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SUCTION DEVICE FOR ELECTRIC VACUUM CLEANER, AND ELECTRIC VACUUM CLEANER WITH SAME
Saugvorrichtung für elektrischen Staubsauger und elektrischer Staubsauger damit
Dispositif d’aspiration pour aspirateur électrique, et aspirateur électrique comprenant ce dispositif

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Description

Technical Field

[0001] The present invention relates to a vacuum cleaner suction tool and a vacuum cleaner including the vacuum cleaner suction tool, and particularly to a vacuum cleaner suction tool whose operability can be further improved, and a vacuum cleaner including the vacuum cleaner suction tool.

Background Art

[0002] Conventionally, various technologies for vacuum cleaners have been proposed in order to improve the operability of a suction tool, which suctions dust and the like, to realize a high cleaning efficiency. For example, PTL 1 proposes a suction port body (suction tool) of a canister type cleaner, the suction port body being constituted by a suction port main body and a universal coupling portion, the universal coupling portion being constituted by two tubular arm portions, for the purpose of allowing a user to operate a handle to easily, arbitrarily control an angle of the suction port body.

[0003] The suction port body is configured such that: a first arm portion out of the two arm portions is attached to the suction port main body by a first rotary portion so as to be rotatable in an attack angle direction Y; and a second arm portion out of the two arm portions is attached to the other end of the first arm portion by a second rotary portion so as to be rotatable in a left-right direction X. Further, a rotary surface of the second rotary portion is always inclined to a front side by a predetermined angle Z. One end of the first arm portion is attached to an upper side of the rotary surface, and one end of the second arm portion is attached to a lower side of the rotary surface.

[0004] PTL 2 discloses an upright type surface treating appliance including: a handle having a longitudinal axis; a surface treating head (suction tool); a support assembly attached to the handle so as to roll; and a linkage between the handle and the surface treating head, for the purpose of improving the operability at the time of a surface treatment, such as cleaning.

[0005] In this surface treating appliance, the support assembly is formed in a ball (sphere) shape or a roller shape and configured to roll around a rolling axis, and the linkage is configured to turn the direction of the surface treating head to a different direction when the support assembly and the handle are rotated around the longitudinal axis.

[0006] GB 2 466 290 A relates to a floor tool for a cleaning appliance. The floor tool for a cleaning appliance comprises a cleaner head rotatably attached to a conduit carried by a pair of wheels that converge beneath the conduit.

[0007] WO 2005/110179 A1 describes an accessory for a cleaning appliance having a head comprising a housing and a downwardly-directed suction opening and a neck adapted for attachment to a hose or wand of the cleaning appliance. A rotatable connection is provided between the neck and the head for allowing rotation of the neck relative to the head, and a wheel arrangement is provided for manoeuvrable supporting the accessory on a surface to be cleaned. The wheel arrangement is mounted on the neck of the accessory. In a preferred embodiment, the wheel arrangement is normally in contact with the surface to be cleaned but the point or points of contact between the wheel arrangement and the surface to be cleaned are dependent upon the rotational position of the neck with respect to the head.

[0008] WO 2007/031819 A1 relates to a suction nozzle and vacuum cleaner provided with such a suction nozzle. In this respect, it is described a suction nozzle for a vacuum cleaner, comprising a suction head having an elongated suction orifice that in a first position extends substantially transverse to a displacement direction of the nozzle, support means for supporting the nozzle during its displacement, and a coupling body for connecting the suction head to the vacuum cleaner. The suction head is rotatable around a first rotation axis into a position in which the elongated suction orifice extends substantially parallel to a displacement direction of the suction nozzle. Upon and through a rotation of the suction head into this position, the support means are displaced from a position within a rotation range occupied by the suction head during said rotation, to a position located outside the rotation range of the suction head.

Citation List

Patent Literature

[0009]

PTL 2: Published Japanese Translation of PCT Application No. 2006-503608
PTL 3: GB 2 466 290 A
PTL 4: WO 2005/110179 A1
PTL 5: WO 2007/031819 A1

Summary of Invention

Technical Problem

[0010] However, according to the above conventional technologies, the operability of the suction tool cannot be adequately improved in some cases.

[0011] For example, the suction tool proposed in PTL 1 is specialized for the canister type cleaner, for example so that it cannot be directly applied to the upright type cleaner.

[0012] The canister type cleaner is typically configured such that: one end of a suction hose is attached to a cleaner main body; one end of a connecting tube is at-
tached to the other end of the suction hose; and the suc-
tion tool is attached to the other end of the connecting
tube. A grip portion is provided at one end side of the
connecting tube (that is, at a side connected to the other
end of the suction hose).

Therefore, the user grips the grip portion to op-
erate the suction tool via the connecting tube. Thus, the
operability is improved by including the arm portion con-
stituted by the first arm portion and the second arm por-
tion. In the upright type cleaner, the cleaner main body
is located at a part corresponding to the connecting tube.
Therefore, even in a case where the configuration of PTL
1 is directly applied to the upright type cleaner, the user
operates so as to swing the cleaner main body that is
large in weight and volume, so that the operability cannot
be practically improved.

According to the surface treating appliance pro-
posed in PTL 2, the suction tool (surface treating head)
is caused to turn by causing the rolling axis of the ball-
shaped or roller-shaped support assembly to be tilted in
an upper-lower direction. Therefore, a turning radius be-
comes large. On this account, the user has to largely
twist the handle to cause the suction tool to turn in a small
radius. In this case, a load on a wrist of the user tends
to become heavy. In a case where it is required to turn
the suction tool in a small radius, it is hard to say that the
operability can be adequately improved.

The present invention was made to solve the
above problems, and an object of the present invention
is to provide a suction tool capable of further improving
the operability of a vacuum cleaner regardless of the type
of the vacuum cleaner, and a vacuum cleaner including
this suction tool.

Solution to Problem

To solve the above problem, a vacuum cleaner
suction tool according to the present invention includes:
a suction tool main body including a lower surface on
which a suction port is formed; a connecting tube portion
connected to a rear portion of the suction tool main body;
and a traveling wheel portion provided at the connecting
tube portion, wherein: the connecting tube portion is con-
stituted by at least a first connecting tube including one
end connected to an upper side of the rear portion of the
suction tool main body and a second connecting tube coupled
to the other end of the first connecting tube so as to be
rotatable in an axial direction thereof; and the wheel
portion is constituted by at least a pair of left and
right wheels and a wheel supporting body including both
ends that rotatably support the wheels, respectively, the
vacuum cleaner suction tool further comprising a wheel
attaching portion by which the wheel supporting body is
attached to a lower portion of the second connecting tube
so as to incline using a middle portion of the wheel sup-
porting body as a fulcrum.

According to the above configuration, the wheel
supporting body is attached to a lower part of the second
connecting tube of the connecting tube portion by the
wheel attaching portion so as to be able to incline. With
this, the wheel portion provided at the lower surface of
the second connecting tube practically, three-dimension-
ally inclines by the swinging of a coupled part where the
suction tool main body and the first connecting tube are
coupled to each other, the rotation of a coupled part
where the first connecting tube and the second connect-
ting tube are coupled to each other, and the inclination of
the wheel supporting body (wheel portion) by the wheel
attaching portion. Therefore, by the inclination of the
wheel portion, the suction tool main body can be caused
to easily turn via the connecting tube portion. On this
account, the operability of the suction tool can be im-
proved.

The above vacuum cleaner suction tool may be
configured such that the wheel attaching portion includes
a torsion spring member configured to bias the second
connecting tube, having been inclined in accordance with
an inclination of the wheel supporting body, toward a di-
rection opposite to an inclination direction of the second
connecting tube.

The above vacuum cleaner suction tool may be
configured such that an attachment axis angle θ1 that is
an angle of the attachment axis relative to a cleaned sur-
face is an acute angle.

The above vacuum cleaner suction tool may be
configured such that in a case where a center of rotation
of the second connecting tube coupled to the first connect-
ing tube rotates is referred to as a rotary surface, the first
connecting tube and the second connecting tube are cou-
pied to each other such that a rotary surface angle θ0 that
is an angle of the rotary surface relative to the cleaned surface is an acute angle larger than the attach-
ment axis angle θ1.

The above vacuum cleaner suction tool may be
configured such that in a case where a center of rotation
of the second connecting tube relative to the first con-
necting tube is referred to as a rotation axis, a direction
of the rotation axis and a direction of the attachment axis
intersect with each other.

The above vacuum cleaner suction tool may be
configured such that: a rotation axis angle θ2 that is an
angle of the rotation axis relative to the cleaned surface
is within a range from 5° to 45°; and the attachment axis
angle θ1 is within a range from 5° to 45°.

The above vacuum cleaner suction tool may be
configured such that: the connecting tube portion further
includes a third connecting tube connected to a second
end of the second connecting tube so as to swing in the
front-rear direction; and a position of the wheel attaching
portion at the second connecting tube is located in front of a position of a swinging axis of the third connecting tube.

[0025] The above vacuum cleaner suction tool may be configured such that a relative position of the wheel portion relative to the suction tool main body is changeable such that: when the vacuum cleaner suction tool is used, that is, when the vacuum cleaner suction tool is attached to a vacuum cleaner to suction dust, a center axis of the vacuum cleaner is located on or behind the wheel portion; and when the vacuum cleaner suction tool is stored, the center axis of the vacuum cleaner is located between the suction tool main body and the wheel portion.

[0026] The above vacuum cleaner suction tool may be configured such that the wheel portion includes a lever mechanism configured to be operated to change a position of the wheel portion relative to the suction tool main body.

[0027] The above vacuum cleaner suction tool may be configured such that: the third connecting tube includes a protruding portion configured to rotate about the swinging axis of the third connecting tube together with swinging of the third connecting tube; and when the vacuum cleaner suction tool is stored, the inclination movement of the wheel portion is limited in such a manner that the protruding portion contacts an upper surface of the wheel supporting body by the swinging of the third connecting tube.

