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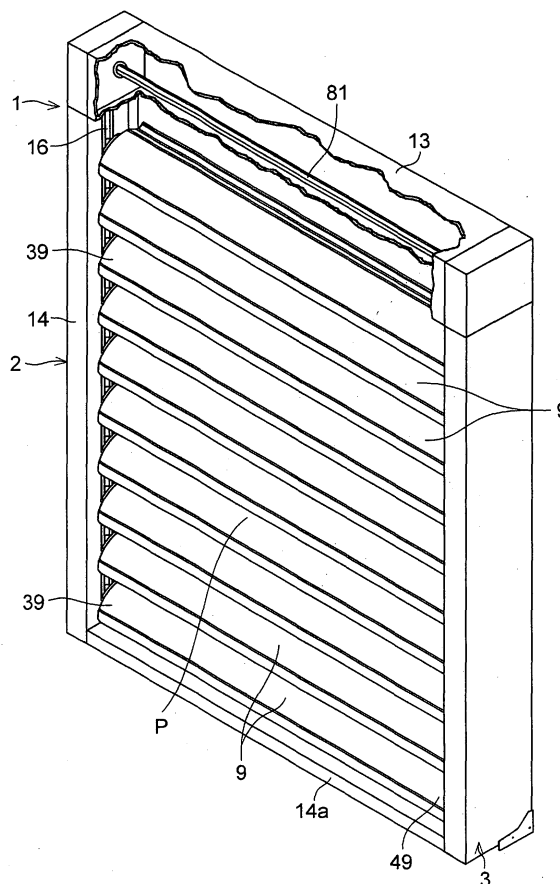
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(54) **Blind apparatus**

(57) A slat supporting member (8), which is interposed between, on the one hand, a pair of link mechanisms (4,5) and, on the other hand, each of a plurality of slats (9) to allow said slat (9) to be supported by said pair of link mechanisms (4,5), has a first support and a second support connected to the first support by means of a fitting and securing device. The first support includes a first arm portion having a pair of shaft holes in which shaft portions of a pair of shaft members (23,26) are respectively inserted and secured rotatably, a shaft portion disposed in such a manner as to pass through a guide slit, and a fitting projection adapted to be fitted in a fitting portion of said slat. The second support includes a second arm portion having at one end portion and the other end portion thereof a pair of shaft holes in which shaft portions at the other end portions of the shaft members (26) are respectively inserted and secured rotatably.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention:

[0001] The present invention relates to a blind apparatus disposed in an opening such as a window of a building to open or close the opening.

Description of the Related Art:

[0002] The present assignee earlier proposed a blind apparatus disclosed in JP-A-8-326445.

[0003] The aforementioned blind apparatus is comprised of a pair of link mechanisms; a plurality of slat supporting members each having one end portion connected to one of the link mechanisms and the other end portion connected to the other link mechanism; slats respectively supported by the slat supporting members; a raising and lowering mechanism for raising and lowering the slats; and a tilting mechanism for tilting the slats by causing the pair of link mechanisms to undergo relative positional changes as the slats are raised or lowered by the raising and lowering mechanism. Each of the slat supporting mechanisms has an arm member for supporting an end portion of the slat at a substantially central portion of the arm member.

[0004] With the slat supporting members of the blind apparatus disclosed in the above-described publication, since shaft members for connecting link members are supported in a cantilevered fashion, in a case where a plurality of slats are supported, deflection can occur in the shaft members due to the weight of the slats and the like, and the smooth rotation of the link members at the shaft members is hampered, thereby possibly making it impossible to effect smooth folding and unfolding of the link members.

[0005] In addition, with the blind apparatus disclosed in the above-described publication, since each of the link mechanisms is formed by linking the plate-shaped rigid link members in a chain form by means of the shafts, substantial time is required for the assembly of the link mechanisms, and a large force is required for raising and lowering the slats due to the weight of the link members.

[0006] Accordingly, in a case where each link mechanism is formed by using, instead of the rigid link members, a flexible belt-shaped body of a woven fabric or a knit fabric of yarn made of a synthetic resin such as polyester, or a flexible belt-shaped body of a nonwoven fabric made of a synthetic resin, the slat supporting members for allowing the slats to be supported by such a belt-shaped body are also required to be suited thereto.

SUMMARY OF THE INVENTION

[0007] The present invention has been devised in

view of the above-described aspects, and its object is to provide a slat supporting member which makes it possible to support the shaft members on both sides, prevent the deflection of the shaft members, and ensure smooth rotation of the shaft members, and which is suitable for supporting the slats with the flexible belt-shaped bodies replacing the rigid link members. Another object of the invention is to provide a slat supporting mechanism which is provided with such slat supporting members, and which can be assembled in a short time, and can be made lightweight without requiring a very large force for the raising and lowering of the slats, thereby making it possible to easily effect the raising and lowering of the slats. Still another object of the invention is to provide a blind apparatus having the slat supporting mechanisms.

[0008] In accordance with a first aspect of the invention, there is provided a slat supporting member for a blind apparatus interposed between, on the one hand, a pair of link mechanisms each having a plurality of shaft members connected to each other at fixed intervals and, on the other hand, an end portion of each of a plurality of slats disposed in parallel to each other and each having a fitting portion at the end portion thereof to allow said slat to be supported by said pair of link mechanisms, said slat supporting member comprising: a first support including a first arm portion having a pair of shaft holes which are respectively provided in one end portion and another end portion thereof, and in which one end portions of said shaft members of said link mechanisms are respectively inserted and secured rotatably, a shaft portion formed integrally on one surface of said first arm portion, and a fitting projection formed integrally with said shaft portion and adapted to be fitted in said fitting portion of said slat; and a second support to be connected to the first support, including a second arm portion having a pair of shaft holes which are respectively provided in one end portion and another end portion thereof, and in which another end portions of said shaft members of said link mechanisms are respectively inserted and secured rotatably, said first support and said second support being connected to each other by means of fitting and securing means such that corresponding ones of the shaft holes in the one end portions and the other end portions of said first arm portion and said second arm portion become coaxial.

[0009] In accordance with the slat supporting member according to the first aspect of the invention, the first arm portion has in its one end portion and other end portion the pair of shaft holes in which one end portions of the shaft members of the link mechanisms are inserted and secured rotatably. Further, the second arm portion has in its one end portion and other end portion the pair of shaft holes in which the other end portions of the shaft members of the link mechanisms are receptively inserted and secured rotatably. Moreover, the arrangement provided is such that the first and second arm portions are connected to each other by means of the fitting and

securing means such that the corresponding shaft holes in the one end portions and the other end portions of the first and second arm portions become coaxial. Therefore, the shaft members of the link mechanisms can be rotatably supported on both sides, and it is possible to ensure smooth rotation of the shaft members. Consequently, even if the flexible belt-shaped bodies are used instead of the rigid link members, the belt-shaped bodies can be easily extended and deflected, making it possible to effect the smooth raising and lowering of the slats and support the slats properly.

[0010] As in the slat supporting member according to a second aspect of the invention, said fitting and securing means may include a tubular portion formed integrally on an opposite surface of said first arm portion to one surface thereof and having a fitting opening, and an engaging projection formed integrally on one surface of said second arm portion and adapted to engage said tubular portion at the fitting opening. Further, as in the slat supporting member according to a third aspect of the invention, said fitting and securing means may include a tubular portion formed integrally on one surface of said second arm portion and having a fitting opening, and an engaging projection formed integrally on an opposite surface of said first arm portion to one surface thereof and adapted to engage said tubular portion at the fitting opening.

[0011] In the slat supporting member according to the second or third aspect of the invention, as in the slat supporting member according to a fourth aspect of the invention, said engaging projection may have a projection body adapted to be inserted and secured in said tubular portion, as well as a pawl portion formed integrally on a distal end of said projection body and adapted to engage said tubular portion at the fitting opening. In this case, engagement of said pawl portion with said tubular portion at the fitting opening may be effected in a snap-fit fashion making use of the resilient deflection of said projection body. In this arrangement, the mutual connection of the first support and the second support by means of the fitting and securing means can be effected simply, and the assembly can be effected in a short time.

[0012] Preferably, as in the slat supporting member according to a fifth aspect of the invention, each of said first support and said second support is an integrally molded piece made of a synthetic resin. If each of said first support and said second support is an integrally molded piece, it is possible to attain further light weight and reduction in cost.

[0013] In accordance with a sixth aspect of the invention, there is provided a slat supporting mechanism comprising: said slat supporting members according to any one of the above-described aspects of the invention; and a pair of link mechanisms each having a plurality of shaft members connected to each other at fixed intervals, each of said link mechanisms having a flexible belt-shaped body, said shaft members of each of said

link mechanisms being secured to said belt-shaped body at fixed intervals, and are connected to each other by said belt-shaped body.

[0014] The slat supporting mechanism in accordance with the sixth aspect of the invention has the pair of flexible belt-shaped bodies and the shaft members to which the belt-shaped bodies are secured and which are rotatably connected to end portions of the respective arm portions, instead of a pair of chains of rigid link members which are linked in chain forms so as to be rotatable by means of shafts. Therefore, the slat supporting mechanism can be assembled in a short time and can be made lightweight, so that not a very large force is required for the raising and lowering of the slats, thereby making it possible to easily effect the raising and lowering of the slats.

[0015] Preferably, as in the slat supporting mechanism according to a seventh aspect of the invention, each of said belt-shaped bodies is passed through each of said shaft members and is fabricated from one continuous belt-shaped member.

[0016] Preferably, as in the slat supporting mechanism according to an eighth aspect of the invention, each of said shaft members is formed by an integrally molded piece made of a synthetic resin and including a cylindrical portion and a pair of shaft portions respectively disposed on opposite end faces of the cylindrical portion, and is rotatably fitted at the shaft portion thereof in the corresponding shaft hole of each of said arm members, each of said belt-shaped bodies being integrally secured to the cylindrical portion and passed through the cylindrical portion.

[0017] In the case where each of the shaft members formed by an integrally molded piece made of a synthetic resin as in the slat supporting mechanism according to the eighth aspect, the securing of each shaft member to the belt-shaped body may be effected simultaneously with the integral molding of each shaft member by clamping the belt-shaped body between a pair of molds for integrally forming the shaft members, and by allowing a forming material of the shaft members to flow into the pair of molds with the belt-shaped body clamped therebetween.

