(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 554 087 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.02.2013 Bulletin 2013/06

(21) Application number: **10848989.9**

(22) Date of filing: **06.09.2010**

(51) Int Cl.:
A47L 9/04 *(2006.01)*

(86) International application number:
PCT/JP2010/065224

(87) International publication number:
WO 2011/121816 (06.10.2011 Gazette 2011/40)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **30.03.2010 JP 2010079055**

(71) Applicants:
- **Kabushiki Kaisha Toshiba**
  Minato-ku
  Tokyo 105-8001 (JP)
- **Toshiba Consumer Electronics Holdings Corporation**
  Tokyo 101-0021 (JP)
- **Toshiba Home Appliances Corporation**
  Tokyo 101-0021 (JP)

(72) Inventors:
- **MORISHITA, Atsushi**
  (JP)
- **SUZUKI, Hitoshi**
  (JP)

(74) Representative: **O'Connell, David Christopher et al**
Haseltine Lake LLP
Redcliff Quay
120 Redcliff Street
Bristol BS1 6HU (GB)

(54) ROTATING CLEANING BODY UNIT, SUCTION MOUTH BODY, AND ELECTRIC CLEANER

(57) In the embodiment of the present invention, a rotary cleaning body unit which is provided with a rotary cleaning body using a turbine as a driving motor and can drive the rotary cleaning body with a high torque without lowering suction power of an electric vacuum cleaner, a suction port body, and an electric vacuum cleaner are proposed. The rotary cleaning body unit comprising: a turbine41; a planetary gear mechanism 43 having a drive shaft connected to the turbine41; and a rotary cleaning body 44 connected to a driven shaft of the planetary gear mechanism 43.

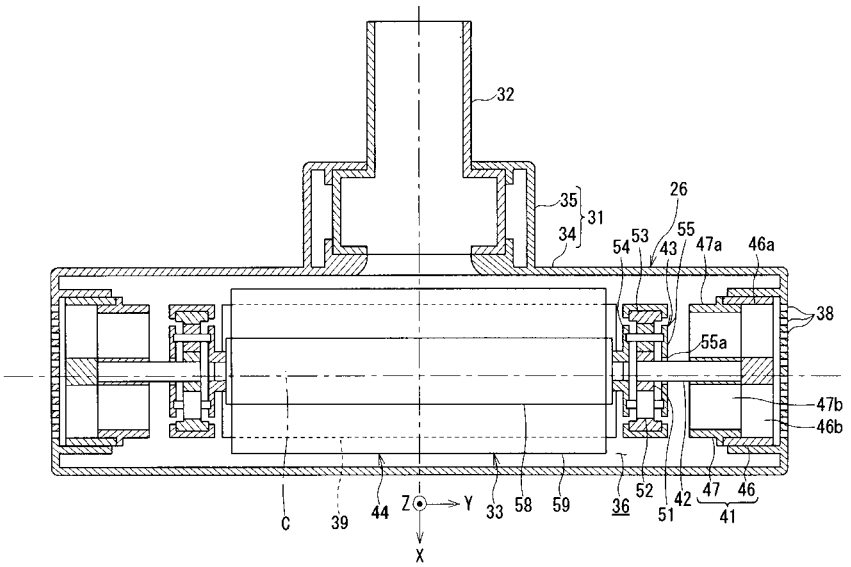

FIG. 2

EP 2 554 087 A1

Description

Technical Field

[0001] An embodiment according to the present invention relates to a rotary cleaning body unit provided with a rotary cleaning body using a turbine as a driving motor, a suction port body, and an electric vacuum cleaner.

Background Art

[0002] In general, an electric vacuum cleaner is provided with a suction port body. The suction port body has a suction port on a bottom surface of a suction port main body. The suction port body suctions dust on a surface to be cleaned together with air through the suction port.
[0003] A suction port body provided with a rotary cleaning body arranged in the suction port has been known. The suction port body is provided with an electric motor or a turbine as a driving motor of the rotary cleaning body.
[0004] The suction port body provided with the rotary cleaning body using the turbine as the driving motor is provided with a transmission mechanism for transmitting a torque of the turbine (See Patent Document 1, for example).

Citation List

Patent Document

[0005] Patent Document 1: Japanese Patent Laid-Open No. 2006-204781

Brief Description of the Drawings

[0006]

Fig. 1 is a perspective view illustrating an appearance of an electric vacuum cleaner according to an embodiment of the present invention.
Fig. 2 is a plan sectional view illustrating a suction port body according to the embodiment of the present invention.
Fig. 3 is a plan sectional view illustrating the suction port body according to the embodiment of the present invention.
Fig. 4 is a side view illustrating a planetary gear mechanism of the suction port body in a simplified manner according to the embodiment of the present invention.
Fig. 5 is a longitudinal sectional view of the suction port body according to the embodiment of the present invention.
Fig. 6 is a plan sectional view illustrating another example of the suction port body according to the embodiment of the present invention.

Description of Embodiment

[0007] An embodiment of an electric vacuum cleaner according to the present invention will be described below.
[0008] First, regarding a suction port body, its size and weight (mass) are limited, considering portability in a use state of the electric vacuum cleaner and easy operability. Due to this limitation, a turbine and an electric motor which are driving motors of a rotary cleaning body have their volume (occupied capacity) and weight limited.
[0009] Thus, in the suction port body of Patent Document 1, a rotating axis of the turbine is arranged orthogonally to a rotating axis of the rotary cleaning body, and a rotation radius of the turbine is ensured as large as possible, in order to obtain an output of the turbine as large as possible.
[0010] However, the suction port body of Patent Document 1 needs a speed reduction mechanism composed of a plurality of gears and a transmission mechanism composed of mechanisms such as a plurality of timing belts, bevel gears in order to transmit a torque from the turbine to the rotary cleaning body. The transmission mechanism has many friction portions and sliding portions, which results in a large mechanical loss.
[0011] Moreover, the suction port body provided with the rotary cleaning body using the turbine as the driving motor drives the turbine by diverting a part of a suction force of an electric blower, and thus, it is difficult to obtain a sufficient torque within a range not lowering a suction power of the electric vacuum cleaner. For example, it may be difficult for the suction port body provided with the rotary cleaning body using the turbine as the driving motor to drive the rotary cleaning body on a surface to be cleaned covered by a carpet.
[0012] In the embodiment of the present invention, a rotary cleaning body unit which is provided with a rotary cleaning body using a turbine as a driving motor and can drive the rotary cleaning body with a high torque without lowering suction power of an electric vacuum cleaner, a suction port body, and an electric vacuum cleaner are proposed.
[0013] In order to solve the above-described problem, the rotary cleaning body unit according to the embodiment of the present invention is characterized by having a turbine, a planetary gear mechanism having a drive shaft connected to the turbine, and a rotary cleaning body connected to a driven shaft of the planetary gear mechanism.
[0014] Moreover, the suction port body according to the embodiment of the present invention is characterized by having a suction port main body having an air inlet, a dust suction port formed in a bottom wall, and a suction chamber in which the air inlet and the dust suction port are made to communicate with each other, a connection pipe tiltable on the suction port body and made to communicate with the suction chamber, and the rotary cleaning body unit accommodated in the suction chamber, the

rotary cleaning body is arranged in the dust suction port, and the turbine is arranged in a passage leading from the air inlet to the connection pipe.