[0028] The above vacuum cleaner suction tool may be configured such that: the lever mechanism is provided with an engaging portion configured to contact the third connecting tube by operating the lever mechanism; and a contact part, which contacts the engaging portion, of the third connecting tube is constituted as an engaged portion having a shape corresponding to the engaging portion.

[0029] In addition, the present invention also includes a vacuum cleaner including any one of the above vacuum cleaner suction tools.

[0030] The above object, other objects, features, and advantages of the present invention will be made clear by the following detailed explanation of preferred embodiments with reference to the attached drawings.

Advantageous Effects of Invention

[0031] According to the above configuration, the present invention can obtain an effect of being able to provide a suction tool capable of further improving the operability of a vacuum cleaner regardless of the type of the vacuum cleaner and a vacuum cleaner including the suction tool.

Brief Description of Drawings

[0032] [Fig. 1] Fig. 1 is a perspective view showing one example of the configuration of a vacuum cleaner suction tool according to an embodiment of the present invention.

[Fig. 2] Fig. 2 is a front view showing the configuration of the vacuum cleaner suction tool of Fig. 1 when viewed from front.

[Fig. 3] Fig. 3 is a rear view showing the configuration of the vacuum cleaner suction tool of Fig. 1 when viewed from rear.

[Fig. 4] Fig. 4 is a left side view showing the configuration of the vacuum cleaner suction tool of Fig. 1 when viewed from a left side.

[Fig. 5] Fig. 5 is a right side view showing the configuration of the vacuum cleaner suction tool of Fig. 1 when viewed from a right side.

[Fig. 6] Fig. 6 is a plan view showing the configuration of the vacuum cleaner suction tool of Fig. 1 when viewed from above.

[Fig. 7] Fig. 7 is a bottom view showing the configuration of the vacuum cleaner suction tool of Fig. 1 when viewed from below.

[Fig. 8] Fig. 8 is a cross-sectional view showing a cross-sectional configuration of the vacuum cleaner suction tool of Fig. 1 in a front-rear direction when viewed from a left side.

[Fig. 9] Fig. 9 is an exploded perspective view showing one example of the configuration of a wheel attaching portion included in the vacuum cleaner suction tool of Fig. 1.

[Fig. 10] Fig. 10 is a comparison diagram including a cross-sectional view and a front view, each showing the detailed configuration of the wheel attaching portion of Fig. 9 and the configuration of a wheel portion.

[Fig. 11] Fig. 11 is a comparison diagram for explaining the attachment axis and a rotation axis of a second connecting tube included in the vacuum cleaner suction tool shown in Fig. 1 and an attachment axis of the wheel attaching portion. Fig. 11B is a schematic diagram for explaining the attachment axis and a rotation axis of the second connecting tube.

[Fig. 12] Fig. 12A is a plan view showing a state where the vacuum cleaner suction tool shown in Fig. 1 turns left. Fig. 12B is a plan view showing a state where the vacuum cleaner suction tool shown in Fig. 1 turns right.

[Fig. 13] Fig. 13A is a comparison diagram including a front view and a rear view, each showing one example of a spring long hole provided at an attaching portion main body of the wheel attaching portion shown in Fig. 9. Fig. 13B is a schematic diagram showing movements of two torsion spring members included in the wheel attaching portion, when viewed from a rear surface.

[Fig. 14] Fig. 14A is a schematic diagram showing a state where the vacuum cleaner suction tool of Fig. 1 is attached to an upright type vacuum cleaner and used, when viewed from a left side.
Hereinafter, preferred embodiments of the present invention will be explained in reference to the drawings. In the following explanations and drawings, the same reference signs are used for the same or corresponding components, and a repetition of the same explanation is avoided.

(Embodyment 1)

First, as Embodiment 1 of the present invention, one example of a specific configuration, use, and the like of a vacuum cleaner suction tool will be specifically explained. In the following explanations, for convenience sake, unless otherwise noted, the vacuum cleaner suction tool is simply abbreviated as a "suction tool".

[Entire Configuration of Suction Tool]

As shown in Figs. 1 to 8, a suction tool 10 according to the present embodiment includes a suction tool main body 11, a connecting tube portion 12, a wheel portion 13, and a wheel attaching portion 14.

As shown in an entire perspective view of Fig. 1, a front view of Fig. 2, and a plan view of Fig. 6, the suction tool main body 11 has a long thin flat plate shape. As shown in side views of Figs. 4 and 5 in addition to Figs. 1 and 6, the connecting tube portion 12 is connected to a rear side of a longitudinal-direction middle portion of the suction tool main body 11. In the suction tool 10 of the present embodiment, a side where the suction tool main body 11 is located is referred to as a "front" side, and an opposite side that is a side where the wheel portion 13 is located is referred to as a "rear" side. A left-right direction of the suction tool 10 is defined as a left-right direction when facing front.

As shown in a bottom view of Fig. 7, the suction tool main body 11 includes a suction port 111 located at a front side of a lower surface thereof. The suction port 111 is a rectangular opening located along a longitudinal direction of the suction tool main body 11. As shown in a cross-sectional view of Fig. 8 in addition to Fig. 7, a rotary brush 112 is provided inside the suction port 111. The rotary brush 112 has, for example, a columnar shape and is configured to be rotatable by a brush rotation mechanism, not shown. The brush rotation mechanism may use a motor as a driving source or may use an air turbine as a driving source.

As shown in Figs. 1 to 8, a suction tool 10 according to the present embodiment includes a suction tool main body 11, a connecting tube portion 12, a wheel portion 13, and a wheel attaching portion 14.

The third connecting tube 23 includes: a first end (one end of the third connecting tube 23) coupled to the second end of the first connecting tube 21; and a second end (the other end of the second connecting tube 22) connected to a side of the suction tool main body 11. As shown in Figs. 1 and 4 to 8, the connecting tube portion 12 is connected to a front portion of the suction tool main body 11; and a second end (the other end of the first connecting tube 21) connected to a side of the suction tool main body 11. As also shown in a rear view of Fig. 3, the rear wheels 15 are located at a rear portion of the suction tool main body 11 so as to be close to the connecting tube portion 12. As shown in Fig. 7, the front wheels 16 are located in front of and outside the rear wheels 15 so as to be close to the suction port 111. The suction tool main body 11 can move on a cleaned surface by the rear wheels 15 and the front wheels 16.

As shown in Figs. 4, 5, and 8 in addition to Fig. 7, a front view of Fig. 2, and a plan view of Fig. 6, the suction tool main body 11 includes a suction port 111 located at a front side of a lower surface thereof. The suction port 111 is a rectangular opening located along a longitudinal direction of the suction tool main body 11. As shown in a cross-sectional view of Fig. 8 in addition to Fig. 7, a rotary brush 112 is provided inside the suction port 111. The rotary brush 112 has, for example, a columnar shape and is configured to be rotatable by a brush rotation mechanism, not shown. The brush rotation mechanism may use a motor as a driving source or may use an air turbine as a driving source.

As shown in Figs. 1 to 8, a suction tool 10 according to the present embodiment includes a suction tool main body 11, a connecting tube portion 12, a wheel portion 13, and a wheel attaching portion 14.

As shown in an entire perspective view of Fig. 1, a front view of Fig. 2, and a plan view of Fig. 6, the suction tool main body 11 has a long thin flat plate shape. As shown in side views of Figs. 4 and 5 in addition to Figs. 1 and 6, the connecting tube portion 12 is connected to a rear side of a longitudinal-direction middle portion of the suction tool main body 11. In the suction tool 10 of the present embodiment, a side where the suction tool main body 11 is located is referred to as a "front" side, and an opposite side that is a side where the wheel portion 13 is located is referred to as a "rear" side. A left-right direction of the suction tool 10 is defined as a left-right direction when facing front.

As shown in a bottom view of Fig. 7, the suction tool main body 11 includes a suction port 111 located at a front side of a lower surface thereof. The suction port 111 is a rectangular opening located along a longitudinal direction of the suction tool main body 11. As shown in a cross-sectional view of Fig. 8 in addition to Fig. 7, a rotary brush 112 is provided inside the suction port 111. The rotary brush 112 has, for example, a columnar shape and is configured to be rotatable by a brush rotation mechanism, not shown. The brush rotation mechanism may use a motor as a driving source or may use an air turbine as a driving source.

As shown in Figs. 1 to 8, a suction tool 10 according to the present embodiment includes a suction tool main body 11, a connecting tube portion 12, a wheel portion 13, and a wheel attaching portion 14.

As shown in Figs. 2 and 8, the first end of the first connecting tube 21 is connected to a side of the suction tool main body 11; and a second end (the other end of the first connecting tube 21) connected to a side of the suction tool main body 11. As also shown in a rear view of Fig. 3, the rear wheels 15 are located at a rear portion of the suction tool main body 11 so as to be close to the connecting tube portion 12. As shown in Fig. 7, the front wheels 16 are located in front of and outside the rear wheels 15 so as to be close to the suction port 111. The suction tool main body 11 can move on a cleaned surface by the rear wheels 15 and the front wheels 16.
tube 23 is shown by an arrow M3, and a rotating direction of the below-described wheel attaching portion 14 is shown by an arrow M1. The suction tool 10 shown in Fig. 1 is in a below-described stored state. In this state, the third connecting tube 23 swings to be located at a front-most position. Therefore, in Fig. 1, the arrow M3 shows that the third connecting tube 23 can swing only in a rear direction.

