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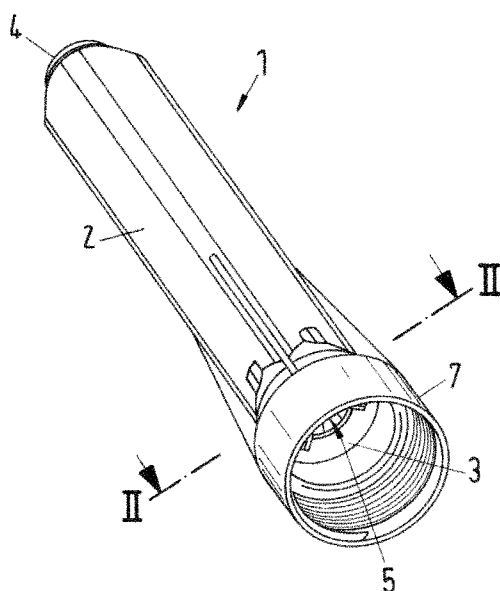
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(54) **Title:** STATIC MIXER FOR A MULTICOMPONENT DISPENSING APPLIANCE



**Fig.1**

(57) **Abstract:** A static mixer 1 for a multicomponent dispensing appliance 200 having at least two storage chambers 9 is disclosed. The static mixer 1 comprises a mixer housing 2 having an inlet section 3 adapted to be connected to the outlet section of at least two storage chambers 9 and an outlet section 4, and the mixer housing 2 contains a mixer element 5 and a deflection body 6 which is arranged in the inlet section 3 so that a cross-section of the deflection body 6 covers a majority of the cross-section of the inlet section 3, wherein the deflection body 6 is embodied such that the flow of the components through the inlet section 3 is deflected radially towards the inner wall of the mixer housing 2 in a substantially symmetrical manner. The invention further relates to a multicomponent mixing system 100 and a multicomponent dispensing appliance 200 comprising the static mixer 1. The present invention further relates also to the use of the static mixer 1, multicomponent mixing system 100, and multicomponent dispensing appliance 200 in the dispensing of a multicomponent mater

## **Static Mixer For A Multicomponent Dispensing Appliance**

### 5 BACKGROUND OF THE INVENTION

The present invention relates to a static mixer for a multicomponent dispensing appliance. The present invention also relates to a multicomponent mixing system and a multicomponent dispensing appliance, both of which are inter-related products comprising said static mixer. The present invention  
10 further relates to the use of said static mixer, mixing system, and dispensing appliance in the dispensing of a multicomponent material.

Static mixers for multicomponent dispensing appliances are known, and they have the function of intimately mixing the components in order to prepare them for their dispensing and end use. For example, multicomponent  
15 dispensing appliances find application in the dental field in the dispensing of bleaching gels, bonding agents, cements, fillers, and materials for creating impressions or in making temporary treatments. In the industrial and construction sectors, multicomponent dispensing appliances are similarly used for the dispensing of adhesives, sealants and related materials.

20 For the sake of clarity, two components are mentioned only in the following description, but it is evident that there can be more than two components. The mixer element of the static mixer as defined here contains one or more mixer element subunits.

In the cartridge/mixer assemblies of the prior art, two or more material  
25 streams flow from the outlets of the cartridge to the dividing edge of the first mixer element subunit of the mixer element where the united material streams

are first divided for subsequent thorough mixing. However, it is often difficult to feed the components in an optimal manner to the first dividing edge of the mixer element, particularly for many ranges of the volumetric ratio of the components and/or the viscosities of the components.

- 5 For example, when mixing ratios higher than 1:1, e.g. 10:1, there is a likelihood that the larger component fills up part of the length of the mixer element of the static mixer at the beginning of the dispensing process and that the flow of the second component, having a smaller volume, is thus suppressed or subdued. In the inlet area in particular, the larger partial flow
- 10 "A" will press the smaller partial flow "B" against the wall of the mixer housing on the "B" side where it is held back by wall friction and therefore subdued or suppressed by the larger "A" component. Thus the mixing process can only begin with some difficulty and delay. Furthermore in this initial phase, the partial flow "A" dominates and a proper mixture cannot be achieved in the
- 15 correct volumetric ratio. Thus the components cannot properly react with each other, resulting in defective bonds, seals, joints, impressions, etc. Since the "B" component is generally a hardener or catalyst, a mixture with an insufficient amount of "B" component is useless. This problem of mixing and ratio may actually arise for all mixing ratios, even including 1:1, because the
- 20 flow of one component into the mixer element may be favored or disfavored depending on the relative orientation of its inlet to the first dividing edge of the mixer element. Because of this it is common practice to dispense and discard a certain quantity of material in order to stabilize the mixing and desired proportions of the components before being able to start the desired
- 25 application of the mixture. However it is difficult for the user of the dispenser to determine exactly what quantity of the initially dispensed material should be discarded. Besides waste of material, the initially dispensed material may not harden and may additionally cause disposal problems. If used, however, it may cause end product failure. For these reasons when the components are,
- 30 for example, used for producing such materials as those in the dental field, it is therefore highly desirable that the two components should be adequately

mixed at the correct mixing ratio at the beginning of the mixing process already and thus in the initially dispensed material.

One approach is to use static mixers containing several additional mixing element subunits in order to ensure adequate mixing even of the initially  
5 dispensed material. This approach may improve the extent of mixing, but it requires higher dispensing pressures and results in bigger waste volumes due to the larger volume of the mixer, and it cannot, of course, correct an incorrect initial mixing ratio. Therefore in EP-B 0 584 428 by the present applicant, a  
10 solution to this problem is suggested by first retaining the larger "A" component in a chamber and by providing means for directing it to the inlet chamber of the second "B" component for carrying the latter along. Although this embodiment provided an improvement with respect to the then state of the art, it results in an increased flow resistance due to several necessary  
15 restrictions of the cross-sectional area which requires higher dispensing forces and may possibly make reinforcement of the cartridge walls necessary.

In the mixer according to EP-B 0 664 153 by the present applicant, the intimate mixing of the components has been improved yet further over that disclosed in previously-cited EP-B 0 584 428. In this disclosure, the smaller  
20 inlet chamber for the second component is arranged and designed in such a manner that the first component envelops the second component at the outlet of the inlet chamber and that the dividing edge of the first mixer element subunit of the mixer element cuts both the first and the second component in half. The use of such inlet chambers typically require however the use of specially constructed coaxial cartridges instead of side by side cartridges.

## 25 SUMMARY OF THE INVENTION

Starting from this state of the art, it is an object of the invention to provide a static mixer for a multicomponent dispensing appliance that does not suffer from the previous mentioned deficiencies, particularly a lack of adequate mixing and a correct mixing ratio even in the initial stages of the mixing and

dispensing process. Further objects of the invention include providing a multicomponent mixing system and a multicomponent dispensing appliance, both of which are inter-related products comprising said static mixer. Yet another object of the invention is to provide a use of said static mixer,  
5 multicomponent mixing system, and multicomponent dispensing appliance in the dispensing of a multicomponent material.

According to the invention, these objects are achieved by a static mixer for a multicomponent dispensing appliance having at least two storage chambers, said mixer comprising a mixer housing having an inlet section adapted to be  
10 connected to the outlet section of at least two storage chambers, the mixer housing further having an outlet section, and the mixer housing containing a mixer element, wherein a deflection body is arranged in the inlet section so that a cross-section of the deflection body covers a majority of the cross-section of the inlet section, and wherein the deflection body is embodied such  
15 that the flow of the components through the inlet section is deflected radially towards the inner wall of the mixer housing in a substantially symmetrical manner.

According to the invention, these further objects are achieved firstly by a multicomponent mixing system comprising said static mixer and at least two  
20 storage chambers, wherein the static mixer is in communication with the at least two storage chambers. According to the invention, these further objects are achieved secondly by a multicomponent dispensing appliance comprising a dispensing mechanism, at least two storage chambers, and said static mixer. Said static mixer, multicomponent mixing system, and multicomponent  
25 dispensing appliance are used in accordance with the invention in the dispensing of a multicomponent material.

The present invention achieves these objects and provides a solution to this problem by means of a deflection body in the inlet section which deflects the flow of all components radially towards the inner wall of the mixer housing in a  
30 substantially symmetrical manner. As a result, inhomogeneities in the flow of

all of the components into the first mixer element subunit are reduced and the dependency of the quality of the mixing obtained on the relative orientation of the mixer element to the incoming flows of the components is eliminated. Furthermore since the flow of the components through the inlet section is

5 deflected radially towards the inner wall of the mixer housing, any smaller partial flows of a component (e.g. "B") pressed against the wall of the mixer housing will be enveloped and/or carried along by the flow of the larger partial flow of another component (e.g. "A"). Therefore the composition of the components entering the first mixer element subunit in the region near the

10 inner wall of the mixer housing will be more homogeneous and any local inhomogeneities in the volumetric ratio of the components will tend to be averaged out over the diameter of the mixer housing. These results are then surprisingly achieved without the need for any specially constructed cartridges or multiple inlet chambers.

