

(19)



(11)

EP 3 662 805 A1

(12)

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

(43) Date of publication:

10.06.2020 Bulletin 2020/24

(51) Int Cl.:

A47L 9/32 (2006.01)

(21) Application number: **18842320.6**

(86) International application number:

PCT/JP2018/028595

(22) Date of filing: **31.07.2018**

(87) International publication number:

WO 2019/026882 (07.02.2019 Gazette 2019/06)

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

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(54) **ELECTRIC VACUUM CLEANER**

(57) To provide an electric vacuum cleaner that can store its movable handle in a non-problematic position even when the cleaner body is set to the standing position or is used in the inverted position. The electric vacuum cleaner 1 includes: a body housing 11 provided with a handle storage recess 11a; a handle 14 that is provided on the body housing 11 and can move between a storage position in which the handle 14 is entered the handle storage recess 11a and a use position in which the handle 14 is released from the handle storage recess 11a; and a handle holding mechanism 61 that holds the handle 14 being in the storage position in the handle storage recess 11a.

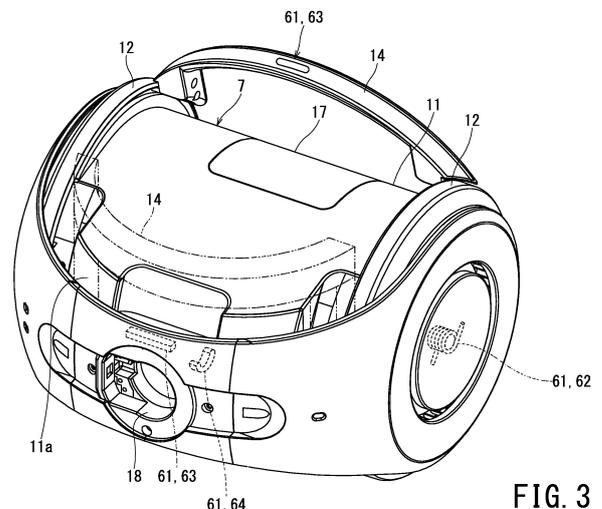


FIG. 3

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Description

FIELD

[0001] Embodiments according to the present invention relate to an electric vacuum cleaner.

BACKGROUND

[0002] A known canister-type electric vacuum cleaner includes a cleaner body and a rotatable handle provided at the front end portion of the cleaner body.

Prior Art Document

Patent Document

[0003] [Patent Document 1] JP 2014-204773 A

SUMMARY

Problems to be solved by Invention

[0004] When the cleaner body is stored in a standing position, the handle of the cleaner body may hang down and interfere with storage. In addition, when the cleaner body is used in an inverted position (turned upside down) with respect to the wheels that support the cleaner body, the handle of the cleaner body may hang down and hinder running.

[0005] Accordingly, it is an object of the present invention to provide an electric vacuum cleaner that can store its movable handle in a non-problematic position even when the cleaner body is set to the standing position or is used in the inverted position.

Means for solving Problem

[0006] To achieve the above object, an electric vacuum cleaner includes: a body housing provided with a handle storage recess; a handle that is provided on the body housing and is configured to move between a storage position in which the handle is entered the handle storage recess and a use position in which the handle is released from the handle storage recess; and a handle holding mechanism that holds the handle being in the storage position in the handle storage recess.

[0007] It may be desired that the handle holding mechanism is configured to hold the handle being in the storage position in the handle storage recess even when the body housing is in a standing position.

[0008] It may be desired that the handle holding mechanism is configured to hold the handle being in the storage position in the handle storage recess even when the body housing is in an inverted position.

[0009] It may be desired that the handle is swingably provided on the body housing.

[0010] It may be desired that the handle is provided in

such a manner that the handle is configured to be linearly moved in a direction of approaching or moving away from the body housing.

[0011] It may be desired that the handle holding mechanism includes an elastic member that generates force to move the handle to the storage position.

[0012] It may be desired that the handle holding mechanism includes a concave member and a convex member that are provided in the handle and the handle storage recess to be interdigitated with each other.

[0013] It may be desired that any one of the concave member and the convex member is provided in the handle storage recess.

[0014] It may be desired that the handle holding mechanism includes a hook mechanism that moves by its own weight to be hooked on the handle before the handle is released from the handle storage recess by its own weight.

[0015] It may be desired that the hook mechanism is provided in the handle storage recess.

BRIEF DESCRIPTION OF DRAWINGS

[0016]

Fig. 1 is a perspective view of a station and an electric vacuum cleaner according to one embodiment of the present invention.

Fig. 2 is another perspective view of the station and the electric vacuum cleaner according to the embodiment of the present invention.

Fig. 3 is a perspective view illustrating a state where a handle of the electric vacuum cleaner according to the embodiment of the present invention is pulled out.

Fig. 4 is a cross-sectional view of a handle holding mechanism of the electric vacuum cleaner according to the embodiment of the present invention.

Fig. 5 is another cross-sectional view of the handle holding mechanism of the electric vacuum cleaner according to the embodiment of the present invention.

Fig. 6 is still another cross-sectional view of the handle holding mechanism of the electric vacuum cleaner according to the embodiment of the present invention.

DETAILED DESCRIPTION

[0017] Embodiments of an electric vacuum cleaner according to the present invention will be described by referring to Fig. 1 to Fig. 6.

[0018] Fig. 1 and Fig. 2 are perspective views of a station and an electric vacuum cleaner according to the embodiment of the present invention.

[0019] As shown in Fig. 1 and Fig. 2, the electric vacuum cleaner 1 according to the present embodiment can be connected to and stored in a station 2 (Fig. 1), and

also can be used in the state of being separated from the station 2 (Fig. 2).

[0020] Fig. 1 shows a configuration in which the electric vacuum cleaner 1 is connected to the station 2. This configuration is called a storage configuration of the electric vacuum cleaner 1. Fig. 2 shows a configuration in which the electric vacuum cleaner 1 is disconnected from the station 2. This configuration is called a use configuration of the electric vacuum cleaner 1.

[0021] The electric vacuum cleaner 1 is a so-called cordless type. Although the electric vacuum cleaner 1 is a so-called canister type, the electric vacuum cleaner 3 is not limited to this type but may be configured as an upright type, a stick type, or a handy type.

[0022] The station 2 has a function of charging the electric vacuum cleaner 1, a function of collecting the dust collected using the electric vacuum cleaner 1, and a function of accumulating the collected dust. The station 2 is placed at an arbitrary place in a room.

[0023] A user separates the cleaner body 7 of the electric vacuum cleaner 1 from the station 2 (Fig. 2), and cleans the surface to be cleaned by running the electric vacuum cleaner 1 on the surface to be cleaned or by holding the electric vacuum cleaner 1 when moving in the room. Afterward, the user returns (connects) the cleaner body 7 to the station 2 and stores it (Fig. 1). When the cleaner body 7 is connected to the station 2, the station 2 charges the cleaner body 7 while collecting the dust accumulated inside the electric vacuum cleaner 1 in a timely manner. That is, every time the electric vacuum cleaner 1 is connected to the station 2 after being used for cleaning, the station 2 collects the dust collected by the electric vacuum cleaner 1 so as to empty the electric vacuum cleaner 1.

[0024] The frequency of collecting the dust from the electric vacuum cleaner 1 to the station 2 may not be each time the electric vacuum cleaner 1 is connected to the station 2. The station 2 may collect dust from the electric vacuum cleaner 1 every plural number of times the electric vacuum cleaner 1 is connected to the station 2. For example, the station 2 may collect dust from the electric vacuum cleaner 1 once a week on the premise that electric vacuum cleaner 1 is used once a day, i.e., the station 2 may collect dust from the electric vacuum cleaner 1 every seven times of the use of the electric vacuum cleaner 1.

