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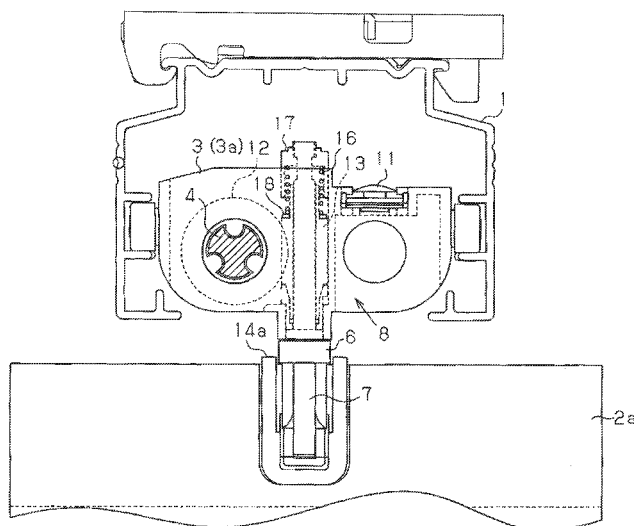
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(54) **BLIND, LONGITUDINAL BLIND, AND LATERAL BLIND**

(57) A plurality of runners (3) are capable of moving along a hanger rail (1). A first slat (2a) or a second slat (2b) is hung down from and supported by a hanging shaft (6) that is rotatably supported by the runner (3). A gear mechanism (8) transmits rotation of a tilt shaft (4) to each hanging shaft (6) to rotate the slat (2a, 2b). The gear ratio

of the gear mechanism (8) corresponding to the first slat (2a) is set to be different from the gear ratio of the gear mechanism (8) corresponding to the second slat (2b). Therefore, in the blind, the angle of the slats (2a, 2b) can be adjusted at different speeds and in conjunction with each other.

Fig.3



Description

TECHNICAL FIELD

[0001] The present invention relates to a blind that can adjust the angles of a plurality of slats at different speeds.

BACKGROUND OF THE INVENTION

[0002] A longitudinal blind has a hanger rail, a plurality of runners that are movable along the hanger rail, and a plurality of slats each of which is hung down from and supported by each runner. The slats are deployed and folded up along the hanger rail, and the angle of each slat is adjusted to adjust the amount of light that enters a room through the longitudinal blind. The material of the slats has a light blocking property.

[0003] A user rotates an operation rod (operation mechanism) or pulls an operation cord to adjust the angles of the slats at the same phase. Therefore, inside of the room is fully visible to the outside depending on the angles of the slats. Even if the light blocking slats and the semitransparent slats made, for example, of lace are alternately hung down from and supported, the slats cannot be adjusted such that only the semitransparent slats are deployed along the hanger rail seen from above. Therefore, even if slats made of different materials are hung down from and supported by the hanger rail, it is difficult to obtain conspicuous effects.

[0004] A longitudinal blind disclosed in Patent Document 1 supports a plurality of non-transparent louvers and a plurality of semitransparent louvers. The non-transparent louvers and the semitransparent louvers are arranged alternately one by one. The angle of the non-transparent louvers and the angle of the semitransparent louvers can be adjusted independently.

[0005] For example, the angle of only the semitransparent louvers can be adjusted such that only the semitransparent louvers extend along the hanger rail as viewed from above. The angle of the semitransparent louver can be adjusted to position the semitransparent louvers so as to be slanted with respect to the hanger rail. The angle of the non-transparent louvers can be adjusted to adjust the non-transparent louvers so as to extend vertically with respect to the hanger rail as viewed from above.

[0006] However, in the longitudinal blind disclosed in the above document, the angle of the semitransparent louvers and the angle of the non-transparent louvers cannot be adjusted simultaneously by a single manipulation of the operation mechanism. That is, the above document discloses one embodiment in which only the angle of the non-transparent louvers can be adjusted and another embodiment in which each of the angle of the non-transparent louvers and the angle of the semitransparent louvers is adjusted independently.

Patent Document 1: Japanese Patent No. 3281544

DISCLOSURE OF THE INVENTION

[0007] An objective of the present invention is to provide a blind in which the angles a plurality of slats can be adjusted at different speeds in an interlocking fashion,

[0008] In accordance with one aspect of the present invention, a blind having a frame and a plurality of slats that are rotatably supported by the frame is provided. The blind further has an operation mechanism that is provided to the frame and a drive force transmission mechanism that rotates each of the slats based on the operation of the operation mechanism. The slats include a first slat and a second slat. The drive force transmission mechanism has a speed charging mechanism that rotates the first slat and the second slat at different speeds.

[0009] Further, in accordance with another aspect of the present invention, a longitudinal blind having a hanger rail, a plurality of runners that are supported by the hanger rail is provided. Each of the runners is movable along the hanger rail. The longitudinal blind has a hanging shaft that is rotatably supported by each runner, a plurality of slats each of which is supported by and hung down from the hanging shaft, and a tilt shaft that extends through the runners. The longitudinal blind further has an operation mechanism that rotates the tilt shaft, a gear mechanism that is provided to each of the runners so as to transmit rotation of the tilt shaft to each of the hanging shafts and rotate the slats, and a torque transmission mechanism that transmits torque of the gear mechanism to the hanging shaft. A torque value that can be transmitted by the torque transmission mechanism is a predetermined value or less. The slats include a first slat and a second slat. Each of the first slat and the second slat has a different material. The gear ratio of the gear mechanism corresponding to the first slat is set to be different from the gear ratio of the gear mechanism corresponding to the second slat.

[0010] Further, in accordance with another aspect of the present invention, a lateral blind having a frame and a plurality of support mechanisms that are provided to the frame is provided. The lateral blind has a plurality of slats that are supported rotatably to the frame by each of the support mechanisms, and an operation mechanism that is provided to the frame so as to adjust the angle of each slat. The slats include a first slat and a second slat. The support mechanisms include a first support mechanism that supports the first slat and a second support mechanism that supports the second slat. The first support mechanism and the second support mechanism each have a drive force transmission mechanism. The driver force transmission mechanisms rotate the first slat and the second slat at different speeds based on an operation of the operation mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a front view showing a longitudinal blind according to a first embodiment of the present invention;

Fig. 2 is a side view of Fig. 1;

Fig. 3 is an enlarged view showing the vicinity of a runner shown in Fig. 2;

Fig. 4 is a plan view showing an operation when the rotational speed of a second slat hanger 14b is twice the rotational speed of a first slat hanger 14a;

Fig. 5 is a plan view showing an operation when the rotation is opposite to the that of Fig. 4;

Fig. 6 is a plan view showing an operation when the rotational speed of the second slat hanger 14b is 1.5 times the rotational speed of the first slat hanger 14a;

Fig. 7 is a plan view showing an operation when the rotational speed of the second slat hanger 14b is three times the rotational speed of the first slat hanger 14a;

Fig. 8 is a plan view showing an operation when the rotational speed of the second slat hanger 14b is four times the rotational speed of the first slat hanger 14a;

Figs. 9(a) to 9(e) are plan views showing the rotation operation of a slat hanger according to a second embodiment;

Fig. 10 is a perspective view showing a longitudinal blind according to a third embodiment;

Figs. 11(a) to 11(e) are plan views showing a rotation operation of the slat hanger shown in Fig. 10;

Fig. 12 is a front view showing a lateral blind according to a fourth embodiment;

Fig. 13 is a perspective view showing a drive belt that is accommodated in the side frame shown in Fig. 12;

Fig. 14 is an exploded perspective view showing 13 first support mechanism that rotatably supports the upper slat shown in Fig. 11;

Fig. 15 is a front view showing the first support mechanism shown in Fig. 14;

Fig. 16 is an exploded perspective view showing a second support mechanism that rotatably supports the lower slat shown in Fig. 11;

Fig. 17 is a front view showing the slide shaft shown in Fig. 16;

Fig. 18 is a front view showing the second drive gear shown in Fig. 16;

Fig. 19 is a side view showing the first support mechanism shown in Fig. 14 and the second support mechanism shown in Fig. 16;

Figs. 20(a) to 20(d) are side views showing operations of the lateral blind shown in Fig. 12;

Fig. 21 is a perspective view showing a modification of the lateral blind shown in Fig. 12;

Fig. 22 is a front view showing a slat angle adjusting mechanism of the lateral blind according to a fifth embodiment;

Fig. 23 is a right side view of Fig. 22;

Fig. 24 is a left side view of Fig. 22;

Fig. 25 is an enlarged view showing the slat angle adjusting mechanism shown in Fig. 23;

Fig. 26 is an enlarged view showing the slat angle adjusting mechanism shown in Fig. 24;

Figs. 27(a) to 27(e) are side views showing operations of the slat angle adjusting mechanism shown in Figs. 25 and 26;

Figs. 28(a) to 28(e) are side views showing operations in the opposite direction to those shown in Fig. 27;

Fig. 29 is a view showing a modification of a rotational speed adjusting mechanism;

Fig. 30 is a front view showing a longitudinal blind according to a sixth embodiment;

Fig. 31 is a plan view and a front view showing a first fully closed state of the longitudinal blind shown in Fig. 30;

Fig. 32 is a plan view and a front view showing a state where the longitudinal blind shown in Fig. 31 is rotated in the counterclockwise direction;

Fig. 33 is a plan view and a front view showing a state where the longitudinal blind is further rotated in the counterclockwise direction from the state shown in Fig. 32;

Fig. 34 is a plan view and a front view showing a state where the longitudinal blind is further rotated in the counterclockwise direction from the state shown in Fig. 33;

Fig. 35 is a plan view and a front view showing a second fully closed state;

Fig. 36 is a plan view and a front view showing a state where the longitudinal blind shown in Fig. 35 is rotated in the clockwise direction;

Fig. 37 is a plan view and a front view showing a state where the longitudinal blind is further rotated in the clockwise direction from the state shown in Fig. 36;

Fig. 38 is a plan view and a front view showing a state where the longitudinal blind is further rotated in the clockwise direction from the state shown in Fig. 37; and

Fig. 39 is a plan view and a front view showing a state where the longitudinal blind is returned to the first fully closed state.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Figs. 1 to 8 show a first embodiment of the present invention.

[0013] Figs. 1 and 2 show a longitudinal blind according to the first embodiment. The longitudinal blind has a hanger rail 1, a plurality of light blocking slats 2a, and a plurality of semitransparent slats 2b. The hanger rail 1 extending in a horizontal direction supports a plurality of runners 3 so as to be movable in a horizontal direction. Each of the light blocking slats 2a and the semitransparent slats 2b is hung down from one of the runners 3. The

light blocking slats 2a and the semitransparent slats 2b are arranged alternately one by one. The light blocking slats 2a and the semitransparent slats 2b extend downwardly from the hanger rail 1, which is a frame.

[0014] A material of the light blocking slat 2a, which is a first slat, has a light blocking property. A material of the semitransparent slat 2b, which is a second slat has semitransparency. The material of the semitransparent slat 2b is, for example, a lace material that allows a part of light to be transmitted.

[0015] A left end cap 5a is provided at a left end (first end) of the hanger rail 1 and a right end cap 5b is provided at a right end (second end) of the hanger rail 1.

[0016] As shown in Fig. 3, each runner 3 supports a hanging shaft 6 so as to be rotatable. Each hanging shaft 6 extends in a vertical direction and supports one of the light blocking slats 2a and the semitransparent slats 2b. A lower end of the hanging shaft 6 has a hook 7. Each of the first slat hanger 14a and a second slat hanger 14b is hooked on one of the hooks 7. As shown in Fig. 1, the light blocking slats 2a are hung down from the first slat hangers 14a, and the semitransparent slats 2b are hung down from the second slat hangers 14b.

[0017] As shown in Fig. 1, an operation cord 10 is hung down from the left end cap 5a. The operation cord 10 is arranged so as to go around within the hanger rail 1. Two ends of the operation cord 10 are attached to a lead runner 3a. The lead runner 3a is arranged, for example, closest to the left end cap 5a. The runners 3 are connected to each other by a spacer 11. Each spacer 11 determines a maximum separated distance between each pair of the runners 3.

[0018] Therefore, when the lead runner 3a is moved from the right end cap 5b to the left end cap 5a by pulling the operation cord 10, the runners following the lead runner 3a are pulled out in sequence. When the operation cord 10 is pulled in an opposite direction, the lead runner 3a moves from the left end cap 5a to the right end cap 5b such that the lead runner 3a pushes back the following runners. Accordingly, the light blocking slats 2a and the semitransparent slats 2b that are hung down from and supported by the runners 3 are pulled out along the hanger rail 1 or fold up in a space under the right end cap 5b.

[0019] The left end cap 5a supports a left end of a tilt shaft 4 rotatably and the right end cap 5b supports a right end (second end) of the tilt shaft 4 rotatably. The tilt shaft 4 extend through the runners 3 so as to support the runners 3. Three splines are formed on the tilt shaft 4. Each runner 3 accommodates a gear mechanism 8 that is engaged with the tilt shaft 4. Each gear mechanism 8 has a worm wheel 12 and a worm 13 that are engaged with each other. The tilt shaft 4 extends through an inner opening of the annular worm wheel 12. The spline of the tilt shaft 4 is engaged with a protrusion formed on an inner peripheral surface of the worm wheel 12. That is, the worm wheel 12 is integrally rotated with the tilt shaft 4. The worm 13 is formed in a cylindrical shape extending in a vertical direction.

[0020] The hanging shaft 6 extends through the inner opening of the worm 13 so as to be rotatable with respect to the worm 13. The upper end of the hanging shaft 6 is projected upwardly from the upper end of the worm 13. A spring receiver 17 is provided at the upper end of the hanging shaft 6. The spring receiver 17 is formed in a cup-shape so as to be open downwardly. The spring receiver 17 accommodates the upper end of a coil spring 16. The hanging shaft 6 extends through the coil spring 16 and the lower end of the coil spring 16 is supported by the upper end of the worm 13 through a washer 18.

[0021] The coil spring 16 presses the washer 18 against the worm 13 with respect to the spring receiver 17. As a result, torque of the worm 13 is transmitted to the hanging shaft 6 through the washer 18, the coil spring 16 and the spring receiver 17. That is, the coil spring 16 forms a torque transmission mechanism. The gear mechanism 8 forms a drive power transmission mechanism.

[0022] The maximum value (predetermined value) of torque that can be transmitted by the torque transmission mechanism is determined by the urging force of the coil spring 16, the friction coefficient of the coil spring 16 and the washer 18, and the friction coefficient of the washer 18 and the worm 13. When the semitransparent slat 2b contacts the light blocking slat 2a, for example, and the semitransparent slat 2b receives resistant force from the light blocking slat 2a, the coil spring 16 corresponding to the semitransparent slat 2b is allowed to slide with respect to the washer 18. The washer 18 is slidable with respect to the worm 13. That is, when the rotation of the semitransparent slat 2b is prevented, the worm 13 corresponding to the semitransparent slat 2b can be slidable with respect to the hanging shaft 6 while transmitting the torque to the hanging shaft 6. In other words, the worm 13 can spin with respect to the hanging shaft 6.

[0023] As shown in Fig. 1, an operation rod 9 is hung down from the left end of the hanger rail 1. The left end cap 5a accommodates a gear mechanism (not shown) that transmits rotation of the operation rod 9 to the rotation of the tilt shaft 4. Therefore, when the operation rod 9 is rotated, the tilt shaft 4 is rotated and each hanging shaft 6 is rotated through each corresponding gear mechanism 8. When each hanging shaft 6 is rotated, the light blocking slats 2a and the semitransparent slats 2b are rotated simultaneously. That is, the operation rod 9 forms an operation mechanism that operates the rotation of the light blocking slats 2a in conjunction with the rotation of the semitransparent slats 2b.

[0024] The gear ratio of the gear mechanism 8 corresponding to the light blocking slat 2a is determined to be different from the gear ratio of the gear mechanism 8 corresponding to the semitransparent slat 2b. In this embodiment, each gear ratio of the gear mechanism 8 is determined such that the rotation angle of the semitransparent slat 2b is twice the rotation angle of the light blocking slat 2a per rotation of the worm wheel 12. That is, the rotation speed of the semitransparent slats 2b is twice the rotation speed of the light blocking slats 2a. The gear

ratio of the gear mechanism 8 is determined by adjusting a helix angle and a lead angle defined by a tooth of the worm wheel 12 and a tooth of the worm 13. The gear mechanism 8 forms a speed changing mechanism.

[0025] Therefore, when the tilt shaft 4 is rotated, the light blocking slats 2a and the semitransparent slats 2b are rotated simultaneously. The rotation speed of the semitransparent slats 2b is twice the rotation speed of the light blocking slats 2a.

[0026] Next, an operation of the longitudinal blind will be explained.

[0027] In a state where the light blocking slats 2a and the semitransparent slats 2b are folded up under the right end cap 5b, when the operation cord 10 is operated, the lead runner 3a is pulled out along the hanger rail 1. When the operation cord 10 is further pulled, the runners 3 following the lead runner 3a are pulled out in sequence with a predetermined distance therebetween. After the lead runner 3a is pulled out to the left end cap 5a, the operation rod 9 is operated to rotate each light blocking slat 2a and each semitransparent slat 2b. When each light blocking slat 2a and each semitransparent slat 2b extend along the hanger rail 1 as viewed from above, the longitudinal blind is in a fully closed state as shown in Fig. 1. When seen from above, the state of each first slat hanger 14a is the same as the state of each light blocking slat 2a, and the state of each second slat hanger 14b is the same as the state of each semitransparent slat 2b.

[0028] Fig. 4 shows transition of the rotation angle of the first and second slat hangers 14a, 14b according to steps S1 to S10. Step S1 shows a first fully closed state of the first and second slat hangers 14a, 14b. Step S10 shows a second fully closed state of the first and second slat hangers 14a, 14b. In the first fully closed state, the second slat hanger 14b is positioned behind (on an upper side in Fig. 4) the first slat hanger 14a that is on a right side of the second slat hanger 14b. In the second fully closed state, the second slat hanger 14b is positioned in front of (on a lower side in Fig. 4) the first slat hanger 14a that is on a right side of the second slat hanger 14b. Steps S2 to S9 show states where the first and second slat hangers 14a, 14b are rotated by approximately 180 degrees from the first fully closed state to the second fully closed state.

[0029] Step S2 shows a state where the first slat hangers 14a are rotated in the counterclockwise direction by 40 degrees from the state of step S1. The second slat hanger 14b is rotated in the counterclockwise direction by approximately 80 degrees from the state of step S1.

[0030] Step S3 shows a state where the first slat hangers 14a are rotated in the counterclockwise direction by 5 degrees from the state of step S2. Step S4 shows a state where the first slat hangers 14a are further rotated in the counterclockwise direction by 5 degrees from the state of step S3, and step S5 shows a state where the first slat hangers 14a are further rotated in the counterclockwise direction by 5 degrees from the state of step S4. In step S5, two ends of the second slat hanger 14b

contact each of the adjacent first slat hangers 14a. In other words, when the first slat hangers 14a are rotated in the counterclockwise direction by 95 degrees from the first fully closed state and the second slat hanger 14b is rotated in the counterclockwise direction by 55 degrees from the first fully closed state, the first slat hangers 14a and the second slat hanger 14b contact each other. That is, in step S5, each of the two ends of the semitransparent slat 2b contacts corresponding one of the adjacent light blocking slats 2a.

[0031] In steps S5 to S9, each of the two ends of the second slat hanger 14b continuously contact corresponding one of the adjacent first slat hangers 14a. That is, in steps S5 to S9, the second slat hanger 14b is restricted by the first slat hangers 14a and continuously rotated. In other words, the rotation speed of the second slat hanger 14b in steps S5 to S9 is lower than the rotation speed of the second slat hanger 14b in steps S1 to S4. The first slat hangers 14a in steps S5 to S9 receive resistance force from the second slat hanger 14b and are continuously rotated. Then, as shown in step S10, the first and second, slat hangers 14a, 14b are in the second fully closed state.

