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ELECTRIC CLEANER

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BACKGROUND OF THE INVENTION

(i) Field of the Invention

The present invention relates to an electric cleaner which comprises an electric cleaner main body, a suction hose, a hand handle, a connection tube and a suction unit, particularly to an electric cleaner and a suction assembly in which a user can expand/contract and fix a connection tube with a simple operation without assuming a forced posture.

10 (ii) Description of the Related Art

The present generally spread electric cleaner is of a canister type, which comprises an electric cleaner main body provided with a blower for sucking in dust to a dust collecting chamber, a flexible suction hose having one end attached to the electric cleaner main body and connected to the blower, a hand handle attached to the other end of the suction hose and connected to the blower, a connection tube attached to the hand handle and connected to the suction hose, and a suction unit attached to the connection tube and connected to the connection tube.

For the canister type electric cleaner, by holding the hand handle in hand to operate the suction unit via the connection tube, the user can operate the cleaner on a floor surface with a standing posture, and can draw around the electric cleaner main body via the suction hose to

comfortably perform cleaning in a wide range.

In this conventional art, since the electric cleaner main body is constituted of a plurality of components of miscellaneous shapes, various storage methods
5 have heretofore been proposed.

As the present mainstream method, a method of storing the entire cleaner in a vertical posture without being disconnected is general. Specifically, the method comprises first raising a main body so that a back surface
10 part abuts on the floor surface, further disconnecting the expandable/contractible connection tube to reduce its length, and attaching the connection tube to a bottom surface side of the electric cleaner main body in the vertical posture in which the suction unit is disposed
15 downward and the hand handle is disposed upward. This attaching method comprises inserting and attaching a protrusion disposed on the end of the connection tube on the side of the suction unit into a recessed portion disposed in the tip end of the electric cleaner main body.

Moreover, the connection tube employed in these
20 conventional examples is constituted of two tube bodies of outer and inner tubes, and the engaging recessed portion formed along the longitudinal direction of the inner tube is structured to be fixed via a stopper disposed on the
25 outer tube in an arbitrary position.

This conventional example is described, for example, in the publications of Japanese Patent Application Laid-Open Nos. 191781/1996 and 56648/1997.

According to the above-described conventional electric cleaner, since the cleaner can be stored in the vertical posture without disassembling a plurality of components, it can readily be used when the user wants to
5 use it, and installation properties can be enhanced.

However, problems are as follows:

(1) First, the operation of raising the electric cleaner main body must be performed in a stooped or squatted posture (it is not recommended to raise the body
10 via the suction hose).

(2) The conventional connection tube can be expanded/contracted by sliding two tubes different in diameter, but to perform the expansion/contraction, by operating a lock mechanism, the length has to be adjusted
15 with both hands. Moreover, during use, the length of the connection tube has to be likewise adjusted with both hands.

(3) Subsequently, the electric cleaner main body of the vertical posture has to be pressed to attach the
20 connection tube to the bottom surface side of the electric cleaner main body in the stooped or squatted posture.

(4) The transport with the vertical storage posture is inhibited, and the electric cleaner main body and the connection tube have to be separated, disassembled,
25 and held in the stooped or squatted posture.

As described above, for the conventional electric cleaner, the stooped or squatted posture has to be assumed during storage or transport, and the user is forced to

assume an unnatural posture. By solving these problems, the electric cleaner is expected to be easily used.

SUMMARY OF THE INVENTION

An object of the present invention is to provide
5 an electric cleaner and a suction assembly in which the length of a connection tube can be adjusted with a simple operation, and the length can be fixed.

Moreover, another object of the present invention is to provide an electric cleaner and a connection body in
10 which a connection tube is fixed to an electric cleaner main body with a simple operation and the transport with a vertical storage posture is facilitated.

According to a first aspect of the present invention, there is provided an electric cleaner, which
15 comprises an electric cleaner main body, a suction hose, a hand handle, a connection tube, and a suction unit for sucking dust. The dust sucked via the suction unit is passed through a ventilating path formed inside the connection tube, the hand handle and the suction hose and introduced to the electric cleaner main body. The connection
20 tube is constituted of a first tube body having one end detachably connected to the hand handle, and a second tube body having one end slidably connected to the other end of the first tube body and having the other end connected to
25 the suction unit. The first tube body comprises fixing means for fixing the sliding of the second tube body, and releasing means for releasing obstruction of the sliding of

the fixing means to allow the sliding operation, and the hand handle comprises a switch for operating the releasing means.

According to a second aspect of the present invention, there is provided an electric cleaner, which comprises an electric cleaner main body provided with a blower for sucking dust to a dust collecting chamber, a connection body detachably attached to a hose attachment part of the electric cleaner main body, a flexible suction hose having one end attached to the connection body and connected to the blower, a hand handle attached to the other end of the suction hose and connected to the blower, a connection tube attached to the hand handle and connected to the suction hose, and a suction unit attached to the connection tube and connected to the connection tube. The dust sucked in via the suction unit is passed through a ventilating path formed inside the connection tube, the hand handle and the suction hose and introduced to the electric cleaner main body. The connection tube is constituted of a first tube body having one end detachably connected to the hand handle, and a second tube body having one end slidably connected to the other end of the first tube body and the other end connected to the suction unit. The first tube body comprises fixing means for fixing the sliding of the second tube body, and releasing means for releasing the stop of the sliding of the fixing means to realize the sliding operation, and the hand handle comprises a switch for operating the releasing means. The

electric cleaner main body comprises a plurality of moving wheels. The moving wheel comprises a pair of moving wheels disposed on the lower rear surface of the electric cleaner main body so that an outer peripheral part of the wheel
5 abutting on a running surface is extended downward and rearward. The tip end of the electric cleaner main body is provided with a hose attachment part to which the connection body is detachably attached. Furthermore, the connection body is provided with connecting means for detachably
10 connecting the connection tube over to the upper surface side of the electric cleaner main body.

According to the cleaner of the present invention, the length of the connection tube can be adjusted with a simple operation in the vicinity of the
15 hand handle, and the length can be fixed. Moreover, there is provided an electric cleaner in which the connection tube is fixed to the electric cleaner main body with a simple operation, and the transport with the vertical storage posture is facilitated.

20 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an appearance view showing an electric cleaner storage posture of a first embodiment of an electric cleaner according to the present invention.

Fig. 2 is a perspective view of a usual cleaning
25 state showing the first embodiment of the electric cleaner according to the present invention.

Fig. 3 is a rearward perspective view of a hand

handle showing the first embodiment of the electric cleaner according to the present invention.

Figs. 4A to 4D are appearance views of the hand handle showing the first embodiment of the electric cleaner
5 according to the present invention.

Fig. 5 is a component developed view of a first tube body showing the first embodiment of the electric cleaner according to the present invention.

Fig. 6 is a sectional view of the hand handle
10 showing the first embodiment of the electric cleaner according to the present invention.

Fig. 7 is a component developed view of a second tube body showing the first embodiment of the electric cleaner according to the present invention.

15 Fig. 8 is a detailed view of the right-side surface view showing the first embodiment of the electric cleaner according to the present invention.

Fig. 9 is a component developed view of a connection tube showing the first embodiment of the electric
20 cleaner according to the present invention.

Fig. 10 is a longitudinal sectional view of a contracted connection tube showing the first embodiment of the electric cleaner according to the present invention.

Figs. 11A to 11C are explanatory views of operation for changing a cleaning posture to a storage posture,
25 showing the first embodiment of the electric cleaner according to the present invention.

Figs. 12A to 12C schematically show operating

mechanisms of connection tube expansion/contraction switch mechanism of the hand handle and connection tube expansion/contraction fixing mechanism of the connection tube, showing another embodiment of the electric cleaner according to
5 the present invention.

Fig. 13 is a partial sectional view of a second tube body showing another embodiment of the electric cleaner according to the present invention.

Figs. 14A to 14D schematically show a fixing
10 structure in the connection tube expansion/contraction fixing mechanism showing another embodiment of the electric cleaner according to the present invention.

Figs. 15A and 15B schematically show the expansion/contraction structure of the connection tube
15 showing another embodiment of the electric cleaner according to the present invention.

Figs. 16A to 16C show a structure for attaching a suction assembly to the electric cleaner main body of another embodiment of the electric cleaner according to the
20 present invention.

Fig. 17 is an appearance view showing the electric cleaner storage posture of the first embodiment of the electric cleaner according to the present invention.

Fig. 18 is a perspective view of the usual cleaning state showing the first embodiment of the electric
25 cleaner according to the present invention.

Fig. 19 is an exploded perspective view of the connected state of a sub-handle and a suction hose showing

the first embodiment of the electric cleaner according to the present invention.

Fig. 20 is an exploded perspective view of another application example of the sub-handle showing the
5 first embodiment of the electric cleaner according to the present invention.

Fig. 21 is an explanatory view of another embodiment of connection tube position holding means showing another embodiment of the electric cleaner according to the
10 present invention.

Figs. 22A and 22B are a partial perspective view and a partial sectional view showing the structure for attaching the connection tube to the sub-handle showing the first embodiment of the electric cleaner according to the
15 present invention.

Fig. 23 is a side view of Fig. 13 showing the first embodiment of the electric cleaner according to the present invention.

Figs. 24A and 24B are explanatory views of the
20 connection tube position holding means showing the first embodiment of the electric cleaner according to the present invention.

Figs. 25A to 25C are explanatory views of a state for moving the electric cleaner having a vertical storage
25 posture showing the first embodiment of the electric cleaner according to the present invention.

Fig. 26 is a partial perspective view of the attached state of a connection tube attaching mechanism and

an attachment part showing another embodiment of the electric cleaner according to the present invention.

Fig. 27 is a partial vertical sectional view showing another embodiment of the electric cleaner according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described hereinafter with reference to Figs. 1 to 27.

10 (First Embodiment)

Figs. 1 to 10 show a first embodiment according to the present invention: Figs. 1 and 2 are appearance perspective views of an electric cleaner; Figs. 3 to 8 are explanatory views of a hand handle; Figs. 9 and 10 are explanatory view of a connection tube; and Figs. 11A to 11C are explanatory views of a use state.

First, the schematic structure of the electric cleaner according to the first embodiment will be described with reference to Figs. 1 and 2. Fig. 1 is an appearance view showing the storage posture of the electric cleaner, and Fig. 2 is a perspective view of a usual cleaning state.

In Figs. 1, 2, an electric cleaner generically denoted with numeral 1 comprises an electric cleaner main body 100 provided with a mechanism (not shown) for sucking dust into a dust collecting chamber, such as a blower; a flexible suction hose 200 having one end attached to the electric cleaner main body 100 and connected to the blower;

a hand handle 300 attached to the other end of the suction hose 200 and connected to the blower; a connection tube 400 attached to the hand handle 300 and connected to the suction hose 200; and a suction unit 500 attached to the connection tube 400 and connected to the connection tube 400.

In this embodiment, a user having the hand handle 300 still in a standing posture attaches a first fixing means 501 disposed on the suction unit 500 to a first fixing means 101 disposed on an upper surface rear part of the electric cleaner main body 100, presses downward the hand handle 300 to change the electric cleaner main body 100 from a usual running posture shown in Fig. 2 to a vertical storage posture with a back surface abutting on a surface to be cleaned as shown in Fig. 1, operates a trigger switch 301 of the connection tube 400 disposed on the hand handle 300 in this vertical storage posture to release the fixed state of a connection tube expansion/contraction mechanism 402 of the connection tube 400 and reduce the length of the connection tube 400, and attaches second fixing means 401 disposed on the end part of the connection tube 400 to second fixing means 108 disposed on the electric cleaner main body 100, so that the connection tube expansion/contraction mechanism 402 can be placed again into the fixed state via the trigger switch 301.

Specifically, according to the first embodiment, the user, in the usual standing posture state, has the hand handle 300 in hand to move the suction unit 500 via the

connection tube 400, connects the first fixing means 501, 101 of the suction unit 500 and the electric cleaner main body 100, and presses downward the hand handle so that the electric cleaner main body 100 can be changed from the running posture to the vertical storage posture. Therefore, the user can change the electric cleaner main body 100 to the vertical storage posture, remaining in his standing posture without taking a stooped or squatted posture.

Moreover, in the first embodiment, since the hand handle 300 is provided with the trigger switch 301 for fixing the length of the connection tube 400, the length adjustment of the connection tube 400, the release of the fixed connection tube expansion/contraction mechanism 402, and the setting of another fixed state can be performed with the operation in the vicinity of the hand handle 300 without largely changing the posture from the standing posture. Thereby, the operation accompanied by the expansion/contraction of the connection tube 400 can be performed with a single-hand operation without using both hands. Additionally, since one end of the connection tube 400 is attached to the heavy suction unit 500, by releasing the trigger switch 301 and moving the hand handle 300 upward, the connection tube 400 can be extended by gravity exerted on the suction unit 500. Conversely, by moving the hand handle 300 downward, the suction unit 500 is pressed against the surface to be cleaned, and the connection tube 400 can be shortened. In this manner, in the embodiment,

by operating the trigger switch 301 to vertically move the hand handle 300, the length of the connection tube 400 can easily be adjusted. Therefore, since the length of the connection tube 400 can be adjusted by moving the hand with
5 the hand handle 300 held therein in the vertical direction, the expansion/contraction and fixing of the connection tube 400 can be performed without largely changing the user's standing posture.

Moreover, height H1 of the cleaner 1 during the
10 vertical storage can be shortened by shortening the connection tube 400 and taking the storage posture. Additionally, in the embodiment, the height H1 during the storage is set to about 1150 mm.

Furthermore, since the connection tube 400 can be
15 fixed to the electric cleaner main body 100 by fixing the length of the connection tube 400, the number of components and the operations can be reduced.

Furthermore, since the connection tube 400 in the vertical storage posture is fixed/supported on the upper-
20 surface side of the electric cleaner main body 100 in the running state, the electric cleaner main body 100 can be moved via running means 102. Additionally, since the hand handle 300 is fixed to the upper end part of the vertical storage posture, by holding the hand handle 300 in this
25 high position, the electric cleaner 1 fixed in the vertical storage posture can be moved by using the running means 102 via this handle.

As described above, the electric cleaner 1 of

this embodiment takes a posture superior in storage property with a simple operation without forcing the user to take an unnatural posture, and is superior in conveying property.

5 The general structure of the embodiment will further be described hereinafter with reference to Figs. 1 and 2.

 In Fig. 2, the electric cleaner main body 100 is provided with a dust collecting chamber having therein a
10 disposable dust collecting bag, a pair of large wheels 103 and one universal wheel 104 constitute the moving means, and the main body can be moved via the suction hose 200. In the usual running posture, the large wheels 103 and universal wheel 104 take a posture which is longitudinal
15 back and forth on the surface to be cleaned. An attachment fitting 105 as the first fixing means 101 is rotatably disposed on the upper-surface rear part of the electric cleaner main body 100. As shown in Fig. 1, when the first fixing means 501 of the suction unit 500 is attached to the
20 attachment fitting 105, and pressed downward from above, the front part, that is, the universal wheel 104 is raised centering on a rotation shaft B1 of the large wheels 103 and rotated as shown by an arrow Z1 so that the running posture can change to the vertical storage posture.

25 In this case, for the electric cleaner main body 100, since gravity center position G1 of the electric cleaner main body 100 is disposed toward the rotating shaft B1 of the large wheels 103 between the universal wheel 104

and the large wheels 103 by considering the drawing/running property via the suction hose 200, the running posture can easily be changed to the vertical storage posture by the operation of pressing downward from above. Moreover, an
5 attachment recessed portion 109 as the second fixing means 108 is disposed on the front surface upper part of the electric cleaner main body 100.

