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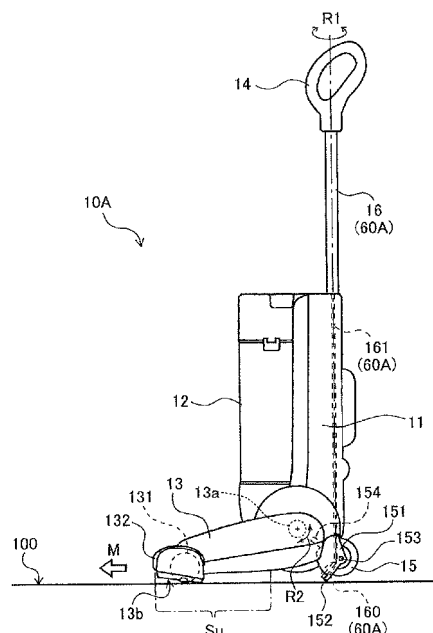
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(54) **UPRIGHT TYPE FLOOR TREATMENT DEVICE**

(57) In a vacuum cleaner (10A) which is an example of an upright floor surface treating apparatus, a suction nozzle (13) is provided forward relative to a lower portion of a body section such that an angle of a lower surface (Su) is changed, and a handle (14) is attached to an upper portion of the body section. A steering wheel (15) which determines a movement direction (M) is provided relative to the lower portion of the body section, and the handle (14) and the steering wheel (15) are coupled together by means of a steering coupling section including a handle shaft (16), a steering wheel adjustment shaft (161) and a rotation transmission section. In this configuration, without using a complicated configuration, a direction of the suction nozzle (13) can be easily changed without moving the entire body section.

Fig. 3



Description

Technical Field

[0001] The present invention relates to a floor surface treating apparatus such as an upright cleaner, a carpet washing apparatus, or a floor surface washing apparatus.

Background Art

[0002] An upright floor surface treating apparatus typically includes a vertical body section at an upper portion thereof, a holding section such as a handle at the upper portion thereof, and a floor surface treating section pivotally mounted to a lower portion of the body section to perform a floor surface treating. Typically, wheels (or rotary members such as rollers) are attached behind a lower surface of the body section. During use, a user holds and manipulates the handle, thereby enabling the floor surface treating apparatus to perform the floor surface treating on a desired location on the floor surface by the wheels. The body section is typically configured to be held in a substantially upright state with respect to the floor surface treating section. Therefore, during non-use, the floor surface treating apparatus can rest in the substantially upright state. When the floor surface treating apparatus is carried, the floor surface treating apparatus can be moved on the floor surface by the wheels in a state where the floor surface treating section is upwardly apart from the floor surface by moving down the handle like the use state, while keeping the floor surface treating apparatus in a fixed state.

[0003] As one example of the floor surface treating apparatus, a vacuum cleaner (suction cleaner) is shown in Fig. 14. A conventional general upright cleaner 610 is constructed in such a manner that a handle 614 is located at an upper portion thereof, a cleaner body 611 including a suction motor, a duct collecting section, and others is located at a lower portion thereof, and a suction nozzle 613 including a rotary brush or the like is mounted to the cleaner body 611. This suction nozzle 613 is pivotable around nozzle support shafts (not shown) provided at the lower portion of the cleaner body 611. During use, dusts suctioned by the suction nozzle 613 are immediately collected into the cleaner body 611.

[0004] As described above, since the upright cleaner 610 is constructed such that the suction nozzle 613 is directly coupled to the cleaner body 611, it has advantages as follows as compared to a canister cleaner. While the canister cleaner is used in a state in which a cleaner body and a suction nozzle are coupled together by means of a hose, an extension pipe, or the like, the upright cleaner 610 is constructed such that the cleaner body 610 and the suction nozzle 613 have a substantially unitary structure. Because of this, the upright cleaner 610 is superior to the canister cleaner in maneuverability. In addition, in the upright cleaner 610, typically, the suction nozzle 613 includes a rotary brush, which enables the upright clean-

er 610 to produce a high duct-collecting capability. Therefore, the upright cleaner 610 is preferably used to clean a carpet, etc..

[0005] During use of the upright cleaner 610 having the above typical configuration, the user may move the suction nozzle 613 via the cleaner body 611 at the lower portion while holding the handle 614 at the upper portion. This enables the user to manipulate the entire upright cleaner 610 merely by substantially holding the handle 614.

[0006] To move the upright cleaner 610 forward and backward, the user has only to move an arm holding the handle 614 forward and backward while walking forward and backward. Thus, its manipulation is relatively easy. However, when changing a direction of the upright cleaner 610, it is not easy to manipulate the upright cleaner 610.

[0007] To be specific, when a pivot around which the upright cleaner 610 is turned is a pivot P0, the pivot P0 is, as shown in Fig. 14, near a connecting portion at which the cleaner body 611 and the suction nozzle 613 are coupled together. When a length from the pivot P0 to a tip end P1 of the suction nozzle 613 is "L1" and a length from the pivot P0 to a tip end P2 of the handle 614 is "L2," the length L2 is much longer than the length L1.

[0008] It is supposed that in this positional relationship, an angle with which the direction of the suction nozzle 613 is changed is a movement angle ψ and the degree to which the handle 613 is displaced laterally when the direction of the suction nozzle 613 is changed (direction crossing the direction in which the upright cleaner 610 is moving) is a displacement amount WL. To enable the user to change the movement angle ψ , the user cannot realize the displacement amount WL corresponding to the movement angle ψ unless the user moves the handle 614 laterally to a great degree as shown in Fig. 14.

[0009] The suction nozzle 613 is adapted to suction the floor surface to collect dusts. Therefore, during use of the upright cleaner 610, a negative pressure for suctioning the floor surface is always generated on the lower surface of the suction nozzle 613. This negative pressure might become a resistance to the movement of the suction nozzle 613. If the floor surface is a carpet, the lower surface of the suction nozzle 613 is subjected to a substantial resistance even when the lower surface of the suction nozzle 613 contacts piles of the carpet. In addition to this, when the carpet piles are scraped up with the rotary brush being rotated, the lower surface of the suction nozzle 613 is subjected to a greater resistance.

[0010] To move the upright cleaner 610 forward and backward, the user moves the arm under a shoulder. Therefore, the user tends to exert a force in the arm. By comparison, to change the direction of the upright cleaner 610, the user must move the arm forward and backward while moving the arm rightward and leftward. Because of this, a greater force is needed in the case where the direction of the upright cleaner 610 is changed than in the case where the arm is moved only forward and back-

ward. This degrades maneuverability of the upright cleaner 610 when the direction of the upright cleaner 610 is changed.

[0011] To solve this, conventionally, techniques for improving the maneuverability of the upright cleaner have been proposed. For example, Patent Literature 1 discloses a vacuum cleaner which improves maneuverability. This vacuum cleaner includes a lower base, a cylindrical motor housing rotatably mounted to the lower base, and a universal joint mounted to the motor housing. In accordance with this configuration, by twisting a handle of the vacuum cleaner, an upper body can be twisted in a clockwise direction or in a counterclockwise direction. This twist manipulation can bend the lower base in a rightward direction or in a leftward direction.

[0012] Patent Literature 2 discloses a surface treating apparatus which improves maneuverability. As one example of the surface treating apparatus, a vacuum cleaner is illustrated. This vacuum cleaner includes a roller assembly positioned at a base portion of a body, and a link mechanism positioned between a handle and a cleaner head. The link mechanism and the cleaner head are coupled together by means of a pivot shaft around which the cleaner head is pivotable in a rightward direction or in a leftward direction. The link mechanism is configured to turn the cleaner head in a new direction by rotating the roller assembly and the handle around a lengthwise axis of the handle.

Citation Lists

Patent Literature

[0013]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. Hei 9-503398 (Translation of PCT Application) (International Publication No: WO95/0174

Patent Literature 2: Japanese Patent No. 4077823(corresponding international publication No. WO2004/014211)

Summary of the Invention

Technical Problem

[0014] However, through careful study of the prior art technique, the present inventors found out a possibility that maneuverability of an upright floor surface treating apparatus cannot be improved well depending on its shape, and a configuration of the upright floor surface treating apparatus becomes complex.

[0015] Specifically, a vacuum cleaner 510 of Fig. 13A and a vacuum cleaner 520 of Fig. 13B correspond to the vacuum cleaner disclosed in Patent Literature 1 or the surface treating apparatus disclosed in Patent Literature 2, respectively. The vacuum cleaner 510 includes a col-

umn-shaped cleaner body 511, a suction nozzle 513 ("lower base" in Patent Literature 1, "cleaner head" in Patent Literature 2) mounted to a lower portion of the cleaner body 511, and is configured such that the suction nozzle 513 is supported on the cleaner body 511 to be pivotable around a nozzle support shaft 517. The vacuum cleaner 520 includes a column-shaped cleaner body 521, a suction nozzle 523 ("lower base" in Patent Literature 1, "cleaner head" in Patent Literature 2) mounted to a lower portion of the cleaner body 521, and is configured such that the suction nozzle 523 is supported on the cleaner body 521 to be pivotable around a nozzle support shaft 527.

[0016] In the vacuum cleaner 510, 520 having the above configuration, by twisting a handle 514, 524 at an upper portion (see W1 or W2 in Fig. 13), a direction of the suction nozzle 513, 523 can be changed via the cleaner body 511, 521. In this case, when the user twists the handle 514, 524, the cleaner body 511, 521 extending vertically is pivoted in a rotational direction (to the right or to the left) to a great degree. Therefore, a weight of the cleaner body 511, 521 and a centrifugal force are applied to a hand holding the handle 514, 524. Because of this, a moment applied to the hand of the user during changing of the direction of the suction nozzle 513, 523 increases, and a great load is applied to the hand. In this situation, the user feels that a great force is required to change the direction of the handle 514, 524, which impairs maneuverability during changing of the direction.

[0017] In the vacuum cleaner 510, 520, an external force for twisting the handle 514, 524 during changing of the direction, and the associated stress tends to concentrate on a pivot 513a, 523a. Because of this, a portion near the pivot 513a, 523a is required to have a strength which can withstand the external force and the stress. To realize a higher strength, a particular structure or a particular material are required, which might make the configuration of the cleaner complex. In particular, in the case of the vacuum cleaner 520, the cleaner body 521 and the suction nozzle 523 are coupled together via the roller assembly 522 by means of a support shaft 527 of the link mechanism. For this reason, the external force and the stress tend to concentrate on the link mechanism and the support shaft 527.

[0018] Furthermore, in the vacuum cleaner 520 including the roller assembly 522, a suction fan and a motor (suction motor) for actuating the suction fan are accommodated into the roller assembly 522. For example, in a configuration in which a rotary brush is provided inside of the suction nozzle 523, the roller assembly 522 is coupled to the suction nozzle 523 via the link mechanism. Therefore, for a structural reason, the suction motor cannot be used as a motor for actuating the rotary brush. Because of this, there is a need for a motor for rotating the rotary brush, inside of the suction nozzle 523. That is, in a case where the surface treating apparatus disclosed in Patent Literature 2 is a cleaner, a two-motor configuration is inevitably employed. This makes the con-

figuration of the cleaner more complex.

[0019] The present invention has been developed to solve the above stated problem, and an object of the present invention is to further improve maneuverability of an upright floor surface treating apparatus while avoiding making its configuration complex.

Solution to Problem

[0020] To solve the above described problem, an upright floor surface treating apparatus of the present invention comprises a columnar body section; a floor surface treating section having a lower surface facing a floor surface which is a treated target and mounted to a lower portion of the body section; and a holding section provided at an upper portion of the body section and held by a user; a steering wheel which is provided on the lower portion of the body section in a location at which the steering wheel is able to contact the floor surface and determines a movement direction of the floor surface treating section, according to its angle; and a steering coupling section which is provided in the body section between the holding section and the steering wheel and changes the angle of the steering wheel according to a manipulation of the holding section, independently of the body section and the floor surface treating section.

[0021] In the above configuration, the steering coupling section may include: a rotary shaft rotatably mounted to the body section, the holding section being fastened to an upper end of the rotary shaft; and a rotation transmission section for coupling a lower end of the rotary shaft to the steering wheel to change the angle of the steering wheel according to a rotational position of the rotary shaft.

[0022] In the above configuration, the steering coupling section may include: a wheel angle adjusting section for adjusting the angle of the steering wheel in response to an electric signal received as an input; and an angle adjusting signal generating section for converting a manipulation of the holding section into the electric signal input to the wheel angle adjusting section.

[0023] In the above configuration, the steering wheel may be mounted to the body section in such a manner that an outer peripheral surface of the steering wheel is apart from the floor surface with the body section being in an upright state, while the outer peripheral surface of the steering wheel is in contact with the floor surface with the body section being in a slanted state in which the body section is slanted in a rearward direction in the movement direction, with respect to the upright state.

[0024] A specific configuration of the upright floor surface treating apparatus of the present invention is not limited. As a typical example, there is a vacuum cleaner.

[0025] The above and further objects, features and advantages of the invention will more fully be apparent from the following detailed description with reference to the accompanying drawings.

Advantageous Effects of the Invention

[0026] As described above, in accordance with the present invention, it is possible to further improve maneuverability of an upright floor surface treating apparatus while avoiding making its configuration complex.

Brief Description of the Drawings

[0027]

[Fig. 1] Fig. 1 is a perspective view showing a configuration of a front side of a vacuum cleaner which is an exemplary upright floor surface treating apparatus according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a perspective view showing a configuration of a back side of the vacuum cleaner of Fig. 1.

[Fig. 3] Fig. 3 is a schematic side view showing an exemplary non-use state of the vacuum cleaner of Fig. 1.

[Fig. 4] Fig. 4A is a perspective view showing an exemplary configuration of major components of a steering coupling section in the vacuum cleaner of Fig. 1, Fig. 4B is a partial cross-sectional view showing an exemplary configuration of a mounting configuration of a cam member and arm members which are a portion surrounded by a broken-line circle in the steering coupling section of Fig. 4A, and Fig. 4C is a schematic rear view showing an example of locations of steering wheels of the steering coupling section of Fig. 4A are at a lower portion of the vacuum cleaner of Fig. 1.

[Fig. 5] Figs. 5A and 5B are schematic views showing exemplary changes of angles of the steering wheels which are caused by the steering coupling section of Fig. 4A.

[Fig. 6] Figs. 6A and 6B are schematic views showing an exemplary outer shape of the steering wheel used in the vacuum cleaner of Fig. 1, and Fig. 6C is a schematic view showing a behavior of the steering wheels which occurs when an operation for twisting a handle is performed in a state in which the vacuum cleaner including the steering wheels of Fig. 4C is disposed substantially horizontally.

[Fig. 7] Fig. 7 is a schematic view showing a comparison between an upright state of the vacuum cleaner of Fig. 1 and a slanted state of the vacuum cleaner of Fig. 1 when viewed from the side.

[Fig. 8] Figs. 8A to 8C are partial side views each showing a positional relation between a suction nozzle and the steering wheels in the vacuum cleaner of Fig. 1.

[Fig. 9] Fig. 9 is a schematic view showing an exemplary operation of a steering coupling section which occurs when a direction of the vacuum cleaner of Fig. 1 is changed.

[Fig. 10] Fig. 10 is a schematic side view showing an exemplary configuration of an upright vacuum cleaner according to Embodiment 2 of the present invention.

[Fig. 11] Fig. 11 is a schematic side view showing another exemplary configuration of the upright vacuum cleaner according to Embodiment 2 of the present invention.

[Fig. 12] Fig. 12 is a schematic side view showing an exemplary configuration of an upright vacuum cleaner according to Embodiment 3 of the present invention.

[Fig. 13] Figs. 13A and 13B are schematic views showing an exemplary direction changing motion in a conventional vacuum cleaner having an improved configuration.

[Fig. 14] Fig. 14 is a schematic view showing an exemplary direction changing in a conventional vacuum cleaner having a general configuration.

Description of the Embodiments

[0028] Hereinafter, preferred embodiments of the present invention will be described with reference to the drawings. Throughout the drawings, the same or corresponding components are designated by the same reference numerals and will not be described in repetition.

(Embodiment 1)

[Overall configuration of vacuum cleaner]

[0029] An overall configuration of an upright vacuum cleaner which is an exemplary floor surface treating apparatus according to an embodiment of the present invention will be described with reference to Figs. 1 to 3.

[0030] As shown in Figs. 1 and 2, an upright vacuum cleaner 10A according to the present embodiment includes a body casing section 11, a body dust collecting section 12, a suction nozzle 13, a handle 14, steering wheels 15, a handle shaft 16 and a sub-suction section, and others. Hereinafter, the upright vacuum cleaner 10A will be abbreviated as a vacuum cleaner 10A. A block arrow M in Fig. 1 indicates a movement direction of a suction nozzle 13 (vacuum cleaner 10A), a forward direction in the movement direction is a forward direction, while a reverse direction in the movement direction is a rearward (backward) direction.

[0031] The body casing section 11 and the body dust collecting section 12 constitute a body section of the vacuum cleaner 10A. As shown in Fig. 1, a front side of the body casing section 11 has a substantially curved surface (not shown) to which the body dust collecting section 12 of a cylindrical shape is mountable. As shown in Fig. 2, a rear side of body casing section 11 has a substantially flat surface (not shown) of a rectangular shape. A carrying handle 111 is attached to a rear surface of the body casing section 11. A user can carry the vacuum cleaner 1

0A while holding the carrying handle 111.

