connected centrally to the arm in order to avoid tilting, must be built relatively robust.

Various embodiments~~The object of the invention is~~ therefore seek to solve the above- described problems and to provide a valve of the type stated in the introduction which is built as simply and compactly as possible and is also capable of withstanding bilaterally acting, high pressure loads, and which is distinguished by low seal wear, even in the face of high differential pressures and pressure fluctuations.

~~This object is achieved by the realization of the characterizing features of the independent patent claims. Features which refine the invention in an alternative or advantageous manner can be gleaned from the dependent patent claims.~~

The ~~invention~~disclosure is based on providing an at least two-part valve disk having an outer disk portion and an inner disk portion and on designing both disk portions such that they form a radial seal. The outer disk portion can be brought into contact with the valve seat of the valve housing via a radially acting main seal. Although such a radial seal offers substantially no axial support, so that another element must attend to the axial support, axial forces do not therefore act upon the seal, whereby the seal is protected. An inner disk portion disposed within the outer disk portion is mounted such that it is axially movable relative to the outer disk portion in a sealing - in particular gas-sealing - manner, wherein a radially acting supplementary seal is provided between the disk portions. In the closed setting of the valve, a pressure differential at the valve disk acts substantially upon the movable inner disk portion, and the inner disk portion is supported, substantially decoupled from

the outer disk portion, directly or indirectly on the valve housing. Through the use of two radial seals, which seal radially in a direction perpendicular to the acting differential pressure force, both radial seals remain unstressed by the prevailing differential pressure, whereby the working life of the seals is increased. Moreover, neither the prevailing differential pressure, nor a contact pressing force, acts upon the drive of the valve disk, so that neither the drive, nor the connection between the drive and the outer disk portion, is exposed to high forces. This enables a compact and simple structure of the valve with relatively few component parts.

According to an aspect, there is provided a valve for the substantially gastight interruption of a flow path, comprising: a valve housing having a first wall, which wall has a first opening for the flow path, said opening having a geometric opening axis and a valve seat, enclosing the first opening, on a first side of the valve housing, a valve disk having an, in particular, ring-like or frame-like outer disk portion, and a closed inner disk portion, which is mounted in a seal tight manner such that it is linearly movable within the outer disk portion in a direction parallel to the opening axis relative to the outer disk portion between a retracted setting and an extended setting, at least one drive, which is connected to the outer disk portion and which is configured such that the valve disk is pivotable or displaceable between an open setting, in which the valve disk is positioned in a retention portion disposed beside the first opening and frees the first opening and the flow path, and an intermediate setting, in which the valve disk is positioned over the first opening and covers the apertural cross section of the first opening, by means of a transverse motion made substantially transverse to the opening axis, and is displaceable between the intermediate setting and a closed setting, in which a

gastight contact, which closes the first opening in a gastight manner and interrupts the flow path, exists between the outer disk portion and the valve seat, by means of a longitudinal motion made parallel to the opening axis, wherein, in the closed setting, a pressure differential at the valve disk acts substantially upon the movable inner disk portion and the inner disk portion is supported in a direction parallel to the opening axis, substantially decoupled from the outer disk portion, directly or indirectly on the valve housing, wherein the valve seat has a first inner face, which points radially inward and runs parallel to the opening axis, the outer disk portion has a first outer face, which points radially outward and runs parallel to the opening axis and which is arranged and configured such that in the closed setting, via an intervening first seal, there exists a radially sealing, contact with the first inner face, the outer disk portion has a second inner face, which points radially inward and runs parallel to the opening axis, and the inner disk portion has a second outer face, which points radially outward and runs parallel to the opening axis and which is arranged and configured such that, via an intervening second seal, a radially sealing contact with the second inner face exists in the region between the retracted setting and the extended setting.

