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(54) **VACUUM CLEANER**

(57) The vacuum cleaner includes a cleaner body comprising a suction motor for generating a suction force, a suction part arranged to communicate with the cleaner body to suction air and dusts, a battery to supply a power to the suction motor, a charger separably connected to

the cleaner body or the suction part to charge the battery, and a voltage regulator regulating a voltage between an output terminal of the charger and the suction motor so that a voltage outputted from the charger is greater than that inputted into the suction motor.

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## Description

### BACKGROUND

[0001] In general, vacuum cleaners are devices that suction air containing dusts by using a suction force generated by a suction motor mounted in a main body to filter the dusts in the main body.

[0002] Vacuum cleaners are classified into manual cleaners and automatic cleaners. The manual cleaners are cleaners that are used for directly performing cleaning by a user, and the automatic cleaners that travel by oneself to perform cleaning.

[0003] The manual cleaners may be classified into a canister type cleaner in which a suction nozzle is provided separately with respect to a main body and connected to the main body by using a connection tube and an upright type cleaner in which a suction nozzle is coupled to a main body.

[0004] A power cord outlet of a cleaner is disclosed in Korean Patent Publication No. 10-2006-0118796 (Published Date: November 24, 2006) that is a prior document 1.

[0005] According to the prior document 1, since a cord reel assembly is provided in a main body, and a power cord is connected to a socket, the main body may receive a power.

[0006] In the prior document 1, since a cleaner receives a power through the cord reel assembly, the cleaner may move by only a distance corresponding to a length of the cord wound around the cord reel assembly when the cleaner performs cleaning.

[0007] A vacuum cleaner is disclosed in Korean Patent Publication No. 10-2008-0105847 (Published Date: December 4, 2008) that is a prior document 2.

[0008] The vacuum cleaner according to the prior document 2 includes a main body including a battery and a charger and a cord reel assembly separably connected to the main body.

[0009] The vacuum cleaner may connect the main body to the cord reel assembly to receive a commercial power and charge the battery. When the cord reel assembly is separated from the main body, the vacuum cleaner may receive a DC power of the battery to operate.

[0010] A connection cord insertion hole is defined in the main body, and the cord reel assembly includes a connection cord.

[0011] However, according to the prior document 2, since the cleaner is capable of receiving a power of the battery to operate, the cleaner may freely move and thus be no constraint in cleaning. Also, a commercial power of about 220 V may be applied to the cord reel assembly. The commercial power is higher than a voltage of about 42.4 V that corresponds to an IEC 60950 safety standard. Thus, if a user touches the connection cord in a state where a power cord of the cord reel assembly is connected to a socket, and the connection cord is not connected to the main body, the user may be dangerous.

[0012] Also, since the battery is built in the cleaner, a power may be applied to a terminal of the connection cord insertion hole of the cleaner. Thus, for the user safety, the battery has to be maintained to a voltage of about 42.4 V or less.

[0013] In general, the more an output of a suction motor provided in the cleaner increases, the more a suction force of the cleaner increases. However, according to the prior document 2, since the battery is maintained to a voltage of about 42.4 V or less, it may be difficult to realize a high-output suction motor.

### SUMMARY

[0014] Embodiments relate to a vacuum cleaner.

[0015] In one embodiment, a vacuum cleaner includes: a cleaner body comprising a suction motor for generating a suction force; a suction part arranged to communicate with the cleaner body to suction air and dusts; a battery to supply a power to the suction motor; a cleaner connector disposed on the cleaner body or the suction part; a charger separably connected to the cleaner connector to charge the battery; and a voltage regulator regulating a voltage between an output terminal of the charger and the suction motor so that a voltage outputted from the charger is greater than that inputted into the suction motor.

[0016] The charger converts an inputted AC voltage into a DC voltage and steps down the voltage to output the voltage to the cleaner connector.

[0017] The voltage regulator comprises a booster for boosting a voltage.

[0018] The charger provides a DC voltage of about 42.4 V or less to the cleaner connector.

[0019] The booster boosts a voltage outputted from the battery, and the voltage boosted by the booster is outputted into the suction motor.

[0020] The battery has a maximum charging voltage of about 42.4 V or less, and the booster boosts the voltage outputted from the battery so that a maximum DC voltage supplied to the suction motor is above about 84.8 V.

[0021] The booster boosts the voltage outputted from the charger, and the voltage boosted by the booster is provided to the battery.

[0022] A maximum charging voltage of the battery exceeds about 42.4 V, and a maximum DC voltage provided to the suction motor is above about 84.8 V.

[0023] The booster comprises a boost converter.

[0024] A plurality of batteries are disposed on one of the cleaner body and the suction part, and the voltage regulator comprises switching mechanisms configured to connect the plurality of batteries to each other in parallel when the plurality of batteries are charged, and to connect the plurality of batteries to each other in series when the plurality of batteries are discharged.

