



(11) **EP 2 252 189 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
06.01.2016 Bulletin 2016/01

(51) Int Cl.:
A47L 9/22 *(2006.01)* **A47L 9/00** *(2006.01)*

(21) Application number: **09709649.9**

(86) International application number:
PCT/JP2009/000444

(22) Date of filing: **05.02.2009**

(87) International publication number:
WO 2009/101775 (20.08.2009 Gazette 2009/34)

(54) **ELECTRIC VACUUM CLEANER**
ELEKTRISCHER STAUBSAUGER
ASPIRATEUR ÉLECTRIQUE

(84) Designated Contracting States:
**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 TR**

(30) Priority: **12.02.2008 JP 2008030993**
29.02.2008 JP 2008051013

(43) Date of publication of application:
24.11.2010 Bulletin 2010/47

(73) Proprietors:
• **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:
• **IWATA, Yoshiyuki**
Tokyo 105-8001 (JP)
• **OSHIMA, Ikuo**
Tokyo 105-8001 (JP)
• **KINOSITA, Yuusuke**
Tokyo 105-8001 (JP)

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

(56) References cited:
DE-C- 519 249 JP-A- 4 193 143
JP-A- 5 084 194 JP-A- 5 084 195
JP-A- 60 103 929 JP-A- 2001 204 655
JP-A- 2001 204 655

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[Technical Field]

[0001] The present invention relates to an electric vacuum cleaner in which an electric blowing part is elastically supported by elastic members.

[Background Art]

[0002] Such kinds of electric vacuum cleaners have conventionally included a vacuum cleaner main body in which an electric blower having a centrifugal fan and a motor for rotating the centrifugal fan in the front and rear is housed in a blowing chamber as a housing chamber formed by partitioning the inside of a main body case. The electric blower is held, in a manner that its outer circumferential surface on the motor side is clamped, from the upper side and lower side, by a pair of plate springs opposite to each other, so as to be elastically supported with respect to the main body case, and thus vibration of the electric blower can be hardly transmitted to the main body case (see JP-4-193143-A).

[0003] JP-2001-204655-A, corresponding to the preamble of claim 1, discloses an arrangement in which there are two elastic members and one further elastic member supporting the electric blowing part with respect to the main body case. JP-5-084195 discloses in Figure 10 an arrangement in which there are two groups of springs at different axial positions of the blower, each group containing a pair of springs.

[Technical Problem]

[0004] In the above electric vacuum cleaner, vibration in the radial direction (upward/downward and leftward/rightward), etc., with driving of the electric blower are elastically supported by the plate springs.

[0005] However, the centrifugal fan side vibrates larger than the motor side, the fan being rotated by the motor, and therefore run-out of a rotation axis, i.e., an axial run-out, is caused that cannot be sufficiently absorbed by the above constitution.

[0006] The present invention has been made in view of the above problem, and aims at providing an electric vacuum cleaner capable of effectively suppressing the axial run-out of an electric blowing part.

[Technical Solution]

[0007] In the present invention, an electric blowing part; a main body case in which a housing chamber for housing the electric blowing part therein is provided; and a plurality of elastic member groups each including a pair of elastic members which is formed along at least a part of an outer circumference of the electric blowing part and supports the electric blowing part with respect to the main

body case at positions opposite to each other, wherein the elastic member groups are arranged at positions different from each other in an axial direction of the electric blowing part, and

characterized in that;

three elastic member groups are arranged shifted from each other by 60 degrees in the circumferential direction of the electric blowing part,

one of the elastic member groups is arranged at a position corresponding to the center of gravity of the electric blowing part, and

the other elastic member groups are arranged at positions between which the one elastic member group is located.

[0008] Additionally, an electric vacuum cleaner includes: a first coil spring group including a plurality of first coil springs which are located between an electric blower and the cover body and elastically support the electric blower with respect to the cover body; and a second coil spring group including a plurality of second coil springs which are located between the cover body and the main body case and elastically support the electric blowing part with respect to the main body case, and the first coil spring and second coil spring are arranged so as to shift from each other in the circumferential direction of the electric blowing part.

[Advantageous Effects]

[0009] Since a plurality of elastic member groups for supporting an electric blowing part with respect to a main body case are arranged at positions different from each other in an axial direction of the electric blowing part and so that elastic members of each group are apart from each other at an approximately even interval in a circumferential direction of the electric blowing part, vibration at the positions different from each other in the axial direction can be suppressed and axial run-out of the electric blowing part can be effectively suppressed.

[0010] Additionally, the electric blowing part, in which an electric blower is supported by a first coil spring group with respect to a cover body, is supported by a second coil spring group with respect to the main body case, first coil spring of the first coil spring group and second coil spring of the second coil spring group are arranged so as to shift from each other in the circumferential direction of the electric blowing part, and thus vibration with driving of the electric blower can be effectively absorbed by each coil spring group and the axial run-out of the electric blowing part can be effectively suppressed.

[Brief Description of Drawings]

[0011]

[Fig. 1]

Fig. 1 is a longitudinal cross sectional view showing an electric vacuum cleaner.

[Fig. 2]

Fig. 2 is a lateral cross sectional view showing a rear side of one elastic member group of the electric vacuum cleaner.

[Fig. 3]

Fig. 3 is a lateral cross sectional view of a front side of the other elastic member group of the electric vacuum cleaner.

[Fig. 4]

Fig. 4 is an explanatory view showing operation of the elastic member group of the electric vacuum cleaner.

[Fig. 5]

Fig. 5 is a perspective view showing the electric vacuum cleaner.

[Fig. 6]

Fig. 6 is a longitudinal cross sectional view showing an electric vacuum cleaner of an embodiment of the present invention.

[Fig. 7]

Fig. 7 is a lateral cross sectional view showing a rear side of one of the elastic member groups of the electric vacuum cleaner.

[Fig. 8]

Fig. 8 is a lateral cross sectional view showing a rear side of another elastic member group of the electric vacuum cleaner.

[Fig. 9]

Fig. 9 is a lateral cross sectional view showing a front side of still another elastic member group of the electric vacuum cleaner.

[Fig. 10]

Fig. 10 is a longitudinal cross sectional view showing a main part of an electric vacuum cleaner.

[Fig. 11]

Fig. 11 is a lateral cross sectional view showing the main part of the electric vacuum cleaner.

[Fig. 12]

Fig. 12 is a longitudinal cross sectional view showing a main part of an electric vacuum cleaner.

[Fig. 13]

Fig. 13 is a longitudinal cross sectional view showing a main part of an electric vacuum cleaner.

[Fig. 14]

Fig. 14 is a longitudinal cross sectional view showing a main part of an electric vacuum cleaner.

[Explanation of Reference]

[0012]

- 5 Main body case
- 6 Blowing chamber as housing chamber
- 11 Electric blowing part
- 41 Electric blower
- 42 Motor cover as cover body
- 45 Plate spring as elastic member
- 46 Plate spring group as elastic member group

- 55 Motor as actuator
- 57 Centrifugal fan as fan
- 101 First coil spring
- 102 First coil spring group
- 103 Second coil spring
- 104 Second coil spring group

[Best Mode for Carrying Out the Invention]

10 **[0013]** Hereinafter, an electric vacuum cleaner will be described with reference to Fig. 1 to Fig. 5.

[0014] In Fig. 1 to Fig. 5, the reference numeral 1 denotes a vacuum cleaner main body, and the vacuum cleaner main body 1 is a so-called canister type electric vacuum cleaner capable of running on a floor surface as a surface to be cleaned.

15 **[0015]** The vacuum cleaner main body 1 includes a main body case 5 having: a lower case 2 opened upward; an upper case 3 which is arranged opposite to an upper rear side of the lower case 2 and covers the upper rear side; and a lid body 4 capable of opening/closing an upper front side of the lower case 2. In the main body case 5, a blowing chamber 6 as a housing chamber is provided between the lower case 2 and upper case 3, a dust collecting chamber (not shown) is provided between the lower case 2 and lid body 4, and a partitioning wall part 8 is provided between the blowing chamber 6 and dust collecting chamber so that both of the chambers are separated from each other.

20 **[0016]** An approximately cylindrical electric blowing part 11 is approximately horizontally housed in the blowing chamber 6 so that an axial direction of the part 11 corresponds to a front and rear direction, the part 11 being a space provided by airtightly attaching the lower case 2 and upper case 3 to each other with screws or the like via a seal packing (not shown). Additionally, the blowing chamber 6 communicates with the outside of the main body case 5 via exhaust holes 12 bored in the rear of the upper case 3. Further, a cord reel chamber for housing a cord reel, around which a power cord 13 capable of feeding power from outside to the electric blowing part 11 is wound, is provided aside of the blowing chamber 6.

25 **[0017]** Here, the power cord 13 can be led out from the cord reel chamber through a cord leading-out port opened at the rear of the lower case 2.

30 **[0018]** On the other hand, a dust collecting part such as a paper pack or cyclone dust collector can be attached/detached to/from the dust collecting chamber. Additionally, a main body suction port 21 is bored in the lid body 4 at the front side of the dust collecting chamber. A hose body 22 is provided attachably/detachably to/from the main body suction port 21, and a hand operating part 23 is provided at the top end of the hose body 22. A gripping part 25 to be gripped by an operator is protruded on the hand operating part 23, and a plurality of setting buttons 26, with which the operator sets an operation mode, etc., of electric blowing part 11, are provided on the gripping part 25. Further, an extension tube 28 and

a floor brush 29 as a suction port body are successively communication-connected with the top end of the hand operating part 23.

[0019] The partitioning wall part 8 includes: a rear partitioning wall 31 positioned at the rear side, blowing chamber 6 side; a front partitioning wall (not shown) positioned at the front side, dust collecting chamber side; and a side partitioning wall 33 which continues to the front partitioning wall and is interposed, as a partition, between the blowing chamber 6 and cord reel chamber. A driving part for activating various mechanisms (not shown) in the vacuum cleaner main body 1 is attached to the rear of the front partitioning wall.

[0020] A round rear communication hole 37 is bored in the rear partitioning wall 31, a round front communication hole is bored in the front partitioning wall, and the rear communication hole 37 and front communication hole are airtightly connected to each other through a duct (not shown).

[0021] The electric blowing part 11 is airtightly connected to the rear of the rear communication hole 37. Additionally, a filter (not shown) is arranged on the front side, dust collecting chamber side, of the front communication hole.

[0022] A communication port (not shown) for making the blowing chamber 6 communicate with the cord reel chamber is formed in the side partitioning wall 33.

[0023] A packing (not shown) is attached to the upper portions of the rear partitioning wall 31, front partitioning wall and side partitioning wall 33, the packing being a seal ring member which is held between the upper portions and the upper case 3 and serves as an airtight partition between the blowing chamber 6, dust collecting chamber and cord reel chamber.

[0024] As shown in Fig. 1 to Fig. 3, the electric blowing part 11 includes: an electric blower 41 which is a fan motor as a heavy object; an approximately cylindrical motor cover 42 which is a relatively light holding member as a cover body for covering and holding at least a part of the electric blower 41; a coil spring group 44 as an inner supporting unit having a plurality of, for example, three, coil springs 43 for elastically supporting the electric blower 41 with respect to the motor cover 42 and damping rotation-vibration of the electric blower 41. The electric blowing part 11 is elastically supported with respect to the main body case 5 by plate spring groups 46 as an elastic member group which are constituted by a plurality of, for example, two, outer supporting units (first outer supporting unit and second outer supporting unit) each having, for example, a pair of elastic members, plate springs 45, 45.

[0025] The electric blower 41 has a motor frame 47 as a case body, the frame 47 being a cylinder with a bottom shape, and an approximately cylindrical fan cover 48 fitted with the front side, opening side, of the motor frame 47 and having a diameter larger than that of the motor frame 47, and is held in the motor cover 42 with axial directions of the blower 41 and motor cover 42 corre-

sponding to each other. An inner circumference side spring support 51 and outer circumference side spring support 52, which constitute the coil spring group 44 and each is a spring receiving ring as a coil spring receiving part, are provided around the motor frame 47 of the electric blower 41, the coil springs 43 are held between the spring supports 51, 52, and the electric blower 41 is elastically supported with respect to the motor cover 42.

[0026] A motor 55, as an actuator which is a driving source is housed in the motor frame 47. A rotary shaft 56 of the motor 55 is connected to and rotates a centrifugal fan 57 which is covered with the fan cover 48 and is a rotor blade.

[0027] Additionally, a plurality of rectangular exhaust ports 61 are bored in a circumferential surface of the rear side of the motor frame 47 so as to shift from each other at an approximately even interval in a circumferential direction, and brush mechanisms (not shown), which are electrically connected to a rectifier of the motor 55, are respectively attached to attachment holes (not shown) bored between the exhaust ports 61.

[0028] 1 Additionally, an air suction port 66 is bored in the center of the fan cover 48.

[0029] In the electric blower 41, air is sucked through the air suction port 66 by the centrifugal fan 57 rotated by the motor 55, the sucked air is exhausted outward from the inside of the motor frame 47 through the exhaust ports 61, and thus negative pressure can be applied to the duct, dust collecting chamber, hose body 22 (Fig. 5), extension tube 28 (Fig. 5), floor brush 29 (Fig. 5) and the like.

[0030] The inner circumference side spring support 51 is made of, for example, synthetic resin or metal so as to have a shape matching the outer circumference of the motor frame 47, for example, an annular shape, and comes into close contact with the outer circumference of the motor frame 47 to hold the electric blower 41. Additionally, the inner circumference side spring support 51 is attached to the motor frame 47 with an axial direction of the support 51 corresponding to that of the electric blower 41, and is located at a position where a center region of the support 51 in the front and rear direction (axial direction) corresponds to a center of gravity G of the electric blower 41, and at the front side of the motor frame 47 and behind the fan cover 48. Moreover, since the center of gravity of the electric blower 41 approximately corresponds to a center of gravity of the electric blowing part 11 in consideration of a weight difference between the electric blower 41 and motor cover 42, the center of gravity G will indicate both the centers of gravity of the electric blower 41 and electric blowing part 11 hereinafter. Additionally, the position corresponding to the center of gravity G will, hereinafter, indicate a position crossing a plane containing the center of gravity G and orthogonal to the electric blowing part 11 (electric blower 41) in its axial direction, or a position being nearly in front of or behind the crossing position in the axial direction of the electric blowing part 11 (electric blower 41). Further,

a plurality of, for example, three, inner circumference spring holding parts 71 as an inner circumference coil spring holding part for holding one end of each coil spring 43 are formed on the outer circumference side of the inner circumference side spring support 51.

[0031] The inner circumference spring holding parts 71 each includes: a cylindrical inner circumference holding cylindrical part 71a for fitting with the one end of the coil spring 43 on the inner circumference side; and an inner circumference protruding holding part 71b which radially protrudes in the inner circumference holding cylindrical part 71a and is inserted into the coil spring 43 to hold the coil spring 43, and are apart from each other at an approximately even angle, 120 degrees, in the embodiment, in a circumferential direction of the inner circumference side spring support 51. One of the inner circumference spring holding parts 71 is located under the electric blower 41 and the other parts 71 are located at both sides above the blower.