The valve according to the ~~invention~~disclosure for the substantially gastight interruption of a flow path comprises a valve housing having a first wall, which wall has a first opening for the flow path. The first opening has a geometric opening axis and a valve seat which encloses the first opening. In other words, the valve seat surrounds the first opening. The first opening and the valve seat are located on a first side of the valve housing. For instance, the first side is that side on which a vacuum pump for evacuating a vacuum chamber is connected, while the second side of the

valve housing leads to the vacuum chamber. Of course, other applications or arrangements are also possible. The first opening has, for instance, a circular or oval cross section or a rectangular cross section with rounded corners. The geometric opening axis is, in particular, the center axis of the first opening and is defined, for instance, by the longitudinal course of the opening, by the course of a connection disposed on the opening, by the connecting line to a possible second opening of the valve housing, or by the surface area of the valve seat. By a valve seat should be understood, in general, functional terms, a portion in the first wall which acts as a

sealing surface and on which a further face acting as the sealing surface can come to rest. The valve housing can also be formed by the wall alone. The flow path is the regular, blockable flow path of a gaseous or liquid medium through the first opening, where necessary a second opening, and the valve.

Moreover, the valve comprises a valve disk by means of which the first opening can be closed off and reopened. The valve disk possesses, for instance, a round, oval or rectangular cross section. The dimensioning of the valve disk enables the first opening to be closed off by overlapping and mounting onto the first opening and its valve seat. The valve disk is of at least two-part configuration and is divided into two components, namely an outer disk portion and an inner disk portion, which are axially movable relative to one another within a motional range.

If, within the scope of the ~~invention~~disclosure, radial and axial directions and sealing effects are mentioned, this refers in general to directions substantially perpendicular or transverse to the geometric opening axis or substantially parallel to the opening axis. All directions or straight lines which lie substantially on a plane to which the opening axis forms a geometric normal should be construed as radial directions or straight lines, even if they do not point directly at or away from the opening axis or intersect the opening axis, but run, for instance, askance thereto. By contrast, all directions or straight lines which run substantially parallel to the opening axis should be construed as axial directions or straight lines. The term "radial" thus refers not only to a circular cross section of the opening or of the valve disk, inclusive of the respective portions, but also to other, for instance rectangular cross

The ~~invention~~disclosure further provides that the valve seat has a first inner face, which points radially inward and runs parallel to the opening axis. The outer disk portion has a first outer face, which points radially outward and runs parallel to the opening axis. This first outer face and this first inner face are arranged and configured such that in the closed setting, via an intervening first seal, a radially sealing contact exists between the first inner face and the first outer face. As a result of this radially sealing contact between the outer disk portion and the valve seat, the gastight closure is realized merely by displacement of the outer disk portion, with its first outer face, into the region within the first inner face of the valve seat, so that the first inner face of the valve seat encloses the first outer face of the outer disk portion and the intervening first seal produces the gastight joint. The gastight contact thus continues to be ensured for as long as the first outer face of the outer disk portion is located within the first inner face of the valve seat with an intervening first seal, wherein a slight relative axial displacement does not impair the gastight joint between the outer disk portion and the valve seat. The first seal can also functionally be formed by a correspondingly sealtight guidance of the first outer face in the first inner face.

Since neither substantial differential pressure forces act upon the outer disk portion, nor a high contact pressure upon the valve seat has to be maintained, the drive and the mounting of the valve disk absorb no large forces and can be dimensioned accordingly. In particular, the outer disk portion can be connected to the at least one drive by an arm arranged in such a way on the side of the outer disk portion and extending in such a way perpendicular to the opening axis

that the arm, in the closed setting, is located outside the apertural cross section, geometrically projected along the opening axis, of the first opening. In other words, an, in particular star-shaped strut arrangement, which is disposed on the rear of the valve disk and connects the outer disk portion to the drive in a central region lying close to the center axis of the first opening, as required by the prior art, can now be dispensed with, since no large forces need to be absorbed by the drive arm. The ~~invention~~disclosure provides that the drive arm is merely disposed on the side of the outer disk portion.

Preferably, the first seal is fixed on the first outer face of the outer disk portion in order to produce the radially sealing contact with the first inner face of the valve seat. This has the advantage that the first seal, when the valve is fully open, is outside the flow region and is thus broadly protected from contaminations generated by the medium and flowing through the valve. Alternatively, it is also a possibility, however, that the first seal is fixed on the first inner face of the valve seat in order to create the radially sealing contact with the first outer face of the outer face of the outer disk portion. It is also possible for the first seal to be arranged on both portions. The first seal is formed, in particular, by an O-Ring, held, for instance, in a groove, or by a vulcanized-on seal.