[0015] Moreover, the electric vacuum cleaner according to the embodiment of the present invention is characterized by having a cleaner main body, an electric blower accommodated in the cleaning main body, and the suction port body made to communicate with the electric blower.

[0016] Subsequently, an embodiment of the rotary cleaning body unit, the suction port body, and the electric vacuum cleaner according to the present invention will be described by referring to Figs. 1 to 3.

[0017] Fig. 1 is a perspective view illustrating an appearance of the electric vacuum cleaner according to the embodiment of the present invention.

[0018] As illustrated in Fig. 1, an electric vacuum cleaner 1 is a so-called canister vacuum cleaner. The electric vacuum cleaner 1 is provided with a cleaner main body 2 arranged on a surface to be cleaned and a pipe portion 3 detachably connected to the cleaner main body 2.

[0019] The cleaner main body 2 is provided with a main body case 5, a pair of wheels 6 pivotally supported by both sides of the main body case 5, a dust separation and collection portion 7 accommodated in the main body case 5, an electric blower 8 made to communicate with the dust separation and collection portion 7, a controller 9 for controlling driving of the electric blower 8, and a power-supply cord 11 leading power to the electric blower 8.

[0020] The main body case 5 has a main body connection port 12 made to communicate with the dust separation and collection portion 7.

[0021] The dust separation and collection portion 7 separates and catches dust from air containing the dust sucked into the electric vacuum cleaner 1 by a negative pressure generated by the electric blower 8.

[0022] The wheel 6 is a traveling wheel having a large diameter for traveling the cleaner main body 2.

[0023] The controller 9 has a plurality of operation modes set in advance. The controller 9 alternatively selects one arbitrary operation mode from the plurality of operation modes in correspondence with an operation signal inputted from the pipe portion 3 and drives the electric blower 8. The respective operation modes are set with different inputs of the electric blower 8 and are associated with the operation signals inputted from the pipe portion 3.

[0024] The power-supply cord 11 is provided with a power plug 14 at a free end portion.

[0025] The pipe portion 3 suctions air containing dust (dust-containing air) from the surface to be cleaned by a negative pressure acting from the cleaner main body 2 with an operation of the electric blower 8 and guides the suctioned dust-containing air to the cleaner main body 2. The pipe portion 3 is provided with a connection pipe 19 detachably connected to the main body connection port 12 of the cleaner main body 2, a dust collecting hose 21 communicating with the connection pipe 19 and having flexibility, a hand operation pipe 22 communicating with the dust collecting hose 21, a grasping portion 23 provided protruding from the hand operation pipe 22, an operation portion 24 provided on the grasping portion 23, an extension pipe 25 detachably connected to and communicating with the hand operation pipe 22, and a suction port body 26 detachably connected to and communicating with the extension pipe 25.

[0026] The dust collecting hose 21 is formed having an elongated substantially cylindrical shape capable of being curved. One end of the dust collecting hose 21 is connected to the connection pipe 19. The dust collecting hose 21 is made to communicate with an inside of the cleaner main body 2 through the connection pipe 19.

[0027] One end of the hand operation pipe 22 is provided on another end of the dust collecting hose 21. The hand operation pipe 22 is made to communicate with an inside of the cleaner main body 2 through the connection pipe 19 and the dust collecting hose 21.

[0028] The grasping portion 23 is to operate the electric vacuum cleaner 1 by being grasped by a user of the electric vacuum cleaner 1. The grasping portion 23 is provided protruding from another end portion of the hand operation pipe 22 and is curved toward the one end portion of the hand operation pipe 22.

[0029] The operation portion 24 is provided with a switch corresponding to each operation mode. Specifically, the operation portion 24 is provided with a stop switch 24a for stopping the electric blower 8 and a start switch 24b for starting an operation of the electric blower 8. The user of the electric vacuum cleaner 1 can alternatively select an operation mode of the electric blower 8 by operating the operation portion 24.

[0030] The extension pipe 25 is formed having an elongated substantially cylindrical shape capable of extension/contraction. The extension pipe 25 is composed having a telescopic structure by overlapping a plurality of cylindrical bodies. One end of the extension pipe 25 is detachably connected to another end of the hand operation pipe 22. The extension pipe 25 is made to communicate with an inside of the cleaner main body 2 through the connection pipe 19, the hand operation pipe 22, and the dust collecting hose 21.

[0031] The suction port body 26 is detachably connected to one end of the extension pipe 25. The suction port body 26 is made to communicate with an inside of the cleaner main body 2 through the extension pipe 25, the hand operation pipe 22 and the dust collecting hose 21.

[0032] The electric vacuum cleaner 1 drives the electric blower 8 when the start switch 24b is operated and has a negative pressure act to the inside of the cleaner main body 2. The negative pressure acts to the suction port body 26 from the main body connection port 12 via the dust collecting hose 21, the hand operation pipe 22, and the extension pipe 25. By means of the negative pressure having acted on the suction port body 26, the electric vacuum cleaner 1 suctions dust accumulated on the sur-

face to be cleaned such as a floor together with air from the suction port body 26 and cleans the surface to be cleaned. The dust-containing air having been suctioned into the suction port body 26 is separated by the dust separation and collection portion 7 accommodated in the cleaner main body 2 into air and dust. The separated dust is caught by the dust separation and collection portion 7. On the other hand, the separated air passes through the dust separation and collection portion 7, is suctioned into the electric blower 8 and is discharged from the cleaner main body 2.

[0033] Fig. 2 is a plan sectional view illustrating the suction port body and the rotary cleaning body unit according to the embodiment of the present invention.

[0034] Fig. 3 is a plan sectional view illustrating the suction port body and the rotary cleaning body unit according to the embodiment of the present invention.

[0035] As illustrated in Figs. 2 and 3, the suction port body 26 is provided with a suction port main body 31 having a substantially cuboid box shape, a connection pipe 32 tiltable with respect to the suction port main body 31, and a rotary cleaning body unit 33 accommodated in the suction port main body 31.

[0036] Here, an advancing direction of the suction port body 26 (a solid line arrow X in Fig. 2) is assumed to be front and a direction opposite to that is assumed to be rear. Moreover, while the suction port body 26 is arranged on the substantially horizontal surface to be cleaned such as a floor surface, a left side (a solid line arrow Y in Figs. 2 and 3) when seen from the rear to the front is assumed to be left and a direction opposite to that is assumed to be right. Moreover, a +Z direction of a right coordinate system orthogonal to a front-and-rear direction and a right-and-left direction of the suction port body 26 is assumed to be up and a direction opposite to that is assumed to be down.

[0037] The suction port main body 31 is provided with a case body 34 having a short side in the front-and-rear direction on plan view and a long side in the right-and-left direction and a connection pipe holding portion 35 integrally formed on a rear portion of the case body 34.

