Claims

1. A dosing system (1) for a dosing substance, which dosing system (1) comprising a housing (11) having a nozzle (60) and a feed channel (64) for dosing substance, a discharge element (51) arranged in the housing (11) for discharging dosing substance from the nozzle (60), at least one first actuator (20), preferably a piezo actuator (20), coupled to the discharge element (51) and/or the nozzle (60), and at least one second actuator (30), preferably an expansion material element (30), coupled to the first actuator (20),
the second actuator (30) being designed to set a position of the at least one first actuator (20) relative to the housing (11), particularly with respect to the discharge element (51) and/or the nozzle (60), wherein the first actuator (20) and the second actuator (30) can be controlled separately.

2. The dosing system according to claim 1, wherein the second actuator (30), particularly the expansion material element (30), is designed and arranged in the housing (11) in order to set a position of the discharge element (51) in relation to the nozzle (60) of the dosing system (1), particularly a distance (a) between a discharge tip (52) of the discharge element (51) and a nozzle opening (61) of the nozzle (60).

3. The dosing system according to claim 1 or 2, having at least one heating device (33) associated with the second actuator (30), particularly the expansion material element (30), and/or at least one cooling device (40) associated with the second actuator (30), particularly the expansion material element (30) and having a control unit (80) for controlling and/or regulating the heating device (33) and/or the cooling device (40).

4. The dosing system according to any one of the preceding claims, wherein the dosing system (1) comprises a sensor arrangement (83, 84) having at least one of the following sensors:
- a temperature sensor (83) associated with the second actuator (30), particularly the expansion material element (30),
- a temperature sensor associated with the first actuator (20),
- a temperature sensor associated with the housing (11),
- a movement sensor (84) for determining a movement of the discharge element (51),
- a position sensor (84) for determining a position of the discharge element (51).

5. The dosing system according to any one of the preceding claims, wherein the second actuator (30), particularly the expansion material element (30), comprises an expansion body (32) and preferably a transmitter (35) coupled therewith and/or wherein the second actuator (30) is coupled to the first actuator (20) in an axial direction for positioning of the first actuator (20), preferably by means of the transmitter (35).

6. The dosing system according to any one of the preceding claims, wherein the dosing system (1) comprises at least one force sensor in order to determine a force exerted on the first actuator (20), particularly by means of the second actuator (30), particularly preferably by means of the expansion material element (30), preferably in order to capture a sealing force of the discharge element (51) based thereon.

7. A method for controlling a dosing system (1) for a dosing substance, which dosing system (1) comprising a housing (11) having a nozzle (60) and a feed channel (64) for dosing substance, a discharge element (51) arranged in the housing (11) for discharging dosing substance from the nozzle (60), at least one first actuator (20), preferably a piezo actuator (20), coupled to the discharge element (51) and/or the nozzle (60), and at least one second actuator (30), preferably an expansion material element (30), coupled to the first actuator (20), wherein the second actuator (30) is controlled and/or regulated in order to set a position of the at least one first actuator (20) relative to the housing (11), particularly with respect to the discharge element (51) and/or the nozzle (60), wherein the first actuator (20) and the second actuator (30) can be controlled separately.

8. The method for controlling a dosing system according to claim 7, wherein for controlling and/or regulating the second actuator (30), particularly the expansion material element (30), a temperature of the second actuator (30), particularly a temperature of the expansion material element (30), is controlled and/or regulated, preferably by means of at least one heating device (33) associated with the second actuator (30) and/or by means of at least one cooling device (40) associated with the second actuator (30).

9. The method for controlling a dosing system according to claim 7 or 8, wherein the second actuator (30), particularly the expansion material element (30), is controlled and/or regulated such that the discharge element (51) is brought to an adjust position (S_2, $S_{2'}$) of the discharge element (51) during a defined operating state, in which preferably the discharge tip (52) of the discharge element (51) has a certain pressing force into the nozzle (60).