In one refinement of the ~~invention~~disclosure, the outer disk portion is of annular configuration, wherein the inner disk portion has the form of a closed circular disk, in particular having lateral flanks in the form of a cylindrical shell surface on which the second outer face is disposed. Preferably, in this or a general embodiment, the first inner face and the first outer face, and/or the second inner face and the second outer

face, are geometric circular-cylindrical shell surfaces. Alternatively, the possibility exists that these are in the form of general cylindrical shell surfaces extending parallel to the opening axis, wherein the base line can also, instead of a circular shape, have an oval, polygonal or other shape. In particular, the valve is a shuttle valve, wherein the drive is preferably configured such that the valve disk is pivotable by means of the transverse motion substantially parallelly over the cross section of the first opening and perpendicularly to the opening axis. It is also possible, however, for the valve to be a slide valve or a transfer valve, for example of the L-type.

As is represented, in the closed setting a pressure differential at the valve disk acts substantially upon the movable inner disk portion, wherein the inner disk portion is supported in a direction parallel to the opening axis, substantially decoupled from the outer disk portion, directly or indirectly on the valve housing. In one refinement of the ~~invention~~disclosure, the inner disk portion is supported indirectly via the outer disk portion in one direction on the valve housing. Preferably, to this end, a first bearing surface, which in particular encloses the first opening, is shaped out on the first wall. This first bearing surface and the outer disk portion are arranged and configured such that, in the closed setting of the valve disk, the outer disk portion rests on the first bearing surface. To this end, on the outer disk portion is provided a first face, which in the intermediate setting lies remotely opposite the first bearing surface and in the closed setting rests on the first bearing surface in the direction of the first side. The first bearing surface of the first wall and the first face of the outer disk portion have mutually corresponding shapes, in particular they respectively have a ring shape. In one refinement, the first

bearing surface is configured as an offset in the first opening, which offset adjoins the first inner face of the valve seat and runs substantially perpendicular to the opening axis. This first bearing surface serves, on the one hand, as a travel limitation for the drive so as to bring the outer disk portion into a defined closed setting, while, on the other hand, it can additionally serve as an indirect supporting surface for the inner disk portion.

One refinement of the ~~invention~~disclosure provides that a stop is provided between the outer disk portion and the inner disk portion in order to limit the relative linear mobility of the inner disk portion in the direction of the first side and of the first opening. This stop is arranged such that in the closed setting the inner disk portion, when relative underpressure prevails on the first side of the first opening, rests in the retracted setting on the outer disk portion. For instance, the stop is configured as a shoulder of the inner disk portion, which shoulder extends radially outward from the second outer face. Given relative underpressure on the first opening, it is thus possible for the inner disk portion to be supported by the stop on the outer disk portion and for the latter, in turn, to be supported by its first face on the first bearing surface. The drive, the drive arm and the two seals remain in this case substantially unstressed.

According to one ~~inventive~~disclosed refinement, the valve housing has on a second side situated remotely opposite the first side a second wall. In this second wall, in remote, substantially parallel opposition to the first wall and to the first opening, a second opening for the flow path is shaped out. This second opening has a second opening axis, which preferably corresponds to the opening axis of the first

opening. On the second wall is found a second bearing surface, which encloses, in particular, the second opening and lies opposite, in particular, the first bearing surface at a parallel distance apart. The second bearing surface and the inner disk portion, in order to limit the relative linear mobility of the inner disk portion in the direction of the second side and of the second opening, are arranged and configured such that in the closed setting the inner disk portion, when relative underpressure prevails on the second side of the second opening, rests in the extended setting with a second face in the direction of the second side on the second bearing surface. In other words, the distance apart and location of the second bearing surface on the second wall and of the second face on the inner disk portion are such that the inner disk portion is supported with its second face in the direction of the second side on the second bearing surface as soon as, in the closed setting of the valve disk, relative underpressure prevails on the second side of the second opening. This setting in which the inner disk portion is found when resting on the second bearing surface is the extended setting of the inner disk portion. In one possible embodiment of the ~~invention~~disclosure, the second face of the inner disk portion is disposed on a shoulder extending radially outward from the second outer face. In particular, the shoulder in question is that shoulder which also serves as said stop of the inner disk portion.

