(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 741 031 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.06.2014 Bulletin 2014/24

(51) Int Cl.:
F25D 17/04 *(2006.01)*

(21) Application number: **13195727.6**

(22) Date of filing: **04.12.2013**

(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

(30) Priority: **06.12.2012 CN 201210518095**

(71) Applicant: **BSH Bosch und Siemens Hausgeräte GmbH**
81739 München (DE)

(72) Inventors:
- **Cen, Jie**
  310000 Hangzhou Zhejiang (CN)
- **Diao, Wentao**
  210046 Nanjing Jiangsu (CN)

(54) Refrigerator and working method thereof

(57) The present invention relates to a refrigerator and a working method thereof. The method includes: determining whether to suck air from a storage space (2) capable of keeping a low-pressure state; and if it is determined to suck air from the storage space, activating a vacuum pump (3) to suck at least a part of air out of the storage space (2) through a sucking path (4) connected between the vacuum pump (3) and the storage space (2). According to the advice of the present invention, when the vacuum pump (3) is in a start phase, a branch (5) connected to the sucking path (4) is opened in at least a part of the start phase or an open state of the branch (5) is kept, so as to decrease a start load of the vacuum pump (3).

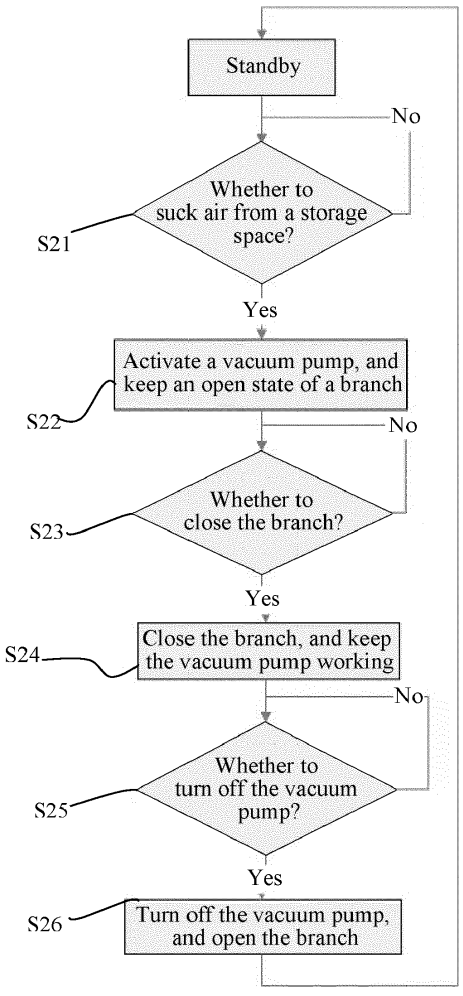


FIG. 3

EP 2 741 031 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a refrigerator and a working method thereof, and more particularly to a refrigerator having a storage space capable of keeping a low-pressure state and a working method thereof.

Related Art

[0002] A refrigerator capable of keeping goods in a low-pressure environment is known in the prior art. A refrigerator of this kind usually has an evacutable storage chamber (commonly known as "a vacuum chamber"). At least a part of air in the storage chamber is evacuated, so that the air content in the storage chamber is decreased to weaken oxidation of foods, thereby improving the preservation time and quality of foods.

[0003] When pressure in the vacuum chamber is lower than an external pressure, and if a vacuum pump needs to be activated again, the vacuum pump is loaded. The start torque of a motor is much smaller than the torque during normal working, so that it may be difficult to activate the motor with load, while it can be activated in a no-load circumstance. A found symptom is that a rotation speed of the motor is too low or the motor cannot rotate.

[0004] In order to make the motor be capable of being normally activated in any loaded environment, output of the motor needs to be increased which makes the motor larger. For many sucking systems having limitation on the size, it is obviously unacceptable. Even if feasible, forced activation not only consumes more electrical energy, but also produces more heat, which may affect normal working of surrounding components.

