

HANDHELD VACUUM SUCTION DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a handheld vacuum suction device, and in particular, to a handheld vacuum suction device that has a suction nozzle for making an inflow of moisture into a vacuum pump be minimized, and is capable of improving durability of a pressure switch for measuring a degree of vacuum, and simplifying the internal configuration by using a diaphragm-type vacuum pump.

2. Description of the Related Art

If foods, such as fruits, vegetables, meats, and dishes, are not stored airtight, they may be spoiled or go bad quickly due to oxygen in the air. Accordingly, a vacuum container that maintains a vacuum state therein by exhausting internal air to the outside is used.

The vacuum container may include an exhaust unit for exhausting internal air to the outside, but it usually includes, at one end thereof, a check valve for exhausting internal air to the outside, and exhausts internal air to the outside by using an additional vacuum suction device. FIG. 1 is a perspective view of a vacuum container and a vacuum suction device according to the related art.

FIG. 1 shows a vacuum container and a vacuum suction

device described in U.S. Patent No. 5,195,427. A vacuum container 1 includes a check valve 3. A vacuum suction device 5 exhausts air in the vacuum container 1 to the outside by using an internal vacuum pump while coming into close contact with the check valve 3 of the vacuum container 1. The vacuum suction device 5 has an actuating button 7. The vacuum suction device 5 may further include a display unit 9, such as an LED, for showing the actuation state.

The vacuum suction device 5 is provided at the tail end of a suction nozzle, which is attached to the check valve 3 to suck in air. Inside the vacuum suction device 5, the vacuum pump for forming the vacuum state and a circuit for controlling the actuation thereof is provided.

Meanwhile, while the vacuum suction device 5 sucks in air from the vacuum container, moisture may be exhausted together with air. It is not desirable that moisture is transferred to the vacuum pump. In the known vacuum suction device, there is not suggested a unit for effectively preventing moisture from being transferred to the vacuum pump.

Furthermore, the known vacuum suction device drives a piston by means of a crown gear and a connecting rod, but it is not effective in view of noise or durability. In addition, a compact vacuum pump may not be realized. Furthermore, in the known vacuum suction device, it is not easy to preserve the vacuum suction device after being used.

SUMMARY OF THE INVENTION

The invention has been finalized in order to solve the above-described problems, and it is an object of the invention to provide a handheld vacuum suction device that has a suction nozzle for making an inflow of moisture into a vacuum pump be minimized, and is capable of improving durability of a pressure switch for measuring a degree of vacuum, and simplifying the internal configuration by using a diaphragm-type vacuum pump.

It is another object of the invention to provide a handheld vacuum suction device that has a stand capable of conveniently placing a vacuum suction device thereon.

According to an aspect of the invention, a handheld vacuum suction device includes: an exterior case; a cap that includes a suction nozzle having a suction port at its lower portion and a side exhaust hole communicating with the suction port formed in its side surface, and is detachably mounted at a lower end of the exterior case; a pressure switch unit that is provided in the exterior case, and includes a pressure switch having a slide body configured to descend against an elastic force of a spring when a pressure in the cap falls below a predetermined pressure, to thereby cut off power supply, and a vertical through suction duct; a vacuum pump that includes an inlet port connected to the suction duct and sucks in air in a diaphragm manner; and a

control unit that includes an actuating switch, and is electrically connected to the vacuum pump and the pressure switch to control the actuation of the vacuum pump.

The pressure switch of the pressure switch unit may include: a conductive contact panel that forms contacts with a pair of terminals; the slide body, to which the contact panel is fixedly mounted; a cover that is provided at a lower portion of the slide body; and the spring that is provided between the slide body and the cover to elastically support the slide body. In this case, when vacuum is completed, the slide body may descend such that the contact panel is separated from the terminals.

The vacuum pump may include: a motor; a fixture that has a slant pin configured to be placed apart at a predetermined distance from a rotation center at its upper portion and to slant toward the rotation center, and is coupled to a driving shaft of the motor; a rolling plate that is coupled to the slant pin to eccentrically shake in a vertical direction; and a diaphragm unit that has at least two diaphragms whose volume is changed according to the actuation of the rolling plate. In this case, intake and exhaust operations may be repeatedly performed according to the change in the volume of the diaphragms.