[0038] The case body 34 is a hollow box-shaped body and has a suction chamber 36 therein. Moreover, the case body 34 is provided with a side wall having an air inlet 38 and a bottom wall having a dust suction port 39. The suction chamber 36 is open to an outer space of the case body 34 through the dust suction port 39 and the air inlet 38. The air inlet 38 can be arranged in a wall other than the bottom wall (side wall on front, rear, right or left or a top wall).

[0039] The connection pipe 32 is pivotally supported by a connection pipe holding portion 35 and is tiltable around an axis in a width direction of the suction port body 26. Moreover, the connection pipe 32 is made to communicate with the suction chamber 36 of the case body 34. The suction port body 26 suctions the dust-containing air and the air by having a negative pressure act on the dust suction port 39 and the air inlet 38 through the connection pipe 32 detachably connected to the extension pipe 25.

[0040] The rotary cleaning body unit 33 is accommodated in the suction chamber 36 of the case body 34. Moreover, the rotary cleaning body unit 33 is provided with a turbine 41 driven by the air suctioned through the air inlet 38, a turbine shaft 42 fixed to the turbine 41, a planetary gear mechanism 43 (planetary gearing) connected to the turbine shaft 42, and a rotary cleaning body 44 having a rotating axis C arranged in the dust suction port 39, pivotally supported by the planetary gear mechanism 43, and substantially coaxial to the rotating axis of the turbine 41. That is, the turbine 41, the turbine shaft 42, the planetary gear mechanism 43, and the rotary cleaning body 44 are accommodated in the suction chamber 36 of the suction port main body 31.

[0041] The turbine 41 is an axial-flow turbine and is provided with a guide blade portion 46 fixed to the case body 34 and a rotor blade portion 47 pivotally supported by the guide blade portion 46. The turbine 41, that is, the guide blade portion 46 and the rotor blade portion 47 have diameters approximately the same as a rotating diameter of the rotary cleaning body 44 when seen in the rotating axis C direction.

[0042] The guide blade portion 46 is provided with a substantially cylindrical shaped frame body 46a communicating with the air inlet 38 and a plurality of guide blades 46b formed integrally with the frame body 46a. The guide blade 46b guides the air flowing into the guide blade portion 46 through the air inlet 38 to the rotor blade portion 47.

[0043] The rotor blade portion 47 is provided with a substantially cylindrical shaped rotor blade frame body 47a pivotally supported by the frame body 46a of the guide blade portion 46 and a plurality of rotor blades 47b formed integrally with the rotor blade frame body 47a. The rotor blade portion 47 rotates around the rotating axis C by receiving the air guided by the guide blade 46b on the rotor blade 47b.

[0044] The numbers and shapes (blade sectional shapes) of the guide blade 46b and the rotor blade 47b are configured such that motion energy of the air suctioned through the air inlet 38 can be appropriately changed to rotational energy.

[0045] The turbine 41 may be either an axial-flow turbine or a radial-flow turbine. The turbine 41 according to this embodiment illustrated in Fig. 2 is an axial-flow turbine. In this case, the case body 34 guides the air through the air inlet 38 formed on the right and left side walls to the guide blade portion 46. As another example, the turbine 41 according to this embodiment illustrated in Fig. 3 is a radial-flow turbine. In this case, the case body 34 has the air flow in through the air inlet 38 opened in a rear wall (or may be a front wall or a top wall) in the vicinity of each of the right and left end portions toward the rotating axis C of the turbine 41 substantially at a right angle from the outer peripheral surface of the turbine 41 so as to obtain a driving force of the turbine 41.

[0046] The turbine shaft 42 is provided on a rotating

axis core (rotating axis C) of the rotor blade portion 47 and transmits rotation of the rotor blade portion 47 to the planetary gear mechanism 43.

[0047] The planetary gear mechanism 43 is a speed reduction mechanism for driving the rotary cleaning body 44 by reducing a speed of the driving force transmitted from the turbine 41 through the turbine shaft 42 and has the drive shaft connected to the turbine 41 and the driven shaft connected to the rotary cleaning body 44. Moreover, the planetary gear mechanism 43 is provided with a sun gear 51 having a drive shaft connected to the turbine shaft 42, a plurality of planetary gears 52 meshed with the sun gear 51 and revolving around the sun gear 51, an outer gear 53 meshed with the planetary gear 52 and fixed to the case body 34, and a planetary carrier 54 having driven shaft driven with revolving of the planetary gear 52 and connected to the rotary cleaning body 44 so as to drive the rotary cleaning body 44.

[0048] The sun gear 51 is connected to the turbine 41 through the turbine shaft 42 and rotates with the rotation of the rotor blade portion 47.

[0049] The planetary gear 52 is arranged around the sun gear 51.

[0050] The outer gear 53 has an annular shaped body containing the sun gear 51 and the planetary gear 52 and has an inner peripheral surface meshed with the planetary gear 52 and an outer peripheral surface fixed to the case body 34.

[0051] The planetary carrier 54 is arranged on a side surface close to the rotary cleaning body 44 of the planetary gear mechanism 43. Moreover, the planetary carrier 54 holds meshing among the planetary gear 52, the sun gear 51, and the outer gear 53 by holding a gear shaft 56 together with a planetary gear cover 55 arranged on a side surface close to the turbine 41 of the planetary gear mechanism 43. The planetary gear cover 55 has a penetrating port 55a through which the turbine shaft 42 is inserted at the center thereof.

[0052] The rotary cleaning body 44 is provided with a shaft body 58 held integrally with the planetary carrier 54 of the planetary gear mechanism 43 in rotational movement and a cleaning body 59 implanted in a helical manner in the axial direction of the shaft body 58.

[0053] The cleaning body 59 is a brush implanted in the helical manner in the axial direction of the shaft body 58, is provided so as to protrude in the radial direction of the shaft body 58 and constitutes the outer peripheral portion of the rotary cleaning body 44. The cleaning body 59 may be obtained by combining a brush and a blade or may be provided only with a blade.

[0054] The suction port body 26 configured as above pivotally supports the rotor blade portion 47, the turbine shaft 42, the sun gear 51, the planetary gear 52, the planetary carrier 54, and the rotary cleaning body 44 by the guide blade portion 46 of the turbine 41 and the outer gear 53 of the planetary gear mechanism 43. The rotary cleaning body unit 33 positions the drive shaft which is a rotation center of the turbine 41 (or the rotor blade portion 47 in more detail), the turbine shaft 42, and the sun gear 51 and the driven shaft which is a revolving center of the planetary gear 52 (that is, a rotation center of the planetary carrier 54) on substantially the same straight line. The straight line is positioned on substantially the same straight line of the rotating axis C of the rotary cleaning body 44.

[0055] The suction port body 26 according to this embodiment is provided with the turbine 41, the turbine shaft 42, and the planetary gear mechanism 43 as a pair on the both ends of the rotary cleaning body 44. As a result, the suction port body 26 can ensure a sufficient driving force of the rotary cleaning body 44. The suction port body 26 may have the turbine 41, the turbine shaft 42, and the planetary gear mechanism 43 provided only on either one of the ends of the rotary cleaning body 44.

[0056] Fig. 4 is a side view illustrating the planetary gear mechanism of the suction port body according to an embodiment of the present invention in a simplified manner.

