pulley is preferably formed in such a manner to protrude from the first spur gear toward a center of the winding shaft in the axial direction thereof and supported by a front end of the case.

[0018] In one aspect of the present invention, the case is preferably provided with a cover covering the pulley, and the cover preferably protrudes from the case toward the center of the winding shaft in the axial direction thereof.

[0019] In one aspect of the present invention, the transmission mechanism preferably includes: a drive gear formed integrally with the pulley; an intermediate gear meshed with the drive gear; and a transmission gear configured to transmit rotation of the intermediate gear to the winding shaft.

[0020] In one aspect of the present invention, the case is preferably provided with a guide configured to guide the operation cord, and the guide preferably opens downward.

[0021] In one aspect of the present invention, the drive mechanism and the case are preferably disposed in such a manner to be axisymmetric in front-back directions.

[0022] According to the present invention, a sunlight shielding apparatus includes: a winding shaft rotatably supported by a pair of support brackets fixed to a mounting surface; a sunlight shielding material configured to be raised or lowered based on rotation of the winding shaft; a pulley in a region adjacent to one end of the winding shaft; an operation cord engaged with the pulley; and a drive mechanism configured to rotationally drive the winding shaft on the basis of an operation of the operation cord. The drive mechanism includes: a case rotatably supporting the pulley, hanging from the support bracket, and being rotatable with respect to the support bracket in front-back directions in such a manner to be inclined at an angle corresponding to a pulling angle in front-back directions of the operation cord; and a transmission mechanism disposed on the case and configured to transmit rotation of the pulley to the winding shaft.

EFFECT OF THE INVENTION

[0023] According to the present invention, it is possible to provide an operation apparatus for a sunlight shielding apparatus where the gap between the edge of the sunlight shielding material and the window frame is reduced

and where overhang of the bracket over the room can be prevented without having to replace the guide member, whether the winding shaft is ceiling-mounted or face-to-face-mounted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a front view showing a roll blind.

FIG. 2 is a longitudinal sectional view showing the roll blind.

FIG. 3 is a sectional view showing an operation apparatus.

FIG. 4 is an exploded perspective view showing the operation apparatus.

FIG. 5 is a drawing showing an operation of the operation apparatus.

FIG. 6 is a drawing showing an operation of the operation apparatus.

FIG. 7 is a drawing showing an operation of the operation apparatus.

FIG. 8 is a drawing showing an operation of the operation apparatus.

FIG. 9 is a front view showing the roll blind.

FIG. 10 is a rear view showing the roll blind.

FIG. 11 is a plan view showing the roll blind.

FIG. 12 is a bottom view showing the roll blind.

FIG. 13 is a right side view showing the roll blind.

FIG. 14 is a left side view showing the roll blind.

FIG. 15 is a partially enlarged perspective view showing a portion XV-XV' of FIG. 9.

EMBODIMENTS

[0025] Now, one embodiment of the present invention will be described with reference to the drawings. In a roll blind shown in FIGS. 1 and 2 and FIGS. 9 to 15, support brackets 2a and 2b including a metal plate material are mounted on both ends of a frame 1, and a winding shaft 3 is rotatably supported between the support brackets 2a and 2b.

[0026] The frame 1 is fixed to a mounting surface by mounting brackets 13. In the roll blind shown in FIGS. 1 and 2, the frame 1 is ceiling-mounted on a horizontal mounting surface. The frame 1 may be face-to-face mounted on a vertical mounting surface or mounted on an inclined mounting surface.

[0027] The upper edge of a screen 4 is attached to the winding shaft 3, and a weight bar 5 is attached to the lower edge of the screen 4. When the winding shaft 3 is rotated in the screen winding direction, the screen 4 is wound around the winding shaft 3 and raised; when the winding shaft 3 is rotated in the screen unwinding direction, the screen 4 is unwound from the winding shaft 3 and lowered.

[0028] The support bracket 2a is provided with an operation apparatus 6 configured to rotationally drive the

winding shaft 3. The operation apparatus 6 has an endless ball chain 7 hanging therefrom. By operating the ball chain 7, the winding shaft 3 is rotated. FIG. 1 shows a roll blind for right-side operation where the operation apparatus 6 is mounted on the right end of the frame 1.

[0029] Next, the specific configuration of the operation apparatus 6 will be described with reference to FIGS. 3 and 4. The base end of a spindle 8 extending in the axial direction of the winding shaft 3 is attached to a lower portion of the support bracket 2a by a screw 9.

[0030] The base end of a case 10 including a synthetic resin is rotatably supported by the base end of the spindle 8. The case 10 has a through hole 11 for passing the spindle 8 therethrough. Disposed adjacent to the through hole 11 is a shaft 12 protruding toward the support bracket 2a.

[0031] Attached to the shaft 12 is a rotation plate 14 including a metal plate similar to the support bracket 2a. That is, the rotation plate 14 has a through hole 22 through which the shaft 12 can be passed, and the shaft 12 is passed through the through hole 22. The rotation plate 14, which is sandwiched between the case 10 and the support bracket 2a, rotates integrally with the case 10 using the spindle 8 as a rotation shaft (rotation axis). The friction between the inner peripheral surface of the through hole 11 of the case 10 and the spindle 8 is set to a small value so that the case 10 usually hangs from the spindle 8 by self-weight thereof.

[0032] The rotation plate 14 has, below the through hole 22, a guide groove 23 having an about 180-degree arc shape centered on the through hole 22. The support bracket 2a has an engaging protrusion 24 protruding into the guide groove 23. The rotation plate 14 and the case 10 can rotate relative to the support bracket 2a in the about 180-degree range, where the engaging protrusion 24 can move in the guide groove 23.

[0033] The case 10 has, on a lower portion thereof, that is, on the front end thereof, a shaft 25 protruding toward the rotation plate 14, and a pulley 15 is rotatably supported by the shaft 25. Using a fixing screw 27 inserted into the center of the shaft 25 through a through hole 26 of the rotation plate 14, the rotation plate 14 is fixed to the case 10 in such a manner to cover a side portion of the case 10.

[0034] The ball chain 7 is engaged with the pulley 15. The case 10 has a guide 28 adjacent to the ball chain 7 engaged with the pulley 15. The guide 28 is configured to guide the ball chain 7 to prevent the ball chain 7 from coming off the pulley 15. The guide 28 also serves as a cover for covering the pulley 15 and protrudes from the case 10 toward the center of the winding shaft 3 in the axial direction thereof. The guide 28 has an aperture 29 which opens downward, and the ball chain 7 hangs through the aperture 29.

[0035] A drive gear 16 is formed integrally with an axial side portion of the pulley 15, that is, a side portion thereof opposed to the rotation plate 14. In other words, the pulley 15 protrudes from the drive gear 16 toward the center of

the winding shaft 3 in the axial direction thereof.

[0036] The case 10 rotatably supports an intermediate gear 17 which is located over the drive gear 16 and meshed therewith. The spindle 8 rotatably supports a transmission gear 18 engaged with the intermediate gear 17. Accordingly, rotation of the pulley 15 is transmitted through the drive gear 16 and the intermediate gear 17 to the transmission gear 18.

[0037] The front end of the transmission gear 18 is fitted to a cap 19 which is fitted to the winding shaft 3. Accordingly, the rotation of the transmission gear 18 rotates the winding shaft 3. The drive gear 16, the intermediate gear 17, and the transmission gear 18 are spur gears constituting a transmission mechanism for transmitting rotation of the pulley 15 to the winding shaft 3. The drive gear 16 is the first gear in the spur gear train; the transmission gear 18 is the last gear therein.