[0025] The switching mechanisms comprise charging switching mechanisms that are turned on when the plurality of batteries are charged and is turned off when the

plurality of batteries are discharged and discharging switching mechanisms that are turned on when the plurality of batteries are discharged and is turned off when the plurality of batteries are charged.

[0026] The plurality of batteries comprise a first battery and a second battery, and the charging switching mechanisms comprise: a first charging switch connecting or disconnecting the second battery to or from the charger; a second charging switch connecting or disconnecting the first battery to or from the charger; and a third charging switch connecting or disconnecting the first battery to or from the second battery.

[0027] The discharging switching mechanisms comprise: a first discharging switch connecting or disconnecting the first battery to or from the suction motor or a controller for controlling the suction motor; a second discharging switch connecting or disconnecting the suction motor or the controller to or from the second battery; and a third discharging switch connecting or disconnecting the first battery to or from the second battery.

[0028] The cleaner connector protrudes from the cleaner body or the suction part.

[0029] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

### **[0030]**

Fig. 1 is a perspective view of a vacuum cleaner according to a first embodiment.

Fig. 2 is a block diagram of the vacuum cleaner according to the first embodiment.

Fig. 3 is a block diagram of a vacuum cleaner according to a second embodiment.

Fig. 4 is a block diagram of a vacuum cleaner according to a third embodiment.

Fig. 5 is a view illustrating an operation of a switching mechanism when a battery is charged according to the third embodiment.

Fig. 6 is a view illustrating an operation of the switching mechanism when a battery is discharged according to the third embodiment.

## **DETAILED DESCRIPTION OF THE EMBODIMENTS**

[0031] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[0032] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific preferred embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is

understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the spirit or scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the invention, the description may omit certain information known to those skilled in the art. The following detailed description is, therefore, not to be taken in a limiting sense.

[0033] Also, in the description of embodiments, terms such as first, second, A, B, (a), (b) or the like may be used herein when describing components of the present invention. Each of these terminologies is not used to define an essence, order or sequence of a corresponding component but used merely to distinguish the corresponding component from other component(s). It should be noted that if it is described in the specification that one component is "connected," "coupled" or "joined" to another component, the former may be directly "connected," "coupled," and "joined" to the latter or "connected," "coupled", and "joined" to the latter via another component.

[0034] Fig. 1 is a perspective view of a vacuum cleaner according to a first embodiment, and Fig. 2 is a block diagram of the vacuum cleaner according to the first embodiment.

[0035] Referring to Figs. 1 and 2, a vacuum cleaner 1 according to the first embodiment may include a cleaner body 10 including a suction motor 150 for generating a suction force and a suction device 20 for guiding air containing dusts to the cleaner body 10.

[0036] The suction device 20 may include a suction part 21 for suctioning dusts disposed on a surface to be cleaned, for example, a bottom surface and connection parts 22, 23, and 24 for connecting the suction part 21 to the cleaner body 10.

[0037] The connection part 22, 23, and 24 may include an extension tube 24 connected to the suction part 21, a handle 22 connected to the extension part 24, and a suction hose 23 connecting the handle 22 to the cleaner body 10.

[0038] Also, the vacuum cleaner 1 may further include a dust separation part (not shown) for separating dusts from air suctioned by the suction device 20 and a dust container 110 for storing the dusts separated by the dust separation part. The dust container 110 may be separably mounted on the cleaner body 10. The dust separation part may be provided as a separate part that is separated from the dust container 110 or be provided as one module together with the dust container 110.

[0039] The vacuum cleaner 1 may further include a battery 120 supplying a power for operating the suction motor 150 and a charger 30 separably connected to the cleaner body 10 to charge the battery 120.

[0040] The charger 30 may include a power cord 31 connected to a socket and a charger connector 32 connected to the cleaner body 10. Also, the cleaner body 10 may include a cleaner connector 102 connected to the

charger connector 32. The cleaner connector 102 may protrude from the cleaner body 10. For another example, the cleaner connector 102 may be provided on the suction part 21. The cleaner connector 102 may protrude from the suction part 21.

**[0041]** The charger 30 may perform rectification and smoothing operations to convert a commercial AC voltage into a DC voltage. Also, the charger 30 may supply the converted DC voltage to the cleaner body 10. For example, the charger 30 may convert the commercial AC voltage into a DC voltage of about 42.4 V or less to supply the converted DC voltage to the cleaner body 10.

**[0042]** Thus, since the DC voltage of about 42.4 V or less is outputted from the charger connector 32 of the charger 30, there is no problem in user safety even though an insulation device is not provided to the charger connector 32. Alternatively, the insulation device may be provided to the charger connector 32.

**[0043]** The battery 120 may include a plurality of unit cells 121 that are connected to each other in series. The plurality of unit cells 121 may be managed by a battery management system (BMS) (now shown) to maintain a predetermined voltage. That is, the BMS may allow the battery 120 to output the predetermined voltage. The battery 120 may be a chargeable and dischargeable secondary battery. A DC voltage charged in the battery 120 may be, for example, a voltage of about 42.4 V or less.