In the present embodiment, the connecting tube portion 12 is constituted by three tubular members that are the connecting tubes 21, 22, and 23. However, the present embodiment is not limited to this, and the connecting tube portion 12 may be constituted by at least two tubular members that are the connecting tubes 21 and 22. According to need, the connecting tube portion 12 may be constituted by four or more tubular members or may include a member and the like other than the tubular members. The swinging, rotations, functions and the like of these connecting tubes 21, 22, and 23 will be described later.

The wheel portion 13 is provided at the connecting tube portion 12 and allows the suction tool 10 to travel in cooperation with the rear wheels 15 and the front wheels 16 provided at the lower surface of the suction tool main body 11. As shown in Figs. 1 and 3 to 7, in the present embodiment, the wheel portion 13 is constituted by a pair of left and right wheels 31, a wheel supporting body 32, and a lever mechanism 33.

The wheels 31 are respectively supported by both ends of the wheel supporting body 32 so as to be rotatable. A specific shape of the wheel 31 is not especially limited and may be a known shape. However, in the present embodiment, as shown in Figs. 3, 6, and 7, the wheel 31 has such a shape that a diameter thereof decreases in a direction from an inner portion thereof supported by the wheel supporting body 32 toward an outer portion thereof. In other words, the shape of the wheel 31 is a shape having a substantially parabolic cross section.

In a case where the wheel 31 has the above shape, a middle part of the outer portion of the wheel 31 projects from the inner portion of the wheel 31. Therefore, even if the suction tool 10 is inclined when the suction tool 10 is turned as described later, a peripheral surface of the projecting part of the wheel 31 contacts the cleaned surface to rotate. On this account, since the wheel 31 can adequately travel on the cleaned surface even in an inclined state, the operability of the suction tool 10 can be improved.

As especially shown in Figs. 3 and 7, the wheel supporting body 32 has a long thin flat plate shape, and a longitudinal length of the wheel supporting body 32 is shorter than that of the suction tool main body 11. As described above, a pair of wheels 31 are respectively supported by both ends of the wheel supporting body 32 so as to be rotatable. A middle portion of the wheel supporting body 32 is attached to the connecting tube portion 12 via the wheel attaching portion 14. As shown in Figs. 6 and 7, the wheel supporting body 32 is basically located so as to be perpendicular to an extending direction (front-rear direction) of the connecting tube portion 12. However, when in use (when the suction tool 10 is attached to the vacuum cleaner, and the vacuum cleaner suctions dust), the wheel supporting body 32 can be inclined relative to the connecting tube portion 12 as described later.

When the suction tool 10 is not used, especially when the suction tool 10 is stored, the lever mechanism 33 limits the swinging of the third connecting tube 23 and the inclination movement of the wheel portion 13. Specifically, in a use state, the third connecting tube 23 has typically swung backward (has fallen). In a case where the third connecting tube 23 is caused to swing forward from the use state to change the stored state as shown in Fig. 1, the lever mechanism 33 is pushed up in conjunction with the swinging of the third connecting tube 23. With this, the swinging of the third connecting tube 23 is limited, and the inclination movement of the wheel portion 13 is also limited. One example of the specific configuration of the lever mechanism 33 and the limitation of the inclination of the wheel portion 13 will be described later.

In the present embodiment, the wheel portion 13 is constituted by the wheels 31, the wheel supporting body 32, and the lever mechanism 33. However, the present embodiment is not limited to this. The wheel portion 13 may be constituted by at least the wheels 31 and the wheel supporting body 32. As described above, the lever mechanism 33 is provided to limit the inclination movement of the wheel supporting body 32. However, the wheel portion 13 may include a mechanism, a member, or the like other than the lever mechanism 33 in order to limit the inclination movement of the wheel supporting body 32, and may include a component other than the wheels 31, the wheel supporting body 32, and the lever mechanism 33.

The wheel attaching portion 14 is provided to attach the wheel supporting body 32 to the connecting tube portion 12. In the present embodiment, since the wheel attaching portion 14 is provided at a lower surface of the second connecting tube 22, the wheel supporting body 32 (that is, the wheel portion 13) is attached to the second connecting tube 22 of the connecting tube portion 12. The wheel supporting body 32 is configured to be able to incline by the wheel attaching portion 14 using the middle portion thereof as a fulcrum (pivot). One example of the specific configuration will be described later.

More specific configurations, such as a material, a size, and parts, of the suction tool main body 11, the connecting tube portion 12, and the wheel portion 13 are not especially limited, and configurations known in the field of vacuum cleaners can be suitably used. For example, each of the suction tool main body 11 and the connecting tube portion 12 may be configured by assembling known resin molded products, and the rotary brush 112 may have a known configuration in which resin brush bristles are planted on a tubular body that is a resin mold-
ed product. The wheel portion 13 may also be configured by assembling known resin molded products. A pair of wheels 31 may be made of an elastic material, such as rubber.

[Detailed Configuration of Wheel Attaching Portion]

[0052] Next, a more detailed configuration of the wheel attaching portion 14 will be specifically explained in reference to Figs. 9 and 10 in addition to Fig. 8.

[0053] As shown in Figs. 8 and 9, the wheel attaching portion 14 is constituted by at least torsion spring members 41A and 41B, an attaching portion main body 42, an attachment shaft portion 43, and a shaft portion fastening member 44.

[0054] The torsion spring member 41A is located at a rear part of the wheel attaching portion 14, and the torsion spring member 41B is located at a front part of the wheel attaching portion 14. The torsion spring members 41A and 41B are torsion coil springs (torsion springs) that are the same in shape as each other. A spring main body 410 of each of the torsion spring members 41A and 41B is configured such that a steel wire turns in a coil shape. Both ends of the spring main body 410 are arms 411 and 412, each of which is the steel wire that extends linearly without turning.

[0055] A first arm 411 that is one of the arms 411 and 412 is an arm that is located at one end of the spring main body 410 and extends in a tangential direction from a circular outer periphery of the spring main body 410. As shown in a lower diagram of Fig. 10, the first arm 411 is exposed from the attaching portion main body 42 so as to be rotatable. The first arm 411 contacts an outer periphery of the second connecting tube 22 and basically moves in accordance with the rotation of the second connecting tube 22. A second arm 412 is an arm that is located at the other end of the spring main body 410 and extends in a winding direction (coil axial direction). The second arm 412 serves as a stopper that limits a rotation range of the torsion spring member 41A or 41B in a state where the second arm 412 is accommodated in the attaching portion main body 42. This point will be described in detail together with the explanation of the use state of the suction tool 10.

[0056] As shown in Fig. 9 and an upper diagram of Fig. 10, the attaching portion main body 42 is formed in a tubular shape and is integrally fixed to the middle portion of the wheel supporting body 32. The torsion spring members 41A and 41B are accommodated in the attaching portion main body 42. As shown in Figs. 8 and 9 and the upper and middle diagrams of Fig. 10, the torsion spring member 41A is accommodated in a rear surface part of the attaching portion main body 42, and the torsion spring member 41B is accommodated in a front surface part of the attaching portion main body 42.

[0057] As shown in the middle diagram of Fig. 10, a spring fixing frame 421 is provided at a middle portion of the attaching portion main body 42. As shown in Fig. 9, when inserting the torsion spring members 41A and 41B into the attaching portion main body 42 through both ends of the attaching portion main body 42, the spring fixing frame 421 defines the positions of the torsion spring members 41A and 41B in order to prevent the torsion spring members 41A and 41B from being inserted into the attaching portion main body 42 beyond necessity. As described below, the spring fixing frame 421 is provided with a spring long hole through which the second arm 412 penetrates. With this, the second arm 412 can serve as the stopper.

[0058] As shown in Fig. 9, the attachment shaft portion 43 has a bolt-like shape or a nail-like shape. A shaft portion main body 431 has a substantially columnar shape, and a lid plate 432 is provided at a rear end of the shaft portion main body 431. Therefore, when viewed from the lid plate 432 located at the rear end, the shaft portion main body 431 stands in a perpendicular direction. As shown in Fig. 8, in a state where the attaching shaft portion 43 is inserted in the attaching portion main body 42, the attachment shaft portion 43 holds the torsion spring members 41A and 41B in the attaching portion main body 42 so as to penetrate the torsion spring members 41A and 41B.

[0059] As shown in Fig. 9, since the attachment shaft portion 43 is inserted through a rear part (rear surface part) of the attaching portion main body 42, the lid plate 432 located at the rear end serves as a lid member that closes a rear opening of the attaching portion main body 42 as shown in Fig. 8 (for convenience sake, in Fig. 8, the reference sign of the lid plate 432 is not shown). Further, as shown in Fig. 9, a shaft portion insertion frame 221 projecting downward is provided at a lower portion of the second connecting tube 22. As shown by a dashed line in Fig. 9, the attachment shaft portion 43 is inserted into the shaft portion insertion frame 221 to be inserted into the attaching portion main body 42. Therefore, the attachment shaft portion 43 also serves as a fixing member that fixes the wheel attaching portion 14 to the second connecting tube 22.

[0060] As shown in Fig. 9, the shaft portion fastening member 44 is constituted by a tip end fitting part 441 fitted to a tip end of the attachment shaft portion 43 and an outer periphery attaching part 442 attached to the outer periphery of the second connecting tube 22. By causing the tip end of the attachment shaft portion 43, having been inserted into the attaching portion main body 42, to be fitted to the tip end fitting part 441, the attachment shaft portion 43 is fastened so as not to be detached from the attaching portion main body 42. By attaching the outer periphery attaching part 442 to the second connecting tube 22, the attachment shaft portion 43 and both ends of the attaching portion main body 42 are fixed to the second connecting tube 22. To be specific, the rear end (rear surface part) of the attaching portion main body 42 is fixed to the second connecting tube 22 in such a manner that the attachment shaft portion 43 is inserted into the shaft portion insertion frame 221 as described above,
and the front end (front surface part) of the attaching portion main body 42 is fixed to the second connecting tube 22 in such a manner that the shaft portion fastening member 44 to which the tip end of the attachment shaft portion 43 is fitted is attached to the outer periphery of the second connecting tube 22.

