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MOUNTING OF A VALVE PLATE ON A VALVE ROD

The invention is with reference to the suspension of a valve plate at a valve rod by means of a cross bar that extends at right angles to the valve rod, and that is connected to the valve rod at a central junction, and that is connected to the valve plate at, at least, two lateral junctions lying on both sides of the central junction, and that, in a central section, comprising the central junction and the adjacent sections of the cross bar on both sides, lies at a distance from the valve plate. The invention is also in connection with a vacuum valve with this type of suspension.

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A suspension of the type mentioned initially emanates from the exemplary embodiment according to Figures 3 – 5 in US 6,471,181 B2. A cross bow that is to be connected to the valve rod comprises a first plate that has a conical opening with which to receive the end of the valve rod that is to be fitted to the first plate. Elastic bearing blocks are placed at the first plate on both sides of the central junction with the valve rod, a second plate being placed opposite the first plate of the elastic bearing blocks, both plates being respectively screwed to the valve plate. Cylindrical load transmission elements are, for example, embedded in the elastic bearing blocks. The elastic bearing blocks and embedded load transmission elements facilitate tilting at an axis lying at right angles to the valve rod, due to which even contact pressure is achieved with the valve plate at the valve seat.

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This type of pivoting of the valve plate about an axis lying at right angles to the valve rod is an advantage, particularly in the case of such vacuum valves in which a closing pressure is exerted through a freely overhanging section of the valve rod on the valve plate with which the valve plate is pressed on to the

5 valve seat. Closing force transmitted via the valve rod results in a certain bending of the valve rod, whereby a parallel arrangement of the valve plate is achieved vis-à-vis the valve seat through a corresponding swivelling (for example, in the range of 0.5°) of the valve plate vis-à-vis the valve rod and the seal located at the valve plate or even at the valve seat is loaded evenly.

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Such vacuum valves with freely overhanging valve rods are established in various designs, such as for example in the shape of L valves. Such freely overhanging valve rods are present even in the case of so-called pendulum valves, in the case of which, the valve rod is swivelled at an axis that is, for example, at right angles to the valve rod, to displace the valve plate from its position in which the valve opening is released to its position in which the valve opening is covered but lifted from the valve seat.

L valves emanate, for example, from US 6,431 518 B1, US 6,416,047 B1, US 6,966,538 B2, US 5,641,149 A and the as yet not pre-published German patent application DE 10 2008 049 353.8.

A vacuum valve in which a valve plate is connected to first and second cross bars is, furthermore, established in US 2008/0066811 A1. The first piston-cylinder unit serves to displace the valve plate along its plane in order to move the same from a position that releases the valve opening to a position in which the valve opening is covered but not yet lifted from the valve seat. A valve lifter that works together with the lateral ends of the cross bar and that is driven by a second piston-cylinder unit serves to exert contact pressure at the valve seat.

30 The cross bars are connected by the connecting link to the valve plate. The connecting links exhibit connecting arms at both sides in the longitudinal direction from a junction with the cross bar, said connecting arms being

5 connected at their ends to a common connecting bracket which extends in the longitudinal direction of the cross bar, said connecting bracket being screwed at several places in the longitudinal direction of the cross bar that are distanced from one another. A more even load transmission is sought to be achieved, thereby, in the longitudinal direction of the cross bars.

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The objective of the invention is to provide a simply designed suspension of the type mentioned initially with which a certain swivelling of the valve plate, for example, in the range of 1° , is facilitated vis-à-vis the valve rod about a swivel axis that is at right angles to the valve rod. This is achieved, in accordance
15 with the invention, by a suspension with the characteristics of Claim 1.

In the case of the suspension of the invention, the swivelling capacity of the valve plate vis-à-vis the valve rod about a swivel axis that is at right angles to the valve rod is made possible by the twisting (torsion) of the cross bar, as a
20 result of which a very simple design is achieved. The cross bar can preferably be designed completely from metal e.g., one material piece. Intermediate elements of elastomer material could be advantageously omitted.

In an advantageous embodiment of the invention, a torque that acts upon the
25 cross bar about the swivel axis and amounts to 80Nm twists the valve plate vis-à-vis the valve rod by at least 0.2° , preferably at least 0.3° , by twisting the cross bar.

