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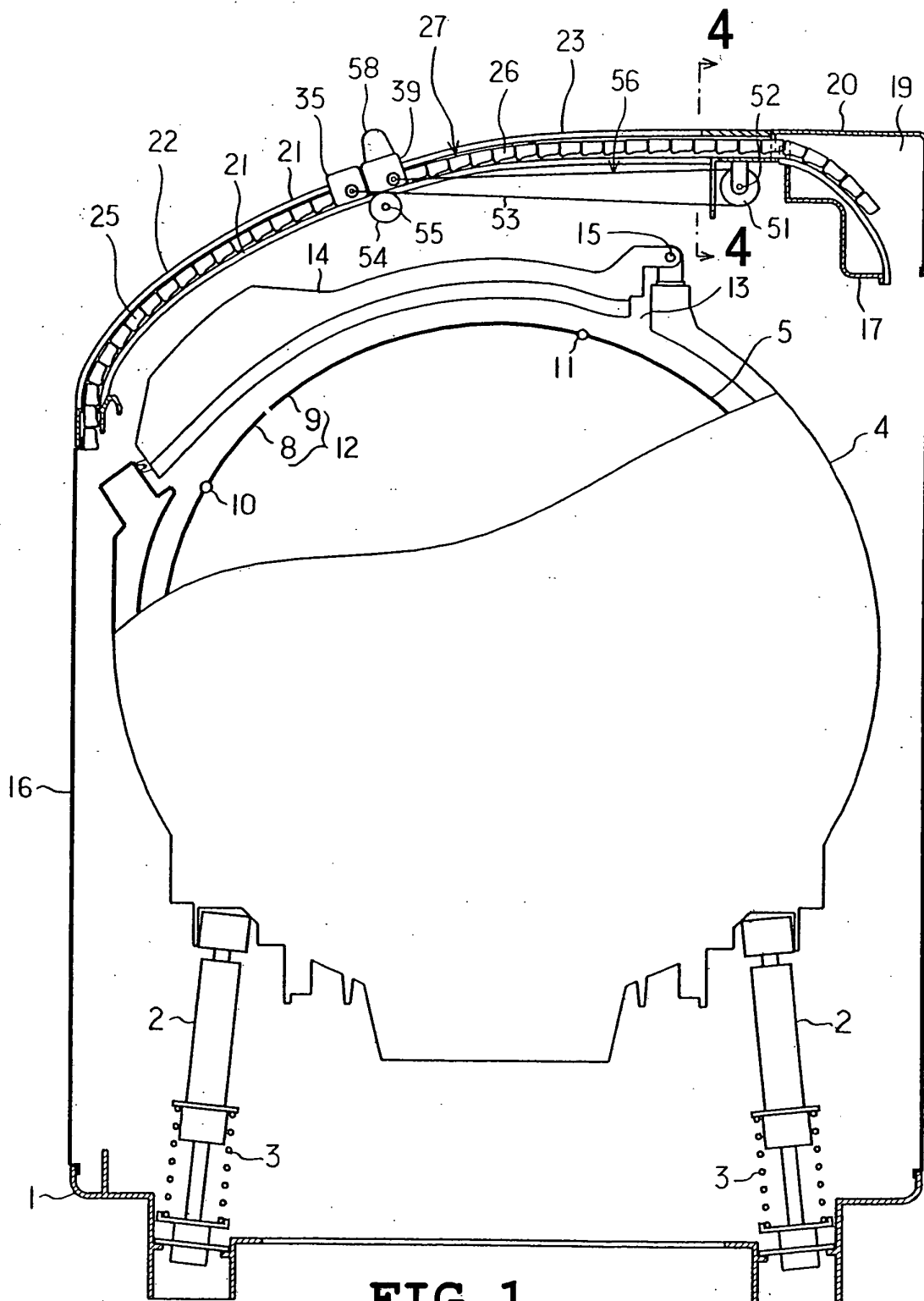
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(54) **WASHING MACHINE**

(57) A washing machine includes a wash tub (5) into which laundry is put, and an outer cover (27) to open and close an opening (18) of the wash tub (5), on a path along which the laundry is put into the wash tub (5), in which the outer cover (5) is divided into a first cover element

(25) and a second cover element (26), the first and second cover elements (25, 26) opening and closing the opening (18) by jointly moving in directions opposite to each other.

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Description

TECHNICAL FIELD

[0001] The present invention relates to a washing machine having an outer cover to open and close therewith an opening of a path for putting laundry into the washing machine.

BACKGROUND ART

[0002] As a washing machine described above, JP-A-H06-335595 discloses one of the above-described type washing machines. The disclosed washing machine includes a rotating cover which is provided as an outer cover on an upper part of an outer cabinet so as to be rotatable about a shaft. In this construction, the outer cover, when opened, projects greatly to the upper direction and there might be an interference with shelves around. Thus, there may be a case that the opening manipulation for opening the outer cover is restricted or the degree of freedom in installing a washing machine is decreased. Therefore, in order to prevent the outer cover from projecting greatly when opened, a sliding cover which can slide along a rail has been conventionally used as the outer cover.

DISCLOSURE OF THE INVENTION

PROBLEM TO BE OVERCOME BY THE INVENTION

[0003] In the conventional washing machine, there is a problem that a manipulation stroke for opening and closing the outer cover comes to be the same length as the size of the opening, resulting in a bigger burden on users.

[0004] The invention was made in view of the foregoing circumstances and an object of the present invention is to provide a washing machine enabling to control an outer cover with small amount of burden.

MEANS FOR OVERCOMING THE PROBLEM

[0005] The present invention provides a washing machine which includes a wash tub into which laundry is put and an outer cover to open and close an opening of the wash tub, on a path along which the laundry is put into the wash tub, characterized in that the outer cover is divided into a first cover element and a second cover element opening and closing the opening by jointly moving in directions opposite to each other.

[0006] By the foregoing construction, the outer cover is divided into the first cover element and the second cover element; and the first cover element and the second cover element open and close the opening by moving in the directions opposite to each other. This causes the moving stroke of each cover element to be shorter compared to the size of the opening such that users are able

to open and close the opening with smaller burden.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 is a perspective cross sectional view of the internal construction of a washing machine according to the first embodiment of present invention, with front cover and a rear cover being closed;
FIG. 2 is a view corresponding to FIG. 1 illustrating the internal construction of the washing machine, with the front cover and the rear cover being opened;
FIG. 3 is a cross sectional view illustrating locking mechanism or the like of the front cover and the rear cover;
FIG. 4 is a cross sectional view along the line 4 - 4 of FIG. 1;
FIG. 5 is a perspective view illustrating the exterior view of the front cover and the rear cover in closed state;
FIG. 6 is a perspective view illustrating, the front cover and the rear cover, viewed from front, in the middle of opening process;
FIG. 7 is a perspective view illustrating, the front cover and the rear cover, viewed from rear, in the middle of opening process;
FIG. 8 is a view corresponding to FIG. 1, illustrating a second embodiment of the present invention;
FIG. 9 is a view corresponding to FIG. 2; and
FIG. 10 is a view corresponding to FIG. 2, illustrating a third embodiment of the present invention.

EXPLANATION OF REFERENCE SYMBOLS

[0008] Reference symbol 5 designates a drum (wash tub), 18 an outer opening (entrance), 21 a rail (a rail member), 22 a steep gradient part, 25 a front cover (first cover member, sliding cover or accordion cover), 26 a rear cover (second cover member, sliding cover or accordion cover), 27 an outer cover, 35 a front supporting element (first supporting element), 37 a hook retainer (first joint element), 38 a first claw, 39 a rear supporting element (second supporting element), 43 a hook (second joint element), 44 a second claw, 45 a spring part (spring element), 46 a locking mechanism (transmission mechanism), 47 a control knob (unlocking control element or release control element), 51 a rear pulley (pulley), 53 a wire (string element), 56 a transmission mechanism, 58 a control knob (movement control element), 62 a cover part (deterrent element), 71 a rear cover (second cover element), 78 a front cover (first cover element), 79 a link mechanism (transmission mechanism), 80 an outer cover, 96 a front cover (first cover element), 97 a rear cover (second cover element), 102 a conveyer mechanism (transmission mechanism) and 103 an outer cover.

BEST MODE FOR CARRYING OUT THE INVENTION

[0009] Embodiments of the present invention will be described with referenced to the accompanying drawings.

<First embodiment>

[0010] FIGS. 1 to 7 show the first embodiment of the present invention. As shown in FIG. 1, a base plate 1 is located on the floor and a plurality of shock absorbers 2 are fixed on the base plate 1. Each one of these shock absorbers 2 is a spring type buffer for absorbing vibration with elastic force of an elastic compression coil 3. On the top end parts of the plurality of shock absorbers 2, a water tank 4 corresponding to an outer tank is fixed. The water tank 4, which is cylindrical with its right and left end sides closed, has a function of reserving water for keeping wash water.

[0011] On the side of the water tank 4, a motor of the washing machine (not illustrated in the drawing) is fixed. The wash motor has a rotation axis projecting into the water tank 4 concentrically to which a drum 5 corresponding to a washing tub is connected. On the peripheral wall of the drum, a plurality of water flowing holes (not illustrated in the drawing), through-holes, and an inner opening with the shape of a through-hole are formed; laundry is inputted into the drum 5 through the inner opening; and, laundry is taken out through the inner entrance from the drum 5. This drum 5 is rotated by the wash motor, and when the drum 5 is rotated, the laundry is repeatedly raised and dropped from and in the reserved water. That is to say, the drum 5 is intended to clean the laundry by beating.

[0012] On the drum 5, a front cover 8 and a rear cover 9 are mounted to enable themselves to rotate around an axis 10 and an axis 11. The front cover 8 and the rear cover 9 form an inner cover 12 to open and close the inner opening of the drum 5, and are mechanically connected to each other through a link mechanism. This link mechanism has a construction to transfer the operation force of one to the other of the front cover 8 and the rear cover 9 the opposite direction. That is to say, the front cover 8 and the rear cover 9 are linked to each other by the link mechanism, and as one of them is rotated to take a closing state in which it comes along the peripheral wall of the drum 5, the other also becomes in closing state. As one of them is rotated to taken an opening state in which it becomes gradient against the peripheral wall of the drum 5, the other also takes the opening state.

