

Description

Title of the invention : Vacuum pump and method for injecting a purging gas

- [1] The present invention relates to a dry vacuum pump. The invention relates also to a
5 method for injecting a purging gas into a vacuum pump.
- [2] Some vacuum pumps are employed in so-called “powder” methods because gases are implemented that generate great quantities of solid by-products. Such is the case, for example, of certain semiconductor fabrication methods or some coating deposition methods or flat panel display manufacturing methods or LED manufacturing methods.
- 10 [3] When gases deriving from these methods are pumped, solid compounds can form in the vacuum pump or in the pipelines and can be deposited in the vacuum pumps, which can restrict gas passage dimensions and lead to pumping capacity losses. These depositions can also disrupt the correct operation of the moving parts of the vacuum pump, notably of the rotors which turn in the stator but also of the active parts of the recirculation, relief or
15 discharge check valves.
- [4] The check valves operate as relief valves which open to avoid undesirable overpressures in the vacuum pump. They also make it possible to allow the circulation of the gases only in a single direction. The check valves need to be able to be opened on the basis of the pressure differentials but they must also be closed tightly. One consequence of an
20 excessive accumulation of deposits in the vacuum pump can be that one of these two functions is no longer ensured correctly. Such malfunctions can be detrimental to the production rates but can also pose problems for safety of personnel and risk damage to the equipment.
- [5] It is possible to reduce these risks by coating the moving parts and the seats of the valves
25 with non-stick coatings such as PTFE, but the cost of this material is relatively high and its use can have a significant environmental impact because of its potentially poisonous properties. It is also possible to deposit coatings by sputtering but their strength over time cannot be guaranteed. Another solution could consist in arranging the check valves horizontally so that the force of gravity contributes to the discharging of the deposited
30 powders. However, the deposits that generally adhere can be difficult to discharge simply by the force of gravity.

[6] One aim of the present invention is to propose an enhanced vacuum pump that at least partially resolves one of the drawbacks of the state of the art.

[7] To this end, the subject of the invention is a vacuum pump comprising :

- 5 - at least one pumping stage within which two rotors are configured to turn synchronously in reverse directions to drive a gas to be pumped,
- at least one check valve comprising a seat and a mobile closure member, the check valve being able to assume a closed position in which the mobile closure member closes a passage of the seat and an open position in which the mobile closure member frees the passage, the pressure difference on either side of the mobile closure member being able to
10 open the check valve, characterized in that the vacuum pump further comprises at least one injection channel emerging through at least one injection orifice configured to inject a purging gas:
 - onto a bearing face of the seat in the open position of the check valve and/or
 - onto the mobile closure member and/or
 - 15 - onto at least one guiding element secured to a stator part of the vacuum pump configured to guide a displacement of the mobile closure member between the open and closed positions of the check valve.
- 20 [8] The injection of a purging gas makes it possible clean the check valve to prevent the presence of deposits which could hamper its operation. The cleaning of the check valve allows the closure sealing function and the opening function of the valve in the event of overpressures to be ensured for a longer time.
- 25 [9] The vacuum pump can comprise at least one injection channel emerging through at least one injection orifice configured to inject a purging gas onto a bearing face of the seat in the open position of the check valve. The sweeping of the bearing face allows the surface of the seat in contact with the mobile closure member in the closed position to be free of particles or of deposits to guarantee a tight closure of the check valve.
- [10] The mobile closure member can be displaced in translation, in rotation or by a combined movement.
- 30 [11] The check valve can comprise at least one guiding element secured to a stator part of the vacuum pump configured to guide the displacement of the mobile closure member between the open and closed positions of the check valve. The vacuum pump can comprise at least one injection channel emerging through at least one injection orifice

configured to inject a purging gas onto this guiding element, which allows the guiding function of the mobile closure member to be ensured.