[0018] As in the slat supporting mechanism according to a ninth aspect of the invention, each of said shaft members in the slat supporting mechanism according to the eighth aspect may be formed by an integrally molded piece made of a synthetic resin and may further have a pair of rectangular projecting portions disposed at symmetrical positions with respect to an axis of the cylindrical portion. In this case, each of said belt-shaped bodies may be integrally secured to the cylindrical portion and the pair of rectangular projecting portions, and may be passed through the cylindrical portion and the pair of rectangular projecting portions.

[0019] In the case of the shaft members each having the pair of rectangular projecting portions, the securing of each shaft member to the belt-shaped body may be

effected simultaneously with the integral molding of each shaft member by clamping the belt-shaped body between a pair of molds for integrally forming the shaft members, and by allowing a forming material of the shaft members to flow into the pair of molds with the belt-shaped body clamped therebetween, as described above.

[0020] Each of the belt-shaped bodies may alternatively have a plurality of belt-shaped pieces which are respectively terminated inside vertically adjacent ones of shaft members. Each belt-shaped body is sufficient if it is tough and flexible, and may not have very large elasticity. It is rather preferred that each belt-shaped body be nonelastic. As for the resiliency, each belt-shaped body may be slightly resilient, but it is rather preferred that the belt-shaped body be not resilient. Preferably, as in the slat supporting mechanism according to a 10th aspect of the invention, each of the belt-shaped bodies may be fabricated from a belt of a woven fabric or a knit fabric of yarn made of a synthetic resin such as polyester, or a belt of a nonwoven fabric made of a synthetic resin.

[0021] In the invention, each of the belt-shaped bodies may be alternatively fabricated from a flat belt made of such as leather. As the yarn made of a synthetic resin, yarn made of polyester is preferable. As a more preferable example, it is possible to cite a flexible belt-shaped body made by plain weaving using such polyester-made yarn and having a width of 6 mm to 12 mm and a thickness of 0.4 mm to 0.7 mm, more specifically a width of 7 mm and a thickness of 0.6 mm.

[0022] In accordance with an 11th aspect of the invention, there is provided a blind apparatus comprising: said slat supporting mechanisms according to any one of above-described aspects; slats respectively supported by said slat supporting mechanisms; a raising and lowering mechanism for raising and lowering said slats by means of said slat supporting mechanisms; and a tilting mechanism for tilting said slats by causing said first and said second link mechanisms to undergo relative positional changes as said slats are raised or lowered by said raising and lowering mechanism.

[0023] In a preferred example, as in the blind apparatus according to a 12th aspect of the invention, each of said slats may have a slat body and a fitting portion formed integrally on one surface of said slat body. In this case, said fitting portion may be made hollow to allow said fitting portion to fit therein.

[0024] As in the blind apparatus according to a 13th aspect of the invention, the raising and lowering mechanism may be connected to an uppermost one of the slat supporting members, and may be adapted to raise the slats by raising the uppermost one of the slat supporting members. Alternatively, the raising and lowering mechanism may be connected to a lowermost one of the slat supporting members, and may be adapted to raise the slats by raising the lowermost one of the slat supporting members.

[0025] In accordance with the present invention, it is possible to provide a slat supporting member which makes it possible to support the shaft members on both sides, prevent the deflection of the shaft members, and ensure smooth rotation of the shaft members, and which is suitable for supporting the slats with the flexible belt-shaped bodies replacing the rigid link members. Further, it is possible to provide a slat supporting mechanism which is provided with such slat supporting members, and which can be assembled in a short time, and can be made lightweight without requiring a very large force for the raising and lowering of the slats, thereby making it possible to easily effect the raising and lowering of the slats. Furthermore, it is possible to provide a blind apparatus having the slat supporting mechanisms.

[0026] Hereafter, a detailed description will be given of the present invention and embodiments thereof on the basis of the preferred embodiments shown in the drawings. It should be noted that the present invention is not limited to these embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

Fig. 1 is a perspective view of a preferred embodiment of the invention;

Fig. 2 is a partial side elevational view of the embodiment shown in Fig. 1;

Fig. 3 is another partial side elevational view of the embodiment shown in Fig. 1;

Fig. 4 is an explanatory cross-sectional view, taken along line IV - IV shown in Fig. 3, of the embodiment including a vertical frame shown in Fig. 1;

Fig. 5 is an explanatory cross-sectional view, taken along line V - V shown in Fig. 3, of the embodiment including the vertical frame shown in Fig. 1;

Fig. 6 is an explanatory cross-sectional view, taken along line VI - VI shown in Fig. 3, of the embodiment including the vertical frame shown in Fig. 1;

Fig. 7 is an explanatory plan view of a transmitting means of the embodiment shown in Fig. 1;

Fig. 8 is an explanatory fragmentary exploded perspective view of the embodiment shown in Fig. 1;

Fig. 9 is an explanatory perspective view of a slat supporting member of the embodiment shown in Fig. 1;

Figs. 10(a) and 10(b) are explanatory views of a link mechanism of the embodiment shown in Fig. 1, in which Fig. 10(a) is an explanatory front elevational view thereof and Fig. 10(b) is an explanatory side elevational view thereof;

Fig. 11 is a diagram explaining the operation of the embodiment shown in Fig. 1;

Fig. 12 is another diagram explaining the operation of the embodiment shown in Fig. 1;

Fig. 13 is still another diagram explaining the operation of the embodiment shown in Fig. 1;

Fig. 14 is a further diagram explaining the operation of the embodiment shown in Fig. 1; and

Fig. 15 is a partial perspective view of another preferred example of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] In Figs. 1 to 10, a window blind apparatus 1 in accordance with this embodiment is comprised of a pair of vertical frames 2 and 3; a link mechanism 4; a link mechanism 5 juxtaposed to the link mechanism 4; a plurality of slat supporting members 8 each having one end portion 6 connected to the link mechanism 4 and the other end portion 7 connected to the link mechanism 5; a plurality of slats 9 supported by the respective slat supporting members 8 and juxtaposed in an opening P between the vertical frames 2 and 3; a raising and lowering mechanism 10 for raising and lowering the slats 9; a tilting mechanism 11 for tilting the respective slats 9 by causing the link mechanisms 4 and 5 to undergo relative changes in their vertical positions as the slats 9 are raised or lowered by the raising and lowering mechanism 10; inhibiting means for inhibiting the raising of the lowermost slat 9; an upper cover frame 13 disposed between upper portions of the pair of vertical frames 2 and 3; and a bottom frame 14a disposed between lower portions of the pair of vertical frames 2 and 3.

[0029] Since the vertical frames 2 and 3 are constructed identically to each other, a description will be given hereafter of the vertical frame 2. The vertical frame 2 has a hollow vertical frame body 14 and a guide-passage forming member 15 fitted to an inner surface of the vertical frame body 14. The vertical frame body 14 has a guide slit 16 extending in the vertical direction. The guide-passage forming member 15 has a plurality of projecting portions 20 so as to form a pair of guide passages 17 as well as a guide passage 18 and a guide passage 19.

[0030] The link mechanisms 4 and 5 and the tilting mechanism 11 are accommodated in the respective vertical frames 2 and 3. Since the link mechanisms 4 and 5 and the tilting mechanism 11 on the vertical frame 3 side are arranged in the same way as the link mechanisms 4 and 5 and the tilting mechanism 11 on the vertical frame 2 side, a detailed description will be given hereafter mainly of the link mechanisms 4 and 5 and the tilting mechanism 11 on the vertical frame 2 side.

[0031] The link mechanism 4 has one continuous flexible belt-shaped body 21 and a plurality of shaft members 23 which are secured to the belt-shaped body 21 and are each rotatably connected to the one end portion 6 of each slat supporting member 8. Thus the link mechanism 4 has the plurality of shaft members 23 connected to each other at fixed intervals, and the plurality of shaft members 23 of the link mechanism 4 are secured to the belt-shaped body 21 and are connected to each other by the belt-shaped body 21.

[0032] In the same way as the link mechanism 4, the link mechanism 5 also has one continuous flexible belt-shaped body 25 similar to the belt-shaped body 21, as well as a plurality of shaft members 26 which are similar to the shaft members 23 and are secured to the belt-shaped body 25, each shaft member 26 being rotatably fitted in the other end portion 7 of each slat supporting member 8. Thus the link mechanism 5 has the plurality of shaft members 26 connected to each other at fixed intervals, and the plurality of shaft members 26 of the link mechanism 5 are secured to the belt-shaped body 25 and are connected to each other by the belt-shaped body 25.

[0033] As particularly shown in Figs. 10(a) and 10(b), the belt-shaped body 21 is passed through the shaft members 23 which are rotatably fitted in the end portions 6 of the respective slat supporting members 8, and is secured to the shaft members 23 at the respective passing positions. The belt-shaped body 21, which is passed at its upper end portion 28 and its lower end portion 29 through the shaft members 23 respectively fitted rotatably to the end portions 6 of the uppermost and lowermost slat supporting members 8, is secured to the shaft members 23 at that upper end portion 28 and that lower end portion 29 and terminates there.

[0034] In the same way as the belt-shaped body 21, the belt-shaped body 25 is passed through the shaft members 26 which are rotatably fitted in the end portions 7 of the respective slat supporting members 8, and is secured to the shaft members 26 at the respective passing positions. The belt-shaped body 25, which is passed at its upper end portion 32 and its lower end portion 33 through the shaft members 26 respectively fitted rotatably to the end portions 7 of the uppermost and lowermost slat supporting members 8, is secured to the shaft members 26 at that upper end portion 32 and that lower end portion 33 and terminates there.

[0035] Each of the belt-shaped bodies 21 and 25 may be fabricated from a belt of a woven fabric or a knit fabric of yarn made of a synthetic resin such as polyester, or a flat belt of a nonwoven fabric made of a synthetic resin, or may be fabricated from another tough flexible belt.

[0036] As particularly shown in Figs. 10(a) and 10(b), each of the shaft members 23 and 26 is formed by an integrally molded piece made of a synthetic resin and including a cylindrical portion 46; a pair of shaft portions 47 which are integrally provided on opposite end faces of the cylindrical portion 46; and a pair of rectangular projecting portions 115 and 116 disposed symmetrically about the axis of the cylindrical portion 46 and formed integrally with the cylindrical portion 46. Each of the belt-shaped bodies 21 and 25 is integrally secured to the cylindrical portion 46 and the pair of rectangular projecting portions 115 and 116, and is passed through the cylindrical portion 46 and the pair of rectangular projecting portions 115 and 116. The securing of each cylindrical portion 46 and the pair of rectangular projecting portions 115 and 116 to each of the belt-shaped bodies 21 and

25 may be effected at the time of the integral molding of each of the shaft members 23 and 26.