[0013] On the peripheral wall of the water tank 4, a middle opening 13 with the shape of a through-hole is formed. Through this middle opening 13, laundry is put into the drum 5 passing the inner opening, and is taken out from the drum 5 passing the inner opening. Further, the wash motor, at the final step of the cleaning operation, is controlled to stop such that the inner opening of the drum 5 overlaps with the middle opening 13 of the water

tank 4 along the diameter direction. Further, on the water tank 4, a mid cover 14 is mounted to rotate around an axis 15. The middle opening 13 is opened and closed by that the mid cover 14 is rotated to take the opening state of being gradient against the peripheral wall of the water tank 4 and take the closing state of being along the peripheral wall.

[0014] On the base plate 1, the bottom end part of an outer case 16 is fixed. This outer case 16 is of a rectangular box whose upper and lower sides are open, and a plurality of the shock absorbers 2, the water tank 4, the drum 5 are housed in the outer case 16. On the top end part of the outer case 16, a top cover 17 is fixed. This top cover 17, as shown in FIGS. 2 and 6, forms a rectangular frame having an outer opening 18 with a hole shape, and the outer opening 18 is located to face the upper side of the mid cover 14. This outer opening 18 is corresponding to the entrance of a path to input laundry into the drum 5 from outside and to the exit entrance of a path to take the laundry out of the drum 5.

[0015] In the rear end part of the top cover 17, as shown in FIG. 1, a mechanical room 19 with the shape of room whose upper side and rear side come to be open is formed. In the mechanical room 19, a water supply valve to supply tap water to the water tank 4 and a supply pump to supply bath water to the water tank 4 are housed. On the upper side and the rear side of the mechanical room, a back cover 20 is fixed, and the upper side and the rear side of the mechanical room are closed by the back cover 20.

[0016] On the inner surface of the top cover 17, as shown in FIG. 4, two rails 21 comprising the cover support are separately placed in the left part and the right part with a longitudinal interval. Each of these rails 21, as shown in FIG. 1, has a steep gradient part 22 and a gentle gradient part 23. Here, the steep gradient part 22 refers to a first half part where the level of descending gradient from the rear toward the front is relatively steep while the gentle gradient part 23 refers to a second half part where the level of descending gradient to the same direction is relatively gentle. That is to say, each rail 21 forms a continuous curve shape as a whole, and the boundary between the steep gradient part 22 and the gentle gradient part 23 is placed to be in the middle of the front-and-rear direction of the outer opening 18 on the rail.

[0017] Between the both rails 21 of each set, as shown in FIG. 4, a rail groove 24 is formed. In both of the rail grooves 24, as shown in FIG. 1, both the left the right end parts of a front cover 25 corresponding to the first cover element and both the left and right end parts of a rear cover 26 corresponding to the second cover element are inserted slidably. These front cover 25 and rear cover 26 form a outer cover 27 to open and close the outer opening 18 and are placed on the steep gradient part 22 and the gentle gradient part 23 of the rail 21 when the outer opening 18 is in the closed state. These front cover 25 and rear cover 26, as shown in FIG. 3, are constructed by rotatably connecting a plurality of rotation pieces 28.

Each rotation piece 28 is set to rotate relatively against rotational pieces 28 neighboring thereto in the front-and-rear direction. That is to say, the front cover 25 and the rear cover 26 are allowed to slide as they curve along the rail 21 using the rotation pieces 28 as units. That is to say, the front cover 25 and the rear cover 26 are corresponding to an accordion cover or a sliding cover. Hereinafter, the rotation piece 28 will be explained with reference to FIG. 3.

[0018] A hollow part 29 is formed by extruding a rigid resin into a cylinder a barrel extending to the left-and-right direction, and an axis retainer part 30 is formed on the front end part of the hollow part 29. This axis retainer part 30 is formed integrally with the hollow part 29, when the hollow part 29 is extruded, and has a cylindrical shape extending along the extrusion direction of a screw of an extender pressure.

[0019] In the rear end part of the hollow part 29, a joint part 31 is formed. This joint part 31 has a supporting part 32 and an axis part 33 both of which extend to the left-and-right direction and is formed integrally with the hollow part 29 by two tone color molding. This joint part 31 is molded by using a soft resin having more elasticity than the material of the hollow part 29, and the rotation pieces 28 are connected to each other rotatably by engaging the axis part 33 with the rearward axis retainer 30. The rotation piece 28 is constructed as described above.

[0020] In the front cover 25, as shown in FIG. 3, a plurality of bosses 34, made of synthetic resin, located in the rotation piece of the last row, are inserted slidably. A front supporting element 35 corresponding to a first supporting element is formed integrally with a top end part of a plurality of bosses 34. This front supporting element 35 is prevented from coming off from the front cover 25 by screwing a screw 36 having a head part 36a of a large diameter to the inner circumference of the plurality of bosses 34. And, in the front supporting element 35, a hook retainer 37, made of synthetic resin, that is located in the middle of the left-and-right direction of the front cover 25 is fixed. This hook retainer 37 is corresponding to a first joint element of a hook shape and a first extension part 38 extending upward is formed integrally with the rear end part of the hook retainer 37.

[0021] In the rear cover 26, a plurality of bosses 34, made of synthetic resin, located in the rotation piece of the frontmost row, are inserted slidably. A rear supporting element 39 corresponding to a second supporting element is formed integrally with the top end part of the plurality of bosses 34. This front supporting element 39 is prevented from coming off from the rear cover 26 by screwing the screw 36 having the head part 36a of a large diameter to inner circumference of the plurality of bosses 34, and in the rear supporting element 39, a hook receiver part 41 of a room shape is formed.

[0022] In the rear supporting element 39, a shaft 42, made of synthetic resin, which is located in the hook receiver part 41, is mounted rotatably. This shaft 42 has a cylindrical shape extending horizontally to the left-and-

right direction and the shaft 42 is formed integrally with a hook 43 located in the middle of the left-and-right direction of the rear cover. The hook 43 is corresponding to a second joint element of a hook shape and a second extension part 44 extending downwardly is formed integrally with the hook element 43.

[0023] A spring part 45 corresponding to a spring element 45 is formed integrally with the shaft 42, and the front part of the spring part 45 is locked with the ceiling side of the hook receiver part 41. This spring part 45 represents a thinner hook shape part as compared with the hook 43. The extension part 44 of the hook element 43 is engaged with the extension part 38 of the hook retainer 37 from upward by being biased in counterclockwise direction in FIG. 3 due to elastic resilience of the spring part 45 counter clockwise in FIG.3. That is to say, the front cover 25 and the rear cover 26 are locked in a linked manner by the engagement force between the extension part 38 and the extension part 44, based on which they are kept in the closed state to close the outer opening of the top cover 17. A locking mechanism 46 to lock the front cover 25 and the rear cover 26 in the closed state consists of the front supporting element 35, the hook retainer 37, the rear supporting element 39, the shaft 42, the hook 43, and the spring part 45.

[0024] To the shaft 42, a control knob 47 made of synthetic resin is mounted rotatably. In the inner peripheral side of the control knob 47, a projecting control part 48 is formed integrally, and the control 48 contacts a controlled part 49, the hook receiver 37 and the hook 43 are in the engagement state from the direction opposite to the both. This controlled part 49 is formed integrally with the shaft 42, and the extension part 44 contacts the extension part 38 of the hook receiver 37, when the hook 43 is in the engagement state, and contacts the control part 48 of the control knob 47. That is to say, the hook 43 is restricted not to rotate by the contact with the hook receiver 37 and the control knob 47.

[0025] The control knob 47 is corresponding to an unlocking control element and a release control element. When the control knob 47 is manipulated to rotate counterclockwise in FIG. 3 with the hook receiver 37 and the hook 43 engaged, the controlled part 49 pressed toward the same direction by the control part 48. And the hook 43 rotates in the same direction to separate from the hook receiver 37. That is to say, the control knob 47 is for switching the relation between the hook receiver 37 and the hook 43 from the locking state to the unlocking state. The front cover 25 and the rear cover 26 are switched by one touch manipulation of the control knob from the locking state to the unlocking state.

[0026] A stopper 50 of a plate shape is formed integrally with the front supporting element 35, as shown in FIG. 3, in the front end part thereof. The front cover 25 slides by its own weight to the front along the rail groove 24 by the front cover 25 and the rear cover 26 being unlocked, and as shown in FIG.3, stops sliding when the stopper 50 contacts the top cover 17. In the opening state

of the front cover 25, exposed portion of the front cover 25 is received into the outer case 16. The exposed portion of the front cover 25 is a portion thereof projecting forward further from the front supporting element 35. The front cover 25 is received into the outer case 16 in the opening state so that it becomes unrecognized visually.

[0027] In the top cover 17, as shown in FIG. 1, a rear pulley 51 is mounted rotatably around a shaft 52. In this rear pulley 51, a wire 53 corresponding to a string element is wound around, and one end of the wire 53 is fixed to the front supporting element 35 while the other end of the wire 53 is fixed to the rear supporting element 39. Further, in the top cover 17, a front pulley 54 is mounted rotatably around a shaft 55, and the lower side part of the wire 53 is supported by the front pulley 54 from the lower direction. The rear pulley, the wire 53 and the front pulley 54 form a transmission mechanism 56 to transmit the sliding force of the front cover 25 to the rear cover 26 in a reversed direction. As the front cover 25 slides to the forward direction with its own weight, the rear cover 26 correspondingly slides to the rear direction along the rail groove 24. As the rear cover 26 is manipulated by a user to slide to the forward direction, the front cover 25 slides to the rear direction.

[0028] That is to say, the front cover 25 and the rear cover 26 are adapted to slide automatically to the opening direction due to mechanical linkage without using electric driving force at all. That is to say, sliding of the front cover 25 and the rear cover 26 to the opening direction is executed with one touch manipulation of the control knob 47, and sliding of the front cover 25 and the rear cover 26 to the closing direction is executed with manipulation of the rear cover 26 by a user. Sliding of the front cover 25 and the rear cover 26 is executed along the rail 21, which corresponds to a curving path (21).