[0032] As shown in Fig. 2, the carrying handle 111 can also be used as a hook for rewinding a power supply code 128, together with a code rewinding hook 112 provided at a rear surface of a lower portion of the handle 14. A hose holding member 113 for holding a suction hose 133 is provided at an upper surface of the body casing section 11. A power supply switch 129 is provided at a rear side of an upper surface of the body casing section 11. These components will be described later.

[0033] As shown in Fig. 1, the body dust collecting section 12 includes a dust collecting body portion 121 and a dust collecting head portion 122, and an inside thereof is a dust collecting chamber of the vacuum cleaner 10A. The dust collecting body portion 121 has a substantially cylindrical shape. The dust collecting head portion 122 is mounted on an upper portion of the dust collecting body portion 121 via a buckle member 123. A rear lid 125 is openably provided on a lower portion of the dust collecting body portion 121 via a hinge member 124. The body dust collecting section 12 is entirely removably mounted to the body casing section 11. A lower surface of the dust collecting head portion 122 faces an inner space (dust collecting chamber) of the dust collecting body portion 121. A HEPA filter 221 is provided at the lower surface of the dust collecting head portion 122. A pre-filter 222 is provided inside of the dust collecting body portion 121.

[0034] A lower surface of the dust collecting body portion 121 faces an air exhaust cover 126. A suction motor 223 (indicated by a broken line in Fig. 1) is built into a lower portion of the body casing section 11. The air exhaust cover 126 is removably attached to the body casing section 11 by means of a buckle 127 in front of the suction motor 223. An air exhaust filter (not shown) is provided inside of the air exhaust cover 126 to filter air exhausted from the suction motor 223. An air exhaust port 224 is provided on a front surface of the air exhaust cover 126 to exhaust the filtered air.

[0035] The body dust collecting section 12 is mounted to the body casing section 11, thereby constructing the body section of the vacuum cleaner 10A as described above. The body section has a shape in which a substantially forward half portion (body dust collecting section 12) has a cylindrical shape and a substantially rearward half portion has a rectangular cylinder shape. Therefore, the body section has a column shape in which forward surface is protrusively curved, and a rearward surface is substantially flat.

[0036] As shown in Fig. 1, the suction nozzle 13 has a substantially flat plate shape and is provided at a lower portion of the body casing section 11. A rear portion of the suction nozzle 13 is mounted to the lower portion of the body casing section 11 to retain both side surfaces of the lower portion of the body casing section 11. When the vacuum cleaner 10A of the present embodiment is recognized as a floor surface treating apparatus for cleaning the floor surface, the suction nozzle 13 corre-

sponds to a floor surface treating section (treating head). As shown in Fig. 3, the floor surface treating section (suction nozzle 13) has a lower surface Su facing a floor surface 100 which is a target of floor surface treating. The suction nozzle 13 is mounted to the lower portion of the body casing section 11 via nozzle support shafts 13a, and is pivotable (swingable) around the nozzle support shafts 13a in a direction indicated by arrow R2 in Fig. 3. Therefore, the suction nozzle 13 is capable of changing an angle of the lower surface Su with respect to a direction in which the column-shaped body section extends. In Fig. 3, a part of the configuration of Fig. 1 is omitted to easily explain the configuration of the steering wheels 15 and a steering coupling section 60A as will be described later.

[0037] As shown in Figs. 1 and 3, a cylindrical rotary brush 131 (indicated by broken line in Figs. 1 and 3) is provided inside of a front portion of the suction nozzle 13. The rotary brush 131 is exposed toward the lower surface Su in a location along a direction perpendicular to a movement direction M. Inside of the suction nozzle 13, a driving mechanism (air turbine, not shown) for rotating the rotary brush 131 is provided. The front portion of the suction nozzle 13 has a greater lateral width to allow the rotary brush 131 extending laterally to be provided therein. As described later, a front portion lower surface 13b (see Fig. 3) of the suction nozzle 13 is a slanted surface slanted downward in a rearward direction. A guard section 132 made of an elastic material is provided on a front surface of the suction nozzle 13. The guard section 132 serves to prevent a furniture, a wall, etc., from being damaged when the suction nozzle 13 collides with the furniture, the wall, etc..

[0038] The suction nozzle 13 is coupled to the body dust collecting section 12 via a suction hose 133. Specifically, as shown in Fig. 2, a suction port 114 is provided on a rearward side surface (at a left side in Fig. 2) of the body casing section 11. The suction port 114 is connected to the body dust collecting section 12. The suction port 114 is attached with a suction connecting pipe 115. The suction connecting pipe 115 has a L-shape. One end of the suction connecting pipe 115 is mounted to the suction port 114, while the other end thereof is coupled to one end (downstream end in a case where the body dust collecting section 12 is a downstream side) of the suction hose 133.

[0039] The other end (upstream end) of the suction hose 133 is coupled to a hose connector 136 positioned on a side surface (at a right side in Fig. 2) which is at an opposite side of the suction port 114. The hose connector 136 is a member by which a nozzle hose 137 and the suction hose 133 which are coupled to a portion of the extension pipe holder 116 are removably coupled to an extension pipe holder 116. As desired, the hose connector 136 can disconnect the nozzle hose 137 and the suction hose 133 from each other. The nozzle hose 137 is connected to a suction opening provided on the lower surface Su of the suction nozzle 13. Therefore, during use, when the power supply switch 129 is ON, the suction

motor 223 is actuated inside of the body casing section 11. A suctioning force of the suction motor 223 travels from the dust collecting head portion 122, through the HEPA filter 221, the dust collecting body portion 121, the suction port 114, the suction connecting pipe 115, the suction hose 133, the hose connector 136, and the nozzle hose 137, and then reaches the suction opening of the suction nozzle 13, thereby generating the suctioning force in the suction nozzle 13.

[0040] The hose connector 136 can disconnect the suction nozzle 13 from the nozzle hose 137. In the disconnected state, a suction extension pipe 134 or a gap nozzle 135 is connectable to the hose connector 136. That is, in a state in which the suction hose 133 is separated from the suction nozzle 13, the suction hose 133 constitutes a sub-suction section different from the suction nozzle 13. The suction extension pipe 134 and the gap nozzle 135 are connectable to the suction hose 133 and therefore constitute a sub-suction section together with the suction hose 133.

[0041] During non-use, as shown in Figs. 1 and 2, the suction hose 133 is placed on an upper surface of an arch-shaped hose holding member 113 above the body casing section 11 and held thereon in a stable manner. The suction extension pipe 134 and the gap nozzle 135 are removably attachable to the body casing section 11 via an extension pipe holder 116. Specifically, as shown in Fig. 2, the extension pipe holder 116 is mounted to a side surface of the body casing section 11 and has a recess directed in an upward direction with a diameter substantially equal to a diameter of the suction extension pipe 134. During non-use of the suction extension pipe 134 and the gap nozzle 135, the gap nozzle 135 is inserted into the suction extension pipe 134 through one end of the suction extension pipe 134, and the other end of the suction extension pipe 134 in this state is inserted into the recess of the extension pipe holder 116. This allows the suction extension pipe 134 and the gap nozzle 135 to be removably mounted to the side surface of the body casing section 11.

[0042] As shown in Figs. 1 to 3, the handle 14 is attached to an upper portion of the body casing section 11 via the handle shaft 16. During use, the handle 14 is a holding section to be held by the user, and has an oval-ring-shape conforming in size to an average palm. A code rewinding hook 112 is provided at a rear surface of a lower portion of the handle 14. The code rewinding hook 112 and the carrying handle 111 form a pair. The carrying handle 111 is directed downward, while the code rewinding hook 112 is directed upward. During non-use, as shown in Fig. 2, by rewinding the power supply code 128 between the code rewinding hook 112 and the carrying handle 111, the power supply code 128 is rewound around a rear surface of the body casing section 11 and held therein.

[0043] As shown in Figs. 1 to 3, the steering wheels 15 are attached to the lower portion of the body casing section 11 in addition to the suction nozzle 13. During

use, the steering wheels 15 are located substantially below the nozzle support shafts 13a, and their outer peripheral surfaces contact the floor surface 100. On the other hand, during non-use, as shown in Fig. 3, the outer peripheral surfaces of the steering wheels 15 are apart from the floor surface 100. The steering wheels 15 serve to determine the movement direction M of the suction nozzle 13. As will be described later, the angles of the steering wheels 15 are changed by the user's manipulation of the handle 14 while holding the handle 14.

[0044] In the present embodiment, as shown in Fig. 2, two steering wheels 15 are provided at both sides of the lower portion of the body casing section 11. The two steering wheels 15 have a positional relationship so as to form a pair along the direction perpendicular to movement direction M. Preferably, the two steering wheels 15 are attached to the lower portion of the body casing section 11 in obliquely rearward location relative to the nozzle support shafts 13a. With this configuration, as will be described later, in the upright state of the body section, during non-use, the steering wheels 15 are not in contact with the floor surface, while in a state in which the body section is slanted while the user is holding the handle 14 during use, the two steering wheels 15 are located substantially below the nozzle support shafts 13a.

[0045] As shown in Fig. 3, the steering wheels 15 are coupled to the handle 14 via a handle shaft 16, a steering wheel adjustment shaft 161 (broken line in Fig. 3), and others. As indicated by arrow R1 in Fig. 3, the handle shaft 16 and the steering wheel adjustment shaft 161 are rotatably attached to the body casing section 11. The handle shaft 16 is exposed above the body casing section 11. The steering wheel adjustment shaft 161 is disposed inside of the body casing section 11. The handle 14, the handle shaft 16 and the steering wheel adjustment shaft 161 form a unitary structure. When the user performs a manipulation for twisting the handle 14 to the left or to the right, the handle shaft 16 and the steering wheel adjustment shaft 161 are rotated according to a position change of the handle 14 which is caused by the rotation of the handle 14. The rotation of the handle shaft 16 and the steering wheel adjustment shaft 161 is transmitted to the steering wheels 15, which causes the angles of the steering wheels 15 to be changed. That is, the handle shaft 16 and the steering wheel adjustment shaft 161 constitute a steering coupling section 60A for changing the angles of the steering wheels 15 according to the manipulation of the handle 14.

[0046] As shown in Fig. 3, the steering wheels 15 are provided with cover members 151 covering the steering wheels 15, respectively, from above. Stoppers 152 (pick-like stoppers 152 ahead of the cover members 151) are provided at front portions of the cover members 151, respectively. The stoppers 152 are plate-shaped portions extending forward relative to the cover members 151, respectively. During non-use state of the vacuum cleaner 10A, as shown in Fig. 3, the body section (body casing section 11 and body dust collecting section 12) are placed

in an upright state, and the stoppers 152 contact the floor surface 100, so that the outer peripheral surfaces of the steering wheels 15 are apart from the floor surface 100.

[0047] Each cover member 151 not only covers the steering wheel 15 from above but also supports a rolling shaft 153 of the steering wheel 15. A wheel support shaft 154 is rotatably attached to an upper portion of the cover member 151 such that the wheel support shaft 154 is rotatable with respect to the body casing section 11. The wheel support shaft 154 extends in a direction substantially conforming to a straight line connecting the nozzle support shaft 13a to the rolling shaft 153. Since the steering wheel 15 is rotatably attached to the body casing section 11 via the wheel support shaft 154 and the cover member 151, the angle of the steering wheel 15 with respect to the body casing section 11 can be changed.

[0048] In the vacuum cleaner 10A shown in Figs. 1 to 3, specific configurations of the body casing section 11, the body dust collecting section 12, the suction nozzle 13, the handle 14, the steering wheels 15, the handle shaft 16, and the sub-suction section (suction hose 133, etc.) are not particularly limited, but configurations in the field of the vacuum cleaner may be suitably used.

[0049] Although in the present embodiment, the body section includes the body casing section 11 and the body dust collecting section 12 which are separable from each other, they may have a unitary structure. Although the body section has a columnar shape in which its front surface is a substantially curved surface and its rear surface is a substantially flat surface, the shape of the body section is not limited to this. The body section may have a substantially rectangular cylinder shape, but may have a columnar shape in which its cross-section decreases in size gradually in an upward direction. The body section may be provided with a recess or a convex portion on a side surface thereof so long as it entirely has a columnar shape.

[0050] Although in the present embodiment, the suction nozzle 13 has a substantially flat plate shape, the shape of the suction nozzle 13 is not limited to this. The suction nozzle 13 may have a semi-spherical shape, a casing shape, etc., so long as it has the lower surface Su. Although in the present embodiment, the handle 14 is provided as a holding section, the shape of the holding section is not limited to this, but a known holding section other than the handle 14 may be used.

[0051] In the vacuum cleaner 10A of Fig. 1, the suction motor 223 and a suction fan (not shown) rotated by the suction motor 223 are provided inside of the body section (specifically body casing section 11), and the rotary brush 131 is provided inside of the suction nozzle 13. In this configuration, a rotary shaft of the suction motor 223 may extend from the nozzle support shafts 13a supporting the suction nozzle 13 toward the suction nozzle 13, and may be coupled to the rotary brush 131 by means of a belt, or the like. In this configuration, the suction fan and the rotary brush 131 can be actuated by the suction motor 223, and therefore, the single suction motor 223 can be

used as driving sources for the suction fan and the rotary brush 131. This makes it possible to simplify the configuration of the vacuum cleaner 10A.

[0052] A specific configuration of the nozzle support shafts 13a for supporting the suction nozzle 13 on the body section is not particularly limited to this. In the present embodiment, as will be described later, the suction nozzle 13 is pivotally supported on the body section by means of a pair of right and left nozzle support shafts 13a in locations at which the lower portion of the body section is sandwiched. Alternatively, single nozzle support shaft 13a may penetrate the lower portion of the body section or nozzle support shafts 13a having a mechanical configuration like a bearing mechanism instead of shafts may be used.

[0053] Any configuration of the nozzle support shaft 13a may be used, so long as it is provided at the lower portion of the body section, and pivotally supports the suction nozzle 13 in a direction to change the angle of the lower surface Su with respect to the direction in which the body section extends. In a case where the floor surface treating apparatus is other than the vacuum cleaner 10A, known configurations may be used as a treating section support shaft corresponding to the nozzle support shaft 13a, so long as it can pivotally support the floor surface treating section.

[0054] A specific configuration of the cover member 151 and a specific configuration of the stopper 152 provided at the steering wheel 15 are not particularly limited. Although in the present embodiment, the cover member 151 covers an entire of a substantially upper half portion of the steering wheel 15, for example, the cover member 151 may cover only an upper surface of the steering wheel 15 with its side surface being exposed. Although in the present embodiment, the stopper 152 has the flat plate shape, for example, a front portion of the cover member 151 may have a block-like form and a floor surface contact surface corresponding to the stopper 152 may be provided in a portion of the front portion of the cover member 151. A length of the stopper 152 is suitably set depending on conditions such as a location at which the steering wheel 15 is mounted to the body casing section 11, and is not limited to a particular length.

[Configuration of steering coupling section]

[0055] Next, a specific configuration of the steering coupling section 60A in the vacuum cleaner 10A will be specifically described with reference to Figs. 4A to 4C and Figs. 5A and 5B, in addition to Fig. 3.

[0056] As described above, the handle shaft 16 and the steering wheel adjustment shaft 161 constitute the steering coupling section 60A. In addition to these, as shown in Fig. 4A, a rotation transmission section 160 connected to the steering wheel adjustment shaft 161 constitutes the steering coupling section 60A.

[0057] Specifically, as shown in Fig. 3, the handle 14 is attached to the upper end of the steering wheel adjust-

ment shaft 161 which is a portion of the steering coupling section 60A, via the handle shaft 16. As shown in Fig. 4A, a cam member 162 is attached to a lower end of the steering wheel adjustment shaft 161, and is coupled to the pair of steering wheels 15 via arm members 163, 164, respectively.

[0058] Each of the cam member 162 and the arm members 163, 164 has an elongate plate shape. The lower end of the steering wheel adjustment shaft 161 is fastened to one end (rear end) of the cam member 162, while one ends of the arm members 163 and 164 are mounted to the other end (front end) of the cam member 162. The other ends of the arm members 163 and 164 are mounted to the stoppers 152 of the cover members 151, respectively. Each cover member 151 serves to cover the corresponding steering wheel 15 from above, and constitutes the rotation transmission section 160 for coupling the lower end of the steering wheel adjustment shaft 161 to the corresponding steering wheel 15 via the cam member 162 and the arm members 163 and 164.

[0059] When a positional relationship among the steering wheel adjustment shaft 161, the cam member 162, the arm members 163 and 164 and the steering wheels 15 is seen, the steering wheel adjustment shaft 161 extends vertically inside of the body casing section 11 and the rear end of the cam member 162 is fastened to the lower end of the steering wheel adjustment shaft 161, as shown in Fig. 3. Therefore, the cam member 162 of an elongate plate shape crosses an axial direction of the steering wheel adjustment shaft 161. On the basis of the location of the cam member 162, the arm members 163 and 164 cross a lengthwise direction of the cam member 162 at a front end of the cam member 162. The cam member 162 is sandwiched between the two steering wheels 15. The cam member 162 and the steering wheels 15 are arranged substantially in parallel.

