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(54) **SUCTION OPENING BODY AND ELECTRIC CLEANER**

(57) A shaft part 51 is axially supported rotatably on the case body 21. A part of a traveling wheel part 52 is positioned around the shaft part 51. A coil spring 53 energizing the traveling wheel part 52 with respect to the shaft part 51 is interposed between the shaft part 51 and the traveling wheel part 52. When the traveling wheel part 52 collides with an obstacle, the traveling wheel part 52 moves with respect to the shaft part 51 and the case body 21 while energizing the traveling wheel part 52 by the coil spring 53 and absorbs an impact. Without lowering the traveling performance by, for example, making the traveling wheel part 52 softer and increasing the thickness thereof, the cushioning characteristics can be improved.

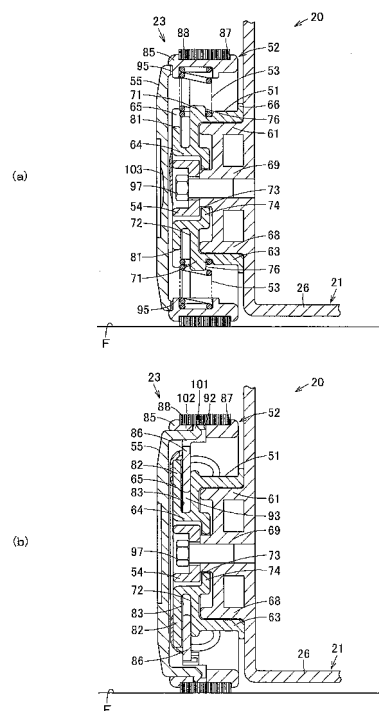


FIG. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to a suction port body including a rotating body unit attached to a case body and an electric vacuum cleaner with the same.

BACKGROUND ART

[0002] Conventionally, a so-called canister-type electric vacuum cleaner includes a cleaner main body housing an electric blower, and a tubular part whose base end side is connected to the cleaner main body. This tubular part includes a hose body, an extension tube, and a floor brush as a suction port body. This floor brush includes a horizontally long case body, and a connection tube communicatively connected turnably to a rear portion of a central region in the left-right width direction of the case body and connectable to the tip end of the extension tube. In a lower surface opposed to a floor surface as a surface to be cleaned of the case body, a horizontally long suction port is opened. To both side portions of the case body, large diameter traveling wheels as rotating body units are respectively attached rotatably to smoothly ride over a level difference caused by a sill or a carpet, etc., and improve traveling performance on the floor surface. These traveling wheels are configured by attaching wheel parts as flexible annular rotating body parts to the outer peripheral portions of comparatively hard traveling wheel main bodies. These traveling wheels are disposed so that their front end sides project more slightly forward than the front portion of the case body. An operator grips a grip part formed on the tip end portion of the hose body and performs cleaning by making the floor brush travel forward and backward on the floor surface via the extension tube (for example, refer to Patent Document 1).

CITATION LIST

Patent Literature

[0003] PTL 1: Japanese Laid-Open Patent Publication No. 11-178758 (page 4, Fig. 1)

SUMMARY OF INVENTION

Technical Problem

[0004] However, there are problems that when the above-described floor brush is made to travel toward an obstacle such as a wall, the front portions of the traveling wheels collide with the obstacle before the case body and are subjected to a large impact.

[0005] In this regard, it is possible to improve the cushioning characteristics by increasing the thicknesses of the wheel parts on the outer peripheries of the traveling wheels and forming the wheel parts to be softer, however,

with this configuration, there are problems that the wheel parts of the traveling wheels sink down due to the weight of the floor brush and may lower the traveling performance.

[0006] The present invention was made in view of the above problem, and an object of the present invention is to provide a suction port body improved in cushioning characteristics without lowering the traveling performance and an electric vacuum cleaner with the same.

Solution to Problem

[0007] According to the present invention, a rotating body unit includes a shaft part axially supported rotatably on the case body, a rotating body part at least a part of which is positioned around this shaft part, and an energizing means that is interposed between the shaft part and the rotating body part, and energizes the rotating body part with respect to the shaft part.

Advantageous Effects of Invention

[0008] According to the present invention, between the shaft part axially supported rotatably on the case body and the rotating body part at least a part of which is positioned around this shaft part, by interposing an energizing means that energizes the rotating body part with respect to the shaft part, when the rotating body part collides with an obstacle, the rotating body part moves with respect to the shaft part and the case body while being energized by the energizing means and absorbs an impact, so that without lowering the traveling performance by, for example, making the rotating body part softer, the cushioning characteristics can be improved.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

Figs. 1 show a rotating body unit of a suction port body according to a first embodiment of the present invention, Fig. 1 (a) is a sectional view at a position corresponding to line A-A in Fig. 6, and Fig. 1(b) is a sectional view at a position corresponding to line B-B in Fig. 6.

Fig. 2 is an exploded plan view showing a state of the same rotating body unit before assembling.

Fig. 3 is a plan view showing a state where a shaft part of the same rotating body unit is inserted into the rotating body part.

Fig. 4 is a plan view showing a state where the same shaft part is rotated with respect to the rotating body part.

Fig. 5 is a plan view showing a state where an energizing means is attached between the same shaft part and the rotating body part.

Fig. 6 is a perspective view showing the same rotating body unit.

Fig. 7 is a longitudinal sectional view showing the same suction port body.

Fig. 8 is a side view showing a movement of the same suction port body near an obstacle in order of (a) to (c).

Fig. 9 is a side view showing a movement when the same suction port body comes into contact with a traveling surface.

Fig. 10 is a plan view showing the same suction port body.

Fig. 11 is a perspective view showing an electric vacuum cleaner with the same suction port body.

Fig. 12 is a side view showing a rotating body unit according to a second embodiment of the present invention.

Fig. 13 is a side view showing a suction port body according to a third embodiment of the present invention.

Fig. 14 is a plan view showing the same suction port body.

Fig. 15 is a plan view showing a movement of an essential portion of the same suction port body near an obstacle.

Fig. 16 is a perspective view showing an electric vacuum cleaner with the same suction port body.

Figs. 17 show a rotating body unit of a suction port body according to a fourth embodiment of the present invention, Fig. 17(a) is a sectional view at a position corresponding to line C-C in Fig. 21, and Fig. 17(b) is a sectional view at a position corresponding to line D-D in Fig. 21.

Fig. 18 is an exploded plan view showing a state of the same rotating body unit before assembling.

Fig. 19 is a plan view showing a state where a shaft part of the same rotating body unit is inserted into a rotating body part and rotated.

Fig. 20 is a plan view showing a state where energizing means are attached between the same shaft part and the rotating body part.

Fig. 21 is a perspective view showing the same rotating body unit.

Fig. 22 is a side view showing a movement of the same suction port body near an obstacle in order of (a) to (c).

Fig. 23 is a front view showing a movement when the same suction port body comes into contact with a traveling surface.

Fig. 24 is a side view showing a movement when the same suction port body comes into contact with a traveling surface.

Fig. 25 is a plan view showing the same suction port body.

Fig. 26 is a side view showing a rotating body unit according to a fifth embodiment of the present invention.

Best Mode for Carrying Out the Invention

[0010] Hereinafter, a configuration of the first embodiment of the present invention will be described with reference to Fig. 1 to Fig. 11.

[0011] In Fig. 11, the reference numeral 11 denotes an electric vacuum cleaner, and this electric vacuum cleaner 11 traps dust suctioned together with suction air generated by driving of an electric blower 13 housed inside a cleaner main body 12 into a dust collecting part not shown.

[0012] Further, in the cleaner main body 12, a main body control circuit not shown as a main body control means for controlling operation of the electric blower 13 is housed, and a main body suction port 14 that suctions air from the outside is opened in the front portion. To this main body suction port 14, a narrow and long substantially cylindrical hose body 15 that has flexibility and is bendable is communicatively connected. On the tip end of this hose body 15, a hand operation part 16 on which an operation mode, etc., of the electric blower 13 can be selected is provided. On this hand operation part 16, a grip part 17 to be gripped by an operator when cleaning is provided to project toward the base end side, and on this grip part 17, a plurality of set buttons 18 for setting the electric blower 13, etc., inside the cleaner main body 12 to a plurality of operation modes by transmitting predetermined signals to the main body control circuit are provided.

[0013] Further, to the tip end of the hand operation part 16, an extensible narrow and long substantially cylindrical extension tube 19 is communicatively connected in a removable manner. Specifically, the extension tube 19 is communicatively connected to the suction side of the electric blower 13 via the hose body 15. To the tip end of this extension tube 19, a floor brush 20 as a suction port body that is placed on, for example, a carpet, etc., as a floor surface F (Fig. 8) that is a traveling surface as a surface to be cleaned in a room and suctions dust on the carpet is communicatively connected in a removable manner. Therefore, the floor brush 20 is communicatively connected to the suction side of the electric blower 13 via the extension tube 19, the hose body 15, and the main body suction port 14. In addition, the electric blower 13 and the main body control circuit, etc., are each configured to be supplied with electric power from a commercial AC power supply, or a secondary battery, etc.

[0014] The floor brush 20 includes, as shown in Fig. 7 to Fig. 11, a horizontally long case body 21 as a suction port body main body, a connection tube 22 connected turnably to the rear portion of the case body 21, traveling wheels 23 as rotating body units disposed on both side portions of the case body 21, and a front cover 25 disposed on the front portion of the case body 21.

[0015] The case body 21 includes a lower case 26 whose upper side is opened, a middle case 27 attached onto the lower case 26, an upper case 28 that covers the lower case 26 and the rear side of the upper portion of

the middle case 27, and sandwiches the connection tube 22 rotatably between the lower case 26 and the middle case 27, a front case 29 attached to the front side of the upper case 28, and a bumper 30 as a buffering member sandwiched between the lower case 26, the upper case 28 and the front case 29. Further, to this case body 21, a drive source that is an electromotive part as a drive means not shown, that is, a motor, and a rotary brush 32 as a rotary cleaning body to be rotated by this motor is attached.

[0016] In the lower case 26, a suction port 35 having a horizontally long quadrilateral shape into which the rotary brush 32 is fitted is notched at the front end portion.

[0017] The middle case 27 is disposed on the rear portion of the lower case 26, and fixed integrally onto the lower case 26.

[0018] In the front case 29, a front side suction port 36 having a horizontally long quadrilateral shape is notched at the front end portion. This front side suction port 36 is formed continuously to the suction port 35, and the front cover 25 is fitted therein.

[0019] The bumper 30 is made of an elastic material, for example, elastomer or rubber, etc., and disposed continuously from both sides of the case body 21 to the rear portion.

[0020] The motor can rotate forward and reverse, and driving thereof is controlled by a control circuit not shown.

[0021] To the surrounding of a substantially columnar rotary brush assembly 37 as an attaching member of the rotary brush 32, a plurality of cleaning members 38 (Fig. 8) are attached.

[0022] Here, the rotary brush assembly 37 is made of, for example, metal or synthetic resin, etc. On the outer peripheral surface of this rotary brush assembly 37, a groove portion not shown for holding the base end side of each cleaning member 38 is formed spirally.

[0023] The cleaning members 38 are, for example, blades as wiping-up members, brush bristles as scraping members, or combinations of these, etc., and by holding the base end sides in the groove portions of the rotary brush assembly 37, the cleaning members assume a spiral wall shape along the axial direction of the rotary brush assembly 37 with respect to the outer peripheral surface of the rotary brush assembly 37, and project at the tip end sides in radial directions of the rotary brush assembly 37.

[0024] The connection tube 22 communicates with the suction port 35, and an end portion thereof projecting rearward from the case body 21 is communicatively connected to the tip end side of the extension tube 19 in a removable manner. This connection tube 22 is connected turnably in the up-down direction to a position close to the rear portion of the case body 21.

[0025] Each traveling wheel 23 includes, as shown in Fig. 1 to Fig. 6, a shaft part 51 as a substantially cylindrical rotating body unit turning shaft, a traveling wheel part 52 as a rotating body part that comes into contact with a floor surface F, coil springs 53 as a plurality of, for exam-

ple, four energizing means interposed between the shaft part 51 and the traveling wheel part 52, a stopper body 54 for preventing the shaft part 51 from coming off the case body 21, and a transparent cover 55 covering the opposite side of the case body 21 side, that is, the outer side portion. In addition, the traveling wheels 23 are symmetrical to each other in the left-right width direction of the floor brush 20, so that only one traveling wheel 23 is described, and description of the other traveling wheel 23 is omitted.

[0026] The shaft part 51 is a portion to be axially supported rotatably on a bearing part 61 formed on the side portion of the case body 21, and is made of, for example, synthetic resin, etc. This shaft part 51 includes integrally a cylindrical shaft part main body 63, a restricting part 65 continued to one end side of the shaft part main body 63 via a cylindrical part 64, and a flange part 66 that projects in a flange form from the entire outer periphery of the other end side of the shaft part main body 63 and fits along the side portion of the case body 21.

[0027] Here, the bearing part 61 includes integrally a substantially cylindrical bearing part main body 68 and a screw boss portion 69 formed coaxially on the central side of the bearing part main body 68, and projects laterally along the horizontal direction from the case body 21. The bearing part 61 is substantially coaxial with the rotary brush 32, and is formed at a position more forward than the turning shaft 22a of the connection tube 22 as shown in Fig. 7. As a result, the center position of the traveling wheel 23 is positioned to be more forward than the center position of the turning shaft 22a of the connection tube 22.

[0028] As shown in Fig. 1 to Fig. 6, the shaft part main body 63 is axially supported rotatably by fitting the inner peripheral side to the bearing part main body 68, and has latching projecting portions 71 formed on the outer periphery for latching coil springs 53, a tip end face portion 72 as a shaft part main body surface portion formed on the tip end side and extending toward the central axis side, an insertion hole 73 through which a screw boss portion 69 is inserted at the center position of the tip end face portion 72, and a stopper surface portion 74 formed on the inner edge portion of the insertion hole 73 and extending toward the central axis side.

[0029] The latching projecting portions 71 are shaped into semicircular columns whose front sides are substantially flush with the tip end face portion 72, and are disposed at substantially even intervals separated in the circumferential direction. Around the base end portion of each latching projecting portion 71, a groove-shaped recess 76 for retaining one end portion of the coil spring 53 is formed.

[0030] The cylindrical part 64 has a base end portion formed integrally around the insertion hole 73 of the tip end face portion 72 of the shaft part main body 63, and is coaxial with the insertion hole 73. This cylindrical part 64 has a diameter smaller than that of the shaft part main body 63.

[0031] Further, the restricting part 65 includes integrally an annular restricting part main body 81 projecting radially in a flange form from the entire outer peripheral surface of the tip end of the cylindrical part 64, and a plurality of shaft part restricting portions 82 projecting from this restricting part main body 81. Therefore, on the outer peripheral side of the cylindrical part 64 between the restricting part 65 and the front surface of the tip end face portion 72 of the shaft part main body 63, an annular fitting portion 83 is formed like a groove.

[0032] A plurality of the shaft part restricting portions 82 are formed corresponding to, for example, the coil springs 53, and are at substantially even intervals to each other in the circumferential direction.

[0033] The flange part 66 covers the case body 21 side of the traveling wheel 23.

[0034] The traveling wheel part 52 is supported by each coil spring 53 with respect to the shaft part 51 movably in a direction crossing (orthogonal to) the axial direction of the shaft part 51, in the present embodiment, movably forward, backward, upward, and downward, and substantially fixed so as not to turn in the circumferential direction with respect to the shaft part 51. This traveling wheel part 52 includes integrally a traveling wheel part main body 85 as a cylindrical rotating body part main body, traveling wheel part restricting portions 86 as a plurality of rotating body part restricting portions formed from the inner peripheral edge portion toward the central axis direction of the traveling wheel part main body 85 corresponding to, for example, the coil springs 53, and a ground contact portion 88 attached to an attaching recess 87 formed across the entire circumference of the outer peripheral surface of the traveling wheel part main body 85.

[0035] The traveling wheel part main body 85 is formed to have a diameter larger than that of the shaft part 51.

