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(54) Title: A SYRINGE FOR STORING AND DISPENSING A MATERIAL

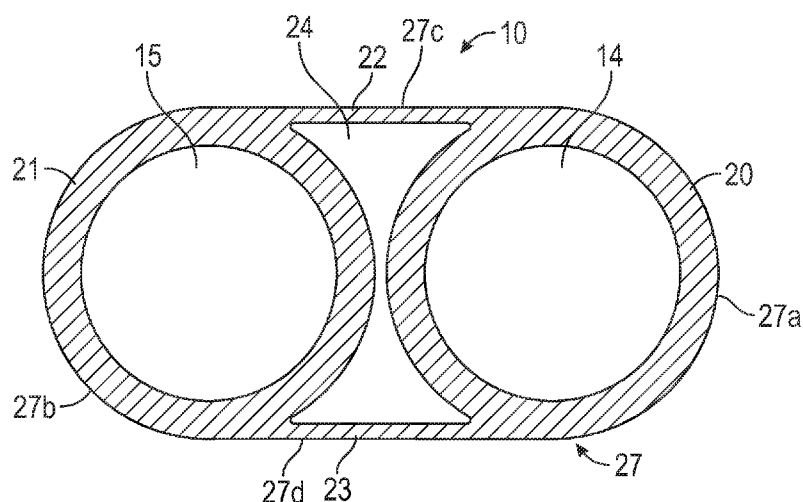


FIG. 3

(57) Abstract: A syringe for storing and dispensing a first and a second component of a material. The syringe has a first chamber containing the first component and a second chamber containing the second component. The syringe further has an empty blank chamber that spaces the first and second chamber from each other.



## A SYRINGE FOR STORING AND DISPENSING A MATERIAL

### Field of the Invention

The invention relates to a syringe for storing and dispensing a first and a second  
5 component of a material, and in particular to a syringe that has a first and a second chamber  
that are separated from each other by an empty blank chamber.

### Background Art

Dental materials are often provided in the form of two or more components that are  
10 stored separate from each other and mixed just before use. Such multi-component dental  
materials may be provided in a syringe that has two or more chambers for each component.  
There are a variety of syringes for storing and dispensing dental materials that are provided  
in the form of two or more components.

To maximize the shelf-life of syringes that are pre-filled with the dental materials it  
15 has been proposed to store the components of the dental materials in separated chambers.

For example, US 4,989,758 relates to a double cartridge for two-component  
compounds. The double cartridge is manufactured in one piece by injection molding and  
has separate reservoir cylinders. The double cartridge enables the storage of the components  
therein for a long time, without the occurrence of an undesired premature reaction due to  
20 diffusion through the plastic material of the cartridge.

EP 1 602 415 A1 describes a syringe comprising a cartridge, a plug, a piston  
assembly and a mixing tip for a multi-component paste. The cartridge may be formed by  
two concentric arranged barrels forming the component chambers for storing the paste  
components.

25 Although existing syringes and cartridges provide advantages regarding shelf-life  
there is still a need for a syringe providing for a maximized shelf-life of the material stored  
therein and which further helps maximizing the hygiene level during use. Such a syringe  
further still shall be manufactured at minimized costs.

### 30 Summary of the Invention

The invention relates to a syringe for storing and dispensing a first and a second  
component of a material, in particular a dental material. The syringe comprises a first

chamber and a second chamber. The first chamber contains or can contain the first component, and the second chamber contains or can contain the second component. The syringe further comprises an empty blank chamber that spaces the first and second chamber from each other.

5            Preferably, the material stored in the syringe can be prepared for use by combining, for example by merging or mixing, the first and second component. The blank chamber is preferably free from any component that is used or required for preparing the material stored in the syringe. More preferably, the blank chamber is empty. The term “empty” thereby means that preferably nothing than eventually air is present in the blank chamber.

10           The invention is advantageous in that it provides a syringe that allows for storing individual material components separated and spaced from each other. Thus, diffusion between the material components can be minimized or prevented. Further, the invention provides for a syringe that has a cartridge exhibiting a smooth outer cartridge surface. The smooth outer cartridge surface enables quick and efficient cleaning through wiping the  
15           cartridge off. Further, the smooth outer cartridge surface minimizes or eliminates any areas that are difficult to access during wiping off. The invention is further advantageous in that it provides a cartridge that can be easily manufactured, for example by injection molding. Thus, the invention helps minimizing the costs for manufacturing the cartridge and helps maximizing the hygiene level during use of the syringe.