[0032] Fig. 5 shows a rotation that is opposite to that in Fig. 4. That is, Fig. 5 shows transition of the first and second slat hangers 14a, 14b when the first and second slat hangers 14a, 14b are rotated in the clockwise direction according to steps S10 to S1 in Fig. 4. The first and second slat hangers 14a, 14b in Fig. 5 are operated in the same manner as in Fig. 4 except for the rotation, direction.

[0033] Steps S11 to S21 in Fig. 6 show a case where the gear ratio of each gear mechanism 8 is determined such that the rotation speed of the second slat hanger 14b is 1.5 times the rotation speed of the first slat hangers 14a. Step S11 shows the first fully closed state, and step S21 shows the second fully closed state.

[0034] In the case of Fig. 6 (1.5 times), the difference between the rotation speed of the first slat hangers 14a and the rotation speed of the second slat hanger 14b is smaller compared to the case of Fig. 4 (twice). The second slat hanger 14b does not contact the first slat hangers 14a in steps S11 to S18. The second slat hanger 14b contacts the first slat hangers 14a in steps S19 to S20. That is, the first and second slat hangers 14a, 14b are continuously rotated under mutual restriction in steps S19 to S20.

[0035] Steps S31 to S40 in Fig. 7 show a case where the gear ratio of each gear mechanism 8 is determined such that the rotation speed of the second slat hanger 14b is triple the rotation speed of the first slat hanger 14a. Step S31 shows the first fully closed state, and step S40 shows the second fully closed state. In step S33, the first slat hangers 14a are rotated in the counterclockwise direction by 30 degrees from the first fully closed state and contact the second slat hanger 14b. In steps S33 to S39, the first and second slat hangers 14a, 14b are continuously rotated under mutual restriction.

[0036] Steps S41 to S50 in Fig. 8 show a case where the gear ratio of each gear mechanism 8 is determined such that the rotation speed of the second slat hanger 14b is four times the rotation speed of the first slat hangers 14a. Step S41 shows the first fully closed state, and step S50 shows the second fully closed state. In step S42, the first slat hangers 14a are rotated in the counterclockwise direction by 20 degrees from the first fully closed state and contact the second slat hanger 14b. In steps S42 to S49, the first and second slat hangers 14a, 14b are continuously rotated under mutual restriction.

[0037] The first embodiment has the following advantages.

(1) While the light blocking slats 2a and the semitransparent slats 2b are rotated by approximately 180 degrees from the first fully closed state to be in the second fully closed state, the light blocking slats 2a having a light blocking property and the semitransparent slats 2b made of a lace material are rotated in a different phase and in conjunction with each other.

(2) The rotation speed of the semitransparent slats 2b that are separated from each other is set to be greater than the rotation speed of the light blocking slats 2a by adjusting the gear ratio of each gear mechanism 8. After the second slat hangers 14b contact the first slat hangers 14a, the light blocking slats 2a and the semitransparent slats 2b are rotated while maintaining the contacted state of the first and second slat hangers 14a, 14b. Therefore, the semitransparent slats 2b closely contact the light blocking slats 2a in an early stage by increasing the difference of the rotation speed.

(3) The light blocking slats 2a and the semitransparent slats 2b are rotated in conjunction with each other while the two ends of the semitransparent slat 2b closely contact corresponding one of the adjacent light blocking slats 2a. That is, the light blocking slats 2a and the semitransparent slats 2b are rotated while the semitransparent slats 2b having the lace material cover a space between the two light blocking slats 2a having a light blocking property. Therefore, lighting amount of gentle light through the lace material is adjusted.

(4) The angle of the light blocking slats 2a and the angle of the semitransparent slats 2b are adjusted while the semitransparent slat 2b having the lace material covers a space between the two light blocking slats 2a having a light blocking property. Therefore, a longitudinal blind having a new appearance is obtained.

(5) The angle of the light blocking slats 2a and the semitransparent slats 2b are simultaneously adjust-

ed only by operating the operation rod 9. In other words, the angle of the light blocking slats 2a and the semitransparent slat 2b are adjusted in conjunction with each other only by rotating the operation rod 9.

(6) The difference between the gear ratio of the gear mechanism 8 corresponding to the light blocking slats 2a and the gear ratio of the gear mechanism 8 corresponding to the semitransparent slats 2b is increased by adjusting the gear ratio of each gear mechanism 8. As a result, the rotation range of the light blocking slats 2a and the rotation range of the semitransparent slats 2b are enlarged when each of the two ends of the semitransparent slats 2b closely contacts corresponding one of the adjacent light blocking slats 2a.

[0038] Next, Figs. 9(a) to 9(e) show a second embodiment of the present invention. Fig. 9(a) shows a first fully closed state, and Fig. 9(e) shows a second fully closed state. As shown in Figs. 9(b) to 9(d), when the first and second slat hangers 14a, 14b are rotated, the distance between a rotation center (hanging shaft 6) of the first slat hanger 14a and a rotation center (hanging shaft 6) of the second slat hanger 14b is set to be greater than half the size of each first and second slat hanger 14a, 14b as viewed from above. As a result, the second slat hanger 14b is capable of rotating by 180 degrees or more. In other words, in the second embodiment, the size of each first and second slat hanger 14a, 14b as viewed from above is set to be smaller than the size in the first embodiment. The rotation speed of the second slat hanger 14b is set to be twice the rotation speed of the first slat hanger 14a. Alternate long and short dash lines L shown in Figs. 9(a) to 9(e) shows an extending direction of the hanger rail 1.

[0039] When the first and second slat hangers 14a, 14b are rotated in the counterclockwise direction from the first fully closed state shown in Fig. 9(a), the first and second slat hangers 14a, 14b are moved from the state of a reversed N-shape to the state of a V-shape shown in Fig. 9(c) and moved to the state shown in Fig. 9(d). In the state shown in Fig. 9(d), light enters a room through the semitransparent slat 2b between the two light blocking slats 2a. In the state shown in Fig. 9(b), the distance between the rotation center of the first slat hanger 14a and the rotation center of the second slat hanger 14b is greater than the state shown in Fig. 9(a).

[0040] While the first and second slat hangers 14a, 14b are moved from the state shown in Fig. 9(b) to the state shown in Fig. 9(d), the second slat hanger 14b is rotated over the alternate long and short dash lines L without contacting the first slat hanger 14a. Accordingly, the rotation of the second slat hangers 14b is not restricted from the state shown in Fig. 9(a) to the state shown in Fig. 9(d). The first slat hangers 14a shown in Fig. 9(d) are rotated by 90 degrees or more from the state shown

in Fig. 9(a) and the second slat hangers 14b are rotated by 180 degrees or more from the state shown in Fig. 9(a).

[0041] When the first and second slat hangers 14a, 14b are further rotated in the counterclockwise direction from the state shown in Fig. 9(d), the second slat hangers 14b contact the first slat hangers 14a and continuously rotated under restriction of the first slat hangers 14a. By the time that the first slat hangers 14a are rotated to be in the second fully closed state as shown in Fig. 9(e), the second slat hangers 14b are pushed back by the first slat hangers 14a and rotated in the counterclockwise direction to be in the second fully closed state. In other words, the second slat hangers 14b shown in Fig. 9(e) are parallel to the first slat hangers 14a.

[0042] Therefore, in the second embodiment, the semitransparent slats 2b made of a lace material cover a space between the light blocking slats 2a having a light blocking property and the angle of the light blocking slats 2a and the angle of the semitransparent slats 2b can be adjusted respectively. In the second embodiment, even if the semitransparent slats 2b are rotated over the state where the semitransparent slats 2b extend along the hanger rail 1, the semitransparent slats 2b are returned to be in the second fully closed state. In other words, the adjustment of the angle is completed such that the light blocking slats 2a and the semitransparent slats 2b are parallel to each other and along the hanger rail 1.

[0043] Next, Figs. 10 and 11 show a third embodiment of the present invention. In the third embodiment, as viewed from above, two contact pieces 15 that are projected from the two ends of the second slat hangers 14b are provided. That is, the size of the second slat hangers 14b are extended horizontally by the contact pieces 15. The rotation speed of the second slat hangers 14b is set to be twice the rotation speed of the first slat hangers 14a. The two ends of the second slat hangers 14b are outer end portions of the second slat hangers 14b with respect to the hanging shaft 6.

[0044] As shown in Figs. 11(a) to 11(e), the first and second slat hangers 14a, 14b are rotated in the counterclockwise direction. In a state where the first and second slat hangers 14a, 14b are in a V-shape as shown in Fig. 11(c), the contact pieces 15 contact the first slat hangers 14a. Thereafter, the second slat hangers 14b are rotated under restriction of the first slat hangers 14a.

[0045] Therefore, the second slat hangers 14b reliably contact the first slat hangers 14a by the contact pieces 15. Accordingly, the second slat hangers 14b are rotated in conjunction with the first slat hangers 14a.

[0046] Next, Figs. 12 to 21 show a fourth embodiment of the present invention. Fig. 12 shows a lateral blind according to the fourth embodiment. The lateral blind has a right side frame 21a, a left side frame 21b, a plurality of upper slats 22a and a plurality of lower slats 22b. The right side frame 21a and the left side frame 21b extend in an up-and-down direction and the upper slats 22a and the lower slats 22b extend in a horizontal direction. The right side frame 21a has a plurality of first support mechanisms 27 and a plurality of second support mechanisms

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[0047] As shown in Fig. 12, the right side frame 21a and the left side frame 21b according to the fourth embodiment form a part of a square frame that supports the two ends of the upper slats 22a and the two ends of the lower slats 22b at the rotation speed.

[0048] The upper slats 22a, which are first slats, are arranged in an upper half of the frame (upper portion) and the lower slats 22b, which are second slats, are arranged in a lower half of the frame (lower portion).

[0049] The upper slats 22a and the lower slats 22b are formed of aluminum thin plates. A plurality of small openings are formed in the upper slats 22a. That is, light partially passes through the upper slats 22a.

[0050] Figs. 14 and 15 show one of the first support mechanisms 27 that are arranged at the right side frame 21a. Each first support mechanism 27 supports the upper slat 22a rotatably with respect to the right side frame 21a. A plurality of first support mechanisms 27 are arranged at the left side frame 21b. The first support mechanisms 27 at the left side frame 21b are the same as the first support mechanisms 27 at the right side frame 21a. Therefore, the first support mechanisms 27 at the right side frame 21a will be explained.

[0051] The right side frame 21a has a right facing piece 21c and a right outer piece 21d that is extended vertically and outwardly from the right facing piece 21c. The right facing piece 21c and the right outer piece 21d are formed in an L-shape. Similarly, the left side frame 21b is formed in an L-shape having a left facing piece and a left outer piece. The right facing piece 21c and the left facing piece face each other. Each right facing piece 21c has a plurality of support openings 28. A slide shaft 29 is inserted through each support opening 28. A peripheral surface of the right facing piece 21c supports the slide shaft 29 rotatably and allows axial movement of the slide shaft 29.

[0052] Each slide shaft 29 has a slat receiving portion 30, a flange 33, and an insertion portion 29a. The flange 33 is positioned between the slat receiving portion 30 and the insertion portion 29a. The insertion portion 29a is inserted through the support opening 28. The insertion portion 29a, has an engagement groove 29b that extends in an axial direction. The slat receiving portion 30 is formed in a flat plate and an engagement projection 31 is formed at a center of the slat receiving portion 30. An engagement opening 32 is formed at a right end of the upper slat 22a. The engagement projection 31 is fitted to the engagement opening 32 such that the slide shaft 29 supports the right end of the upper slat 22a.

[0053] As shown in Fig. 14, the insertion portion 29a is inserted through a washer 34, a first sprocket 35, a friction washer 36, a coil spring 37 and a rotation restriction piece 38 and a clip 39 is fitted to a distal end of the insertion portion 29a. The clip 39 prevents the rotation restriction piece 38 from being dropped off the slide shaft 29. That is, the right facing piece 21c, the washer 34, the first sprocket 35, the friction washer 36, the coil spring

37 and the rotation restriction piece 38 are provided between the flange 33 and the clip 39 in this order.

[0054] The friction washer 36 and the rotation restriction piece 38 have an engagement member that is engaged to the engagement groove 29b and are rotated integrally with the slide shaft 29. The coil spring 37 urges the friction washer 36 toward the first sprocket 35. Therefore, the rotation of the first sprocket 35 is transmitted to the friction washer 36 by a friction force caused between the surface of the first sprocket 35 and the surface of the friction washer 36. That is, the rotation of the first sprocket 35 rotates the slide shaft 29. The first sprocket 35 forms a part of a drive force transmission mechanism. When the rotation restriction piece 38 is engaged to the right outer piece 21d so as to restrict the rotation of the slide shaft 29, the first sprocket 35 spins with respect to the friction washer 36.

[0055] The rotation restriction piece 38 is formed like a home base (pentagon) and determines a rotation area of the slide shaft 29 that is approximately 180 degrees. Any side edge of the rotation restriction piece 38 contacts the right outer piece 21d to restrict the rotation of the slide shaft 29. As a result, the rotation area of the upper slat 22a is also approximately 180 degrees. That is, the upper slat 22a is rotatable from the first fully closed state where the upper slat 22a extends in an up-and-down direction as shown in Fig. 20(a) to the second fully closed state where the upper slat 22a is reversed from the first fully closed state as shown in Fig. 20(d).

[0056] The lower end of the right side frame 21a rotatably supports a first drive gear 24 shown in Fig. 13, and the upper end of the right side frame 21a rotatably supports a following gear 25. An endless drive belt 23 is provided over the first drive gear 24 and the following gear 25. The drive belt 23 is accommodated in right side frame 21a. The drive belt 23 has a plurality of engagement openings 26 at equal intervals so as to be engaged to the first drive gear 24 and the following gear 25.

[0057] The lateral blind has the operation rod 9 shown in Fig. 1 or the operation mechanism (not shown in Fig. 12) such as the operation cord 10. A user operates the operation mechanism to rotate the first drive gear 24. The left side frame 21b accommodates the first drive gear 24, the following gear 25 and the drive belt 23, similarly. For example, the operation rod 9 rotates the first drive gear 24 in the right side frame 21a and the first drive gear 24 in the left side frame 21b synchronously at the same speed. As a result, the drive belts 23 at the right and left sides are driven synchronously. The drive belt 23 is provided around the first sprocket 35. When the drive belt 23 is driven, the first sprocket 35 is rotated. This rotates the upper slats 22a.

[0058] Figs. 16 to 18 show a second support mechanism 40. The second support mechanism 40 supports a lower slats 22b rotatably with respect to the right, side frame 21a.

[0059] As shown in Fig. 16, the second support mechanism 40 has the slide shaft 29, the friction washer 36,

the coil spring 37, the rotation restriction piece 38 and the clip 39 similar to the first support mechanism 27. The second support mechanism 40 has a support cylinder 41 and a transmission gear 42 instead of the washer 34 and the first sprocket 35. Further, the second support mechanism 40 has a gear shaft 43, a second sprocket 44 and a second drive gear 45. The gear shaft 43 is integrally formed with the second sprocket 44 and the second drive gear 45.

[0060] As shown in Fig. 16, the right facing piece 21c has a second support opening 47 in adjacent to each support opening 28. A peripheral surface of the right facing piece 21c rotatably supports the gear shaft 43 that is inserted through the second support opening 47. As shown in Fig. 18, the drive belt 23 is meshed with the second sprocket 44.

[0061] A slat receiving portion 30 of the slide shaft 29 supports an end portion of the lower slat 22b. The right facing piece 21c, the support cylinder 41, the transmission gear 42, the friction washer 36, the coil spring 37, and the rotation restriction piece 38 are arranged between the flange 33 and the clip 39 of the second support mechanism 40 in this order. The support cylinder 41 has a cylinder portion 41a and a flange 41b that is formed at an end portion of the cylinder portion 41a. The flange 41b contacts the right facing piece 21c. The transmission gear 42 is arranged between the cylinder portion 41a and the friction washer 36. The second drive gear 45 is meshed with the transmission gear 42.

[0062] The transmission gear 42 is rotatable with respect to the slide shaft 29. The coil spring 37 urges the friction washer 36 against the transmission gear 42. A surface of the transmission gear 42 is frictionally engaged with a surface of the friction washer 36.

[0063] When the drive belt 23 is rotated, the gear shaft 43 is rotated. The rotation of the gear shaft 43 is transmitted from the second drive gear 45 to the transmission gear 42. The rotation of the transmission gear 42 is transmitted to the friction washer 36 through the frictional engagement. The friction washer 36 is rotated integrally with the slide shaft 29. This rotates the lower slat 22b. The second sprocket 44 and the second drive gear 45 form a drive force transmission mechanism.

[0064] The ratio of the number of the teeth of the second sprocket 44 and the number of the teeth of the first sprocket 35 is set to be 1:2.5. The ratio of the number of the teeth of the transmission gear 42 and the number of the teeth of the second drive gear 45 is set to be 1:0.6. Therefore, the rotation speed of the slide shaft 29 of the second support mechanism 40 is 1.5 times the rotation speed of the slide shaft 29 of the first support mechanism 27. That is, the first sprocket 35, the second sprocket 44 and the second drive gear 45 form a part of a speed changing mechanism. The drive belt 23 that is rotated in the right side frame 21a rotates the upper slat 22a and the lower slat 22b at a different rotation speed.

[0065] With reference to Figs. 20(a) to 20(d), an operation of the lateral blind will be explained.

[0066] Fig. 20(a) shows a first fully closed state, and Fig. 20(d) shows a second fully closed state. As shown in Fig. 20(a), the upper slats 22a and the lower slats 2b in the first fully closed state are extended in an up-and-down direction seen from the side. Each upper slat 22a in the first fully closed state is positioned behind (at the right side in Fig. 20(a)) each lower slat 22b. When a user operates the operation rod 9, the drive belt 23 is rotated and this rotates the upper slats 22a and the lower slats 22b.

[0067] According to the setting of the teeth number ratio (gear ratio) of the first support mechanism 27 and the second support mechanism 40, the lower slats 22b are rotated at a speed 1.5 times the upper slats 22a. Therefore, as shown in Fig. 20(c), the lower slats 22b enter the second fully closed state earlier. That is, the lower half of the lateral blind shown in Fig. 20(c) prevents the outer light from entering the room and covers the inside of a room and the upper half of the lateral blind adjusts the lighting amount.

[0068] When the lower slats 22b are in the second fully closed state, the rotation restriction piece 38 of the second support mechanism restricts the rotation of the lower slats 22b. Therefore, the transmission gear 42 spins with respect to the friction washer 36.

[0069] As a result, in the case of Fig. 20(c), only the upper slats 22a are continuously rotated by the drive belt 23. Accordingly, the upper slats 22a enter the second fully closed state as shown in fig. 20(d). When the operation rod 9 is rotated in a reverse direction, the upper slats 22a and the lower slats 22b in the second fully closed state are rotated from the state shown in Fig. 20(d) to the state shown in Fig. 20(a). First, the lower slats 22b become in the first fully closed state, and then the upper slats 22a enter the first fully closed state.

[0070] The fourth embodiment has the following advantages.

(4-1) The upper slats 22a, which are positioned in the upper half of the blind, and the lower slats 22b, which are positioned in the lower half of the blind, are rotated at different speeds.

(4-2) The lower slats 22b are rotated at a higher speed than the upper slats 22a. Therefore, only by operating the operation rod 9, the outer light enters from the upper half of the blind while the outer light is prevented from entering the room from the lower half of the blind,

(4-3) A plurality of small openings are formed in the upper slats 22a. Therefore, even if the upper half of the blind is a fully closed state, the outer light enters partially from the upper half of the blind.

[0071] Figs. 22 to 28 show a fifth embodiment of the present invention. A lateral blind according to the fifth embodiment has a head box 51, a plurality of upper slats

53a, and a plurality of lower slats 53b. Each of the head box 51, the upper slats 53a and the lower slats 53b is formed in an elongated shape so as to extend in a left-and-right direction. The head box 51 forms a frame that rotatably supports the upper slats 53a and the lower slats 53b.