- [12] According to an exemplary embodiment, the guiding element comprises a rod cooperating with a guiding envelope of the mobile closure member to guide the axial translational displacement of the mobile closure member. The injection channel can be configured to inject a purging gas along the rod of the guiding element. The rod and/or the guiding envelope of the mobile closure member can have, for that, a helical groove communicating with the injection channel for the guiding of the purging gas.
- [13] According to another exemplary embodiment, the check valve has rotational guiding elements for the mobile closure member.
- [14] The vacuum pump can comprise at least one injection channel emerging through at least one injection orifice configured to inject a purging gas onto the mobile closure member, notably in the closed position of the check valve. The injection of a purging gas onto the mobile closure member makes it possible to avoid an accumulation of deposits which could prevent or limit the opening of the check valve.
- [15] For example, the vacuum pump can comprise an injection channel comprising a first channel formed in the guiding element, the first channel emerging through at least one injection orifice for the injection of a purging gas onto the mobile closure member in the closed position of the check valve.
- [16] The vacuum pump can also comprise one or more features which are described hereinbelow, taken alone or in combination.
- [17] The injection channel can comprise at least one injection orifice for a purging gas, blocked by the mobile closure member in the closed position of the check valve and freed in the open position. The check valve is therefore self-blocking, the closure of the check valve sealing the injection of the purging gas.
- [18] The check valve can comprise an elastic return member stressing the mobile closure member into the closed position.
- [19] The vacuum pump can comprise an injection channel comprising a first channel formed in the guiding element and at least one second channel formed in the mobile closure member emerging through the at least one injection orifice, the at least one injection orifice being disposed facing the seat, the first and the second channels communicating with one another. The purging gas thus cleans the bearing face of the seat via the guiding element.

- [20] In the case of a guiding element comprising a rod cooperating with a guiding envelope of the mobile closure member to guide the axial translational displacement of the mobile closure member, the at least one injection orifice of the first channel of the guiding element and the guiding envelope of the mobile closure member can be positioned relative to one another in such a way that:
- a purging gas can be injected through the at least one injection orifice of the guiding element in the closed position of the check valve, and
 - a purging gas can be injected through the at least one injection orifice emerging from the mobile closure member in the open position of the check valve.
- [21] The injection of the purging gas is thus differentiated according to the position of the check valve, either to clean the bearing face of the seat when the valve is open, or to clean a rear part of the mobile closure member when the check valve is closed.
- [22] According to another exemplary embodiment, the injection channel emerging through at least one injection orifice is configured to inject a purging gas in a direction tangential to a plane separating a planar bearing face of the seat and a complementary planar surface of the mobile closure member in the open position of the check valve.
- [23] According to another exemplary embodiment, the injection channel emerging through at least one injection orifice is configured to inject a purging gas onto a tapered flank of a head of the mobile closure member blocking the passage in the closed position of the check valve.
- [24] The at least one injection channel can be configured to inject a swirling purging gas. The swirling of the purging gas makes it possible to improve the cleaning.
- [25] The vacuum pump can comprise at least two pumping stages and the check valve is a relief valve arranged at the output of the first or second pumping stage. In the open position, the relief valve makes it possible to short-circuit the last pumping stages of the vacuum pump which could limit the total flow rate generated in case of pumping of a strong gaseous flow.
- [26] The vacuum pump can comprise at least two pumping stages and the check valve is a discharge valve arranged at the output of the last pumping stage. The discharge check valve makes it possible to avoid the return of the pumped gases into the vacuum pump.
- [27] The check valve can be a recirculation check valve connected between an output and an input of a first pumping stage. The opening of the check valve makes it possible to

make the gases to be pumped recirculate in the same pumping stage in the case of the pumping of strong gaseous flows.

[28] Another subject of the invention is a method for injecting a purging gas into a vacuum pump as described previously, characterized in that a purging gas is injected onto a bearing face of the seat in the open position of the check valve and/or onto the mobile closure member and/or onto the guiding element secured to a stator part of the vacuum pump configured to guide a displacement of the mobile closure member between the open and closed positions of the check valve.