The cross bar can be designed to be straight in a possible embodiment,
30 whereby the same extends parallel to the swivel axis. It can also have segments that run inclined to the swivel axis in another embodiment.

- 5 Expansion in the direction of the swivel axis here is considerably greater than in the direction parallel to the valve rod or in the direction that is right-angled to the swivel axis and right-angled to the valve rod. It's expansion in a direction that is parallel to the valve rod is, advantageously, 5 times greater than that in a direction which is at right angles to this.

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Other advantages and details of the invention are explained below by means of the accompanying drawings.

Figure 1 presents a valve plate suspended at a valve rod in a manner that is in
15 accordance with the invention.

Figure 2 is a bottom view of this part (viewing direction A in Figure 1).

Figure 3 is a magnified section B of Figure 2.

Figure 4 presents a section along line CC in Figure 1.

Figure 5 presents a section along line DD in Figure 1.

20 Figure 6 is a diagonal and magnified presentation.

Figure 7 is a schematic, sectional illustration an L valve in which the suspension in Figures 1 to 6 can be used.

Figure 8 presents a section along line EE of Figure 7.

Figure 9 is a view of another possible embodiment of an L valve with a
25 suspension corresponding to Figures 1 to 6.

Figure 10 presents a section along line FF in Figure 9.

Figure 11 is an enlargement of G of Figure 10.

Figure 12 is a diagonal view of this vacuum valve.

- 5 Figure 13 is a diagonal view of the valve gear of this vacuum valve with the valve rod.

Figure 14 is a magnified diagonal view of a valve gear of this vacuum valve with the valve rod.

- 10 Figure 15, 16 and 17 present a side view, view and bottom view respectively of a valve plate suspended at a valve rod in a manner that is in accordance with the invention according to a second embodiment of the invention.

Figure 18 presents a section along line HH in Figure 16.

Figure 19 is an enlargement of I in Figure 17.

Figure 20 is an enlargement of J in Figure 17.

- 15 Figure 21 is a view of the valve plate with a cross bar that is shaped as a single piece at the valve plate, an end section of a valve rod and a connecting screw in accordance with a third embodiment of the invention.

Figures 22 and 23 present a diagonal view of the valve plate with a top view of the cross bow formed at it.

- 20 Analogous parts in the various figure are furnished with the same reference numbers.

A first embodiment of a suspension, in accordance with the invention, of a valve plate 1 at a valve rod 2 is presented in Figures 1 to 6. Suspension takes
25 place through a cross bar 3 that is rigidly connected at a central junction 4 to the valve rod 2 and that is rigidly connected to the valve plate 1 at junctions 5, 6 lying laterally on both sides of the central junction. Connection of the valve plate 1 to the valve rod 2 takes place immediately and directly respectively i.e., the cross bar 3 is adjacent to the central junction 4 at the valve rod 2 and at the
30 lateral junctions 5, 6 at the valve plate.

- 5 Connecting screws 7, 8 and 9 are used to effect connection to the valve rod 2 as well as connections to the valve plate 1 in this embodiment.

The cross bar 3 has an attachment piece 10 into which the end section of valve rod 2 can be inserted in order to effect a connection with valve rod 2. Valve rod 2 is furnished with a threaded hole 11 at the front side into which connecting screw 7 can be screwed and which can be inserted through a through-bore 12 that has a sufficient receiving opening. The valve rod 2 is preferably secured against swivelling in the receiving opening of attachment piece 10.

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Through-bores 13, 14 through which connecting screws 8, 9 extend, are designed in the lateral end sections of cross bar 3 in the embodiment to enable connection to the valve plate 1. Connecting screws 8, 9 are, furthermore, screwed into threaded holes 15, 16 of the valve plate.

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The cross bar 3 is distanced from valve plate 1 in a central section 17 of the cross bar 3 that extends across the area of junction 4 and across laterally adjacent sections up to projections 18 that are designed in the area of the lateral junctions 5, 6. This distance (the dimension of which can vary) is indicated by way of example at one place in Figure 3. The lateral ends of the cross bar 3 with junctions 5, 6 are angled in the embodiment presented. Other designs are also possible such as, for example, straight ends (compare with embodiment according to Figures 15 to 20, described later) are conceivable and feasible.