[0037] Each of the slat supporting members 8 is interposed between, on the one hand, the pair of link mechanisms 4 and 5 and, on the other hand, each of ends 39 and 49 of the plurality of slats 9 arranged parallel to each other to allow the slats 9 to be supported by the pair of link mechanisms 4 and 5. Each of the slat supporting members 8 has a support 22 and a support 42 which is connected to the support 22 by means of a fitting and securing means 40. The support 22 has an arm portion 31 having a pair of shaft holes, i.e., a pair of through holes 30 in this embodiment, which are respectively provided in one end portion and the other end portion thereof (which are also the one end portion 6 and the other end portion 7 of the slat supporting member 8), and in which the shaft portions 47 at one end portions of the shaft members 23 and 26 of the link mechanisms 4 and 5 are respectively inserted and secured rotatably; a shaft portion 36 formed integrally on one surface of the arm portion 31 and disposed in and outside the vertical frame 2 through the guide slit 16; and a fitting projection 37 formed integrally with the shaft portion 36 and adapted to be fitted in a fitting portion 60 of the slat 9. The support 42 has an arm portion 35 having a pair of shaft holes, i.e., a pair of through holes 34 in this embodiment, which are respectively provided in one end portion and the other end portion thereof (which are also the one end portion 6 and the other end portion 7 of the slat supporting member 8), and in which the shaft portions 47 at the other end portions of the shaft members 23 and 26 of the link mechanisms 4 and 5 are respectively inserted and secured rotatably.

[0038] Each of the shaft members 23 and 26 is rotatably fitted and inserted in the corresponding through holes 30 and 34 of the arm portions 31 and 35 at the pair of shaft portions 47 which are integrally provided on opposite end faces of the cylindrical portion 46 disposed in such a manner as to be sandwiched between the arm portion 31 and the arm portion 35.

[0039] The fitting and securing means 40 is adapted to connect the support 22 and the support 42 so that the corresponding through holes 30 and 34 in the one end portions and the other end portions of the arm portions 31 and 35 become coaxial. The fitting and securing means 40 has a hollow rectangular tubular portion 43 formed integrally on an opposite surface of the arm portion 31 to one surface thereof on which the shaft portion 36 is integrally formed, the hollow rectangular tubular portion 43 having a pair of fitting openings 41, as well as a pair of engaging projections 44 formed integrally on one surface of the arm portion 35 and adapted to engage the tubular portion 43 at its fitting openings 41.

[0040] Each engaging projection 44 has a projection body 45 formed integrally on one surface of the arm member 35 and adapted to be inserted and secured in the tubular portion 43, as well as a pawl portion 48 formed integrally on a distal end of the projection body

45 and adapted to engage the tubular portion 43 at its fitting opening 41. The engagement of the pawl portion 48 with the tubular portion 43 at its fitting opening 41 is effected in a snap-fit fashion making use of the resilient deflection of the projection body 45.

[0041] The support 22 including the tubular portion 43 is an integrally molded piece formed of a synthetic resin. Also, the support 42 including the pair of engaging projections 44 is an integrally molded piece formed of a synthetic resin.

[0042] Each of the slats 9 is supported at its respective end portions 39 and 49 by a pair of slat supporting mechanisms 50 each including the plurality of slat supporting members 8 and the pair of link mechanisms 4 and 5 respectively having the plurality of shaft members 23 and 26 respectively connected to each other at fixed intervals. Each of the slats 9 has a plate-like curved slat body 51 and the rectangular fitting portion 60 formed integrally with one surface of the slat body 51 in such a manner as to extend from the end portion 39 to the end portion 49 on the one surface of the slat body 51. The fitting portion 60 is made hollow to allow the fitting projections 37 to fit therein. The slats 9 are supported at their opposite end portions 39 and 49 by the slat supporting mechanisms 50 on the vertical frame 2 side and the vertical frame 3 side so as to be parallel to each other in the opening P. The fitting portion 60 need not be provided so as to extend from the end portion 39 to the end portion 49 on one surface of the slat body 51, and it suffices if the fitting portion 60 is provided on the one surface of the slat body 51 at at least each of the end portions 39 and 49.

[0043] The raising and lowering mechanism 10 for raising and lowering the slats 9 by means of the slat supporting mechanisms 50 includes a chain 52 disposed in each of the vertical frames 2 and 3 and serving as a flexible traveling body; a connecting mechanism 55 for connecting to the uppermost slat supporting member 8 the other end portion 54 of the chain 52 having one end portion 53 which is a free end; a traveling unit 56 for causing the chain 52 to travel in directions A and B; and a preventing mechanism 57 for preventing the deflection of the chain 52 as the chain 52 travels in the directions A and B.

[0044] Since the chain 52, the connecting mechanism 55, and the preventing mechanism 57 are respectively arranged in the same way on the vertical frame 2 side and the vertical frame 3 side, a detailed description will be given hereafter of the vertical frame 2 side.

[0045] The chain 52 is disposed in the guide passages 17 so as not to be deflected, and its traveling in the directions A and B is guided by the guide passage 17.

[0046] The connecting mechanism 55 includes a connecting plate 62 connected rotatably to the arm portion 35 by means of a pin member 61 disposed concentrically with the shaft portion 36 of the uppermost slat supporting member 8, as well as a slider 64 secured to the connecting plate 62 by means of a pair of pin members

63. The slider 64 includes a slider body 65 and a pair of rollers 66 (only one is illustrated) which are supported rotatably by the slider body 65 by means of the pair of pin members 63 and are disposed vertically movably in the other guide passage 17 sandwiched between one guide passage 17 and the guide passage 18. The other end portion 54 of the chain 52 is rotatably connected to the slider body 65 by means of a pin member 67.

[0047] The traveling unit 56 has an endless ball chain 71 for generating a traveling force for the chain 52 by a manual operation as well as a transmitting means 72 for transmitting the traveling force from the ball chain 71 to the chain 52.

[0048] The transmitting means 72 includes a pulley 74 around which the ball chain 71 is wound and which is secured to a rotating shaft 73; a gear 75 secured to the rotating shaft 73; a gear 77 meshing with the gear 75 and secured to a rotating shaft 76; a gear 78 secured to the rotating shaft 76; a gear 80 meshing with the gear 78 and secured to a rotating shaft 79; a gear 82 meshing with the gear 80 and secured to a rotating shaft 81; a sprocket wheel 84 which is secured to one end portion 83 of the rotating shaft 81 and around which the chain 52 is wound; and a braking mechanism 85 for imparting fixed braking to the rotation of the rotating shaft 81.

[0049] The ball chain 71 wound around the pulley 74 is suspended on an indoor side 88 in an opening of a window or the like of a building where the window blind apparatus 1 is installed, in such a manner as to be manually operable.

[0050] The rotating shafts 73, 76, 79, and 81 are rotatably supported by a bracket 91, and the bracket 91 is secured to an inner surface of an upper portion of the vertical frame body 14 of the vertical frame 2.

[0051] The gears 75, 77, 78, 80, and 82 constitute a reduction gear mechanism for reducing the rotational speed of the pulley 74 and transmitting it to the rotating shaft 81. The rotating shaft 81, to one end portion 83 of which the sprocket wheel 84 disposed in the vertical frame body 14 is disposed is secured, is passed in the upper cover frame 13, and extends to the interior of the vertical frame body of the vertical frame 3. A sprocket wheel similar to the sprocket wheel 84 is also secured to the other end portion of the rotating shaft 81 on the vertical frame 3 side. In the same way as the chain 52 disposed in the vertical frame 2, a chain disposed in the vertical frame 3 is wound around the sprocket wheel on the other end portion side of the rotating shaft 81.

[0052] The braking mechanism 85 includes an annular braking plate 93 disposed in a housing 92 secured to the bracket 91; an annular braking backing plate 94 secured to the rotating shaft 81; and a coil spring 95 interposed between the housing 92 and the braking plate 93 and adapted to cause the braking plate 93 to be resiliently pressed against the braking backing plate 94 so as to be brought into frictional contact therewith. As a result of the frictional contact between the braking plate 93 and the braking backing plate 94, when the ball

chain 71 is manually caused to travel to rotate the pulley 74, the braking mechanism 85 allows the rotating shaft 81 to rotate, whereas when the ball chain 71 is not manually caused to travel, the braking mechanism 85 inhibits the rotation of the rotating shaft 81 by means of the chain 52 and the sprocket wheel 84 due to the self-weight of the slats 9 and the like.

[0053] The preventing mechanism 57 has chain guides 86 and 87 disposed around the outer periphery of the sprocket wheel 84 and secured to the inner surface of the upper portion of the vertical frame body 14 by means of a mounting plate 96. The chain guides 86 and 87 are adapted to ensure the meshing of the chain 52 with the sprocket wheel 84 by preventing the deflection of the chain 52 around the sprocket wheel 84.

[0054] In the raising and lowering mechanism 10, if an operator manually causes the ball chain 71 to travel in one direction, the pulley 74 rotates, which causes the sprocket wheel 84 to rotate by means of the gears 75, 77, 78, 80, and 82, causing the chain 52 to travel in the direction A, for example. Then, the connecting mechanism 55 is raised while being guided by the guide passage 17 together with the raising of the end portion 54. As the connecting mechanism 55 is thus raised, the uppermost slat supporting member 8 having the arm portion 35 connected rotatably to the connecting mechanism 55 by means of the pin member 61 is also raised. As the uppermost slat supporting member 8 is thus raised, the lower slat supporting members 8 which are connected to the uppermost slat supporting member 8 by the pair of link mechanisms 4 and 5 are also consecutively raised starting with the slat supporting member 8 located immediately below the uppermost slat supporting member 8. Consequently, the slats 9 supported by the respective slat supporting members 8 are also consecutively raised. Thus the raising and lowering mechanism 10 connected to the uppermost slat supporting member 8 is adapted to lift the uppermost slat supporting member 8 to consecutively raise the slats 9.

[0055] In addition, in the raising and lowering mechanism 10, if the operator manually causes the ball chain 71 to travel in the other direction, the pulley 74 rotates, which causes the sprocket wheel 84 to rotate by means of the gears 75, 77, 78, 80, and 82, causing the chain 52 to travel in the direction B. Then, the connecting mechanism 55 is lowered while being guided by the guide passage 17 together with the lowering of the end portion 54. As the connecting mechanism 55 is thus lowered, the uppermost slat supporting member 8 having the arm portion 35 connected rotatably to the connecting mechanism 55 by means of the pin member 61 is also lowered. As the uppermost slat supporting member 8 is thus lowered, the lower slat supporting members 8 which are connected to the uppermost slat supporting member 8 by the pair of link mechanisms 4 and 5 are also consecutively lowered starting with the lowermost slat supporting member 8. Consequently, the slats 9 supported by the respective slat supporting members 8

are also consecutively lowered. Thus the raising and lowering mechanism 10 connected to the uppermost slat supporting member 8 is adapted to lower the uppermost slat supporting member 8 to consecutively lower the slats 9.