[0032] Moreover, the state where the inner circumference spring holding parts 71 shift from each other by 120 degrees in the circumferential direction includes a state of shifting from each other by approximately 120 degrees.

[0033] Similarly, a numerical value indicating the angle of each part will, hereinafter, contain not only the numerical value but approximate values thereof.

[0034] On the other hand, the outer circumference side spring support 52 is made of, for example, synthetic resin or metal so as to have a shape matching the inner circumference of the motor cover 42, for example, an annular shape having a diameter larger than that of the inner circumference side spring support 51, arranged concentrically with the inner circumference side spring support 51 and located at the motor cover 42 side. Accordingly, the outer circumference side spring support 52 is also located at a position where a center region of the support 52 in the front and rear direction (axial direction) corresponds to the center of gravity G. In other words, the outer circumference side spring support 52 is located at a position where a part of the support 52 crosses the plane containing the center of gravity G and orthogonal to the electric blowing part 11 (electric blower 41) in the axial direction. Additionally, outer circumference spring holding parts 73 as an outer circumference coil spring holding part for holding the other end of each coil spring 43, are formed, in accordance with the inner circumference spring holding parts 71 of the inner circumference side spring support 51, on the inner circumference side of the outer circumference side spring support 52.

[0035] The outer circumference spring holding part 73 includes: a cylindrical outer circumference holding cylindrical part 73a for fitting with one end of the coil spring 43 on the inner circumference side; and an outer circumference protruding holding part 73b which radially protrudes in the outer circumference holding cylindrical part 73a and is inserted into the coil spring 43 to hold the coil spring 43. One of the outer circumference spring holding

parts 73 is located under the electric blower 41 and the other parts 73 are located at both sides above the blower.

[0036] Accordingly, the coil springs 43 are radially provided between the spring supports 51, 52 in relation to the electric blower 41, and are apart from each other at an approximately even interval (approximately even angle). That is, one end, the electric blower 41 side, of each coil spring 43 is held by each inner circumference spring holding part 71 of the inner circumference side spring support 51 toward the center of gravity G or center axis, and the other end is held by each outer circumference spring holding part 73 of the outer circumference side spring support 52. Thus, the coil spring group 44 is provided at the position corresponding to the center of gravity G of the electric blowing part 11 (electric blower 41), that is, provided so that the center of gravity G is located inside of an enclosure of the coil spring group 44. The coil springs 43, when being viewed in the axial direction of the electric blowing part 11, shift from each other by 120 degrees in the circumferential direction, that is, are arranged in a Y-shape in relation to the electric blower 41. In other words, the coil spring group 44 is located at a position where at least a part of the group 44 crosses the plane containing the center of gravity G and orthogonal to the electric blowing part 11 (electric blower 41) in the axial direction.

[0037] On the other hand, the motor cover 42 has an approximately cylindrical front motor cover 75 as a first motor cover and an approximately cylindrical rear motor cover 76 as a second motor cover, the cover 76 being connected to the rear of the cover 75. That is, the motor cover 42 can be assembled and disassembled in the axial direction (thrust direction) of the electric blowing part 11. The motor cover 42 concentrically houses the electric blower 41 therein.

[0038] The front motor cover 75 is made of, for example, synthetic resin, and includes an approximately disc-shaped front plate 81 serving as a front lid body and a front circumference wall 82 extending backward from the outer circumferential edge of the front plate 81. A round front communication opening 83 is formed in the approximate center of the front plate 81, the opening 83 being a communication opening for communicating the rear communication hole 37 of the main body case 5 with the air suction port 66 of the electric blower 41. Accordingly, a rear end of the front motor cover 75 is opened.

[0039] An approximately cylindrical seal ring 88 is provided at a position, which is aside of the front communication opening 83 and between the rear partitioning wall 31 and the front plate 81, the seal ring 88 being a packing as a seal ring member for airtightly connecting the rear communication hole 37 communicating with the dust collecting chamber of the main body case 5 to the air suction port 66 of the electric blower 41 on the negative pressure side of the electric blowing part 11. The seal ring 88 is approximately cylindrically made of a member having elasticity, for example, rubber or elastomer, and elastically deformed in the axial direction by vibration of the

electric blowing part 11 in the axial direction, and thus serves as a vibration damping part for damping the vibration so that the vibration is not transmitted to the main body case 5 via the partitioning wall part 8.

[0040] Moreover, the seal ring 88 is attached so as to be energized slightly forward, that is, so that the front of the seal ring 88 is brought into slight pressure-contact with a rear face of the rear partitioning wall 31 of the partitioning wall part 8, in a state of stopping the electric blowing part 11.

[0041] On the other hand, the rear motor cover 76 is made of, for example, synthetic resin, and includes: an approximately disc-shaped rear plate 91 serving as a rear lid body; a rear circumference wall 92 extending forward from the outer circumferential edge of the rear plate 91; and a flange part 93 extending radially from the outer circumferential edge of the rear circumference wall 92. The flange part 93 is connected to the rear end of the front circumference wall 82 of the front motor cover 75 by, for example, screwing.

[0042] A motor cushion 95 as a cushioning member which is a buffering member is attached to the rear of the rear plate 91. The motor cushion 95 faces the rear of the lower case 2 at a predetermined gap, and comes into contact with the lower case 2 so as to be plastically deformed in the case where, for example, the electric blowing part 11 moves backward by vibration. Thus, an impact of the contact is absorbed so as not to be transmitted to the lower case 2 side or electric blowing part 11 side.

[0043] A rear communication opening 97 for exhausting air after passing through the electric blower 41 outward of the motor cover 42 is opened at a lower portion of the rear circumference wall 92.

[0044] Screw holes (not shown) for screw-engagement are provided in a plurality of portions of the flange part 93. Screws (not shown) are screw-engaged with the screw holes, and thus the front motor cover 75 and rear motor cover 76 are fixed to each other.

[0045] Each plate spring 45 includes: a curved part 45a archly curved; continuing parts 45b, 45b continuing to both sides of the curved part 45a; and supporting parts 45c, 45c continuing to the continuing parts 45b, 45b, and is formed by properly curving a predetermined metallic member.

[0046] The curved part 45a is formed in a shape matching a part of the outer circumference of the motor cover 42 (front motor cover 75, rear motor cover 76) which is the outer circumference of the electric blowing part 11.

[0047] Each continuing part 45b protrudes approximately straight from the end of the curved part 45a on the same side as a protrusion side of the curved part 45a.

[0048] Each supporting part 45c is bent to each continuing part 45b at the curved part 45a side, and extends approximately orthogonally to each continuing part 45b.

[0049] Each curved part 45a is held between blowing part side ribs 98, 98 protruding on the outer circumference of the motor cover 42 (front motor cover 75, rear motor cover 76), each continuing part 45b and supporting

part 45c are held between main body side ribs 99, 99 protruding on an inner wall of the blowing chamber 6 of the main body case 5, and each plate spring 45 is prevented from moving in the front and rear direction.

[0050] Additionally, one of the plate spring groups 46 is located at the centrifugal fan 57 side in front of the center of gravity G, that is, on the outer circumference of the front motor cover 75 of the motor cover 42 (hereinafter, referred to as plate spring group 46a), and the other plate spring group 46 is located at the motor 55 side behind the center of gravity G, that is, on the outer circumference of the rear motor cover 76 of the motor cover 42 (referred to as plate spring group 46b). In other words, the plate spring groups 46a, 46b shift from each other in the axial direction of the electric blowing part 11 (electric blower 41), and are arranged at positions between which the center of gravity G is located, that is, at the front side (one side) and rear side (the other side) in relation to the center of gravity G in the axial direction, and at positions between which the coil spring group 44 is located, in the present embodiment. That is, the centers or vicinities thereof of the plate spring groups 46a, 46b in the front and rear direction are arranged at positions not crossing the plane containing the center of gravity G and orthogonal to the electric blowing part 11 (electric blower 41) in the axial direction. Further, the plate spring groups 46a, 46b are arranged at an approximately even distance from the center of gravity G. In other words, the plate spring groups 46a, 46b are arranged at an approximately even distance from the coil spring group 44.

[0051] Further, the plate spring groups 46a, 46b are arranged so as to shift from each other at a predetermined angle, for example, 90 degrees, in a circumferential direction of the electric blowing part 11. That is, as shown in Fig. 2, the plate springs 45, 45 of the plate spring group 46a are arranged vertically opposite to each other, for example, and as shown in Fig. 3, the plate springs 45, 45 of the plate spring group 46b are arranged laterally opposite to each other in the axial direction, for example. Thus, the plate springs 45 of the spring groups 46a, 46b are arranged at an even interval in the circumferential direction of the electric blowing part 11.

[0052] Moreover, all the plate springs 45 of the plate spring groups 46a, 46b may be made of the same material, or arbitrarily made of different materials.

[0053] Next, a method for manufacturing the electric vacuum cleaner shown in Fig 1 to Fig 5 will be described.

[0054] First, in a state where the coil spring group 44, in which the spring supports 51, 52 are pre-connected to each other through the coil spring 43, is attached to the outer circumference of the motor frame 47 of the electric blower 41, the electric blower 41 is covered with the motor covers 75, 76 from front and rear and put in the motor cover 42, whereby forming the electric blowing part 11.

[0055] Next, each curved part 45a is held between the blowing part side ribs 98, 98 outside the electric blowing part 11, each plate spring 45 is attached to the outer circumference of the electric blowing part 11, the electric

blowing part 11 and plate spring groups 46a, 46b are fitted into the blowing chamber 6 so that the continuing part 45b and supporting part 45c of each plate spring 45 are held between the main body side ribs 99, 99, and wirings of the electric blowing part 11 side and main body case 5 side are connected to each other.

[0056] In this state, each component is built in, the lower case 2 is covered with the upper case 3 connected to the cover 4 from above, and the upper case 3 and lower case 2 are assembled together with screws or the like. Thus, the vacuum cleaner body 1 is completed.

[0057] Next, operation of the vacuum cleaner in Fig. 1 to Fig. 5 will be described.

[0058] In cleaning, first, the hose body 22, extension tube 28 and floor brush 29 are first communication-connected to the main body suction port 21 in this order, the lid body 4 of the main body case 5 is taken off, the dust collecting part is attached to the dust collecting chamber, and the lid body 4 is put thereon.

[0059] Before cleaning, the electric blowing part 11 is located at a predetermined starting position by balance of energizing forces of the plate springs 45 of the plate spring group 46.

[0060] When an operator pulls out the power cord 13 from the main body case 5, connects the cord to an outlet of a wall or the like, grips the gripping part 25 and operates a predetermined setting button 26, the electric blower 41 of the electric blowing part 11 is driven.

[0061] Vibration is generated in the electric blowing part 11 in a radial direction (center axial direction) crossing a rotation direction of the electric blower 41 by driving of the electric blower 41 and negative pressure generated by the driving.

[0062] At this time, each coil spring 43 energized in a direction of the center of gravity G (center of gravity G side) of the electric blower 41 properly expands and contracts so as to center the electric blower 41, and thus the vibration in the radial direction (center axial direction) with the driving of the electric blower 41 is absorbed by the coil spring group 44.

[0063] Additionally, the electric blowing part 11 vibrates in the axial direction (front and rear direction) and radial direction (upper/lower and left/right directions) by the vibration of the electric blower 41.

[0064] Particularly, the centrifugal fan 57 side of the electric blower 41 vibrates larger than the motor 55 side thereof.

[0065] At this time, as shown in Fig. 4, the curved part 45a of each plate spring 45 is radially pressed by the electric blowing part 11, and thus deformed so that the both ends of the curved part 45a approach each other. The continuing parts 45b, 45b are obliquely deformed with the deformation, and thus the vibration of the electric blowing part 11 is absorbed by the deformation of each plate spring 45. Moreover, in Fig. 4, the deformations of the curved part 45a and continuing parts 45b, 45b are exaggeratedly shown for convenience.

[0066] Consequently, the electric blowing part 11 is en-

ergized upward/downward or rightward/leftward (shown in Figs. 2 and 3) by energization of each plate spring 45 of the plate spring groups 46a, 46b so as to be centered, the front side (centrifugal fan 57 side) and rear side (motor 55 side) of the electric blowing part 11 are held by the plate spring groups 46a, 46b respectively, and the vibration in the axial direction (front and rear direction) and in upper/lower and left/right directions with the driving of the electric blowing part 11 is absorbed.

[0067] Moreover, the vibration of the electric blowing part 11 in the front and rear direction is regulated by rigidity of each plate spring 45 in its width direction and hardly generated.

[0068] An air passage extending through the floor brush 29, extension tube 28, hose body 22, main body suction port 21 and dust collecting part is formed by the negative pressure by the driving of the electric blower 41, and dust is sucked with air.

[0069] The sucked air becomes suction air, the dust contained in the suction air is collected in the dust collecting part when the suction air passes through the dust collecting part.

[0070] Further, the suction air, after passing through the dust collecting part, passes through the filter, front communication hole, duct and rear communication hole 37, and flows into the fan cover 48 of the electric blower 41 via the suction port 66 of the electric blower 41, is sucked from the center of the centrifugal fan 57 to be exhausted in the circumferential direction, passes through the inside of the motor frame 47, and is exhausted, as exhaust air, outside of the electric blower 41 from each exhaust hole 61.

[0071] The exhaust air is exhausted downward via the rear communication opening 97 of the motor cover 42, a part of the exhaust air flows upward from the circumference of the electric blowing part 11 to be exhausted outside of the main body case 5 from the exhaust hole 12 of the main body case 5, and then the rest of the exhaust air flows into the cord reel chamber from a communication port of the partitioning wall part 8 to be exhausted outside of the main body case 5 via the cord leading-out port while cooling the cord reel (power cord 13).

[0072] After the cleaning, the operator operates the setting button 26 to stop the electric blower 41, and thus the driving of the electric vacuum cleaner is stopped.

[0073] At this time, the electric blowing part 11 returns to the predetermined starting position by centering action of the plate spring groups 46a, 46b.

[0074] In the case where dust more than a predetermined amount accumulates in the dust collecting part, the lid body 4 is taken off and the dust collecting part is taken out from the dust collecting chamber. In the case where the dust collecting part is a paper pack, the paper pack is discarded together with the dust and a new paper pack is attached to the dust collecting chamber. In the case where the dust collecting part is a dust collecting cup, the dust is discarded and then the cup is attached to the dust collecting chamber again.

[0075] As described above, the electric blowing part 11 is supported with respect to the main body case 5 by the plate springs 45, 45 of the plate spring groups 46a, 46b arranged at the positions different from each other in the axial direction, the plate springs 45 of the plate spring groups 46a, 46b are arranged so as to shift from each other in the circumferential direction of the electric blowing part 11, and thus the deformation of each plate spring 45 allows the vibration at the different positions in the axial direction with the driving of the electric blowing part 11 (electric blower 41) to be suppressed, axial run-out of the electric blowing part 11 to be effectively suppressed, and vibration-isolation for the main body case 5 to be realized.

