

Valve device for at least one liquid plastic component

The invention concerns a valve device having the features of the classifying
5 portion of claim 1, a metering valve having such a valve device and a metering
apparatus having such a valve device and/or such a metering valve.

Such a valve device, metering valves or metering apparatuses preferably serve
for influencing flows of liquid plastic or liquid plastic components. Metering valves are
for example part of metering apparatuses which serve for the production of bonded
10 joints, casting applications or in particular foamed seals.

Hitherto both the needle and also the seat were made of metal, in which
respect it was already known for the seat to be made from a softer metal than the
needle. After several hundred closure processes the softer seat is plastically adapted
to the contour of the needle. If the needle and/or the seat is replaced however a
15 reliable closure process no longer occurs. In addition it is time-consuming to carry out
the necessary, several hundred closure processes before the valve device is brought
into operation. If foreign bodies are jammed between the needle and the seat the
foreign body can cause a notch or a recess in the seat so that reliable closure is no
longer guaranteed. Admittedly a certain deformation naturally also occurs when using
20 a metal needle or a metal seat, but that is not identifiable by measurement.

The object of the present invention is to provide a valve device, a metering
valve or a metering apparatus, in which the above-discussed disadvantages do not
arise.

That object is attained by a valve device having the features of claim 1, a
25 metering valve having such a valve device, and a metering apparatus having such a
valve device and/or such a metering valve. Advantageous embodiments of the present
invention are recited in the appendant claims.

The invention makes it possible, while ensuring resistance to wear:

- For the needle and the seat to be pressed against each other in such a
30 way that a reliable closure effect is permitted immediately even without
time-consuming preparation procedures,
- For the needle and the seat to be over-pressed if necessary, that is to
say the needle can move relative to the seat beyond the actual sealing
point, and

- To carry out a measurement which permits assessment of the closure state, by virtue of the yielding nature and the relative movement linked thereto of the needle and the seat.

In a first variant the needle and/or the seat are themselves yielding. For
 5 example it can be provided that the needle and/or the seat at least portion-wise
 comprise plastic. That plastic can in principle be plastically deformable. Preferably
 however it is provided that said plastic is elastically or at least part-elastically
 deformable. Part-elastic deformability is used to mean that only a small region is also
 10 plastically deformable. Therefore the plastic does not have to be elastically deformable
 over the entire extent. Above all therefore end regions or partial regions can be at least
 partially plastically deformable. Any notches or recesses in the seat and/or the needle
 are compensated by the pressing pressure. It is preferably provided that the plastic of
 the needle and/or the seat is PEK (polyetherketone), preferably PEEK
 (polyetheretherketone).

15 In a second variant which can possibly also be used jointly with the first variant
 it is preferably provided that the needle and/or the seat is/are mounted yieldingly by
 way of a needle mounting and by way of a seat mounting respectively, wherein the
 needle mounting and/or the seat mounting has/have a force storage means or an
 elastically or part-elastically deformable portion.

20 Particularly preferably it is further provided that there is provided at least one
 sensor for – preferably contact-less – position monitoring of the position of the needle
 and/or the seat and/or the needle mounting and/or the seat mounting, the signals of
 which can be fed to an evaluation device which from the signals determines a signal
 which is characteristic of the closure action. For example it can be provided that stored
 25 in the evaluation device are at least two positions which are characteristic of
 predetermined closure states of the closure device.

In a metering valve according to the invention it can be provided that a
 discharge opening of the metering valve is closeable by the at least one valve device.
 Alternatively or additionally it can be provided that an intake opening of a recirculation
 30 line is closeable by the at least one valve device.

Further details and advantages of the invention are described more fully
 hereinafter by means of the specific description with reference to the embodiments by
 way of example illustrated in the drawings.

Figure 1 shows a diagrammatically illustrated valve device 1 having a valve
 35 opening 3. There is provided a closure device 2 for closing the valve opening 3, having

a seat 4 and a needle 5. In the illustrated embodiment the needle 5 can be of a yielding design in its entirety, for example it can comprise a suitable plastic or – as indicated by the dotted line – it can be of a yielding design only portion-wise (for example only in the front region 51 or in the rear region 52). The seat 4 can comprise either a non-yielding material like for example metal or a yielding material, for example a suitable plastic. It can be seen that the seat 4 has a (peripherally extending) bevel 17 to reduce the surface pressure in the region of the contact location with the needle 5. In the illustrated structure the valve opening 3 is completely opened and the needle 5 has no contact with the seat 4. That corresponds to the position P0 of the needle 5.

Figure 2 shows the valve device 1 of Figure 1 in an altered state. In this state the needle 5 has been moved relative to the seat 4 to such an extent that the needle 5 contacts the seat 4 without contact pressure. The contact pressure (given by the pressing force F divided by the area of the bevel 17) is produced by way of a drive device (not shown here) which is for example pneumatic, hydraulic or force storage means-based. That corresponds to the position P1 of the needle 5.

Figure 3 shows the valve device 1 illustrated in Figures 1 and 2 in that state in which the needle 5 is pressed against the seat 4 with the predetermined contact pressure. That corresponds to the position P2 of the needle 5.

Figure 4 shows the valve device 1 illustrated in Figures 1, 2 and 3 in that state in which the needle 5 is over-pressed in relation to the seat 4. Due to the yielding nature of the needle 5 this involves deformation of the needle 5, which is shown on an exaggerated scale. Any notches or recesses in the needle 5 and/or the seat 4 can be compensated thereby, which ensure reliable closure of the valve opening 3 by the closure device 2. This corresponds to the position P3 of the needle 5.