[0025] The electric vacuum cleaner includes: the cleaner body 7 that can travel on the surface to be cleaned; and a tubular part 8 that is attachable to and detachable from the cleaner body 7. The tubular part 8 is fluidly connected to the cleaner body 7.

[0026] The cleaner body 7 includes: a body housing 11; a pair of wheels 12 provided on the respective right and left sides of the body housing 11; a primary dust container 13 detachably attached to the body housing 11; a handle 14 provided on the body housing 11; a primary electric blower 15 accommodated in the body housing 11; a cleaner controller 16 mainly for controlling the

primary electric blower 15, and a rechargeable battery 17 for storing power to be supplied to the primary electric blower 15.

[0027] The cleaner body 7 drives the primary electric blower 15 by the power stored in the rechargeable battery 17. The cleaner body 7 acts negative pressure to be generated using the primary electric blower 15 to the tubular part 8. The electric vacuum cleaner 1 sucks on dust-containing air from the surface to be cleaned through the tubular part 8, separates dust from the dust-containing air, collects and accumulates the dust after separation, and exhausts the dust-removed clean air.

[0028] In the front of the body housing 11, a connection port 18 is provided as a suction port of the cleaner body 7. The connection port 18 is a coupling joint to which the tubular part 8 can be attached, and from which the tubular part 8 can be detached. The connection port 18 fluidly connects the tubular part 8 to the primary dust container 13. The connection port 18 may be provided at a portion other than the front portion of the body housing 11, for example, may be provided on the side face or the top face of the body housing 11.

[0029] The cleaner body 7 according to the present embodiment is connected to the station 2 in a position in which the front of the body housing 11 is directed upward. This position in which the front of the body housing 11 is directed upward is referred to as a storage position of the cleaner body 7 or a storage position of the electric vacuum cleaner 1. The cleaner body 7 is connected to the station 2 by being lowered down from above. The cleaner body 7 connected to the station is detached from the station 2 by being lifted up (elevated). The position in which the connection port 18 is directed upward is also referred to as a standing position of the cleaner body 7.

[0030] In the use configuration of the electric vacuum cleaner 1, the cleaner body 7 is directed such that the front of the body housing 11 faces the traveling direction, i.e., the forward direction. Such a position in which the cleaner body 7 can move on the cleaning target region by traveling on the surface to be cleaned is referred to as a use position (Fig. 2) of the cleaner body 7. The cleaner body 7 in the use position grounds the wheels 12 on the surface to be cleaned, and supports the body housing 11 such that body housing 11 can travel.

[0031] The wheels 12 support the cleaner body 7 such that the cleaner body 7 can travel. The cleaner body 7 is supported by casters (not shown) in addition to the pair of wheels 12.

[0032] The primary dust container 13 accumulates the dust to be sucked into the electric vacuum cleaner 1. The primary dust container 13 separates, collects, and accumulates the dust from the dust-containing air flowing into the cleaner body 7 while sending the dust-removed clean air to the primary electric blower 15.

[0033] The handle 14 is used when a user carries the cleaner body 7. The handle 14 is arched in the width direction of the body housing 11.

[0034] The primary electric blower 15 sucks in air from

the primary dust container 13 so as to generate negative pressure (i.e., suction vacuum pressure).

[0035] The cleaner controller 16 includes a microprocessor (not shown) and a storage device (not shown) for storing, for example, parameters and various operation programs to be executed by the microprocessor. The storage device stores various settings (arguments) related to a plurality of preset operation modes. The operation modes are related to the output of the primary electric blower 15. Different input values (i.e., input values of the primary electric blower 15 and current values flowing to the primary electric blower 15) are set for each operation mode. Each operation mode is associated with an input received using the tubular part 8. The cleaner controller 16 alternatively selects an arbitrary operation mode corresponding to the input received using the tubular part 8 from the preset operation modes, and reads out the selected operation mode from the storage device so as to drive the primary electric blower 15 on the basis of the settings of the operation mode having been read out.

[0036] The rechargeable battery 17 supplies power to the primary electric blower 15 and the cleaner controller 16. The rechargeable battery 17 is electrically connected to a pair of charging electrodes 19 provided on the cleaner body 7.

[0037] The tubular part 8 sucks in dust-containing air from the surface to be cleaned by the negative pressure that acts from the cleaner body 7, and leads the dust-containing air to the cleaner body 7. The tubular part 8 is provided with: a connecting tube 21 detachably connected as a joint to the cleaner body 7; a dust collecting hose 22 fluidly connected to the connecting tube 21; a hand operation tube 23 fluidly connected to the dust collecting hose 22; a grip 25 protruding from the hand operation tube 23; an input unit 26 provided on the grip 25; an extension tube 27 detachably connected to the hand operation tube 23; and a cleaner head 28 detachably connected to the extension tube 27.

[0038] The connecting tube 21 is a joint detachable from the connection port 18. The connecting tube 21 is fluidly connected to the primary dust container 13 through the connection port 18.

[0039] The dust collecting hose 22 is a long, flexible, and substantially cylindrical hose. One end (i.e., the rear end in this case) of the dust collecting hose 22 is fluidly connected to the connecting tube 21. The dust collecting hose 22 is fluidly connected to the primary dust container 13 through the connecting tube 21.

[0040] The hand operation tube 23 relays the dust collecting hose 22 and the extension tube 27. One end (i.e., the rear end in this case) of the hand operation tube 23 is fluidly connected to the other end (i.e., the front end in this case) of the dust collecting hose 22. The hand operation tube 23 is fluidly connected to the primary dust container 13 through the dust collecting hose 22 and the connecting tube 21.

[0041] The grip 25 is a portion to be gripped by a user's hand for operating the electric vacuum cleaner 1. The

grip 25 protrudes from the hand operation tube 23 in an appropriate shape that can be readily grasped by the user's hand.

[0042] The input unit 26 includes switches corresponding to the respective operation modes. For example, the input unit 26 includes: a stop switch 26a corresponding to the operation of stopping the primary electric blower 15; a start switch 26b corresponding to the operation of starting the primary electric blower 15; and a brush switch 26c corresponding to power supply to the cleaner head 28. The stop switch 26a and the start switch 26b are electrically connected to the cleaner controller 16. A user of the electric vacuum cleaner 1 can operate the input unit 26 to alternatively select one of the operation modes of the primary electric blower 15. The start switch 26b also functions as a selecting switch of the operation modes during operation of the primary electric blower 15. Each time the cleaner controller 16 receives an operation signal from the start switch 26b, the cleaner controller 16 switches the operation mode in order of strong → medium → weak → strong → medium → weak → Instead of the start switch 26b, the input unit 26 may be individually provided with a strong operation switch (not shown), a medium operation switch (not shown), and a weak operation switch (not shown).

[0043] The extension tube 27 has a telescopic structure in which a plurality of tubular bodies are overlaid, and is expandable and contractable. A joint structure is provided at one end (i.e., the rear end in this case) of the extension tube 27, and this joint structure is attachable to and detachable from the other end (i.e., the front end in this case) of the hand operation tube 23. The extension tube 27 is fluidly connected to the primary dust container 13 through the hand operation tube 23, the dust collecting hose 22, and the connecting tube 21.