[0076] Particularly, since the electric blower 41 rotates the centrifugal fan 57 by the motor 55, the electric blowing part 11 whirls at the front side and rear side in relation to the center of gravity G, that is, the axial run-out is caused. Therefore, if the plate spring groups 46a, 46b are respectively arranged at the positions, between which the center of gravity G is located, of the electric blowing part 11, at the front side and rear side of the part 11 in relation to the center of gravity G, so as to shift from each other by 90 degrees in the circumferential direction of the electric blowing part 11, and elastically support the electric blowing part 11 by the plate spring groups 46a, 46b, the whirling of the electric blowing part 11 can be reliably suppressed, and the axial run-out can be effectively suppressed.

[0077] In addition, the upward/downward vibration of the electric blowing part 11 with the driving of the electric blower 41 is absorbed by the deformation of each plate spring 45 of the plate spring group 46a, the leftward/rightward vibration of the electric blowing part 11 is absorbed by the deformation of each plate spring 45 of the plate spring group 46b, a position where one of the plate spring groups hardly absorbs the vibration is covered by the other plate spring group, and thus the vibration with the driving of the electric blower 41 can be reliably suppressed.

[0078] Furthermore, since the three coil springs 43 of the coil spring group 44 are arranged so as to shift from each other by 120 degrees in the circumferential direction, the vibration with the driving of the electric blower 41 can be, by the coil spring group 44, effectively absorbed and hardly transmitted to the motor cover 42. Therefore, the vibration can be further reliably absorbed by a synergistic effect of the coil spring group 44 and plate spring groups 46.

[0079] In addition, since the coil spring group 44 is arranged at the position corresponding to the center of gravity G, the vibration, which is generated upward/downward in front of or behind the center of gravity G by the driving of the electric blower 41, can be minimized and hardly transmitted to the motor cover 42.

[0080] The above constitution of hardly transmitting each vibration to the main body case 5 allows the vibration of the electric blowing part 11 in driving the electric

vacuum cleaner to be prevented from generating a sound, operation sound to be made small even in cleaning a wood floor, on which vibration particularly easily echoes, even the electric blower 41 having relatively large vibration to be adopted, and the quality of the vacuum cleaner to be stabilized.

[0081] Moreover, the plate spring groups 46a, 46b may be arranged reversely. That is, the electric blowing part 11 may be held, from left and right sides in the axial direction, by the plate springs 45, 45 of the plate spring group 46a, and may be held, from upper and lower sides, by the plate springs 45, 45 of the plate spring groups 46b. Also in this case, the same operation and effect as that of the first embodiment can be obtained.

[0082] Additionally, as long as the plate spring groups 46a, 46b are arranged at the position, between which the center of gravity G is located, of the electric blowing part 11 so as to shift from each other by 90 degrees in a main direction of the electric blowing part 11, the plate spring groups 46a, 46b may be arranged regardless of upper and lower sides of the electric blowing part 11 and left and right sides of the part 11 in the axial direction.

[0083] Next, an embodiment of the invention will be described with reference to Fig. 6 to Fig. 9. Moreover, the same reference numeral is attached to each part having the same constitution and operation as that of shown in Fig. 1 to Fig. 5, and description thereof will be omitted.

[0084] In the second embodiment, three plate spring groups 46a, 46b and 46c are included in Fig. 1 to Fig. 5.

[0085] The plate spring group 46a is arranged at the position corresponding to the center of gravity G of the electric blowing part 11. That is, the plate spring group 46a is arranged at a position where at least a part of the group 46a crosses the plane containing the center of gravity G and orthogonal to the electric blowing part 11 (electric blower 41) in the axial direction.

[0086] Additionally, the plate spring groups 46b, 46c are arranged at positions between which the plate spring group 46a is located. That is, the plate spring groups 46b, 46c are respectively arranged at one side and the other side in relation to the center of gravity G of the electric blowing part 11 in the axial direction.

[0087] Specifically, the plate spring group 46b is attached to the outer circumference of the front motor cover 75 on the front side of the electric blowing part 11. That is, the plate spring group 46b is located at the centrifugal fan 57 side of the electric blower 41.

[0088] Additionally, the plate spring group 46c is attached to the outer circumference, which is behind the plate spring group 46a, of the rear motor cover 76 on the rear side of the electric blowing part 11. That is, the plate spring group 46c is located at the motor 55 side of the electric blower 41.

[0089] Further, the plate spring groups 46a, 46b and 46c are arranged so as to shift from each other by 60 degrees in the circumferential direction of the electric blowing part 11.

[0090] Specifically, the plate springs 45, 45 of the plate

spring group 46a are, as shown in Fig. 7, located at the upper and lower sides, the plate springs 45, 45 of the plate spring group 46b are, as shown in Fig. 8, located at lower left and upper right sides, and the plate springs 45, 45 of the plate spring group 46c are, as shown in Fig. 9, located at upper left and lower right sides.

[0091] Therefore, the plate springs 45, 45 of the plate spring groups 46a, 46b and 46c are successively arranged at a predetermined angle, for example, 60 degrees, and at an even interval, in the circumferential direction of the electric blowing part 11. Additionally, in each plate spring 45 of the plate spring groups 46a to 46c, the curved part 45a is held between the blowing part side ribs 98, 98. Further, in each plate spring 45 of the plate spring groups 46b, 46c, the continuing part 45b is bent from the curved part 45a so as to run along the side of the blowing chamber 6, the supporting part 45c is bent from the continuing part 45b so as to run along the bottom or upper face of the blowing chamber 6, and the continuing part 45b and supporting part 45c are held between the main body side ribs 99, 99.

[0092] By having the same constitution as that of the first embodiment, for example, arranging the plurality of plate spring groups 46 for elastically supporting the electric blowing part 11 with respect to the main body case 5 so that the groups shift from each other in the circumferential direction of the electric blowing part 11, the same operation and effect as that of the first embodiment can be obtained.

[0093] The plate spring groups 46a, 46b and 46c are arranged so as to shift from each other by 60 degrees in the circumferential direction of the electric blowing part 11, the plate spring group 46a is arranged at the position corresponding to the center of gravity G of the electric blowing part 11, the plate spring groups 46b, 46c are arranged at the positions between which the plate spring group 46a is located, and thus the whirling of the electric blowing part 11 can be more reliably suppressed and the axial run-out of the part 11 can be effectively suppressed.

[0094] Moreover, in each of the above figures, the electric blowing part 11 may be constituted by not only the electric blower 41 and motor cover 42 but, for example, only the electric blower 41. That is, a constitution in which the electric blower 41 itself may be elastically supported by each plate spring group 46 may be included in each of the above embodiments.

[0095] In the electric blowing part 11, the electric blower 41 may be supported with respect to the motor cover 42 by an arbitrary constitution as long as the axial run-out can be suppressed.

[0096] Further, two or more plate spring groups 46 may be provided. In the case of providing, for example, three or more odd numbers of plate spring groups 46, one of them is located at the position corresponding to the center of gravity G, the others are balancedly arranged in front of and behind the one plate spring group. In the case of providing two or more even numbers of plate spring groups 46, they are balancedly arranged at positions,

between which the center of gravity G is located, and the plate springs 45 of each plate spring group 46 may be arranged so as to be apart from each other at an approximately even interval in the circumferential direction of the electric blowing part 11.

[0097] By forming a long hole in the supporting part 45c for example, each plate spring 45 may be attached to the main body case 5, motor cover 42 or the like via the long hole with screws or the like.

[0098] Next, a vacuum cleaner will be described with reference to Fig. 10 and Fig. 11. Moreover, the same reference numeral is attached to each part having the same constitution and operation as that of each of the above figures, and description thereof will be omitted.

[0099] In this vacuum cleaner, the electric blowing part 11, as shown in Fig. 10 and Fig. 11, includes a first coil spring group 102 as a first supporting unit having a plurality of, for example, three, first coil springs 101 for elastically supporting the electric blower 41 with respect to the motor cover 42 and damping the rotation vibration of the electric blower 41, and is elastically supported with respect to the main body case 5 by a plurality of, for example, two, second coil spring groups 104 as a second supporting unit each having a plurality of, for example, three, second coil springs 103.

[0100] An inner circumference side spring support 111 and outer circumference side spring support 112, which constitute the first coil spring group 102 and each is a first spring receiving ring as a first coil spring receiving part, are provided around the motor frame 47 of the electric blower 41, the first coil springs 101 are held between the supports 111, 112, and the electric blower 41 is elastically supported with respect to the motor cover 42.

[0101] The inner circumference side spring support 111 is made of, for example, synthetic resin or metal so as to have a shape matching the outer circumference of the motor frame 47, for example, an annular shape, and comes into close contact with the outer circumference of the motor frame 47 to hold the electric blower 41. Additionally, the inner circumference side spring support 111 is attached to the motor frame 47 with an axial direction of the support 111 corresponding to that of the electric blower 41, and is located at a position where a center region of the support 111 in the front and rear direction (axial direction) corresponds to the center of gravity G, and at the front side of the motor frame 47 and behind the fan cover 48. Further, a plurality of, for example, three, first inner circumference spring holding parts 121 as a first inner circumference coil spring holding part each for holding one end of each first coil spring 101, are formed on the outer circumference side of the inner circumference side spring support 111.

[0102] The first inner circumference spring holding parts 121 each includes : a cylindrical first inner circumference holding cylindrical part 121a for fitting with the one end of the first coil spring 101 on the inner circumference side; and a first inner circumference protruding holding part 121b which radially protrudes in the first inner

circumference holding cylindrical part 121a and is inserted into the first coil spring 101 to hold the first coil spring 101, and are apart from each other at an approximately even angle, 120 degrees, in the present embodiment, in a circumferential direction of the inner circumference side spring support 111. One of the first inner circumference spring holding parts 121 is located under the electric blower 41 and the other parts 121 are located at both sides above the blower.

[0103] Moreover, the state where the first inner circumference spring holding parts 121 shift from each other by 120 degrees in the circumferential direction includes a state of shifting from each other by approximately 120 degrees.

[0104] On the other hand, the outer circumference side spring support 112 is made of, for example, synthetic resin or metal so as to have a shape matching the inner circumference of the motor cover 42, for example, an annular shape having a diameter larger than that of the inner circumference side spring support 111, is arranged concentrically with the inner circumference side spring support 111 and located at the motor cover 42 side. Accordingly, the outer circumference side spring support 112 is also located at a position where a center region of the support 112 in the front and rear direction (axial direction) corresponds to the center of gravity G. Additionally, first outer circumference spring holding parts 123 as a first outer circumference coil spring holding part for holding the other end of each first coil spring 101 are formed in accordance with the first inner circumference spring holding parts 121 of the inner circumference side spring support 111, on the inner circumference side of the outer circumference side spring support 112.

[0105] The first outer circumference spring holding part 123 includes: a cylindrical first outer circumference holding cylindrical part 123a for fitting with the one end of the first coil spring 101 on the inner circumference side; and a first outer circumference protruding holding part 123b which radially protrudes in the first outer circumference holding cylindrical part 123a and is inserted into the first coil spring 101 to hold the first coil spring 101. One of the first outer circumference spring holding parts 123 is located under the electric blower 41 and the other parts 123 are located at both sides above the blower.

[0106] Accordingly, the first coil springs 101 are provided between the spring supports 111, 112 radially in relation to the electric blower 41, and apart from each other at an approximately even interval (approximately even angle). That is, one end, the electric blower 41 side, of each first coil spring 101 is held by each first inner circumference spring holding part 121 of the inner circumference side spring support 111 toward the center of gravity G or center axis, and the other end is held by each first outer circumference spring holding part 123 of the outer circumference side spring support 112. Thus, the first coil spring group 102 is provided at the position corresponding to the center of gravity G of the electric blowing part 11 (electric blower 41), that is, provided so

that the center of gravity G is located inside of an enclosure of the first coil spring group 102. The first coil springs 101, when being viewed in the axial direction of the electric blowing part 11, shift from each other by 120 degrees in the circumferential direction, that is, are arranged in a Y-shape in relation to the electric blower 41.

[0107] Around the motor cover 42, a plurality of second inner circumference spring holding parts 131 as a second inner circumference coil spring holding part each for holding one end of each second coil spring 103 are formed, and a main body case side spring support 132 is provided which constitutes each second coil spring group 104 and is a second spring receiving ring as a second coil spring receiving part. The second coil springs 103 are held between the second inner circumference spring holding parts 131 and main body case side spring support 132, and the electric blowing part 11 is elastically supported with respect to the main body case 5.

[0108] The three second inner circumference spring holding parts 131 are formed on each of the front and rear motor covers 75, 76, for example. The second inner circumference spring holding parts 131 each includes: a cylindrical second inner circumference holding cylindrical part 131a for fitting with the one end of the second coil spring 103 on the inner circumference side; and a second inner circumference protruding holding part 131b which radially protrudes in the second inner circumference holding cylindrical part 131a and is inserted to the second coil spring 103 to hold the second coil spring 103, and are apart from each other at an approximately even angle, 120 degrees, in the present embodiment, in a circumferential direction of the motor cover 42. Additionally, one of the second inner circumference spring holding parts 131 is located at the upper portion of the electric blowing part 11, and the other parts 131 are located at both sides of the lower portion of the part 11.

[0109] On the other hand, the main body case side spring support 132 is made of, for example, synthetic resin or metal so that the inner side of the support 132 has a shape matching the outer circumference of the motor cover 42, for example, an annular shape having a diameter larger than that of the motor cover 42. The outer side of the support 132 is formed so as to have a shape matching an inner face of the blowing chamber 6, for example, an approximately rectangular shape running along an inner wall of the lower case 2 and an upper case lower plate 3a of the upper case 3, and located at the main body case 5 side. Additionally, second outer circumference spring holding parts 137 as a second outer circumference coil spring holding part each for holding the other end of each second coil spring 103 are formed in accordance with the second inner circumference spring holding parts 131 respectively, on the inner circumference side of the main body case side spring support 132.

[0110] The second outer circumference spring holding part 137 includes: a cylindrical second outer circumference holding cylindrical part 137a for fitting with the one

end of the second coil spring 103 on the inner circumference side; and a second outer circumference protruding holding part 137b which radially protrudes in the second outer circumference holding cylindrical part 137a and is inserted to the second coil spring 103 to hold the second coil spring 103. Additionally, one of the second outer circumference spring holding parts 137 is located above the electric blowing part 11, and the other parts 137 are located at both sides under the electric blowing part 11.

[0111] Accordingly, the second coil springs 103 are radially provided between the motor cover 42 and the main body case side spring support 132 in relation to the electric blowing part 11, and apart from each other at an approximately even interval (approximately even angle). That is, one end, the electric blowing part 11 side, of each second coil spring 103 is held by each second inner circumference spring holding part 131 of the motor cover 42 toward the center of gravity G or the center axis of the electric blowing part 11, and the other end is held by each second outer circumference spring holding part 137 of the main body case side spring support 132. Thus, the second coil springs 103 of each second coil spring group 46, when being viewed in the axial direction of the electric blowing part 11, shift from each other by 120 degrees in the circumferential direction, that is, are arranged in a reverse Y-shape in relation to the electric blower 41.