Moreover, to control the operation of the electric cleaner main body 100, an operation signal trans-
10 mitted from the hand handle 300 is received by an infrared ray receiving part 107 in an operation display part 106 disposed on the upper surface of the electric cleaner main body 100 to perform the operation. Additionally, the operation of the electric cleaner 1 may be controlled by
15 disposing an electric conductive wire along the suction hose 200 from the hand handle 300, and transmitting a signal for controlling the operation of the electric cleaner 1, for example, a signal for controlling the rotation speed of a motor disposed on the blower via the
20 conductive wire.

Furthermore, the electric cleaner main body 100 is provided with two rising/setting handles 136, 137 in its upper surface center which is positioned upward in the running posture and in the front surface lower part which
25 is positioned upward in the vertical storage posture.

The suction hose 200 is provided with a function as a conveyance passage for conveying dust to the electric cleaner main body 100, and a function as moving/drawing

means for moving the electric cleaner main body 100. In the embodiment, a bellows-shaped flexible hose is employed.

The hand handle 300 is provided with a function of connecting the suction hose 200 and the connection tube 400, a function of controlling the operation of the electric cleaner main body 100 and moving the electric cleaner main body 100, a function of operating the movement of the suction unit 500, and a function of fixing or releasing the expansion/contraction of the connection tube 400.

The hand handle 300 is detachably connected to the suction hose 200, and further detachably attached to the connection tube 400, so that the suction hose 200 and the connection tube 400 are interconnected to form the dust conveyance path.

The hand handle 300 is further provided with a handle part 302 whose longitudinal direction A2 substantially agrees with the connection direction of the suction hose 200 and the connection tube 400 with an angle (α in Fig. 2) of 90 degrees to 160 degrees, preferably 100 degrees to about 120 degrees with a central axis A1 in an upper end of an extension line of the longitudinal direction of the connection tube 400, that is, the central axis A1 of the connection tube 400. The electric cleaner main body 100 can be moved by the handle part 302 via the suction hose 200, and further the movement of the suction unit 500 can be operated.

Particularly, a twisting operation, that is,

rotation P1 centering on the central axis A1 can easily be performed by the handle part 302. Additionally, in the twisting operation, since the suction hose 200 is rotatably attached to the hand handle 300 so that the suction hose is always positioned below the handle part 302 by gravity, the suction hose 200 is not lifted up by the twisting operation of the handle part 302, so that the burden on a wrist can be reduced. In this case, since the handle part 302 is disposed upward, the suction hose 200 disposed below fails to obstruct the twisting operation. Thereby, as described later, the suction unit 500 can be rotated by 90 degrees or more on the floor surface (surface to be cleaned) as described later (P2 in Fig. 2).

Moreover, the rotating operation of the suction unit 500 can relatively easily be performed by the above-described shape of the handle part 302. This is because by providing the handle part 302 with the angle (α in Fig. 2), a rotation moment is generated when the handle part 302 is twisted.

Furthermore, an operation part 303 for operating the electric cleaner main body 100 is disposed in the vicinity of the handle part 302. The operation part 303 is provided with an infrared ray transmission part 304, and the infrared ray transmission part 304 transmits an operation signal to the infrared ray receiving part 107 disposed on the electric cleaner main body 100, so that the power supply of the electric cleaner main body 100 can be subjected to ON/OFF control and other various controls.

Moreover, the trigger switch 301 for fixing or releasing the expansion/contraction of the connection tube 400 is disposed in the vicinity of the handle part 302. In this embodiment, the trigger switch 301 is disposed on the
5 lower part in the vicinity of the root of the handle part 302, so that when the handle part 302 is held, the part can be operated with an index finger as if the trigger of a gun is pulled. By this mechanism, the user can perform the operation of fixing and releasing the expansion/contraction
10 of the connection tube 400 with one hand while holding the handle 302.

By connecting the hand handle 300 and the suction unit 500, and further by fixing the hand handle 300 and the suction unit 500 in predetermined positions, the connection
15 tube 400 is provided with a transmission function of converting the movement (movement and rotation) of the hand handle 300 to the movement (movement and rotation) of the suction unit 500. In this embodiment, by combining two tube bodies different in size, that is, first and second
20 tube bodies 420 and 440, the connection tube 400 is telescopically constituted so that it can be fixed with the predetermined length. The hand handle 300 is detachably attached to one end of the connection tube 400, and the suction unit 500 is detachably attached to the other end
25 thereof.

Additionally, in this embodiment, the fixing or releasing of expansion/contraction of this connection tube 400 can be operated with the trigger switch 301 disposed on

the hand handle 300. The connection tube expansion/
contraction mechanism 402 is provided with a second lock
switch 403 so that even when the connection tube 400 is
disconnected from the hand handle 300, it can expand/
5 contract.

Moreover, in this embodiment, an attachment
protrusion 410 as the second fixing means 401 is disposed
on the end of the tube body whose length with the suction
unit 500 changes when it expands/contracts, and the attach-
10 ment protrusion 410 is provided with an engagement part 411
protruded in the expansion/contraction direction. By this
structure, when the connection tube 400 is contracted, the
engagement part 411 can necessarily be engaged in the
attachment recessed portion 109 as the second fixing means
15 108 disposed on the electric cleaner main body 100, so that
the operation property can be enhanced.

The suction unit 500 is constituted of a suction
main body 1000 provided with a suction port for sucking
dust in a bottom surface; and a universal connecting
20 section 1500 which connects the suction main body 1000 to
the connection tube 400, operates so that the bottom
surface of the suction main body 1000 constantly contacts
on the surface to be cleaned (floor surface) with respect
to the movement of the hand handle 300 transmitted via the
25 connection tube 400, and connects so that air current
including the dust taken from the suction main body 1000 is
guided to the connection tube 400.

The suction main body 1000 substantially has a

flat rectangular shape, and the universal connecting section 1500 is rotatably attached to the upper surface center of the body.

The universal connecting section 1500 is
5 constituted of tubular first and second arm parts 1501 and 1502, one end of the first arm part 1501 is rotatably attached via a first rotating part 1503 in Y direction which is an elevation with respect to the suction main body 1000, and one end of the second arm part 1502 is disposed
10 on the other end of the first arm part 1501 via a second rotating part 1504 and rotatably attached in X direction to rotate the suction main body 1000 in parallel with the surface to be cleaned. Additionally, the universal connecting section 1500 connects so that it can rotate in
15 height direction Y and horizontal direction X of the hand handle 300 centering on the suction unit 500, and can additionally transmit rotation P1 of the twisting operation of the hand handle 300 to rotation P2 of the suction main body 1000 with respect to the surface to be cleaned as it
20 is.

Specifically, according to the embodiment, in the posture in which the handle part 302 of the hand handle 300 is straightened, as shown by a solid line of Fig. 2 a first drive mode is obtained in which the depth direction of the
25 suction main body 1000 coincides with the back and forth direction of the cleaning so that a wide cleaning can be realized in V1 direction. In an operation of twisting the handle part 302 by 90 degrees, as shown by a dotted line of

Fig. 2, a second drive mode is obtained in which the longitudinal direction of the suction main body 1000 coincides with the cleaning back and forth direction so that a narrow cleaning can be realized in V2 direction.

5 Moreover, since the first rotating part 1503 is disposed above a gravity center position G2 of the suction main body 1000, and even when the suction unit 500 is raised from the floor surface via the connection tube 400, the bottom surface part of the suction main body 1000 is
10 set to be substantially parallel with the floor surface.

 Furthermore, in the embodiment, a projected part 1012 is disposed on the rear middle of the suction main body 1000, and the projected part 1012 is provided with a large rear roller 1007 (see Fig. 11A) with both sides
15 supported by a rotation shaft. The rear roller 1007 receives a load from the hand handle 300 when the surface to be cleaned is cleaned, so that the running and rotating properties of the suction unit 500 during cleaning are enhanced. Furthermore, the rear roller 1007 also serves as
20 the first fixing means 501, and the rear roller 1007 is engaged with the attachment fitting 105 as the first fixing means 101 of the electric cleaner main body 100. In this case, as described above, in the embodiment, even when the rear roller 1007 is largely projected backward in the
25 middle of the suction main body 1000, and the suction unit 500 is lifted, the suction main body 1000 maintains its horizontal state. The position of the rear roller 1007 is easily seen from the user, the engaging with the attachment

fitting 105 is facilitated and the operation property can be enhanced.

In this case, according to the electric cleaner 1 of the embodiment, when there are provided a function of
5 controlling the operation of the electric cleaner main body 100, moving the electric cleaner main body 100 and controlling the movement of the suction unit 500 via the hand handle 300 and a function of fixing or releasing the expansion/contraction of the connection tube 400, the user
10 holding the hand handle 300 in standing posture can perform the operation control, cleaning and storage without largely changing the posture.

Particularly, in this embodiment, the electric cleaner main body 100 is changed from the running posture
15 to the vertical storage posture with the control (operation) of the hand handle 300 via the first fixing means 501, 101 disposed on the electric cleaner main body 100 and the suction unit 500 without largely changing the user's posture, and a suction assembly 700 constituted of
20 the suction unit 500, shortened and stored connection tube 400, and hand handle 300 in the vertical posture can stably be supported and attached onto the electric cleaner main body 100 of the vertical storage posture by the second fixing means 401, 108 of the electric cleaner main body 100
25 and the connection tube 400.

Additionally, in the vertical storage posture, since the hand handle 300 is disposed and held on the uppermost part, the cleaner can be moved via the hand

handle 300 even in the vertical storage posture.

The concrete structure of the hand handle will next be described in more detail with reference to Figs. 3 to 8. Fig. 3 is a rear perspective view of the hand
5 handle. Fig. 4A is a front perspective view showing the appearance of the hand handle, Fig. 4B is a plan view, Fig. 4C is a front view, and Fig. 4D is a right side view. Fig. 5 is a component developed view of the first tube body of the hand handle. Fig. 6 is a sectional view of the hand
10 handle. Fig. 7 is a component developed view of the second tube body. Fig. 8 is a detailed view of the right side view of the hand handle.

First, in Fig. 3, the hand handle 300 is constituted of a first tube body 310 detachably attached to the
15 connection tube 400, and a second tube body 350 to which the suction hose 200 is detachably attached. Additionally, the first tube body 310 and the second tube body 350 are rotatably attached so that the suction hose 200 can rotate around the central axis A1 of the connection tube 400.
20 Therefore, for example, by twisting the handle part 302 of the hand handle 300 in the direction of arrow M1 (clockwise), the second tube body 350 rotates in the direction of arrow M2 (counterclockwise) with the twisting operation, so that the suction hose 200 is constantly positioned
25 downward.

Moreover, as shown in Figs. 4A to 4D, the operation part 303, and a lock switch 371 of the connection tube fixing mechanism 370 for realizing attachment/

detachment with the connection tube 400 are disposed on the upper surface of the first tube body 310. The operation part 303 is provided with the infrared ray transmission part 304, and other various operation switches.

5 The first tube body 310 is provided with a conveyance path 311 so that its longitudinal direction substantially coincides with the extension line of the central axis A1 of the connection tube 400, a connection tube connecting part 305 is formed on one end of the first
10 tube 310 provided with one end of the conveyance path 311, and the connection tube connecting part 305 is engaged and connected to the end of the connection tube 400.

 The handle part 302 is integrally disposed on the other end of the first tube body 310. The handle part 302
15 is formed so that the longitudinal direction of the first tube body 310 deviates from the extension line of the central axis A1 of the connection tube 400 to form a space S1 above the other end (upper end) of the conveyance path 311, and the tip end is bent, so that the bent end is
20 positioned on the extension line of the central axis A1 of the connection tube 400 and has a predetermined angle α with the central axis A1. Thereby, a hold part 302a to be manually gripped is bent and formed on the end of the handle part 302.

25 In Figs. 5 and 6, the first tube body 310 is provided with the conveyance path 311 formed below, and a component arrangement part 312 formed upward and inward. One end of the conveyance path 311 is connected to the

connection tube connecting part 305, the other end is connected to the second tube body 350, and the second tube body 350 is rotatably attached to the other end, so that the dust taken together with the air current via the suction unit 500 is conveyed. Specifically, the second tube body 350 is positioned on the extension line of the central axis A1 of the connection tube 400 via the conveyance path 311, and the suction hose 200 is rotatably attached centering on the extension line of the central axis A1.

Moreover, as shown in Fig. 5, the first tube body 310 is constituted of a lower case 313 as a resin molded material constituting the lower part, and an upper case 314 as a resin molded material constituting the upper part. The conveyance path 311 is disposed in the lower case 313, the component arrangement part 312 is disposed toward the tip end of the handle part 302 from the connection tube connecting part 305, and the lower case 313 and the upper case 314 constitute the lower and upper parts of the connection tube connecting part 305. Additionally, a rib (not shown) is formed inside the component arrangement part 312 to provide the first tube body 310 with strength and to fix inner mounted components, and the rib is provided with an operation substrate 315, a battery storage part 316 for housing a battery 317, a connection tube expansion/contraction switch mechanism 380, and the connection tube fixing mechanism 370 of the connection tube 400. Moreover, in the embodiment, since the connection tube expansion/

contraction switch mechanism 380 is disposed before the operation substrate 315, and the trigger switch 301 is disposed behind the operation substrate 315, operation peripheral components can be collected around the operation
5 part 303, and the inner mounting efficiency is enhanced. Additionally, numeral 306 denotes a battery lid detachably attached to the upper case 314 to attach the battery 317 to the battery storage part 316.

Moreover, for the lock switch 371 of the connec-
10 tion tube fixing mechanism 370, the center of the longitudinal direction is rotatably supported, a switch part 372 exposed from an opening 319 disposed in the upper case 314 is formed on one end, and a fixing click 373 is formed on the other end.

15 Additionally, the fixing click 373 is always projected into the conveyance path 311 via an opening formed in the lower case 313 by a spring 374 to act so that the fixed state with the connection tube 400 is maintained.

A control circuit, a switch, a light emitting
20 diode, and the like are mounted on the operation substrate 315, and power is supplied to the operation substrate 315 from the battery 317 stored in the battery storage part 316. Moreover, an operation switch for operating the switch, and the infrared ray transmission part 304 are
25 disposed on the upper surface of the upper case 314. Additionally, in the embodiment, since the attachment position of the operation substrate 315 is specified by the rib, the positional relation of the operation switch, and

the like disposed on the upper case 314 and the operation substrate 315 is determined. Thereby, through the operation by the operation switch, a light signal for remotely operating the inner circuit of the electric cleaner main body 100 is transmitted to the infrared ray receiving part 107 of the electric cleaner main body 100 via the infrared ray transmission part 304 from the light emitting diode using ceiling reflection, and the like.

Moreover, the battery storage part 306 is disposed on the tip end of the handle part 302. Therefore, the dead space of the handle part 302 can effectively be utilized, and the battery storage part 316 can be disposed in the vicinity of the operation substrate 315 so that wire connection can be shortened.

Furthermore, the connection tube expansion/contraction switch mechanism 380 fixes the length of the connection tube 400 to the fixed length, or releases the fixing as described above. In the embodiment, a link mechanism is utilized to perform the remote control of the connection tube expansion/contraction mechanism 402 positioned apart from the hand handle 300.