[0061] Since the wheel attaching portion 14 configured as above is provided integrally with the wheel supporting body 32 of the wheel portion 13, as shown in the lower diagram of Fig. 10 (that is, a front view of the wheel portion 13), the wheel portion 13 can be caused to rotate about a central axis S1 (which is shown by a broken line in Fig. 10 and coincides with a central axis of the attachment shaft portion 43 not shown in Fig. 10) of each of the torsion spring members 41A and 41B in a direction of the block arrow M1. Since the central axis S1 that is a rotational center of the wheel portion 13 is also an axis extending along an attachment direction of the wheel attaching portion 14, the central axis S1 is hereinafter referred to as an "attachment axis S1" for convenience of explanation.

[0062] As described above, the second arms 412 of the torsion spring members 41A and 41B of the wheel attaching portion 14 serve as the stops. Therefore, the rotation of the wheel portion 13 by the wheel attaching portion 14 is not such a complete rotation that the wheel portion 13 rotates one revolution. That is, the rotation of the wheel portion 13 by the wheel attaching portion 14 is such a partial rotation that the wheel portion 13 swings at a position under the second connecting tube 22. Further, as described below, the torsion spring members 41A and 41B function to bias the second connecting tube 21, having been inclined in accordance with the inclination of the wheel supporting body 32 (wheel portion 13), toward a direction opposite to the inclination direction of the second connecting tube 22 (that is, toward an original position of the second connecting tube 22).

[0063] More specific configurations of the torsion spring members 41A and 41B, the attachment shaft portion 43, and the shaft portion fastening member 44 are not especially limited. The torsion spring members 41A and 41B may be known steel torsion springs. The attaching portion main body 42, the attachment shaft portion 43, and the shaft portion fastening member 44 may be made of resin molded products as with the wheel portion 13. For convenience sake, the reference numbers of the spring main bodies 410, first arms 411, and second arms 412 of the torsion spring members 41A and 41B, the shaft portion main body 431 and lid plate 432 of the attachment shaft portion 43, and the tip end fitting part 441 and outer periphery attaching part 442 of the shaft portion fastening member 44 are shown only in Fig. 9 and are not shown in Fig. 8 or 10.

[Use State of Suction Tool]

[0064] Next, one example of the use state of the suction tool 10 and a positional relation between the connecting tube portion 12 and the wheel attaching portion 14 will be specifically explained in reference to Figs. 11A, 11B, 12A, and 12B. Figs. 11A and 11B are schematic diagrams each showing axes and angles in a state where the suction tool 10 is placed on a cleaned surface F. The state where the suction tool 10 is placed in Fig. 11A is the same as that in Fig. 11B. Each of Figs. 11A and 11B shows the use state that is a state where the third connecting tube 23 has swung backward. In Fig. 11A, a stored state that is a state where the third connecting tube 23 is standing at a frontmost position is shown by a dashed line. Further, in each of Figs. 12A and 12B, a left diagram shows a state where the suction tool 10 moves straight in the use state, and a right diagram shows a state where the suction tool 10 turns.

[0065] Since the turning performance of the suction tool 10 of the present embodiment in a case where the suction tool 10 is attached to the vacuum cleaner is improved, the operability of the vacuum cleaner can also be improved. In order to improve the turning performance, the positional relation between the connecting tube portion 12 and the wheel attaching portion 14 constituting the suction tool 10 is important.

[0066] First, an attached position of the wheel attaching portion 14 will be explained. The wheel attaching portion 14 is fixed to an outer peripheral surface of a lower portion of the second connecting tube 22 (that is, to the lower surface of the second connecting tube 22). As shown in Fig. 11A, the attachment axis S1 (the rotation axis of the wheel portion 13) that coincides with the attachment direction of the wheel attaching portion 14 is an axis inclined to a front side along the front-rear direction of the connecting tube portion 12. The degree of the inclination of the attachment axis S1 is not especially limited. However, in order to further improve the operability, it is preferable that the attachment axis S1 be inclined such that an angle of the attachment axis S1 relative to the cleaned surface F becomes an acute angle.

[0067] Specifically, an angle of the attachment axis S1 relative to the cleaned surface F in a state where the suction tool 10 is placed on the cleaned surface F is referred to as an attachment axis angle θ1 shown in Fig. 11A. It is preferable that the attachment axis angle θ1 be at least an acute angle (smaller than 90°), and it is more preferable that the attachment axis angle θ1 be in a range from 5° to 45°. In a case where the attachment axis angle θ1 is the acute angle, as shown in the right diagrams of Figs. 12A and 12B, the wheel supporting body 32 is inclined by the partial rotation (swinging) of the wheel portion 13, whose rotational center is the wheel attaching portion 14, such that one of the wheels 31 is located in front of the other wheel 31. For example, in the right diagram of Fig. 12A, the wheel supporting body 32 is inclined such that the left wheel 31 is located at a front side whereas the right wheel 31 is located at a rear side. In the right diagram of Fig. 12B, the wheel supporting body 32 is inclined such that the right wheel 31 is located at the front side whereas the left wheel 31 is located at the rear side.
Here, as described above, the wheel supporting body 32 rotates about the attachment axis S1 of the wheel attaching portion 14. Therefore, relative to the connecting tube portion 12, the wheel supporting body 32 inclines planarly (two-dimensionally) such that the left or right wheel 31 moves to the front side and also inclines sterically (three-dimensionally) such that the wheel 31 located at the front side is located at a lower side whereas the wheel 31 located at the rear side is located at an upper side. For example, in the right diagram of Fig. 12A, the left wheel 31 moves to the front side, and the wheel supporting body 32 inclines, and in the right diagram of Fig. 12B, the right wheel 31 moves to the front side, and the wheel supporting body 32 inclines.

As shown in Figs. 12A and 12B, when the suction tool 10 is viewed from above (that is, in a plan view shown in Fig. 6), relative to the wheel supporting body 32, one of the left and right wheels 31 located at the wheel supporting body 32 moves to the front side, and the connecting tube portion 12 inclines in the same direction as the moved wheel 31. For example, in the right diagram of Fig. 12A, in a case where the left wheel 31 moves to the front side, and the wheel supporting body 32 inclines, the connecting tube portion 12 inclines to the left side. In the right diagram of Fig. 12B, in a case where the right wheel 31 moves to the front side, and the wheel supporting body 32 inclines, the connecting tube portion 12 inclines to the right side.

As shown in Figs. 12A and 12B, when the suction tool main body 11 turns moves backward, the suction tool main body 11 via the first connecting tube 21. As a result, the suction tool main body 11 turns in the inclination direction of the second connecting tube 22. Therefore, the user can easily operate the suction tool 10.

As shown in the right diagrams of Figs. 12A and 12B, when the suction tool main body 11 turns, one end of the suction tool main body 11 and one of the wheels 31 of the wheel portion 13 get close to each other at a side toward which the suction tool main body 11 moves. Since Fig. 12A shows a left turn, the left end of the suction tool main body 11 and the left wheel 31 get close to each other. Since Fig. 12B shows a right turn, the right end of the suction tool main body 11 and the right wheel 31 get close to each other. In other words, in a case where the wheel portion 13 moves such that the wheel 31 located opposite to the side toward which the suction tool main body 11 moves moves backward, the suction tool main body 11 turns in a desired direction.

In the present embodiment, in addition to the definition of the inclination of the wheel attaching portion 14 as described above, it is preferable to define the position of the wheel attaching portion 14 based on the third connecting tube 23. Specifically, as shown in Figs. 11A and 11B, the third connecting tube 23 can swing in a swinging direction M3 that is the front-rear direction. Therefore, in a case where a central axis of the swinging direction M3 is a swinging axis S3, the swinging axis S3 is an axis located in the left-right direction. Here, it is preferable that the wheel attaching portion 14 be set based on the swinging axis S3 so as to be located at a position in front of the swinging axis S3. In a case where the wheel attaching portion 14 is located at this position, an interval between the wheel portion 13 and the suction tool main body 11 does not become too large. Therefore, the suction tool main body 11 can be caused to effectively turn by the inclination of the wheel supporting body 32.

In addition to the definitions of the inclination and position of the wheel attaching portion 14, it is preferable to define a coupling angle of the second connecting tube 22 relative to the first connecting tube 21. Specifically, as with the definition of the inclination of the attachment axis S1, in a state where the suction tool 10 is placed on the cleaned surface F, the angle of the second connecting tube 22 relative to the cleaned surface F is set in a suitable range. With this, the coupling angle between the first connecting tube 21 and the second connecting tube 22 can be practically defined.

Specifically, as shown in Fig. 11A, a surface at which the second connecting tube 22 rotates relative to the first connecting tube 21 is referred to as a rotary surface P0. An angle of the rotary surface P0 relative to the cleaned surface F is referred to as a rotary surface angle o0. It is preferable that the rotary surface angle o0 be an
With this, the second connecting tube 22 is coupled to the first connecting tube 21 so as to be inclined to the rear side. Therefore, when the second connecting tube 22 rotates by the inclination of the wheel portion 13, torque generated by the rotation of the second connecting tube 22 is applied to an obliquely upper side of the first connecting tube 21. The first connecting tube 21 can swing relative to the suction tool main body 11 in the front-rear direction (see the swinging direction M4 in Fig. 11A) but does not move in the left-right direction. Therefore, the rotation of the second connecting tube 22 is effectively transferred to the suction tool main body 11. Thus, the suction tool main body 11 easily turns left or right.