[0112] Thus, the first coil spring 101 and second coil spring 103 are arranged so as to shift from each other at an approximately even interval, by 60 degrees, in the circumferential direction of electric blowing part 11.

[0113] Moreover, although the main body case side spring support 132 has approximately the same width as that of each of the spring supports 111, 112, these supports may have different materials or different widths.

[0114] Additionally, one of the second coil spring groups 104 is located at the centrifugal fan 57 side in front of the center of gravity G, that is, on the outer circumference of the front motor cover 75 of the motor cover 42 (hereinafter, referred to as second coil spring group 104a), and the other spring group 104 is located at the motor 55 side behind the center of gravity G, that is, on the outer circumference of the rear motor cover 76 of the motor cover 42 (hereinafter, referred to as second coil spring group 104b). In other words, the second coil spring groups 104a, 104b are arranged at positions, between which the center of gravity G is located, of the electric blowing part 11 (electric blower 41), that is, at positions between which the first coil spring group 102 is located. Further, the second coil spring groups 104a, 104b are arranged at an approximately even distance from the center of gravity G. In other words, the second coil spring groups 104a, 104b are arranged at an approximately even distance from the first coil spring group 102.

[0115] Additionally, the spring constant of the second coil spring 103 of the second coil spring group 104a is set so as to be smaller than that of the second coil spring 103 of the second coil spring group 104b. That is, the second coil 103 of the second coil spring group 104a has

elasticity smaller (easily expand and contract by smaller force) than that of the second coil spring 103 of the second coil spring group 104b.

[0116] Additionally, the numbers of vibrations of the first coil spring 101 and second coil spring 103 are different from each other. Specifically, the materials, diameters, wire diameters or the like of the first coil spring 101 and second coil spring 103 are different from each other.

[0117] Next, a method for manufacturing the electric vacuum cleaner according to Fig.10 and Fig.11 will be described.

[0118] First, the electric blower 41 is covered with the motor covers 75, 76 from the front and rear and built in the motor cover 42 with the first coil spring group 102, in which the spring supports 111, 112 are connected to each other by the first coil springs 101, pre-attached to the outer circumference of the motor frame 47 of the electric blower 41, whereby forming into the electric blowing part 11.

[0119] Next, the motor cover 42 and main body case side spring support 132 are pre-connected to each other by the second coil springs 103, these are fitted into the blowing chamber 6, and the wirings of the electric blowing part 11 side and main body case 5 side are connected to each other.

[0120] In this state, each part is built in, the lower case 2 is covered with the upper case 3 connected to the lid body 4 from above, the upper case 3 and lower case 2 are assembled together with screws or the like. Thus, the vacuum cleaner main body 1 is completed.

[0121] Next, operation of Fig.10 and Fig.11 will be described.

[0122] Before cleaning, the electric blowing part 11 is located at a predetermined start position in the axial direction (front and rear direction) by balance of energizing forces of the second coil springs 103 of the second coil spring group 104.

[0123] When the operator pulls out the power cord 13 from the main body case 5, connects the cord to an outlet of a wall or the like, grips the gripping part 25 and operates a predetermined setting button 26, the electric blower 41 of the electric blowing part 11 is driven, and the electric blowing part 11 vibrates forward/backward in the axial direction by the driving of the electric blower 41 and negative pressure generated by the driving.

[0124] At this time, the electric blowing part 11 is energized upward/downward or rightward/leftward (shown in Fig.2) by the energization of each second coil spring 103 of the second coil spring groups 104a, 104b so as to be centered, and energized forward/backward by the second coil spring group 104a on the centrifugal fan 57 side and second coil spring group 104b on the motor 55 side, that is, centered by each second coil spring 103 of the second coil spring groups 104a, 104b. Thus, the vibration in the axial direction (front and rear direction) and upper and lower direction with the driving of the electric blowing part 11 is absorbed.

[0125] Further, vibration is generated in the electric

blowing part 11 in the radial direction (center axial direction) crossing the rotation direction of the electric blower 41 by the driving of the electric blower 41.

[0126] At this time, each first coil spring 101 energized toward the center of gravity G of the electric blower 41 properly expands and contracts so as to center the electric blower 41, and thus the vibration in the radial direction (center axial direction) with the driving of the electric blower 41 is also absorbed by the first coil spring group 102.

[0127] After the cleaning, the operator operates the setting button 26 and stops the electric blower 41, and thus the driving of the electric vacuum cleaner is stopped.

[0128] At this time, the electric blowing part 11 returns to the predetermined starting position by centering action of the second coil spring groups 104a, 104b.

[0129] As described above, in Fig.10 and Fig.11, the electric blowing part 11, in which the electric blower 41 is supported by the first coil springs 101 of the first coil spring group 102 with respect to the motor cover 42, is supported with respect to the main body case 5 by the second coil springs 103 of the second coil spring groups 104, and the first coil spring 101 of the first coil spring group 102 and second coil spring 103 of the second coil spring groups 104 (second coil spring groups 104a, 104b) are arranged so as to shift from each other in the circumferential direction of the electric blowing part 11.

[0130] In a conventional electric vacuum cleaner described in, for example, Japanese Patent No. 2874401, since the electric blower 41 is directly connected to the main body case 5 by a plurality of coil springs, the vibration of the electric blower 41 is insufficiently absorbed by the coil springs. However, according to the present embodiment, the vibration in the upper/lower and left/right directions and axial direction with the driving of the electric blower 41 can be absorbed by expansion/contraction of the first coil springs 101 with respect to the motor cover 42, the vibration remaining in the motor cover 42 can be absorbed by expansion/contraction of the second coil springs 103, a position, where one of the coil springs 101, 103 hardly absorbs the vibration, can be covered by the other coil spring, that is, the vibration with the driving of the electric blower 41 can be effectively absorbed by the coil spring groups 102, 104, the axial run-out of the electric blowing part 11 can be effectively suppressed, and therefore the vibration-isolation for the main body case 5 can be realized.

[0131] Additionally, the first coil springs 101 are held-between the spring supports 111, 112 and these are unitized as the first coil spring group 102, and therefore the first coil springs 101 can be easily attached to the electric blower 41 and productivity can be improved.

[0132] Similarly, one end of each second coil spring 103 is held by the main body case side spring support 132 and the second coil springs 103 with the supports 132 are unitized as the second coil spring group 104, and therefore the second coil springs 103 can be easily attached to the second inner circumference spring holding parts 131 of the electric blowing part 11 respectively, and

the productivity can be improved.

[0133] Further, since the three first coil springs 101 of the first coil spring group 102 and the three second coil springs 103 of each second coil spring group 104 are arranged so as to shift from each other by 60 degrees in the circumferential direction, the first coil springs 101 and second coil springs 103 can be arranged at an even interval and the vibration with the driving of the electric blower 41 can be more effectively absorbed by the coil spring groups 102, 104.

[0134] Since the first coil springs 101 of the first coil spring group 102 are located under and at both sides above the electric blower 41 and the second coil springs 103 of the second coil spring group 104 are located at the upper portion and both sides on the lower portion of the electric blowing part 11, the electric blowing part 11 can be held with it suspended in the second coil spring groups 104, and the vibration with the driving of the electric blower 41 can be made to hardly transmit to the main body case 5 compared with the case where, for example, the second coil springs 103 are arranged on the lower portion and both sides on the upper portion of the electric blowing part 11.

[0135] Since the first coil spring group 102 is arranged at the position corresponding to the center of gravity G, the vibration, which is generated upward/downward in front of or behind the center of gravity G by the driving of the electric blower 41, can be minimized and can be made to hardly transmit to the motor cover 42. Further, since the second coil spring groups 104a, 104b are arranged at the positions between which the first coil spring group 102 is located, the vibration in front of and behind the center of gravity G of the electric blowing part 11 can be absorbed.

[0136] The centrifugal fan 57 side (front side) of the electric blowing part 11 whirls larger than the motor 55 side (rear side) thereof in relation to the center axis by the centrifugal fan 57 rotated by the driving of the electric blower 41. Therefore, if the spring constant of each second coil spring 103 of the second coil spring group 104a on the centrifugal fan 57 side is made smaller than that of each second coil spring 103 of the second coil spring group 104b on the motor 55 side, the whirling on the centrifugal fan 57 side can be reliably absorbed.

[0137] The above constitution of hardly transmitting each vibration to the main body case 5 allows the vibration of the electric blowing part 11 in driving the electric vacuum cleaner to be prevented from generating a sound, an operation sound to become small even in cleaning a wood floor, on which vibration particularly easily echoes, the electric blower 41 having relatively large vibration to be adopted, and the quality of the vacuum cleaner to be stabilized.

[0138] Next, a vacuum cleaner will be described with reference to Fig. 12. Moreover, the same reference numeral is attached to each part having the same constitution and operation as that of each of the above figures, and description thereof will be omitted.

[0139] In the vacuum cleaner shown in Fig.12, the first coil spring group 102 has four first coil springs 101 and each second coil spring group 104 has four second coil springs 103 in the third embodiment.

[0140] The first inner circumference spring holding parts 121 are arranged at four places of the inner circumference side spring support 111 constituting the first coil spring group 102, and apart from each other at an approximately even angle, 90 degrees, in the present embodiment, in a circumferential direction of the inner circumference side spring support 111. Additionally, the first inner circumference spring holding parts 121 are located above, under and on the left and right of the electric blower 41.

[0141] Similarly, the first outer circumference spring holding parts 123 are arranged at four places of the outer circumference side spring support 112 constituting the first coil spring group 102, and apart from each other at an approximately even angle, 90 degrees, in the present embodiment, in a circumferential direction of the outer circumference side spring support 112. Additionally, the first outer circumference spring holding parts 123 are located at respective positions corresponding to the first inner circumference spring holding parts 121, that is, above, under and on the left and right of the electric blower 41.

[0142] Accordingly, the first coil springs 101, when being viewed in the axial direction of the electric blowing part 11, shift from each other by 90 degrees in the circumferential direction, that is, are arranged in a cross-shape in relation to the electric blower 41.

[0143] On the other hand, the second inner circumference spring holding parts 131 are arranged at four places of each of the front and rear motor covers 75, 76 of the motor cover 42. The four second inner circumference spring holding parts 131 are apart from each other at an approximately even angle, 90 degrees, in the present embodiment, in the circumferential direction of the motor cover 42. Additionally, the four second inner circumference spring holding parts 131 are located at both sides above and both sides under the electric blower 41.

[0144] Similarly, the second outer circumference spring holding parts 137 are formed at four places of the main body case side spring support 132 constituting the second coil spring group 104, and apart from each other at an approximately even angle, 90 degrees, in the embodiment, in a circumferential direction of the main body case side spring support 132. Additionally, the second outer circumference spring holding parts 137 are located at respective positions corresponding to the second inner circumference spring holding parts 131, that is, at both sides above and both sides under the electric blowing part 11.

[0145] Accordingly, the second coil springs 103, when being viewed in the axial direction of the electric blowing part 11, shift from each other by 90 degrees in the circumferential direction, that is, are arranged in an X-shape in relation to the electric blower 41.

[0146] Thus, the first coil spring 101 and second coil spring 103 are arranged so as to shift from each other at an approximately even interval in the circumferential direction and by 45 degrees in the circumferential direction of the electric blowing part 11.

[0147] By having the same constitution as that of the vacuum cleaner in Fig. 1 to Fig. 5, for example, arranging the plurality of first coil springs 101 for elastically supporting the electric blower 41 with respect to the motor cover 42 and the plurality of second coil springs 103 for elastically supporting the electric blowing part 11 with respect to the main body case 5 so that the springs shift from each other in the circumferential direction of the electric blowing part 11, the same operation and effect as that of the vacuum cleaner in Fig.1 to Fig.5 can be obtained. Additionally, since the four first coil springs 101 and four second coil springs 103 are provided, the vibration with the driving of the electric blower 41 can be reliably absorbed.

[0148] Next, a vacuum cleaner will be described with reference to Fig. 13. Moreover, the same reference numeral is attached to each part having the same constitution and operation as that of each of the above figures, and description thereof will be omitted.

[0149] In the vacuum cleaner shown in Fig.13, the first coil spring group 102 has two first coil springs 101 and each second coil spring group 104 has two second coil springs 103 in the third embodiment.

[0150] The first inner circumference spring holding parts 121 are arranged at two places of the inner circumference side spring support 111 constituting the first coil spring group 102, and apart from each other at an approximately even angle, 180 degrees, in the present embodiment, in the circumferential direction of the inner circumference side spring support 111. In other words, the first inner circumference spring holding parts 121 are arranged symmetrically with respect to the center of gravity G. Additionally, the first inner circumference spring holding parts 121 are arranged on the left and right of the electric blower 41.

[0151] Similarly, the first outer circumference spring holding parts 123 are arranged at two places of the outer circumference side spring support 112 constituting the first coil spring group 102, and apart from each other at an approximately even angle, 180 degrees, in the present embodiment, in the circumferential direction of the outer circumference side spring support 112. Additionally, the first outer circumference spring holding parts 123 are respectively located at positions corresponding to the first inner circumference spring holding part 121, on the left and right of the electric blower 41.

[0152] Accordingly, the first coil springs 101 are, when being viewed in the axial direction of the electric blowing part 11, arranged so as to be approximately horizontal in relation to the electric blower 41.

[0153] On the other hand, the second inner circumference spring holding parts 131 are arranged at two places of each of the front and rear motor covers 75, 76 of the

motor cover 42. The two second inner circumference spring holding parts 131 are apart from each other at an approximately even angle, 180 degrees, in the present embodiment, in the circumferential direction of the motor cover 42. In other words, the two second inner circumference spring holding parts 131 are arranged symmetrically with respect to the center of gravity G, and located above and under the electric blower 41.

[0154] Similarly, the second outer circumference spring holding parts 137 are formed at two places of the main body case side spring support 132 constituting the second coil spring group 104, and apart from each other at an approximately even angle, 180 degrees, in the present embodiment, in a circumferential direction of the main body case side spring support 132. Additionally, the second outer circumference spring holding parts 137 are respectively located at positions corresponding to the second inner circumference spring holding parts 131, that is, at above and under the electric blowing part 11.

[0155] Accordingly, the second coil springs 103 are, when being viewed in the axial direction of the electric blowing part 11, arranged so as to be approximately perpendicular to the electric blower 41.

[0156] Thus, the first coil spring 101 and second coil spring 103 are arranged so as to shift from each other at an approximately even interval in the circumferential direction and by 90 degrees in the circumferential direction of the electric blowing part 11.