[0057] As illustrated in Fig. 4, the planetary gear mechanism 43 of the suction port body 26 is a speed reduction mechanism using the turbine shaft 42 connected to the sun gear 51 as an input axis and the rotary cleaning body 44 (or the shaft body 58 in more detail) integrally held by the planetary carrier 54 as an output axis. The planetary gear mechanism 43 is provided with the sun gear 51, the planetary gear 52, and the outer gear 53 from the inside when seen from the rotating axis C.

[0058] The planetary gear 52 is arranged at an apex position of each of a regular polygonal shape having the sun gear 51 at its center or more specifically, at an apex position of each of a regular triangle.

[0059] The planetary gear mechanism 43 rotates the sun gear 51 in one direction (a solid line arrow CW 1 in Fig. 4) by the driving force of the turbine 41. Moreover, the planetary gear mechanism 43 rotates the plurality of planetary gears 52 in another direction (a solid line arrow CCW in Fig. 4) around the respective gear shafts 56 with rotation of the sun gear 51 and also revolves them in one direction (a solid line arrow CW2 in Fig. 4) around the rotating axis C. Furthermore, the planetary gear mechanism 43 rotates the planetary carrier 54 in one direction (the solid line arrow CW2 in Fig. 4) around the rotating axis C with the revolving of the planetary gear 52. At this time, the outer gear 53 holds the rotation with the sun gear 51, the planetary gear 52, and the planetary carrier 54.

[0060] At this time, the rotary cleaning body 44 rotates in one direction (the solid line arrow CW2 in Fig. 3) integrally with the planetary carrier 54.

[0061] The rotating direction of the rotary cleaning body 44 may be a direction for generating an advancing force (forward direction) in the suction port body 26 or may be a direction for generating a retreating force (backward direction) in the suction port body 26. The turbine 41 has the guide blade 46b and the rotor blade 47b formed as appropriate in correspondence with either of

the forward direction or the backward direction of the rotary cleaning body 44.

[0062] Fig. 5 is a longitudinal sectional view illustrating the suction port body according to the embodiment of the present invention.

[0063] As illustrated in Fig. 5, the suction port body 26 (or the case body 34 of the suction port main body 31 in more detail) has an auxiliary air inlet 60 (second air inlet) for blowing an air F so as to assist rotation of the rotary cleaning body 44, faced with the rotary cleaning body 44. The auxiliary air inlet 60 is opened in the case body 34 of the suction port main body 31 while being directed so as to blow the flow of the air F suctioned into the suction chamber 36 to the cleaning body 59 of the rotary cleaning body 44.

[0064] Fig. 6 is a plan sectional view illustrating another example of the suction port body according to the embodiment of the present invention.

[0065] In a rotary cleaning body unit 33A, the same configurations as those in the rotary cleaning body unit 33 are given the same reference numerals and duplicated explanation will be omitted.

[0066] As illustrated in Fig. 6, the rotary cleaning body unit 33A accommodated in the suction port body 26 is provided with a turbine 41A driven by air suctioned through the air inlet 38.

[0067] The turbine 41A is an axial-flow turbine and is provided with a bearing portion 61 provided on the guide blade portion 46 and a guide blade portion support shaft 62 fixed on the rotating axis of the rotor blade portion 47 and pivotally supported by the bearing portion 61.

[0068] The guide blade portion support shaft 62 is formed integrally with the turbine shaft 42 which is extended. Moreover, the guide blade portion support shaft 62 is configured so as not to prevent relative rotation between the guide blade portion 46 and the rotor blade portion 47 and is provided with a retaining swollen portion 62a so as not to be separated from the bearing portion 61.

[0069] Subsequently, an operation of the electric vacuum cleaner 1 according to this embodiment will be described.

[0070] A user of the electric vacuum cleaner 1 first connects the pipe portion 3 to the cleaner main body 2, that is, the dust collecting hose 21, the extension pipe 25, and the suction port body 26 in an appropriate order.

[0071] Subsequently, the user withdraws the power-supply cord 11 from the cleaner main body 2 and connects the power plug 14 to an outlet for supplying commercial power supply (not shown).

[0072] Subsequently, the user of the electric vacuum cleaner 1 grasps the grasping portion 23 and operates the start switch 24b.

[0073] Then, the control portion 9 drives the electric blower 8 in accordance with an operation mode set by the start switch 24b. A negative pressure is generated in the cleaner main body 2 and the pipe portion 3 by the driving of the electric blower 8, and the electric vacuum cleaner 1 suctions air through the air inlet 38 of the suction port body 26 and the dust suction port 39.

[0074] Subsequently, the user of the electric vacuum cleaner 1 arranges the suction port body 26 on the surface to be cleaned and reciprocally moves the hand operation pipe 22 and the extension pipe 25 back and forth while grasping the grasping portion 23.

[0075] Then, the suction port body 26 suctions the dust on the surface to be cleaned together with the air (dust-containing air) through the dust suction port 39 while reciprocally traveling on the surface to be cleaned back and forth. The dust-containing air suctioned through the dust suction port 39 is guided to the cleaner main body 2 through the connection pipe 32.

[0076] At this time, the suction port body 26 suctions air also through the air inlet 38. The air suctioned through the air inlet 38 is guided to the rotor blade portion 47 by the guide blade portion 46 of the turbines 41 and 41A, passes through the rotor blade portion 47 while rotating it, join together the dust-containing air suctioned through the dust suction port 39 in the suction chamber 36 and reaches the connection pipe 32. The rotation of the rotor blade portion 47 is inputted to the planetary gear mechanism 43 through the turbine shaft 42 and drives the rotary cleaning body 44. By means of the driving of the rotary cleaning body 44, the suction port body 26 cleans the dust on the surface to be cleaned and also polishes the surface to be cleaned. The dust cleaned by the rotary cleaning body 44 is suctioned into the suction port body 26 through the dust suction port 39. At this time, the flow of the air F suctioned through the auxiliary air inlet 60 into the suction chamber 36 is blown to the cleaning body 59 of the rotary cleaning body 44 and assists rotation of the rotary cleaning body 44.

[0077] The dust containing air suctioned into the suction port body 26 sequentially passes through the extension pipe 25, the hand operation pipe 22, and the dust collecting hose 21 and then, is guided to the cleaner main body 2.

[0078] The dust containing air guided to the cleaner main body 2 is suctioned into the dust separation and collection portion 7 and is separated into the dust and the air. The separated dust is caught by the dust separation and collection portion 7. On the other hand, the separated air passes through the dust separation and collection portion 7, is suctioned into the electric blower 8 and is discharged from the cleaner main body 2.

[0079] As described above, the electric vacuum cleaner 1 catches the dust suctioned from the suction port body 26.

