WO 2004/053362 A1 relates to a piston pump system having a piston which is guided in a guide tube and which can perform a lifting movement along its longitudinal axis, with an O-ring seal held in a groove being provided in the guide tube and sealing the piston. It has been recognized that a good seal can be achieved if the degree of filling of the seal in the groove is optimally adjusted. The “degree of filling” corresponds to the ratio of the volume of the (undeformed) seal to the volume of the groove. It is proposed to use a degree of filling of more than 90% - that is, to use a sufficiently voluminous sealing ring.

A method by which reliable sealing of a conveying element of a dispensing device is to be achieved is known, for example, from WO 2007/051536 A1 or US 2007/0282276 A1. It has been recognized that the sealing elements are subject to certain manufacturing tolerances, as a result of which the sealing elements of different batches differ in size, such that reliable sealing is problematic. To eliminate this problem, a size of the sealing elements that corresponds in particular to the volume is determined for each batch of sealing elements. Each batch of sealing elements is assigned to a specific group of components of the dispensing device, the components each forming a groove-shaped receiving space for the sealing element, and the different groups of components differing in the size of the receiving space. Each batch of sealing elements is then combined with a specific group of components of the dispensing device so that a desired degree of filling and thereby a good seal by the sealing element are achieved.

In the aforementioned method, there is an increased storage requirement for storing the different batches of sealing elements and the different groups of components. In addition, the method cannot be used flexibly for different sealing materials.

It is an object of the present disclosure to provide a simple and flexible solution for reliably and permanently sealing a conveying element of a dispensing device for dispensing a medicament.

The above object is achieved by a method as described herein, or by a dispensing device as described herein. Advantageous refinements are the subject of the present disclosure.

According to the proposal, a sealing element is installed in a dispensing chamber of a dispensing device with a previously determined assembly parameter.

The assembly parameter can be determined individually for each sealing element, or randomly for a batch of sealing elements.

The assembly parameter can be determined either in a receiving space of the dispensing device or, in particular in the case of a random determination, in a test system. For this purpose, the test system preferably has a receiving space which, in particular, has the same dimensions as the receiving space of the dispensing device.

In particular, the present disclosure relates to a method for assembling dispensing devices for dispensing a medicament, and to a dispensing device for dispensing a medicament, wherein a sealing element with the specific assembly parameter is arranged and fixed in the receiving space of the dispensing device.

The sealing element arranged in the receiving space of a dispensing device or test system is preferably deformed, and the assembly parameter is determined in the process on the basis of the deformation behavior and/or friction behavior of the sealing element during the deformation.

After the assembly parameter has been determined, the sealing element, or a further sealing element to be installed, is fixed in the receiving space of a dispensing device utilizing the assembly parameter.

In one aspect, the present disclosure relates to a method for assembling dispensing devices for dispensing a medicament,

wherein a preferably ring-shaped sealing element is arranged in a receiving space, in particular of a dispensing device,

characterized in that

the sealing element arranged in the receiving space is deformed, and an assembly parameter (M) is determined in the process on the basis of the deformation behavior and/or friction behavior of the sealing element during the deformation,

wherein the sealing element, or a different sealing element to be installed, is fixed in a receiving space of a dispensing device using the assembly parameter (M).

The dispensing device that is assembled or in which the sealing element is fixed can be the same dispensing device in which or in whose receiving space the sealing element was arranged to determine the assembly parameter. However, it is also possible that the dispensing device that is assembled or in which the sealing element is fixed is a different dispensing device or a different copy of the same dispensing device or has a different copy of the same receiving space than the dispensing device or receiving space that was used in the determination of the assembly parameter. This is the case in particular with the batch method explained in more detail below.

By determining the assembly parameter based on the deformation behavior and/or friction behavior, and/or by using the assembly parameter, manufacturing tolerances and differences in size and/or material of sealing elements can be taken into account or compensated for in a simple manner, and a reliable seal and/or sealing effect can be

The force in the force/displacement curve is preferably the force used to deform the sealing element, and/or the frictional force between the sealing element and the boundary of the receiving space that is moved relative to the sealing element.