[0038] Disposed between the transmission gear 18 and the spindle 8 is a brake apparatus 20. The brake apparatus 20 is disposed on the outer peripheral surface of a brake drum 31 and has protrusions at both ends thereof. The brake drum 31 is supported by the spindle 8 in such a manner to be rotatable integrally with the spindle 8 and unmovable in the axial direction of the spindle 8. The transmission gear 18 has thereon a convex portion 30 configured to rotate integrally therewith. The convex portion 30 contacts the protrusions after rotating by a predetermined idle angle (in this case, 30 degrees). When the convex portion 30 contacts the protrusions, the brake apparatus is deactivated, allowing the cap 19 to rotate based on rotation of the transmission gear 18. The brake apparatus prevents the cap 19 from rotating based on rotation torque transmitted from the winding shaft 3 to the cap 19.

[0039] In the operation apparatus 6 thus configured, the case 10 and the rotation plate 14 and the gears 16, 17, and 18, and the like accommodated therebetween are formed in such a manner to be axisymmetric in the front-back directions with respect to the center of the spindle 8. More specifically, the case 10 and the rotation plate 14, and the gears 16, 17, and 18 and the like accommodated therebetween are symmetric with respect to a plane including the axis lines of the shafts 12 and 25. Accordingly, it is possible to mount the operation apparatus 6 on the left end of the frame 1 to form a roll blind for left-side operation.

[0040] As shown in FIG. 1, a spring motor 21 including a torsion coil spring is disposed at an end of the winding shaft 3 in the winding shaft 3. One end of the spring motor 21 is fixed to the support bracket 2b; the other end thereof is fixed to the inner peripheral surface of the winding shaft 3. When the winding shaft 3 is rotated in the screen unwinding direction and thus the screen 4 is lowered, the spring motor 21 stores energy. Thus, when the winding shaft 3 is rotated in the screen winding direction, the energy stored in the spring motor 21 reduces operation force required to rotate the winding shaft 3.

[0041] Next, effects of the operation apparatus for the

roll blind thus configured will be described.

[0042] As shown in FIGS. 2 and 5, during non-operation of the ball chain 7, the case 10 and the rotation plate 14 of the operation apparatus 6 hang down from the support bracket 2a, and the centers of the drive gear 16 and intermediate gear 17 are located on a vertical line passing through the center of the transmission gear 18.

[0043] By operating the ball chain 7 in the screen lowering direction, rotation of the pulley 15 is transmitted through the drive gear 16, the intermediate gear 17, and the transmission gear 18 to the winding shaft 3. Thus, the screen 4 is unwound from the winding shaft 3 and lowered, so that the spring motor 21 stores energy.

[0044] By releasing the ball chain 7 after the screen 4 is lowered to the desired height, the brake apparatus 20 is activated and thus the screen 4 is maintained at the desired height.

[0045] In contrast, by operating the ball chain 7 in the screen raising direction, rotation of the pulley 15 is transmitted to the winding shaft 3 and thus the screen 4 is wound around the winding shaft 3 and raised. At this time, the energy stored in the spring motor 21 reduces operation force required to wind the screen 4.

[0046] If, during the above screen raising/lowering operation, the ball chain 7 is pulled down diagonally toward the room, the case 10 and the rotation plate 14 rotate integrally in such a manner to be inclined with respect to the vertical line, as shown in FIG. 6. Then, by releasing the ball chain 7, the case 10 and the rotation plate 14 hang from the spindle 8 and restore a state shown in FIG. 5.

[0047] The case 10 and the rotation plate 14 can rotate in the range of the guide groove 23 in the front-back directions (in the left and right directions in FIG. 6). Assuming that the operation apparatus 6 is mounted on the left end of the frame 1, when the ball chain 7 is pulled down diagonally toward the room, the case 10 and the rotation plate 14 rotate as shown by a chain line in FIG. 6.

[0048] As seen above, the case 10 and the rotation plate 14 can rotate in the front-back directions with respect to the support bracket 2a (2b) in such a manner to be inclined at an angle corresponding to a pulling angle in the front-back directions of the ball chain 7 (the inclined angle of the ball chain 7 with respect to the vertical line).

[0049] FIG. 7 shows a case where the frame 1 of the above roll blind is face-to-face-mounted on a vertical surface, such as a wall. In this case also, the case 10 and the rotation plate 14 automatically hang from the spindle 8.

[0050] By pulling down the ball chain 7 diagonally toward the room in order to raise or lower the screen 4, the case 10 and the rotation plate 14 rotate integrally in such a manner to be inclined with respect to the vertical line, as shown in FIG. 8. By releasing the ball chain 7, the case 10 and the rotation plate 14 restore a state shown in FIG. 7.

[0051] The operation apparatus for the roll blind thus configured can show the following advantages.

(1) The pulley 15 having the ball chain 7 engaged therewith is located below the winding shaft 3 in an area adjacent to one end of the winding shaft 3. That is, the pulley 15 is not coaxial with the winding shaft 3. Accordingly, it is not necessary to reserve space for the pulley 15 between the winding shaft 3 and the support bracket 2a. As a result, it is possible to reduce the gap between the edge of the screen 4 and the support bracket 2a.

(2) Since the gap between the edge of the screen 4 and the support bracket 2a can be reduced, leakage of light through the gap can be prevented. Particularly for a roll blind mounted on a narrow window, it is possible to reduce the gap between the edge of the screen 4 and the window frame to improve the appearance.

(3) Since the case 10 supporting the pulley 15, the drive gear 16, and the intermediate gear 17, and the rotation plate 14 attached to the case 10 hang from the spindle 8 of the winding shaft 3, the case 10 and the rotation plate 14 do not protrude toward the room.

(4) The case 10 and the rotation plate 14 vertically hang from the spindle 8 by self-weight. Accordingly, whether the frame 1 is ceiling-mounted, face-to-face-mounted, or mounted on a diagonal wall, it is possible to hang down the case 10 and the rotation plate 14 from the spindle 8 without requiring such as replacement of the guide member.

(5) When the ball chain 7 is pulled down diagonally, the case 10 and the rotation plate 14 rotate integrally in such a manner to be inclined. Accordingly, the aperture 29 through which the ball chain 7 is drawn out from the case 10 can be usually located in the direction in which the ball chain 7 has been pulled. As a result, it is possible to smoothly rotate the pulley 15 using the ball chain 7.

(6) The synthetic-resin case 10 is rotatably supported by the spindle 8, and the metal rotation plate 14 is attached to the case 10. Thus, the case 10 and the rotation plate 14 can be smoothly rotated with respect to the spindle 8.

(7) Rotation of the drive gear 16 is transmitted through the intermediate gear 17 to the transmission gear 18. Thus, it is possible to match the rotation directions of the drive gear 16 and the transmission gear 18. As a result, when raising or lowering the screen 4, it is possible to operate the ball chain 7 in the same direction as the direction in which the winding shaft 3 is directly rotated by the pulley 15.

(8) The case 10 housing the drive gear 16, the intermediate gear 17, and the transmission gear 18, and the rotation plate 14 are formed in such a manner to be axisymmetric in the front-back directions with respect to the spindle 8 mounted on the support bracket 2a. Thus, the operation apparatus 6 can be mounted on any of the right and left ends of the frame 1. As a result, the operation apparatus 6 can be used for both right-side operation and left-side operation.

[0052] The above embodiment may be carried out in the following mode.

