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

(11) EP 2 545 835 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
16.01.2013 Bulletin 2013/03

(21) Application number: **11753043.6**

(22) Date of filing: **09.03.2011**

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

(86) International application number:
PCT/JP2011/001371

(87) International publication number:
WO 2011/111379 (15.09.2011 Gazette 2011/37)

(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 RS SE SI SK SM TR

(30) Priority: **20.04.2010 JP 2010096805**
10.03.2010 JP 2010052718

(71) Applicant: **Panasonic Corporation**
Kadoma-shi
Osaka 571-8501 (JP)

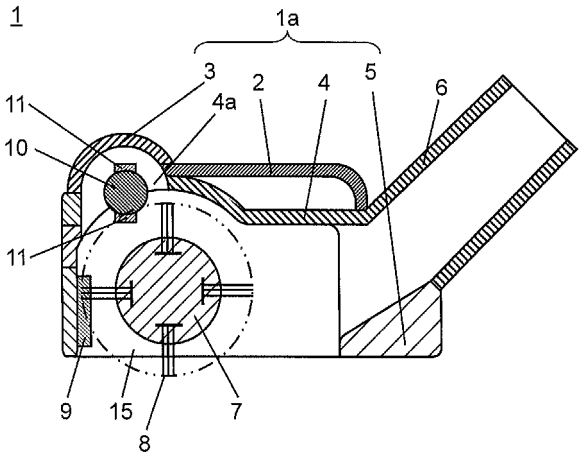
(72) Inventors:
- **FUJITA, Kouichi**
c/o Panasonic Corporation, IPROC, IP Development
Osaka 540-6207 (JP)
- **HATANO, Tsuyoshi**
c/o Panasonic Corporation, IPROC, IP Development
Osaka 540-6207 (JP)
- **KIM, Minsu**
c/o Panasonic Corporation, IPROC, IP Development
Chuo-ku
Osaka 540-6207 (JP)

(74) Representative: **Schwabe - Sandmair - Marx**
Patentanwälte
Stuntzstraße 16
81677 München (DE)

(54) SUCTION TOOL FOR ELECTRIC CLEANER AND ELECTRIC CLEANER USING SAME

(57) A suction tool for an electric cleaner of the present invention includes suction tool main body (1) with suction inlet (15), rotary brush (7) rotatably provided inside suction tool main body (1), brush body (8) provided protruding from an outer periphery of rotary brush (7), and friction body (10) rotatably provided to come into contact with brush body (8). This improves durability of brush body (8), and enables stable supply of negative ions to a cleaning surface.

FIG. 2



EP 2 545 835 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to suction tools for electric cleaners and electric cleaners using same for sweeping the floor.

BACKGROUND ART

[0002] A conventional suction tool for an electric cleaner has multiple brush groups with different charges in triboelectric series in the suction tool for an electric cleaner, and produces negative ions by rotating these brush groups as they rub each other. These generated negative ions adsorb to dust on a cleaning surface, such as floor, and are then vacuumed up by the suction tool for an electric cleaner to collect dust. An electric cleaner configured in this way is proposed typically in PTL 1.

[0003] The conventional suction tool for an electric cleaner disclosed in PTL 1 is described below with reference to Fig. 9.

[0004] Fig. 9 is a side sectional view of the conventional suction tool for an electric cleaner. As shown in Fig. 9, brush group 43 including brushes 42 listed in the negative side of the triboelectric series and another brush group 45 including brushes 44 listed in the positive side of the triboelectric series are rotatably provided, respectively, inside opening 41 on a bottom face of suction tool for electric cleaner 40 (hereafter shortly referred to as "suction tool"). Brush group 43 and brush group 45 rotate by resistance (friction force) generated between brush groups 43 and 45 and the cleaning surface when suction tool 40 moves on the cleaning surface. Here, brushes 42 of brush group 43 and brushes 44 of brush group 45 rotate as they contact each other. Friction caused by this contact of brushes 42 of brush group 43 and brushes 44 of brush group 45 produces negative ions. Negative ions produced in this way adsorb to dust on the cleaning surface, such as floor, to collect dust.

[0005] However, conventional suction tool for electric cleaner 40 has room for improvement with respect to durability of brushes 42 and 44 of brush groups 43 and 45. An inventor finds that the following point causes a disadvantage related to durability of brushes 42 and 44 of brush groups 43 and 45.

[0006] More specifically, conventional suction tool for electric cleaner 40 produces negative ions by mutual contact of brushes 44 of brush group 45 and brushes 42 of brush group 43. Therefore, a contact area of brushes 42 and brushes 44 are large. This makes both brushes 42 and brushes 44 wear away and wear out, or entangled and torn off, degrading durability of brushes 42 and 44.

[Citation List]

Patent Literature

[0007] PTL1 Japanese Patent Unexamined Publication No. 2005-305194 **SUMMARY OF THE INVENTION**

[0008] A suction tool for an electric cleaner of the present invention includes a suction tool main body with a suction inlet, a rotary brush rotatably provided inside the suction tool main body, a brush body provided protruding from an outer periphery of the rotary brush, and a friction body rotatably provided so as to come into contact with the brush body.

[0009] This structure improves durability by reducing a contact area of the brush body and the friction body, and also stably supplies negative ions to a cleaning surface.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

Fig. 1 is a perspective view of an entire electric cleaner to which a suction tool for an electric cleaner is mounted in accordance with a first exemplary embodiment of the present invention.

Fig. 2 is a side sectional view of the suction tool for an electric cleaner in accordance with the first exemplary embodiment of the present invention.

Fig. 3 is a top view of the suction tool for an electric cleaner in accordance with the first exemplary embodiment of the present invention.

Fig. 4 is a top view of the suction tool for an electric cleaner in a state that an upper part is removed in accordance with the first exemplary embodiment of the present invention.

Fig. 5 is a sectional view of a suction tool for an electric cleaner in accordance with a second exemplary embodiment of the present invention.

Fig. 6 is a back view of the suction tool for an electric cleaner in accordance with the second exemplary embodiment of the present invention.

Fig. 7 is a back view of the suction tool for an electric cleaner in a state that a rotating brush is removed in accordance with the second exemplary embodiment of the present invention.

Fig. 8 s a back view of the suction tool for an electric cleaner in a state that the rotating brush and a holder are removed in accordance with the second exemplary embodiment of the present invention.

Fig. 9 is a side sectional view of a conventional suction tool for an electric cleaner.

DESCRIPTION OF EMBODIMENTS

[0011] A suction tool for an electric cleaner in exemplary embodiments of the present invention is described below with reference to drawings. In the description be-

low, same reference marks are given to same or equivalent components.