20           In one embodiment the blank chamber and the first and second chamber each extend straight and parallel to a longitudinal axis. Preferably the first and second chamber have a first and second chamber length, respectively, in a dimension parallel to the longitudinal axis. The first and second chamber preferably each extend at a uniform cross-section along the first and second length, respectively. Preferably the first and second chamber each  
25           extend at a circular cross-section. Other shapes are possible, for example an oval or D-shaped cross-section.

             In an embodiment the blank chamber extends at least over the longer of, or both of, the first and second chamber length. For example, the first and second chamber length may be equal and the blank chamber may have a blank chamber length in a dimension parallel  
30           to the longitudinal axis. The blank chamber length may be equal to the first and second chamber length.

In an embodiment the syringe has a cartridge front wall that closes a front end of each of the blank chamber and the first and second chamber. The first chamber preferably has a first dispensing outlet. Further, the second chamber preferably has a second dispensing outlet. The first and second dispensing outlet preferably each extend through the cartridge front wall. The front end of the blank chamber and the front ends of the first and second chamber further form a front end of the cartridge. Accordingly, the front end of the cartridge comprises the first and second dispensing outlet. The first and second dispensing outlet may be part of a receptacle of the cartridge, for receiving a mixer, preferably a static mixer, thereon. Accordingly, the syringe may comprise a mixer, preferably a static mixer. The mixer preferably has an inlet for connecting to the first and second dispensing outlet of the cartridge. Thus, the syringe is configured for advancing the first and second component through the mixer where the first and second component are mixed as they flow through the mixer.

Preferably the blank chamber does not comprise a dispensing outlet. Thus, the blank chamber is prevented from picking up any undesired substances that may be present at the front end of the cartridge, for example during use of the syringe in a patient's mouth.

In one embodiment a first piston is received within the first chamber and closes a rear end of the first chamber. A second piston is preferably received within the second chamber and closes a rear end of the second chamber. The rear end of the first and second chamber are located at or adjacent a rear end of the cartridge. The rear end of the cartridge is located opposite of the front end of the cartridge. The rear end of the cartridge may have a fingerplate for supporting the cartridge for advancing or expelling the first and second component.

In a further embodiment the syringe has a first plunger arranged adjacent the rear end of the first chamber and a second plunger arranged adjacent the rear end of the second chamber. The first plunger is preferably connected to (or is monolithically formed with) the first piston and the second plunger is connected to (or is monolithically formed with) the second piston. The first and second plunger may be connected to each other. For example, a fingerplate may be arranged at a rear end of each of the first and second plunger. The fingerplate preferably connects the first and second plunger with each other.

In a further embodiment the rear end of the blank chamber is open. Thus, the blank chamber may form a reservoir. The reservoir may be used for accommodating an applicator therein. Such an applicator may be selected from a brush or a spatula for example.

5 In one embodiment the first chamber is formed by a circumferential first chamber wall and the second chamber is formed by a circumferential second chamber wall. The first and second chamber wall forms an inner surface which may be cylindrical or of an oval or D-shaped cross-section as mentioned above. The syringe may further comprise a first connecting wall connecting the first and second chamber wall. And the syringe may further comprise a second connecting wall connecting the first and second chamber wall. Thus, the  
10 first and second chamber wall may be indirectly connected to each other by both, the first and second connecting wall. Further, the first and second chamber wall may not be in direct contact with each other. In particular, preferably the first and second chamber wall do not form any common wall with each other.

Preferably the blank chamber is formed between the first chamber wall, the second  
15 chamber wall, the first connecting wall and the second connecting wall. In particular, a portion of the first chamber wall, a portion of the second chamber wall, the first connecting wall and the second connecting wall preferably delimit the blank chamber. Preferably the first and second connecting wall (each) extend tangentially from the first chamber wall. Further, preferably the first and second connecting wall (each) extend tangentially from the  
20 second chamber wall. The term “tangentially” means that the first and second connecting wall at a joint to the first chamber wall (or second chamber wall) each extend along a path on a tangent of the first chamber wall (or the second chamber wall). Thus, the first chamber wall, the second chamber wall, the first connecting wall and the second connecting wall transition into each other smoothly, in particular without a groove formed between the first  
25 and second chamber wall. This facilitates cleaning and disinfection by wiping, because areas at the cartridge that are difficult to access are minimized.

