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(54) SELF-REPAIRING VACUUM DEVICE

(57) The present invention refers to a vacuum device (1) for removing air from a flexible container (2), in particular a polymer bag, in particular filled with food. The vacuum device (1) according to the present invention comprises

a movable compression element (4) for compressing the container (2),

a pump unit (6) for removing air from the container (2),

a control unit (8) for controlling operation of the vacuum device (1),

a frame structure (10) for holding the pump unit (6) and the control unit (8) and for providing a counter compression element (12) for compressing the container (2),

an actuator (14) for moving the movable compression member (4) between a first position (16) and a second position (18), wherein the first position (16) is a starting position and located in a distance to the counter compression element (12) and wherein the second position (18) is an end position, wherein the end position is closer to the counter compression element (12) compared to the starting position,

at least one switch (20) for switching operation of the actuator (14) from on to off, wherein the switch (20) is at least partially arranged in a region of the starting position within a traveling path (22) of the movable compression element, (4) wherein the switch (20) preferably comprises a contact section to be directly or indirectly contacted by the movable compression element for actuating the switch (20), and

at least one expanding element (24) for pushing the movable compression element (4) from the end position into the direction of the starting position.

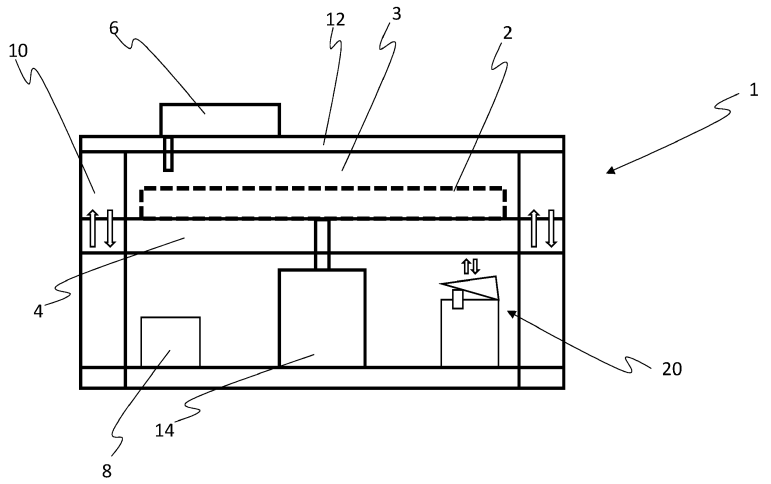

Fig. 1

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Description

[0001] The present invention refers according to claim 1 two a vacuum device, according to claim 10 a kitchen appliance and according to claim 11 to a method for operating a vacuum device.

Background of the invention

[0002] Document EP3450893A1 discloses a food bag vacuuming system. Documents US7331163B2 and KR101312648B1 describe further examples of vacuum devices. High forces are used in such systems to compress a food bag. Due to said high forces sometime the situation occurs that a movable compression element cannot be moved into a starting position, thus the compression element is stuck and the vacuum device cannot be used anymore or a

Object of the invention

[0003] It is the object of the present invention to provide a vacuum device and a method for operating the vacuum device, wherein the vacuum device and the method should provide an increased user comfort, in particular in case of an error condition.

Description of the invention

[0004] The before mentioned object is solved by a vacuum device according to claim 1. The vacuum device according to the present invention is a vacuum device for removing air from a flexible container, in particular a polymer bag, in particular filled with food. The vacuum device preferably comprises at least a movable compression element for compressing the container. The vacuum device preferably also comprises a pump unit for removing air from the container, a control unit for controlling operation of the vacuum device. The vacuum device preferably also comprises a frame structure for holding the pump unit and the control unit and for providing a counter compression element for compressing the container. Furthermore, the vacuum device preferably comprises an actuator for moving the movable compression member between a first position and a second position, wherein the first position is a starting position and located in a distance to the counter compression element and wherein the second position is an end position, wherein the end position is closer to the counter compression element compared to the starting position. At least one switch for switching operation of the actuator from on to off is preferably provided, wherein the switch is at least partially arranged in a region of the starting position within a traveling path of the movable compression element, wherein the switch preferably comprises a contact section to be directly or indirectly contacted by the movable compression element for actuating the switch. At least one expanding element and preferably two or more that two expanding elements for pushing the movable compression from the end position into the direction of the starting position. Arranged in a region of the starting position preferably means that the switch is at least in contact with the movable compression element in case the movable compression element is in the starting position. The expanding element is preferably mad of a polymer material, in particular hard plastic or rubber or PVC or Polyurethane. The vacuuming device can also be part of a food bag vacuuming system.

[0005] This solution is beneficial since the torque applied by the actuator when it is required to move the mechanism downwards in case of failure can be insufficient. So, in a faulty situation of the system, this can happen with over compression. In these situations, actuators torque is insufficient. Thus, expanding element is operated to support the actuator by moving the movable compression member into the first position.

[0006] Further preferred embodiments are described in the following specification passages and/or are subject-matter of the dependent claims.