The displacement in the force/displacement curve is preferably the travel distance of the plunger or fixing element and/or contact element, or the height of the receiving space, or a displacement corresponding thereto.

The sealing element is preferably designed to seal a conveying element for conveying the medicament against a guide element which comprises or forms the receiving space and in which the conveying element is guided.

The sealing element is preferably ring-shaped, and/or a molded seal or a sealing ring, in particular an O-ring.

The sealing element is preferably a separate component that can be inserted into the receiving space. The sealing element preferably consists of an elastic material. An elastic material within the meaning of the disclosure is preferably a material with a modulus of elasticity of less than 100 MPa, preferably less than 50 MPa, in particular less than 10 MPa.

The sealing elements of different batches can consist of different materials and/or can have different deformation properties, different compression sets, and/or different creep behavior or different creep moduli. The method, in which an assembly parameter is determined separately for each batch, ensures that in each case a reliable seal and/or sealing effect is achieved even for such different sealing elements or batches of sealing elements. In particular, due to the precise adjustment of the volume of the receiving space that is possible with this method, materials can also be used for sealing elements which are partially plastic or have a comparatively high creep behavior—such as thermoplastic elastomers (TPE). Such sealing elements require receiving spaces that are particularly precisely designed or adapted to each of the sealing elements.

The present disclosure relates to a dispensing device for dispensing a medicament. The dispensing device has a conveying element, in particular an axially movable conveying element, for conveying the medicament out of a container of the dispensing device, a guide element for guiding the conveying element, and an, in particular ring-shaped, sealing element for

arrangement in a receiving space of the guide element. The sealing element is preferably designed to seal the conveying element against the guide element, in particular as a sealing ring. Furthermore, the sealing element can preferably be fixed in the receiving space by means of a fixing element and/or contact element that can be fastened to the guide element. The guide element preferably forms the pressure chamber of a piston pump, or the guide element comprises the pressure chamber, with the conveying element forming the piston of the piston pump.

The fixing element and/or contact element can preferably be fastened to the guide element in different axial positions relative to the guide element. As a result, it is possible and intended that the sealing element is or will be fixed with an adapted, specific assembly parameter. In this way, manufacturing tolerances and differences in size and/or material of sealing elements can be taken into account or compensated for in a simple manner, and a reliable seal and/or sealing effect can be ensured. This is conducive to consistent quality in the manufacture or assembly of a plurality of dispensing devices, in particular in an automated process.

In another aspect, the present disclosure relates to a dispensing device for dispensing a medicament, having a conveying element which can be moved in particular axially for conveying the medicament, a guide element for guiding the conveying element, and a particularly ring-shaped sealing element for sealing the conveying element against the guide element, wherein the guide element at least partially delimits a receiving space for receiving the sealing element, and the sealing element can be fixed in the receiving space by means of a fixing element or contact element which can be fastened to the guide element,

characterized in that

the fixing and/or contact element can be fastened to the guide element in different axial and/or discrete positions relative to the guide element, and the sealing element can thereby be fixed with a previously determined assembly parameter (M).

The fixing and/or contact element can preferably be locked on the guide element in different axial positions relative to the guide element. This facilitates the correct or desired positioning of the fixing and/or contact element and is therefore conducive to simple and error-free assembly. This is conducive to consistent quality in the manufacture or assembly of a plurality of dispensing devices, in particular in an automated process.

Alternatively or additionally, the fixing and/or contact element and/or the guide element preferably has a positioning device for positioning the fixing and/or contact element relative to the guide element. The positioning device particularly preferably has one or more locking elements, in particular locking cams, or is formed from them. This is conducive to easier assembly and/or determination of the position of the fixing and/or contact element. As a result, manufacturing tolerances of sealing elements can be taken into account or compensated for in a simple manner, and a reliable seal and/or sealing effect can be ensured. This is conducive to consistent quality in the manufacture or assembly of a plurality of dispensing devices, in particular in an automated process.

The positioning device preferably has an inclined plane or helix structure or is formed therefrom. This is conducive to a simple adjustment of the position of the fixing and/or contact element relative to the guide element.

The positioning device is preferably arranged on the end face of the fixing and/or contact element and/or the guide element.