By the definition of the inclination of the wheel attaching portion 14 and the definition of the coupling angle between the connecting tubes 21 and 22, a relation between an inclination state of the second connecting tube 21 and an inclination state of the wheel attaching portion 14 is also defined. To be specific, both the wheel attaching portion 14 and the second connecting tube 22 are arranged in the front-rear direction. However, the wheel attaching portion 14 is inclined such that a rear portion thereof is located at an upper side, and the second connecting tube 22 is inclined such that a front portion thereof is located at the upper side.

Therefore, as shown in Fig. 11B, in a case where the center of the rotation of the second connecting tube 22 relative to the first connecting tube 21 is referred to as a rotation axis S2, a direction of the rotation axis S2 and a direction of the attachment axis S1 of the wheel attaching portion 14 may intersect with each other. Further, as shown in Fig. 11B, in a case where an angle of the rotation axis S2 relative to the cleaned surface F is referred to as a rotation axis angle $\theta_2$, the rotation axis angle $\theta_2$ may be an acute angle. It is more preferable that the rotation axis angle $\theta_2$ be in a range from $5^\circ$ to $45^\circ$.

In a case where the attachment axis S1 of the wheel attaching portion 14 and the rotation axis S2 of the second connecting tube 22 intersect with each other, as shown by the rotating direction M2 in Fig. 11B, the second connecting tube 22 efficiently rotates while inclining in accordance with the inclination of the wheel portion 13. Further, the second connecting tube 22 is coupled to the first connecting tube 21, and the first connecting tube 21 may be fixed to the suction tool main body 11 as described above, or as shown in Fig. 11A, the first connecting tube 21 may be able to swing relative to the suction tool main body 11 in the swinging direction M4 about the swinging axis S4. In other words, when viewed from the first connecting tube 21, the suction tool main body 11 may be able to swing relative to the first connecting tube 21 in the front-rear direction. Therefore, both the rotation of the second connecting tube 22 in the rotating direction M2 and the swinging of the first connecting tube 21 in the swinging direction M4 are transferred to the suction tool main body 11. As a result, the suction tool main body 11 efficiently turns.

A positional relation among the attachment axis S1 of the wheel attaching portion 14, the rotation axis S2 of the second connecting tube 22, and the swinging axis S3 of the third connecting tube 23 can be explained as below. To be specific, the attachment axis S1 and the rotation axis S2 are located on the same plane, and the swinging axis S3 is perpendicular to this plane. In other words, the swinging axis S3 corresponds to a normal line of a plane including the attachment axis S1 and the rotation axis S2. The swinging axis S3 does not directly intersect with the attachment axis S1 or the rotation axis S2. Thus, the swinging axis S3 is skew to each of the attachment axis S1 and the rotation axis S2.

As above, in the present embodiment, the wheel supporting body 32 is attached to a lower part of the second connecting tube 22 of the connecting tube portion 12 by the wheel attaching portion 14 so as to be able to incline. With this, the wheel portion 13 provided at the lower surface of the second connecting tube 22 practically, three-dimensionally inclines by the swinging of a coupled part where the suction tool main body 11 and the first connecting tube 21 are coupled to each other, the rotation of a coupled part where the first connecting tube 21 and the second connecting tube 22 are coupled to each other, and the inclination of the wheel supporting body 32 (wheel portion 13) by the wheel attaching portion 14. Therefore, by the inclination of the wheel portion 13, the suction tool main body 11 can be caused to easily turn via the connecting tube portion 12. On this account, the operability of the suction tool 10 can be improved.

Further, in the present embodiment, since the wheel attaching portion 14 includes two torsion spring members 41A and 41B, the suction tool main body 11 can be caused to stably turn by the inclination of the wheel supporting body 32. This point will be specifically explained in reference to Figs. 13A and 13B in addition to Figs. 12A and 12B.

An upper diagram of Fig. 13A is a front view of the wheel portion 13 when viewed from front, and a lower diagram of Fig. 13A is a front view of the wheel portion 13 when viewed from rear. In each of the upper diagram and lower diagram of Fig. 13A, only the attaching portion main body 42 is shown among the components of the wheel attaching portion 14, and the torsion spring members 41A and 41B, the attachment shaft portion 43, and the like are not shown. The movements of the torsion spring members 41A and 41B at the time of the left turn, the straight movement, and the right turn are respectively shown in a left column, a middle column, and a right column in Fig. 13B. An upper diagram of each column shows the torsion spring member 41A located at the rear side, and a lower diagram of each column shows the torsion spring member 41B located at the front side (see Figs. 8, 9, and 10).

First, a spring long hole 422 will be explained. As shown in Fig. 13A, the spring fixing frame 421 is provided inside the attaching portion main body 42 of the
wheel attaching portion 14 as described above. The spring fixing frame 421 is not provided so as to cover the entire inner periphery of the attaching portion main body 42, and the spring long hole 422 is formed by cutting out left and right portions of the spring fixing frame 421. In a case where nothing is accommodated in the attaching portion main body 42, the spring long hole 422 is a cutout. However, in a case where the torsion spring members 41A and 41B are accommodated in the attaching portion main body 42, and the attachment shaft portion 43 is inserted in the attaching portion main body 42, the spring long hole 422 becomes an arc-shaped hole through which the second arms 412 of the torsion spring members 41A and 41B penetrate.

[0085] Next, as shown in Fig. 13B, the movements of the torsion spring members 41A and 41B when viewed from a rear surface side will be explained. An interval between dashed lines in Fig. 13B is an interval of the spring long hole 422 in the upper-lower direction. For convenience sake, the reference sign of the spring long holes 422 is not shown in Fig. 13B.

[0086] For example, in a case where the suction tool 10 moves straight as shown in the left diagrams of Figs. 12A and 12B, as shown in the middle column of Fig. 13B (at the time of the straight movement), each of the first arm 411 of the torsion spring member 41A located at the rear side and the first arm 411 of the torsion spring member 41B located at the front side projects from the attaching portion main body 42 and is located at a home position (see the lower diagram in Fig. 10), and each of the second arms 412 of the torsion spring members 41A and 41B contacts the spring fixing frame 421 located at the lower side in the spring long hole 422. The first arm 411 of the torsion spring member 41A contacts the outer periphery of a left portion of the second connecting tube 22, and the first arm 411 of the torsion spring member 41B contacts the outer periphery of a right portion of the second connecting tube 22.

[0087] In a case where the suction tool main body 11 turns left as shown in the right diagram of Fig. 12A, as shown in the left column of Fig. 13B (at the time of the left turn), the second arm 412 of the torsion spring member 41A (upper diagram) located at the rear side moves from a lower side to an upper side in the spring long hole 422, and the first arm 411 of the torsion spring member 41A moves from the upper side to the lower side in accordance with the rotation (left rotation) of the second connecting tube 22. In this state, the torsion spring member 41A rotates (left rotation) together with the second connecting tube 22, so that the torque is not generated by the torsion spring member 41A.

[0088] The first arm 411 of the torsion spring member 41B (lower diagram) located at the front side moves from the lower side to the upper side in accordance with the rotation (left rotation) of the second connecting tube 22, and the second arm 412 of the torsion spring member 41B is located at the home position in the spring long hole 422 without movement and contacts the spring fixing frame 421 located at the lower side. To be specific, the second arm 412 of the torsion spring member 41B serves as the stopper, so that the torque is generated by the torsion spring member 41B. As a result, force acts on the second connecting tube 22 such that the second connecting tube 22 moves from the left side to the right side.

[0089] In a case where the suction tool main body 11 turns right as shown in the right diagram of Fig. 12B, as shown in the right column of Fig. 13B (at the time of the right turn), the first arm 411 of the torsion spring member 41A (upper diagram) located at the rear side moves from the lower side to the upper side in accordance with the rotation (right rotation) of the second connecting tube 22, and the second arm 412 of the torsion spring member 41A is located at the home position in the spring long hole 422 without movement and contacts the spring fixing frame 421 located at the lower side. With this, the torque is generated by the torsion spring member 41A, so that force acts on the second connecting tube 22 such that the second connecting tube 22 moves from the right side to the left side. As with the torsion spring member 41A at the time of the left turn, the torsion spring member 41B rotates (right rotation) together with the second connecting tube 22, so that the torque is not generated by the torsion spring member 41B.

[0090] As above, these two torsion spring members 41A and 41B apply to the second connecting tube 22, repulsive force by which the second connecting tube 22 inclined in the revolution direction in accordance with the left or right turn returns to an original state (in the front-rear direction). Therefore, the suction tool 10 can return to a straight movement state immediately after the left or right turn. On this account, the suction tool 10 can be prevented from wobbling by its own weight. As a result, the operability of the suction tool 10 can be further improved.

[Stored State of Suction Tool]

[0091] Next, one example of the configuration by which the state of the suction tool 10 is changed from the use state to the stored state will be specifically explained in reference to Figs. 14A, 14B, 15, and 16.

[0092] According to the suction tool 10 of the present embodiment, not only the operability when in use but also the operability when switching between the stored state and the use state is improved. Specifically, each of Figs. 14A and 14B shows an example in which the suction tool 10 according to the present embodiment is attached to a main body portion 51 of an upright type vacuum cleaner. As shown in Fig. 14A, when the suction tool 10 is used, a center axis Cb of the suction tool 10 shown by a chain double-dashed line is located on the wheel portion 13. As shown in Fig. 14B, when the suction tool 10 is stored, the center axis Cb of the suction tool 10 is located between the suction tool main body 11 and the wheel portion 13. The center axis Cb of the suction tool 10 when the suction tool 10 is used may be located behind the wheel
Since the main body portion 51 is located at the rear side in the use state, the center of gravity is located in the vicinity of the wheel portion 13 or behind the wheel portion 13. With this, the user can easily incline the wheel portion 13, and as a result, the operability improves. In contrast, in order to realize the stored state, the user just moves the main body portion 51 to the front side. Thus, the center of gravity moves to the front side of the center of gravity when in use. With this, the main body portion 51 can be placed immediately above the suction tool 10 to be stabilized. Therefore, the upright type vacuum cleaner can be stably stored. Even in a state where the suction tool 10 is connected to, for example, the connecting tube of a canister type vacuum cleaner, the same change in the center of gravity as above occurs. On this account, in a case where the center of gravity of the suction tool 10 is changeable, the switching between the stored state and the use state becomes easy, so that the operability can be further improved.