[0056] Although in this embodiment the rotating shaft 73 is connected to the rotating shaft 81 by means of the speed reducing mechanism consisting of the gears 75, 77, 78, 80, and 82, in stead of indirectly transmitting the rotation of the pulley 74 to the rotating shaft 81, the pulley 74 may be secured to the rotating shaft 81 to directly transmit the rotation of the pulley 74 to the rotating shaft 81. In addition, instead of the ball chain 71 or in addition to the ball chain 71, an electric motor may be used. In that case, the output rotating shaft of the electric motor may be connected to the rotating shaft 73, or the output rotating shaft of the electric motor may be used as the rotating shaft 81, in which case an electric motor whose speed is controllable may be used, as required.

[0057] The tilting mechanism 11 has a cylindrical projection 101 which is formed integrally on a surface of the arm portion 35 of the uppermost slat supporting member 8 opposite to the surface thereof on which the engaging projection 44 is formed, as well as a cam member 103 having a guide recess 102 attached to the guide-passage forming member 15 and communicating with the guide passage 19.

[0058] When the uppermost slat supporting member 8 is raised due to the traveling of the chain 52 in the direction A, the tilting mechanism 11 causes the projection 101 to abut against the cam member 103 to guide the projection 101 from the guide passage 19 to the guide recess 102, causing the uppermost slat supporting member 8 having the arm member 35 with the projection 101 formed thereon to rotate about the shaft portion 36 in an R1 direction. As a result, the belt-shaped body 25 of the link mechanism 5 is lifted up and raised relative to the belt-shaped body 21 of the link mechanism 4. In addition, the lower slat supporting members 8 following the uppermost slat supporting member 8 are also made to undergo rotation similarly in the R1 direction by means of the link mechanisms 4 and 5, with the result that all the slats 9 are similarly rotated in the R1 direction. On the other hand, when the uppermost slat supporting member 8 is lowered due to the traveling of the chain 52 in the direction B, the projection 101 is guided from the guide recess 102 to the guide passage 19, causing the uppermost slat supporting member 8 to rotate about the shaft portion 36 in an R2 direction. As a result, the belt-shaped body 21 of the link mechanism 4 is lifted up and raised relative to the belt-shaped body 25 of the link mechanism 5, thereby causing all the slats 9 to rotate similarly in the R2 direction.

[0059] The inhibiting means 12 includes a connecting plate 121 disposed in a lower portion of the guide-passage forming member 15; a coil spring 124 having one end portion 122 connected to the connecting plate 121 and the other end portion 123 secured to a lower end of

the guide-passage forming member 15; a roller 126 attached rotatably to the connecting plate 121 by means of a shaft member 125 and disposed in the other guide passage 17 sandwiched between the one guide passage 17 and the guide passage 18; and a pair of rollers 129 (only one is shown) attached rotatably to the connecting plate 121 by means of shaft members 127 and 128 and disposed in the guide passage 18. The connecting plate 121, which is prevented from swinging by the pair of rollers 129, is connected to the arm portion 35 of the lowermost slat supporting member 8 rotatably in the R1 and R2 directions by means of a shaft member (not shown) disposed concentrically with the shaft portion 36 of the lowermost slat supporting member 8.

[0060] As the connecting plate 121 is raised along the guide passages 17 and 18 due to the raising of the lowermost slat supporting member 8, the inhibiting means 12 is adapted to pull the connecting plate 121 downward by the resiliency of the coil spring 124, thereby resiliently preventing the lifting up of the lowermost slat supporting member 8 by more than a fixed amount.

[0061] It should be noted that, in the state in which the opening P is completely closed (the state shown in Fig. 13), a closing plate 141 may be provided uprightly on the bottom frame 14a to close a gap occurring between the lowermost slat 9 and the bottom frame 14a.

[0062] In the above-described window blind apparatus 1, in the state in which the opening P is open, the projection 101 is disposed in the guide passage 19, and the belt-shaped bodies 21 and 25 remain deflected, as shown in Fig. 12, while the slats 9 are superposed one on top of another (stacked) in a lower position, as shown in Fig. 11. At the time of closing the opening P as the ball chain 71 is manually caused to travel in one direction to cause the chain 52 to travel in the direction A, the uppermost slat supporting member 8 first starts to be raised. As the uppermost slat supporting member 8 is thus raised, the belt-shaped bodies 21 and 25 of the link mechanisms 4 and 5 are fully extended, allowing the slat supporting members 8 following the uppermost slat supporting member 8 to start to be raised. Thereafter, the ensuing slat supporting members 8 are consecutively raised in a similar manner, and the slats 9 are also consecutively raised at the same time. When the projection 101 is raised while being guided by the guide passage 19, the slats 9 are held in a substantially horizontally tilted state, with the result that the opening P is closed by the slats 9 in the form of a rattan blind, as shown in Figs. 1 and 2.

[0063] As the chain 52 is caused to travel further in the direction A, the belt-shaped bodies 21 and 25 are fully extended at a position immediately before the complete closure of the opening P. Meanwhile, the lowermost slat supporting member 8 is slightly raised against the resiliency of the coil spring 124 by means of the belt-shaped bodies 21 and 25. Then, when the projection 101 faces the guide recess 102 and abuts against the cam member 103, the uppermost slat supporting mem-

ber 8 starts to be rotated in the R1 direction, and the upper end portion 32 of the belt-shaped body 25 comes to be lifted more than the upper end portion 28 of the belt-shaped body 21. Consequently, the uppermost slat 9 is rotated in the R1 direction, and the rotation of the uppermost slat supporting member 8 is transmitted to the lower slat supporting members 8 by means of the belt-shaped body 21 and the belt-shaped body 25, thereby holding all the slat supporting members 8 and slats 9 in a substantially vertically tilted state, as shown in Figs. 13 and 14. As a result, the opening P is fully closed by the slats 9.

[0064] When the opening P is opened, the ball chain 7.1 is manually operated in the opposite direction to the one described above, and the projection 101 is guided from the guide recess 102 to the guide passage 19, consecutively deflecting the belt-shaped bodies 21 and 25 starting with their lower portions at the same time as the uppermost slat supporting member 8 is lowered.

[0065] With the above-described window blind apparatus 1 provided with the pair of slat supporting mechanisms 50 each having the link mechanisms 4 and 5 and the slat supporting members 8, the link mechanisms 4 and 5 are respectively comprised of the flexible belt-shaped bodies 21 and 25 and the shaft members 23 and 26 to which the belt-shaped bodies 21 and 25 are secured and which are rotatably connected to the end portions 6 and 7 of the slat supporting members 8, instead of a pair of chains of rigid link members which are linked in chain forms so as to be rotatable by means of shafts. Therefore, the link mechanisms 4 and 5 can be assembled in a short time. Moreover, the link mechanisms 4 and 5 can be made lightweight, so that not a very large force is required for the raising and lowering of the slats 9, thereby making it possible to easily effect the raising and lowering of the slats 9.

[0066] In addition, according to the slat supporting members 8, the arm portion 31 has in its one end portion and other end portion the pair of through holes 30 in which the shaft portions 47 at one end portions of the shaft members 23 and 26 of the link mechanisms 4 and 5 are respectively inserted and secured rotatably. Further, the arm portion 35 has in its one end portion and other end portion the pair of through holes 34 in which the shaft portions 47 at the other end portions of the shaft members 23 and 26 of the link mechanisms 4 and 5 are respectively inserted and secured rotatably. Moreover, the arrangement provided is such that the arm portions 31 and 35 are connected to each other by means of the fitting and securing means 40 such that the corresponding through holes 30 and 34 in the one end portions and the other end portions of the arm portions 31 and 35 become coaxial. Therefore, the shaft members 23 and 26 of the link mechanisms 4 and 5 can be rotatably supported on both sides, and it is possible to ensure smooth rotation of the shaft members 23 and 26. Consequently, even if the flexible belt-shaped bodies 21 and 25 are used instead of the rigid link members, the belt-

shaped bodies 21 and 25 can be easily extended and deflected, making it possible to effect the smooth raising and lowering of the slats 9 and support the slats 9 properly.

[0067] In the above-described embodiment, instead of the chain 52 with ends having the end portions 53 and 52, an endless chain may be used. In this case, it suffices if another sprocket wheel is disposed in addition to the sprocket wheel 84, and the endless chain is wound around and trained between the two sprocket wheels. The preventing mechanism 57 can be omitted if such an endless chain is used. In addition, a timing belt or the like may be used instead of the chain 52. In the case where the timing belt is used, it suffices if a toothed pulley is used instead of the sprocket wheel 84.

[0068] In addition, as described above, the fitting and securing means 40 is arranged such that the hollow rectangular tubular portion 43 having the fitting opening 41 is integrally formed on the other surface of the arm portion 31, while the pair of engaging projections 44 are integrally formed on one surface of the arm portion 35. Instead of this arrangement, the fitting and securing means 40 may be arranged such that the hollow rectangular tubular portion 43 having the fitting opening 41 is integrally formed on one surface of the arm portion 35, while the pair of engaging projections 44 for engaging the tubular portion 43 in the fitting opening 41 are integrally formed on the other surface of the arm portion 31.

[0069] Furthermore, as described above, the fitting and securing means 40 is formed by the pair of engaging projections 44 for engaging the tubular portion 43 at the pair of fitting openings 41. In stead of this arrangement, as shown in Fig. 15, the fitting and securing means 40 may be formed by comprising one engaging projection 152 formed integrally on one surface of the arm portion 35 and adapted to engage the tubular portion 43 at one fitting opening 151, and a pair of fitting projections 153 disposed with the engaging projection 152 located therebetween and adapted to be fitted in the tubular portion 43. In this case, the engaging projection 152 has a projection body 155 for being inserted and secured in the tubular portion 43, as well as a pawl portion 156 formed integrally on a distal end of the projection body 155 and adapted to engage the tubular portion 43 at its fitting opening 151. The engagement of the pawl portion 156 with the tubular portion 43 at its fitting opening 151 is effected in a snap-fit fashion making use of the resilient deflection of the projection body 155.