[0029] A stopper 57 of a perpendicular plate shape is formed integrally with the rear supporting element 39 at the rear end part thereof, as shown in FIG. 3. The rear cover 26, as shown in FIG. 2, stops sliding when the stopper 57 contacts the back cover 20. In such an opening state of this rear cover 26, exposed portion of the rear cover 26 is received within a mechanical room 19 and the outer case 16. This exposed portion of the rear cover 26 is a portion thereof projecting backward further from the rear supporting element 39. The rear cover 26 is received into the mechanical room 19 and the outer case 16 in its opening state so that it becomes unrecognized visually.

[0030] The outer cover 27 is divided into the front cover 25 and the rear cover 26 in the middle of the forward-and-rear direction of the outer opening 18 of the top cover 17. The stroke when the front cover 25 is switched from an closing state to the opening state, and the stroke when the front cover 25 is switched from the opening state to the closing state; and the stroke when the rear cover 26 is switched from the closing state to the opening state, and the stroke when the rear cover is switched from the opening state to the closing state are all set to be the

same.

[0031] A projecting control knob 58 is formed integrally with the rear supporting element 39, as shown in FIG. 3 in the middle of the left-and-right direction of the rear cover 26. This control knob 58 is corresponding to a movement control element, and a projecting handle part 59 is formed integrally with the rear side of the control knob 58. This handle part 59 allows a user to hold it with fingers from the forward direction when a user manipulates to close the rear cover from the opening state towards the forward direction. The control knob 47 for unlocking is placed close to the control knob 58 for movement control enough to allow the user put to manipulate it with using different fingers from those of the same hand to hold the handle part 59.

[0032] In the extension part 38 of the hook retainer 37 and the extension part 44 of the hook 43, a gradient side 60 and a gradient side 61 are formed. These gradient sides 60 and 61 are adapted to ascend from the backward direction to the forward direction. This causes the gradient side 61 to run on the gradient side 60 of the hook retainer 37 and slide to the forward direction along the gradient side 60 when the rear cover 26 is manipulated to close. In that case, the hook 43 resists the bias force applied by the spring part 45 to rotate clockwise as shown in FIG. 3 and the gradient side 61 passes the gradient side 60 so that the hook 43 engages with the hook retainer 37 by the bias force applied by the spring part 45. As the rear cover 26 is manipulated from the opening state to the closing state, the hook retainer 37 and the hook 43 return automatically from a unlocked joint state to a joint state by the manipulation force. And the front cover 25 and the rear cover 26 are locked to be closed without any other manipulation except for the closing manipulation of the rear cover 26.

[0033] A projecting cover part 62 corresponding to a deterrent element is formed integrally with the rear part of the front supporting element 35, as shown in FIG. 3, and a joint part 63 is engaged with the cover part 62 from the downward direction when the rear cover 26 is manipulated to close. This joint part 63, which is formed integrally with the rear supporting element 39, is engaged with the cover part 62 at the same timing that the gradient side 61 of the hook 43 runs on the gradient side 60 of the hook retainer 37. That is to say, the cover part 62, by pressing the joint part 63 from the upper direction, prevents a ceiling side of the rear supporting element 39 from being elastically deformed to the upper direction by the bias force of the spring part 45. The hook 43 is supported in a normal position which leads it to engagement with the hook retainer 37, by restraining elastic deformation of the rear supporting element 39.

[0034] According to the above-described first embodiment, the outer cover 27 is divided into the front cover 25 and the rear cover 26, and the front cover 25 and the rear cover 26 are moved to the opposite directions each other to open and close the outer opening 18. This causes the moving stroke of the front cover 25 and the moving

stroke of the rear cover 26 to be shorter than the size of the outer opening 18. By the construction, a user can open and close the outer opening 18 with a small burden.

[0035] Further, the front cover 25 and the rear cover 26 are designed to be slidable so that the front cover 25 and the rear cover 26 do not project upward from the top cover 17 in their opening state. This prevents the front cover 25 and the rear cover 26 from interfering with a tap of a water supply or the like so that degree of freedom of installation of the outer case 16 increases.

[0036] Further, the front cover 25 and the rear cover 26 are designed as accordion covers. Accordingly, when the front cover 25 and the rear cover 26 slide along the rail 21, the shape of the front cover 25 and the shape of the rear cover 26 change along the curving path 21 and the front cover 25 and the rear cover 26 slide smoothly.

[0037] Further, the front cover 25 and the rear cover 26 are constructed with a combination of the same elements, the rotating pieces 28. Therefore, cost decreases in comparison with the case that the front cover 25 and the rear cover 26 are constructed with a combination of different elements.

[0038] Further, the front cover 25 and the rear cover 26 are hidden so as not to be recognized visually in their opening state, thereby improving the impression of products when the covers 25 and 26 are opened.

[0039] Further, the outer cover 27 is divided into the front cover 25 and the rear cover 26 in the center of the forward-and-backward direction of the outer opening 18. Because of this, the moving stroke of the front cover 25 and the moving stroke of the rear cover 26 become same.

[0040] Further, the transmission mechanism 56 to transmit the movement force of the front cover 25 to the rear cover 26 in the opposite direction is provided. Because of this, it is not required to manipulate the front cover 25 and the rear cover 26 separately.

[0041] Further, the locking mechanism is provided to lock the front cover 25 and the rear cover 26. Because of this, the movements of the front cover 25 and the rear cover 26 are restrained in their closing state. Accordingly, it is possible to prevent a noise generated by vibration due to interference of the front cover 25 with the rear cover 26.

[0042] Further, at an occasion of unlocking between the front cover 25 and the rear cover 26, the front cover 25 moves spontaneously from the closing state to the opening state. Because of this, a user is not required to manipulate the front cover 25 directly to open, and the opening manipulation of the front cover 25 becomes simple.

[0043] Further, the weight of the front cover 25 is used as a diving force to execute spontaneous movement of the front cover 25. Because of this, there is no need for electric power and mechanical driving source like a spring to execute spontaneous movement of the front cover 25 so that the construction becomes simple.

[0044] Further, at an occasion of unlocking the front cover 25 and the rear cover 26, the front cover 25 slides

with its own weight from the closing state to the opening state, and the rear cover 26 is slid from the closing state to the opening state by the sliding force of the front cover 25. Accordingly, it becomes not necessary for a user to manipulate to open the front cover 25 and it becomes easy to manipulate to open the front cover 25. Furthermore, the front cover 25 and the rear cover 26 are unlocked to open the outer opening 18 by single manipulation and it become simpler to open the outer opening 18.

[0045] Further, when the rear cover 26 is slid from the closing state to the opening state, it is ascended along the gentle gradient side 23 of the rail 21, and on the contrary, when slid from the opening state to the closing state, it is descended along the gentle gradient side 23. Because of this, when a user manipulates to close the rear cover 26, manipulation force decreases as much as the weight of the rear cover 26 itself so that a user's burden to close the rear cover 26 decreases.

[0046] Further, because the control knob 58 for movement control is provided in the rear cover 26, a user can close the outer opening 18 by holding the control knob 58 with his fingers to pull the rear cover 26 just to the forward direction. Because of this, in comparison with the case that the front cover 25 is pushed backward to close the outer opening 18, it becomes easy to apply force and the closing manipulation of the outer entrance 18 becomes simple.

[0047] Further, the control knob 58 for manipulating movement is mounted only on the rear cover 26. Therefore, it can be clearly understood by a user that can close the outer opening 18 of the top cover 17 can be closed just by the manipulation of the rear cover 26.

[0048] Further, the control knob 47 for unlocking is placed near to the control knob 58 for movement control. Because of this, while putting finger into the handle part 59 of the control knob 58, a user can manipulate the control knob 47 with other fingers of the same. Therefore, it is more convenient to use the washing machine.

[0049] Further, the hook retainer 37 and the hook 43 are formed by the first extension part 37 and the second extension 44 facing upward and downward respectively. Because of this, when the front cover 25 and the rear cover 26 are in the closing state, and when external force is applied from the upward-to-downward direction by pushing the rear supporting element 39 with a user's hand, the second extension part 44 moves to a direction for engaging with the first extension part 38. This can prevent the front cover 25 and the rear cover 26 from sliding inadvertently to the opening direction by unlocking both of the covers.

[0050] Further, the hook 43 is restricted not to rotate by bringing the hook 43 into contact with both the hook retainer 37 and the control knob 47 while being engaged with the hook retainer 37. This prevent the hook 43 from rotating by vibration and the like at the time of operation, and therefore, the front cover 25 and the rear cover 26 can be prevented from inadvertently sliding to the opening direction by unlocking of the hook retainer 37 from

the hook 43 to generate vibration, when operated.

[0051] Further, the joint part 63 of the rear supporting element 39 is engaged with the cover part 62 of the front supporting element 35. This restricts elastic deformation of the rear supporting element 39 and also prevents the hook 43 from being positioned abnormally in conjunction with elastic deformation of the rear supporting element 39. Thus, the hook 43 is certainly engaged with the hook retainer 37 based on the closing manipulation of the rear cover 26, and the front cover 25 and the rear cover 26 are certainly locked in conjunction with the closing manipulation of the rear cover 26.

[0052] Further, the wire 53 is folded wound around the rear pulley to form an upper side part and a lower side part of the wire 53, and the front cover 25 and the rear cover 26 are connected to the upper side part and the lower side part of the wire 53, respectively. This allows the transmission mechanism 56 to become more compact and degree of freedom to set up the transmission mechanism 56 increases.

[0053] Further, although the first embodiment described above shows a construction to hide both the front cover 25 and the rear cover 26 not to be recognized visually when opened, the present invention is not limited to it, and for instance, only one of the front cover 25 and the rear cover 26 may be hidden.

[0054] Further, although both the front cover 25 and the rear cover 26 are received in the outer case 16 when opened to be hidden, and unrecognized visually, the present invention is not limited to this configuration, and it is also allowed to provide a cover for exclusive use to hide the front cover 25 and the rear cover 26.

[0055] Further, although the outer cover 27 is divided into the front cover 25 and the rear cover 26 from a center of the forward-and-backward direction of the outer opening 18, the present invention is not limited to this configuration, and for instance, it may be divided at a little biased place from the center of the forward and backward direction of the outer opening 18.

[0056] Further, although the front cover 25 is switched from the closing state to the opening state to slide by its own weight and the rear cover 26 is switched from the closing state to the opening state to slide by the sliding force of the front cover 25, the present invention is not limited to this configuration and is also allowed to be as follows.