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5 An acting torque swivels valve plate 1 about an imaginary swivel axis 19, for example in the range of $\pm 1^\circ$. The swivel axis 19 lies at right angles to the longitudinal axis 20 of the valve rod 20 and parallel to the principle plane of the valve plate 1. This type of torque that acts at the swivel axis 19 results when the valve plate 1 is pressed against a valve seat by means of the valve rod 2
10 and the valve rod 2 is bent as a result. The pivoting about the swivel axis 19 takes place in this connection by a torsion of cross bar 3. For example, torque of up to 80Nm exerted at the swivel axis 19 can cause swivelling of valve plate 1 vis-à-vis the valve rod 2 at swivel axis 19 by a swivel angle of 0.4° .

15 Swivelling of the valve plate 1 vis-à-vis the valve rod 2 at swivel axis 19 is thus made possible by the elasticity of the material of which the cross bar 3 is composed. The cross bar 3 is preferably composed of metal here.

Swivelling of valve plate 1 of at least 0.5° about swivel axis 19, preferably at
20 least 1° , is possible starting from the zero position in which no external forces can act upon valve plate 1 vis-à-vis valve rod 2, whereby the valve plate is placed back in the zero position once acting external forces are terminated. Swivelling, at least in this range, thus takes place through an elastic deformation of cross bar 3.

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The swivel angle that occurs, starting from the zero position in which no external forces act upon the valve plate 1 vis-à-vis the valve rod 2, is in practice less than 3° , most often less than 1° .

30 The cross bar presented in the embodiment is designed as one material piece i.e., it does not consist of several - for example, material-fit - interconnected

5 parts. A design composed of several - for example, material-fit - interconnected parts is, however, conceivable and feasible.

Connecting screw 7 through which cross bar 3 in the embodiment presented is connected to valve rod 2, lies parallel to the longitudinal axis 20 of the valve rod 2 and at right angles to the swivel axis 19. Connecting screws 8, 9, through which the cross bar 3 in the embodiment presented is connected to valve plate 1, are at right angles to the plane of the valve plate 1 and at right angles to the swivel axis 19.

15 An elastic seal 26 is located at valve plate 1 in order to seal valve plate 1 vis-à-vis a valve seat. This valve can, for example, be an O-ring inserted in a groove or a vulcanised seal placed at valve plate 1. An elastic seal could, on the other hand, also be placed at the valve seat and the valve plate 1 could be furnished with a sealing surface that would work together with the elastic seal.

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A central line 60 of the valve plate 1 lying parallel to swivel axis 19, is, furthermore, sketched in Figure 1. The central line 60 extends in dead centre between the two positions at which the elastic seal 26 intersects with the longitudinal axis 20 of the valve rod 2 (these are the two intersecting points of the elastic seal 26 shown in Figure 4). If the elastic seal 26 has two sections that run parallel to swivel axis 19 and to the central line 60 as in the embodiment (said sections being connected at the edge through connecting sections) then the central line 60 will lie between these two sections when the viewing direction is onto the valve plate.

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5 The swivel axis 19 is preferably distanced from this central line 60 of valve plate 1 that lies parallel to the swivel axis 19. Distance b is sketched in Figure 1. This distance b preferably amounts to at least one-fifth the distance between the two intersecting points of elastic seal 26 with the longitudinal axis 20 of the valve rod 2. Swivel axis 19 is hereby distanced in one direction from
10 the central line 60, that is opposite the direction in which the valve rod projects from cross bar 3.

(A more even compression under pressure of the elastic seal 26 can be achieved in a closed state due to this distance between swivel axis 19 from the
15 central line 60. Distance b can be dimensioned in such a manner that an approximately equal pressing force acts on sections of the seal 26 that lie on both opposite sides of the central line 60 when valve plate 1 is pressed against the valve seat (pressing forces vary preferably by less than 20%).

20 In case the seal 26 is located at the valve seat and the sealing surface that interacts with it is located at the valve plate 1, then what has been said before in connection with the seal that interacts with the respective sections of the
(sealing surface when the valve is closed regarding the position of the central line 60 applies.

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Swivel axis 19 in the embodiment extends through the central section of cross bar 3 that is distanced from valve plate 1.

A possible design of the vacuum valve in which a suspension in accordance
30 with the invention is used is schematically presented in Figures 7 and 8,

5 whereby Figure 8 presents the opened and Figure 7 the closed state of the vacuum valve.