[0005] The Chinese invention patent No. CN 101331970 B discloses a vacuum preserving system and a control method thereof, which includes a low-pressure chamber/vacuum chamber, a vacuum pump, and a sucking path connected between the vacuum pump and the low-pressure chamber. During working of the vacuum pump, a gas in the low-pressure chamber may be sucked out through the sucking path. A refrigerator has a branch having one end connected to the sucking path and the other end exposed to external air (the external atmospheric pressure). During vacuuming, the branch keeps closed, and when the vacuum pump is turned off, the branch is opened to input external air into the sucking path, so as to cause a pressure difference between two ends of a mechanical valve/pressure keeping valve of the low-pressure chamber, and close, through the pressure difference, the mechanical valve disposed on the low-pressure chamber. However, CN 101331970 B is silent regarding the technical problems to be solved by the present invention.

SUMMARY OF THE INVENTION

[0006] An objective of the present invention is to solve at least one of the foregoing problems, so as to provide a working method of a refrigerator, which is reliable and is advantageous for reducing size of a vacuum pump, and to provide a refrigerator configured to be capable of implementing such a method.

[0007] Therefore, an aspect of the present invention relates to a working method of a refrigerator, which includes: determining whether to suck air from a storage space capable of keeping a low-pressure state; and if it is determined to suck air from the storage space, activating a vacuum pump to suck at least a part of air out of the storage space through a sucking path connected between the vacuum pump and the storage space; characterized in that when the vacuum pump is in a start phase, a branch connected to the sucking path is opened or an open state of the branch is kept for at least a part of the start phase.

[0008] During the start phase of the vacuum pump, ambient air may be introduced into the sucking path connected to an air inlet of the vacuum pump, so that at this phase, a pressure difference between inlet and outlet of the vacuum pump can be significantly decreased, that is, a starting load of the vacuum pump can be significantly decreased. Therefore, even a vacuum pump of smaller output power is used, the vacuum pump may also be activated when the storage space is in a low pressure. Therefore, it can be expected that a vacuum pump, which is of smaller power and is more compact, can be used on a refrigerator.

[0009] It should be understood that, the opening the branch in the present invention includes a situation where the branch is switched from a closed state to a completely open or partially open state, and correspondingly, the open state of the branch includes a situation where the branch is partially open and a situation where the branch is completely open.

[0010] Other separate features or featured regarded as characteristics of the present invention when combined with other features are illustrated in the following appended claims.

[0011] According to a possible embodiment of the present invention, when it is determined to suck air from the storage space, the branch is opened or keeps at an open state for a first predetermined time, and when the first predetermined time is lapsed, the branch is closed. Preferably, the first predetermined time is not greater than 5 seconds.

[0012] According to a possible embodiment of the present invention, the method includes determining whether the vacuum pump has completed the start phase, and if it is determined that the vacuum pump completes the start phase, closing the branch.

[0013] According to a possible embodiment of the present invention, a control unit determines, based on obtained information about rotation speed of a motor of

the vacuum pump, whether the vacuum pump completes the start phase.

[0014] According to a possible embodiment of the present invention, when it is determined to suck air from the storage space, the branch is switched from a closed state to an open state, before the vacuum pump is powered on.

[0015] According to a possible embodiment of the present invention, when it is determined to suck air from the storage space, the vacuum pump and a valve for selectively closing or opening the branch are powered on at the same time to open the branch, or the valve is powered on earlier than the vacuum pump by a a predetermined time period.

[0016] According to a possible embodiment of the present invention, when it is determined to suck air from the storage space, the valve for opening or closing the branch is powered on later than the vacuum pump by a predetermined time period, and when the valve is powered on , the branch is closed.

[0017] According to a possible embodiment of the present invention, the method includes determining whether to turn off the vacuum pump or not, and after the vacuum pump is turned off, the branch is opened again to import ambient air into the sucking path.

[0018] According to a possible embodiment of the present invention, after the vacuum pump is turned off, the branch is opened again for a second predetermined time and then is closed.

[0019] According to a possible embodiment of the present invention, when a measured pressure inside the sucking path reaches a preset value, the branch opened again is closed.

[0020] Another aspect of the present invention relates to a refrigerator, including: a storage space capable of keeping a low-pressure state, a vacuum pump, a sucking path connected between the storage space and the vacuum pump, a branch which is connected to the sucking path and is capable of being selectively closed or opened, and a control unit; wherein the control unit is configured to be capable of executing the method according to any one of the foregoing.