15 Furthermore these benefits in the mixing of the components and the achievement of the correct volumetric ratio of the components in the dispenses material, especially in the initial stages of mixing and dispensing, is achieved by using a deflection body which then contributes to a somewhat increased flow resistance. The use of additional flow-resisting subunits is

20 generally considered to be unfavorable because of the substantially higher dispensing forces required by their presence. Surprising in the case of the present invention, the use of the deflection body only gives a modest increase in flow resistance. Furthermore the use of the single deflection body actually improves the mixing and achievement of the correct ratio of the components

25 much more than would the inclusion of multiple mixing element subunits, which would act to substantially increase the flow resistance but without providing any substantial benefits in terms of obtaining the correct mixing ratio of the components in the early stages of the mixing and dispensing process. Therefore the use of the deflection body in the invention actually reduces the

30 total flow resistance of the static mixer relative to that of a similar static mixer without a deflection body but having the same quality of mixing.

In a preferred embodiment, the deflection body has a substantially circular cross-section. A substantially circular cross-section of the deflection body is particularly useful in combination with an inlet section also having a substantially circular cross-section in order to ensure that flow of the components through the inlet section is confined to a restricted region adjacent to the inner wall of the inlet section and thus also of the mixer housing.

According to another preferred embodiment, the deflection body is in the form of a disk. Disks are a relatively simple and easy-to-manufacture shape that fulfils the functional requirements for the deflection body.

According to another preferred embodiment, the deflection body has a concave or convex profile when viewed in the direction of the flow of the components. A concave or convex profile is useful in guiding the flow of the components over the surface of the deflection body.

In yet another preferred embodiment, the deflection body is incorporated at one end of the mixer element. The forming of plastic mixer elements having incorporated deflection bodies is readily achieved by plastic melt processing methods well known in the art such as injection and compression molding. Production and assembly of the static mixer is then simplified due to the lesser number of parts. Furthermore incorporation of the deflection body onto the mixer element assists in ensuring that the deflection body is correctly positioned in the inlet section during assembly and use.

In still another preferred embodiment, the deflection body has a surface provided with channels extending in the radial direction. Said channels advantageously enhance the deflection and flow of the components towards the inner wall of the mixer housing.

In still yet another preferred embodiment, the deflection body has openings for the components to flow through. Said openings advantageously enhance the

deflection and flow of the components towards the inner wall of the mixer housing and through the inlet section.

5 In a further preferred embodiment, the deflection body is rotationally symmetric. A rotationally symmetric deflection body helps to ensure that the flows are deflected by the deflection body in a substantially symmetrical manner.

10 In yet a further preferred embodiment, the inlet section of the mixer housing has a common inlet for all of the components. The use of a common inlet simplifies the manufacture and construction of the mixer housing and provides a simple and ready communication between the static mixer and its attached storage chambers.

15 In still yet a further preferred embodiment, the static mixer additionally comprises a threaded connecting part or a bayonet connecting part. Such connecting parts provide for an easy, rapid, secure and reversible connection of the static mixer with the outlet section of one or more storage chambers containing the components of a multicomponent mixture to be mixed and dispensed.

20 Other aspects of the present invention are inter-related products comprising the static mixer of the present invention. One inter-related product of the present invention is a multicomponent mixing system comprising the static mixer of the invention and at least two storage chambers, wherein the static mixer is in communication with the at least two storage chambers. A second inter-related product of the present invention is a multicomponent dispensing appliance comprising a dispensing mechanism, at least two storage  
25 chambers, and the static mixer of the invention. Such multicomponent mixing systems and multicomponent dispensing appliances may be used advantageously in the dispensing of a multicomponent material due to the previously mentioned advantages of the static mixer of the present invention.

Further aspects of the present invention include the use of the static mixer, the multicomponent mixing system, or the multicomponent dispensing appliance of the invention in the dispensing of a multicomponent material. Such use benefits then from the previously discussed advantages of the static mixer of the invention. In a preferred embodiment, the multicomponent material is an adhesive, bleaching, bonding, cementing, impression generating, sealing, or temporary treatment material.

On skilled in the art will understand that the combination of the subject matters of the various embodiments of the invention is possible without limitation in the invention. For example, the subject matter of one of the above-mentioned preferred embodiments may be combined with the subject matter of one or more of the other above-mentioned preferred embodiments without limitation. By way of example, according to a particularly preferred embodiment, the deflection body is in the form of a disk and is incorporated at one end of the mixer element. By way of another example, according to another particularly preferred embodiment, the deflection body is in the form of a disk and is incorporated at one end of the mixer element and has a surface provided with channels extending in the radial direction.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be explained in more detail hereinafter with reference to various embodiments of the invention as well as to the drawings. The schematic drawings show:

Fig. 1 shows a perspective view of an embodiment of a static mixer according to the invention.

Fig. 2 shows a cross-section through the embodiment of Fig. 1 along the line II-II in Fig. 1.

- Fig. 3 shows a perspective view of the mixer element and a deflection body of the static mixer in Fig. 1.
- Fig. 4 shows a cross-section of the mixer element and the deflection body of Fig. 3 along the line IV-IV in Fig. 3.
- 5 Fig. 5 shows illustrative embodiments of combinations of inlet section and deflection body cross-section according to the invention.
- Fig. 6 shows flow lines illustrating the flow of components for deflection body embodiments having flat, convex, and concave profiles.
- Fig. 7 shows a perspective view of the mixer element and a deflection  
10 body having a concave profile.
- Fig. 8 shows a cross-section of the mixer element and the deflection body of Fig. 7 along the line VIII-VIII in Fig. 7.
- Fig. 9 shows plan views illustrating alternative embodiments of  
15 deflection bodies having openings for the components to flow through.
- Fig. 10 shows a perspective view of the mixer element and a deflection body having openings for the components to flow through.
- Fig. 11 shows a plan view of the mixer element and the deflection body of Fig. 10.
- 20 Fig. 12 shows a perspective view of a multicomponent mixing system comprising the static mixer in communication with two storage chambers.
- Fig. 13 shows a cross-section of the multicomponent mixing system of Fig. 12 along the line XIII-XIII in Fig. 12.

- Fig. 14 shows an exploded view of the multicomponent mixing system of Fig. 12.
- Fig. 15 shows a multicomponent dispensing appliance comprising a dispensing mechanism, two storage chambers and the static mixer
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## DETAILED DESCRIPTION OF THE INVENTION

In prior art static mixers, the components are randomly supplied to the first helix of the mixer element, the mixer element being designed in such a manner that the two components are well-mixed by their passage through the mixer element to the outlet section where they are dispensed. As discussed in the introduction, in known static mixers having different volume ratios of components, e.g. cross-sections of the storage cylinders, it occurs that the substance having a larger volume suppresses or subdues the flow of the substance having a smaller volume, particularly in the initial phase, i.e. when the mixer housing is being filled up, so that the prescribed mixing ratio cannot be obtained. After a certain time, i.e. when the mixer is completely filled and a certain amount has been dispensed, the mixing ratio of the partial flows stabilizes at a predetermined level.

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FIG. 1 shows a perspective view of an embodiment of a static mixer according to the invention which as a whole is labeled with reference number 1. FIG. 2 shows a cross-section through the embodiment of FIG. 1 along the line II-II in FIG. 1. The static mixer 1 has been conceived for use in a multicomponent dispensing appliance 200 (FIG. 12) having at least two storage chambers 9 and has the function of intimately mixing the components of a multicomponent mixture in order to prepare it for its dispensing and end use.

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In the following description reference is made to such embodiments in which only two components are mixed. Of course the invention is suited in an

analogous manner also for such applications in which three or more components are to be mixed.

5 The static mixer 1 comprises a mixer housing 2 having an inlet section 3 adapted to be connected to the outlet section of at least two storage chambers 9. In some specific embodiments, the mixer housing 2 may be constructed of a plastic such as a thermoplastic and may be produced by melt processing of a thermoplastic by methods well known in the art such as injection molding.

10 As shown in the embodiment in FIG. 1, the inlet section 3 of the mixer housing 2 may have a common inlet for all of the components in some embodiments. A common inlet simplifies the manufacture and construction of the mixer housing 2 and may be used to advantage in providing a simple and ready communication between the static mixer 1 and the at least two storage chambers 9, for example, in the case of side by side cartridges.