[0072] Figs. 22 to 24 show an end portion of the head box 51. At least two ends of the head box 51 each accommodate a cord hanging mechanism 56. The lateral blind has a drive shaft 58 that is inserted through a small drum 57a, a large drum 57b and a winding cylinder 62 so as not to be rotatable relatively. That is, the small drum 57a, the large drum 57b and the winding cylinder 62 are rotated integrally with the drive shaft 58. The large drum 57b, the small drum 57a and the winding cylinder 62 are aligned along the drive shaft 58. The diameter of the large drum 57b is greater than that of the small drum 57a. The small drum 57a and the large drum 57b form a rotation speed adjustment mechanism.

[0073] A small hanging ring 59a is engaged to an outer peripheral surface of the small drum 57a, which is a first drum. A large hanging ring 59b is engaged to an outer peripheral surface of the large drum 57b, which is a second drum. Each of the small hanging ring 59a and the large hanging ring 59b is formed by a twisted coil spring.

[0074] An upper end of a first ladder cord 52a is attached to the small hanging ring 59a. An upper end of a second ladder cord 52b is attached to the large hanging ring 59b. The first ladder cord 52a and the second ladder cord 52b are extended downwardly from the cord hanging mechanism 56.

[0075] As shown in Figs. 23 and 24, the first ladder cord 52a has a plurality of lateral strings each of which supports one of the upper slats 53a, which are a plurality of first slats. A middle bottom rail 54 is hung down from and supported by a lower end of the first ladder cord 52a. The second ladder cord 52b has a plurality of lateral strings each of which supports each of the lower slats 53b that are a plurality of second slats. A bottom rail 55 is hung down from and supported by a lower end of the second ladder cord 52b.

[0076] The frictional engagement of the small hanging ring 59a and the small drum 57a allows integral rotation of the small hanging ring 59a and the small drum 57a. Similarly, the frictional engagement of the large drum 57b and the large hanging ring 59b allows integral rotation of the large hanging ring 59b and the large drum 57b. The rotation of the small hanging ring 59a changes the inclination of the lateral string of the first ladder cord 52a. This rotates the upper slats 53a. Similarly, the rotation of the large hanging ring 59b changes the inclination of the lateral string of the second ladder cord 52b. This rotates the lower slats 53b.

[0077] As shown in Fig. 22, the upper end of a lifting/lowering cord 64 is wound around the winding cylinder 62, and the winding cylinder 62 winds up the lifting/lowering cord 64. A bottom rail 55 is hung down from and supported by the lower end of the lifting/lowering cord 64.

[0078] When a user operates the operation mechanism such as the operation rod or the operation cord 10 as shown in Fig. 1, the drive shaft 58 is rotated. Accordingly, when the winding cylinder 62 is rotated in a winding direction, the lifting/lowering cord 64 is wound up by the winding cylinder and the bottom rail 55 is lifted up. As a result, the upper slats 53a and the lower slats 53b are folded up in sequence upwardly. When the winding cylinder 62 is rotated in a unwinding direction that is the opposite direction of the winding direction, the lifting/lowering cord 64 is unwound and the bottom rail 55 is lowered. As a result, the upper slats 53a and the lower slats 53b are recovered into the deployed state as shown in Figs. 23 and 24. The lateral strings of the second ladder cord 52b are arranged only in the lower half of the second ladder cord 52b so as not to interfere with the upper slats 53a in the state where the lifting/lowering cord 64 is completely unwound from the winding cylinder 62 (the deployed state).

[0079] As shown in Fig. 25, two small contact portions 60a are formed by folding two ends of the small hanging ring 59a. Similarly, as shown in Fig. 26, two large contact portions 60b are formed by folding two ends of the large hanging rings 59b.

[0080] As shown in Figs. 25 and 26, a stopper 61 is provided below the small drum 57a and the large drum 57b. The stopper 61 is a rotation restricting mechanism that restricts the small hanging ring 59a and the large hanging ring 59b from being rotated by a predetermined angle or more. The stopper 61 is positioned on a rotation track of the small hanging ring 59a and on a rotation track of the large hanging ring 59b. When the small contact portion 60a contacts the stopper 61, the rotation of the small hanging ring 59a is restricted. As a result, the small drum 57a spins with respect to the small hanging ring 59a. Similarly, when the large contact portion 60b contacts the stopper 61, the rotation of the large hanging ring 59b is restricted and the large drum 57b spins with respect to the large contact portion 60b.

[0081] As shown in Fig. 25, when the small drum 57a is rotated in the counterclockwise direction and the small contact portion 60a at a left side of the small hanging ring 59a contacts the stopper 61, the upper slats 53a are in the first fully closed state as shown in Fig. 27(a). When the small drum 57a is rotated in the clockwise direction and the small contact portion 60a at a right side of the small hanging ring 59a contacts the stopper 61, the upper slats 53a are in the second fully closed state as shown in Fig. 27(e).

[0082] Similarly, as shown in Fig. 26, when the large drum 57b is rotated in the counterclockwise direction and the large contact portion 60b at a left side of the large hanging ring 59b contacts the stopper 61, the lower slats 53b are in the first fully closed state as shown in Fig. 27(a). When the large drum 57b is rotated in the clockwise direction and the large contact portion 60b at a right side of the large hanging ring 59b contacts the stopper 61, the lower slats 53b are in the second fully closed state

as shown in Fig. 27(e).

[0083] As shown in Fig. 25, the rotation angle of the small drum 57a from the state where the left side small contact portion 60a contacts the stopper 61 to the state where the right side small contact portion 60a contacts the stopper 61 is a first angle range α . Similarly, as shown in Fig. 26, the rotation angle of the large drum 57b from the state where the left side large contact portion 60b contacts the stopper 61 to the state where the right side large contact portion 60b contacts the stopper 61 is a second angle range β . The first angle range α is set to be greater than the second angle range β .

[0084] After the small contact portion 60a contacts the stopper 61 and the small drum 57a is further rotated, the frictional engagement of the small hanging ring 59a and the small drum 57a is reduced. As a result, the small drum 57a spins with respect to the small hanging ring 59a. Similarly, after the large contact portion 60b contacts the stopper 61 and the large drum 57b is further rotated, the frictional engagement of the large hanging ring 59b and the large drum 57b is reduced. As a result, the large drum 57b spins with respect to the large hanging ring 59b.

[0085] Accordingly, the drive shaft 58, the small drum 57a, the large drum 57b, the small hanging ring 59a, and the large hanging ring 59b form the drive force transmission mechanism and the speed changing mechanism. The small drum 57a, the large drum 57b, the small hanging ring 59a, and the large hanging ring 59b form a slat angle adjustment mechanism. When the common drive shaft 58 is rotated manually, the slat angle adjustment mechanism adjusts the angle of the upper slats 53a and the angle of the lower slats 53b to be a different angle in conjunction with each other.

[0086] Next, an operation of the lateral blind will be explained.

[0087] As shown in Fig. 27(a), the operation cord 10 is operated from the first fully closed state of the upper slats 53a and the lower slats 53b to rotate the drive shaft 58 in the clockwise direction. Accordingly, the lower slats 53b are adjusted to extend horizontally as viewed from the side as shown in Fig. 27(b). The drive shaft 58 is further rotated in the clockwise direction so as to adjust the upper slats 53a to extend horizontally as viewed from the side as shown in Fig. 27(c). In the first fully closed state shown in Fig. 27(a), the upper slats 53a and the lower slats 53b are in a convex state toward the outside of the room (left side). This reliably prevents the light from above such as sunshine during daytime from entering the room. In the second fully closed state shown in Fig. 27(e), the upper slats 53a and the lower slats 53b are in a convex state toward the inside of the room (right side). This reliably prevents the light from leaking from the room to the outside during nighttime.

[0088] During the states shown in Figs. 27(a) to 27(c), the rotation angle of the small drum 57a is the same as the rotation angle of the large drum 57b. However, since the diameter of the large drum 57b is greater than that of the small drum 57a, the lower slats 53b are rotated in

the clockwise direction prior to the upper slats 53a as shown in Figs. 27(b) and 27(c).

[0089] As shown in Fig. 27(c), when the drive shaft 53 is further rotated in the clockwise direction from the state where the lower slats 53b are in the fully closed state, the stopper 61 restricts the rotation of the large hanging ring 53b. Therefore, the large drum 57b spins with respect to the large hanging ring 59b and the lower slats 53b are in the second fully closed state, as shown in Fig. 27(d). Only the upper slats 53a are continuously rotated in the clockwise direction.

[0090] The upper slats 53a enter the second fully closed state, as shown in Fig. 27(e), after the state shown in Fig. 27(d). As a result, the stopper 61 restricts the rotation of the small hanging ring 59a. This restricts the upper slats 53a from being further rotated.

[0091] As shown in Figs. 28(a) to 28(c), when the upper slats 53a and the lower slats 53b in the second fully closed state are rotated in the counterclockwise direction, the lower slats 53b are rotated in the counterclockwise direction prior to the upper slats 53a.

[0092] When the drive shaft 58 is further rotated in the counterclockwise direction from the state where the lower slats 53b are in the first fully closed state as shown in Fig. 28(c), only the upper slats 53a are rotated as shown in Fig. 28(d). Then, the upper slats 53a enter the first fully closed state as shown in Fig. 28(e).

[0093] The upper slats 53a and the lower slats 53b in the state shown in Fig. 27(d) are rotated in the counterclockwise direction such that the upper slats 53a and the lower slats 53b are adjusted to be horizontally extended. For example, if the diameter of the large drum 57b is set to be twice that of the small drum 57a, the second ladder cord 52b is lifted and lowered at a speed twice the first ladder cord 52a per rotation of the drive shaft 58. Therefore, the rotation speed of the lower slats 53b is twice the rotation speed of the upper slats 53a. As a result, while the upper slats 53a shown in Fig. 27(d) are rotated in the counterclockwise direction by 45 degrees, the lower slats 53b are rotated in the counterclockwise direction by 90 degrees.

[0094] Similarly, when the drive shaft 58 is rotated in the clockwise direction from the state shown in Fig. 28(d), the upper slats 53a and the lower slats 53b are adjusted so as to be horizontally extended. All the slats can be adjusted to be extended vertically with respect to the frame in the first to fourth embodiments.

[0095] The lateral blind according to the fifth embodiment has following advantages.

(5-1) The drive shaft 58 is rotated integrally with the small drum 57a and the large drum 57b. The small hanging ring 59a is frictionally engaged to the small drum 57a and the large hanging ring 59b is frictionally engaged to the large drum 57b. The first ladder cord 52a is attached to the small hanging ring 59a and the second ladder cord 52b is attached to the large hanging ring 59b. Therefore, the rotation speed of

the upper slats 53a and the rotation speed of the lower slats 53b can be set to be different from each other by rotating the common drive shaft 58.

[0096] The rotation speed of the lower slats 53b is set to be faster than the rotation speed of the upper slats 53a. Therefore, in the state where the upper slats 53a are horizontally extended, the lower slats 53b are in the fully closed state. Therefore, the lower slats 53b prevent the light from entering the room from the outside, while the light appropriately enters the room from spaces between the upper slats 53a.

(5-2) Both of the upper slats 53a and the lower slats 53b are adjusted to be in the first fully closed state and the second fully closed state. There the first fully closed state that prevents the light from entering the room is selected during daytime and the second fully closed state that prevents the light from leaking from the room is selected during nighttime.

(5-3) Both of the upper slats 53a and the lower slats 53b can be horizontally extended.

(5-4) The common drive shaft 58 rotates the small drum 57a and the large drum 57b. The small hanging ring 59a, the large hanging ring 59b and the stopper 61 adjust the angle of the upper slats 53a and the lower slats 53b. Therefore, the slat angle adjustment mechanism can be formed by a simple structure without enlarging the size of the head box 51.

[0097] Each of the above embodiments may be modified as follows.

[0098] In the first to third embodiments, the rotation speed of the first slat hangers 14a corresponding to the light blocking slats 2a may be set to be greater than the rotation speed of the second slat hangers 14b corresponding to the semitransparent slats 2b.

[0099] In the fourth embodiment, the small openings may be omitted from the upper slats 22a. That is, the upper slats 22a may be normal slats without having any openings.

[0100] As shown in Fig. 21, in the fourth embodiment, the side frame 46 of the lateral blind may be bent at the center portion to be formed in an L-shape. The upper portion of the lateral blind covers a window on a ceiling. The lower slats 22b may be set to be rotated faster than the upper slats 22a. In this case, the lower slats 22b prevent the light from entering the room from the outside through the window that extends in an up-and-down direction.

[0101] In the fourth embodiment, the upper slats 22a and the lower slats 22b may be provided alternately one by one. The upper slats 22a have small openings and the lower slats 22b are normal slats without having any openings. In this case, even if the lower slats 22b are fully closed state, the light may selectively enter the room

from the outside through the upper slats 22a each of which is provided between two lower slats 22b. Even if the upper slats 22a are in the fully closed state, the light is permitted to partially enter the room from the outside through the small openings.

[0102] In the fifth embodiment, instead of the small drum 57a and the large drum 57b having different diameters, the first drum and the second drum having the same diameter may be prepared and a speed reducing mechanism may be provided only between the first drum and the drive shaft 58. The speed reducing mechanism reduces the rotation speed of the drive shaft 58 and transmits the rotation to the first drum so as to set the rotation speed of the lower slats 53b to be faster than the rotation speed of the upper slats 53a. For example, as shown in Fig. 29, the speed reducing mechanism includes a plurality of planetary gears 63 that are arranged between the small drum 57a and the drive shaft 58.

[0103] Next, Figs. 30 to 39 show a sixth embodiment of the present invention. Fig. 30 shows a longitudinal blind according to the sixth embodiment. The longitudinal blind has left slats 2c and right slats 2d. The left slats 2c are a plurality of first slats that occupy a left half of Fig. 30, and the right slats 2d are a plurality of second slats that occupy a right half of Fig. 30. The left slats 2c form a left slat group G1, which is a first slat group. The right slats 2d form a right slat group G2, which is a second slat group. The left slat group G1 is pulled out along the hanger rail 1 prior to the right slat group G2. The material of the left slats 2c and the material of the right slats 2d have a light blocking property.

[0104] The longitudinal blind has a runner 3 and a gear mechanism 8 corresponding to each of the left slats 2c and each of the right slats 2d similarly to Figs. 2 and 3. The gear ratio of the gear mechanism 8 corresponding to each left slat 2c is different from the gear ratio of the gear mechanism 8 corresponding to each right slat 2d. For example, the rotation speed of the right slats 2d is set to be twice the rotation speed of the left slats 2c. The gear ratio of the gear mechanism 8 is set by adjusting a helix angle and a lead angle made by a tooth of the worm wheel 12 and a tooth of the worm 13 of the gear mechanism 8.

[0105] When the tilt shaft 4 is rotated, the left slats 2c and the right slats 2d are rotated simultaneously (in conjunction with each other).

[0106] Next, an operation of the longitudinal blind will be explained.

[0107] When the operation cord 10 is operated to pull out the lead runner 3a along the hanger rail 1, the following runners 3 are pulled out in sequence with a predetermined distance therebetween. After the lead runner 3a is pulled out to one end of the hanger rail 1, the operation rod 9 is operated to adjust the left slats 2c and the right slats 2d along the hanger rail 1. Accordingly, the left slats 2c and the right slats 2d are in the fully closed state as shown in Fig. 31.

[0108] Figs. 31 to 35 show transition of the rotation

angle of the left slats 2c and the right slats 2d from the first fully closed state to the second fully closed state where the left slats 2c and the right slats 2d are rotated by approximately 180 degrees from the first fully closed state.

[0109] In the first fully closed state shown in Fig. 31, the operation rod 9 is operated to rotate the left slats 2c and the right slats 2d in the counterclockwise direction as viewed from above. The rotation angle of the right slats 2c is twice the rotation angle of the left slats 2c. Therefore, when the right slats 2d are rotated by 90 degrees, the left slats 2c are rotated by 45 degrees, as shown in Fig. 32.

[0110] As shown in Fig. 33, when the right slat group G2 is rotated by approximately 180 degrees and in the second fully closed state, the left slats 2c are rotated by approximately 90 degrees. This prevents further rotation of the right slats 2d and the worms 13 corresponding to the right slats 2d spin with respect to the hanging shaft 6. When the operation rod 9 is further operated, all the left slats 2c and the right slats 2d are in the second fully closed state as shown in Fig. 35 after the state shown in Fig. 34.

[0111] When the slats 2 are rotated in the clockwise direction from the second fully closed state shown in Fig. 35, the right slats 2d and the left slats 2c are rotated in the following manner. When the right slats 2d are rotated by 90 degrees, the left slats 2c are rotated by 45 degrees, as shown in Fig. 36. When the right slat group G2 is rotated by approximately 180 degrees and in the first fully closed state as shown in Fig. 37, the left slats 2c are rotated by approximately 90 degrees. When the operation rod 9 is further rotated, the left slats 2c and the right slats 2d are in the first fully closed state as shown in Fig. 39 after the state shown in Fig. 38.

[0112] The longitudinal blind according to the sixth embodiment has following advantages.

(6-1) The left slat group G1 and the right slat group G2 are rotated simultaneously by the rotation operation of the operation rod 9. Further, the left slats 2c and the right slats 2d are rotated by a different angle.

(6-2) The rotation speed of the right slats 2d are set to be twice the rotation speed of the left slats 2c. Therefore, as shown in Figs. 33 and 37, the left slats 2c are adjusted to extend vertically with respect to the hanger rail 1 as viewed from above in the fully closed state of the right slats 2d. Accordingly, the light enters the room from the outside. As shown in Figs. 32, 34, 36 and 38, in the state where the right slats 2d are adjusted to extend vertically with respect to the hanger rail 1, the left slats 2c are adjusted to extend to be slanted with respect to the hanger rail 1. Accordingly, the light is partially prevented from entering the room from the outside. Therefore, each of the left slat group G1 and the right slat group G2 selectively allows the light to enter the room from the

outside.

[0113] The sixth embodiment may be modified as follows.

[0114] The ratio of the rotation angles (rotation speed) of the left slat group G1 and the right slat group G2 is not necessarily set to be 1:2.

[0115] First to third slat groups may be provided. In other words, a left slat group, an intermediate slat group, and a right slat group may be provided. The rotation speed of the intermediate slat group may be different from the rotation speed of the left slat group or the right slat group.

Claims

1. A blind comprising:

a frame (1, 21a, 21b, 51);
a plurality of slats (2a, 2b, 22a, 22b, 53a, 53b, 2c, 2d) that are rotatably supported by the frame;
an operation mechanism (9) that is provided to the frame; and
a drive force transmission mechanism (8, 35, 42, 44, 45, 57a, 57b, 58, 59a, 59b, 61) that rotates each of the slats based on operation of the operation mechanism,
the blind being **characterized in that** the slats include a first slat (2a, 22a, 53a, 2c) and a second slat (2b, 22b, 53b, 2d), wherein the drive force transmission mechanism has a speed changing mechanism (8, 35, 43, 44, 45, 57a, 57b, 59a, 59b) that rotates the first slat and the second slat at different speeds.

2. A longitudinal blind comprising:

a hanger rail (1);
a plurality of runners (3) that are supported by the hanger rail (1), each of the runners being movable along the hanger rail (1);
a hanging shaft (6) that is rotatably supported by each runner (3);
a plurality of slats (2a, 2b) each of which is supported by and hung down from the hanging shaft (6);
a tilt shaft (4) that extends through the runners (3);
an operation mechanism (9) that rotates the tilt shaft (4);
a gear mechanism (8) that is provided to each of the runners (3) so as to transmit rotation of the tilt shaft (4) to each of the hanging shafts (6), thereby rotating the slats (2a, 2b); and
a torque transmission mechanism (16) that transmits torque of the gear mechanism (8) to the hanging shaft (6), wherein a torque value

that can be transmitted by the torque transmission mechanism is a predetermined value or less,

the longitudinal blind being **characterized in that** the slats include a first slat (2a) and a second slat (2b), and the first slat (2a) and the second slat (2b) have different materials from each other, wherein the gear ratio of the gear mechanism (8) corresponding to the first slat (2a) is set to be different from the gear ratio of the gear mechanism (8) corresponding to the second slat (2b).