[29] Other features and advantages of the invention will emerge from the following description, given as a nonlimiting example, in light of the attached drawings in which:

[30] **[Fig. 1]** Figure 1 represents a schematic view of a pump unit comprising a multistage primary vacuum pump and a roots vacuum pump mounted upstream of the primary vacuum pump.

[31] **[Fig. 2]** Figure 2 shows a schematic cross-sectional view of a check valve according to a first exemplary embodiment, in closed position.

[32] **[Fig. 3]** Figure 3 shows the check valve of Figure 2 in open position.

[33] **[Fig. 4]** Figure 4 shows a mobile closure member of the check valve of Figure 2 turned over compared to the view of Figure 2.

[34] **[Fig. 5]** Figure 5 shows a schematic cross-sectional view of a check valve according to a second exemplary embodiment, in closed position.

[35] **[Fig. 6]** Figure 6 shows a view similar to Figure 5 in open position.

[36] **[Fig. 7]** Figure 7 shows a schematic cross-sectional view of a check valve according to a third exemplary embodiment, in open position.

[37] **[Fig. 8]** Figure 8 shows a variant of the check valve of Figure 7, seen from above.

[38] **[Fig. 9]** Figure 9 shows a schematic cross-sectional view of a check valve according to a fourth exemplary embodiment, in closed position.

[39] **[Fig. 10]** Figure 10 shows a schematic cross-sectional view of a check valve according to a fifth exemplary embodiment, in closed position.

[40] **[Fig. 11]** Figure 11 shows a schematic cross-sectional view of a check valve according to a sixth exemplary embodiment, in closed position.

[41] In these figures, the elements that are identical bear the same reference numbers.

[42] The following embodiments are examples. Although the description refers to one or more embodiments, this does not necessarily mean that each reference relates to the same

embodiment, or that the features apply only to a single embodiment. Simple features of different embodiments can also be combined or interchanged to provide other embodiments.

- [43] A primary vacuum pump is defined as a volumetric vacuum pump which is
5 configured to, using two rotors, suck, transfer, then discharge the gas to be pumped at atmospheric pressure. The rotors are borne by two shafts driven in rotation by a motor of the primary vacuum pump. A primary vacuum pump can be multistage, that is to say that it comprises several stages (at least two), such as two to nine pumping stages.
- [44] A roots type vacuum pump (also called “roots blower”) is defined as a volumetric
10 vacuum pump configured to, using rotors of roots type, suck, transfer then discharge the gas to be pumped. The vacuum pump of roots type is mounted upstream of and in series with a primary vacuum pump. The rotors are borne by two shafts driven in rotation by a motor of the roots-type vacuum pump. The roots vacuum pump comprises one to three pumping stages.
- [45] “Upstream” is understood to mean an element which is placed before another relative
15 to the direction of circulation of the gas. On the other hand, “downstream” is understood to mean an element placed after another relative to the direction of circulation of the gas to be pumped.
- [46] The vacuum pump 1 is, for example, connected to a chamber for the pumping of the
20 gases. It can be a chamber in which the deposition and etching processes used in the production of microelectronic devices on silicon wafers or coating processes or flat panel display production processes or LED manufacturing processes take place.
- [47] The invention applies to any type of dry vacuum pump, single-stage or multistage,
that is to say comprising one or more stages (at least two). This vacuum pump can be a
25 multistage primary vacuum pump configured to discharge the gases pumped at atmospheric pressure or a roots vacuum pump of one to three pumping stages which, in use, is connected upstream of a primary vacuum pump.
- [48] The vacuum pump 1 comprises, as is known per se, a mechanical driving part (not
30 represented here), comprising a motor driving rotors, rotor synchronising gears and bearings supporting the shafts of the rotors. The vacuum pump 1 also comprises a dry pumping stage in which the gases circulate, the vacuum pump 1 also comprising sealing means, allowing the rotation of the shafts in the dry pumping part while limiting the migrations of lubricant from the mechanical driving part to the dry pumping part.