[0044] The cleaner head 28 can run or slide on the surface to be cleaned such as a wooden floor and a carpet, and includes a suction port 31 on its bottom face opposed to the surface to be cleaned in a running state or a sliding state. In addition, the cleaner head 28 includes: a rotatable brushbar (roller brushbar, rotatable brush, brush roller) 32 disposed at the suction port 31; and an electric motor 33 for driving the brushbar 32. A joint structure is provided on one end (i.e., the rear end in this case) of the cleaner head 28, and this joint structure is attachable to and detachable from the other end (i.e., the front end in this case) of the extension tube 27. The cleaner head 28 is fluidly connected to the primary dust container 13 through the extension tube 27, the hand operation tube 23, the dust collecting hose 22, and the connecting tube 21. That is, the cleaner head 28, the extension tube 27, the hand operation tube 23, the dust collecting hose 22, the connecting tube 21, and the primary dust container 13 is a suction-air passage from the suction port 31 to the primary electric blower 15. Each time the electric motor 33 receives the operation signal from the brush switch 26c, the electric motor 33 alternately repeats the operation start and the operation stop.

[0045] When the start switch 26b is operated, the electric vacuum cleaner 1 starts up the primary electric blower 15. For example, when the start switch 26b is operated in the state where the primary electric blower 15 is stopped, first, the electric vacuum cleaner 1 starts the primary electric blower 15 in the strong operation mode. When the start switch 26b is operated again in the strong operation mode, the electric vacuum cleaner 1 drives the primary electric blower 15 in the medium operation mode. When the start switch 26b is operated three times, the electric vacuum cleaner 3 drives the primary electric blower 15 in the weak operation mode. In this manner, every time the start switch 26b is operated, the above-described mode switching is repeated. The strong operation mode, the medium operation mode, and the weak operation mode are predetermined operation modes. The input value to be set for the strong operation mode is the largest, and the input value to be set for the weak operation mode is the smallest. The primary electric blower 15 having started up sucks in air from the primary dust container 13 so as to reduce the pressure inside of the primary dust container 13 into a negative pressure.

[0046] The negative pressure inside the primary dust container 13 passes sequentially through the connection port 18, the connecting tube 21, the dust collecting hose 22, the hand operation tube 23, the extension tube 27, and the cleaner head 28 so as to act on the suction port 31. The electric vacuum cleaner 1 sucks in the dust on the surface to be cleaned together with the air using the negative pressure acting on the suction port 31. The primary dust container 13 separates, collects, and accumulates the dust from the inhaled dust-containing air, and sends the air having been separated from the dust-containing air to the primary electric blower 15. The primary electric blower 15 discharges the air sucked in from the primary dust container 13 to the outside of the cleaner body 7.

[0047] The station 2 is installed at an arbitrary place on the surface to be cleaned. The station 2 includes a platform 41 connectable to the cleaner body 7, and a dust collection part 42 integrally provided with the platform 41. The station 2 further includes a dust transfer tube 43 to be connected to the primary dust container 13 of the electric vacuum cleaner 1 in the storage configuration of the electric vacuum cleaner 1.

[0048] The platform 41 has substantially the same width dimension as that of the dust collection part 42, and protrudes to the front of the dust collection part 42 so as to spread in a rectangular shape. The platform 41 has a shape and size that can accommodate the cleaner body 7 of the electric vacuum cleaner 1 in plan view.

[0049] The platform 41 has charging terminals 45 connectable to the cleaner body 7. When the electric vacuum cleaner 1 is connected to the station 2, the charging terminals 45 contact the charging electrodes 19 of the cleaner body 7 and are electrically connected to the charging electrodes 19.

[0050] The platform 41 has a bulge 46 that is disposed

to be close to and along the side face of the cleaner body 7 in the storage configuration of the electric vacuum cleaner 1.

[0051] The dust collection part 42 is disposed behind the platform 41. The dust collection part 42 is a box formed in an appropriate shape such that the dust collection part 42 can be placed on the surface to be cleaned integrally with the platform 41. The dust collection part 42 extends upward above the platform 41. The dust collection part 42 has an appropriate shape that does not interfere with the cleaner body 7 connected to the platform 41.

[0052] The dust collection part 42 includes: a housing 47; a secondary dust container 48 that collects the dust to be discharged from the primary dust container 13 through the dust transfer tube 43 and accumulates the collected dust; a secondary electric blower 49 accommodated in the dust collection part 42 and fluidly connected to the secondary dust container 48; a station controller 51 mainly for controlling the secondary electric blower 49; and a power cord 52 for feeding power from a commercial AC power supply to the dust collection part 42.

[0053] The top plate of the platform 41 and the housing 48 is an integral molding of resin.

[0054] The secondary dust container 48 is fluidly connected to the dust transfer tube 43. The secondary dust container 48 separates, collects, and accumulates the dust from the dust-containing air flowing from dust transfer tube 43, and sends the dust-removed clean air to the secondary electric blower 49. The secondary dust container 48 is detachably mounted on the left side (i.e., right side as viewed from the front) of the dust collection part 42 and exposed to the appearance of the station 2.

[0055] The secondary electric blower 49 sucks in air from the secondary dust container 48 so as to generate negative pressure (i.e., suction vacuum pressure), and transfers the dust from the primary dust container 13 to the secondary dust container 48. The secondary electric blower 49 is accommodated in the right side (i.e., left part as viewed from the front) of the dust collection part 42.

[0056] The station controller 51 includes: a microprocessor (not shown); and a storage device (not shown) for storing, for example, parameters and various operation programs to be executed using the microprocessor. The station controller 51 executes drivability control of the secondary electric blower 49 and charge control of the rechargeable battery 17 of the electric vacuum cleaner 1.

[0057] The dust transfer tube 43 is connected to the primary dust container 13 in the storage configuration of the electric vacuum cleaner 1. The dust transfer tube 43 is an air passage for transferring the dust collected using the electric vacuum cleaner 1 to the secondary dust container 48. When the electric vacuum cleaner 1 is connected to the station 2, the dust transfer tube 43 is connected to the primary dust container 13 and fluidly connects the primary dust container 13 to the secondary dust container 48.

[0058] The dust transfer tube 43 is connected to the

suction side of the secondary dust container 48. The negative pressure to be generated using the secondary electric blower 49 acts on the dust transfer tube 43 through the secondary dust container 48.

[0059] The dust transfer tube 43 includes: an inlet connected to the primary dust container 13 of the electric vacuum cleaner 1; and an outlet connected to the secondary dust container 48. The dust transfer tube 43 extends rearward from the inlet disposed at the platform 41 so as to reach the inside of the dust collection part 42, and bends and extends upward inside the dust collection part 42 so as to reach the outlet disposed at the side of the secondary dust container 48.

[0060] The charging terminals 45 and the inlet of the dust transfer tube 43 are provided on the platform 41 side by side.

[0061] When the electric vacuum cleaner 1 is connected to (i.e., returned to) the station 2, the charging electrodes 19 of the electric vacuum cleaner 1 are electrically connected to the charging terminals 45 of the station 2 and the dust transfer tube 43 of the station 2 is connected to the primary dust container 13. Thereafter, the station 2 starts charging the rechargeable battery 17 of the electric vacuum cleaner 1. Additionally, the station 2 starts the secondary electric blower 49 in a timely manner. The secondary electric blower 49 having been started up sucks in air from the secondary dust container 48 and reduces the pressure inside of the secondary dust container 48 into a negative pressure.

[0062] The negative pressure inside the secondary dust container 48 acts on the primary dust container 13 through the dust transfer tube 43. The station 2 sucks in the dust accumulated in the primary dust container 13 together with air using the negative pressure acting on the primary dust container 13. The secondary dust container 48 separates, collects, and accumulates the dust from the sucked air, and sends the dust-separated air to the secondary electric blower 49. The secondary electric blower 49 discharges the clean air sucked from the secondary dust container 48 to the outside of the station 2.

[0063] Note that the station 2 may be a simple stand that does not have the charging function of the rechargeable battery 17 or the function of collecting dust from the primary dust container 13. In addition, the station 2 may be a charging stand having only the charging function of the rechargeable battery 17. Further, the station 2 may be a dust station having only the function of collecting dust from the primary dust container 13.