Specifically, in the embodiment, the connection tube expansion/contraction switch mechanism 380 is constituted of the trigger switch 301 disposed in the vicinity of the root of the handle part 302 of the lower case 313, a connection plate 381 disposed between the trigger switch 301 and the connection tube 400, a spring 382 attached to the connection plate 381, a first

connection rod 383 for connecting the trigger switch 301 and the connection plate 381, and a second connection rod 384 with one end attached to the connection plate 381 and the other end supported by connection tube connecting part
5 305 with the connection tube 400.

In the embodiment, a switch attachment hole 385 is formed in the vicinity of the root of the handle part 302 of the lower case 313, and the trigger switch 301 is slidably attached to the switch attachment hole 385 in the
10 longitudinal direction of the connection tube 400. The trigger switch 301 is constituted of an inner plate part 386 attached inside the lower case 303, and a switch plate 387 attached outside the lower case 303 and connected to the inner plate part 386 to surround (hold) the switch
15 attachment hole 385.

The connection plate 381 is rotatably attached to a screw seat 318, to which the upper and lower cases 314, 313 are attached, via a screw (not shown) for attaching both cases. The connection plate 381 is provided on both
20 sides with connection rod attachment parts 381a, 381b to which the first and second connection rods 383, 384 are attached, respectively. Furthermore, one end of the first connection rod 383 is disposed on one connection rod attachment part 381a, and the other end of the first
25 connection rod 383 is attached to the connection rod attachment part 386a disposed on the inner plate part 386. Moreover, one end of the second connection rod 384 is attached to the other connection rod attachment part 381b

of the connection plate 381, and the other end of the second connection rod 384 is exposed to the connection tube connecting part 305. Additionally, the spring 382 is attached between one connection rod attachment part 381a of
5 the connection plate 381 and the lower case 313, a force of pulling the trigger switch 301 (force of fixing the connection tube expansion/contraction mechanism 402) is exerted.

According to the structure, the user gripping the handle part 302 firmly holds the grip with thumb, middle
10 finger, medical finger, and little finger, and can operate the trigger switch 301 with the remaining index finger without any difficulty as if pulling a gun trigger. Additionally, the force exerted in a direction apart from the connection tube 400 by the trigger switch 301 is
15 converted to a force of an opposite direction, that is, a direction approaching the connection tube 400 by the connection plate 381 to act so that the end of the second connection rod 384 on the side of the connection tube connecting part 305 is protruded, and is converted to a
20 force of a direction such that the fixed state of the connection tube expansion/contraction mechanism 402 of the connection tube 400 is released as described later. Furthermore, the trigger switch 301 in a not-pulled state (non-operated state) is constantly placed in a fixed state
25 by the spring 382.

As described above, in the embodiment, a force is easily exerted in one-hand operation with the hand having the handle part 302, and in the mechanism the connection

tube expansion/contraction mechanism 402 is easily released or fixed with this force.

Moreover, as shown in Fig. 6, in the second tube body 350 rotatably connected to the conveyance path 311 of the first tube body 310, a first connecting part 351 having a central axis A4 coincident with the extension line of the central axis A1 of the connection tube 400, and a second connecting part 352 provided with a central axis A5 having a predetermined angle with a central axis A3 of the conveyance path 311 substantially coincident with the extension line of the central axis A1 of the connection tube 400 are bent below the first connecting part 351 and formed.

Furthermore, the first connecting part 351 of the second tube body 350 is inserted in the conveyance path 311 so that it can relatively rotate, and the conveyance path 311 of the first tube body 310 and the first connecting part 351 of the second tube body 350 are interconnected by coupling means 353 not to be disengaged from each other. Thereby, the second tube body 350 is constituted such that it can rotate centering on the extension line of the central axis A1 of the connection tube 400.

Here, arbitrary means can be employed as the coupling means 353 for preventing dislocation of the conveyance path 311 and the first connecting part 351. In the embodiment, as shown in Fig. 7, the first connecting part 351 is provided with an annular groove 354. After the first connecting part 351 is inserted to the conveyance path 311, a part of a dislocation preventive piece 356 is

inserted to the annular groove 354 from openings 355 disposed in both side faces of the conveyance path 311, the first tube body 310 and the second tube body 350 are rotatably connected not to be disconnected from each other.

5 Additionally, since the dislocation preventive piece 356 is detachably attached, the first tube body 310 and the second tube body 350 can easily be disassembled by detaching the dislocation preventive piece 356 at the time of maintenance, for example, when the tube is clogged with dust.

10 Moreover, as shown in Fig. 7, a connection ring 210 is attached to the end of the suction hose 200, and by detachably inserting the connection ring 210 to the end of the second connecting part 352 of the second tube body 350, the second tube body 350 and the suction hose 200 are
15 connected. Additionally, numeral 211 denotes an engaging part of the connection ring 210, 356 denotes an engaging part of the second connecting part 352, and by inserting and coupling the engaging parts 211 and 356, the second connecting part 352 and the suction hose 200 are coupled
20 not to be disengaged.

Here, since the engaging part 211 of the connection ring 210 is formed by cutting the other three sides except one side, and provided with a spring function using resin elasticity, by holding and depressing the connected
25 engaging part 211 from both sides, the part is disconnected so that the second connecting part 352 and the suction hose 200 can be detached. Therefore, disassembly can easily be performed, and the maintenance at the time of dust clogging

is facilitated.

Moreover, in the embodiment, the end of the suction hose 200 is rotatably held on the connection ring 210 by the connecting means. As a result, while the
5 suction hose 200 is connected to the second connecting part 352 of the second tube body 350, the suction hose 200 is constituted to relatively rotate to the second connecting part 352. Thereby, the suction hose 200 can be prevented from being distorted. Specifically, according to the
10 embodiment, since the suction hose 200 is connected to the handle part held by the user by double rotation mechanism, unnecessary load on the holding wrist can extremely be reduced.

Furthermore, as shown in Fig. 8, in the embodi-
15 ment, when the first tube body 310 and the second tube body 350 are assembled to complete the hand handle 300, and the suction hose 200 and the connection tube 400 are attached to the hand handle 300, an angle β formed by the central axis A3 of the conveyance path 311 on the extension line of
20 the central axis A1 of the connection tube 400 and the central axis A4 of the first connecting part 351 with the second connecting part 352 is set to be in the range of 90 to 150 degrees. The angle is set in this manner in order that when the user stands having the hold part 302a of the
25 handle part 302 of the hand handle 300 in hand during cleaning, the suction hose 200 necessarily hangs obliquely downward, and the electric cleaner main body 100 can easily be drawn and moved, and that the hand having the hold part

302a of the handle part 302 and operating the trigger switch 301 is prevented from being obstructed.

The connection tube 400 will next be described in more detail with reference to Figs. 9 and 10. Fig. 9 is a component developed view of the connection tube 400, and Fig. 10 is a longitudinal sectional view of the connection tube 400 in a contracted state. As described above, the connection tube 400 is constituted of the first tube body 420 disposed on the side of the hand handle 300, and the second tube body 440 disposed on the side of the suction unit 500. The second tube body 440 is formed to be thinner than the first tube body 420, one end is inserted to a connecting part 421 (opening) in one end of the first tube body 420, and this second tube body 440 moves in the first tube body 420, so that the length of the connection tube 400 can be adjusted.

The first tube body 420 is constituted of a connection tube part 423 formed of a resin material provided with a conveyance path 422 for passing dust therein, and a connection tube cover 425 formed of a resin material to constitute a component arrangement part 424 with this connection tube part 423, and both members are attached via screws (not shown). The conveyance path 422 is disposed to pass through both ends of the longitudinal direction of the connection tube part. Moreover, in the component arrangement part 424, a recessed portion is formed on one side (upper side) of the longitudinal direction of the connection tube part 423 along the longitudinal

direction, and the connection tube cover 425 is attached to lid this recessed portion.

The component arrangement part 424 is provided with the connection tube expansion/contraction mechanism 5 402 and a third connection rod 426. The connection tube expansion/contraction mechanism 402 is disposed on the end of the component arrangement part 424 on the side of the suction unit 500, one end of the third connection rod 426 is attached to the connection tube expansion/contraction 10 mechanism 402, and the other end of the rod is attached to the end on the side of the hand handle 300.

The connection tube expansion/contraction mechanism 402 is constituted of a fixing click 428 rotatably attached to an opening 427 formed in a wall of 15 the conveyance path 422, a second lock switch 431 for operating the fixing click 428, and a spring 429 for constantly placing the second lock switch 431 in the fixed state. For the fixing click 428, the middle of the longitudinal direction is supported in the opening 427 by the 20 rotation shaft, and one end is provided with a click portion. When the click portion is exposed toward the conveyance path 422 from the opening 427 and engaged in a fixing groove 441 disposed at a predetermined interval on the surface of the second tube body 440, the connection 25 tube expansion/contraction mechanism 402 is placed in the fixed state. The other end of the fixing click 428 forms an inclined surface which becomes higher (thicker) toward the end of the second lock switch 431 on which the surface

abuts. When a protrusion disposed inside the second lock switch 431 abuts on the inclined surface and moves in the longitudinal direction of the connection tube 400, the click portion of the fixing click 428 rises from/sets in
5 the conveyance path 422.

On the other hand, the second lock switch 431 is provided with a switch part 431a exposed from an opening 430 formed in the connection tube cover 425, and a protrusion 432 disposed inside the switch part 431a and
10 abutting on the fixing click 428. Furthermore, the second lock switch 431 is attached so that it can slide in the longitudinal direction of the connection tube 400. By this movement, the click portion of the fixing click 428 is stored on the side of the component storage part, or
15 protruded toward the conveyance path 422. Moreover, the spring 429 makes the switch part 431a jut outward via the opening 430 and constantly maintain the fixed state.

The second lock switch 431 is also provided with the connection rod attachment part 433 to which one end of
20 the third connection rod 426 is attached. When the connection rod attachment part 433 receives a force along the longitudinal direction of the connection tube 400 by the third connection rod 426, the second lock switch 431 is pushed to move, to act in the same manner as when the
25 switch part 431a is independently moved/operated and to operate so that the fixing of the connection tube expansion/contraction mechanism 402 is released. Therefore, the connection rod attachment part 433 and the third

connection rod 426 do not need to be necessarily connected, and may abut on each other to act so that the fixed state is released with the movement of the third connection rod 426. In this case, the assembly property can be enhanced.

5 Additionally, in the embodiment, the connection tube cover 425 and the connection tube part 423 constitute a handle connecting part 434 for connection with the hand handle 300.

 In the handle connecting part 434, an end 435 of
10 the conveyance path 422 is formed in a protruded shape. Moreover, by connecting the handle connecting part 434 and the connection tube connecting part 305, the protruded end 435 of the conveyance path 422 is inserted/engaged in the opening of the connection tube connecting part 305, and
15 further the fixing click 373 of the lock switch 371 shown in Fig. 5 is engaged and fixed with a protrusion 436 disposed on the end 435 by the connection tube fixing mechanism 370.

 Moreover, the end of the second connection rod
20 384 and the end of the third connection rod 426 are interconnected by the above-described engagement. Thereby, the second and third connection rods 384, 426 moving along the longitudinal direction of the connection tube 400 are interconnected, and the operation of the trigger switch 301
25 can be transmitted to the connection tube expansion/contraction mechanism 402. In the embodiment, one support part is recessed and the other end is protruded in the support part by which the ends of the second and third

connection rods 384, 426 are supported, so that the ends of the second and third connection rods 384 and 426 abut on each other by connecting the ends of the connecting parts. Thereby, the positioning of both support parts is facilitated, and the connection is secured.

Furthermore, the end (on the side of the second connection tube) of the connection tube part 423 of the first tube body 420 is provided with the engagement part 411 protruded in the expansion/contraction direction to form the attachment protrusion 410. Since the attachment protrusion 410 is formed on the back surface of the connection tube expansion/contraction mechanism 402, and positioned in the lowermost part on the side of the first tube part end, it is strong, and the hand handle 300 can be attached to the electric cleaner main body 100 in the highest position.

On the other hand, the second tube body 440 is constituted of a pipe part 444 of a metal material constituting a dust conveyance path 452, and first and second end members 442 and 443 of resin materials disposed on both ends of the pipe part 444. The first end member 442 is disposed so that it can move in the conveyance path 422 of the first tube body 420, and its peripheral side surface is attached to be thicker than the pipe part 444, so that it can move in the conveyance path 422 without any air leakage. Additionally, the first end member 442 is also provided with a stopper function to prevent the second tube body 440 from dropping from the conveyance path 422.

Moreover, the pipe part 444 is provided on the surface with the fixing grooves 441 arranged at predetermined intervals as described above. When the fixing click 428 is engaged in the fixing groove 441, the connection
5 tube 400 can be adjusted to provide the predetermined length. The intervals of the fixing grooves 441 can appropriately be determined. Moreover, the length always used by the user may be recognized by attaching a numeral to each fixing groove 441.

10 Furthermore, the second end member 443 can realize connection with the universal connecting part 1500 of the suction unit 550. This second end member 443 is constituted of a base part 443a provided with an attachment part 453 connected to the pipe part 444, and an upper cover
15 443b. Disposed on side surface of the base part 443a is a recessed component arrangement part 446, in which a suction unit connecting mechanism 445 is disposed to connect to the universal connecting part 1500. The upper cover 443b is attached via screws (not shown) to cover the component
20 arrangement part 446.

The suction unit connecting mechanism 445 is constituted of a lock switch 447 and a spring 448. For the lock switch 447, the middle of the longitudinal direction is rotatably supported by a shaft, and one end is provided
25 with a switch part 447a formed to be exposed from an opening 449 disposed in the upper cover 443b, and other end is provided with the fixing click 450. Furthermore, the fixing click 450 is projected inward by the spring 448 via

an opening 451 formed in a wall surface inside the attachment part 441 to act so that the fixed state with the universal connecting part 1500 of the suction unit 500 is maintained.

5 As described above, according to the connection tube 400 of the embodiment, by operating the second lock switch 431 of the connection tube 400, the length of the connection tube 400 can be adjusted, which is effective when the electric cleaner 1 is disassembled into individual
10 components for storage or assembly. Furthermore, in the embodiment, since the length of the connection tube 400 can be adjusted even by operating the hand handle 300, the length of the connection tube 400 can be adjusted with the standing posture during cleaning without largely changing
15 the posture. Additionally, in the embodiment, the length adjusting means of the connection tube 400 is disposed in the hand handle 300, while the hand handle 300 and the connection tube 400 can be separated so that the storage property can be enhanced.

20 The method of operating the electric cleaner 1 of the embodiment will next be described in further detail with reference to Figs. 1, 2 and 11A to 11C. Figs. 11A to 11C are operation explanatory views in which the cleaning posture is changed to the storage posture.

25 In Fig. 2, for the electric cleaner 1 of the embodiment, when the user holds the hand handle 300 in the standing posture, various operations can be performed. For example, in the embodiment, the user holding the hand

handle 300 straightens/holds the handle part 302 and moves the hand handle 300 in V1 direction to move the suction unit 500, so that cleaning can be performed in a wide direction of a usual suction port 1004. In this case, an
5 excellent running can be obtained via a large rear roller 1007 and a front roller 1006 which positively receive the load from the hand handle 300. Moreover, the electric cleaner main body 100 can be drawn and run via the suction hose 200 connected to the hand handle 300.