[0007] According to a preferred embodiment of the present invention the expanding element is a flexible respectively elastic deformable polymer element, wherein the flexile polymer element forms a receiving chamber, wherein the receiving chamber is connected to a fluid supply element, wherein the flexible polymer element is expanded by supplying fluid via the fluid supply element into the receiving chamber. This embodiment is beneficial since the expanding element can be manufactured without causing significant costs. Furthermore, since the pump unit is already present for removing air from the container, the pump unit can be used to inflate the expansion element. Thus, the pump unit is preferably used for two different function.

[0008] The expanding element is arranged according to a further preferred embodiment of the present invention on the movable compression element or is part of the movable compression element, wherein the expanding element expands into the direction of the counter compression element in case fluid is supplied into the receiving chamber or the expanding element is arranged on the counter compression element or is part of the counter compression element, wherein the expanding element expands into the direction of the movable compression element in case fluid is supplied into the receiving chamber. This embodiment is beneficial since due to the expanding element an additional force respectively torque can be provided to open a vacuuming space again. Thus, the actuator does not have to be very strong. This helps to reduce cost of components and therefore the overall production costs.

[0009] At least one valve unit, in particularly a two-channel valve is provided according to a further preferred embodiment of the present invention, wherein the vale unit, in particular two-channel valve, is coupled with a vacuum section arranged between the movable compression element and the counter compression element

and wherein the valve unit, in particular two-channel valve, is coupled with the fluid supply element for supplying air into the receiving chamber of the expanding element. This embodiment is beneficial since valve units, in particular two-channel valves, are standard components and therefore do not cause significant costs. However, due to the valve unit the pump unit can be used for both functions (vacuuming of container and inflating of expanding element).

[0010] Multiple expanding elements are provided according to a further preferred embodiment of the present invention, wherein each expanding element is coupled via the supply element to the pump unit, wherein each of the expanding elements is arranged on the movable compression element or is part of the movable compression element, wherein the expanding elements expand into the direction of the counter compression element in case fluid is supplied into the receiving chambers or the expanding elements are arranged on the counter compression element or are part of the counter compression element, wherein the expanding elements expand into the direction of the movable compression element in case fluid is supplied into the receiving chambers. This embodiment is beneficial since the force respectively torque for moving the movable compression element into the direction of the first position can be applied in a more homogeneous manner.

[0011] A pressure sensor is provided according to a further preferred embodiment of the present invention on or in the movable compression element facing the counter compression element for providing pressure sensor signals or pressure sensor date for indicating contact, in particular indirect or direct contact, between the movable compression element and the counter pressure element or for emitting pressure sensor signals or pressure sensor data representing a pressure value, in particular a pressure value above a defined threshold value or the pressure sensor is provided on or in the counter compression element facing the movable compression element for providing pressure sensor signals or pressure sensor date for indicating contact between the counter compression element and the movable pressure element or for emitting pressure sensor signals or pressure sensor data representing a pressure value, in particular a pressure value above a defined threshold value. This embodiment is beneficial since a force resulting from an operation of the actuator can be detected. Furthermore, even in case the actuator is switched of, it can be possible to detect pressure between the movable compression element and the counter compression element.

[0012] The control unit is according to a further preferred embodiment of the present invention configured to operate the actuator and the expanding element in dependency of the pressure signals and/or pressure data provided by the pressure sensor. This embodiment is beneficial since actuator data representing movements of the actuator and/or pressure sensor data representing pressure sensed by the pressure sensor can be evaluated by the control unit. Preferably in case a predefined pressure value and/or an actuator operation value (e.g., path) is /are above a respective threshold value the control unit operates the actuator and the expanding element since such values can be interpreted as representing an error condition.

[0013] The control unit is configured according to a further preferred embodiment of the present invention to measure time and wherein the control unit is configured to switch the pump unit from a first air-conducting configuration which is a vacuuming configuration or an idle configuration into a second air-conducting configuration, wherein air is transported in the second configuration in a direction opposite to the first air-conducting configuration, wherein air is conducted into the receiving chamber of the expanding element in the second configuration, wherein the control unit switches the pump unit into the second air-conducting configuration in case the switch is not operated in a predefined time from the start of a vacuuming process. This embodiment is beneficial since an error status can be determined by means of software. The software detects a warning when there is no signal to the limit switch at the bottom of the mechanism and detects this as an error. The hardware is sensed by a pressure surface and pressure sensor to be added to the compression site so that the microcontroller also determines how much the customer's bag is compressed in the upward direction.

[0014] The actuator is according to a further preferred embodiment of the present invention a stepper motor, wherein the stepper motor is connected to the control unit at least via a signal and/or date connection. This embodiment is beneficial since the system can measure how much distance the stepper motor will move up or down with each movement. For example, in one revolution of the stepper motor, the system can move 2mm up or down. When the customer puts the bag in the vacuuming area, the stepper motor starts to move and while it moves upwards, the pressure sensor is located at the bottom and/or top of the bag. When the bag starts to be compressed by the mechanism, the measurement is made in the pressure sensor and the position of the stepper motor is determined. From said data the compression is determined. As a result of this situation, the system determines the customer's bag to be vacuumed, in particular in case the determined compression value is higher than a defined threshold value.