- [49] In the dry pumping part, the vacuum pump 1 comprises at least one pumping stage 1a-1e within which two rotors are configured to turn synchronously in reverse directions to drive a gas to be pumped. The vacuum pump 1 is said to be “dry” because, in operation, the rotors turn inside the stator without any mechanical contact with the stator, which makes it possible not to use oil in the dry pumping part.
- [50] The vacuum pump 1 is, for example, a primary vacuum pump of “roots” or “claw” type or of spiral or screw type or based on another similar volumetric vacuum pump principle.
- [51] Figure 1 thus represents an example of pump unit comprising a single-stage vacuum pump arranged upstream of a multistage vacuum pump.
- [52] The multistage vacuum pump 1 comprises, for example, five pumping stages 1a-1e, mounted in series between a suction 2 and a discharge 3. The pumping stage 1a communicating with the suction 2 of the vacuum pump 1 is the first pumping stage, also called low-pressure stage, and the pumping stage 1e communicating with the discharge 3 is the last pumping stage, also called high-pressure stage. The compression chambers of the successive pumping stages 1a-1e are connected in series one after the other by at least one respective inter-stage channel connecting the output of the compression chamber of the preceding pumping stage to the input of the compression chamber of the following stage. During rotation, the gas sucked from the suction 2 of the vacuum pump 1 is imprisoned in the volume generated by the rotors and the stator of the pumping stage 1a-1f, then is compressed and driven to the next stage and so on to the discharge 3 of the vacuum pump 1. The pumping stages 1a-1e have a generated volume, that is to say a pumped gas volume, that decreases (or remains equal) with the pumping stages 1a-1e, the first pumping stage 1a having the highest generated flow rate and the last pumping stage 1e having the lowest generated flow rate.
- [53] The vacuum pump 1 also comprises at least one check valve 4. The check valve 4 comprises a seat 5 and a mobile closure member 6. The mobile closure member 6 can be displaced in translation, in rotation or by a combined movement.
- [54] The check valve 4 can assume a closed position (Figure 2) in which the mobile closure member 6 is in contact with a bearing face of the seat 5 and closes a passage 7 of the seat 5 for the gases to be pumped, and an open position (Figure 3) in which the mobile closure member 6 is away from the seat 5, freeing the passage for the gases.

- [55] The check valve 4 can be opened according to the pressure difference on either side of the mobile closure member 6. For example, the check valve 4 opens in case of an overpressure in a pumping stage. When the upstream/downstream pressure difference is below the loading threshold of the check valve 4, the check valve 4 is closed, the mobile closure member 6 prevents the passage of the gases. When the upstream/downstream pressure difference of the check valve 4 is above the loading threshold of the check valve 4, the mobile closure member 6 is separated from the seat 5, freeing the passage for the gases to be pumped through the check valve 4.
- [56] The vacuum pump 1 comprises, for example, a recirculation check valve 4a and/or at least two pumping stages 1a-1e and at least one relief check valve 4b and/or at least one discharge check valve 4c.
- [57] The recirculation check valve 4a (also called pressure release check valve) is connected between the output and the input of one and the same pumping stage 1a. It is configured to open as soon as the pressure difference between the input and the output of the pumping stage 1a exceeds a predefined threshold. The opening of the check valve 4a makes it possible to make the gases to be pumped recirculate in the same pumping stage 1a in the case of the pumping of strong gaseous flows. The threshold is predefined notably according to the ratio of the generated flow rates and according to the mechanical safety settings. The recirculation check valve 4a is also arranged between the output and the input of the first pumping stage 1a for example of a roots vacuum pump of one to three pumping stages, arranged upstream of a primary vacuum pump.
- [58] The relief check valve 4b makes it possible to absorb and punctually transfer a strong gaseous flow while limiting the electrical consumption of the vacuum pump 1, for example during a depressurization of a chamber at atmospheric pressure. It is for example arranged at the output of a low-pressure pumping stage, such as at the output of the first or second pumping stage 1a, 1b of a multistage vacuum pump 1. In the open position, the relief check valve 4b makes it possible to short-circuit the last pumping stages 1c-1e of the vacuum pump 1 which could limit the total generated flow rate.
- [59] The discharge check valve 4c (also called non-return check valve) is arranged at the output of the last pumping stage 1e, that is to say at the discharge 3 of a multistage vacuum pump 1, generally upstream of a silencer of the vacuum pump 1. It makes it possible to avoid the return of pumped gases in the vacuum pump 1.