[0053] By omitting the intermediate gear 17, the drive gear 16 may be meshed with the transmission gear 18. In this case, the rotation directions of the pulley 15 and the winding shaft 3 are not matched.

·Rotation of the pulley may be transmitted to the winding shaft using transmission mechanisms other than the gear train, for example, a timing belt.

·In the above embodiment, the roll blind has been described as one example of a sunlight shielding apparatus. However, the operation apparatus of the present invention can be used in roll blinds, as well as in roll-up curtains, pleated screens, and the like.

·The sunlight shielding apparatus may include a holder holding the case 10 and the rotation plate 14 on the support bracket 2a at any angle. The holder includes, for example, a first engaging portion disposed on the support bracket 2a and a second engaging portion which is disposed on at least one of the case 10 and the rotation plate 14 and can be engaged with or disengaged from the first engaging portion.

DESCRIPTION OF NUMERALS

[0054] 2a, 2b: support bracket, 3: winding shaft, 4: sunlight shielding material (screen), 6: operation apparatus, 7: operation cord (ball chain), 8: spindle, 10: drive mechanism (case), 11: through hole, 12: shaft, 14: rotation plate, 15: pulley, 16, 17, 18: transmission mechanism (drive gear, intermediate gear, transmission gear), 28: guide (cover)

Claims

1. An operation apparatus for a sunlight shielding apparatus, the sunlight shielding apparatus comprising:

a winding shaft rotatably supported by a pair of support brackets fixed to a mounting surface;
a sunlight shielding material configured to be raised or lowered based on rotation of the winding shaft;

a pulley provided in a region adjacent to one end of the winding shaft;

an operation cord engaged with the pulley; and
a drive mechanism configured to rotationally drive the winding shaft on the basis of an operation of the operation cord, wherein
the drive mechanism comprises:

a case rotatably supporting the pulley, being rotatable with respect to the support bracket, and hanging from the support bracket by

self-weight; and

a transmission mechanism disposed on the case and configured to transmit rotation of the pulley to the winding shaft.

2. The operation apparatus of claim 1, wherein the case comprises a synthetic resin and is rotatably supported by a spindle fixed to the support bracket, and
a rotation plate comprising a metal plate is attached to the case.

3. The operation apparatus of claim 2, wherein the case having a through hole through which the spindle can be passed and a shaft adjacent to the through hole, and
the rotation plate is fitted to the shaft.

4. The operation apparatus of claim 2 or 3, wherein the pulley and the transmission mechanism are supported between the case and the rotation plate.

5. The operation apparatus of any one of claims 2 to 4, wherein
the sunlight shielding apparatus further comprises a holder holding the case and the rotation plate on the support bracket at any angle.

6. The operation apparatus of claim 1, wherein a base end of the case is rotatably supported by the spindle fixed to the support bracket, the transmission mechanism comprises a plurality of spur gears,
the first spur gear in the train of the spur gears is formed integrally with the pulley, and
the pulley is disposed in such a manner to protrude from the first spur gear toward a center of the winding shaft in the axial direction thereof and supported by a front end of the case.

7. The operation apparatus of claim 6, wherein the case is provided with a cover covering the pulley, and
the cover protrudes from the case toward the center of the winding shaft in the axial direction thereof.

8. The operation apparatus of any one of claims 4 to 7, wherein
the transmission mechanism comprises:

a drive gear formed integrally with the pulley;
an intermediate gear meshed with the drive gear; and
a transmission gear configured to transmit rotation of the intermediate gear to the winding shaft.

9. The operation apparatus of any one of claims 1 to 8, wherein

the case is provided with a guide configured to guide the operation cord, and the guide opens downward.

10. The operation apparatus of any one of claims 1 to 9, wherein the drive mechanism and the case are formed in such a manner to be axisymmetric in front-back directions. 5
11. An operation apparatus for a sunlight shielding apparatus, the sunlight shielding apparatus comprising: 10
- a winding shaft rotatably supported by a pair of support brackets fixed to a mounting surface; 15
- a sunlight shielding material configured to be raised or lowered based on rotation of the winding shaft;
- a pulley in a region adjacent to one end of the winding shaft;
- an operation cord engaged with the pulley; and 20
- a drive mechanism configured to rotationally drive the winding shaft on the basis of an operation of the operation cord, wherein the drive mechanism comprises: 25
- a case rotatably supporting the pulley, hanging from the support bracket, and being rotatable with respect to the support bracket in front-back directions in such a manner to be inclined at an angle corresponding to a pulling angle in front-back directions of the operation cord; and 30
- a transmission mechanism disposed on the case and configured to transmit rotation of the pulley to the winding shaft. 35

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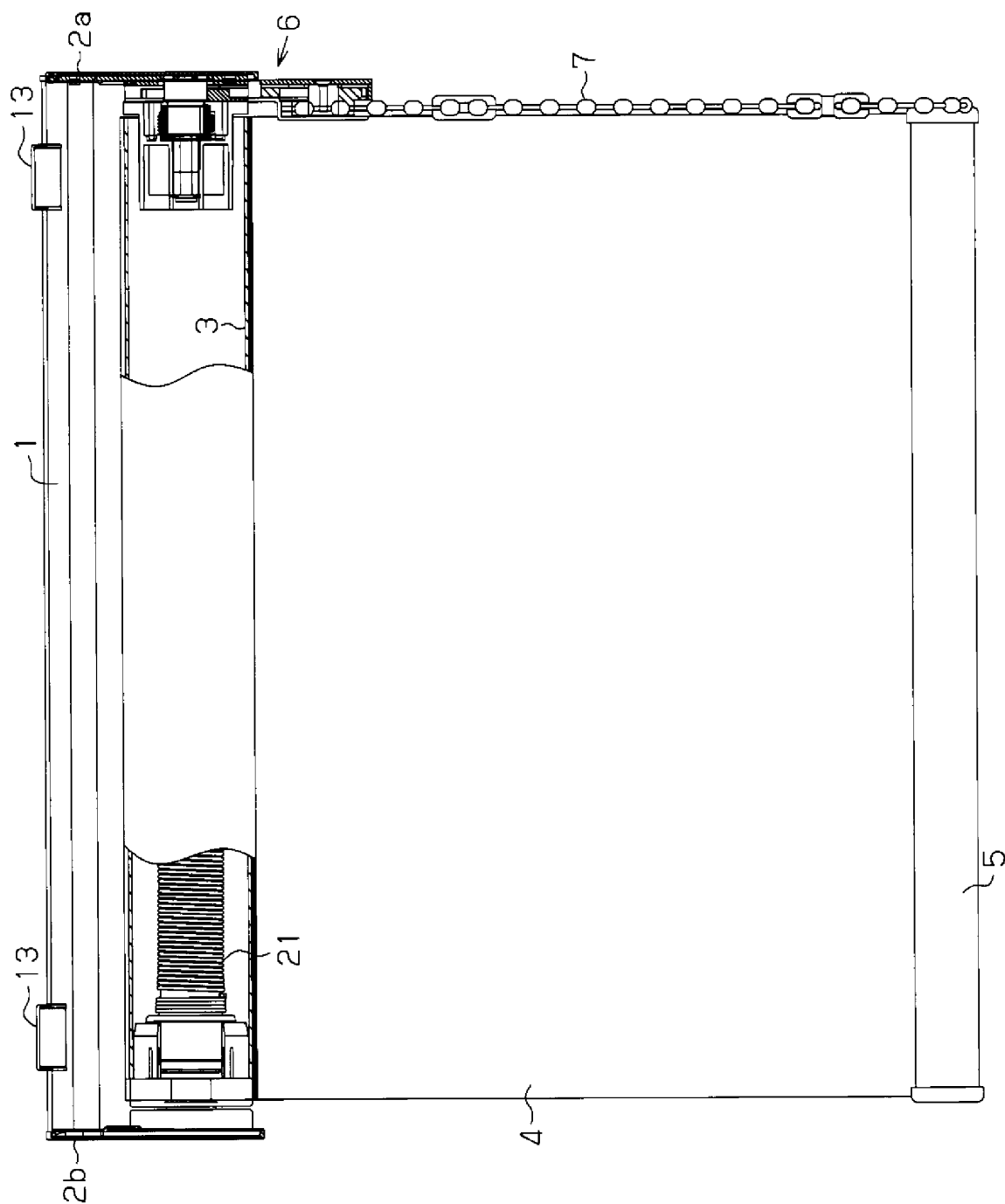