(1) The rear cover 26 is switched from the closing state to the opening state to slide by its own weight and the rear cover 25 is switched from the closing state to the opening state to slide by the sliding force of the rear cover 26.

(2) Both of the front cover 25 and the rear cover 26 are switched from the closing state to the opening state to slide by their own weights. In this case, it is not necessary to provide the transmission mechanism 56 connecting the front cover 25 to the rear cover 26.

[0057] Further, although the front cover 25 has used its own weight as a driving force for the front cover 25 to be switched from the closing state to the opening state to slide, the present invention is not limited to this configuration, and may also have a configuration, for instance, that a user manipulates the front cover 25 directly, or that the front cover 25 is operated by using a motor and a electric driving source such as a solenoid. In this case, a switch is provided to detect whether an effective manipulation of the control knob 47 for unlock exists, and the front cover 25 is opened by the driving source when any effective manipulation of the control knob 47 is detected.

[0058] Further, although the front cover 25 and the rear cover 26 are locked by connecting themselves with the lock mechanism 46, the present invention is not limited to this configuration, and applied to the rail 21 may be used, for instance, frictional resistance force to stop their moving and keep them closed.

[0059] Further, although the control knob 47 for unlocking and the control knob 58 for manipulating movement are provided neighboring each other to control them simultaneously, the present invention is not limited to this configuration, and for instance, the knobs 47, 58 may be provided with a certain interval which does not allow them to be manipulated simultaneously.

[0060] Further, although the front cover 25 and the rear cover 26 are formed as accordion covers, the present invention is not limited to this configuration, and for instance, they may comprise a plate type element which is not bended. In this case, it is preferable to use an elastic plate as a plate element, which is elastically deformable along the rail 21.

[0061] Further, the control knob 58 for manipulating movement is provided only in the rear cover 26, the present invention is not limited to this configuration, and for instance, the knob 58 may be provided only in the front cover 25 or both in the front cover 25 and the rear cover together.

[0062] Further, although the wire 53 is used as a string element to transmit a moving force of any one of the front cover 25 and the rear cover 26 to the other in reversed direction, the present invention is not limited to this configuration, and for instance, a piano wire, a rubber belt or the like may be used.

[0063] Further, although the outer cover 27 is divided into the front cover 25 and the rear cover 26 around at the center of the forward and backward direction of the outer opening, the present invention is not limited to this configuration, and the outer cover 27 only has to be divided almost at the center thereof.

[0064] Further, although the wire transmission mechanism is used as the transmission mechanism 56 to transmit a moving force of any one of the front cover 25 and the rear cover 26 to the other to the reversed direction, the present invention is not limited to this configuration, and for instance, a linkage mechanism, cam mechanism, conveyer mechanism or the like may be

used.

<Second embodiment>

[0065] Next, a second embodiment of the present invention is explained with reference to FIG. 8 and FIG. 9. In comparison with the first embodiment described above, differences are as follows.

[0066] As shown in FIG. 8, in a top cover 17, a rear cover 71 corresponding to a second cover element is mounted to rotate about an axis 72. This rear cover 71 is made of synthetic resin formed in a shape of a plate, and the upper part of a rear arm 73 is fixed on the axis of the rear cover 71. In the lower part of the rear arm 73, the rear end part of the front arm 74 is connected to rotate about an axis 77. In the front end part of the front arm 74, the lower part of the front bracket 76 is mounted to rotate about the axis 77. In the upper end part of the front bracket 76, a front cover 78 is fixed. This front cover 78 is corresponding to a first cover element and is made of synthetic resin formed in a shape of a plate.

[0067] The front arm 73, the rear arm 74 and the front bracket 76 forma linkage mechanism 79 as a transmission mechanism to transmit rotation force of any one of the front cover 78 and the rear cover 71 to the other to the reversed direction. The front cover 78 and the rear cover 71 form an outer cover 80 to open and close the outer opening of the top cover 17 based on their rotations in directions opposite to each other. That is to say, when the front arm 74 and the rear arm 73 are bended as shown in FIG. 8, the front cover 78 and the rear cover 71 become the closing state to close the outer opening. In opening state, when the rear cover 71 is manipulated to rotate to the backward direction, the front cover 78 moves forward based on the rotating force transmitted to the backward direction of the rear cover 71 in reversed direction to the front cover 78. And as shown in FIG. 9, the front cover 78 and the rear cover 73 are together moved to be opened by the front arm 74 and the rear arm 73 being in the stretched state. In this opening state, the front cover 78 projects to the forward direction of the outer case 16.

<Third embodiment>

[0068] Next, a third embodiment of the present invention is explained with reference to FIG. 10. In comparison with the first embodiment described above, differences are as follows.

[0069] As shown in FIG. 10, in a top cover 17, a front sprocket 91 and a rear sprocket 92 is mounted to rotate about an axis 93 and an axis 94. And on the external circumference of a front sprocket 91 and a rear sprocket 92, a plurality of a gear teeth part 95 is formed. Further, in the left side guide groove 24 and the right side guide groove 24 of the top cover 17 respectively, located in first half part, the front cover 96 corresponding to the first cover element is inserted slidably and located in second half part, the rear cover 97 corresponding to the second

cover element is inserted slidably. These front cover 96 and rear cover 97 formed with a plate made of elastic synthetic resin come to a state in which the outer entrance 18 of the top cover 18 is closed by moving in directions getting closer to each other, and come to a state in which the outer entrance 18 is opened by moving in directions departing away from each other. That is to say, the front cover 96 and the rear cover 97 form an outer cover 103 to open and close the outer entrance 18.

[0070] In the lower side of the front cover 96 and the lower side of the rear cover 97, a plurality of concavities 98 are formed. These concavities 98 are lined one after another forward and backward. And when the front sprocket 91 and the rear sprocket 92 rotates, rotating force of the front sprocket 91 and rotating force of the rear sprocket 92 is transmitted to the front cover 96 and the rear cover 97 through the gear tooth 95 and the concavity 98. Accordingly, the front cover 96 and the rear cover 97 slide along the rail 21.

[0071] A belt 99 without ends is wound around the axis 93 of the front sprocket 91 and the axis 94 of the rear sprocket 92. This belt 99 is twisted 180°, so that top and bottom cross, in its longitudinal center area, and the belt 99 is supported by a roller 100 and a roller 101 at the front and the rear of the crossing point. These rollers 100 and 101 are mounted rotatably in the top cover 17, and the belt 99 is supported by the roller 100 and the roller 101 not to droop downward.

[0072] The front sprocket 91, the rear sprocket 92 and the belt 99 form a conveyer mechanism 102 as transmission mechanism to transmit a moving force of any one of the front cover 96 and the rear cover 97 to the other to the opposite direction. That is to say, when either the front cover 96 or the rear cover 97 linked together is switched from the closing state to the opening state, the other also comes to be opened, and the front cover 96 and the rear cover 97 project in a forward and backward directions respectively from the top cover to expose the opening. Further, when either the front cover 96 or the rear cover 97 linked together is switched from the opening state to the closing state, the other comes to be closed.

[0073] Further, although in the first to third embodiments, the outer cover 27, the outer cover 80 and the outer cover 103 are divided in the forward direction and the backward direction, the present invention is not limited to this configuration and the cover also may be divided in a leftward direction and a rightward direction.

[0074] Further, although the present invention is applied to drum type of washing machine beating laundries to wash, the present invention is not limited to this configuration and is also allowed, for instance, to apply a washing machine using a stream of water generated by an agitating body to wash.

INDUSTRIAL APPLICABILITY

[0075] As described above, the washing machine of the present invention is effective when the outer cover is

operated with small amount of burden.

Claims

1. A washing machine which includes a wash tub (5) into which laundry is put and an outer cover (27, 80, 103) to open and close an opening (18) of the wash tub (5), on a path along which the laundry is put into the wash tub, **characterized in that** the outer cover (27, 80, 103) is divided into a first cover element (25, 78, 96) and a second cover element (26, 71, 97) opening and closing the opening (18) by jointly moving in directions opposite to each other.
2. The washing machine according to claim 1, **characterized in that** the first cover element is in front of the second cover element, and the two serve as a front cover and a rear cover respectively.
3. The washing machine according to claim 1, **characterized in that** the first cover element and the second cover element open and close the opening by sliding in directions opposite to each other.
4. The washing machine according to claim 1, **characterized in that** at least one of the first cover element and the second cover element is a linked segmented cover to connect a plurality of hinging elements (28) turnably.
5. The washing machine according to claim 1, **characterized in that** at least one of the first cover element and the second cover element is not visible in its opening state where the opening is exposed.
6. The washing machine according to claim 1, **characterized in that** the outer cover is divided into the first cover element and the second cover element at the middle area of the opening.
7. The washing machine according to claim 1, further **characterized by** a transmission mechanism (56, 79, 102) for transmitting a moving force of either the first cover element or the second cover element to the other element in the reverse direction.
8. The washing machine according to claim 1, further **characterized by** a locking mechanism (46) for maintaining the door in the closing state by locking the first cover element and the second cover element to be connected to each other.
9. The washing machine according to claim 1, further **characterized by** a locking mechanism for maintaining the door in a closing state by locking the first cover element and the second cover element to be connected to each other, wherein when the first cover element or the second cover element or both is unlocked, both move by themselves from the locking state to the opening state where the opening is exposed.
10. The washing machine according to claim 1, further **characterized by** a locking mechanism for maintaining the door in a closing state by locking the first cover element and the second cover element to be connected to each other, wherein the first cover element or the second cover element or both is constructed so that when the cover elements are unlocked, the elements move by themselves from the locking state to the opening direction.
11. The washing machine according to claim 1, further **characterized by** rail members (21) supporting the first cover element and the second cover element slidably, a locking mechanism for keeping the opening covered by locking the first cover element and the second cover element to be connected to each other, and a transmission mechanism for transmitting a moving force of either the first cover element or the second cover element to the other element in the reverse direction, wherein the rail is provided with a slanted portion to make the first cover element slide by its own weight from the closing state to the opening direction to open the door by unlocking the first cover element and the second cover element.
12. The washing machine according to claim 1, further **characterized by** rail members supporting the first cover element and the second cover element slidably, a locking mechanism for keeping the opening in a covered state by locking the first cover element and the second cover element to be connected to each other, and a transmission mechanism for transmitting the moving force of either the first cover element or the second cover element to the other element in the reverse direction, wherein the rail comprises a steeply slanted portion (22) for the first cover element to make the first cover element slide with its own weight from the closing state to the opening direction to expose the opening, and a gently slanted rail portion (23) for the second cover element with a more gentle slant than that of the steep gradient element which supports the second cover element in the closed state.
13. The washing machine according to claim 1, further **characterized by** a transmission mechanism for transmitting a moving force of either the first cover element or the second cover to the other element in the reverse direction, and rail members supporting the first cover element and the second cover element slidably, wherein the rail comprises a steeply slanted portion descending from the rear to the front and a gently slanted portion with a slant more gentle than

that of the steep gradient element, the first cover element and the second cover element are formed with the front cover and the rear cover supported by the steep gradient element and the gentle gradient element when the opening is covered, and a moving control element (58) for controlling the rear cover to slide the door from the opening state to the closing state is provided in the rear cover.