[60] In all cases of arrangement of the check valve 4, the head 8 of the mobile closure member 6 is configured to block the passage 7 of the gases.

[61] In the example of Figures 2 to 4, the seat 5 has a planar form and the head 8 has a cylindrical form complementing the passage 7 of the seat 5. The mobile closure member 6 and/or the seat 5 can also have a sealing coating or gasket 9, for example made of elastomer material or silicone, to enhance the mechanical strength and the resistance to high temperatures.

[62] The check valve 4 can comprise an elastic return member 11 which strains the mobile closure member 6 into the closed position. The elastic return member 11 comprises, for example, a spring interposed between the mobile closure member 6 and a stator part 12 of the vacuum pump 1. It is also possible to not use a spring and to use the force of gravity to strain the mobile closure member 6 into the closed position.

[63] The check valve 4 can comprise at least one guiding element 13 secured to the stator part 12 configured to guide a displacement of the mobile closure member 6 between the open and closed positions of the check valve 4.

[64] According to an exemplary embodiment, the guiding element 13 comprises a rod cooperating with a guiding envelope 14 of the mobile closure member 6 to guide the axial translational displacement of the mobile closure member 6. The guiding envelope 14 is, for example, a cylindrical cavity. It can be formed in a central axis of the mobile closure member 6. The elastic return member 11 is, for example, disposed around the rod of the guiding element 13, the rod also guiding the compression of the elastic return member 11.

[65] The vacuum pump 1 further comprises at least one injection channel 10 emerging through at least one injection orifice 15 configured to inject a purging gas onto a bearing face of the seat 5 in the open position of the check valve 4 and/or onto the mobile closure member 6 and/or onto the guiding element 13.

[66] The purging gas is, for example, nitrogen.

[67] The injection of a purging gas makes it possible to clean the check valve 4 to prevent the presence of deposits which could be detrimental to its operation. The sealing closure function and the opening function of the check valve 4 in cases of overpressure can thus be ensured for a longer time between two maintenance periods.

[68] The injection of the purging gas is targeted locally on the active parts of the check valve 4, such as on the bearing face of the seat 5, the mobile closure member 6 and/or the guiding element 13.

[69] The injection of the purging gas can be continuous or targeted in time. The time-discontinuous injection can make it possible not to disturb the pumping and ultimate vacuum performance levels of the vacuum pump 1 (in the absence of gas flows to be pumped).

5 [70] In particular, the injection of the purging gas can be controlled in a so-called “clean” phase when no process is taking place in the chamber connected to the vacuum pump 1. For that, the vacuum pump 1 comprises, for example, a driver unit configured to receive information on the process taking place in the chamber and to control the injection of the purging gas on the basis of this information.

10 [71] The time-discontinuous injection can also be determined by previously defined injection times.

[72] According to another example, this discontinuous injection is triggered by the movement of the check valve 4 itself, the injection channel 10 comprising at least one injection orifice 15 for a purging gas, blocked by the mobile closure member 6 in the closed position and freed in the open position. The check valve 4 is thus self-blocking, the closing of the check valve 4 closing the injection of the purging gas.

[73] This embodiment is particularly suited to the case where an injection channel 10 emerges through an injection orifice 15 configured to inject a purging gas onto a bearing face of the seat 5 of the check valve 4 in the open position of the check valve 4.

20 [74] The sweeping of the bearing face by the purging gas allows the surface of the seat 5 in contact with the mobile closure member 6 in the closed position of the check valve 4 to be free of particles or of deposits to guarantee a tight closure of the check valve 4.

