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(54) A FOOD BAG VACUUMING SYSTEM, AN OPERATION METHOD THEREOF AND A COOLING DEVICE COMPRISING THE SAME

(57) A vacuuming system developed according to the present invention comprises the vacuum pump (S6); the carrier chassis (4); the stationary plate (1); the movable plate (2), being able to move to get close to and away from the stationary plate (1), having a closed state and an open state, and comprising a reservoir (14) in which a vacuuming operation takes plate when it assumes its closed state; the insulation element (6), which when placed in the vacuuming chamber (S1), is provided so as to extend along the edge of the stationary plate (1) and/or the movable plate (2) that is remote to the opening (S2); the heater (5), which when placed in the vacuuming chamber (S1), is provided so as to extend along the edge of the stationary plate (1) or the movable plate (2) that is remote to the opening (S2), and after a vacuuming operation is completed, applies heat to the part of a bag left in the heater so that the bag becomes sealed; the first resilient element (12) provided on the movable plate (2) or stationary plate (1) against the heater (5); and the actuator mechanism effecting the movement of the movable plate (2).

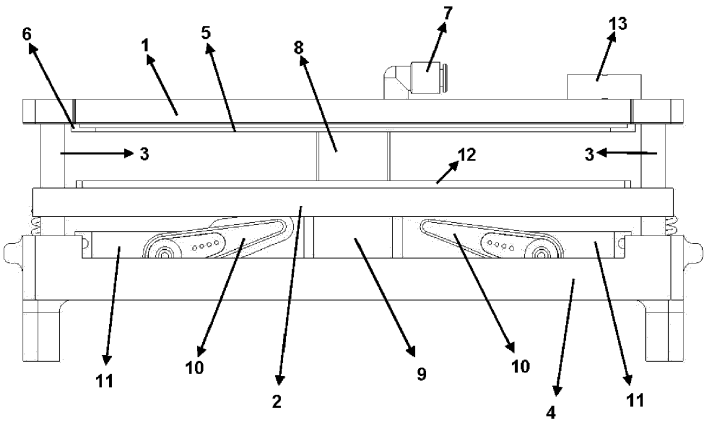

Figure - 2

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Description

Technical Field

[0001] The present invention relates to a vacuuming systems and to an operation method thereof used in cooling devices for prolonging the preservation time of foodstuff, as well as to a cooling device comprising said vacuuming system.

Prior Art

[0002] Many practices have been developed for a prolonged preservation of foodstuff. These practices can be exemplified by salting, drying, freezing, heat treating, and the use of chemical additives. Such practices are generally not of the sort that one user would be able to effect at home, or would require much time and effort to do so. Another food preserving practice is the preservation of foodstuff in a vacuum food bag, which provides a prolonged preservation. In this practice, a user puts a food instantly into a vacuumed medium in a bag and keeps it there, and when the food is needed back, the user takes it out of the bag for consumption without requiring any extra effort.

[0003] Many practices have been developed for taking foods into bags and vacuuming the same for preservation, one of these practices being disclosed in the patent document US8438870B2. A device is described within this practice, said device being mounted to the door of a refrigerator, wherein an open end of a food bag is inserted into a slot provided on the refrigerator, vacuum is applied to the bag thereafter by means of a vacuum pump and the open end of the bag is sealed through a sealing operation. According to the device, the presence of the food bag is detected by a sensor and then the food bag is retained in place for the vacuuming operation. Following vacuuming, the mouth of the bag is sealed and thus the vacuuming operation is completed. When the hand of a user is detected following the vacuuming operation, the device releases the bag. According to the approach disclosed in said document, a correct placement of the mouth of the food bag is let to the respective user, meaning that when the mouth of the bag is not placed correctly by the user, an inefficient vacuuming operation takes place. Additionally, when the bag is retained in place, holes are punched in the bag, this however, having the risk of tearing the bag due to the weight of foods contained in the bag.

Brief Description of Invention

[0004] A vacuuming system developed according to the present invention is suitable for use in at least one vacuuming chamber, having at least one opening to receive the mouth of a bag to be vacuumed, and being provided in a door of a cooling device having at least one food preservation compartment and at least one door which controls access to said compartment, the vacuuming system comprising

- at least one vacuum pump;
- at least one carrier chassis;
- at least one stationary plate;
- at least one movable plate, which can move close to and away from the stationary plate, has a closed state in which it contacts with the stationary plate and an open state in which it does not have any contact with the stationary plate, and comprises at least one reservoir in communication with the vacuum pump, wherein a vacuuming operation takes place in said reservoir when the movable plate is in its closed state;
- at least one insulation element, which when placed in the vacuuming chamber, is provided so as to extend along the edge of the stationary plate and/or the movable plate that is remote to the opening;
- at least one heater, which when placed in the vacuuming chamber, is provided so as to extend along the edge of the stationary plate or the movable plate that is close to the opening, and when the mouth of a bag to be vacuumed is placed into the reservoir and the vacuuming operation is completed with the movable plate assuming its closed state, applies heat to the part of the bag left in the heater so that the bag becomes sealed;
- at least a first resilient element, provided on the movable plate or stationary plate against said heater, and providing an efficient sealing of the bag and
- at least one actuator mechanism, provided in said carrier chassis and providing

said movement of the movable plate.

[0005] An operation method developed according to the present invention, in turn, comprises the steps of

- determining by a user an operation to be performed using the vacuuming system and positioning a bag to the vacuuming system such that the mouth of the bag is placed in said reservoir;
- if the operation determined is vacuuming, sealing, or cutting, moving the movable plate by means of the actuator mechanism so as to come close to the stationary plate and clamping the bag between the movable plate and the stationary plate;
- if the operation determined is vacuuming and once the movable plate assumes its closed state, generating a vacuum medium in said reservoir by energizing the vacuum pump, and meanwhile, evacuating the air out of the bag through the mouth of the bag placed in the reservoir so that a target vacuum value in the reservoir is achieved;
- once the vacuum value targeted is achieved and the vacuuming operation is completed, or if the operation determined is sealing, energizing the heater and heat-sealing the bag;

- following the sealing operation, moving the movable plate away from the stationary plate so that the bag is released.

[0006] A cooling device developed according to the present invention, in turn, comprises at least one food preservation compartment in which foodstuff is preserved under a certain temperature value; at least one door, controlling access to said compartment, and having an open state giving access to, and a closed state preventing access to said compartment; at least one vacuuming chamber provided in said door, and having at least one opening providing access into its interior in the closed or open state of door; and at least one vacuuming system provided in the vacuuming chamber, and comprising said operation method.

[0007] By virtue of the vacuuming system and operation method developed according to the present invention, the preservation time of foods in household use can be prolonged in an efficient and practical manner. Additionally, a correct placement and a smooth sealing are provided for the bag so that any air leak into the bag is avoided and a safe vacuuming system is achieved. Furthermore, by virtue of the cooling device developed, consumers are enabled to perform an easy and practical vacuuming operation whenever they need to do so, and the need for an external device for vacuuming is avoided.

Object of Invention

[0008] An object of the present invention is to provide a vacuuming system and an operation method thereof for vacuuming a foodstuff in a bag and for preserving the same in a vacuumed state.

[0009] Another object of the present invention is to provide a vacuuming system and an operation method thereof applicable in cooling devices.

[0010] A further object of the present invention is to provide a vacuuming system and an operation method thereof wherein a correct placement is provided for the mouth part of a bag to be vacuumed.

[0011] Still a further object of the present invention is to provide a vacuuming system and an operation method thereof with low cost and low energy consumption and an easy assembly and use.

[0012] Yet a further object of the present invention is to provide a vacuuming system and an operation method thereof wherein the vacuuming duration can be controlled independently of the user.

[0013] Another object of the present invention is to provide a cooling device comprising a vacuuming system and an operation method thereof which are suitable to realize the aforesaid objects.

Description of Figures

[0014] Exemplary embodiments of a vacuuming system developed according to the present invention, as well as a cooling device comprising the same are illustrated in the accompanying figures, in which:

Figure 1; is a front view of the developed cooling device.
Figure 2; is a front cross-sectional view of an embodiment of the vacuuming system according to the present invention in an open state.
Figure 3; is a front cross-sectional view of the vacuuming system according to the present invention in a closed state.
Figure 4; is a side cross-sectional view of the vacuuming system in the open state.
Figure 5; is another side cross-sectional view of the vacuuming system in the open state.
Figure 6; is a front cross-sectional view of the cooling device.
Figure 7; is a top cross-sectional perspective view of a detail of the door comprised within the cooling device.
Figure 8; is a front cross-sectional view of another embodiment of the vacuuming system according to the present invention in the closed state.
Figure; 9 is a front cross-sectional view of another embodiment of the vacuuming system.
Figure; 10 is a front cross-sectional view of another embodiment of the vacuuming system.
Figure, 11 is a front cross-sectional view of another embodiment of the vacuuming system.
Figure; 12 is a front cross-sectional view of a further embodiment of the vacuuming system.
Figure; 13 is a front cross-sectional view of another embodiment of the vacuuming system.
Figure; 14 is a side cross-sectional view of another exemplary embodiment of the vacuuming system.
Figure; 15 is a perspective view of the developed vacuuming system.

[0015] All the parts illustrated in figures are individually assigned a reference numeral and the corresponding terms of these numbers are listed below:

Cooling device	(S)
Vacuuming chamber	(S1)
Opening	(S2)
Door	(S3)
Vacuum line	(S4)
Cap	(S5)
Vacuum pump	(S6)
Switch	(S7)
Stationary plate	(1)
Movable plate	(2)
Hole	(2a)
Guide	(3)
Carrier chassis	(4)
Heater	(5)

(continued)

Fireproof tape	(5a)
Insulation element	(6)
Connection element	(7)
Blocker plate	(8)
Housing	(9)
Arm	(10)
Sealing member	(10a)
Actuating member	(11)
First resilient element	(12)
Tensioning element	(13)
Reservoir	(14)
Actuating shaft	(15)
Gearwheel	(16)
Toothed rack	(17)
Drive element	(18)
Transmission element	(19)
Magnetic element	(20)
Second resilient element	(21)

Description of Invention

[0016] There are various practices, such as salting, drying, freezing, etc. for prolonging the preservation time of foods. These practices, however, both take time, and are not practical enough for household use. In this context, there are various vacuuming systems available in the prior art, wherein a user puts a foodstuff into a bag and then carries out the vacuuming process. In these practices, however, since particularly the vacuuming systems are external devices, the consumers cannot easily carry out vacuum-preservation whenever they want, and therefore the preservation time of foods cannot be prolonged. In this context, a vacuuming system is developed according to the present invention for use in prolonging the shelf life of foodstuffs.