[0060] When ends of the arm members 163 and 164 which are attached to the front end of the cam member 162 are referred to as inner ends, and ends of the arm members 163 and 164 which are attached to the stoppers 152 are referred to as outer ends, preferably, the inner ends and the outer ends are attached to the front end of the cam member 162 and to the stoppers 152 in such a manner that protruding portions are inserted into openings, for example. For example, as shown in Fig. 4B which is a cross-sectional view of a portion surrounded by a broken-line circle in Fig. 4A, a through-hole 162a is provided on the front end of the cam member 162, and a protruding portion 163b provided on a lower surface of the inner end of the arm member 163 is inserted into the through-hole 162a. An upper hole 163a is formed on an upper surface of the protruding portion 163b. A protruding portion 164b provided on a lower surface of the inner end of the arm member 164 is inserted into the upper hole 163a. An attaching configuration of the outer ends of the arm members 163 and 164 and the stoppers 152 is similar to the above. Protruding portions 163c and 164c provided on lower surfaces of the outer ends of the arm

members 163 and 164 are inserted into through-holes (not shown in Fig. 4A) formed in the stoppers 152, respectively.

[0061] As described above, the steering wheels 15 are covered with the cover members 151 from above, the stoppers 152 are provided at the front end portions of the cover members 151, respectively, and the outer ends of the arm members 163 and 164 are attached to the stoppers 152, respectively. The cover members 151 support the rolling shafts 153 of the steering wheels 15, and the wheel support shafts 154 are provided at upper surfaces thereof, respectively. In a state where the wheel support shafts 154 are attached to the body casing section 11, the cover members 151 and the steering wheels 15 are rotatable around the wheel support shafts 154 as indicated by an arrow R3.

[0062] The pair of steering wheels 15 are arranged in one row along the direction perpendicular to the movement direction M of the suction nozzle 13 at the lower portion of the body casing section 11. Specifically, as schematically shown at the left side in Fig. 4C, when the lower portion of the body casing section 11 is seen from a back side, steering wheels 15-1 in a pair indicated by solid lines are positioned so as to sandwich the body casing section 11. In Fig. 4C, a left-side view and a right-side view are rear views of the vacuum cleaner 10A. Therefore, a direction along from a near side to a far side in Fig. 4C is the movement direction M.

[0063] Since two or more steering wheels 15 may be provided, for example, steering wheels 15-2 indicated by broken lines are provided at the inner side and adjacently to the pair of steering wheels 15-1. In this way, four steering wheels 15 may be provided. Or, a steering wheel 15-3 indicated by one-dotted line may be provided at the middle between the steering wheels 15-1. In this way, three steering wheels 15 may be provided. Or, the steering wheels 15-1~15-3 may be provided, and thus, five steering wheels 15 may be provided.

[0064] In the above configuration, in a state in which the steering wheel adjustment shaft 161, the cam member 162, the arm members 163 and 164, and the steering wheels 15 are coupled, the steering wheel adjustment shaft 161 and the cam member 162 are coupled together in a fixed state, while the front end of the cam member 162, the inner ends of the arm members 163 and 164, the stoppers 152, and the outer ends of the arm members 163 and 164 are coupled together in an incompletely fixed state, the pair of steering wheels 15 are rotatably mounted to the lower portion of the body casing section 11.

[0065] When the user performs an operation for twisting the handle 14, a position change in the handle 14 caused by the twist action (rotation) is transmitted to the handle shaft 16 and to the steering wheel adjustment shaft 161. As shown in Fig. 4A and Fig. 5A, the steering wheel adjustment shaft 161 rotates as indicated by arrow R1. This rotation is transmitted to the cam member 162. As shown in Fig. 5A, the front end of the cam member 162 moves from a location indicated by a solid line to a

location indicated by two-dotted line, for example. Thereby, the arm members 163 and 164 are pivoted in the direction crossing the lengthwise direction of the cam member 162, which causes the steering wheels 15 coupled to the arm members 163 and 164 via the cover members 151 to be rotated in the direction indicated by arrow R3. As a result, as shown in Fig. 5A, the angles of the steering wheels 15 are changed.

[0066] Since the pair of steering wheels 15 are arranged along the direction perpendicular to the movement direction M, a direction of the twist manipulation of the handle 14 can correspond with a change in the direction of the suction nozzle 13. This makes it possible to avoid that the user feels difficulty in the manipulation for changing the direction of the suction nozzle 13. In the configuration in which, the plurality of steering wheels 15 are arranged in one row, if the angles of all of the steering wheels 15 are changed to allow the steering wheels 15 to be directed in the same direction, by the user's manipulation of the handle 14, the movement direction M of the suction nozzle 13 can be effectively restricted by the plurality of steering wheels 15.

[0067] In the present embodiment, the mounting structures of the cam member 162, the arm members 163 and 164, and the stoppers 152 are the insertion configuration as shown in Fig. 4B. Therefore, the configuration of the cam member 162, and the arm members 163 and 164 can be made flexible. For example, in a case where a longer plate member is required to be used as the cam member 162 depending on the specific configuration of the body casing section 11 and the suction nozzle 13, as shown in Fig. 5B, the arm members 163 and 164 move suitably according to the movement of the front end of the cam member 162 by means of the insertion configuration and the angles of the steering wheels 15 can be changed.

[0068] The specific configurations of the steering wheel adjustment shaft 161, the cam member 162, and the arm members 163 and 164 are not particularly limited, but shapes, dimensions, materials, etc., which are known in the field in which similar mechanisms are used, may be suitably used depending on the specific configuration, use, etc., of the vacuum cleaner 10A. As will be described later in Embodiment 2 or 3, the configuration of the steering coupling section 60A is not limited to the configuration having the steering wheel adjustment shaft 161, the cam member 162, and the arm members 163 and 164.

[0069] For example, in the present embodiment, since the steering wheel adjustment shaft 161 is configured such that the position change caused by twisting the handle 14 is transmitted to the steering wheel adjustment shaft 161 via the handle shaft 16, any kind of shaft may be used so long as it is made of a material having durability or stiffness to the twist force, or has a shape having such durability or stiffness. In a case where the steering wheel adjustment shaft 161 has durability or stiffness to the twist force, either the cam member 162 or the arm members 163, 164, or both of them are preferably made

of a flexible material or have a shape for allowing for flexibility. This makes it possible to mitigate a difference in a degree of rotation between the wheel support shafts 154 of the steering wheels 15 and the steering wheel adjustment shaft 161, due to, for example, a resistance or the like applied from the floor surface 100 to the steering wheels 15.

[Configuration of steering wheel]

[0070] Next, a specific configuration of the steering wheels 15 of the steering coupling section 60A will be described with reference to Figs. 6A and 6B with reference to Fig. 4C.

[0071] A specific shape of the steering wheels 15 will not be particularly limited. Preferably, the outer peripheral surface of the steering wheel 15 is entirely flat, or a peripheral portion of the outer peripheral surface of the steering wheel 15 protrudes more than its center portion. For example, as shown in Fig. 6A, a wheel 15a having a general form is used, in which a cross-sectional shape taken along a rolling shaft 153 (center axis) has a substantially rectangular shape. By comparison, as shown in Fig. 6B, a wheel 15b may be used, in which its cross-sectional shape has two protruding portions.

[0072] A configuration of the wheel 15a having a general form is not particularly limited, and its outer peripheral surface may be entirely flat. The wheel 15b having two protruding portions is not particularly limited, so long as the peripheral portion of the outer peripheral surface protrudes more than its center portion to form the two protruding portions on the outer peripheral surface in the cross-section, and a degree of protrusion is not particularly limited. The wheel 15a and the wheel 15b are each configured such that an entire cross-section taken along the rolling shaft 153 may be made of a single material. However, the present invention is not limited to this. For example, a portion near the rolling shaft 153, i.e., rolling center of the wheel 15a, 15b is made of metal, a portion near the outer peripheral surface may be made of a resin, and its inner portion may be hollow. That is, the shape of the wheel 15a, 15b shown in Fig. 6A, Fig. 6B is not limited to the cross-sectional shape taken along the center axis (rolling shaft 153), but may be a shape in which a projection shape (cross-sectional shape) with respect to the movement direction M is not illustrated

[0073] The shape of the wheel 15a or the wheel 15b allows a relative location of the rolling shaft 153 of the steering wheel 15 to be maintained higher in a state in which the peripheral portion of the steering wheel 15 contacts the floor surface 100 in a slanted state of the wheel 15a, 15b. That is, as shown in the upper view of Fig. 6A, 6B, when a height of the rolling shaft 153 from the floor surface 100 is Hw1 in a normal attitude of the wheel 15a, 15b, a height Hw2 of an upper portion of a slanted rolling shaft 153 is greater than the height Hw1 in a slanted state of the wheel 15a, 15b as shown in lower views of Fig. 6A, 6B.

[0074] As shown in the left view of Fig. 4C, in the configuration including two to five steering wheels 15, all of the steering wheels 15 may be the wheels 15a having a general form or the wheels 15b having two protruding portions, or the wheels 15a and the wheels 15b may co-exist.

[0075] Or, as schematically shown in the right view of Fig. 4C, rollers 15c may be used as steering wheels 15 instead of the wheels 15a, 15b. Although the wheel 15a, 15b has a shape in a which a lateral width of the outer peripheral surface is smaller than its diameter, the roller 15c has a shape in which a ratio of the lateral width of the outer peripheral surface is greater. In this case, a relative location of the rolling shaft 153 of the steering wheel 15 in the state in which the peripheral portion of the slanted steering wheel 15 is in contact with the floor surface 100 can be made higher. Thus, in the present invention, a rotary member having any shape may be suitably used as the steering wheel 15 so long as it can move the suction nozzle 13 and its direction can be changed by the manipulation of the handle 14.

[0076] Since the relative location of the rolling shaft 153 is higher in the slanted state of the steering wheel 15, the relative location of the nozzle support shaft 13a can also be made higher. Since the nozzle support shaft 13a is positioned at the rear portion of the suction nozzle 13, the front portion of the suction nozzle 13 can be lowered. As described later, in a state in which the body section is maintained in a substantially horizontal state, reduction of a close contact state between the suction nozzle 13 and the floor surface can be made up for.

[0077] Although in the present invention, the specific configuration of the wheel 15a, 15b or the roller 15c for use as the steering wheel 15 is not particularly limited, at least the outer peripheral surface thereof is preferably made of an elastic material. As the elastic material, for example, there are rubber (elastomer) materials such as styrene-butadiene rubber, butadiene rubber, chloroprene rubber, nitrile butadiene rubber, ethylene-propylene rubber, butyl rubber, urethane rubber, silicon rubber, and fluoro-rubber, or a cork, etc.. However, the elastic material is not particularly limited.

[0078] The elastic material may be used for at least only the outer peripheral surface. A larger portion of the steering wheel 15 including the outer peripheral surface or the entire of the steering wheel 15 may be made of the elastic material. For example, a portion of the steering wheel 15 for holding the rolling shaft 153 for supporting the steering wheel 15 such that the steering wheel 15 is rotatable may be made of metal or a resin material having high stiffness and the other portion may be made of an elastic material.

[0079] As described above, in the case where at least the outer peripheral surface of the steering wheel 15 is made of the elastic material, the floor surface 100 contacts the elastic material surface. Because of this, it is possible to effectively lessen a possibility that the steering wheels 15 slip on the floor surface 100 without de-

pending on a state or a material of the floor surface 100. As a result, maneuverability of the vacuum cleaner 10A can be further improved.

[Use example of vacuum cleaner]

[0080] Next, a typical example of use of the vacuum cleaner 10A of the present embodiment will be described in conjunction with its basic operation and operation method, with reference to Fig. 6C and Figs. 7 to 9.

[0081] As shown in the left view of Fig. 7, during non-use of the vacuum cleaner 10A, the body section (body casing section 11 and body dust collecting section 12) is in an upright state. This upright state is the same as the state shown in Fig. 3. The steering wheels 15 are held in a state in which their forward portions are lower and their rearward portions are higher because of the upright state of the body section. This is because the steering wheels 15 are provided at the lower portion of the body casing section 11 in obliquely rearward locations relative to the nozzle support shafts 13a, respectively, and each of the wheel support shafts 154 for supporting the steering wheel 15 such that the steering wheel 15 is rotatable is disposed in a location substantially conforming to a straight line connecting the nozzle support shaft 13a to the rolling shaft 153.

[0082] Since the stoppers 152 which are a portion of the cover members 151 are provided at the front portions of the steering wheels 15, the stoppers 152 contact the floor surface 100 and the outer peripheral surfaces of the steering wheels 15 are apart from the floor surface 140. Since the center axes of the rolling shafts 153 are located obliquely rearward and below relative to the center axes of the nozzle support shafts 13a, the relative locations of the nozzle support shafts 13a with respect to the floor surface 100 are lower as compared to the use state (slanted state of the body section) as will be described later.

[0083] A front portion lower surface 13b of the suction nozzle 13 is located at the front portion of the suction nozzle 13. The nozzle support shafts 13a of the suction nozzle 13 are located at the rear portion of the suction nozzle 13. When the relative locations of the nozzle support shafts 13a are relatively lower, the rear portion of the suction nozzle 13 is lowered. Therefore, the front portion lower surface 13b located at the front portion of the suction nozzle 13 is held in a slanted state such that its front portion is upwardly apart from the floor surface with the rear portion being a point of support.

[0084] When the user uses the vacuum cleaner 10A, the body section is slanted in a rearward direction as shown in the right view of Fig. 7. This slanted state is the use state. The user slants the body section as indicated by arrow C 1 in Fig. 7 while holding the handle 14 or the like. Thereby, the steering wheels 15 move to be located substantially below the nozzle support shafts 13a such that the front portions of the cover members 151 are higher and the rear portions of the cover members 151 are

lower. As indicated by arrow C2 in Fig. 7, the stoppers 152 having been in contact with the floor surface 100 move up, and the steering wheels 15 having been higher move down. As a result, the outer peripheral surfaces of the steering wheels 15 contact the floor surface 100, which allows the vacuum cleaner 10A to be movable on the floor surface 100 by the steering wheels 15. Although an inclination angle (body inclination angle) As of the body section is not particularly limited, it may generally be in a range from 40 degrees to 50 degrees, and preferably, about 45 degrees.

[0085] The locations of the nozzle support shafts 13a with respect to the floor surface 100 are higher (see difference Df indicated by one-dotted line) in the slanted state than in the upright state. Correspondingly, the rear portion of the suction nozzle 13 having been located lower moves up as indicated by arrow C3 in Fig. 7. At this time, the front portion lower surface 13b of the suction nozzle 13 entirely contacts the floor surface 100.

[0086] More specifically, as shown in Fig. 8A, in the upright state, the front portion lower surface 13b of the suction nozzle 13 is slanted such that the front portion is higher so as to form an angle α between the front portion lower surface 13b and the floor surface 100. This angle α will be referred to as "lower surface inclination angle α " to be distinguished from the body inclination angle As. In this state, as described later, the stoppers 152 are in contact with the floor surface 100, and therefore the outer peripheral surfaces of the steering wheels 15 are apart from the floor surface 100. Then, when the vacuum cleaner 10A shifts from the upright state to the slanted state, the nozzle support shafts 13a move to be higher. Therefore, the rear portion of the suction nozzle 13 moves to be higher, and therefore the rear portion of the front portion lower surface 13b of the suction nozzle 13 moves to be higher. As a result, as shown in Fig. 8B, the lower surface inclination angle α formed between the front portion lower surface 13b and the floor surface 100 is cancelled, and the front portion lower surface 13b and the floor surface 100 substantially conform to each other. Thus, the front portion lower surface 13b is entirely in contact with the floor surface 100.

[0087] As shown in Fig. 8B (and slanted state of Fig. 7), the stoppers 152 move to be higher such that they are placed substantially horizontally, and the outer peripheral surfaces of the steering wheels 15 contact the floor surface 100. Therefore, the steering wheels 15 allow the suction nozzle 13 to be movable, and the rotary brush 131 provided at the front portion of the suction nozzle 13 to sufficiently contact the floor surface 100. As a result, the vacuum cleaner 10A can shift to a use attitude in which cleaning can be carried out.

[0088] Then, the user operates the power supply switch 129 to actuate the suction motor 223 (see Fig. 1). Thereby, an air pressure in an interior (dust collecting chamber) of the body dust collecting section 12 decreases, and a suction force is generated in the suction nozzle 13 via the suction hose 133. Then, the user moves the

suction nozzle 13 in a desired direction and carries out cleaning by holding the handle 14.

[0089] To change the direction of the suction nozzle 13, as shown in Fig. 9, the user may perform a manipulation for twisting the handle 14 in the direction of the arrow R1. With this operation, a position change caused by the twist manipulation (rotation) of the handle 14 is transmitted to the cam member 162 via the handle shaft 16 and the steering wheel adjustment shaft 161. The front end of the cam member 162 is swung to the right or to the left, thereby allowing the angles of the pair of steering wheels 15 to be changed via the arm members 163 and 164. For example, if the handle 14 is twisted to the right in Fig. 9, the angles of the steering wheels 15 can be changed in the direction of the arrow M1 (to the right) without moving the entire of the body section of the vacuum cleaner 10A. Therefore, without pivoting (swinging) the handle 14 to a greater degree, and feeling that a great force must be applied to manipulate the handle 14, the user can easily move the suction nozzle 13 in the direction of the arrow M1. In the same manner, when the handle 14 is twisted to the left in Fig. 14, the angles of the steering wheels 15 can be changed in the direction of the arrow M2 (to the left), so that the user can easily move the suction nozzle 13 in the direction of the arrow M2.