[0036] The traveling wheel part restricting portions 86 are portions that restrict the positions in the axial direction of the shaft part 51 and the traveling wheel part 52 by coming into sliding contact with the respective shaft part restricting portions 82 by fitting the fitting portion 83 of the shaft part 51, and are formed on the inner edge portion on an end portion on one end side in the axial direction distant from the case body 21 of the traveling wheel part main body 85. These traveling wheel part restricting portions 86 are formed into substantially trapezoid shapes whose widths become gradually smaller toward the central axis direction of the traveling wheel part main body 85, and are disposed at substantially even intervals separated in the circumferential direction. Therefore, between the traveling wheel part restricting portions 86, hole portions 91 (Fig. 2) into which coil springs 53 are attached, respectively, are formed at substantially even intervals in the circumferential direction. Further, on the base end portions of these traveling wheel part restricting portions 86, attaching holes 92 for attaching a cover 55 are formed in arc shapes along the inner edge portion of the traveling wheel part main body 85. Between the tip

end portions of these traveling wheel part restricting portions 86, an insertion hole portion 93 through which the restricting part main body 81 of the restricting part 65 of the shaft part 51 can be inserted and the shaft part main body 63 cannot be inserted is formed.

[0037] Each hole portion 91 is formed to have a width larger than that of each shaft part restricting portion 82 of the shaft part 51. On each hole portion 91, a cylindrical holding portion 95 for holding the other end side of the coil spring 53 is formed to project toward the central axis direction from the inner edge portion of the traveling wheel part main body 85.

[0038] The ground contact portion 88 is a portion that comes into contact with a floor surface F in a state where the floor brush 20 is placed on the floor surface F as shown in Fig. 8. Further, this ground contact portion 88 is, for example, raised fabric, etc., and is formed across the entire circumference of the traveling wheel part main body 85. In the state where the traveling wheel 23 is axially supported on the bearing part 61 of the case body 21, the front portion of this ground contact portion 88 is positioned to be more forward than the front portion of the case body 21 and more rearward than the front end portion of the front cover 25, and the lower portion of the ground contact portion 88 is positioned lower than the lower surface of the case body 21.

[0039] As shown in Fig. 5 and Fig. 6, the coil springs 53 are disposed radially along the radial directions of the traveling wheel 23 so that one end portions of the coil springs 53 are held in the recesses 76 (Fig. 1), and the other end portions are held by the holding portions 95, respectively. These coil springs 53 are substantially equal in elastic coefficient to each other and support the traveling wheel part 52 so that the traveling wheel part 52 becomes substantially coaxial with the shaft part 51 in a state that no external force is applied. In addition, other than the coil springs 53, arbitrary energizing means made of an elastic material (flexible material), for example, rubber, leaf springs, or elastomer, etc., may be provided between the recesses 76 and the holding portions 95, or tension springs, etc., that energize the traveling wheel part 52 inward with respect to the shaft part 51 along the radial directions may be provided.

[0040] As shown in Fig. 1, the stopper body 54 is formed into a substantially cylindrical shape, and is fitted into the shaft part main body 63. The stopper body 54 is formed to be larger in diameter than the screw boss portion 69 of the bearing part 61, and fixed to the screw boss portion 69 via a screw 97 as a fixing means. As a result, the stopper surface portion 74 of the shaft part 51 is positioned between the bearing part 61 and the stopper body 54 to prevent the shaft part 51 from coming off the bearing part 61.

[0041] The cover 55 is formed into a substantially disk shape covering one side of the traveling wheel part main body 85. On the peripheral edge portion of the cover 55, a plurality of claws 101 are disposed at substantially even intervals in the circumferential direction. These claws 101

are inserted into the attaching holes 92 of the traveling wheel part 52 and latched on the latching projecting portions 102 formed on one sides in the circumferential direction of these attaching holes 92, and accordingly, the cover 55 is fixed so as not to come off the traveling wheel part 52. Further, at the central portion of the cover 55, a turning groove portion 103 having a longitudinal groove shape along the radial direction is formed. This turning groove portion 103 is for turning the cover 55 in the circumferential direction by inserting a coin, etc., therein when the cover 55 is removed from the traveling wheel part 52.

[0042] The front cover 25 is formed to be horizontally long continuously between the ends of the front side suction port 36, and is curved in an arc shape so as to project forward in a sectional view. Further, the upper end portion of this front cover 25 is axially supported turnably on the upper end portion of the front side suction port 36, and energized so as to turn forward by a front cover energizing means not shown such as a torsion spring. At the position close to the lower end of the front cover 25, projections 25a and 25a are formed to project forward, and these projections 25a and 25a project more forward than the front ends of the traveling wheels 23 in a natural state (normal state). In addition, these projections 25a and 25a are not essential components, and alternatively, it is also possible that a part of the front cover 25 itself projects more forward than the front ends of the traveling wheels 23.

[0043] Next, operation and effect of the first embodiment described above will be described.

[0044] First, a method for assembling each traveling wheel 23 will be described.

[0045] From the state shown in Fig. 2, as shown in Fig. 3, the shaft part 51 is inserted into the traveling wheel part 52 from the other end side. In detail, in a state where the shaft part restricting portions 82 are fitted in the hole portions 91, respectively, the restricting part main body 81 is inserted into the insertion hole portion 93 from the other end side.

[0046] Then, as shown in Fig. 4, the shaft part restricting portions 82 are positioned closer to one end side than the traveling wheel part restricting portions 86, the shaft part 51 is turned a predetermined angle, in the present embodiment, approximately 90 degrees in the circumferential direction (for example, clockwise direction) relative to the traveling wheel part 52, and accordingly, the shaft part restricting portions 82 come into sliding contact with the end faces of the traveling wheel part restricting portions 86, and as shown in Fig. 1(b), the traveling wheel part restricting portions 86 fit the fitting portion 83.

[0047] In this state, the latching projecting portions 71 of the shaft part 51 are opposed to the holding portions 95 of the traveling wheel part 52, so that the center position of the shaft part 51 is made slightly eccentric with the center position of the traveling wheel part 52, one latching projecting portion 71 is inserted in one end portion of one coil spring 53, and in the state where one end

portion of this coil spring 53 is held in one recess 76, the other end portion of this coil spring 53 is fitted and held on one holding portion 95.

[0048] Similarly, the latching projecting portions 71 are inserted in one end portions of the other three coil springs 53, respectively, and in the state where the one end portions of the coil springs 53 are held in the recesses 76, as shown in Fig. 5, the other end portions of the coil springs 53 are fitted and held on the holding portions 95. In this state, the coil springs 53 fit in the hole portions 91 and are exposed in the axial direction of the traveling wheel 23.

[0049] Thereafter, as shown in Fig. 1(a) and Fig. 1(b), the shaft part main body 63 of each shaft part 51 is fitted to each bearing part 61 on each side portion of the case body 21 assembled separately, and the screw boss portion 69 is inserted through the insertion hole 73, and the stopper body 54 is fitted into the shaft part main body 63 and the screw 97 is screwed to the screw boss portion 69, and accordingly, each shaft part 51 is axially supported rotatably on the bearing part 61 of the case body 21.

[0050] Then, the claws 101 of the cover 55 are inserted into the attaching holes 92 of the traveling wheel part 52 from one end side, and the cover 55 is turned a predetermined angle in the circumferential direction, and accordingly, the claws 101 are latched on the latching projecting portions 102 of the attaching holes 92, respectively, and the cover 55 is fixed to the traveling wheel part 52.

[0051] When cleaning, as shown in Fig. 11, the connection tube 22 is connected to the tip end portion of the extension tube 19, the floor brush 20 is placed on the floor surface F (Fig. 8), the grip part 17 is gripped, and a state where the electric blower 13 is operated in a desired operation mode by operating a desired set button 18, the floor brush 20 is made to travel forward and backward via the extension tube 19.

[0052] As shown in Fig. 8, when the floor brush 20 travels, the ground contact portions 88 of the traveling wheels 23 come into contact with the floor surface F and rotate, and accordingly, excellent traveling performance is obtained.

[0053] Then, the floor brush 20 suctions dust on the floor surface F (Fig. 8) together with air via the suction port 35 by a negative pressure applied according to operation of the electric blower 13 shown in Fig. 11 to clean the floor surface. This suctioned air becomes suctioning wind, and is suctioned together with dust into a dust collecting part via the extension tube 19, the hose body 15, and the main body suction port 14 shown in Fig. 11, and after the dust is trapped in the dust collecting part, the suctioning wind is suctioned into the electric blower 13 and becomes exhaust wind, and exhausted from an exhaust port not shown of the cleaner main body 12.

[0054] Further, as shown in Fig. 8(a), when the floor brush 20 is made to travel forward and this floor brush 20 collides with an obstacle O such as a wall or furniture, first, the projections 25a of the front cover 25 come into

contact with the obstacle O and the front cover 25 turns rearward against the energization of the front cover energizing means, and then, as shown in Fig. 8(b), the front portions of the traveling wheels 23 come into contact with the obstacle O.

[0055] In this state, when the floor brush 20 further travels forward, as shown in Fig. 8(c), the traveling wheel parts 52 of the traveling wheels 23 are fixed at the position of the obstacle O, and accordingly, the shaft parts 51 and the case body 21 move to the lower front side relative to the traveling wheel parts 52 against the energization of the coil springs 53. Therefore, the impact of the collision is absorbed by expansion and contraction of the coil springs 53. At the same time, from the lower portion of the front side suction port 36 (Fig. 8(b)) opened according to rearward turning of the front cover 25, parts of the tip end sides of the cleaning members 38 of the rotary brush 32 protrude forward and are positioned near the obstacle O, and parts on the tip end sides of the cleaning members 38 protrude downward relative to the traveling wheels 23 and come into contact with the floor surface F. Then, by rotating the rotary brush 32 by an operation on a predetermined set button 18 (Fig. 11), the rotary brush 32 scrapes dust off the floor surface F near the obstacle O and suctions the dust from the front side suction port 36 (Fig. 8(b)) to clean the floor surface.

[0056] When the floor brush 20 separates from the obstacle O, the coil springs 53 assist the floor brush 20 to separate from the obstacle O by pushing the floor brush 20 in a direction in which the floor brush 20 separates from the obstacle O, so that the traveling operation of the floor brush 20 becomes easy, and the burden on the hand of an operator who performs the traveling operation can be reduced.

[0057] As described above, according to the first embodiment described above, between the shaft part 51 axially supported rotatably on the case body 21 and the traveling wheel part 52 a part of which is positioned around the shaft part 51, coil springs 53 that energize the traveling wheel part 52 with respect to the shaft part 51 are interposed, and accordingly, when the traveling wheel part 52 collides with an obstacle O, the traveling wheel part 52 moves with respect to the shaft part 51 and the case body 21 while being energized by the coil springs 53 and absorbs the impact, so that without lowering the traveling performance by, for example, further making the traveling wheel part 52 softer and increasing the thickness thereof, the cushioning characteristics can be improved.

[0058] Specifically, in a case such as where sufficient cushioning characteristics are obtained by making the traveling wheel part 52 of an elastic material, etc., and increasing the thickness thereof, when the traveling wheel part 52 comes into contact with the floor surface F, the traveling wheel part 52 is distorted by the own weight of the floor brush 20, and the ground contact area (grip force) to come into contact with the floor surface F increases and may lower the traveling performance, and

on the other hand, in the first embodiment described above, a larger cushioning stroke can be obtained by coil springs 53 without increasing the thickness of the traveling wheel part 52, so that when traveling, the traveling wheel part 52 is not distorted and the grip force does not increase, so that excellent traveling performance is obtained.

[0059] By disposing a plurality of coil springs 53 at substantially even intervals in the circumferential direction of the traveling wheel 23, the traveling wheel part 52 can be uniformly energized and supported with respect to the shaft part 51, and regardless of the rotating position of the traveling wheel 23, cushioning characteristics can be reliably obtained.

[0060] Further, the floor brush 20 includes the connection tube 22 turnable in the up-down direction, so that when an operator places the floor brush 20 on the floor surface F while gripping the grip part 17 of the hand operation part 16, the front side of the case body 21 turns downward due to the own weight of the case body 21 with respect to the connection tube 22 fixed to the hand operation part 16 side via the extension tube 19 (shown by the solid lines in Fig. 9), and tries to come into contact with the floor surface F from the front side of the case body 21. Therefore, by positioning the center position of the traveling wheel 23, that is, the position of the shaft part 51 of the traveling wheel 23 axially supported on the bearing part 61 of the case body 21 more forward than the center position of the turning shaft 22a of the connection tube 22, when the floor brush 20 is placed on the floor surface F as shown by the solid lines in Fig. 9, the traveling wheel 23 comes into contact with the floor surface F before the case body 21, so that the impact when the floor brush 20 is placed on the floor surface F can be cushioned by the traveling wheel 23.

[0061] Further, by disposing traveling wheels 23 on both side portions of the case body 21, respectively, as compared with the case, for example, such as where the traveling wheel 23 is disposed only at one point of the central portion of the case body 21, the traveling performance can be further improved, and when the front side of the floor brush 20 collides with an obstacle O, at least either of the traveling wheels 23 can be reliably brought into contact with the obstacle O regardless of the angle between the floor brush 20 and the obstacle O, so that the cushioning characteristics can be secured. In addition, when cleaning the vicinity of the obstacle O, an operator presses the floor brush 20 against the obstacle O, and due to this pressing, the shaft parts 51 of the traveling wheels 23 and 23 (bearing parts 61 of the case body 21) relatively move to the lower front side against the energization of the coil springs 53 with respect to the traveling wheel part 52 and 52 and the case body 21 sinks down and approaches the floor surface F in the vicinity of the obstacle O, so that suctioning of dust from the suction port 35 and the front side suction port 36 and scraping off of dust from the floor surface F by the rotary brush 32 are respectively improved, so that the vicinity of the ob-

stacle O can be efficiently cleaned.

[0062] Further, by positioning the traveling wheel 23 substantially coaxially with the rotary brush 32, vibrations caused by rotational driving of the rotary brush 32 are absorbed by the coil springs 53 of the traveling wheel 23 and hardly transmitted to the floor surface F, etc.

[0063] By projecting a part of the traveling wheel 23 more forward than the case body 21, when making the floor brush 20 travel forward and backward when cleaning, the traveling wheel 23 comes into contact with the obstacle O before the case body 21, so that the impact when the front side of the floor brush 20 collides with the obstacle O can be cushioned by the traveling wheel 23.

[0064] By using the coil springs 53 as energizing means, the traveling wheel part 52 can be easily uniformly supported with respect to the shaft part 51, and degradation of the coil springs 53 themselves is reduced, and a large cushioning stroke can be secured, so that sufficient cushioning characteristics are obtained.

[0065] Further, by mutually restricting the positions in the axial direction of the shaft part 51 and the traveling wheel part 52, when the traveling wheel 23 collides with the obstacle O or the floor surface F and the coil springs 53 bend, the shaft part 51 and the traveling wheel part 52 can be prevented from being displaced in the axial direction and the coil springs 53 can be prevented from coming off.

[0066] A plurality of shaft part restricting portions 82 projecting outward are formed on the shaft part 51, and on the traveling wheel part 52, a plurality of hole portions 91 through which the shaft part restricting portions 82 can be inserted, and traveling wheel part restricting portions 86 that are positioned between these hole portions 91 and restrict the positions in the axial direction of the shaft part 51 and the traveling wheel part 52 by contact with the shaft part restricting portions 82, are formed, and the coil springs 53 are disposed in the hole portions 91, respectively. Accordingly, when the traveling wheel 23 is assembled, the shaft part restricting portions 82 are inserted through the hole portions 91, turned in the circumferential direction, and brought into contact with the shaft part restricting portions 82, and the coil springs 53 are disposed in the hole portions 91, whereby easily assembling the traveling wheel 23. In addition, by contact between the shaft part restricting portions 82 and the traveling wheel part restricting portions 86, the shaft part 51 can be held in a state where the shaft part is prevented from coming off the traveling wheel part 52 when the coil springs 53 are attached at the time of assembly of the traveling wheel 23, so that the assembling performance of the traveling wheel 23 is further improved.

[0067] Further, by covering the coil springs 53 of the traveling wheel 23 by a transparent cover 55, the supporting mechanism for the shaft part 51 and the traveling wheel part 52, including the coil springs 53 exposed in the axial direction of the traveling wheel 23 from the hole portions 91, can be viewed from the outside of the traveling wheel 23 via the cover 55. Therefore, an oper-

ator can view expansion and contraction of the coil springs 53 and the movements of the shaft part 51 and the traveling wheel part 52 when the traveling wheel 23 comes into contact with an obstacle O or the floor surface F, so that visual appearance is improved.