3. The longitudinal blind according to claim 2, being **characterized in that** the material of the first slat (2a) has a light blocking property and the material of the second slat (2b) is semi-transparent so as to partially transmit light.

4. The longitudinal blind according to claim 2 or 3, being **characterized in that** the gear ratio of the gear mechanism (8) corresponding to the second slat (2b) is set to be greater than the gear ratio of the gear mechanism (8) corresponding to the first slat (2a).

5. The longitudinal blind according to any one of claims 2 to 4, being **characterized in that** the first slat (2a) and the second slat (2b) are arranged alternately on the hanger rail (1).

6. The longitudinal blind according to claim 4 or 5, being **characterized by:**

a first slat hanger (14a) that is provided to the hanging shaft (6) so as to support the first slat (2a); and

a second slat hanger (14b) that is provided to the hanging shaft (6) so as to support the second slat (2b),
wherein, when the second slat hanger (14b) contacts the first slat hanger (14a), the first slat hanger (14a) and the second slat hanger (14b) are refutable.

7. The longitudinal blind according to claim 6, being **characterized by** contact pieces (15) each of which is provided on one of two ends of the second slat hanger (14b), the two ends of the second slat hanger (14b) being outer ends with respect to the hanging shaft (6),
wherein the contact pieces (15) extend along the second slat hanger (14b) so as to contact the first slat hanger (14a).

8. A lateral blind comprising:

a frame (21a, 21b);
a plurality of support mechanisms (27, 40) that

are provided to the frame;
 a plurality of slats (22a, 22b) that are supported rotatably to the frame by each or the support mechanisms; and
 an operation mechanism (9) that is provided to the frame so as to adjust the angle of each slat, the lateral blind being **characterized in that** the slats include a first slat (22a) and a second slat (22b),
 wherein the support mechanisms include a first support mechanism (27) that supports the first slat (22a) and a second support mechanism (40) that supports the second slat (22b), and wherein each of the first support mechanism (27) and the second support mechanism (40) has a drive force transmission mechanism (35, 42, 44, 45) that rotates the first, slat (22a) and the second slat (22b) at different speeds based on operation of the operation mechanism (9).

9. A lateral blind comprising:

a head box (51);
 a ladder cord (52a, 52b) that extends from the head box;
 a plurality of slats (53a, 53b) that are hung down from and supported by the ladder cord (52a, 52b);
 a drive shaft (58);
 a slat angle adjustment mechanism (57a, 57b, 59a, 59b) that is arranged in the head box (51), wherein the slat angle adjustment mechanism rotates the slats through the ladder cord (52a, 52b) based on rotation of the drive shaft (58); and
 a rotation restricting mechanism (61) that restricts rotation of the slats (53a, 53b) that are in a fully closed state,
 the lateral blind being **characterized in that** the slats (53a, 53b) include a first slat (53a) and a second slat (53b) that is arranged below the first slat (53a),
 wherein the ladder cord includes a first ladder cord (52a) and a second ladder cord (52b), wherein the first ladder cord supports the first slat (53a) with respect to the head box (51), and the second ladder cord supports the second slat (53b) with respect to the head box (51), and wherein the slat angle adjustment mechanism has a rotation speed adjustment mechanism that rotates the first slat (53a) and the second ladder cord (52b) at different rotation speeds based on rotation of the drive shaft (58).

10. The lateral blind according to claim 9, being **characterized in that** the rotation speed adjustment mechanism includes:

a small drum (57a) that supports the first ladder cord (52a) with respect to the drive shaft (58); and
 a large drum (57b) that supports the second ladder cord (52b) with respect to the drive shaft (58), wherein the diameter of the large drum (57b) is larger than the diameter of the small drum (57a), and the small drum (57a) and the large drum (57b) are rotated by the drive shaft (58).

11. The lateral blind according to claim 9, being **characterized in that** the rotation speed adjustment mechanism includes:

a drum (57a) that supports the first ladder cord (52a) with respect to the drive shaft (58); and
 a speed reducing mechanism (63) that is arranged between the drum (57a) and the drive shaft (58),
 wherein the speed reducing mechanism (63) reduces the rotation speed of the drive shaft (58) and transmits the rotation to the drum (57a).

12. A longitudinal blind comprising:

a hanger rail (1);
 a plurality of runners (3) that are supported by the hanger rail (1), each of the runners being movable along the hanger rail (1);
 a hanging shaft (6) that is rotatably supported by each runner (3);
 a plurality of slats (2c, 2d) each of which is supported by and hung down from the hanging shaft (6);
 a tilt shaft (4) that extends through the runners (3);
 an operation mechanism (9) that rotates the tilt shaft (4); and
 a gear mechanism (8) that is provided to each of the runners (3) to transmit rotation of the tilt shaft (4) to each hanging shaft (6), thereby rotating the slats (2c, 2d) simultaneously,
 the longitudinal blind being **characterized in that** the slats form a plurality of slat groups (G1, G2),
 wherein each gear mechanism corresponds to one of the slat groups (G1, G2), the gear ratio of each gear mechanism is different from the gear ratio of another gear mechanism that corresponds to adjacent one of the slat groups (G1, G2).

13. The longitudinal blind according to claim 12, being **characterized in that** the slat groups (G1, G2) include a first slat group (G1) and a second slat group (G2), wherein, from a state where the first slat group (G1) and the second slat group (G2) are folded, the first slat group (G1) is pulled out along the hanger

rail (1) prior to the second slat group (G2), and wherein the gear ratio of the gear mechanism (8) corresponding to the first slat group (G1) is set to be different from the gear ratio of the gear mechanism (8) corresponding to the second slat group (G2). 5

14. The longitudinal blind according to claim 12 or 13, being **characterized in that** the ratio of the rotation speed of the first slat group (G1) and the rotation speed of the second slat group (G2) is set to be 1:2. 10

15. The longitudinal blind according to claim 12, being **characterized in that** the slat groups further includes a third slat group, wherein the gear ratio of the gear mechanism (8) corresponding to the second slat group (G2) is different from the gear ratio of the gear mechanism (8) corresponding to the first slat group (G1) and from the gear ratio of the gear mechanism (8) corresponding to the third slat group. 15 20

16. The longitudinal blind according to any one of claims 12 to 15, being **characterised in that** a torque transmission mechanism (16) is provided, between each gear mechanism (8) and each hanging shaft (6), and a torque value that can be transmitted by the torque transmission mechanism (16) is a predetermined value or less. 25

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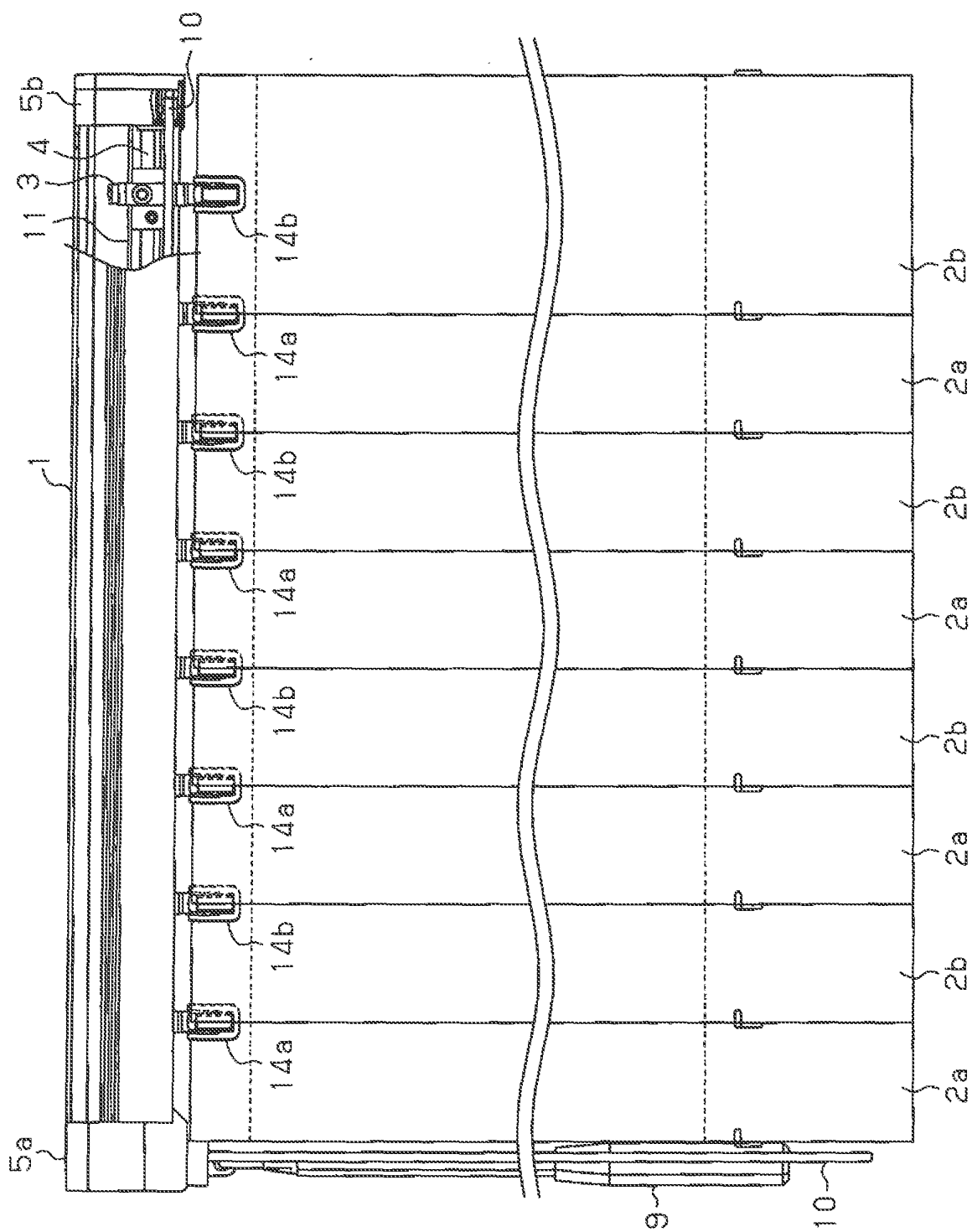