**[0044]** In the current embodiment, the suction motor 150 may be, for example, a BLDC motor. Also, the suction motor 150 may have a maximum output of about 600 W or more.

**[0045]** When the voltage charged in the battery 120 is below about 42.4 V, current of at least 14.15 A or more has to be applied to operate the high-output suction motor 150. As a result, a circuit required for operating the suction motor 150 may be complicated.

**[0046]** Thus, to operate the high-output suction motor 150 by using the voltage charged in the battery 120 in the current embodiment, the cleaner body 10 may further include a booster 140 for boosting the voltage outputted from the battery 120.

**[0047]** The booster 120 may include, for example, a boost converter 140 (or a DC/DC converter).

**[0048]** The boost converter may include an inductor, a diode, a capacitor, and a switching device. Also, the switching device may be quickly and repeatedly turned on/off by the control of a controller 130 to allow the boost converter to boost an input voltage.

**[0049]** Here, the switching device may include a MOS-FET, but is not limited thereto. For example, the switching device may include a bipolar junction transistor (BJT) or an insulated gate bipolar transistor (IGBT).

**[0050]** Also, the controller 130 may be disposed between the battery 120 and the booster 140. The controller 130 may output a switching device of the switching device of the boost converter. Also, the controller 130 may control the suction motor 150.

**[0051]** Thus, the DC voltage of about 42.4 V or less,

which is outputted from the battery 120 may be outputted to the booster 140 by the controller 130. Also, the booster 140 may boost the inputted voltage to output the boosted voltage to the suction motor 150.

**[0052]** Here, the booster 140 may boost the output voltage of the battery 120 to a voltage that is greater than two times or more than the output voltage. For example, the booster 140 may output a DC voltage of about 84.8 V or more. Since the booster 140 outputs the DC voltage of about 84.8 V or more, the current required for operating the suction motor 150 may be less by about 7.1 A than the output voltage of the booster 140. Thus, a circuit required for operating the suction motor 150 may be simplified.

**[0053]** Of course, the output voltage of the booster 140 may be below about 84.8 V according to the circuit for operating the suction motor 150.

**[0054]** Also, since the output voltage of the battery 120 is boosted by the booster 140 and then supplied to the suction motor 150 in the current embodiment, the suction motor 150 may realize a high output. Thus, the suction force of the vacuum cleaner 1 may increase to improve cleaning performance.

**[0055]** Also, since the charging voltage of the battery 120 is below about 42.4 V, there is no problem in user safety even though an insulation device is not provided to the cleaner connector 102. Alternatively, the insulation device may be provided to the cleaner connector 102.

**[0056]** Also, the charger 30 may be connected to the vacuum cleaner 1 only during the charging of the battery 120. When the vacuum cleaner performs cleaning, the charger 30 may be separated from the vacuum cleaner 1. Thus, the degree of freedom in movement of the cleaner 1 may be improved.

**[0057]** That is, since the vacuum cleaner 1 does not include the cord reel and receives a power from the battery 120, the vacuum cleaner 1 is not limited to a movement direction thereof. While the vacuum cleaner 1 moves, it may be unnecessary to move over a cord wound around the cord reel or arrange the cord. Thus, the vacuum cleaner 1 may smoothly move.

**[0058]** Fig. 3 is a block diagram of a vacuum cleaner according to a second embodiment.

**[0059]** The current embodiment is the same as the first embodiment except for a position of the booster and a charging voltage of the battery. Thus, only characterized parts in the current embodiment will be described below.

**[0060]** Referring to Fig. 3, a vacuum cleaner 2 according to the second embodiment may include a booster 140 for receiving a DC voltage of about 42.4 V or less to boost the received DC voltage and a battery 123 for receiving the voltage boosted by the booster 140.

**[0061]** Alternatively, the vacuum cleaner 2 may further include a transformer 142 connected to an output terminal of the booster 140. In this case, the battery 123 may be connected to the transformer 142.

**[0062]** The battery 123 may include a plurality of unit cells 121. The plurality of unit cells 121 is managed by

the BMS to maintain a predetermined voltage.

**[0063]** In the current embodiment, the booster 140 may be, for example, a boost converter. For example, the boost converter 140 may boost an output voltage of the charger 30, and the transformer 142 may boost or step down the voltage outputted from the boost converter 140 or output the voltage outputted from the boost converter 140 as it is.

**[0064]** In the current embodiment, the boost converter 140 and the transformer 142 may be designed so that the DC voltage of about 42.4 V or less, which is inputted to the boost converter 140 is boosted two times or more to output a voltage of about 84.8 V or more to the transformer 14.

**[0065]** Of course, a DC voltage of about 84.8 V or less may be outputted from the transformer 142 according to a circuit for operating the suction motor 150.

**[0066]** For example, the boost converter 140 may primarily boost the output voltage of the charger 30, and the transformer may secondarily boost the output voltage of the boost converter 140.

**[0067]** For another example, the boost converter 140 may boost the output voltage of the charger 30, and the transformer may output the same voltage as the output voltage of the boost converter 140. In either case, the battery 123 may have the maximum charging voltage of about 84.8 V or more.