In one embodiment the first and second connecting wall each have an outer planar surface. The outer planar surface is preferably a surface that faces in a direction away from the syringe, in particular radially away from the longitudinal axis. A cartridge with a planar  
30 shape of the first and second connecting wall preferably forms an outer cartridge surface that extends at a racetrack-shaped cross-section.

In a further embodiment the first and second connecting wall each have an outer surface that corresponds to a cylinder segment. The outer surface corresponding to a cylinder segment preferably faces in a direction away from the syringe, in particular radially away from the longitudinal axis. A cylinder segment for the purpose of the present specification extends over less than 360 degrees of a full cylinder. A cartridge in which the first and second connecting wall has an outer surface corresponding to a cylinder segment preferably forms an outer cartridge surface that is cylindrical (meaning having a shape of a full cylinder). Therefore, the first and second connecting wall in combination with a portion of the first chamber wall and a portion of the second chamber wall, may form an outer cartridge surface that is cylindrical.

In one embodiment the syringe has a label. The label is preferably adhered on the outer cartridge surface. Therefore, the label preferably has an adhesive layer provided on one major side of the label. Preferably the adhesive layer is provided over the entire major side of the label. Due to the shape of the outer cartridge surface (with only tangential transitions between the first and second chamber wall and the first and second connecting wall) the label may be adhered on the outer cartridge surface with the entire adhesive layer in contact with the cartridge. In particular the label is preferably nowhere spaced from the cartridge. Therefore, areas between the cartridge and the label that are difficult to access or in which bacteria or undesired substances can accumulate are minimized. Thus, the syringe helps maximizing the hygiene level during use.

In one embodiment the cartridge is monolithically formed, for example injection molded. In particular, the first and second chamber wall as well as the first and second connecting wall are preferably monolithically formed, for example injection molded.

#### Brief Description of the Figures

- Fig. 1 is a perspective view of a syringe according to an embodiment of the invention;
- Fig. 2 is a perspective cross-sectional view of the syringe shown in Fig. 1;
- Fig. 3 is a cross-sectional view of a cartridge of a syringe according to an embodiment of the invention; and

Fig. 4 is a cross-sectional view of a further cartridge of a syringe according to an embodiment of the invention;

Fig. 5 is a cross-sectional view of a further cartridge of a syringe according to a further embodiment of the invention.

5

### Detailed Description of the Invention

Fig. 1 shows an exemplary syringe 1 of the invention. The syringe 1 has a cartridge 10 in which a material in the form of a first and a second flowable component can be stored separated from each other. The syringe 1 is configured for expelling the first and second component. Therefore, the syringe 1 comprises a plunger arrangement 11 that has a first and a second plunger 12, 13. The first and second plunger 12, 13 are (partially) received within a first and a second chamber 14, 15, respectively. In particular, a front end 16 of the first plunger 12 is received within the first chamber 14, and a front end 17 of the second plunger 13 is received within the second chamber 15. The front end 16 of the first plunger 12 and the front end 17 of the second plunger 13 in combination form a front end (16, 17) of the plunger arrangement 11. For expelling the first and second component, the plunger arrangement 11 (and thus the first and second plunger 12, 13) are pushed forward in a direction toward a front end 18 of the syringe 1. In the example the syringe 1 at a front end 25 of the cartridge 10 has a receptacle 19 to which a static mixer (see 30 in Fig. 2) can be attached. The first and second component, expelled from the first and second chamber 14, 15, are guided through the static mixer where they are merged and mixed as they flow through the static mixer.

As shown in Fig. 2 the first chamber 14 has a first dispensing outlet 14a and the second chamber 15 has a second dispensing outlet 15a. The first and second dispensing outlet 14a, 15a extend through a cartridge front wall 28. The first and second dispensing outlet 14a, 15a are connectable to an inlet 31 (or inlets) of the static mixer 30.