Fig. 1

Fig. 2

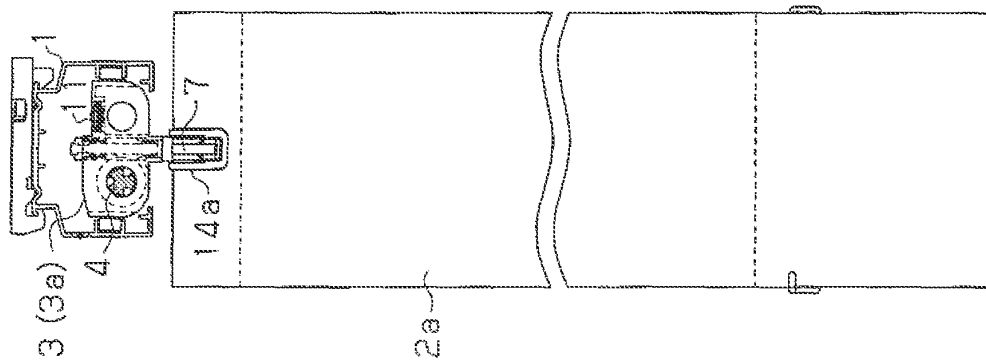


Fig. 3

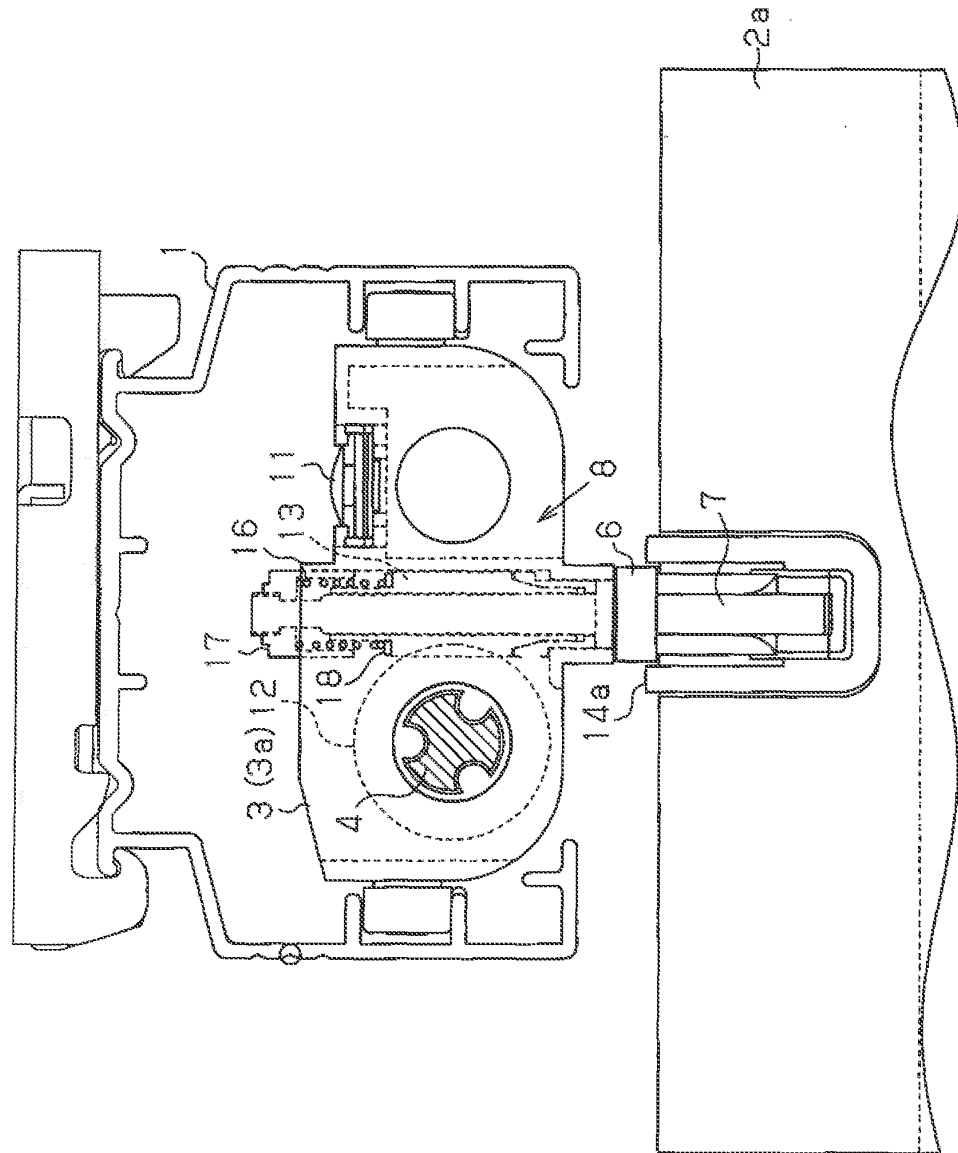


Fig.4

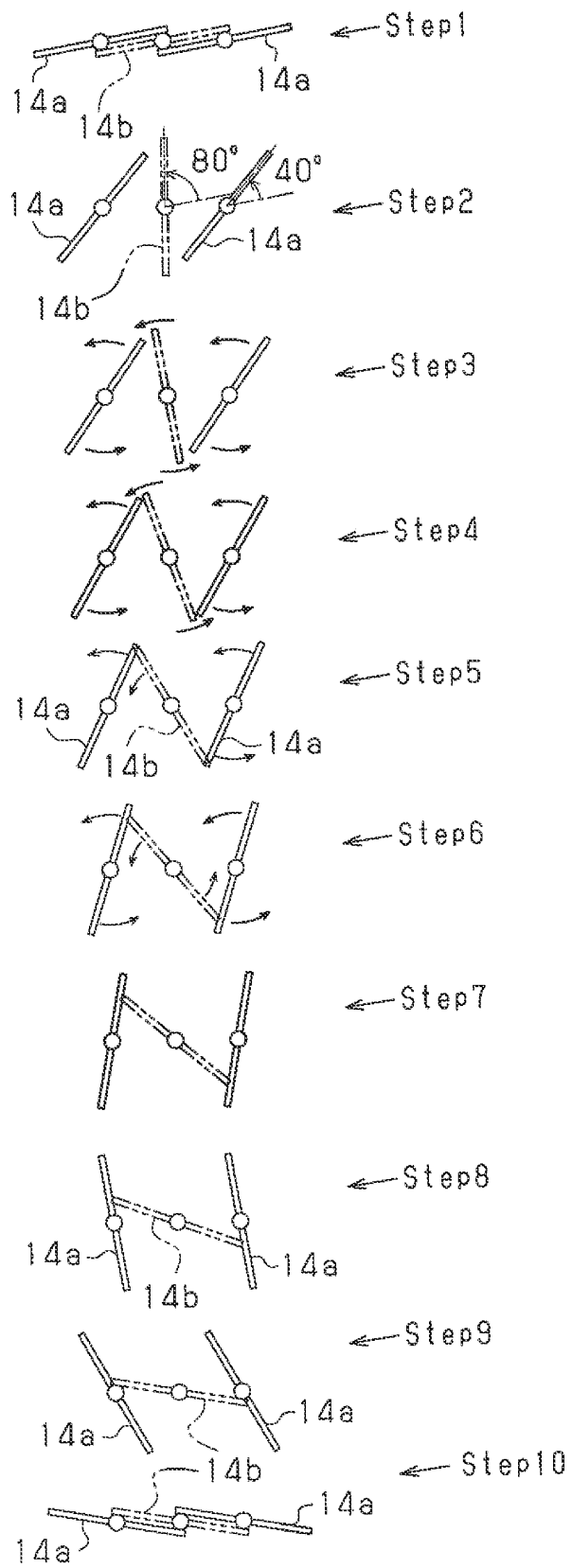


Fig.5

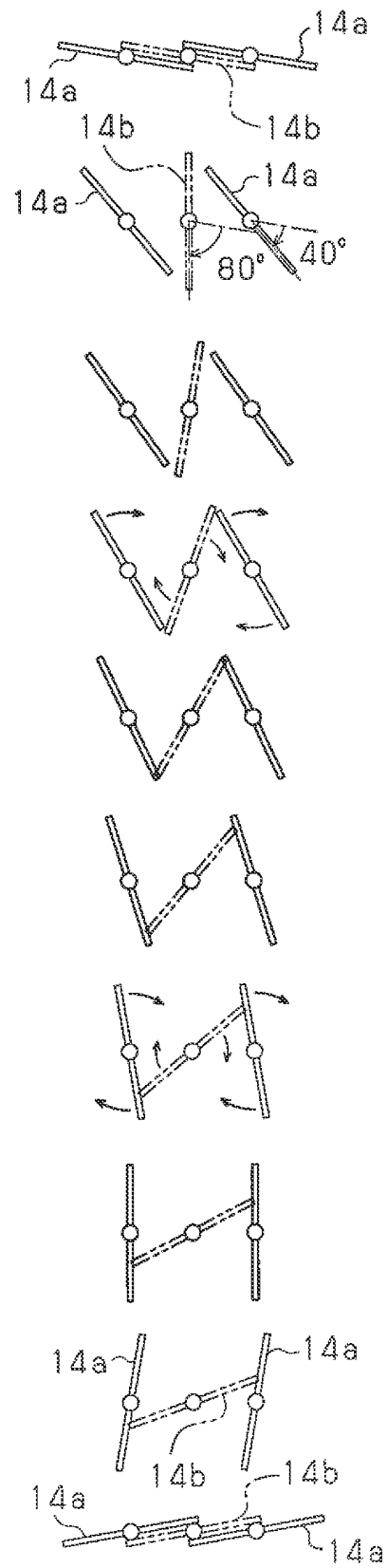


Fig.6

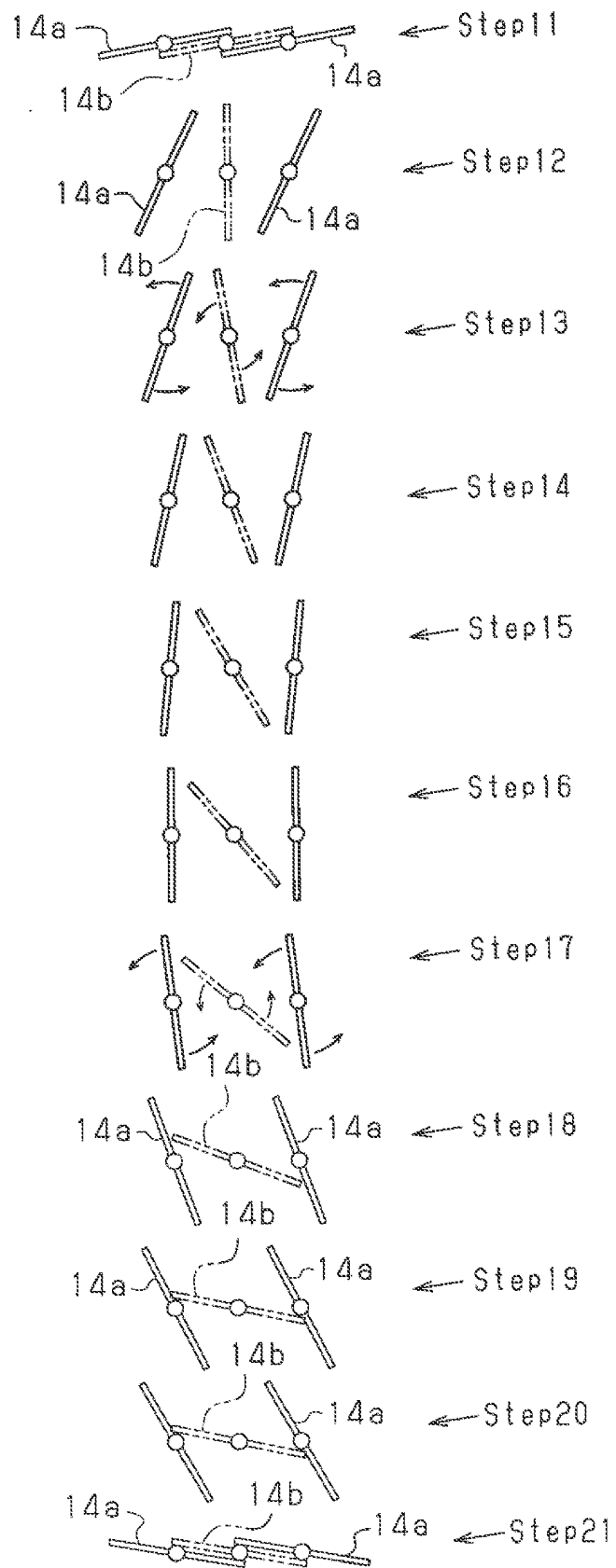


Fig.7

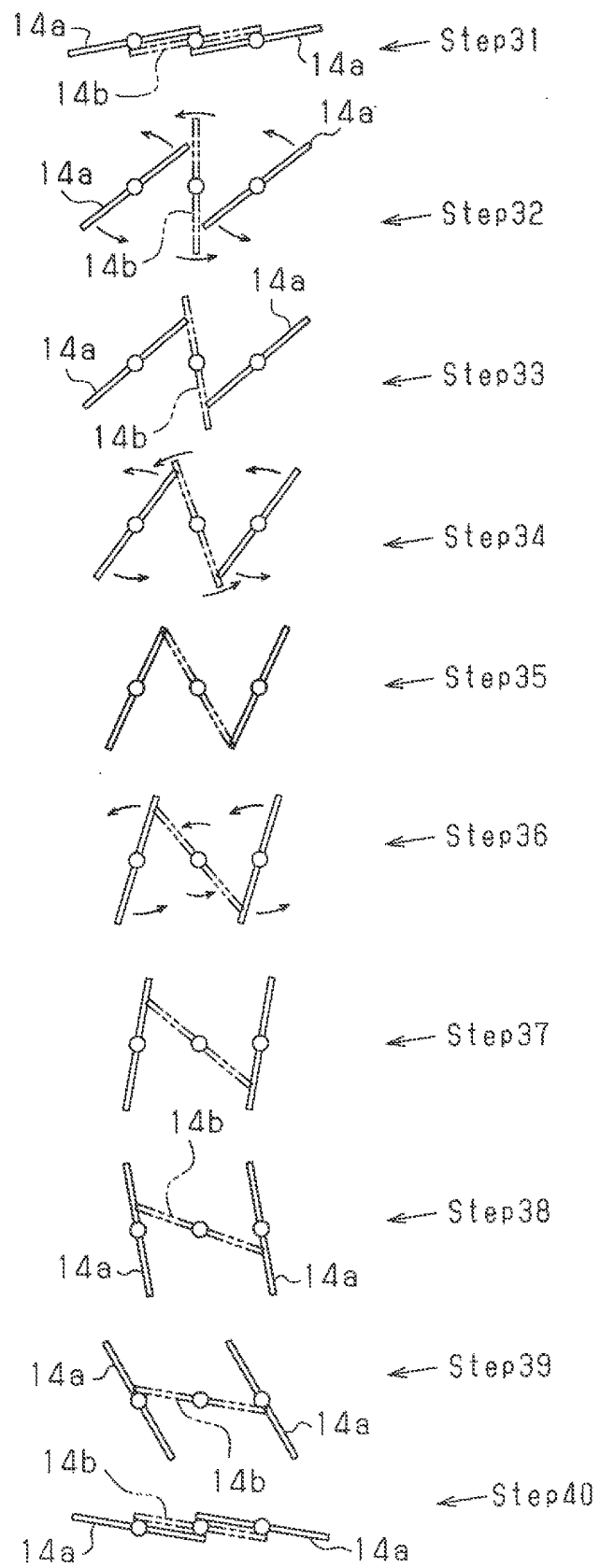


Fig.8

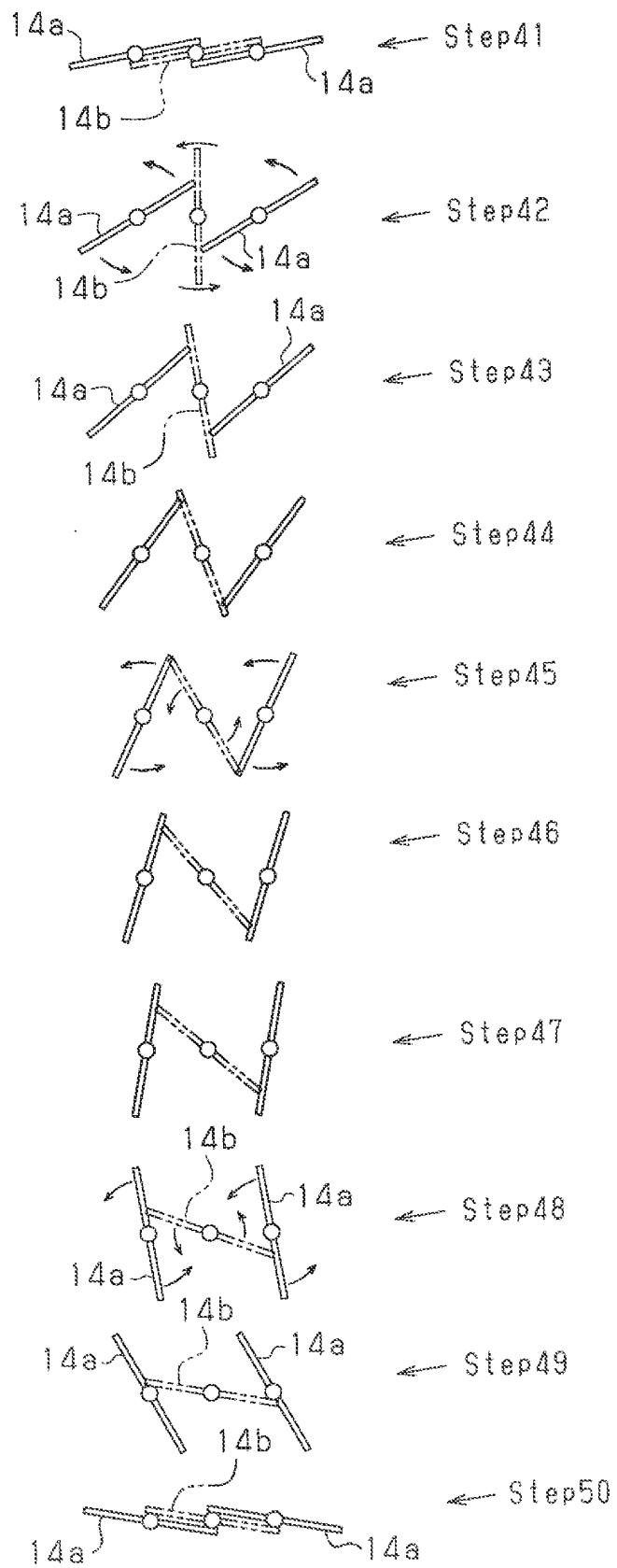


Fig.9(a)

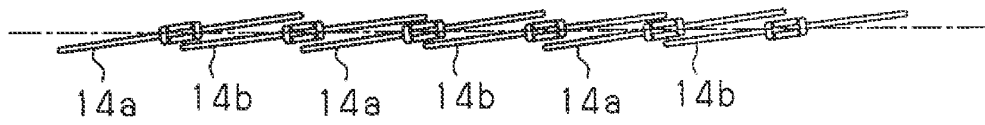


Fig.9(b)

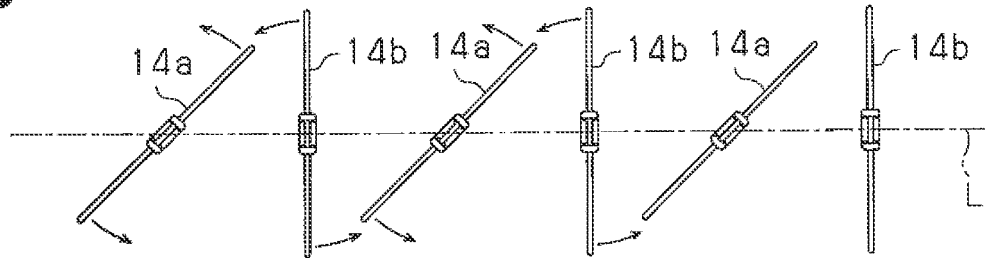


Fig.9(c)

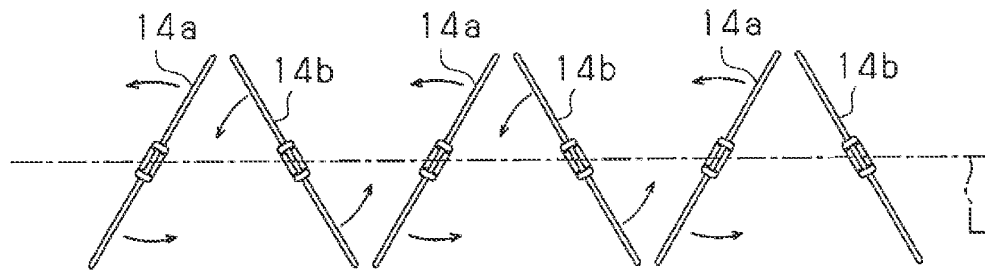


Fig.9(d)

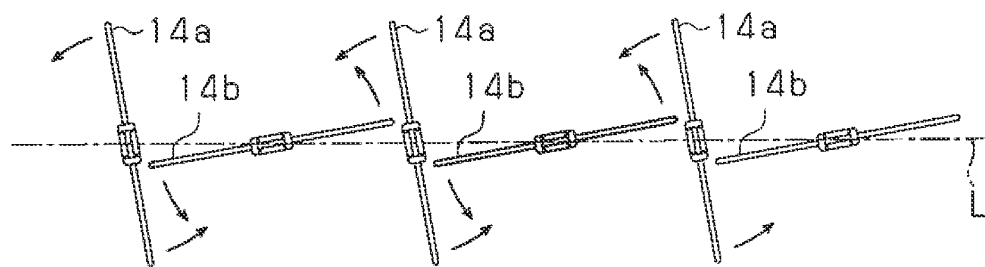


Fig.9(e)

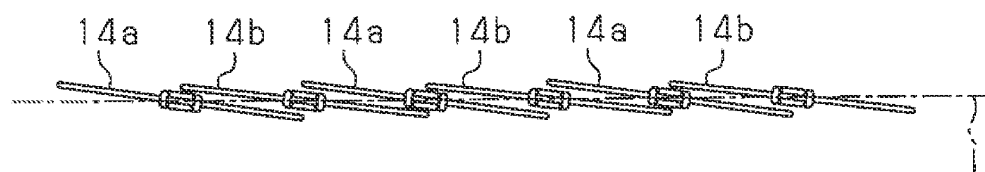


Fig.10

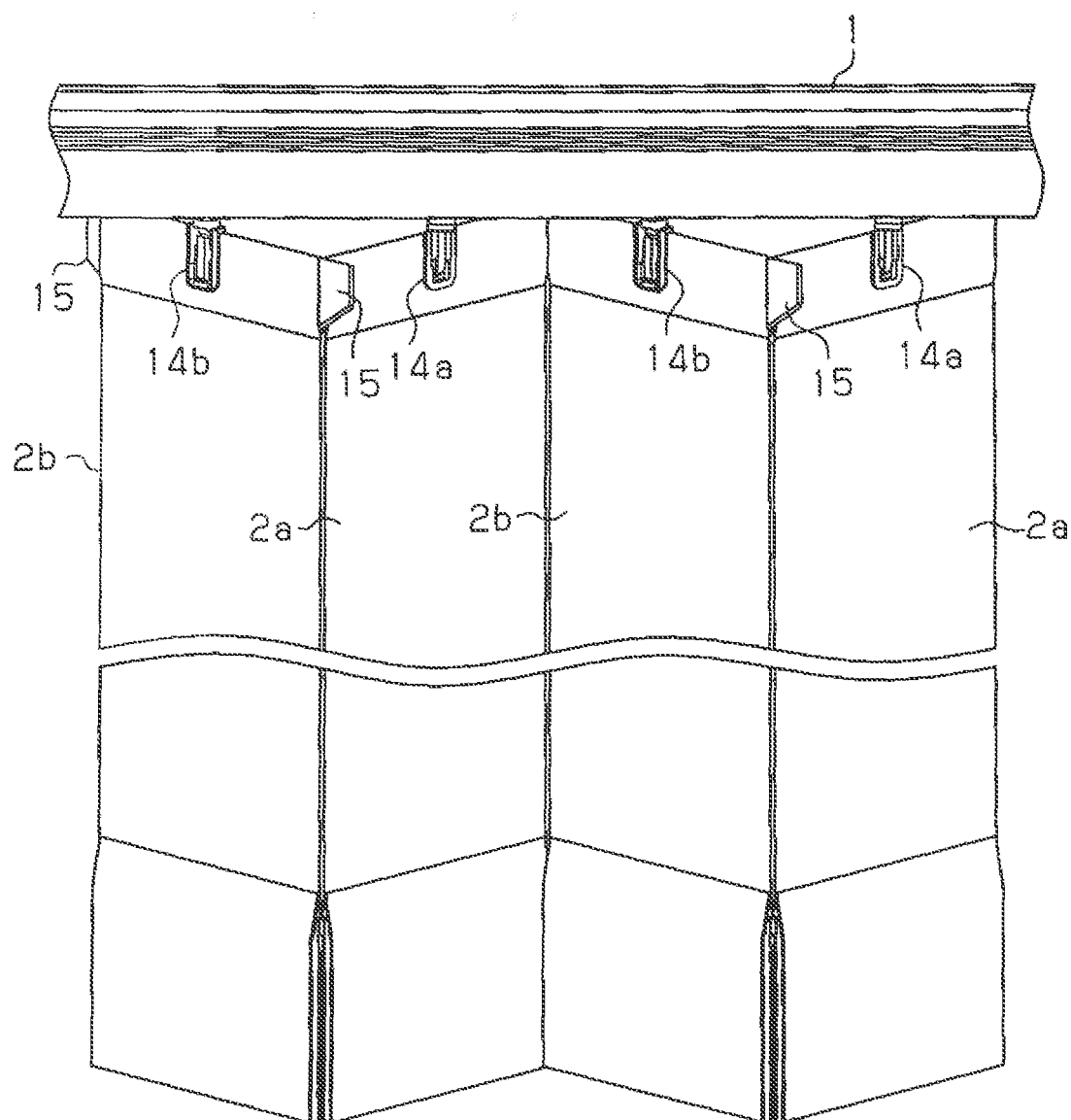


Fig.11 (a)

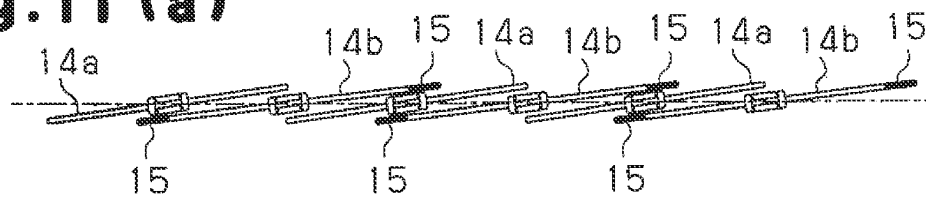


Fig.11 (b)

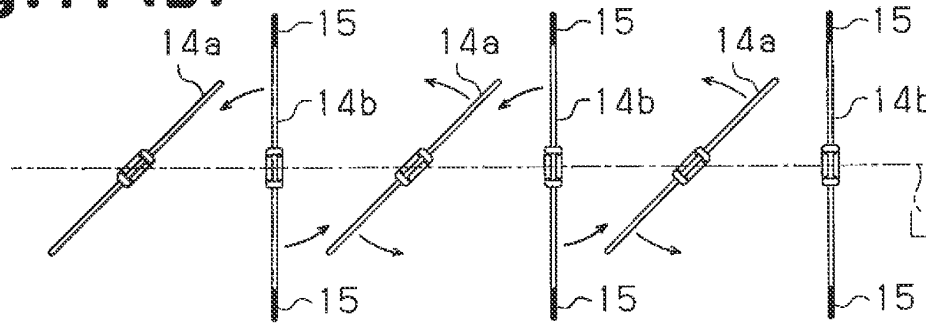


Fig.11 (c)

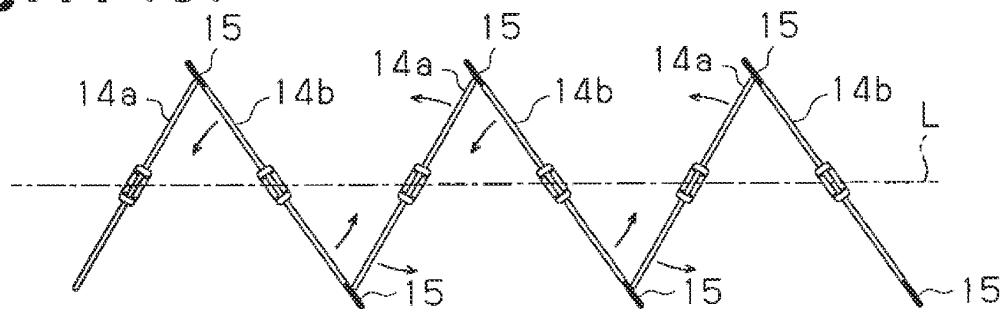


Fig.11 (d)