Starting from an open position (Figure 8) in which valve plate 1 releases a valve opening 22 located in wall 21, valve plate 1 can be moved by means of a first piston-cylinder unit 23 to an intermediate position in which it covers valve opening 22 but in which it is still lifted from the valve seat 24 surrounding valve opening 22. Valve rod 2 is moved in an axial manner i.e. valve plate 1 is displaced in its principle plane when moving the valve plate 1 from its open position to its intermediate position. Valve rod 2 is connected to piston 25 of the first piston-cylinder unit 23 and can thus be regarded as the piston rod of the first piston-cylinder unit 23.

A second piston-cylinder unit 27 serves to move valve plate 1 from its intermediate position to its closed position in which it is pressed against valve seat 24 (this could also be located at valve seat 24) and in which a seal 26, located at the valve plate 1, seals the valve opening 22. This second piston-cylinder unit 27 is connected to cylinder 28 of the first piston-cylinder unit 23 which pivots around axis 29. Piston 30 of the second piston-cylinder unit 27 supports itself at the transmission housing 31 (which is rigidly connected to wall 21) in order to pivot cylinder 28 at axis 29.

An elastic seal 59 located between cylinder 28 and the valve casing 33 serves to seal cylinder 28 of the first piston-cylinder unit 23. Valve rod 2 is, furthermore, led out, sealed, from cylinder 28 (the seals are not illustrated here in order to simplify matters). A bellow-type seal, for example, that is connected sealed to the valve casing 33 on one side and connected sealed to the valve rod 2 on the other side, could also be provided instead.

5 Piston 30 is pulled in to open the vacuum valve, whereby a spring 32 swings cylinder 28 back and moves the valve plate 1 from its closed position to its intermediate position. Valve plate 1 is, subsequently, moved to its open position by means of the first piston-cylinder unit 23.

10 Wall 21 in this embodiment represents a part of a valve casing 33 to which the transmission housing 31 is rigidly connected. Wall 21 could also be a part of a vacuum chamber in another embodiment, whereby valve opening 22 is formed by an opening of the vacuum chamber. Valve casing 33 could, furthermore, also be a type of insert in which case wall 21 will be inserted into the vacuum
(area of a vacuum chamber. This type of design also emerges in the other
15 embodiment for a vacuum valve described below with a suspension of the valve plate at the valve rod in accordance with the invention.

20 This other embodiment is presented in Figures 9 to 14. Valve casing 33 is designed as an insert here for installation in a vacuum chamber 34 that is only presented with a dotted line.

(A transmission housing 31 that has actuators with which to open and close the vacuum valve, is rigidly fixed to valve casing 33.

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Valve plate 1 is, again, moved from an open position in which it releases valve opening 22 through an intermediate position in which it covers the valve opening 22 but is lifted from the valve seat 24 surrounding the valve opening 22, into a closed position in which elastic seal 26, located at the valve plate, is
30 pressed against the sealing surface provided at the valve seat 24. Seal 26 could also be located at valve seat 24 and the sealing surface at valve plate 1.

5 The first piston-cylinder unit with piston 25 is used to move valve plate 1 in its axial direction 36 from its open position to its intermediate position by moving valve rod 2 at which valve plate 1 is suspended in accordance with the invention. The first piston-cylinder unit is connected to valve rod 2 by a brace 35. Cylinder spaces for piston 25 are located in bearing unit 37. Cylinder
10 cover 58 closes the cylinder spaces for piston 25.

Bearing unit 37 is supported in such a manner vis-à-vis the transmission housing 31 that it can be moved in and against direction 38 that lies at right angles to the axial direction 36 of valve rod 2 and parallel to axis 39 of valve
15 opening 22. Bearing unit 37 also guides valve rod 2 in and against axial direction 36.

Moving valve plate 1 from its intermediate position to its closed position takes place by moving the bearing unit 37 in direction 38 vis-à-vis transmission
20 housing 31. Springs 40 located between bearing unit 37 and the transmission housing 31 are used for this purpose.

In order to open the vacuum valve, valve plate 1 is first pushed from its closed position to its intermediate position, in that bearing unit 37 is pushed against
25 direction 38 by second piston-cylinder units that exhibit pistons 30. Cylinder spaces 41 for pistons 30 are designed in bearing unit 37. Pistons 30 are placed at piston rods 42 that are fastened at transmission housing 31 and establish openings with a passage through bearing unit 37.

