

Protection device against overpressure

The present invention relates to a device for the protection of an apparatus against an overpressure, which device is provided with a valve applied by means of a pneumatic force to an orifice communicating with the internal space of the apparatus, the valve being situated on the other side of the orifice with respect to said space.

Such a device is generally used for gas reservoirs under pressure which could be destroyed by an overpressure.

Such a protection device against overpressure with pneumatically operated valve is known from EP-A-0 027 227. The device described therein comprises a flexible closed space which is inflated to a suitable pressure and applied against the valve.

The invention has for its object to simplify considerably the realization of such a device, and also to improve its performance such that it can be used in an apparatus intended for carrying out chemical depositions from the vapour phase, for example, an epitaxy reactor. In this case, the space inside the apparatus is not normally subjected to high pressures, but specific problems arise. Highly toxic gases are used therein, which involves the necessity of providing washing and purification devices at the outlet and solid deposits are formed therein. These deposits are capable of clogging the gas outlet nozzles and consequently producing an overpressure in the reactor: such overpressures must be absolutely avoided, even if they are very low (the limit not to be exceeded is about 0.1 bar) and even if they are of short duration. Since the gas flowrate in the reactor is about 60 to 80 litres/min and the internal volume of the reactor is about one litre, an overpressure of 0.1 bar can be attained in one tenth of a second if the gas outlet is clogged.

A protection device for such an apparatus must therefore have the following properties:

- It operates in a reliable and reproducible manner, even for low

overpressures.

- Its action is very rapid.
- Its switching-on pressure is adjustable.
- The fact that the device has acted can be readily detected.
- 5 - Its gastightness is perfect and controllable.

All these properties are obtained according to the invention in that, for creating said pneumatic force, the device comprises a second orifice, which is situated at the same side of the valve as the first orifice and to which the valve is also applied, 10 in that sealing means prevent the first and second orifice from communicating with each other when the valve is applied, and in that the second orifice is connected to a closed space having a given pressure, while the other side of the valve is subjected to a pressure higher than that in said closed space having a given pressure.

When the valve starts to move away from its seat, it will also leave the 15 second orifice, and the pneumatic force will cease to exist: an immediate uncoupling of the valve is thus obtained in a very simple manner.

In an advantageous embodiment, the sealing means are constituted by two seals, one of which entirely surrounds the other, and the second orifice issues between the two seals.

20 The achievable triggering overpressure is suitable for an epitaxy reactor when the pressure of the closed space having a given pressure is adjustable between zero and atmospheric pressure while the other side of the valve is subjected to atmospheric pressure. The triggering overpressure itself is thus adjustable.

To prevent the gases present in the closed space from entering the 25 device, in the case of an epitaxy reactor, and depositing impurities there, a gas source advantageously issues into that one of the spaces delimited by the sealing means when the valve is applied into which the first orifice issues.

The detection of the fact that the device operates is extremely easy with such a device because it is sufficient that a pressure detector is connected to the space 30 into which the second orifice issues: when the device operates, the pressure in this space rises.

The following description with reference to the sole Figure describing a non-limitative embodiment of the invention will make the invention clearly understood.

The sole Figure is a sectional view through the centre of a device according to the invention made in the form of a cylinder.

The valve could be applied directly to the outer wall of an apparatus to be protected. Nevertheless, in order to obtain a greater commodity of use, it is
5 preferred to manufacture a distinct device.

This device comprises a cylindrical body made of a base plate 1 and a cover 3. At the centre of the base plate, a tube 9 intended to be connected to the space to be protected is secured by soldering; in the present case, it is connected to the gas outlet tube of an epitaxy reactor. At the centre of the cover 3, a tube 8 communicating
10 with the free outer space is secured by soldering. The cover is fixed to the base plate by means of bolts 11.

The device is preferably used in the position shown, in which the tube 9 is turned upwards.

The tube 9 issues into a space 14 constituted by a circular cavity
15 provided in the lower surface of the base plate (the internal surface of the device) surrounded by another annular cavity 13 also provided in the base plate. The valve 2 constituted by a flat circular plate is applied to these two cavities simultaneously. The rib 15 situated between the two cavities does not touch the valve so that a narrow passage is left between the cavities when the valve is applied. The assembly of the two
20 cavities 13, 14 in communication with the space to be protected constitutes what has thus far been designated as "the orifice communicating with the internal space of the apparatus".