[0021] To make the structure, other objectives, and beneficial effects of the present invention more obvious and understandable, possible embodiments are described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] As a part of the specification and used for providing further understanding of the present invention, the following accompanying drawings illustrate specific embodiments of the present invention and describe principles of the present invention together with the specification, where:

FIG. 1 is a schematic view of a refrigerator having a sucking system according to a preferable embodiment of the present invention;

FIG. 2 is a schematic flowchart of a evacuation process of a refrigerator according to a preferable embodiment of the present invention; and

FIG. 3 is a schematic flowchart of a evacuation process of a refrigerator according to another preferable embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Referring to FIG. 1, a refrigerator 1 has a thermally insulated inner space 10. An inner space 2 may be defined by a cabinet (not shown) having a thermally insulating material, and may be closed or opened by a door (not shown) connected to thecabinet.

[0024] The refrigerator 1 has a storage space 2 capable of keeping a low-pressure state. The storage space 2 may be formed by a storage unit 11 mounted in the inner space 10, and may also be directly defined by the inner space 10.

[0025] The refrigerator 1 has a sucking system 12 for sucking at least a part of air out of the storage space 2. The sucking system 12 includes a vacuum pump 3 and a sucking path 4 connected between the storage space 2 and the vacuum pump 3. The sucking path 4 may be defined by at least one pipe and at least one pipe fitting.

[0026] The vacuum pump 3 may include motor and a piston received in an air cylinder and driven by the motor. With the reciprocating movement of the piston, air is sucked in the air cylinder or is discharged out of the air cylinder. The sucking system 12 includes a mechanical valve 8 that is located in the sucking path 4 to prevent an external air from entering the storage space 2. The mechanical valve 8 may be disposed on the storage unit 11. In a preferable embodiment, the mechanical valve 8 may have a deformable valve plate, and due to a difference between internal and external pressures, the valve plate is deformed to tightly close a sucking channel disposed on the storage unit 11. The mechanical valve 8 may adopt an existing solution, for example, the solution disclosed by patent application No. CN200910028963.1, and therefore no more description is provided herein.

[0027] The sucking system 12 includes a detection unit 9 for determining whether the storage space 2 reaches a set pressure. The detection unit 9 may include a pressure sensor for detecting an air pressure.

[0028] In this embodiment, the detection unit 9 is connected to the sucking path 4, and determines a pressure in the storage space 2 by detecting a pressure of the sucking path 4. In another embodiment, the detection unit 9 may also directly detect the pressure within the storage space 2.

[0029] The sucking system 12 further includes a branch 5 connected to the sucking path 4. One end of the branch 5 is in fluid communication with the sucking path 4, and the other end is connected to ambient air,

that is, connected to the atmospheric pressure.

[0030] The branch 5 is provided with a valve 7 for controlling the branch 5 to be opened or closed. Preferably, the valve 7 is a solenoid valve, is operatively associated with a controller 6, and may be powered on or powered off according to a signal of the controller 6 to selectively open the branch or close the branch. In a preferable embodiment, the valve 7 is a normal-close valve, and when the valve 7 is powered on, a coil of the valve 7 is powered on, a spool, under the action of an electromagnetic force, may be instantaneously displaced, so as to open the branch 5. After the valve 7 is powered off, the electromagnetic force disappears, and the spool may move due to return force of a return mechanism (for example, a spring) to a close position. In a replacement embodiment, the valve 7 may also be a normally open solenoid valve.

[0031] The controller 6 includes a printed circuit board, and is operatively connected to the vacuum pump 3, the detection unit 9, and the valve 7. The vacuum pump 3 and the valve 7 may be selectively powered on or powered off according to a signal generated by the controller 6.

[0032] When the vacuum pump 3 is just activated, i.e. just powered on, rotation speed of the motor of the vacuum pump 3 is low. After a start phase in which the rotation speed of the motor increases gradually, the vacuum pump 3 runs at a normal operation phase where the rotation speed of the motor is relatively stable. At the start phase, the output torque of the motor of the vacuum pump 3 is relatively small.

[0033] FIG. 2 is a schematic flowchart of a sucking procedure of a refrigerator 1 according to a preferable embodiment of the present invention. Referring to FIG. 2 in combination with FIG. 1, firstly in Step S1: determines whether to suck air from a storage space 2 to decrease a pressure of the storage space 2. This may be determined by the control unit 6 according to an input instruction of a user, pressure information, measured by a detection unit 9, in the storage space 2, or a time signal. For example, when a user presses/touches a switch on the refrigerator 1, or when the pressure in the storage space 2 measured by the detection unit 9, is lower than a preset value, or a time signal generated by a timing unit, the control unit 6 sends an instruction for f sucking air from the storage space 2 when the control unit 6 receives/generates the user input instruction, pressure information, or time signal,. If the control unit 6 does not receive the instruction from the user or a feedback from the detection unit 9 or the timing unit, the control unit 6 remains a standby state.