[0068] By disposing the front cover 25 turnable in the front-rear direction at the front portion of the case body 21 and positioning the projections 25a of the front cover 25 more forward than the traveling wheels 23, when cleaning the vicinity of the obstacle O, the front cover 25 comes into contact with the obstacle O before the traveling wheels 23 and turns rearward, so that the lower portion of the front side suction port 36 can be opened by this front cover 25 and dust on the front side can be suctioned from the lower portion of the front side suction port 36. In addition, from the lower portion of the front side suction port 36 opened by contact of the front cover 25 with the obstacle O and rearward turning of the front cover, the cleaning members 38 of the rotary brush 32 relatively protrude, so that when the rotary brush 32 is rotated, dust can be scraped off the floor surface F in the vicinity of the obstacle O by the protruded cleaning members 38. Therefore, the floor surface F in the vicinity of the obstacle O can be efficiently cleaned.

[0069] The traveling wheel 23 includes a traveling wheel part 52 formed to be large in diameter, so that the traveling wheel smoothly rides over a level difference, etc., and excellent traveling performance is obtained. Further, damage to the obstacle O when the traveling wheel collides with the obstacle O does not occur as a result of making the ground contact portion 88 of the traveling wheel part 52 softer.

[0070] In addition, in the first embodiment described above, the traveling wheel 23 may be configured so that an annularly formed energizing means 105 formed of an elastic material (flexible material), for example, rubber, a leaf spring, or elastomer, etc., is disposed on the entire periphery between the outer peripheral side of the shaft part 51 and the inner peripheral side of the traveling wheel part 52 without using the coil springs 53 as in the second embodiment shown in Fig. 12. Even in this case, the same operation and effect as in the first embodiment described above can be obtained.

[0071] Next, a third embodiment will be described with reference to Fig. 13 to Fig. 16. The same components and operations as those of the embodiments described above will be designated by the same reference numerals, and description thereof will be omitted.

[0072] In this third embodiment, the traveling wheels 23 and 23 of the first embodiment described above are attached to the case body 21 in a state where their central axes are along the up-down direction.

[0073] Specifically, as shown in Fig. 13, Fig. 14, and Fig. 16, the traveling wheels 23 are disposed on both side portions of the case body 21 so that the covers 55 come to the upper side, and from the side surfaces of the case body 21, side portions of the ground contact portions 88 project. In a state where the traveling wheels

23 are axially supported on the case body 21, the front portions of the ground contact portions 88 are positioned to be more forward than the front portion of the case body 21 and more rearward than the front end portion of the front cover 25. Further, the traveling wheels 23 are axially supported rotatably so that the shaft parts 51 are sandwiched from above and below by the front side of the lower case 26 and the front case 29.

[0074] As shown in Fig. 15, when the floor brush 20 travels laterally and collides with a wall section W as an obstacle, first, the ground contact portion 88 of the traveling wheel 23 comes into contact with the wall section W. In this state, as shown by the imaginary lines, when the floor brush 20 further travels laterally, the traveling wheel part 52 of each traveling wheel 23 is fixed at the position of the wall section W, and accordingly, the shaft part 51 and the case body 21 move laterally relative to the traveling wheel part 52 against the energization of the coil springs 53. Therefore, the impact of the collision is absorbed by expansion and contraction of the coil springs 53.

[0075] When the floor brush 20 is made to travel forward and collides with an obstacle O such as a wall or furniture, first, the projections 25a of the front cover 25 come into contact with the obstacle O and the front cover 25 turns rearward against the energization of the front cover energizing means, and then, as shown by the imaginary lines, the front portions of the traveling wheels 23 come into contact with the obstacle O, and when the floor brush 20 further travels forward, the traveling wheel parts 52 of the traveling wheels 23 are fixed at the position of the obstacle O, and accordingly, the shaft parts 51 and the case body 21 move forward relative to the traveling wheel parts 52 against the energization of the coil springs 53. Therefore, the impact of the collision is absorbed by expansion and contraction of the coil springs 53.

[0076] Thus, by attaching the traveling wheels 23 to the case body 21 so that their central axes are along the up-down direction and projecting parts of the traveling wheels 23 from the side surfaces of the case body 21, when the floor brush 20 is made to travel in the left-right direction for cleaning, the traveling wheel 23 comes into contact with a wall section W before the case body 21, so that the impact of the collision of the side portion of the floor brush 20 with the wall section W can be cushioned by the traveling wheel 23. Similarly, by protruding parts of the traveling wheels 23 more forward than the case body 21, when the floor brush 20 is made to travel in the front-rear direction when cleaning, the traveling wheels 23 come into contact with an obstacle O before the case body 21, so that the impact of the collision of the front side of the floor brush 20 with the obstacle O can be cushioned by the traveling wheels 23.

[0077] Cushioning is possible against both of a wall section W on the lateral side and an obstacle O on the front side by the traveling wheels 23, so that such as when the floor brush 20 is moved forward to the obstacle O along the wall section W on the lateral side and then

moved laterally along the obstacle O to clean the inner edge, excellent cushioning characteristics are obtained. In addition, when traveling along the wall section W on the lateral side, traveling wheels 23 rotate due to contact with the wall section W and hardly become a resistance, so that the traveling performance is not lowered.

[0078] In addition, even when the energizing means 105 of the second embodiment described above is adopted instead of the coil springs 53 of the traveling wheel 23 of the third embodiment described above, the same operation and effect are obtained.

[0079] Each traveling wheel 23 may be disposed so that the cover 55 comes to the lower side.

[0080] Next, a fourth embodiment will be described with reference to Fig. 17 to Fig. 25. The same components and operations as those of the embodiments described above will be designated by the same reference numerals, and description thereof will be omitted.

[0081] In the fourth embodiment, the traveling wheel part 52 of each traveling wheel 23 includes, as shown in Fig. 17 to Fig. 25, a traveling wheel part main body 111 as an annular (cylindrical) rotating body part main body, a covering 112 molded integrally with the traveling wheel part main body 111, and a raised fabric portion 113 as a ground contact portion that is a friction reducing portion attached across these traveling wheel part main body 111 and covering 112, and the traveling wheel part main body 111 and the covering 112 are molded integrally by, for example, double molding (two-color molding). In addition, disposition of the traveling wheel parts 52 on both sides of the case body 21 includes a configuration in which the traveling wheel parts 52 are disposed in the vicinity of both sides of the case body 21.

[0082] The traveling wheel part main body 111 is, for example, a primary side of double molding, and is formed to be larger in diameter than the shaft part 51 from a comparatively hard material (synthetic resin), for example, such as ABS, and has an axial direction along the left-right width direction of the case body 21. This traveling wheel part main body 111 has, as shown in Fig. 17(b), an outer recess 111b formed in a stepped shape as an outer side fitting portion that fits the covering 112 at a position outside the outer peripheral surface 111a, that is, a position close to the side distant from the case body 21 which is one end side in the axial direction, and an inner recess 111c formed in a stepped shape as an inner side fitting portion that fits the covering 112 at a position on the inner side of the outer peripheral surface 111a, that is, a position close to the side near the case body 21 which is the other end side in the axial direction. Further, on this traveling wheel part main body 111, traveling wheel part restricting portions 115 as a plurality of rotating body part restricting portions corresponding to, for example, the coil springs 53, are formed integrally to project from the inner peripheral edge portion toward the central axis direction.

[0083] The outer recess 111b and the inner recess 111c are formed continuously in the entire circumferential

direction of the traveling wheel part main body 111, respectively. These outer recess 111b and inner recess 111c communicate with each other via communicating portions 111d shown in Fig. 17 (a) and Fig. 21 at predetermined positions in the circumferential direction, for example, positions between the traveling wheel part restricting portions 115 and 115.

[0084] The traveling wheel part restricting portions 115 shown in Fig. 17 to Fig. 21 are portions that mutually restrict the positions in the axial direction of the shaft part 51 and the traveling wheel part 52 by coming into sliding contact with the shaft part restricting portions 82 by respectively fitting the fitting portion 83 of the shaft part 51, and are respectively formed on the inner edge portion on the outer side of the traveling wheel part main body 111. These traveling wheel part restricting portions 115 are formed into substantially trapezoid shapes whose widths become gradually smaller toward the central axis direction of the traveling wheel part main body 111, and are disposed at substantially even intervals separated in the circumferential direction. Therefore, between these traveling wheel part restricting portions 115, hole portions 121 (Fig. 18) into which the coil springs 53 are attached are formed at substantially even intervals in the circumferential direction. Further, on the base end portions of these traveling wheel part restricting portions 115, attaching holes 122 for attaching the cover 55 are formed in arc shapes along the inner edge portion of the traveling wheel part main body 111. Between tip end portions of these traveling wheel part restricting portions 115, an insertion hole portion 123 through which the restricting part main body 81 of the restricting part 65 of the shaft part 51 can be inserted and the shaft part main body 63 cannot be inserted is formed. On at least any of the traveling wheel part restricting portions 115, a gate not shown to be used when molding the traveling wheel part main body 111 is formed on the outer side surface 115a.

[0085] Each hole portion 121 has a width larger than that of each shaft part restricting portion 82 of the shaft part 51 formed. In each hole portion 121, a holding portion 125 that is a wall portion for holding the other end side of the coil spring 53 is formed in a U shape projecting from the inner edge portion of the traveling wheel part main body 111 toward the central axis direction and opening outward is formed.

[0086] The covering 112 is, for example, a secondary side of double molding, and is molded from a material (synthetic resin), for example, such as elastomer softer than the traveling wheel part main body 111. Further, the covering 112 includes an annular outer side covering 127 covering the outer peripheral side of the axially outer side portion of the traveling wheel part main body 111 and an annular inner side covering 128 covering the outer peripheral side of the axially inner side portion of the traveling wheel part main body 111, and these outer side covering 127 and inner side covering 128 are spaced substantially parallel from each other, and between these coverings 127 and 128, an attaching recess 129 into

which the raised fabric portion 113 is attached is formed. The coverings 127 and 128 are connected to each other via a connecting portion 130 at the communicating portions 111d of the traveling wheel part main body 111.

[0087] The outer side covering 127 covers the outer side end face 111e and the portion on the outer side of the outer peripheral surface 111a of the traveling wheel part main body 111, and fits the outer side recess 111b. Therefore, the outer side coverings 127 cover the outer sides in the lateral direction of the entire floor brush 20 on the outer peripheral sides of the traveling wheel part main bodies 111, that is, the side portions on the sides distant from the connection tube 22 (Fig. 25) on the outer peripheral sides of the traveling wheel part main bodies 111, in other words, side portions opposite to the traveling wheels 23 on mutually the other sides on the outer peripheral sides of the traveling wheel part main bodies 111 of the traveling wheels 23, and the end faces 127a of the outer side coverings 127 constitute the entire outer side portions of the traveling wheels 23. On this outer side covering 127, as shown in Fig. 21, outer side fitting projections 127b that are area-enlarged portions as covering fitting portions (outer side covering fitting portions) that fit outer side fitting notched portions 111f as outer side notched portions respectively formed at a plurality of positions in the circumferential direction of the outer side end face 111e of the traveling wheel part main body 111, for example, positions on the outer sides of both ends of the attaching holes 122 of the traveling wheel restricting portions 115 are formed integrally. Further, as shown in Fig. 17, the outer peripheral surface 127c of the outer side covering 127 is inclined so as to gradually project radially toward the attaching recess 129 side.

[0088] Each outer side fitting projection 127b shown in Fig. 21 is a portion for increasing the thickness of the outer side covering 127 (covering 112) and increasing the contact area between the outer side covering 127 (covering 112) and the traveling wheel part main body 111, and is formed substantially flush with the end face 127a of the outer side covering 127, projects toward the central axis side of the outer side covering 127, and is substantially flush with the inner peripheral surface of the traveling wheel part main body 111.

[0089] The inner side covering 128 shown in Fig. 17 covers the portion on the inner side of the outer peripheral surface 111a of the traveling wheel part main body 111. This inner side covering 128 has an end face 128a substantially flush with the end face 111g on the inner side of the traveling wheel part main body 111, and inner side fitting portions 128b formed integrally as inner side covering fitting portions that fit inner side fitting notched portions 111h as inner side notched portions notched at a plurality of positions on this end face 111g, for example, positions corresponding to the holding portions 125. Further, the outer peripheral surface 128c of this inner side covering 128 is inclined so as to gradually project radially toward the attaching recess 129 side.

[0090] Each inner side fitting portion 128b is formed to

have a base end side substantially flush with the end face 111g on the inner side of the traveling wheel part main body 111 at the position of the inner side fitting notched portion 111h, and have a tip end side along each holding portion 125, and this tip end side is a portion on which a gate not shown to be used when molding the covering 112 is formed.

[0091] The attaching recess 129 is a portion at which a part of the outer peripheral surface 111a of the traveling wheel part main body 111, that is, the region between the communicating portions 111d and 111d is exposed.

[0092] The connecting portion 130 is a portion formed when a material for molding the covering 112 is distributed from the gate formed on the inner side fitting portion 128b of the inner side covering 128 to the outer side covering 127 side. Specifically, the covering 112 includes an outer side covering 127 and an inner side covering 128 formed integrally by filling of the material from the gate formed on the inner side fitting portion 128b.

[0093] The raised fabric portion 113 includes, as shown in Fig. 22, numerous raised fibers 113a as a portion that comes into contact with the floor surface F in a state where the floor brush 20 is placed on the floor surface F, a bonded portion as an attached portion on which the raised fibers 113a are disposed integrally, that is, a belt-like sheet portion 113b as a friction reducing portion main body, and the friction against the floor surface F is set to be smaller than that of the covering 112. The sheet portion 113b is bonded and fixed to the attaching recess 129 with an adhesive, etc., not shown. The sheet portion 113b is wound around the entire circumference of the attaching recess 129 so that both end portions become adjacent to each other. Specifically, the raised fabric portion 113 is disposed across the entire circumference of the traveling wheel 23. Further, both end portions of the sheet portion 113b are positioned on, for example, the outer peripheral surface 111a of the traveling wheel part main body 111. The raised fibers 113a project radially with respect to the outer peripheral surface (outer peripheral surfaces 127c and 128c) of the covering 112, and the tip end sides are curved along the rotation direction of the traveling wheel 23 (traveling wheel part 52) when the case body 21 (floor brush 20) travels forward, that is, tilts in the arrow Y direction of Fig. 21. In the state where the traveling wheel 23 is axially supported on the bearing part 61 of the case body 21, this raised fabric portion 113 is set so that the front portions on the tip end sides of the raised fibers 113a are positioned to be more forward than the front portion of the case body 21 and more rearward than the front end portion of the front cover 25, and the lower portions of the tip end sides of the raised fibers 113a are positioned lower than the lower surface of the case body 21.

[0094] Next, operation and effect of the fourth embodiment described above will be described.

[0095] First, a method for assembling each traveling wheel 23 will be described.

[0096] The traveling wheel part 52 is formed by injection-molding the covering 112 by setting the traveling

wheel part main body 111 as the core side of a mold after injection-molding the traveling wheel part main body 111.

[0097] At this time, as the covering 112, by injecting the material by using the inner side fitting portion 128b of the inner side covering 128 as a gate, this material is filled from the communicating portions 111d of the traveling wheel part main body 111 to the outer side covering 127 side, and the inner side covering 128 and the outer side covering 127 are molded integrally via the connecting portion 130.

[0098] In this state, the inner side fitting portions 128b fit into the inner side fitting notched portions 111h and the outer side fitting projections 127b fit into the outer side fitting notched portions 111f, and accordingly, the contact area of the covering 112 with the traveling wheel part main body 111 is enlarged.

[0099] Then, from the state shown in Fig. 18, as shown by the imaginary lines in Fig. 19, the shaft part 51 is inserted into the traveling wheel part 52 from the other end side. In detail, in a state where the shaft part restricting portions 82 are fitted into the hole portions 121, the restricting part main body 81 is inserted into the insertion hole portion 123 from the other end side.

[0100] Next, as shown by the solid lines in Fig. 19, in a state where the shaft part restricting portions 82 are positioned closer to one end side than the traveling wheel part restricting portions 115, by turning the shaft part 51 a predetermined angle, in the present embodiment, approximately 90 degrees in the circumferential direction (for example, clockwise direction) relative to the traveling wheel part 52, the shaft part restricting portions 82 come into sliding contact with the end faces of the traveling wheel part restricting portions 115, and the traveling wheel part restricting portions 115 fit in the fitting portion 83 as shown in Fig. 17(b).