10 Moreover, by twisting the handle part 302 from the movement of the V1 direction, the suction unit 500 is turned in accordance with the twisting angle, and the suction main body 1000 is moved in an inclined posture. Additionally, the advancing direction of the suction unit
15 500 can be changed along the short direction of the turned suction main body 1000 in the same manner as in turning the wheel of a car. In this case, by the rotating operation of the hand handle 300 centering on the central axis A1 of the connection tube 400, the suction hose 200 operates so as to
20 be constantly positioned below the hand handle 300. Even when the user twists the handle part 302, the suction hose 200 fails to be lifted up. Therefore, the load applied to the hand can be reduced. Moreover, for the rotating operation of the hand handle 300, even when the electric
25 cleaner main body 100 is drawn/run, or even when the hand handle 300 is rapidly moved, the rotating operation provides a buffer action, so that the load applied to the hand can be lightened.

Furthermore, in the embodiment, by twisting the handle part 302 by 90 degrees, the suction main body 1000 can be turned by about 90 degrees. Additionally, by setting the longitudinal direction of the suction unit 500 to the same direction as the back and forth direction of the hand handle 300, the suction unit 500 can be inserted to a narrow gap. Additionally, the front long side of the suction unit 500 can be placed in contact with the wall surface and moved in the V2 direction.

10 A method of storing the electric cleaner 1 will be described with reference to Figs. 1 and 11A to 11C. Here, Figs. 11A to 11C are explanatory views showing the process of changing the electric cleaner main body 100 from the cleaning posture to the vertical storage posture.

15 First, Fig. 11A shows a transverse posture in which the electric cleaner main body 100 is supported by the moving means 102. The process of changing this state to the vertical storage posture will be described. To change the state of Fig. 11A to the vertical storage posture, by

20 manually holding the hand handle 300, or the hand handle 300 and connection tube 400, the suction unit 500 is raised, and the first fixing means 501 of the raised suction unit 500 and the first fixing means 101 of the electric cleaner main body 100 are interconnected. In this

25 case, since the suction unit 500 is provided with the first rotating part 1503 in the vicinity of the gravity center position G1 of the suction main body 1000, its bottom surface can be placed parallel (substantially parallel)

with the surface to be cleaned. Therefore, the rear roller 1007 as the first fixing means 501 can be directed toward the user who holds the hand handle 300. Additionally, since the rear roller 1007 is disposed on the end of the
5 projected part 1012 projected behind the suction main body 1000, the user easily performs positioning to connect the first fixing means 101, 501 while viewing the rear roller 1007 as the first fixing means 101.

Here, in the structure of the embodiment, the
10 bottom surface of the suction unit 500 can be parallel with the surface to be cleaned to enhance the handling property when the suction unit 500 is once raised from the surface to be cleaned and again placed onto the surface to be cleaned, and to enhance the handling property for the
15 connection of the first fixing means 101, 501. However, to enhance the handling property for the connection of the first fixing means 101, 501, the parallel posture does not have to be necessarily taken. For example, since the conventional suction unit 500 has the gravity center
20 position G1 in front, the front part of the suction unit 500 is lowered while the suction unit 500 is lifted up. However, the front part of the suction unit 500 may be lifted up, and the gravity center position G1 of the suction main body 1000 may rather be disposed behind the
25 first rotating part 1503 from the horizontal position so that the rear roller 1007 is projected downward.

Additionally, according to the embodiment, the user connects the first fixing means 101, 501 in the

operation of Fig. 11A, presses the hand handle 300 downward along the longitudinal direction of the connection tube 400 to raise and rotate the tip end of the electric cleaner main body 100 (on the side of the hose attachment part) centering on rotating axis B1 of the large wheels 103 so that the state changes to Fig. 11B, and further presses the hand handle 300 downward to take the vertical storage posture in which the back surface of the electric cleaner main body 100 (on the side of an exhaust part 154) abuts on the surface to be cleaned as shown in Fig. 11C.

Here, in this embodiment, with the depressing operation of the hand handle 300, the rotating part incorporated in the first fixing means 101 rotates to start a power cord windup switch (not shown), and a power cord can be drawn into a cord reel device (not shown) in the rear part of the electric cleaner main body 100. Thereby, the user can omit the process of operating the windup switch.

Moreover, in this embodiment, since the gravity center position G1 of the electric cleaner main body 100 is moved rearward by the windup operation of such power cord, or the first fixing means 101 is disposed in the vicinity of the rotating axis B1 of the large wheels 103, further the large wheel 103 has a large diameter, or the depressing operation comprises pressing downward toward the oblique rear direction from the front upper direction, the electric cleaner main body 100 can easily change the posture in its fixed position.

Furthermore, the first fixing means 101, 501 are connected in the vertical storage posture. By controlling the trigger switch 301 disposed on the hand handle 300 from this state, the fixing of the connection tube 400 can be released. In this embodiment, the released state is maintained while the trigger switch 301 is pulled, and by releasing the trigger switch 301, the fixed state is obtained. Therefore, the connection tube 400 is shortened while the trigger switch 301 is pulled. Thereby, since the control and the operation are cooperatively performed, handling is easy for the user.

Moreover, by further depressing operation of the hand handle 300, the length of the connection tube 400 is shortened. Specifically, the end of the second tube body 440 is taken into the first tube body 420. By the continuous depressing operation, the attachment protrusion 410 as the second fixing means 401 disposed on the lower end of the first tube body 420 is inserted to the attachment recessed portion 109 as the second fixing means 108 of the electric cleaner main body 100 positioned upward in the vertical storage posture.

When the connection tube 400 is depressed straight toward the oblique rear lower part, the attachment protrusion 410 necessarily reaches the attachment recessed portion 109. As seen from the user, the attachment protrusion 410 is largely projected, and the attachment recessed portion 109 is disposed on the upper end. Therefore, the positional relation of the attachment protrusion 410 and

the attachment recessed portion 109 can visually be confirmed, and the engaging is facilitated. Additionally, when the length of the connection tube 400 is fixed again by the operation of the trigger switch 301, the connection
5 tube 400 provided with the hand handle 300 on its upper end is fixed over the back of the electric cleaner main body 100. Thereby, the electric cleaner 1 can be placed in the vertical storage posture in which the lower part of the cleaner is supported by a pair of large wheels 103 and the
10 attachment protrusion 410 disposed on the back surface upper part of the electric cleaner main body 100 and the hand handle 300 is disposed on the upper end part of the cleaner.

According to the vertical storage posture, since
15 the installation area can be reduced in the installed state, the electric cleaner 1 comprising a plurality of components of miscellaneous shapes can be stored in the assembled state ready for use, without occupying a large space in the gap of furniture or the corner of a room.
20 Moreover, in the vertical storage posture, since the suction unit assembly 700 constituted of the hand handle 300, connection tube 400 and suction unit 500 is fixed/ supported on the electric cleaner main body 100 by the first and second fixing means 501, 101, 108, 401, the
25 electric cleaner 1 of the vertical storage posture can be lifted up or moved by the hand handle 300 disposed on the upper end.

For example, during cleaning, the user holds the

hand handle 300 to lightly lift up the electric cleaner 1 of the vertical storage posture disposed in the corner of the room, so that the posture can be changed to direct the large wheels 103 to a direction in which the cleaner is to
5 be moved.

Subsequently, when the vertical storage posture is inclined via the hand handle 300 so that the electric cleaner main body 100 is supported by a pair of large wheels 103, and the cleaner is drawn via the hand handle
10 300 as it is, the electric cleaner 1 can easily be moved with two-wheel running.

Specifically, the conventional electric cleaner 1 can take the vertical storage posture, but the fixing means disposed on the connection tube 400 is just hooked onto the
15 electric cleaner 1 to such a degree that the connection tube 400 maintains its vertical posture with respect to the electric cleaner main body 100. When the hand handle 300 is pulled, the connection tube 400 is separated from the electric cleaner 1. Therefore, in the conventional art,
20 when the electric cleaner 1 of the storage state is moved, it has to be held with the handle disposed on the electric cleaner main body 100, such as the first rising/setting handle 136. In this case, the user has to change the standing posture to the stooped posture and hold the handle
25 of the electric cleaner 1.

In this embodiment, however, since the connection tube 400 is fixed to the electric cleaner main body 100, the electric cleaner 1 can be moved via the hand handle 300

disposed on the upper end of the connection tube 400.
Additionally, since the hand handle 300 is disposed in a
high position, the user can move the electric cleaner 1
without largely changing the posture from the standing
5 posture.

Moreover, when cleaning is performed in the
predetermined position, the user operates the trigger
switch 301 disposed on the hand handle 300 to release the
fixed connection tube 400, and pulls up the hand handle 300
10 as it is, so that the second fixing means can be dis-
connected. Additionally, by further pulling up the hand
handle 300 and releasing the trigger switch 301 while the
length of the connection tube 400 is set to the arbitrary
length, the length of the connection tube 400 is again
15 fixed. By further pulling up the hand handle 300, the
first fixing means 501, 101 are rotated centering on the
rotation axis B1 of the large wheels 103, so that the
vertical storage posture of the electric cleaner main body
100 can be changed to the transverse cleaning posture
20 supported by the running means 102. Since the operation of
changing the cleaning posture releases the connection of
the first fixing means 501, 101, the user can install the
suction unit 500 on the surface to be cleaned.
Subsequently, by pulling out the power cord and plugging in
25 a household plug socket, a state ready for starting
cleaning can be obtained.

As described above, according to the embodiment,
since the user can control most operations with the hand

handle 300 disposed in a position such that the operations can be performed in the standing posture, the user can operate the electric cleaner without largely changing the posture from the standing posture, so that a burden of the
5 house on the back of the user can be lightened.

Of course, in the embodiment, the operation method is not limited. For example, the user may take a stooping posture to change the electric cleaner main body 100 of the cleaning posture to the vertical storage
10 posture, further raise the attachment fitting 105 to draw in the power cord 120, or connect the attachment fitting 105 and the first fixing means 501, 101 while drawing in the cord, further operate the second lock switch 403 to adjust the length of the connection tube 400, so that the
15 second fixing means 401, 108 may be connected. Similarly, the user can take a stooping posture, and directly operate the second lock switch 103 or the attachment fitting 105 so that the vertical storage posture of the electric cleaner main body 100 may be changed to the cleaning posture.

20 As described above, in this embodiment, the user can select two operations. One operation comprises manually operating the trigger switch 301 and the attachment fitting 105 directly. The other operation comprises indirectly performing the operation via the hand handle
25 300. The two operations can be selected by the user's desire.

(Another Embodiment of Suction Assembly of First Embodiment)

Another embodiment of the suction assembly 700 will next be described with reference to Figs. 12A to 12C.

5 Figs. 12A to 12C schematically show the operation mechanisms of the connection tube expansion/contraction switch mechanism 380 of the hand handle 300 and the connection tube expansion/contraction fixing mechanism 402 of the connection tube 400. Fig. 12A is a schematic

10 mechanism diagram of the first embodiment, Fig. 12B is a schematic mechanism diagram when the trigger switch 301 is disposed in the vicinity of the upper part of the root of the handle part 302, for example, behind the operating part 303, and Fig. 12C is a schematic conceptual diagram when

15 the embodiment of Fig. 12A is more simplified.

The structure of the suction assembly 700 of the embodiment is not limited to that of the first embodiment shown in Fig. 12A as long as the hand handle 300 and the connection tube 400 provided with a expanding/contracting

20 function can be detached, and further the connection tube 400 can be expanded/contracted by the operation of the trigger switch 301 disposed on the hand handle 300.

For example, when the trigger switch 301 is disposed below the handle part 302, the operation is

25 performed with the index finger. Therefore, when the trigger switch 301 is structured to be pulled up as shown in Figs. 12A and 12C, the operation can easily be performed.

Specifically, in the first embodiment shown in Fig. 12A, when the trigger switch 301 disposed on the hand handle 300 is pulled up as shown by an arrow E1, the first connection rod 383 is transformed via the connection plate 381 to produce a stress for pushing downward the end of the second connection rod 384 as shown by an arrow E2. By connection of the hand handle 300 and the connection tube 400, the stress reaches the end of the third connection rod 426 of the connection tube 400 to press the connection rod downward. Subsequently, the other end of the third connection rod 426 rotates the fixing click 428 and pulls up the click part fixing the second tube body 440 to release the fixed state.

Moreover, in the embodiment shown in Fig. 12C, instead of converting the force direction with the connection plate 381, the operation of the trigger switch 301 may directly be transmitted to the connection tube expansion/contraction mechanism 402 via two connection rods (first connection rod 383 and third connection rod 426).

Specifically, the trigger switch 301 is formed in a rod shape, its middle is rotatably attached to the switch hole 385, one end is exposed to the outside, and the other end is positioned inside and provided with the first connection rod 383. According to the structure, the connection plate 381 is removed, two connection rods can be used, so that the number of components can be reduced.

On the other hand, when the trigger switch 301 is disposed above the handle part 302, by pushing with the

thumb, a force is easily applied. In the structure of pushing the trigger switch 301, one of the hand handle 300 and the connection tube 400 is newly provided with converting means for converting the stress, such as the connection plate 381X. For example, in the structure of Fig. 12B, by providing the handle connecting part 434 of the connection tube 400 with the connection plate 381X, the force for depressing the trigger switch 301 as shown by an arrow E3 is converted to pull up the click part so that the fixing can be released.

As described above, in the embodiment, for example, the structures of the parts of Figs. 12A to 12C are appropriately combined by considering the place in which the trigger switch 301 is to be disposed, and the direction of the stress for operating this switch.

Moreover, in the first embodiment shown in Figs. 9 and 10, by providing the second tube body 440 with the component arrangement part 424, the third connection rod 426 and the connection tube expansion/contraction mechanism 402 are stored in the cover and the appearance of the connection tube 400 is formed to be clear without any recesses/protrusions so that the cleaning and design properties are enhanced. Furthermore, this space may be utilized to arrange the cord for supplying power to the suction unit 500 provided a drive motor (not shown) and signal conductors.

However, to reduce the size of the connection tube 400, in the structure shown in Fig. 13, the third

connection rod 426 may be exposed to the outside. For example, Fig. 13 is a partial sectional view of the second tube body 440 showing the example. In the embodiment, the second tube body 440 is integrally molded with a guide
5 groove 457 disposed along the outer periphery of the tube body, so that the third connection rod 426 is attached to the guide groove 457. Of course, by appropriately attaching a separate adapter provided with the same guide groove 457 along the tube body, the general-purpose properties
10 with the conventional product may be obtained. According to the embodiment of Fig. 13, the recesses/protrusions are reduced, so that the cleaning and design properties are enhanced while the number of components can be reduced. In this case, the third connection rod 426 may be directly
15 attached to the guide groove 457. For example, by employing connecting means provided with a wire 459 which can slidably move in a tube body 458 of a flexible resin material, the abrasion by the guide groove 457 and the third connection rod 426 is reduced and the assembly
20 properties can be enhanced.

Moreover, Figs. 14A to 14D schematically show a fixing structure in the connection tube expansion/contraction mechanism 402. Figs. 14A, 14B are partial sectional views showing the relation of the second tube
25 body 440 and a click part 460, Fig. 14C is a partial enlarged view of the fixing structure of a clamping type, and Fig. 14D is a schematic electric structure diagram of Fig. 14C.

In the first embodiment, as shown in Fig. 14A, when the click part 460 is engaged in the fixing groove 441 disposed at the predetermined interval on the surface of the second tube body 440, the fixed state is obtained.

5 According to this structure, the click part 460 is engaged with the force of the spring 429 (see Fig. 9), and the fixing groove 441 has a V-shaped section. When a large force is exerted in the longitudinal direction of the connection tube 400, the engagement is detached by the
10 stress so that component breakage can be reduced. However, to achieve more secure fixing, as shown in Fig. 14B, holes may be made instead of the fixing grooves 441, or the groove may be provided with a rectangular recessed section.