30 Spaces 43 lying between the transmission casing 31 and the bearing unit 37 could be loaded with a pressure medium, particularly compressed air, in order

- 5 to increase closing pressure with which valve plate 1 is pressed onto valve seat 24 when the vacuum valve is closed.

Bellows 44 serve to guide valve rod 2 out from the vacuum area.

- 10 In this embodiment, a section of valve rod 2 that projects from out of bearing unit 37 at that side that faces away from valve plate 1, is supported at stopper 45 at the end region of the valve rod when the vacuum valve is closed. Stopper 45 hereby lies at the same side of the valve rod 2 as the valve plate 1 and is located at transmission housing 31 or at a part connected to the same.
- 15 Load transmission from bearing unit 37 to valve plate 1 is thereby improved when valve plate 1 is closed.

Acting forces are schematically presented in Figure 11. Valve rod 2 is bent as a result of a closing force of approximately 2000N executed through valve rod 2, whereby torque is produced at swivel axis 19 (refer Figure 9) to the extent of 80Nm, for example, which leads to a twisting of cross bar 3 and, therewith, to a swivelling of valve plate 1 about swivel axis 19 by, for example, 0.4°.

A second embodiment of a suspension of the valve plate 1 at valve rod 2, in accordance with the invention, that can be used in the case of the previously described L valves for example, is illustrated in Figures 15 to 20. The difference when compared to the embodiment presented in Figures 1 to 6 is only in the shape of the cross bar 3. While the cross bar in the embodiment according to Figures 1 to 6 is angled at its end sections in which the lateral junctions lie with projections 18, the cross bar 3 in embodiments according to 30 Figures 15 to 20 is designed to be straight right up to its ends. Projections 18

5 are again provided in the areas of the lateral junctions 5, 6 and the cross bar 3 is distanced from valve plate 1 in the central section 17 that lies between these projections 18 (refer distance a in Figures 19 and 20).

An attachment piece 10 into which the end side of valve rod 2 can be inserted,
10 can, again, be provided in the area of the central junction 4. Connecting screws 7, 8, 9 are used to connect the valve plate 1 and valve rod 2.

(Valve plate 1 can be swivelled a little vis-à-vis the valve rod 2 about swivel axis 19 by twisting cross bar 3 as a result of the elasticity of cross bar 3. The
15 swivelling range and/or the swivel angle occurring due to a specific torque could, for example, be the same as that of the embodiment described by means of Figures 1 to 6.

The swivel axis 19 in this embodiment is again distanced from the central line
20 60 of the valve plate; compare same to distance b sketched in Figure 16. The explanation that has been provided for embodiments in Figures 1 to 6 apply here too with regard to the position of the central line 60 and its distance from the swivel axis 19.

(Another embodiment of the suspension of a valve plate 1 at a valve rod 2 in
25 accordance with the invention is illustrated in Figures 21 to 23. Suspension again takes place through a cross bar 3 whose shape, as described below, is different from that of the cross bars previously described. Furthermore, the cross bar 3 in this embodiment is designed as one material piece with the valve
30 plate 1. A design comprising separate parts that are connected to one another, for example, as one material piece by welding for example, is, however, also

- 5 possible. A design comprising separate parts and connection through a screw connection is conceivable and feasible.

Cross bar 3 is connected in the area of a central junction 4 to the valve rod 2. An end section of the valve rod is inserted into recess 46 in a central
10 connecting piece 47 of cross bar 3 for this purpose and held in the same by a connecting screw 47 which establishes a through bore 12 through the central connecting piece of cross bar 3 and is screwed into a threaded hole of valve
(rod 2. Arms 48, 49 that extend up to branching points 50, 51 stretch from the central connecting piece 47. A first and a second branching section 52, 53 that
15 each extend up to lateral junctions 54, 55 and 56, 57 respectively at which cross bar 3 is connected to valve plate 1, extend from the branching points.

Cross bar 3 is distanced from valve plate 1 by the central section 17 of the cross bar that consists of the central connecting piece 47 and arms 48, 49
20 projecting on both sides of it. Branching sections 52, 53 that start from branching points 50, 51 are, at first, also distanced from valve plate 1 and move progressively closer to the valve plate 1 as they approach junctions 54 –
(57. Junctions 54 – 57 are formed by material bridges in the case of the one material piece design of valve plate 1 with cross bar 3.