**[0068]** Thus, the maximum DC voltage outputted from the battery 123 may be about 84.8 V or more, and the outputted voltage may be provided to the suction motor 150 by a controller 130.

**[0069]** Since a high voltage of about 84.8 V or more is supplied to the suction motor 150 in the current embodiment, the suction motor may realize a high output. Thus, the suction force of the vacuum cleaner 1 may increase to improve cleaning performance.

**[0070]** In the current embodiment, since the battery 123 is electrically connected to the cleaner connector 102, and the battery 123 has the maximum charging voltage of about 84.8 V or more, if the transformer 142 is not provided, the user may be dangerous when the user contacts the cleaner connector 102. However, according to the current embodiment, since the transformer 142 is disposed between the booster 140 and the battery 123, the transformer may function as an insulation device to improve user safety.

**[0071]** In the foregoing embodiment, the boost converter may be a non-isolated boost converter or isolated boost converter. If the boost converter is the isolated boost converter, the vacuum cleaner 1 may be doubly insulated by the boost converter and the transformer 142 to more improve product safety.

**[0072]** For another example, the transformer 142 may be omitted, or only the isolated boost converter may be used. The isolated boost converter may be a converter in which an inductor is replaced with a transformer. Also, when only the isolated boost converter is used, the insulation may be realized to maintain the product safety.

**[0073]** Fig. 4 is a block diagram of a vacuum cleaner according to a third embodiment.

**[0074]** Referring to Fig. 4, a vacuum cleaner 3 according to the third embodiment may include a charger 30, a suction motor 150, and a battery 160.

**[0075]** Since the charger 30 and the suction motor 150 have the same as those of the first embodiment, their detailed descriptions will be omitted. That is, the charger 30 supplies a DC voltage of about 42.4 V or less to a cleaner body.

**[0076]** The battery 160 may include a first battery 161 and a second battery 162. Each of the first and second batteries 161 and 162 may include a plurality of unit cells connected to each other in series.

**[0077]** Also, each of the first and second batteries 161 and 162 may have a charging voltage of about 42.4 V or less.

**[0078]** The vacuum cleaner 3 may further include a switching mechanism. The switching mechanism may be configured to connect the first and second batteries 161 and 162 to each other in parallel when the battery 160 is charged, and connect the first and second batteries 161 and 162 to each other in series when the battery 160 is discharged (a DC voltage of the battery 160 is supplied to the suction motor 150).

**[0079]** The switching mechanism may include charging switch mechanisms 171, 172, and 173 and discharging switch mechanisms 181, 182, and 183.

**[0080]** The charging switch mechanisms 171, 172, and 173 may include a first charging switch 171, a second charging switch 172, and a third charging switch 173. The first charging switch 171 may connect or disconnect the charger 30 to or from the second battery 162.

**[0081]** The second charging switch 172 may connect or disconnect the first battery 161 to or from both ends of the charger 30. The third charging switch 173 may connect or disconnect the first battery 161 to or from the second battery 162.

**[0082]** The discharging switch mechanisms 181, 182, and 183 may include a first discharging switch 181, a second discharging switch 182, and a third discharging switch 183. The first discharging switch 181 may connect or disconnect the suction motor 150 to or from both ends of the first battery 161.

**[0083]** The second discharging switch 182 may connect or disconnect the second battery 162 to or from the suction motor 150. The third discharging switch 183 may connect or disconnect the first battery 161 to or from the second battery 162.

**[0084]** Fig. 5 is a view illustrating an operation of a switching mechanism when a battery is charged according to the third embodiment, and Fig. 6 is a view illustrating an operation of the switching mechanism when a battery is discharged according to the third embodiment.

**[0085]** Referring to Fig. 5, when the battery 160 is charged, the first to third charging switches 171, 172, and 173 are turned on, and the first to third discharging switches 181, 182, and 183 are turned off.

**[0086]** Thus, the first and second batteries 161 and 162 are connected to each other in parallel. Also, a voltage outputted from the charger 30 may be supplied to each of the first and second batteries 161 and 162 to charge the first and second batteries 161 and 162.

**[0087]** Referring to Fig. 6, when the battery 160 is discharged, the first to third charging switches 171, 172, and 173 are turned off, and the first to third discharging switches 181, 182, and 183 are turned on. Thus, the first and second batteries 161 and 162 are connected to each other in series.

**[0088]** Thus, a voltage obtained by adding a charging voltage of the first battery 161 to a charging voltage of the second battery 162 may be outputted to the suction motor 150. That is, the battery 160 may have an output voltage of about 84.8 V or less.

**[0089]** When a power-off command is inputted into the vacuum cleaner, each of the switches may be turned off.

**[0090]** Since a high voltage of about 84.8 V or less is supplied to the suction motor 150 in the current embodiment, the suction motor may realize a high output. Thus, the suction force of the vacuum cleaner 3 may increase to improve cleaning performance.