[0101] In this state, the latching projecting portions 71 of the shaft part 51 are opposed to the holding portions 125 of the traveling wheel part 52, so that the center position of the shaft part 51 is made slightly eccentric with the center position of the traveling wheel part 52, and in a state where one latching projecting portion 71 is inserted in one end portion of one coil spring 53 and this one end portion of the coil spring 53 is held in one recess 76, the other end portion of this coil spring 53 is fitted to and held on one holding portion 125.

[0102] Similarly, the latching projecting portions 71 are respectively inserted in one end portions of the other three coil springs 53, and in a state where the one end portions of the coil springs 53 are held in the recesses 76, as shown in Fig. 20, the other end portions of the coil springs 53 are fitted to and held on the holding portions 125. In this state, the coil springs 53 fit in the hole portions 121 and are exposed in the axial direction of the traveling wheel 23.

[0103] Further, the sheet portion 113b of the raised fabric portion 113 is bonded and fixed to the attaching recess 129. At this time, the sheet portion 113b is fixed

to the outer peripheral surface 111a of the traveling wheel part main body 111 whose one end portion is exposed to the attaching recess 129, and at a position once around the outer periphery of the traveling wheel part main body 111 along the attaching recess 129, the other end portion is adjacent to the one end portion and is fixed to the outer peripheral surface 111a of the traveling wheel part main body 111. In addition, this raised fabric portion 113 may be attached after the traveling wheel part 52 is molded.

[0104] Thereafter, as shown in Fig. 17 (a) and Fig. 17 (b), the shaft part main body 63 of each shaft part 51 is fitted to each bearing part 61 on each side portion of the case body 21 assembled separately and the screw boss portion 69 is inserted through the insertion hole 73, and the stopper body 54 is fitted into the shaft part main body 63 and the screw 97 is screwed to the screw boss portion 69, whereby axially supporting each shaft part 51 rotatably on the bearing part 61 of the case body 21.

[0105] Further, by inserting the claws 101 of the cover 55 into the attaching holes 122 of the traveling wheel part 52 from one end side and turning the cover 55 a predetermined angle in the circumferential direction, the claws 101 are respectively latched on latching projections 133 formed on one sides in the circumferential direction of the attaching holes 122, and accordingly, the cover 55 is fixed to the traveling wheel part 52.

[0106] Then, when cleaning, the connection tube 22 is turnable with respect to the case body 21, so that in a state where an operator grips the grip part 17, due to the weight balance of the case body 21 side, for example, the weight of the motor, etc., the case body 21 of the floor brush 20 turns relative to the connection tube 22 connected to the extension tube 19. Therefore, according to this turning, as shown in Fig. 23, when the operator tries to place the floor brush 20 on the floor surface F, either of both sides in the left-right width direction of the case body 21 is inclined downward with respect to the other side, and the outer side covering 127 of the covering 112 positioned on the outer side of the traveling wheel 23 positioned on either of both sides in the left-right width direction of the case body 21 first comes into contact with the floor surface F, and then, the other side of both sides in the left-right width direction of the case body 21 comes into contact with the floor surface F. Therefore, when the floor brush 20 is placed on the floor surface F, cushioning characteristics against the floor surface F are secured by the covering 112 (outer side covering 127) made of a material softer than the traveling wheel part main body 111.

[0107] An operator makes the floor brush 20 travel forward and backward alternately via the extension tube 19 in a state where the operator operates the electric blower 13 in a desired operation mode by operating a desired setting button 18 on the grip part 17.

[0108] As shown in Fig. 17, when the floor brush 20 travels, the raised fibers 113a of the raised fabric portion 113 on each traveling wheel 23 come into contact with the floor surface F and rotate, and accordingly, excellent

traveling performance is obtained.

[0109] Specifically, when the floor brush 20 is made to travel forward, an operator applies a force to push the floor brush 20 against the floor surface F via the grip part 17. At this time, on each traveling wheel 23, the raised fibers 113a of the raised fabric portion 113 are pressed against the floor surface F and become a resistance, however, the tip end sides of the raised fibers 113a themselves are inclined forward, so that they hardly become a resistance when each traveling wheel 23 travels forward on the floor surface F, that is, when each traveling wheel 23 rotates forward. As a result, an appropriate resistance is generated between the floor brush 20 and the floor surface F, and without each traveling wheel 23 spinning around or excessively catching on the floor surface F, each traveling wheel 23 can smoothly travel forward. On the other hand, when the floor brush 20 is made to travel backward, an operator applies a force to pull the floor brush 20 to the upper rear side from the floor surface F via the grip part 17. At this time, on each traveling wheel 23, the raised fibers 113a of the raised fabric portion 113 are pulled away in a direction from the floor surface F and the resistance is reduced, however, the tip end sides of the raised fibers 113a of the raised fabric portion 113 are inclined forward, so that when each traveling wheel 23 travels backward on the floor surface F, that is, when each traveling wheel 23 rotates rearward, the raised fibers 113a are caught on the floor surface F and generate an appropriate resistance. As a result, an appropriate resistance is generated between the floor brush 20 and the floor surface F, and without each traveling wheel 23 spinning around or excessively catching on the floor surface F, each traveling wheel 23 can smoothly travel backward.

[0110] As described above, according to the fourth embodiment described above, at least the outer peripheral side of the outer side portion in the axial direction of the traveling wheel part main body 111 is covered by the covering 112 formed of a material softer than the traveling wheel part main body 111, and on the outer peripheral side of the traveling wheel part main body 111, the raised fabric portion 113 whose tip end side projects to the outer peripheral side relative to the covering 112 and which has a smaller friction against the floor surface F than that of the covering 112 is disposed, and accordingly, when the floor brush 20 is placed on the floor surface F, even if the case body 21 relatively turns around the connection tube 22, the covering 112 (outer side covering 127) of the traveling wheels 23 positioned on both sides of the case body 21 come into contact with the floor surface F, so that cushioning characteristics against the floor surface F can be secured, and noise when placing the floor brush 20 on the floor surface F can be reduced, and when traveling, the raised fibers 113a of the raised fabric portion 113 come into contact with the floor surface F, so that traveling noise can be reduced while traveling performance is secured.

[0111] Specifically, when an operator tries to place the

floor brush 20 on the floor surface F from a state where the operator grips the gripping part 17, due to the weight balance of the case body 21 side, for example, by the weight of the motor, etc., the case body 21 turns relative to the connection tube 22 (Fig. 22) connected to the extension tube 19, and either of both sides in the left-right width direction of the case body 21 is inclined downward with respect to the other side. Therefore, when the floor brush 20 is placed on the floor surface F, either of both sides of the case body 21 comes into contact with the floor surface F before the other side. In the case of a conventional floor brush in which traveling wheels including soft wheel parts are attached to both side portions of the case body, by contact of the wheel part of either of the traveling wheels on both side portions of the case body with the floor surface, the impact can be reduced, however, the wheel part is soft, so that the grip force against the floor surface relatively increases, and not only is the traveling performance lowered, but also the lower side of the wheel part successively adheres to the floor surface when traveling on the floor surface, for example, flooring, etc., and when this adhering portion successively separates from the floor surface, noise may continuously occur. On the other hand, if the wheel part is made hard for improving the traveling performance, the cushioning characteristics when the floor brush is placed on the floor surface may become insufficient.

[0112] On the other hand, in the fourth embodiment described above, the outer side covering 127 of the covering 112 that is positioned on the outer side of the traveling wheel 23 on either one side of both sides in the left-right width direction of the case body 21 and made of a material softer than the traveling wheel part main body 111 first comes into contact with the floor surface F, and accordingly, cushioning characteristics against the floor surface F are secured. In addition, when traveling, not the covering 112 but the raised fibers 113a of the raised fabric portion 113 come into contact with the floor surface F, so that as compared with the case where the covering 112 is brought into contact with the floor surface F, the traveling performance is secured such that the floor brush 20 can be easily slid laterally, and the side portion of the floor brush 20 can be more easily brought close to a wall side, etc.

[0113] On the outer peripheral surface (outer peripheral surfaces 127c and 128c) side of the covering 112, by forming the attaching recess 129 to which the raised fabric portion 113 is attached, the end face of the sheet portion 113b of the raised fabric portion 113 is positioned within the attaching recess 129 and is not exposed to the outside, and is protected by the attaching recess 129, so that the raised fabric portion 113 hardly separates from the end face, etc., of the sheet portion 113b with respect to the traveling wheel part main body 111 and the covering 112.

[0114] In addition, the traveling wheels 23 are positioned on both side portions of the case body 21, so that in particular, when dust on the floor surface F adheres

to the raised fibers 113a of the raised fabric portion 113, contamination due to the dust easily stands out, however, by forming the raised fabric portion 113 to be narrower in its width, the contamination hardly stands out as compared with the case where the raised fabric portion 113 is formed across the entire width direction of the traveling wheel 23.

[0115] Further, by bonding the sheet portion 113b of the raised fabric portion 113 to the outer peripheral surface 111a of the traveling wheel part main body 111 exposed to the attaching recess 129, for example, as compared with a case where the sheet portion is bonded to the covering 112 softer than the traveling wheel part main body 111, bonding performance is improved and firm fixation is realized, and accordingly, the raised fabric portion 113 becomes harder to separate. In particular, by bonding both end portions of the sheet portion 113b to the position of the traveling wheel part main body 111, these end portions can be more firmly fixed to the traveling wheel part 52, and the raised fabric portion 113 can be more effectively prevented from separating.

[0116] By tilting the tip end sides of the raised fibers 113a of the raised fabric portion 113 along the rotation direction of each traveling wheel 23 when the case body 21 (floor brush 20) travels forward, when each traveling wheel 23 (each traveling wheel part 52) rotates forward (the case body 21 of the floor brush 20 moves forward), the raised fibers 113a hardly become a resistance against the floor surface F although they are pressed against the floor surface F, and when each traveling wheel 23 (each traveling wheel part 52) rotates rearward (the case body 21 of the floor brush 20 moves backward), the raised fibers 113a are caught on the floor surface F and generate an appropriate resistance although they are not pressed against the floor surface F, so that for both forward and rearward rotations, an appropriate resistance can be applied between each traveling wheel 23 (each traveling wheel part 52) and the floor surface F and each traveling wheel 23 (each traveling wheel part 52) can be smoothly rotated, so that excellent traveling performance is obtained.

[0117] Further, on the covering 112, by forming a plurality of outer side fitting projections 127b that are positioned on the outer side portion of the traveling wheel part main body 111 and fit the traveling wheel part main body 111 in the circumferential direction so that the outer side fitting projections 127b are directed toward the central axis direction of the traveling wheel part main body 111, the thickness of the covering 112 (outer side covering 127) is increased by these outer side fitting projections 127b, whereby improving the cushioning characteristics on the covering 112 against the floor surface F. The outer side covering 127 is easily subjected to an impact by contact with the floor surface F when the floor brush 20 is placed on the floor surface F, so that the outer side covering may easily separate from the traveling wheel part main body 111 due to an impact. Therefore, by forming the outer side fitting projections 127b on the

outer side covering 127 of the covering 112, the contact area between the traveling wheel part main body 111 and the covering 112 is increased by these outer side fitting projections 127b, and these traveling wheel part main body 111 and covering 112 can be firmly integrated so as not to easily separate from each other. Further, these outer side fitting projections 127b are formed to be substantially flush with the inner peripheral surface of the traveling wheel part main body 111, so that they do not stand out in terms of design, and do not lower the visual appearance.

[0118] By interposing the coil springs 53 that energize the shaft part 51 and the traveling wheel part 52 relative to each other between the shaft part 51 and the traveling wheel part 52, the cushioning characteristics against the floor surface F of the shaft part 51 axially supported rotatably on the case body 21 can be improved by the resiliency of the coil springs 53, and noise when the floor brush 20 is placed on the floor surface F can be reduced, and when the traveling wheel part 52 collides with an obstacle O, the traveling wheel part 52 moves with respect to the shaft part 51 and the case body 21 while being energized by the coil springs 53 and absorbs the impact, so that without lowering the traveling performance by, for example, making the traveling wheel part 52 softer and increasing the thickness of the traveling wheel part, the cushioning characteristics can be further improved.

[0119] Specifically, in a case such as where the traveling wheel part 52 is made of an elastic material, etc., and its thickness is increased to obtain sufficient cushioning characteristics, when the traveling wheel part 52 comes into contact with the floor surface F, due to the own weight of the floor brush 20, the traveling wheel part 52 is distorted, and the ground contact area (grip force) with the floor surface F may increase and lower the traveling performance, and on the other hand, in the fourth embodiment described above, a larger cushioning stroke is obtained by the coil springs 53 without increasing the thickness of the traveling wheel part 52, so that the traveling wheel part 52 is not distorted and increases the grip force when traveling, and accordingly, more excellent traveling performance is obtained.

[0120] The floor brush 20 includes the connection tube 22 turnable in the up-down direction, so that when an operator places the floor brush 20 on the floor surface F while gripping the grip part 17 on the hand operation part 16, the front side of the case body 21 turns downward due to the own weight of the case body 21 with respect to the connection tube 22 fixed to the hand operation part 16 side via the extension tube 19 (solid lines in Fig. 24), and tries to come into contact with the floor surface F from the front side of the case body 21. Therefore, the center position of the traveling wheel 23, that is, the position of the shaft part 51 of the traveling wheel 23 axially supported on the bearing part 61 of the case body 21 is positioned to be more forward than the center position of the turning shaft of the connection tube 22, and ac-

cordingly, when the floor brush 20 is placed on the floor surface F as shown in Fig. 24, the raised fabric portion 113 of the traveling wheel 23 comes into contact with the floor surface F before the case body 21, so that the impact when the floor brush 20 is placed on the floor surface F can be cushioned by the raised fabric portion 113 of the traveling wheel 23.

[0121] In addition, in the fourth embodiment described above, the traveling wheel 23 may be configured so that an energizing means 135 formed annularly from an elastic material (flexible material), for example, rubber, a leaf spring, or elastomer, etc., is disposed on the entire circumference between the outer peripheral side of the shaft part 51 and the inner peripheral side of the traveling wheel part 52 in the same manner as in the fifth embodiment shown in Fig. 26 without using the coil springs 53. Even in this case, the same operation and effect as in the first embodiment described above are obtained.

[0122] In addition, the traveling wheel part 52 may be directly axially supported on the case body 21 rotatably.

[0123] Further, the covering 112 is configured to cover at least the outer side portion of the outer peripheral side of the traveling wheel part main body 111. Specifically, the covering 112 may consist of, for example, only the outer side covering 127, etc.

[0124] The friction reducing portion is not limited to the raised fabric portion 113, and for example, a material such as cloth may also be used as long as the friction of the material against the floor surface F is smaller than that of the covering 112.

[0125] In the embodiments described above, the details of the electric vacuum cleaner 11 are not limited to the configurations described above, and for example, the present invention is applicable not only to the canister-type electric vacuum cleaner 11 but also to an arbitrary electric vacuum cleaner such as an upright-type electric vacuum cleaner including a floor brush 20 connected to the lower portion of a vertically long cleaner main body 12.

REFERENCE SIGNS LIST

[0126]

11	Electric vacuum cleaner
12	Cleaner main body
13	Electric blower
20	Floor brush as suction port body
21	Case body
22	Connection tube
22a	Turning shaft
23	Traveling wheel as rotating body unit
25	Front cover
32	Rotary brush as rotary cleaning body
51	Shaft part
52	Traveling wheel part as rotating body part
53	Coil spring as energizing means
55	Cover
82	Shaft part restricting portion

- 86 Traveling wheel part restricting portion as rotating body part restricting portion
- 91 Hole portion
- 105, 135 Energizing means
- 111 Traveling wheel part main body as rotating body part main body
- 112 Covering
- 112 Raised fabric portion as friction reducing portion
- 113a Raised fibers
- 127b Outer side fitting projection as covering fitting portion
- 129 Attaching recess

Claims

1. A suction port body comprising:

a case body; and
a rotating body unit attached to the case body, wherein
the rotating body unit includes:

a shaft part axially supported rotatably on the case body;
a rotating body part at least a part of which is positioned around the shaft part; and
an energizing means that is interposed between the shaft part and the rotating body part and energizes the rotating body part with respect to the shaft part.

2. The suction port body according to Claim 1, wherein a plurality of the energizing means are disposed at substantially even intervals in the circumferential direction of the rotating body unit.