The handheld vacuum suction device according to the aspect of the invention may further include a stand that has

a stand main body and a crater-shaped standing portion at an upper portion of the stand main body, the cap being inserted into the standing portion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a vacuum container and a vacuum suction device according to the related art;

FIG. 2 is a perspective view of a vacuum suction device according to an exemplary embodiment of the invention;

FIG. 3 is a cross-sectional view of a cap in the vacuum suction device according to the embodiment of the invention;

FIG. 4 is a cross-sectional view of a stand for placing the vacuum suction device according to the embodiment of the invention thereon;

FIG. 5 is an exploded perspective view of the vacuum suction device according to the embodiment of the invention;

FIG. 6 is an exploded perspective view of a pressure switch unit in the vacuum suction device according to the embodiment of the invention;

FIG. 7 is a cross-sectional view showing a case where the pressure switch unit of the vacuum suction device according to the embodiment of the invention is in a normal state;

FIG. 8 is a cross-sectional view showing a case where

vacuum is completed in the pressure switch unit of the vacuum suction device according to the embodiment of the invention;

FIG. 9 is an exploded perspective view of a vacuum pump in the vacuum suction device according to the embodiment of the invention;

FIG. 10(a) is a perspective view showing a case where an air port and a guide ring are coupled to each other in the vacuum pump of the vacuum suction device according to the embodiment of the invention;

FIG. 10(b) is a bottom view of the air port;

FIG. 10(c) is a perspective view of the guide ring;
and

FIG. 11 is a diagram illustrating an intake operation (a) and an exhaust operation (b) in the vacuum pump of the vacuum suction device according to the embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An exemplary embodiment of the invention will now be described in detail with reference to the accompanying drawings. It should be noted that the same components are represented by the same reference numerals even if they are shown in different drawings. In the embodiment of the invention, detailed description of known structures and functions incorporated herein will be omitted when it may

make the subject matter of the invention unclear. In the following description, the exemplary embodiment will be illustrated and described in detail. However, it should be understood that the embodiments are not intended to limit the invention, and various changes, equivalents, and alternatives are resorted without departing from the spirit of the invention and fall within the technical scope of the invention.

FIG. 2 is a perspective view of a vacuum suction device according to an exemplary embodiment of the invention. FIG. 3 is a cross-sectional view of a cap in the vacuum suction device according to the embodiment of the invention. FIG. 4 is a cross-sectional view of a stand for placing the vacuum suction device according to the embodiment of the invention thereon.

Referring to FIG. 2, a vacuum suction device 10 according to an exemplary embodiment of the invention includes an exterior case 12 and a cap 16 that is detachably mounted at a lower end of the exterior case 12. The exterior case 12 is provided with a power supply portion 14, into which a jack for power supply (not shown) is inserted. An actuating button 24 is provided at the top of the exterior case 12. The cap 16, which is detachably mounted at the lower end of the exterior case 12, is preferably transparent such that a user can view the inside. A suction nozzle 18 is mounted to the cap 16, and has a suction port

20 formed at its lower portion of the suction nozzle 18 and a side exhaust hole 22 formed in its side surface.

Referring to FIG. 3, the suction port 20 is formed to communicate with the side exhaust hole 22. The suction port 20 comes into close contact with an upper end of a check valve in the vacuum container to function as an entrance through which air in the vacuum container is sucked. Meanwhile, the side exhaust hole 22 is formed at the side of the suction nozzle 18, and thus air sucked through the suction port 20 is exhausted through the side surface of the suction nozzle 18. Accordingly, moisture contained in air exhausted from the vacuum container can condense in the suction nozzle 18, such that moisture can be prevented from being supplied directly to the vacuum pump.

The vacuum suction device 10 according to the embodiment of the invention may further include a stand 26. The stand 26 includes a stand main body 30 and a crater-shaped standing portion 28 formed at an upper portion of the stand main body 30. The stand main body 30 may be in a truncated cone shape. The interior of the standing portion 28 is formed, as shown in FIG. 4, to correspond to the exterior shape of the cap 16 in the vacuum suction device 10. Then, if the vacuum suction device 10 is placed on the stand 26, the circumference of the cap 16 comes into close contact with the inner surface of the standing portion 28, such that the vacuum suction device 10 is stably placed on the stand

26.

FIG. 5 is an exploded perspective view of the vacuum suction device according to the embodiment of the invention.

The exterior case 12 of the vacuum suction device 10 is formed by assembling a first case 12a and a second case 12b with each other. The cap 16 is coupled at the tail end of the exterior case 12. Inside the exterior case 12, a pressure switch unit 40, a vacuum pump 50, and a control unit 60 are provided. The actuating button 24 is provided at the top of the exterior case 12.