[0015] The above-mentioned object is also solved by a kitchen appliance, in particular refrigerator, according to claim 10. The kitchen appliance, in particular refrigerator, preferably comprises at least one vacuum device according to the present invention.

[0016] The above-mentioned object is also solved according to claim 11by a method for operating a vacuum device, in particularly according to claims 1 to 9. The vacuum device preferably comprises at least a movable compression element for compressing the container, a pump unit for removing air from the container, a control

unit for controlling operation of the vacuum device, a frame structure for holding the pump unit and the control unit and for providing a counter compression element for compressing the container, an actuator for moving the movable compression member between a first position and a second position, wherein the first position is a starting position and located in a distance to the counter compression element and wherein the second position is an end position, wherein the end position is closer to the counter compression element compared to the starting position, at least one switch for switching operation of the actuator at least from on to off, wherein the switch is at least partially arranged in a region of the starting position within a traveling path of the movable compression element, wherein the switch comprises a at least indirectly contact section to be contacted by the movable compression element for actuating the switch, and at least one expanding element for pushing the movable compression element into the direction of the starting position. The method preferably comprises at least the steps: Determining an error condition by means of the control unit, Causing the expanding element to expand to push the movable compression element into the direction of the starting position, Moving the movable compression element into the starting position, in particular by means of the actuator and the expanding element.

[0017] According to a further preferred embodiment of the present invention the method also comprises a step of: Reconfiguring the pump unit to conduct air to the expanding element, wherein the expanding element is deformed in elastic manner due to the air conducted into the receiving chamber.

[0018] According to a further preferred embodiment of the present invention the control unit causes the expanding element to expand by reconfiguring the pump unit in case an actuation of the switch does not take place within a predefined time limit after the movable compression member.

[0019] Further benefits, goals and features of the present invention will be described by the following specification of the attached figures, in which components of the invention are exemplarily illustrated. Components of the devices and methods according to the inventions, which match at least essentially with respect to their function, can be marked with the same reference sign, wherein such components do not have to be marked or described in all figures.

[0020] The invention is just exemplarily described with respect to the attached figure in the following.

Brief Description of the Drawings

[0021]

Fig. 1 shows schematically an example of the vacuum device according to the present invention;

Fig. 2a shows a schematically an example of the vacuum device according to the present invention, wherein the movable compression element is positioned in a first position;

Fig. 2b shows a schematically an example of the vacuum device according to the present invention, wherein the movable compression element is positioned in a second position;

Fig. 3a shows a schematically an example of the vacuum device according to the present invention, wherein two expanding elements are shown in a standard configuration;

Fig. 3b shows a schematically an example of the vacuum device according to the present invention, wherein two expanding elements are shown in an inflated configuration;

Fig. 4a shows schematically regular steps of an operation of the vacuum device;

Fig. 4b shows schematically steps executed in case an error condition is detected.

Fig. 4c shows schematically a kitchen appliance comprising a vacuum device according to the present invention.

[0022] Fig. 1 shows schematically an example of a vacuum device 1 according to the present invention. According to that embodiment a frame structure 10 is provided the frame structure 10 can be covered by a housing (not shown). The frame structure 10 preferably comprises a bottom section 11, wherein an actuator 14 is preferably arranged or attached to said bottom section 11. The actuator is coupled with a movable compression element 4, wherein the movable compression element 4 can be moved from a first position 16 (cf. Fig. 2a) to a second position 18 (cf. Fig. 2b) and vice versa. The movable compression element 4 is thereby preferably moved on a straight travel path 22 (cf. Fig. 2a). The frame structure 10 preferably also comprises a top section respectively a counter compression element 12. The movable compression element 4 and the counter compression element 12 delimit a vacuuming section 3 in vertical direction. The vacuuming section 3 is present in case the movable compression element 4 is positioned in the first position 16. In this case a container 2, in particular a bag respectively a food bag, can be at least partially arranged inside said vacuuming section 3.

[0023] Reference number 6 indicates a pump unit. Fig. 3b schematically shows that the pump unit 6 may comprise the valve unit 30. However, it is also possible that valve unit 30 is a unit which is separate from pump unit 6. According to Fig. 3b the valve unit 30 is coupled via a fluid supply element 28 with the expanding elements 24. The expanding elements24 are schematically shown in

an inflated respectively expanded configuration. Reference number 7 indicates an air outlet which is also connected via valve unit 30 to the pump unit 6 for vacuuming the containers 2. Fig. 3a schematically shows the expanding elements 24 in a regular configuration respectively in a not-inflated configuration. In case air is feed into the expanding element 24 an additional force respective torque is generated to push the movable compression element 4 into the first direction 16.