14. The washing machine according to claim 1, further **characterized by** a locking mechanism for switch-over between a locking state joining the first cover element and second cover element continuously to keep the opening covered and a unlocking state to unlock the first cover element and the second cover element, an unlocking control element (47) switching the locking mechanism from locking state to unlocking state, a transmission mechanism transmitting a moving force of either the first cover element or the second cover element to the other element in the reverse direction, and a movement control element, provided in either the first cover element or the second cover element, for controlling the movement of either the first cover element and the second cover element, wherein the unlocking control element is constructed so that it can be controlled by movement of the element by the hand of a user, while the movement control element is hooked by another finger of the same hand.
15. The washing machine according to claim 1, further **characterized by** a locking mechanism for switch-over between a locking state to maintain the covered state of the opening by locking the first cover element and the second cover element in a connected state and a unlocking state to unlock the connection between the first cover element and the second cover element, a unlocking control element switching the locking mechanism from the locking state to the unlocking state, a transmission mechanism for transmitting a moving force of either the first cover element and the second cover element to the other element in the reverse direction, and a movement control element, provided in either the first cover element or the second cover element, controlling the movement of either the first cover element or the second cover element, wherein the first cover element comprises the front cover in the front and the second cover element comprises the rear cover having the movement control element, and the unlocking control element is provided so as to be controlled by the movement of the element by the hand of a user while the movement control element is hooked by another finger of the same hand.
16. The washing machine according to claim 1, further **characterized by** a first joint element (37) provided in the first cover element, and a second joint element

(43), provided in the second cover element, combining with the first joint element when the lid is closed, wherein the first joint element and the second joint element each have extensions with hook shape extending upwardly and downwardly respectively, and hook with each other.

17. The washing machine according to claim 1, further **characterized by** a first joint element provided in the first cover element, a second joint element, provided in the second cover element, engaging with the first element with the first cover element and closing the cover elements, a spring element (45) applying force to the second joint element toward the first joint element, and an unlocking control element (47) to unlock the first joint element and the second joint element by moving the second joint element against the force applied by the spring element, wherein the movement of the second joint element in a state engaged with the first joint element, is restricted due to contact with both the first joint element and the unlocking control element.
18. The washing machine according to claim 1, further **characterized by** a first supporting element (35), provided in the first cover element, for supporting a first joint element, a second supporting element (39), provided in the second cover element, for supporting a second joint element engaged with the first joint element when the first cover element and the second cover element are closed; ; a spring element, provided in the second supporting element, for applying force to the second joint element toward the first joint element; and a restraining element (62), provided in the first supporting element, for engaging with the second supporting element when the first joint element and the second joint element are engaged, wherein the restraining element restrains movement of the second joint element away from the first joint element, that is, the joint unlocking direction, due to displacement of the second supporting element by elastic force of the spring element.
19. The washing machine according to claim 1, further **characterized by** pulleys (51), and a string element (53) having ends laid around the pulleys, wherein the first cover element and the second cover element are connected to respective ends of the string element.
20. The washing machine according to claim 1, further **characterized by** pulleys, and a string element having ends laid around the pulleys, wherein the first cover element and the second cover element are connected to respective ends of the string element, and a movement control element to control movement of either the first cover element or the second cover element is provided in one of the first cover

element and the second cover element.

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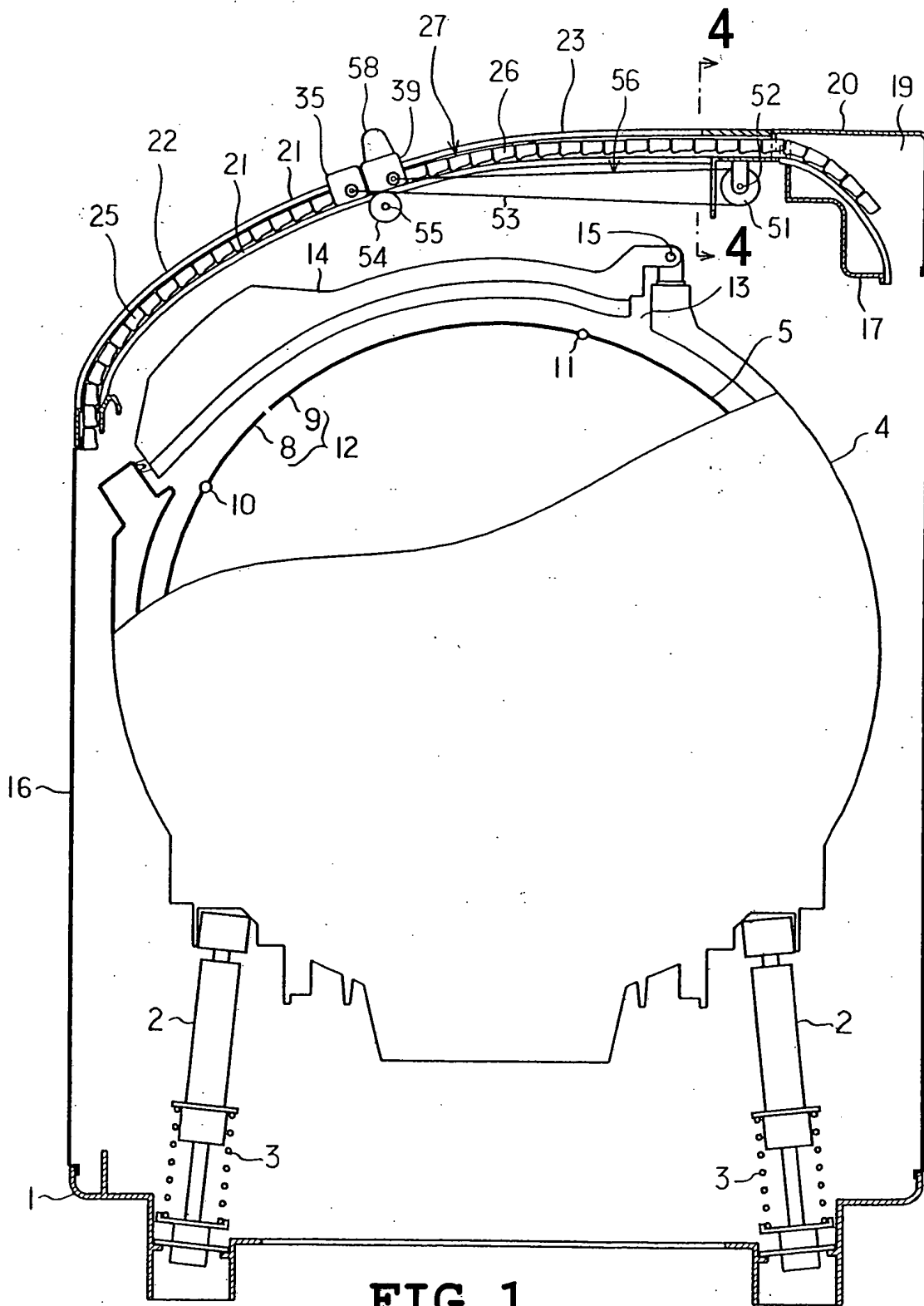