[0157] By having the same constitution as that of the first embodiment, for example, arranging the plurality of first coil springs 101 for elastically supporting the electric blower 41 with respect to the motor cover 42 and the plurality of second coil springs 103 for elastically supporting the electric blowing part 11 with respect to the main body case 5 so that the springs shift from each other in the circumferential direction of the electric blowing part 11, the same operation and effect as that of the first embodiment can be obtained. Additionally, since the two first coil springs 101 and two second coil springs 103 are provided, the constitutions of the coil spring groups 102, 104 can be simplified.

[0158] Moreover, in Fig. 10 to Fig. 13, three or more second coil spring groups 104 may be provided. In the case of providing, for example, three or more odd numbers of second coil spring groups 104, one of them is located at the position corresponding to the center of gravity G, and the others are balancedly arranged in front of and behind the center of gravity G. In the case of providing two or more even numbers of second coil spring groups 104, they may be balancedly arranged at positions between which the center of gravity G is located.

[0159] Additionally, each second coil springs 103 of one of the second coil spring groups 104 and each second coil spring 103 of the other second coil spring group 104 may be shifted from each other in the circumferential direction. In this case, if each second coil spring 103 is arranged between the first coil springs 101 of the first coil spring group 102, at a position shifting from the first coil

spring 101, the same operation and effect as that of each of the above embodiments can be obtained.

[0160] Next, a vacuum cleaner will be described with reference to Fig. 14. Moreover, the same reference numeral is attached to each part having the same constitution and operation as that of each of the above figures, and description thereof will be omitted.

[0161] In the vacuum cleaner shown in Fig. 14, one second coil spring group 104 is provided in Fig. 10 to Fig. 13.

[0162] That is, the second coil spring group 104 is arranged outside of the first coil spring group 102, at the position corresponding to the center of gravity G of the electric blowing part 11. Moreover, the number and arrangement of first coil springs 101 and the number and arrangement of second coil spring 103 are made similar to those of the third embodiment for convenience, however, they may be made similar to those of the third to fifth embodiment.

[0163] By having the same constitution as that of each of above figures, for example, arranging the plurality of first coil springs 101 for elastically supporting the electric blower 41 with respect to the motor cover 42 and the plurality of second coil springs 103 for elastically supporting the electric blowing part 11 with respect to the main body case 5 so that the springs shift from each other in the circumferential direction of the electric blowing part 11, the same operation and effect as that of each of the above embodiments can be obtained. Additionally, since only one second coil spring group 104 is arranged at the position corresponding to the center of gravity G of the electric blowing part 11, the electric blowing part 11 can be effectively elastically supported by the group 104 and the constitution can be simultaneously simplified.

[0164] Moreover, in Fig. 10 to Fig. 14, the coil springs 101, 103 can be arbitrarily arranged as long as shifting from each other in the circumferential direction so as to hold the electric blowing part 11.

[0165] Similarly, the coil spring groups 102, 104 may include the arbitrary number (two or more) of coil springs 101, 103 respectively.

[0166] That is, each of the coil springs 101, 103 of the coil spring groups 102, 104 of the third to sixth embodiments can be replaced with a plurality of coil springs having a spring constant as a whole equivalent to the spring constant of each of the springs 101, 103.

[0167] Although the first coil spring group 102 is formed as a unit by the spring supports 111, 112, both ends of the first coil spring 101 may be directly locked to the outer circumference of the motor frame 47 and inner circumference of the motor cover 42, for example.

[0168] Further, in each of the spring holding parts 121, 123 of the spring supports 111, 112, the end of the first coil spring 101 may be fitted with a groove, or attached to a guide rib, for example.

[0169] Similarly, although the second coil spring group 104 is formed as a unit by the main body case side spring support 132, both ends of the second coil spring 103 may be directly locked to the outer circumference of the motor

cover 42 and inner face of the blowing chamber 6, for example.

[0170] Further, in each of the spring holding parts 131, 137, the end of the second coil spring 103 may be fitted with a groove, or attached to a guide rib.

[0171] Additionally, the constitution of the details of the electric vacuum cleaner of the present invention is not limited to the constitutions of the above figures, and is applicable to an upright vacuum cleaner, handy vacuum cleaner, etc.

[Industrial Applicability]

[0172] An electric vacuum cleaner of the present invention is used as, for example, a home electric vacuum cleaner.

Claims

1. An electric vacuum cleaner comprising:

an electric blowing part (11);
a main body case (5) in which a housing chamber (6) for housing the electric blowing part (11) therein is provided; and

a plurality of elastic member groups (46) each including a pair of elastic members (45, 45) which is formed along at least a part of an outer circumference of the electric blowing part (11) and supports the electric blowing part (11) with respect to the main body case (5) at positions opposite to each other,

wherein the elastic member groups (46) are arranged at positions different from each other in an axial direction of the electric blowing part, and wherein the elastic member groups (46) are arranged shifted from each other in a circumferential direction of the electric blowing part (11), so that the pair of elastic members in one of the elastic member groups and the pair of elastic members in another of the elastic member groups are apart from each other at an approximately even interval in a circumferential direction of the electric blowing part;

characterized in that;

three elastic member groups (46a, 46b, 46c) are arranged shifted from each other by 60 degrees in the circumferential direction of the electric blowing part (11),

one of the elastic member groups (46a) is arranged at a position corresponding to the center of gravity (G) of the electric blowing part, and the other elastic member groups (46b, 46c) are arranged at positions between which the one elastic member group (46a) is located.

Patentansprüche

1. Elektrischer Staubsauger, umfassend:

einen elektrischen Gebläseteil (11);
ein Hauptgehäuse (5), in welchem eine Aufnahmekammer (6) zum Aufnehmen des elektrischen Gebläseteils (11) darin bereitgestellt ist; und

mehrere Gruppen elastischer Glieder (46), jede ein Paar elastischer Glieder (45, 45) beinhaltend, welches entlang zumindest eines Teils eines äußeren Kreisumfangs des elektrischen Gebläseteils (11) gebildet ist und den elektrischen Gebläseteil (11) in Bezug auf das Hauptgehäuse (5) an einander entgegengesetzten Positionen stützt,

wobei die Gruppen elastischer Glieder (46) an voneinander verschiedenen Positionen in einer Achsenrichtung des elektrischen Gebläseteils angeordnet sind, und

wobei die Gruppen elastischer Glieder (46) in einer Umfangsrichtung des elektrischen Gehäuseteils (11) zueinander verschoben angeordnet sind, so dass die Paare elastischer Glieder in einer der Gruppen elastischer Glieder und die Paare elastischer Glieder in einer anderen der Gruppen elastischer Glieder in einem annähernd regelmäßigen Intervall in einer Umfangsrichtung des elektrischen Gebläseteils voneinander entfernt sind;

dadurch gekennzeichnet, dass;

drei Gruppen elastischer Glieder (46a, 46b, 46c) in der Umfangsrichtung des elektrischen Gebläseteils (11) um 60 Grad zueinander verschoben angeordnet sind,

eine der Gruppen elastischer Glieder (46a) an einer Position entsprechend dem Schwerpunkt (G) des elektrischen Gebläseteils angeordnet ist, und

die anderen Gruppen elastischer Glieder (46b, 46c) an Positionen angeordnet sind, zwischen welchen die eine Gruppe elastischer Glieder (46a) gelegen ist.

Revendications

1. Aspirateur électrique comprenant :

une partie soufflante électrique (11) ;
un boîtier de corps principal (5) dans lequel une chambre de logement (6) destinée à accueillir la partie soufflante électrique (11) en son sein est fournie ; et

une pluralité de groupes d'éléments élastiques (46) comprenant chacun une paire d'éléments élastiques (45, 45) qui est formée le long d'au

moins une partie d'une circonférence externe de la partie soufflante électrique (11) et supporte la partie soufflante électrique (11) par rapport au boîtier de corps principal (5) en des positions en regard l'une de l'autre, 5

dans lequel les groupes d'éléments élastiques (46) sont agencés en des positions différentes les uns des autres dans une direction axiale de la partie soufflante électrique (11), 10

et dans lequel les groupes d'éléments élastiques (46) sont agencés décalés les uns des autres dans une direction circonférentielle de la partie soufflante électrique (11), de sorte que la 15

paire d'éléments élastiques dans l'un des groupes d'éléments élastiques et la paire d'éléments élastiques dans un autre groupe d'éléments élastiques soient séparées l'une de l'autre d'un 20

intervalle plus au moins régulier dans une direction circonférentielle de la partie soufflante électrique ;

caractérisé en ce que ;

trois groupes d'éléments élastiques (46a, 46b, 46c) sont agencés décalés les uns des autres de 60 degrés dans la direction circonférentielle 25

de la partie soufflante électrique (11),

l'un des groupes d'éléments élastiques (46a) est agencé en une position correspondant au centre de gravité (G) de la partie soufflante électrique, 30

et

les autres groupes d'éléments élastiques (46b, 46c) sont agencés en des positions entre lesquelles le premier groupe d'éléments élastiques (46a) est situé.

