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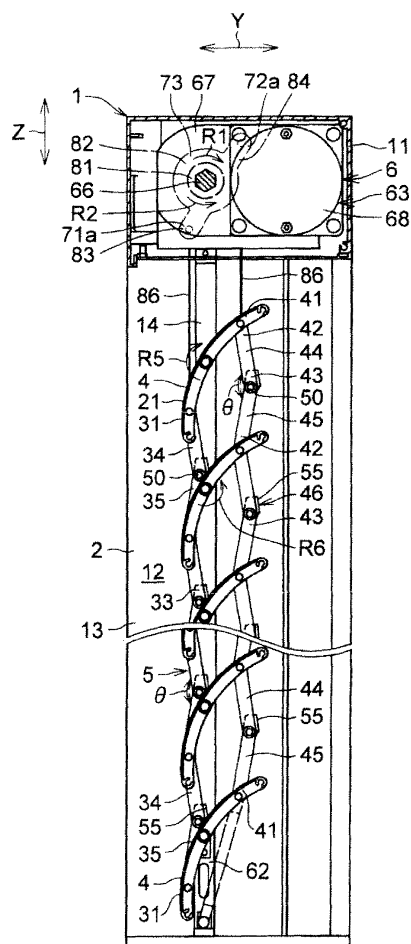
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(54) **Window blind apparatus**

(57) A window blind apparatus 1 includes a plurality of slats 4 juxtaposed in a vertical direction Z between a pair of vertical frames 2 and 3 which oppose each other in a lateral direction X; pairs of foldable link mechanisms 5 connecting the plurality of slats 4 to each other; a pair of raising/lowering mechanisms 6 for raising or lowering the plurality of slats 4 in the vertical direction Z; and a pair of tilt mechanisms 7 for tilting the plurality of slats 4 by causing pairs of front edge link members 34 and 35 and pairs of rear edge link members 44 and 45 of the respective link mechanisms 5 to undergo relative positional change.

FIG. 2



Description

BACKGROUND OF THE INVENTION

Field of the Invention:

[0001] The present invention relates to a window blind apparatus for screening a window or the like of a building by raising/lowering and tilting a plurality of slats disposed in the window or the like.

Description of the Related Art:

[0002] In JP-A-2002-168068, for example, a window blind apparatus has been proposed in which a plurality of slats are connected to each other by link mechanisms each comprising a pair of foldable front edge link members which are rotatably connected at respective one ends thereof to a front edge portion of the slat in a slit formed in each of opposite end portions in the longitudinal direction of the mutually adjacent slats, and which are rotatably connected to each other at other ends thereof; and a pair of foldable rear edge link members which are rotatably connected at respective one ends thereof to a rear edge portion of the slat in the slit of each of the mutually adjacent slats, and which are rotatably connected to each other at other ends thereof. The pair of front edge link members and the pair of rear edge link members of such a window blind apparatus are arranged to be folded such that the other ends of the pair of front edge link members are located rearwardly of the one ends thereof, and the other ends of the pair of rear edge link members are located forwardly of the one ends thereof. The pair of front edge link members and the pair of rear edge link members thus constructed are disposed by being juxtaposed to each other in the longitudinal direction of the slat so as to avoid their mutual interference during folding.

[0003] With the above-described window blind apparatus, since folding is effected such that the other ends of the pair of front edge link members are located rearwardly of the one ends thereof, and the other ends of the pair of rear edge link members are located forwardly of the one ends thereof, the pair of front edge link members and the pair of rear edge link members are disposed by being juxtaposed to each other in the longitudinal direction of the slat so as to avoid their mutual interference during folding. As a result, it is difficult to narrow the installation width of the link mechanisms in the longitudinal direction of the slat. It should be noted that if the installation widths of vertical frames and the link mechanisms of such a window blind apparatus can be narrowed, it is possible to secure the opening of the building widely, and enlarge the area of shielding the light, wind, and the like by means of the slats. In addition, the narrowing of the aforementioned installation width of such a window blind apparatus is required when there is a demand for narrowing the distance between the window blind apparatus

and the window blind apparatus in connection with the column width when the window blind apparatuses are juxtaposed for the respective windows of a building arranged in the lateral direction.

[0004] The present invention has been devised in view of the above-described aspects, and its object is to provide a window blind apparatus capable of narrowing the installation width of the link mechanisms.

10 SUMMARY OF THE INVENTION

[0005] A window blind apparatus according to the present invention comprises: a plurality of slats juxtaposed to each other; pairs of foldable link mechanisms connecting the plurality of slats to each other; a pair of raising/lowering mechanisms for raising or lowering the plurality of slats, wherein the link mechanism has a pair of foldable front edge link members which are rotatably connected at respective one ends thereof to front edge portions of the mutually adjacent slats, and which are rotatably connected to each other at respective other ends thereof; a pair of foldable rear edge link members which are disposed in juxtaposition to the pair of front edge link members in a transverse direction, which are rotatably connected at respective one ends thereof to rear edge portions of the mutually adjacent slats, and which are rotatably connected to each other at respective other ends thereof; and specifying means for specifying a direction of folding each of the pair of front edge link members and the pair of rear edge link members, such that when the pair of front edge link members and the pair of rear edge link members are folded, the respective other ends of the pair of front edge link members and the pair of rear edge link members are located forwardly of the respective one ends thereof, or the respective other ends of the pair of front edge link members and the pair of rear edge link members are located rearwardly of the respective one ends thereof, or the other ends of the pair of front edge link members are located forwardly of the one ends thereof and the other ends of the pair of rear edge link members are located rearwardly of the one ends thereof.

[0006] According to the present invention, specifying means is particularly provided for specifying a direction of folding each of the pair of front edge link members and the pair of rear edge link members, such that when the pair of front edge link members and the pair of rear edge link members are folded, the respective other ends of the pair of front edge link members and the pair of rear edge link members are located forwardly of the respective one ends thereof, or the respective other ends of the pair of front edge link members and the pair of rear edge link members are located rearwardly of the respective one ends thereof, or the other ends of the pair of front edge link members are located forwardly of the one ends thereof and the other ends of the pair of rear edge link members are located rearwardly of the one ends thereof. Accordingly, the pair of front edge link members and the pair of

rear edge link members can be disposed by being arranged in the transverse direction such that they do not interfere with each other during folding. Thus, it is possible to narrow the installation width of the link mechanisms in the longitudinal direction of the slat,

[0007] In a preferred embodiment according to the present invention, one of a slit and an elongated hole is formed at an end portion in a longitudinal direction of each of the slats, and the respective one ends of the pair of front edge link members which are folded such that the other ends thereof are located rearwardly of the one ends thereof or the pair of rear edge link members which are folded such that the other ends thereof are located forwardly of the one ends thereof are rotatably connected to the respective end portion of the slat in one of the slit and the elongated hole.