[0080] In the rotary cleaning body units 33, the rotary cleaning body units 33A, the suction port body 26, and the electric vacuum cleaner 1 according to this embodiment, by configuring the rotation diameter of the rotary cleaning body 44 to be substantially the same as the diameters of the turbines 41 and 41A, the drive shaft which is a rotation center of the turbines 41 and 41A (or the rotor blade portion 47 in more detail), the turbine shaft 42, and the sun gear 51, the driven shaft which is a rev-

olution center of the planetary gear 52 (that is, the rotation center of the planetary carrier 54), and the rotation center of the rotary cleaning body 44 can be arranged on substantially the same straight line (rotating axis C), and when the torque is transmitted from the turbines 41 and 41A to the rotary cleaning body 44, the elements generating a mechanical loss caused by friction and sliding can be made as small as possible. Specifically, the mechanical loss substantially depends on a mechanical loss of the planetary gear mechanism 43, and reduction of a loss of the entire mechanism driving the rotary cleaning body 44 can be easily reduced.

[0081] Moreover, in the rotary cleaning body units 33 and 33A, the suction port body 26, and the electric vacuum cleaner 1 according to this embodiment, even if the torque generated by the turbines 41 and 41A is not sufficient to directly drive the rotary cleaning body 44, since the planetary gear mechanism 43 having a speed reduction ratio relatively larger than a speed reducer composed of a spur gear or a bevel gear which can be incorporated in the same capacity (volume) is provided, the torque which can reliably drive the rotary cleaning body 44 can be obtained even on the surface to be cleaned with high friction coefficient such as that on which a carpet is laid.

[0082] Moreover, the rotary cleaning body unit 33A according to this embodiment improves convenience of handling and assembling performance of the suction port body 26 by configuring the turbine 41, the turbine shaft 42, the planetary gear mechanism 43, and the rotary cleaning body 44 as a single module.

[0083] Therefore, according to the electric vacuum cleaner 1, the suction port body 26, and the rotary cleaning body units 33 and 33A according to this embodiment, the rotary cleaning body 44 using the turbines 41 and 41A as driving motors is provided, and the rotary cleaning body 44 can be driven with a high torque without lowering a suction power of the electric vacuum cleaner 1.

[0084] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention. Indeed, the novel apparatuses and units described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the apparatuses and units described herein may be made without departing from the spirit of the invention. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

Description of Symbols

[0085]

1	electric vacuum cleaner
2	cleaner main body
3	pipe portion
5	main body case
6	wheels
7	dust separation and collection portion
8	electric blower
9	controller
11	power-supply cord
12	main body connection port
14	power plug
19	connection pipe
21	dust collecting hose
22	hand operation pipe
23	grasping portion
24	operation portion
24a	stop switch
24b	start switch
25	extension pipe
26	suction port body
31	suction port main body
32	connection pipe
33	rotary cleaning body unit
34	case body
35	connection pipe holding portion
36	suction chamber
38	air inlet
39	dust suction port
41,41A	turbine
42	turbine shaft
43	planetary gear mechanism
44	rotary cleaning body
46	guide blade portion
46a	frame body
46b	guide blades
47	rotor blade portion
47a	rotor blade frame body
47b	rotor blade
51	sun gear
52	planetary gears
53	outer gear
54	planetary carrier
55	planetary gear cover
55a	penetrating port
56	gear shaft
58	shaft body
59	cleaning body
60	auxiliary air inlet
61	bearing portion
62	guide blade portion support shaft
62a	retaining swollen portion

Claims

1. A rotary cleaning body unit comprising:

a turbine;

a planetary gear mechanism having a drive shaft connected to the turbine; and

a rotary cleaning body connected to a driven shaft of the planetary gear mechanism.

2. The rotary cleaning body unit according to claim 1, wherein
a rotating shaft of the turbine, the drive shaft and the driven shaft of the planetary gear mechanism, and a rotating axis of the rotary cleaning body are arranged on a substantially same axis.

3. The rotary cleaning body unit according to claim 1 or 2, wherein
the planetary gear mechanism further includes:

a sun gear connected to the turbine;
a planetary gear meshed with the sun gear and revolving around the sun gear;
an outer gear meshed with the planetary gear; and
a planetary carrier driven with revolution of the planetary gear and connected to the rotary cleaning body.

4. The rotary cleaning body unit according to any one of claims 1 to 3, wherein
the turbine and the planetary gear mechanism are provided in a pair on both ends of the rotary cleaning body.

5. The rotary cleaning body unit according to any one of claims 1 to 4, wherein
the turbine includes:

a rotor blade portion having a plurality of rotor blades; and
a guide blade portion having a plurality of guide blades for leading air to the rotor blade portion.

6. The rotary cleaning body unit according to claim 5, further comprising:

a bearing portion provided on the guide blade portion; and
a guide blade portion support shaft fixed on a rotating axis of the rotor blade portion and pivotally supported by the bearing portion.

7. A suction port body comprising:

a suction port main body having an air inlet, a dust suction port formed in a bottom wall, and a suction chamber in which the air inlet and the dust suction port are made to communicate with each other;
a connection pipe tiltable on the suction port body and made to communicate with the suction chamber; and
a rotary cleaning body unit accommodated in the suction chamber, according to any one of claims 1 to 6, wherein
the rotary cleaning body is arranged in the dust suction port and the turbine is arranged in a passage leading from the air inlet to the connection pipe.

8. The suction port body according to claim 7, wherein the outer gear of the planetary gear mechanism is fixed to the suction port main body.

9. The suction port body according to claim 7 or 8, wherein
the air inlet is arranged on right and left side walls with respect to an advancing direction of the suction port main body.

10. The suction port body according to claim 7 or 8, wherein
the air inlet is arranged on a top wall of the suction port main body.

11. The suction port body according to any one of claims 7 to 10, wherein
the suction port main body has a second air inlet which is faced with the rotary cleaning body and blows air so as to assist rotation of the rotary cleaning body.

12. An electric vacuum cleaner comprising:

a cleaner main body;
an electric blower accommodated in the cleaner main body; and
the suction port body made to communicate with the electric blower, according to any one of claims 7 to 11.