[0024] Reference number 8 indicates a control unit. The control unit preferably controls the actuator 14 and the pump unit 6. As shown in Fig. 2a the movable compression element 4 preferably contacts in a first position 16 respectively starting position switch 20, wherein switch 20 is preferably a micro limit switch. The switch 20 can be spring loaded, in particular in case the movable compression element 4 is in the first position. In case the actuator 14 starts operating to move the movable compression element from the first position 16 into the direction of a second position 18 (cf. Fig. 2b) the control unit 8 measures time. Time measurement can be triggered by switch 20, respectively in the moment the switch switches from one configuration into another configuration due to the movement of the movable compression element 4 into the direction of the second position 18. Alternatively, or additionally time measurement can be triggered by starting an operation of the actuator 14. Alternatively, or additionally time measurement can be triggered in case a pressure sensor detects a pressure change. Since the required time for vacuuming a container 2 that fits into the vacuuming space 3 is known control unit 8 determines an error condition in case the measured time is above a defined threshold time. The threshold time preferably is equal to or more than the time necessary for: moving the movable compression element 4 form the first position 14 to the second position 18 and for vacuuming the container 2 and for moving the movable compression element 4 from the second position 18 to the first position 16 and preferably also an additional safety time value or safety time factor.

[0025] Additionally, or alternatively the control unit 8 receives pressure signals and/or pressure data from the pressure sensor 32. In case the control unit 8 determines that the pressure signals and/or pressure data represent pressure values above a defined threshold, the control unit 8 determines an error condition.

[0026] The control unit 8 preferably operates the pump unit 6 to inflate the expansion element 24 in case an error condition is determined. The pump thereby pumps air into a receiving chamber 26 formed by a body section of the expansion element 24. Preferably at the same time the control unit 8 operates the actuator 12 to move the movable compression element 4 into the direction of the first position 16.

[0027] Fig. 4a shows a flow chart of an operation of a vacuum device 1 according to the present invention in case no error occurs.

[0028] S1 indicates start of a vacuuming operating. S2 indicates an operation of the actuator 14 for moving the movable compression element 4 into the direction of the counter compression element 12 respectively into an upwards direction. S3 indicates that the pressure sensor 32 detects that the movable compression element is in the right position. Preferably the control unit 8 interprets or evaluates signals and/or date provided by the pressure sensor 32 and particular preferably stops movement of the actuator 14 in case a defined pressure level respectively pressure value is reached. S. 4 indicates start of pump unit 6 for vacuuming air from container 2. S. 5 indicates a sealing step. The container 2 is sealed by a sealing unit (not shown) in case the vacuuming of the container is finished. Sealing is preferably carried out identical or similar to sealing described in EP3450893A1. S6 indicates that the movable compression element 4 is moved into the first position 16.

[0029] Fig. 4b shows a further flow chart. According to E1.1 an error condition is detected by means of the pressure sensor 32 and/or by means of a time evaluation respectively a missing actuation of the switch 20. E2.1 indicates a normal operation in case no error condition is detected and E2.2 indicates start of the force respective torque boosting system. Thus, in step E2.2. the expanding element is operated.

[0030] Fig. 4c shows a kitchen appliance 50, in particular a refrigerator and/or deep freezer. Said kitchen appliance 50 preferably comprises a door 52, in particularly to put food into the kitchen appliance, in particular into the refrigerator.

[0031] Thus, the present invention is preferably solved by a vacuum device 1 for removing air from a flexible container 2, in particular a polymer bag, in particular filled with food. The vacuum device 1 preferably comprises a movable compression element 4 for compressing the container 2, a pump unit 6 for removing air from the container 2, a control unit 8 for controlling operation of the vacuum device 1, a frame structure 10 for holding the pump unit 6 and the control unit 8 and for providing a counter compression element 12 for compressing the container 2, an actuator 14 for moving the movable compression member 4 between a first position 16 and a second position 18, wherein the first position 16 is a starting position and located in a distance to the counter compression element 12 and wherein the second position 18 is an end position, wherein the end position is closer to the counter compression element 12 compared to the starting position,

at least one switch 20 for switching operation of the actuator 14 from on to off, wherein the switch 20 is at least partially arranged in a region of the starting position within a traveling path 22 of the movable compression element 4, wherein the switch 20 preferably comprises a contact section 21 to be directly or indirectly contacted by the movable compression element for actuating the switch 20, and

at least one expanding element 24 for pushing the movable compression element 4 from the end position into

the direction of the starting position.

[0032] Therefore, the present invention relates to a method that provides an electromechanical solution for detecting a locking condition in a vacuum device that vacuums the vacuum bag and not to repeat said locking condition and a vacuum device to which this method can be applied. Said vacuum device preferably comprises a compression zone; a locking mechanism; a limit switch; a pressure surface and a pressure sensor located in said compression zone; a torque boosting mechanism (expanding element); It comprises a stepper motor and a control unit that determines how much said vacuum bag is compressed upwards. Said method is that an error condition occurs; determining whether said error condition is software or hardware; activation of the torque boosting mechanism in said vacuum cavity area; It comprises the steps of opening the locking mechanism by said stepper motor. It is understood from the fact that a warning is given in case there is no signal to said limit switch in order to determine that the error condition mentioned here is software. The pressure surface and the pressure sensor are sensed to determine that the error condition mentioned here is hardware.