[0008] In a preferred further embodiment according to the present invention, the specifying means has hampering pieces which are respectively provided integrally at the respective other ends of one of the front edge link members and one of the rear edge link members, and which prevent the mutual rotation of the pair of front edge link members by not less than a predetermined amount and the mutual rotation of the pair of rear edge link members by not less than a predetermined amount by coming into contact with the respective other ends of another one of the front edge link members and another one of the rear edge link members, in order to specify the direction of folding each of the pair of front edge link members and the pair of rear edge link members.

[0009] In a preferred still further embodiment according to the present invention, the window blind apparatus further comprises: a pair of tilt mechanisms for tilting the plurality of slats by causing the pairs of front edge link members and the pairs of rear edge link members to undergo relative positional change.

[0010] In that embodiment, the tilt mechanism may include a swingable member which is connected at a front edge portion thereof to the front edge portion of an uppermost one of the slats or the one end of an uppermost one of the front edge link members, and is connected at a rear edge portion thereof to the rear edge portion of the uppermost one of the slats or the one end of an uppermost one of the rear edge link members, so as to be able to tilt the plurality of slats by swinging; and a clutch mechanism for transmitting the operation of the raising/lowering mechanism to the swingable member so as to swing the swingable member.

[0011] In a preferred still further embodiment according to the present invention, the raising/lowering mechanism is adapted to raise the plurality of slats starting with the lowermost one of the slats and lower the plurality of slats starting with the lowermost one of the slats,

[0012] According to the present invention, it is possible to provide a window blind apparatus capable of narrowing the installation width of the link mechanisms,

[0013] Hereafter, a more detailed description will be given of an embodiment of the present invention with

reference to the accompanying drawings. It should be noted that the present invention is not limited to the following preferred embodiment.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is an explanatory perspective view of an embodiment of the invention;

Fig. 2 is an explanatory side cross-sectional view of the embodiment shown in Fig. 1;

Fig. 3 is a partially enlarged explanatory front elevational view of the embodiment shown in Fig. 1;

Fig. 4 is a partially enlarged explanatory perspective view of the embodiment shown in Fig. 1;

Fig. 5 is a partially enlarged explanatory plan cross-sectional view of the embodiment shown in Fig. 1;

Fig. 6 is an explanatory diagram of mainly a clutch mechanism of the embodiment shown in Fig. 1;

Fig. 7 is an explanatory diagram of mainly the clutch mechanism of the embodiment shown in Fig. 1;

Fig. 8 is an explanatory diagram of mainly the clutch mechanism of the embodiment shown in Fig. 1; and

Fig. 9 is a diagram explaining the operation of the embodiment shown in Fig.

1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] In Figs. 1 to 9, a window blind apparatus 1 in accordance with this embodiment is comprised of a plurality of slats 4 juxtaposed in a vertical direction Z between a pair of vertical frames 2 and 3 which oppose each other in a lateral direction X; pairs of foldable link mechanisms 5 connecting the plurality of slats 4 to each other; a pair of raising/lowering mechanisms 6 for raising or lowering the plurality of slats 4 in the vertical direction Z; and a pair of tilt mechanisms 7 for tilting the plurality of slats 4 by causing pairs of front edge link members 34 and 35 and pairs of rear edge link members 44 and 45 of the respective link mechanisms 5 to undergo relative positional change.

[0016] Since the link mechanism 5, the raising/lowering mechanism 6, and the tilt mechanism 7 on the vertical frame 2 side and the link mechanism, the raising/lowering mechanism, and the tilt mechanism on the vertical frame 3 side are respectively constructed in a substantially mutually similar manner, a detailed description will be given below mainly of the link mechanism 5, the raising/lowering mechanism 6, and the tilt mechanism 7 on the vertical frame 2 side. The link mechanism, the raising/lowering mechanism, and the tilt mechanism on the vertical frame 3 side are denoted by the same reference numerals in the drawings, as required, and a detailed description thereof will be omitted.

[0017] The vertical frame 2 and the vertical frame 3 are bridged by an upper frame 11 extending in the lateral direction X. The vertical frames 2 and 3 and the upper frame 11 define an opening 12 which is opened and closed by the plurality of slats 4. A slit 14 extending in the vertical direction Z is formed in a side wall 13 on the slat 4 side of the vertical frame 2.

[0018] As particularly shown in Figs. 4 and 5, each of the slats 4 has a slat body 21 having a circular arc-shaped cross section, as well as a pair of connectors 23 which are respectively provided at end portions 22 in the longitudinal direction (the same direction as the lateral direction X in this embodiment) of the slat body 21, and each of which connects the link mechanism 5 to the slat body 21 at the end portion 22. It should be noted that the number of the slats 4 juxtaposed between the vertical frames 2 and 3 is set appropriately in correspondence with the size and the like of the window or the like of the building where the window blind apparatus 1 is installed.

[0019] The connector 23 has a substantially circular arc-shaped main body 24; a slit 25 formed in the main body 24 in such a manner as to extend in a transverse direction Y, such that the pair of front edge link members 34 and 35 or the pair of rear edge link members 44 and 45, i.e., the pair of front edge link members 34 and 35 in this embodiment, are disposed therein; and a shaft portion 26 which is inserted in the slit 14 of the vertical frame 2 and is guided by the slit 14 in the vertical frame Z. Instead of the slit 25, an elongated hole extending in the transverse direction Y may be formed in the connector 23.

[0020] The link mechanism 5 has the pair of foldable front edge link members 34 and 35 which are rotatably connected at respective one ends 32 to front edge portions 31 of the slats 4 mutually adjacent in the vertical direction Z, and which are rotatably connected to each other at their other ends 33; the pair of foldable rear edge link members 44 and 45 which are disposed in juxtaposition to the pair of front edge link members 34 and 35 in the transverse direction Y of the window blind apparatus 1, which are rotatably connected at respective one ends 42 to rear edge portions 41 of the slats 4 mutually adjacent in the vertical direction Z, and which are rotatably connected to each other at their other ends 43; and a specifying means 46 for specifying the direction of folding each of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45, such that when the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are folded, the respective other ends 33 and 43 of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are located rearwardly of the respective one ends 32 and 42.