35

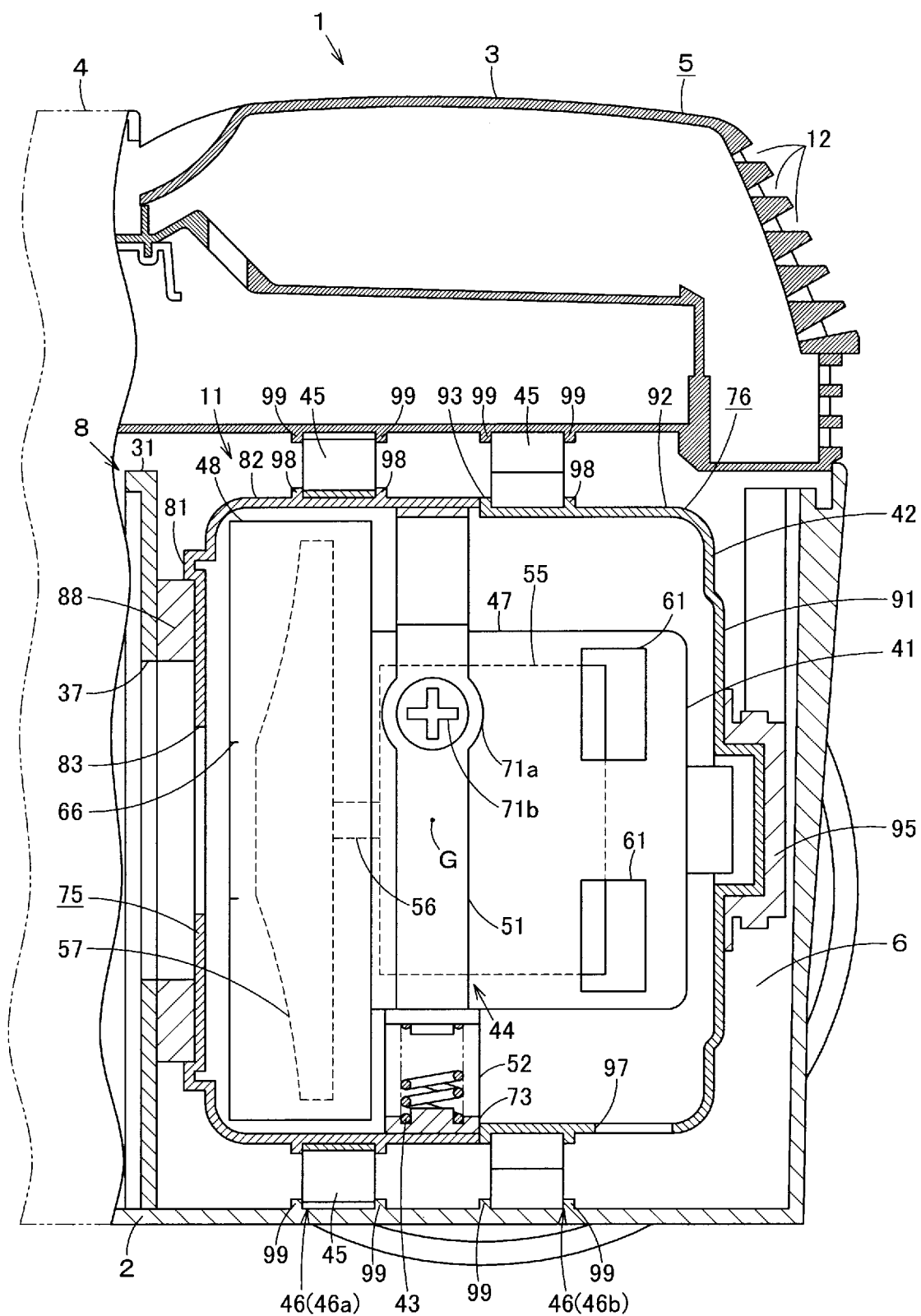
40

45

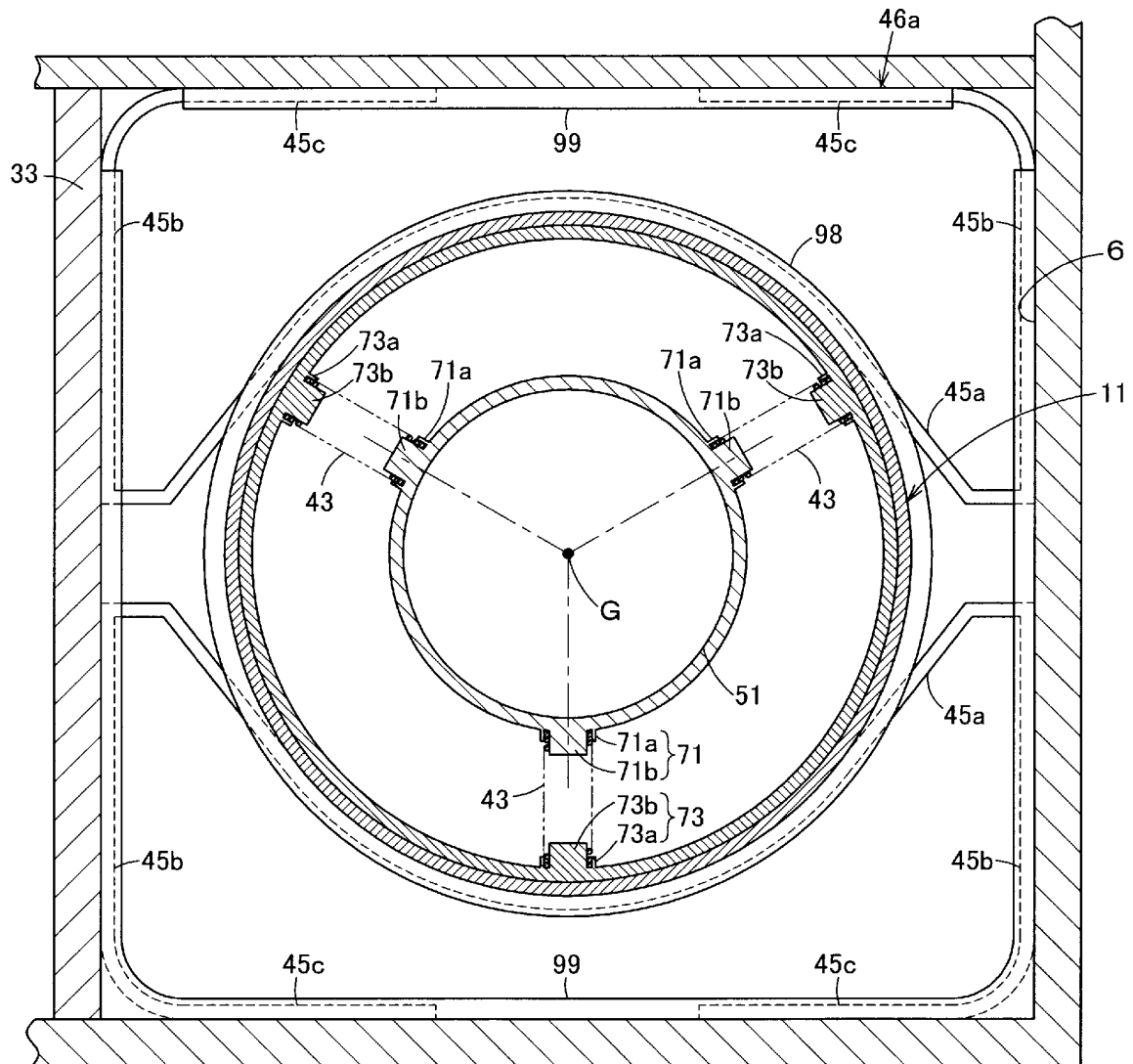
50

55

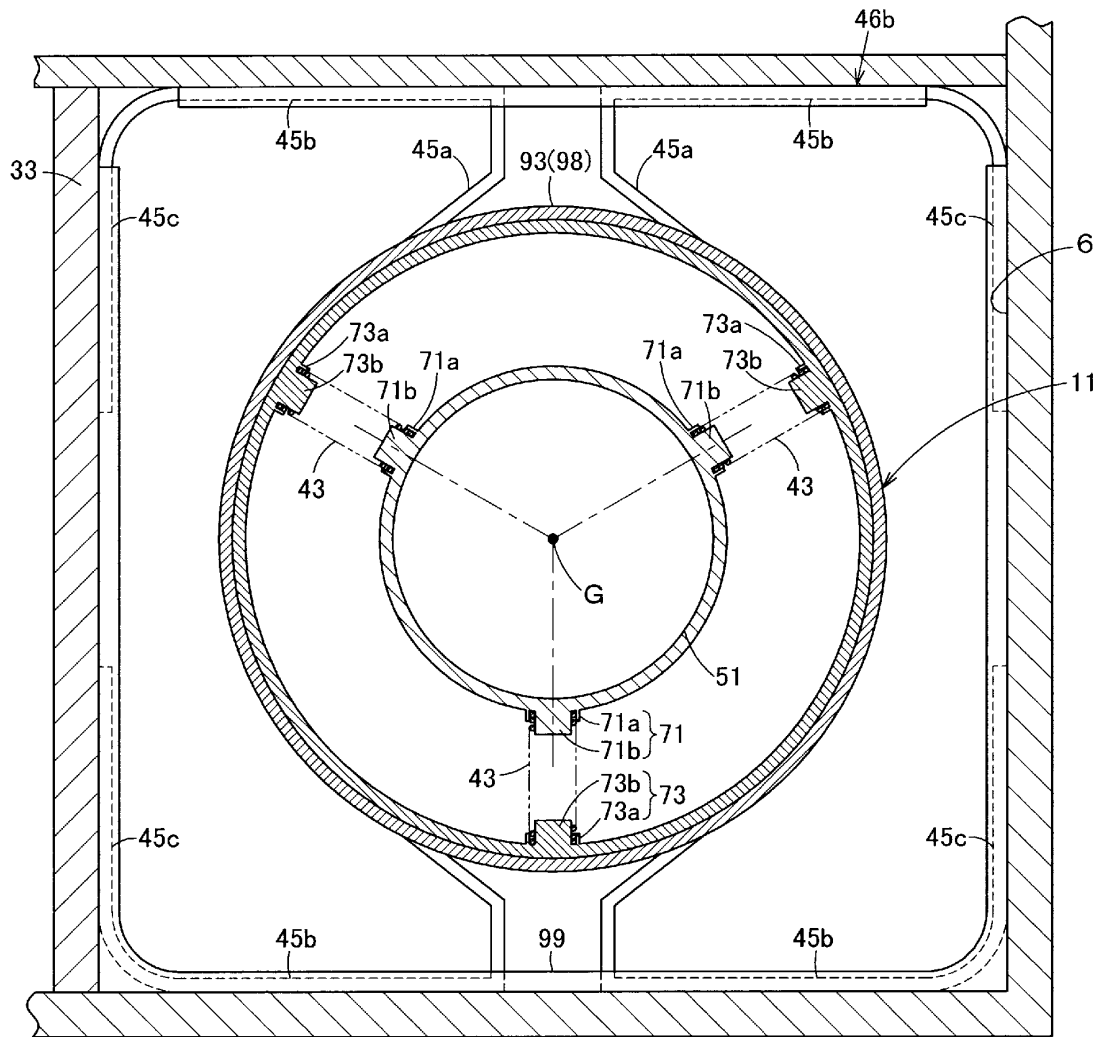
[Fig. 1]



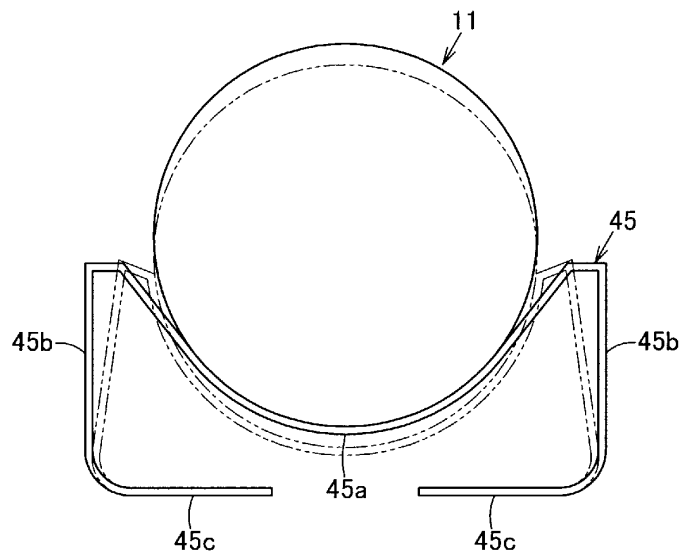
[Fig. 2]



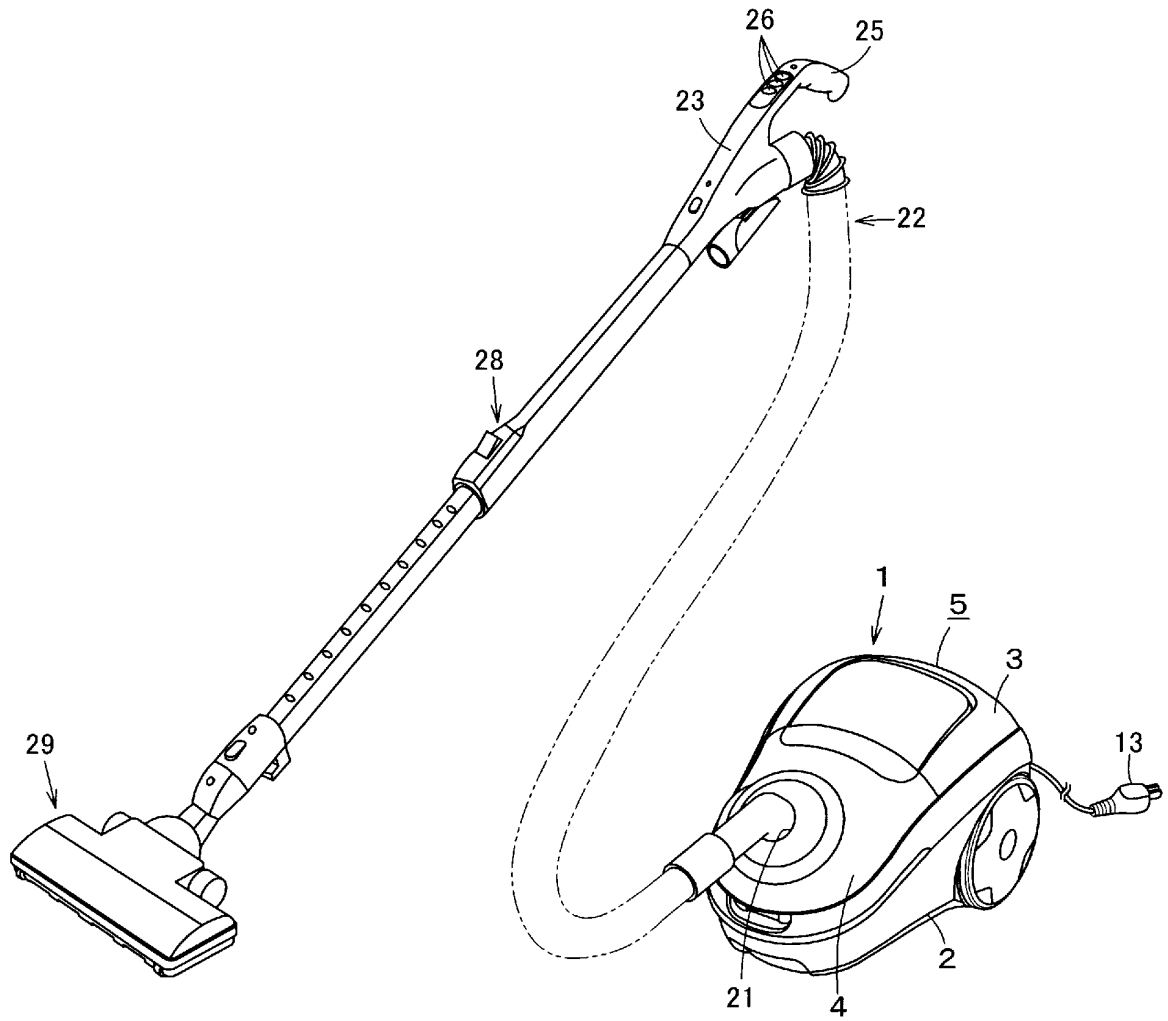
[Fig. 3]



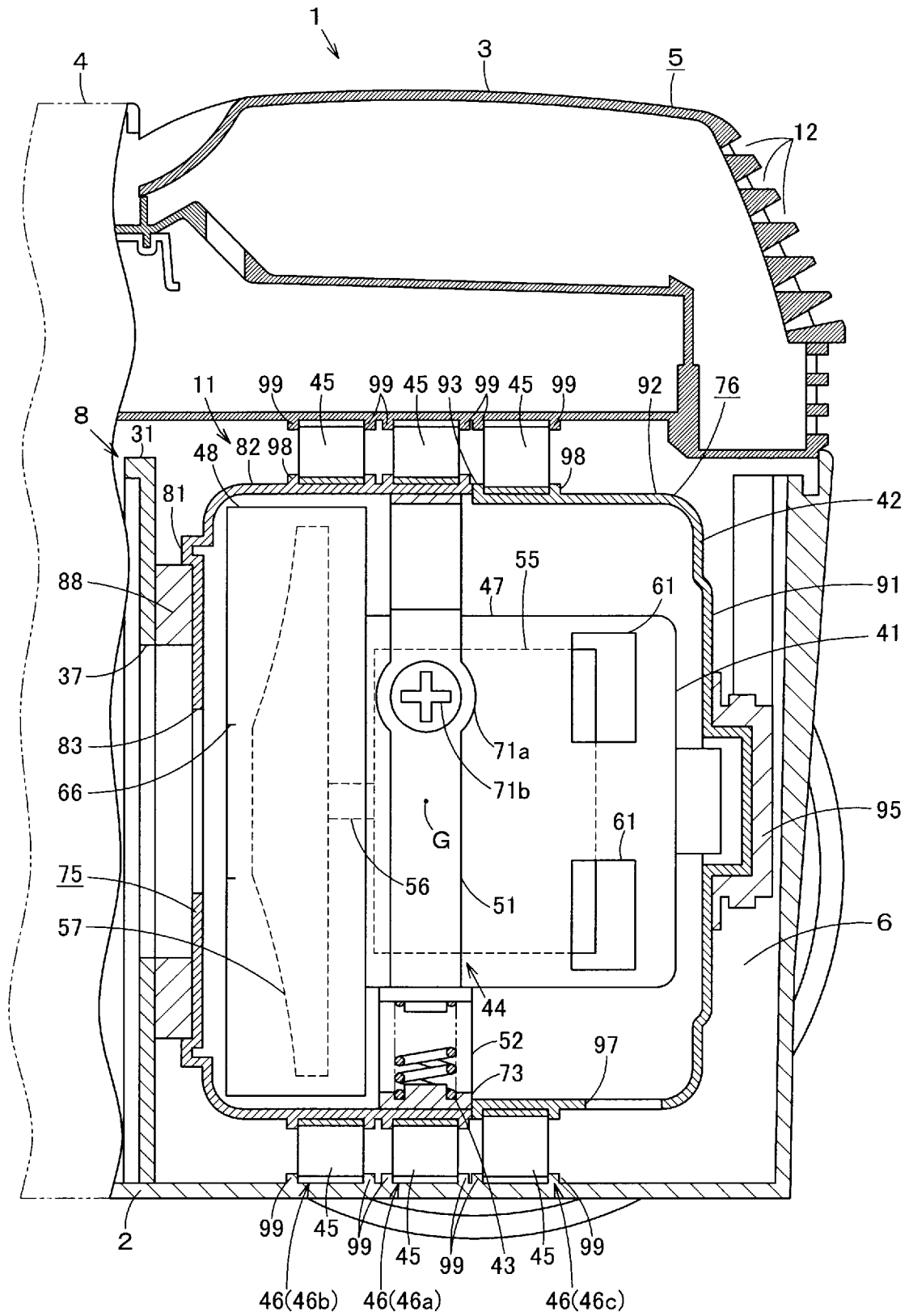
[Fig. 4]