3. The suction port body according to Claim 1 or 2, comprising:

a connection tube axially supported turnably in at least the up-down direction on the case body, wherein
the rotating body unit whose rotating body part is contactable with a traveling surface, and whose at least center position is positioned to be more forward than the center position of a turning shaft of the connection tube.

4. The suction port body according to Claim 3, wherein the rotating body unit is disposed on each of both side portions of the case body.

5. The suction port body according to any one of Claims 1 to 4, comprising:

a rotary cleaning body attached rotatably to the

case body so as to be opposed to a surface to be cleaned, wherein
the rotating body unit is positioned substantially coaxially with the rotary cleaning body.

6. The suction port body according to any one of Claims 1 to 5, wherein
the rotating body unit at least a part of which projects more forward than the case body.

7. The suction port body according to Claim 1 or 2, wherein
the rotating body unit is attached to the case body in a state where the central axis thereof is along the up-down direction, and a part of the rotating body unit projects from the side surface of the case body.

8. The suction port body according to Claim 7, wherein the rotating body unit at least a part of which projects more forward than the case body.

9. The suction port body according to any one of Claims 1 to 8, wherein
the energizing means is a coil spring.

10. The suction port body according to any one of Claims 1 to 9, wherein
the positions in the axial direction of the shaft part and the rotating body part are mutually restricted.

11. The suction port body according to Claim 10, wherein the shaft part includes a plurality of shaft part restricting portions,
the rotating body part includes:

a plurality of hole portions through which the shaft part restricting portions can be inserted; and
rotating body part restricting portions that are positioned between the hole portions, and restrict the positions in the axial direction of the shaft part and the rotating body part by contact with the shaft part restricting portions, and
the energizing means are disposed respectively on the hole portion.

12. The suction port body according to any one of Claims 1 to 11, wherein
the rotating body unit includes a transparent cover covering the energizing means.

13. The suction port body according to any one of Claims 1 to 12, comprising:

a front cover which is disposed turnably in the front-rear direction on the front portion of the case body, and at least a part of which is positioned more forward than the rotating body unit.

14. The suction port body according to Claim 1, wherein the case body is formed to be long in the width direction, the suction port body comprises a tubular connection tube connected rotatably in at least the circumferential direction between both sides in the width direction of the case body, the rotating body unit is disposed rotatably on both sides of the case body, the rotating body part includes:
- an annular rotating body part main body having an axial direction along the width direction of the case body;
 - a covering that is made of a material softer than the rotating body part main body and covers at least the outer peripheral side of the outer side portion in the axial direction of the rotating body part main body; and
 - a friction reducing portion which is positioned on the outer peripheral side of the rotating body part main body, projects on the tip end side to the outer peripheral side relative to the covering, and is smaller in friction against the surface to be cleaned than the covering.
15. The suction port body according to Claim 14, wherein the covering includes, in the circumferential direction, a plurality of covering fitting portions that are positioned on the outer side portion of the rotating body part main body, and project toward the central axis side of the rotating body part main body and fit the rotating body part main body.
16. The suction port body according to Claim 14 or 15, wherein at least a part of the shaft part is positioned on the inner peripheral side of the rotating body part.
17. The suction port body according to any one of Claims 14 to 16, wherein the covering includes an attaching recess to which at least a part of the friction reducing portion is attached on the outer peripheral surface side.
18. The suction port body according to Claim 17, wherein a part of the rotating body part main body is exposed to the attaching recess, and at least a part of the friction reducing portion is bonded to the rotating body part main body exposed to the attaching recess.
19. The suction port body according to any one of Claims 14 to 18, wherein the friction reducing portion has raised fibers whose tip end sides tilt along a rotation direction of the rotating body part when the case body travels forward.
20. An electric vacuum cleaner comprising:

a cleaner main body that houses an electric blower; and
a suction port body according to any one of Claims 1 to 19, communicatively connected to a suction side of the electric blower.

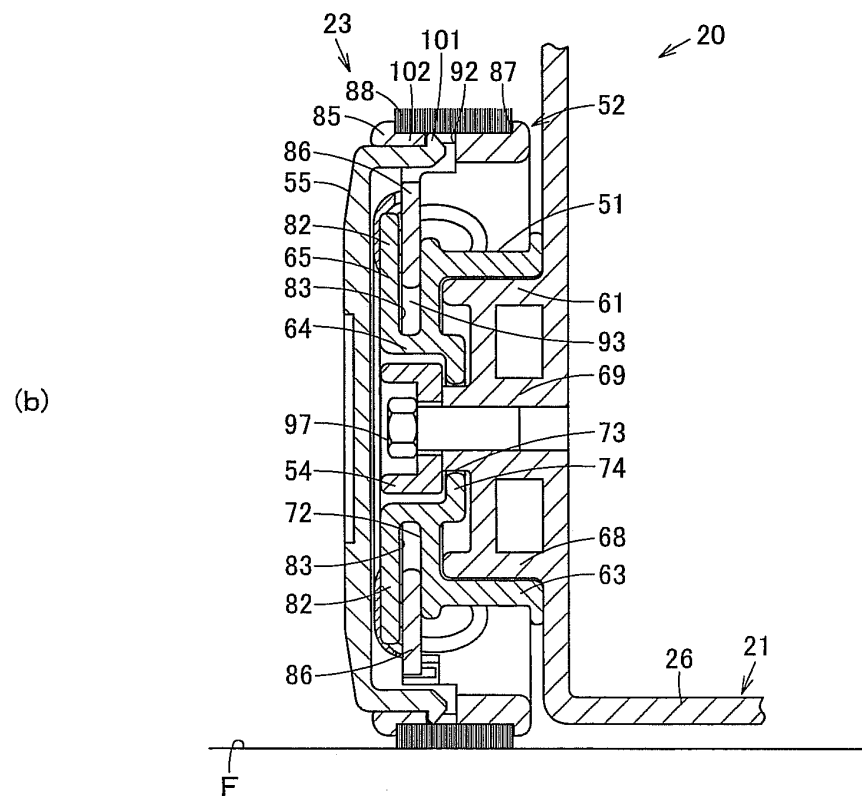
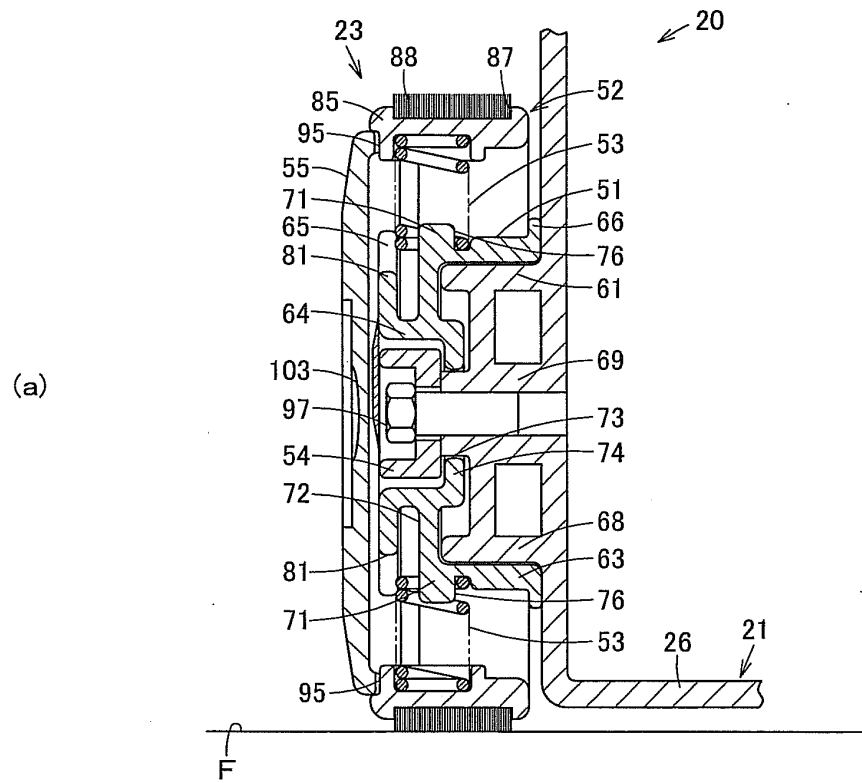