[0021] The one end 32 of the upper front edge link member 34 between the pair of front edge link members 34 and 35 is rotatably connected to the front edge portion 31 of the upper slat 4 in the slit 25 through a pin 50, while the one end 32 of the lower front edge link member 35 between the pair of front edge link members 34 and 35

is rotatably connected to the front edge portion 31 of the lower slat 4 in the slit 25 through the pin 50. The front edge link members 34 and 35 are in a chain form by being rotatably connected at their respective one ends 32 in correspondence with the number of slats 4 adjacent to each other in the vertical direction Z in this embodiment. Such pairs of front edge link members 34 and 35 constitute a train of front edge links. Each of the front edge link members 34 and 35 is constituted by a link arm or the like,

[0022] As the mutual rotation of the pair of front edge link members 34 and 35 by not less than a predetermined amount is prevented by a hampering piece 55, a bent angle θ of less than 180° is maintained even in a case where the pair of front edge link members 34 and 35 are extended.

[0023] The one end 42 of the upper rear edge link member 44 between the pair of rear edge link members 44 and 45 is rotatably connected to the rear edge portion 41 of the upper slat 4 through the pin 50, while the one end 42 of the lower rear edge link member 45 between the pair of rear edge link members 44 and 45 is rotatably connected to the rear edge portion 41 of the lower slat 4 through the pin 50. The pair of rear edge link members 44 and 45 are in a chain form by being rotatably connected at their respective one ends 42 in correspondence with the number of slats 4 adjacent to each other in the vertical direction Z in this embodiment. Such pairs of rear edge link members 44 and 45 constitute a train of rear edge links. Each of the rear edge link members 44 and 45 is constituted by a link arm or the like.

[0024] As the mutual rotation of the pair of rear edge link members 44 and 45 by not less than a predetermined amount is prevented by the hampering piece 55, the bent angle θ of less than 180° equivalent to the bent angle of the pair of front edge link members 34 and 35 is maintained even in the case where the pair of rear edge link members 44 and 45 are extended.

[0025] The specifying means 46 has the hampering pieces 55 which are respectively provided integrally at the other end 33 of the front edge link member 35 and the other end 43 of the rear edge link member 45, and which prevent the mutual rotation of the pair of front edge link members 34 and 35 by not less than a predetermined amount and the mutual rotation of the pair of rear edge link members 44 and 45 by not less than a predetermined amount by coming into contact with the other end 33 of the front edge link member 34 and the other end 43 of the rear edge link member 44, in order to specify the direction of folding each of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45.

[0026] The raising/lowering mechanism 6 includes an ended chain 61 serving as a flexible elongated body; a connecting member 62 connecting one end of the chain 61 suspended on the front edge portion 31 side to the shaft portion 26 of a lowermost slat 4 among the plurality of slats 4; and a traveling means 63 for causing the chain 61 to travel in directions A and B.

[0027] The traveling means 63 includes a sprocket wheel 65 around which the chain 61 is wound and which serves as a rotator supported rotatably in directions R1 and R2 by the vertical frame 2; a rotating shaft 66 with a hexagonal cross section to which the sprocket wheel 65 is secured, and which extends in the lateral direction X and is rotatable in the directions R1 and R2; a reduction gear 67 whose output rotating shaft is the rotating shaft 66 and which is supported by the vertical frame 2; and an electric motor 68 whose output rotating shaft is an input rotating shaft of the reduction gear 67 and which is mounted on the reduction gear 67. The traveling means 63 is arranged such that as the electric motor 68 is operated, the sprocket wheel 65 is rotated in the directions R1 and R2 by means of the reduction gear 67 and the rotating shaft 66, and the chain 61 is caused to travel in the directions A and B by this rotation.

[0028] The chain 61 is sandwiched between respective two pairs of guide protrusions 71 and 72 which are formed integrally with the vertical frame 2 inside the vertical frame 2 in such a manner as to extend in the vertical direction Z, and its unnecessary deflection is prevented, so that the traveling of the chain 61 will be guided in the vertical direction Z. Unnecessary deflection of the chain 61 is prevented by being held down by a chain holder 70 which is disposed around the sprocket wheel 65 above the guide protrusions 71 and 72 and is supported by the vertical frame 2.

[0029] The rotating shaft 66 extends in the lateral direction X from inside the vertical frame 2 to inside the vertical frame 3, and is also secured to the sprocket wheel inside the vertical frame 3 constructed in the same way as the sprocket wheel 65.

[0030] The above-described raising/lowering mechanism 6 is adapted to raise and lower the lowermost slat 4 among the plurality of slats 4 by means of the connecting member 62 as the chain 61 is caused to travel by the traveling means 63, thereby allowing the plurality of slats 4 to be raised and lowered starting with the lowermost slat 4.

[0031] The raising/lowering mechanism on the vertical frame 3 side shares the traveling means 63 on the vertical frame 2 side with the raising/lowering mechanism 6 on the vertical frame 2 side, since the sprocket wheel of the raising/lowering mechanism on the vertical frame 3 side is secured to an end portion of the rotating shaft 66 inside the vertical frame 3.

[0032] The tilt mechanism 7 includes a swingable member 73 which is swingable in the directions R1 and R2, and which is connected at its front edge portion 71a to the front edge portion 31 of the uppermost slat 4 or the one end 32 of the uppermost front edge link member 34, and is connected at its rear edge portion 72a to the rear edge portion 41 of the uppermost slat 4 or the one end 42 of the uppermost rear edge link member 44, so as to be able to tilt the plurality of slats 4 in directions R5 and R6 by swinging in the directions R1 and R2; and a clutch mechanism 75 for transmitting the operation of the

raising/lowering mechanism 6 to the swingable member 73 so as to swing the swingable member 73 when the pairs of front edge link members 34 and 35 and the pairs of rear edge link members 44 and 45 are extended by the raising/lowering mechanism 6.

[0033] The swingable member 73 includes a disk portion 82 which is provided on the rotating shaft 66 rotatably in the directions R1 and R2 relative to the rotating shaft 66 by means of a bearing 81; a projecting portion 83 provided integrally on the disk portion 82 and projecting forwardly from the disk portion 82; and a projecting portion 84 provided integrally on the disk portion 82 and projecting rearwardly from the disk portion 82. The front edge portion 71a of the projecting portion 83 is connected to the front edge portion 31 of the connector 23 of the uppermost slat 4 through a cord-like body 86 constituted by a wire or the like, while the rear edge portion 72a of the projecting portion 84 is connected to the rear edge portion 41 of the connector 23 of the uppermost slat 4 through the cord-like body 86.