It is preferred that the rotational position of the fixing and/or contact element, in particular relative to the guide element or the dispensing device, defines the axial position of the fixing and/or contact element. In particular, the positioning device is designed accordingly.

A specific deformation or a specific deformation value of the sealing element and/or a size or a volume of the receiving space is preferably defined by the position of the fixing and/or contact element relative to the guide element, such that the deformation of the sealing element and/or the size or the volume of the receiving space can be varied or adapted to one another by varying the position of the fixing element.

The aforementioned and following aspects and features of the present disclosure can be combined with one another in different combinations, but can also be implemented independently of one another.

Further aspects, features, advantages, and properties of the present disclosure are found in the claims and the following description of preferred embodiments, with reference to the drawings, in which:

Fig. 1 is a schematic section of a dispensing device according to the invention in a first state;

Fig. 2 is a schematic section, rotated by 90° compared to Fig. 1, of the dispensing device in a second state;

Fig. 3 is a schematic section of a pressure generator of the dispensing device;

Fig. 4A is a schematic section of the pressure generator during a first situation in a determination of the assembly parameter;

Claims:

1. A method for assembling dispensing devices for dispensing a medicament,

wherein a preferably ring-shaped sealing element is arranged in a receiving space, in particular of a dispensing device,

characterized in that

the sealing element arranged in the receiving space is deformed, and an assembly parameter (M) is determined in the process on the basis of the deformation behavior and/or friction behavior of the sealing element during the deformation,

wherein the sealing element, or a different sealing element to be installed, is fixed in a receiving space of a dispensing device using the assembly parameter (M).

2. The method according to claim 1, characterized in that a plurality of sealing elements is provided in batches, and an assembly parameter (M) is determined separately for each batch using a random sample of sealing elements of the given batch, wherein the assembly parameter (M) determined for this batch is used for each fixing of a sealing element of the batch in a receiving space.

3. The method according to claim 2, characterized in that the assembly parameter (M) is selected in each case in such a way that the same deformation value of the sealing element results for completely assembled dispensing devices for different batches of sealing elements, preferably wherein the deformation value is a measure of how much the sealing element is deformed, and in particular compressed.

4. The method according to claim 2 or 3, characterized in that, to determine the assembly parameter (M) of a batch, an assembly parameter (M) is first determined separately for each sealing element in the random sample, and a mean value of these assembly parameters (M) determined separately is defined as the assembly parameter (M) for all sealing elements of this batch.

5. The method according to any of claims 2 to 4, characterized in that, to determine the assembly parameter (M), a central element is guided through an opening in the sealing

element and/or through the receiving space, and the volume of the receiving space is reduced or delimited by the central element.

6. The method according to any of claims 2 to 5, characterized in that the number of sealing elements in the random sample is less than 50‰, preferably less than 20‰, in particular less than 10‰, particularly preferably less than 5‰, very particularly preferably less than 2‰ of the number of sealing elements of the batch, and/or in that the volumes of the sealing elements of a batch deviate by less than 10%, preferably less than 5%, particularly preferably less than 4%, from the mean volume of the sealing elements of the batch.

7. The method according to claim 1, characterized in that the sealing element is permanently fixed in the receiving space immediately after the deformation and determination of the assembly parameter (M) by means of a fixing element or contact element acting on the sealing element.

8. The method according to claim 1 or 7, characterized in that the assembly parameter (M) is determined separately for each sealing element to be installed and is used in each case only when fixing the sealing element for which it was determined.

9. The method according to any of the preceding claims, wherein the assembly parameter (M) is a particularly adjustable and/or geometric value which is prespecified for and/or implemented in the assembly of the dispensing device, preferably wherein the assembly parameter (M) can be prespecified in a preferably variable manner in the configurations of an assembly process.

10. The method according to any of the preceding claims, characterized in that the assembly parameter (M) is a position, in particular an axial position, of a fixing element or contact element relative to the receiving space and/or to a guide element of the dispensing device, or this position is defined by the assembly parameter (M), in particular wherein the guide element at least partially delimits the receiving space, and the fixing element or contact element is used for fixing the sealing element in the receiving space.