10. The method for controlling a dosing system according to any one of the preceding claims 7 to 9, wherein for controlling and/or regulating the second actuator (30), preferably for controlling and/or regulating the expansion material element (30), particularly for setting an adjust position (S_2, $S_{2'}$), at least one of the following operating parameters of the dosing system (1) is taken into account:

- a temperature of the second actuator (30), particularly a temperature of the expansion material element (30), particularly preferably a temperature of an expansion body (32),
- a position of the discharge element (51) in the dosing system (1), particularly a position of a lever (16) coupled to the discharge element (51),
- a deflection of the first actuator (20), preferably an activation signal of the actuator (20),
- a temperature of the first actuator (20),
- a temperature of the housing (11),
- an amount and/or a weight of the dosing substance to be dispensed from the dosing system (1) during a respective discharge process,
- a signal from a flow sensor for dosing substance,
- calibration data of the dosing system (1),
- a sealing force.

11. The method for controlling a dosing system according to any one of the preceding claims 9 or 10, wherein the second actuator (30), particularly the expansion material element (30), is controlled and/or regulated such that a discharge end position (S_3) of the discharge element (51) during operation of the dosing system (1) corresponds to an adjust position (S_2, $S_{2'}$) determined in a previously performed adjustment process.

12. The method for controlling a dosing system according to claim 11, wherein in an adjustment process for setting the adjust position (S_2, $S_{2'}$) of the discharge element (51), a regulation algorithm having at least the following steps is run through:

- setting a maximum deflection of the first actuator (20),
- setting an adjustment start temperature of the second actuator (30), particularly an adjustment start temperature of the expansion material element (30), preferably by means of cooling the expansion material element (30),
- heating the second actuator (30), particularly heating the expansion material element (30), until full contact is detected between the discharge element (51) and the nozzle (60) and a full contact position (S_1, $S_{1'}$) of the discharge element (51) is determined and/or a full contact temperature (T_1) which is associated with the full contact position (S_1, $S_{1'}$),

and/or heating the second actuator (30), particularly heating of the expansion material element (30), until a maximum system deflection of the first actuator (20) and the second actuator (30) is reached and a system end contact position of the discharge element (51) is determined and/or a system end contact temperature which is associated with the system end contact position,

- determining an adjust position (S_2, $S_{2'}$) of the discharge element and/or an adjust temperature (T_2) which is associated with the adjust position (S_2, $S_{2'}$),
  wherein to determine the adjust position (S_2, $S_{2'}$) and/or the adjust temperature (T_2), the full contact position (S_1, $S_{1'}$) of the discharge element (51) and/or the full contact temperature (T_1) or the system end contact position of the discharge element (51) and/or the system end contact temperature and optionally at least one adjust parameter are taken into account,
- optionally transferring the discharge element (51) to the adjust position (S_2, $S_{2'}$).

13. The method for controlling a dosing system according to claim 11 or 12, wherein a regulation algorithm having at least the following steps is run through to regulate the discharge end position (S_3) during operation:

- setting a discharge end position (S_3) of the discharge element (51),
- determining a position of the discharge element (51) as a function of a deflection of the first actuator (20) during a retraction movement of the discharge element (51), particularly as a function of an electrical control voltage (U) applied to the first actuator (20),
- determining an actual value (ΔU) of a value representing a sealing position actuator deflection, wherein the discharge element (51) in the sealing position actuator deflection is pressed by a certain minimum beyond the full contact between the discharge element (51) and the nozzle (60) into a sealing seat (63) of the nozzle (60),
- controlling and/or regulating the second actuator (30), preferably controlling and/or regulating the expansion material element (30), particularly as a function of a difference between the actual value (ΔU) of the value representing the sealing position actuator deflection and a target value of the value representing the sealing position actuator deflection, for setting the target value of the value representing the sealing position actuator deflection, wherein the target value of the value representing the sealing position actuator deflection is associated with the adjust position (S_2, $S_{2'}$) of the discharge element (51).

14. The method for controlling a dosing system according to claim 13, wherein a temperature of the second actuator (30), particularly a temperature of the expansion material ele-

ment (30), in the event of a positive deviation of the actual value (ΔU) of the value representing the sealing position actuator deflection from the target value of the value representing the sealing position actuator deflection is reduced and/or wherein the temperature of the second actuator (30), particularly the temperature of the expansion material element (30), in the event of a negative deviation of the actual value (ΔU) of the value representing the sealing position actuator deflection from the target value of the value representing the sealing position actuator deflection is increased.

15. The method for controlling a dosing system according to claim 13 or 14, wherein during operation of the dosing system (1) at regular intervals, preferably with each discharge process of the discharge element (51), a difference between the actual value (ΔU) of the value representing the sealing position actuator deflection and the target value of the value representing the sealing position actuator deflection is determined.