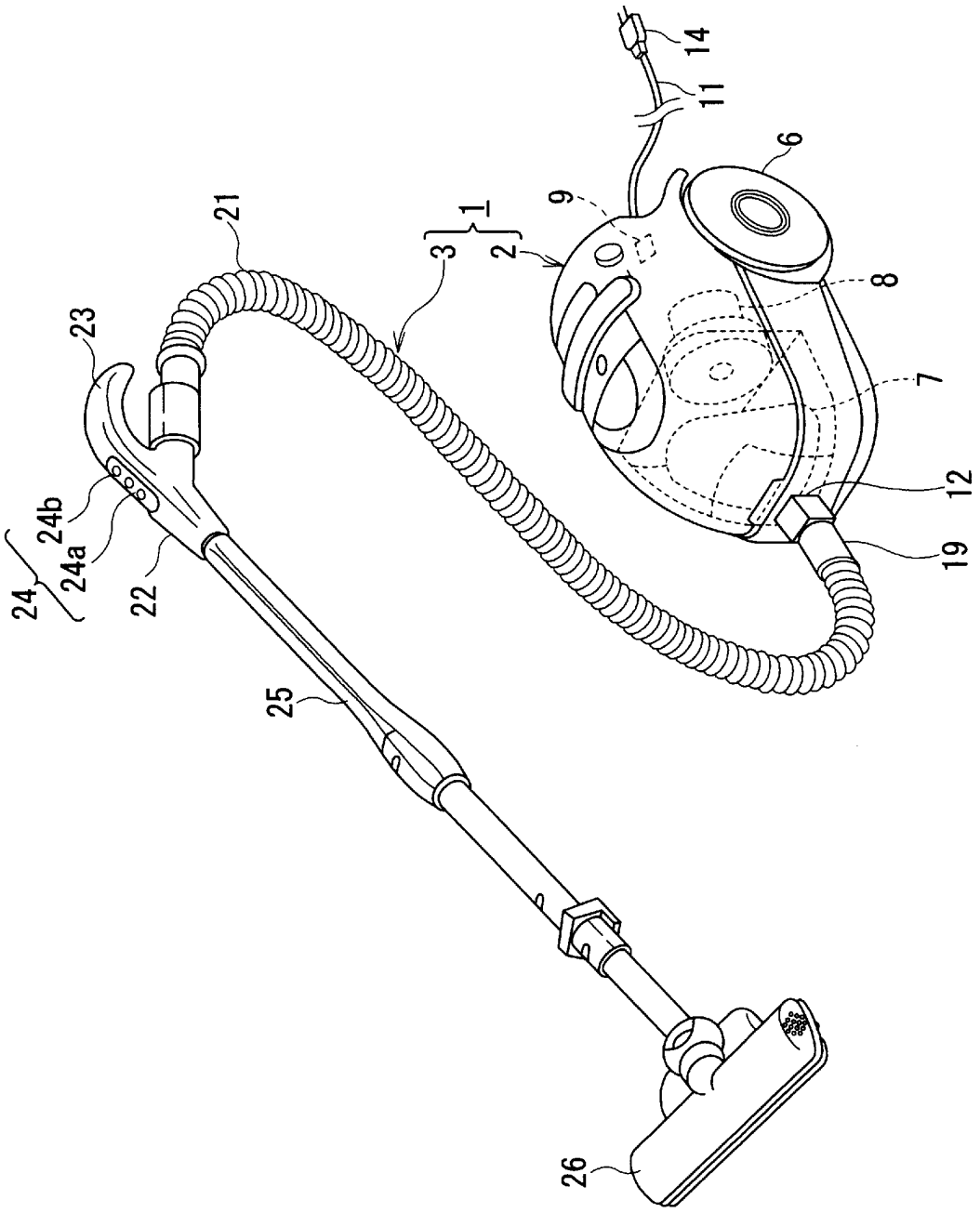

FIG. 1

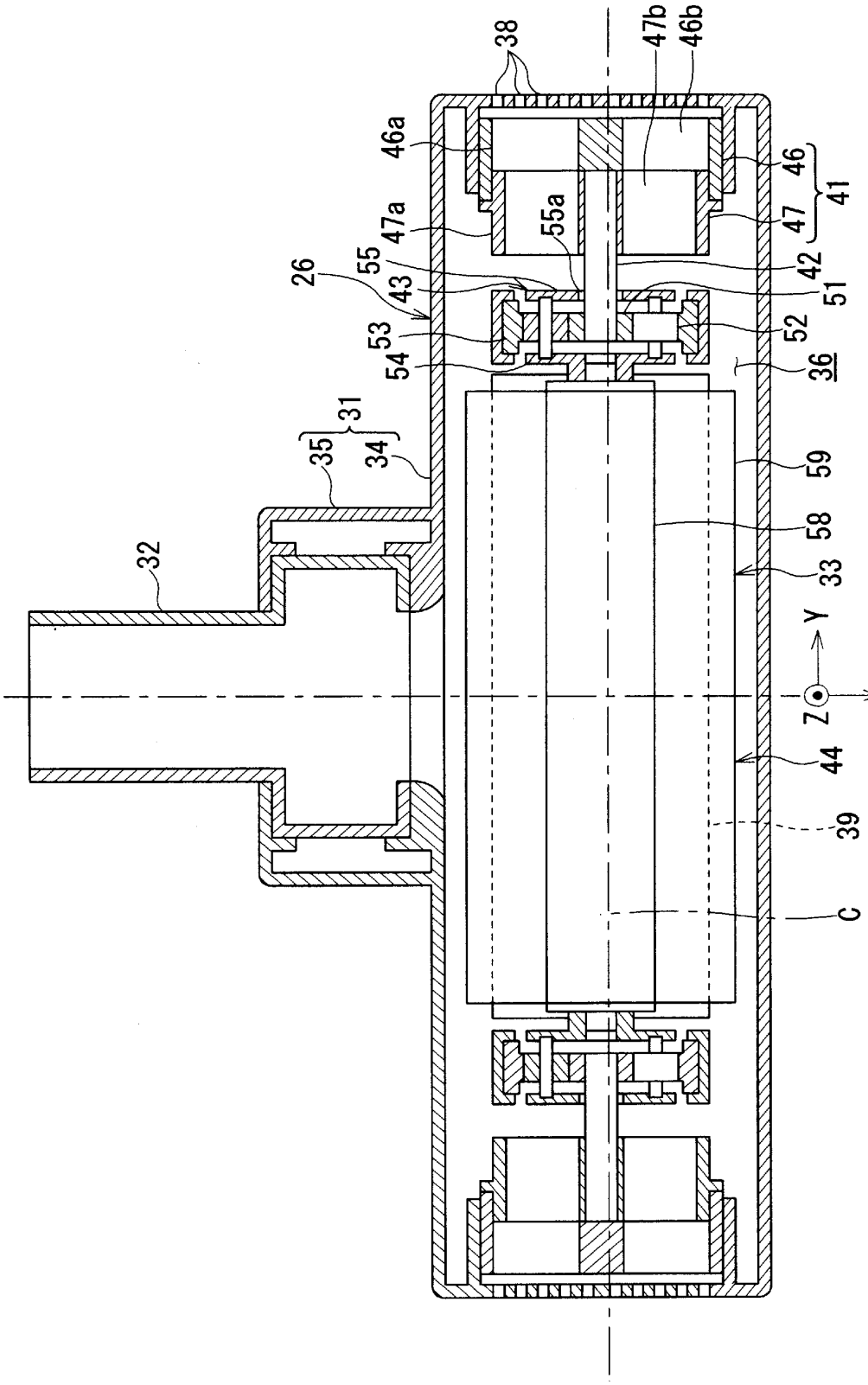
38
47b
46b
46a
46
41
47
47a
55a
55
26
43
42
51
53
52
54
36
31
35
34
59
58
32
33
Y
Z
X
44
39
C