[0017] A vacuuming system developed according to the present invention, exemplary views of which are illustrated in figures 1 to 15, is suitable for use in at least one vacuuming chamber (S1), having at least one opening (S2) to receive the mouth of a bag to be vacuumed, and being provided in a door (S3) of a cooling device (S) having at least one food preservation compartment and at least one door (S3) which controls access to said compartment, the vacuuming system comprising at least one vacuum pump (S6); at least one carrier chassis (4); at least one stationary plate (1) preferably provided in an upper part of said carrier chassis (4); at least one movable plate (2), which is preferably provided between the stationary plate (1) and the carrier chassis (4) and can be moved close to and away from the stationary plate (1), has a closed state in which it contacts with the stationary plate (1) (Figure 3) and an open state in which it does not have any contact with the stationary plate (1), and comprises at least one reservoir (14) (shown in Figure 4) in communication with the vacuum pump (S6), wherein a vacuuming operation takes place in said reservoir when the movable plate is in its closed state; at least one insulation element (6) (e.g. a sealing element), which when placed in the vacuuming chamber (S1), is provided so as to extend along the edge of the stationary plate (1) and/or the movable plate (2) that is remote to the opening (S2); at least one heater (5), which when placed in the vacuuming chamber (S1), is provided so as to extend along the edge of the stationary plate (1) or the movable plate (2) that is close to the opening (S2), and when the mouth of the bag to be vacuumed is placed into the reservoir (14) and the vacuuming operation is completed with the movable plate (2) assuming its closed state, applies heat to the part of the bag left in the heater so that the bag becomes sealed; at least a first resilient element (12), preferably a sponge, provided on the movable plate (2) or stationary plate (1) against said heater (5), and providing an efficient sealing of the bag; and at least one actuator mechanism, provided in said carrier chassis (4) and providing said movement of the movable plate (2).

[0018] In an exemplary embodiment according to present invention, the vacuuming system is placed in the vacuuming chamber (S1) of the cooling device (S), so that the heater (5) and the first resilient element (12) are close to said opening (S2) and the insulation element (6) stays far from said opening (S2). When the user wants to vacuum a bag containing a foodstuff, the user places the mouth of the bag into the reservoir (14). After the mouth of the bag is positioned in the reservoir (14), the vacuuming operation is started so that the movable plate (2) moves towards the stationary plate (1). As a result of this movement, the movable plate (2) assumes its closed state and contacts the stationary plate (1), such that the insulation element (6), the heater (5) and the first resilient element (12) stay in between them. Then, the vacuum pump (S6) is activated and the vacuuming operation is effected; following the vacuuming operation, the heater (5) is activated and the bag is closed by means of heat-sealing. Thus, a foodstuff can be vacuumed and saved for a prolonged period of time in an efficient and reliable manner.

[0019] In a preferred embodiment according to the present invention, the vacuuming system comprises at least one blocker plate (8), which is provided between the movable plate (2) and stationary plate (1) so that said reservoir (14) stays between itself (8) and the opening (S2) and becomes aligned with the edge of the reservoir (14) that is remote to the opening (S2), and preferably has a form that extends from the stationary plate (1) to the movable plate (2), and when the mouth of a bag to be vacuumed is to be placed in said reservoir (14), it contacts the mouth of the bag to provide a correct positioning of the mouth; and at least one housing (9), preferably provided on the movable plate (2) to receive the blocker plate (8) in the closed state. By virtue of the block-

er plate (8) provided on the side of the reservoir (14) that is remote to the opening (S2), the user passes the mouth of a bag through said opening (S2) and contacts the mouth of the bag with this blocker plate (8) so as to make sure that the mouth is placed in a correct manner.

[0020] In a preferred embodiment according to the present invention, as illustrated in Figure 2, Figure 3 and Figure 5, said actuator mechanism comprises at least one guide (3) (preferably at least two guides, passing through the opposed edges of the movable plate (2)), preferably in the form of a shaft, at least one end thereof being connected to the carrier chassis (4), at least the other end thereof being connected to the stationary plate (1), and guiding the movement of the movable plate (2) by being passed through at least one aperture comprised within said movable plate (2); at least one actuating member (11) (preferably at least two actuating members, provided on the opposed edges of the carrier chassis (4)) provided on said carrier chassis (4), being preferably a motor, which has a component that can rotate once it is energized; at least one arm (10) (preferably at least two arms, on the opposed edges of the carrier chassis (44)), preferably in the form of a cam, at least one end thereof being connected to said component of the actuating member (1), at least the other end thereof contacting the movable plate (2), and when said component starts moving, effecting said movement of the movable plate (2) by assuming a sloped position so that an angle is created (preferably lower than 85°) between itself and the carrier chassis as a result of its rotation around an axis passing through a region in which it is connected to said component. Thus, the movable plate (2) can be moved in a practical manner. The actuator mechanism developed according to this embodiment preferably comprises at least one (preferably at least two) second resilient element (21), at least one end thereof being connected to the carrier chassis (4), at least the other end thereof being connected to the movable plate (2), and in the closed state of the movable plate (2), exerting force to the movable plate (2) so as to move it away from the stationary plate (1), thus providing a more stable transition for the movable plate (2) from the closed state to the open state. This second resilient element (21) can be a spring, but can also be made of a shape memory material, which is coupled to an electrical energy source (e.g. a control unit of the cooling device, mains supply etc.), and which, once energized, tends to change size (e.g. shortens) so as to exert force to the movable plate (2) so that it moves away from the stationary plate (1), and which, when the movable plate (2) is moved towards the stationary plate (1), becomes stretched to change size (e.g. elongates).

[0021] In another alternative embodiment of the present invention, as illustrated in Figure 9, said actuator mechanism comprises, preferably, at least one actuating component (15) (in terms of a stable movement, preferably at least four actuating components), made of a shape memory material, which is connected to the carrier chassis (4) from at least one side, and connected to the movable plate (2) from at least the other side, is connected to an electrical energy source (e.g. a control unit of the cooling device, mains supply etc.) and once energized by means of this source, elongates so that the movable plate (2) in the open state assumes its closed state, and once de-energized, shortens so that the movable plate (2) in its closed state assumes its open state. This actuating component (15) can be in the form of a spring, bar, or wire. By virtue of this embodiment, the movement of the movable plate (2) can be effected in a more silent manner and with lower energy consumption. The actuator mechanism developed according to this embodiment preferably comprises at least one guide (3) (preferably at least two guides, passing through the opposed edges of the movable plate (2)), preferably in the form of a shaft, at least one end thereof being connected to the carrier chassis (4), at least the other end thereof being connected to the stationary plate (2), and guiding the movement of the movable plate (2) by being passed through at least one aperture comprised within said movable plate (2).

[0022] In a further embodiment of the present invention, as illustrated in Figure 10, the actuator mechanism comprises preferably at least one actuating member (11) (preferably at least two actuating members, provided on the opposed sides of the carrier chassis (4)), being preferably a motor, provided on said carrier chassis (4) and having at least one component which can rotate when energized, and at least one guide (3) (preferably at least two guides, provided on the opposed sides of the movable plate (2)), of which at least one end is connected to said part, and which can rotate around its own axis with said component starting rotating, and is passed through a threaded aperture in the movable plate (2) so that at least the other end thereof is connected to the stationary plate (1), and which is in the form of a shaft with threads on it which match up with the threads in the aperture, and effects said movement of the movable plate (2) when it rotates around its own axis. Thus, the movable plate (2) can be moved in a gradual manner.

[0023] In a further embodiment of the present invention, as illustrated in Figure 11, the actuator mechanism comprises preferably at least one actuating member (11) (preferably at least two actuating members, provided on the opposed sides of the carrier chassis (4)), being preferably a motor, provided on said carrier chassis (4) and having at least one component which can rotate when energized; at least one gearwheel (16) (preferably at least two), which is coupled to said component, and can rotate around an axis when said component rotates, and at least one toothed rack (17) (preferably at least two), of which at least one end is connected to the gearwheel (16), of which at least another end is connected to the movable plate (2), and which converts the rotational motion of the gearwheel (16) into linear motion to effect said movement of the movable plate (2).

[0024] In another exemplary embodiment, as illustrated in Figure 12, the actuator mechanism preferably comprises at least one drive element (18) (preferably at least

two), being preferably a motor, having at least one wheel that can rotate around an axis once energized, and at least one transmission element (19) (preferably at least two transmission elements, i.e. one for each of the drive elements (18)) in the form of a belt, at least one end thereof being connected to said wheel, at least the other end thereof being connected to the movable plate (2), and being wound around the rotating wheel once the drive element is energized, or being released from the wheel without its connection to the wheel being lost, thus converting the rotational motion of the wheel to a linear motion to let the movable plate (2) perform said movement. Said drive element (18) is preferably provided on the stationary plate (1).

[0025] In a further preferred embodiment according to the present invention, as illustrated in Figure 13, the actuator mechanism comprises at least two magnetic elements (20), at least one thereof being provided on the stationary plate (1) and at least the other one thereof on the movable plate (2), in an opposed fashion, having connection to an electrical energy source (e.g. a control unit of the cooling device, mains supply, etc.), and exerting an pulling force onto each other once energized by said source, thus enabling the movable plate (2) to move and assume its closed state, wherein upon deactivation of the energy supply, the exerted force is removed, and by this way, the movable plate (2) is enabled to move and assume its open state; and at least one guide (3) (preferably at least two guides on the opposed edges of the movable plate (2)), being preferably in the form of a shaft, at least one end thereof being connected to the carrier chassis (4), at least the other end thereof being connected to the stationary plate (1), and being passed through at least one aperture comprised in said movable plate (2), thereby guiding the movement of the movable plate (2). Thus, the movable plate (2) is enabled to effect a silent motion. Said actuator mechanism according to this embodiment preferably further comprises at least a second resilient element (21) (e.g. a spring) (preferably at least two second resilient elements), at least one end thereof being connected to the carrier chassis (4), and at least the other end thereof to the movable plate (2), and in the closed state of the movable plate (2), exerting force to the movable plate (2) so as to move it away from the stationary plate (1), thus providing a more stable transition for the movable plate (2) from the closed state to the open state.

[0026] In another preferred embodiment according to the present invention, as illustrated in Figure 14, said movable plate (2) and stationary plate (1) are provided with a certain inclination with respect to the carrier chassis (4). Thus, the mouth of a bag to be vacuumed can be provided in the reservoir (14) in a more efficient manner.