[0070] In addition, the raising and lowering mechanism 10 may be so arranged to be connected to the lowermost slat supporting member 8 and to be adapted to raise the slats 9 by lifting the lowermost slat supporting member 8.

Claims

1. A slat supporting member for a blind apparatus in-

terposed between, on the one hand, a pair of link mechanisms each having a plurality of shaft members connected to each other at fixed intervals and, on the other hand, an end portion of each of a plurality of slats disposed in parallel to each other and each having a fitting portion at the end portion thereof to allow said slat to be supported by said pair of link mechanisms, said slat supporting member comprising:

a first support including a first arm portion having a pair of shaft holes which are respectively provided in one end portion and another end portion thereof, and in which one end portions of a pair of said shaft members of said link mechanisms are respectively inserted and secured rotatably, a shaft portion formed integrally on one surface of said first arm portion, and a fitting projection formed integrally with said shaft portion and adapted to be fitted in said fitting portion of said slat; and

a second support to be connected to said first support, including a second arm portion having a pair of shaft holes which are respectively provided in one end portion and another end portion thereof, and in which another end portions of said shaft members of said link mechanisms are respectively inserted and secured rotatably,

said first support and said second support being connected to each other by means of fitting and securing means such that corresponding ones of the shaft holes in the one end portions and the other end portions of said first arm portion and said second arm portion become coaxial.

2. The slat supporting member for a blind apparatus according to claim 1, wherein said fitting and securing means includes a tubular portion formed integrally on an opposite surface of said first arm portion to one surface thereof and having a fitting opening, and an engaging projection formed integrally on one surface of said second arm portion and adapted to engage said tubular portion at the fitting opening.
3. The slat supporting member for a blind apparatus according to claim 1, wherein said fitting and securing means includes a tubular portion formed integrally on one surface of said second arm portion and having a fitting opening, and an engaging projection formed integrally on an opposite surface of said first arm portion to one surface thereof and adapted to engage said tubular portion at the fitting opening.
4. The slat supporting member for a blind apparatus according to claim 2 or 3, wherein said engaging projection has a projection body adapted to be in-

serted and secured in said tubular portion, as well as a pawl portion formed integrally on a distal end of said projection body and adapted to engage said tubular portion at the fitting opening, and engagement of said pawl portion with said tubular portion at the fitting opening is effected in a snap-fit fashion making use of the resilient deflection of said projection body.

5. The slat supporting member for a blind apparatus according to any one of claims 1 to 4, wherein each of said first support and said second support is an integrally molded piece made of a synthetic resin.

6. A slat supporting mechanism comprising:

said slat supporting members for a blind apparatus according to any one of claims 1 to 5; and a pair of link mechanisms each having a plurality of shaft members connected to each other at fixed intervals, each of said link mechanisms having a flexible belt-shaped body, said shaft members of each of said link mechanisms being secured to said belt-shaped body at fixed intervals, and are connected to each other by said belt-shaped body.

7. The slat supporting mechanism according to claim 6, wherein each of said belt-shaped bodies is passed through each of said shaft members and is fabricated from one continuous belt-shaped member.

8. The slat supporting mechanism according to claim 6 or 7, wherein each of said shaft members is formed by an integrally molded piece made of a synthetic resin and including a cylindrical portion and a pair of shaft portions respectively disposed on opposite end faces of the cylindrical portion, and is rotatably fitted at the shaft portion thereof in the corresponding shaft hole of each of said arm members, each of said belt-shaped bodies being integrally secured to the cylindrical portion and passed through the cylindrical portion.

9. The slat supporting mechanism according to claim 8, wherein each of said shaft members is formed by an integrally molded piece made of a synthetic resin and further having a pair of rectangular projecting portions disposed at symmetrical positions with respect to an axis of the cylindrical portion, and each of said belt-shaped bodies is integrally secured to the cylindrical portion and the pair of rectangular projecting portions, and is passed through the cylindrical portion and the pair of rectangular projecting portions.

10. The slat supporting mechanism according to any one of claims 6 to 9, wherein each of said belt-shaped bodies is fabricated from a belt of a woven fabric or a knit fabric of yarn made of a synthetic resin such as polyester, or a belt of a nonwoven fabric made of a synthetic resin. 5
11. A blind apparatus comprising:
- said slat supporting mechanisms according to any one of claims 6 to 10; 10
 - slats respectively supported by said slat supporting mechanisms;
 - a raising and lowering mechanism for raising and lowering said slats by means of said slat supporting mechanisms; and 15
 - a tilting mechanism for tilting said slats by causing said first and said second link mechanisms to undergo relative positional changes as said slats are raised or lowered by said raising and lowering mechanism. 20
12. The blind apparatus according to claim 11, wherein each of said slats has a slat body and a fitting portion formed integrally on one surface of said slat body, and said fitting portion is made hollow to allow said fitting portion to fit therein. 25
13. The blind apparatus according to claim 11 or 12, wherein said raising and lowering mechanism is connected to an uppermost one of said slat supporting members, and is adapted to raise said slats by raising the uppermost one of said slat supporting members. 30