Moreover, as shown in Fig. 14C, a plurality of
15 cut parts 461 are disposed in the end of the second tube body 440, a residual part 462 of the end is formed to become gradually thicker toward the end, and a thread groove is formed in the surface. Moreover, a ring 463 is disposed inside which is engaged in the thread groove and
20 which rotates to move in the longitudinal direction of the connection tube 400.

Additionally, when the ring 463 is rotated and moved toward the end, the residual part 462 is pressed against the inside so that the second tube body 440 is held
25 and fixed inside.

When the connection tube expansion/contraction mechanism 402 provided with such structure is employed, the mechanism may be provided with a motor 464 so that remote

operation is performed via the hand handle 300. For example, as shown in Fig. 14C, there may be provided a structure in which a gear 456 disposed on the motor 464 meshes with a gear 465 disposed on the periphery of the ring 463. In this structure, a contact point (not shown) contacting when connected to the connection tube connecting part 305 and the handle connecting part 434 is disposed, for example, so that the second connection rod 384 and the third connection rod 426 abut on the contact, and the power obtained, for example, from the battery storage part 316 may be supplied by the trigger switch 301 which turns ON/OFF the power supply disposed on the hand handle 300.

Moreover, by disposing the trigger switch 301 for supplying the power in the same manner as described above, the expansion/contraction of the connection tube 400 may automatically be performed by the motor 464. For example, as shown in Fig. 15A, the first tube body 420 is provided with the motor 464 for driving the gear 465, and a plate gear 466 to mesh with the gear 465 (gear mechanism) is disposed on the second tube body 440. By operating the trigger switch 301 to drive the motor 464, the expansion/contraction of the connection tube 400 may be under remote control. In the structure, since the connection tube 400 does not have to be expanded/contracted with the above-described relation of the gravity and the floor surface. During the cleaning of staircases or ceiling surfaces, the operation can be performed without taking the relation, so that the operation property can be enhanced. In this case,

if the connection tube 400 is expanded/contracted too early, it is difficult to adapt to a desired length. If too late, the user becomes irritated. Therefore, in this structure, movement may be completed at an expansion/

5 contraction speed at which the user is not irritated, for example, in the range of 5 to 10 seconds for the length with the expansion/contraction distance of about 300 mm. In this case, the second tube body 440 is provided with the fixing groove 441, the first tube body 420 is provided with

10 the click part provided with a spring which abuts on the fixing groove 441, and sliding is performed to sound, and the like in a stepwise manner, so that the user can recognize the sense of expansion/contraction.

Furthermore, the connection tube 400 may be

15 expanded/contracted by replacing the motor 464 with a spring 467. For example, in the embodiment shown in Fig. 15B, the first tube body 420 is provided with a guide rail 468 or a guide tube disposed parallel with the first tube body 420, the second tube body 440 is provided with a guide

20 rod 469 which is slidably inserted to the guide rail 468, and the spring 467 is disposed between the guide rail 468 and the end of the guide rod 469 to act and push the guide rod 469. In the embodiment, the guide rod 469 inserted in the guide rail 468 is constantly pushed out of the guide

25 rail 468. Specifically, the second tube body 440 provided with the guide rod 469 operates to be drawn from the first tube body 420, so that the connection tube 400 is extended. Therefore, when the connection tube 400 about to extend is

provided with the connection tube expansion/contraction mechanism 402 (not shown), by operating the trigger switch 301 (not shown), the fixed state of the connection tube is released and can be stretched by the force of the spring 467. Additionally, when the connection tube 400 is contracted, by pressing the suction unit 500 against the surface to be cleaned and depressing the hand handle 300, the fixed state may be obtained again with the trigger switch 301.

10 The structure of attaching the suction assembly 700 to the electric cleaner main body 100 will next be described with reference to Figs. 16A to 16C. Figs. 16A to 16C show the structure of attaching the suction assembly 700 to the electric cleaner main body 100. In the first 15 embodiment, the suction assembly 700 is attached to the electric cleaner main body 100 via the rear roller 1007 disposed on the suction unit 500 and the attachment protrusion 410 disposed on the first tube body 420, but this is not limited.

20 For example, instead of the rear roller 1007, an attachment parts (not shown) protruded rearward to the middle of the suction main body 1000, such as both ends of a pipe formed by bending the pipe in a U-shape as seen from the upper surface, are disposed on the suction main body 25 1000, which may form the first fixing means 501 disposed on the electric cleaner main body 100.

Alternatively, the second tube body 440 and the first tube body 420 are provided with first fixing means

470 and second fixing means 401, respectively. The distance of the first and second fixing means 470, 401 is adjusted by using the expansion/contraction of the connection tube 400, the first and second fixing means 470, 401
5 and the first and second fixing means 101, 108 disposed on the electric cleaner main body 100 are engaged, and the suction assembly 700 may be attached to the electric cleaner main body 100. In this case, there are a method of contracting the first and second fixing means 470, 401
10 disposed on the connection tube 400 and attaching the means to the electric cleaner main body 100, and conversely, a method of expanding the means to attach the means to the electric cleaner main body 100. This structure will further be described with reference to Figs. 16A to 16C.

15 Figs. 16A, 16B are schematic structure views in which the connection tube 400 is operated to contract and attached, and Fig. 16C is a schematic structure view in which the connection tube 400 is operated to expand and attached.

20 In the embodiment of Fig. 16A, a projected part 158 is formed on the electric cleaner main body 100, and attachment recessed portions 159, 160 as the first and second fixing means 101, 108 are formed on the upper and lower surfaces of the projected part 158. On the other
25 hand, the first and second fixing means 470, 401 of the connection tube 400 are constituted of protrusions 471, 473 protruded from the connection tube 400, and attachment protrusions 472, 474 projected from the protrusions 471,

473 in a direction (inwardly) opposite to each other.

According to this structure, first by operating the hand handle 300 to slide the first fixing means 470 of the connection tube 400 in the first fixing means 101 of the electric cleaner main body 100 and to engage the first fixing means 470 and 101, subsequently by operating the trigger switch 301 to release the fixing of the connection tube 400, and by depressing the hand handle 300 and contracting the connection tube 400 to engage the second fixing means 108, 401, the suction assembly 700 can be attached to the electric cleaner main body 100.

Moreover, during detaching, the trigger switch 301 is operated, the fixed state is released, the hand handle 300 is pulled up to disengage the second fixing means 108, 401, then the first fixing means 470, 101 are disengaged, and subsequently the connection tube 400 is set to the arbitrary length so that the fixed state may be obtained. In this embodiment, the first and second fixing means 101, 108 formed on the electric cleaner main body 100 may simply be structured.

Furthermore, in Fig. 16B, in the embodiment, the recessed portion 161 as the first fixing means 101 is disposed on the upper surface rear part of the electric cleaner main body 100, and the attachment recessed portion 109 as the second fixing means 108 is disposed on the upper surface of the electric cleaner main body 100 in the vertical storage posture. Furthermore, to secure the engagement, an attachment recessed portion 162 is disposed

in the recessed portion 161 on the upper side in the vertical posture. Then, the electric cleaner 1 is constituted together with the suction assembly 700 described with reference to Fig. 16A.

5 According to this embodiment, the operation comprises first lifting up the suction unit 500 via the hand handle 300, obliquely inserting the first fixing means 470 of the connection tube 400 in the recessed portion 161 as the first fixing means 101 of the electric cleaner main
10 body 100, subsequently operating the trigger switch 301 of the hand handle 300 to release the fixing of the connection tube expansion/contraction mechanism 402, and depressing the hand handle 300, so that the attachment protrusion 474 as the second fixing means 401 can be engaged in the
15 attachment recessed portion 109. Particularly, in this embodiment, by forming the first fixing means 101 of the electric cleaner main body 100 by the recessed portion 161, when the hand handle 300 is depressed, the bottom surface in the recessed portion 161 in the vertical storage posture
20 can receive a depressing force, so that the operation of contracting the connection tube 400 can easily be performed.

Moreover, in Fig. 16C, this embodiment comprises attaching the suction assembly 700 to the electric cleaner
25 main body 100 by the operation of the connection tube 400 which is about to extend. Specifically, the recessed portions 161 provided with the attachment recessed portions 162 described with reference to Fig. 16B are disposed on

the upper and lower sides of the electric cleaner main body 100 of the vertical storage posture as the first and second fixing means 101, 108. Then, the protrusions 471 provided with the attachment protrusions 472 described with reference to Fig. 16B are disposed as the first and second fixing means 470, 401 of the connection tube 400. In this case, an attachment protrusion 472a is disposed opposite to the attachment protrusion 472 of the protrusion 471 as the first fixing means 470, and further an attachment protrusion 162a is disposed on the inner lower side of the recessed portion 161 to engage with the protrusion 472a.

Furthermore, the attaching comprises first lifting up the suction unit 500 via the hand handle 300, obliquely inserting the first fixing means 470 of the connection tube 400 in the recessed portion 161 as the first fixing means 101 of the electric cleaner main body 100, and engaging the attachment protrusion 472a in the attachment recessed portion 162a to perform positioning. Subsequently, the attaching comprises operating the trigger switch 301 of the hand handle 300 to release the fixing of the connection tube expansion/contraction mechanism 402, depressing the hand handle 300, inserting the protrusion 471 as the second fixing means of the connection tube 400 into the recessed portion 161 as the second fixing means 108 of the electric cleaner main body 100, and pulling up the hand handle 300 in this state, so that the attachment recessed portion 162a and the attachment protrusion 472a of the first fixing means 101, 470, and the attachment

recessed portion 162 and the attachment protrusion 472 of the second fixing means 108, 401 are engaged. In this state, the connection tube expansion/contraction mechanism 402 is placed into the fixed state. Additionally, the
5 attachment protrusion 472 of the first fixing means 470 performs positioning and prevents dislocation when the hand handle 300 is pulled up.

Moreover, the fixing groove 441 disposed on the second tube body 440 is not placed in the fixed state when
10 the protrusion 471 is inserted in the recessed portion 161 as the second fixing means 108, 401. The interval of the fixing groove 441 is adjusted so that when the hand handle is pulled up, the attachment protrusion 472 is engaged in the attachment recessed portion 162 to obtain the fixed
15 state. According to the structure, since the connection tube 400 is engaged so as to open both sides between the first fixing means 101 and the second fixing means 108 of the electric cleaner main body 100 with the first fixing means 470 and the second fixing means 108, it can firmly be
20 fixed.

As described above, in the embodiment shown in Fig. 16, since the connection tube 400 can firmly be held on the electric cleaner main body 100 by its expansion/contraction by the operation of the hand handle 300, the
25 electric cleaner 1 of the vertical storage posture can be moved via the hand handle 300 in the same manner as in the first embodiment. Moreover, according to the embodiment, since the engagement of the first fixing means 470, 101 is

not influenced by the structure of the suction unit 500, the suction assembly 700 combined with various suction units 500 can be employed, so that the general-purpose properties are superior.

5 Additionally, also in the embodiment, by disposing the second lock switch 403 in the same manner as the first embodiment, the user can take a stooping posture to directly hand-hold the first and second tube bodies 420, 440 so that the operation can be performed.

10 (Other Application Examples of First Embodiment)

 The electric cleaner which reduces the frequency of the user's stooping posture in the cleaning operation has been described based on some modes for carrying out the present invention, but these modes relate to one embodi-
15 ment, and the present invention is not limited to the embodiment.

 For example, the hand handle 300 has been described in the embodiment in which the second tube body 350 is rotatably constituted with the first tube body 310,
20 but the handle is not limited to this as long as it is provided with the trigger switch 301. For example, the first tube body 310 and the second tube body 350 may integrally be formed. Moreover, instead of disposing the independent handle part 302, the tube body may be bent in a
25 V-shape, so that the bent portion is directly held.

 Furthermore, in the embodiment, the hand handle 300 and the connection tube 400 are disconnectably connected, but they may integrally be formed. Such

integration can reduce the number of components and can achieve inexpensive manufacture.

Moreover, in the embodiment, the hand handle 300 is provided with the trigger switch 301, but the trigger
5 switch 301 may be disposed on the upper end of the connection tube 400. In this case, since the expansion/contraction fixing mechanism can be intensively constituted in the connection tube 400, the number of components is reduced, and cost can be reduced. Additionally, since the
10 connection tube 400 employing this structure can be attached to other hand handles, the general-purpose properties can be achieved.

Moreover, in the embodiment, the suction main body 1000 can be rotated by the twisting operation of the
15 hand handle 300 in the suction unit 500, but the suction unit is not limited as long as it is provided with the first fixing means 501. Therefore, even the suction unit provided with the conventional bent tube joint can be employed. Particularly, by disposing the first fixing
20 means 501 on the connection tube 400 as shown in Fig. 11A, excellent cleaning and storage can be realized without being influenced by the mode of the suction unit 500.

(Second Embodiment)

Figs. 17 to 25 show a second embodiment according
25 to the present invention. Figs. 17 and 18 are appearance perspective views of the electric cleaner, Figs. 19 to 21 are explanatory views of connection state of a sub-handle and a suction hose, Figs. 22 and 23 are explanatory views

showing attachment of the connection tube to the sub-handle, Figs. 24A and 24B are explanatory views of connection tube position holding means, and Figs. 25A to 25C are explanatory views of use states.

5 First, the general structure of the electric cleaner according to the embodiment will first be described with reference to Figs. 17 and 18. Fig. 17 is an appearance view showing the vertical storage posture of the electric cleaner, and Fig. 18 is a perspective view showing
10 the usual cleaning posture.

 In Figs. 17, 18, an electric cleaner generically denoted with numeral 1 comprises an electric cleaner main body 100 provided with a mechanism (not shown) for sucking dust into a dust collecting chamber, such as a blower; a
15 connecting part (hereinafter referred to as the sub-handle part) 600 attached to a hose attaching part 101 of the electric cleaner main body 100; a flexible suction hose 200 having one end attached to the sub-handle 600 and connected to the blower; a hand handle 300 attached to the other end
20 of the suction hose 200 and connected to the blower; a connection tube 400 attached to the hand handle 300 and connected to the suction hose 200; and a suction unit 500 attached to the connection tube 400 and connected to the connection tube 400.

25 In the embodiment, the sub-handle 600 is provided with a main body attaching mechanism 610 for attachment to the electric cleaner main body 100, a hose attaching mechanism 620 for attaching the suction hose 200, a dust

passage 630 for connecting the electric cleaner main body 100 and the suction hose 200, a connection tube attaching mechanism 640 for holding the connection tube 400, and a handle part 660 for the user to hold the sub-handle 600, so
5 that a general electric cleaner can be constituted as the electric cleaner 1 superior in storage and conveyance properties.

For example, this embodiment is provided with running means 102, and in the cleaning posture shown in
10 Fig. 18 the drawing run by the suction hose 200 attached to the host attaching part 101 is possible. This cleaning posture can be changed to the vertical storage posture in which the hose attaching part 101 is positioned upward as shown in Fig. 17, by using the running means 102 as
15 rotation center and rotating in a direction of arrow Z so that the storage and conveyance properties of the electric cleaner 1 can remarkably be enhanced.

Specifically, in this embodiment, in the cleaning posture shown in Fig. 18, the electric cleaner main body
20 100 and the suction hose 200 are connected by the sub-handle 600 to secure the dust passage 630, so that the drawing run by the suction hose 200 is possible. Moreover, in the sub-handle 600, the handle part 660 is disposed to be projected upward in the cleaning posture. Therefore,
25 the tip end of the electric cleaner main body 100 provided the hose attaching part 101 is easily raised via the handle part 660 to an upward position from a position close to the floor surface by using a rear end of the electric cleaner

main body 100 supported by the running means 102 as a support so that the cleaning posture can easily be changed to the vertical storage posture.