The material (not shown) present in the first and second chamber 14, 15 is preferably a hardenable dental material. The first and second component (stored in the first and second chamber 14, 15, respectively) are flowable and are composed so as to harden or otherwise increase viscosity (typically by chemical reaction) once they are mixed.

The front end 16 of the first plunger 12 and the front end 17 of the second plunger 13 form a first and a second seal 16a, 17a, respectively. The first and second seal 16a, 17a,

seal the first and second chamber 14, 15, respectively. In an initial situation in which the cartridge 10 is filled with the first and second component the first and second seal 16a, 17a seal a rear end 26 of the cartridge 10. In the embodiment, the first and second seal 16a, 17a each form a conical lip seal. Such a conical lip seal typically provides for an increased sealing effect in response to an increased pressure during advancing the material or component.

Fig. 3 shows a cross-section of the cartridge 10. The cartridge 10 forms the first and the second chamber 14, 15 (see also Figures 2 and 3). The first chamber 14 is formed by a circumferential first chamber wall 20 and the second chamber 12 is formed by a circumferential second chamber wall 21. In other words, the first and second chamber 14, 15 are formed by circumferentially closed and side-by-side arranged barrels that are not in direct contact with each other.

The cartridge 10 further comprises a first connecting wall 22 that connects the first and second chamber wall 20, 21 with each other. Furthermore, the cartridge 10 comprises a second connecting wall 23 connecting the first and second chamber wall 20, 21 with each other. Thus, the barrels (or the first and second chamber wall 20, 21) are only indirectly connected to each other and are otherwise spaced from each other.

A blank chamber 24 is formed between the first chamber wall 20, the second chamber wall 21, the first connecting wall 22 and the second connecting wall 23. The blank chamber 24 spaces the first and second chamber 14, 15 (and the first and second chamber wall 20, 21) from each other. The blank chamber 24 further is empty, meaning the blank chamber 24 does not contain any material or component thereof that is to be dispensed from the syringe 1.

The first and second chamber wall 20, 21 and the first and second connecting wall 22, 23 in combination provide the cartridge 10 with an outer cartridge surface 27. The outer cartridge surface 27 is thus composed of:

- a first outer cartridge surface portion 27a (provided by the first chamber wall 20),
- a second outer cartridge surface portion 27b (provided by the second chamber wall 21),
- a third outer cartridge surface portion 27c (provided by the first connecting wall 22) and

- a fourth outer cartridge surface portion 27d (provided by the second connecting wall 23).

The first and the fourth outer surface portion 27a, 27d transition into each other  
5 based on the same tangent on the first and fourth outer surface portion 27a, 27d. Further, the fourth and the second outer surface portion 27d, 27b transition into each other based on the same tangent on the fourth and second outer surface portion 27d, 27b. The second and the third outer surface portion 27b, 27c transition into each other based on the same tangent on the second and third outer surface portion 27b, 27c. And the third and the first outer surface  
10 portion 27c, 27a transition into each other based on the same tangent on the third and first outer surface portion 27c, 27a. Accordingly, the outer cartridge surface 27 is free of sharp transitions, cavities, grooves or edges. This facilitates the cleaning by wiping off the outer cartridge surface 27 with a disinfectant because bacteria are hindered in hiding or being trapped in areas that cannot be easily accessed. In the example the outer cartridge surface  
15 27 extends straight and at a racetrack-shaped cross-section.

Fig. 4 shows an alternative cross-section of the cartridge 10. Again, the cartridge 10 forms the first and the second chamber 14, 15 (see also Figures 2, 3 and 4). The first and second chamber 14, 15 are formed by a circumferential first and second chamber wall 20, 21, respectively. In other words, the first and second chamber 14, 15 are formed by  
20 circumferentially closed and side-by-side arranged barrels that are not in direct contact with each other.

The cartridge 10 further comprises a first connecting wall 22 that connects the first and second chamber wall 20, 21 with each other. Furthermore, the cartridge 10 comprises a second connecting wall 23 connecting the first and second chamber wall 20, 21 with each  
25 other.