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FIG. 1

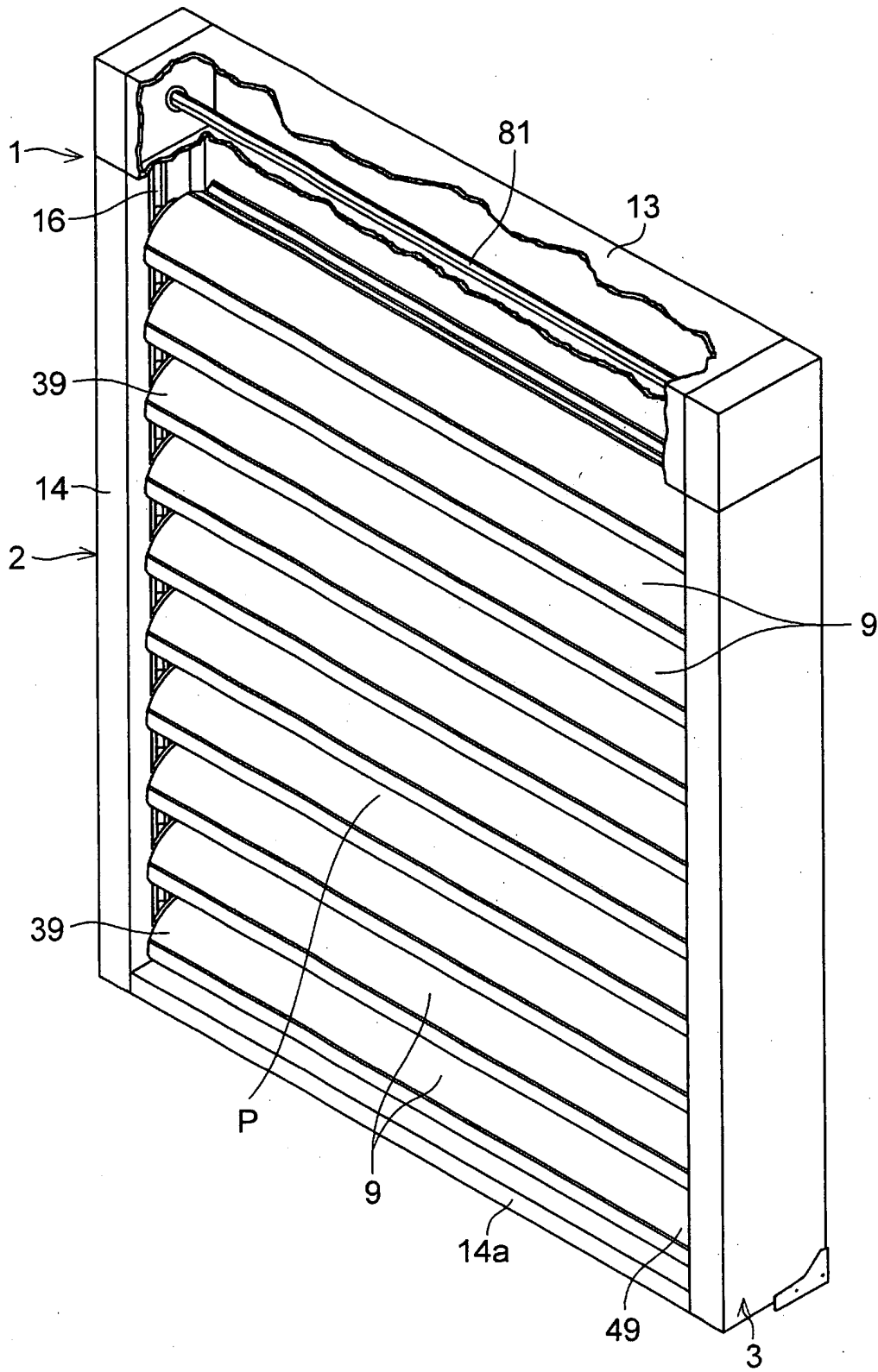


FIG. 2

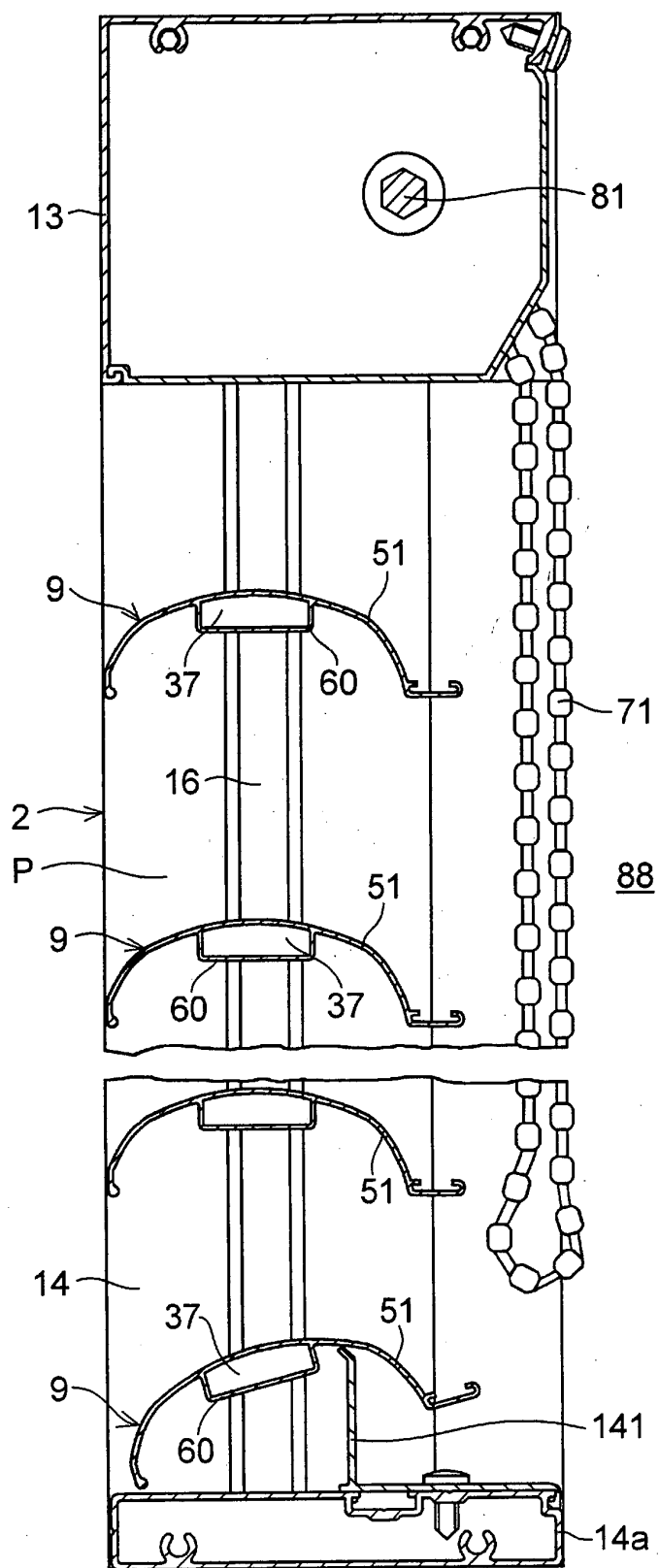


FIG. 3

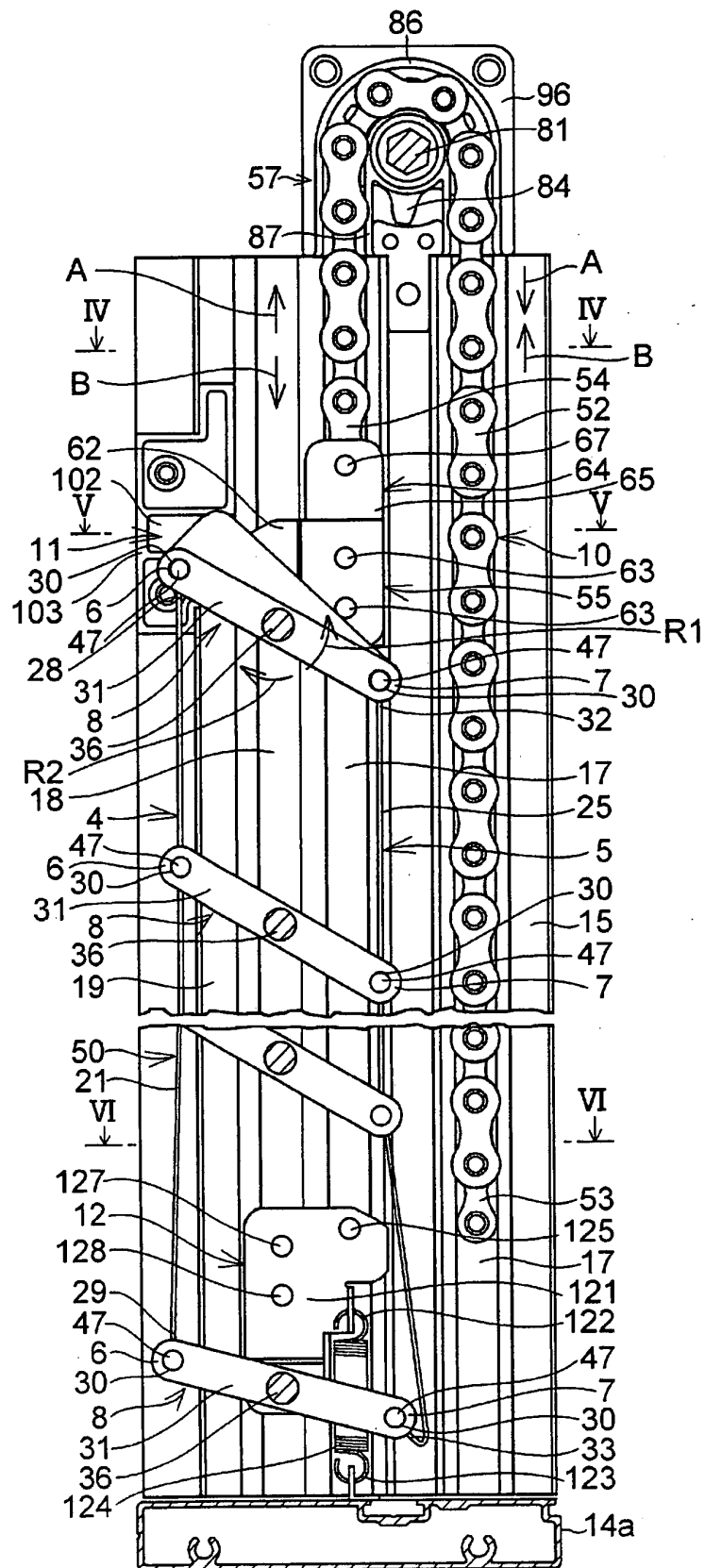


FIG. 4

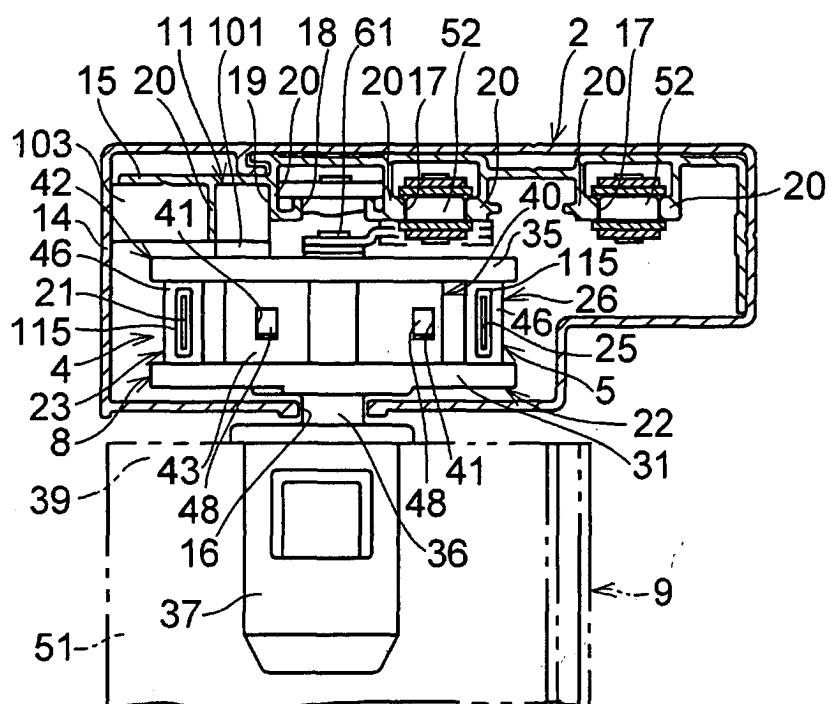