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The respective branching sections 52 distance themselves progressively from the central junction 4 during their progression from the respective branching point 50 and/or 51 to junctions 54 and/or 56 and, in this sense, continue the
respective arms 48, 49. The respective branching sections 53 come
30 progressively closer to the central junction 4 during their progression from the respective branching point 50 and/or 51 to junction 55 and/or 57.

5 In this embodiment, consequently, two lateral junctions 54, 55 and 56, 57 are respectively present on both sides of central junction 4. An even load transmission across valve plate 1 can thereby be achieved so that the same can be designed with less material thickness.

10 On the whole, more than two each, i.e., more than four lateral junctions 54 – 57 can be designed through corresponding branching sections.

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Valve plate 1 can swivel to some extent vis-à-vis the valve rod 2 about swivel axis 19 due to twisting of cross bar 3. The swivel range and the extent of the
15 swivel angle in the case of a specific torque acting at swivel axis 19 can, hereby, for example, be the same as in the case of embodiments described earlier. Twisting of cross bar 3 takes place mainly in the area of arms 48, 49 which are designed to be correspondingly thin for this purpose.

20 The unit consisting of valve plate 1 and cross bar 3 can, for example, be manufactured using extrusion moulding (together with other processing steps).

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Swivel axis 19 in all the embodiments described lies at right angles to the longitudinal axis 20 of valve rod 2 and the greatest expansion of cross bar 3
25 takes place in the direction of swivel axis 19. The expansion of cross bar 3 in the direction of swivel axis 19 is preferably at least 5 times greater than in all other right-angled directions to the same.

All described embodiments of suspension of valve plates 1 at valve rods 2 can
30 be employed in connection with the L valves described. These suspensions

5 can be employed even in the case of other valves such as, for example, L or pendulum valves, especially in valves with freely overhanging valve rods through which contact pressure of the valve plate can be transmitted to the valve seat.

10 The valve plate 1 preferably exhibits a greater expansion in the direction of the swivel axis 19 than in the direction of the longitudinal axis 20 of the valve rod 2 (with reference to the orientation in which the principle plane of valve plate 1
(lies parallel to swivel axis 19 and to valve rod 20). Expansion in the direction of swivel axis 19 is hereby preferably at least 3 times greater, at least 5 times
15 greater being particularly preferable, than expansion in the direction of the longitudinal axis 20 of valve rod 2.

Expansion of valve plate 1 in the direction of swivel axis 19 can, for example, lie in the range of between 200 and 400 mm and expansion in the direction of
20 the longitudinal axis 20 could lie in the range of between 30 and 80 mm.

(Connecting the cross bar 3 to the valve rod 2 can also take place in a manner other than that presented in the embodiments. Cross bar 3 could, for example, also have a projection in the direction of the longitudinal axis of valve plate 20
25 that could be inserted into a recess of valve rod 2.

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REFERENCE SIGNS

- | | | |
|----|----|------------------|
| | 1 | Valve plate |
| | 2 | Valve rod |
| | 3 | Cross bar |
| 10 | 4 | Central junction |
| (| 5 | Lateral junction |
| | 6 | Lateral junction |
| | 7 | Connecting screw |
| | 8 | Connecting screw |
| 15 | 9 | Connecting screw |
| | 10 | Attachment piece |
| | 11 | Threaded hole |
| (| 12 | Through hole |
| | 13 | Through hole |
| 20 | 14 | Through hole |
| | 15 | Threaded hole |
| | 16 | Threaded hole |
| | 17 | Central section |
| | 18 | Projection |
| 25 | 19 | Swivel axis |

- 5 20 Longitudinal axis
- 21 Wall
- 22 Valve opening
- 23 First piston-cylinder unit
- 24 Valve seat
- 10 25 Piston
- (26 Seal
- 27 Second piston-cylinder unit
- 28 Cylinder
- 29 Axis
- 15 30 Piston
- 31 Transmission housing
- 32 Spring
- 33 Valve casing
- (34 Vacuum chamber
- 20 35 Bellow
- 36 Axial direction
- 37 Bearing unit
- 38 Direction
- 39 Axis
- 25 40 Spring