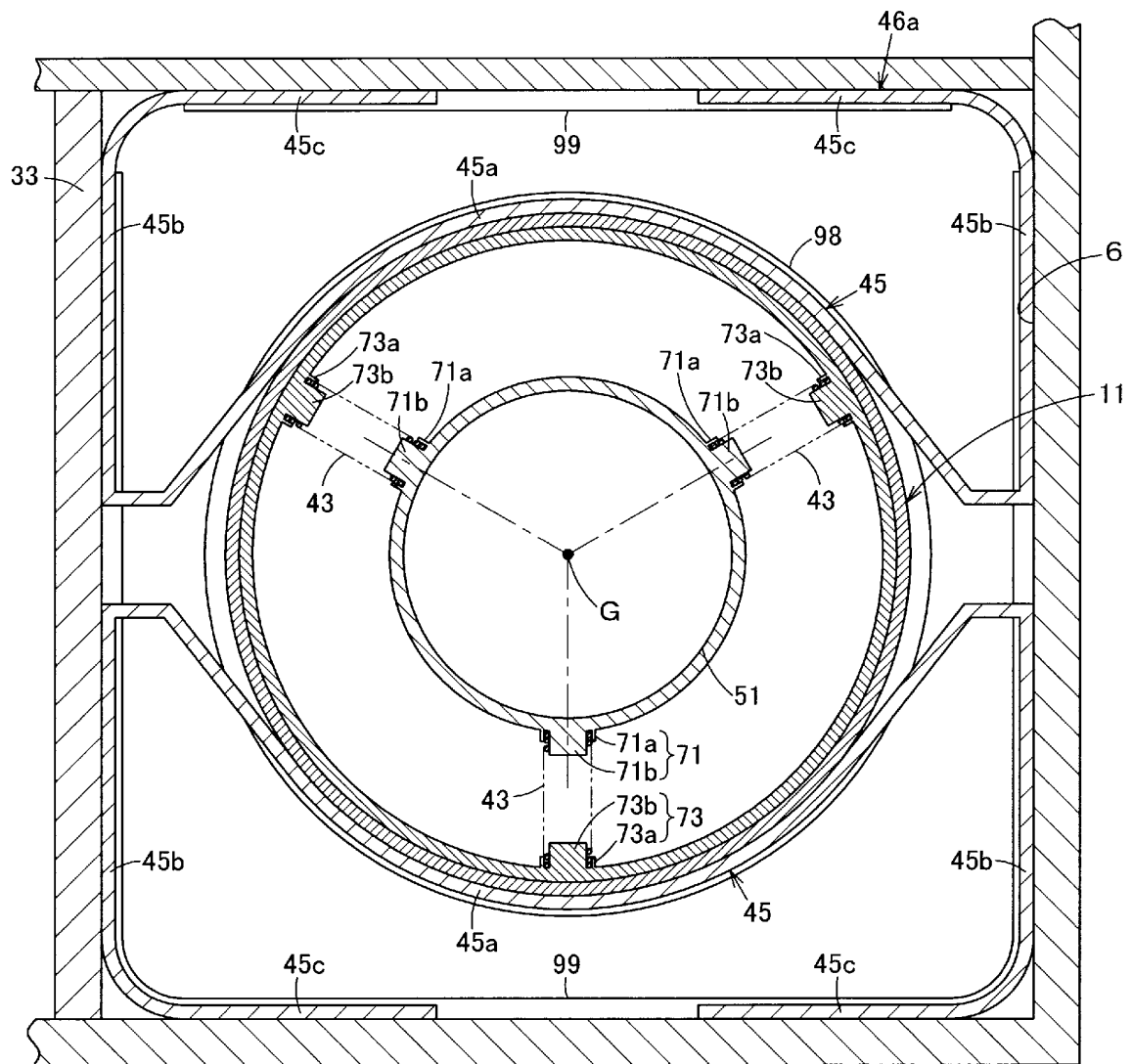
[Fig. 5]



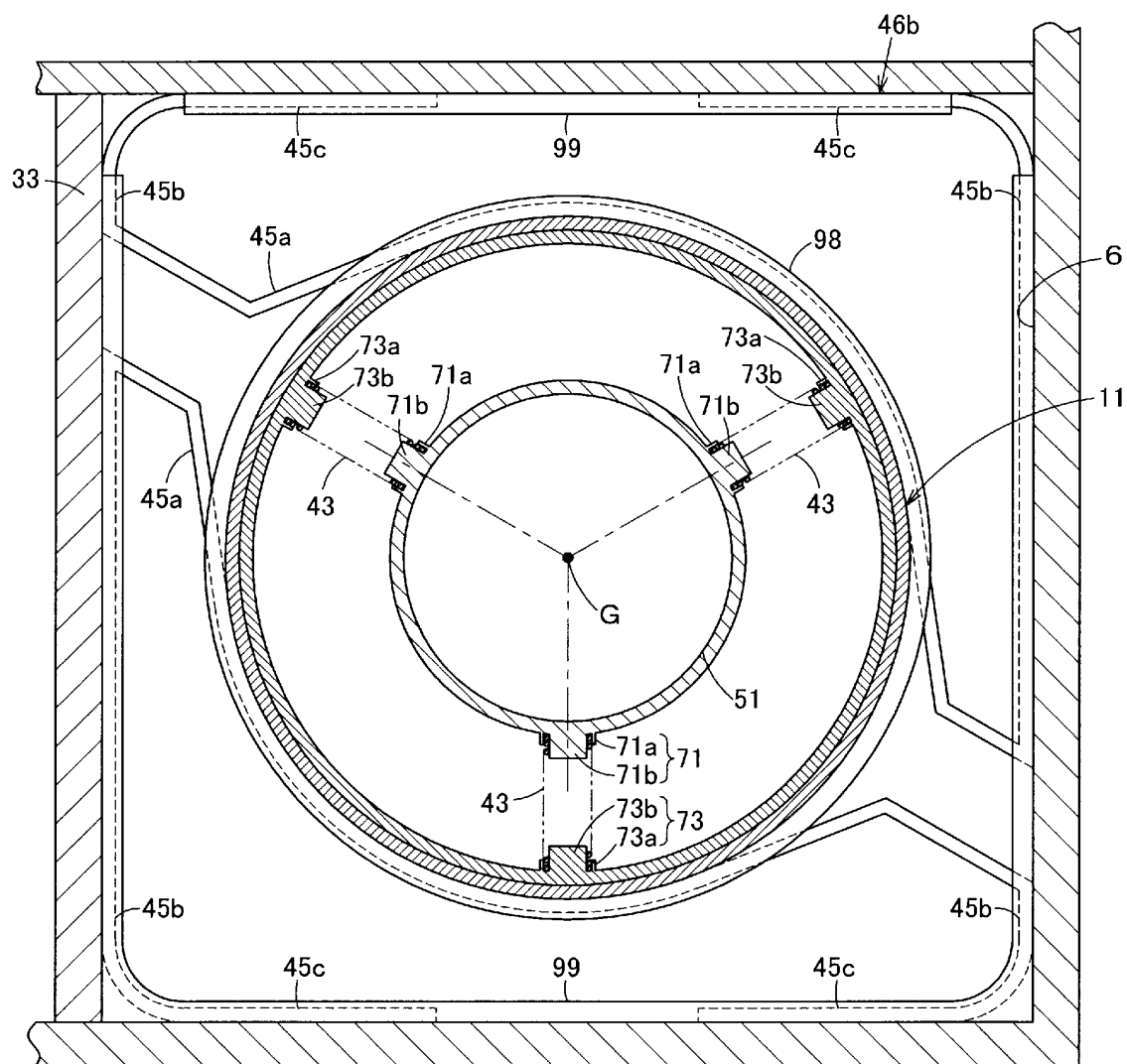
[Fig. 6]



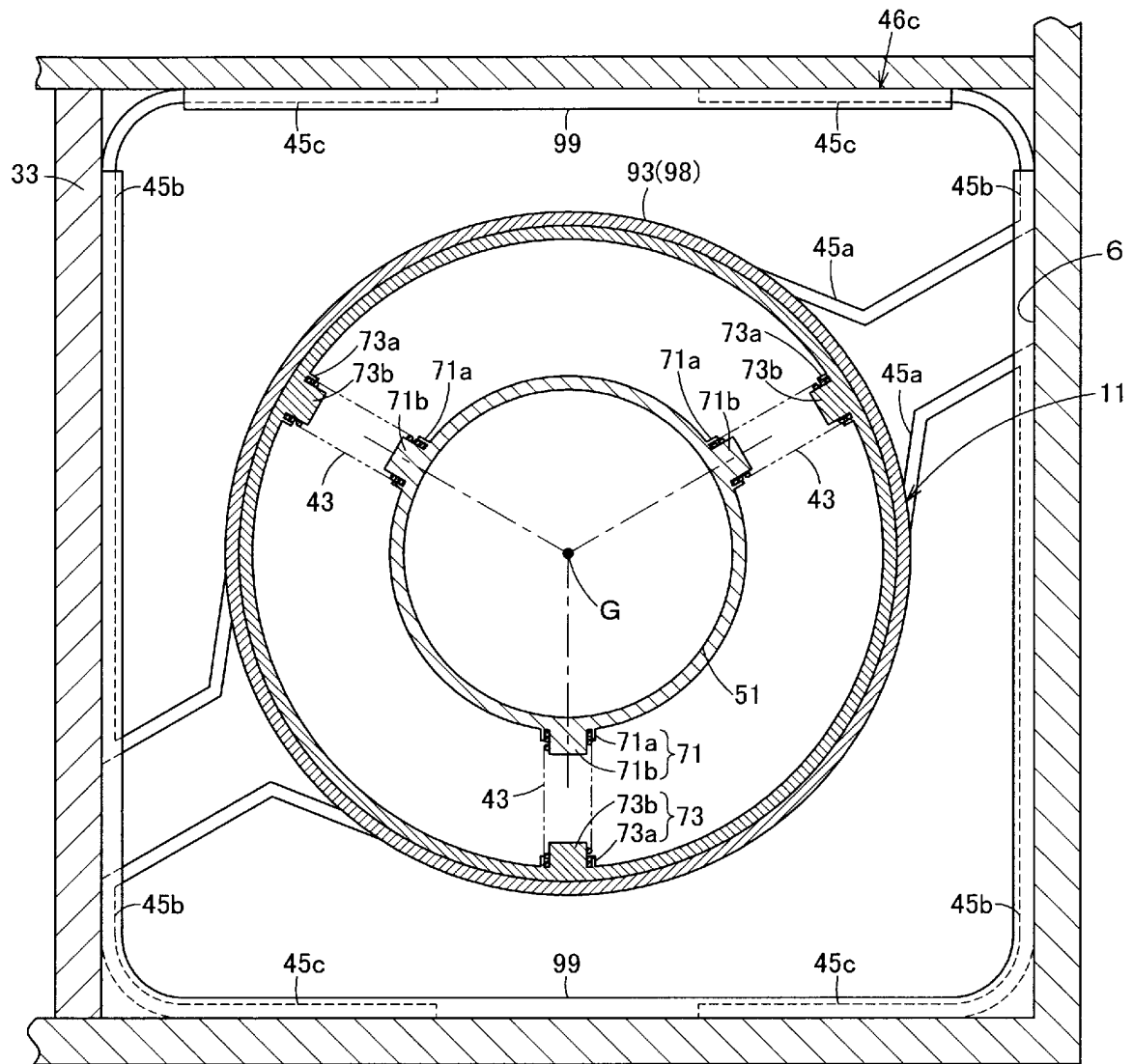
[Fig. 7]



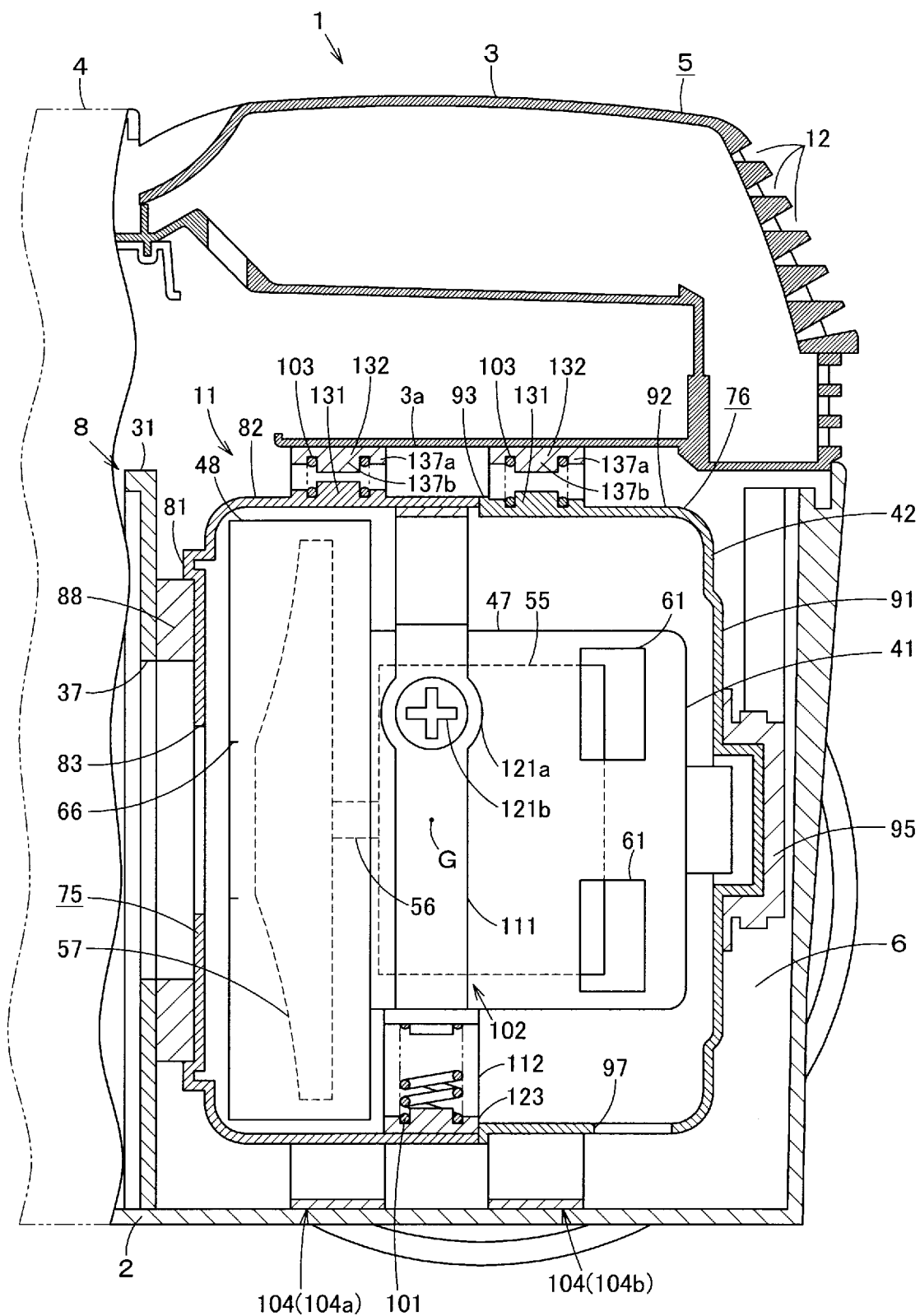
[Fig. 8]