The lower surface of the base plate and the outer side of the two cavities 13, 14 are provided with two concentric recesses each receiving a sealing means, i.e.
25 a respective toroidal seal 4, 5. Due to the fact that it is applied to these seals, the valve limits two concentric spaces: the sealing means prevent the two orifices from communicating with each other when the valve is applied. The internal space limited by the seal 5 comprises the orifice communicating with the internal space of the apparatus, while between the two seals 4, 5 the valve is applied to a second orifice 7 provided with
30 a screwthread for connecting to it a tube communicating with a closed space having a given pressure. This space (not shown) is a vacuum reservoir whose pressure is adjustable between atmospheric pressure and a primary vacuum. Therefore, the underpressure between the two seals 4, 5 applies the valve to its seat, while an

overpressure in the tube 9 and the volumes 13, 14 tends to remove it therefrom. The area between the two seals 4, 5 is about equal to one tenth of that surrounded by the internal seal 5 and the underpressure in the vacuum reservoir is usually fixed at half the atmospheric pressure: thus, the forces exerted by the pressure and the vacuum on each of the areas are about equal to each other when the overpressure in the tube 9 is equal to 0.05 bar. The valve is then detached from the base plate 1 and drops under its own weight; it is withheld by bolt heads 10 so that a narrow passage is left between the valve and the cover 3 for the evacuation of the gas at overpressure through the tube 8.

The function of the subdivision of the orifice communicating with the reactor into two cavities 13, 14 is as follows: an orifice 12 provided with a screwthread for connecting to it a tube connected to a gas source issues into the external cavity 13. Through this orifice a very small flow of a so-called sweeping gas, for example, nitrogen, is conducted, which passes between the rib 15 and the valve 2 and then passes towards the reactor through the tube 9 so as to prevent the gas contained in the space of the reactor from penetrating into the device and from depositing contaminations therein.

In order to attract the attention of an operator operating the reactor when an excess pressure has been produced, a pressure sensor is connected to the space which, when the valve is applied, is defined by the two seals 4 and 5, into which space the second orifice 7 issues. The sensor is connected to this space, for example via another orifice (not shown) identical to the orifice 7 and situated elsewhere in the ring defined by the seals 4, 5. When the valve descends, this space is opened on the outside and the vacuum condition cannot be maintained therein. Said sensor then triggers an alarm.

It should be noted that the gastightness of the device is ensured by the fact that, if there were a leakage via the seal 5, the gas would leak away to the vacuum reservoir and not to the outside. Moreover, the vacuum in this reservoir is preferably static, that is to say that after an initial pumping, the pump is disconnected and the vacuum is maintained due to the fact that the space between the seals 4 and 5 is closed. Now, if there were a leakage via the seal 5, the vacuum would be destroyed and the system would be switched on and would consequently give an alarm.

CLAIMS:

1. A device for protection of an apparatus against an overpressure provided with a valve (2) applied by means of a pneumatic force to an orifice (13, 14) communicating with the internal space (9) of the apparatus, the valve being situated on the other side of the orifice with respect to said space, characterized in that, for creating
5 said pneumatic force, the device comprises a second orifice (7), which is situated at the same side of the valve as the first orifice and to which the valve is also applied, in that sealing means (5) prevent the two orifices from communicating with each other when the valve is applied, and in that the second orifice is connected to a closed space having a given pressure, while the other side of the valve is subjected to a pressure higher than
10 that in said closed space having a given pressure.
2. A device as claimed in Claim 1, characterized in that the sealing means are constituted by two seals (4, 5), one (4) of which entirely surrounds the other (5), and in that the second orifice (7) issues between the two seals.
3. A device as claimed in any one of Claims 1 and 2, characterized in that
15 the pressure of said closed space having a given pressure is adjustable between zero and atmospheric pressure, while the other side of the valve is subjected substantially to atmospheric pressure.
4. A device as claimed in any one of the preceding Claims, characterized in that a gas source (12) issues into that one (13) of the spaces delimited by the sealing
20 means when the valve is applied which is in communication with the internal space (9) of the apparatus.
5. A device as claimed in any one of the preceding Claims, characterized in that a pressure sensor is connected that one of the spaces delimited by the sealing means when the valve is applied into which the second orifice (7) issues.