The pressure switch unit 40 has a pressure switch unit main body 42, a pressure switch 44, which is actuated according to a degree of vacuum in the cap 16, and a vertical through suction duct 46. The suction duct 46 is coupled to an inlet port of the vacuum pump 50. The vacuum pump 50 includes a motor 52 and a pump housing 54. The control unit 60 is provided with an actuating switch 62, which is actuated as the actuating button 24 is pushed, and an LED 64, which displays an actuation state. The control unit 60 is electrically connected to the power supply portion 14, the motor 52 of the vacuum pump 50, and the pressure switch 44. Therefore, the control unit 60 is supplied with power from the power supply portion 14, and drives the motor 52 of the vacuum pump 50 according to the operation of the actuating switch 62. In addition, when a pressure in the cap 16 falls below a predetermined pressure,

the control unit 60 stops the motor 52 according to the actuation of the pressure switch 44.

The structures of the pressure switch unit 40 and the vacuum pump 50 will now be described in detail.

FIG. 6 is an exploded perspective view of the pressure switch unit in the vacuum suction device according to the embodiment of the invention. FIG. 7 is a cross-sectional view showing a case where the pressure switch unit of the vacuum suction device according to the embodiment of the invention is in a normal state. FIG. 8 is a cross-sectional view showing a case where vacuum is completed in the pressure switch unit of the vacuum suction device according to the embodiment of the invention.

The pressure switch unit main body 42 is provided with a first terminal insertion hole 74a and a second terminal insertion hole 74b, into which rod-shaped first and second terminals 72a and 72b are fixedly inserted. Wiring lines (not shown) are connected to the terminals 72 fixedly inserted into the terminal insertion holes 74. A cover fixing hole 89 is formed at a lower portion of the pressure switch unit main body 42, and a cover 86 is fixedly fitted thereinto.

A contact panel 76 is provided below the terminals 72. The contact panel 76 is formed of a conductive material. The contact panel 76 is preferably in a center-through disc shape. Contacts 77a and 77b are formed in the contact panel

76 to elastically support and come into contact with the terminals 72, respectively. The contacts 77a and 77b are a kind of plate spring. The contact panel 76 is fixed to a contact panel fixing portion at an upper portion of a main body 82 of a slide body 70 by means of screws.

The slide body 70 includes a cylindrical main body 82 and a slide rod 80, which is coupled at the upper center of the main body 82. Engagement protrusions 83a and 83b are provided at the bottom of the main body 82. Meanwhile, a first ring engagement groove 81a and a second ring engagement groove 81b, into which a first ring 78a and a second ring 78b are correspondingly fitted, are provided in the side surfaces of the slide rod 80 and the main body 82, respectively.

The cover 86 is provided below the slide body 70. A hollow cylindrical spring mounting portion 90 is provided at the center of the spring cover 86, and engagement protrusion insertion grooves 92a and 92b are formed at the sides of the spring mounting portion 90. In addition, the cover 86 is provided with a cover mounting protrusion 88, which is formed to extend laterally. The cover mounting protrusion 88 is fitted into the cover fixing hole 89 formed in the pressure switch unit main body 42, such that the cover 86 is fixedly mounted to the pressure switch unit main body 42. Engagement protrusions 83a and 83b of the slide body 70 are fitted into the engagement protrusion insertion grooves 92a

and 92b of the cover 86, respectively.

A spring 94 is mounted between the slide body 70 and the cover 86.

Referring to FIG. 7, in a normal state, the slide body 70 is elastically supported by the spring 94, and the contact panel 76 is in contact with the terminals 72. Accordingly, if the actuating switch 62 is operated, power is supplied to the motor 52 of the vacuum pump 50. If air in the vacuum container is exhausted to the outside according to the actuation of the vacuum pump 50, the pressure in the cap 16 is gradually reduced. If the pressure is reduced to be less than a predetermined pressure, the slide body 70 descends against an elastic force of the spring 94. Referring to FIG. 8, if the slide body 70 descends, the contact panel 76 also descends and is separated from the terminals 72. Accordingly, power supplied to the motor 52 of the vacuum pump 50 is cut off, and the motor 52 is stopped.

Next, the configuration of the vacuum pump 50 will be described in detail.