[0090] As described above, by merely manipulating the handle 14 to change the direction of the steering wheels 15, the suction nozzle 13 itself can be moved in an oblique direction without changing its angle. Because of this, even when cleaning is carried out toward a wall surface in front, a region to be cleaned can be changed sequentially while maintaining the front portion of the suction nozzle 13 in parallel with the wall surface. Therefore, as compared to a conventional vacuum cleaner, for example, a corner region in a room can be cleaned very easily, and the direction of the suction nozzle 13 itself is not changed in changing the direction. As a result, a resistance applied from, for example, a carpet which is an example of the floor surface 100 can be mitigated when changing the direction.

[0091] Since the steering wheels 15 are disposed obliquely rearward relative to the lower portion of the body section in the present embodiment, the configuration of the steering coupling section 60A can be simplified as compared to a configuration in which the steering wheels 15 are provided in forward location. In addition, as shown in Fig. 7, by merely placing the body section in the upright state, the outer peripheral surfaces of the steering wheels 15 can be made apart from the floor surface 100. That is, the suction nozzle 13 is pivotally mounted to the body section such that the suction nozzle 13 is pivotable around the nozzle support shafts 13a. Therefore, when the nozzle support shaft 13a is a point of support, the handle 14 located above the body section is a point of effort, and the steering wheel 15 is a point of load, a distance from the point of support (nozzle support shaft 13a) to the point of effort (handle 14) is longer than a distance from the point of support (nozzle support shaft

13a) to the point of load (steering wheel 15). Because of this, the user has only to hold the handle 14 with a small force to make the body section upright, the stoppers 152 protruding near the point of load (steering wheel 15) to move to locations under the steering wheels 15. Therefore, the steering wheels 15 can be made apart from the floor surface easily.

[0092] Since the front portion lower surface 13b which is in a foremost location, of the lower surface Su, is the slanted surface, the nozzle support shafts 13a which are the point of support, i.e., rear portion of the suction nozzle 13 move down, so that the front portion of the suction nozzle 13 move up. This allows the front portion lower surface 13b in contact with the floor surface 100 in the slanted state to be apart from the floor surface 100. Since the rotary brush 131 is exposed in the front portion lower surface 13b, it can be held or preserved so as not to contact the floor surface 100 depending on a magnitude of the lower surface inclination angle α , or a location of the rotary brush 131.

[0093] As shown in Fig. 9, the suction nozzle 13 is pivotally mounted to the body section by means of the pair of right and left nozzle support shafts 13a provided so as to sandwich the lower portion of the body section (in Fig. 9, body casing section 11). Because of this, as compared to the improved prior arts (see Figs. 13A, 13B), a mounting stiffness of the suction nozzle 13 to the body section can be improved with a simple configuration without using a special material, etc.. As a result, cost of the vacuum cleaner 10A will not increase.

[0094] As shown in Fig. 8C, for example, when a vertically narrower region, such as a space under a furniture or a bed, is cleaned, the steering wheels 15 are in locations forward relative to the nozzle support shafts 13a with the body section being placed substantially horizontally. In this state (down state), the relative locations of the nozzle support shafts 13a are lower than those in the slanted state, as in the case of the upright state. Therefore, the rear portion of the suction nozzle 13 is made lower than that in the slanted state (two-dotted line in Fig. 8C).

[0095] When a vertical location of the nozzle support shaft 13a in the upright state is a height Hs1 as shown in Fig. 8A and a vertical location of the nozzle support shaft 13a in the slanted state is a height Hs2 as shown in Fig. 8B, it is clear that the height Hs2 is greater than the height Hs1. However, as shown in Fig. 8C, in the down state of the body section, the location of the nozzle support shaft 13a becomes closer to the height Hs1 in the upright state. In the down state, the location of the nozzle support shaft 13a does not completely conform to the height Hs1, but substantially conforms to the height Hs1.

[0096] In a state in which the body section is in the down state, the steering wheels 15 are positioned below the suction nozzle 13 and forward relative to the nozzle support shafts 13a. Therefore, the suction nozzle 13 is maintained in a state in which it is movable by the steering

wheels 15. Even in the vertically narrower space, the location of the entire suction nozzle 13 can be lowered by merely placing the body section in the down state. Therefore, the floor surface 100 can be suitably cleaned.

[0097] In the vacuum cleaner 10A, the wheels 15a having a general form or the wheels 15b having two protruding portions are more preferable when the body section is used in the down state. Specifically, as shown in Fig. 8C, in the state in which the body section is in the slanted state (indicated by two-dotted line in Fig. 8C), the steering wheels 15 are located substantially below the nozzle support shafts 13a (see Fig. 8B as well as Fig. 8C). When the body section changes to the down state (indicated by solid line in Fig. 8C), the locations of the nozzle support shafts 13a move to be lower than those in the slanted state. This causes the front portion of the suction nozzle 13 to move up a little. Therefore, as in the case of the upright state (see Fig. 8A), the front edge of the front portion lower surface 13b provided at the front portion is a little apart from the floor surface 100.

[0098] When a positional relationship between the body section, the suction nozzle 13 and the steering wheels 15 in the down state of the body section is seen from the perspective of the handle 14, as shown in Fig. 6C, the body section (body casing section 11 and body dust collecting section 12) and the suction nozzle 13 are placed substantially horizontally, and the handle 14 and the handle shaft 16 are placed substantially horizontally (handle shaft 16 is indicated by a broken line in Fig. 6C). However, in the down state, as shown in Fig. 8C, the wheel support shafts 154 are slanted as indicated by dotted line Sx2 in Fig. 8C, and therefore the steering wheels 15 are slanted with respect to the floor surface 100.

[0099] As indicated by dotted line Sx1 in Fig. 8C, since the wheel support shaft 154 is disposed to substantially conform to a straight line connecting the nozzle support shaft 13a and the rolling shaft 153, it is maintained in a substantially vertical state in the state in which the body section is slanted (see Fig. 8B in addition to Fig. 8C). Therefore, in the slanted state, the user can change only the direction of the steering wheel 15 by manipulating the handle 14. That is, the steering wheels 15 are not slanted with respect to the floor surface 100. By comparison, in the down state of the body section, the direction in which the wheel support shaft 154 extends changes from the substantially vertical state as indicated by the dotted line Sx1 into the slanted state indicated by the dotted line Sx2.

[0100] When the user performs a manipulation for twisting the handle 14 as shown in Fig. 6C in the state in which the wheel support shafts 154 are slanted, the steering wheels 15 are slanted with respect to the floor surface 100 according to a change in the direction of the steering wheels 15 by the steering coupling section 60A. Since the steering wheels 15 are the wheels 15a having a general form or the wheels 15b having two protruding portions, the peripheral portion of the steering wheels 15 contact the floor surface 100.

[0101] In a state in which the handle 14 is not twisted, the locations of the handle 14, the steering wheels 15, and the rear portion of the suction nozzle 13 are relatively lower as indicated by two-dotted lines in Fig. 6C. On the other hand, when the handle 14 is twisted, as indicated by solid line in Fig. 6C, the relative locations of the steering wheels 15 are made higher by a height H_u (difference between a height H_{w2} and a height H_{w1} shown in Figs. 6A and 6B), and correspondingly the relative locations of the nozzle support shafts 13a are made higher.

[0102] Thereby, the rear portion of the suction nozzle 13 is made higher and the front portion of the suction nozzle 13 is made lower. Therefore, the state shown in Fig. 8C in which the front periphery of the front portion lower surface 13b is a little apart from the floor surface 100 is effectively lessened. Thereby, a close contact state between the lower surface S_u (see Fig. 7) of the suction nozzle 13 and the floor surface 100 is improved. Therefore, even in the down state of the body section, degradation of a suctioning action performed by the suction nozzle 13 can be suppressed effectively. Therefore, the floor surface 100 corresponding to the vertically narrow space under the bed or the like, can be suitably cleaned by merely manipulating the handle 14 to move the suction nozzle 13 forward and backward. Thus, regardless of the slanted state or the down state of the body section, a good cleaning capability can be realized.

[Modified example]

[0103] Although in the present embodiment, the steering wheels 15 are placed apart from the floor surface 100 in the upright state to restrict movement of the suction nozzle 13 (vacuum cleaner 10A) during the non-use, the present invention is not limited to this. For example, the steering wheels 15 may be locked so as to be unrotatable. In this case, the steering wheels 15 may be locked automatically by a mechanical configuration, an electric configuration, etc., when the body section is switched from the slanted state to the upright state.

[0104] If the steering wheels 15 are provided in locations other than the locations behind the lower portion of the body section, the steering wheels 15 may be entirely moved up by a mechanical configuration, an electric configuration, etc., so that they move apart from the floor surface 100.

[0105] Furthermore, since the upright state and the slanted state (see Fig. 7) in the present embodiment are in a relative positional relationship, specific angles of the upright state and of the slanted state are, of course, not particularly limited. Therefore, the angle of the body section in the upright state is not limited to a right angle, and a specific angle formed when the body section shifts to the slanted state is suitably set depending on a specific configuration of the vacuum cleaner 10A. Likewise, a specific value of the lower surface inclination angle α (see Fig. 8A) of the front portion lower surface 13b set as corresponding to the angle of the slanted state is not

particularly limited.

[0106] Although in the present embodiment, the steering wheels 15 are provided in locations behind the lower portion of the body section, the locations of the steering wheels 15 are not limited to this, but may be immediately below the lower portion of the body section or forward relative to the lower portion of the body section. For example, in the case where the steering wheels 15 are located forward relative to the lower portion of the body section, extended portions may be provided at the rear portions of the cover members 151 and the arm members 163 and 164 may be mounted to the extended portions, respectively. That is, when the rotation transmission section 160 includes the cam member 162 and the arm members 163 and 164, the portions of the arm members 163 and 164 relative to the cover members 151 may be coupled to the front end of the cam member 162.

[0107] Although in the present embodiment, the steering wheels 15 are attached with the cover members 151, respectively, the configuration for protecting or supporting the steering wheels 15 is not limited to this. In the present embodiment, the cover members 151 can protect the steering wheels 15 and serve as connecting members for connecting the rotation transmission section 160 to the steering wheels 15. Since the cover members 151 support the rolling shafts 153 and the wheel support shafts 154 are provided at the upper portions thereof, the steering wheels 15 can be supported on the body casing section 11. This makes it possible to protect the steering wheels 15 and suppress an increase in the number of components. The connecting members connecting the cover members 151 to the rotation transmission section 160, and the support members of the steering wheels 15 may be separate members. Or, the cover members 151 may be omitted, but instead, the steering wheels 15 may be provided with members serving as the connecting members and the support members.

[0108] Moreover, in the present embodiment, the rotation transmission section 160 is comprised of the cam member 162 and the arm members 163 and 164. This allows the motion of the steering wheel adjustment shaft 161 to be transmitted to the plurality of steering wheels 15 well with a simplified configuration. The configuration of the rotation transmission section 160 is not limited to this. For example, another known configuration can be suitably used so long as it couples the steering wheel adjustment shaft 161 to the steering wheels 15 such that the angles of the steering wheels 15 are changed according to the rotational position of the steering wheel adjustment shaft 161.

[0109] Three or more steering wheels 15 may be provided instead of the two steering wheels 15 in the present embodiment. Or, instead of the steering wheels 15, rotatable members such as wheels or rollers may be provided to contact the lower surface Su. The steering wheels 15 determine the movement direction M of the suction nozzle 13. When the plural steering wheels 15 are provided, these steering wheels 15 are preferably

aligned along the direction perpendicular to the movement direction M. Thus, the twist manipulation of the handle 14 corresponds with the changing direction of the suction nozzle 13, which can avoid a possibility of burdensome manipulation for changing the direction of the suction nozzle 13.

[0110] The configuration of the steering coupling section 60A including the rotation transmission section 160 is not limited to the configuration including the handle shaft 16 and the steering wheel adjustment shaft 161, so long as the steering coupling section 60A is rotated according to the twist motion (rotation) of the handle 14 by the user's twist manipulation of the handle 14 to a desired angle, and the angles of the steering wheels 15 can be changed according to a change in the rotation of the steering coupling section 60A. For example, the handle shaft 16 may be extended to a location near the steering wheels 15, and the cam member 162 may be directly fastened to the lower end of the handle shaft 16. The handle shaft 16 may be omitted, and the handle 14 may be provided at the upper portion of the body section and directly fastened to the upper end of the steering wheel adjustment shaft 161.

[0111] It is sufficient that the steering wheel adjustment shaft 161 may be rotatably mounted with respect to the body section (in the present embodiment, the body casing section 11). Therefore, the steering wheel adjustment shaft 161 may be entirely accommodated into the body section or an entire or part of it may be exposed on a back surface of the body section.

[0112] In the present embodiment, the handle shaft 16 and the steering wheel adjustment shaft 161 are rotary shafts which are rotatably mounted to the body section with the handle 14 being fastened to the upper end thereof. For example, when the handle shaft 16 is referred to as a first rotary shaft connected to the handle 14, the steering wheel adjustment shaft 161 may be a second rotary shaft. In the present embodiment, it is sufficient that the steering coupling section 60A includes at least a single rotary shaft. For a structural reason of the vacuum cleaner 10A, providing either one of the handle shaft 16 and the steering wheel adjustment shaft 161 as the rotary shaft can avoid an increase in the number of components.

[0113] By comparison, by providing both of the handle shaft 16 and the steering wheel adjustment shaft 161 as the rotary shaft in combination, the steering coupling section 60A can be incorporated into the existing upright vacuum cleaner 10A without substantially changing its configuration. In this case, without conducting a design change adapted to a complex configuration, maneuverability of the vacuum cleaner 10A can be improved.

[0114] Moreover, although in the present embodiment, the vacuum cleaner 10A is exemplarily described as a floor surface treating apparatus, the present invention is not limited to this, and is applicable to any kind of an upright apparatus having a floor surface treating section which perform treating on a floor surface. For example,

as another examples of the floor surface treating apparatus, there are a floor surface polishing apparatus in which a floor surface treating section includes a polishing pad for polishing a floor surface, a floor surface coating apparatus in which a floor surface treating section coats a liquid such as wax or a paint on a floor surface, a carpet washing apparatus in which a floor surface treating section washes a carpet which is the floor surface, etc..

[0115] As described above, the upright floor surface treating apparatus of the present invention comprises a columnar body section, a floor surface treating section having a lower surface facing a floor surface of a treated target and mounted to lower portion of the body section, a holding section provided at an upper portion of the body section and held by a user, steering wheels provided at the lower portion of the body section in locations at which the steering wheels are able to contact the floor surface and configured to determine a movement direction of the floor surface treating section by the angles of the steering wheels, and a steering coupling section provided at the body section between the holding section and the steering wheels and configured to change the angle of the steering wheel according to a manipulation of the holding section, independently of the body section and the floor surface treating section.

[0116] In accordance with this configuration, the holding section and the steering wheels are coupled together by means of the steering coupling section provided at the columnar body section. By the user's manipulation of the holding section, the angles of the steering wheels can be changed via the steering coupling section without a need to move the body section. This allows the user to change the direction of the floor surface treating section without feeling that a great force must be exerted to manipulate the holding section. The floor surface treating apparatus has only to include the steering coupling section for coupling the holding section and the steering wheels together without additionally providing a manipulation member, etc.. Therefore, it is possible to avoid that the configuration of the floor surface treating apparatus becomes complex. Thus, maneuverability of the upright floor surface treating apparatus can be improved, and its configuration does not become complex.

[0117] In the above upright floor surface treating apparatus, an example of the steering coupling section may include a rotary shaft which is rotatably mounted to the body section and is fastened with the holding section at an upper end thereof, and a rotation transmission section for coupling a lower end of the rotary shaft to the steering wheels to change the angles of the steering wheels according to a rotational position of the rotary shaft.

[0118] In accordance with this configuration, since the steering coupling section includes the rotary shaft and the rotation transmission section, a motion for rotating the holding section is transmitted to the steering wheels and thereby the angles of the steering wheels can be changed. Because of this, without using a complex configuration, maneuverability of the floor surface treating

apparatus can be improved. Since the floor surface treating section pivotally mounted to the body section can be supported by treating section support shafts (described later), etc., at right and left sides of the body section, a mounting stiffness of the floor surface treating section with respect to the body section can be improved.

[0119] In the above upright floor surface treating apparatus, one or a plurality of steering wheels may be provided. In this case, all of the steering wheels are preferably arranged in one row along the direction perpendicular to the movement direction of the floor surface treating section.

[0120] In accordance with this configuration, the plurality of steering wheels allow the floor surface treating apparatus to move easily on the floor surface. Since the plurality of steering wheels are arranged along the direction perpendicular to the movement direction, the direction of the manipulation of the holding section can conform to the changing direction of the floor surface treating section. This makes it avoid that the user feels difficulty in the manipulation for changing direction. If the angles of all of the plurality of steering wheels arranged in one row are changed such that the steering wheels are oriented in the same direction by the user's manipulation of the holding section, the movement direction of the floor surface treating section can be restricted effectively by the steering wheels.

[0121] In the above configuration, preferably, the rotation transmission section includes a cam member fastened at one end to a lower end of the rotary shaft and arm members for coupling the other end of the cam member to the steering wheels.

[0122] In accordance with this configuration, since the motion of the rotary shaft can be transmitted well to the plurality of steering wheels with a combination of the cam member and the arm members, maneuverability of the upright floor surface treating apparatus can be improved with a simple configuration.