FIG. 1

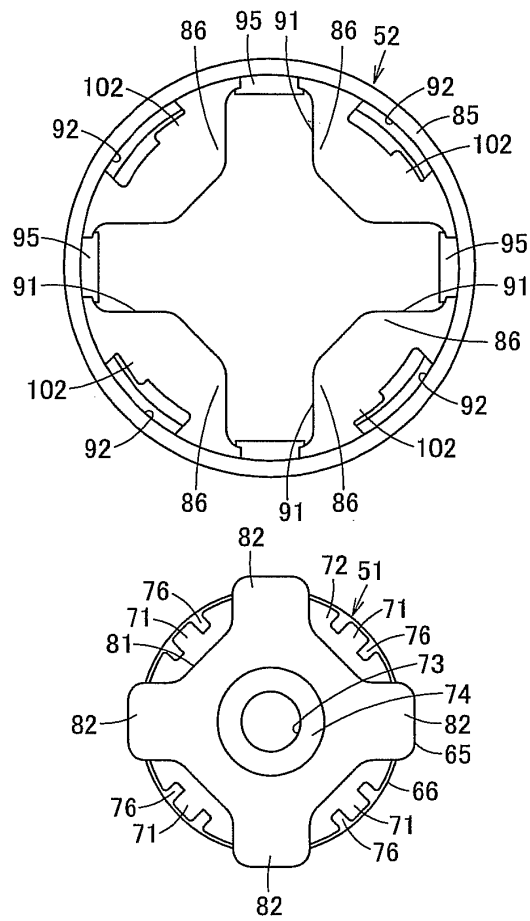


FIG. 2

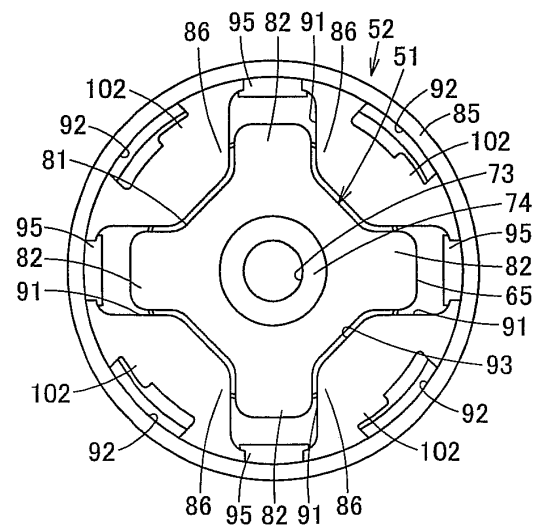


FIG. 3

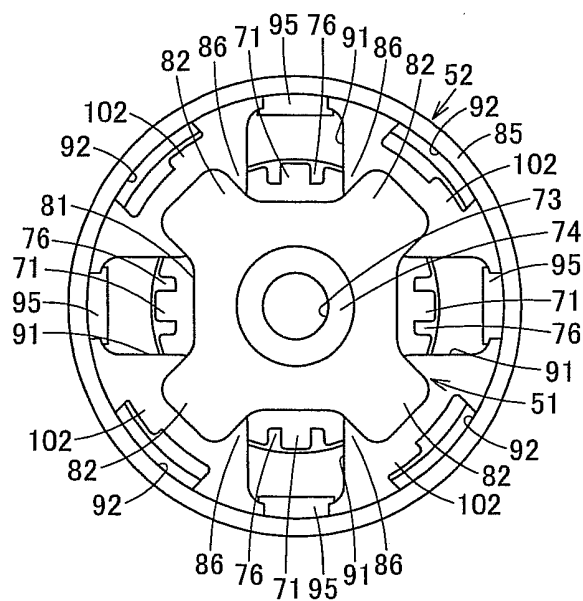


FIG. 4

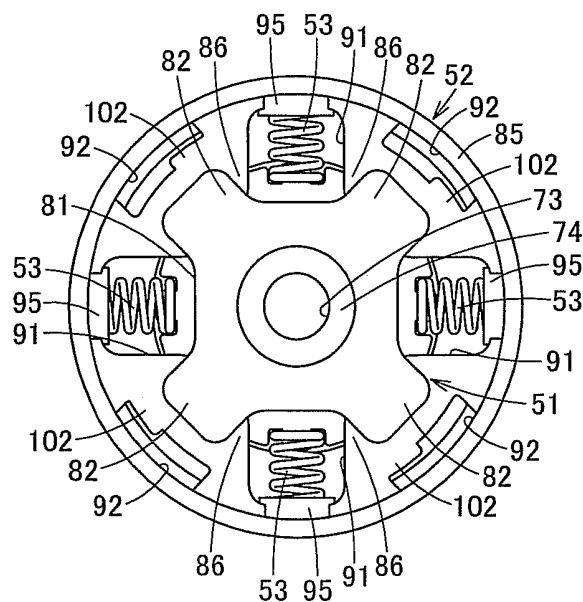


FIG. 5

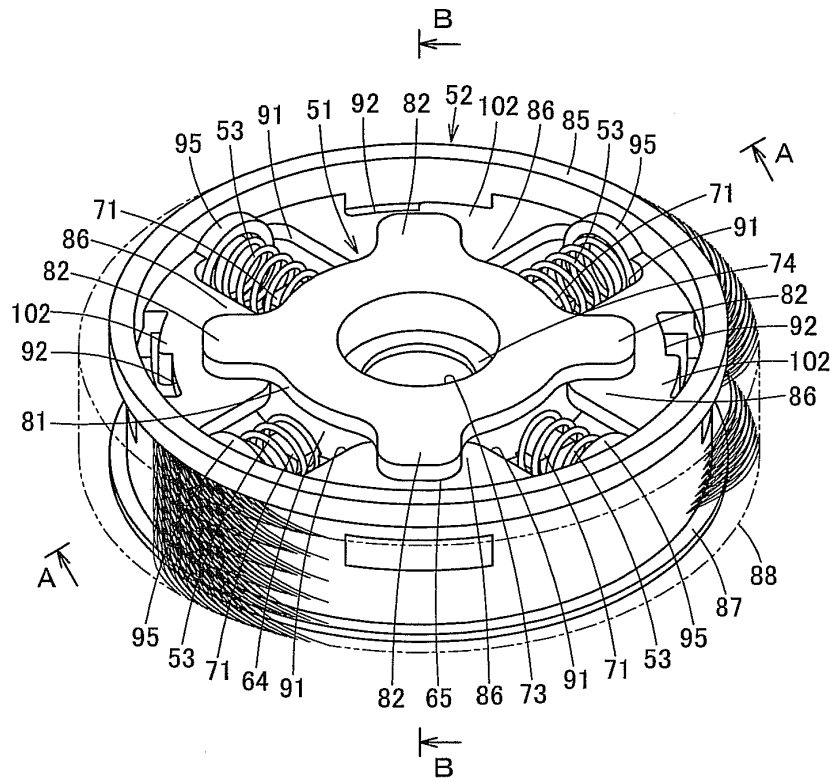


FIG. 6

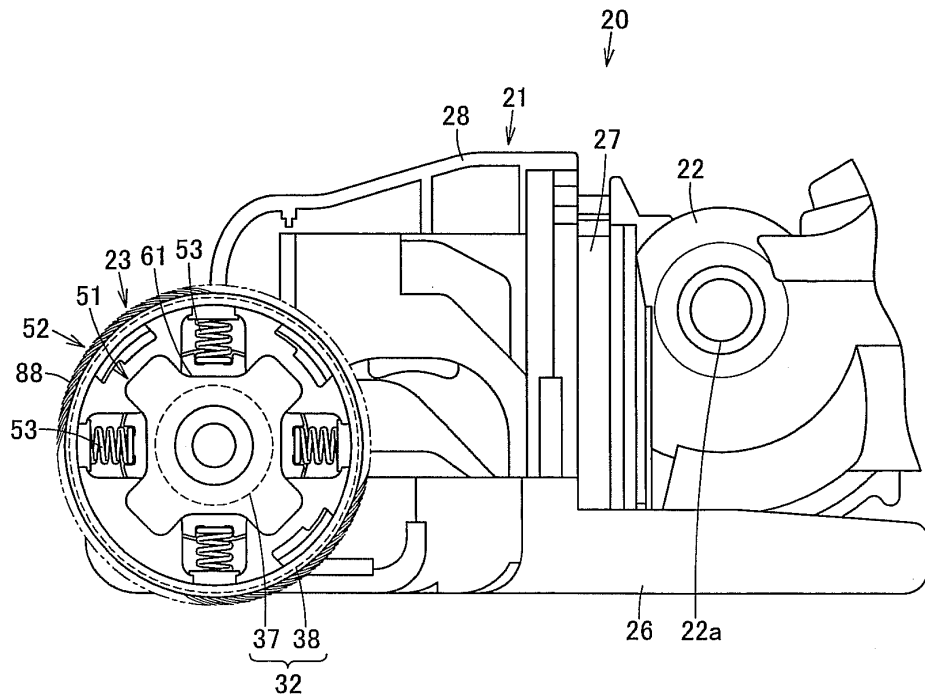
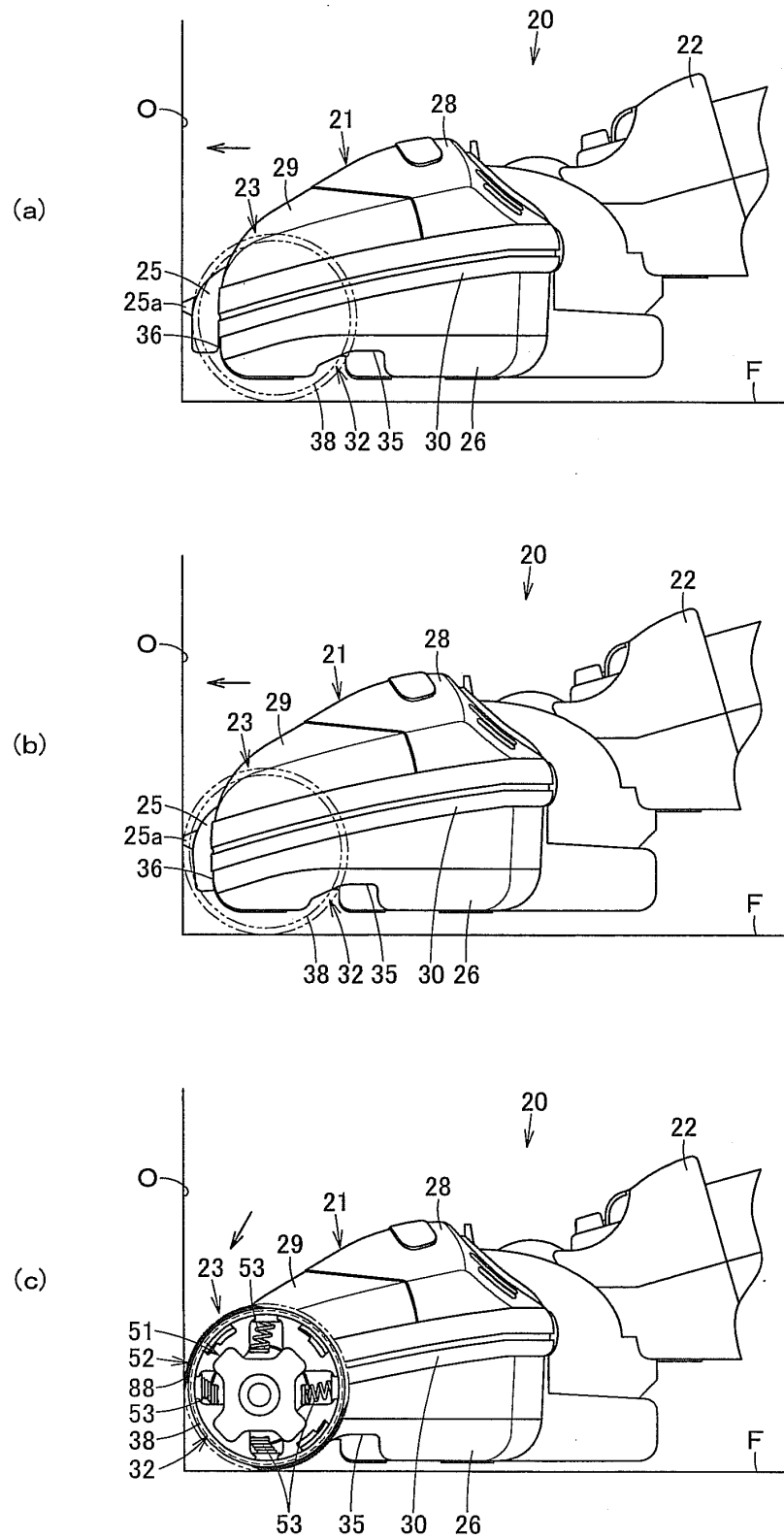