15 As shown in the embodiment in FIG. 1, the static mixer 1 additionally comprises a threaded connecting part 7. As shown in this embodiment, the mixer housing 2 may have the threaded connecting part 7 incorporated at the inlet section 3. A threaded connecting part 7 provides for an easy, rapid, secure and reversible connection of the static mixer 1 with the outlet section  
20 of one or more storage chambers 9 containing the components of a multicomponent mixture to be mixed and dispensed. In an alternative embodiment, the static mixer 1 instead comprises a bayonet connecting part. A bayonet connection has two parts, namely a lug which is pushed into a socket and then twisted to lock it in position. For example, the lug may have  
25 one or more pins, and the socket may have one or more corresponding L-shaped slots into which the pins are inserted and then turned. A bayonet connecting part has the further advantages over a threaded connecting part 7 of providing a quicker connection and not being subject to cross-threading. In a preferred embodiment, the threaded connecting part 7 or bayonet  
30 connecting part is used to connect the common inlet section 3 of the mixer

housing 2 with the common outlet section of at least two storage chambers 9. In a specific preferred embodiment, the connection is to the common outlet section of a side by side cartridge.

As shown in the embodiment in FIG. 1, the mixer housing 2 further has an outlet section 4, and the mixer housing 2 contains a mixer element 5.

It will be understood that the outlet section 4 of the static mixer 1 of the invention may have a variety of forms and shapes in order to ease and/or direct the dispensing of the multicomponent material. For example, the outlet section 4 may taper to a narrow outlet in order to dispense the multicomponent material over a more focused area and to thus guide the dispensing process. Alternatively the outlet section 4 may be in communication with such a tapered channeled tip. In addition, the outlet section 4 or its optional tip may be angled to the side in order to allow the static mixer 1 to be readily held in a tangential orientation towards the point of dispensing or to further guide the dispensing process. Such angling may ease the dispensing of the multicomponent material in narrow or confined spaces such as in dental applications.

FIG. 3 shows a perspective view of the mixer element 5 and a deflection body 6 of the static mixer 1 in FIG. 1. FIG. 4 shows a cross-section of the mixer element 5 and the deflection body 6 of FIG. 3 along the line IV-IV in FIG. 3. As already mentioned, the mixer element 5 as a whole is labeled with reference number 5, and a mixer element subunit is labeled as 51. The mixer element 5 of the present invention contains one or more mixer element subunits 51.

The deflection body 6 is arranged in the inlet section 3 so that a cross-section of the deflection body 6 covers a majority of the cross-section of the inlet section 3, wherein the deflection body 6 is embodied such that the flow of the components through the inlet section 3 is deflected radially towards the inner wall of the mixer housing 2 in a substantially symmetrical manner. As discussed earlier in the present application, this radial deflection of the flow of

all of the components ensures that none of the component flows is suppressed or subdued and that the mixer housing 2 is rapidly and completely filled in a homogeneous manner.

5 In the embodiment shown in FIG. 3, the deflection body 6 has a substantially circular cross-section. A substantially circular cross-section is particularly useful in combination with inlet sections 3 also having substantially circular cross-sections such as the inlet section 3 in FIG. 1. The use of deflection body 6 and inlet section 3 cross-sections having similar or matched geometric forms ensures that flow of the components through the inlet section 3 is  
10 confined to a restricted region adjacent to the inner wall of the inlet section 3 and thus also of the mixer housing 2.

In the embodiment shown in FIG. 3, the deflection body 6 is in the form of a disk. Disks are a relatively simple and easy-to-manufacture shape that fulfils the functional requirements for the deflection body 6.

15 In the embodiment shown in FIG. 3, the deflection body 6 is rotationally symmetric with respect to the longitudinal axis of the mixer element 5. A rotationally symmetric deflection body 6 helps to ensure that the flows are deflected by the deflection body 6 in a substantially symmetrical manner.

It will be understood that the deflection body 6 may have a variety of  
20 geometric cross-sections and shapes so long as it fulfils the function of deflecting the flow of the components through the inlet section 3 radially towards the inner wall of the mixer housing 2 in a substantially symmetrical manner. For this reason, the optimum cross-section and geometric shape of the deflection body 6 will depend somewhat on the cross-section of the inlet  
25 section 3. Some illustrative embodiments of combinations of inlet section 3 and deflection body 6 cross-sections according to the invention are shown in FIG. 5. For example, in one embodiment, the cross-section of both the inlet section 3 and the deflection body 6 are substantially circular, as shown in FIG. 5A. In another embodiment, the cross-section of both the inlet section 3 and  
30 the deflection body 6 are substantially square, as shown in FIG. 5B. In yet

another embodiment, the cross-section of the inlet section 3 is substantially circular, and the cross-section of the deflection body 6 is substantially square, as shown in Fig. 5C. In still yet another embodiment, the cross-section of the inlet section 3 is substantially circular, and the cross-section of the deflection body 6 is substantially square, as shown in Fig. 5D, or vice versa (not shown). In still yet a further embodiment, the cross-section of the inlet section 3 is substantially circular, and the cross-section of the deflection body 6 is substantially circular but serrated, as shown in Fig. 5E.

A deflection body 6 having a substantially square cross-section may be obtained in a specific embodiment by a deflection body 6 having a pyramidal shape. In this specific embodiment, the apex of the pyramidal shape is oriented towards the entrance of the inlet section 3 of the mixer housing 2 and the incoming flow of the components, and the base of the pyramidal shape is oriented towards the exit of the inlet section 3 of the mixer housing 2 and the mixer element 5. In another specific embodiment, a deflection body 6 having a substantially square cross-section may be obtained by a deflection body 6 in the form of a square plate.

A deflection body 6 having a substantially circular cross-section may be obtained in other specific embodiments by a deflection body 6 having a substantially hemispherical, conical or disk shape. According to a preferred embodiment, the deflection body 6 is in the form of a disk, as shown in the embodiment in FIG. 3.

In the embodiment shown in FIG. 4, the deflection body 6 has a slightly convex profile when viewed in the direction of the flow of the components. If the deflection body 6 has a convex profile, the flow of the components will be deflected away from the central apical (summit) region towards the nonapical (shoulder) regions near the edge of the deflection body 6 and thus towards the inner wall of the mixer housing 2, as illustrated in FIG. 6A by the arrows without reference numeral.

In alternative embodiments, the deflection body 6 may have a flat or concave profile when viewed in the direction of the flow of the components. If the deflection body 6 has a flat profile, it will act as a dam or barrier towards the incoming flow of the components in the central regions of the inlet section 3, and the flow will thus be deflected radially towards the edges of the deflection body 6 and the gap between the edge of the deflection body 6 and the inner wall of the mixer housing 2 where the flow is not blocked, as illustrated in FIG. 6B. If the deflection body 6 has a concave profile, the deflection body 6 will again act as a dam or barrier towards the incoming flow of the components in the central regions of the inlet section 3. After the central concave depression of the deflection body 6 is filled by the components, the components will flow over the edges and through the gap between the edge of the deflection body 6 and the inner wall of the mixer housing 2 where the flow is not blocked, as illustrated in FIG. 6 C.

FIG. 7 shows a perspective view of an embodiment of the mixer element 5 and the deflection body 6 having a slightly concave profile when viewed in the direction of the flow of the components, as can be seen also in the cross-sectional view shown in FIG. 8.

In the embodiments shown in FIG. 3 and FIG. 7, the deflection body 6 is incorporated at one end of the mixer element 5. In a preferred embodiment, the deflection body 6 and the mixer element 5 are integral parts of a single plastic article. The plastic article comprising the integrated deflection body 6 and mixer element 5 may be produced by thermoforming processes known in the art, such as injection or compression molding. In alternative embodiments, the deflection body 6 is attached at one end of the mixer element 5 by adhesive and/or mechanical attachment methods known in the art such as fasteners or through the use of interlocking connecting surfaces and shapes.

In the embodiments shown in FIG. 3 and FIG. 7, the deflection body 6 has four support arms 61 extending in the radial direction. In preferred embodiments, the deflection body 6 has support arms 61 extending in the

radial direction. These support arms 61 may be used to center and/or maintain the position of the deflection body 6 in the cross-section of the inlet section 3. Furthermore gaps established between the deflection body 6 and the inner wall of the mixer housing 2 due to the presence of the support arms 5 61 may be used as openings for the directed flow of the components through the inlet section 3.

In the embodiments shown in FIG. 3 and FIG. 7, the deflection body 6 has a surface provided with channels 62 extending in the radial direction. In preferred embodiments, the deflection body 6 is equipped with features for enhancing the deflection of the flow of the components through the inlet 10 section 3 radially towards the inner wall of the mixer housing 2 in a substantially symmetrical manner. In one preferred embodiment, the deflection body 6 has a surface provided with channels 62 extending in the radial direction, as in FIG. 3 and in FIG. 7. It will be understood that the 15 channels 62 may have a variety of physical forms including grooves and a variety of depths in order to fulfill the function of enhancing the deflection of the flow towards the inner wall of the mixer housing 2.