FIG. 5

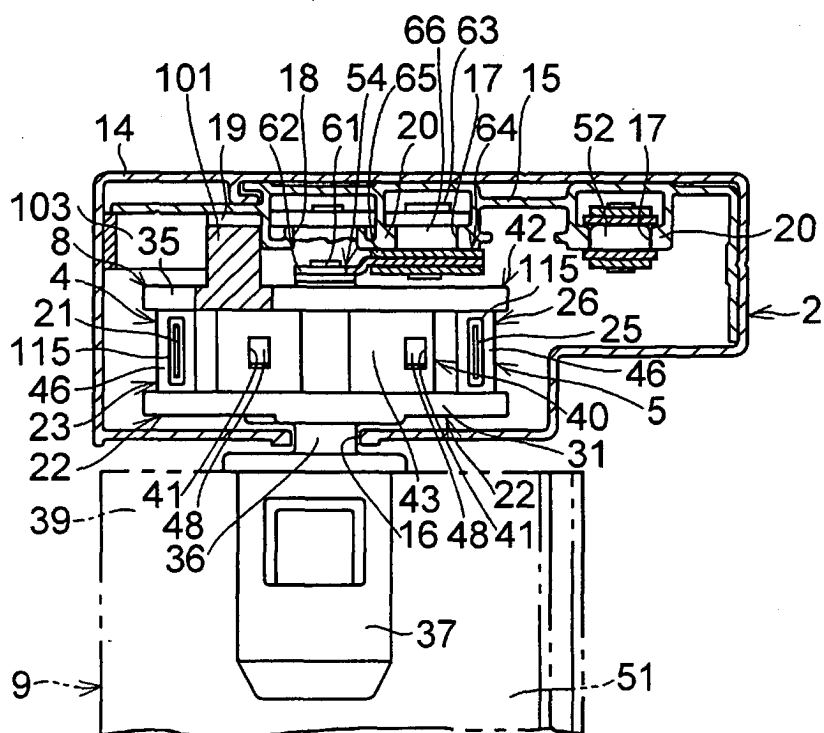


FIG. 6

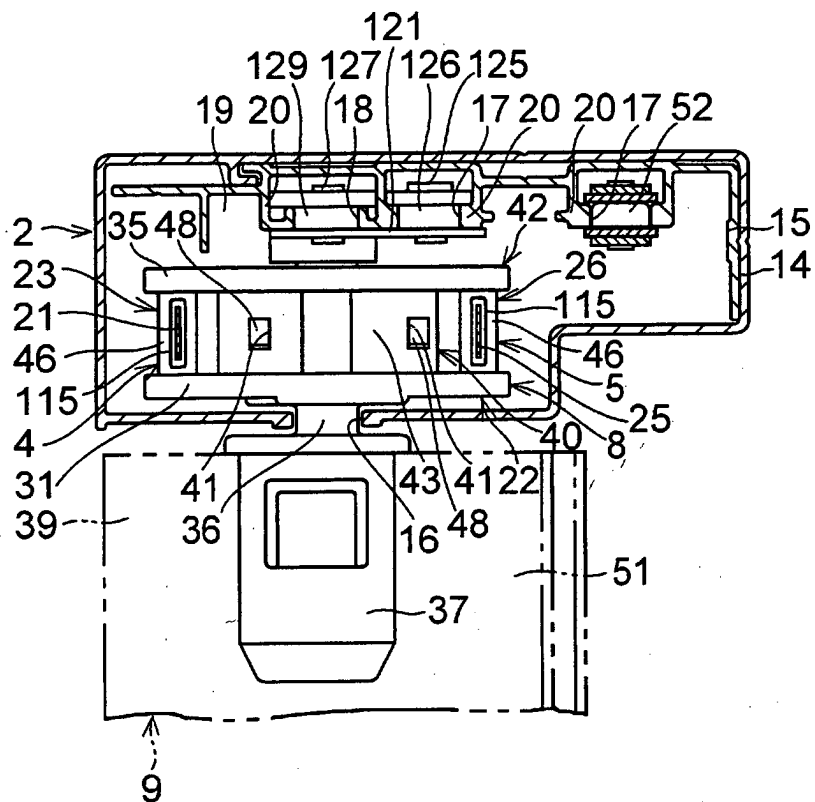


FIG. 7

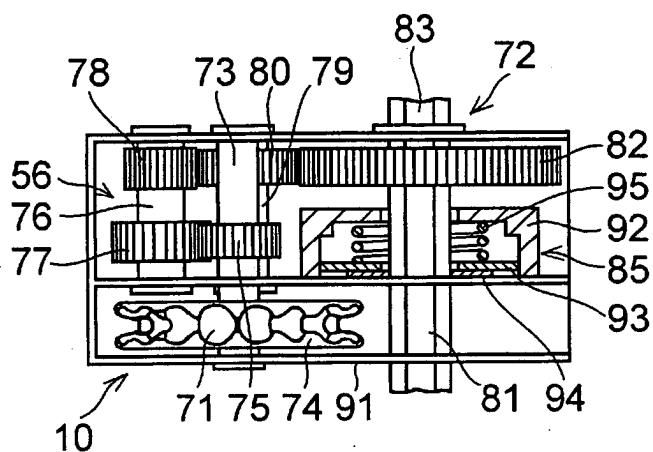


FIG. 8

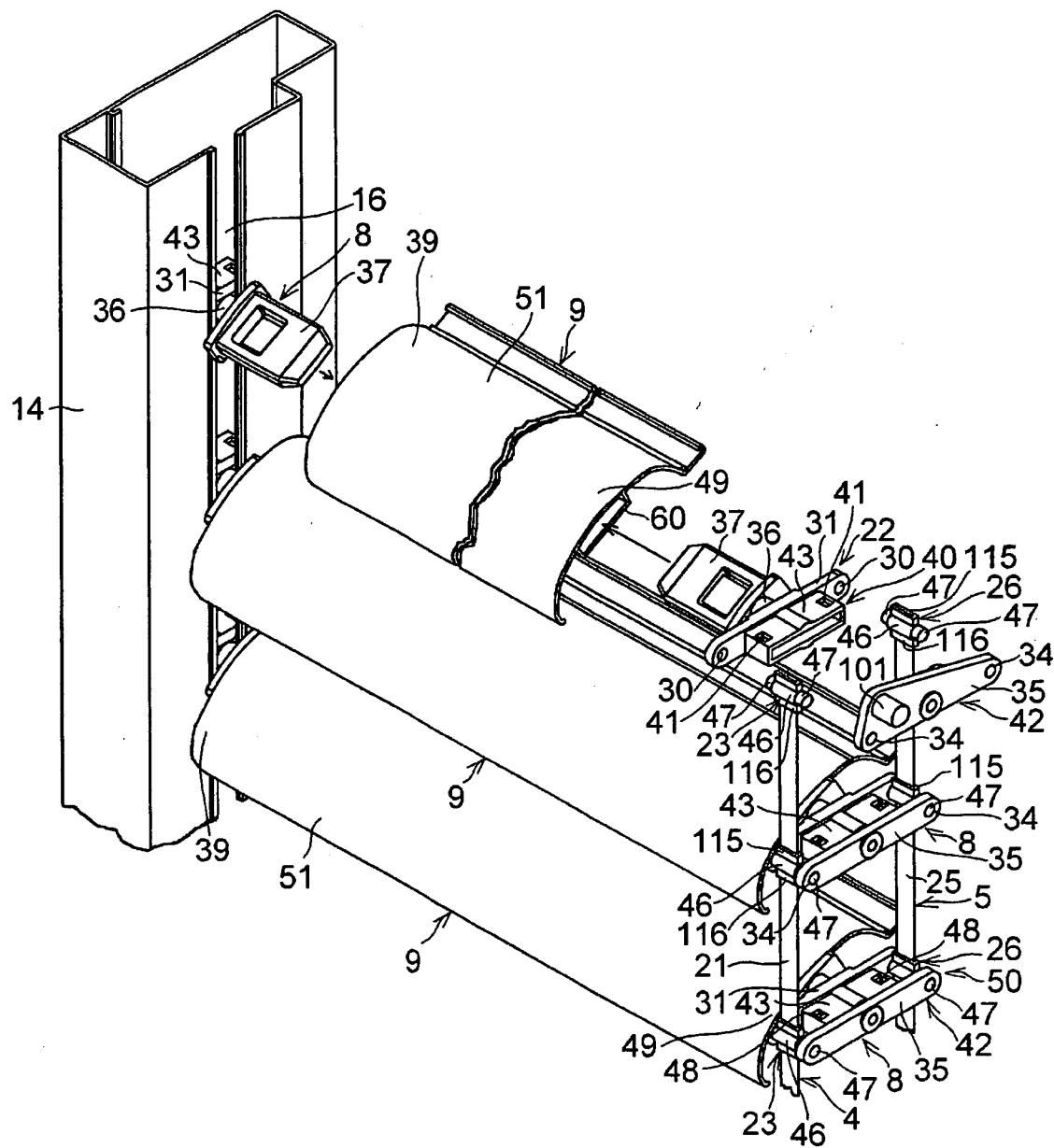


FIG. 9

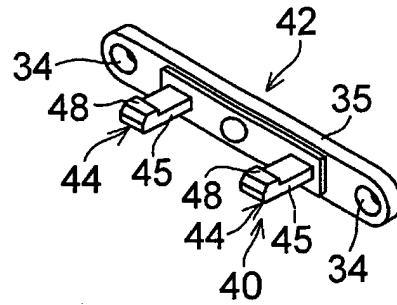


FIG. 10