[0034] The clutch mechanism 75 includes a projection 96 attached to the chain 61; a disk member 95 in which a recess 97 for the projection 96 to fit therein in the traveling of the chain 61 is formed, and which is fixed to the swingable member 73; a latch member 98 which, when set to a rotation prohibiting state shown in Fig. 8, is engaged with the disk member 95 to prohibit the swinging of the swingable member 73, while when fitted in the recess 97 of the projection 96, is set in a rotation allowing state shown in Fig. 7 by the projection 96, so as to cancel the engagement with the disk member 95 to allow the swinging of the swingable member 73; and a resilient means 99 for resiliently urging the latch member 98 so as to set the latch member 98 in the rotation prohibiting state.

[0035] The latch member 98 is attached at its one end 100 to the chain holder 70 rotatably in directions R3 and R4 by means of a shaft 101. Thus, the latch member 98 is rotatably attached to the vertical frame 2 by means of the chain holder 70. The latch member 98 has a pawl portion 102 at its other end. When the latch member 98 is set in the rotation prohibiting state, the pawl portion 102 is disposed in the recess 97 of the disk member 95, and a guide wedge space 103 is formed between the recess 97 and the pawl portion 102. The resilient member 99 is constituted by a torsion coil spring, and is disposed such that its one end is retained by the chain holder 70, its other end is retained by the latch member 98, and its central portion is wound around the shaft 101. The resilient means 99 resiliently urges the latch member 98 so as to rotate it in the direction R4 about the shaft 101. The clutch mechanism 75 has a projection 104 formed on the disk member 95, and the latch member 98 has a recess 105 between its one end 100 and the pawl portion 102. When the latch member 98 is set in the rotation prohibiting state, the projection 104 is disposed in the recess 105, so that the projection 104 and the recess 105 are engaged with each other. Owing to the engagement be-

tween the projection 104 and the recess 105, the disk member 95 is prohibited from rotating in the directions R1 and R2 about the rotating shaft 66. Thus, the arrangement provided is such that the swingable member 73, to which the disk member 95 is secured, is prohibited from swinging in the directions R1 and R2 about the rotating axis 66.

[0036] Hereafter, a detailed description will be given of the operation of the window blind apparatus 1 in accordance with this embodiment with reference to the drawings. As shown in Fig. 2, in the state in which the link mechanisms 5 are extended, the plurality of slats 4 are in a state of being tilted with a tilt angle of 60° or thereabouts with respect to the transverse direction Y so as to close the opening of the building; the swingable member 73 is also in a state of being swung by a fixed amount; the projection 96 provided on the chain 61 is disposed in the recess 97 and is in a state in which the projection 104 and the recess 105 are disengaged, as shown in Fig. 6; and the latch member 98 abuts against an outer edge portion 107 of the disk member 95, and maintains the rotation allowing state for the disk member 95. When the electric motor 68 is operated in such a state, the sprocket wheel 65 rotates in the direction R1 by means of the reduction gear 67 and the rotating axis 66, and this rotation causes the chain 61 to travel in the direction A. In conjunction with the traveling of the chain 61 in the direction A, the projection 96 also moves in the direction R1 about the rotating shaft 66. As a result of the movement of the projection 96, the disk member 95 also rotates in the direction R1, and causes the swingable member 73 to swing in the direction R1. As a result of the swinging of the swingable member 73, the uppermost pair of front edge link members 34 and 35 and the lower pairs of front edge link members 34 and 35 connected below that pair of front edge link members 34 and 35 are raised by means of the cord-like body 86 on the front edge portion 71 a side which is pulled upward. At the same time, the uppermost pair of rear edge link members 44 and 45 and the lower pairs of rear edge link members 44 and 45 connected below that pair of rear edge link members 44 and 45 are lowered by means of the cord-like body 86 on the rear edge portion 72a side which is pulled downward. Thus, the plurality of slats 4 are synchronously tilted in the direction R5 so as to be set in a substantially horizontal state, as shown in Fig. 1.

[0037] If the chain 61 is further caused to travel in the direction A, the projection 96 starts to be dislocated from the recess 97, and the projection 96 is disengaged from the recess 97, thereby allowing the latch member 98 to rotate in the direction R4 about the shaft 101 and engaging the projection 104 and the recess 105. As shown in Fig. 8, as the projection 104 and the recess 105 are engaged, the rotation of the swingable member 73 is prevented. As the traveling of the chain 61 in the direction A is continued, the link mechanisms 5 connected to the chain 61 at the lower portion thereof start to be folded by the connecting member 62. As a result of this folding, the

plurality of slats 4 connected to the link mechanisms 5 are consecutively superposed on top of each other starting with the lower ones. When all of the plurality of slats 4 are superposed, the operation of the electric motor 68 is stopped, and the open state of the opening 12 as shown in Fig. 9 is maintained.

[0038] When the electric motor 68 is reversely operated in the open state as shown in Fig. 9, the chain 61 travels in the direction B. In consequence of this traveling, the uppermost pair of front edge link members 34 and 35 and the uppermost pair of rear edge link members 44 and 45 start to be consecutively extended, with the result that the superposition of the plurality of slats 4 is consecutively canceled starting with the upper slats 4. When all the link mechanisms 5 are extended, and the superposition of all of the plurality of slats 4 is canceled, the projection 96 passes the guide wedge space 103 and is fitted in the recess 97, as shown in Fig. 7. As a result of this fitting in, the projection 96 rotates the latch member 98 in the direction R3 against the resiliency of the resilient means 99 to disengage the projection 104 from the recess 105. As a result of this disengagement, the swingable member 73 is swung in the direction R2 opposite to the direction R1 in conjunction with the movement of the projection 96. As a result of this swinging, the pairs of rear edge link members 44 and 45 are raised through the cord-like body 86 on the rear edge portion 72a side which is pulled upward. At the same time, the pairs of front edge link members 34 and 35 are lowered through the cord-like body 86 on the front edge portion 71a side which is pulled downward. Thus, the plurality of slats 4 are rotated synchronously in the direction R6 to obtain the closed state of the opening 12 as shown in Fig. 2. Subsequently, the operation of the electric motor 68 is stopped, and the closed state of the opening 12 is maintained.