In the illustrative alternative embodiments of deflection bodies 6 having enhanced flow in FIG. 9, the deflection body 6 has openings 81; 82; 83 for the 20 components to flow through. It will likewise be understood that these openings 81; 82; 83 may have a variety of forms in order to fulfill the function of enhancing the deflected flow. In the embodiment shown in FIG. 9A, openings are provided in the form of holes 81. In the alternative embodiment shown in FIG 9 B, openings are provided by means of serrations or scalloping 82 of the 25 outside edge of the deflection body 6 directly opposed to the inner wall of the mixer housing. In the embodiment shown in FIG. 9C, openings are provided in the form of slots 83.

FIG. 10 and FIG. 11 show an embodiment of the static mixer 1 and a deflection body 6 having openings in the form of slots 83.

Other aspects of the present invention are inter-related products comprising the static mixer 1 of the present invention. One inter-related product of the present invention is a multicomponent mixing system comprising the static mixer 1 of the invention and at least two storage chambers 9, wherein the static mixer is in communication with the at least two storage chambers 9. FIG. 12 illustrates one embodiment of such a multicomponent mixing system 100 of the present invention. FIG. 13 shows a cross-sectional view of this embodiment, and FIG. 14 shows an exploded view of this embodiment.

As illustrated by the embodiment shown in FIG. 15, a second inter-related product of the present invention is a multicomponent dispensing appliance 200 comprising a dispensing mechanism 10, at least two storage chambers 9, and the static mixer 1 of the invention.

Such multicomponent mixing systems 100 and multicomponent dispensing appliances 200 may be used to advantage in the dispensing of a multicomponent material such as bleaching gels, bonding agents, cements, fillers, and materials for creating impressions or in making temporary treatments in the dental field, or such multicomponent materials as adhesives, sealants and related materials in the industrial and construction sectors.

In specific embodiments of the multicomponent mixing system 100 and the multicomponent dispensing appliance 200, the at least two storage chambers 9 are part of a side by side cartridge.

Yet another aspect of the present invention is the use of the static mixer 1, the multicomponent mixing system 100, or the multicomponent dispensing appliance 200 of the present invention in the dispensing of a multicomponent material. In one embodiment, the use is in the dispensing of an adhesive, bleaching, bonding, cementing, impression generating, sealing, or temporary treatment material.

Patent claims

1. A static mixer 1 for a multicomponent dispensing appliance 200 having  
5 at least two storage chambers 9, said mixer 1 comprising:  
a mixer housing 2 having an inlet section 3 adapted to be connected to  
the outlet section of at least two storage chambers 9,  
the mixer housing 2 further having an outlet section 4, and the mixer  
housing 2 containing a mixer element 5, **characterized in that**  
10 a deflection body 6 is arranged in the inlet section 3 so that a cross-  
section of the deflection body 6 covers a majority of the cross-section  
of the inlet section 3, wherein the deflection body 6 is embodied such  
that the flow of the components through the inlet section 3 is deflected  
radially towards the inner wall of the mixer housing 2 in a substantially  
15 symmetrical manner.
2. The static mixer 1 of claim 1, wherein the deflection body 6 has a  
substantially circular cross-section.
- 20 3. The static mixer 1 of claim 1 or 2, wherein the deflection body 6 is in  
the form of a disk.
4. The static mixer 1 of any one of claims 1 to 3, wherein the deflection  
body 6 has a concave or convex profile when viewed in the direction of  
25 the flow of the components.
5. The static mixer 1 of any of claims 1 to 4, wherein the deflection body 6  
is incorporated at one end of the mixer element 5.

6. The static mixer 1 of any of claims 1 to 5, wherein the deflection body 6 has a surface provided with channels 62 extending in the radial direction.
- 5
7. The static mixer 1 of any of claims 1 to 6, wherein the deflection body 6 has openings 8 for the components to flow through.
8. The static mixer 1 of any of claims 1 to 7, wherein the deflection body 6 is rotationally symmetric.
- 10
9. The static mixer 1 of any of claims 1 to 8, wherein the deflection body 6 has support arms 61 extending in the radial direction.
10. The static mixer 1 of any of claims 1 to 9, wherein the inlet section 3 of the mixer housing 2 has a common inlet for all of the components.
- 15
11. The static mixer 1 of any of claims 1 to 10, wherein the static mixer 1 additionally comprises a threaded connecting part 7 or a bayonet connecting part.
12. A multicomponent mixing system 100 comprising the static mixer 1 of any of claims 1 to 11 and at least two storage chambers 9, wherein the static mixer 1 is in communication with the at least two storage chambers 9.
- 20
13. A multicomponent dispensing appliance 200 comprising:
- (a) a dispensing mechanism 10,
- 25 (b) at least two storage chambers 9,
- (c) a static mixer 1 according to any one of claims 1 to 11.

14. Use of the static mixer 1 of any of claims 1 to 11, the multicomponent mixing system 100 of claim 12, or the multicomponent dispensing appliance 200 of claim 13 in the dispensing of a multicomponent material.
- 5      15. The use of claim 14, wherein the multicomponent material is an adhesive, bleaching, bonding, cementing, impression generating, sealing, or temporary treatment material.