FIG. 7



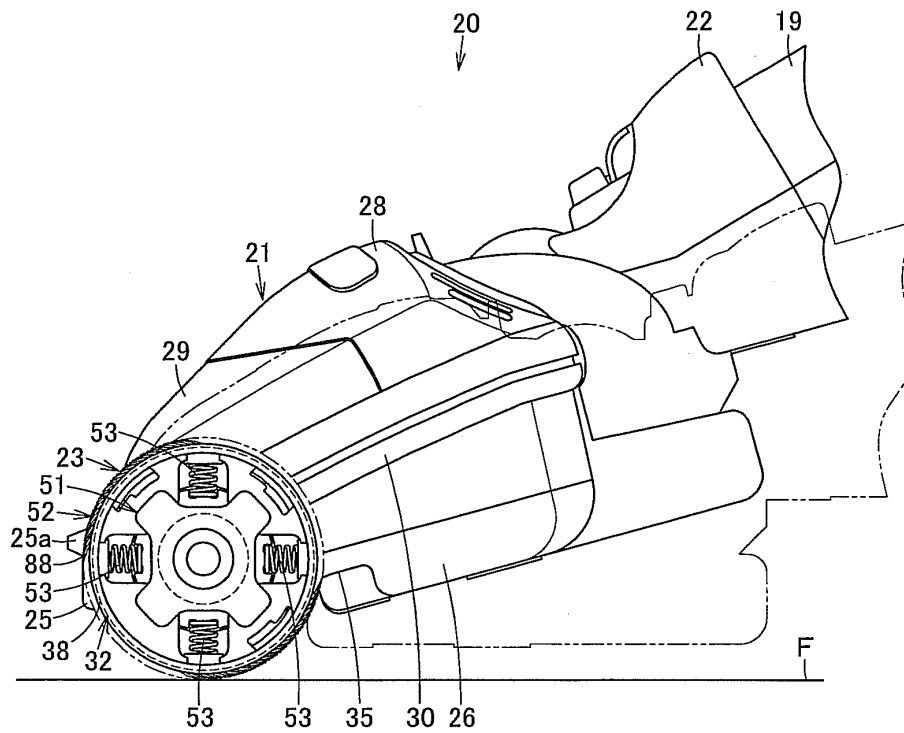


FIG. 9

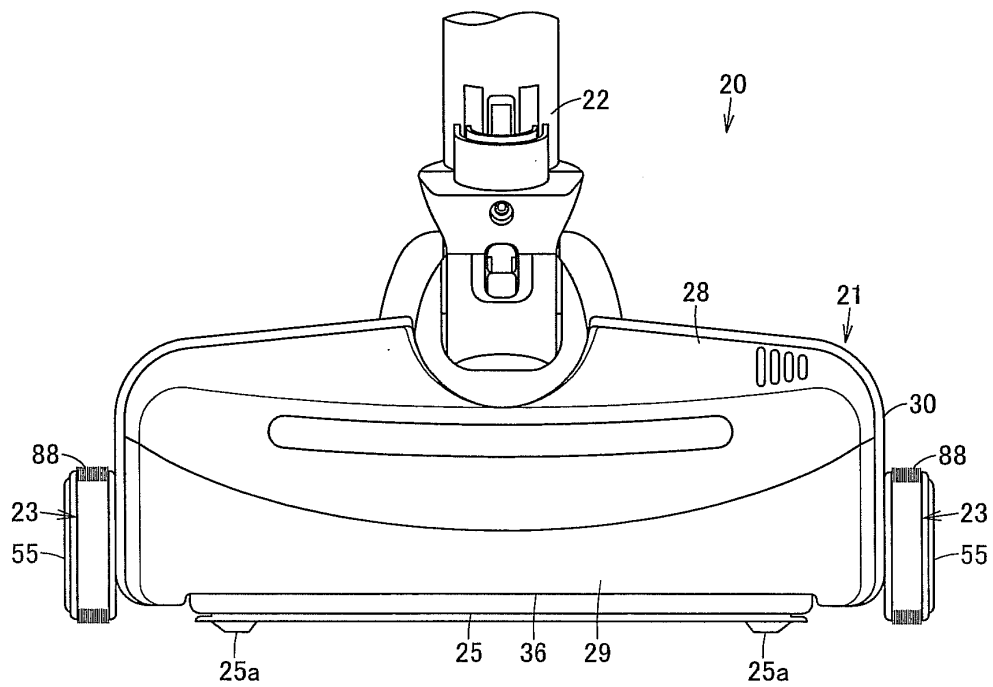


FIG. 10

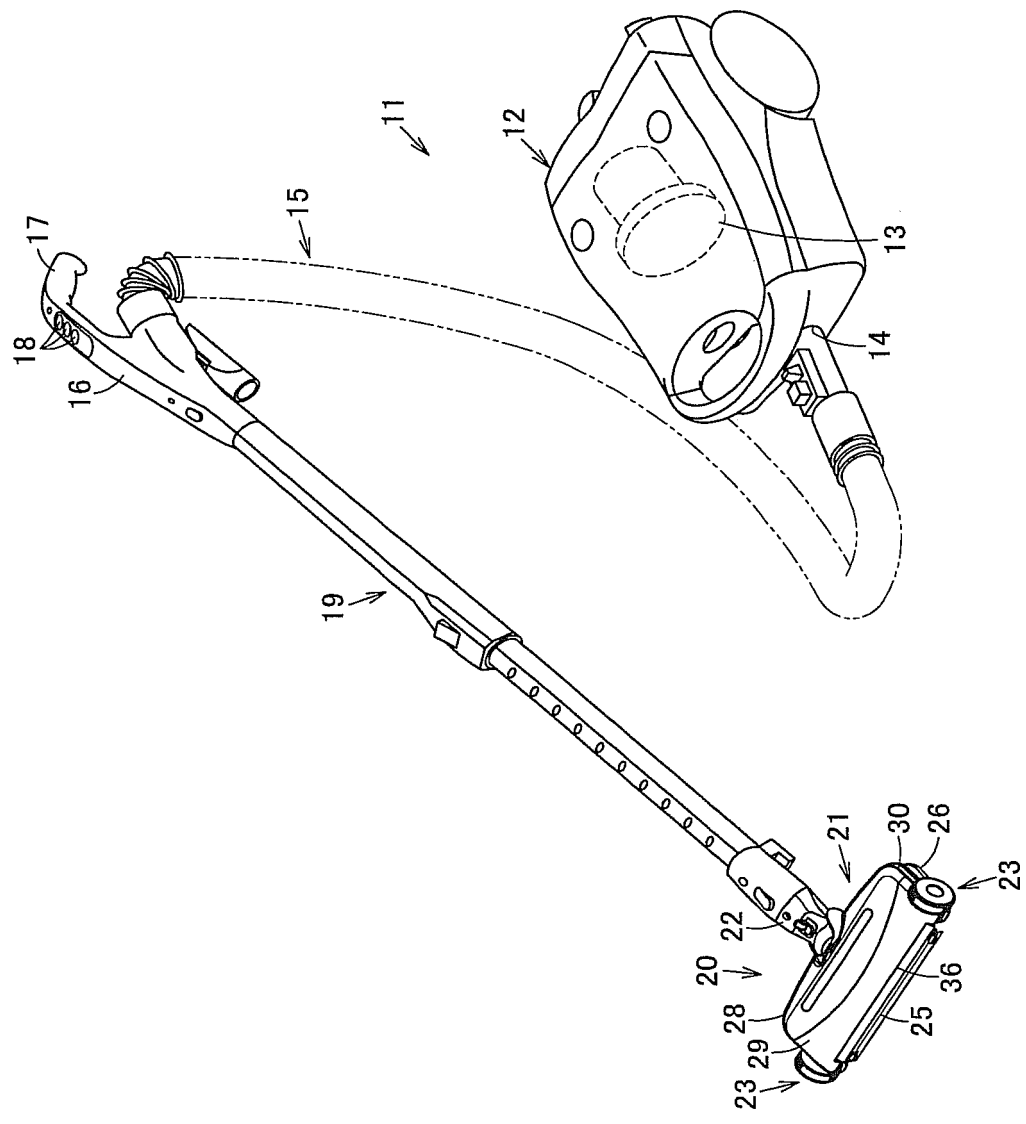


FIG. 11

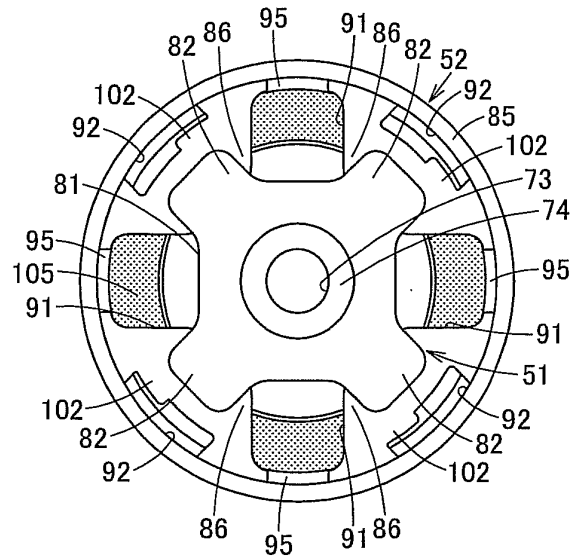


FIG. 12

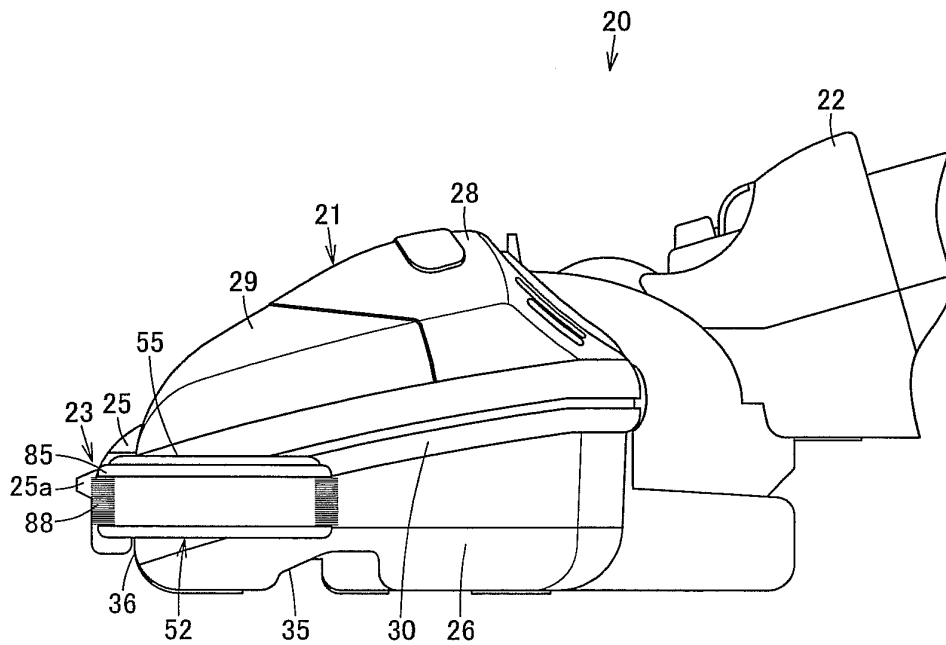


FIG. 13

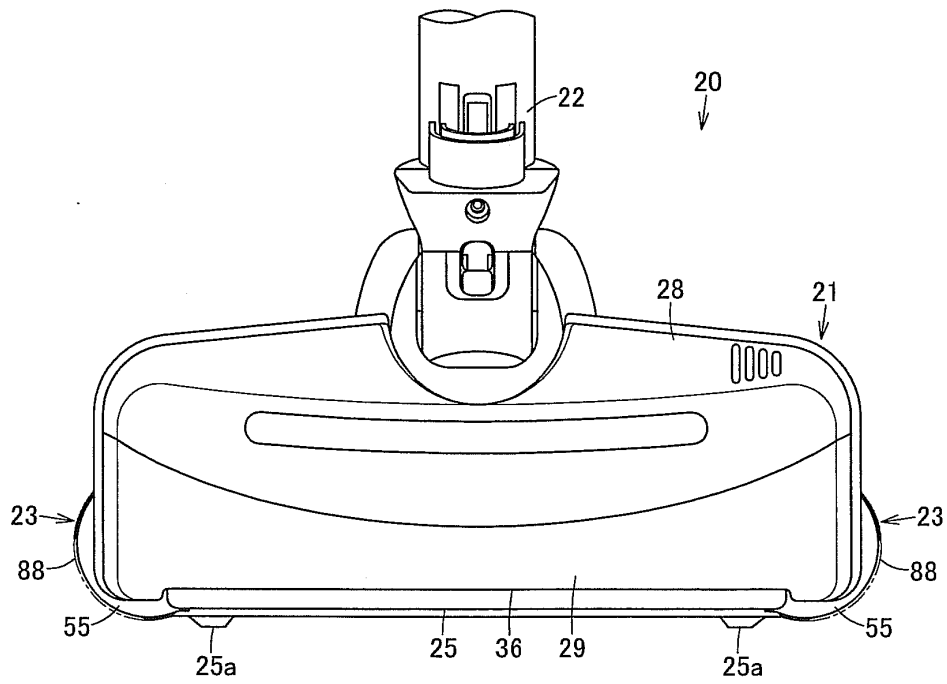


FIG. 14

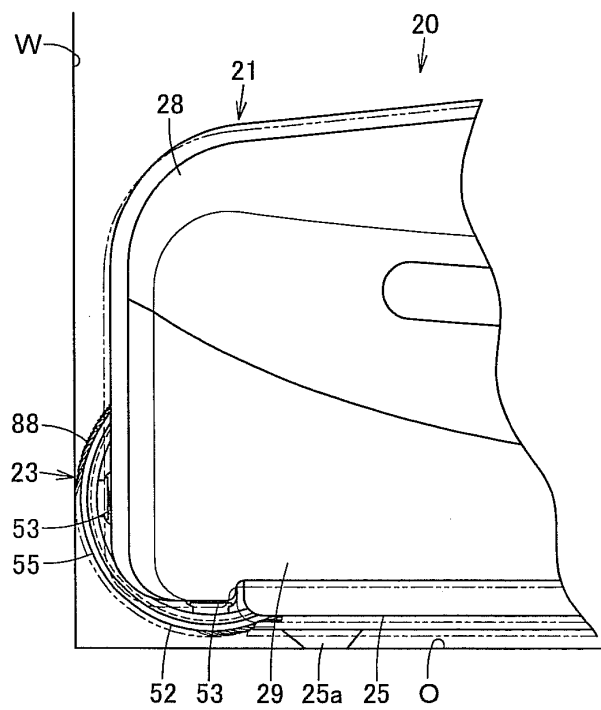


FIG. 15

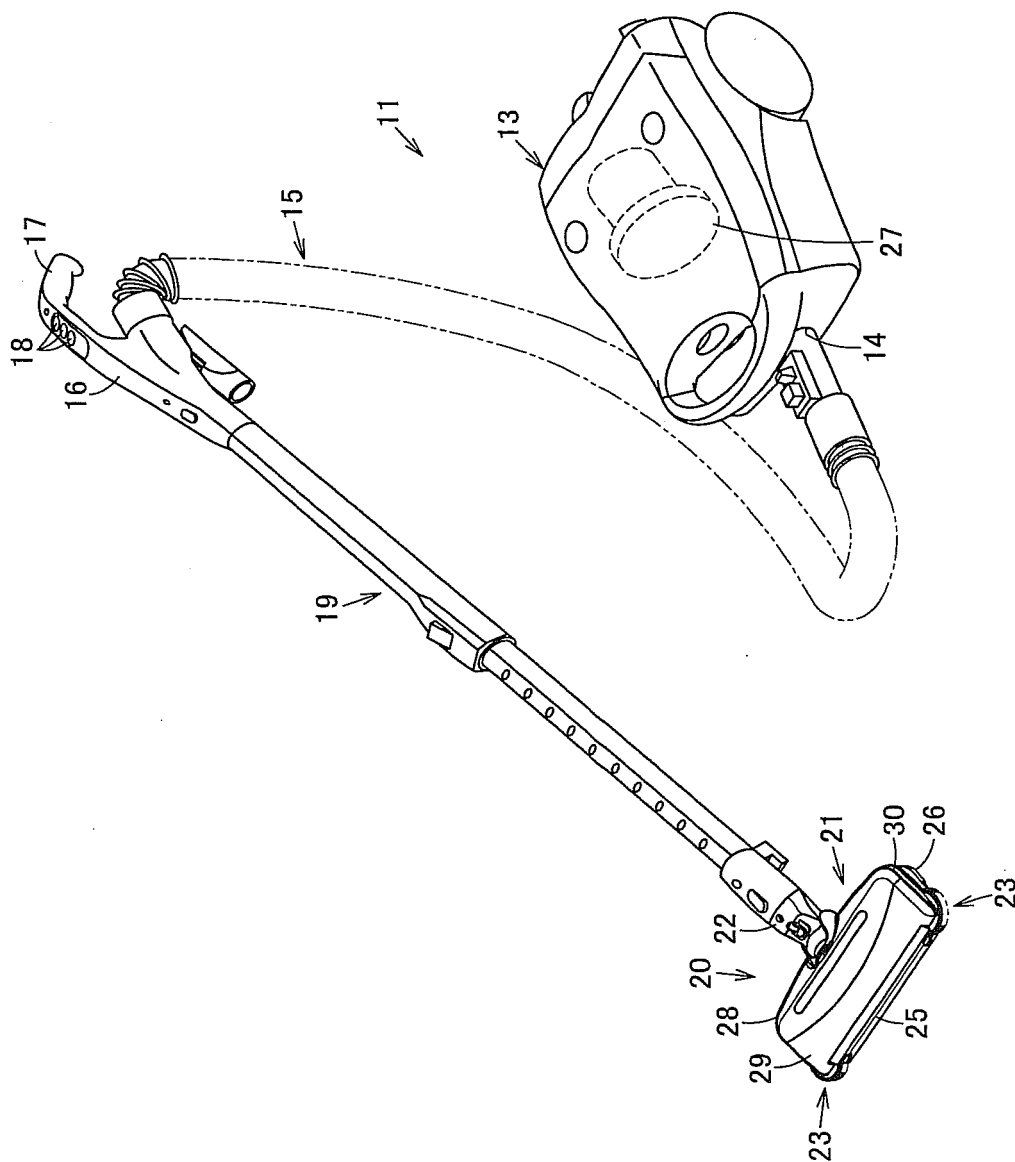


FIG. 16

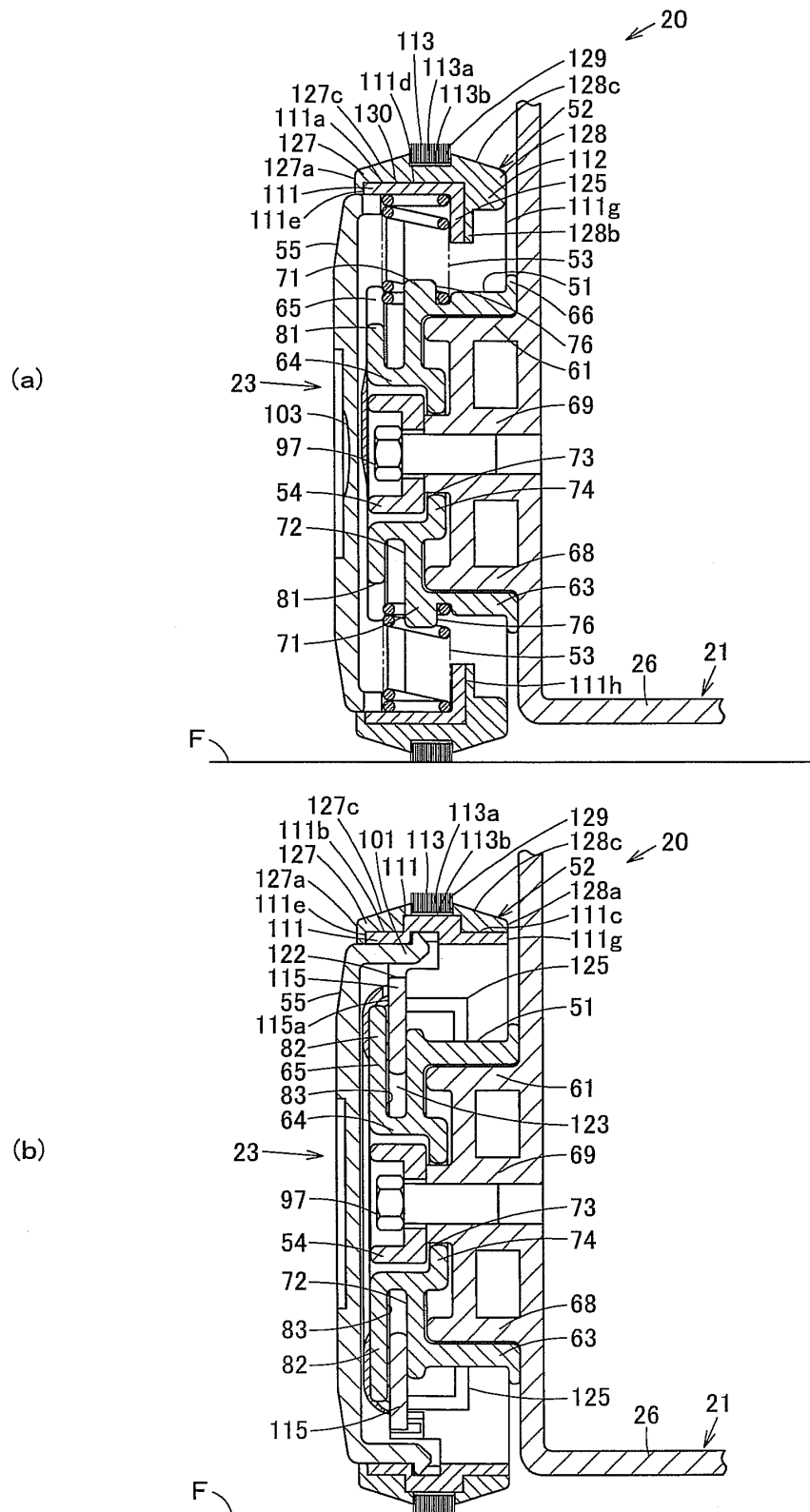


FIG. 17

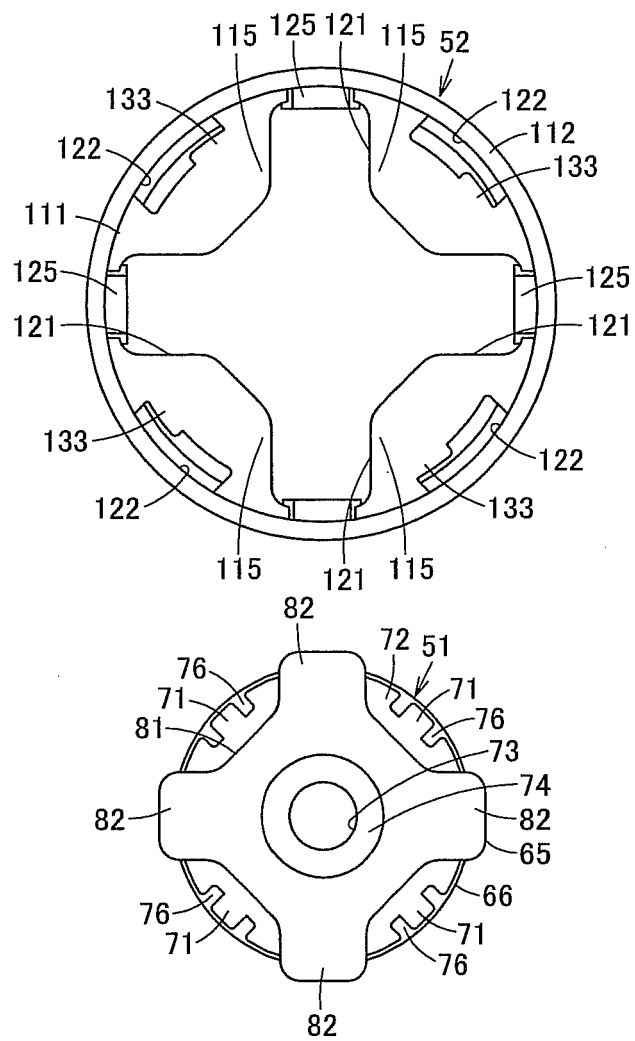


FIG. 18

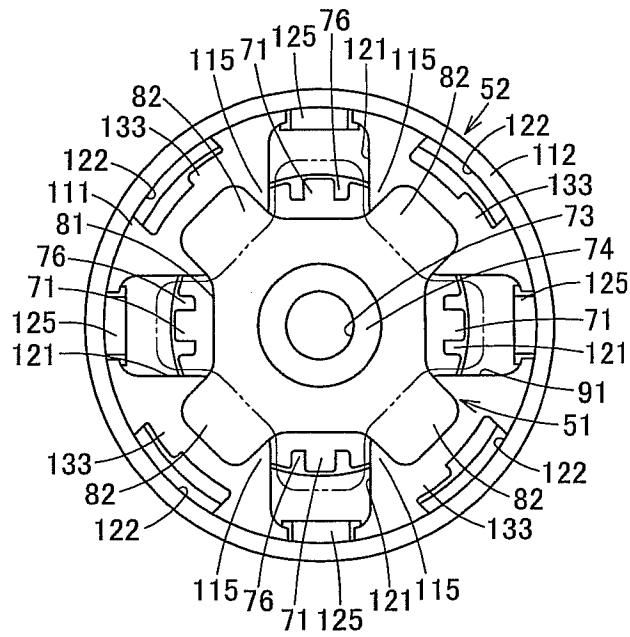


FIG. 19

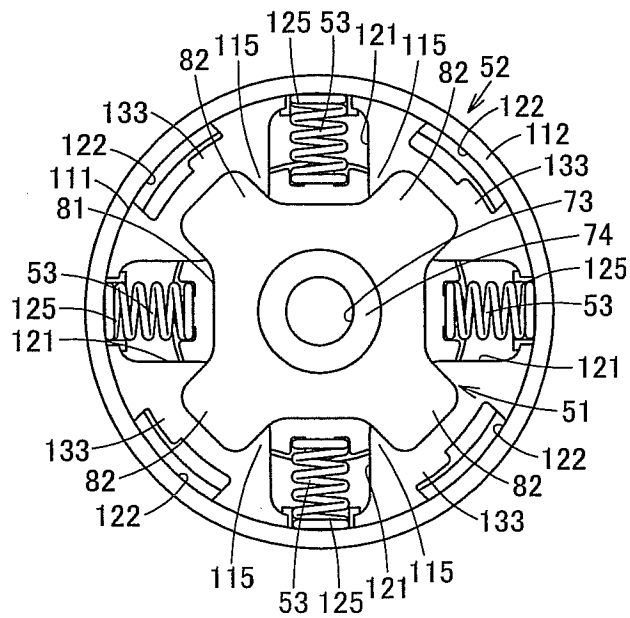


FIG. 20

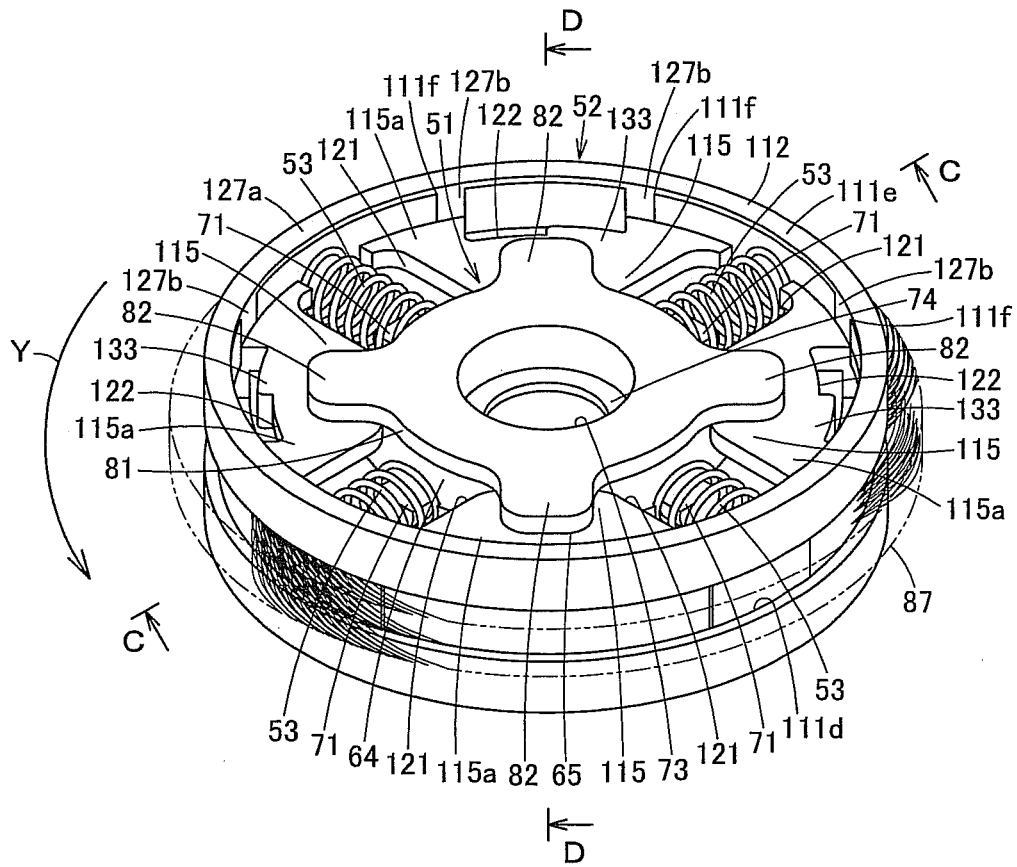


FIG. 21

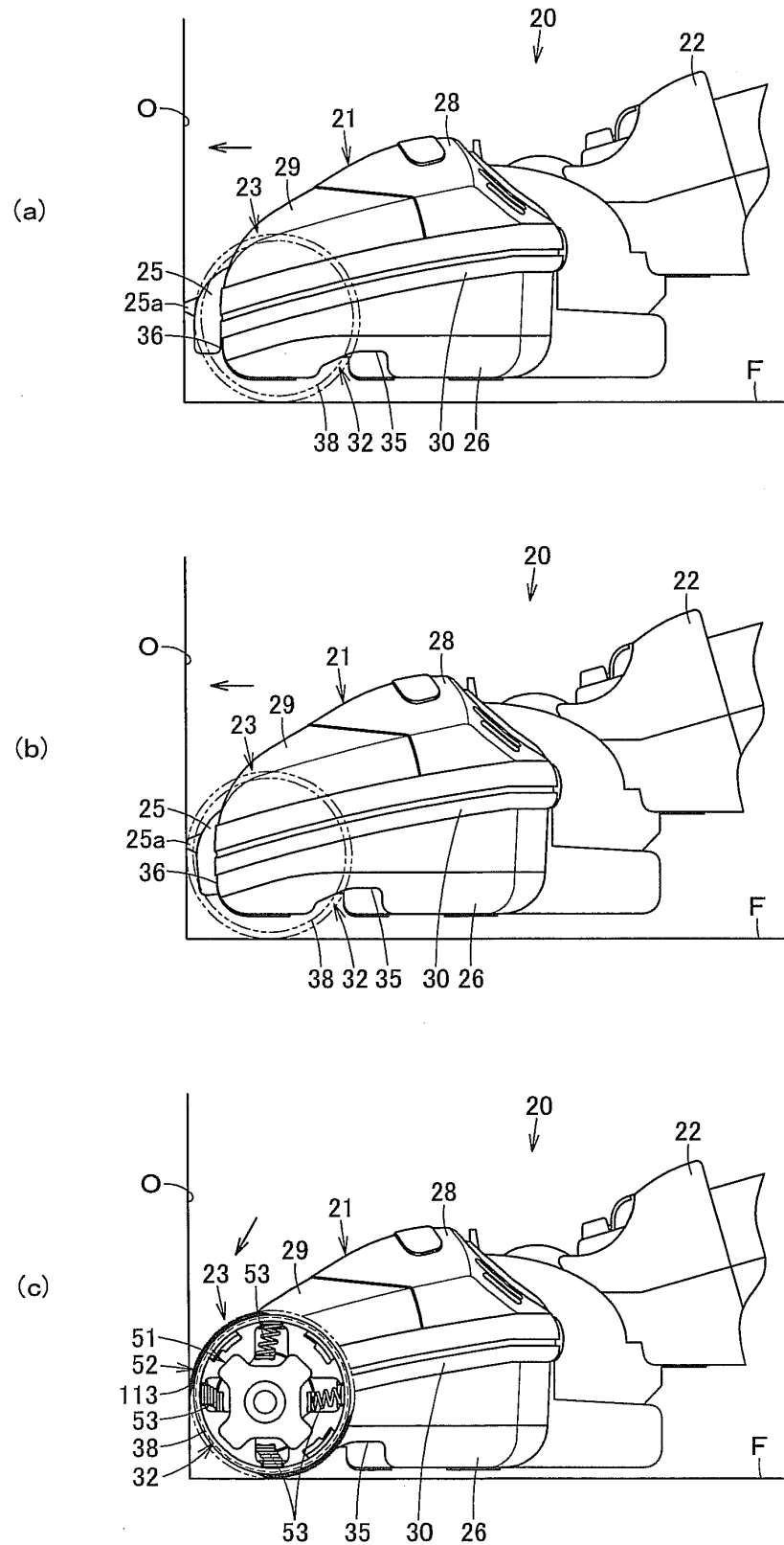


FIG. 22

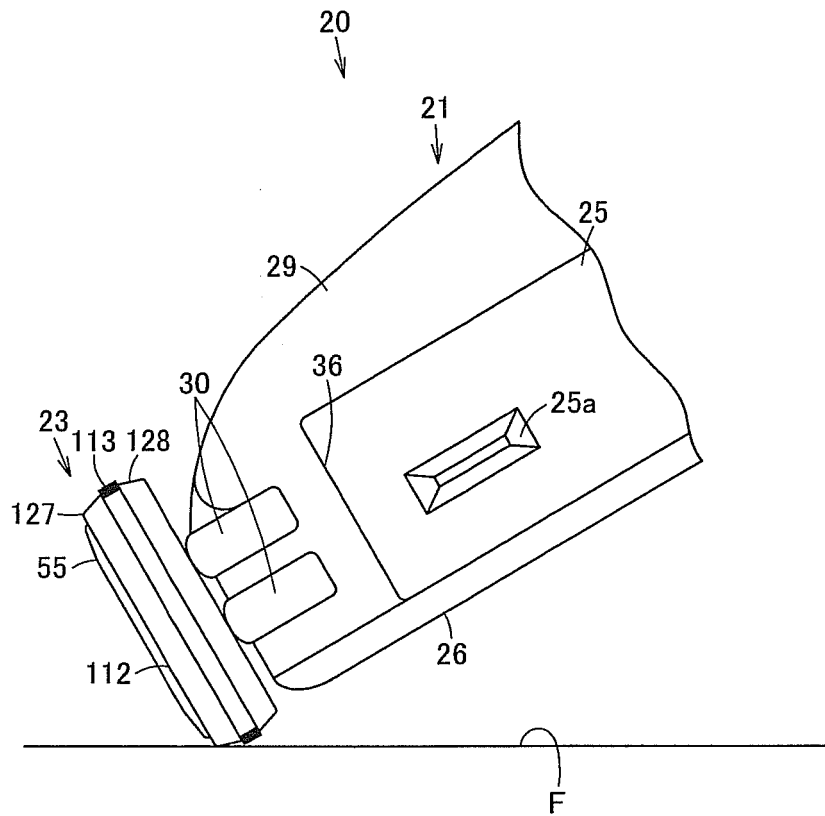


FIG. 23

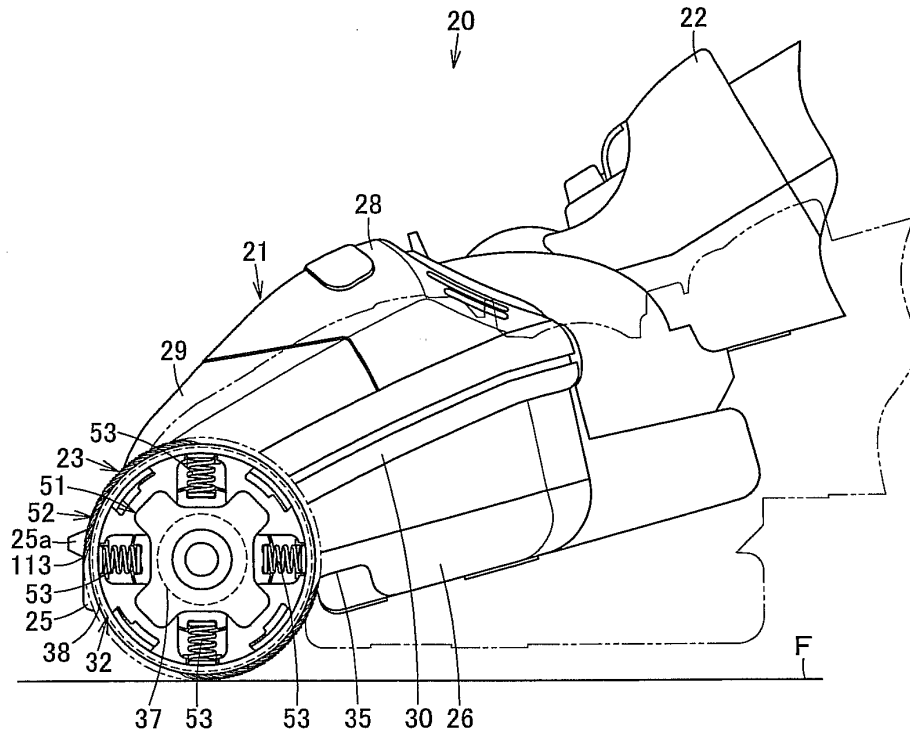


FIG. 24

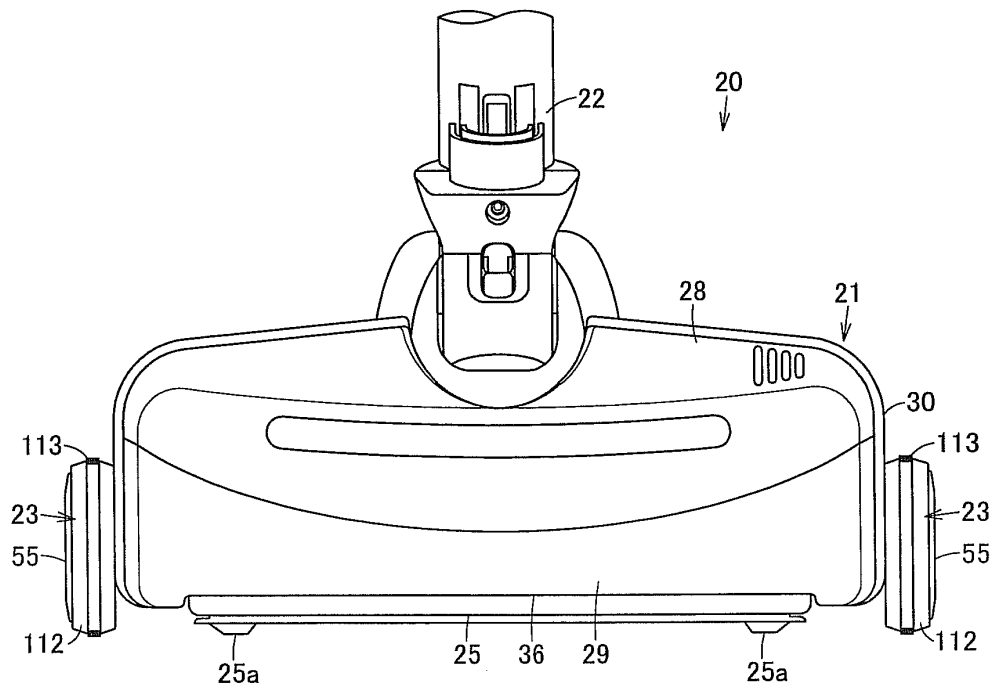


FIG. 25

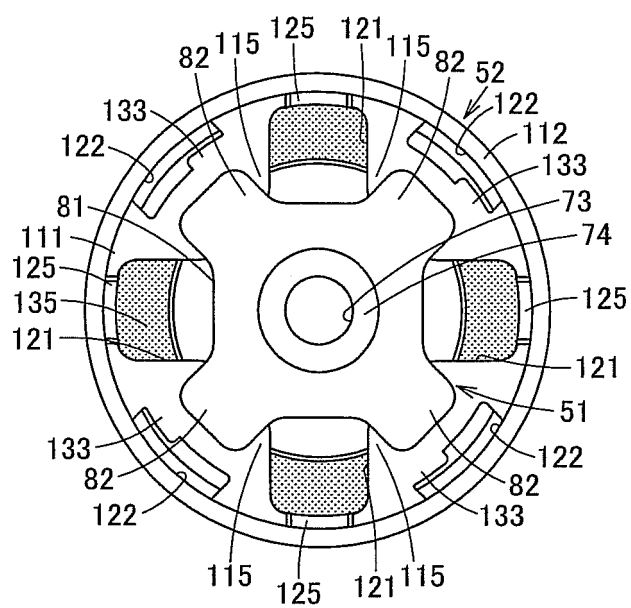


FIG. 26

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/056914

A. CLASSIFICATION OF SUBJECT MATTER

A47L9/02(2006.01) i, A47L9/04(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L9/02, A47L9/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

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.
X	JP 4-122230 A (Matsushita Electric Industrial Co., Ltd.),	1, 3, 4, 6, 9,
Y	22 April 1992 (22.04.1992),	10, 12, 20
A	entire text; all drawings (Family: none)	5, 7, 8, 13 2, 11, 14-19
X	JP 5-245072 A (Matsushita Electric Industrial Co., Ltd.),	1, 3, 4, 6, 9,
Y	24 September 1993 (24.09.1993),	10, 12, 20
A	entire text; all drawings (Family: none)	5, 7, 8, 13 2, 11, 14-19

☒ 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
10 June, 2010 (10.06.10)Date of mailing of the international search report
22 June, 2010 (22.06.10)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/056914

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 405729/1990 (Laid-open No. 93051/1992) (NEC Home Electronics Ltd.), 13 August 1992 (13.08.1992), entire text; all drawings (Family: none)	1, 2, 9, 10, 20 5, 13 3, 4, 6-8, 11-12, 14-19