List of reference numbers

[0033]

1	vacuum device
2	flexible container
3	vacuum space
4	movable compression element
6	pump unit
7	air outlet
8	control unit
10	frame structure
11	bottom section
12	counter compression element
14	actuator
16	first position
18	second position
20	switch
21	contact section
22	traveling path
24	expanding element
26	receiving chamber
28	fluid supply element
30	valve unit, in particular two-channel valve
32	pressure sensor
50	kitchen appliance, in particular refrigerator
52	door of refrigerator for closing receiving space

Claims

1. Vacuum device (1) for removing air from a flexible container (2), in particular a polymer bag, in particular filled with food,
at least comprising
a movable compression element (4) for compressing the container (2),
a pump unit (6) for removing air from the container (2),
a control unit (8) for controlling operation of the vacuum device (1),
a frame structure (10) for holding the pump unit (6) and the control unit (8) and for providing a counter compression element (12) for compressing the container (2),
an actuator (14) for moving the movable compression member (4) between a first position (16) and a second position (18), wherein the first position (16) is a starting position and located in a distance to the counter compression element (12) and wherein the second position (18) is an end position, wherein the end position is closer to the counter compression element (12) compared to the starting position,
at least one switch (20) for switching operation of the actuator (14) from on to off, wherein the switch (20) is at least partially arranged in a region of the starting position within a traveling path (22) of the movable compression element, (4) wherein the switch (20) preferably comprises a contact section to be directly or indirectly contacted by the movable compression element for actuating the switch (20),
at least one expanding element (24) for pushing the movable compression element (4) from the end position into the direction of the starting position.

2. Vacuum device according to claim 1,
characterized in that
the expanding element (24) is a flexible polymer element, wherein the flexile polymer element forms a receiving chamber (26), wherein the receiving chamber (26) is connected to a fluid supply element (28), wherein the flexible polymer element is expanded by supplying fluid via the fluid supply element (28) into the receiving chamber (24).

3. Vacuum device according to claim 2,
characterized in that
the expanding element (24) is arranged on the movable compression element (4) or is part of the movable compression element (4), wherein the expanding element (24) expands into the direction of the counter compression element (12) in case fluid is supplied into the receiving chamber (26) or the expanding element (12) is arranged on the counter compression element (12) or is part of the counter compression element (12), wherein the expanding element (24) expands into the direction of the movable compression element (4) in case fluid is supplied into the receiving chamber (26).

4. Vacuum device according to claim 3,
characterized in that

at least one two-channel valve (30) is provided, wherein the two-channel valve (30) is coupled with a vacuum section (32) arranged between the movable compression element (4) and the counter compression element (12) and wherein the two-channel valve (30) is coupled with the fluid supply element (28) for supplying air into the receiving chamber (26) of the expanding element (24).

5. Vacuum device according to claim 4,
characterized in that
multiple expanding elements (24) are provided, wherein each expanding element (24) is coupled via the supply element(28) to the pump unit (6), wherein each of the expanding elements (24) is arranged on the movable compression element (4) or is part of the movable compression element (4), wherein the expanding elements (24) expand into the direction of the counter compression element (12) in case fluid is supplied into the receiving chambers (26) or the expanding elements (24) are arranged on the counter compression element (12) or are part of the counter compression element (12), wherein the expanding elements (26) expand into the direction of the movable compression element (4) in case fluid is supplied into the receiving chambers (26).

6. Vacuum device according to claims 2 to 5,
characterized in that
a pressure sensor (32) is provided on or in the movable compression element (4) facing the counter compression element (12) for providing pressure sensor signals or pressure sensor date for indicating contact between the movable compression element (4) and the counter pressure element (12) or for emitting pressure sensor (32) signals or pressure sensor data representing a pressure value, in particular a pressure value above a defined threshold value or the pressure sensor (32) is provided on or in the counter compression element (12) facing the movable compression element (4) for providing pressure sensor signals or pressure sensor date for indicating contact between the counter compression element (12) and the movable pressure element (4) or for emitting pressure sensor signals or pressure sensor data representing a pressure value, in particular a pressure value above a defined threshold value.

7. Vacuum device according to claim 6,
characterized in that
the control unit (8) is configured to operate the actuator (14) and the expanding element (24) in dependency of the pressure signals and/or pressure data provided by the pressure sensor (32).

8. Vacuum device according to claim 6 or 7,
characterized in that
the control unit (8) is configured to measure time and wherein the control unit (8) is configured to switch the pump unit (2) from a first air-conducting configuration which is a vacuuming configuration or an idle configuration into a second air-conducting configuration, wherein air is transported in the second configuration in a direction opposite to the first air-conducting configuration, wherein air is conducted into the receiving chamber (26)of the expanding element (24) in the second configuration, wherein the control unit (8) switches the pump unit (6) into the second air-conducting configuration in case the switch (20) is not operated in a predefined time from the start of a vacuuming process.

9. Vacuum device according to claim 7 or 8,
characterized in that
the actuator (14) is a stepper motor, wherein the stepper motor is connected to the control unit (8) at least via a signal and/or date connection.

10. Kitchen appliance (50), in particular refrigerator, comprising a vacuum device according to any of the before mentioned claims.