[0027] The vacuuming system developed according to another alternative embodiment preferably comprises at least one tensioning element (13) (e.g. a screw), being connected to said heater (5), enabling to bring the heater (5) to a stretched state so that the bag can be properly subjected to heat-sealing. According to this embodiment, the heater (5) is fixed from one of its sides to the stationary plate (1) or to the movable plate (2), and from its other side, to the tensioning element (13). Preferably, tightening the tensioning element (13) will bring the heater (5) to a stretched state, such that air leakage into the mouth of the bag is prevented and an efficient vacuuming system is achieved.

[0028] According to a further preferred embodiment, the vacuuming system comprises at least one fireproof tape (5a) provided on the heater (5), preventing an instant burning of the bag due to the heat of the heater (5), and transferring the heat of the heater (5) to the bag.

[0029] The vacuuming system developed in a further exemplary embodiment of the present invention preferably comprises at least one switch (S7), measuring the amount of vacuum within said reservoir (14), and once the measured value of vacuum reaches a predetermined value, deactivating the vacuum pump (S6) and activating the heater (5). Thus, a vacuuming operation is controlled independently of the user to achieve a reliable vacuuming system.

[0030] The vacuuming system developed in a further preferred embodiment preferably comprises at least one warning device, alerting the respective user in relation to a vacuuming operation. This warning device can provide visual and/or aural alerts. The warning device preferably comprises more than one light source (e.g. LEDs) to inform / warn the respective user visually.

[0031] In another alternative embodiment, the vacuuming system preferably comprises a data input device having at least a first control element to initiate a vacuuming operation. By means of this data input device, the respective user can initiate the vacuuming operation after the user places the mouth of a bag into the reservoir (14). Said data input device can preferably further enable a user to determine the amount of vacuum to be generated in the reservoir (14), and can comprise at least a second control element for this purpose. By means of this second control element, the amount of vacuum to be generated in the reservoir (14) can be directly determined, but the desired amount of vacuum in the reservoir (14) can also be adjusted by selecting the size and/or type of a bag. Thus, foods having different hardness can be vacuumed using differing vacuum values so as to achieve a more efficient vacuuming system. In another embodiment, said data input device can also preferably be used to seal the mouth of a bag without performing a vacuuming operation and comprises at least a third control element for this purpose. When a user uses the third control element, the movable plate (2) comes closer to the stationary plate (1) and the vacuuming system directly energizes the heater (5) without activating the vacuum pump (S6). Thus, a more effective vacuuming system is achieved.

[0032] In a preferred embodiment according to the present invention, said vacuum pump (S6) is provided on the movable plate (2) so as to be in communication with said reservoir (14). In another preferred embodi-

ment, the vacuum pump (S6) is provided on the carrier chassis (4), wherein the vacuuming system according to this embodiment preferably comprises at least one vacuum line (S4) (e.g. a hose), providing communication between the vacuum pump (S6) and said reservoir (14), and one end thereof being connected to the vacuum pump (S6), and the other end thereof opening to said reservoir (14).

[0033] As illustrated in Figure 8, the vacuuming system developed according to another preferred embodiment of the present invention comprises at least one hole (2a) in the movable plate (2) in a region where said reservoir (14) is provided, and at least one adjustment element, closing said hole (2a) during a vacuuming operation, and after the vacuuming operation is completed, opening the hole (2a) to allow airflow through the hole (2a) to provide an easy removal of the movable plate (2) from the stationary plate (1). This adjustment element can be in the form of a valve. In the embodiment where the actuator mechanism comprises an arm (10), said hole (2a) is provided in the part of the movable plate (2) to which this arm (10) contacts, wherein a sealing member (10a) is provided on the part of the arm (10) that contacts at least to the movable plate (2). It is thus practically enabled to close the hole (2a) during vacuuming, and open the hole (2a) by a movement of the arm (10) once a vacuuming operation is completed.

[0034] The vacuuming system developed according to another alternative embodiment of the present invention preferably comprises at least one temperature sensor measuring the temperature of said heater (5). According to this embodiment, the temperature of the heater (5) is measured by means of said temperature sensor and is transmitted to a control unit to be compared with a predetermined value. Thus, the heater (5) is prevented from punching or tearing a bag because of getting overheated, as may be the case when the vacuuming system is activated again and again.

[0035] The vacuuming system developed according to another exemplary embodiment preferably comprises at least one cutting element, capable of moving along the edge of the stationary plate (1) or the movable plate (2) that is close to said opening (S2) to put out a foodstuff from a vacuumed and heat-sealed bag. When the user wishes to open the mouth of the bag, the user places it to the vacuuming system through said opening (S2), then the movable plate (2) moves towards the stationary plate (1) to get the mouth of the bag clamped between the stationary plate (1) and the movable plate (2), and the cutting element moves along said edge to smoothly cut the bag. Thus, the bag can be used in another vacuum packaging operation. According to this embodiment, the vacuuming system also preferably comprises at least one pushing member, pushing any remaining part of the bag out through the opening (S2) so that no part of a cut bag remains in the vacuuming system.

[0036] In another alternative embodiment according to the present invention, the surface of said movable plate (2) facing the stationary plate (1) has an inclined structure and comprises at least one outlet hole and at least one outlet valve opening and closing said hole at its tip part that is remote to the stationary plate (1). Thus, the juice of any food in a bag is allowed to be discharged through the outlet hole by means of the inclined surface during vacuuming and therefore the juice is prevented from filling and getting accumulated in the reservoir (14). According to this embodiment, the vacuuming system preferably comprises at least one fluid collection member that is in communication with said outlet hole. This fluid collection member can be in the form of a tube, guiding the juice of a food to any desired target, or may be in the form of a container in which the juice is collected. According to this embodiment, said inclined surface is preferably provided with a layer made of a dirt- and liquid-repellent (e.g. hydrophobic) material. According to this embodiment, the vacuuming system preferably comprises at least one dirt sensor to prevent dirt emerging from the juice of foods giving rise to an obstruction in the system. Thus, the dirtiness of the system can be continuously followed and when the dirt level exceeds a threshold, the respective user can be alerted to perform the required cleaning operation. According to this embodiment, the vacuuming system also preferably comprises at least one transmission line, one end thereof being connected to a water source (e.g. a water dispenser comprised in the respective cooling device), and the other end thereof becoming opened to said surface of said movable plate (2) so as to transfer water from the source to said surface, and at least one valve, in communication with said dirt sensor, controlling water flow through the transmission line according to the value measured by the dirt sensor. Thus, the vacuuming system can be practically cleaned when it is required to do so.

[0037] An operation method for the vacuuming system developed according to the present invention, in turn, comprises the steps of determining by the user an operation (e.g. vacuuming, sealing, cutting, cleaning etc.) to be performed using the vacuuming system, and positioning a bag to the vacuuming system so that the mouth of the bag is placed in said reservoir (14); if the operation determined is vacuuming, sealing, or cutting, moving the movable plate (2) by means of said actuator mechanism so as to come close to the stationary plate (1) and clamping the bag between the movable plate (2) and the stationary plate (1); if the operation determined is vacuuming and when the movable plate (2) assumes its closed state, generating a vacuum medium in said reservoir (14) by energizing the vacuum pump (S6), and meanwhile, evacuating the air out of the bag through the mouth of the bag placed in the reservoir (14) so that a target vacuum value in the reservoir (14) is achieved; once vacuuming is completed, or if the operation determined is sealing, energizing the heater (5) and heat-sealing the bag; following the sealing operation, moving the movable plate (2) away from the stationary plate (1) so that the bag is released.

[0038] In a preferred embodiment of the developed

method, the vacuuming operation can be effected for a first time period, or can be effected until the vacuum value in the reservoir (14) reaches a user-determined vacuum value (e.g. 0,50 to 0,05 bar interval). In another embodiment, the vacuuming operation can be effected until a vacuum value is reached that matches the size and/or the type of a bag selected by the user by means of a data input device. For this purpose, the method according to the present invention preferably comprises the steps of measuring the vacuum value in the reservoir (14) by at least one switch (S7) and transmitting it to a control unit; comparing the measured value with a target vacuum value saved in the control unit (the target vacuum value is a value determined by the user and/or a value correlating with the size and type of the bag); and once the measured value reaches the target value, stopping the vacuum pump (S6).

[0039] In another preferred embodiment of the method according to the present invention, the sealing operation can be effected for a second time period, or can be effected until a temperature value of the heater (5), as measured using a temperature sensor, reaches a first threshold temperature value. This first threshold temperature value is preferably a value saved in a control unit according to the type of the bag that is used.

[0040] Another preferred embodiment of the method according to the present invention comprises the steps of measuring the temperature of said heater (5) prior to a vacuuming operation by means of a temperature sensor; comparing the measured temperature value to a second threshold temperature value (e.g. 55°C); if the measured value is higher than the second threshold temperature value, not initiating the vacuuming operation, and if the measured value is lower than the second threshold temperature value, initiating the vacuuming operation. Said second threshold temperature value is preferably a temperature value, at which the bag does not burn and melt, and which is correlated to the type of bag selected by the user. Thus, when the vacuuming system is used again and again, any tearing and breaking will be prevented, which may be due to the overheated state of the heater (5), such that a reliable vacuuming system and operation method are achieved. The method according to this embodiment further comprises the steps of determining a maximum time period for which the heater (5) can be operated in line with the difference between the measured temperature value and the second threshold temperature value when the measured temperature value is lower than the second threshold temperature value, and deactivating the heater (5) at the completion of this maximum time period.

[0041] The method according to another preferred embodiment of the present invention comprises the step of waiting for a second period of time, after the user determines the operation and if the determined operation is vacuuming, sealing, or cutting; and moving the movable plate (2) at the end of this second time period. Thus, the time period required by the user to correctly place the mouth of bag into the reservoir (14) is provided.

[0042] The method according to another preferred embodiment comprises the steps of alerting the user if a target vacuum value in the reservoir (14) cannot be reached in a third time period, and terminating the vacuuming operation. When the mouth of the bag is not placed correctly or if there is a puncture in the bag, a target vacuum value cannot be reached in said reservoir (14) as the air present in the bag cannot be evacuated. When this occurs, the user will be alerted to provide a reliable operation method.