[0034] If the control unit 6 determines that it is required to suck air from the storage space 2, in Step S2, a vacuum pump 3 is activated (for example, the vacuum pump 3 is powered on), and a branch 5 is opened. During the start phase in which the vacuum pump 3 is just powered on, the rotation speed of motor is relatively low and therefore its output torque is small, and the opening of the branch 5 can decrease a pressure difference between an inlet and an outlet of the vacuum pump 3, which decrease a start load of the vacuum pump 3.

[0035] In this embodiment, the branch 5 is in a closed state before Step S2, therefore the opening of the branch 5 requires the branch 5 to be switched from the closed state to an open state. When a valve 7 is a normal-close solenoid valve, powering on the valve 7 can switch the branch 5 from the closed state to the open state.

[0036] Due to the branch 5 is in the closed state before Step S2, in a preferable embodiment, the branch 5 is opened before turning on of the vacuum pump 3, for example, the valve 7 is powered on earlier than the vacuum pump 3 by a predetermine time period (for example, 0.5 to 1 second), and therefore the branch 5 is at least partially opened before the vacuum pump 3 is powered on, so that when the vacuum pump 3 is activated, the pressure difference between the inlet and outlet of the vacuum pump 3 can be decreased or even be zero.

[0037] In an alternative embodiment, the branch 5 and the vacuum pump 3 may be opened/turned on at the same time, for example, the valve 7 and the vacuum pump 3 are powered on at the same time.

[0038] Then, in Step S3, determines whether to close the branch 5. This may be determined based on a time signal. In the embodiment where the branch 5 is switched from the closed state to the open state in Step S2, when an open time of the branch 5 (that is, in a preferable embodiment, the power-on period of the valve 7) reaches a first predetermined time T1, the branch 5 is closed in Step S4 (that is, in a preferable embodiment, the valve 7 is power off). The first predetermined time T1 ranges from, for example, 1 second to 5 seconds, and preferably 1 second to 2 seconds.

[0039] In an alternative embodiment, when the vacuum pump 3 includes a motor, in Step S3, whether the vacuum pump 3 completes the start phase may also be determined according to information about rotation speed of the motor of the vacuum pump 3, and accordingly determines whether to close the branch 5. For example, when the rotation speed of the vacuum pump 3 changes from the start phase at the beginning in which the rotation speed increases gradually to a normal working phase in which the rotation speed is steady, the control unit 6 determines that the vacuum pump 3 already completes the start phase, and therefore closes the branch 5.

[0040] When it is determined to close the branch 5, the branch is closed in Step S4. When the branch 5 is closed, the vacuum pump 3 continues working to continue sucking the air from the storage space 2, so as to decrease the oxygen content in the storage space 2.

[0041] Then, in Step S5, determines whether to turn off the vacuum pump 3. It may be determined by determining whether the pressure in the storage space 2 reaches a preset value, for example, it is determined according to pressure information, measured by the detection unit 9, in a sucking path 4. When the pressure in the storage space 2 reaches the preset value, the vacuum

pump 3 is turned off.

[0042] In an alternative embodiment, determining of whether to turn off the vacuum pump 3 may also be based on calculation of a power-on time period of the vacuum pump 3. For example, when the vacuum pump 3 is already powered on for a preset time period, the vacuum pump 3 is turned off.

[0043] When it is determined in Step S5 to turn off the vacuum pump 3, the vacuum pump is turned off in Step S6. In the embodiment shown in FIG. 2, after the vacuum pump 3 is de-electrified, the branch 5 is opened again to introduce external air into the sucking path 4 to rapidly increase the pressure in the sucking path 4 in Step S6, thereby producing a pressure difference between two sides of a mechanical valve 8, so that the mechanical valve 8 may be reliably and rapidly closed to enhance air-tightness of the storage space 2.