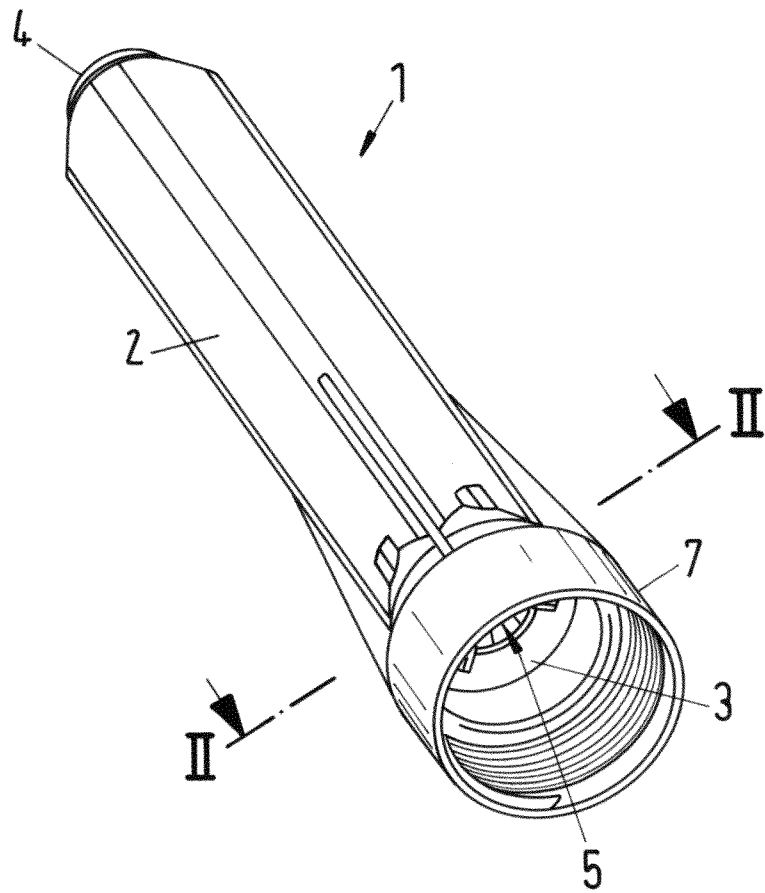


Fig.1

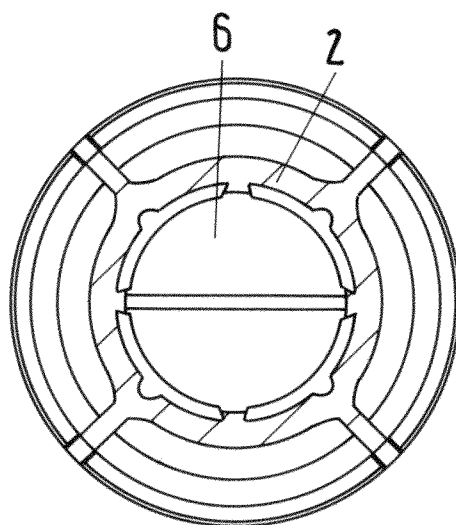


Fig.2

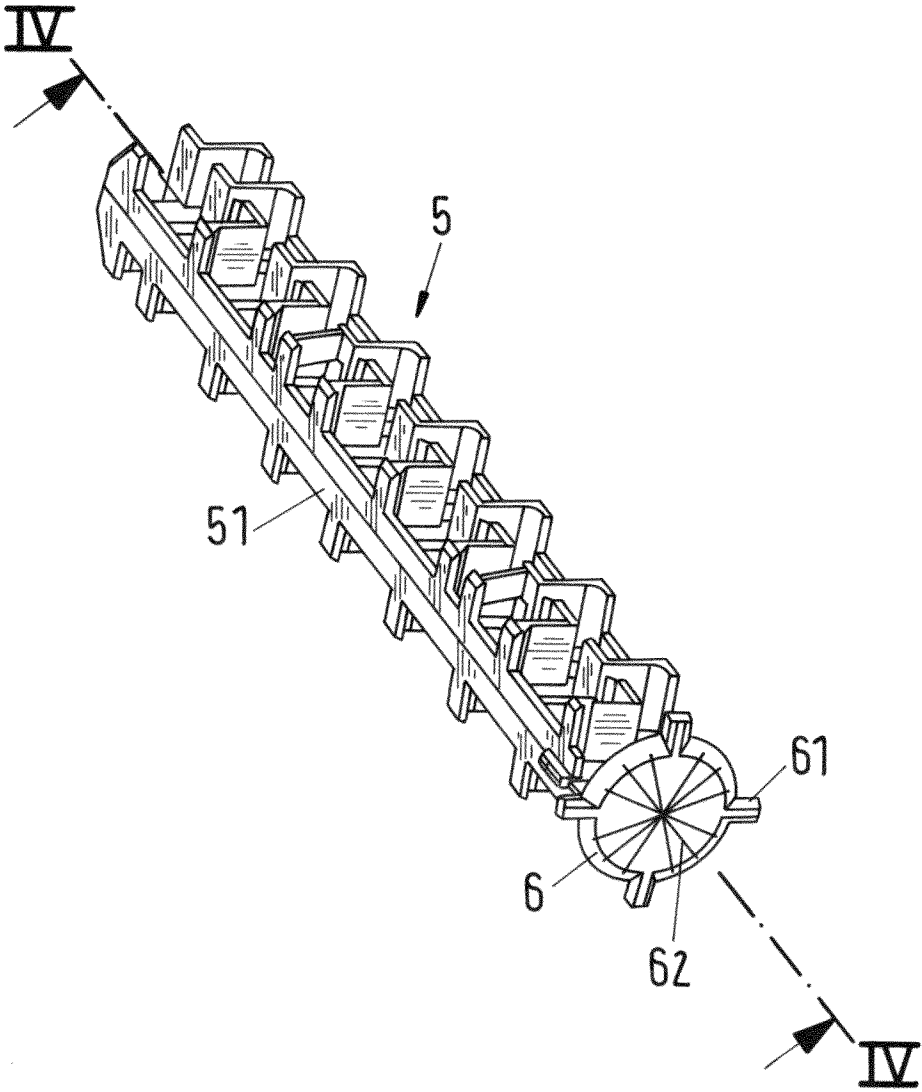


Fig.3

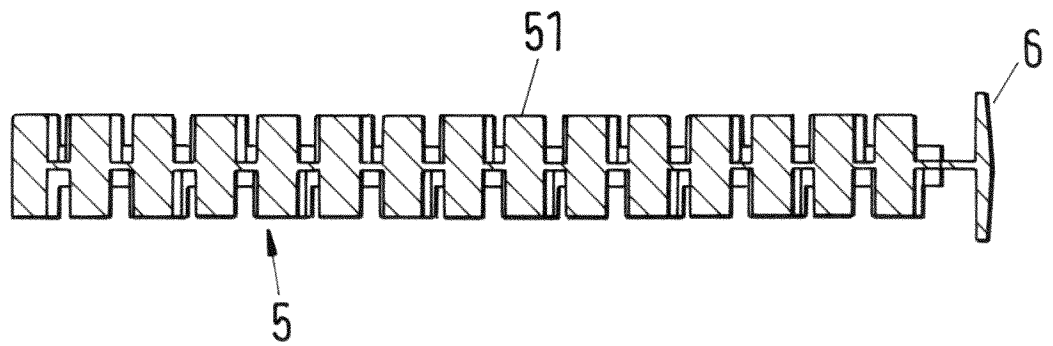


Fig.4

Fig.5A

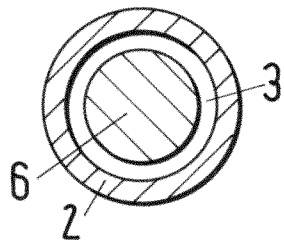


Fig.5C

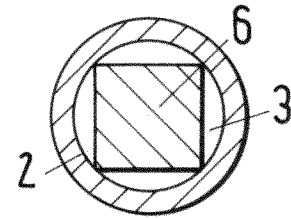


Fig.5B

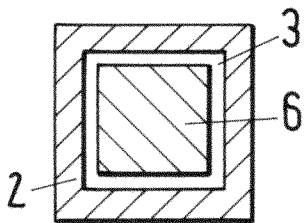


Fig.5D

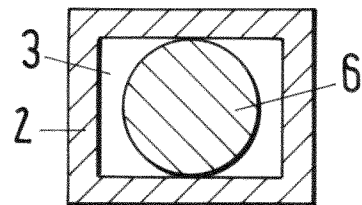


Fig.5E

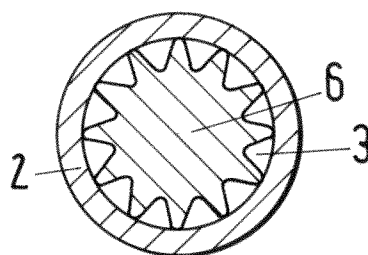


Fig.5

Fig.6B

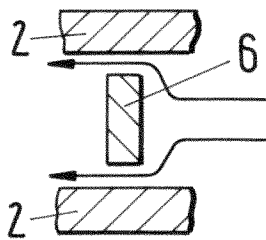


Fig.6A

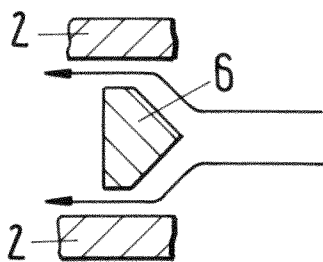


Fig.6C

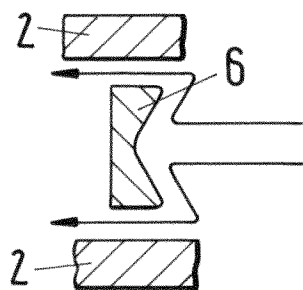
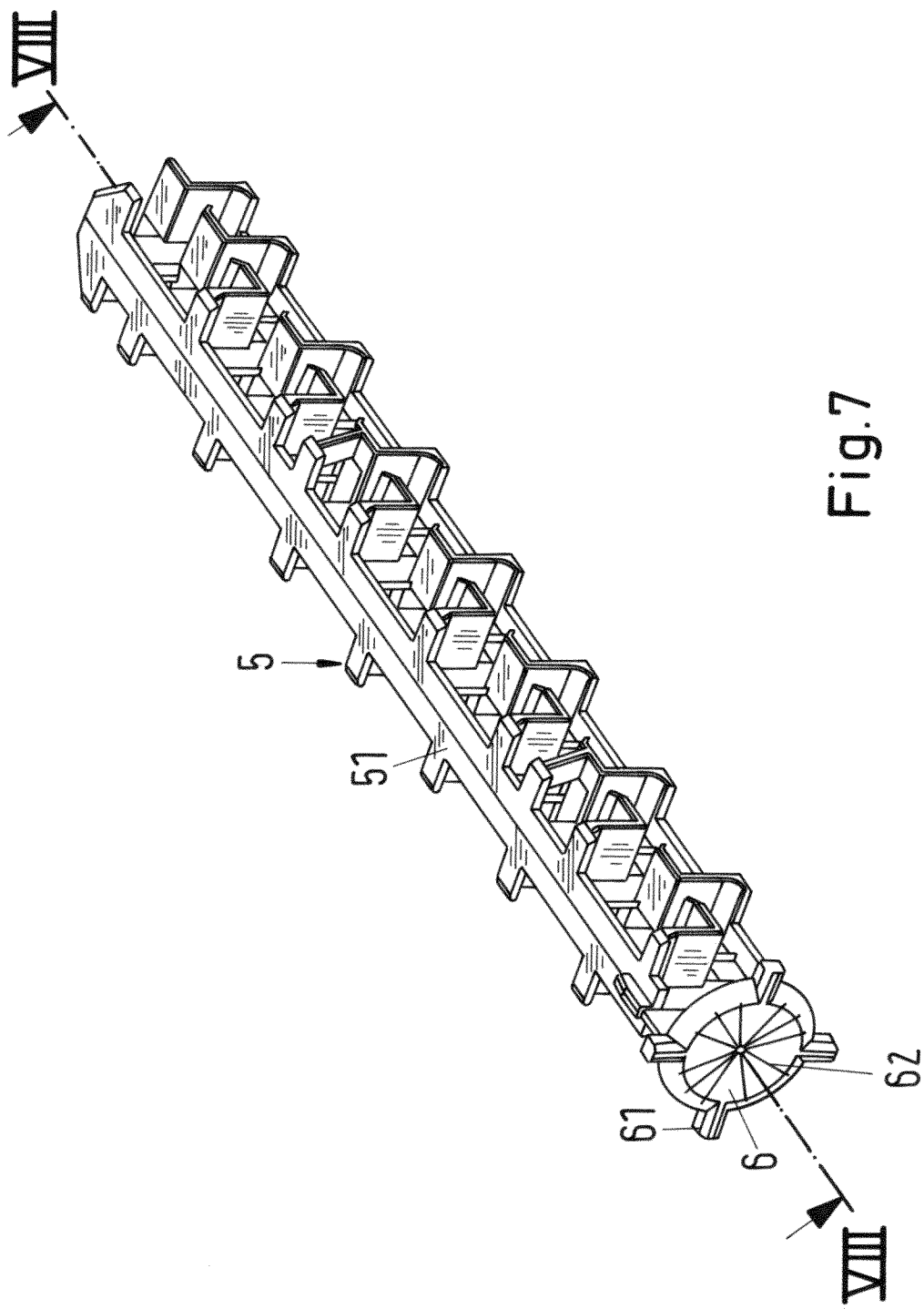