[75] For that, for example, the vacuum pump 1 comprises an injection channel 10 comprising a first channel 16 formed in the guiding element 13 and at least one second channel 17 formed in the mobile closure member 6. The at least one second channel 17 emerges from the mobile closure member 6 through a respective injection orifice 15 disposed facing the seat 5. The first channel and the second channel 16, 17 communicate with one another. There are for example several second channels 17 emerging through a respective injection orifice 15, such as six and ten, evenly distributed over the perimeter of the mobile closure member 6 so as to form a “shower head” for the uniform cleaning of the bearing face of the seat 5 (Figure 4).

30 [76] In operation, when the check valve 4 is in the closed position, the injection orifices 15 for a purging gas are blocked by the mobile closure member 6.

[77] In overpressure cases, the mobile closure member 6 is pushed back against the elastic return member 11, which opens the check valve 4. The opening of the check valve 4 allows the passage of the gases to be pumped and frees the injection orifices 15 for the injection of a purging gas onto the bearing face of the seat 5 (Figure 3). The injection of the purging gas cleans the bearing face of the seat 5 via the guiding element 13.

[78] Figures 5 and 6 show a second exemplary embodiment.

[79] In this example, the vacuum pump 1 comprises an injection channel 10 emerging through at least one injection orifice 18 configured to inject a purging gas onto a rear part 19 of the mobile closure member 6. More specifically, the injection channel 10 comprises a first channel 16 formed in the guiding element 13. The first channel 16 emerges through at least one injection orifice 18 for the injection of a purging gas onto the mobile closure member 6 in the closed position of the check valve 4 (Figure 5).

[80] There are, for example, at least two diametrically opposing injection orifices 18 emerging from the first channel 16.

[81] The injection of a purging gas onto the rear part 19 of the mobile closure member 6 makes it possible to clean the mobile closure member 6 in the closed position to avoid an accumulation of deposits which could prevent or limit the opening of the check valve 4.

[82] In the case of a guiding element 13 comprising a rod cooperating with a guiding envelope 14 of the mobile closure member 6 to guide the axial translational displacement of the mobile closure member 6, it is also possible to provide for the at least one injection orifice 18 of the first channel 26 of the guiding element 13 and the guiding envelope 14 of the mobile closure member 6 to be positioned relative to one another to inject a purging gas through the at least one injection orifice 18 of the guiding element 13 in the closed position of the check valve 4, and to inject a purging gas through the at least one injection orifice 15 emerging from the mobile closure member 6 in the open position of the check valve 4.

[83] In operation, when the check valve 4 is in the closed position (Figure 5), the purging gas is injected through the at least one first injection orifice 18 formed in the guiding element 13, which cleans the rear part 19 of the mobile closure member 6 and prevents the formation of clumps of powder on the mobile closure member 6. Moreover, the second injection orifices 15 are blocked by the mobile closure member 6 in contact with the seat 5.

[84] In overpressure cases, the mobile closure member 6 is pushed back against the elastic return member 11, which opens the check valve 4 (Figure 6). The opening of the check valve 4 allows the passage of the gases to be pumped, frees the second injection orifices 15 to inject a purging gas onto the seat 5 and closes the first injection orifices 18.

5 [85] The injection of the purging gas is thus differentiated according to the position of the check valve 4, either to clean the bearing face of the seat 5 when the check valve 4 is open, or to clean the rear part 9 of the mobile closure member 6 when the check valve 4 is closed.

10 [86] Figure 7 shows a third exemplary embodiment in which the injection channel 10 is located in the stator part 12 (fixed) of the vacuum pump 1.

[87] The vacuum pump 1 comprises an injection channel 10 emerging through at least one injection orifice 15 configured to inject a purging gas onto the seat 5 of the check valve 4, in a direction tangential to a plane separating a planar bearing face of the seat 5 and a complementary planar surface of the mobile closure member 6, when the check valve 4 is in the open position. The injection of the purging gas in the tangential direction makes it possible to clean the bearing face of the seat 5 to ensure a tight closure of the check valve 4.