[0044] When the valve 7 is a normal-close solenoid valve, and when the valve 7 is powered on, an electromagnetic force generated by a coil may instantaneously open the branch 5 completely, external air rapidly enters the sucking path 4, and the pressure in the sucking path 4 may be increased instantaneously to the atmospheric pressure. Because a large pressure difference is produced between the inside of the sucking path 4 and the storage space 2, the mechanical valve 8 may be instantaneously closed. A air returning phenomenon (after the vacuum pump 3 stops working, the external air enters into the storage space 2 via a sucking channel which is not timely closed by the mechanical valve 8) may be effectively eliminated, accordingly the low-pressure state in the storage space 2 can be kept longer.

[0045] In this embodiment, the method includes, after Step S6, determining whether to close the branch 5 again (Step S7). In a preferable embodiment, it may be determined by calculating time period of opening of the branch 5 time (which may be equivalent to the time period of power-on of the valve 7) for this. When the branch 5 is already open for a second predetermined time T2, it is determined that the branch 5 shall be closed.

[0046] In another preferable embodiment, in Step S7, determining of whether to close the branch 5 can also be based on whether the pressure in the sucking path 4 already reaches a preset value. For example, when the pressure, measured by the detection unit 9, in the sucking path 4 rises to an atmospheric pressure or close to an atmospheric pressure, it may be determined that the branch 5 shall be closed.

[0047] When it is determined in Step S7 to close the branch 5, the branch 5 is closed in Step S8.

[0048] At this point, a evacuation process ends, and the standby state is returned again.

[0049] FIG. 3 is a schematic flowchart of a sucking procedure of a refrigerator 1 according to another preferable embodiment of the present invention. A main difference between FIG. 3 and FIG. d lies in the state of the branch 5 after a evacuation process ends and different operation resulted therefrom. Preferably, in this embodiment, the valve 7 is a normal-open solenoid valve, and when the valve 7 is powered on, the branch 5 is closed. The following mainly describes the difference between FIG. 3 and FIG. 2.

[0050] As shown in FIG. 3, when it is determined in Step S21 to suck air from the storage space 2, the vacuum pump 3 is activated in Step S22. As the branch 5 is in the open state in the standby state, the branch 5 is kept at the open state in Step S22, that is, the state of the valve 7 does not need to be changed.

[0051] In Step S23, it determines whether to close the branch 5. As stated above, determining of whether to close the branch 5 can be based on a time signal or information of rotation speed of the vacuum pump 3. For example, the time signal may be generated by comparing whether, a time period that elapses since the control unit 6 sends a vacuuming instruction, or a power-on time period of the vacuum pump 3, has reached the first predetermined time T1. According to a signal generated due to elapse of the first predetermined time T1, the control unit 6 determines that the branch 5 needs to be closed.

[0052] When the control unit 6 determines that the branch 5 needs to be closed, the branch 5 is closed in Step S24. In this embodiment, the valve 7 is powered on. The vacuum pump 3 continues operating after completing the start phase.

[0053] In the embodiment of FIG. 3, when it is determined to suck air from the storage space 2, the valve 7 is power on after the vacuum pump 3 is powered on.

[0054] When it is determined in Step S25 to turn off the vacuum pump 3, for example when the inside of the storage space 2 already reaches a predetermined pressure, the vacuum pump 3 is turned off in Step S26, and the branch 5 is opened again (that is, the valve 7 is powered off) to import external air into the sucking path 4 to rapidly close the mechanical valve 8. The branch 5 maintains the open state until it is closed when necessary in a next evacuation process.

[0055] At this point, an evacuation process ends, and the standby state is returned to.

[0056] In the foregoing embodiment, when it is determined to suck air from the storage space 2, the control unit 6 takes it by default that the branch 5 is in a certain state (the closed state in FIG. 2 and the open state in FIG. 3), and directly opens the branch 5 or keeps the open state of the branch 5. However, in an alternatively embodiment, the control unit 6 may also first determine the state of the branch 5, and then determine whether to power on the valve 7, keep the valve 7 being powered on, power off the valve 7, or keep the valve 7 being powered off. The state of the branch 5 may be determined by determining the state of the valve 7.

Claims

1. A working method of a refrigerator, comprising:

determining whether to suck air from a storage space (2) capable of keeping a low-pressure state; and

if it is determined to suck air from the storage space (2), activating a vacuum pump (3) to suck at least a part of air out of the storage space (2) through a sucking path (4) connected between the vacuum pump (3) and the storage space (2); **characterized in that**,

when the vacuum pump (3) is in a start phase, a branch (5) connected to the sucking path (4) is at least partially opened or the branch (5) is kept at an open state for at least part of the start phase, to reduce a starting load of the vacuum pump (3).