FIG. 9 is an exploded perspective view of a vacuum pump in the vacuum suction device according to the embodiment of the invention. FIG. 10(a) is a perspective view showing a case where an air port and a guide ring are coupled to each other in the vacuum pump of the vacuum suction device according to the embodiment of the invention.

FIG. 10(b) is a bottom view of the air port. FIG. 10(c) is a perspective view of the guide ring. FIG. 11 is a diagram illustrating an intake operation (a) and an exhaust operation (b) in the vacuum pump of the vacuum suction device according to the embodiment of the invention.

The vacuum pump 50 includes the motor 52 and the pump housing 54. The pump housing 54 is formed by sequentially assembling a first housing 54a, a second housing 54b, an air port 150, and a third housing 54c. Engagement bolts 164 are mounted to the third housing 54c. The engagement bolts 164 sequentially pass through the air port 150 and the second housing 54b, and are coupled to the first housing 54a.

A fixture 100 and a rolling plate 110 are provided in the first housing 54a. The fixture 100 is coupled to a driving shaft of the motor 52. A slant pin 102 is provided at an upper end of the fixture 100 to be placed apart at a predetermined distance from a rotation center and to slant toward the rotation center.

The rolling plate 110 has an insertion hole 112 formed at its lower center and actuating wings 114 extending laterally. The actuating wings 114 are provided in correspondence with the number of diaphragms 122 described below. The slant pin 102 of the fixture 100 is fitted into the insertion hole 112, such that the rolling plate 110 eccentrically shakes in a vertical direction according to the rotation of the fixture 100. That is, if one actuating

wing is at right angle based on the rotation center of the rolling plate 110, the other is inclined based on the rotation center, thereby compressing or expanding the diaphragms 122 coupled to the actuating wings 114 of the rolling plate 110.

Through-holes 118, into which the diaphragms 122 are inserted, are formed in the second housing 54b. The actuating protrusions 124 of the individual diaphragms 122 pass through the through-holes 118, and are correspondingly fitted into actuating protrusion insertion grooves 116 formed in the individual actuating wings 114 of the rolling plate 110.

The diaphragm unit 120 includes a plurality of diaphragms 122, and preferably, three diaphragms 122, as shown in FIG. 9. Each actuating protrusion 124 is coupled to the corresponding diaphragm 122, such that a chamber 126 is formed in the diaphragm 122. An exhaust valve 128 is provided at the upper center of the diaphragm unit 120, that is, at the center of the diaphragm 122. A guide ring 130 is disposed above the chamber 126 and fitted into a guide ring insertion groove 134 formed at the bottom of the air port 150. An intake valve 140 is provided in the chamber 126 of the diaphragm 122. The diaphragms 122, the exhaust valves 128, and the intake valves 140 are formed of flexible materials, and thus they may be easily deformed by an external force.

The guide ring 130 is provided with exhaust paths 132, as shown in FIG. 10(c). Accordingly, if the diaphragm 122 contracts, internal air pushes through the exhaust valve 128 along the exhaust path 132 of the guide ring 130 and is exhausted to an exhaust port 152. Meanwhile, if the diaphragm 122 expands, air is sucked along an inlet port 160 formed in the third housing 54c and flows into the chamber 126 via the intake valve 140 along a groove 154 formed at the upper portion of the air port 150. The inlet port 160 is connected to the suction duct 46 of the pressure switch unit 40.

The exhaust port 152 of the air port 150 extends to the outside through an exhaust port exposure hole 162 formed in the third housing 54c. An exhaust port O-ring 158 is mounted to the circumference of the exhaust port 152.

Referring to FIG. 11, as the rolling plate 110 rotates, an intake operation (a) and an exhaust operation (b) are sequentially made. Meanwhile, it is preferable that a boss 170 be formed at the bottom of the second housing 54b to come into contact with the center of the rolling plate 110, thereby supporting the central portion of the rolling plate 110.

Although the invention has been described in connection with the exemplary embodiments of the present invention, it will be apparent to those skilled in the art

that various modifications and changes may be made thereto without departing from the scope and spirit of the invention. Therefore, it should be understood that the above embodiments are not limitative, but illustrative in all aspects. The scope of the present invention is defined by the appended claims rather than by the description preceding them, and all changes and modifications that fall within metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the claims.

As described above, according to the invention, a handheld vacuum suction device that has a compact internal configuration is provided. In addition, an inflow of moisture into the vacuum pump can be minimized, the durability of the pressure switch can be improved, and a simple structure can be realized. Furthermore, by using a diaphragm-type vacuum pump, durability and vacuum efficiency can be increased.