11. Method for operating a vacuum device (1),
wherein the vacuum device (1) comprises at least
a movable compression element (4) for compressing a flexible container (2),
a pump unit (6) for removing air from the container (2),
a control unit (8) for controlling operation of the vacuum device (1),
a frame structure (10) for holding the pump unit (6) and the control unit (8) and for providing a counter compression element (12) for compressing the container (2),
an actuator (14) for moving the movable compression member (4) between a first position (16) and a second position (18), wherein the first position (16) is a starting position and located in a distance to the counter compression element (12) and wherein the second position (18) is an end position, wherein the end position is closer to the counter compression element (12) compared to the starting position,
at least one switch (20) for switching operation of the actuator (14) at least from on to off, wherein the switch (20) is at least partially arranged in a region of the starting position within a traveling path (22) of the movable compression element (4), wherein the switch (20) comprises at least indirectly a contact section (21) to be contacted by the movable compression element for actuating the switch (20),
and at least one expanding element (24) for pushing the movable compression element (4) into the direction of the starting position
comprising the steps:

determining an error condition by means of the

control unit (8),
causing the expanding element (24) to expand to push the movable compression element (4) into the direction of the starting position,
moving the movable compression element (4) into the starting position by means of the actuator (20) and the expanding element (24).

12. Method according to claim 11, further comprising the step:
Reconfiguring the pump unit (6) to conduct air to the expanding element (24), wherein the expanding element (24) is deformed in elastic manner due to the air conducted into the receiving chamber (26).

13. Method according to claim 12, further comprising the step:
the control unit (8) causes the expanding element (24) to expand by reconfiguring the pump unit (6) in case an actuation of the switch does not take place within a predefined time limit after the movable compression member (4).