[0043] The method according to another alternative embodiment of the present invention preferably comprises the step of controlling by a control unit the amount of current drawn by the vacuum pump (S6) to detect if or not the vacuum value in the reservoir (14) reached a target vacuum value. For each vacuum value provided by the vacuum pump (S6), there is provided a different current value. These values can be determined by the user, but they can also be determined during the manufacture of the vacuuming system. When these values are saved in the control unit, the current value drawn by the vacuum pump (S6) during vacuuming is measured and compared to the values saved in the control unit, and the vacuum value corresponding to the measured current value can be determined and it can be easily and practically determined if or not the determined vacuum value is equivalent to the target vacuum value.

[0044] The method according to another preferred embodiment comprises the steps of measuring the dirt level of the movable plate (2) and/or the stationary plate (1) by at least one dirt sensor; and alerting the user when the dirt level reaches a threshold dirt value. The method according to this embodiment further comprises the step of automatically cleaning the movable plate (2) with water fed from a water source, when the dirt level equals to or is higher than the threshold dirt value. It is thus ensured that the vacuuming system is always kept clean and a system that operates independently of its user is achieved.

[0045] A cooling device (S) developed according to the present invention, in turn, comprises at least one food preservation compartment in which foodstuff is preserved under a certain temperature value, and at least one door (S3), controlling access to said compartment, and having an open state giving access to, and a closed state preventing access to said compartment. The cooling device (S) according to the present invention further comprises at least one vacuuming chamber (S1) provided in said door (S3), and having at least one opening (S2) providing access into its interior in the closed or open state of door (S3); and at least one said vacuuming system provided in the vacuuming chamber (S1). By virtue of the cooling device (S) according to the present invention, the need of users for an external device for vacuuming, sealing and/or cutting operations of bag mouths is avoided.

[0046] In a preferred embodiment according to the

present invention, the vacuum pump (S6) and switch (S7) comprised by the vacuuming system, as illustrated in figure 7, are provided in a cap (S5) of the door (S3) of the cooling device (S). According to this embodiment, the cooling device (S) further comprises at least one vacuum line (S4) (e.g. a hose), at least one end thereof being connected to the vacuum pump (S6) and at least the other end thereof opening into said reservoir (14) for a vacuuming operation. In order to make said vacuum line (S4) open into the reservoir (14), its connection to the vacuuming system is preferably carried out by means of at least one connection element (7) provided in the stationary plate (1).

[0047] In another preferred embodiment, the cooling device (S) comprises at least one sensor measuring the current and/or voltage instantaneously drawn by the cooling device (S), and at least one control unit, which is in connection with the sensor, compares the values measured by the sensor to a threshold standard value saved in itself, and as a result of this comparison, determines the difference between the value measured by the sensor and the threshold standard value on a percent basis, and if the measured value is higher than the threshold standard value, shortens the running time of the heater (5) according to this difference (e.g. up to this percentage difference), and if the measured value is lower than the threshold standard value, increases the running time of the heater (5) according to this difference (e.g. up to this percentage difference). Since the cooling device (S) and the vacuuming system are connected to a common energy supply under normal operation conditions, when the energy drawn by the cooling device (S) increases, the amount of energy drawn by the vacuuming system increases too, therefore leading to a similar increase in the operation power of the heater (5). As a result of this increase, a bag can burn and melt down during a sealing operation. In order to prevent this situation, this embodiment enables to shorten the running time of the heater (5). Similarly, if the amount of energy drawn by the cooling device (S) drops down, the operation power of the vacuuming system and therefore the heater (5) becomes lower. This, in turn, may cause an inadequate heating and sealing of the bag during a heat-sealing operation, so that the running time of the heater (5) is prolonged to eliminate any failures.

[0048] By virtue of the vacuuming system and operation method developed according to the present invention, the preservation time of foods in household use can be prolonged in an efficient and practical manner. Additionally, a correct placement and a smooth sealing are provided for the bag so that any air leak into the bag is avoided and a safe vacuuming system is achieved. Furthermore, by virtue of the cooling device (S) according to the present invention, consumers are enabled to perform an easy and practical vacuuming operation whenever they need to do so, and the need for an external device for vacuuming is avoided.

Claims

1. A vacuuming system which is suitable for use in at least one vacuuming chamber (S1) having at least one opening (S2) to receive the mouth of a bag to be vacuumed and being provided in a door (S3) of a cooling device (S) having at least one food preservation compartment and at least one door (S3) which controls access to said compartment, and which comprises at least one vacuum pump (S6), the vacuuming system being **characterized by** comprising;

   - at least one carrier chassis (4);
   - at least one stationary plate (1);
   - at least one movable plate (2), which can move close to and away from the stationary plate (1), has a closed state in which it contacts with the stationary plate (1) and an open state in which it does not have any contact with the stationary plate (1), and comprises at least one reservoir (14) in connection with the vacuum pump (S6), wherein a vacuuming operation takes place in said reservoir (14) when the movable plate is in its closed state;
   - at least one insulation element (6), which when placed in the vacuuming chamber (S1), is provided so as to extend along the edge of the stationary plate (1) and/or the movable plate (2) that is remote to the opening (S2);
   - at least one heater (5), which when placed in the vacuuming chamber (S1), is provided so as to extend along the edge of the stationary plate (1) or the movable plate (2) that is close to the opening (S2), and when the mouth of a bag to be vacuumed is placed into the reservoir (14) and the vacuuming operation is completed with the movable plate (2) assuming its closed state, applies heat to the part of the bag left in the heater so that the bag becomes sealed;
   - at least a first resilient element (12), which is provided on the movable plate (2) or stationary plate (1) against said heater (5), and provides an efficient sealing of the bag and
   - at least one actuator mechanism, which is provided in said carrier chassis (4) and provides said movement of the movable plate (2).

2. A vacuuming system according to claim 1, **characterized by** comprising at least one blocker plate (8), which is provided between the movable plate (2) and stationary plate (1) so that said reservoir (14) stays between itself and the opening (S2) and it becomes aligned with the edge of the reservoir (14) that is remote to the opening (S2), and which, when the mouth of a bag to be vacuumed is to be placed in said reservoir (14), contacts the mouth of the bag to provide a correct positioning of the mouth; and at

least one housing (9), which receives the blocker plate (8) in the closed state.

3. A vacuuming system according to claim 1, **characterized in that** said actuator mechanism comprises:

• at least one guide (3), at least one end thereof being connected to the carrier chassis (4), and at least the other end thereof being connected to the stationary plate (1), and guiding the movement of the movable plate (2) by being passed through at least one aperture comprised within said movable plate (2);
• at least one actuating member (11) provided in said carrier chassis (4) and having at least one component which can rotate once energized, and
• at least one arm (10), at least one end thereof being connected to said component of the actuating member (11), at least the other end thereof contacting the movable plate (2), and when said component starts moving, effecting said movement of the movable plate (2) by assuming a sloped position so that an angle is created between itself and the carrier chassis as a result of its rotation around an axis passing through a region in which it is connected to said component.

4. A vacuuming system according to claim 3, **characterized in that** the actuator mechanism comprises at least a second resilient element (21), at least one end thereof being connected to the carrier chassis (4), and at least the other end thereof being connected to the movable plate (2), and in the closed state of the movable plate (2), exerting force to the movable plate (2) so as to move it away from the stationary plate (1) and thus providing a more stable transition for the movable plate (2) from the closed state to the open state.

5. A vacuuming system according to claim 4, **characterized in that** the second resilient element (21) is made of a shape memory material, which is coupled to an electrical energy source, which, once energized, tends to change size so as to exert force to the movable plate (2) so that it moves away from the stationary plate (1), and which, when the movable plate (2) is moved towards the stationary plate (1), stretches to change size.

6. A vacuuming system according to claim 1, **characterized in that** said actuator mechanism comprises:

• at least one actuating member (11) provided in said carrier chassis (4) and having at least one component which can rotate once it is energized, and
• at least one guide (3), at least one end thereof being connected to said component, and being capable of rotating around its own axis with the component starting rotating, and being passed through a threaded aperture provided in the movable plate (2) with its other end connected to the stationary plate (1), and having the form of a shaft with threads on it which match up with the threads in the aperture, and effecting said movement of the movable plate (2) by rotating around its own axis.

7. A vacuuming system according to claim 1, **characterized in that** said actuator mechanism comprises:

• at least one actuating member (11) provided in said carrier chassis (4) and having at least one component which can rotate once it is energized;
• at least one gearwheel (16) coupled to said component, and being able to rotate around an axis when said component rotates, and
• at least one toothed rack (17), at least one end thereof being connected to the gearwheel (16) and at least the other end thereof being connected to the movable plate (2), and converting the rotational motion of the gearwheel (16) into linear motion to effect said movement of the movable plate (2).

8. A vacuuming system according to claim 1, **characterized in that** said actuator mechanism comprises at least one drive element (18), having at least one wheel rotatable around an axis once energized, and at least one transmission element (19) in the form of a belt, at least one end thereof being connected to said wheel and at least the other end thereof being connected to the movable plate (2), and being wound around the rotating wheel with the drive element (18) becoming energized, or being released from the wheel without its connection to the wheel being lost, thus converting the rotational motion of the wheel to a linear motion to let the movable plate (2) perform said movement.

9. A vacuuming system according to claim 1, **characterized in that** the actuator mechanism comprises at least two magnetic elements (20), at least one thereof being provided on the stationary plate (1) and at least the other one thereof being provided on the movable plate (2) in an opposed fashion, having connection to an electrical energy source, and exerting a pulling force onto each other once energized by said source, thus enabling the movable plate (2) to move and assume its closed state, wherein upon deactivation of the energy supply, the exerted force is removed, and by this way, the movable plate (2) is enabled to move and assume its open state; and

at least one guide (3), at least one end thereof being connected to the carrier chassis (4) and at least the other end thereof being connected to the stationary plate (1), and being passed through at least one aperture comprised in said movable plate (2), thereby guiding the movement of the movable plate (2).

10. A vacuuming system according to claim 1, **characterized by** comprising at least one hole (2a) in the movable plate (2) in a region where said reservoir (14) is provided, and at least one adjustment element, closing said hole (2a) during a vacuuming operation, and after the vacuuming operation is completed, opening the hole (2a) to allow airflow through the hole (2a) to provide an easy removal of the movable plate (2) from the stationary plate (1).