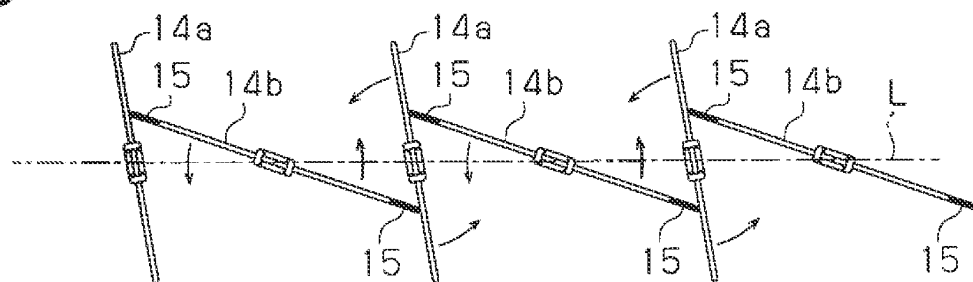


Fig.11 (e)

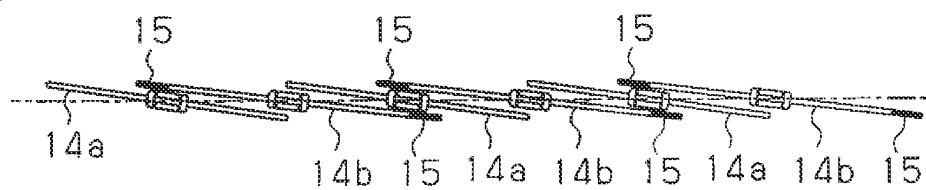


Fig.12

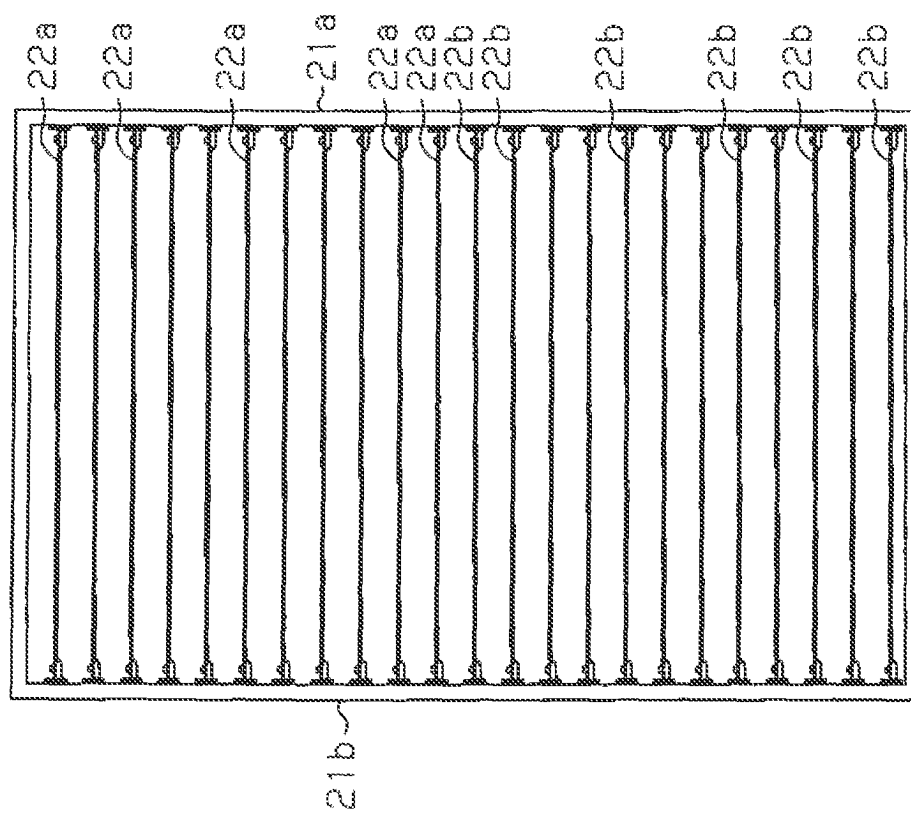


Fig.13

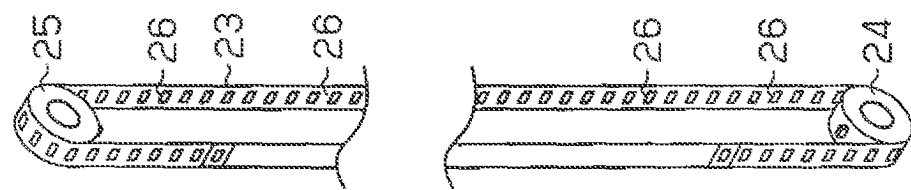


Fig.14

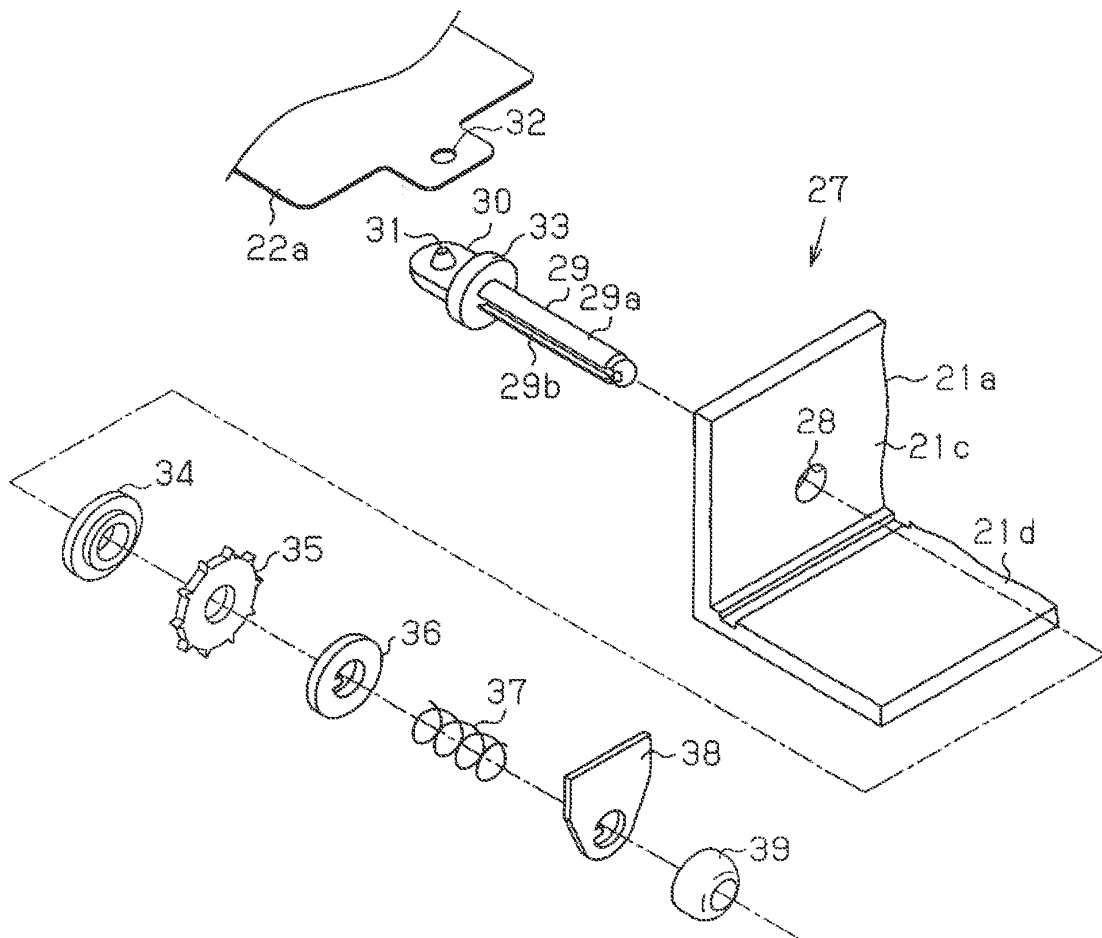


Fig.15

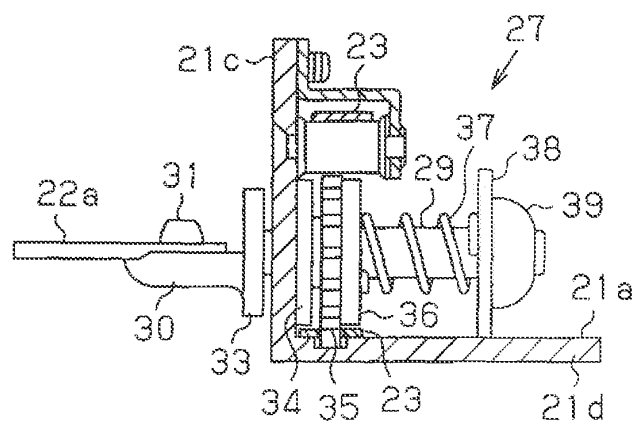


Fig.16

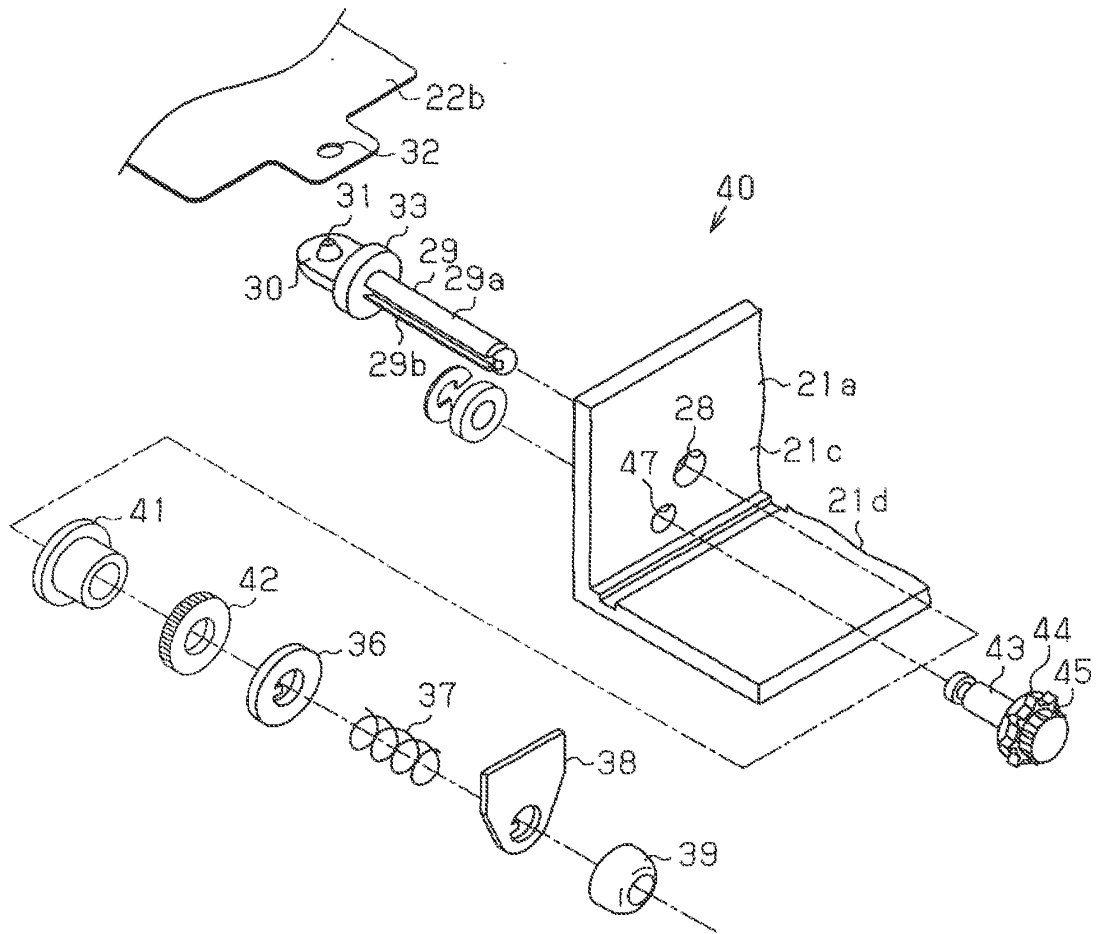


Fig.17

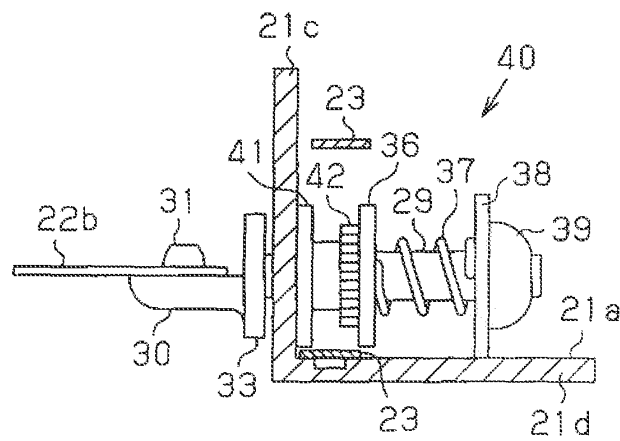


Fig.18

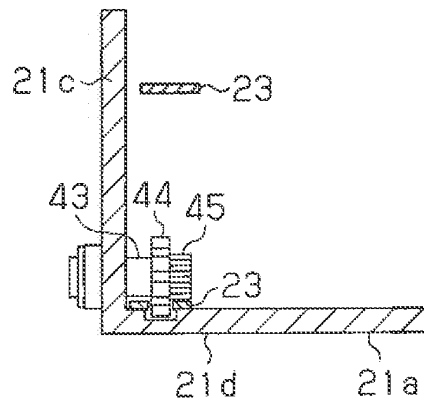


Fig.19

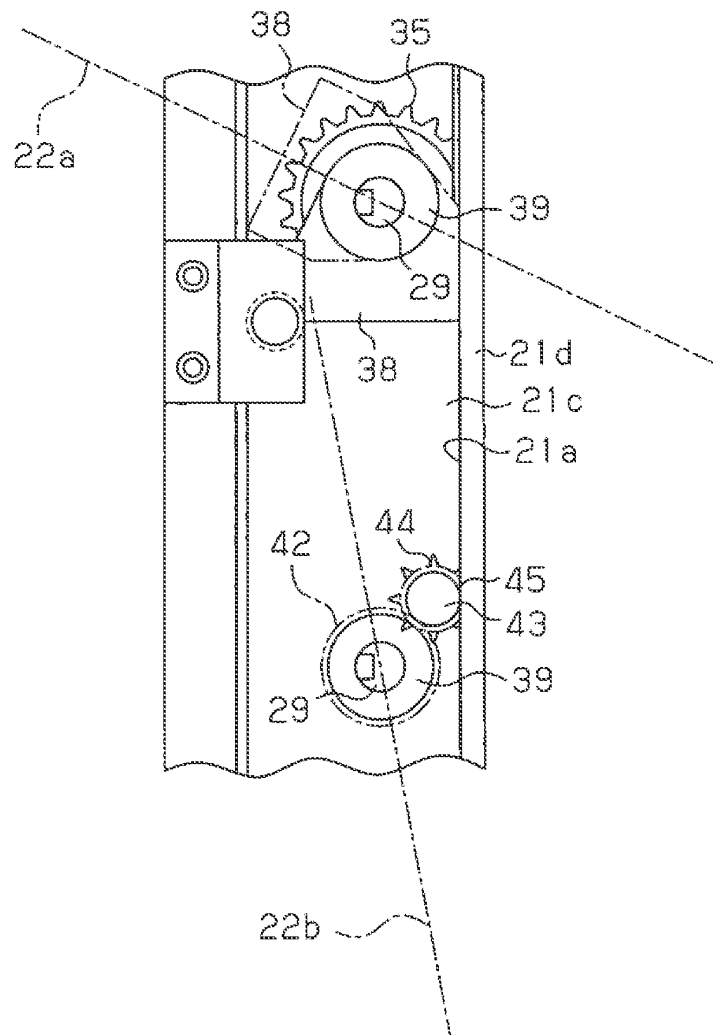


Fig.20(a) Fig.20(b) Fig.20(c) Fig.20(d)