[0039] According to the above-described window blind apparatus 1, there are provided the plurality of slats 4 juxtaposed to each other; the pairs of foldable link mechanisms 5 connecting the plurality of slats 4 to each other; and the pair of raising/lowering mechanisms 6 for raising or lowering the plurality of slats 4. The link mechanism 5 has the pair of foldable front edge link members 34 and 35 which are rotatably connected at the respective one ends 32 to the front edge portions 31 of the mutually adjacent slats 4, and which are rotatably connected to each other at their other ends 33; the pair of foldable rear edge link members 44 and 45 which are disposed in juxtaposition to the pair of front edge link members 34 and 35 in the transverse direction Y, which are rotatably connected at the respective one ends 42 to the rear edge portions 41 of the mutually adjacent slats 4, and which are rotatably connected to each other at their other ends 43; and the specifying means 46 for specifying the direction of folding each of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45, such that when the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and

45 are folded, the respective other ends 33 and 43 of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are located rearwardly of the respective one ends 32 and 42. Accordingly, the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 can be disposed by being arranged in the transverse direction Y such that they do not interfere with each other during folding. Thus, it is possible to narrow the installation width of the link mechanisms 5 in the longitudinal direction of the slat 4.

[0040] The window blind apparatus 1 may have, instead of the specifying means 46, a specifying means for specifying the direction of folding each of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45, such that when the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are folded, the respective other ends 33 and 43 of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are located forwardly of the respective one ends 32 and 42, or the other ends 33 of the pair of front edge link members 34 and 35 are located forwardly of their one ends 32, and the other ends 43 of the pair of front edge link members 44 and 45 are located rearwardly of their one ends 42. In the case where the window blind apparatus 1 has the specifying means for specifying the direction of folding each of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45, such that when the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are folded, the respective other ends 33 and 43 of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are located forwardly of the respective one ends 32 and 42, the window blind apparatus 1 may have, instead of the connectors 23, connectors in each of which a slit or an elongated hole extending in the transverse direction Y is formed and where the pair of rear edge link members 44 and 45 is disposed. Alternatively, in the case where the window blind apparatus 1 has the specifying means for specifying the direction of folding each of the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45, such that when the pair of front edge link members 34 and 35 and the pair of rear edge link members 44 and 45 are folded, the other ends 33 of the pair of front edge link members 34 and 35 are located forwardly of their one ends 32, and the other ends 43 of the pair of front edge link members 44 and 45 are located rearwardly of their one ends 42, the window blind apparatus 1 may have, instead of the connectors 23, connectors in which the configurations of the slits or elongated holes are omitted.

Claims

1. A window blind apparatus comprising:

a plurality of slats juxtaposed to each other;
 pairs of foldable link mechanisms connecting the plurality of slats to each other;
 a pair of raising/lowering mechanisms for raising or lowering the plurality of slats,
 wherein said link mechanism has a pair of foldable front edge link members which are rotatably connected at respective one ends thereof to front edge portions of the mutually adjacent slats, and which are rotatably connected to each other at respective other ends thereof; a pair of foldable rear edge link members which are disposed in juxtaposition to said pair of front edge link members in a transverse direction, which are rotatably connected at respective one ends thereof to rear edge portions of the mutually adjacent slats, and which are rotatably connected to each other at respective other ends thereof; and specifying means for specifying a direction of folding each of said pair of front edge link members and said pair of rear edge link members, such that when said pair of front edge link members and said pair of rear edge link members are folded, the respective other ends of said pair of front edge link members and said pair of rear edge link members are located forwardly of the respective one ends thereof, or the respective other ends of said pair of front edge link members and said pair of rear edge link members are located rearwardly of the respective one ends thereof, or the other ends of said pair of front edge link members are located forwardly of the one ends thereof and the other ends of said pair of rear edge link members are located rearwardly of the one ends thereof.

2. The window blind apparatus according to claim 1, wherein one of a slit and an elongated hole is formed at an end portion in a longitudinal direction of each of the slats, and the respective one ends of the pair of front edge link members which are folded such that the other ends thereof are located rearwardly of the one ends thereof or the pair of rear edge link members which are folded such that the other ends thereof are located forwardly of the one ends thereof are rotatably connected to the respective end portion of the slat in one of the slit and the elongated hole.
3. The window blind apparatus according to claim 1 or 2, wherein said specifying means has hampering pieces which are respectively provided integrally at the respective other ends of one of said front edge link members and one of said rear edge link members, and which prevent the mutual rotation of said pair of front edge link members by not less than a predetermined amount and the mutual rotation of said pair of rear edge link members by not less than a predetermined amount by coming into contact with

the respective other ends of another one of said front edge link members and another one of said rear edge link members, in order to specify the direction of folding each of said pair of front edge link members and said pair of rear edge link members.

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4. The window blind apparatus according to any one of claims 1 to 3, further comprising:

a pair of tilt mechanisms for tilting the plurality of slats by causing said pairs of front edge link members and said pairs of rear edge link members to undergo relative positional change.

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5. The window blind apparatus according to claim 4, wherein said tilt mechanism includes a swingable member which is connected at a front edge portion thereof to the front edge portion of an uppermost one of the slats or the one end of an uppermost one of said front edge link members, and is connected at a rear edge portion thereof to the rear edge portion of the uppermost one of the slats or the one end of an uppermost one of said rear edge link members, so as to be able to tilt the plurality of slats by swinging; and a clutch mechanism for transmitting the operation of said raising/lowering mechanism to said swingable member so as to swing said swingable member.

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6. The window blind apparatus according to any one of claims 1 to 5, wherein said raising/lowering mechanism is adapted to raise the plurality of slats starting with the lowermost one of the slats and lower the plurality of slats starting with the lowermost one of the slats.