It is preferable that the wheel portion 13 incline (swing) as little as possible in the stored state. In the present embodiment, the wheel portion 13 includes the lever mechanism 33 that contacts a part of the third connecting tube 23 to be able to engage with the part of the third connecting tube 23. Specifically, as shown in Fig. 14A, the lever mechanism 33 is located at a lower side in the use state. At this time, since the engagement between the lever mechanism 33 and the third connecting tube 23 is canceled, the third connecting tube 23 swings backward, and the protruding portion 231 of the third connecting tube 23 rotates to the front side in accordance with the swinging of the third connecting tube 23.

As shown in Fig. 14B, in order to realize the stored state, the third connecting tube 23 swings to the front side, so that the lever mechanism 33 is pushed up in conjunction with the swinging of the third connecting tube 23. At this time, as shown in Fig. 15, an engaging portion 331 of the lever mechanism 33 can engage with an engaged portion 232 located at an outer periphery of a swing portion of the third connecting tube 23. Further, as shown by a broken line in Fig. 14B, the protruding portion 231 of the third connecting tube 23 rotates from the front side to the lower side. With this, as shown in Fig. 15, the protruding portion 231 contacts an upper surface 32a of the wheel supporting body 32. Thus, the inclination movement of the wheel portion 13 can be limited.

The contact of the protruding portion 231 will be specifically explained. As described above, the third connecting tube 23 can swing relative to the second connecting tube 22 in the front-rear direction (the swinging direction M3; see Fig. 11A). The protruding portion 231 is provided so as to rotate about the swinging axis S3 (see Figs. 11A and 11B) of the third connecting tube 23 together with the swinging of the third connecting tube 23. Since the swinging axis S3 extends in the left-right direction, the protruding portion 231 rotates in the front-rear direction. Therefore, when the suction tool 10 is stored, the third connecting tube 23 is caused to swing to the front side as shown in Fig. 15. With this, the protruding portion 231 contacts the upper surface 32a of the wheel supporting body 32. Thus, the inclination of the wheel portion 13 (wheel supporting body 32) is limited by the friction between the protruding portion 231 and the upper surface 32a.

As above, in a case where the suction tool 10 includes the lever mechanism 33 and the protruding portion 231 of the third connecting tube 23, the contact between the protruding portion 231 and the wheel portion 13 is canceled in the use state. Therefore, in a case where the second connecting tube 22 (and the third connecting tube 23) is caused to rotate about the rotation axis S2, the wheel portion 13 changes in position relative to the suction tool main body 11 so as to incline.

In other words, in a case where the second connecting tube 22 is caused to rotate about the rotation axis S2 in the use state, the attached position of the wheel portion 13 does not change, but the wheel 31 located at the same side as the side toward which the second connecting tube 22 is rotated about the rotation axis S2 gets close to the suction tool main body 11, and the wheel 31 located at the opposite side gets away from the suction tool main body 11.

In the stored state, since the third connecting tube 23 and the lever mechanism 33 engage with each other, the swinging of the third connecting tube 23 is limited. In addition, since the protruding portion 231 of the third connecting tube 23 contacts the wheel portion 13, the inclination movement of the wheel portion 13 is limited.

Further, as shown in Fig. 16, the present embodiment may be configured such that: an engaging portion 332 that engages with the second connecting tube 22 is provided at the lever mechanism 33; and an engaged portion 222 that engages with the engaging portion 332 is provided at the second connecting tube 22. In the example shown in Fig. 16, the engaging portion 332 having a convex shape is provided at a part of the lever mechanism 33, and the engaged portion 222 having a hook shape corresponding to the engaging portion 332 is provided at the second connecting tube 22. With this, by operating the lever mechanism 33, the lever mechanism 33 engages with not only the third connecting tube 23 but also the second connecting tube 22, so that both the third connecting tube 23 and the second connecting tube 22 are fixed. As a result, the contact state between the upper surface 32a of the wheel supporting body 32 and the protruding portion 231 is stably maintained, so that the limitation of the inclination movement of the wheel portion 13 can be stably maintained as long as the lever mechanism 33 is not operated.

[Modification Example]

The suction tool 10 according to the present em-
bodiment includes the third connecting tube 23 as the tubular member constituting the connecting tube portion 12. However, the present invention is not limited to this, and the third connecting tube 23 may not be included in the suction tool 10. As described above, the second connecting tube 22, the wheel portion 13, and the wheel attaching portion 14 significantly contribute to the operability of the suction tool 10 in the use state, and the first connecting tube 21 is the tubular member that couples the second connecting tube 22 and the suction tool main body 11. Therefore, the third connecting tube 23 is not an essential component of the connecting tube portion 12.

[0102] The specific configuration of the wheel attaching portion 14 is not limited to the configuration constituted by the torsion spring members 41A and 41B, the attaching portion main body 42, the attachment shaft portion 43, and the shaft portion fastening member 44 explained in the present embodiment and may be a configuration by which the wheel portion 13 is attached to the lower portion of the second connecting tube 22 such that the wheel portion 13 can three-dimensionally incline. The attaching portion main body 42 of the wheel attaching portion 14 is integrally provided at the middle portion of the wheel supporting body 32. However, the attaching portion main body 42 may be provided separately from the wheel supporting body 32.

[0103] Further, in the present embodiment, the lever mechanism 33 is used as a component (switching unit) configured to switch the state of the suction tool 10 from the use state to the stored state. However, the present embodiment is not limited to this, and the switching unit may be a mechanical switching unit or a switching unit configured to operate by electrical control.

(Embodiment 2)

[0104] In the present embodiment, an upright type vacuum cleaner will be specifically explained as a vacuum cleaner to which the suction tool 10 explained in Embodiment 1 is applied.

[0105] As shown in Fig. 17, an upright type vacuum cleaner 50 according to the present embodiment includes the main body portion 51, a handle 52, a handle shaft 53, and the suction tool 10.

[0106] The main body portion 51 has a substantially columnar shape. A dust chamber is provided at an upper part of the main body portion 51, and a suction motor and the like, not shown, are incorporated in a lower part of the main body portion 51. The suction tool 10 is connected to the main body portion 51. The dust and the like suctioned through the suction tool 10 by the operation of the suction motor are accumulated in the dust chamber in the main body portion 51. A carrying grip 54 is provided at the upper part of the main body portion 51, and the user can grip the carrying grip 54 to carry the upright type vacuum cleaner 50.

[0107] The handle 52 is provided at the upper part of the main body portion 51 via the handle shaft 53. The handle 52 is a grip portion that is gripped by the user when in use. The handle 52 is formed in an oval ring shape having a size corresponding to an average palm size.

[0108] When using the upright type vacuum cleaner 50, the user first pulls out a power supply cord from the main body portion 51 and inserts a power supply plug of a tip end of the power supply cord into a power supply outlet. Then, the user operates a power supply switch to turn on the upright type vacuum cleaner 50. With this, the suction motor operates to generate suction force at the suction port 111 of the suction tool 10. Therefore, the dust on the floor surface is suctioned to be accumulated in the dust chamber in the main body portion 51. The user grips the handle 52 to cause the upright type vacuum cleaner 50 to move on the floor surface. Thus, the user can change a cleaned area of the floor surface.

[0109] In the present embodiment, the operability of the suction tool 10 is improved. Therefore, even in a case where the user tries to turn the upright type vacuum cleaner 50 in a small radius, the user can easily turn the suction tool 10 without largely twisting the handle 52. Therefore, the load on the wrist of the user can be reduced, and the operability can be further improved.

[0110] The specific components of the upright type vacuum cleaner 50 shown in Fig. 17, that is, the components, such as the main body portion 51 and the handle 52, are not especially limited, and various components known in the field of upright type vacuum cleaners can be suitably used.

(Embodiment 3)

[0111] Embodiment 2 has explained the upright type cleaner as the vacuum cleaner to which the suction tool 10 explained in Embodiment 1 is applied. Embodiment 3 will specifically explain a canister type vacuum cleaner as the vacuum cleaner.

[0112] A canister type vacuum cleaner 60 according to the present embodiment includes a cleaner main body 61, a suction hose 62, a hand operating portion 63, a suction extension pipe 64, and the suction tool 10.

[0113] The cleaner main body 61 includes an electric blower, a dust chamber, a power supply cord, and the like, and one end of the suction hose 62 is detachably connected to the cleaner main body 61. The hand operating portion 63 is provided at an upper part of the suction hose 62, and one end of the suction extension pipe 64 is detachably connected to a tip end of the hand operating portion 63. Further, the suction tool 10 is detachably attached to the other end of the suction extension pipe 64. A suction nozzle 65 is detachably attached to a lower part of the hand operating portion 63. The suction nozzle 65 can be attached to the tip end of the hand operating portion 63 instead of the suction extension pipe 64.

[0114] The suction motor and the dust chamber are provided inside the cleaner main body 61. The suction
force is generated by the operation of the suction motor. Thus, the suction force is generated at the suction port 111 of the suction tool 10 via the suction hose 62 and the suction extension pipe 64. The power supply cord is stored in the cleaner main body 61 so as to be able to be pulled out.