Moreover, the handle part 660 is provided on one
5 end with the dust passage 630 and on the other end with the connection tube attaching mechanism 640 of the connection tube 400. By this structure, in the vertical storage posture, since the connection tube attaching mechanism 640 is positioned upward, the attaching part 401 disposed on
10 the connection tube 400 can easily be attached to the connection tube attaching mechanism 640 in the vicinity of user's sight.

Furthermore, in this embodiment, since the second tube body 440 is stored in the first tube body 420, the
15 connection tube 400 is structured to be expandable/contractible, and the attaching part 401 is disposed below the first tube body 420. Moreover, the connection tube position holding means 140 of the connection tube 400 is disposed on the upper surface of the electric cleaner main
20 body 100. Thereby, in the vertical storage posture, the connection tube 400 is attached over the electric cleaner main body 100.

Furthermore, in the connection tube 400, the connection tube expansion/contraction mechanism 402 is
25 provided with a lock mechanism, and the hand handle 300 is provided with a trigger switch 301 as operating means for releasing and locking the lock mechanism. Thereby, since the expansion/contraction of the connection tube 400 can be

adjusted by the operation of the hand handle 300, in the vertical storage posture of the electric cleaner main body 100, the trigger switch 301 is operated to reduce the length of the connection tube 400 so that the connection
5 tube 400 can be attached to ride over the electric cleaner main body 100.

Moreover, the connection tube attaching mechanism 640 is provided with means for holding the connection state with the attaching part 401 of the connection tube 400.
10 The holding means may be held as the minimum function to a degree such that the vertical storage posture is maintained, or may firmly be held. According to the embodiment, in the storage posture, there is provided the holding means in which when the connection tube 400 is pulled
15 upward, the connected state is released by the weight of the electric cleaner main body 100. In the embodiment, the connection tube attaching mechanism 640 and the attaching part 401 of the connection tube 400 are formed of resin, the friction and strain of the contact surface are
20 utilized, the connected state is maintained in an obliquely drawn state, and the friction coefficient of the contact surface is set so that the connected state is released by the force to lift upward the electric cleaner main body 100. Additionally, the lock mechanism provided with the
25 above-described conditions may be disposed. These concrete solving means will be described later in detail.

As described above, according to the embodiment, by connecting the electric cleaner main body 100 and the

connection tube 400 via the sub-handle 600, the vertical storage posture is easily taken, and the vertical storage posture can be maintained. Moreover, in the embodiment, the electric cleaner main body 100 and the connection tube
5 400 are divided and held on both sides of the handle part 660, and the electric cleaner 1 of the vertical storage posture can be lifted up with one hand via the handle part 660 while maintaining the posture. Thereby, since the load applied to the connecting part of the handle part 660 can
10 be dispersed, the structure unit of the sub-handle 600 can be simplified. Additionally, the left and right weight balance when holding the cleaner with the handle part 660 is enhanced and the conveyance properties can be enhanced.

Moreover, in the embodiment, when the entire
15 electric cleaner 1 is lifted up via the hand handle 300, the connection tube attaching mechanism 640 and the attaching part 401 are disengaged, so that the connection of the hand handle 300 and the connection tube 400 does not have to be unnecessarily firm. Furthermore, when the cleaner is
20 tentatively lifted up, the above-described connection is released. Therefore, the breakage of the device by dropping of the electric cleaner 1, or the damage of the connecting part of the hand handle 300 and the connection tube 400 can be prevented in advance.

25 Furthermore, in the embodiment, the connection of the connection tube attaching mechanism 640 and the attaching part 401 are not released even if they are obliquely pulled. By using this, the user manually holds the hand

handle 300, and can draw or push to move the electric cleaner 1 of the vertical storage posture. Specifically, in the embodiment, the vertical storage posture is maintained by the moving means 102, and the leg part 103
5 which forms the bottom surface in the vertical storage posture and is disposed on the back surface of the electric cleaner main body 100.

Moreover, since the connecting tube 400 is attached to ride over the electric cleaner main body 100,
10 the electric cleaner 1 of the vertical storage posture is inclined via the moving means 102 to raise the leg part 103 without being obstructed by the suction unit 500 attached to the connection tube 400, so that the electric cleaner main body 100 can be supported singly by the moving means
15 102. Therefore, the electric cleaner 1 of the oblique posture can be moved by using the moving means 102 via the hand handle 300.

Additionally, since the hand handle 300 is fixed on the upper end of the vertical storage posture, the hand
20 handle 300 in this high position is held, and the electric cleaner 1 fixed in the vertical storage posture can easily be moved by using the running means 102 via the handle.

Furthermore, in the embodiment, since the sub-handle 600 is detachably attached between the suction hose
25 200 and the electric cleaner main body 100, the electric cleaner superior in storage and conveyance properties can easily be provided without largely changing the structure of the conventional electric cleaner.

Moreover, when the length of the connection tube 400 can easily be shortened with the operation of the hand handle 300 to take the storage posture, the height H1 of the electric cleaner 1 during vertical storage can be
5 shortened. Additionally, in this embodiment, the height H1 during storage is set to about 1150 mm.

As described above, the electric cleaner 1 of the embodiment is superior in storage and conveyance properties in the vertical storage posture.

10 To simplify the following description, the section different from that of the embodiment shown in Figs. 1 and 2 will be described.

In Fig. 18, the electric cleaner main body 100 is provided with a dust collecting chamber having therein a
15 disposable dust collecting bag, and a pair of large wheels 104 and one universal wheel 105 constitute the moving means 102, which can be moved via the suction hose 200. In the usual cleaning (running) posture, the posture installed long back and forth on the surface to be cleaned with the
20 large wheels 104 and the universal wheel 105 is taken.

The electric cleaner main body 100 comprises the dust collecting chamber on one end of the longitudinal direction, and an electric blower and a cord reel part (not shown) on the other end. Furthermore, the universal wheel
25 105 is disposed below the dust collecting chamber, and a pair of large wheels 104 are disposed on both sides of the electric blower or the cord reel. Moreover, the hose attaching part 101 directed in the horizontal direction

along the longitudinal direction is formed on the end of the longitudinal direction. Moreover, the pair of large wheels 104 are disposed on the other end of the longitudinal direction which is opposite to the end with the
5 hose attaching part 101 disposed thereon, and installing parts 104a on the periphery of the large wheels 104 are disposed to jut out of the bottom surface and the back surface (the other end) of the electric cleaner main body 100. Thereby, by raising and rotating the universal wheel
10 105 centering on the rotation axis B1 of the large wheel 104, the electric cleaner main body 100 can be changed from the cleaning posture supported by the pair of large wheels 104 and the universal wheel 105 to the vertical storage posture of the vertical position in which the hose attaching
15 ing part 101 is directed in the vertical direction.

In the vertical storage posture, the electric cleaner main body 100 is stably supported by the pair of large wheels 104 and the and the leg part 103 disposed on the back surface upper part of the electric cleaner main
20 body 100. Moreover, for the electric cleaner main body 100, by increasing the height on the side of the end of the longitudinal direction in which the large wheels 104 are arranged, the arrangement space of the electric blower and the cord reel part disposed inside is secured. Addition-
25 ally, since the upper surface of the electric cleaner main body 100 is inclined from the high end of the longitudinal direction toward the other end, the running property and compact structure are achieved.

Moreover, a main handle part 107 by which the cleaner can be transported while maintaining the transversely long cleaning posture is disposed on the upper surface of the electric cleaner main body 100. The main
5 handle part 107 can be rotated centering on the rotation axis 108 disposed above the gravity center position G1 of the electric cleaner main body 100 and stored in the electric cleaner main body 100.

Furthermore, according to the embodiment, the
10 connection tube position holding means 140 for holding the posture of the connection tube 400 is disposed on the upper surface as the uppermost part of the electric cleaner main body 100 in the cleaning posture. This connection tube position holding means 140 is constituted of a pair of
15 protrusions 141 which support the connection tube 400 from left and right in the vertical storage state, and is disposed on the outer surface of the electric cleaner main body 100 which is positioned below the connection tube attaching mechanism 640 in the vertical storage posture.

20 Moreover, the operation control of the electric cleaner main body 100 is performed by the infrared ray receiving part 109 disposed on the upper surface of the electric cleaner main body 100 in response to the operation signal transmitted from the hand handle 300.

25 The sub-handle 600 is provided with a function for attaching the sub-handle 600 to the electric cleaner main body 100, a function for attaching the suction hose 200 to the sub-handle 600, a function for connecting the

electric cleaner main body 100 and the suction hose 200, a function for holding the connection tube 400, and a handle function for the user to hold this sub-handle 600.

In this embodiment, the appearance structure of
5 the sub-handle 600 comprises a tubular pipe structure member 601 for connecting the electric cleaner main body 100 and the suction hose 200, a connection tube attaching member 602 disposed parallel with the pipe structure member 601, a main connector 603 for connecting the connection
10 tube attaching structure member 602 to the pipe structure member 601, and a sub connector 604, and these four structure members are provided with a space 605 passing in the middle.

The sub connector 604 is positioned on the side
15 of the electric cleaner main body 100, and the main connector 603 is positioned on the opposite side. Additionally, the main connector 603 and the connection tube attaching structure member 602 are formed in a thickness such that the user can grip the members and at
20 least the through space 605 part is subjected to surface treatment such as rounding off the corners so that the user has no feeling of difference even when holding these two structure members.

In the sub-handle 600, the pipe structure member
25 601 constitutes the dust passage 630, the main body attaching mechanism 610 is disposed on one end, the hose attaching mechanism 620 is disposed on the other end, the connection tube attaching structure member 602 is provided

with the connection tube attaching mechanism 640, and the main connector 603 is provided with the handle part 660. Moreover, in the embodiment, the hose attaching mechanism 620 is attached to the hose attaching part 101 so that the
5 connection tube attaching structure member 602 is upward in the cleaning posture, and a hose connecting part 230 of the suction hose 200 is attached to the hose attaching mechanism 620.

According to the sub-handle 600, the user can
10 grip the connection tube attaching structure member 602 or the main connector 603 to easily change the posture from the cleaning posture shown in Fig. 2 to the vertical storage posture shown in Fig. 1.

Moreover, in the vertical storage posture, when
15 the electric cleaner main body 100 and the connection tube 400 are connected so that longitudinal directions are substantially parallel with each other, that is, the connection tube 400 is substantially placed in the vertical posture, the stability of the vertical storage posture is
20 enhanced, and the installation area can be reduced. For the electric cleaner main body 100 of the embodiment, the bottom surface of the electric cleaner main body 100 provided with the moving means 102 is substantially flat (substantially straight as seen from the side face), and
25 the upper surface of the electric cleaner main body 100 is constituted of an inclined surface so that the side of the large wheels 104 is thicker and the tip end with the hose attaching part 101 disposed thereon is tapered. Moreover,

in the electric cleaner main body 100, to reduce the falling during running, the hose attaching part 101 is attached in a low position.

Therefore, there is formed a wide space between
5 the connection tube 400 and the hose attaching part 101 which are substantially vertically to ride over the electric cleaner main body 100. In the embodiment, this space is utilized to arrange the sub-handle 600. The position in which this sub-handle 600 is disposed is above
10 the gravity center position of the electric cleaner 1 of the vertical storage posture, in the middle between the electric cleaner main body 100 as a main device and the connection tube 400 connected to the hand handle 300 and the suction unit 500, and is the upper position in which
15 the user can easily perform the operation.

Additionally, since there is a wide space in the position in which the sub-handle 600 is disposed, the transversely long hand handle 300 with a necessary length can be disposed so that the user firmly holds the electric
20 cleaner 1 of the vertical storage posture.

Furthermore, in the embodiment, the sub-handle 600 is provided with the sub connector 604 to maintain the strength, but when the sub-handle 600 is formed of a metal material or the like, the sub connector 604 does not need
25 to be necessarily disposed.

Moreover, in the embodiment, the connection tube 400 is held in a substantially vertical posture, but the vertical posture does not need to be strictly assumed. For

example, in the vertical storage posture, when the suction unit 500 disposed below the connection tube 400 deviates apart from the electric cleaner main body 100 to provide the connection tube attaching structure member 602 with an angle so that the hand handle 300 is positioned above the electric cleaner main body 100, the vertical storage posture is more stably supported. Additionally, during movement by the hand handle 300, since an angle of inclining the electric cleaner main body 100 can be reduced, the load of the user holding the hand handle 300 can be reduced.

Since the suction hose 200, the hand handle 300, the connection tube 400 and the suction unit 500 are substantially common in content with those described with reference to Figs. 1 and 2, the description thereof is omitted.

As described above, according to the embodiment, the electric cleaner 1 is provided with a function of controlling the operation of the electric cleaner main body 100 and moving the electric cleaner main body 100 and a function of controlling the movement of the suction unit 500 via the hand handle 300, and a function of fixing or releasing the expansion/contraction of the connection tube 400. Therefore, the user holding the hand handle 300 in the standing posture can perform the operation control, cleaning and storage without largely changing the attitude.

Additionally, since the hand handle 300 is disposed and held in the uppermost part in the vertical

storage posture, the cleaner can be moved by the hand handle 300 still in the vertical storage posture.

The concrete structure of the sub-handle will next be described in further detail with reference to Figs. 19 to 23. Fig. 19 is an exploded perspective view of the connected state of the sub-handle and the suction hose, Figs. 20 and 21 are exploded perspective views of another application example of the sub-handle, Figs. 22A and 22B are a partial perspective view and a partial sectional view showing the structure of attaching the connection tube to the sub-handle, and Fig. 23 is a side view of Fig. 22.

The connection structure of the sub-handle 600 and the suction hose 200 will first be described with reference to Figs. 19 to 21. In Fig. 19, the embodiment shown in Fig. 19 is constituted by integrally molding the tubular pipe structure member 601, the connection tube attaching structure member 602, the main connector 603 and the sub connector 604 with the resin material. Of course, the structure does not have to be necessarily integrally molded. For example, the structure may be constituted of two members divided to left and right in a position by a dotted line, and attached via screws.

Moreover, the main body attaching mechanism 610 disposed on one end of the pipes structure member 601 is protruded to be fit for the attachment shape of the hose attaching part 101 of the electric cleaner main body 100. In the embodiment, protrusions 611 are disposed on both sides of a projected pipe 617, which prevents the main body

attaching mechanism 610 from being rotated when attached to the hose attaching part 101. Additionally, the protrusion 611 is provided with a fixing mechanism 612 for fixing the coupling of the main attaching mechanism 610 and the hose
5 attaching part 101.

The fixing mechanism 612 is constituted of a recessed portion 613 formed in the outer peripheral face of the protrusion 611, a protective plate 614 for covering the recessed portion 613, a seesaw switch 615 disposed in the
10 protective plate 614, and a spring 616 for constantly placing the fixing mechanism 612 into a fixed state. The seesaw switch 615 has a protruded button on one end, and a fixing click on the other end, and the protective plate 614 are provided with windows via which the protruded button
15 and fixing click are exposed. Additionally, the protruded button and fixing click are disposed to always jut out to the outer periphery by the spring 616. Therefore, when the switch is attached to the hose attaching part 101, this fixing click can be engaged and fixed in a recessed portion
20 disposed on the inner side of the hose attaching part 101. To release the engagement, the protruded button may be depressed.