FIG. 1

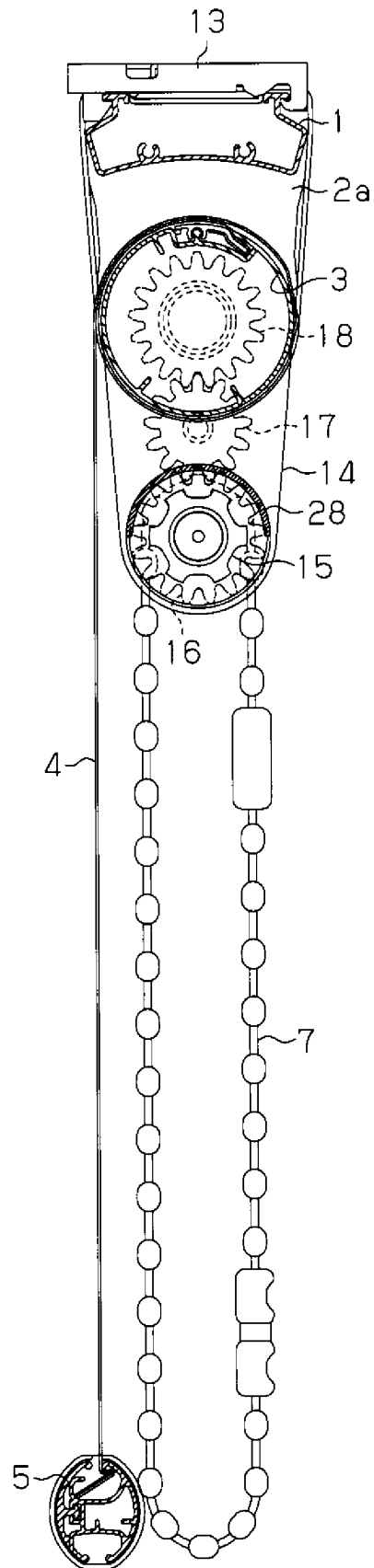
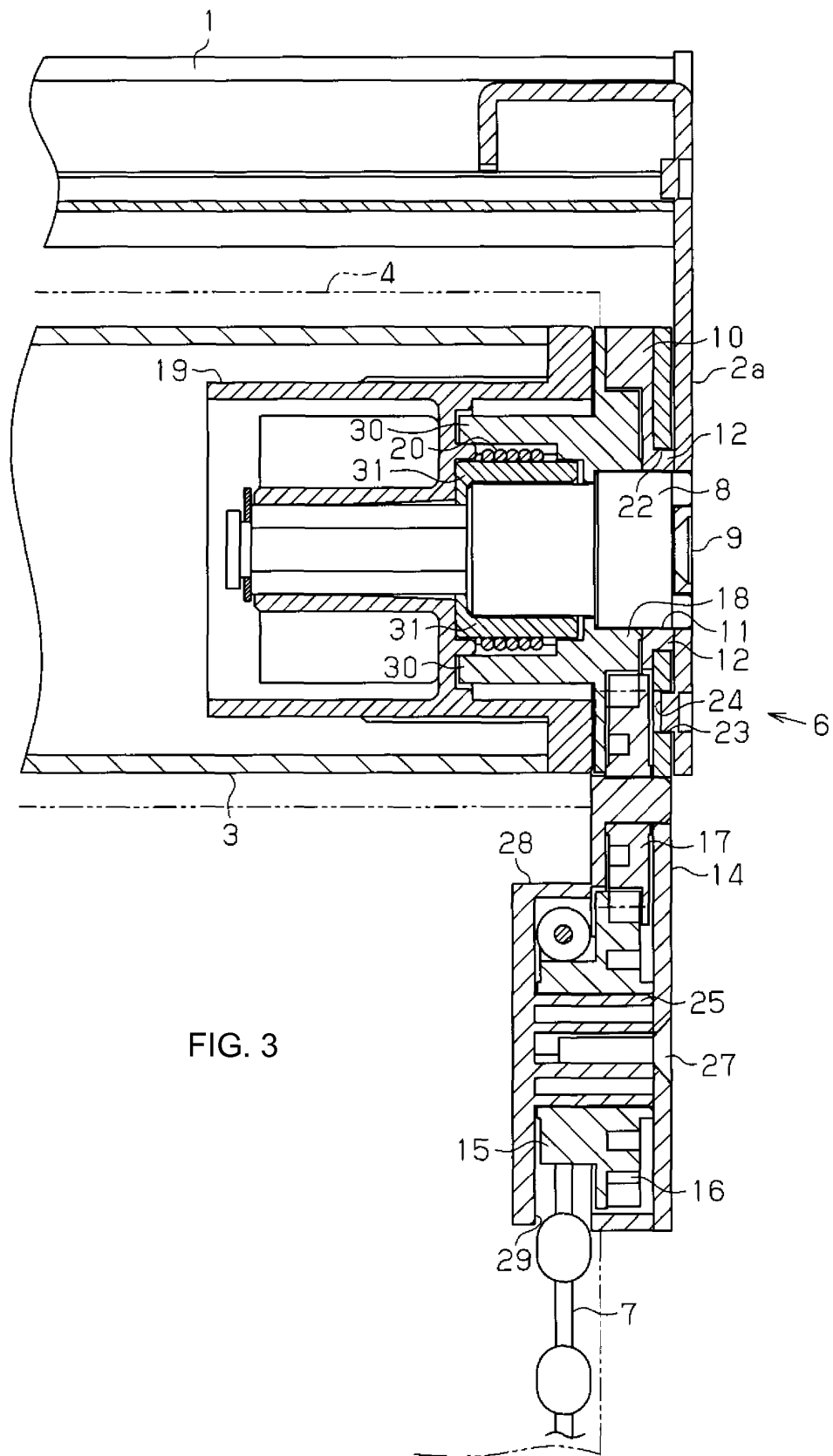