[0064] Next, the handle 14 of the cleaner body 7 according to the embodiment of the present invention will be described.

[0065] Fig. 3 is a perspective view illustrating the state where the handle of the electric vacuum cleaner according to the embodiment of the present invention is pulled out.

[0066] As shown in Fig. 3, the cleaner body 7 of the electric vacuum cleaner 1 according to the present embodiment includes the pair of wheels 12.

[0067] The respective wheels 12 are disposed at the right and left ends of the rear half of the cylindrical structure of the body housing 11 so as to be concentric with the rear half of the cylindrical structure of the body housing 11. The diameter of each wheel 12 is larger than the height of the body housing 11 in the vertical direction (this height corresponds to the diameter of the rear half of the cylindrical structure). In the side view of the cleaner body 7, i.e., when viewed from the direction of the rotation centerline of the wheels 12, the wheels 12 cover the rear end of the body housing 11. Thus, even when the cleaner body 7 is in a state where the body housing 11 is turned upside down (i.e., front and rear of the housing 11 is inverted), the cleaner body 7 can ground the wheels 12 on the surface to be cleaned. The body housing 11 can be turned upside down (i.e., front and rear of the housing 11 can be inverted) around the rotation centerline of each wheel 12 without causing its rear end to interfere with the surface to be cleaned. The cleaner body 7 is provided with a first auxiliary wheel (not shown) that supports the cleaner body 7 in cooperation with the wheels 12 when the front side (top side) of the cleaner body 7 is directed upward. The connecting tube 21 is provided with a second auxiliary wheel (not shown) that supports the cleaner body 7 in cooperation with the wheels 12 when the rear side (bottom side) of the cleaner body 7 is directed upward.

[0068] Fig. 3 shows the cleaner body 7 in the position in which the front side (rear side) faces upward.

[0069] The cleaner body 7 includes: the body housing 11 having a handle storage recess 11a; the handle 14 that is provided on the body housing 11 and can be moved between the storage position (Fig. 2) where it has entered the handle storage recess 11a and the use position (Fig. 3) where it has come out of the handle storage recess 11a; and a handle holding mechanism 61 that holds the handle 14 being in the storage position in the handle storage recess 11a.

[0070] The handle storage recess 11a is provided at the front edge of the top side of the body housing 11. The handle storage recess 11a extends so as to follow the shape of the front edge of the top side of the body housing 11.

[0071] In the use position (i.e., recumbent position) of the cleaner body 7, the use position in which the handle storage recess 11a of the body housing 11 is directed upward is referred to as the first use position (i.e., prone position or face-down position). The use position in which the handle storage recess 11a of the body housing 11 is directed downward is referred to as the second use position (i.e., inverted position, supine position, or face-up position). In the first use position, the cleaner body 7 supports the body housing 11 using the wheels 12 and first auxiliary wheel (not shown) with the top side (top face) of the body housing 11 directed upward. In the second use position, the cleaner body 7 supports the body housing 11 using the wheels 12 and second auxiliary wheel (not shown) with the bottom side (bottom face) of the

body housing 11 directed upward.

[0072] The handle 14 is bridged between the right and left wheels 12 in an arch. When the handle 14 is not in use, the handle 14 is housed in the handle storage recess 11a of the body housing 11 (storage state of the handle 14 as shown in Fig. 2). When being used, the handle 14 is pulled out of the handle storage recess 11a (the use state of the handle 14 as shown in Fig. 3).

[0073] The handle 14 is swingably provided on the body housing 11. The swinging centerline of the handle 14 extends in the width direction (right-left direction) of the body housing 11 or the cleaner body 7. In other words, the handle 14 moves around the swinging centerline extending in the width direction of the body housing 11 so as to be pulled and raised from the handle storage recess 11a.

[0074] The shape of the handle 14 matches the shape of the front edge of the arcuate front half of the body housing 11. The handle 14 reaches the rear end of the cleaner body 7 when being pulled out most.

[0075] In the first use position in which the cleaner body 7 is placed on the horizontal plane and the handle storage recess 11a is directed upward, the handle 14 can be moved to the rear of the cleaner body 7 substantially passing directly above the cleaner body 7.

[0076] The handle 14 may be provided so as to be linearly movable in the direction of approaching or moving away from the body housing 11, for example, in the vertical direction in the first use position (i.e., the direction of passing through the top side and the bottom side or the direction of passing through the top face and the bottom face). In other words, the handle 14 may slide in the direction of approaching or moving away from the body housing 11. In this case, the handle 14 is pulled out of or enters the handle storage recess 11a.

[0077] In the storage configuration of the electric vacuum cleaner 1, the cleaner body 7 takes the storage position (standing position). In the use configuration of the electric vacuum cleaner 1, the cleaner body 7 turns over from the first use position with the handle storage recess 11a directed upward to the second use position with the handle storage recess 11a directed downward through the standing position, and turns over from the second use position to the first use position through the standing position. Such behavior (position change) of the cleaner body 7 may cause the handle 14 to be released from or housed in the handle storage recess 11a if no restraining force is applied to the handle 14. Under the assumption that no restraining force is applied to the handle 14, for example, in the case of changing the position of the cleaner body 7 from the first use position with the handle storage recess 11a directed upward to the standing position, the handle 14 is released from the handle storage recess 11a so as to hang on the top side of the cleaner body 7 due to its own weight and the inertia force caused by this position change and thereby hinders the movement or running of the cleaner body 7. Under the assumption that no restraining force is applied to the handle 14, when the

cleaner body 7 is stored in the station 2 in the standing position (Fig. 1), the handle 14 is released from the handle storage recess 11a by its own weight and hangs down on the top side of the cleaner body 7 so as to impair the appearance of the electric vacuum cleaner 1. Further, under the assumption that no restraining force is applied to the handle 14 in the second use position (inverted position) with the handle storage recess 11a directed downward, the handle 14 is released from the handle storage recess 11a so as to hang down toward the surface to be cleaned and thereby hinders the movement or running of the cleaner body 7. For example, if the handle 14 hangs down (like bowing) in the traveling direction (i.e., forward direction) in the second use position (i.e., inverted position), there is a possibility that the handle 14 collides so as to hit a step in the traveling direction. If the handle 14 hits a step in the traveling direction, the cleaner body 7 is naturally obstructed from running.

[0078] For this reason, the cleaner body 7 includes the handle holding mechanism 61. When the body housing 11 is in the standing position, the handle holding mechanism 61 holds the handle 14 being in the storage position in the handle storage recess 11a. In addition, when the body housing 11 is in the inverted position, the handle holding mechanism 61 holds the handle 14 being in the storage position in the handle storage recess 11a. Further, when the body housing 11 is in the middle position between the standing position and the inverted position, the handle holding mechanism 61 holds the handle 14 being in the storage position in the handle storage recess 11a.

[0079] The handle holding mechanism 61 includes: an elastic member 62 that generates force to move the handle 14 from the use position to the storage position; concave-convex portions 63 that are provided on the handle 14 and the handle storage recess 11a so as to be interdigitated with each other; and a hook mechanism 64 that swings by its own weight so as to be hooked on the handle 14 before the handle 14 comes out of the handle storage recess 11a by its own weight.

[0080] Fig. 4 to Fig. 6 are cross-sectional views of the handle holding mechanism of the electric vacuum cleaner according to the embodiment of the present invention.

[0081] As shown in Fig. 4 to Fig. 6, the handle holding mechanism 61 of the electric vacuum cleaner 1 according to the present embodiment includes the concave-convex portions 63 and the hook mechanism 64 in addition to the elastic member 62.

[0082] Fig. 4 illustrates the relationship between the handle holding mechanism 61 and the handle 14 of the cleaner body 7 in the first use position. Fig. 5 illustrates the relationship between the handle holding mechanism 61 and the handle 14 of the cleaner body 7 in the standing position. Fig. 6 illustrates the relationship between the handle holding mechanism 61 and the handle 14 of the cleaner body 7 in the second use position.