(FIRST EXEMPLARY EMBODIMENT)

[0012] Fig. 1 is a perspective view of an entire electric cleaner to which a suction tool for an electric cleaner is mounted in the first exemplary embodiment of the present invention. Fig. 2 is a side sectional view of the suction tool for an electric cleaner in the first exemplary embodiment. Fig. 3 is a top view of the suction tool for an electric cleaner in the first exemplary embodiment. Fig. 4 is a top view of the suction tool for an electric cleaner in a state that an upper part is removed in the first exemplary embodiment.

[0013] The suction tool for an electric cleaner is shortly indicated as a suction tool in the following description. Also in the following description, the side of arrow C in Fig. 1 is a left side face of suction tool 1, the side of arrow A in Fig. 1 is front or a front part of suction tool 1 (equivalent to the direction that the user moves suction tool 1 forward), the side of arrow B in Fig. 1 is back or a rear part of suction tool 1 (equivalent to the direction that the user moves suction tool 1 backward), and the side of arrow D in Fig. 1 is a right side face of suction tool 1.

[0014] As shown in Fig. 1, electric cleaner 100 mainly includes suction tool 1 for collecting dust on a cleaning surface, such as floor, electric cleaner main body 32 with built-in electric blower 33, hose 31 detachably connected to electric cleaner main body 32, and extension pipe 30 detachably connected to hose 31.

[0015] One end of extension pipe 30 is connected to hose 31, and the other end of extension pipe 30 is connected to suction tool 1 typically via movable pipe 6. Hand control unit 34 that the user uses for selecting an operation mode (e.g., strong, medium, or weak suction power and power off) for operating electric blower 33 is provided at an end of hose 31 to the side of one end of extension pipe 30. Hand control unit 34 has a control circuit (not illustrated) for controlling electric blower 33 based on the operation mode selected by the user.

[0016] As shown in Figs. 2 to 4, suction tool main body 1a includes bottom part 5 with suction inlet 15 that configures a bottom face of suction tool main body 1a, middle part 4 with window-like hole 4a at its front provided such that middle part 4 covers an upper portion of bottom part 5, and top part 2 on which window 3 is formed to configure a top face of suction tool main body 1a. Pipe 6 is disposed at the back center of suction tool main body 1a. Pipe 6 is sandwiched between bottom part 5 and top part 2 of suction tool main body 1a. The state of dust entangled to friction body 10 can be confirmed by eyes, for example, through window 3 on top part 2 via hole 4a on middle part 4. The user can thus easily recognize the timing to clean friction body 10.

[0017] Rotary brush 7 is rotatably supported by suction tool main body 1a in suction inlet 15 of suction tool main body 1a. Multiple brush bodies 8 configured with a material (e.g., nylon) listed in the positive side of the triboelectric series are spirally disposed on an outer peripheral face of rotary brush 7. Board 9 made of a material (e.g., resin fluoride) listed in the negative side of the triboelectric series is provided on a front inner wall of bottom part 5 of suction tool main body 1a. Brush bodies 8 of rotary brush 7 and board 9 are disposed such that they come into contact as rotary brush 7 rotates.

[0018] In addition, as shown in Fig. 2, friction body 10 that rotates by making contact with brush bodies 8 of rotary brush 7 as rotary brush 7 rotates is provided at an upper front part relative to a central rotation axis of rotary brush 7.

[0019] As shown in Fig. 4, friction body 10 is disposed facing suction inlet 15 on bottom part 5 of suction tool main body 1a, and is rotatably supported by suction tool main body 1a via shaft 12. A volume (length) of contact between brush bodies 8 of rotary brush 7 and friction body 10 is not particularly limited as long as friction body 10 does not block the rotation of rotary brush 7. However, a length of 1 to 2 mm is particularly preferable, taking into account a dust suction volume, increase of negative-ion generation, and ease of operation of suction tool 1.

[0020] Furthermore, as shown in Fig. 4, drive unit 13, such as electric motor and turbine, is provided on either right or left side at the back of suction tool main body 1a. An output of drive unit 13 is transmitted to a gear (not illustrated) provided on one end of rotary brush 7 via belt 14 so that rotary brush 7 rotates in one direction. Since this enables brush bodies 8 of rotary brush 7 to rotate in one direction, as described later, negative ions that are produced by contact of brush bodies 8 of rotary brush 7 with friction body 10 and board 9 can be stably released in one direction (toward the front of suction tool main body 1a). In other words, suction of negative ions into suction tool 40 due to an inversed rotating direction (clockwise rotation) of the brush group during backward operation of conventional suction tool 40 shown in Fig. 9 can be prevented to ensure supply of negative ions to the cleaning surface. Here, brush bodies 8 of rotary brush 7 and friction body 10 rotate each other. This changes a contact position of brush bodies 8 of rotary brush 7 with friction body 10, and avoids their contact at the same position. Accordingly, durability of friction body 10 improves.

[0021] A length of friction body 10 in the longitudinal direction is set shorter than the total length of rotary brush 7 in the longitudinal direction. Friction body 10 may be provided in multiple pieces (e.g., 2 to 3 pieces) relative to the longitudinal direction of rotary brush 7. This reduces a contact area (length in the longitudinal direction) of brush bodies 8 of rotary brush 7 and friction bodies 10 to reduce a load applied to brush bodies 8 of rotary brush 7 for improving operability of suction tool 1.

[0022] Still more, a strip-like plate 11 made of a material (e.g., fluoride resin) listed in the negative side of the triboelectric series may be provided protruding from the surface of friction body 10 along the longitudinal direction

of friction body 10. This prevents a continuous contact of brush bodies 8 of rotary brush 7 and friction body 10, and thus improves durability of friction body 10. In addition, the rotation force of brush bodies 8 of rotary brush 7 can be reliably transmitted to friction body 10 via plate 11 protruding from friction body 10. This increases the number of rotations of friction body 10 and generation of negative ions.

[0023] A material that easily carries positive charge, such as wool and Teflon® can be used as a material listed in the positive side of the triboelectric series in this exemplary embodiment, in addition to nylon. A material listed in the negative side of the triboelectric series that easily carries negative charge, such as vinyl chloride, can be used as a material listed in the negative side of the triboelectric series in this exemplary embodiment, in addition to fluoride resin.

[0024] The operation and effect of the suction tool for an electric cleaner as configured above are described below.

[0025] First, as shown in Fig. 1, electric blower 33 is activated by a switch in a circuit provided in hose 31. At this point, suction air that flows into electric cleaner main body 32 is produced inside hose 31 and extension pipe 30 by negative pressure generated by electric blower 33. Suction air is then produced in suction inlet 15 of suction tool main body 1a via pipe 6 connected to extension pipe 30. As a result, the suction air sends dust present on the cleaning surface, such as floor, into electric cleaner main body 32.