WHAT IS CLAIMED IS:

1. A handheld vacuum suction device, comprising:
an exterior case(12);

a cap(16) that includes a suction nozzle(18) having a suction port(20) formed at its lower portion and a side exhaust hole(22) communicating with the suction port(20) formed in its side surface, and is detachably mounted at a lower end of the exterior case(12);

a pressure switch unit that is provided in the exterior case(12), and includes a pressure switch(44) having a slide body(70) configured to descend against an elastic force of a spring(94) when a pressure in the cap(16) falls below a predetermined pressure, to thereby cut off power supply, and a vertical through suction duct(46);

a vacuum pump(50) that includes an inlet port(160) connected to the suction duct(46) and sucks in air in a diaphragm manner; and

a control unit(60) that includes an actuating switch(62), and is electrically connected to the vacuum pump(50) and the pressure switch(44) to control the actuation of the vacuum pump(50).

2. The handheld vacuum suction device of claim 1, wherein the pressure switch(44) of the pressure switch(44) unit includes:

a conductive contact panel(76) that forms contacts with a pair of terminals(72);

the slide body(70), to which the contact panel(76) is fixedly mounted;

a cover(86) that is provided at a lower portion of the slide body(70); and

the spring(94) that is provided between the slide body(70) and the cover(86) to elastically support the slide body(70), and

when vacuum is completed, the slide body(70) descends such that the contact panel(76) is separated from the terminals(72).

3. The handheld vacuum suction device of claim 2, wherein one end of each of the terminals(72) extends to the outside through a terminal insertion hole(74), which is formed at a pressure switch(44) unit main body of the pressure switch(44) unit.

4. The handheld vacuum suction device of claim 2, wherein the contact panel(76) is in a center-through disc

shape and has contacts(77a, 77b), which elastically support the tail ends of the terminals(72).

5. The handheld vacuum suction device of claim 2, wherein the slide body(70) includes a cylindrical main body(82) and a slide rod(80) formed at the upper center of the main body(82), and

a ring engagement groove(81b), into which a ring(78b) for keeping airtight is fitted, is provided at a side of the main body(82).

6. The handheld vacuum suction device of claim 5, wherein engagement protrusions(83a, 83b) are provided at a lower portion of the main body(82) to be fitted into engagement protrusion insertion grooves(92a, 92b), which are formed in the cover(86).

7. The handheld vacuum suction device of claim 2, wherein a hollow cylindrical spring mounting portion(90) is provided at an upper center of the cover(86).

8. The handheld vacuum suction device of claim 1, wherein the vacuum pump(50) includes:

a motor(52);

a fixture(100) that has a slant pin(102) configured

to be placed apart at a predetermined distance from a rotation center at its upper portion and to slant toward the rotation center, and is coupled to a driving shaft of the motor(52);

a rolling plate(110) that is coupled to the slant pin(102) to eccentrically shake in a vertical direction; and

a diaphragm unit(120) that has at least two diaphragms(122) whose volume is changed according to the actuation of the rolling plate(110), and

intake and exhaust operations are repeatedly performed according to the change in the volume of the diaphragms(122).

9. The handheld vacuum suction device of claim 8, wherein the rolling plate(110) has actuating wings(114) extending laterally, and each of the actuating wings(114) has an actuating protrusion insertion groove(116), into which an actuating protrusion(124) of the corresponding diaphragm is fitted.

10. The handheld vacuum suction device of claim 8, wherein an exhaust valve(128) is provided at the center of the diaphragm unit(120), a guide ring(130) having exhaust paths(132) at its side is provided above the

diaphragms(122), and the guide ring(130) is fixedly mounted to an air port(150).

11. The handheld vacuum suction device of claim 10, wherein an intake valve(140) is provided in a chamber(126) of each of the diaphragms(122).

12. The handheld vacuum suction device of claim 10, wherein an exhaust port(152) is formed at the center of the air port(150), and a groove(154) for air inflow is formed at an upper portion of the air port(150).

13. The handheld vacuum suction device of any one of claims 1 to 12, further comprising:

a stand(26) that has a stand main body(30) and a crater-shaped standing portion(28) formed at an upper portion of the stand main body(30), the cap(16) being inserted into the standing portion(28).

14. The handheld vacuum suction device of claim 13, wherein the stand main body(30) is in a truncated cone shape, and the standing portion(28) is formed to follow the exterior shape of the cap(16).