[0083] The handle 14 is swingably supported by the body housing 11 of the cleaner body 7 via a handle shaft

14a.

[0084] The elastic member 62 is, for example, a torsion spring. When the handle 14 comes out from the storage position and moves to the use position, the elastic member 62 deforms due to this movement so as to store elastic energy. When the force acting on the handle 14 (i.e., force for moving the handle 14 from the storage position to the use position) decreases or is lost, the elastic member 62 consumes the stored elastic energy so as to generate the force to move the handle 14 from the use position to the storage position.

[0085] The elastic member 62 may be provided directly on the handle shaft 14a that is provided so as to match the swinging centerline of the handle 14. Additionally or alternatively, the elastic member 62 may indirectly transfer the power to and from the handle 14 via the power transmission mechanism 66. The power transmission mechanism 66 is, for example, a cam mechanism, a link mechanism, or a speed reduction mechanism in which a plurality of gears (not shown) are meshed. The elastic member 62 may be a coil spring or a rubber elastic body depending on the power transmission mechanism 66.

[0086] One of the concave-convex portions 63 is provided in the handle storage recess 11a, and the other of the concave-convex portions 63 is provided in the handle 14. The concave-convex portions 63 according to the present embodiment include: a convex member 67 provided on the handle storage recess 11a; and a concave member 68 provided on the handle 14. When the handle 14 enters the handle storage recess 11a and reaches the storage position, the concave member 68 and the convex member 67 interdigitate with each other so as to hinder the movement of the handle 14. One of the concave-convex portions 63, for example, the convex member 67 may be provided so as to be able to approach and move away from the concave member 68. In this case, for example, it is preferred that the handle holding mechanism 61 includes a coil spring (not shown) for generating spring force in the direction in which the convex member 67 is interdigitated with the concave member 68. In other words, the convex member 67 is provided so as to be able to protrude and retract from the inner wall face of the handle storage recess 11a. It is preferred that the protruding and retracting direction of the convex member 67 intersects the moving direction of the handle 14.

[0087] The hook mechanism 64 is provided in the handle storage recess 11a. The handle storage recess 11a is provided with a base 69 for supporting the hook mechanism 64. The handle 14 includes a hook receiver 71 that is hooked the hook mechanism 64. The hook mechanism 64 is provided so as to be movable and constantly hangs down with its hook opened upward by its own weight. On the one hand, the hook mechanism 64 can hook on the hook receiver 71; on the other hand, when the cleaner body 7 is in the first use position, the hook mechanism 64 hangs down to unhook or moved away from the hook receiver 71 due to its own weight. Further, the hook mechanism 64 is hooked on the hook receiver 71 in the process

in which the cleaner body 7 moves from the first use position to the standing position. When the hook mechanism 64 hooks on the hook receiver 71, the handle 14 is held in the handle storage recess 11a. Further, when the cleaner body 7 is in the process of moving from the standing position to the second use position and when the cleaner body 7 is in the second use position, the hook mechanism 64 maintains the state of hooking on the hook receiver 71. The hook mechanism 64 is supported by the base 69 and can rotate at least 180 degrees about the hook receiver 71. In Fig. 4 to Fig. 6, the gravitational acceleration acting on the hook mechanism 64 is indicated by the solid arrow G.

[0088] The hook mechanism 64 may include a weight 72 for increasing its own weight. Further, the hook mechanism 64 may have a hook shape of a so-called fishhook. In this case, the hook mechanism 64 may be provided with a plurality of hooks that includes: a first hook (not shown) for holding the handle 14 in the standing position; and a second hook (not shown) for holding the handle 14 in the inverted position.

[0089] It is sufficient that the handle holding mechanism 61 includes at least one of the elastic member 62, the concave-convex portions 63, and the hook mechanism 64. When the handle 14 can be held in the handle storage recess 11a against the weight of handle 14, it is not required that the handle holding mechanism 61 includes all of the elastic member 62, the concave-convex portions 63, and the hook mechanism 64, but it is sufficient that the handle holding mechanism 61 includes any one of them (62, 63, and 64) or a combination of two or more of them (62, 63, and 64).

[0090] As described above, the electric vacuum cleaner 1 according to the present embodiment includes the handle holding mechanism 61 that holds the handle 14 being in the storage position in the handle storage recess 11a. Consequently, even if the cleaner body 7 is erected (standing position) or is used upside down (i.e., used in the inverted position), the electric vacuum cleaner 1 can prevent the handle 14 from being released from the handle storage recess 11a. That is, in the electric vacuum cleaner 1, the handle 14 neither hinders storage by hanging down nor hinders running by being caught on a step on the surface to be cleaned.

[0091] In addition, the electric vacuum cleaner 1 according to the present embodiment includes the elastic member 62 that generates force to move the handle 14 to the storage position. Consequently, when storing the handle 14, the electric vacuum cleaner 1 can automatically store the handle 14 by the restoring force of the elastic member 62 without intentionally moving the handle 14 to the handle storage recess 11a.

[0092] Further, the electric vacuum cleaner 1 according to the present embodiment includes the concave-convex portions 63 that are provided in the handle 14 and the handle storage recess 11a so as to be interdigitated with each other. The concave-convex portions 63 prevents the handle 14 from being released from the handle

storage recess 11a by its simple structure. In other words, in the electric vacuum cleaner 1, the handle 14 does not hang down so as to hinder storage or running.

[0093] Moreover, the electric vacuum cleaner 1 according to the present embodiment can dispose any one of the concave member 68 and the convex member 67 in the handle storage recess 11a and can dispose the other in the handle 14. Consequently, the electric vacuum cleaner 1 can improve the holding force of the handle 14 without impairing manufacturability.

[0094] Furthermore, the electric vacuum cleaner 1 according to the present embodiment includes the hook mechanism 64 that moves by its own weight so as to be hooked on the handle 14. Consequently, the electric vacuum cleaner 1 can reliably hold the handle 14 depending on the position change of the cleaner body 7. In other words, in the electric vacuum cleaner 1, the handle 14 neither obstructs storage nor hinders running by hanging down.

[0095] As described above, according to the electric vacuum cleaner 1 of the present embodiment, even if the cleaner body 7 is set in the standing position or is used in the inverted position, the movable handle 14 can be stored at a non-problematic position.

[0096] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

Reference Signs List

[0097]

- 1 electric vacuum cleaner
- 2 station
- 7 cleaner body
- 8 tubular part
- 11 body housing
- 11a handle storage recess
- 12 wheel
- 13 primary dust container
- 14 handle
- 14a handle shaft
- 15 primary electric blower
- 16 cleaner controller
- 17 rechargeable battery
- 18 connection port
- 19 charging electrode
- 21 connecting tube
- 22 dust collecting hose
- 23 hand operation tube

- 25 grip
- 26 input unit
- 26a stop switch
- 26b start switch
- 5 26c brush switch
- 27 extension tube
- 28 cleaner head
- 31 suction port
- 32 brushbar
- 10 33 electric motor
- 41 platform
- 42 dust collecting part
- 43 dust transfer tube
- 45 charging terminal
- 15 46 bulge
- 47 housing
- 48 secondary dust container
- 49 secondary electric blower
- 51 station controller
- 20 52 power cord
- 61 handle holding mechanism
- 62 elastic member
- 63 concave-convex portion
- 64 hook mechanism
- 25 66 power transmission mechanism
- 67 convex member
- 68 concave member
- 69 base
- 71 hook receiver
- 30 72 weight

Claims

- 35 1. An electric vacuum cleaner comprising:
 - a body housing provided with a handle storage recess;
 - a handle that is provided on the body housing and can be moved between a storage position in which the handle is entered the handle storage recess and a use position in which the handle is released from the handle storage recess; and
 - 40 a handle holding mechanism that holds the handle being in the storage position in the handle storage recess.
- 45 2. The electric vacuum cleaner according to claim 1, wherein the handle holding mechanism is configured to hold the handle being in the storage position in the handle storage recess even when the body housing is in a standing position.
- 50 3. The electric vacuum cleaner according to claim 1 or claim 2, wherein the handle holding mechanism is configured to hold the handle being in the storage position in the handle storage recess even when the

body housing is in an inverted position.