FIG. 2



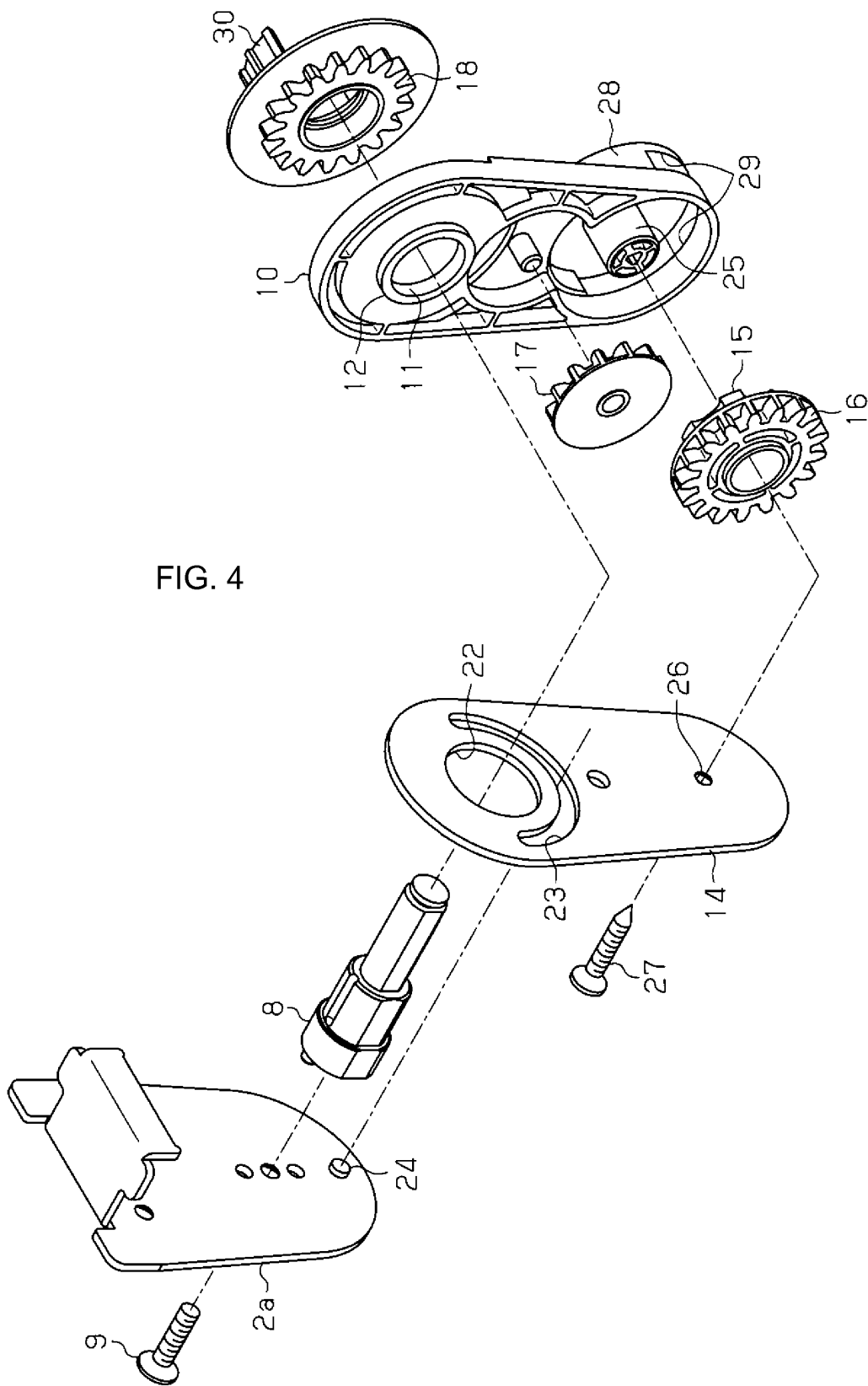


FIG. 5

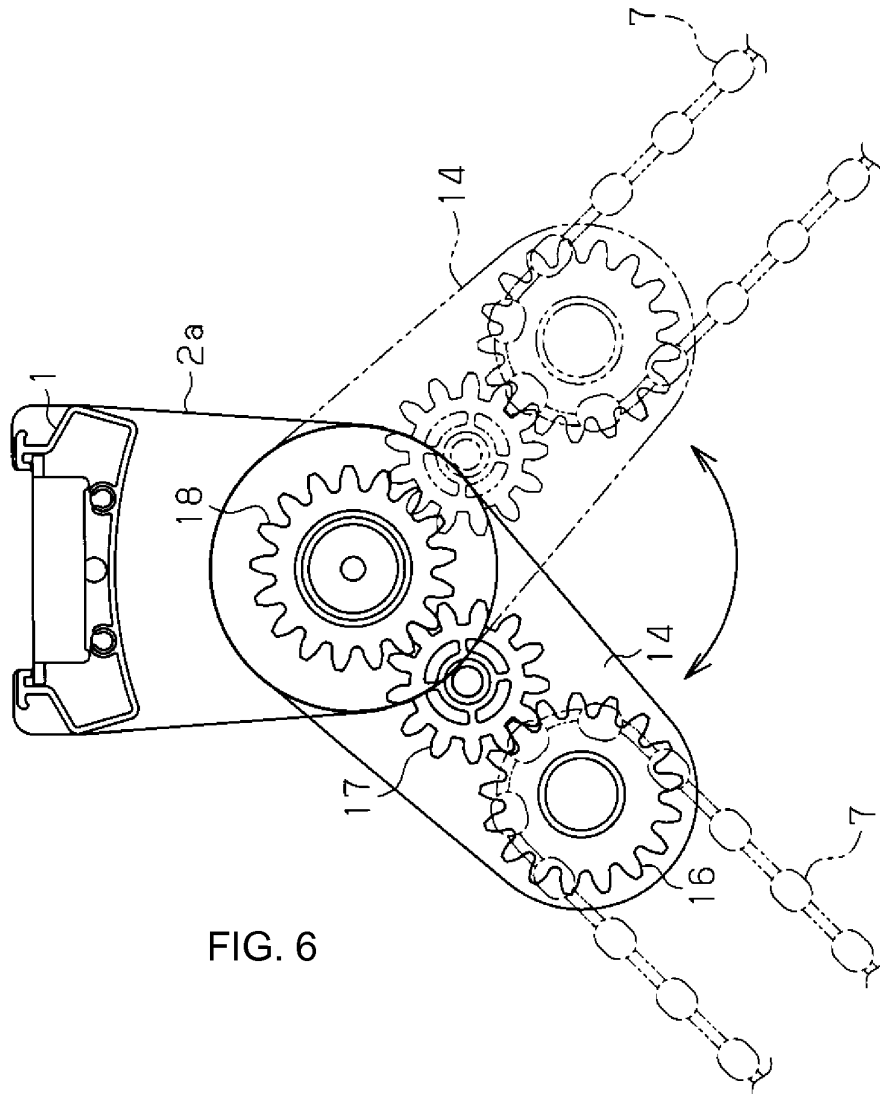