[0026] At this point, if drive unit 13 for rotating rotary brush 7 is an electric motor, drive unit13 is also activated by activating electric blower 33. Power of drive unit 13 is transmitted to rotary brush 7 via belt 14, and rotary brush 7 rotates. The rotating direction of rotary brush 7 is counterclockwise when seeing suction tool 1 from the left side face of suction tool 1, which is indicated by arrow C in Fig. 1.

[0027] By the rotation of rotary brush 7, brush bodies 8 of rotary brush 7 come into contact with friction body 10, and friction body 10 then rotates by drive force of brush bodies 8 of rotary brush 7. Since rotary brush 7 rotates counterclockwise, as described above, friction body 10 will rotate clockwise. The rotation of friction body 10 can be confirmed through window 3 provided on top part 2 of suction tool main body 1a.

[0028] Brush bodies 8 of rotary brush 7 also come into contact with friction body 10 or strip-like plate 11 provided on friction body 10 and board 9. Brush bodies 8 of rotary brush 7 listed in the positive side of the triboelectric series thus make contact and rub friction body 10 or plate 11 listed in the negative side of the triboelectric series, provided on friction body 10 and board 9. As a result, negative ions are generated by friction between brush bodies 8 of rotary brush 7 and friction body 10 or plate 11 provided on friction body 10 and board 9.

[0029] Brush bodies 8 of rotary brush 7 that rotate counterclockwise via drive unit 13 flick out generated minus ions toward the front of suction tool main body 1a. Negative ions are thus scattered on the cleaning surface, such as floor. Since plate 11 of friction body 10 and board 9 are provided facing the longitudinal direction of brush bodies 8 of rotary brush 7, negative ions are spread in front of suction tool main body 1a in a wide range in the longitudinal direction of brush bodies 8 of rotary brush 7. This enables reliable discharge of negative ions produced by contact of brush bodies 8 of rotary brush 7, and friction body 10 or board 9 to the cleaning surface in one direction (toward front of suction tool main body 1a).

[0030] The exemplary embodiment improves durability of brush bodies 8 of rotary brush 7 and friction body 10, and also achieves suction tool for an electric cleaner 1 and electric cleaner 100 using this suction tool for reliably supplying negative ions to the cleaning surface.

[0031] The exemplary embodiment refers to an example of producing negative ions by contact of brush bodies 8 of rotary brush 7, and friction body 10 or plate 11 provided on friction body 10 and board 9. However, the present invention is not limited to this structure. For example, either friction body 10 or board 9 may not be provided. This simplifies the structure of suction tool 1, enabling cost reduction. In addition, a load applied to brush bodies 8 of rotary brush 7 can be reduced to improve ease of operation of suction tool 1.

[0032] Still more, the exemplary embodiment refers to an example of providing plate 11 on friction body 10. However, only friction body 10 may be provided. This simplifies the structure of friction body 10, enabling cost reduction. In this case, friction body 10 may have an oval shape, in addition to cylindrical shape, or friction body 10 may be provided with multiple concaves around friction body 10 like a gear. This reliably transmits the rotation of rotary brush 7 to friction body 10.

[0033] Furthermore, the exemplary embodiment refers to an example of a flat plate for board 9 in the drawing. However, board 9 may have, for example, an uneven face with which brush bodies 8 of rotary brush 7 makes contact. This uneven face may also be provided along the rotating face of brush bodies 8 of rotary brush 7.

(SECOND EXEMPLARY EMBODIMENT)

[0034] Fig. 5 is a sectional view of a suction tool for an electric cleaner in the second exemplary embodiment of the present invention. Fig. 6 is a back view of the suction tool for an electric cleaner in the second exemplary embodiment. Fig. 7 is a back view of the suction tool for an electric cleaner in a state that a rotary brush is removed in the second exemplary embodiment. Fig. 8 is a back view of the suction tool for an electric cleaner in a state that the rotary brush and a holding part are removed in the second exemplary embodiment.

[0035] The suction tool for an electric cleaner in the second exemplary embodiment of the present invention differs from the suction tool for an electric cleaner in the first exemplary embodiment at a point that a friction body

is detachably held by the suction tool main body using the holding part. Other structure is basically the same as that in the first exemplary embodiment.

[0036] Therefore, the exemplary embodiment is described below with reference mainly to a drawing of the holding part of the suction tool for an electric cleaner, the first exemplary embodiment, and Fig. 1.

[0037] Same as the first exemplary embodiment, as shown in Fig. 1, electric cleaner 100 in the second exemplary embodiment includes suction tool for electric cleaner 1 (hereafter referred to as "suction tool"), electric cleaner main body 32 with built-in electric blower 33, hose 31, and extension pipe 30. One end of extension pipe 30 is connected to hose 31, and the other end of extension pipe 30 is connected to suction tool 1 via pipe 6. At an end of hose 31 to the side of one end of extension pipe 30, hand control unit 34 for selecting operation mode is provided. Hand control unit 34 has a control circuit (not illustrated) for controlling electric blower 33 based on the operation mode.

[0038] As shown in Figs. 5 to 8, suction tool main body 1a includes top part 2 that configures an appearance and has window 3, bottom part 5 with suction inlet 15, and middle part 4 disposed between top part 2 and bottom part 5 and has a hole (not illustrated) in which friction body 10, which is described later, is disposed. Pipe 6 is disposed at the back center of suction tool main body 1a, as shown in Fig. 1. Pipe 6 is sandwiched by bottom part 5 and top part 2 of suction tool main body 1a. Here, the state of dust entangled to friction body 10 can be confirmed by eyes, for example, through window 3 on top part 2 via the hole on middle part 4. The user can thus easily recognize the timing to clean friction body 10.

[0039] As shown in Fig. 5, two rotary brushes 7, for example, for sweeping dust on the cleaning surface, such as floor, are detachably and rotatably attached to bottom part 5 of suction tool main body 1a inside suction inlet 15 of suction tool main body 1a. Multiple brush bodies 8 configured with a material (e.g., nylon) listed in the positive side of the triboelectric series are spirally disposed on an outer peripheral face of rotary brush 7. Board 9 formed of a material (e.g., Teflon®) listed in the negative side of the triboelectric series is provided on a front inner wall of bottom part 5 of suction tool main body 1a. Brush bodies 8 of rotary brush 7 and board 9 are disposed such that they come into contact as rotary brush 7 rotates.

[0040] In addition, as shown in Fig. 5, friction body 10 including friction main body 10a and shaft 12 that rotate by making contact with brush bodies 8 of rotary brush 7 as rotary brush 7 rotates is provided on an upper front part relative to a central rotation axis of rotary brush 7.