[0115] When using the canister type vacuum cleaner 60, the user first pulls out the power supply cord from the cleaner main body 61 and inserts the power supply plug of the tip end of the power supply cord into the power supply outlet. Then, the user operates the hand operating portion 63 to turn on the cleaner main body 61. With this, the suction motor operates to generate the suction force at the suction tool 10. Therefore, the dust on the floor surface is suctioned to be accumulated in the dust chamber in the cleaner main body 61 through the suction extension pipe 64 and the suction hose 62. The user grips the hand operating portion 63 to cause the suction tool 10 to move on the floor surface. Thus, the user can change the cleaned area of the floor surface. When changing the place to be cleaned, the user pulls the suction hose 62 to cause the cleaner main body 61 to move on the floor surface.

[0116] In the present embodiment, the operability of the suction tool 10 is improved. Therefore, even in a case where the user tries to turn the suction tool 10 in a small radius, the user can easily turn the suction tool 10 without largely moving the hand operating portion 63. Therefore, the load on the wrist of the user can be reduced, and the operability can be further improved.

[0117] A knob, not shown, is provided at the cleaner main body 61. With this, the user can lift and carry the cleaner main body 61. In a case where the user would like to clean not the floor surface but narrow spaces, such as a corner of a room and a space between pieces of furniture, the suction extension pipe 64 or the suction tool 10 is detached from the canister type vacuum cleaner 60, and the suction nozzle 65 is attached to the canister type vacuum cleaner 60. Thus, the user can clean those narrow spaces.

[0118] The specific components of the canister type vacuum cleaner 60 shown in Fig. 18, that is, the components, such as the cleaner main body 61, the suction hose 62, the hand operating portion 63, the suction extension pipe 64, and the suction nozzle 65 are not especially limited, and various components known in the field of canister type vacuum cleaners can be suitably used.

[0119] The present invention is not limited to the above embodiments. Various modifications may be made.

**Industrial Applicability**

[0120] The present invention can be suitably used in the field of vacuum cleaner suction tools and can also be used widely and suitably in the field of vacuum cleaners using the suction tools.

**Reference Signs List**

<table>
<thead>
<tr>
<th>Page</th>
<th>Reference Signs List</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>[0121]</td>
</tr>
<tr>
<td>5</td>
<td>10 vacuum cleaner suction tool</td>
</tr>
<tr>
<td>11</td>
<td>11 suction tool main body</td>
</tr>
<tr>
<td>12</td>
<td>12 connecting tube portion</td>
</tr>
<tr>
<td>13</td>
<td>13 wheel portion</td>
</tr>
<tr>
<td>14</td>
<td>14 wheel attaching portion</td>
</tr>
<tr>
<td>15</td>
<td>15 second connecting tube</td>
</tr>
<tr>
<td>20</td>
<td>20 first connecting tube</td>
</tr>
<tr>
<td>23</td>
<td>23 third connecting tube</td>
</tr>
<tr>
<td>31</td>
<td>31 wheel</td>
</tr>
<tr>
<td>32</td>
<td>32 wheel supporting body</td>
</tr>
<tr>
<td>15a</td>
<td>32a upper surface of wheel supporting body</td>
</tr>
<tr>
<td>33</td>
<td>33 lever mechanism</td>
</tr>
<tr>
<td>111</td>
<td>41A, 41B torsion spring member</td>
</tr>
<tr>
<td>22</td>
<td>111 suction port</td>
</tr>
<tr>
<td>23</td>
<td>222 engaged portion</td>
</tr>
<tr>
<td>23</td>
<td>231 protruding portion</td>
</tr>
<tr>
<td>33</td>
<td>232 engaged portion</td>
</tr>
<tr>
<td>33</td>
<td>331 engaging portion</td>
</tr>
<tr>
<td>33</td>
<td>332 engaging portion</td>
</tr>
<tr>
<td>Cb</td>
<td>41 center axis</td>
</tr>
<tr>
<td>F</td>
<td>S2 rotation axis</td>
</tr>
<tr>
<td>P0</td>
<td>S3 swinging axis</td>
</tr>
<tr>
<td>S1</td>
<td>00 rotary surface angle</td>
</tr>
<tr>
<td>S2</td>
<td>01 attachment axis angle</td>
</tr>
<tr>
<td>S3</td>
<td>02 rotation axis angle</td>
</tr>
</tbody>
</table>

**Claims**

1. A vacuum cleaner suction tool (10) comprising:

   a suction tool main body (11) including a lower surface on which a suction port (111) is formed;
   a connecting tube portion (12) connected to a rear portion of the suction tool main body (11);
   and
   a traveling wheel portion (13) provided at the connecting tube portion (12), wherein:

   the connecting tube portion (12) is constituted by at least

   a first connecting tube (21) including one end connected to an upper side of the rear portion of the suction tool main body (11) and
   a second connecting tube (22) coupled to the other end of the first connecting tube (21) so as to be rotatable in an axial direction thereof; and
the wheel portion (13) is constituted by at least

a pair of left and right wheels (21) and

a wheel supporting body (32) including

both ends that rotatably support the

wheels, respectively.

the vacuum cleaner suction tool (10) further

comprising a wheel attaching portion (14);

characterized by:

the wheel attaching portion (14) by

which the wheel supporting body (32)

is attached to a lower portion of the sec-

ond connecting tube (22) so as to in-

cline using a middle portion of the wheel

supporting body (32) as a fulcrum.

2. The vacuum cleaner suction tool (10) according to

claim 1, wherein the wheel attaching portion (14) is

attached to a position along a lower surface of the

second connecting tube (22) such that the wheel por-

tion (13) is rotatable about an attachment axis that

is an axis inclined to a front side along a front-rear

direction of the connecting tube portion (12).

3. The vacuum cleaner suction tool (10) according to

claim 2, wherein the wheel attaching portion (14) in-

cludes a torsion spring member (41A, 41B) config-

ured to bias the second connecting tube (22), having

been inclined in accordance with an inclination of

the wheel supporting body (32), toward a direction op-

posite to an inclination direction of the second con-

nec ting tube (22).

4. The vacuum cleaner suction tool (10) according to

claim 2 or 3, wherein an attachment axis angle

θ_1 that is an angle of the attachment axis (S1) relative

to a cleaned surface (F) is an acute angle.

5. The vacuum cleaner suction tool (10) according to

claim 4, wherein in a case where a surface at which

the second connecting tube (22) coupled to the first

connecting tube (21) rotates is referred to as a rotary

surface (P0), the first connecting tube (21) and the

second connecting tube (22) are coupled to each

other such that a rotary surface angle θ_0 that is an

angle of the rotary surface (P0) relative to the

cleaned surface (F) is an acute angle larger than the

attachment axis angle θ_1.

6. The vacuum cleaner suction tool (10) according to

any one of claims 1 to 5, wherein:

the third connecting tube (23) includes a pro-

truding portion (231) configured to rotate about

the swinging axis (S3) of the third connecting

tube (23) together with swinging of the third con-
nec ting tube (23); and

when the vacuum cleaner suction tool (10) is

stored, the inclination movement of the wheel

portion (13) is limited in such a manner that the

protruding portion (231) contacts an upper sur-

face (32a) of the wheel supporting body (32) by

the swinging of the third connecting tube (23).

7. The vacuum cleaner suction tool (10) according to

claim 6, wherein:

a rotation axis angle θ_2 that is an angle of the

rotation axis (S2) relative to the cleaned surface

(F) is within a range from 5° to 45°, and

the attachment axis angle θ_1 is within a range

from 5° to 45°.

8. The vacuum cleaner suction tool (10) according to

any one of claims 1 to 7, wherein:

the connecting tube portion (12) further includes

a third connecting tube (23) connected to a sec-

ond end of the second connecting tube (22) so as to swing in the front-rear direction; and

a position of the wheel attaching portion (14) at

the second connecting tube (22) is located in

front of a position of a swinging axis (S3) of the

third connecting tube (23).

9. The vacuum cleaner suction tool (10) according to

any one of claims 1 to 8, wherein a relative position

of the wheel portion (13) relative to the suction tool

main body (11) is changeable such that: when the

vacuum cleaner suction tool (10) is used, that is, when the vacuum cleaner suction tool (10) is attached to a vacuum cleaner to suction dust, a center axis of the vacuum cleaner is located on or behind the wheel portion (13); and when the vacuum cleaner suction tool (10) is stored, the center axis of the vac-

uum cleaner is located between the suction tool main body (11) and the wheel portion (13).

10. The vacuum cleaner suction tool (10) according to

claim 9, wherein the wheel portion (13) includes a

lever mechanism (33) configured to be operated to change a position of the wheel portion (13) relative

to the suction tool main body (11).

11. The vacuum cleaner suction tool (10) according to

claim 9 or 10, wherein:

the third connecting tube (23) includes a pro-

truding portion (231) configured to rotate about

the swinging axis (S3) of the third connecting

tube (23) together with swinging of the third con-
nec ting tube (23); and

when the vacuum cleaner suction tool (10) is

stored, the inclination movement of the wheel

portion (13) is limited in such a manner that the

protruding portion (231) contacts an upper sur-

face (32a) of the wheel supporting body (32) by

the swinging of the third connecting tube (23).
claim 10, wherein:

the lever mechanism (33) is provided with an engaging portion (331, 332) configured to contact the third connecting tube (23) by operating the lever mechanism (33); and a contact part, which contacts the engaging portion (331, 332), of the third connecting tube (23) is constituted as an engaged portion (222, 232) having a shape corresponding to the engaging portion (331, 332).