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FIG. 1

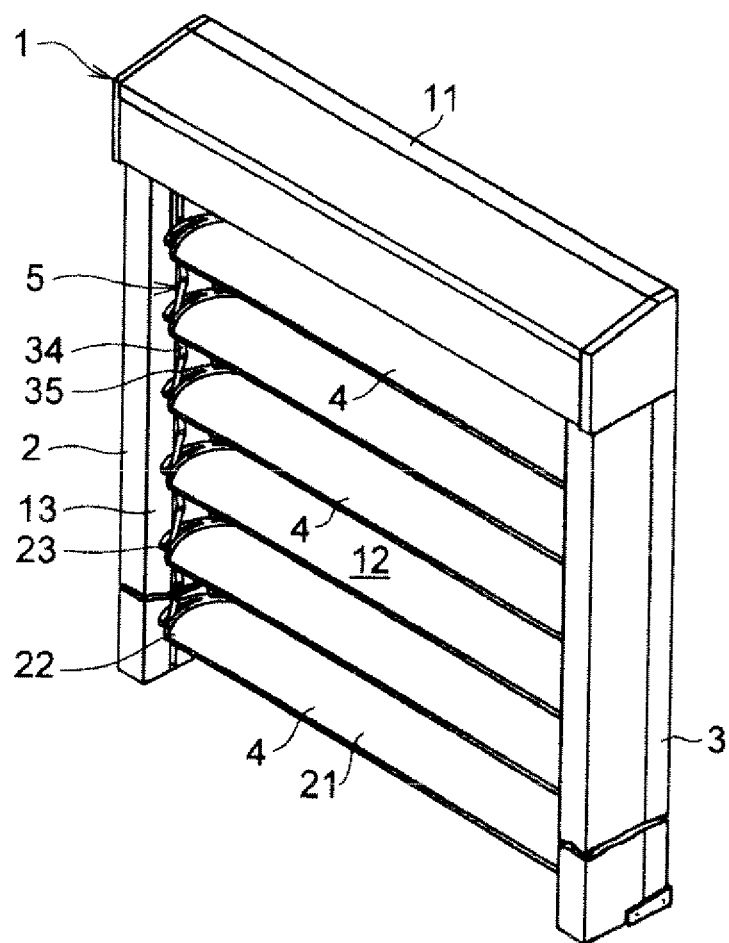


FIG. 2

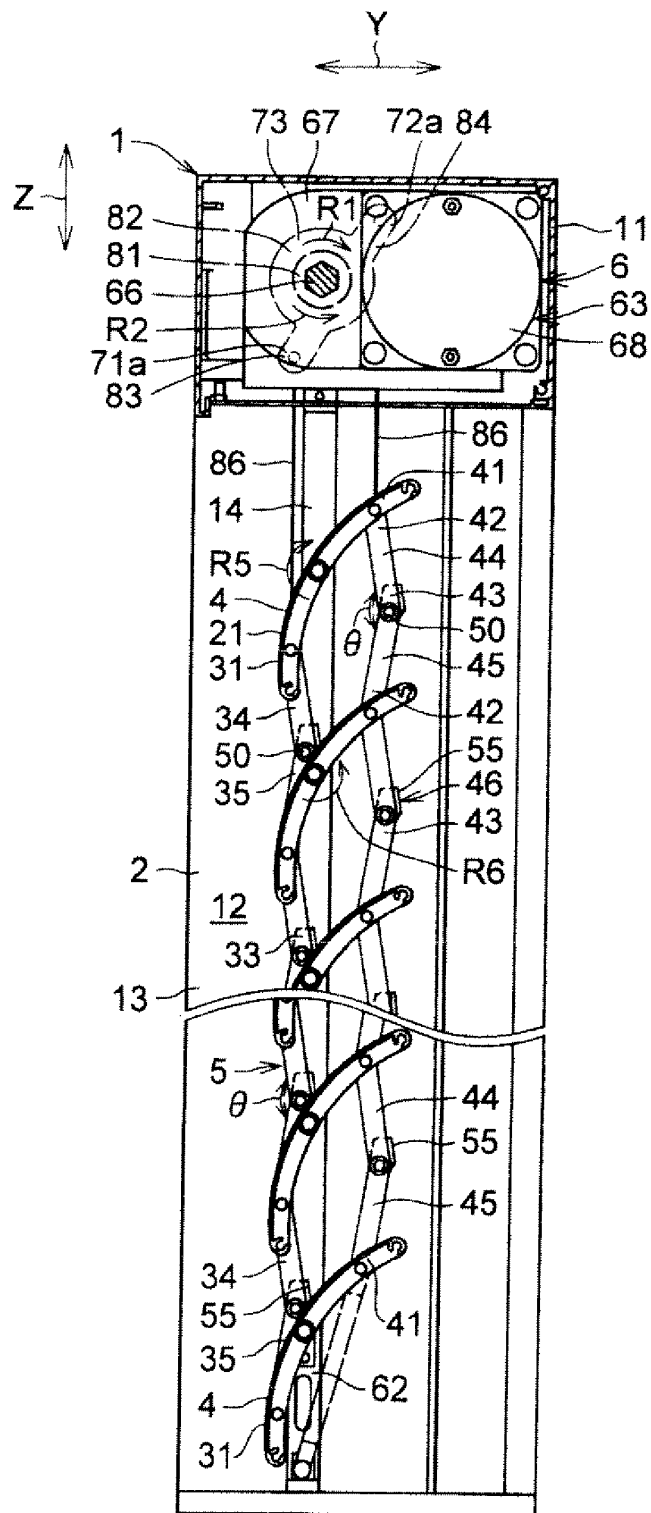