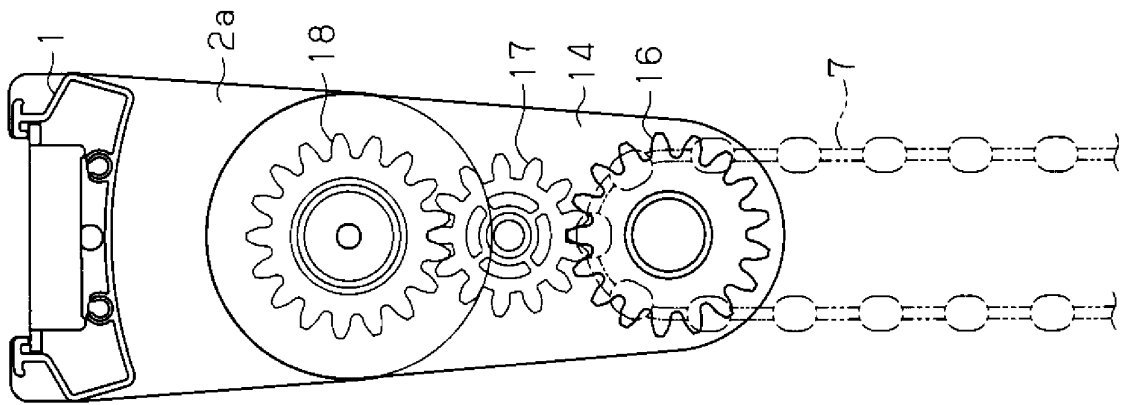
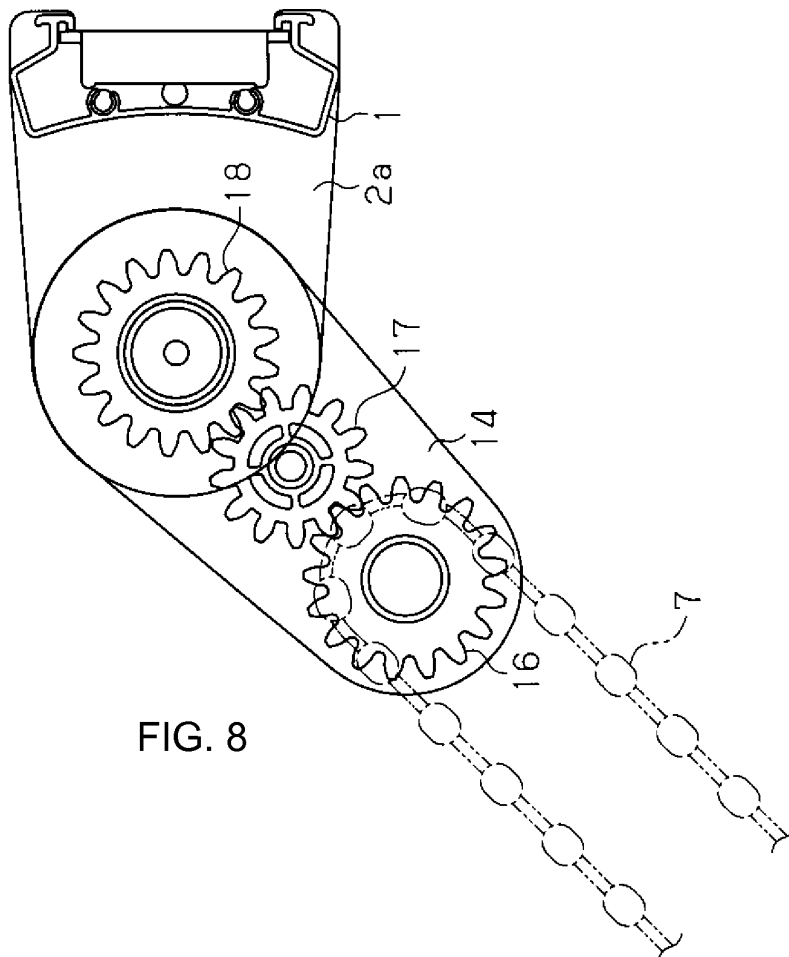
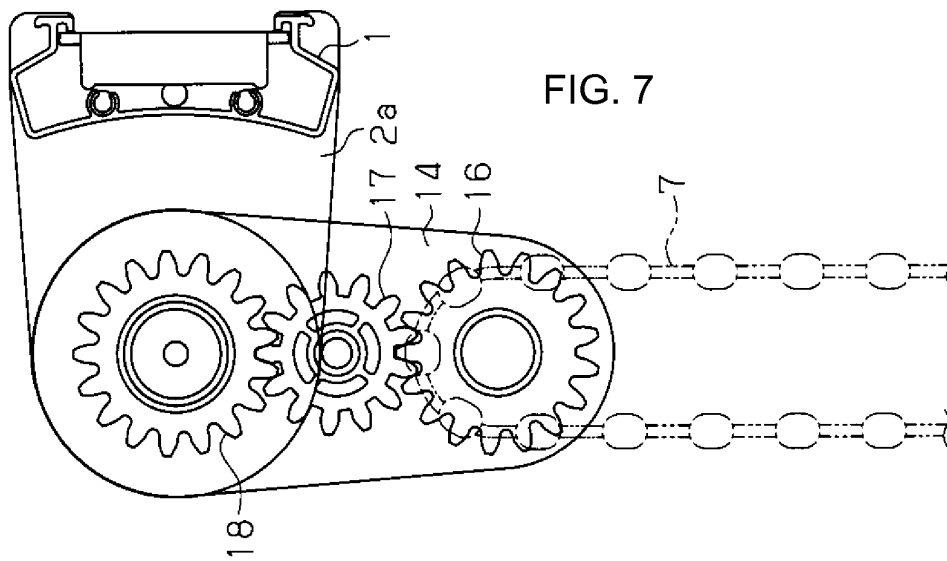