FIG. 2

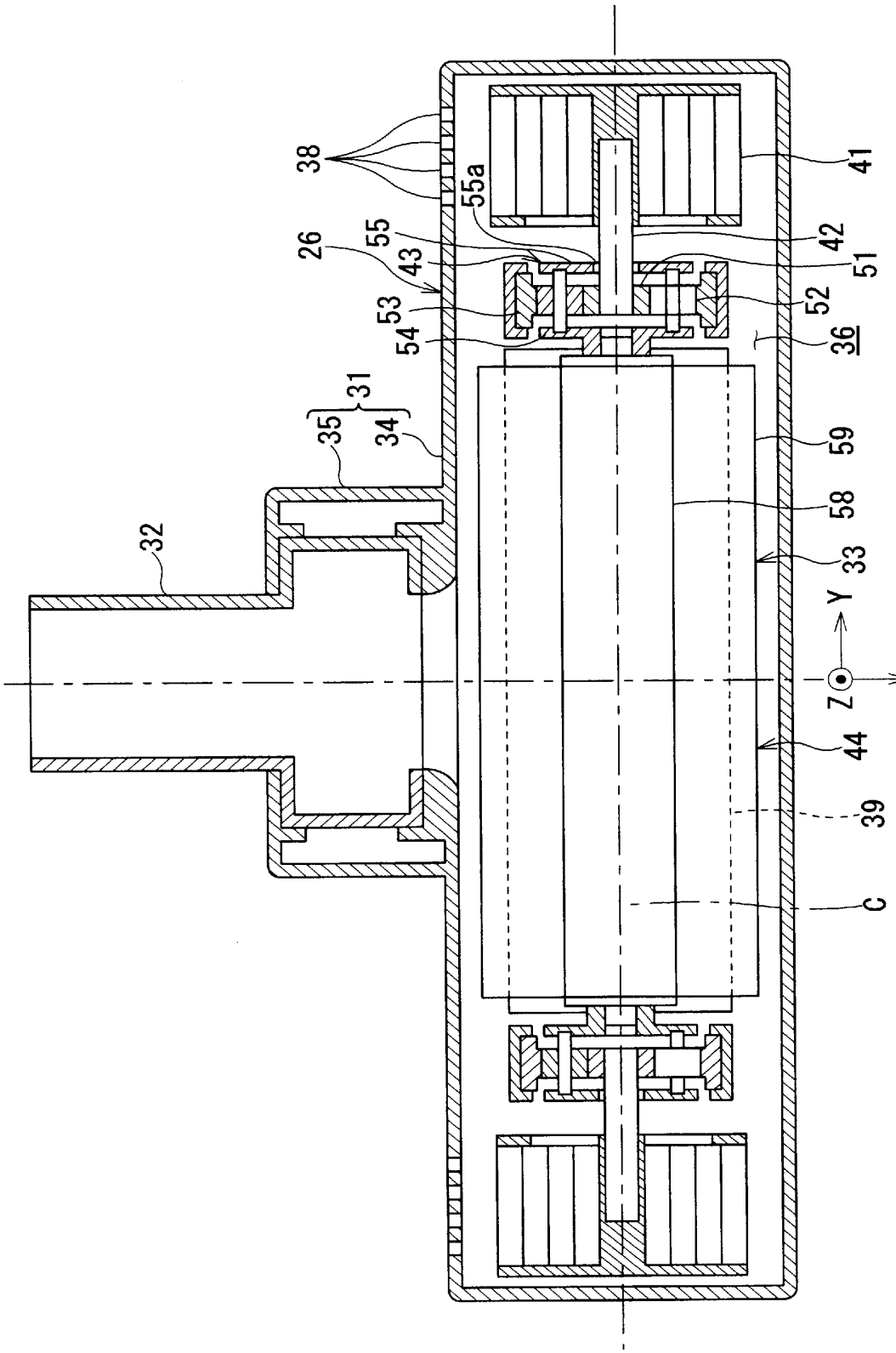

FIG. 3

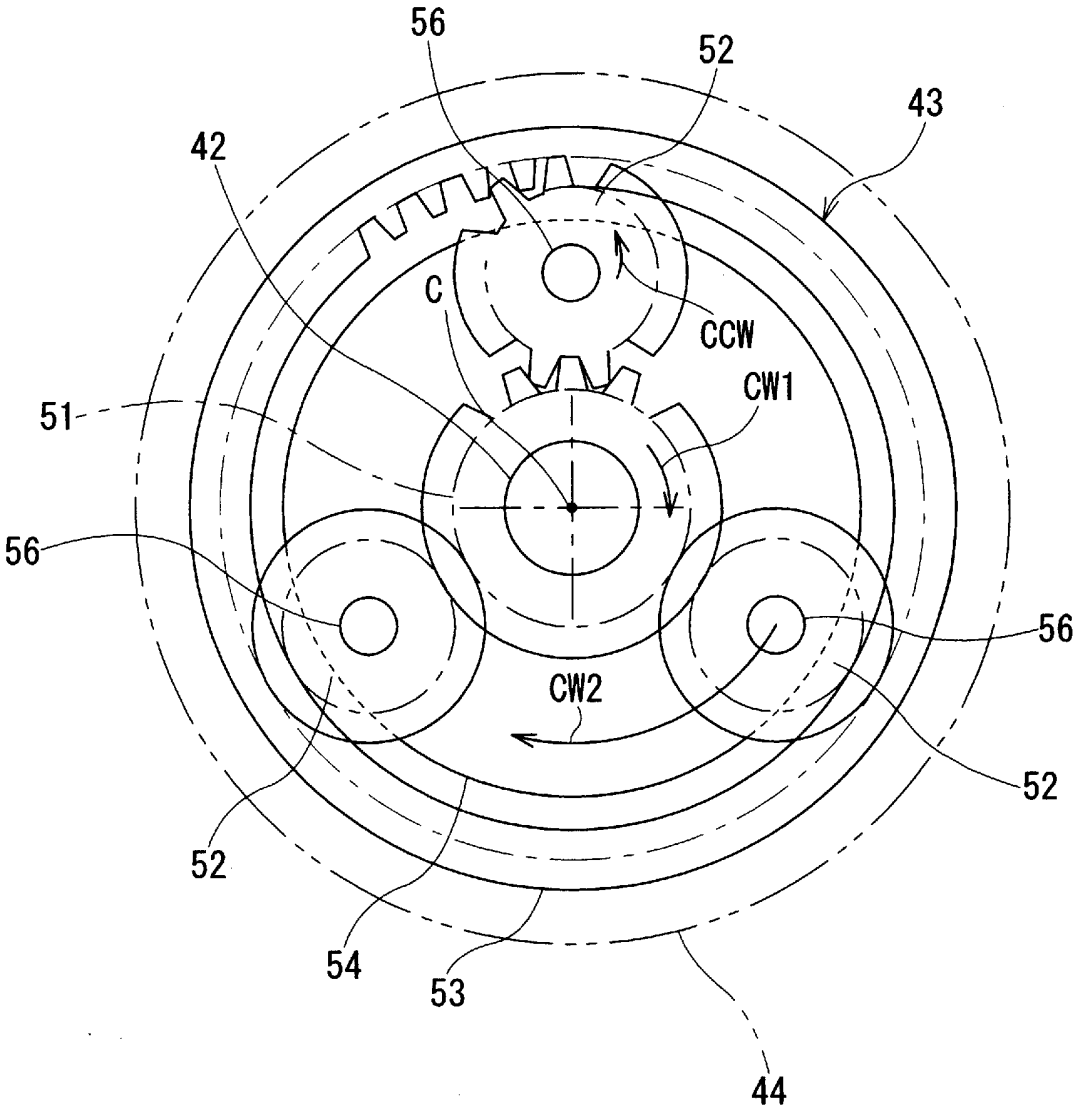

FIG. 4

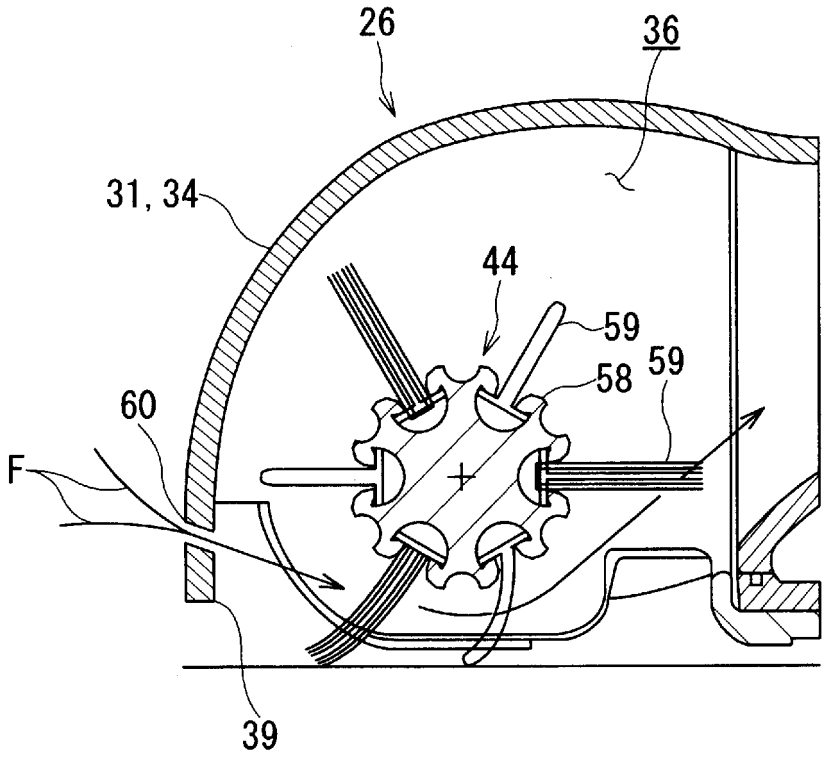

FIG. 5

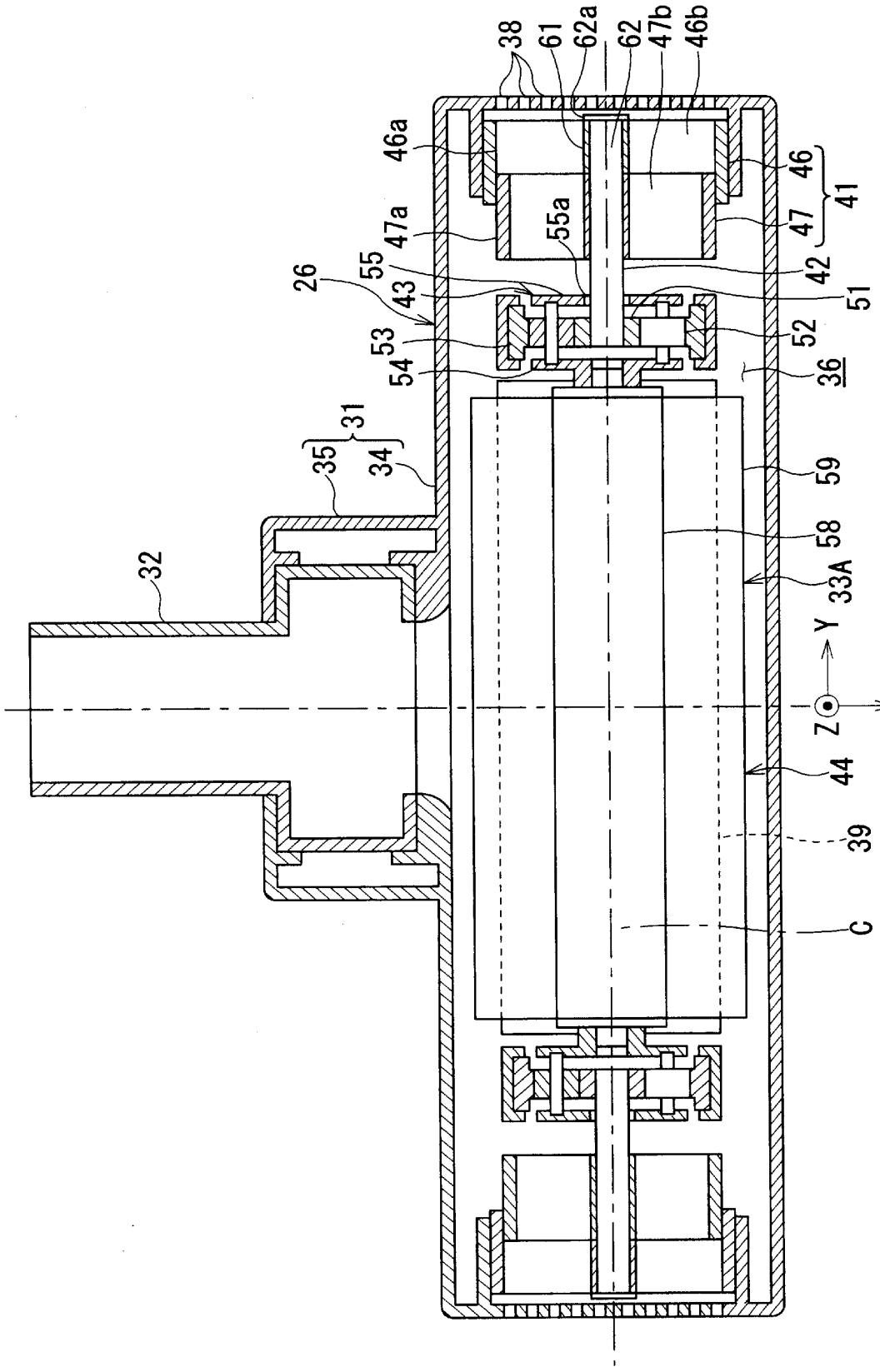
38
61
62a
62
47b
46b
46a
46
41
47
47a
55a
55
42
26
43
51
53
52
54
36
31
35
34
59
58
32
33A
Y
Z
X
44
39
C

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/065224

A. CLASSIFICATION OF SUBJECT MATTER
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)
A47L9/04

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 Y	JP 2002-85299 A (Hitachi, Ltd.), 26 March 2002 (26.03.2002), entire text; all drawings (Family: none)	1-3,5-10,12 11
X Y	JP 11-253371 A (Hitachi, Ltd.), 21 September 1999 (21.09.1999), entire text; all drawings (Family: none)	1-4,7-8,10, 12 11
Y	JP 2000-354567 A (Toshiba Tec Corp.), 26 December 2000 (26.12.2000), paragraph [0064] (Family: none)	11

☐ 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	Date of mailing of the international search report
22 September, 2010 (22.09.10)	05 October, 2010 (05.10.10)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

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 2006204781 A **[0005]**