[0041] Friction body 10 is placed facing suction inlet 15 on middle part 4 with window-like hole (not illustrated) at its front to cover an upper portion of bottom part 5 of suction tool main body 1. As shown in Fig. 8, friction body 10 is rotatably supported by shaft 12 passing through a central axis of friction main body 10a.

[0042] One end of shaft 12 has insert 20, and the other end of shaft 12 has holder 21 that is longer than the length of insert 20. Insert 20 of shaft 12 is held by being inserted into a holding hole (not illustrated) formed with bottom part 5 and top part 2 configuring suction tool main body 1a. On the other hand, rotation stopper 16 is provided on a part of holder 21 of shaft 12. Rotation stopper 16 of holder 21 is fitted into receiver 17 provided on bottom part 5 of suction tool main body 1a, and is sandwiched by holding part 18 (Fig. 7) to be detachably held and rotatably fixed. In other words, insert 20 of shaft 12 of friction body 10 is a holding hole, and holder 21 of shaft 12 is detachably held by suction tool main body 1a using holding part 18. Therefore, when friction body 10 rotates, wear, looseness, or vibration of shaft 12 is prevented by rotatably fixing shaft 12. This improves durability. In addition, by making the length of holder 21 longer than that of insert 20 of shaft 12, the user can easily remove friction body 10 by hand, and clean friction body 10 without directly touching dust attached to friction body 10. Accordingly, a user-friendly electric cleaner is achieved.

[0043] Antislip part 22 to which antislip processing, such as knurling and coating, is applied is preferably provided near end 12a of shaft 12 to the side of holder 21. This further improves handling by user's hand, such as removal of friction body 10, so as to facilitate cleaning of friction body 10.

[0044] Still more, as shown in Fig. 6, drive unit 13, such as an electric motor and turbine, is provided on either right or left side at the back of suction tool main body 1a. An output of drive unit 13 is transmitted to a gear (not illustrated) provided on one end of rotary brush 7 via belt 14 so that rotary brush 7 rotates in one direction. Since this enables brush bodies 8 of rotary brush 7 to rotate in one direction, as described later, negative ions that are produced by contact of brush bodies 8 of rotary brush 7 with friction body 10 and board 9 can be stably released in one direction (toward the front of suction tool main body 1a). In other words, suction of negative ions into suction tool 40 due to an inversed rotating direction (clockwise rotation) of the brush group during backward operation of conventional suction tool 40 shown in Fig. 9 can be prevented to ensure supply of negative ions to the cleaning surface. Here, brush bodies 8 of rotary brush 7 and friction body 10 rotate each other. This changes a contact position of brush bodies 8 of rotary brush 7 with friction body 10, and avoids their contact at the same position. Accordingly, durability of friction body 10 improves.

[0045] Still more, as shown in Fig. 7, holding part 18 is disposed to form a part of suction inlet 15 inside suction inlet 15. Here, a face of holding part 18 forming suction inlet 15 is formed on the substantially same face (including the same face) as the face where suction inlet 15 of suction tool main body 1a is formed. This prevents brush bodies 8 of rotary brush 7 or vacuumed dust from being stuck, and improves durability of friction body 10 or brush bodies 8 of rotary brush 7. Cleaning also becomes easy.

[0046] Furthermore, as shown in Fig. 7, buckle 19 is

rotatably provided on holding part 18 for detachably fixing holding part 18 onto bottom part 5 of suction tool main body 1a. Buckle 19 is configured such that its face is substantially leveled (including same face) with holding part 18 when holding part 18 is fixed onto bottom part 5 of suction tool main body 1a. By fixing holding part 18 onto bottom part 5 of suction tool main body 1a using buckle 19, friction body 10 can be rotatably fixed and held via shaft 12.

[0047] The operation and effect of the suction tool for an electric cleaner as configured above is described below. The operation and effect that duplicate with the suction tool for an electric cleaner in the first exemplary embodiment are just briefly described.

[0048] First, as shown in Fig. 1, electric blower 33 is activated using a switch provided on hose 31 to generate negative pressure. This produces suction air that flows into electric cleaner main body 32. Generated suction air sends dust present on the cleaning surface, such as floor, from suction inlet 15 of suction tool main body 1a into electric cleaner main body 32 via extension pipe 30, pipe 6.

[0049] At this point, drive unit 13 configured with an electric motor for rotating rotary brush 7 is also activated. Drive unit 13 simultaneously rotate two rotating brushes 7, for example, via belt 14. When seen from the direction indicated by arrow C in Fig. 1, rotary brush 7 rotates counterclockwise. By contact of rotating brush bodies of rotary brush 7 and friction body 10, friction body 10 rotates clockwise, which is opposite the rotating direction of rotary brush 7. However, since brush bodies 8 of rotary brush 7 and friction body 10 rotate by making contact, the rotation of friction body 10 and the rotation of brush bodies 8 of rotary brush 7 are not completely synchronized. Therefore, friction occurs due to difference in the rotation of brush bodies 8 of rotary brush 7 and that of friction body 10, depending on the state of load on the cleaning surface. By adopting the structure to rotate friction body 10, a load applied to brush bodies 8 of rotary brush 7 due to generation of friction, for example, can be reduced, compared to fixed friction body 10. This improves durability.

[0050] Brush bodies 8 of rotary brush 7 listed in the positive side of the triboelectric series come into contact with and are rubbed against friction body 10 or plate 11 listed in the negative side of the triboelectric series provided on friction body 10 and board 9 as brush bodies 8 rotate. As a result, negative ions are produced by friction between brush bodies 8 of rotary brush 7 and friction body 10 or plate 11 provided on friction body 10 and board 9.

[0051] Generated negative ions are scattered toward the cleaning surface, such as floor, in front of suction tool main body 1a by brush bodies 8 of rotary brush 7 that is rotating counterclockwise. Here, plate 11 of friction body 10 and board 9 provided facing the longitudinal direction of brush bodies 8 of rotary brush 7 scatter negative ions over a wide area in front of suction tool main body 1a. Accordingly, negative ions produced by contact of brush bodies 8 of rotary brush 7 and friction body 10 or board 9 can be reliably discharged to the cleaning surface in one direction (toward the front of suction tool main body 1a). In other words, drive load, such as a friction force against friction body 10, applied to rotary brush 7 can be reduced and negative ions can be efficiently produced by rotating friction body 10.

[0052] However, dust or entangled long particles, such as threads or hair, on friction body 10 cannot be completely prevented. Therefore, smooth rotation of friction body 10 cannot be always maintained.

[0053] In this exemplary embodiment, friction body 10 is detachably configured using holding part 18 in order to maintain smooth rotation of friction body 10. More specifically, rotary brush 7 is first removed from suction tool 1. Then, buckle 19 is released to remove holding part18 from suction tool 1. Lastly, friction body 10 is removed via shaft 12. This achieves the suction tool for an electric cleaner and an electric cleaner using this suction tool in which friction body 10 is easily maintained typically by removing dust.