[0123] In the above configuration, preferably, the steering wheels may be provided with cover members for supporting rolling shafts of the steering wheels with the steering wheels being covered with the cover members from above, and the arm members may couple forward portions or rearward portions of the cover members in the movement direction to the other end of the cam member.

[0124] In accordance with this configuration, since the cover members cover the steering wheels, the steering wheels can be protected. In addition, the cover members serve as connecting members for connecting the rotation transmission section to the steering wheels. Thus, protection of the steering wheels and suppressing an increase in the number of components can be achieved.

[0125] In the above upright floor surface treating apparatus, preferably, the steering wheels are attached (mounted) to the body section in such a manner that in an upright state of the body section, the outer peripheral surfaces of the steering wheels are apart from the floor

surface, while in a state where the body section is slanted in a rearward direction of the movement direction, with respect to the upright state, the steering wheels are in contact with the floor surface. Specifically, in the case of providing the cover members covering the steering wheels, front portions of the cover members may be protruded forward to form stoppers.

[0126] In accordance with this configuration, in the upright state of the body section, the steering wheels are apart from the floor surface. This prevents the floor surface treating section from moving inadvertently. By comparison, when the user slants the body section while holding the holding section, the steering wheels contact the floor surface, thereby allowing the floor surface treating section to be movable. In this way, by merely placing the body section in the upright state or slanting the body section, switching between non-use state and use state is enabled. As a result, maneuverability of the upright floor surface treating apparatus can be further improved.

[0127] In the above configuration, more preferably, the floor surface treating apparatus may further comprise treating section support shafts which are provided at the lower portion of the body section and support the floor surface treating section such that the floor surface treating section is pivotable in a direction to change an angle of the lower surface with respect to the extending direction of the body section, and the steering wheels are provided at the lower portion of the body section in locations rearward in the movement direction relative to the floor surface treating section.

[0128] In accordance with this configuration, the floor surface treating section is mounted to the body section such that the body surface treating section is pivotable around the treating section support shafts, and the steering wheels are located rearward relative to the lower portion of the body section. By slanting the body section during use, the steering wheels can be located substantially below the treating section support shafts such that the outer peripheral surfaces of the steering wheels are in contact with the floor surface. Also, by placing the body section in the upright state during non-use, the outer peripheral surfaces of the steering wheels can be made apart from the floor surface. Therefore, the user can bring the steering wheels into contact with the floor surface or make them apart from the floor surface in an easy manner by placing the body section in the upright state or slanting the body section with a small force while holding the holding section.

[0129] In the configuration in which the stoppers are provided as described above, the user has only to place the body section in the upright state while holding the holding section with a small force to make the steering wheels apart from the floor surface because the floor surface treating section is movable with respect to the body section. When the movable section is a point of support, the holding section located above the body section is a point of effort, and the steering wheels are point of load, a distance from the point of support to the point

of effort (holding section) is longer than a distance from the point of support to the point of load (steering wheel). Because of this, the user has only to place the body section in the upright state while holding the holding section with a small force, cover member forward portions protruding near the point of load (steering wheel) move to locations below the steering wheels, so that the steering wheels can be made apart from the floor surface easily. Therefore, it is not necessary to use a complex configuration to make the steering wheels apart from the floor surface and to bring them into contact with the floor surface. Thus, it is possible to effectively avoid that the configuration of the floor surface treating section becomes complex.

[0130] In the configuration in which the treating section support shafts are provided, more preferably, the outer peripheral surfaces of the steering wheels are entirely flat, or the peripheral portions of the outer peripheral surfaces protrude more than the center portions.

[0131] In accordance with this configuration, locations of the treating section support shafts in the slanted state of the body section are higher than vertical locations of the treating section support shafts in the upright state. In the down state of the body section, the locations of the treating section support shafts can be made closer to the locations of them in the upright state. In the down state of the body section, the steering wheels are located below the floor surface treating section and forward relative to the treating section support shafts, and therefore, the floor surface treating section is maintained to be movable by the steering wheels. Therefore, by merely placing the body section in the down state, the entire floor surface treating section can be lowered even in a vertically narrow space. Thus, the floor surface under a furniture such as a bed can be suitably cleaned.

[0132] In the configuration in which the outer peripheral surfaces of the steering wheels are entirely flat, or the peripheral portions of the outer peripheral surfaces protrude more than the center portions, the peripheral portions of the steering wheels contact the floor surface by manipulating the handle in the down state, and thereby the treating section support shafts can be pushed up. This can effectively lessen a possibility that the front portion of the floor surface treating section is a little apart from the floor surface in the down state of the body section, and improve a close contact state with respect to the floor surface. As a result, a floor surface treating location can be shifted easily while effectively suppressing degradation of a floor surface treating action.

[0133] At least the outer peripheral surfaces of the steering wheels are preferably made of an elastic material.

[0134] In accordance with this configuration, since the outer peripheral surfaces made of the elastic material contact the floor surface, it is possible to effectively lessen a possibility that the steering wheels slip on the floor surface. As a result, maneuverability of the upright floor surface treating apparatus can be further improved.

[0135] A specific configuration of the upright floor surface treating apparatus of the present invention is not particularly limited. The present invention is applicable to various kinds of floor surface treating apparatuses. As a representative floor surface treating apparatus, there is a vacuum cleaner as described above. The vacuum cleaner having a specific configuration is, for example, such that the body section includes a suction motor and a dust collecting chamber, and the floor surface treating section includes a rotary brush.

(Embodiment 2)

[0136] In Embodiment 1, the steering coupling section 60A in the vacuum cleaner 10A includes, the handle shaft 16, the steering wheel adjustment shaft 161, the cam member 162 and the arm members 163 and 164. In the present embodiment, an example of another configuration as the steering coupling section will be described with reference to Figs. 10 and 11.

[0137] As shown in Fig. 10, a vacuum cleaner 10B which is a first example of the present embodiment is configured such that the handle 14 and the handle shaft 16 are located forward relative to the body section (forward handle configuration). In the vacuum cleaner 10B, a forward protruding section 117 (indicated by one-dotted oval in Fig. 10) is provided at an upper portion of a body casing section 17, and the handle 14 is attached on an upper surface of a front portion of the forward protruding section 117 via the handle shaft 16.

[0138] More specifically, a basic configuration of the body casing section 17 is the same as that of the body casing section 11 in Embodiment 1, except that the forward protruding section 117 extending obliquely forward is integrally provided immediately above the casing (corresponding to the body casing section 11) extending vertically, and the handle shaft 16 is attached on an upper surface of a front portion of the forward protruding section 117.

[0139] As in the case of the vacuum cleaner 10A, the steering wheel adjustment shaft 161 is provided inside the body casing section 17. The forward protruding section 117 is positioned between the steering wheel adjustment shaft 161 and the handle shaft 16, and a gear mechanism 165 is accommodated in the forward protruding section 117. The gear mechanism 165 includes, for example, a sector gear fastened to a lower end of the handle shaft 16, an upper end gear fastened to an upper end of the steering wheel adjustment shaft 161, and an intermediate gear provided between the sector gear and the upper end gear. In this configuration, when the user performs a manipulation (direction indicated by arrow R1) for twisting the handle 14 in front, a position change in the handle 14 is transmitted via the handle shaft 16 and the gear mechanism 165, to the steering wheel adjustment shaft 161, which rotates (direction indicated by arrow R1).

[0140] Thus, in the vacuum cleaner 10B of the first ex-

ample, the body section includes the forward protruding section 117, and a steering coupling section 60B includes the handle shaft 16, the steering wheel adjustment shaft 161, the gear mechanism 165 and the rotation transmission section 160.

[0141] It is sufficient that the gear mechanism 165 serves as a means (position change transmission section) for coupling the handle shaft 16 and the steering wheel adjustment shaft 161 together to transmit the position change in the handle 14. More preferably, the gear mechanism 165 also serves as a means (rotational speed changing section) for increasing/decreasing a speed of the position changing of the handle 14, i.e., a rotation of the handle shaft 16.

[0142] For example, when the user twists the handle 14, the handle shaft 16 is rotated to a predetermined angle. By increasing the "speed" of the rotation of the handle shaft 16 by means of a gear change "speed change function" of the gear mechanism 165, the angles of the steering wheels 15 can be changed to a greater degree even when the user twists the handle 14 to a smaller degree (an angle change caused by the twist manipulation is small). Or, by decreasing the "speed" of the rotation of the handle shaft 16 by means of the gear change "speed change function" of the gear mechanism 165, the force required to twist the handle 14 can be lessened. This allows the user to manipulate the handle 14 with "a smaller force".

[0143] As shown in Fig. 11, a vacuum cleaner 10C which is a second example of the present embodiment has a configuration in which the handle 14 and the handle shaft 16 are slanted in a forward direction (slant handle configuration). In the vacuum cleaner 10C, an upward slant section 118 is provided at an upper portion of a body casing section 18, and the handle 14 is attached to the upper surface of the upward slant section 118 via the handle shaft 16.

[0144] More specifically, a basic configuration of the body casing section 18 is the same as that of the body casing section 11 in Embodiment 1, except that the upward slant section 118 having an upper surface which is slanted in the forward direction is provided integrally with and immediately above a casing (corresponding to the body casing section 11) extending vertically, and the handle shaft 16 is attached to the upper surface of the upward slant section 118.

[0145] As in the case of the vacuum cleaner 10A, the steering wheel adjustment shaft 161 is provided inside the body casing section 18. The upward slant section 118 is positioned between the steering wheel adjustment shaft 161 and the handle shaft 16. A joint mechanism 166 is mounted inside of the upward slant section 118. The joint mechanism 166 is constructed as, for example, constant speed universal joints configured to contact a downward end surface of the slanted handle shaft 16. When the user performs a manipulation for twisting the handle 14 (direction indicated by arrow R1 in Fig. 11), the slanted handle shaft 16 rotates (direction indicated

by arrow R1 in Fig. 11) and the resulting rotation is transmitted via the joint mechanism 166 to the steering wheel adjustment shaft 161, which rotates (direction indicated by arrow R1 in Fig. 11).

[0146] Thus, in the vacuum cleaner 10C of the second example, the body section includes the upward slant section 118, and a steering coupling section 60C includes the handle shaft 16, the steering wheel adjustment shaft 161, the joint mechanism 166 and the rotation transmission section 160.

[0147] In the above stated configurations of the present embodiment, the handle 14 is positioned in a forward portion of the vacuum cleaner 10B or 10C. Because of this, in the case where the user performs cleaning in the state in which the body section is directed substantially horizontally (see Fig. 8C), the user need not significantly bend down. This has an advantage that the maneuverability of the vacuum cleaner 10B or 10C can be further improved.

[0148] A specific configuration of the gear mechanism 165 and a specific configuration of the joint mechanism 166 are not particularly limited. Any known configuration may be used so long as the rotation of the rotary shaft can be transmitted from coaxially to a different location or the rotation of the rotary shaft can be transmitted in a different direction. The present embodiment is the same as Embodiment 1 in that the steering coupling section 60B, 60C includes the handle shaft 16 and the steering wheel adjustment shaft 161 as rotary shafts in a broad sense. The gear mechanism 165 or the joint mechanism 166 is mounted between the handle shaft 16 and the steering wheel adjustment shaft 161. Therefore, when the handle shaft 16 is expressed as a first rotary shaft, the steering wheel adjustment shaft 161 can be expressed as a second rotary shaft. Of course, depending on the configuration of the steering coupling section 60B, 60C, rotary shafts other than the handle shaft 16 and the steering wheel adjustment shaft 161 may be provided.

[0149] Thus, in the upright floor surface treating apparatus of the present invention, the steering coupling section includes the gear mechanism or the joint mechanism coupled to the lower end of the rotary shaft and the second rotary shaft coupled at the upper end thereof to the gear mechanism or the joint mechanism and coupled at the lower end thereof to the rotation transmission section, and the holding section fastened to the upper end of the rotary shaft is positioned forward in the movement direction relative to the body section.

[0150] In accordance with this configuration, since the gear mechanism or the joint mechanism is used as desired, the holding section can be positioned forward relative to the body section without being restricted by the second rotary shaft coupled to the rotation transmission section. Therefore, even when the body section is oriented substantially horizontally to, for example, perform floor surface treating in a vertically narrow space such as a space under a furniture or a bed, the holding section can be kept higher. This can reduce a need for the user to

significantly bend while holding the holding section. As a result, the maneuverability of the upright floor surface treating apparatus can be further improved.

[0151] Since the gear mechanism of the steering coupling section has "a gear change function", the maneuverability of the upright floor surface treating apparatus can be further improved. For example, if the "speed" of the rotation of the rotary shaft which is caused by manipulation of the holding section increases, an angle change of the secondary rotary shaft can be increased even when an angle change of the rotary shaft is small. Therefore, the angle change of the steering wheels can be increased. Or, if the "speed" of the rotation of the rotary shaft is decreased, the force required to change the angle of the rotary shaft when the user manipulate the holding section can be lessened. This allows the user to manipulate the holding section with "a smaller force".

(Embodiment 3)

[0152] In Embodiment 1 or Embodiment 2, the vacuum cleaners 10A to 10C include the steering coupling sections 60A to 60C having a mechanical configuration, respectively. By comparison, in the present embodiment, an example of a vacuum cleaner including a steering coupling section having an electric configuration will be described with reference to Fig. 12.

[0153] As shown in Fig. 12, a vacuum cleaner 10D of the present embodiment has the same configuration as that of the vacuum cleaner 10A of Embodiment 1 except for a steering coupling section 60D. The steering coupling section 60D includes an angle adjusting signal generating section 167 for converting a manipulation of the handle 14 into an electric signal, and a wheel angle adjusting section 168 for adjusting angles of the steering wheels 15 in response to the electric signal received from the angle adjusting signal generating section 167. The angle adjusting signal generating section 167 and the wheel angle adjusting section 168 are coupled together by means of a known wire 169. In this configuration, advantages provided by Embodiment 1 or Embodiment 2 can be achieved.

[0154] A specific configuration of the angle adjusting signal generating section 167 and a specific configuration of the wheel angle adjusting section 168 are not particularly limited, but known configurations may be suitably used.

[0155] For example, in the case where the manipulation of the handle 14 is twisting of the handle 14 like Embodiment 1 and Embodiment 2, examples of the angle adjusting signal generating section 167 may include a known dial input device for generating an electric signal corresponding to a position change caused by the twisting (rotation) of the handle 14, a known relay switch device configured to open/close a contact point based on whether or not the position change caused by the twisting (rotation) of the handle 14 exceeds a certain magnitude, a sensor device which detects a position change of a

marker provided at a tip end of the handle shaft 16 and generates an electric signal based on a result of the detection, etc.. Or, instead of twisting the handle 14, in the case where the handle 14 is attached with a known manipulation section such as a lever or a switch, a known configuration in which the electric signal is generated by manipulating the manipulation section may be used. In this case, the angle adjusting signal generating section 167 includes the manipulation section.

[0156] In a case where the steering coupling section 60D includes the rotation transmission section 160 comprised of the cam member 162 and the arm members 163 and 164 like Embodiment 1 and Embodiment 2, the wheel angle adjusting section 168 may be configured such that a small motor (gear mechanism as desired) is provided at the rear end of the cam member 162 and the front end of the cam member 162 is swung according to the operation of the small motor. In this case, the rotation transmission section 160 and the small motor correspond to the wheel angle adjusting section 168. Instead of the small motor, a known actuator or the like may be used.

[0157] Of course, the steering coupling section 60D of the present embodiment may include components other than the angle adjusting signal generating section 167 and the wheel angle adjusting section 168.

[0158] As described above, in the upright floor surface treating apparatus of the present invention, the steering coupling section may include a wheel angle adjusting section for adjusting angles of the steering wheels in response to an electric signal received, and an angle adjusting signal generating section for converting a manipulation of the holding section into an electric signal input to the wheel angle adjusting section.

[0159] In accordance with this configuration, the steering coupling section having an electric configuration is provided instead of the steering coupling section having a mechanical configuration comprised of a rotary shaft and a rotation transmission section. With this configuration, in the present embodiment, the same advantages as those provided by the mechanical configuration described in Embodiment 2 can be achieved.

[0160] Numeral modifications and alternative embodiments of the present invention will be apparent to those skilled in the art in view of the foregoing description. Accordingly, the description is to be construed as illustrative only, and is provided for the purpose of teaching those skilled in the art the best mode of carrying out the invention. The details of the structure and/or function may be varied substantially without departing from the spirit of the invention.

Industrial Applicability

[0161] The present invention is suitably used in fields of upright floor surface treating apparatuses such as a vacuum cleaner, a floor surface polishing apparatus, a floor surface coating apparatus and a carpet washing apparatus, each of which includes a floor surface treating

section at a lower portion thereof and a holding section such as a handle at an upper portion thereof.