4. The electric vacuum cleaner according to any one of claim 1 to claim 3, wherein the handle is swingably provided on the body housing. 5
5. The electric vacuum cleaner according to any one of claim 1 to claim 3, wherein the handle is provided in such a manner that the handle is configured to be linearly moved in a direction of approaching or moving away from the body housing. 10
6. The electric vacuum cleaner according to any one of claim 1 to claim 5, wherein the handle holding mechanism includes an elastic member that generates force to move the handle to the storage position. 15
7. The electric vacuum cleaner according to any one of claim 1 to claim 6, wherein the handle holding mechanism includes a concave member and a convex member that are provided in the handle and the handle storage recess to be interdigitated with each other. 20
8. The electric vacuum cleaner according to claim 7, wherein any one of the concave member and the convex member is provided in the handle storage recess. 25
9. The electric vacuum cleaner according to any one of claim 1 to claim 8, wherein the handle holding mechanism includes a hook mechanism that moves by own weight to be hooked on the handle before the handle is released from the handle storage recess by its own weight. 30
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10. The electric vacuum cleaner according to claim 9, wherein the hook mechanism is provided in the handle storage recess. 40

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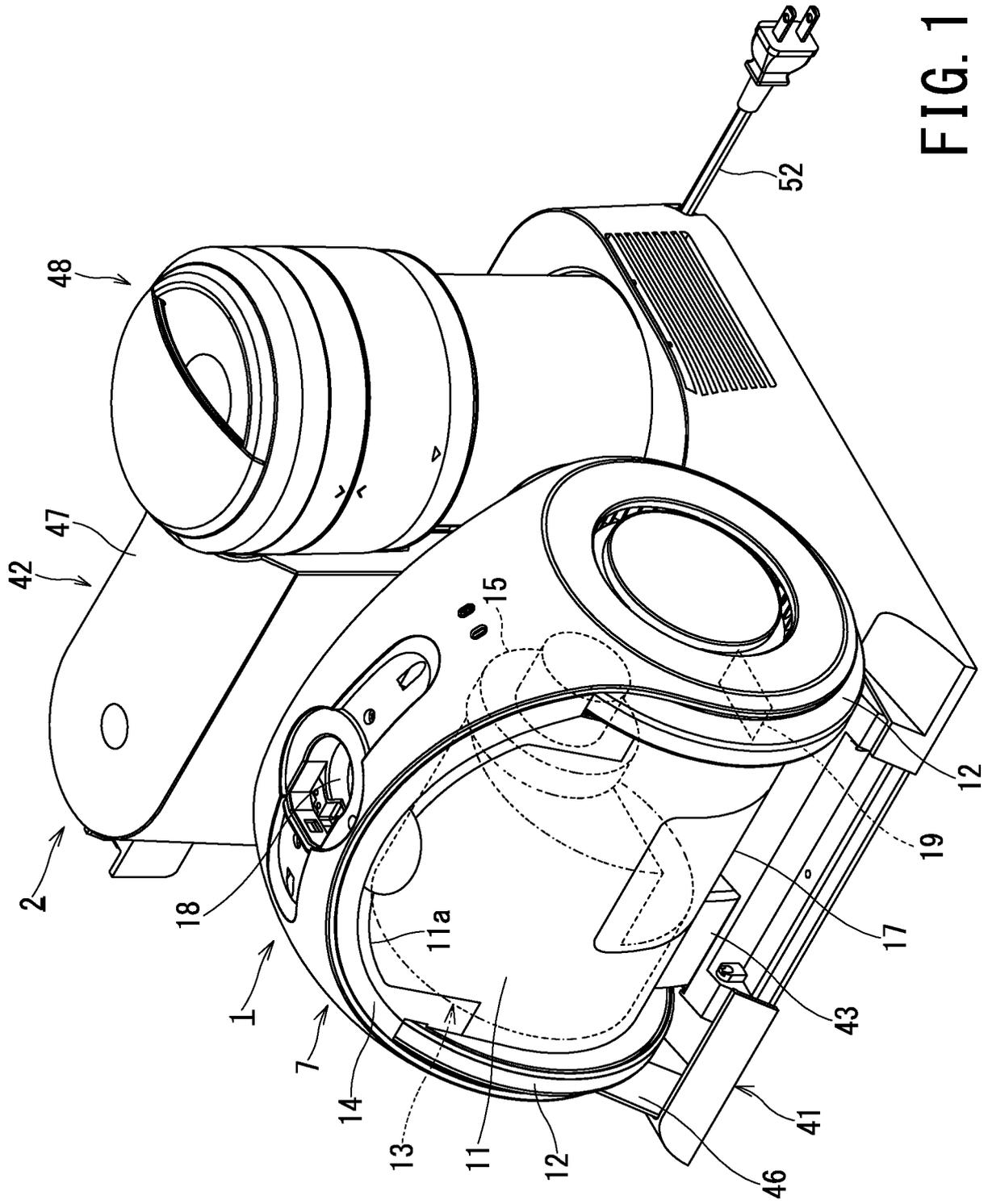