**[0091]** Although the two batteries 151 and 162 are connected to each other in parallel or series in the foregoing embodiment, at least three batteries may be connected to each other in parallel or series.

**[0092]** Also, although the battery 160 is directly connected to the suction motor 150 in the foregoing embodiment, the battery 160 may be connected to the controller, and the suction motor 150 may be connected to the controller.

**[0093]** Although a canister-type cleaner is described as an example of the vacuum cleaner, the foregoing embodiments may be applied to an upright-type cleaner. That is, the upright-type cleaner may include a suction part and a cleaner body connected to the suction part. Here, a battery for supplying a power to a suction motor may be disposed on the suction part or the cleaner body. Also, the above-described charger may be connected to the suction part or the cleaner body.

**[0094]** Here, the cleaner body may be divided into two or more bodies. For example, the suction motor may be disposed on a first body of the two or more bodies, and the first body on which the suction motor is disposed may be connected to the suction part. Also, a second body may be connected to the first body, and a dust container for storing dusts may be disposed in the second body.

**[0095]** In this specification, since the booster and the switching mechanism regulate a voltage between an output terminal of the charger and an input terminal of the suction motor within the vacuum cleaner so that a voltage applied to the suction motor is greater than that outputted from the charger, the booster and the switching mechanism may be called as voltage regulators.

**[0096]** Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other

modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

## Claims

1. A vacuum cleaner comprising:

a cleaner body (10) comprising a suction motor (150) for generating a suction force;  
a suction part (21) arranged to communicate with the cleaner body and receive air and dust;  
a battery (120) arranged to supply power to the suction motor (150);  
a cleaner connector (102), disposed on the cleaner body (10) or the suction part (21), and arranged to receive a voltage;  
a voltage regulator arranged to regulate a voltage between the cleaner connector (102) and the suction motor (150) so that the voltage received by the cleaner connector (102) is less than a voltage inputted into the suction motor (150).

2. The vacuum cleaner according to claim 1, wherein the voltage regulator comprises a booster (140) for boosting a voltage.

3. The vacuum cleaner according to claim 1 or 2, wherein the voltage received by the cleaner connector (102) is a DC voltage of about 42.4 V or less.

4. The vacuum cleaner according to claim 2 or 3, wherein the booster (140) boosts a voltage outputted from the battery (120), and the voltage boosted by the booster (140) is output to the suction motor (150).

5. The vacuum cleaner according to claim 2, 3 or 4, wherein the battery (120) has a maximum charging voltage of about 42.4 V or less, and the booster (140) boosts the voltage output from the battery (120) so that a maximum DC voltage supplied to the suction motor (150) is above about 84.8 V.

6. The vacuum cleaner according to any of claims 2 to 5, wherein the booster (140) boosts the voltage received by the cleaner connector (102), and the voltage boosted by the booster (140) is inputted to the battery (120).

7. The vacuum cleaner according to any preceding claim 6, wherein a maximum charging voltage of the battery (120) exceeds about 42.4 V, and a maximum DC voltage provided to the suction motor (150) is above about 84.8 V. 5
8. The vacuum cleaner according to any one of claims 2 to 7, wherein the booster (140) comprises a boost converter. 10
9. The vacuum cleaner according to any preceding claim, wherein a plurality of batteries (161, 162) are disposed on one of the cleaner body (10) and the suction part (21), and the voltage regulator comprises switching mechanisms (171, 172, 173, 181, 182, 183) configured to connect the plurality of batteries (161, 162) in parallel with the cleaner connector (102) when the plurality of batteries (161, 162) are charged, and to connect the plurality of batteries (161, 162) to each other in series with the suction motor (150) when the plurality of batteries (161, 162) are discharged. 15 20
10. The vacuum cleaner according to claim 9, wherein the switching mechanisms (171, 172, 173, 181, 182, 183) comprise charging switching mechanisms (171, 172, 173) that are arranged to be closed for charging the plurality of batteries (161, 162) and open for discharging the plurality of batteries (161, 162) and discharging switching mechanisms (181, 182, 183) arranged to be closed for discharging the plurality of batteries (161, 162) and open for charging the plurality of batteries (161, 162). 25 30
11. The vacuum cleaner according to claim 10, wherein the plurality of batteries (161, 162) comprise a first battery (161) and a second battery (162), and the charging switching mechanisms (171, 172, 173) comprise: 35 40
- a first charging switch (171) arranged to connect or disconnect the second battery (162) to or from the cleaner connector (102);
- a second charging switch (172) arranged to connect or disconnect the first battery (161) to or from the cleaner connector (102); and 45
- a third charging switch (173) arranged to connect or disconnect the first battery (161) to or from the second battery (162). 50
12. The vacuum cleaner according to claim 10 or 11, wherein the discharging switching mechanisms (181, 182, 183) comprise: 55
- a first discharging switch (181) arranged to connect or disconnect the first battery (161) to or from the suction motor (150) or a controller (130) for controlling the suction motor (150);
- a second discharging switch (182) arranged to connect or disconnect the suction motor (150) or the controller (130) to or from the second battery (162); and
- a third discharging switch (183) arranged to connect or disconnect the first battery (161) to or from the second battery (162).
13. The vacuum cleaner according to any preceding claim, wherein the cleaner connector (102) protrudes from the cleaner body (10) or the suction part (21).
14. A vacuum cleaner system comprising the vacuum cleaner of any preceding claim and a charger (30), wherein the charger (30) is arranged to convert an input AC voltage into a DC voltage, step down the voltage and output the voltage to the cleaner connector (102).