11. An operation method for a vacuuming system according to any of the preceding claims, **characterized by** comprising the steps of:

- determining by a user an operation to be performed using the vacuuming system and positioning a bag to the vacuuming system such that the mouth of the bag is placed in said reservoir (14);
- if the operation determined is vacuuming, sealing, or cutting, moving the movable plate (2) by means of the actuator mechanism so as to come close to the stationary plate (1) and clamping the bag between the movable plate (2) and the stationary plate (1);
- if the operation determined is vacuuming and once the movable plate (2) assumes its closed state, generating a vacuum medium in said reservoir (14) by energizing the vacuum pump (S6), and meanwhile, evacuating the air out of the bag through the mouth of the bag placed in the reservoir (14) so that a target vacuum value in the reservoir (14) is achieved;
- once the vacuum value targeted is achieved and the vacuuming operation is completed, or if the operation determined is sealing, energizing the heater (5) and heat-sealing the bag;
- following the sealing operation, moving the movable plate (2) away from the stationary plate (1) so that the bag is released.

12. A method according to claim 11, **characterized in that** the target vacuum value is a value that is determined by the user by means of a data input device, or is a value that is saved in the control unit and matches to the size and/or type of a bag selected by the user using the data input device.

13. A method according to claim 11, **characterized by** comprising the steps of:

- measuring the temperature of the heater (5) during a sealing operation by means of a temperature sensor and transmitting it to a control unit;
- comparing the measured temperature value to a first threshold temperature value;
- if the measured temperature value reaches or exceeds the first threshold temperature value, completing the sealing operation.

14. A method according to claim 11, **characterized by** comprising the steps of measuring the amount of current drawn by the vacuum pump (S6) to detect if the vacuum value in the reservoir (14) has reached a target value and transmitting it to a control unit; comparing the amount of current measured by the control unit to a current value saved in the control unit; as a result of this comparison, determining the vacuum value that correlates with the measured current amount; if the determined current value is equal to or larger than a target current value, completing the vacuuming operation.

15. A cooling device (S) comprising at least one food preservation compartment in which foodstuff is preserved under a certain temperature value; and at least one door (S3), controlling access to said compartment, and having an open state giving access to, and a closed state preventing access to said compartment; **characterized by** comprising at least one vacuuming chamber (S1) located in said door (S3), and having at least one opening (S2) providing access into its interior in the closed or open state of door (S3); at least one vacuuming system, according to any of the claims 1 to 10, and comprising an operation method according to any of the claims 11 to 14, provided in said vacuuming chamber (S3); at least one sensor measuring the current and/or voltage instantaneously drawn by the cooling device (S); and at least one control unit, which is in connection with the sensor, compares the values measured by the sensor to a threshold standard value saved in itself, and as a result of this comparison, determines the difference between the value measured by the sensor and the threshold standard value on a percent basis, and if the measured value is higher than the threshold standard value, shortens the running time of the heater (5) according to this difference, and if the measured value is lower than the threshold standard value, increases the running time of the heater (5) according to this difference.