Fig.6



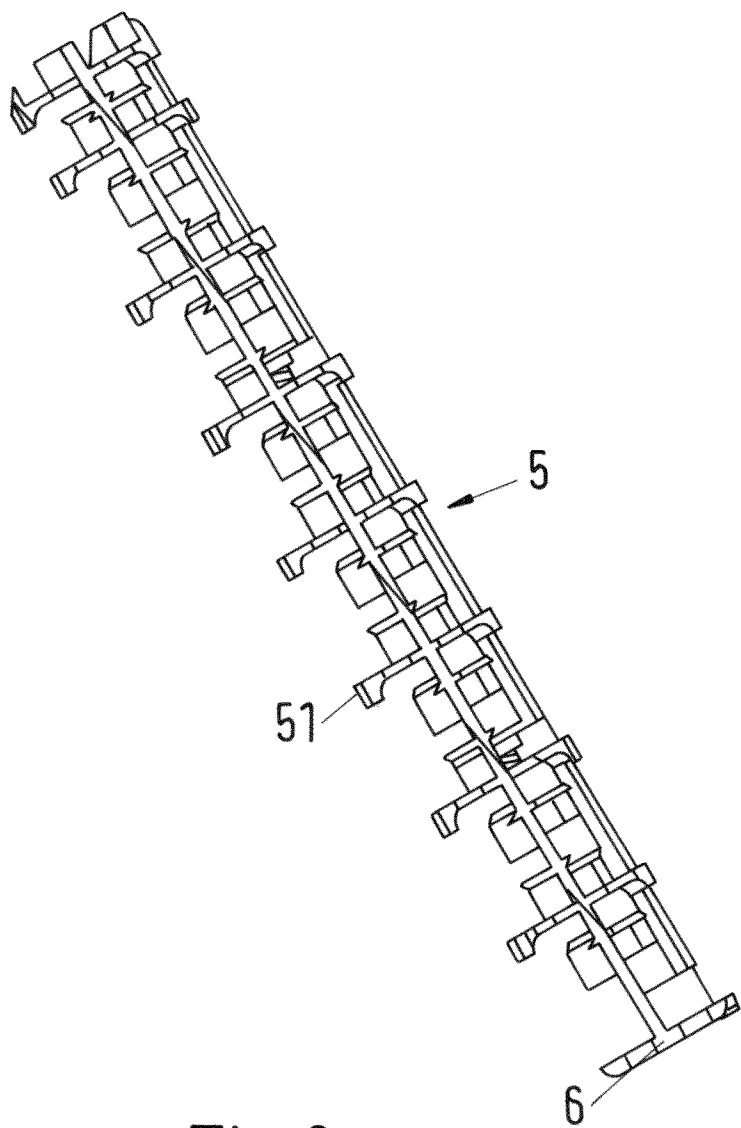


Fig.8

Fig.9A

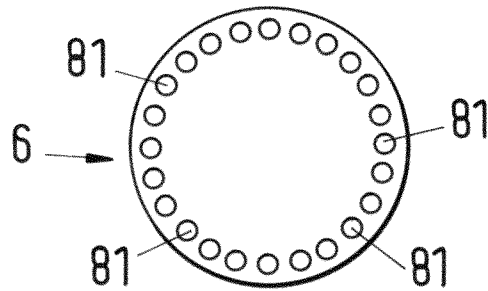


Fig.9B

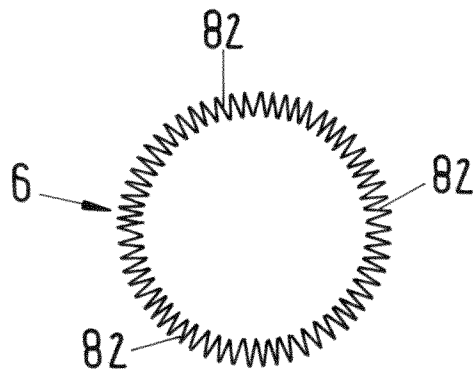


Fig.9C