FIG. 3

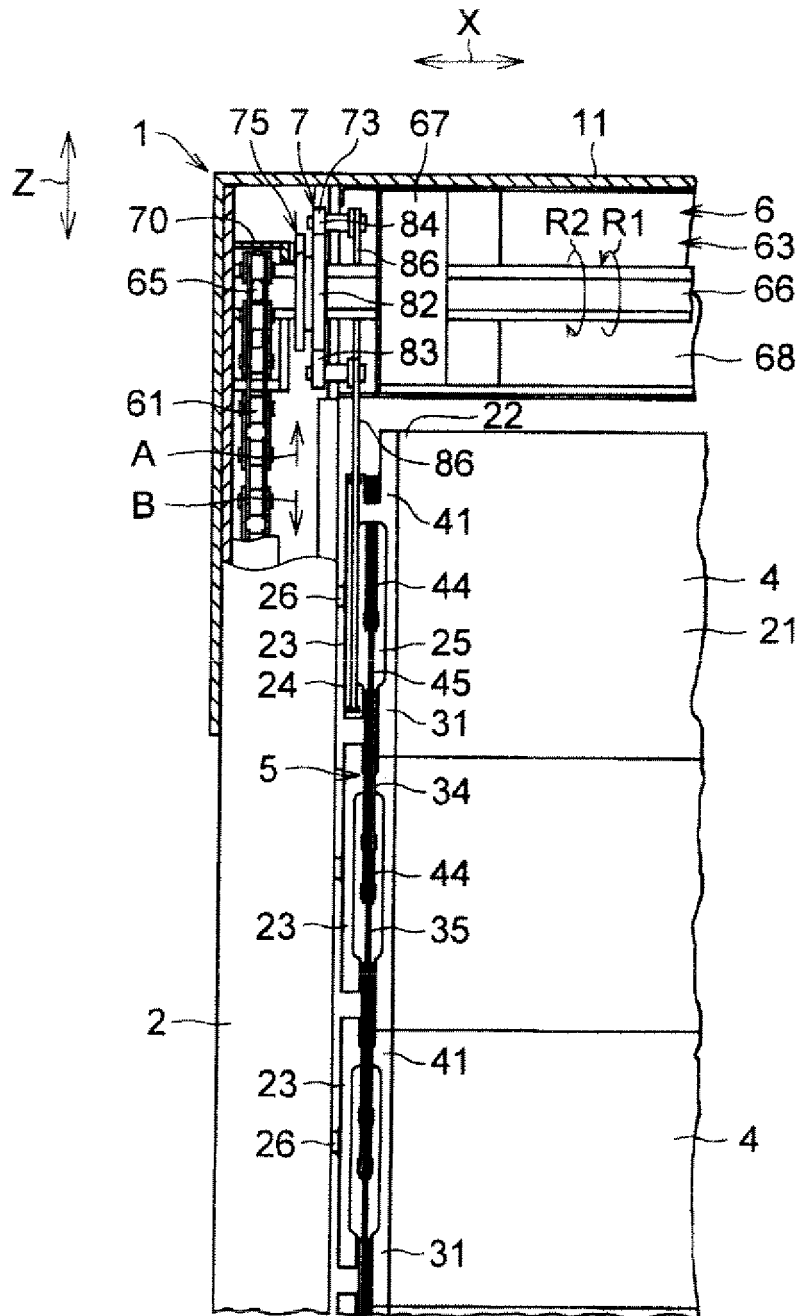


FIG. 4

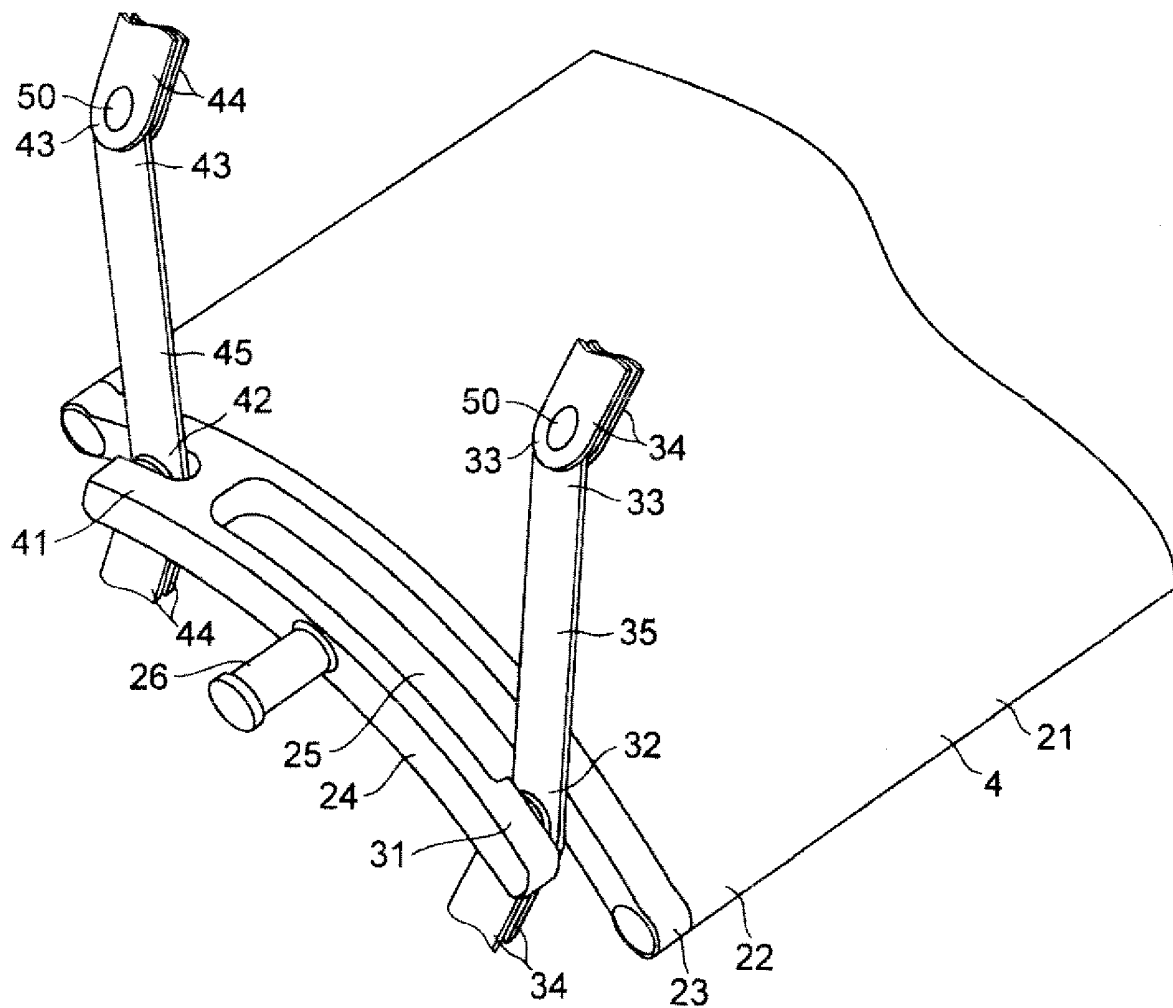


FIG. 5

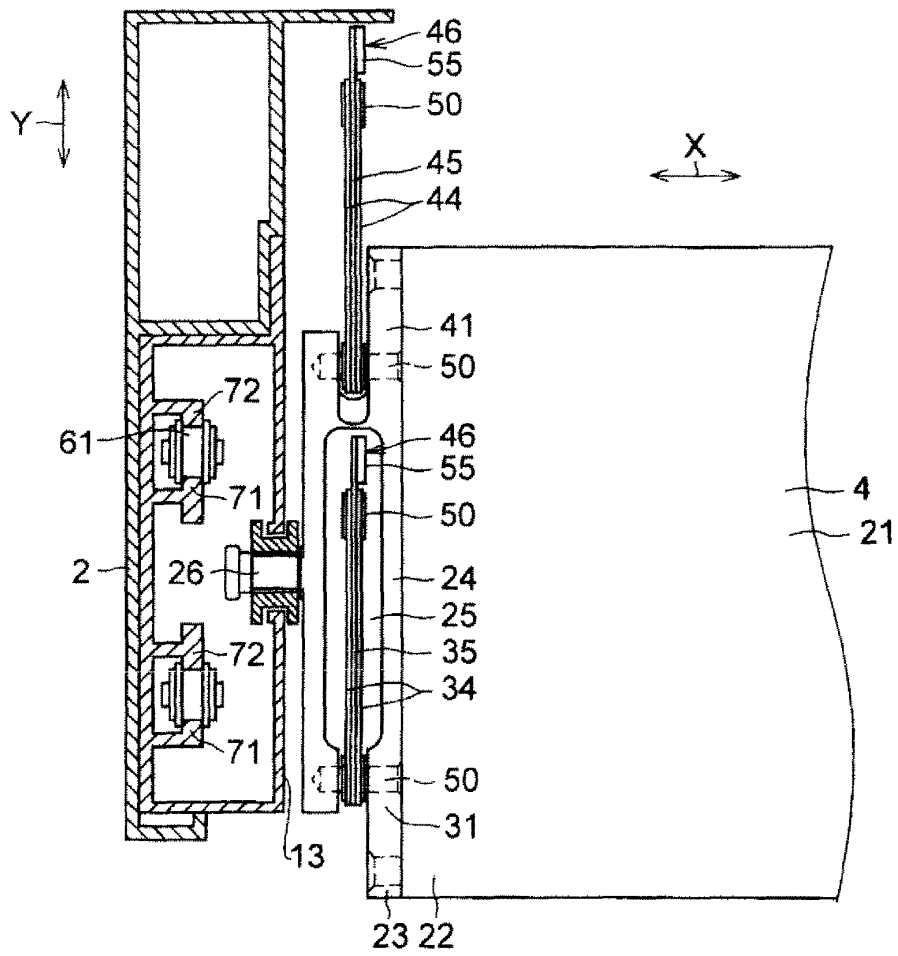


FIG. 6