Moreover, the hose attaching mechanism 620 disposed on the other end of the pipe structure member 601
25 is structured so that a connection ring 230 disposed on the end of the suction hose 200 is inserted and coupled. Specifically, in the embodiment, a fixed ring 231 is attached to the end of a bellows hose, and the connection

ring 230 is attached to be rotatable to the fixed ring 231 and be protruded from the fixed ring 231 in the tube axis direction. Additionally, an engaging part 232 is formed on the outer periphery of the connection ring 230 to be always
5 protruded in the outer peripheral direction by using the elasticity of resin, and an engagement hole 621 for engaging with the engaging part 232 is disposed in the outer wall of the dust passage 630 of the hose attaching mechanism 620.

10 Thereby, when the connection ring 230 is inserted to the hose attaching mechanism 620 and the engaging part 232 is engaged in the engagement hole 621, the ring and mechanism are interconnected.

 According to the structure, since the suction
15 hose 200 is rotatably attached to the sub-handle 600, the distortion of the suction hose 200 can be reduced. Furthermore, in the embodiment, by pushing the engaging portion 232 inward via the engagement hole 621, the engagement can be released, which is effective during
20 maintenance.

 The application example of the sub-handle 600 will next be described with reference to Fig. 20. In the embodiment of Fig. 19, the pipe structure member 601, the connection tube attaching structure member 602, the main
25 connector 603 and the sub-connector 604 are integrally molded with resin, but this is not limited, and the pipe structure member 601 may be structured to be separable from the other structure members.

For example, in the embodiment shown in Fig. 20, the pipe structure member 601a is separated from the other structure members, and this pipe structure member 601a is provided with the main body attaching mechanism 610 for
5 attachment to the electric cleaner main body 100, the hose attaching mechanism 620 for attaching the suction hose 200, and the dust passage 630 for connecting the electric cleaner main body 100 and the suction hose 200. Additionally, a separate structure member 608 is integrally molded
10 with resin of a tubular pipe structure member attaching part 606 to be attached to the pipe structure member 601a, the connection tube attaching structure member 602 disposed parallel with the pipe structure member 601a via the pipe structure member attaching part 606, the main connector 603
15 for connecting the connection tube attaching structure member 602 to the pipe structure member attaching part 606, and the sub connector 604. This separate structure member 608 and the pipe structure member 601a are detachably attachable.

20 In the embodiment, the pipe structure member attaching part 606 is formed to be tubular, and by inserting and passing the pipe structure member 601a through the part 606, the main body attaching mechanism 610 disposed on one end of the pipe structure member 601a is attached to
25 the hose attaching part 101. For the pipe structure member attaching part 606, an engagement part 609 is disposed on the inner surface of the pipe structure member attaching part 606 so that the pipe structure member attaching part

606 is prevented from being dislocated toward the suction hose by a positioning protrusion 607 disposed on the outer periphery of the pipe structure member 601a.

Here, the separate structure member 608 may be
5 constituted of divided left and right members and fixed with screws in the same manner as in the integral structure of Fig. 19. Moreover, the pipe structure member attaching part 606 is not limited to the tubular shape as long as it is detachably attached to the pipe structure member 601a
10 and the connected state can firmly be maintained. Moreover, since the same numerals as those shown in Figs. 4 and 3 denote the same positions and functions, the description thereof is omitted.

According to the embodiment shown in Fig. 20,
15 even when the separate structure member 608 is removed, the function as the electric cleaner 1 is not deteriorated. Therefore, the member can easily be removed if convenience in the vertical storage posture is not required. Moreover, even when no remarkable design change is applied to the
20 pipe structure member 601a to detachably attach the pipe structure member attaching part 606, the handiness in the vertical storage posture can be enhanced and the general-purpose properties can be enhanced.

Next, in Fig. 21, a connection tube attaching
25 mechanism 830 connectable to the hose attaching part 101 of the electric cleaner main body 100 is disposed on the tip end of the suction hose 200, and a detachable/attachable sub-handle 600 is disposed between the hose attaching part

101 of the electric cleaner main body 100 and the connection tube attaching mechanism 830. Fig. 21 is a sectional view in a connected state of the electric cleaner main body 100, the sub-handle 600 and the suction hose 200.

5 The sub-handle 600 of the embodiment is also integrally molded with the resin material of the pipe structure member 601, the connection tube attaching structure member 602, the main connector 603 and the sub connector 604.

10 The main body attaching mechanism 690 disposed on one end of the pipe structure member 601 has the same outer shape as that of the connection tube attaching mechanism 830, and a sub-handle hose attaching part 691 provided with the same shape as that of the hose attaching part 101 of
15 the electric cleaner main body 100 is disposed on the other end. Additionally, the main body attaching mechanism 690 and the connection tube attaching mechanism 830 are both provided with the fixing mechanism 612 (not shown).

 According to the structure, the main body attaching
20 ing mechanism 690 of the sub-handle 600 and the connection tube attaching mechanism 830 of the suction hose 200 both have the same outer shape. Therefore, the sub-handle 600 is unnecessary, the sub-handle 600 may be removed, and the connection tube attaching mechanism 830 can directly be
25 attached to the hose attaching part 101 of the electric cleaner main body 100.

 Therefore, according to this embodiment, since the sub-handle 600 can easily be attached to, or detached

from various electric cleaner main bodies 100 provided with the characteristics described with reference to Figs. 17, 18, the general-purpose properties can be enhanced.

Additionally, in the application to the suction
5 hose 200 provided with the power supply or the signal conductor, the main body attaching mechanism 690 and the sub-handle hose attaching part 691 are provided with the power sources or signal conductor connection terminals, respectively, and further a cord may be disposed to connect
10 the terminals.

The connection structure of the connection tube attaching mechanism 640 and the attaching part 401 disposed on the connection tube 400 will next be described with reference to Figs. 22A, 22B, 23. In Fig. 22A, as described
15 above, the attaching part 401 is provided with the attachment protrusion 410 disposed on the back surface of the connection tube 400, and the engagement parts 411 protruded in the expansion/contraction direction and to both sides. When the engagement part 411 is provided with a stopper
20 part 412 in the upper part, and a recessed groove 413 is formed from both sides toward the lower side of the attachment protrusion 410, as shown in Fig. 22B, a cross section shape is formed in T-type in which both sides of the protruded part are projected. As shown in Fig. 23, in
25 the side surface shape, the protruded tip end is formed to protrude downward.

On the other hand, for the connection tube attaching mechanism 640, a recessed rail 641 is formed

along the longitudinal direction of the connection tube attaching structure member 602. For the rail 641, a pair of guide rails 642 projected inward are formed along the rail 641, and the guide rails 642 are engaged in the

5 recessed grooves 413 to support the attachment protrusion 410 from both sides. Moreover, in the vertical storage posture, an inclined face 643 is formed on the rail 641 as the upper side to guide the attachment protrusion 410 to the rail 641.

10 According to this structure, as shown in Figs. 22A, 22B and 23, when the attaching part 401 is be inserted to the connection tube attaching mechanism 640 from above, the lower engagement part 411a of the attachment protrusion 410 first abuts on the inclined surface 643, and is guided
15 to the rail 641, further engaged with both engagement parts 411b of the attachment protrusion 410, and inserted until the stopper part 412 abuts on the connection tube attaching structure member 602.

 Therefore, when the connection tube attaching
20 structure member 602 is pulled upward via the sub-handle 600, the attaching part 401 is held by the stopper part 412 and the guide rail 642 in the vertical direction and the horizontal direction, so that the connection tube 400 can be lifted up. On the other hand, when the connection tube
25 400 is lifted up via the hand handle 300, the weight of the electric cleaner main body 100 cannot be held with the engagement structure of the connection tube attaching mechanism 640 and the attaching part 401, so that the

connection tube 400 can be lifted up without lifting up the electric cleaner main body 100 and by releasing the engagement.

On the other hand, when the electric cleaner 1 of the vertical storage posture is inclined, a part of stress generated by the weight of the electric cleaner main body 100 held by the moving means 102 is applied to the engagement part of the connection tube attaching mechanism 640 and the attaching part 401, the engagement part of the rail 641 and the engagement part 611 is strained, and the engagement cannot easily be released. Therefore, by this engagement the hand handle 300 is held and the electric cleaner 1 of the inclined posture can be moved. Additionally, the strength of the engagement may be adjusted by increasing the contact surfaces of the rail 641 and the engagement part 611, or by adjusting the engagement degree to obtain an appropriate engagement stress. Moreover, the contact surface may be subjected to surface treatment to raise the friction coefficient.

The connection tube position holding means 140 will next be described with reference to Figs. 24A, 24B. Figs. 24A, 24B are explanatory views of the connection tube position holding means, Fig. 24A is a side view of the electric cleaner of the vertical storage posture, and Fig. 24B is a A-A sectional view of Fig. 24A.

In Figs. 24A, 24B, in this embodiment, by coupling the connection tube attaching mechanism 640 and the attaching part 401 disposed on the connection tube 400, the

connection of the electric cleaner main body 100 and the connection tube 400 can sufficiently be maintained.

However, to reduce the load on the connected part, while the lower position of the connected part, that is, the
5 connection tube 400 in the substantially vertical posture is attached to the sub-handle 600, there is provided the connection tube position holding means 140 constituted of a pair of protrusions 141 for holding the lower position of the connection tube 400 in the position in which the
10 connection tube 400, or the suction unit 500 disposed below the connection tube 400 and the upper surface of the electric cleaner main body 100 contact each other.

The connection tube position holding means 140 resists against stresses of directions of arrows Q1 shown
15 in Fig. 24B. For example, in the electric cleaner of the vertical storage posture of Fig. 24A, when the hand handle 300 is held, the force of bringing down the hand handle 300 to the right (arrow Q3) allows the electric cleaner main body 100 to easily fall down by the large wheels 104 so
20 that the load applied to the connection part of the attaching part 101 and the sub-handle 600 is not large.

Moreover, for the force of bringing down the handle to the left (arrow Q2) in Figs. 24A, 24B, the connection tube 400 or the suction unit 500 is pressed
25 against the upper surface of the electric cleaner main body 100 so that the load applied to the connection part of the attaching part 101 and the sub-handle 600 can be reduced.

However, since the force of bringing down the

hand handle 300 in the horizontal direction (arrow Q1) forms a force of rotating centering on the connection part of the attaching part 101 and the sub-handle 600, a large load is applied to the connection part. To prevent this, a
5 rigid structure becomes necessary.

Therefore, in this embodiment, a pair of protrusions 141 are disposed to prevent the deviation in the horizontal direction in the position (uppermost part in the cleaning posture) in which the connection tube 400 or the
10 suction unit 500 contacts the upper surface of the electric cleaner main body 100. Thereby, the strength of the connection part stronger than necessary is reduced and lightening can be achieved.

A method of using the sub-handle will next be
15 described with reference to Figs. 25A to 25C. Figs. 25A to 25C are explanatory views of a state of moving the electric cleaner 1 of the vertical storage posture, Fig. 25A is an explanatory view when the conventional example is lifted up, Fig. 25B is an explanatory view when the electric
20 cleaner 1 of the embodiment is lifted up, and Fig. 25C is an explanatory view of a state of moving the electric cleaner 1 of the embodiment via the moving means.

First, in the conventional art of Fig. 25A, in a general structure, the connection tube 400 is attached to
25 the side of the bottom surface of the electric cleaner main body 100 in the vertical storage posture. In the vertical storage posture of the conventional type, the attaching part disposed on the connection tube 400 is directly

attached to the tip end of the electric cleaner main body 100 in the structure. Therefore, when the electric cleaner of the vertical storage posture is lifted up, the cleaner is lifted up via the sub handle disposed on the bottom surface of the electric cleaner main body 100 (disposed below the hose attaching part).

However, since the sub handle is disposed in the position deviating from the gravity center position of the electric cleaner with the vertical storage posture, and when the electric cleaner is held with the sub handle, the electric cleaner of the vertical storage posture has to be held in the inclined posture. Particularly, when the electric cleaner is lifted up, it falls from the vertical posture down to the inclined posture. Therefore, the suction hose 200 obstructs the lifting. It is difficult to lift up the cleaner or to take balance.

On the other hand, as shown in Fig. 25B, the electric cleaner 1 of the embodiment can be lifted up via the sub-handle 600 in the vicinity of and above the gravity center position of the electric cleaner 1. In this case, the handle part 660 is easily gripped. Additionally, since the electric cleaner main body 100 and the connection tube 400 are divided and supported on both sides of the longitudinal direction of the handle part 660, it is easy to take balance. Moreover, as shown in Fig. 25B, since the user can carry the suction hose 200 under her arm, the transport posture becomes excellent.

Moreover, as shown in Fig. 25C, in the embodi-

ment, the user holding the hand handle 300 brings obliquely down the electric cleaner 1 of the vertical storage posture centering on the large wheels 104, and pulls or pushes the held hand handle 300 so that the electric cleaner 1 can be
5 moved by using the large wheels 104.

However, in the conventional art, since the connection tube 400 is attached to the side of the bottom surface provided with the large wheels, the connection tube offers obstruction and the movement by the large wheels 104
10 is difficult. Moreover, in the conventional art, since the attaching part of the connection tube 400 is hooked onto the electric cleaner main body 100 from above, the connection tube 400 is detached when pulled obliquely. However, in the embodiment, the cleaner can easily be moved simply
15 by inclining the vertical storage posture via the hand handle 300.

(Other Embodiment of Connection Tube Attaching Mechanism provided with Lock Mechanism)

The lock mechanism of the connection tube
20 attaching mechanism 640 and the attaching part 401 will next be described with reference to Figs. 26 and 27. Fig. 26 is a partial perspective view of the attached state of the connection tube attaching mechanism 640 and the attaching part 401, and Fig. 27 is a partial vertical sectional
25 view.

In the embodiment, the connection tube attaching mechanism 640 of the sub-handle 600 is provided with a lock mechanism 731 for fixing the attaching part 401. The lock

mechanism 731 is constituted of a lock lever 732 disposed on the outer surface of the sub-handle 600, a seesaw bar 733 incorporated in the sub-handle and a spring 734. In the embodiment, by disposing the lock lever 732 on the upper surface of the handle part 660, the visibility and operation properties are enhanced. Moreover, when the user holds the handle, the upper surface of the handle part 660 is most difficult to be touched, so that error operation can be prevented.

10 Furthermore, one end of the seesaw bar 733 abuts on the lock lever 732, other end thereof forms an attachment click 735 which rises from or sets in a window 737 disposed in the connection tube attaching mechanism 640, and the attachment click 735 is always protruded from the window 737 by the spring 734 to maintain the locked state.

On the other hand, a recessed portion 736 to be engaged with the attachment click 735 is disposed on the surface of the attaching part 401 which abuts on the connection tube attaching mechanism 640.

20 Moreover, in the embodiment, when the connection tube 400 is pulled upward via the hand handle 300, the strength of the spring 734 is set so that the engagement of the attachment click 735 and the recessed portion 736 cannot bear the weight of the electric cleaner main body 100. Of course, the fixed state may be maintained.

Additionally, the tip end of the attachment click 735 is wedge-shaped. Moreover, since the recessed portion to be engaged with the click is formed to have a V-shaped

section, and if the force of pressing the spring 734 is weakened, the engagement is released.

(Other Embodiment concerning Structure of Connection Tube Attaching Mechanism of Second Embodiment)

5 Additionally, the structure of the connection tube attaching mechanism 640 is not limited to the above-described embodiments. For example, a recessed rail is formed along the longitudinal direction of the connection tube 400 in the attaching part 401 of the connection tube
10 400, and the connection tube attaching mechanism 640 may be provided with the protrusion 702 having a T-shaped sectional shape to be engaged in the recessed rail.