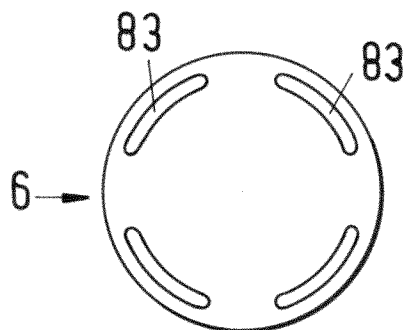


Fig.9

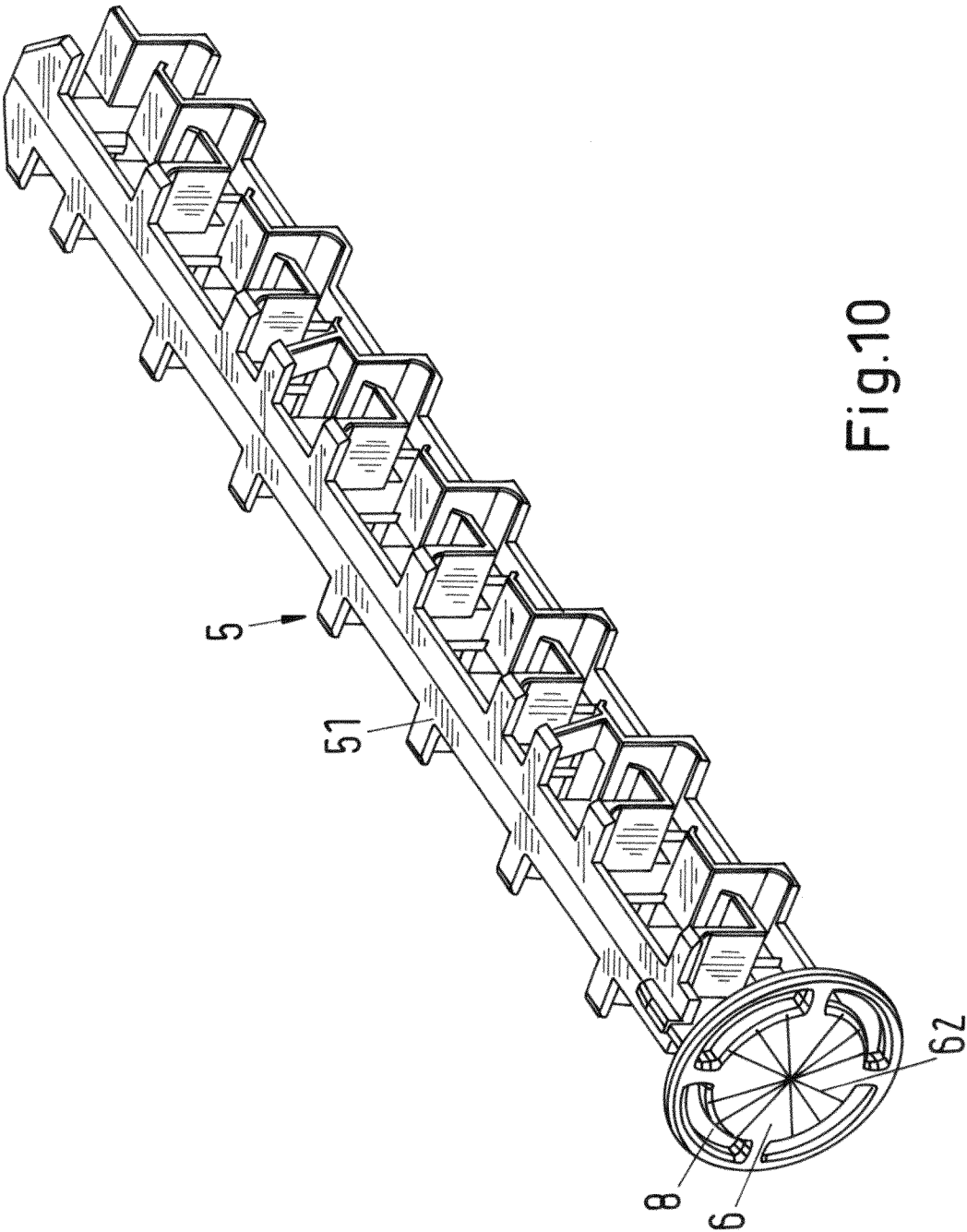


Fig.10

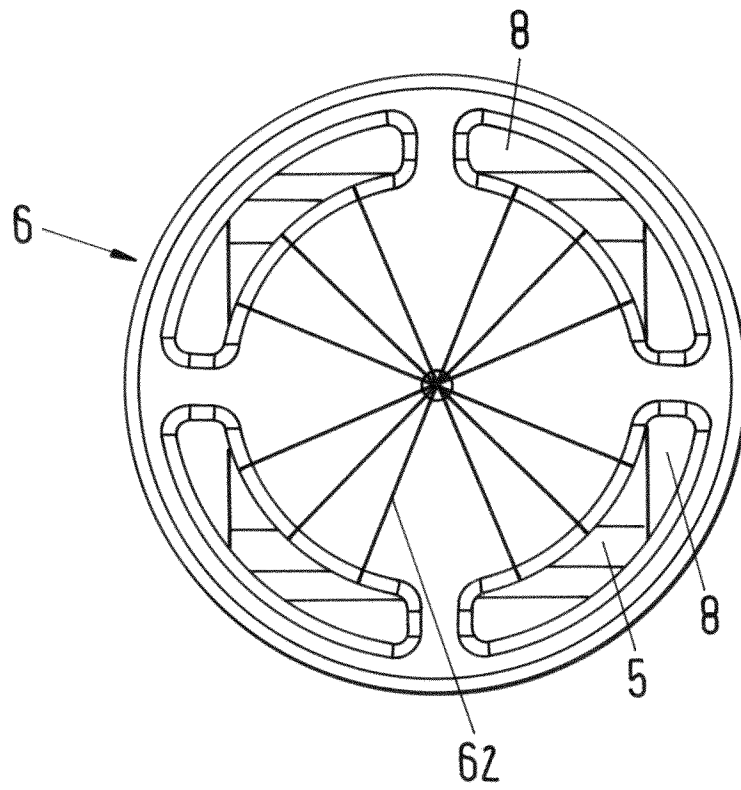
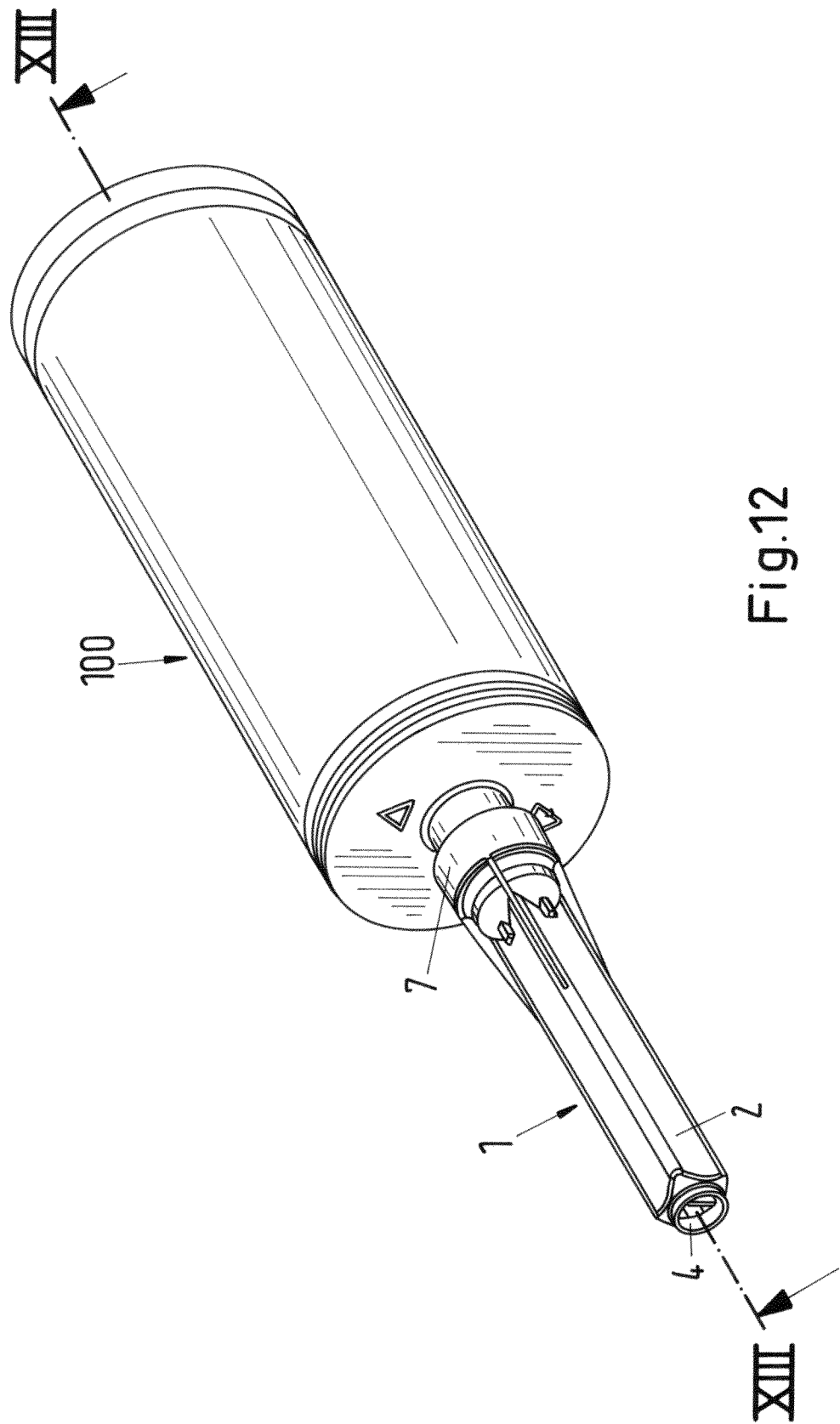