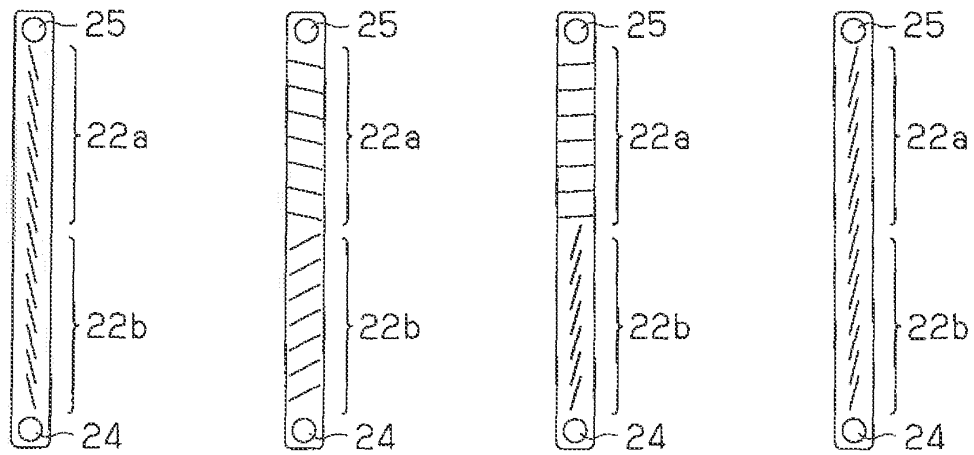


Fig.21

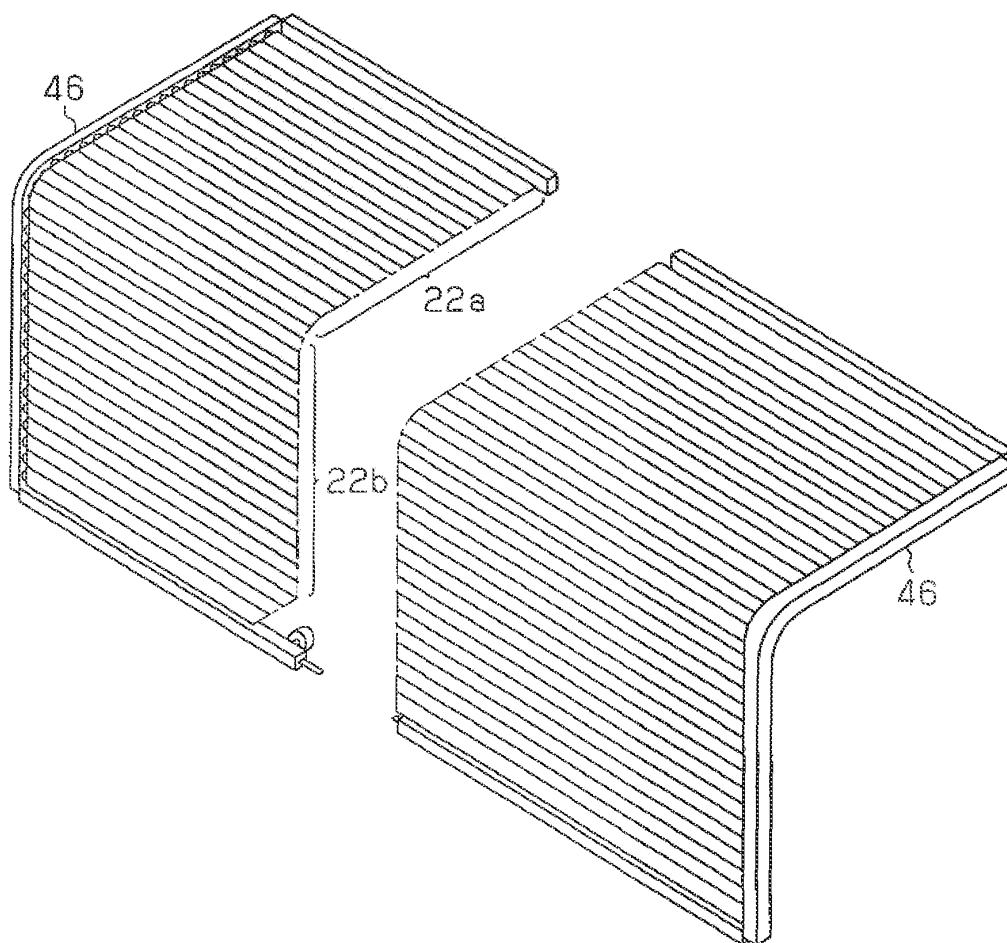


Fig. 22

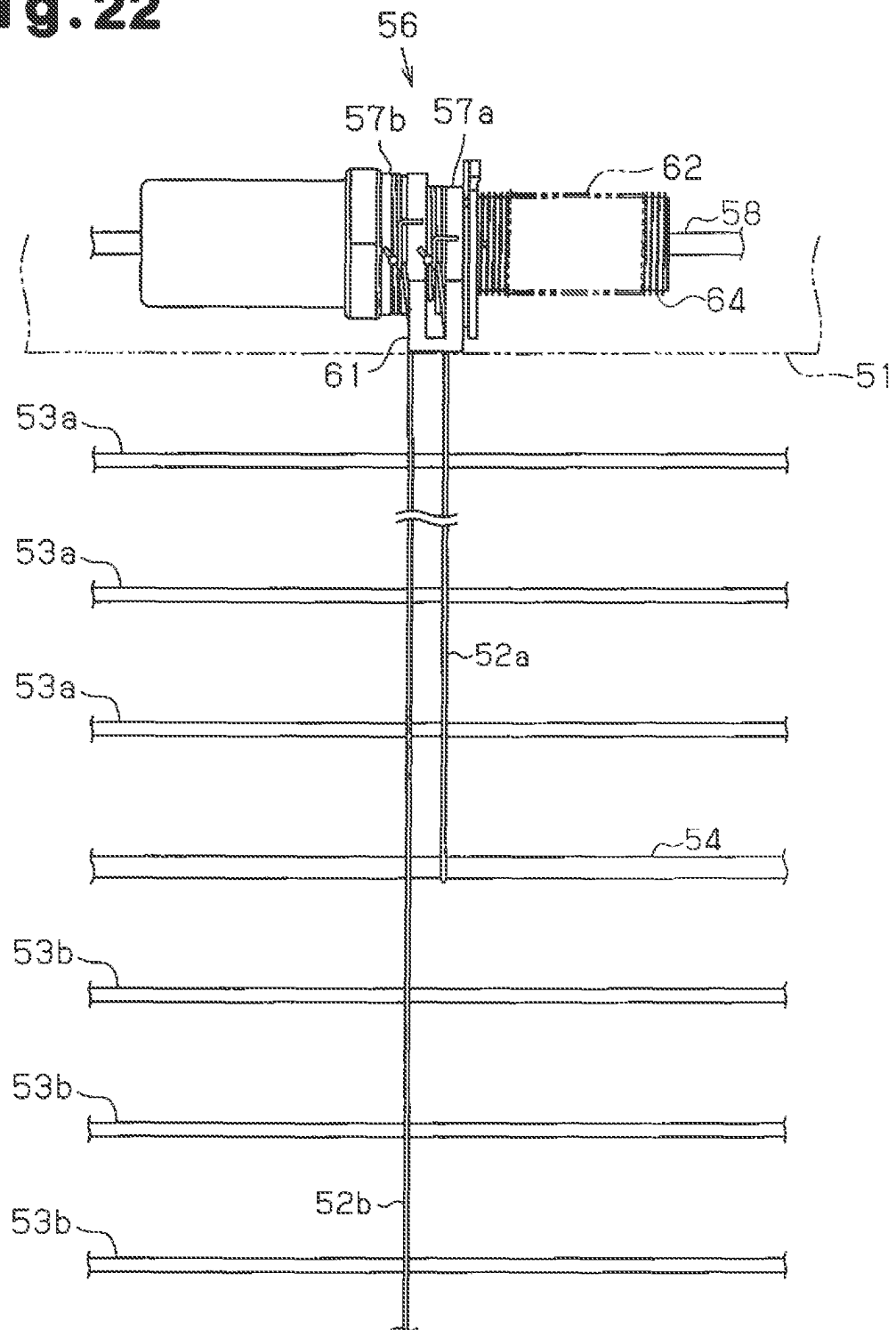


Fig.23

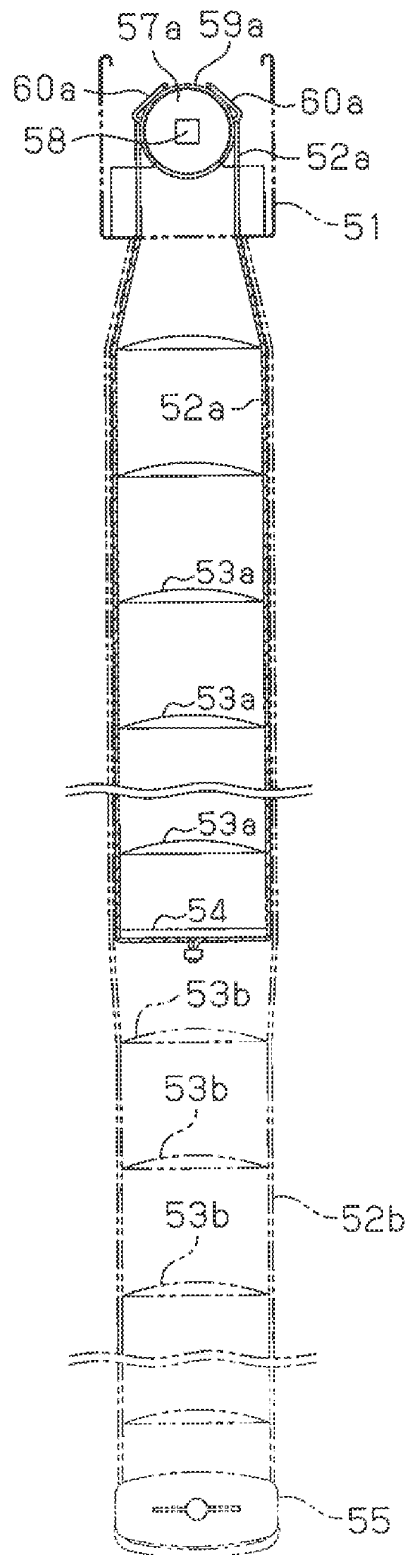


Fig.24

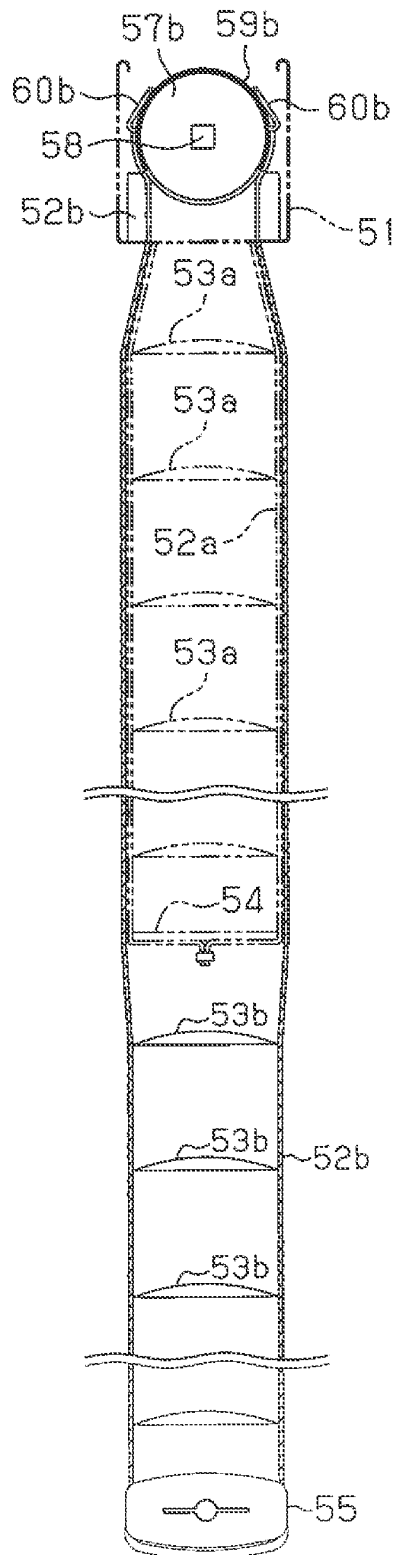


Fig. 25

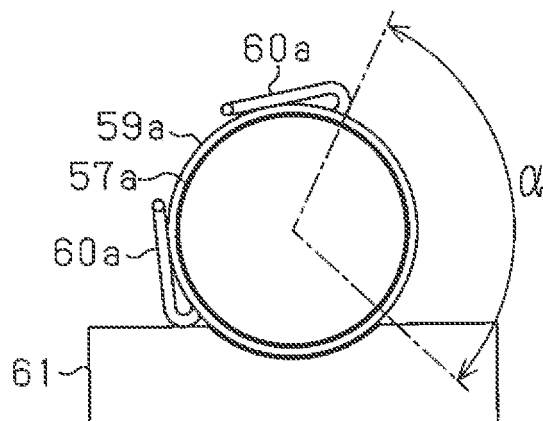


Fig. 26

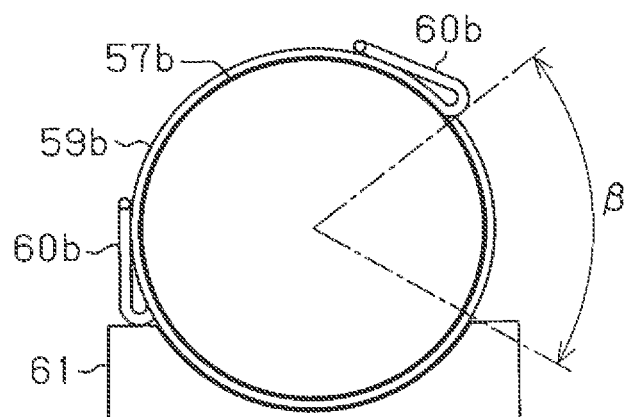


Fig.27 (a) Fig.27 (b) Fig.27 (c) Fig.27 (d) Fig.27 (e)

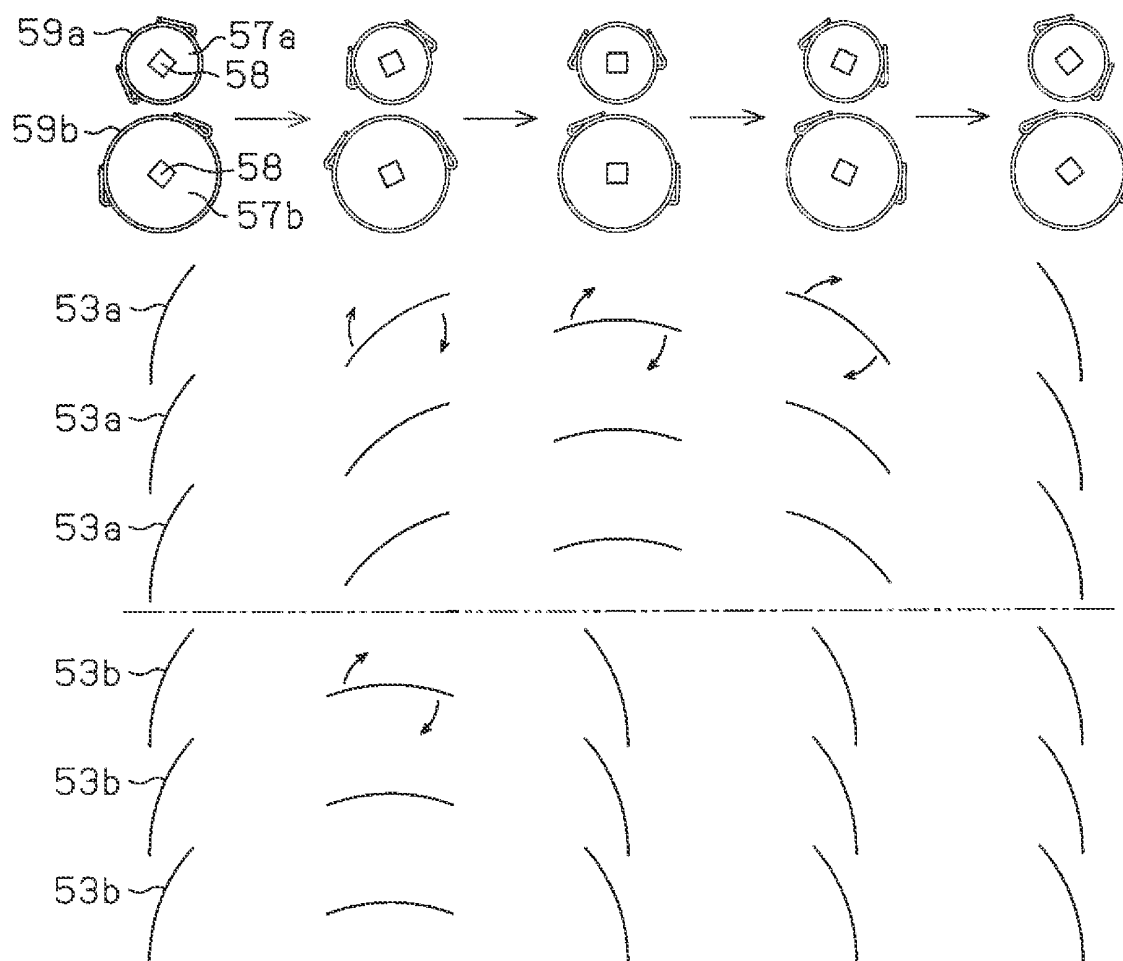


Fig.28(a) Fig.28(b) Fig.28(c) Fig.28(d) Fig.28(e)

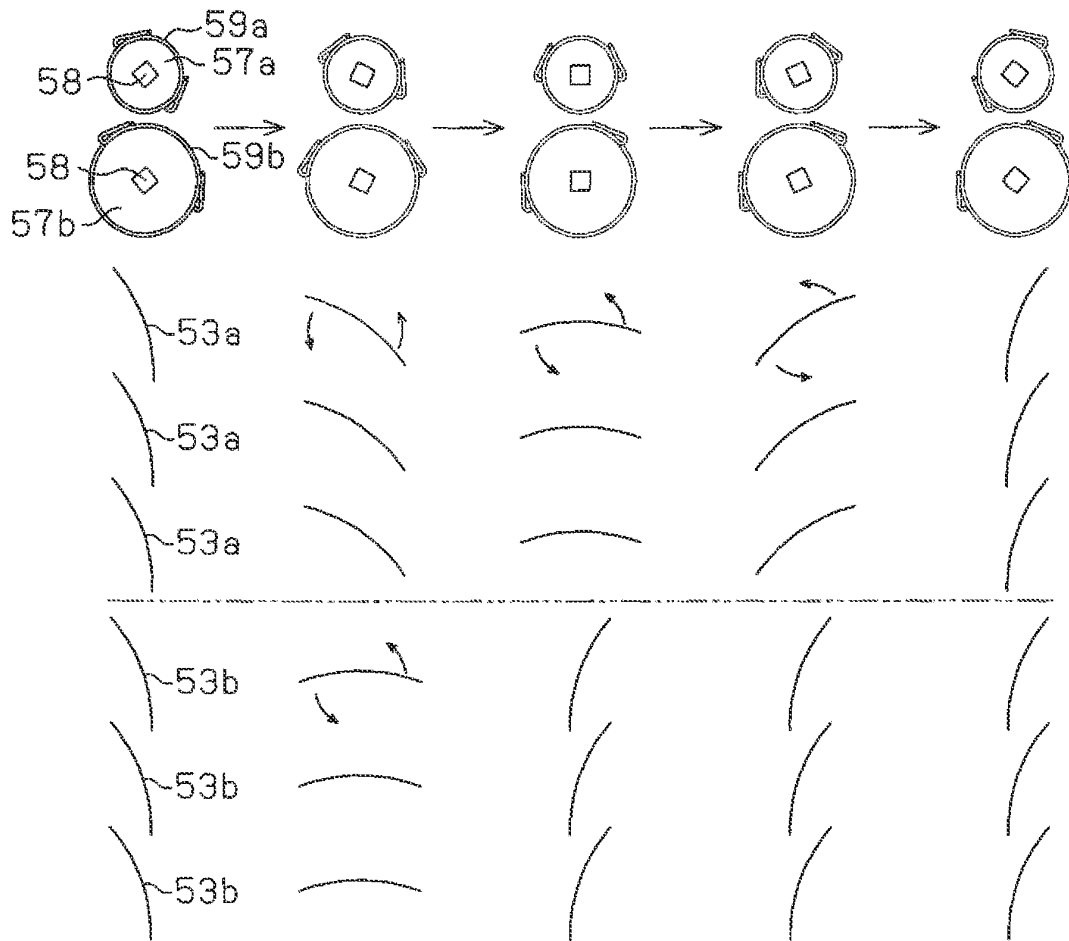
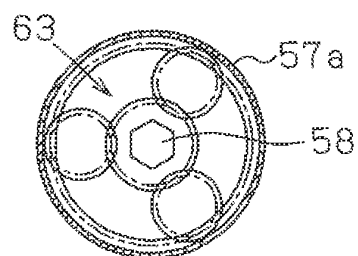