Reference Signs Lists

[0162]

10A ~ 10D	vacuum cleaner (floor surface treating apparatus)
11	body casing section (body section)
12	body duct collecting section (body section, duct collecting chamber)
13	suction nozzle (floor surface treating section)
13a	nozzle support shaft (treating section support shaft)
14	handle (holding section)
15	steering wheel
15a, 15b	wheel (steering wheel)
15c	roller (steering wheel)
16	handle shaft (rotary shaft, steering coupling section)
60A ~ 60D	steering coupling section
100	floor surface
131	rotary brush
151	cover member
160	rotation transmission section
161	steering wheel adjustment shaft (second rotary shaft, steering coupling section)
162	cam member (rotation transmission section, steering coupling section)
163	arm member (rotation transmission section, steering coupling section)
164	arm member (rotation transmission section, steering coupling section)
165	gear mechanism (steering coupling section)
166	joint mechanism (steering coupling section)
167	angle adjusting signal generating section (steering coupling section)
168	wheel angle adjusting section (steering coupling section)
223	suction motor

Claims

1. An upright floor surface treating apparatus comprising:

a columnar body section;
a floor surface treating section having a lower surface facing a floor surface which is a treated target and mounted to a lower portion of the body section;
a holding section provided at an upper portion of the body section and held by a user;

- a steering wheel which is provided on the lower portion of the body section in a location at which the steering wheel is able to contact the floor surface and determines a movement direction of the floor surface treating section, according to its angle; and
a steering coupling section which is provided in the body section between the holding section and the steering wheel and changes the angle of the steering wheel according to a manipulation of the holding section, independently of the body section and the floor surface treating section.
2. The upright floor surface treating apparatus according to Claim 1,
wherein the steering coupling section includes:
- a rotary shaft rotatably mounted to the body section, the holding section being fastened to an upper end of the rotary shaft; and
a rotation transmission section for coupling a lower end of the rotary shaft to the steering wheel to change the angle of the steering wheel according to a rotational position of the rotary shaft.
3. The upright floor surface treating apparatus according to Claim 2,
wherein the steering coupling section further includes:
- a gear mechanism or a joint mechanism coupled to the lower end of the rotary shaft; and
a second rotary shaft coupled at an upper end thereof to the gear mechanism or the joint mechanism and coupled at a lower end thereof to the rotation transmission section;
wherein the holding section fastened to the upper end of the rotary shaft is positioned in a forward location in the movement direction relative to the body section.
4. The upright floor surface treating apparatus according to Claim 1 or 2,
wherein the steering wheel includes a plurality of steering wheels; and
wherein the plurality of steering wheels are arranged in one row along a direction perpendicular to the movement direction of the floor surface treating section.
5. The upright floor surface treating apparatus according to Claim 4,
wherein the rotation transmission section includes at least:
- a cam member fastened at one end thereof to the lower end of the rotary shaft; and
- an arm member for coupling the other end of the cam member to the steering wheel.
6. The upright floor surface treating apparatus according to Claim 5,
wherein the steering wheel is provided with a cover member supporting a rolling shaft of the steering wheel with the cover member covering the steering wheel from above; and
wherein the arm member couples a forward portion or a rearward portion of the cover member in the movement direction to the other end of the cam member.
7. The upright floor surface treating apparatus according to Claim 1,
wherein the steering coupling section includes:
- a wheel angle adjusting section for adjusting the angle of the steering wheel in response to an electric signal received as an input; and
an angle adjusting signal generating section for converting a manipulation of the holding section into the electric signal input to the wheel angle adjusting section.
8. The upright floor surface treating apparatus according to Claim 1,
wherein the steering wheel is mounted to the body section in such a manner that an outer peripheral surface of the steering wheel is apart from the floor surface with the body section being in an upright state, while the outer peripheral surface of the steering wheel is in contact with the floor surface with the body section being in a slanted state in which the body section is slanted in a rearward direction in the movement direction, with respect to the upright state.
9. The upright floor surface treating apparatus according to Claim 1, comprising:
- a treating section support shaft provided at the lower portion of the body section to support the floor surface treating section such that the floor surface treating section is pivotable in a direction to change an angle of the lower surface with respect to an extending direction of the body section; wherein
the steering wheel is provided at the lower portion of the body section such that the steering wheel is positioned rearward in the movement direction, relative to the floor surface treating section.
10. The upright floor surface treating apparatus according to Claim 4,
wherein the steering wheel has a shape in which an outer peripheral surface thereof is entirely flat or a

peripheral portion of the outer peripheral surface protrudes more than a center portion thereof.

11. The upright floor surface treating apparatus according to Claim 1, 5
wherein at least an outer peripheral surface of the steering wheel is made of an elastic material.
12. The upright floor surface treating apparatus according to Claim 1, 2, 7 or 8, being a vacuum cleaner. 10