FIG. 1

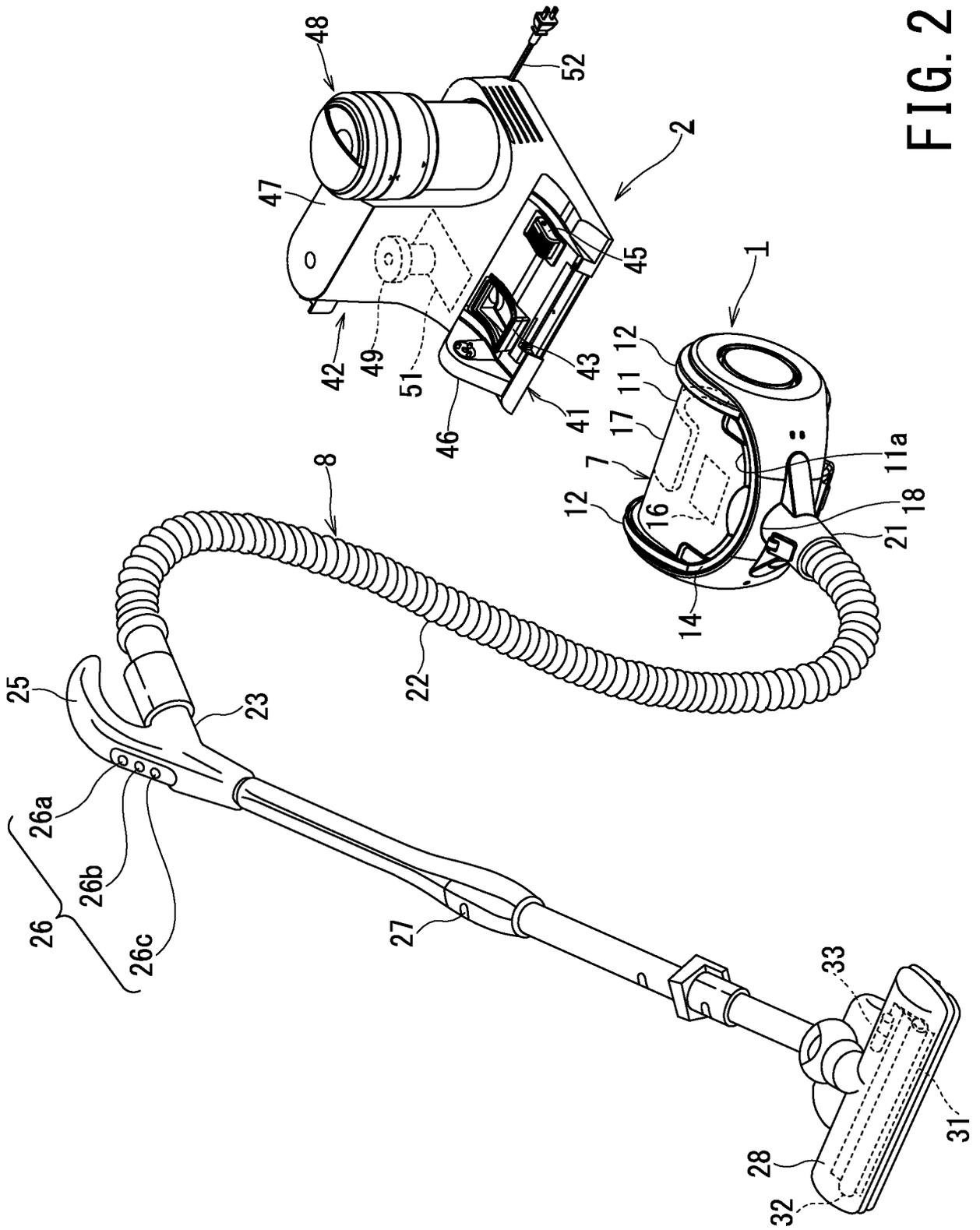


FIG. 2

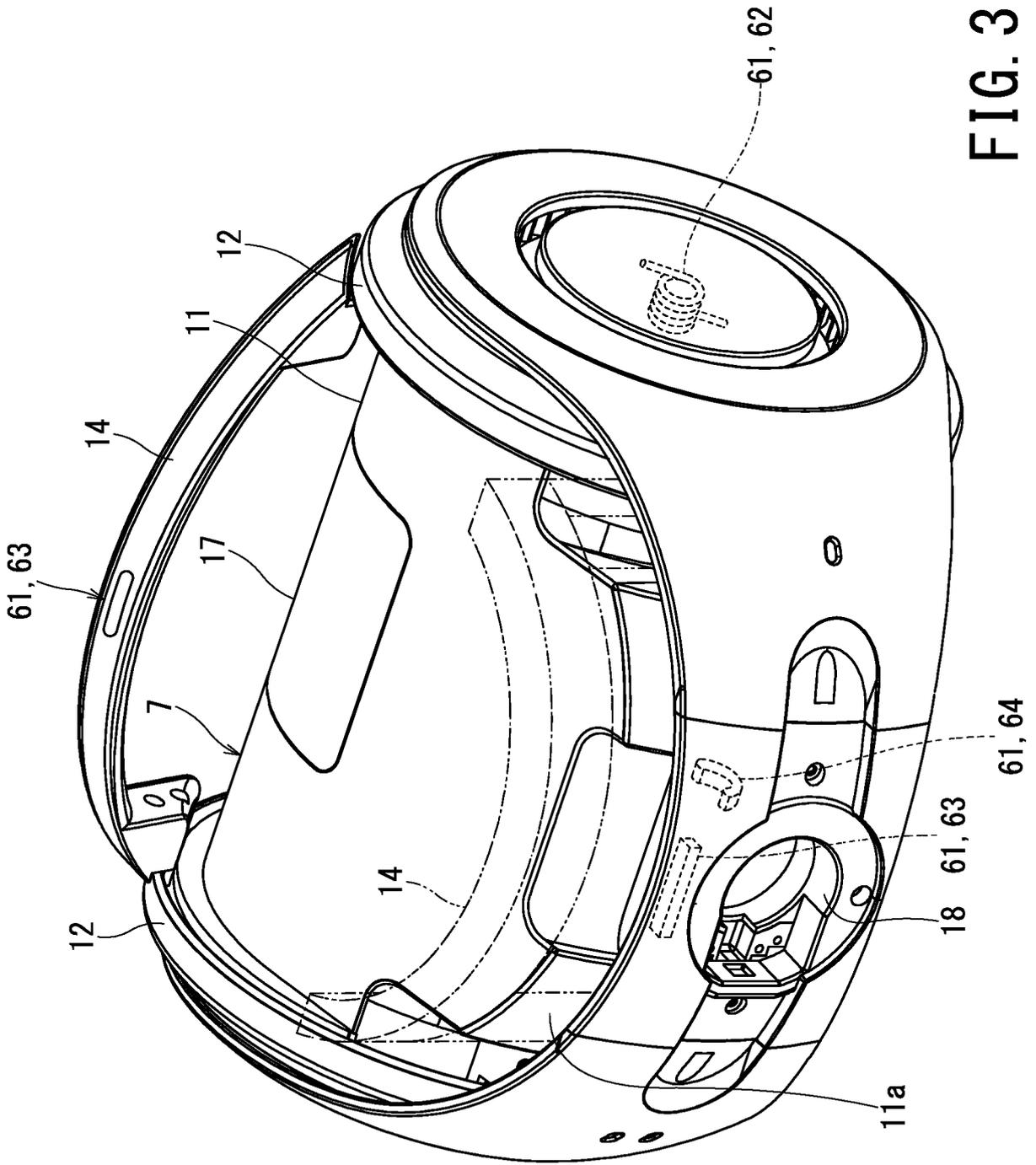


FIG. 3

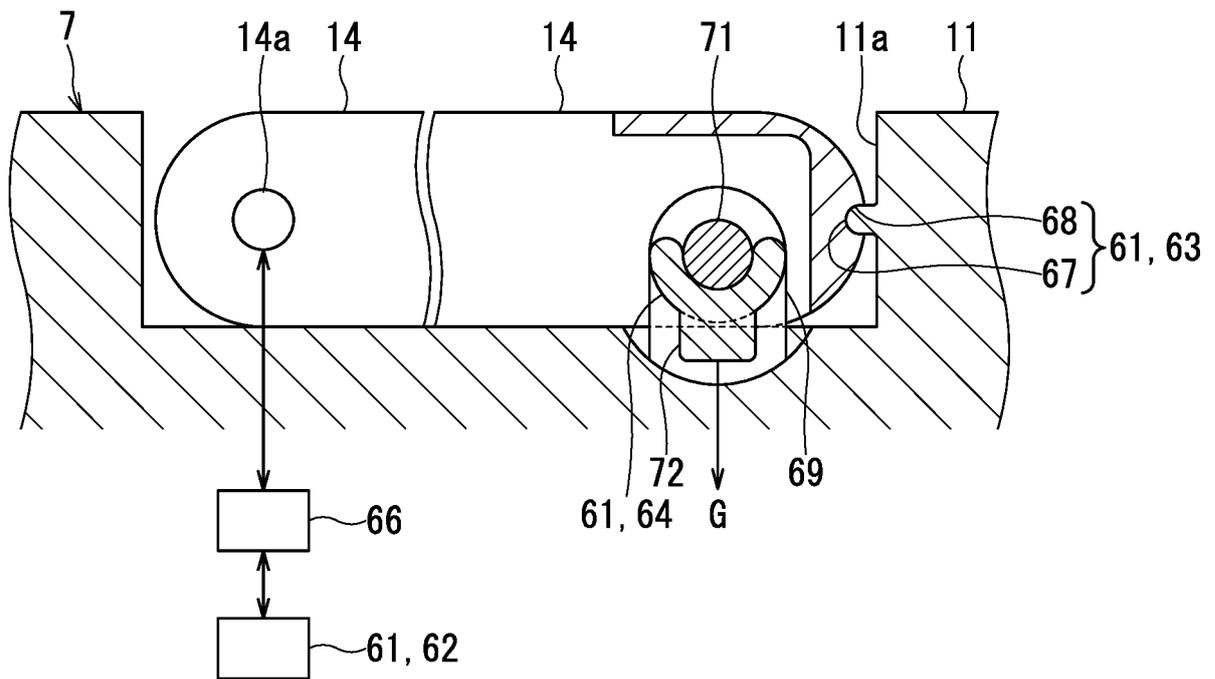


FIG. 4

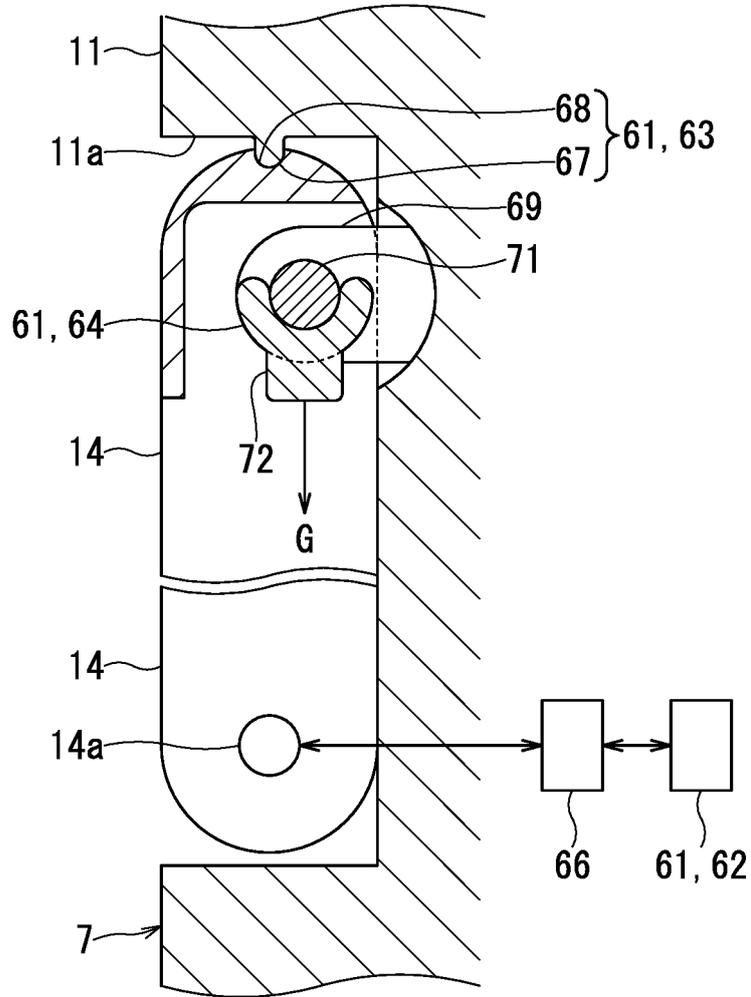


FIG. 5

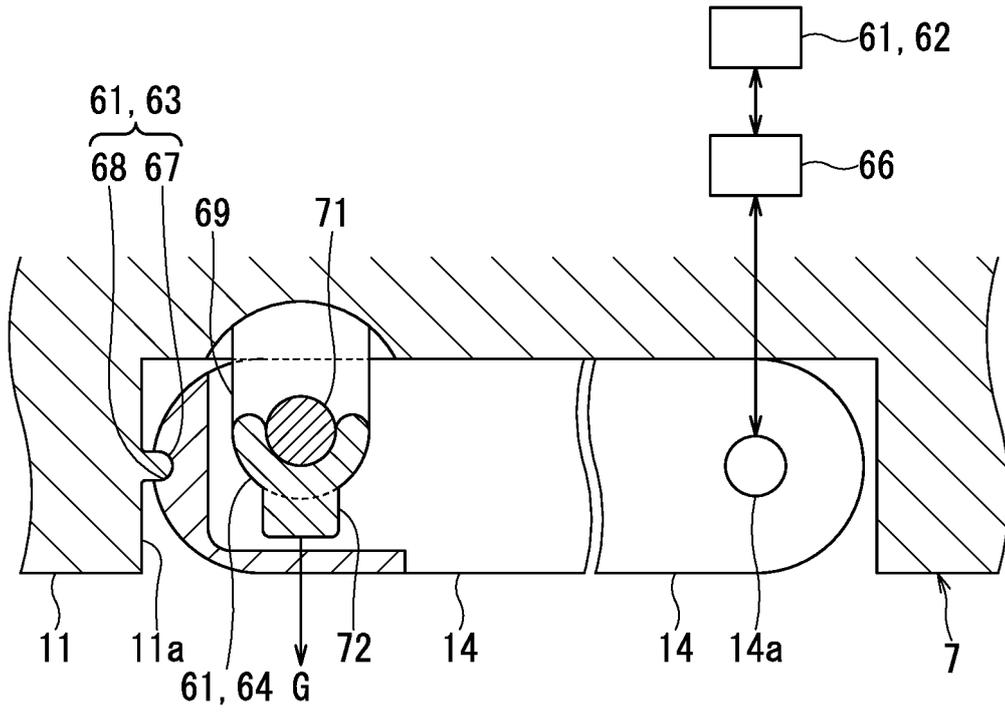


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/028595

5	A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. A47L9/32 (2006.01) i	
	According to International Patent Classification (IPC) or to both national classification and IPC	
	B. FIELDS SEARCHED	
10	Minimum documentation searched (classification system followed by classification symbols) Int.Cl. A47L9/32	
	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
	Published examined utility model applications of Japan	1922-1996
	Published unexamined utility model applications of Japan	1971-2018
	Registered utility model specifications of Japan	1996-2018
15	Published registered utility model applications of Japan	1994-2018
	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)	
	C. DOCUMENTS CONSIDERED TO BE RELEVANT	
20	Category*	Citation of document, with indication, where appropriate, of the relevant passages
	X A	JP 9-299295 A (MITSUBISHI ELECTRIC CORP.) 25 November 1997, paragraphs [0011]-[0029], fig. 1-11 (Family: none)
		1-4, 7 5-6, 8-10
25	X A	JP 8-224199 A (SHARP CORP.) 03 September 1996, paragraphs [0018]-[0027], fig. 1-9 (Family: none)
		1-4, 6-8 5, 9-10
	X A	JP 2009-089811 A (HITACHI APPLIANCES, INC.) 30 April 2009, paragraphs [0001]-[0028], fig. 1-10 (Family: none)
		1-5, 7-8 6, 9-10
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35		
40	<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input type="checkbox"/> See patent family annex.
	* Special categories of cited documents:	"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
	"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
45	"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
	"O" document referring to an oral disclosure, use, exhibition or other means	
	"P" document published prior to the international filing date but later than the priority date claimed	
50	Date of the actual completion of the international search 11 October 2018 (11.10.2018)	Date of mailing of the international search report 23 October 2018 (23.10.2018)
55	Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/028595

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 064737/1988 (Laid-open No. 168241/1989) (SHARP CORP.) 27 November 1989, specification, pp. 1-9, fig. 1-5 (Family: none)	1-4 5-10
A	US 6154921 A (AKTIEBOLAGET ELECTROLUX) 05 December 2000, entire text, all drawings & EP 935944 A1 & JP 11-267071 A	1-10
A	WO 2004/064592 A1 (GIOEL ITALIA'96 S. R. L.) 05 August 2004, entire text, all drawings & EP 1585420 A1 & AU 2003300739 A1 & AT 410949 T & ES 2315572 T3	1-10

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2014204773 A [0003]