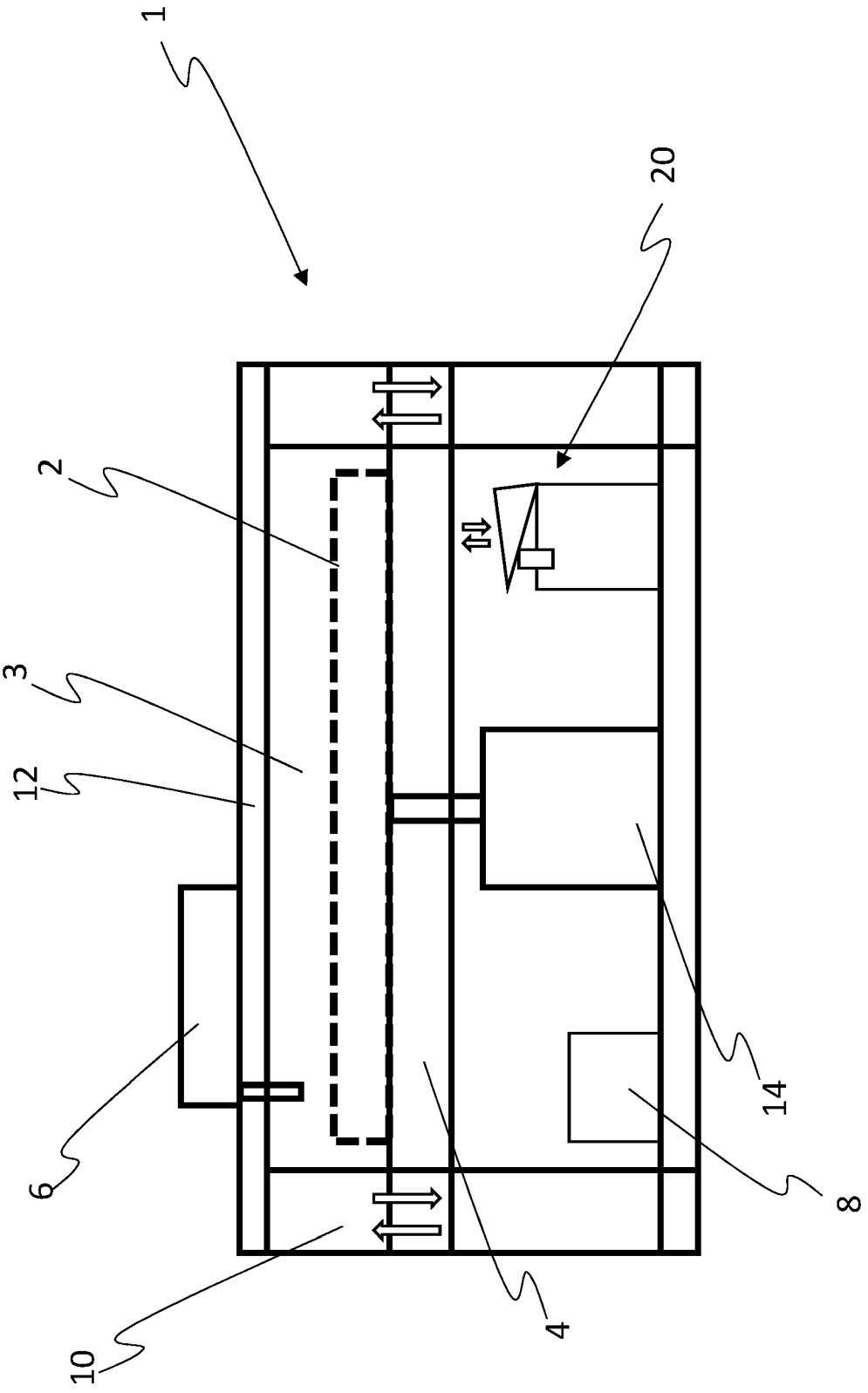

Fig. 1

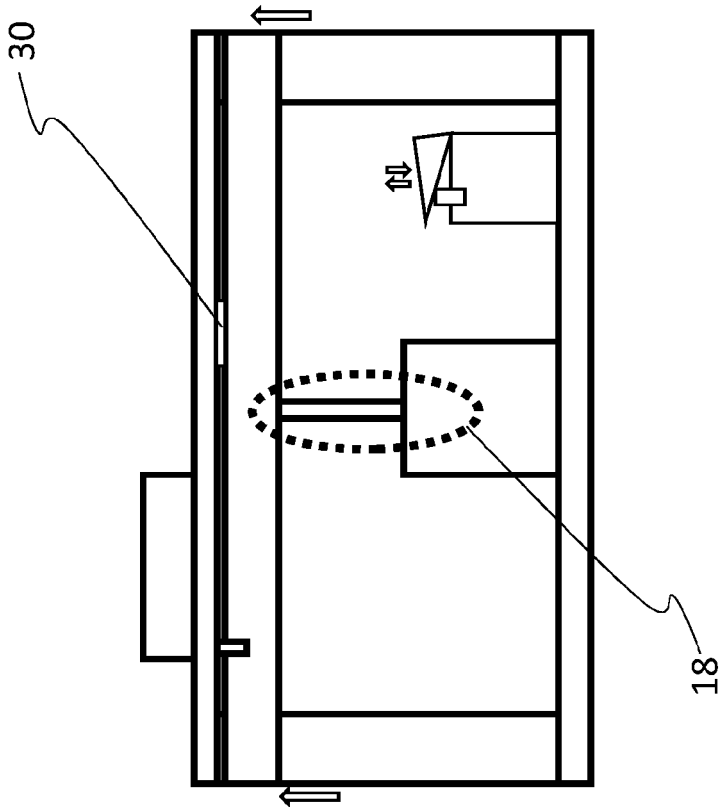

Fig. 2b

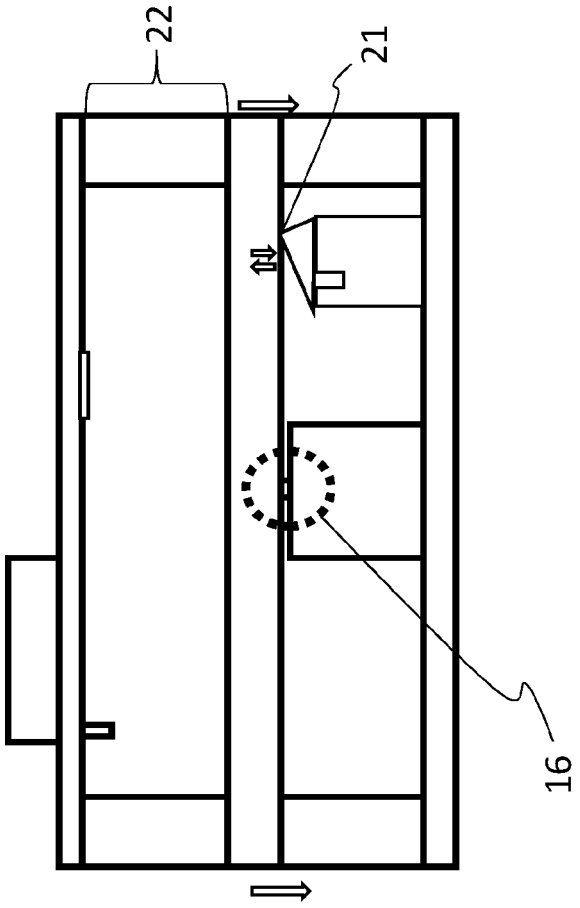

Fig. 2a

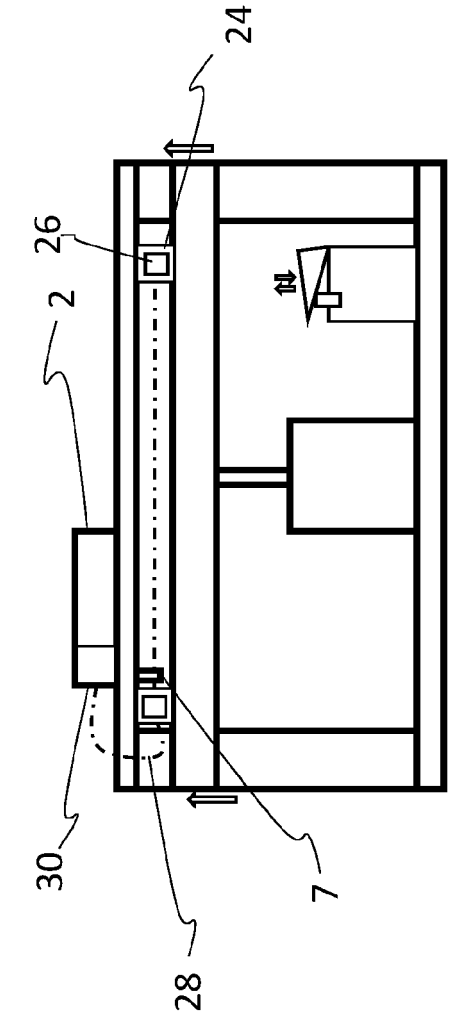

Fig. 3b

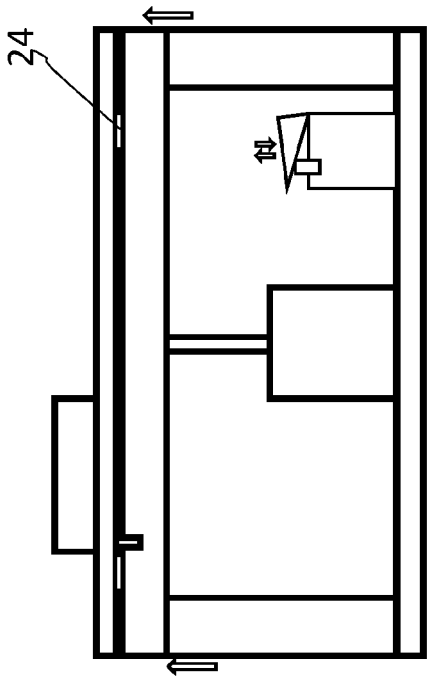

Fig. 3a

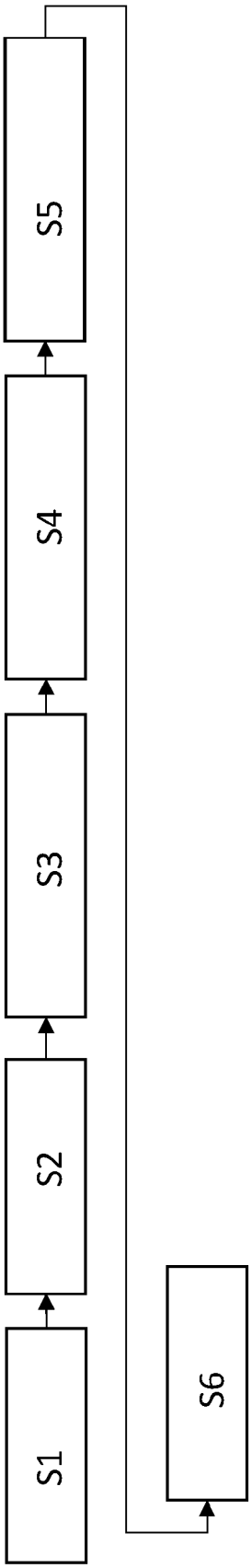

Fig. 4a