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Fig. 1

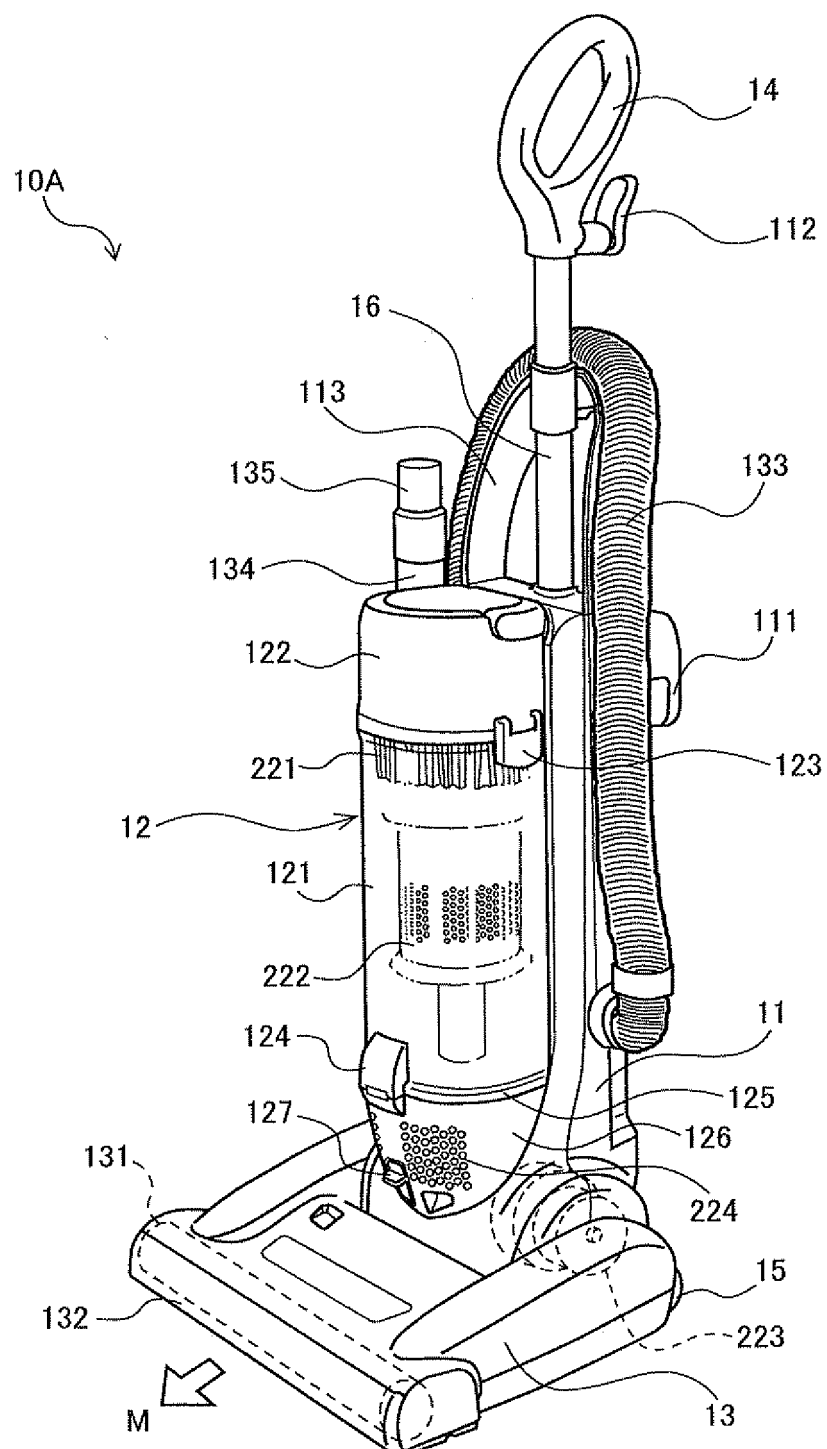


Fig. 2

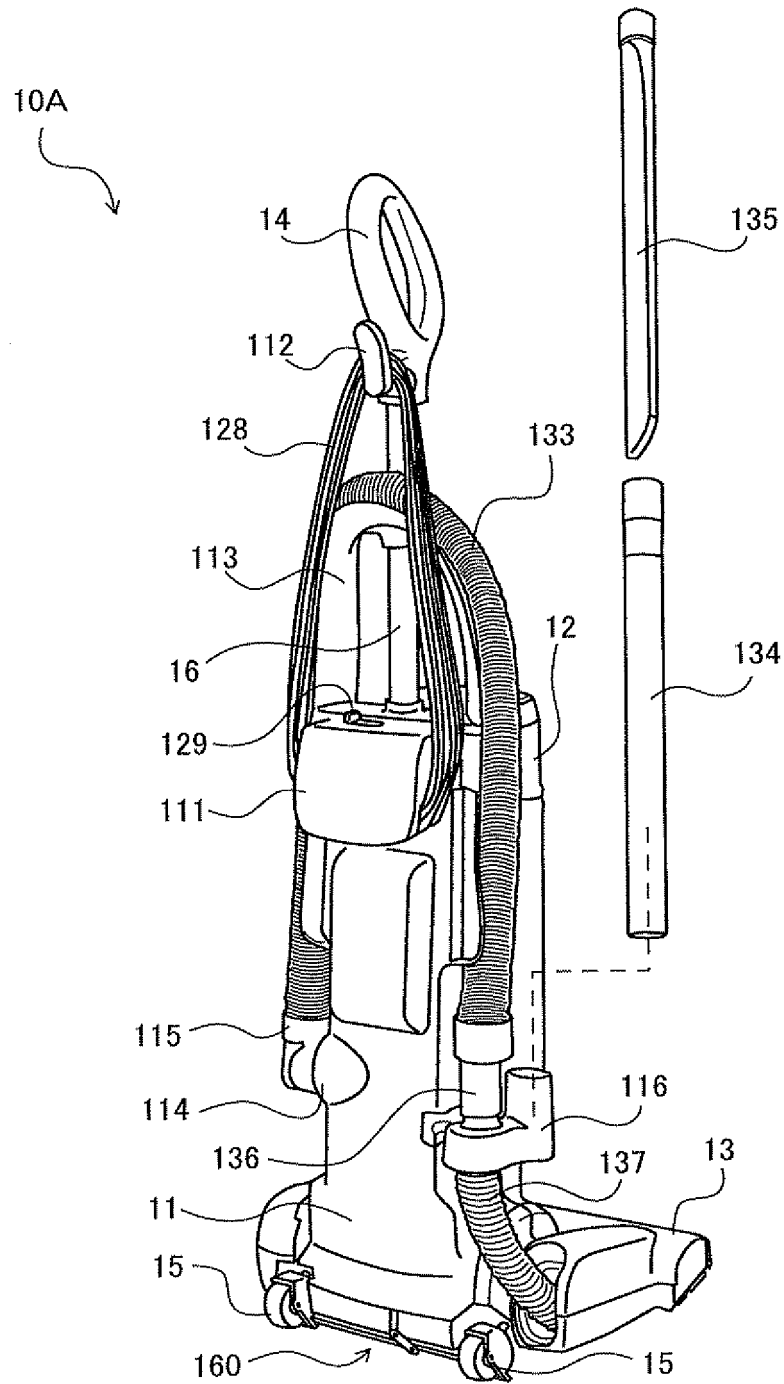


Fig. 3

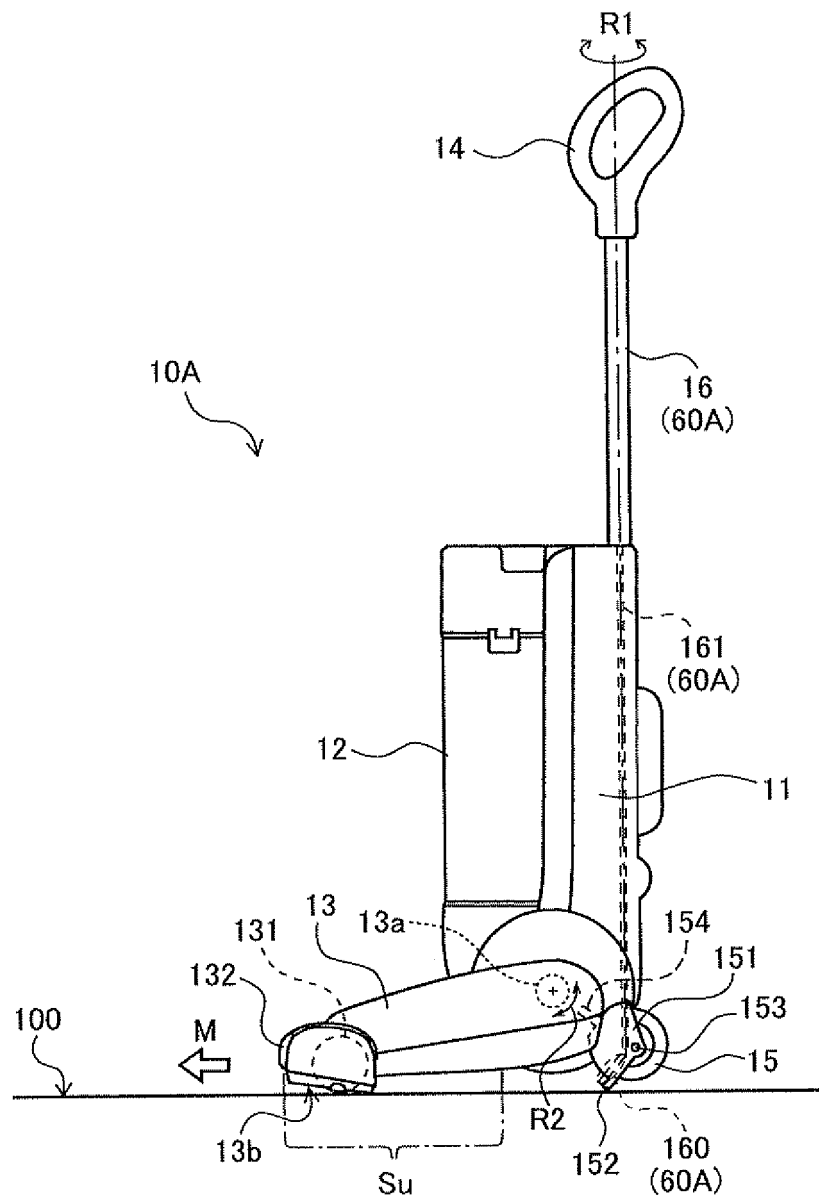


Fig. 4A

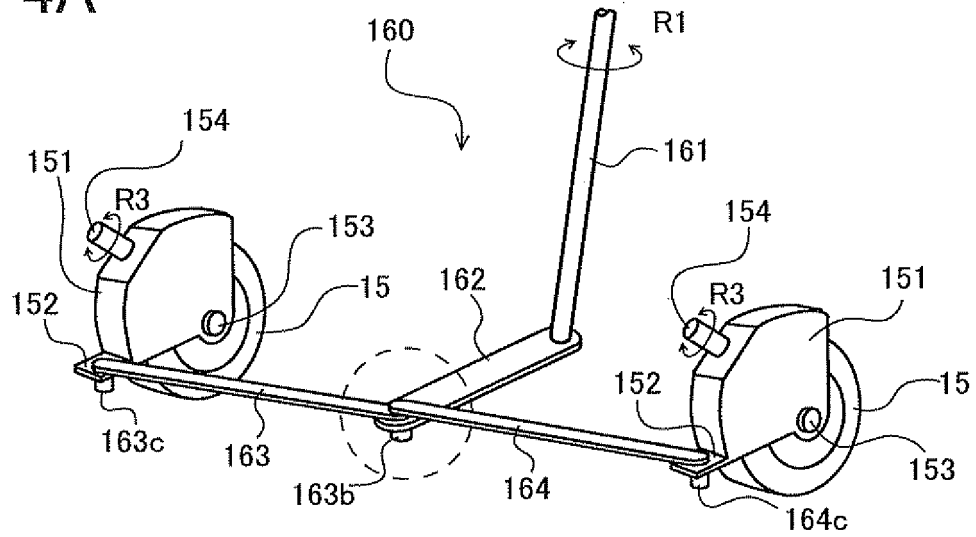


Fig. 4B

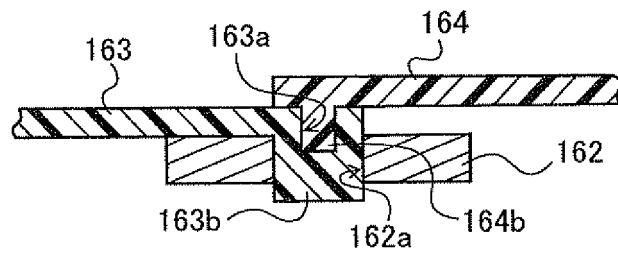


Fig. 4C

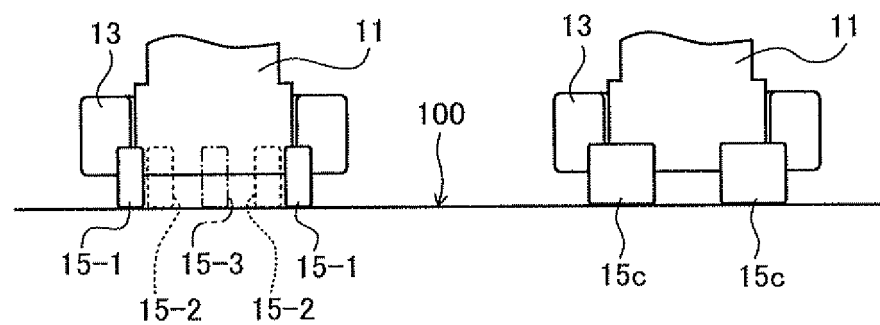


Fig. 5A

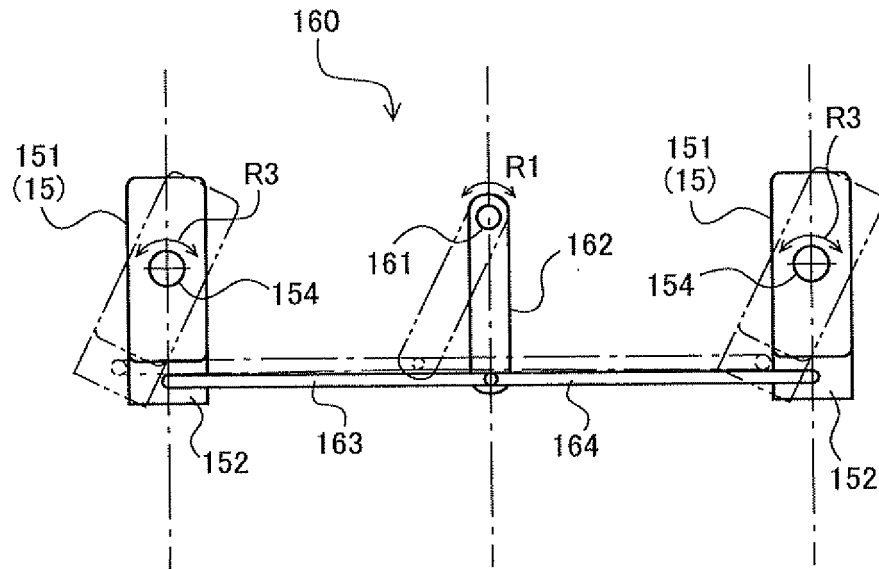


Fig. 5B

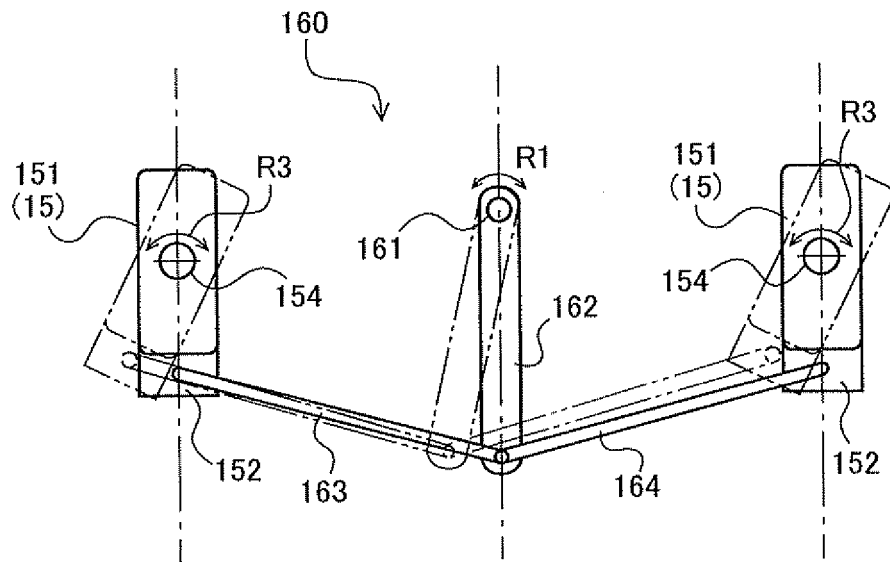


Fig. 6A

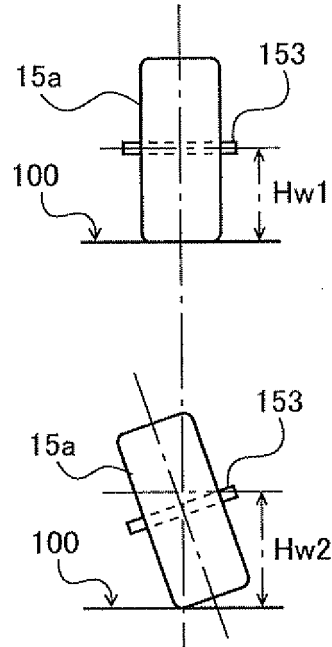


Fig. 6B

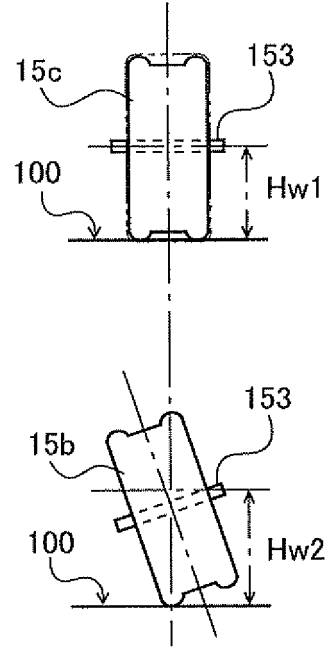


Fig. 6C

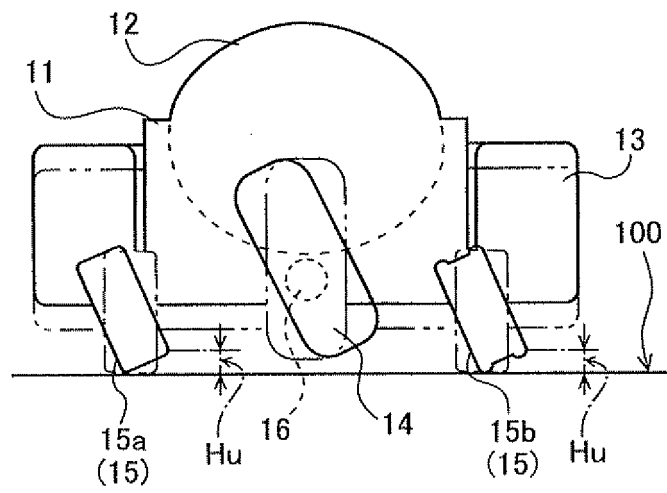


Fig. 7

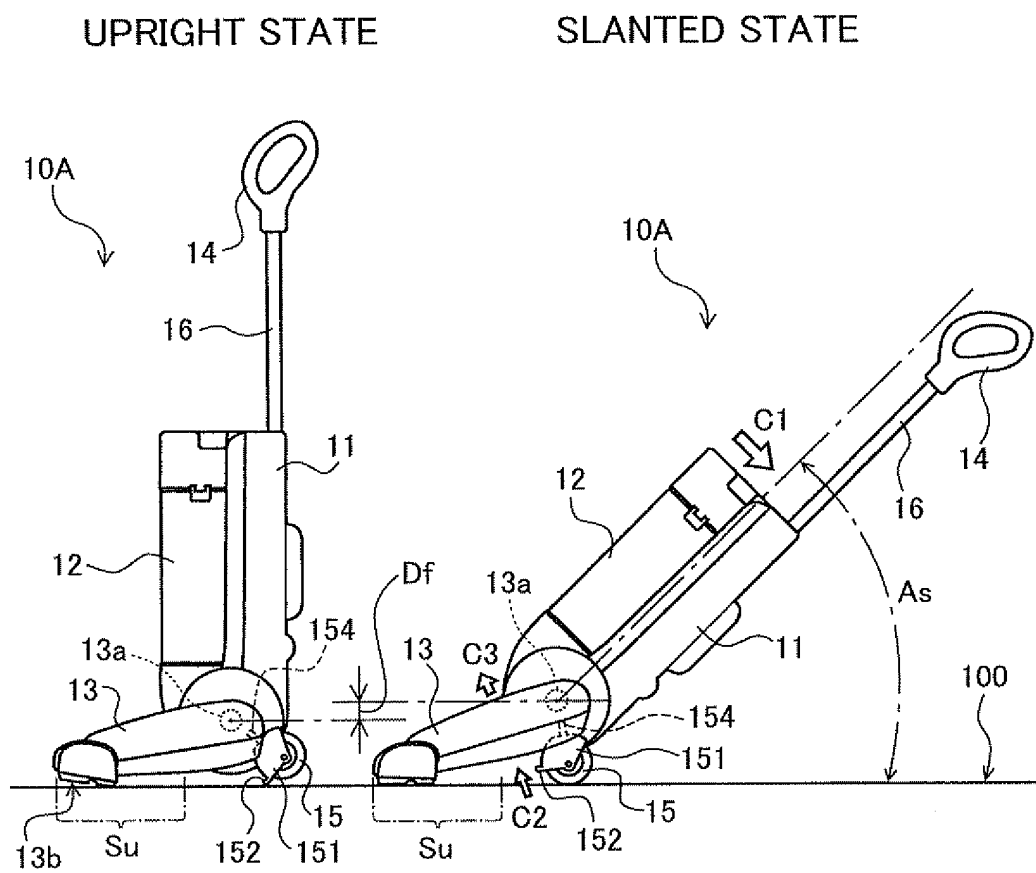


Fig. 8A

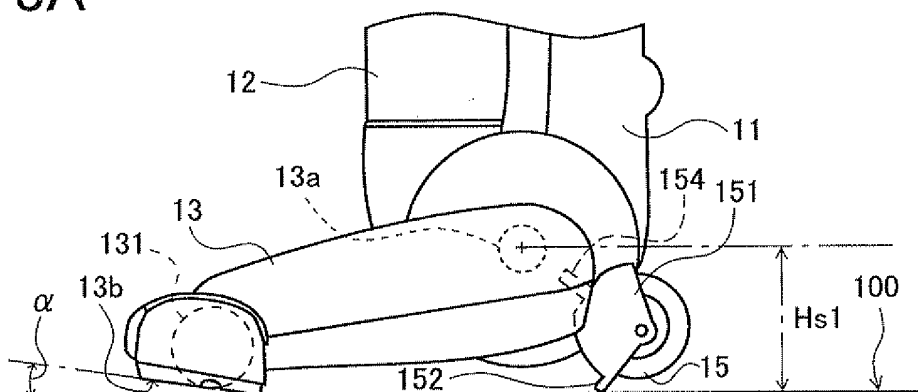


Fig. 8B

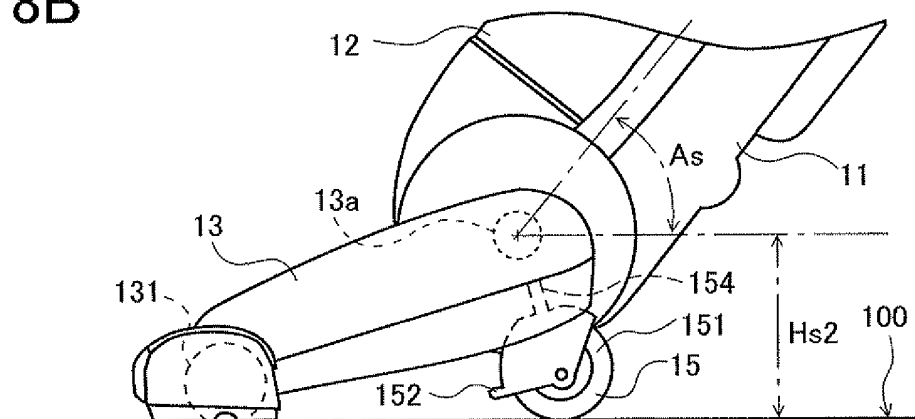


Fig. 8C

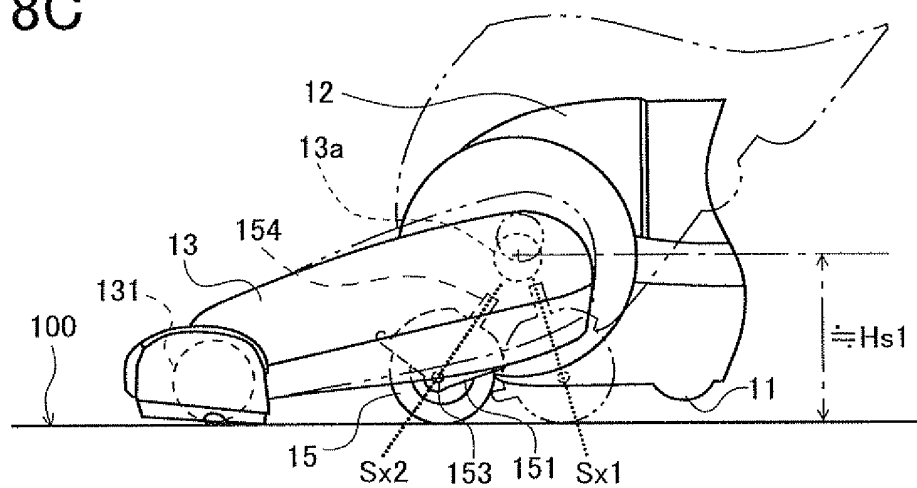


Fig. 9

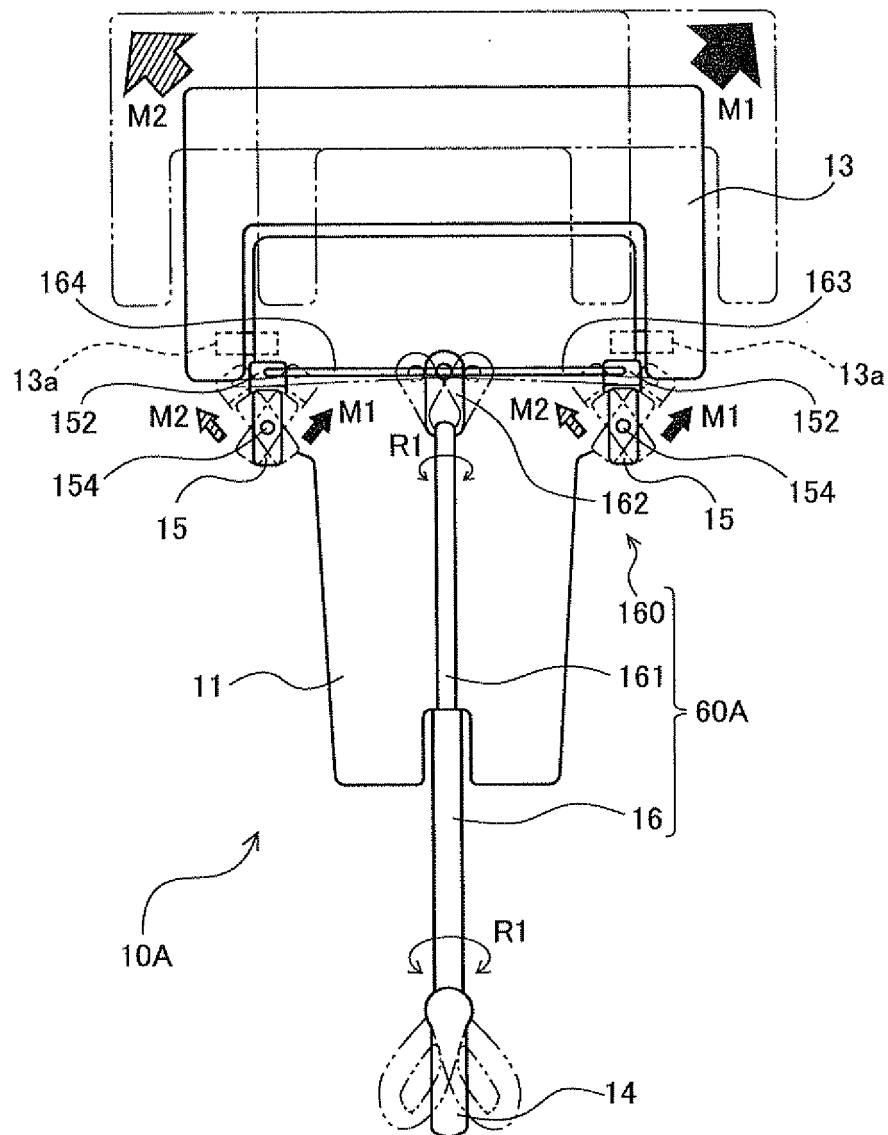


Fig. 10

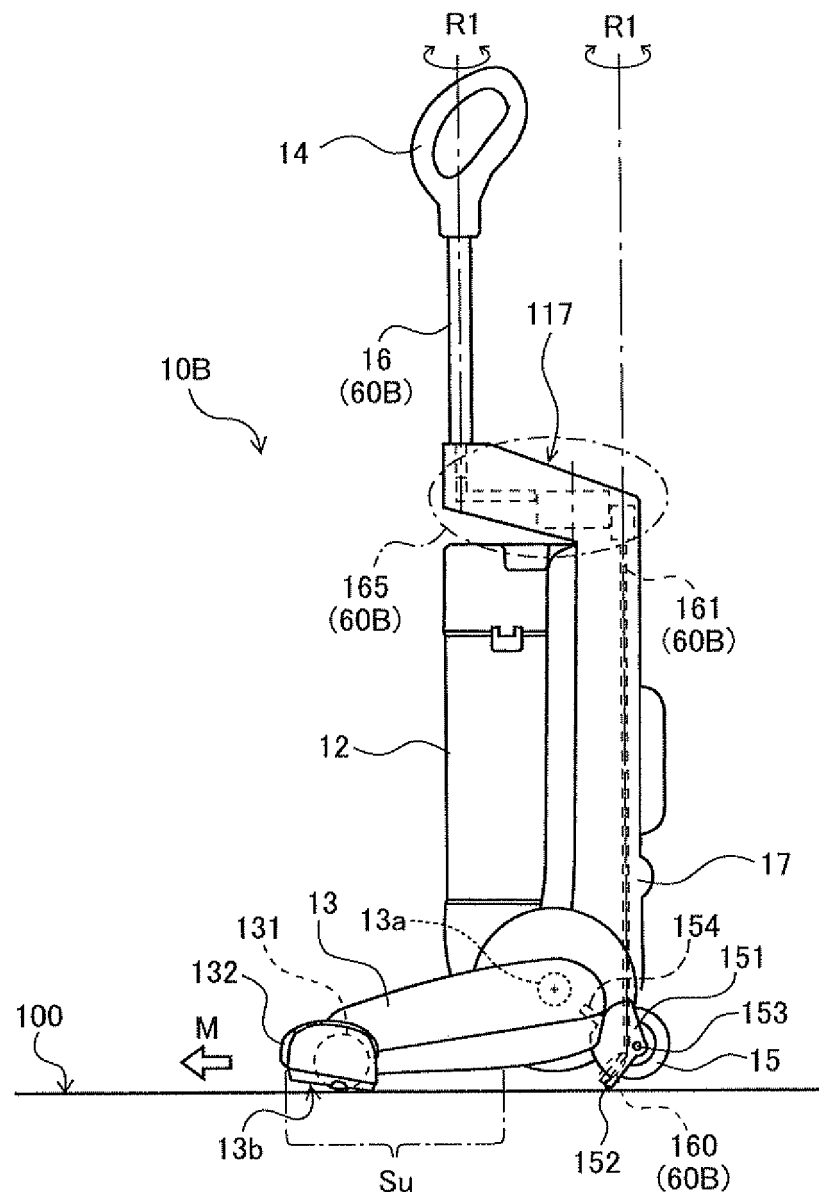


Fig .11

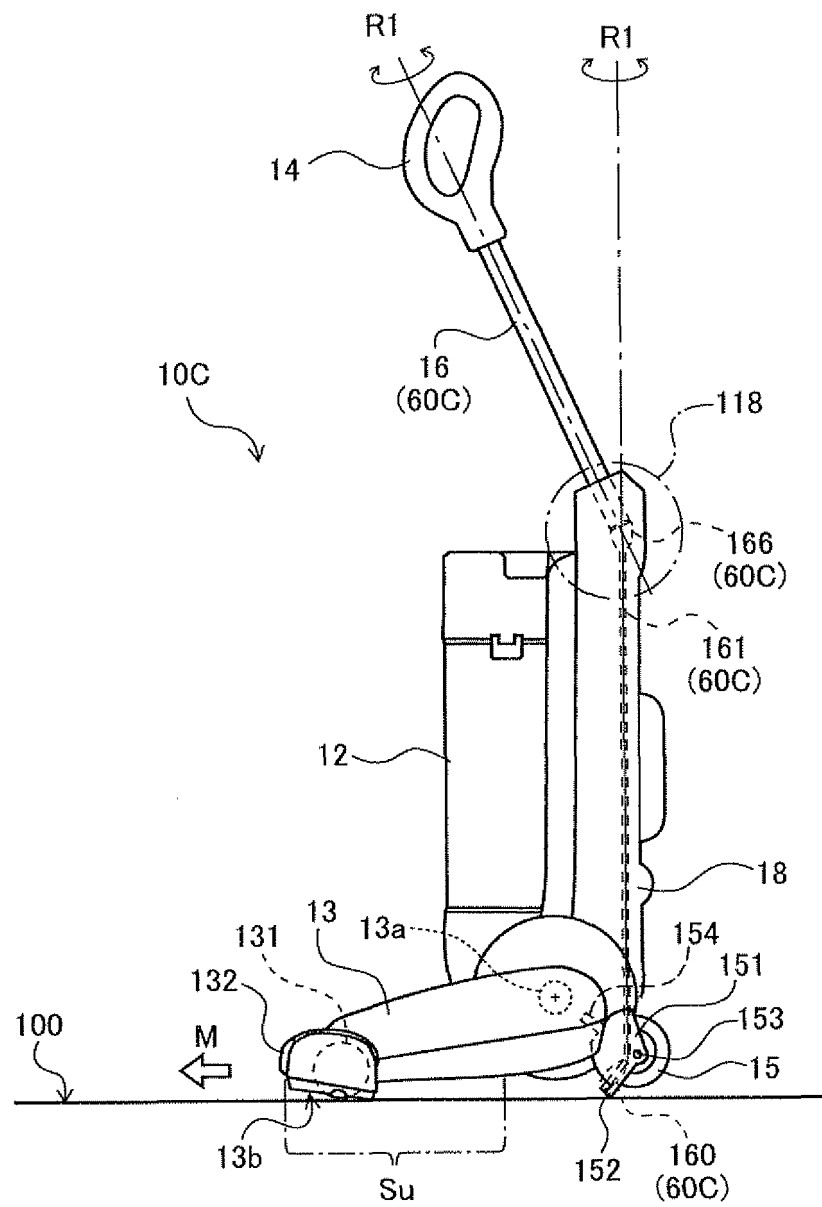


Fig. 12

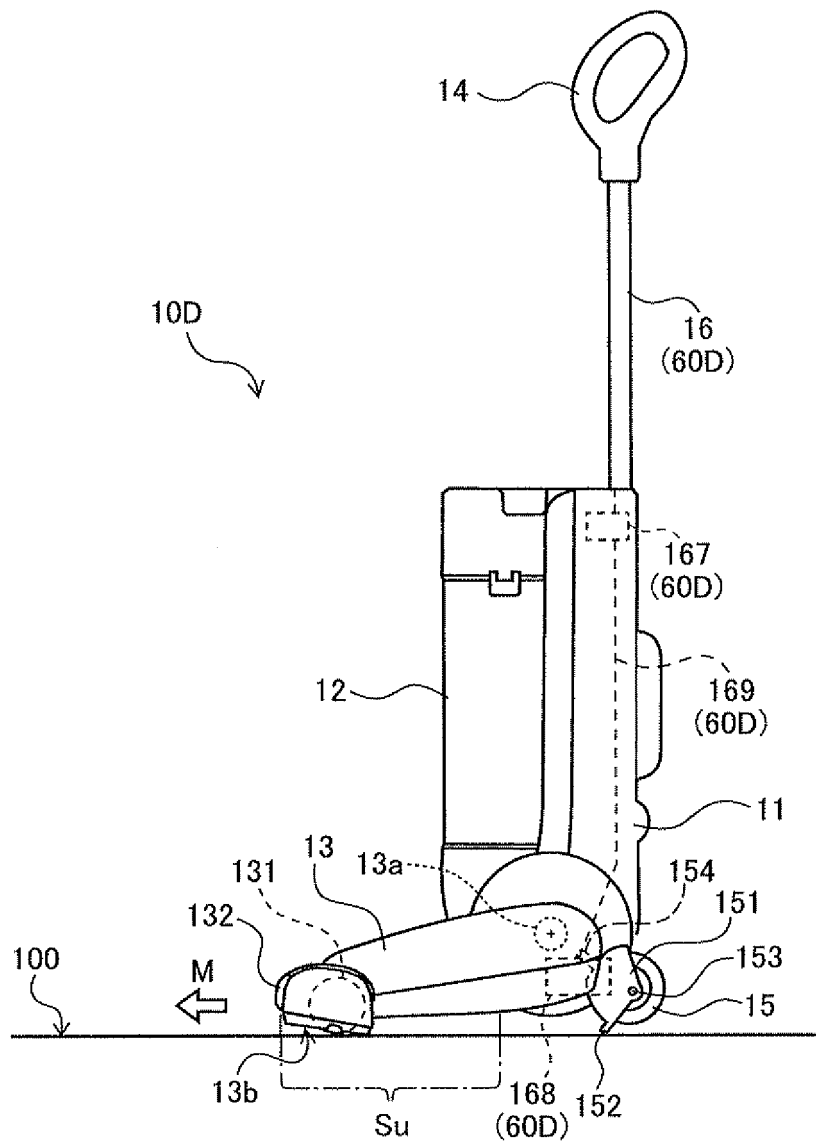
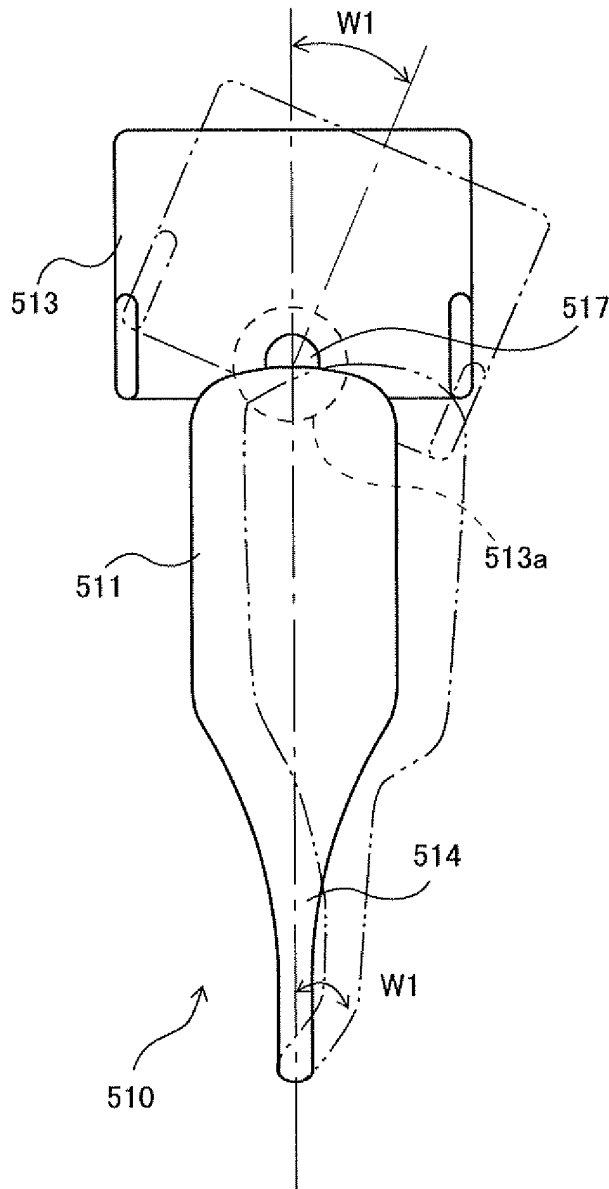
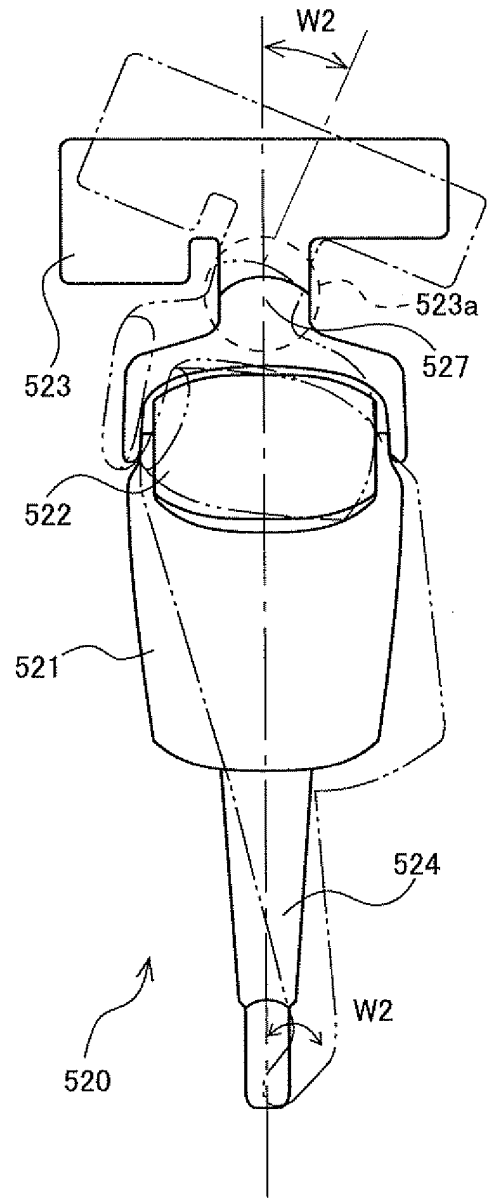


Fig. 13A



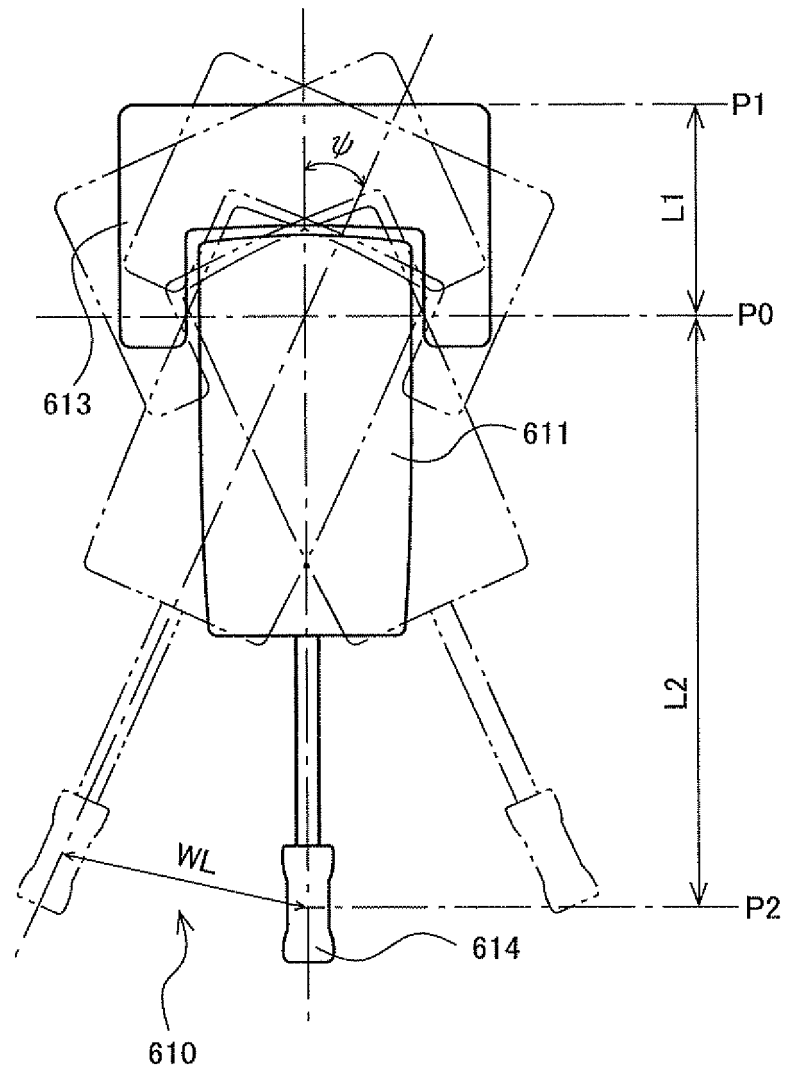
PRIOR ART

Fig. 13B



PRIOR ART

Fig. 14



PRIOR ART

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/003088

A. CLASSIFICATION OF SUBJECT MATTER

A47L9/00(2006.01) i, A47L5/28(2006.01) i, A47L9/32(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)

A47L9/00, A47L5/28, A47L9/32

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	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 091605/1979(Laid-open No. 9345/1981) (Matsushita Electric Industrial Co., Ltd.), 27 January 1981 (27.01.1981), entire text; all drawings (Family: none)	1-5, 7, 9-12 6, 8
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 39331/1986(Laid-open No. 151834/1987) (Matsushita Electric Industrial Co., Ltd.), 26 September 1987 (26.09.1987), entire text; all drawings (Family: none)	6