Fig.29



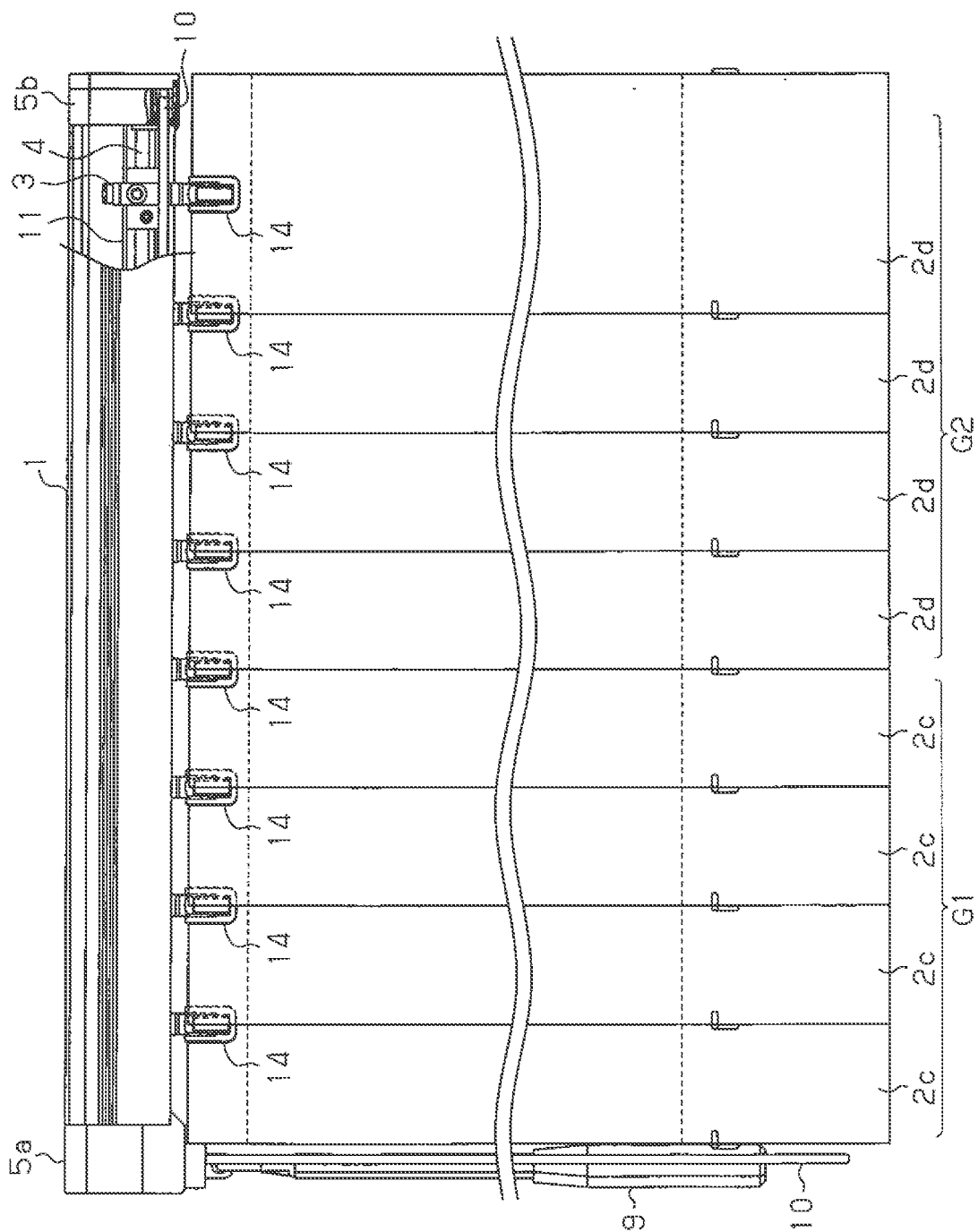


Fig. 30

Fig. 31

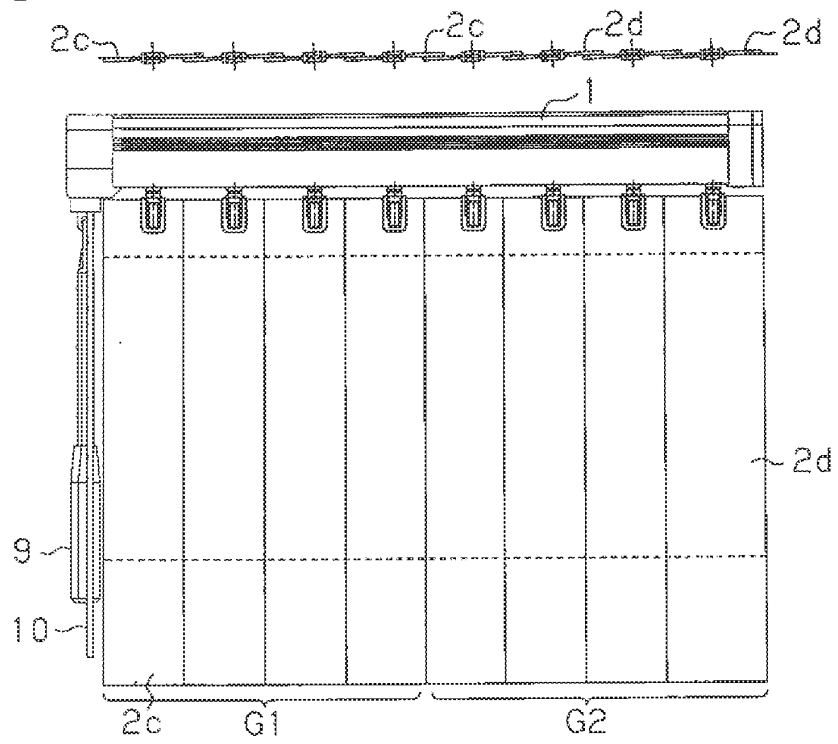


Fig. 32

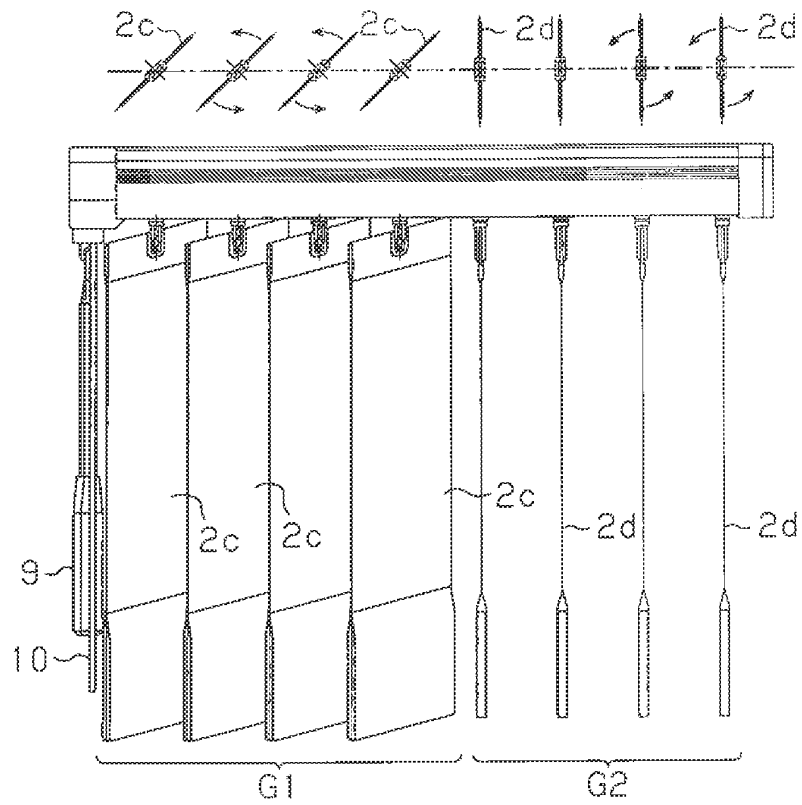


Fig.33

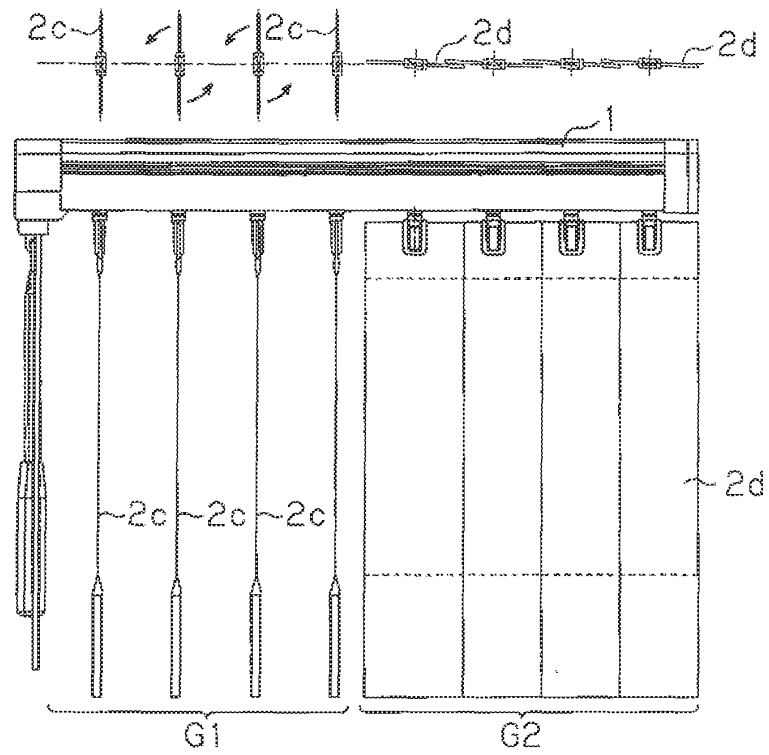


Fig.34

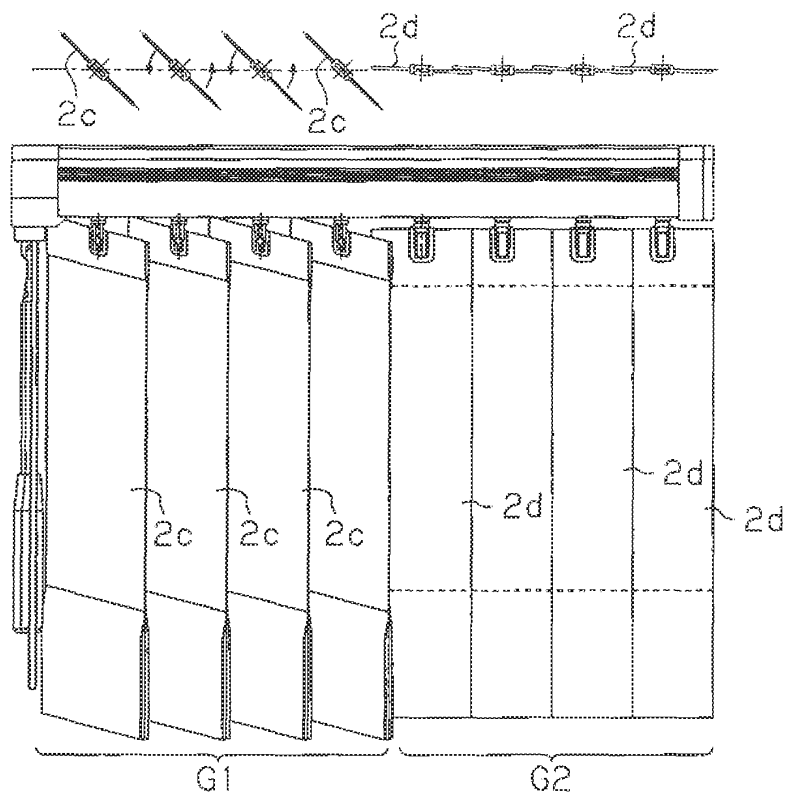


Fig. 35

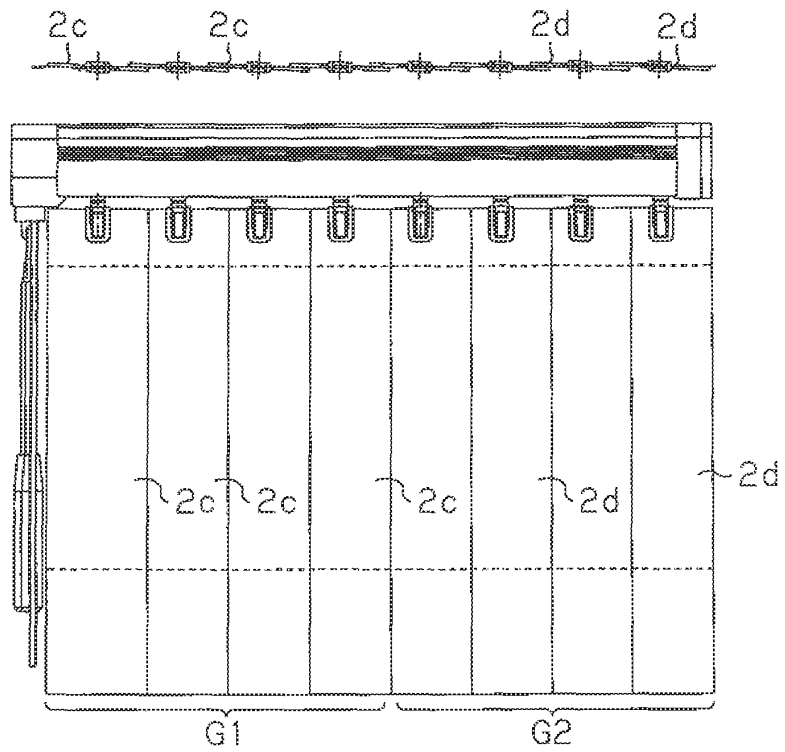


Fig. 36

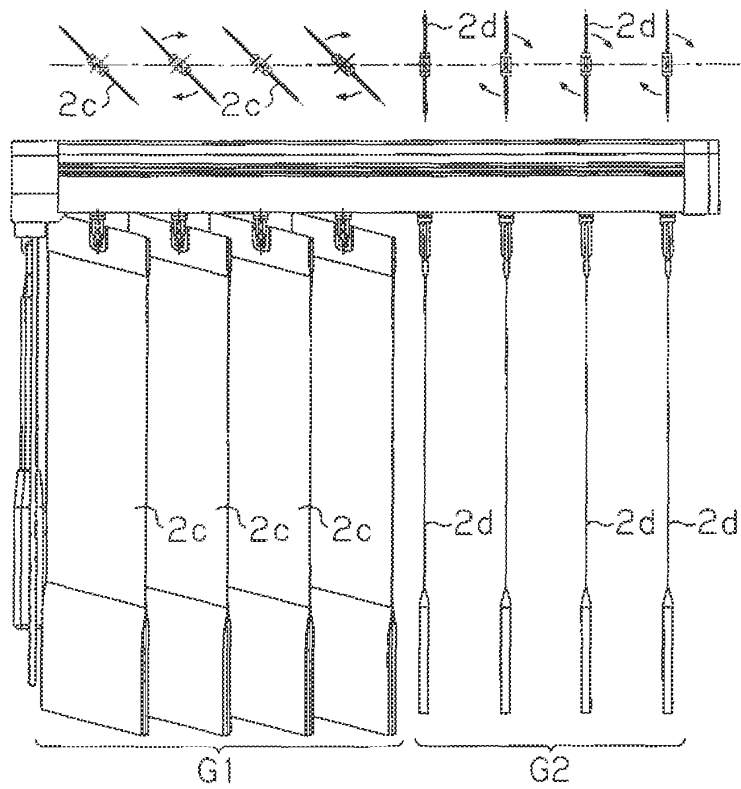


Fig.37

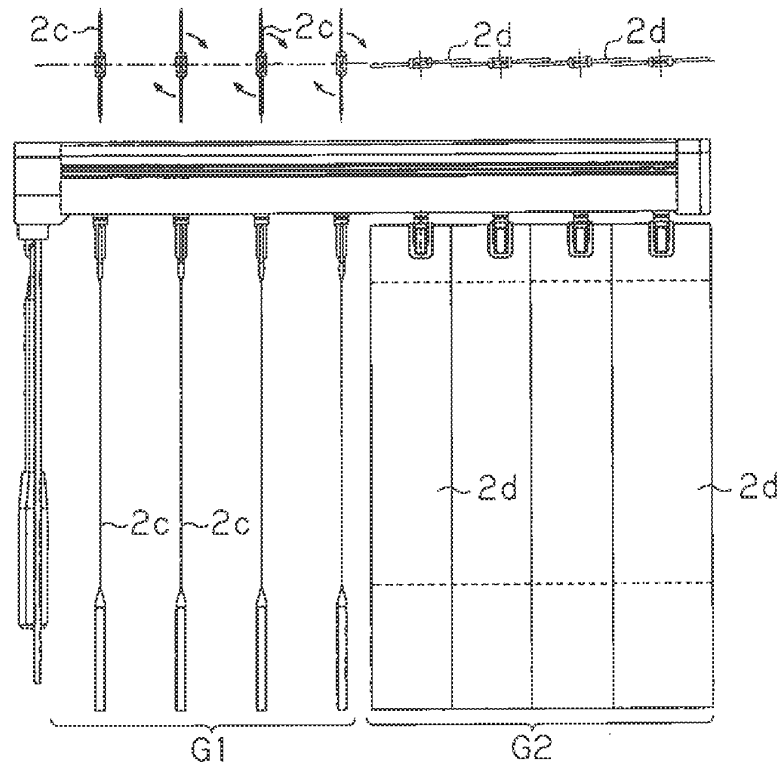


Fig.38

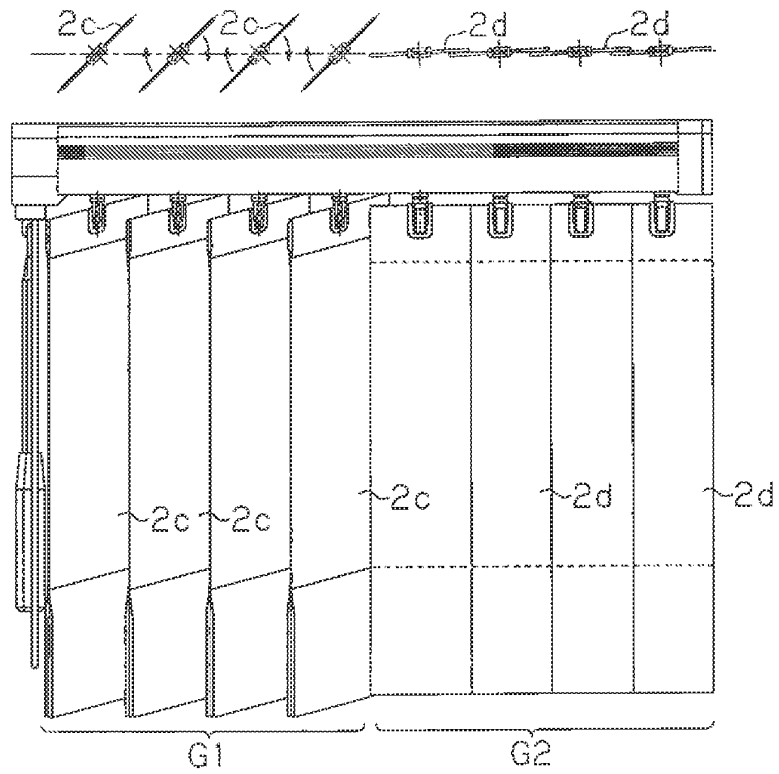
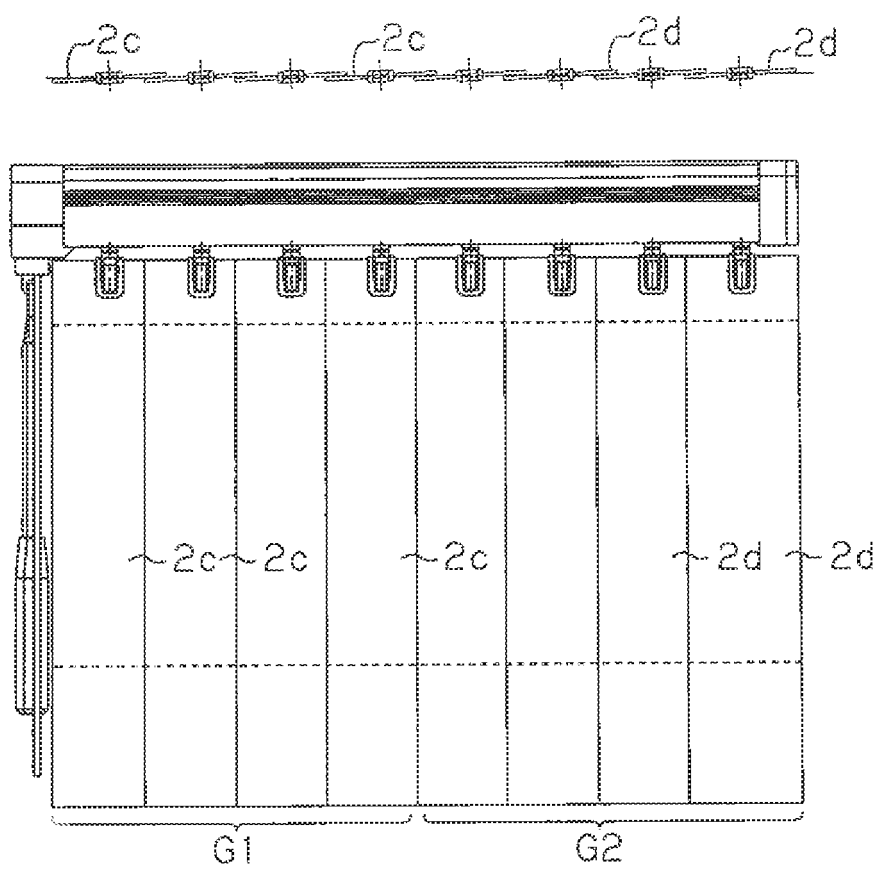


Fig. 39



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/067408

A. CLASSIFICATION OF SUBJECT MATTER

E06B9/36(2006.01) i, E06B9/322(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)

E06B9/36, E06B9/322

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	1996-2007
Kokai Jitsuyo Shinan Koho	1971-2007	Toroku Jitsuyo Shinan Koho	1994-2007

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.
A	JP 7-293150 A (Kabushiki Kaisha Nichibei), 07 November, 1995 (07.11.95), Full text; all drawings (Family: none)	1-16
A	FR 2691744 A (GARIN Joseph), 03 December, 1993 (03.12.93), Full text; all drawings (Family: none)	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

02 November, 2007 (02.11.07)

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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