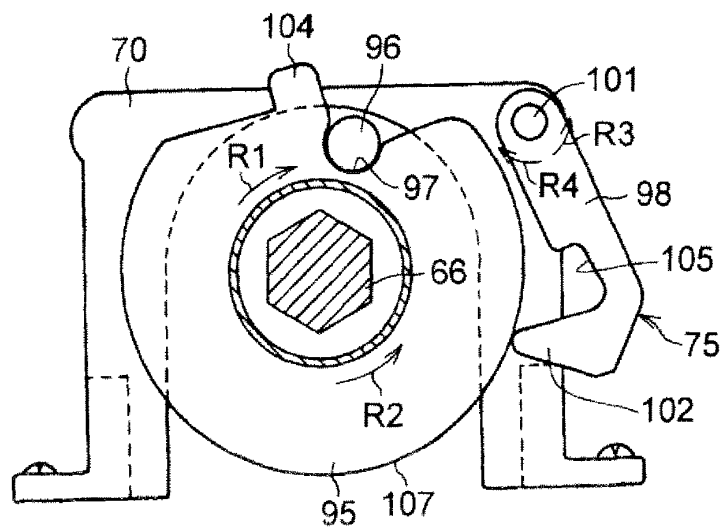


FIG. 7

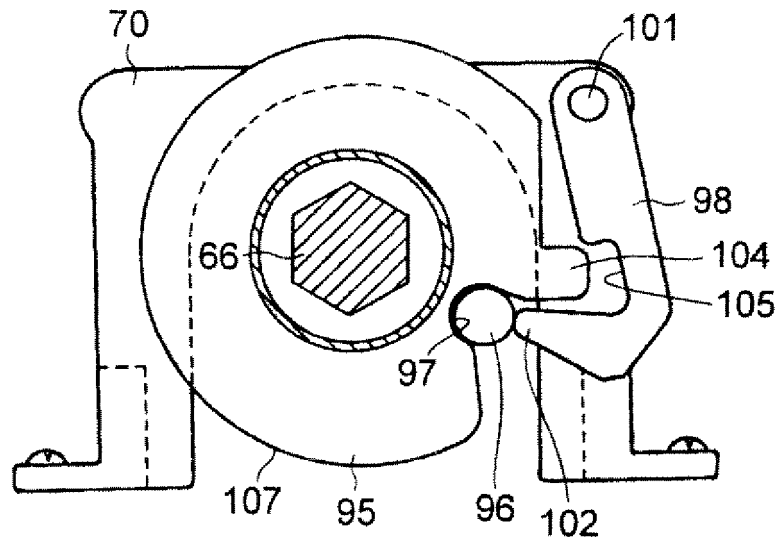


FIG. 8

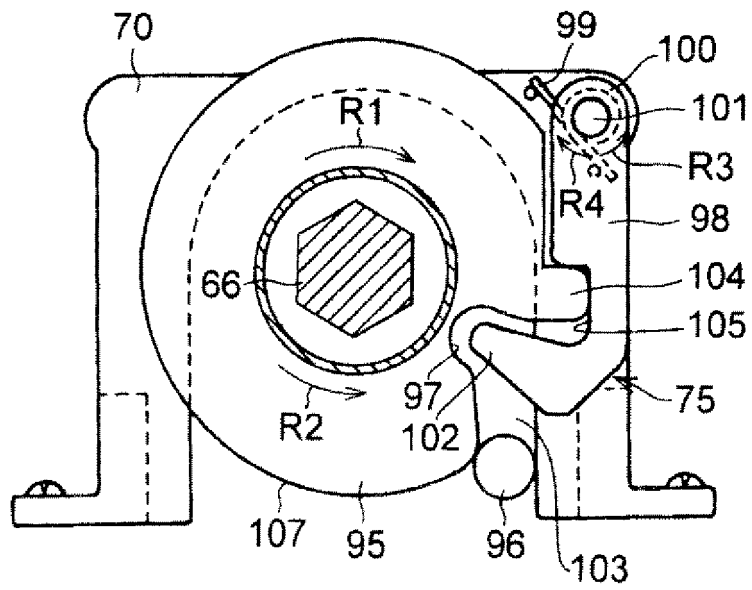


FIG. 9