Fig.1

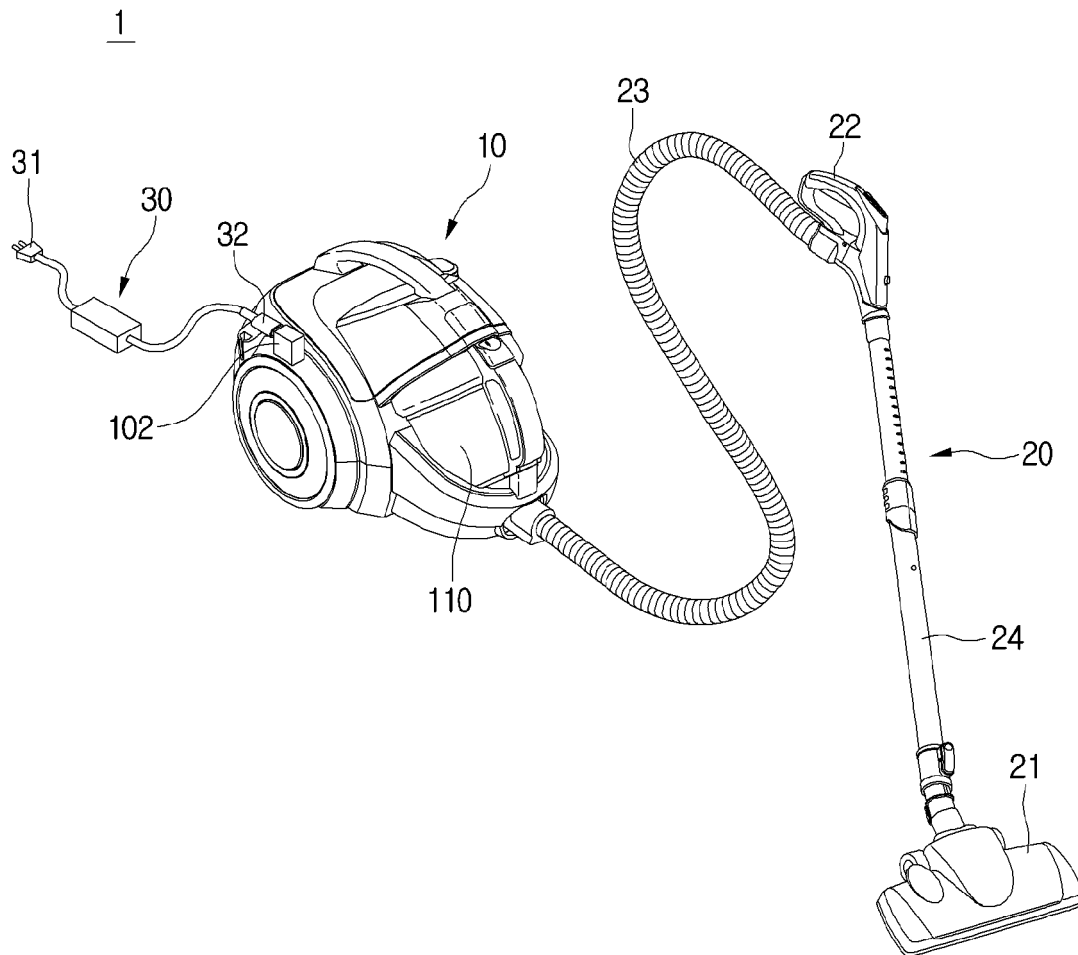


Fig.2

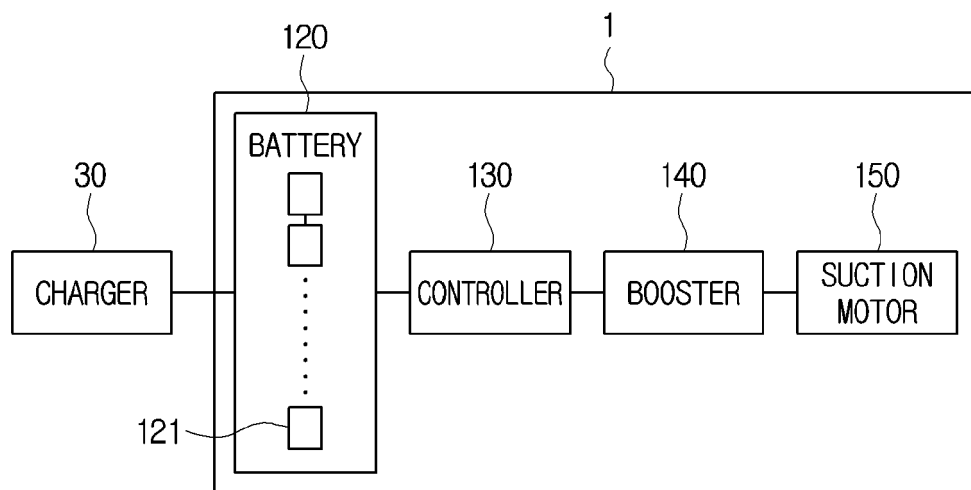


Fig.3

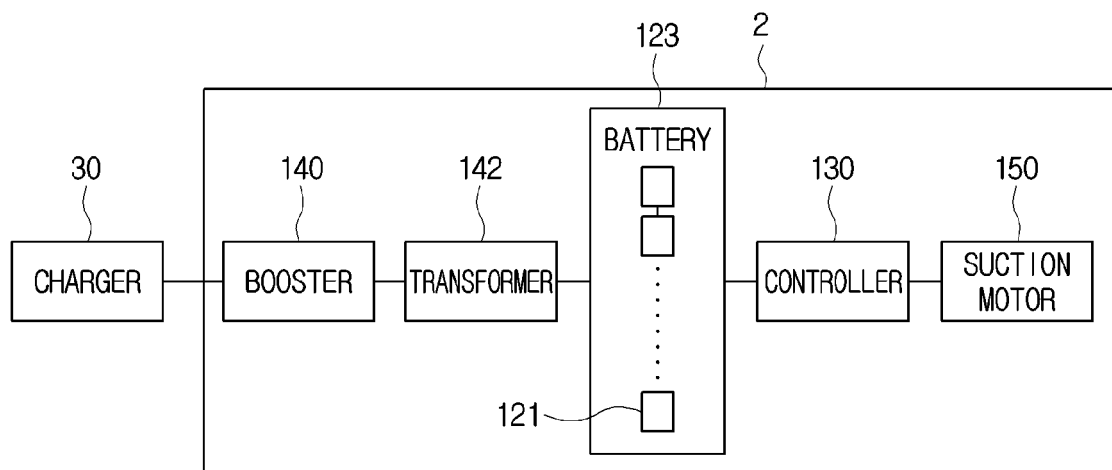


Fig.4

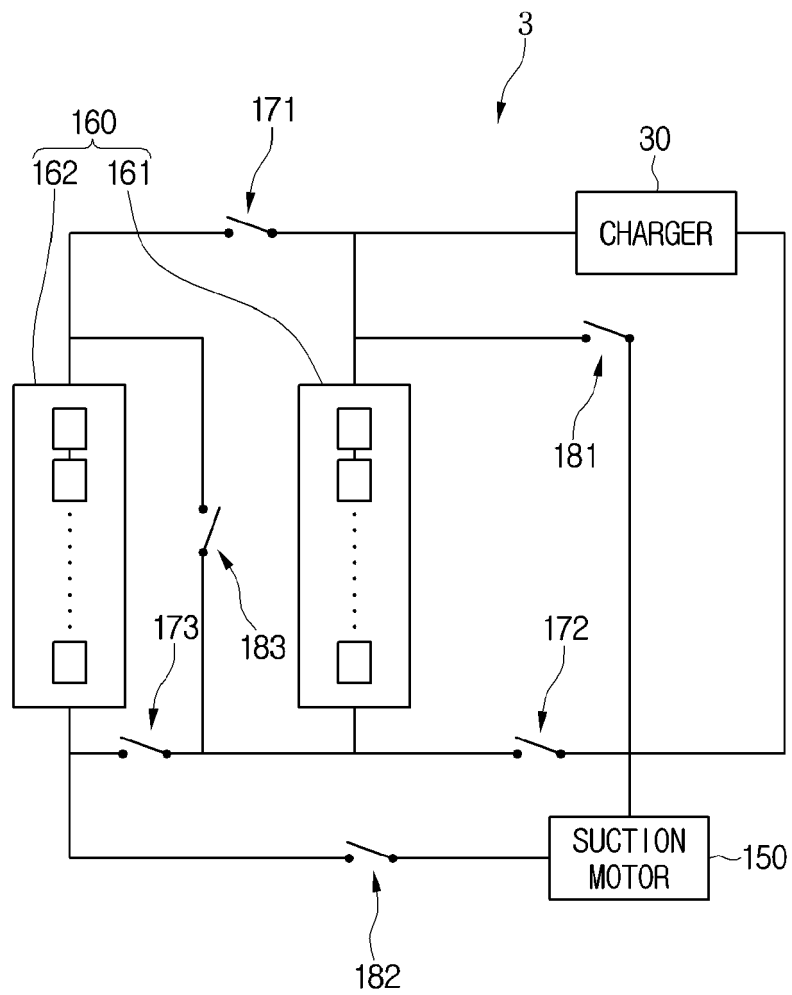