The change in position from P2 to P3, that is caused by over-pressing the needle 5, can be readily measured, for example by way of a sensor 10 which is illustrated by way of example and which is connected to an evaluation device 11. If a calibration operation is carried out the evaluation device 11 knows which of the positions of the needle 5 corresponds to reliable closure of the closure device 2 and by application of the spring law with a known spring stiffness it is also possible to assess how great the corresponding contact pressing force F or the contact pressure is. It may however be sufficient to know that P3 is greater than P2 by a predetermined amount (without also determining the contact pressing force F).

A numerical (non-limiting) example is as follows:

- P0 = -2 mm

- P1 = 0 mm
- P2 = 0.05 mm
- P3 = 0.10 mm
- Inside diameter of the bevel = 2 mm
- 5 - Thickness (diameter) of the needle = 5 mm
- Length of the needle = 20 mm.

Alternative configurations of the seat 4 and/or the needle 5 are shown in following Figure 5 showing a valve device 1 in a housing (not shown).

10 Possible variants of the yielding nature of the seat 4 and/or the yielding seat mounting 7 are cumulatively shown on the left-hand side. The illustrated variants can also be used individually or in any combination.

It is possible to see here:

- successively arranged cross-sectional weakenings 18 to provide for the yielding configuration of the seat 4;
- 15 • yielding, part-elastic or elastic layer 19 to provide the yielding seat mounting 7, for example including PEK, PEEK, PU (polyurethane), rubber, silicone, and so forth;
- a force storage means 8 in the form of a compression spring and a preferably elastically deformable portion 9 which is shown only portion- wise and which can be provided instead of or in addition to the force storage means 8 to provide the yielding configuration of the seat 4 and/or the yielding seat mounting 7.
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25 The measures described and illustrated for the seat mounting 7 can also be used additionally or alternatively for the only diagrammatically illustrated needle mounting 8.

Figure 6a shows a metering device 14 having a storage container 20 for a liquid plastic or a liquid plastic component and a metering valve 12. The liquid plastic or the liquid plastic component can be conveyed from the storage container 20 by means of a pump 22 to a metering valve 12 by way of a line 21. The metering valve 12 can have a valve device 1 according to the invention (see the detail in Figure 6b). In the illustrated detail in Figure 6b there are two valve devices 1; on the one hand for closing a discharge opening 13 of the metering valve 12 and on the other hand for closing off a recirculation line 15 leading back to the storage container 20. A further valve device 11 is shown by way of example in the recirculation line 15. Further valve devices 1 can be used as desired at required positions.

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List of references:

	1	valve device
	2	closure device
5	3	valve opening of the valve device
	4	seat of the closure device
	5	needle of the closure device
	51	front region of the needle
	52	rear region of the needle
10	6	needle mounting of the needle
	7	seat mounting of the seat
	8	force storage means
	9	elastically deformable portion
	10	sensor
15	11	evaluation device
	12	metering valve
	13	discharge opening
	14	intake opening
	15	recirculation line
20	16	metering device
	17	bevel
	18	cross-sectional weakening of the seat
	19	part-elastic or elastic layer
	20	storage container
25	21	line
	22	pump
	P0, P1, P2, P3	positions of the needle
	F	contact pressing force

CLAIMS

1. A valve device (1) for at least one liquid plastic component or liquid plastic, comprising a closure device (2) which has a needle (5) which can be pressed against a seat (4) for closing a valve opening (3) of the valve device (1), wherein the needle (5) and/or the seat (4) is/are adapted to be yielding or mounted yieldingly, characterized in that the needle (5) can move relative to the seat (4) beyond the actual sealing point, and that at least one sensor (10) for position monitoring of the position of the needle (5) and/or the seat (4) and/or a needle mounting (6) and/or a seat mounting (7), signals of which can be fed to an evaluation device (11) which from the signals determines a signal which is characteristic of the closure action.

2. A valve device as set forth in claim 1 characterised in that the needle (5) and/or the seat (4) at least portion-wise comprise plastic.

3. A valve device as set forth in claim 2 characterised in that the plastic of the needle (5) and/or the seat (4) is elastically or at least partially elastically deformable.

4. A valve device as set forth in claim 2 or claim 3 characterised in that the plastic of the needle (5) and/or the seat (4) is PEK, preferably PEEK.

5. A valve device as set forth in one of the preceding claims characterised in that the at least one sensor (10) enables contact-less position monitoring of the position of the needle (5) and/or the seat (4) and/or the needle mounting (6) and/or the seat mounting (7). .

6. A valve device as set forth in claim 5 characterised in that stored in the evaluation device (11) are at least two positions (P1, P2) which are characteristic of predetermined closure states of the closure device (2).

7. A metering valve (12) for metered discharge of at least one liquid plastic component or liquid plastic comprising at least one valve device (1) as set forth in at least one of claims 1 through 6.

8. A metering valve as set forth in claim 7 characterised in that a discharge opening (13) of the metering valve (12) is closeable by the at least one valve device (1).

5 9. A metering valve as set forth in claim 7 or claim 8 characterised in that an intake opening (14) of a recirculation line (15) is closeable by the at least one valve device (1).

10 10. A metering device (16) comprising a storage container (20) for liquid plastic or at least one liquid plastic component and at least one valve device (1) as set forth in at least one of claims 1 through 6 and/or a metering valve (12) as set forth in at least one of claims 7 through 9.