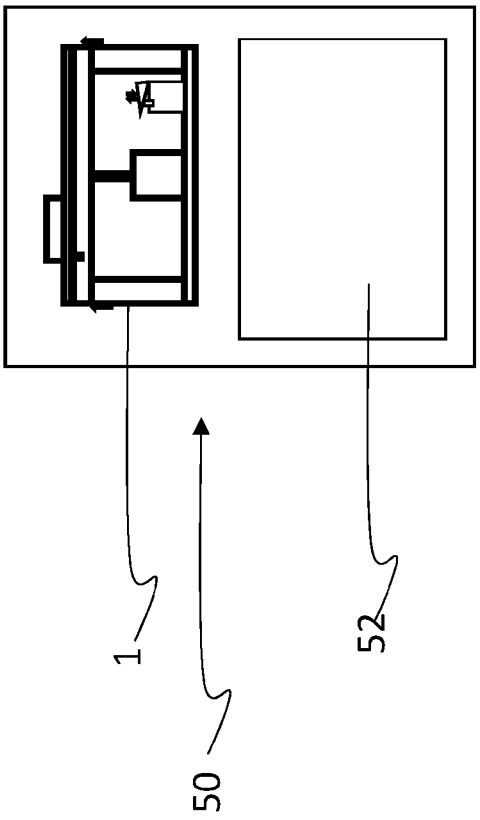

Fig. 4c

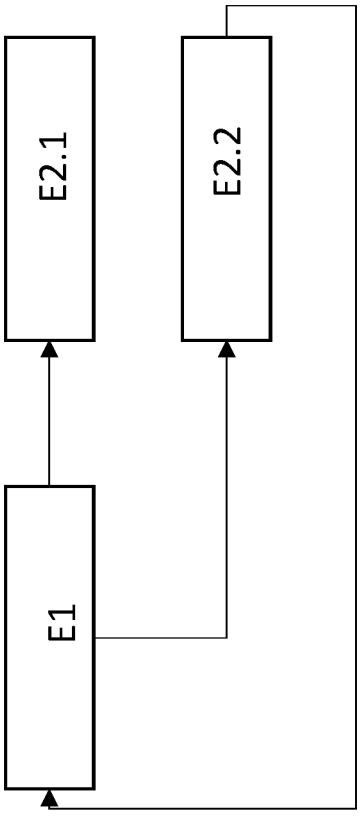

Fig. 4b

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EUROPEAN SEARCH REPORT

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Munich	9 June 2021	Ngo Si Xuyen, G

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