2. The method according to claim 1, **characterized in that**, when it is determined to suck air from the storage space (2), the branch (5) is opened or is kept at an open state for a first predetermined time (T1), and when the first predetermined time (T1) is lapsed, the branch (5) is closed.

3. The method according to claim 2, **characterized in that**, the first predetermined time (T1) is not greater than 5 seconds.

4. The method according to claim 1, **characterized by** comprising determining whether the start phase of the vacuum pump (3) is finished, and if it is determined that the start phase of the vacuum pump (3) is finished, closing the branch (5) .

5. The method according to claim 4, **characterized in that**, according to obtained information about rotation speed of a motor of the vacuum pump (3), a control unit (6) determines whether the vacuum pump (3) has completed the start phase.

6. The method according to any one of claims 1 to 5, **characterized in that**, when it is determined to suck air from the storage space (2), the branch (5) is switched from a close state to an open state before the vacuum pump (3) is powered on.

7. The method according to any one of claims 1 to 5, **characterized in that**, when it is determined to suck air from the storage space (2), the vacuum pump (3) and a valve (7) for selectively closing or opening the branch are powered on at the same time to open the branch (5), or the valve (7) is powered on earlier than the vacuum pump (3) by a predetermined time period.

8. The method according to any one of claims 1 to 5, **characterized in that**, when it is determined to suck air from the storage space (2), a valve (7) for opening or closing the branch (5) is powered on earlier than the vacuum pump (3 by a predetermined time period, and when the valve (7) is powered on , the branch (3) is closed.

9. The method according to any one of claims 1 to 8, **characterized by** comprising determining whether to turned off the vacuum pump (3) or not, and after the vacuum pump (3) is turned off, the branch (5) is opened again to import ambient air into the sucking path (4).

10. The method according to claim 9, **characterized in that**, after the vacuum pump (3) is turned off, the branch (5) is opened again for a second predetermined time (T2) and then is closed.

11. The method according to claim 9, **characterized in that**, when a measured pressure inside the sucking path (4) reaches a preset value, the branch (5) opened again is closed.

12. A refrigerator, comprising: a storage space (2) capable of keeping a low-pressure state, a vacuum pump (3), a sucking path (4) connected between the storage space (2) and the vacuum pump (3), a branch (5) which is connected to the sucking path (4) and is selectively closed or opened, and a control unit (6); **characterized in that**, the control unit (6) is set to be capable of executing a method according to any one of claims 1 to 11.