 Moreover, an engagement hole is formed in one side of the handle part 660 as the upper part of the sub-
15 handle 600 in the vertical storage posture, and the attaching part 401 of the connection tube 400 may be engaged in the engagement hole. In this case, the entrance of the engagement hole is wide, and the inside thereof is narrowed.

20 Moreover, in the lock mechanism 731 for fixing the attaching part 401, the abutment surfaces of the connection tube attaching mechanism 640 and the attaching part 401 may be provided with means for preventing the slippage (sliding) of both members. For example, the
25 contact surfaces of the connection tube attaching mechanism 640 and the attaching part 401 may be provided with concave/convex patterns, such as wave patterns along the sliding surface.

Furthermore, by providing the contact surfaces of the attaching part 401 and the connection tube attaching mechanism 640 with a spring, they are positively pressed against each other, so that the insertion property of the attaching part 401 may be enhanced. For example, the contact surface of the connection tube attaching mechanism 640 is provided with a recessed portion, and a leaf spring may be disposed in the recessed portion. In this case, to enhance the positioning at the time of insertion, the entrance portion of the rail part 641 is enlarged, and the leaf spring is disposed at an interval from the entrance portion of the contact surface so that the insertion easiness and click feeling at the time of locking are obtained.

Furthermore, the lock mechanism of the attaching part 401 and the connection tube attaching mechanism 640 is disposed on the side of the connection tube 400 provided with the attaching part 401, and by operation of the trigger switch 301 disposed on the hand handle 300, the locking (fixing) of the lock mechanism can be released. For example, the lock mechanism provided with the attachment rising/setting click rising from/setting in the attaching part 401 is disposed on the attaching part 401 of the connection tube 400, and the recessed portion for engaging with the attachment click may be disposed in the rail part of the connection tube attaching mechanism. Therefore, by the operation of the trigger switch 301 disposed on the hand handle 300, and the operation of the

second lock switch 431, the connection tube expansion/
contraction mechanism 402 is operated so that the length of
the connection tube 400 can be adjusted, and the connection
of the sub-handle 600 and the connection tube 400 can be
5 released.

(Other Embodiment)

When the suction hose is provided with the power
supply wire or the signal conductor, and the power supply
or the like is operated by the hand handle, or when the
10 suction unit 500 is provided with a rotation brush drive
motor, the sub-handle, the suction hose, the hose attaching
part of the electric cleaner main body, or each connecting
part of the connection tube may be provided with a known
connection terminal.



WHAT IS CLAIMED IS:

1. An electric cleaner, comprising: an electric cleaner main body; a suction hose; a hand handle; a connection tube; and a suction unit for sucking dust, said dust sucked via said suction unit being passed through a ventilating path formed inside said connection tube, said hand handle and said suction hose and being introduced to said electric cleaner main body,

said connection tube comprising a first tube body having one end detachably connected to said hand handle, and a second tube body having one end slidably connected to the other end of said first tube body and the other end connected to said suction unit,

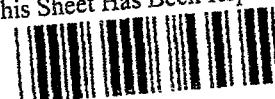
said first tube body comprising fixing means for fixing sliding of said second tube body, and releasing means for releasing obstruction of the sliding of said fixing means to allow said sliding operation,

said hand handle comprising a switch for operating said releasing means.

2. An electric cleaner, comprising: an electric cleaner main body; a suction hose; a hand handle; a connection tube; and a suction unit for sucking dust, said dust sucked via said suction unit being passed through a ventilating path formed inside said connection tube, said hand handle and said suction hose and being introduced to said electric cleaner main body,

said connection tube comprising a first tube body in which the ventilation path is formed and a second tube

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body in which the ventilation path is formed,

said second tube body being formed to be thinner than said first tube body, one end of said second tube body being inserted into said first tube body, and one end of said second tube body having a structure slidable inside said first tube body,

fixing means for obstructing said sliding and releasing means for releasing obstruction of said sliding to allow said sliding operation being disposed on the side on which said first tube body is inserted,

said hand handle comprising a switch for releasing said sliding obstruction, said first tube body comprising transmitting means for transmitting the operation of said switch to said first tube body, wherein

the sliding of said second tube body inserted into said first tube body can be obstructed by said fixing means, the operation of said switch disposed on said hand handle is transmitted to said releasing means via said transmitting means, and the obstructing operation of the sliding by said fixing means is released.

3. An electric cleaner, comprising: an electric cleaner main body; a flexible hose; a hand handle; a connection tube; and a suction unit for sucking dust, said flexible hose being disposed between said electric cleaner main body and said hand handle, said connection tube being disposed between said suction unit and said hand handle, said hand handle being curved on the side opposite to said connection tube,

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said connection tube comprising a first tube body and a second tube body in which ventilation paths are formed, respectively,

said second tube body being formed to be thinner than said first tube body, one end of said second tube body being inserted into said first tube body, and one end of said second tube body having a structure slidable inside said first tube body,

said first tube body comprising fixing means for pressing said second tube body to obstruct the sliding of said second tube body,

said hand handle comprising a switch for releasing said sliding obstruction,

said first tube body comprising releasing means for releasing the pressing of said second tube body based on the operation of said switch,

said releasing means comprising a structure in which by operation of said switch disposed on said hand handle, the obstructing operation of the sliding by said fixing means is released.

4. An electric cleaner, comprising an electric cleaner main body provided with a blower for sucking dust to a dust collecting chamber; a flexible suction hose having one end attached to said electric cleaner main body and connected to said blower; a hand handle attached to the other end of said suction hose and connected to said blower; a connection tube attached to said hand handle and connected to said suction hose; and a suction unit attached





to said connection tube and connected to the connection tube,

said connection tube comprising a first tube body having one end detachably connected to said hand handle, and a second tube body having one end slidably connected to the other end of said first tube body and having the other end connected to said suction unit,

said first tube body comprising fixing means for fixing sliding of said second tube body, releasing means for releasing obstruction of the sliding of said fixing means to allow said sliding operation, and second transmitting means for operating the fixing means,

said hand handle comprising a switch for operating said releasing means, and first transmitting means for transmitting the operation of said switch, wherein

said first transmitting means and the second transmitting means are connected by connecting said hand handle and the connection tube.

5. An electric cleaner, comprising an electric cleaner main body provided with a blower for sucking dust to a dust collecting chamber; a flexible suction hose having one end attached to said electric cleaner main body and connected to said blower; a hand handle attached to the other end of said suction hose and connected to said blower; a connection tube attached to said hand handle and connected to said suction hose; and a suction unit attached to said connection tube and connected to the connection tube,





said connection tube comprising a first tube body having one end detachably connected to said hand handle, and a second tube body having one end slidably connected to the other end of said first tube body and having the other end connected to said suction unit,

said first tube body comprising fixing means for fixing sliding of said second tube body, releasing means for releasing obstruction of the sliding of said fixing means to allow said sliding operation, and second transmitting means for operating the fixing means,

said hand handle comprising a switch for operating said releasing means, and first transmitting means for transmitting the operation of said switch, wherein

said first transmitting means and the second transmitting means are connected by connecting said hand handle and the connection tube,

said fixing means and said releasing means are disposed on the end of the first tube body connected to said second tube body,

said second transmitting means is disposed between said releasing means, and the end of the first tube body connected to said hand handle.

6. The electric cleaner according to any one of claims 1 to 5, wherein

said second tube body comprises recessed parts arranged at predetermined intervals along a longitudinal direction and slidably attached inside said first tube body,

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said fixing means comprises a fixing click disposed so that the fixing click can rise/set in said first tube body, the fixing click is engaged in said recessed part of said second tube body, and said releasing means releases said engagement.

7. The electric cleaner according to any one of claims 1 to 5, wherein

said first transmitting means comprises a first connection rod disposed between said switch and a connecting part of said hand handle connected to said connection tube,

said second transmitting means comprises a second connection rod disposed between said releasing means and the end of the first tube body connected to said hand handle,

the ends of said first connection rod and the second connection rod are allowed to abut on each other by connecting said hand handle and the connection tube to transmit the operation of said switch to said releasing means.

8. The electric cleaner according to any one of claims 1 to 5, wherein

said hand handle is provided with a bar-shaped grip part long in a back and forth direction on an extension line of a tube axis of said connection tube, and said switch is disposed below the grip part,

said first transmitting means comprises a first connection rod disposed between said switch and a





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connecting part of said hand handle connected to said connection tube,

said second transmitting means comprises a second connection rod disposed between said releasing means and an end of the first tube body connected to said hand handle,

the ends of said first connection rod and the second connection rod are allowed to abut on each other by connecting said hand handle and the connection tube to transmit the operation of said switch to said releasing means,

said first connection rod comprises a rotating member for reversing in a movement direction, a first rod member for connecting the rotating member and said switch, and a second rod member abutting on said rotating member and said second connection rod,

said switch can slide in a direction of the extension line of the tube axis of said connection tube, and by moving the switch in a direction attracted to said grip part, said releasing means performs releasing operation.

9. The electric cleaner according to any one of claims 1 to 5, wherein

said hand handle is provided on one end with a connection tube connecting part connected to said connection tube, and on the other end with a handle part,

said suction hose is attached between said connection tube connecting part and said handle part to extend in a bending direction to a tube axis direction of

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said connection tube,

said handle part formed into a bar shape by bending the handle part so that the handle part is positioned above said suction hose, and said switch is disposed below the front part of the grip part,

said first transmitting means comprises a first connection rod disposed between said switch and a connecting part of said hand handle connected to said connection tube,

said second transmitting means comprises a second connection rod disposed between said releasing means and the end of the first tube body connected to said hand handle,

the ends of said first connection rod and the second connection rod are allowed to abut on each other by connecting said hand handle and the connection tube to transmit the operation of said switch to said releasing means,

said first connection rod comprises a rotating member for reversing in a movement direction, a first rod member for connecting the rotating member and said switch, and a second rod member abutting on said rotating member and said second connection rod,

said switch can slide in a direction of the extension line of the tube axis of said connection tube, and by moving the switch in a direction attracted to said grip part, said releasing means performs releasing operation.

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10. The electric cleaner according to claim 1 or 5, wherein

said hand handle is provided with a bar-shaped grip part long in a back and forth direction on an extension line of a tube axis of said connection tube, and said switch is disposed below the front part of the grip part,

said first transmitting means comprises a first connection rod disposed between said switch and a connecting part of said hand handle connected to said connection tube,

said second transmitting means comprises a second connection rod disposed between said releasing means and the end of the first tube body connected to said hand handle,

the ends of said first connection rod and the second connection rod are allowed to abut on each other by connecting said hand handle and the connection tube to transmit the operation of said switch to said releasing means,

said first connection rod comprises a rotating member for reversing in a movement direction, a first rod member for connecting the rotating member and said switch, and a second rod member abutting on said rotating member and said second connection rod,

said switch can slide in a direction of the extension line of the tube axis of said connection tube, and by moving the switch in a direction attracted to said





grip part, said releasing means performs releasing operation,

said hand handle comprises a lower case provided with a conveyance path for connecting said connection tube and said suction hose, an upper case provided with an operation switch, and a component arrangement part extended and formed to said handle,

said component arrangement part formed on said lower case is provided with said switch, and said first connection rod for transmitting the operation of the switch, and the component arrangement part formed on said upper case is provided with an operation substrate.

11. The electric cleaner according to claim 1 or 5, wherein said first tube body comprises a second switch for operating said releasing means.

12. An electric cleaner, comprising an electric cleaner main body provided with a blower for sucking dust to a dust collecting chamber; a connecting unit detachably attached to a hose attaching part of the electric cleaner main body; a flexible suction hose having one end attached to said connecting unit and connected to said blower; a hand handle attached to the other end of said suction hose and connected to said blower; a connection tube attached to said hand handle and connected to said suction hose; and a suction unit attached to said connection tube and connected to the connection tube,

said electric cleaner main body comprises a plurality of moving wheels, the moving wheels comprising a





pair of moving wheels disposed on the lower surface rear of said electric cleaner main body so that the outer peripheral portion of the wheel contacting a running surface is projected downward and rearward;

said electric cleaner main body further comprising the hose attaching part for detachably attaching said connecting unit on a tip end,

said connecting unit comprising connecting means which can detachably attach said connection tube to ride over the side of the upper surface of said electric cleaner main body.

13. An electric cleaner, comprising an electric cleaner main body provided with a blower for sucking dust to a dust collecting chamber; a connecting unit detachably attached to a hose attaching part of the electric cleaner main body; a flexible suction hose having one end attached to said connecting unit and connected to said blower; a hand handle attached to the other end of said suction hose and connected to said blower; a connection tube attached to said hand handle and connected to said suction hose; and a suction unit attached to said connection tube and connected to the connection tube,

said electric cleaner main body comprises a plurality of moving wheels, the moving wheels comprising a pair of moving wheels disposed on the lower surface rear of said electric cleaner main body so that the outer peripheral portion of the wheel contacting a running surface is projected downward and rearward;

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said electric cleaner main body further comprising the hose attaching part for detachably attaching said connecting unit on a tip end,

said connecting unit comprising connecting means which attaches a handle part projected on the side of the upper surface of said electric cleaner main body, attaches said suction hose below the connecting unit, and can detachably attach said connection tube to ride over the side of the upper surface of said electric cleaner main body on the upper end of said handle part.

14. The electric cleaner according to claim 12 or 13, wherein said connecting unit comprises a main body attaching mechanism part for attaching the connecting unit to said electric cleaner main body, a hose attaching mechanism part for attaching said suction hose, a dust passage for connecting said electric cleaner main body and said suction hose, a connection tube attaching mechanism part for holding said connection tube on the side of the upper surface of said electric cleaner main body in a posture in which a longitudinal direction coincides with a movement direction of said pair of moving wheels, and the handle part for holding the connecting unit.

15. The electric cleaner according to claim 12 or 13, wherein said connecting unit comprises attaching means for attaching the connecting unit to said electric cleaner main body, attaching means for attaching said suction hose to the connecting unit, connecting means for connecting said electric cleaner main body and said suction hose, and





handle means for holding the connecting unit for holding said connection tube on the side of the upper surface of said electric cleaner main body in a posture in which a longitudinal direction coincides with a movement direction of said pair of moving wheels.

16. The electric cleaner according to claim 12 or 13, wherein said connecting unit comprises a tubular pipe structure unit for connecting said electric cleaner main body and said suction hose, a connection tube attaching structure unit disposed parallel with the pipe structure unit, a main connecting unit for connecting said connection tube attaching structure unit to said pipe structure unit, and a sub connecting unit,

said four structure units are formed to be provided with a space passing through a middle thereof.

17. The electric cleaner according to claim 12 or 13, wherein said connecting unit comprises: a pipe structure unit comprising on one end a main body attaching mechanism part for attaching the connecting unit to said electric cleaner main body, comprising on the other end a hose attaching mechanism part for attaching said suction hose, and constituting a dust passage for connecting said electric cleaner main body and said suction hose;

a connection tube attaching part disposed parallel with the pipe structure unit for holding said connecting tube on the side of the upper surface of said electric cleaner main body in a posture in which a longitudinal direction coincides with a movement direction of





said pair of moving wheels; and

a main connecting unit for connecting said connection tube attaching structure unit to said pipe structure unit, and

a space is formed to constitute a handle between said pipe structure unit and said connection tube attaching mechanism part.

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