Fig.11



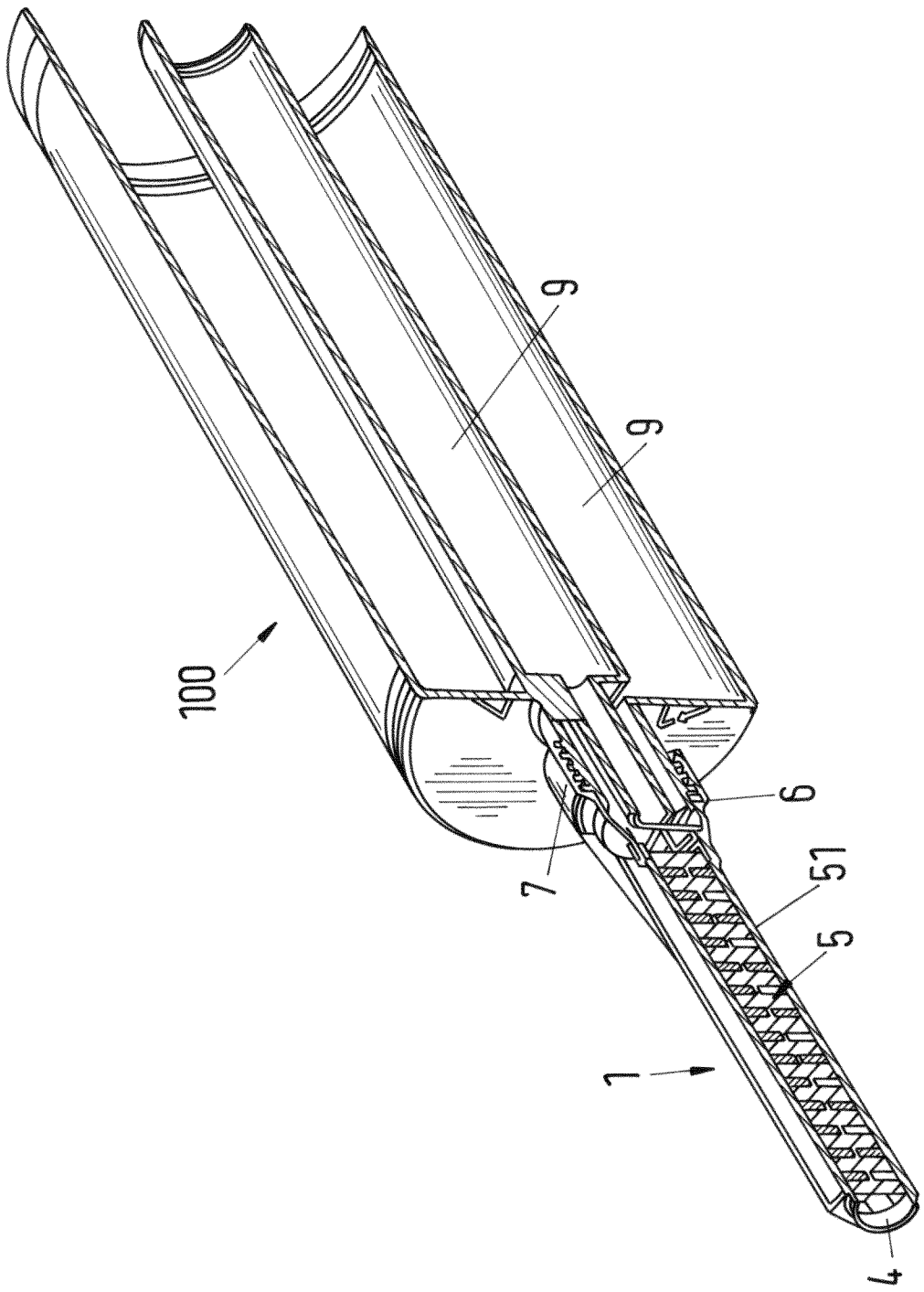


Fig.13

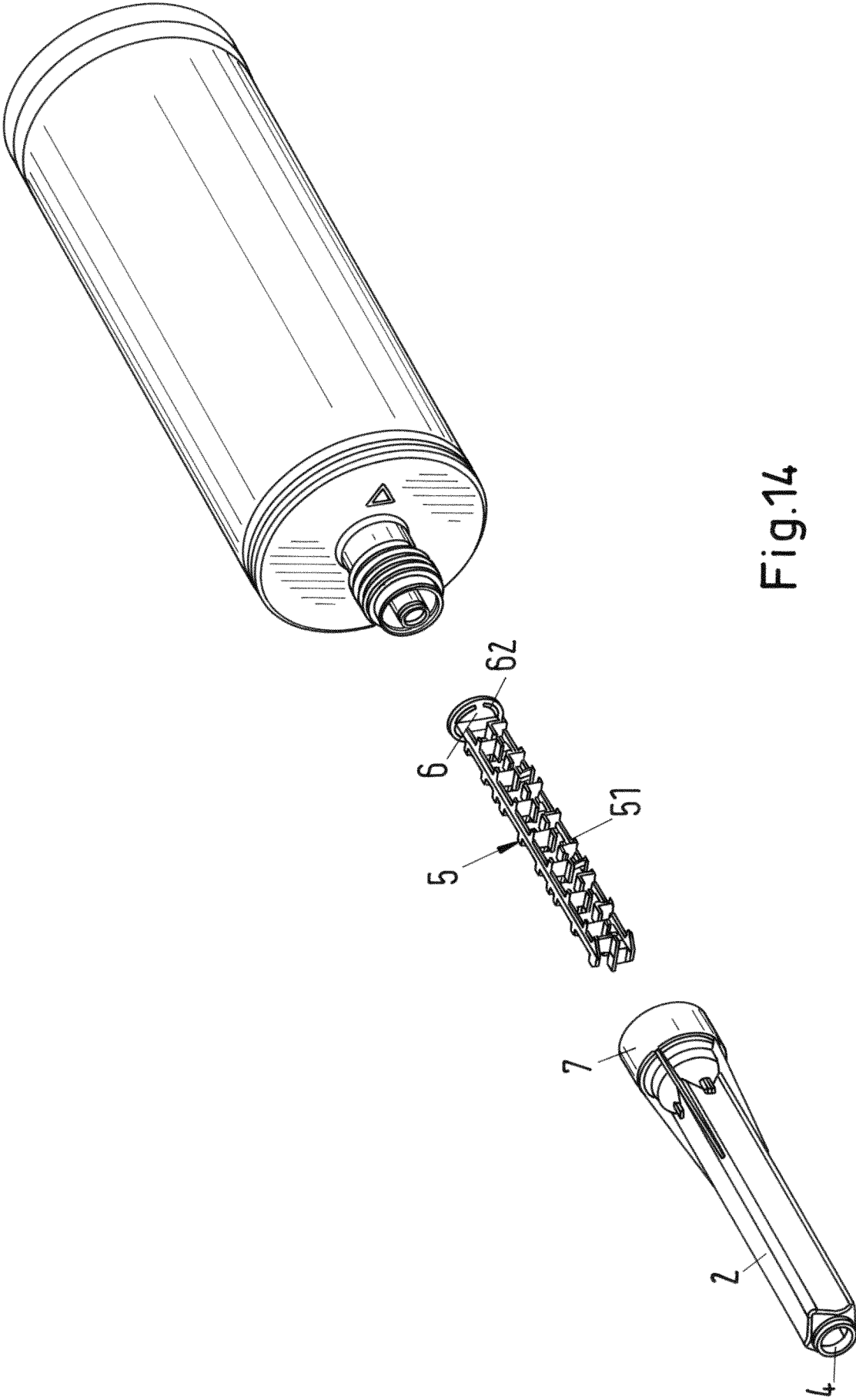


Fig.14

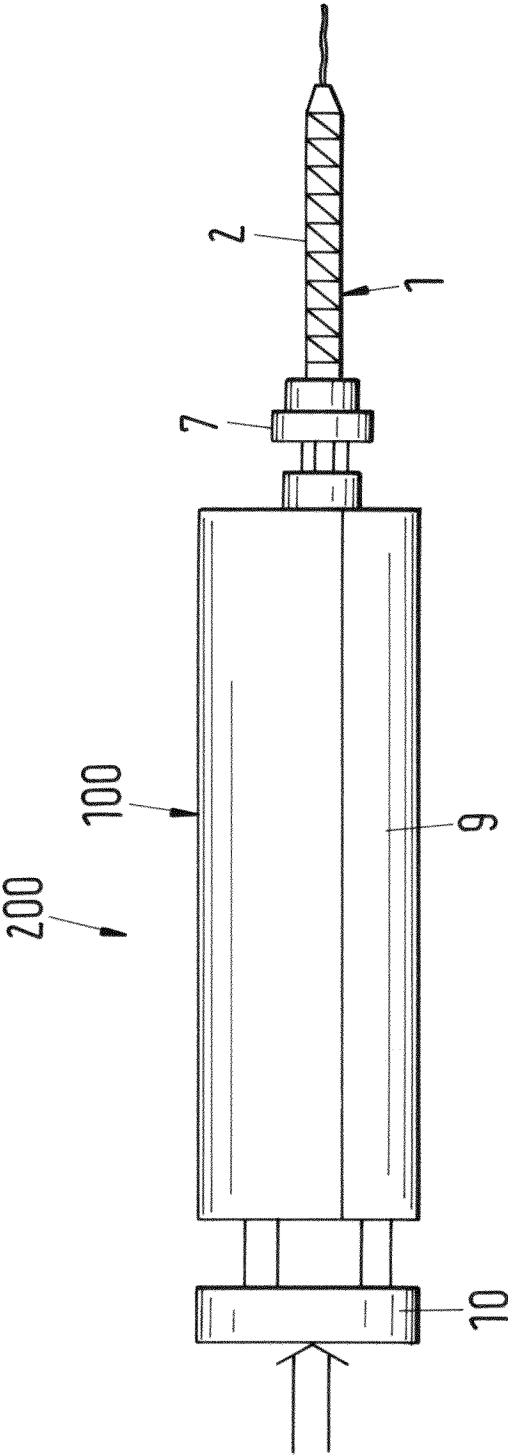


Fig.15

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/051919

## A. CLASSIFICATION OF SUBJECT MATTER

INV. B05C17/005 B01F13/10 B01F5/06  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B05C B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                         | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | DE 92 07 048 U1 (CHEMOFAST KORTE-JUNGERMANN)<br>30 July 1992 (1992-07-30)<br>page 1 - page 5<br>figure 1                                                                                                                                   | 1-3,5,<br>7-15        |
| Y         |                                                                                                                                                                                                                                            | 6                     |
| X         | -----<br>EP 0 289 882 A1 (KELLER WILHELM A)<br>9 November 1988 (1988-11-09)<br>figures 1,3,4<br>column 1, line 5 - line 48<br>column 3, line 18 - column 4, line 1<br>column 4, line 37 - column 5, line 27<br>column 6, line 35 - line 48 | 1-4,7-15              |
| X         | -----<br>EP 1 825 927 A2 (3M ESPE AG [DE])<br>29 August 2007 (2007-08-29)<br>figures 1-6<br>paragraph [0031] - paragraph [0035]<br>-----<br>-/-                                                                                            | 1-3,5,7,<br>8,10-15   |



Further documents are listed in the continuation of Box C.



See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

11 April 2012

Date of mailing of the international search report

18/04/2012

Name and mailing address of the ISA/

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Authorized officer

Krasenbrink, B

## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/051919

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                                               |                       |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Category*                                            | Citation of document, with indication, where appropriate, of the relevant passages                                                                            | Relevant to claim No. |
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| A                                                    | -----<br>US 2 271 982 A (KREVELD ARNOLD VAN)<br>3 February 1942 (1942-02-03)<br>figure 1<br>page 1, column 2, line 54 - page 2, column<br>1, line 48<br>----- | 4                     |

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Information on patent family members

International application No

PCT/EP2012/051919

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date      |
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