13. A vacuum cleaner comprising the vacuum cleaner suction tool (10) according to any one of claims 1 to 12.

Patentansprüche

1. Staubsauger-Ansauggerät (10), das umfasst:

- ein Ansauggerät-Hauptgehäuse (11) mit einer unteren Fläche, an der ein Ansauganschluss (111) ausgebildet ist;
- einen Verbindungsrohrteil (12), der mit einem hinteren Teil des Ansauggerät-Hauptgehäuses (11) verbunden ist; und
- einen Laufradteil (13), der an dem Verbindungsrohrteil (12) bereitgestellt wird, wobei:
  - der Verbindungsrohrteil (12) durch wenigstens ein erstes Verbindungsrohr (21), das ein Ende aufweist, das mit einer oberen Seite des hinteren Teils des Ansauggerät-Hauptgehäuses (11) verbunden ist, und ein zweites Verbindungsrohr (22) gebildet wird, das mit dem anderen Ende des ersten Verbindungsrohrs (21) gekoppelt ist, so dass es in einer axialen Richtung davon drehbar ist; und
  - der Radteil (13) durch wenigstens ein Paar von linken und rechten Rädern (21) und ein Radlagergehäuse (32) gebildet wird, das beide Enden aufweist, die die Räder jeweils drehbar lagern,

wobei das Staubsauger-Ansauggerät (10) des Weiteren einen Radbefestigungsteil (14) umfasst; gekennzeichnet durch:

den Radbefestigungsteil (14), durch
und der Befestigungssachsenwinkel $\theta_1$ in einem Bereich von 5° bis 45° liegt.

8. Staubsauger-Ansauggerät (10) nach einem der Ansprüche 1 bis 7, wobei:
   der Verbindungsrohrtteil (12) des Weiteren ein drittes Verbindungsrohr (23) aufweist, das mit einem zweiten Ende des zweiten Verbindungsrhrs (22) verbunden ist, so dass es in einer Richtung von vorn nach hinten schwingt; und
   sich eine Position des Radbefestigungssteils (14) an dem zweiten Verbindungsrhr (22) vor einer Position einer Schwingungssachse (S3) des dritten Verbindungsrhrs (23) befindet.

9. Staubsauger-Ansauggerät (10) nach einem der Ansprüche 1 bis 8, wobei:
   der Verbindungsrohrteil (12) des Weiteren ein drittes Verbindungsrohr (23) aufweist, das mit einem zweiten Ende des zweiten Verbindungsrhros (22) verbunden ist, so dass es in einer Richtung von vorn nach hinten schwingt; und
   sich eine Position des Radbefestigungssteils (14) an dem zweiten Verbindungsrhrohr (22) vor einer Position einer Schwingungssachse (S3) des dritten Verbindungsrhros (23) befindet.

10. Staubsauger-Ansauggerät (10) nach Anspruch 9, wobei:
   der Hebelmechanismus (33) mit einem Eingriffsteil (331, 332) bereitgestellt wird, der konfiguriert ist, um mit dem dritten Verbindungsrhrohr (23) durch Betätigen des Hebelmechanismus (33) in Kontakt zu kommen; und
   ein Kontaktteil, das mit dem Eingriffsteil (331, 332) des dritten Verbindungsrhros (23) in Kontakt kommt, als ein in Eingriff zu bringender Teil (222, 232) mit einer Form entsprechend dem Eingriffsteil (331, 332) gebildet wird.

11. Staubsauger, der das Staubsauger-Ansauggerät (10) nach einem der Ansprüche 1 bis 12 umfasst.

12. Staubsauger-Ansauggerät (10) nach Anspruch 10, wobei:

13. Staubsauger, der das Staubsauger-Ansauggerät (10) nach einem der Ansprüche 1 bis 12 umfasst.

Revendications

1. Ustensile d’aspiration pour aspirateur (10) comportant:
   un corps principal d’ustensile d’aspiration (11) comprenant une surface inférieure dans laquelle est formée une ouverture d’aspiration (111) ;
   une partie de tube de raccordement (12) connectée à une partie arrière du corps principal d’ustensile d’aspiration (11) ; et
   une partie de roues de déplacement (13) disposée au niveau de la partie de tube de raccordement (12), où :

   la partie de tube de raccordement (12) est constituée d’au moins

   un premier tube de raccordement (21) comprenant une extrémité connectée à un côté supérieur de la partie arrière du corps principal d’ustensile d’aspiration (11) et

   un second tube de raccordement (22) couplé à l’autre extrémité du premier tube de raccordement (21) de manière à pouvoir tourner dans sa direction axiale ; et

   la partie de roues (13) est constituée d’au moins

   une paire de roues gauche et droite (21) et

   un support de roues (32) comprenant deux extrémités qui respectivement supportent les roues,

   l’ustensile d’aspiration pour aspirateur (10) comprenant en outre une partie de fixation de roues (14) ;

   caractérisé par :
la partie de fixation de roues (14) par laquelle le support de roues (32) est attaché à une partie inférieure du second tube de raccordement (22) de manière à s’incliner en utilisant une partie centrale du support de roues (32) comme pivot.

2. Ustensile d’aspiration pour aspirateur (10) selon la revendication 1, où la partie de fixation de roues (14) est attachée en une position le long de la surface inférieure du second tube de raccordement (22) telle que la partie de roues (13) peut tourner autour d’un axe de fixation correspondant à un axe incliné vers un côté avant dans une direction avant-arrière de la partie de tube de raccordement (12).

3. Ustensile d’aspiration pour aspirateur (10) selon la revendication 2, où la partie de fixation de roues (14) inclut un organe de ressort de torsion (41 A, 41B) conçu pour pré-contraindre le second tube de raccordement (22), ayant été incliné conformément à une inclinaison du support de roues (32), dans une direction opposée à une direction d’inclinaison du second tube de raccordement (22).

4. Ustensile d’aspiration pour aspirateur (10) selon la revendication 2 ou 3, où un angle d’axe de fixation θ1 qui est un angle de l’axe de fixation (S1) par rapport à une surface nettoyée (F) est un angle aigu.

5. Ustensile d’aspiration pour aspirateur (10) selon la revendication 4, où si l’on se réfère à une surface, au niveau de laquelle le second tube de raccordement (22) couplé au premier tube de raccordement (21) est en rotation, comme étant une surface de rotation (P0), le premier tube de raccordement (21) et le second tube de raccordement (21) sont couplés de telle manière qu’un angle de surface de rotation θ0, qui est un angle de la surface de rotation (P0) par rapport à la surface nettoyée (F), est un angle aigu plus grand que l’angle d’axe de fixation θ1.

6. Ustensile d’aspiration pour aspirateur (10) selon l’une quelconque des revendications 2 à 5, où si l’on se réfère à un centre de rotation du second tube de raccordement (22) par rapport au premier tube de raccordement (21) comme étant un axe de rotation (S2), une direction de l’axe de rotation (S2) et une direction de l’axe de fixation (S1) se coupent.

7. Ustensile d’aspiration pour aspirateur (10) selon la revendication 6, où :

un angle d’axe de rotation θ2, qui est un angle de l’axe de rotation (S2) par rapport à la surface nettoyée (F), est compris entre 5° et 45°, et l’angle d’axe de fixation θ1 est compris entre 5° et 45°.

8. Ustensile d’aspiration pour aspirateur (10) selon l’une quelconque des revendications 1 à 7, où :

la partie de tube de raccordement (12) comprend en outre un troisième tube de raccordement (23) connecté à une seconde extrémité du second tube de raccordement (22) de manière à pivoter dans la direction avant-arrière ; et une position de la partie de fixation de roues (14) au niveau du second tube de raccordement (22) se situe en avant d’une position d’un axe de pivotement (S3) du troisième tube de raccordement (23).

9. Ustensile d’aspiration pour aspirateur (10) selon l’une quelconque des revendications 1 à 8, où une position relative de la partie de roues (13) par rapport au corps principal d’ustensile d’aspiration (11) est modifiable de telle manière que : lorsque l’ustensile d’aspiration pour aspirateur (10) est utilisé, c’est-à-dire lorsque l’ustensile d’aspiration pour aspirateur (10) est attaché à un aspirateur pour aspirer de la poussière, un axe central de l’aspirateur est situé sur ou derrière la partie de roues (13) ; et lorsque l’ustensile d’aspiration pour aspirateur (10) est rangé, l’axe central de l’aspirateur se situe entre le corps principal d’ustensile d’aspiration (11) et la partie de roues (13).

10. Ustensile d’aspiration pour aspirateur (10) selon la revendication 9, où la partie de roues (13) comprend un mécanisme de levier (33) conçu pour être actionné pour changer une position de la partie de roues (13) par rapport au corps principal d’ustensile d’aspiration (11).

11. Ustensile d’aspiration pour aspirateur (10) selon l’une quelconque des revendications 9 ou 10, où :

le troisième tube de raccordement (23) comprend une partie faisant saillie (231) conçue pour tourner autour de l’axe de pivotement (S3) du troisième tube de raccordement (23) avec le pivotement du troisième tube de raccordement (23) ;

et lorsque l’ustensile d’aspiration pour aspirateur (10) est rangé, le mouvement d’inclinaison de la partie de roues (13) est limité de telle manière que la partie faisant saillie (231) entre en contact avec une surface supérieure (32a) du support de roues (32) en raison du pivotement du troisième tube de raccordement (23).

12. Ustensile d’aspiration pour aspirateur (10) selon la revendication 10, où le mécanisme de levier (33) est
pourvu d’une partie d’engagement (331, 332) conçue pour entrer en contact avec le troisième tube de raccordement (23) par l’actionnement du mécanisme de levier (33) ; et 
une partie de contact du troisième tube de raccordement (23), qui entre en contact avec la partie d’engagement (331, 332), est formée comme une partie engagée (222, 232) ayant une forme correspondant à la partie d’engagement (331, 332)

13. Aspirateur comprenant l’ustensile d’aspiration pour aspirateur (10) selon l’une quelconque des revendications 1 à 12.
Fig. 2
Fig. 5
Fig. 6
Fig. 9
Fig. 14A

Fig. 14B
Fig. 18
REFERENCES CITED IN THE DESCRIPTION

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