Fig.5

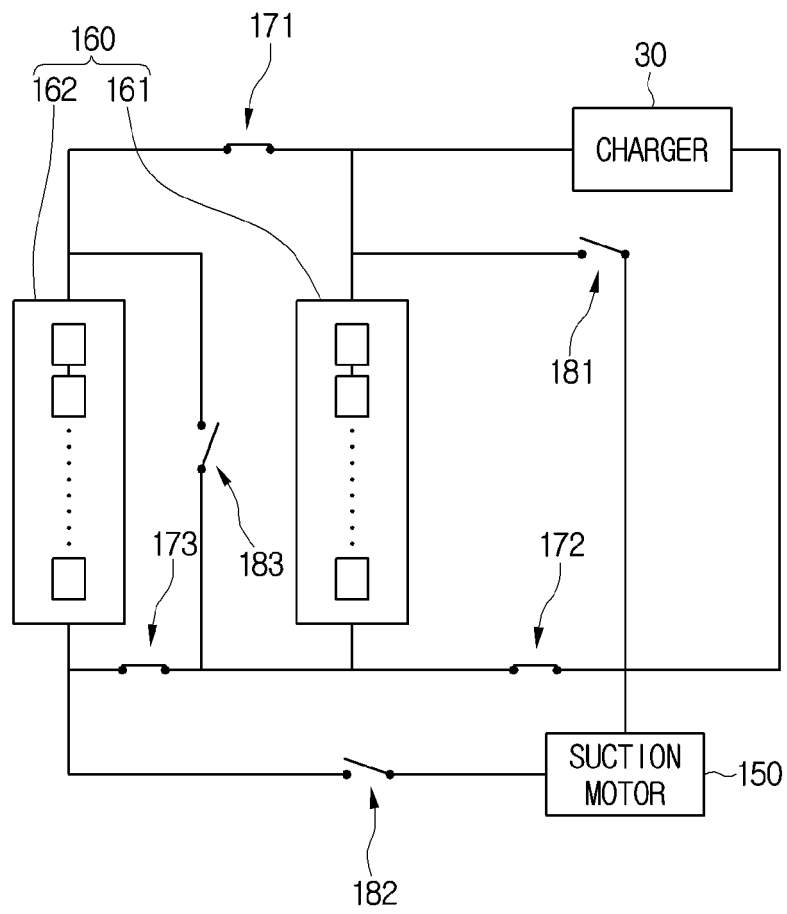
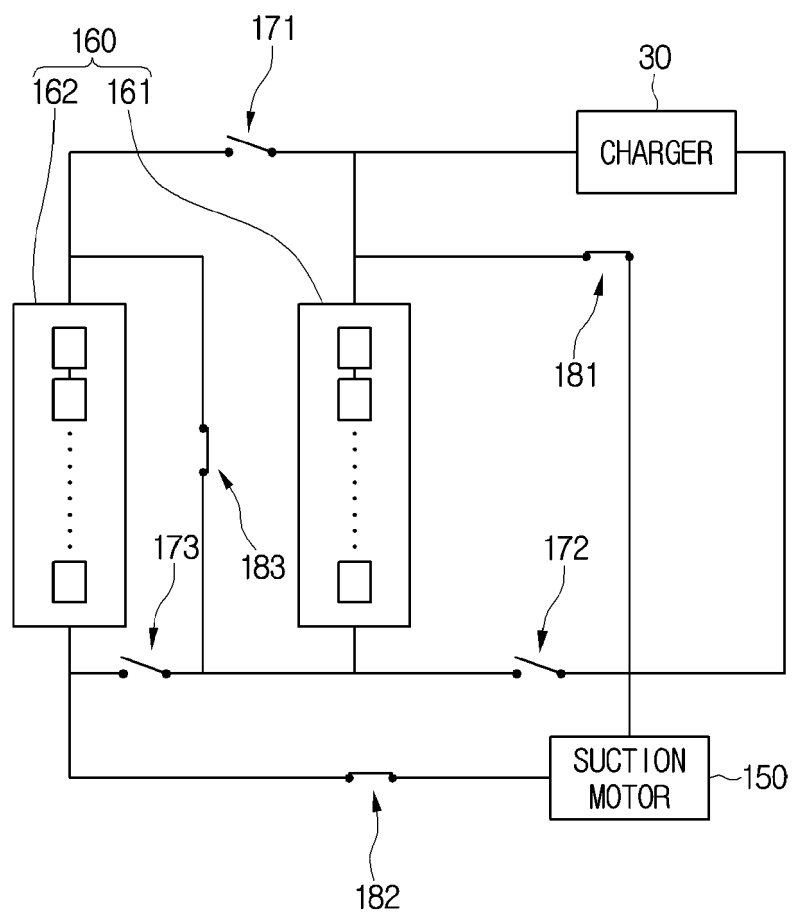


Fig. 6





## EUROPEAN SEARCH REPORT

 Application Number  
 EP 15 16 6996

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                 |                                  |                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
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