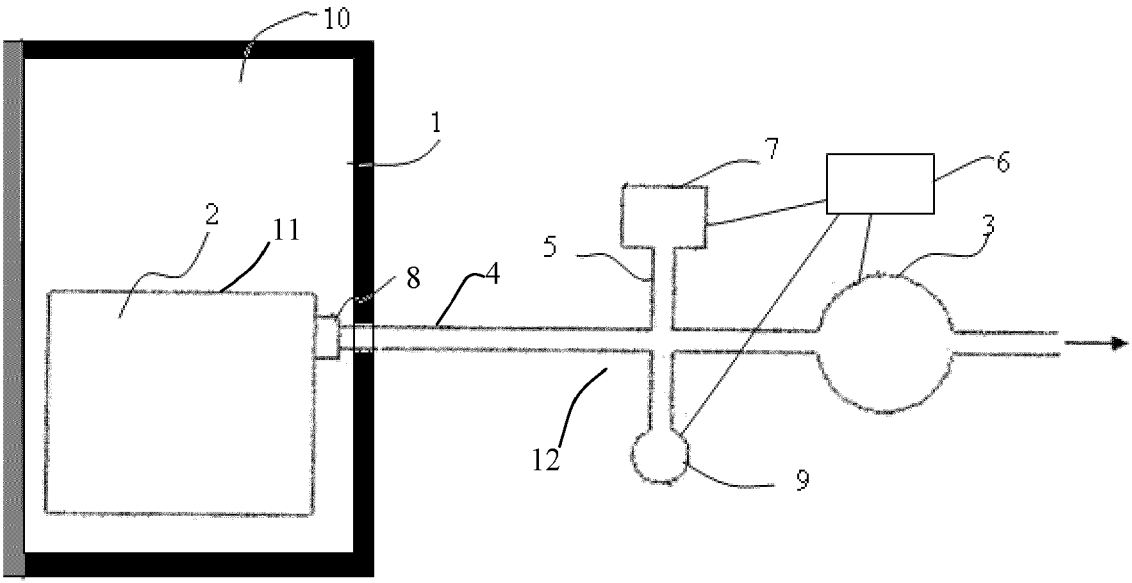


FIG. 1

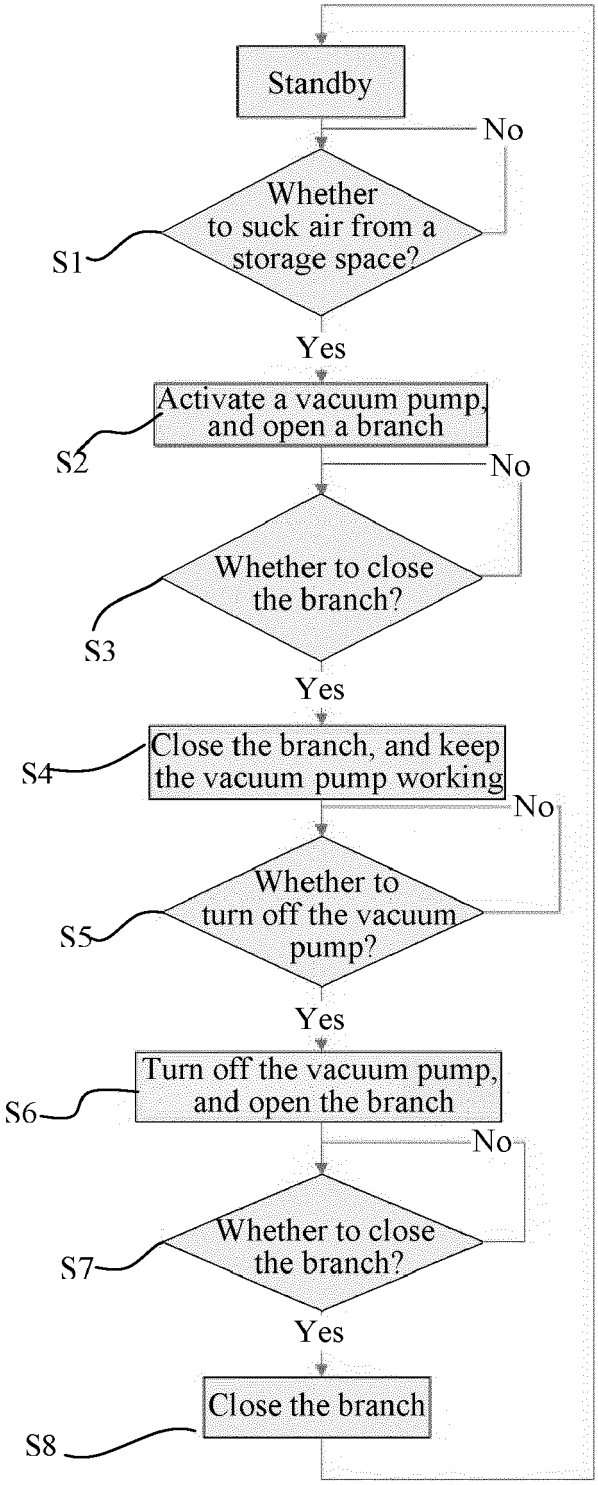

Standby
No
Whether to suck air from a storage space?
S1
Yes
Activate a vacuum pump, and open a branch
S2
No
Whether to close the branch?
S3
Yes
Close the branch, and keep the vacuum pump working
S4
No
Whether to turn off the vacuum pump?
S5
Yes
Turn off the vacuum pump, and open the branch
S6
No
Whether to close the branch?
S7
Yes
Close the branch
S8