- 5 41 Cylinder space
- 42 Piston rod
- 43 Space
- 44 Bellow
- 45 Stopper
- 10 46 Recess
- (47 Connecting piece
- 48 Arm
- 49 Arm
- 50 Junction
- 15 51 Junction
- 52 Branching section
- 53 Branching section
- (54 Lateral junction
- 55 Lateral junction
- 20 56 Lateral junction
- 57 Lateral junction
- 58 Cylinder cover
- 59 Seal
- 60 Central line

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PATENT CLAIMS

1. Suspension of a valve plate (1) at a valve rod (2) by means of a cross bar (3) extending perpendicular to the valve rod (2) and being connected to the valve rod (2) at a central junction (4) and being connected at, at least, two lateral junctions (5, 6, 54, 55, 56, 57) lying on both sides of the central junction (4), the cross bar (3) having a distance (a) from valve plate (1) in a central section (17) comprising the central junction (4) and adjacent sections of the cross bar (3) on both sides of the same, characterised in that, through a torsion of the cross bar (3), the valve plate (1) can be swivelled vis-à-vis the valve rod (2) about a swivel axis (19) which is at right angles to the valve rod (2).

2. Suspension according to Claim 1, characterised in that, the cross bar (3) is designed as one material piece.

3. Suspension according to Claim 1 or 2, characterised in that, the cross bar (3) is connected to valve rod (2) by means of at least one connecting screw (7).

4. Suspension according to one of Claims 1 to 3, characterised in that, the cross bar (3) and the valve plate (1) are designed as one material piece.

5. Suspension according to one of Claims 1 to 3, characterised in that, the cross bar (3) is connected to valve plate (1) by means of connecting screws (8, 9).

- 5 6. Suspension according to one of Claims 1 to 5, characterised in that, a
single lateral junction (5, 6) is present on both sides of the central
junction (4).
- 10 7. Suspension according to one of Claims 1 to 6, characterised in that, two
lateral junctions (54, 55 ; 56, 57) are present respectively on both sides
of the central junction (4).
- 15 8. Suspension according to one of Claims 1 to 7, characterised in that, a
swivelling of valve plate (1) by at least 0.2° takes place vis-à-vis the
valve rod (2) about swivel axis (19) through a torque of 80Nm acting
upon cross bar (3) at swivel axis (19).
- 20 9. Suspension according to Claim 8, characterised in that, swivelling about
swivel axis (19) of at least 0.3° takes place due to torque of 80Nm acting
upon cross bar (3) at swivel axis (19).
- 25 10. Suspension according to one of Claims 1 to 9, characterised in that, the
swivel axis (19) exhibits a distance (b) from central line (60) which lies
parallel to swivel axis (19) and which extends centrally between
intersection points of elastic seal (26) with the longitudinal axis (20) of
the valve rod (2) in the case of a design with an elastic seal (26) at the
valve plate (1) or which, in the case of a design with a sealing surface at
valve plate (1) that is provided to interact with an elastic seal at a valve
seat, extends centrally between two intersection points that exhibit
30 sections of the sealing surface to enable the elastic seal to interact with
the longitudinal axis (20) of the valve rod (2).

5 11. Vacuum valve comprising a valve plate (1) and a valve rod (2) at which
the valve plate (1) is suspended and by means of which valve plate (1)
can be moved between an open position in which the vacuum valve is
open and a closed position in which the vacuum valve is closed and the
10 valve plate (1) seals a valve opening (22), characterised in that,
suspension of the valve plate (1) at the valve rod (2) is designed
according to one of Claims 1 to 9.

12. Vacuum valve according to Claim 11, characterised in that, the valve
plate (1), starting from an open position in which it releases a valve
15 opening (22), can be displaced by means of at least one first piston-
cylinder unit (23) that moves the valve rod (2) in an axial direction to an
intermediate position in which it covers the valve opening (22) but is
however lifted from a valve seat (24) surrounding the valve opening (22)
and that the valve plate (1), starting from the intermediate position, can
20 be swivelled by means of at least one second piston-cylinder unit (27)
that can swivel the valve rod (2) about an axis (39) or move the same in
a direction that is at right angles to its longitudinal axis (20), to a closing
position in which the valve plate (1) is pressed against the valve seat
(2).

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