☒ 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
05 August, 2011 (05.08.11)Date of mailing of the international search report
16 August, 2011 (16.08.11)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/003088

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-178756 A (Toshiba Tec Corp.), 06 July 1999 (06.07.1999), paragraphs [0010] to [0011] (Family: none)	8
Y	JP 5-31048 A (Matsushita Electric Industrial Co., Ltd.), 09 February 1993 (09.02.1993), paragraph [0002]; fig. 10 to 13 (Family: none)	8

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/003088

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 the microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No.54-091605 (Laid-open No. 56-9345), (Matsushita Electric Industrial Co., Ltd.), 27 January 1981 (27.01.1981), entire text, all drawings, (Family: none), and therefore, 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/JP2011/003088

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

As a result of judging special technical features with respect to special technical features in claims dependent on claim 1, it is considered that the following seven inventions are involved. Meanwhile, the inventions in claims 1 and 2 having no special technical feature are classified into invention 1, and the inventions in claims 4 and 5 are classified into invention 2.

- (Invention 1) the inventions in claims 1-3
- (Invention 2) the inventions in claims 4-6
- (Invention 3) the inventions in claims 7, 12
- (Invention 4) the invention in claim 8
- (Invention 5) the invention in claim 9
- (Invention 6) the invention in claim 10
- (Invention 7) the invention in claim 11

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 HEI9503398 B [0013]
- WO 950174 PCT [0013]
- JP 4077823 B [0013]
- WO 2004014211 A [0013]