11. The method according to any of the preceding claims, characterized in that the assembly parameter (M) corresponds to a volume of the receiving space and/or to a deformation value, in particular to an onset of volume compression, of the sealing element.

12. The method according to any of the preceding claims, characterized in that the assembly parameter (M) is selected or determined in such a manner that, when the sealing element is fixed in the receiving space, a deformation value corresponding to a deformation of the sealing element reaches or exceeds a threshold value, preferably wherein the deformation value is a measure of how much the sealing element is deformed, and the threshold value corresponds to an onset of volume compression of the sealing element.

13. The method according to any one of the preceding claims, characterized in that, to determine the deformation behavior and/or friction behavior of each of the sealing elements with different deformations, in each case a characteristic value is measured which corresponds to a deformation value of the sealing element and/or from which the deformation value of the sealing element can be calculated, determined, and/or derived.

14. The method according to claim 12, characterized in that the characteristic value is a force, in particular a frictional force or a compressive force, a pressure, or a position.

15. The method according to any of the preceding claims, characterized in that, to determine the deformation behavior of each of the sealing elements, the force required for deformation is determined in each case for different deformations.

16. The method according to any of the preceding claims, characterized in that, to determine the friction behavior of each of the sealing elements, the sealing element and a boundary of the receiving space are moved relative to one another, and the frictional force between the sealing element and the boundary is determined in each case for different deformations.

17. The method according to any of the preceding claims, characterized in that a force/displacement curve is recorded to determine the deformation behavior or friction behavior and/or to determine the assembly parameter (M), preferably wherein the assembly parameter (M) is determined on the basis of the profile and/or the curvature of the force/displacement curve.

18. The method according to any of the preceding claims, characterized in that the sealing element is designed to seal a conveying element for conveying the medicament against a guide element which comprises or forms the receiving space and in which the conveying element is guided.

19. A dispensing device for dispensing a medicament, having a conveying element which can be moved in particular axially for conveying the medicament, a guide element for guiding the conveying element, and a particularly ring-shaped sealing element for sealing the conveying element against the guide element, wherein the guide element at least partially delimits a receiving space for receiving the sealing element, and the sealing element can be fixed in the receiving space by means of a fixing element or contact element which can be fastened to the guide element,

characterized in that

the fixing and/or contact element can be fastened to the guide element in different axial and/or discrete positions relative to the guide element, and the sealing element can thereby be fixed with a previously determined assembly parameter (M).

20. The dispensing device according to claim 19, characterized in that the different discrete positions are defined by the geometric shape of the guide element, of the fixing element, and/or of the contact element.

21. The dispensing device according to claim 19 or 20, characterized in that the fixing and/or contact element can be locked in particular on the guide element in different axial and/or or discrete positions relative to the guide element.

22. The dispensing device according to any of claims 19 to 21, characterized in that the fixing and/or contact element and/or the guide element has/have a positioning device for positioning the fixing and/or contact element relative to the guide element.

23. The dispensing device according to claim 22, characterized in that the positioning device has or is formed by one or more locking elements.

24. The dispensing device according to claim 22 or 23, characterized in that the positioning device has or is formed by an inclined plane or helix structure.

25. The dispensing device according to any of claims 22 to 24, characterized in that the positioning device is arranged on the end face of the fixing and/or contact element, and/or on the end face of the guide element.

26. The dispensing device according to any of claims 19 to 25, characterized in that the rotational position of the fixing and/or contact element, in particular relative to the guide element or the dispensing device, defines the axial position of the fixing and/or contact element.

27. The dispensing device according to any of claims 19 to 26, characterized in that the position of the fixing and/or contact element defines a deformation of the sealing element and/or a size of the receiving space, such that the deformation of the sealing element and/or the size of the receiving space can be varied by varying the position of the fixing element or contact element.

28. The dispensing device according to any of claims 19 to 27, characterized in that the fixing and/or contact element can be moved into the receiving space to different extents before it is fixed in the desired position.

29. The dispensing device according to any of claims 19 to 28, characterized in that the sealing element is a sealing ring and/or a separate component which can be inserted into the receiving space, preferably wherein the sealing element is made of an elastic material with a modulus of elasticity of less than 100 MPa, preferably less than 50 MPa, in particular less than 10 MPa.