[0054] In the exemplary embodiment, the length of holder 21 of shaft 12 is made longer than that of insert 20 of shaft 12, and antislip part 22 is provided on holder 21. This facilitates removal of friction body 10.

[0055] Still more, in the exemplary embodiment, rotation stopper 16 for holder 21 of shaft 12 is provided at the side of holding part 18, so as to prevent wear and looseness. This fixes the rotation of shaft 12 and also facilitates attachment and removal of friction body 10.

[0056] Furthermore, in the exemplary embodiment, holding part 18 and buckle 19 are substantially leveled (including the same face) with the inner wall of suction inlet 15, so as to suppress increase of load due to hooking of brush bodies 8 of rotary brush 7. Clogging of dust on the inner wall of suction inlet 15 can also be prevented.

[0057] It is apparent that operation and effect same as that in the first exemplary embodiment are achieved in this exemplary embodiment.

[0058] It is also apparent that the same effect is achieved by applying the structure of the exemplary embodiments to each other.

[0059] In the above exemplary embodiments, the brush bodies of the rotary brush are configured with a material listed in the positive side of the triboelectric series; and the friction body, plate, or board is configured with a material listed in the negative side of the triboelectric series. However, the present invention is not limited to these materials. For example, the brush bodies of the rotary brush may be configured with a material listed in the negative side of the triboelectric series, and the friction body, plate, or board may be configured with a material listed in the positive side of the triboelectric series. In other words, as long as the brush bodies of the rotary brush that come into contact and the friction body, plate, or board are configured with materials with different charges in triboelectric series, the same effect and op-

eration are achievable.

INDUSTRIAL APPLICABILITY

[0060] The present invention is effectively applicable to a suction tool for an electric cleaner, such as an electric cleaner for sweeping floor, for which stable supply of negative ions and high durability are demanded.

REFERENCE MARKS IN THE DRAWINGS

[0061]

1, 40	Suction tool (suction tool for an electric cleaner)
1a	Suction tool main body
2	Top part
3	Window
4	Middle part
4a	Hole
5	Bottom part
6	Pipe
7	Rotary brush
8	Brush body
9	Board
10	Friction body
10a	Friction main body
11	Plate
12	Shaft
12a	End
13	Drive unit
14	Belt
15	Suction inlet
16	Rotation stopper
17	Receiver
18	Holding part
19	Buckle
20	Insert
21	Holder
22	Antislip part
32	Electric cleaner main body
33	Electric blower
30	Extension pipe
31	Hose
34	Hand control unit
41	Opening
42, 44	Brush
43, 45	Brush group
100	Electric cleaner

Claims

1. A suction tool for an electric cleaner, comprising:

a suction tool main body with a suction inlet;
a rotary brush rotatably provided inside the suction tool main body;
a brush body provided protruding from an outer periphery of the rotary brush; and
a friction body rotated by rotation of the brush body of the rotary brush.

2. The suction tool for an electric cleaner of claim 1, wherein
the brush body is made of a material listed in the positive side of the triboelectric series, and at least a part of the friction body is made of another material in the negative side of the triboelectric series.

3. The suction tool for an electric cleaner of claim 1, wherein
the brush body is made of a material listed in the negative side of the triboelectric series, and at least a part of the friction body is made of another material in the positive side of the triboelectric series.

4. The suction tool for an electric cleaner of claim 1, wherein
the suction tool main body has a drive unit for rotating the rotary brush, and
the drive unit rotates the rotary brush counterclock-

wise when the suction tool main body is seen from a left side face of the suction tool main body.

5. The suction tool for an electric cleaner of claim 1, wherein
a length of the friction body in the longitudinal direction is shorter than a length of the rotary brush in the longitudinal direction.

6. The suction tool for an electric cleaner of claim 1, wherein
a plurality of pieces of the friction body is provided in the longitudinal direction.

7. The suction tool for an electric cleaner of claim 1, wherein
the suction tool main body has a window for visual examnation of the friction body from above the suction tool main body.

8. The suction tool for an electric cleaner of claim 2 further comprising a plate made of a material listed in the negative side of the triboelectric series is provided on an outer periphery of the friction body.

9. The suction tool for an electric cleaner of claim 3 further comprising a plate made of a material listed in the positive side of the triboelectric series is provided on an outer periphery of the friction body.

10. The suction tool for an electric cleaner of one of claims 8 and 9,
wherein
the plate is provided protruding from a surface of the friction body.

11. The suction tool for an electric cleaner of claim 2 further comprising a board made of a material listed in the negative side of the triboelectric series is provided on a front part of the suction tool main body on a face opposing the rotary brush.

12. The suction tool for an electric cleaner of claim 3 further comprising a board made of a material listed in the negative side of the triboelectric series is provided on a front part of the suction tool main body on a face opposing the rotary brush.

13. The suction tool for an electric cleaner of claim 1 further comprising a holding part is provided for detachably holding the friction body on the suction tool main body.

14. The suction tool for an electric cleaner of claim 13, wherein
the holding part is provided inside the suction inlet of the suction tool main body such that the holding part forms a part of the suction inlet.

15. The suction tool for an electric cleaner of claim 13, wherein
the holding part includes a buckle for detachably fixing the holding part onto the suction tool main body.

16. The suction tool for an electric cleaner of claim 13, wherein
the friction body includes a friction main body and a shaft protruding from the friction main body for rotatably supporting the friction main body, the shaft including an insert on its one end and a holder on its other end;
the insert of the shaft of the friction body is held by the suction tool main body, and the holder of the shaft is held by the suction tool main body using the holding part; and
a length of the holder of the shaft is longer than a length of the insert of the shaft.

17. The suction tool for an electric cleaner of claim 16 further comprising a rotation stopper is provided on one side of the shaft having the holder.

18. The suction tool for an electric cleaner of claim 16 further comprising an antislip part is provided on one side of the shaft having the holder.

19. An electric cleaner comprising:

an electric cleaner main body with built-in electric blower for producing suction air; and
the suction tool for an electric cleaner of claim 1.