FIG. 1

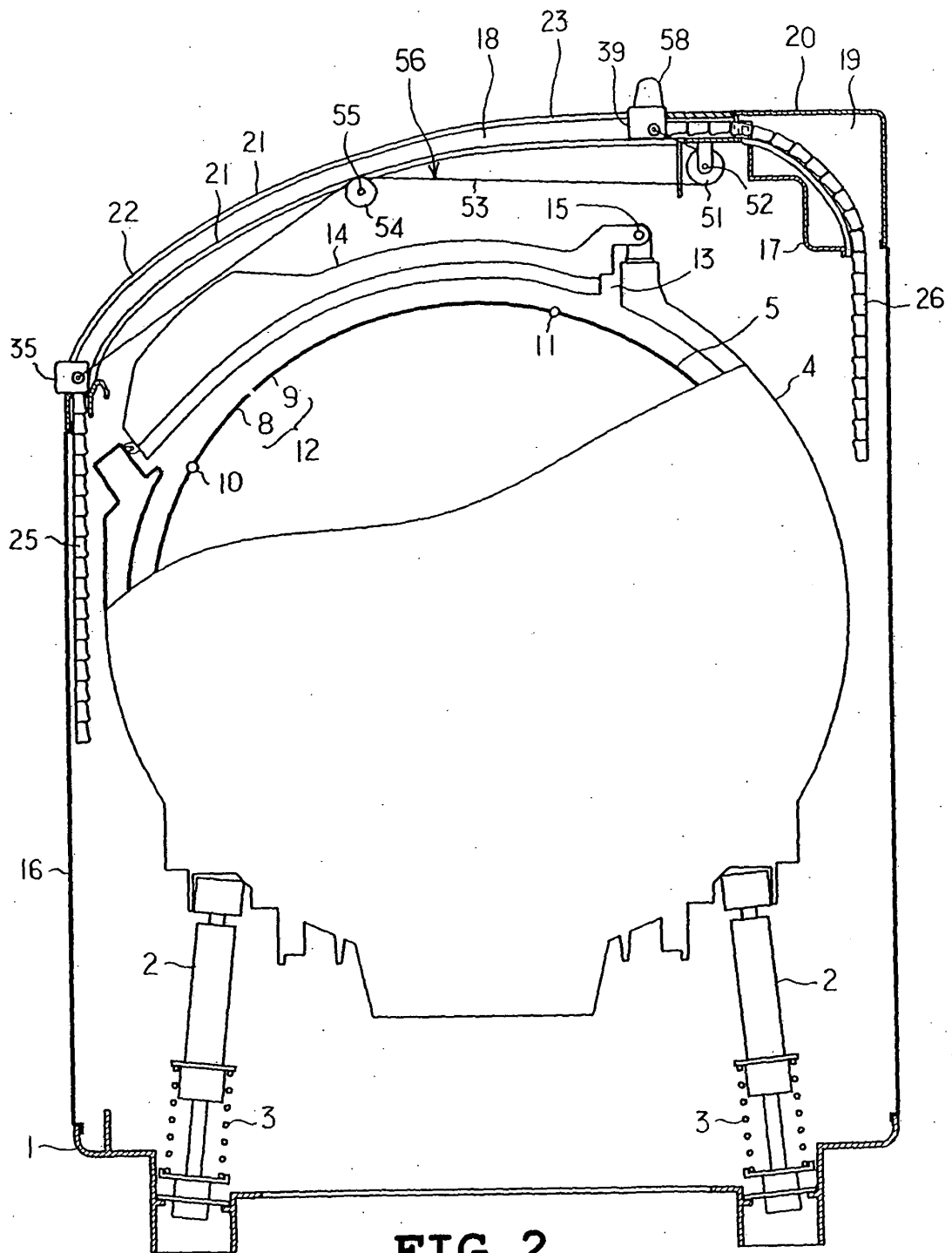


FIG. 2

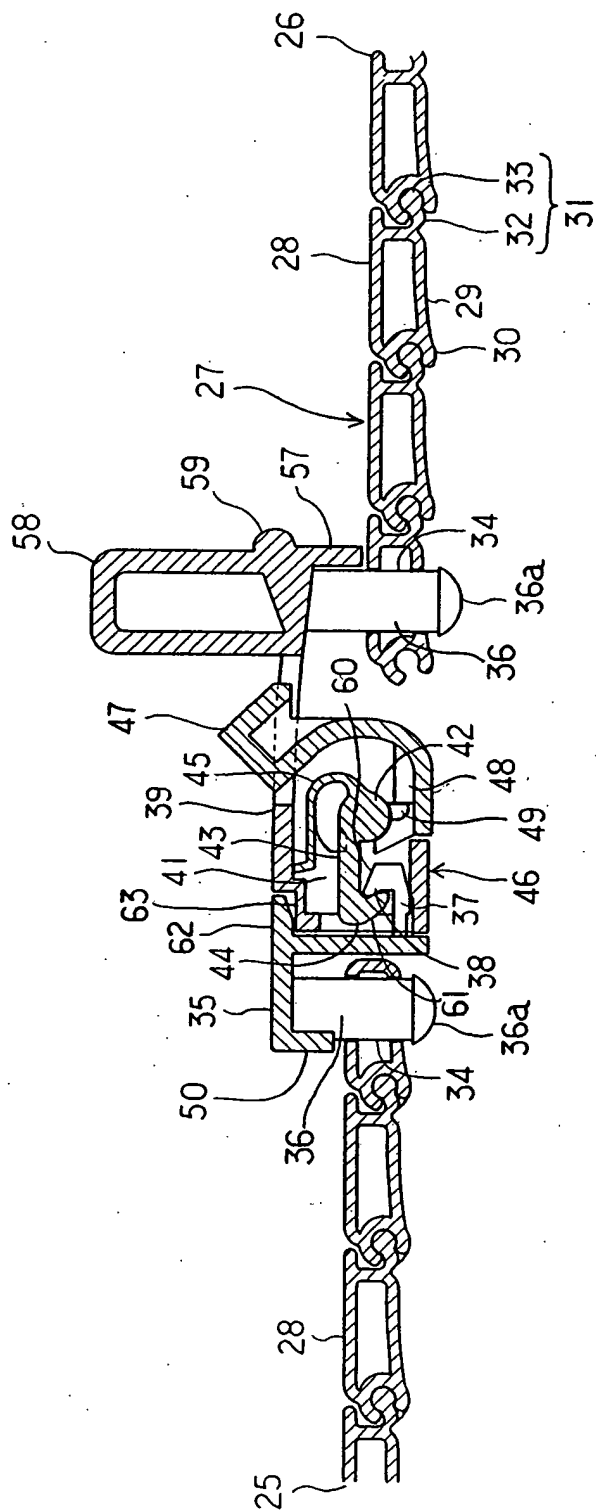


FIG. 3

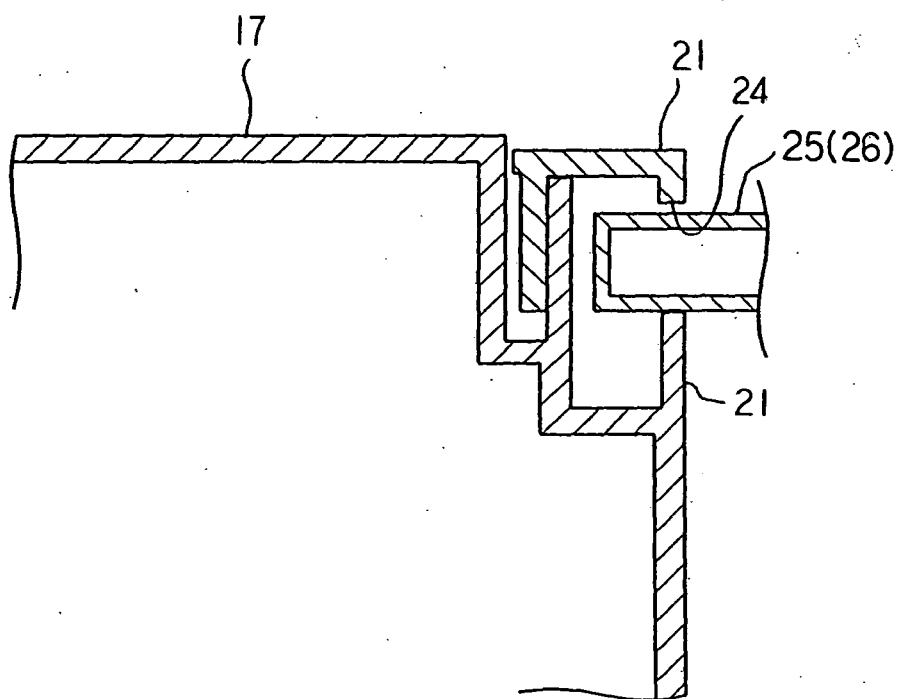


FIG. 4

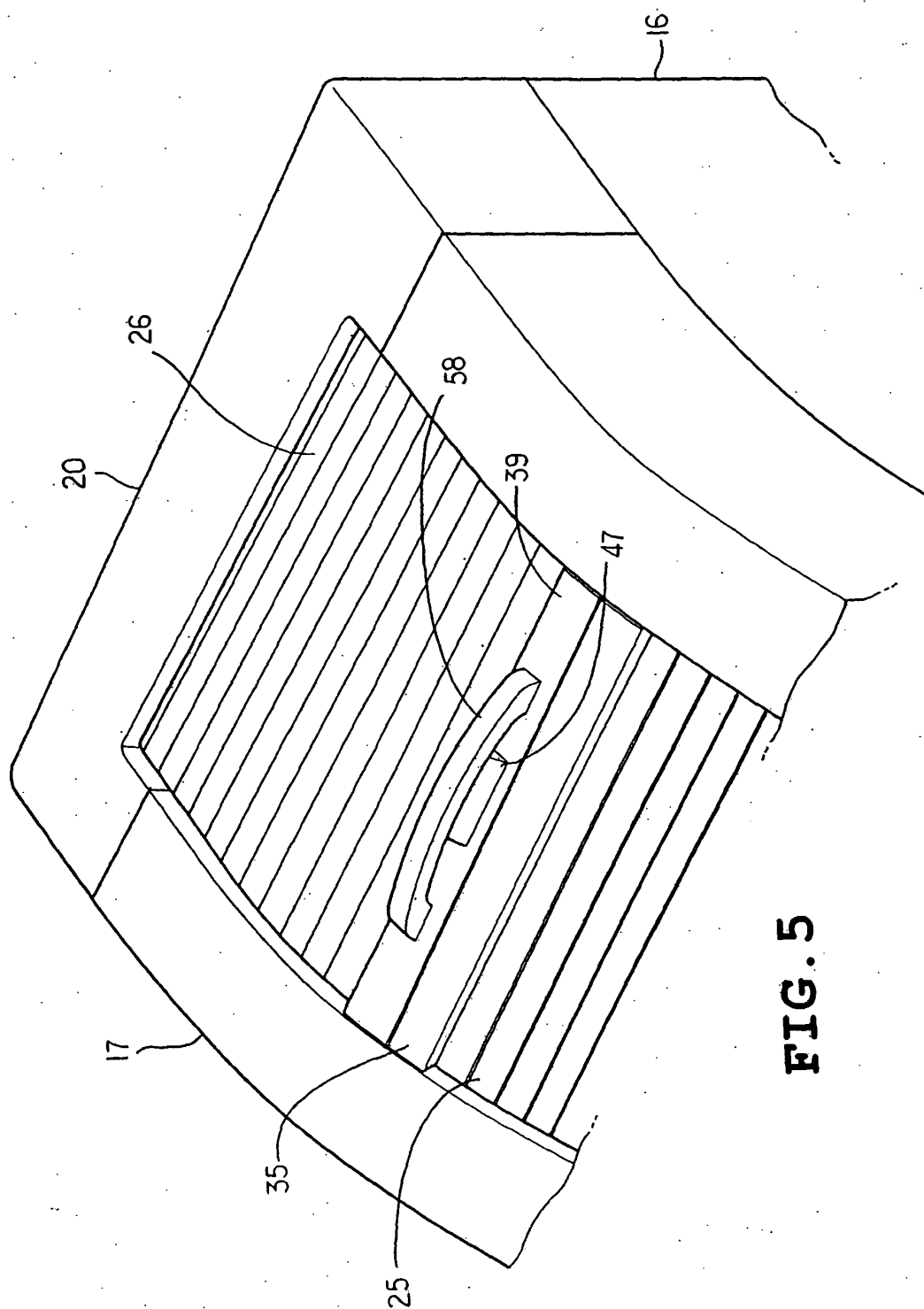
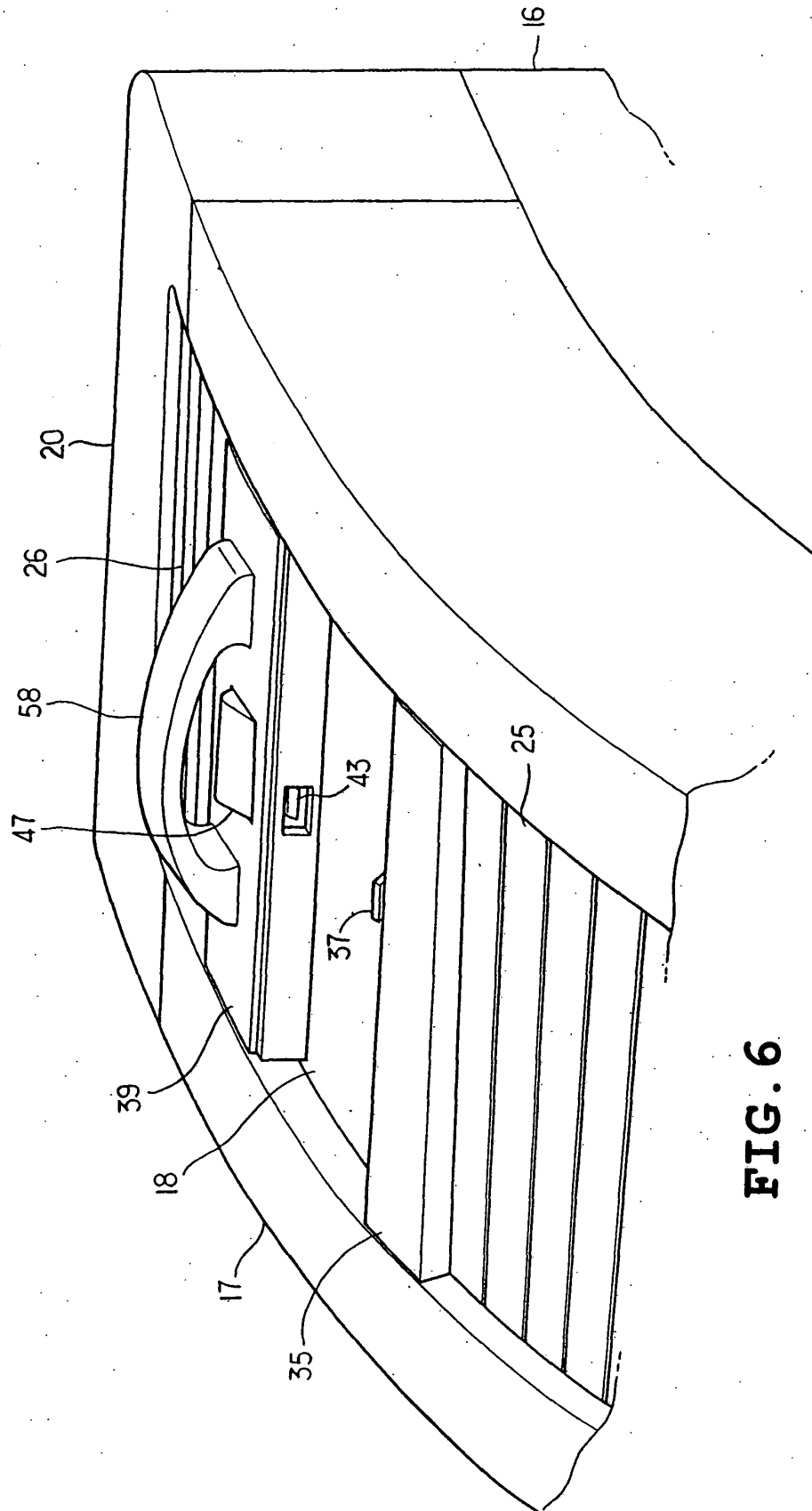