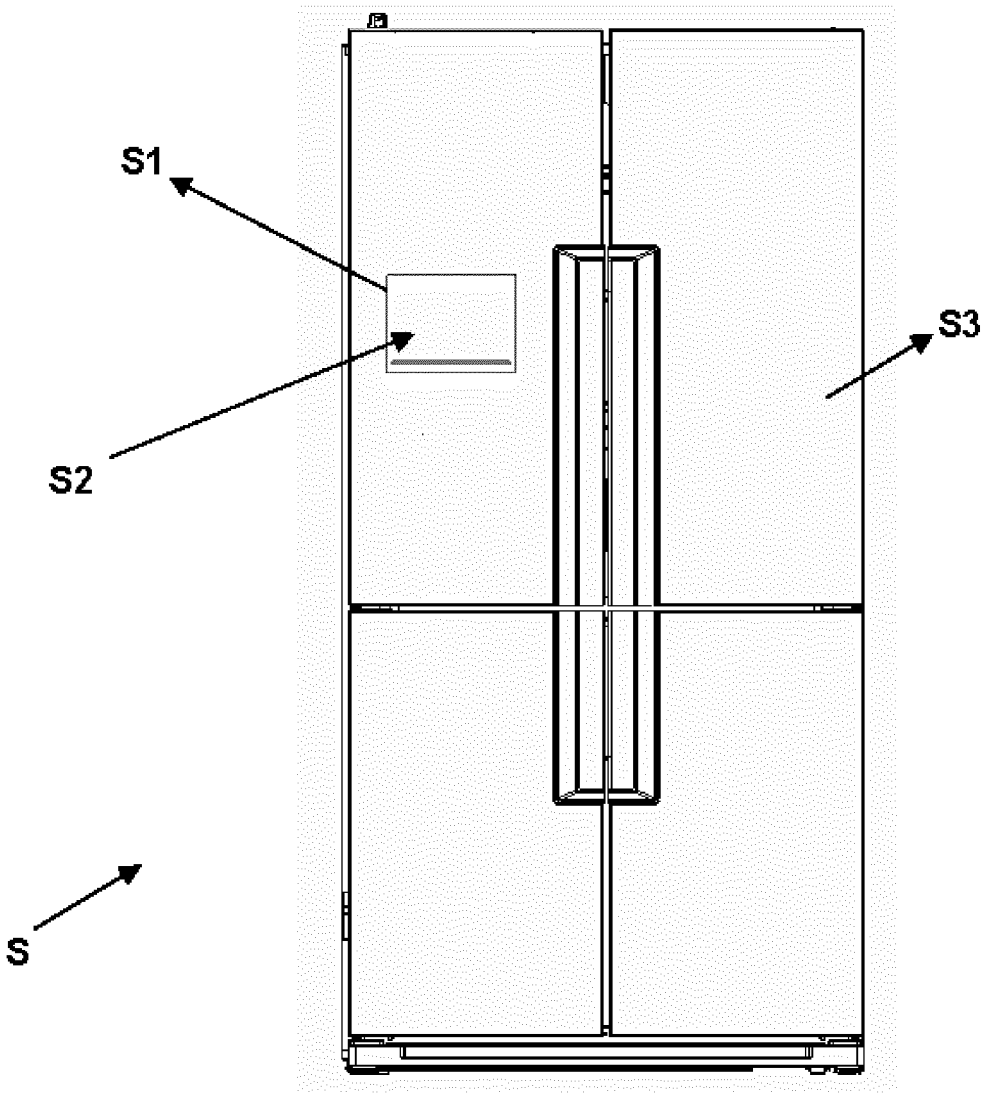

Figure - 1

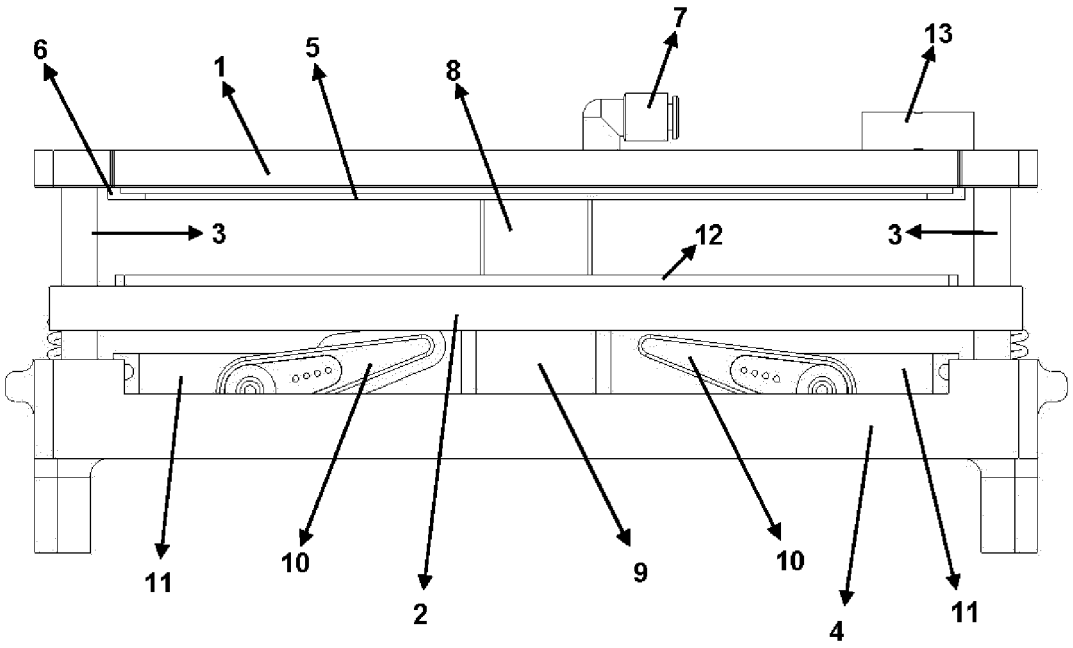

Figure - 2

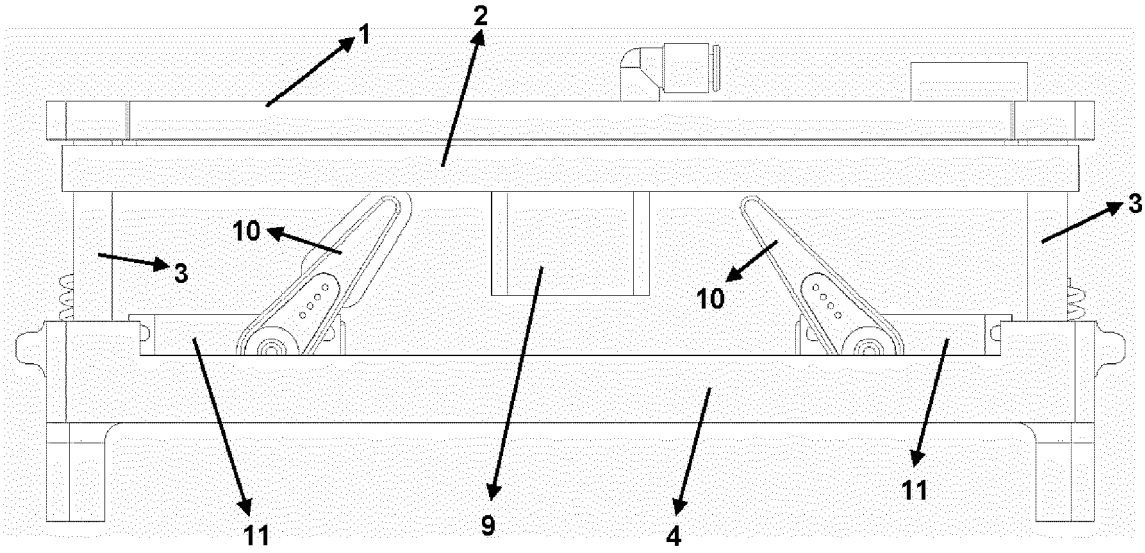

Figure - 3

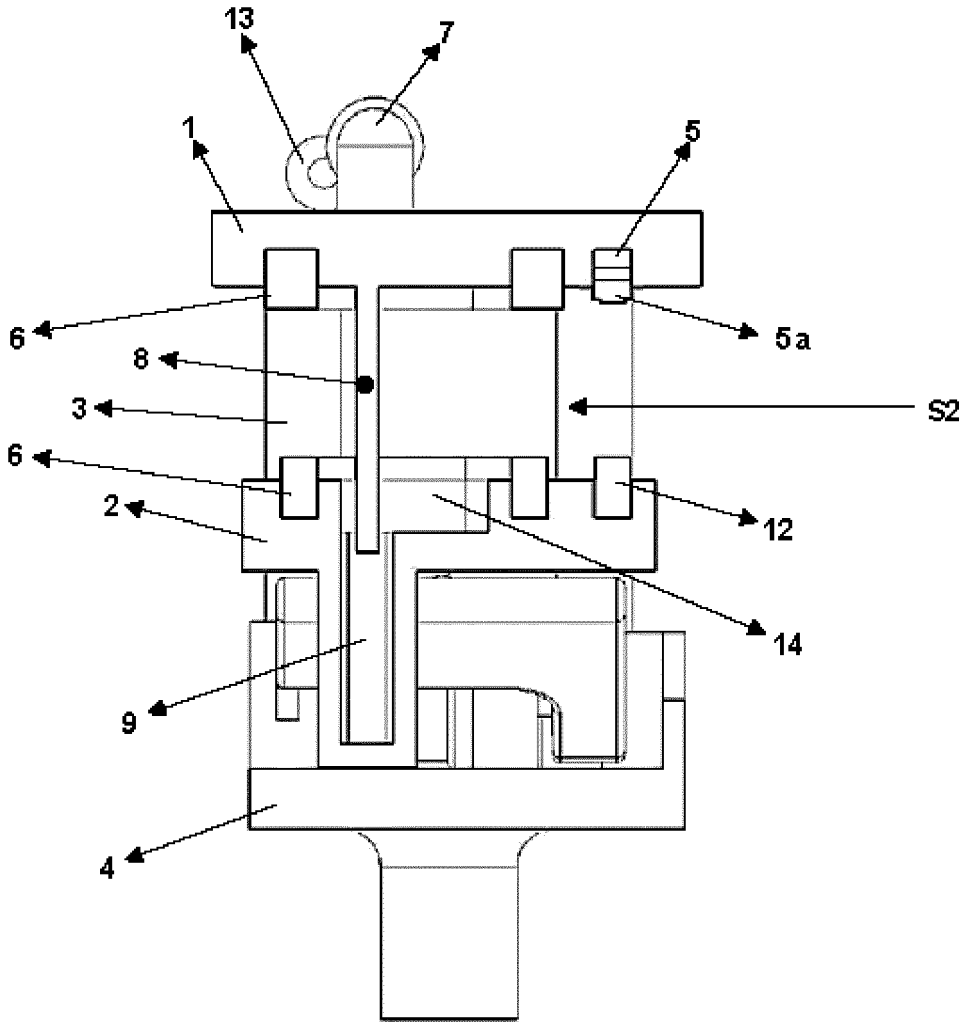

Figure - 4

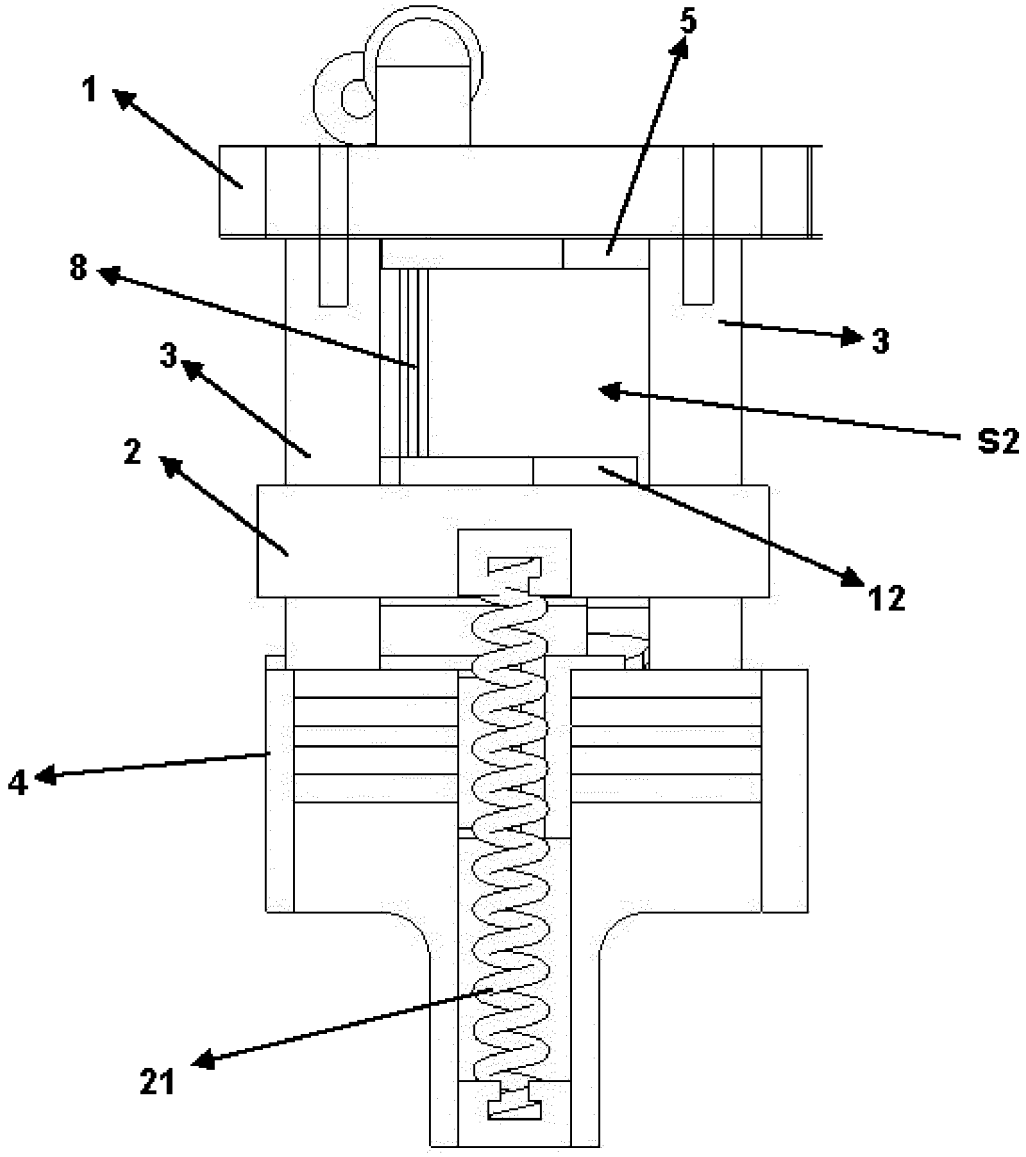

Figure - 5

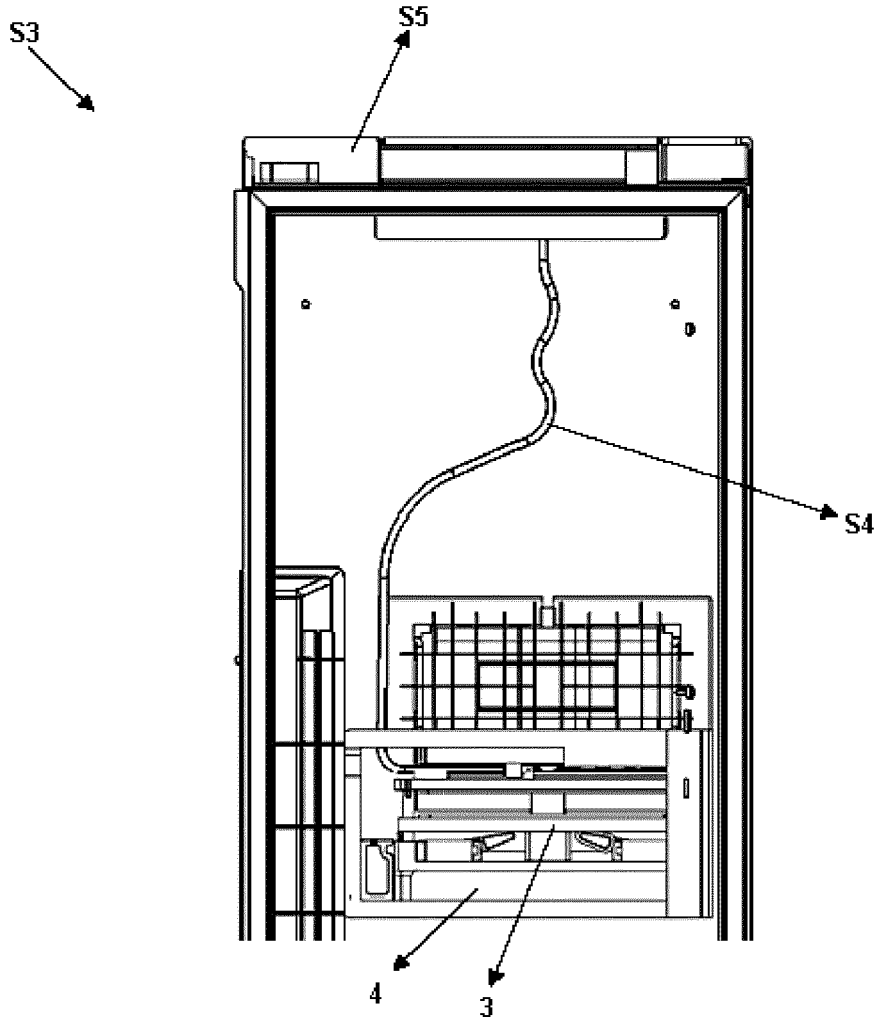

Figure - 6

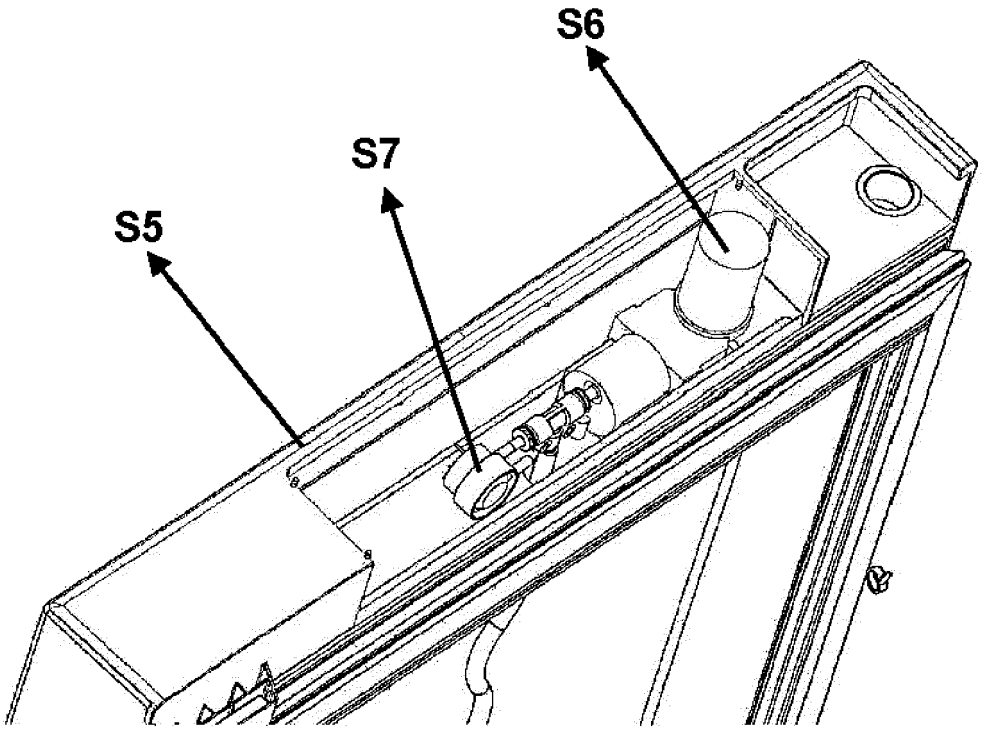

Figure - 7

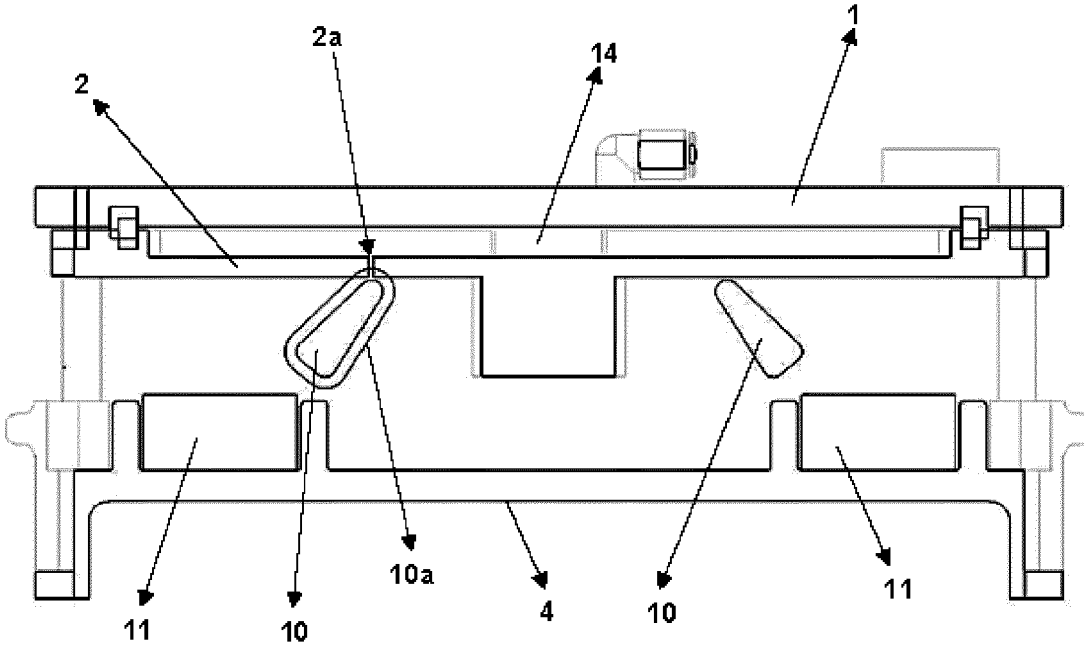

Figure - 8

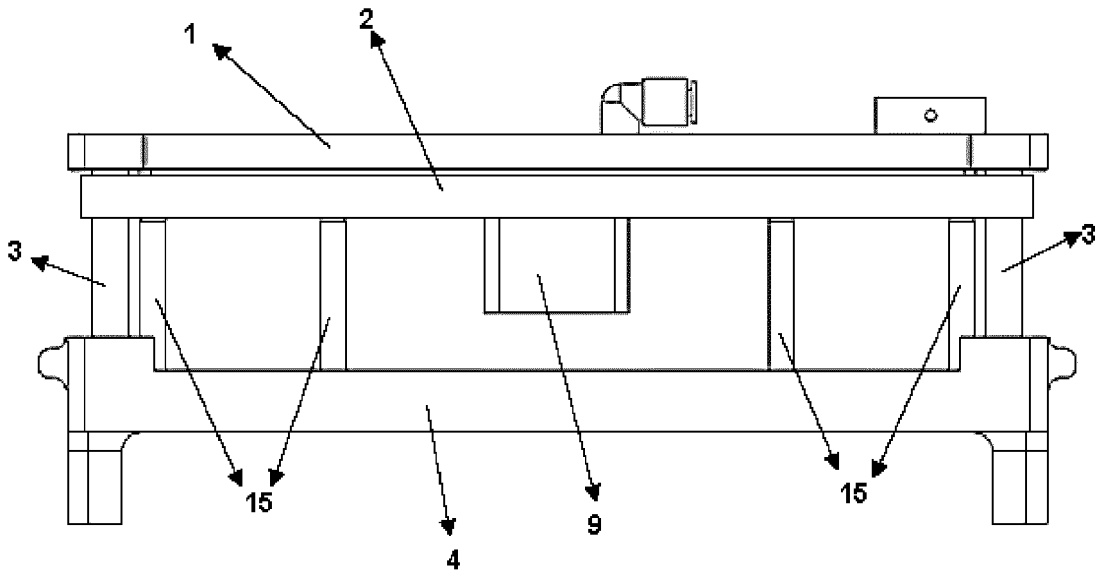

Figure - 9

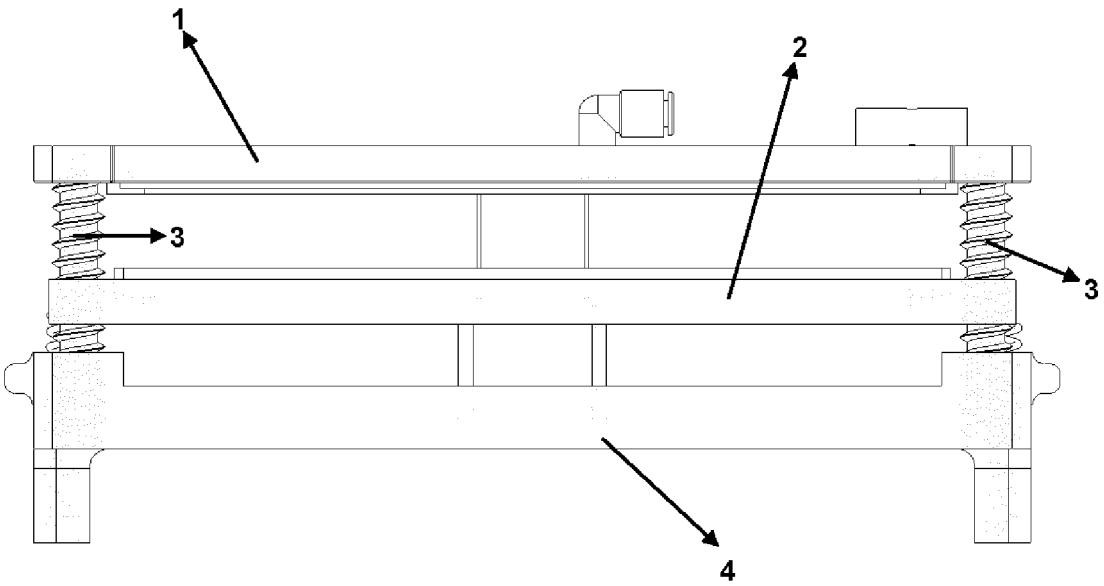

Figure - 10

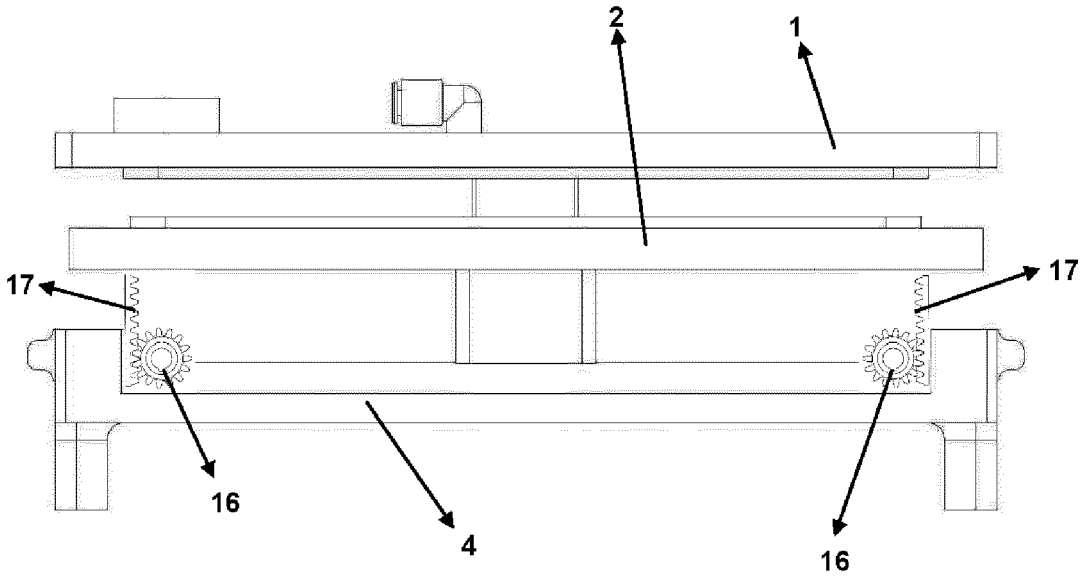

Figure - 11