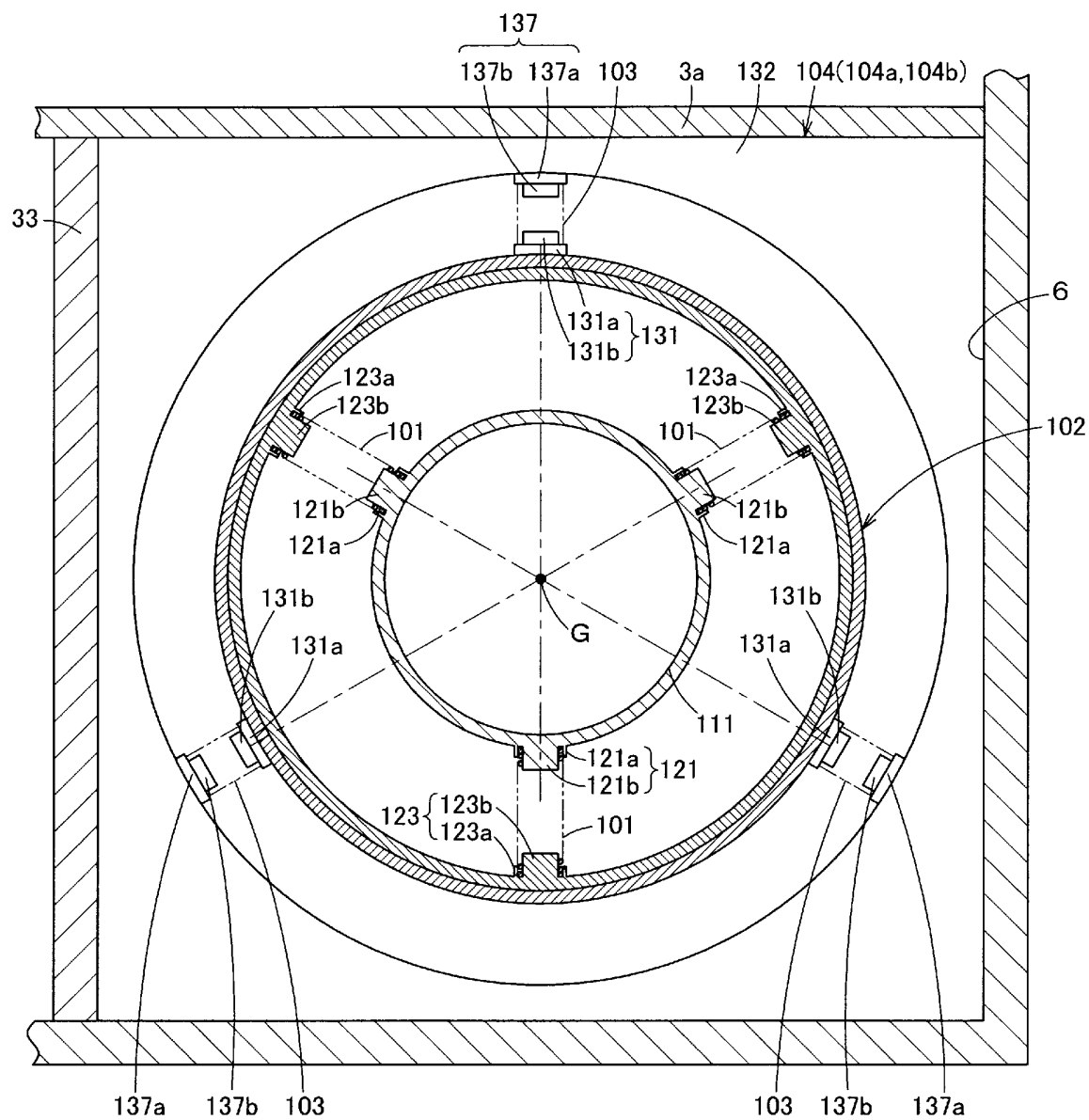
[Fig. 9]



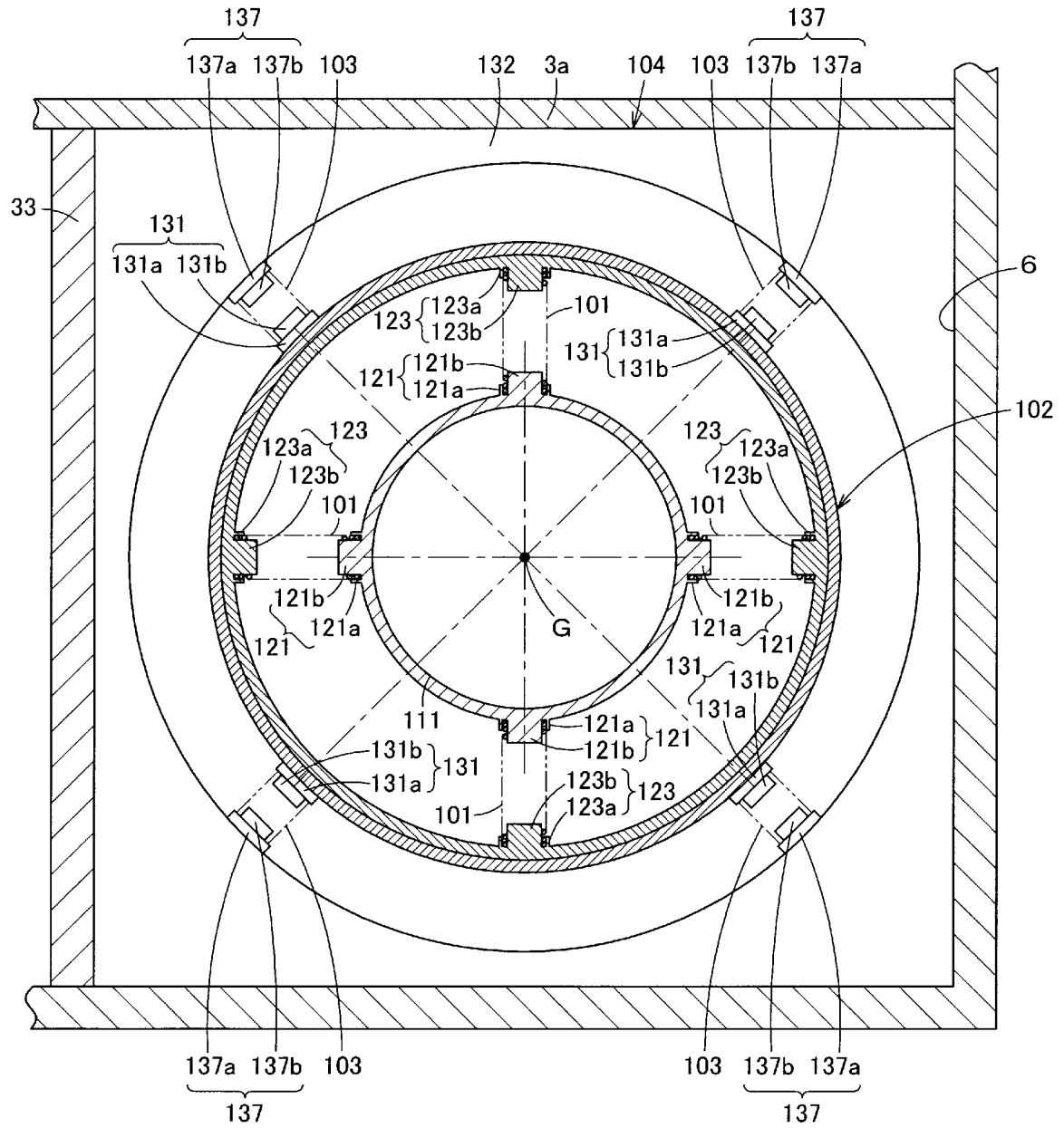
[Fig. 10]



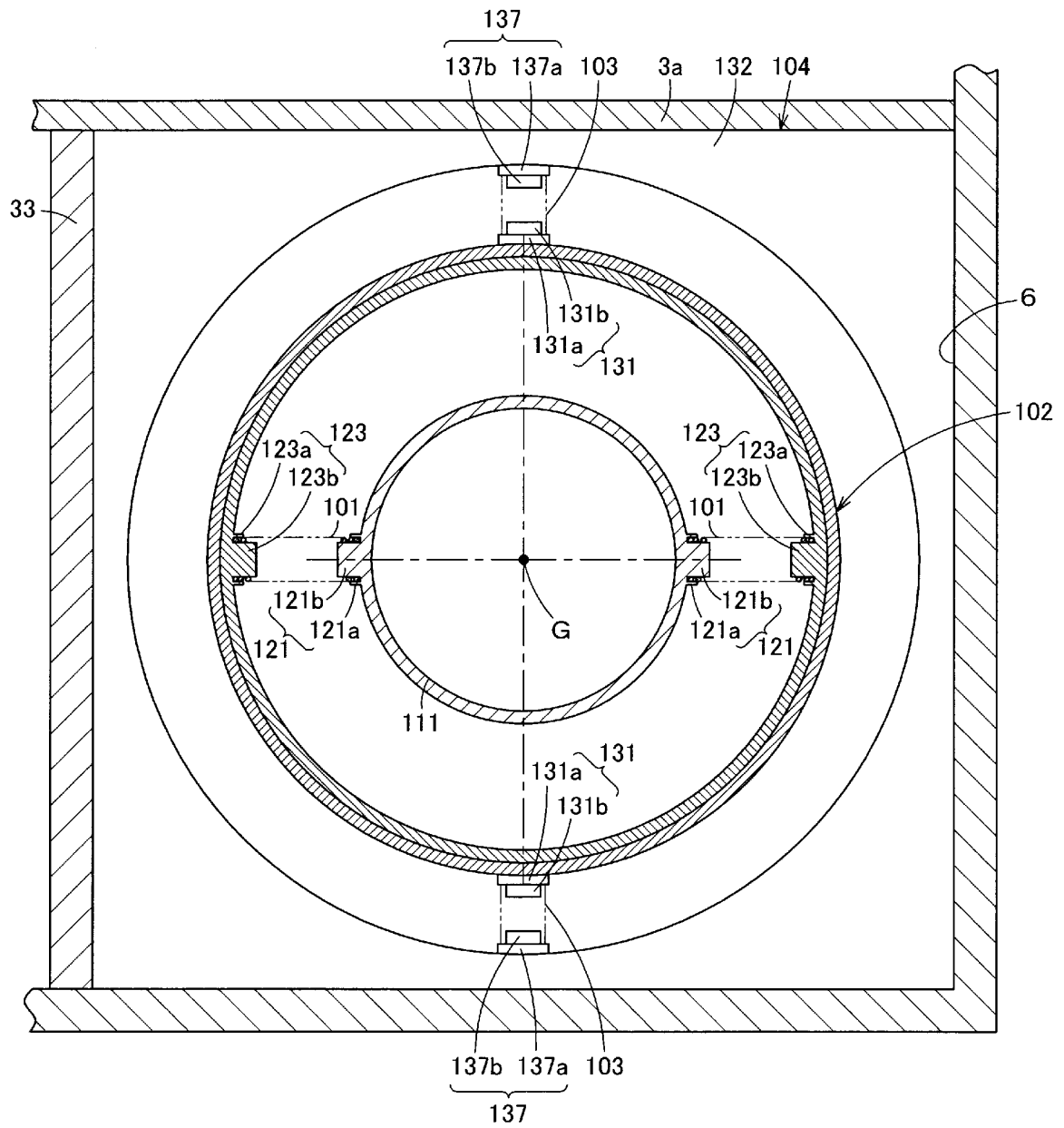
[Fig. 11]



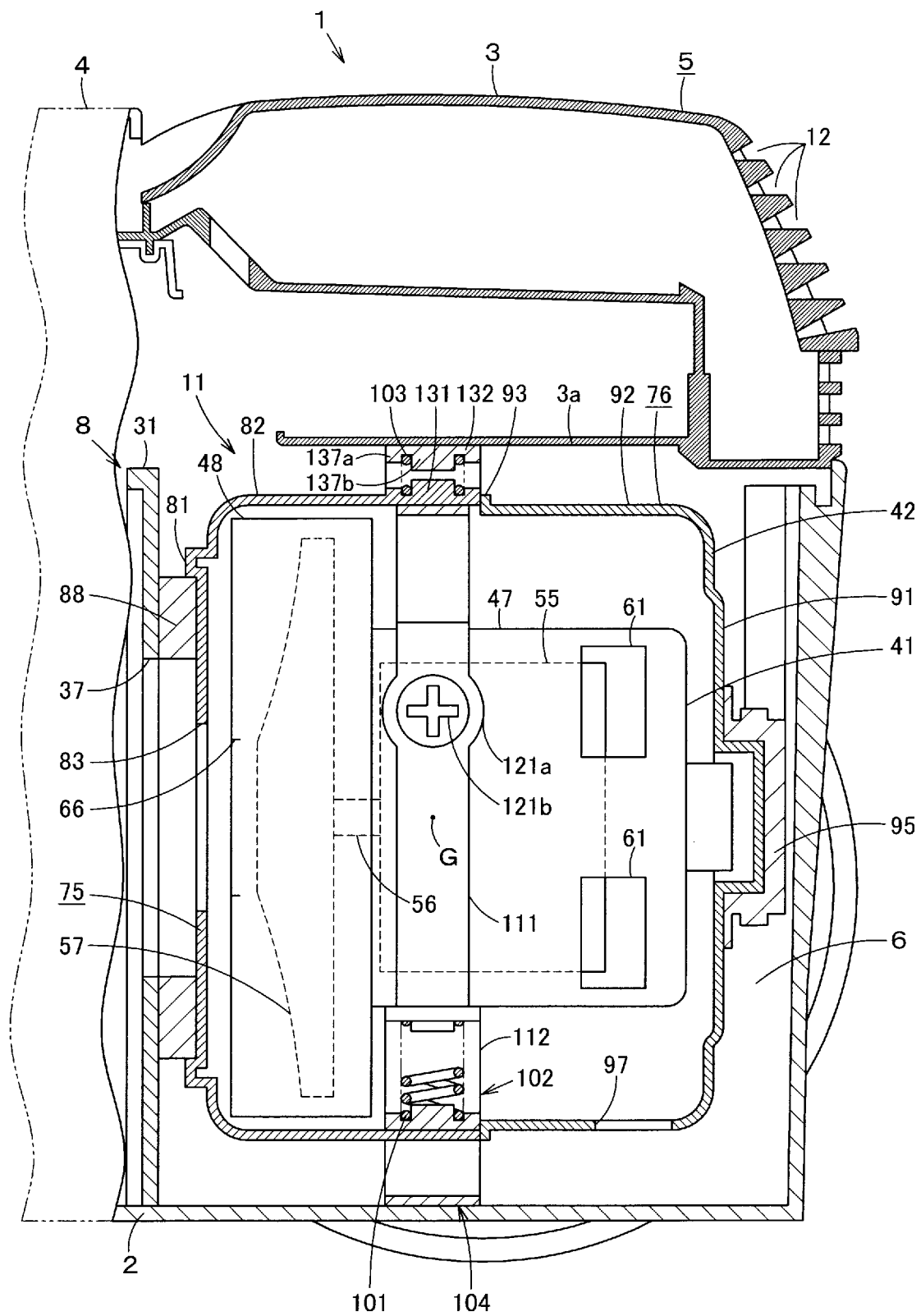
[Fig. 12]



[Fig. 13]



[Fig. 14]



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 4193143 A [0002]
- JP 2001204655 A [0003]
- JP 5084195 A [0003]
- JP 2874401 B [0130]