FIG. 6



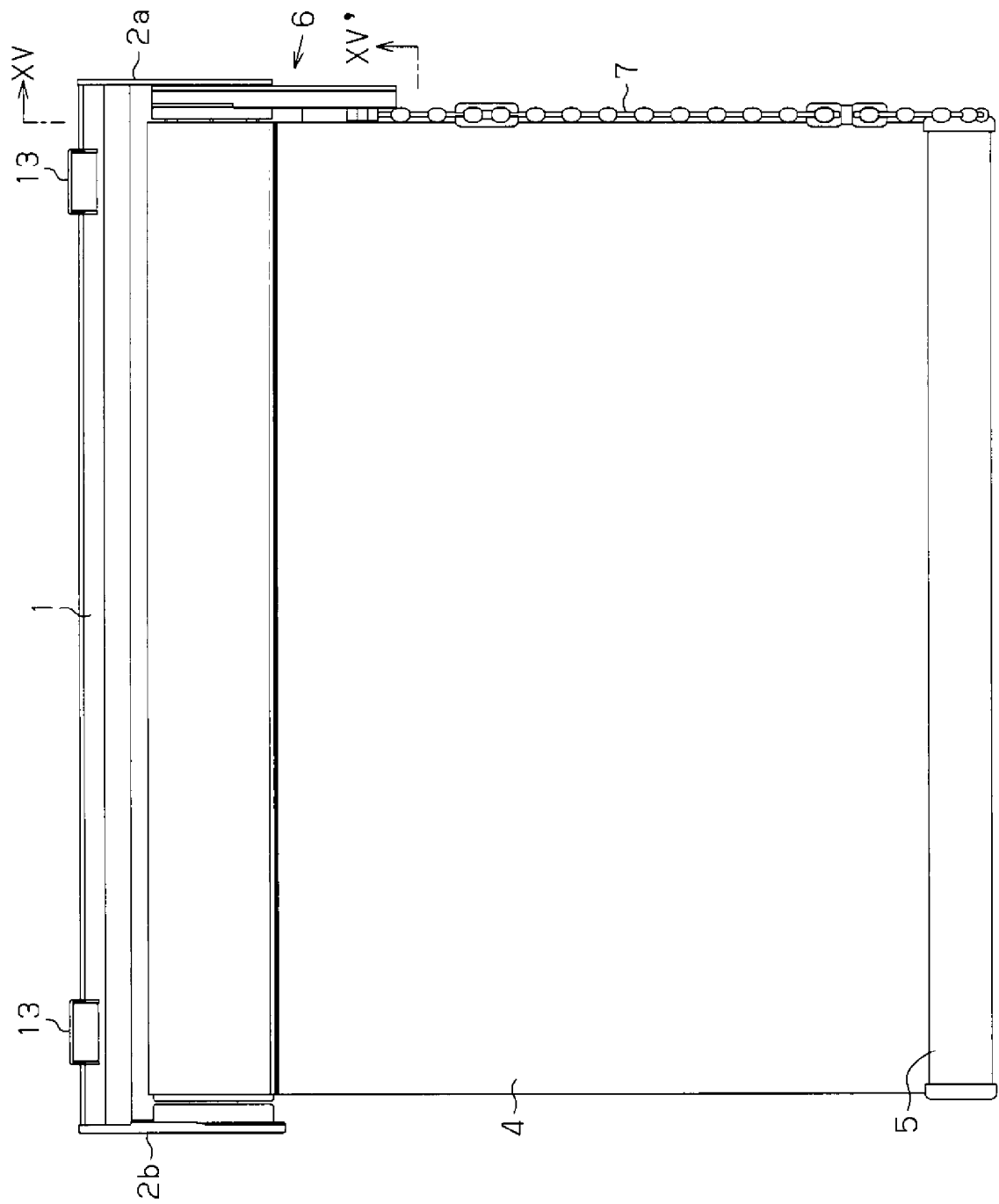


FIG. 9

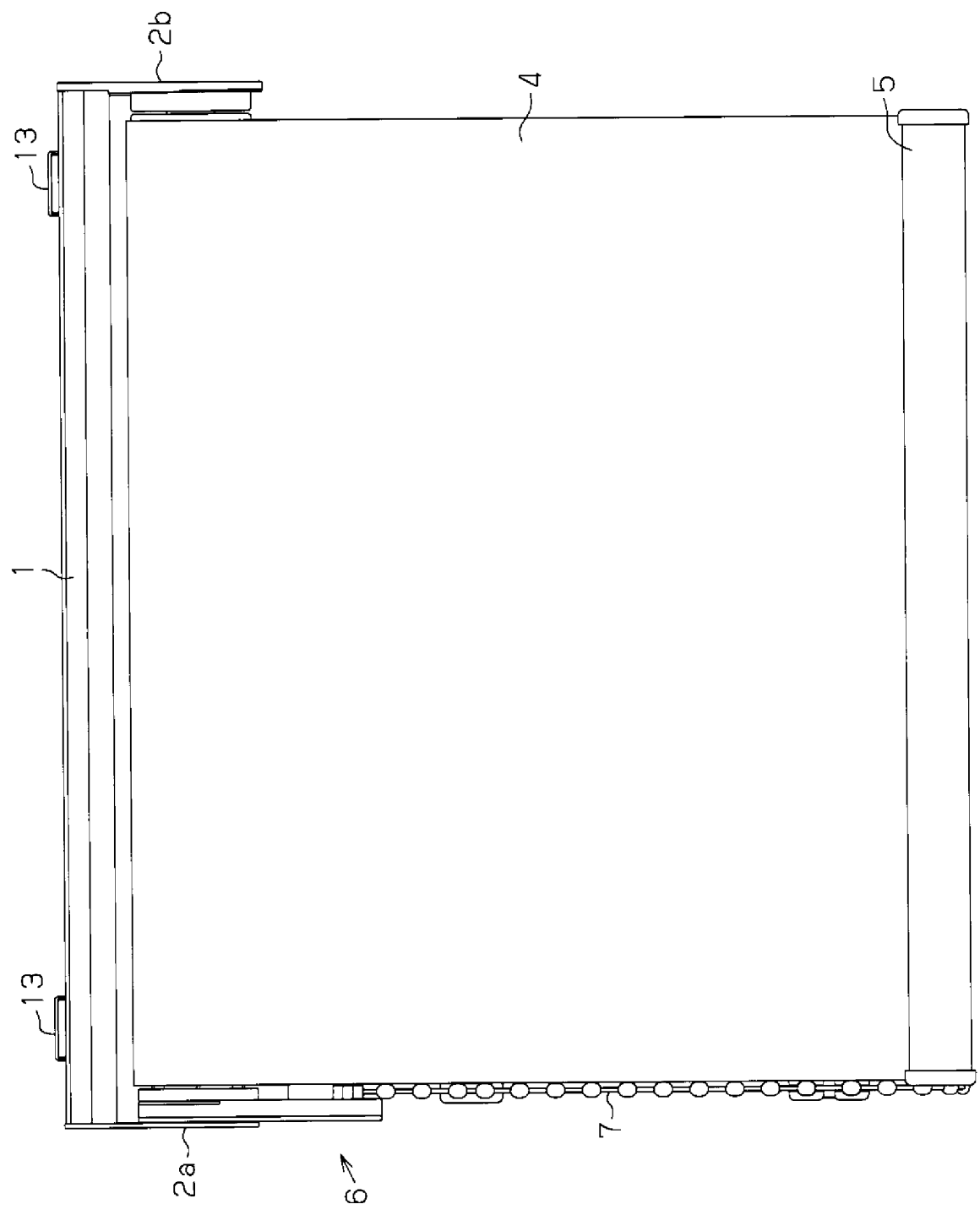


FIG. 10

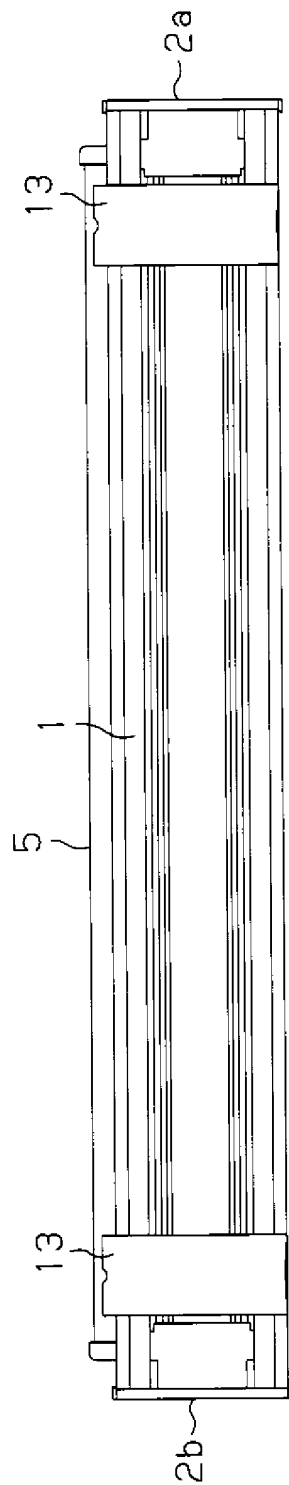


FIG. 11

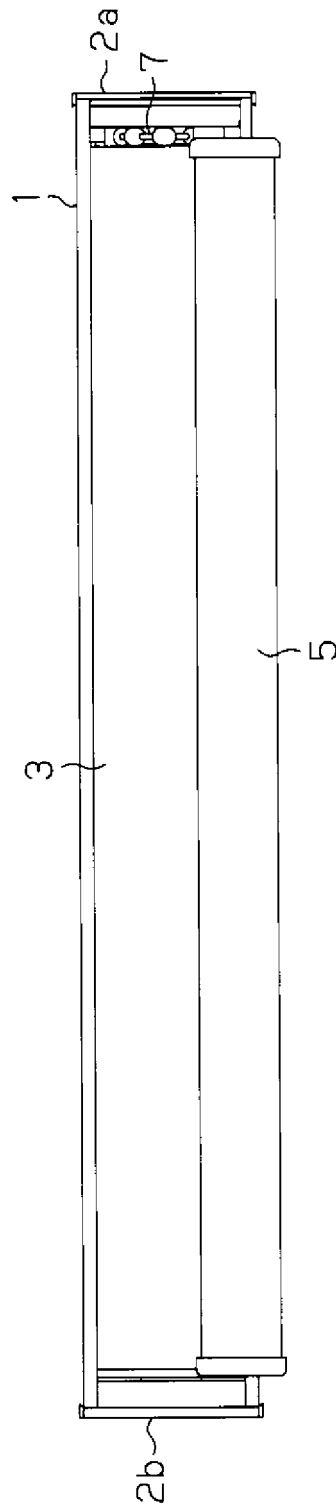
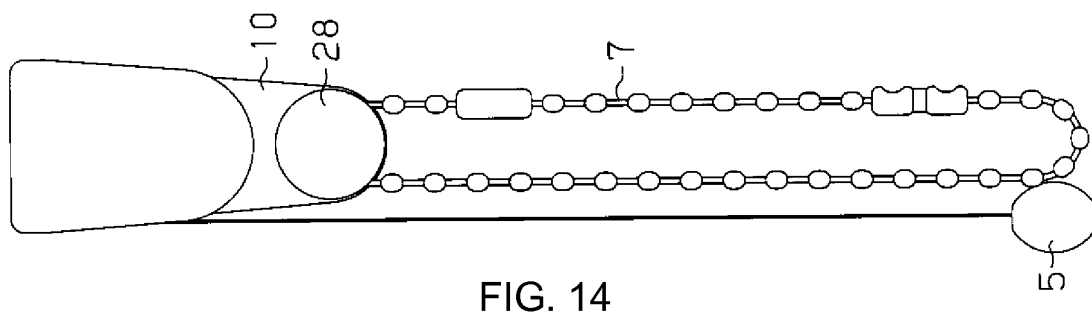
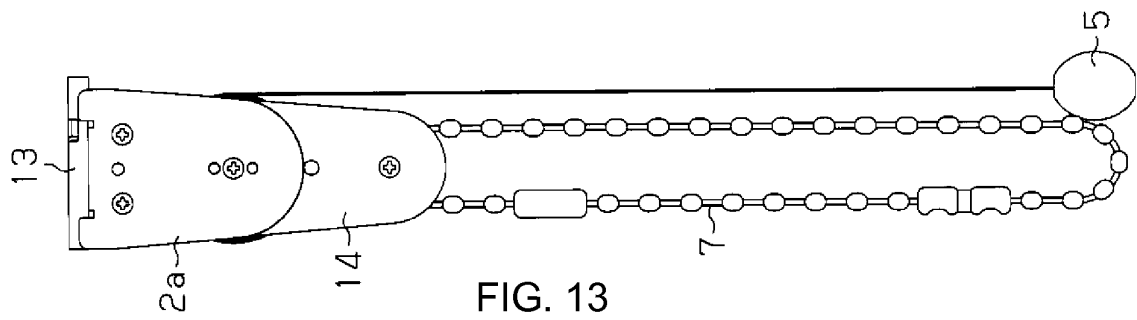


FIG. 12



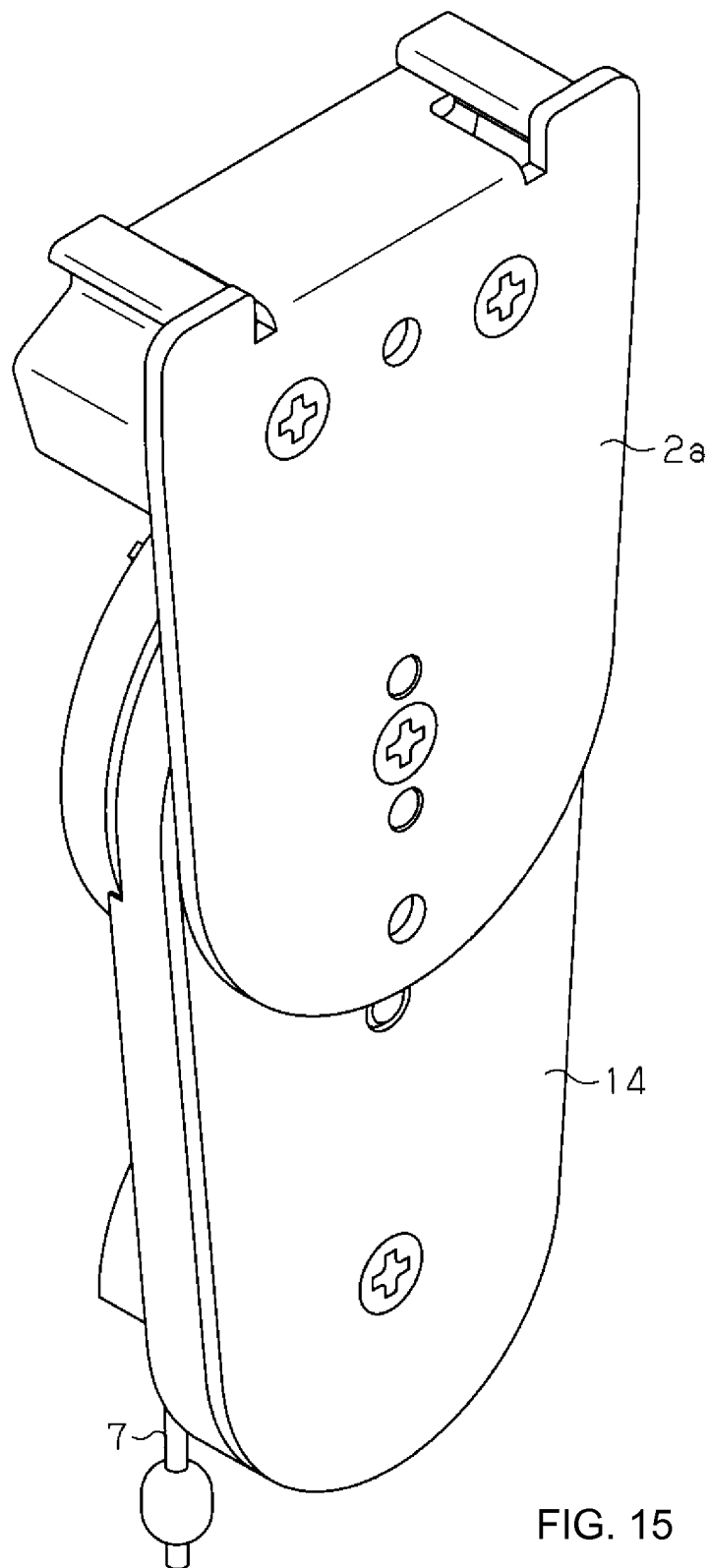


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/063081

A. CLASSIFICATION OF SUBJECT MATTER <i>E06B9/68</i> (2006.01) i, <i>E06B9/322</i> (2006.01) i, <i>E06B9/323</i> (2006.01) i, <i>E06B9/324</i> (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) <i>E06B9/68</i> , <i>E06B9/322</i> , <i>E06B9/323</i> , <i>E06B9/324</i> Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2012 Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012 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.
Y	JP 2010-31592 A (Tachikawa Corp.), 12 February 2010 (12.02.2010), entire text; all drawings (Family: none)	1-11
Y	JP 6-146753 A (Tachikawa Corp.), 27 May 1994 (27.05.1994), entire text; all drawings (Family: none)	1-11
☐ 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 06 June, 2012 (06.06.12)		Date of mailing of the international search report 19 June, 2012 (19.06.12)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010031592 A [0004]
- JP 2009138326 A [0004]
- JP 2994552 B [0004]
- JP 3181841 B [0004]