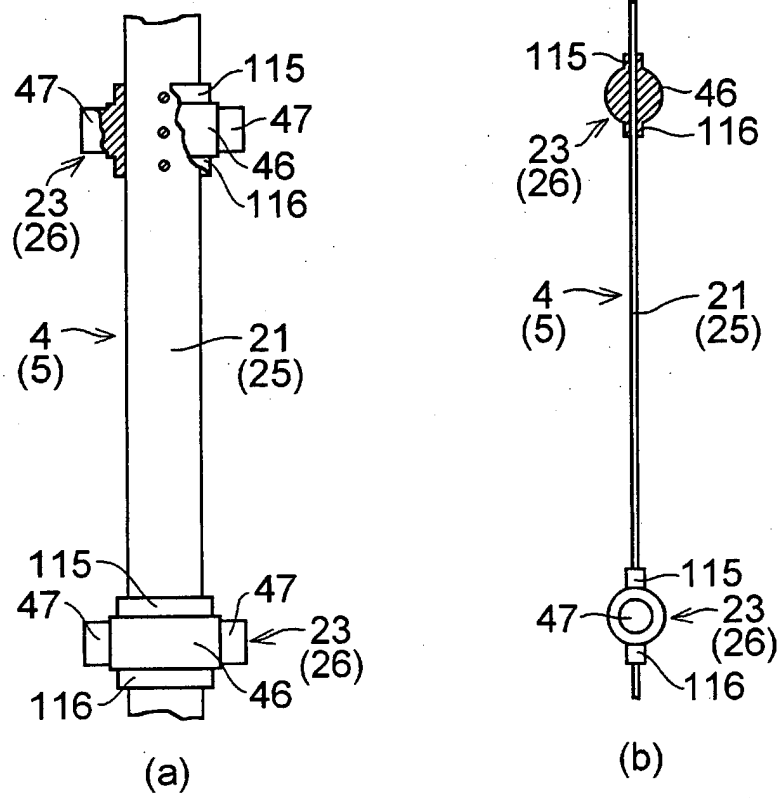


FIG. 11

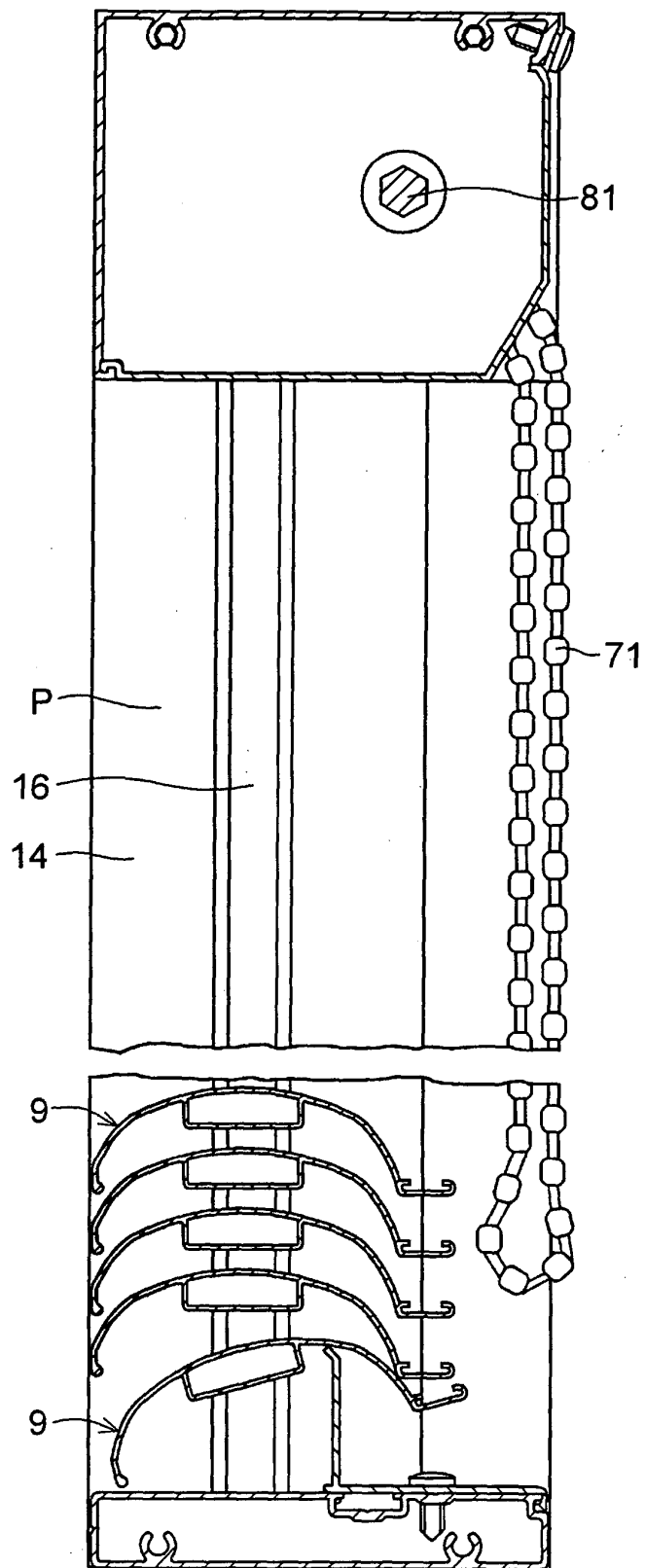


FIG. 12

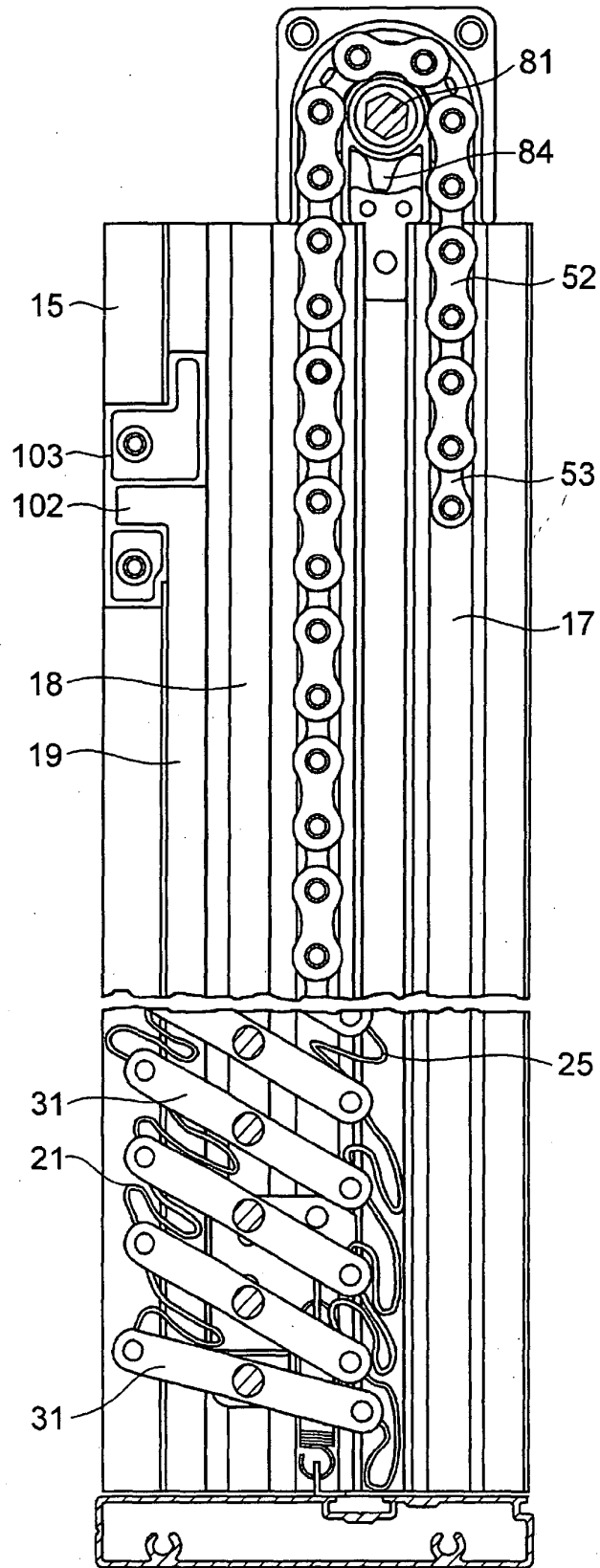


FIG. 13

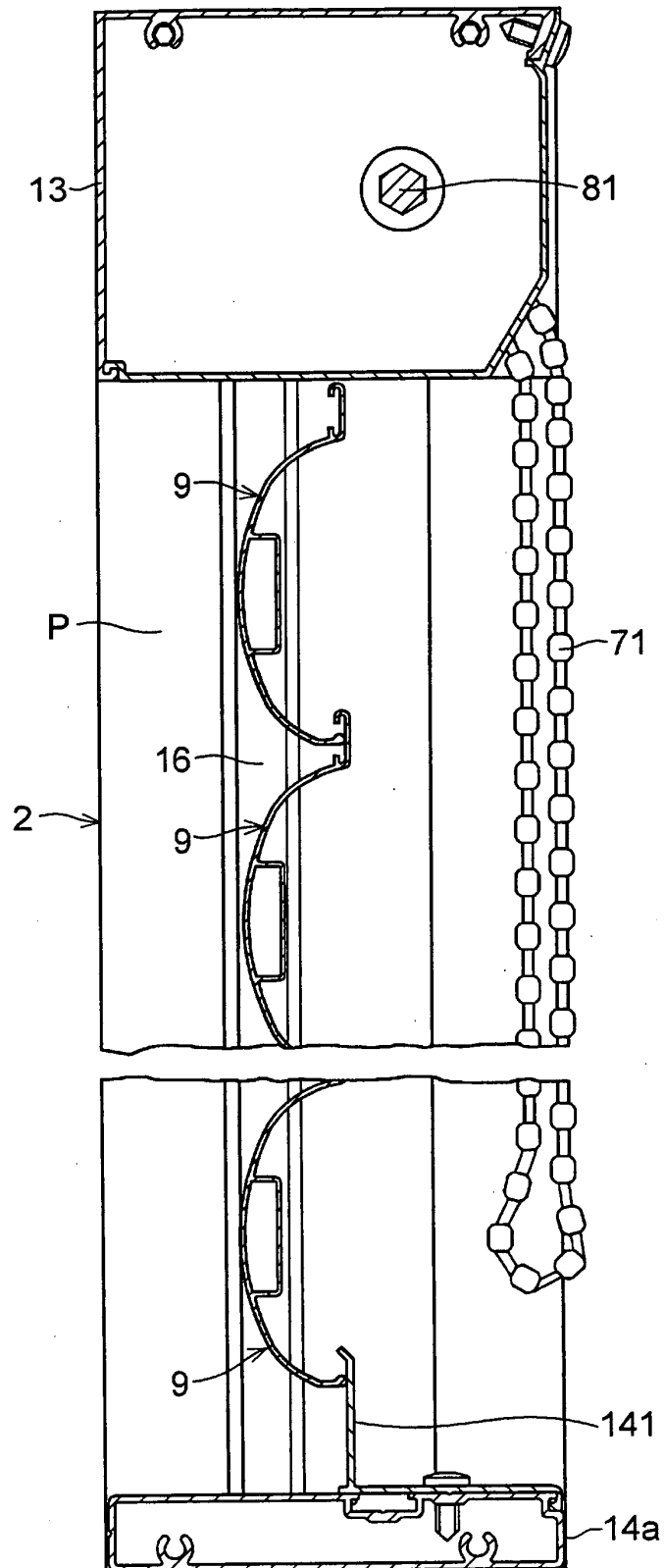


FIG. 14

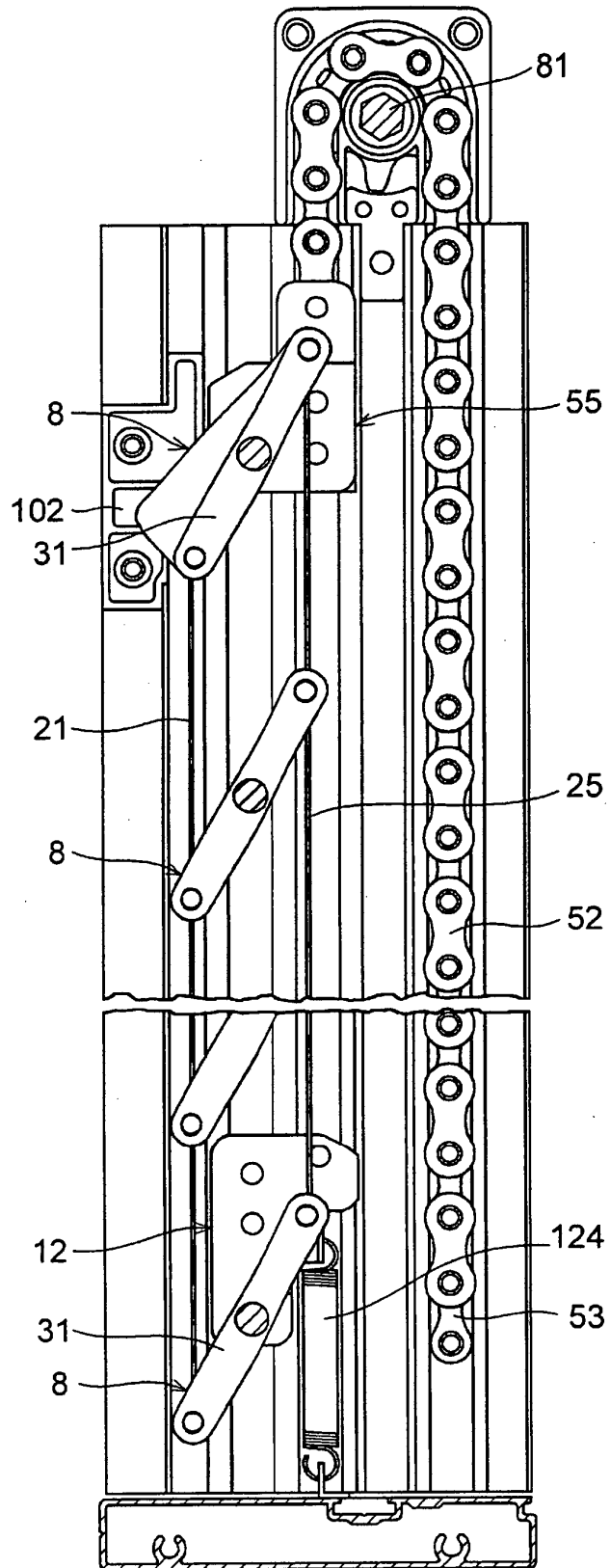


FIG. 15