20 [88] The vacuum pump 1 can also comprise an injection channel 10 emerging through at least one injection orifice 15 configured to send a purging gas along the rod of the guiding element 13, which makes it possible to guarantee the guiding function of the mobile closure member 6 and of the elastic return member 11, if necessary.

[89] The vacuum pump 1 can also comprise an injection channel 10 emerging through at least one injection orifice 15 configured to inject a purging gas onto the mobile closure member 6, notably in the closed position, to prevent the accumulation of powders on the check valve 4. The injection of the purging gas can be performed in a direction at right angles or tangential to the surface of the rear part 19 of the mobile closure member 6.

25 [90] The injection of the purging gas can be continuous or targeted in time. The injection of the purging gas is, for example, controlled in a so-called "clean" phase or determined by predefined injection times.

30 [91] The at least one injection channel 10 can be configured to inject a swirling purging gas (Figure 8).

[92] The swirling effect of the gas can be obtained by the combination of a specific orientation of one or more injection orifice 15 and an at least partially circular or

cylindrical geometry of the stator part 12. The swirling purge gas makes it possible to improve the cleaning.

[93] The swirling gas can be injected onto the seat 5 of the check valve 4, in the direction tangential to the plane separating the planar bearing face of the seat 5 and the complementary planar surface of the mobile closure member 6 when the check valve 4 is in the open position. The swirling gas can also be injected around the guiding element 13 or onto the mobile closure member 6.

[94] Figure 9 shows a fourth exemplary embodiment.

[95] In this example for which the guiding element 13 comprises a rod cooperating with a guiding envelope 14 of the mobile closure member 6 to guide the axial translational displacement of the mobile closure member 6, the vacuum pump 1 comprises an injection channel 10 emerging through at least one injection orifice 15 configured to inject a purging gas along the rod of the guiding element 13. The rod and/or the guiding envelope 14 of the mobile closure member 6 has, for example, for that, a helical groove 20 communicating with the injection channel 10 for the guiding of the purging gas. This embodiment makes it possible to avoid deposits on the guiding surfaces of the check valve 4 which could hamper the mobility of the check valve 4. The injection of the purging gas makes it possible to ensure the easy sliding of the rod in the guiding envelope 14. The purging gas can be injected in the open and/or closed position of the check valve 4.

[96] Although Figures 2 to 9 show a mobile closure member 6 of generally cylindrical two-stage form and a planar seat 5, other embodiments are possible. In particular, the mobile closure member 6 can be spherical or partially spherical or have a tapered or partially tapered head and the seat 5 can be tapered. The mobile closure member can also have a generally planar form, such as a plate form and be displaced by pivoting between the open and closed positions of the check valve via rotational guiding elements of the mobile closure member.

[97] Figures 10 and 11 show another example of a mobile closure member 6 whose head 8 has a tapered flank 21 complementing a tapered seat 5 to block a passage 7 of the seat 5 in the closed position.

[98] In this example, the injection channel 10 emerges through at least one injection orifice 15 configured to inject a purging gas onto the tapered flank 21 of the head 8 of the mobile closure member 6 blocking the passage 7 in the closed position of the check valve 4. The

injection channel 10 is, for example, formed in the stator part 12 of the vacuum pump 1. The vacuum pump 1 comprises, for example, a single injection channel 10 emerging through a single injection orifice 15 configured to inject a significant flow rate (Figure 10) or the vacuum pump 1 comprises several smaller injection channels 10 configured to inject a purging gas onto opposing sides of the head 8 of the mobile closure member 6 (Figure 11).

[99] The injection channel 10 can be configured to inject a purging gas in a direction at right angles to the axial direction of displacement of the check valve (Figure 10) or in a direction at right angles to the tapered flank 21 of the head 8 of the mobile closure member 6 (Figure 11).