FIG. 5



9. GI

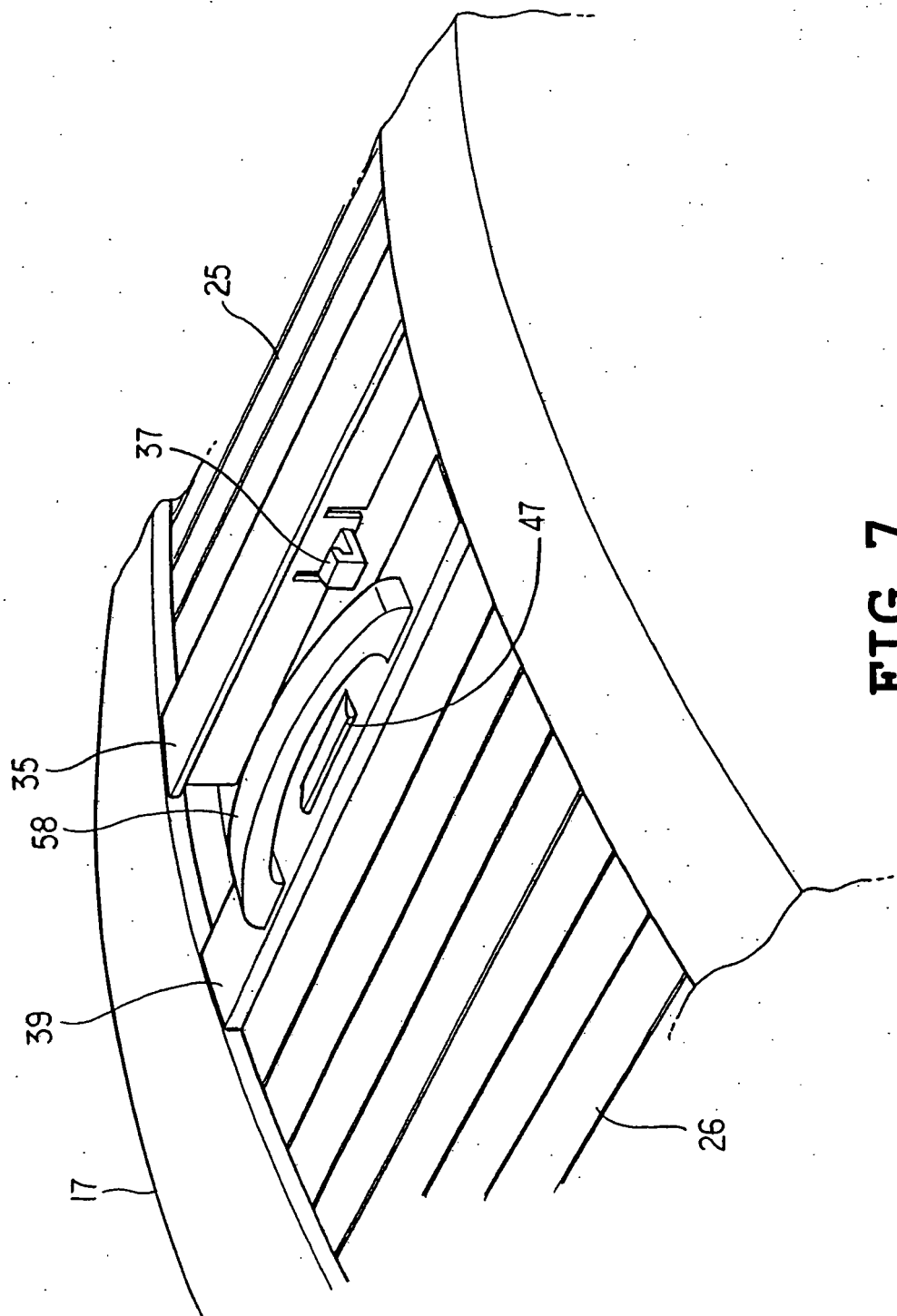


FIG. 7

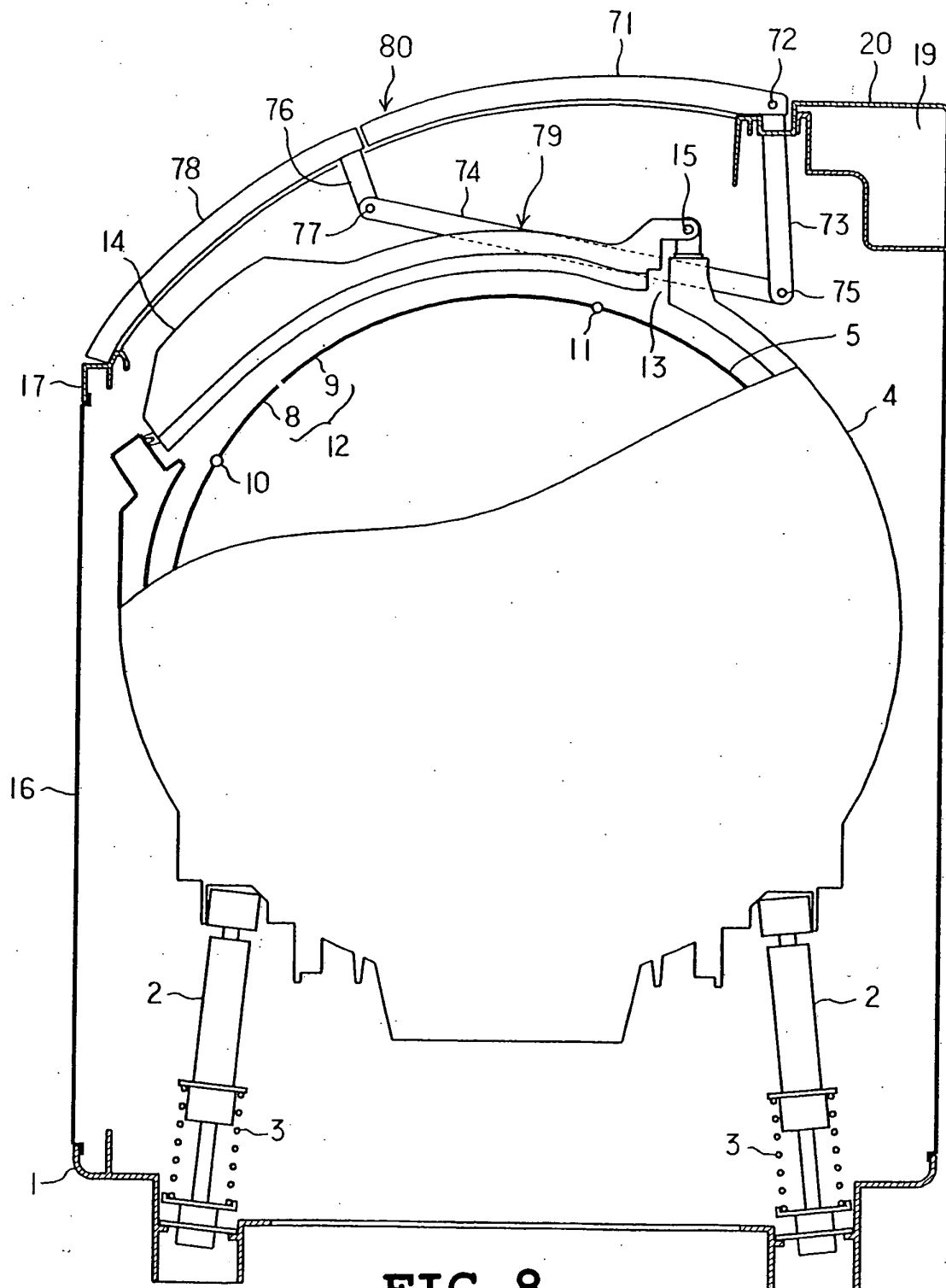


FIG. 8

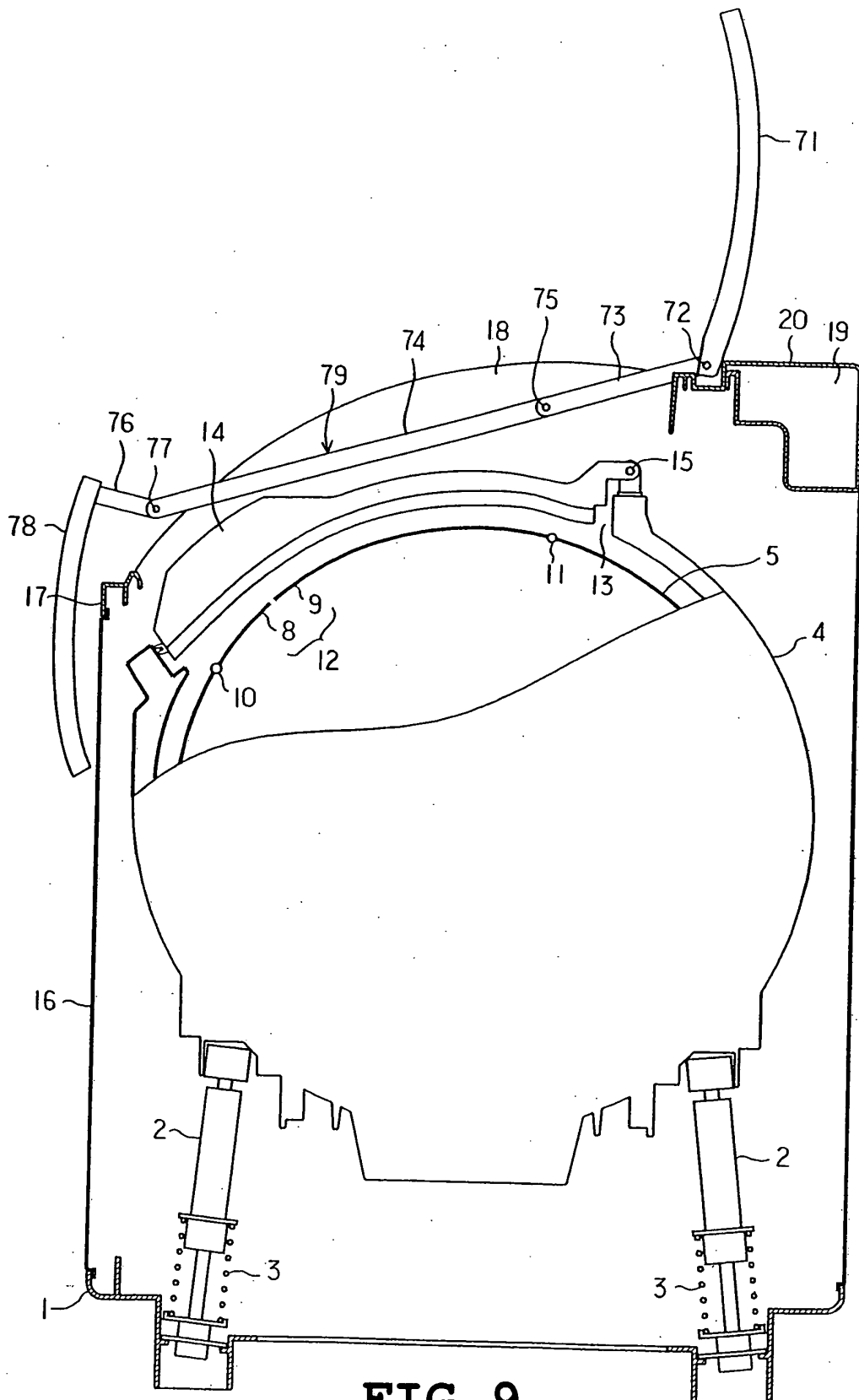


FIG. 9

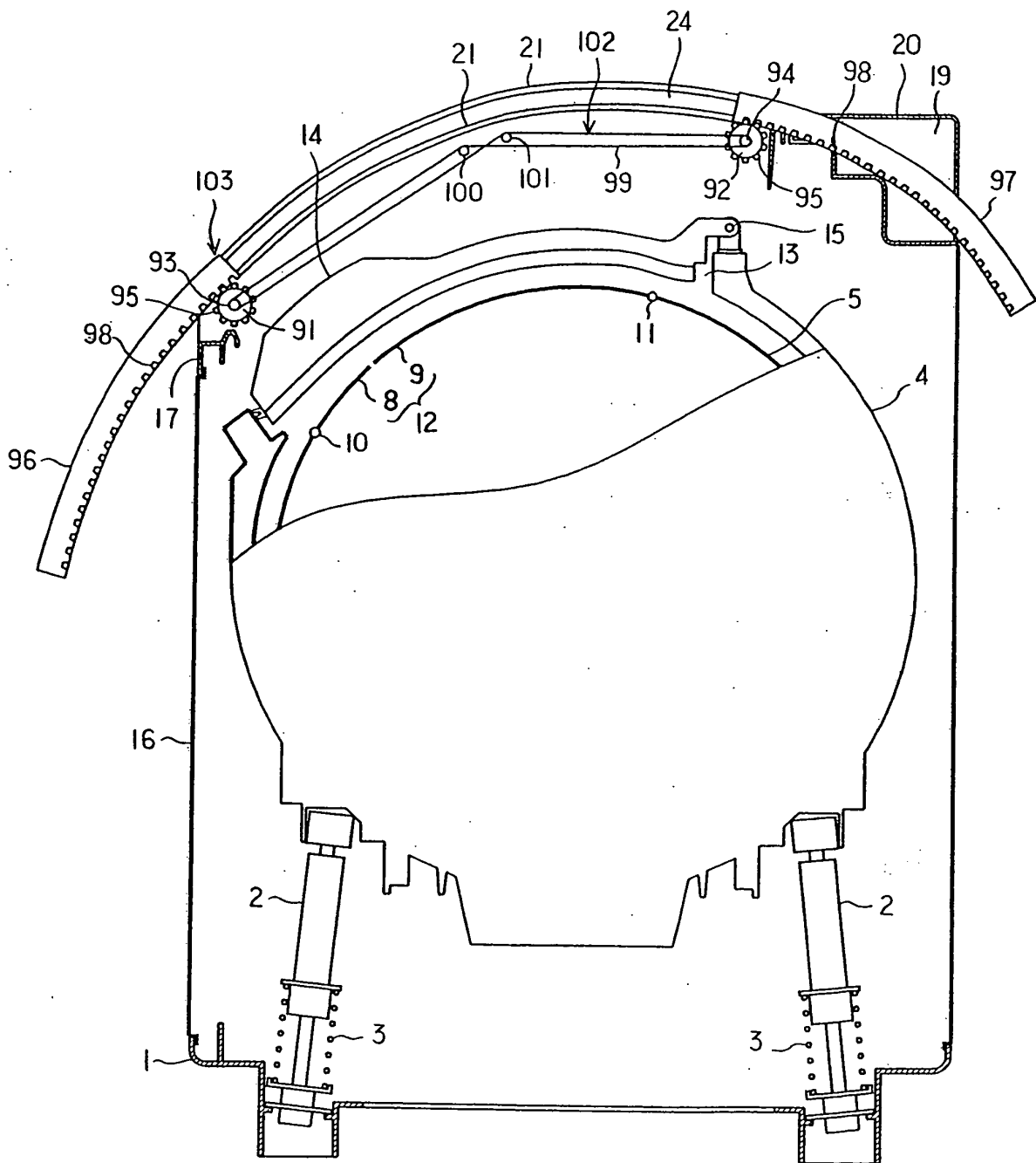


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/012844

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ D06F37/28, 39/14		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ D06F37/28, 39/14		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2004 Kokai Jitsuyo Shinan Koho 1971-2004 Jitsuyo Shinan Toroku Koho 1996-2004		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 6-335595 A (Toshiba Corp.), 06 December, 1994 (06.12.94), Full text; Figs. 1 to 8 (Family: none)	1-20
Y	JP 2-4233 Y (Daiwa Kabushiki Kaisha), 31 January, 1990 (31.01.90), Full text; Figs. 1 to 4 (Family: none)	1-20
Y	JP 2003-230795 A (Sanyo Electric Co., Ltd.), 19 August, 2003 (19.08.03), Full text; Figs. 1 to 17 & US 2003/0061841 A1	11-13
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 12 November, 2004 (12.11.04)		Date of mailing of the international search report 30 November, 2004 (30.11.04)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/012844

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2003-311072 A (Sanyo Electric Co., Ltd.), 05 November, 2003 (05.11.03), Full text; Figs. 1 to 8 (Family: none)	11-13

Form PCT/ISA/210 (continuation of second sheet) (January 2004)