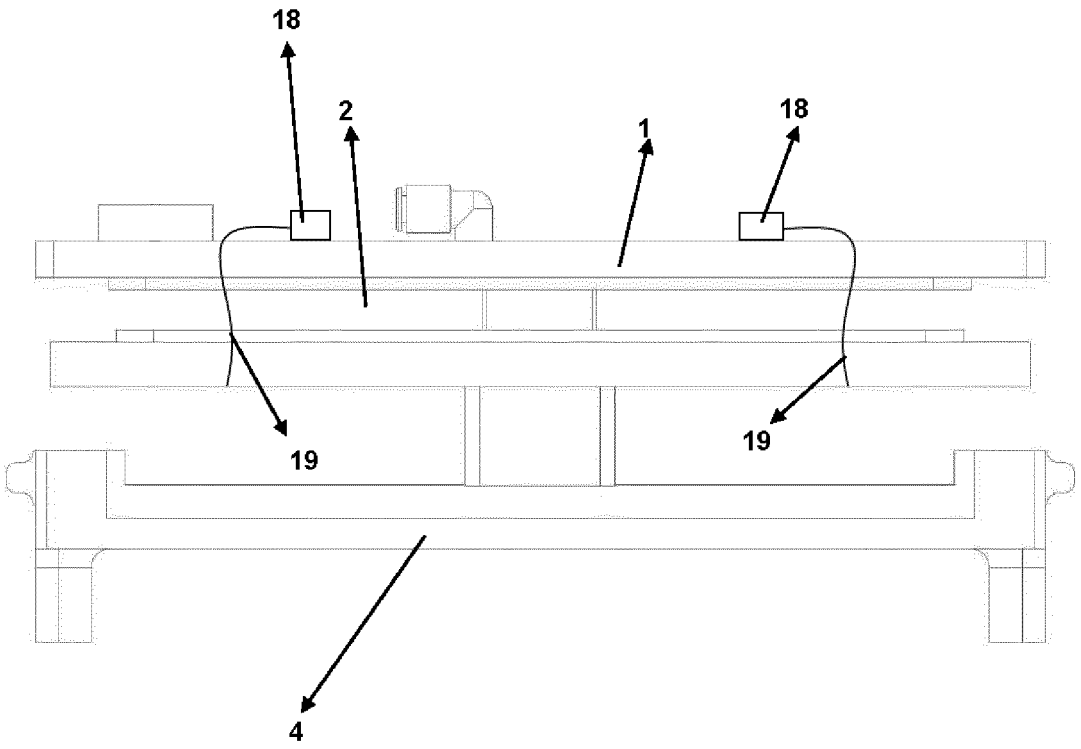

Figure - 12

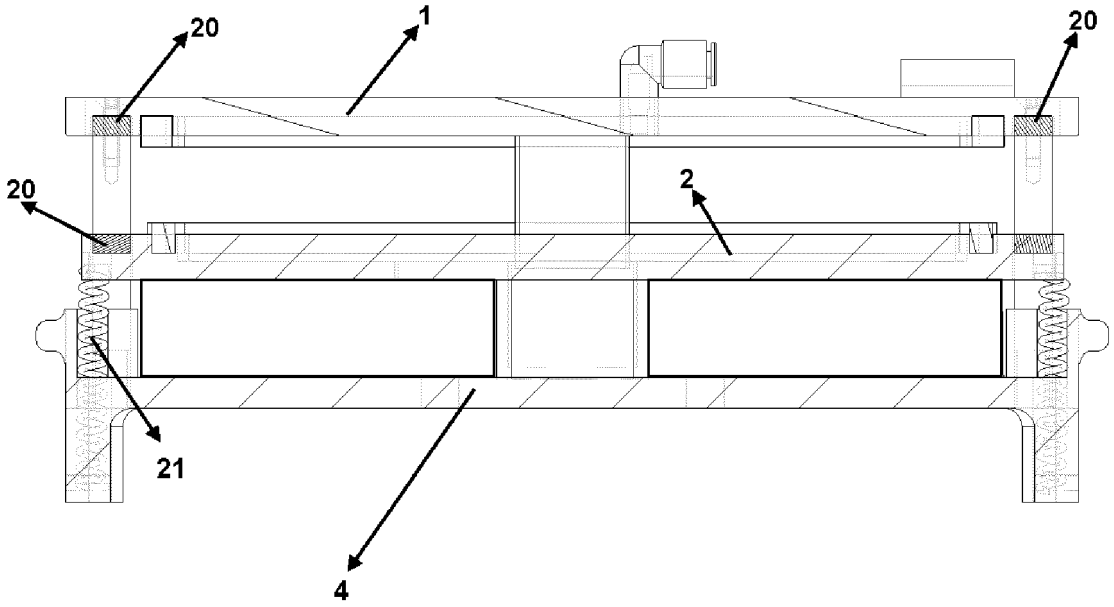

Figure - 13

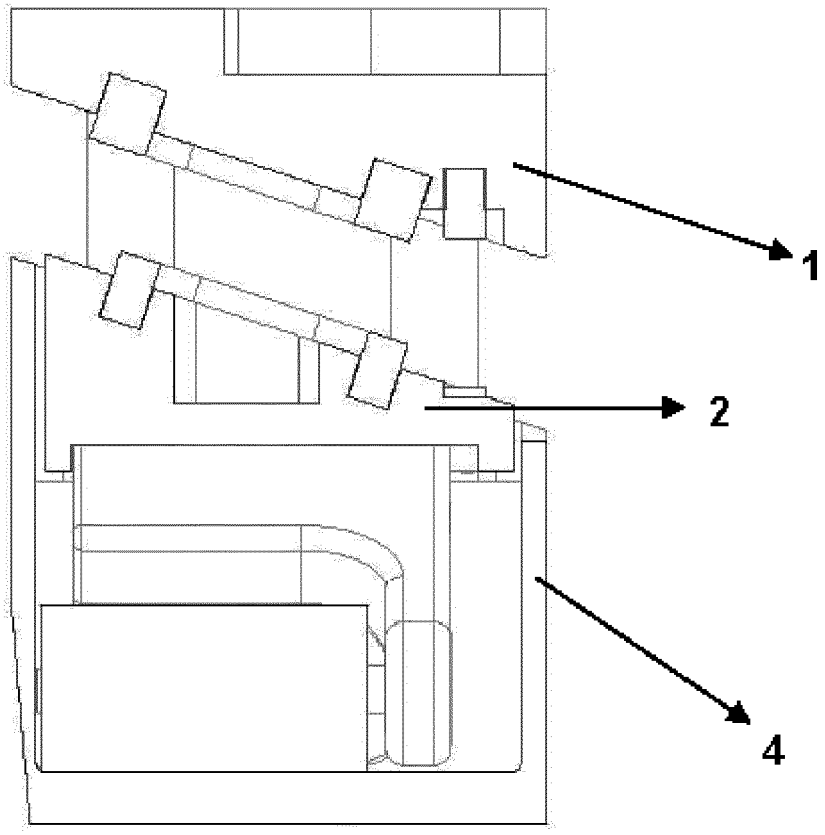

Figure - 14

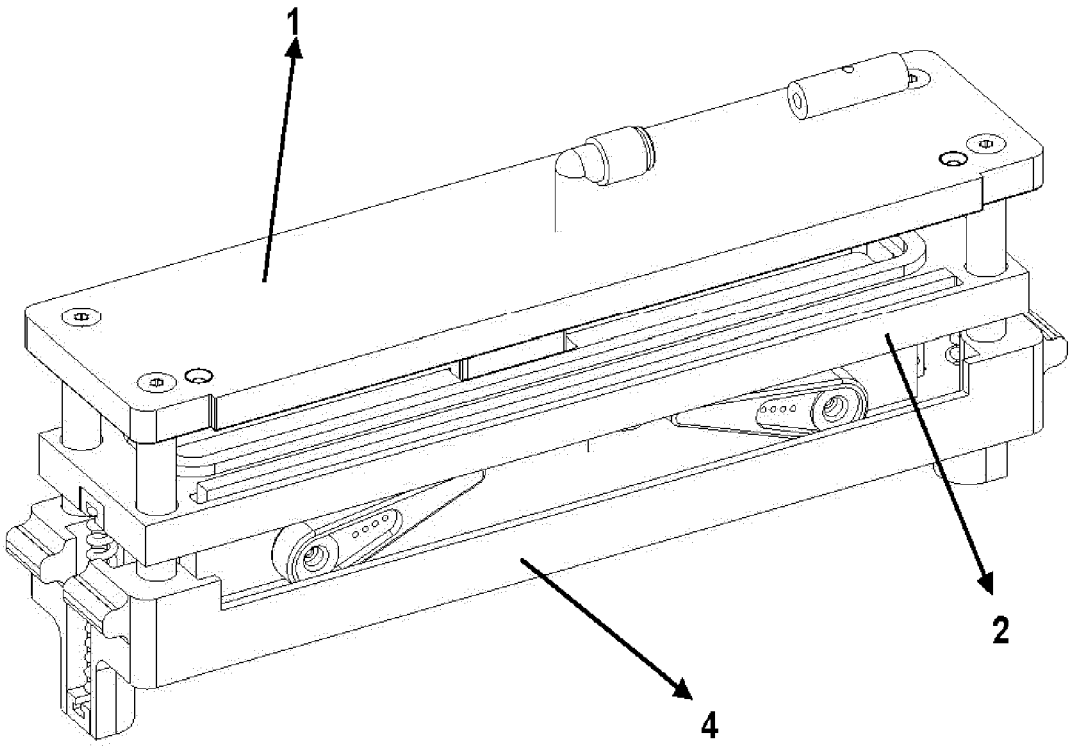

Figure - 15

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EUROPEAN SEARCH REPORT

Application Number
EP 18 18 6132

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 Y	CN 106 895 650 A (QINGDAO HAIGAO DESIGN MFT CO LTD) 27 June 2017 (2017-06-27) * figures 1-4 *	1,3-14 2,15	INV. F25D23/12 B65B31/02
X	WO 2012/174339 A2 (SUNBEAM PRODUCTS INC [US]; HAMMAD JAMAL [US]) 20 December 2012 (2012-12-20) * figures 10,11,14,15 *	1,11	
Y	US 2006/230711 A1 (HIGER LANDEN [US] ET AL) 19 October 2006 (2006-10-19) * figure 1 *	2	
Y	JP H09 288765 A (WATANABE NORIO; NISSHO KK) 4 November 1997 (1997-11-04) * figure 5 *	15	

TECHNICAL FIELDS SEARCHED (IPC)

F25D
B65B
B65D
A23L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 January 2019	Kuljis, Bruno

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 18 6132

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
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28-01-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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