FIG. 1

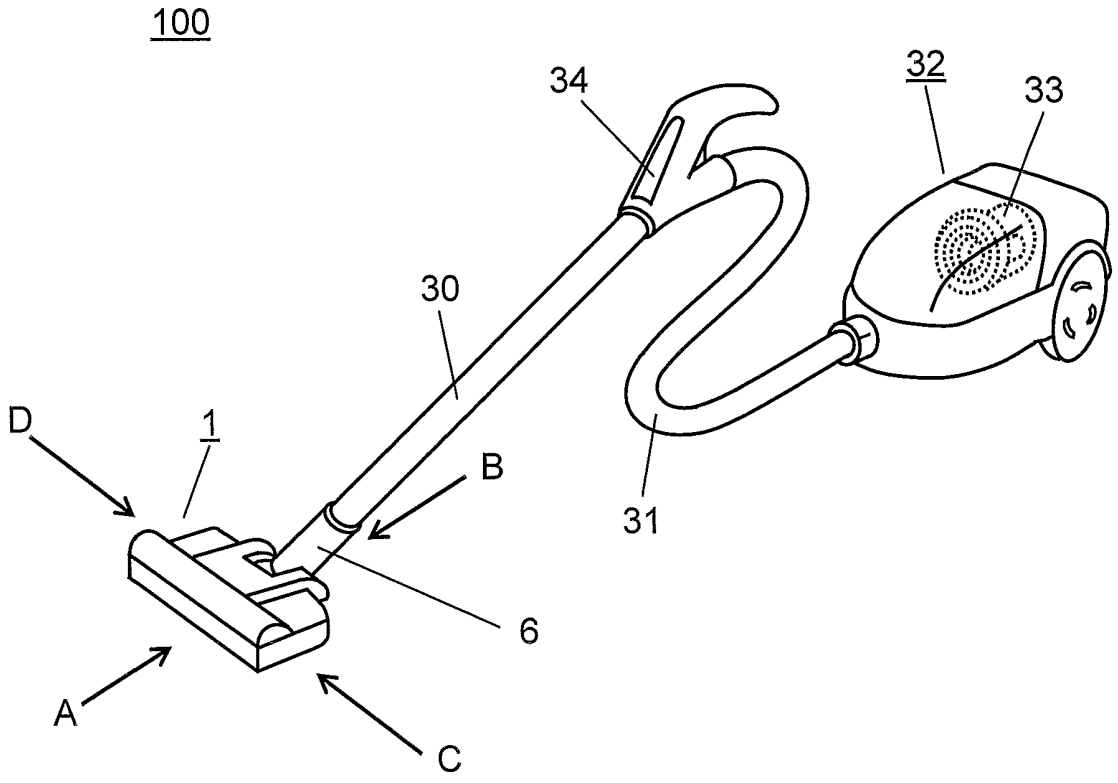


FIG. 2

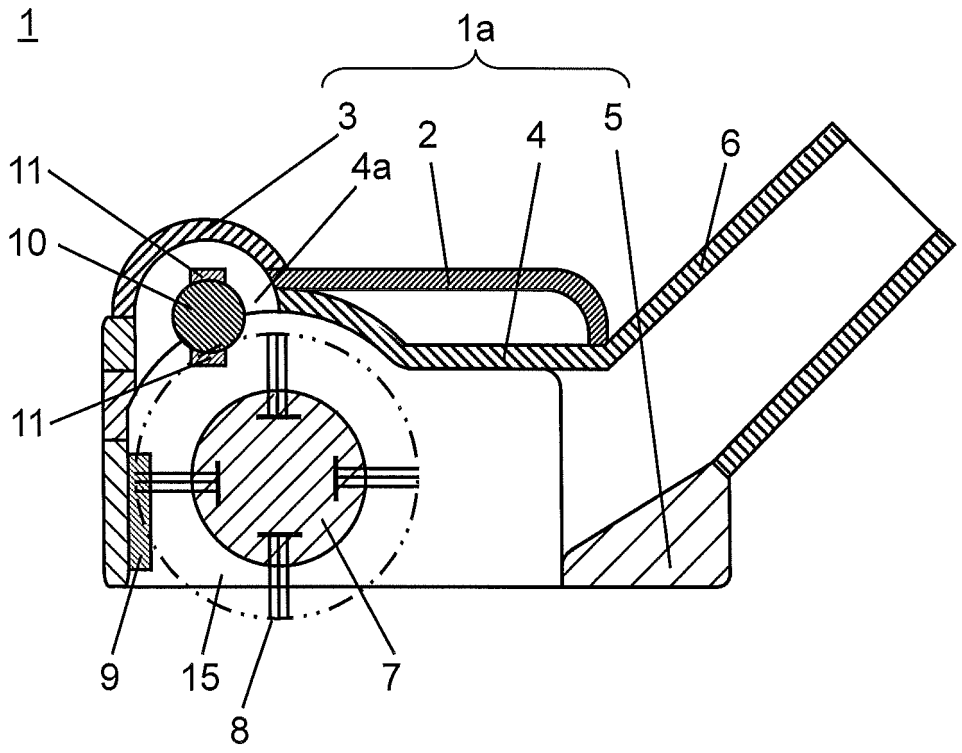


FIG. 3

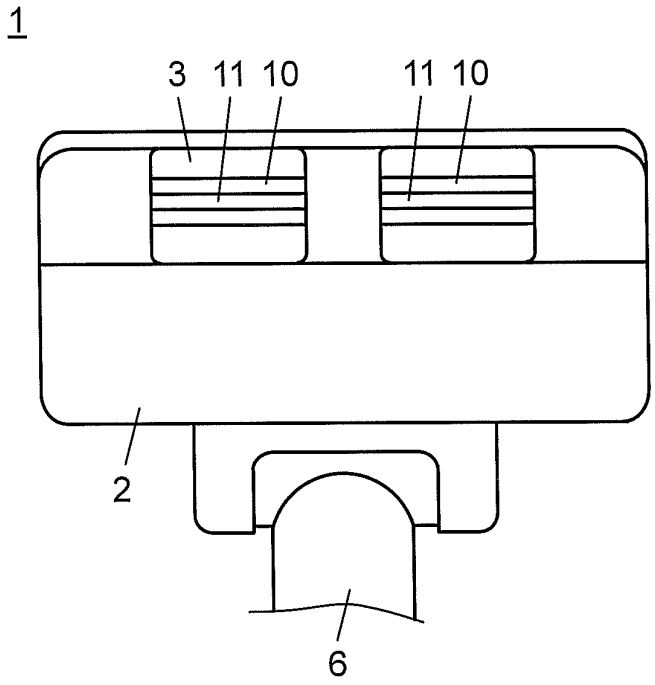


FIG. 4

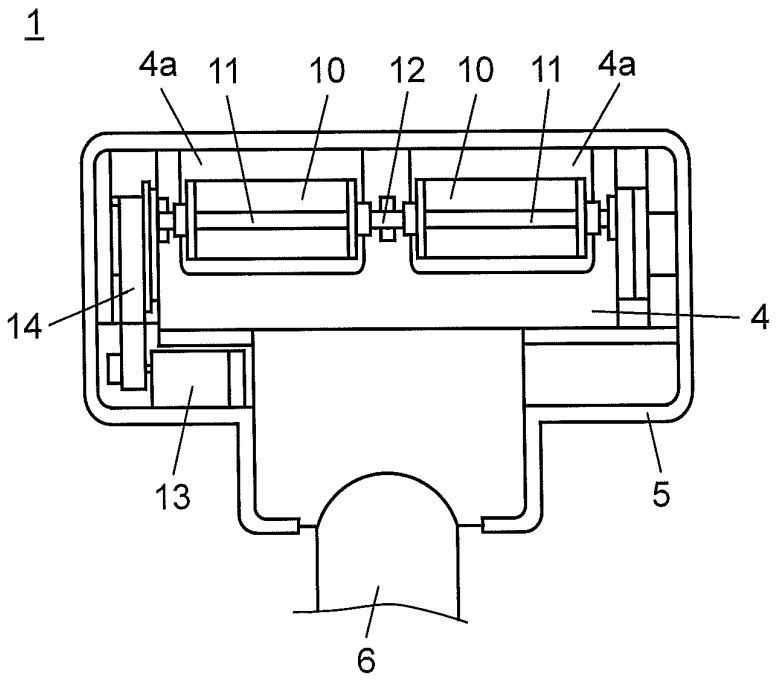


FIG. 5

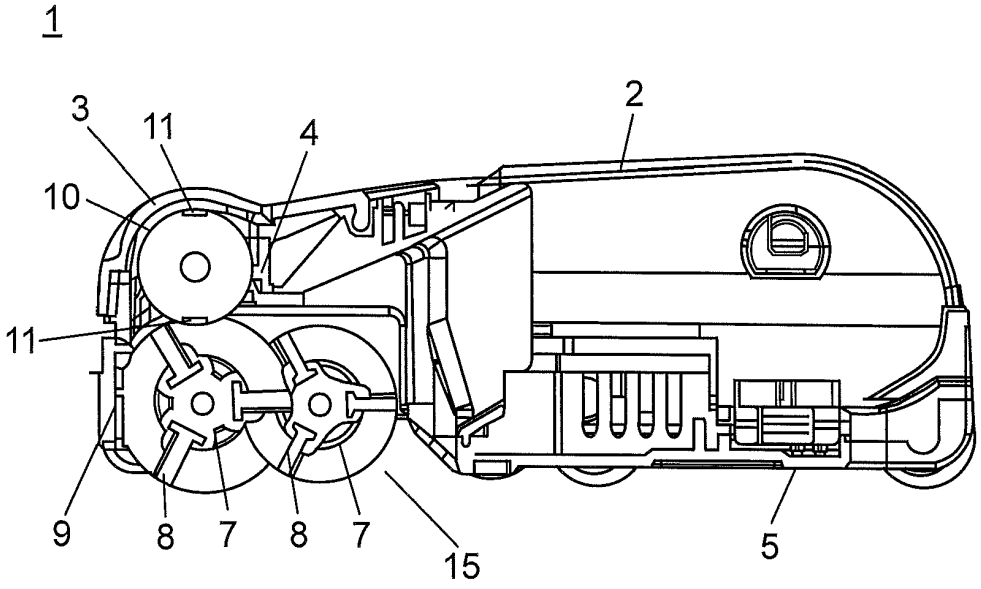


FIG. 6

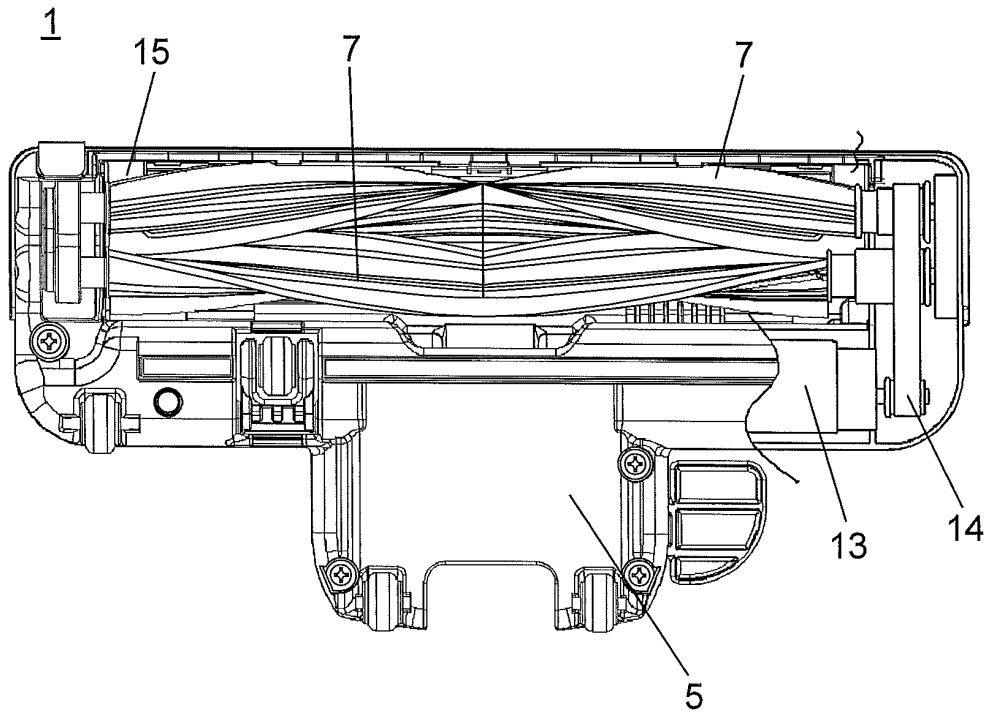


FIG. 7

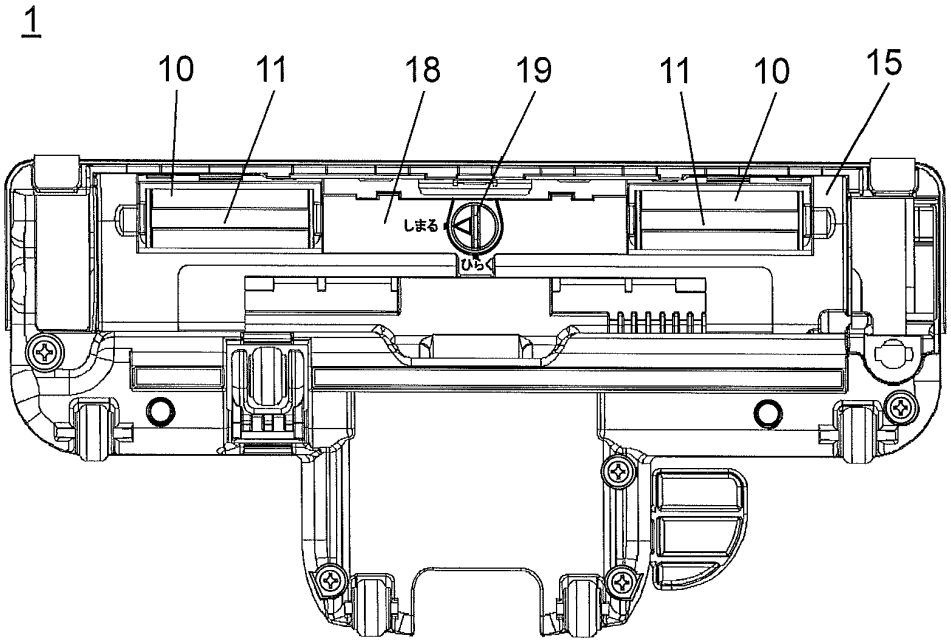

1
10
11
18
19
11
10
15
しまる
ひらく

FIG. 8

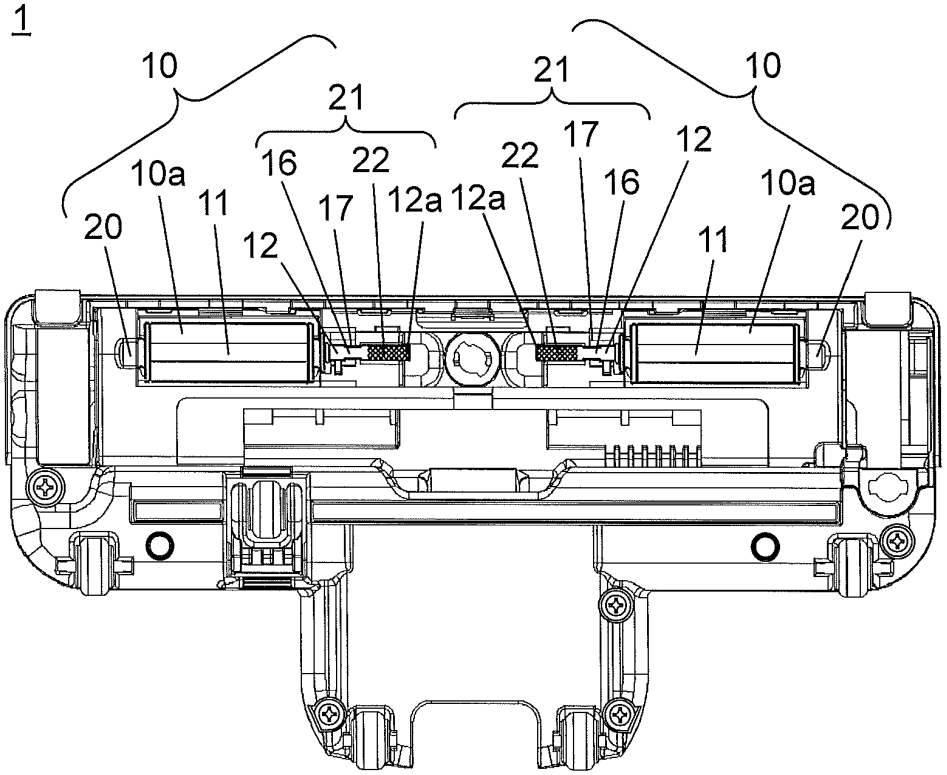
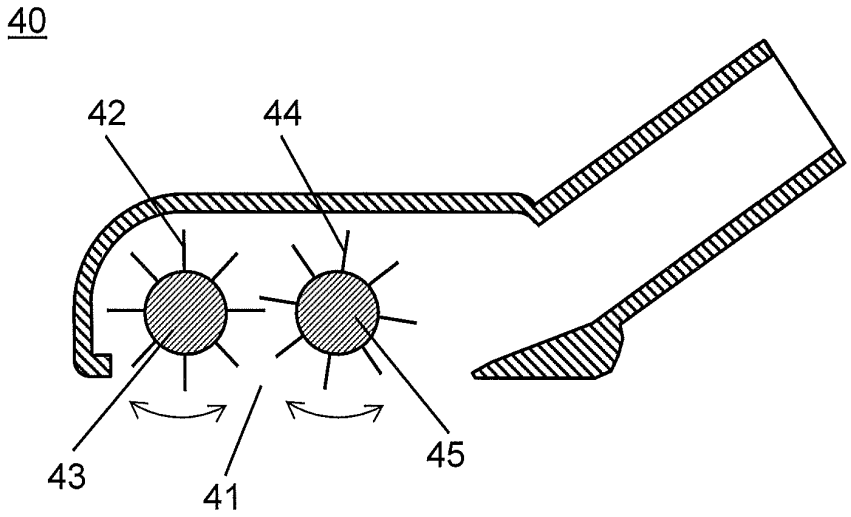

1
10
21
21
10
16
22
22
17
12
10a
11
17
12a
12a
16
10a
20
12
11
20

FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/001371

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 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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 11-216089 A (Hitachi, Ltd.), 10 August 1999 (10.08.1999), entire text; all drawings (Family: none)	1,3,4,8, 13-19 2,5-7,9-12
Y	JP 2006-158753 A (Matsushita Electric Industrial Co., Ltd.), 22 June 2006 (22.06.2006), entire text; all drawings (Family: none)	2,5,6,9-12