Y A	JP 10-243897 A (Sharp Corp.), 14 September 1998 (14.09.1998), paragraph [0002] (Family: none)	5 1-4, 6-20
Y A	JP 2003-61873 A (Akihiro HIGASHINAKA), 04 March 2003 (04.03.2003), entire text; all drawings (Family: none)	7, 8 1-6, 9-20
Y A	JP 2003-33301 A (Eiichi OMORI), 04 February 2003 (04.02.2003), entire text; all drawings (Family: none)	7, 8 1-6, 9-20
Y A	JP 2008-253853 A (Sanyo Electric Co., Ltd.), 23 October 2008 (23.10.2008), entire text; all drawings (Family: none)	13 1-12, 14-20

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/056914

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The invention in claim 1 is not novel and does not have a special technical feature, since the invention is disclosed JP 4-122230 A (Matsushita Electric Industrial Co., Ltd.), 22 April 1992 (22.04.1992), entire text, all drawings; JP 5-245072 A (Matsushita Electric Industrial Co., Ltd.), 24 September 1993 (24.09.1993), entire text, all drawings; and the microfilm of the specification and drawings annexed to the request of Japanese utility model application No. 2-405729 (Laid-open No. 4-93051), (NEC Home Electronics Ltd.), 13 August 1992 (13.08.1992), entire text, all drawings.

(continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/056914

Continuation of Box No.III of continuation of first sheet(2)

As a result of judging special technical features with respect to claims dependent on claim 1, it is recognized that the following three inventions are involved.

(Invention 1) the group consisting of claims 1 - 6 and claims 9 - 13, 20 referring to any one of claims 1 - 6

(Invention 2) the group consisting of claims 7 - 8 and claims 9 - 13, 20 referring to any one of claims 7 - 8

(Invention 3) the group consisting of claims 14 - 19 and claim 20 referring to any one of claims 14 - 19

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 11178758 A [0003]