A fundamental requirement of a vacuum valve used in a production process for semiconductors is the avoidance of friction particles. Depending on the field of application of the valve, it can be fundamentally important that no metal to metal contact occurs in the opening and closing of the valve. The inner disk portion, which in the extended setting rests on the second bearing surface, should therefore, prior to the

transversely directed adjustment of the valve disk from the intermediate setting into the open setting, be brought back into the retracted setting, in order that a frictional contact of the inner disk portion on the second bearing surface of the second wall during the transverse adjustment of the valve disk between the intermediate setting and the open setting is avoided. This can be realized, for example, by the use of a spring, which acts between the inner and the outer disk portion and holds the inner disk portion in the unloaded state in the retracted setting. A spring arrangement of this type is known from the closest prior art. A drawback of such a spring arrangement consists in the fact that the complexity of the structure of the valve disk further increases and the springs make cleaning of the valve more difficult. Furthermore, the use of springs increases the risk of particle generation. Instead of springs, other elastically working elements, which act between the inner and outer disk portion and exert a force in the direction of the retracted setting, can also therefore be used according to the ~~invention~~disclosure.

Preferably, the use of such elastic elements between the inner and outer disk portion is wholly dispensed with, however. To this end, the ~~invention~~disclosure provides, in particular, that, prior to adjustment of the valve disk from the closed setting into the open setting, a relative underpressure on the first side of the first opening is applied to the valve, so that the inner disk portion is moved from the, where necessary, adopted extended setting, or an intermediate setting, into the retracted setting. Alternatively, on the second side, a relative overpressure is applied. If the creation of such pressure ratios prior to the opening of the valve is not possible, however, the ~~invention~~disclosure alternatively provides that a guide is provided in the valve housing, which

guide is arranged in the valve housing such that, when the valve disk is pivoted in the transverse direction from the intermediate setting into the open setting, the inner disk portion is guided into the retracted setting.

In a preferred, advantageous refinement of the ~~invention~~disclosure, the drive is used to return the inner disk portion into the retracted setting. To this end, the at least one drive is configured such that the valve disk is both pivotable or displaceable between the open setting and the intermediate setting by means of the transverse motion, and is displaceable between the intermediate setting, the closed setting and an initialization setting by means of the longitudinal motion. In the initialization setting, the distance of the outer disk portion from the second wall is reduced such that the inner disk portion rests with its second face on the second bearing surface and is pushed - in particular fully - into the retracted setting. The intermediate setting lies between the closed setting and the initialization setting, wherein the initialization setting lies on the second side, i.e. the side of the second opening, and the closed setting lies on the first side, i.e. the side of the first opening.

For the automation of the collision-free closing and opening process, the ~~invention~~disclosure provides that the valve has a control system, which is configured such that and is connected, in particular control-connected, to the drive such that the valve disk, for the gastight interruption of the flow path, is adjustable by means of the transverse motion of the drive from the open setting into the intermediate setting and by means of the longitudinal motion of the drive from the intermediate setting into the closed setting. Moreover, the control system is configured such that and is connected, in

particular control-connected, to the drive such that the valve disk, for the complete opening of the flow path, is adjustable by means of the longitudinal motion of the drive from the closed setting into the initialization setting, and subsequently into the intermediate setting, and by means of the transverse motion of the drive from the intermediate setting into the open setting. Prior to the opening of the valve, the inner disk portion can thus be in an optional setting between the retracted setting and the extended setting, since, by the adjustment of the valve disk from the closed setting into the initialization setting, the inner disk portion is pushed - in particular fully - into the retracted setting. A frictional contact or a collision between the inner disk portion and the valve housing, in particular the second bearing surface, and a resulting particle generation, are thus avoided. Depending on the drive which is used, the control system can be constituted by an electronic, electrical, mechanical, pneumatic, hydraulic or other control system, wherein a suitable transmission should also be construed as a control system. In particular, the control system is constituted by an electronic control system, which is in appropriate electrical signal connection with the electric drive.

The valve according to the ~~invention~~disclosure is described in greater detail below, purely by way of example, on the basis of concrete illustrative embodiments represented schematically in the drawings.

More specifically,

figure 1 shows an oblique view of a valve according to the invention in the intermediate setting;