Y	JP 2008-183173 A (Mitsubishi Electric Corp.), 14 August 2008 (14.08.2008), paragraph [0021] (Family: none)	7

☐ 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
16 June, 2011 (16.06.11)	28 June, 2011 (28.06.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/001371

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

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

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

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

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

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

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

The invention same as the invention in claim 1 is described in JP 11-216089 A (Hitachi, Ltd.), 10 August 1999 (10.08.1999), entire text, all drawings, (Family: none), the invention in claim 1 cannot be considered to be novel in the light of the invention described in the afore-said document and does not have a special technical feature.

(continued to extra sheet)

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

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

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/001371

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

As a result of judging special technical features with respect to claims dependent on claim 1, it is considered that the following nine inventions are involved. Meanwhile, the invention in claim 1 having no special technical feature is classified into invention 1.

(Invention 1) the inventions in claims 1, 2, 8, 10, 11

(Invention 2) the inventions in claims 3, 9

(Invention 3) the invention in claim 4

(Invention 4) the invention in claim 5

(Invention 5) the invention in claim 6

(Invention 6) the invention in claim 7

(Invention 7) the invention in claim 12

(Invention 8) the inventions in claims 13, 14, 15, 16, 17, 18

(Invention 9) the invention in claim 19

Form PCT/ISA/210 (extra 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 2005305194 A **[0007]**