FIG. 2

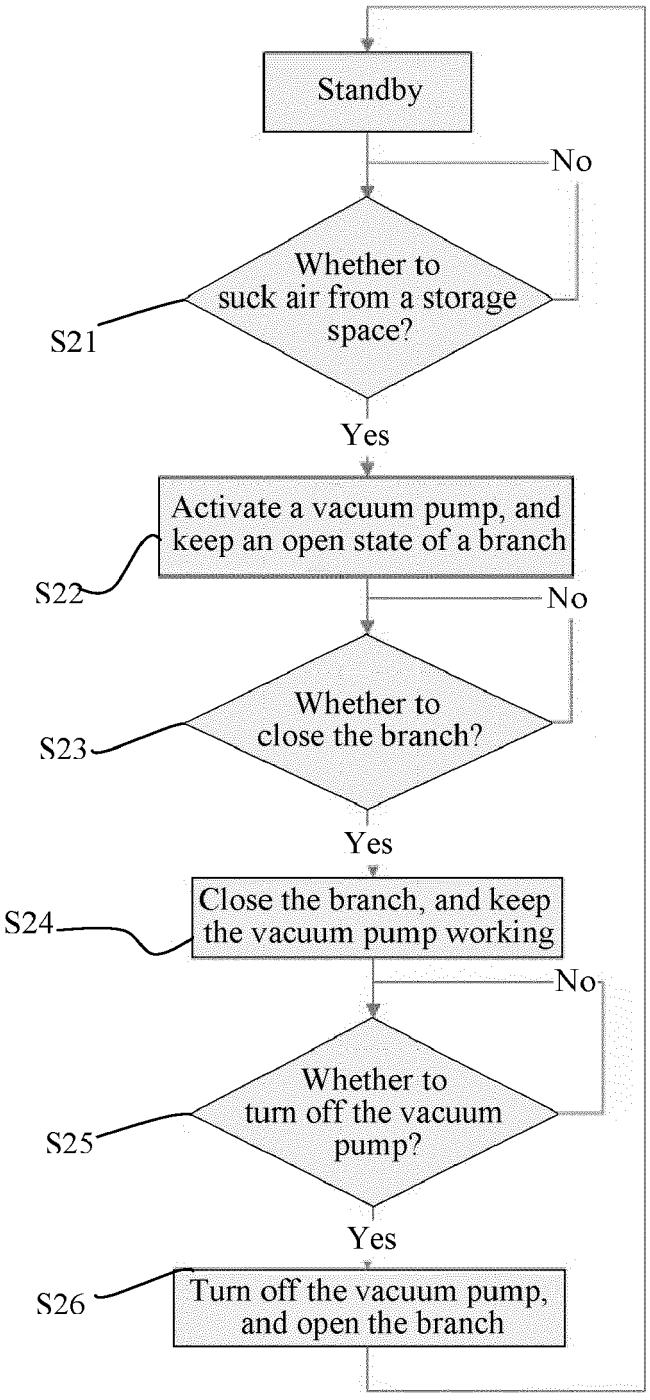

Standby
No
Whether to suck air from a storage space?
S21
Yes
Activate a vacuum pump, and keep an open state of a branch
S22
No
Whether to close the branch?
S23
Yes
Close the branch, and keep the vacuum pump working
S24
No
Whether to turn off the vacuum pump?
S25
Yes
Turn off the vacuum pump, and open the branch
S26

FIG. 3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 13 19 5727

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2005/057103 A1 (ELECTROLUX HOME PROD CORP [BE]; PIMPUTKAR GIRISH [IT]; HUE XAVIER [IT]) 23 June 2005 (2005-06-23) * page 9, line 15 - line 31; figure 1 *	1-4,6-9, 12	INV. F25D17/04
X	US 6 090 422 A (TARAGAN ARIE [US] ET AL) 18 July 2000 (2000-07-18) * column 5, line 52 - column 6, line 37; figures 1-3 *	1	TECHNICAL FIELDS SEARCHED (IPC) F25D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 February 2014	Jessen, Flemming

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 19 5727

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-02-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2005057103 A1	23-06-2005	AT 390610 T	15-04-2008
		AU 2003291801 A1	29-06-2005
		CA 2548978 A1	23-06-2005
		CN 1910417 A	07-02-2007
		JP 2007528971 A	18-10-2007
		US 2007234754 A1	11-10-2007
		WO 2005057103 A1	23-06-2005
US 6090422 A	18-07-2000	AU 6091000 A	05-03-2001
		US 6090422 A	18-07-2000
		WO 0110250 A1	15-02-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 101331970 B **[0005]**
- CN 200910028963 **[0026]**