A blank chamber 24 is formed between the first chamber wall 20, the second chamber wall 21, the first connecting wall 22 and the second connecting wall 23. The blank chamber 24 spaces the first and second chamber 14, 15 (and the first and second chamber wall 20, 21) from each other. The blank chamber 24 further is empty, meaning the blank  
30 chamber 24 does not contain any material or component thereof that is to be dispensed from the syringe 1. However, if desired the blank chamber might be used for storing other items, e.g. an instruction of use or mixing equipment (e.g. static mixer).

The first and second chamber wall 20, 21 and the first and second connecting wall 22, 23 in combination provide the cartridge 10 with an outer cartridge surface 27. The outer cartridge surface 27 is thus composed of:

- 5       - a first outer cartridge surface portion 27a (provided by the first chamber wall 20),
- a second outer cartridge surface portion 27b (provided by the second chamber wall 21),
- a third outer cartridge surface portion 27c (provided by the first connecting wall 22) and
- 10       - a fourth outer cartridge surface portion 27d (provided by the second connecting wall 23).

The first and the fourth outer surface portion 27a, 27d transition into each other based on the same tangent on the first and fourth outer surface portion 27a, 27d. Further, the  
15       fourth and the second outer surface portion 27d, 27b transition into each other based on the same tangent on the fourth and second outer surface portion 27d, 27b. The second and the third outer surface portion 27b, 27c transition into each other based on the same tangent on the second and third outer surface portion 27b, 27c. And the third and the first outer surface portion 27c, 27a transition into each other based on the same tangent on the third and first  
20       outer surface portion 27c, 27a. Accordingly, the outer cartridge surface 27 is free of sharp transitions, cavities, grooves or edges. In the example the outer cartridge surface 27 is cylindrical.

Alternative embodiments of these devices could be made with the two inner barrels in direct but tangential contact with each other. The separating wall between them would be  
25       the additive thickness of each barrel wall. This would form a syringe with 4 parallel chambers: two side-by-side cylindrical chambers containing paste or other flowable material, which separate two empty chambers whose cross sections are circular horn triangles.

In another embodiment the syringe further comprises a plurality of empty blank  
30       chambers that provide spaces between portions of the first and second chamber from each other. In yet another embodiment the empty blank chambers comprise a circular triangle cross-sectional shape (see Figure 5).

What is claimed is:

1. A syringe for storing and dispensing a first and a second component of a material, comprising a first chamber containing the first component and a second chamber  
5 containing the second component, wherein the syringe further comprises an empty blank chamber that spaces the first and second chamber from each other.
2. The syringe of claim 1, wherein the blank chamber and the first and second chamber each extend straight and parallel to a longitudinal axis.
- 10 3. The syringe of claim 2, wherein the first and second chamber have a first and second chamber length, respectively, in a dimension parallel to the longitudinal axis, and wherein the first and second chamber each extend at a uniform cross-section along the first and second length, respectively.
- 15 4. The syringe of claim 3, wherein the blank chamber extends at least over the longer of or both of the first and second chamber length.
- 20 5. The syringe of any of the preceding claims, having a cartridge front wall that closes a front end of each of the blank chamber and the first and second chamber, and wherein the first chamber has a first dispensing outlet and the second chamber has a second dispensing outlet, wherein the first and second dispensing outlet each extend through the cartridge front wall.
- 25 6. The syringe of claim 5, wherein the blank chamber does not comprise a dispensing outlet.
7. The syringe of any of the preceding claims, wherein a first piston is received within the first chamber and closes a rear end of the first chamber, and wherein a second  
30 piston is received within the second chamber and closes a rear end of the second chamber.
8. The syringe of claim 7, having a first plunger arranged adjacent the rear end of the first chamber and a second plunger arranged adjacent the rear end of the second chamber,

wherein the first plunger is connected to the first piston and the second plunger is connected to the second piston.

9. The syringe of claim 7 or 8, wherein the rear end of the blank chamber is open.

5

10. The syringe of any of the preceding claims, wherein the first chamber is formed by a circumferential first chamber wall and the second chamber is formed by a circumferential second chamber wall, and wherein the syringe further comprises a first connecting wall connecting the first and second chamber wall and a second connecting wall also connecting the first and second chamber wall, wherein the blank chamber is formed between the first chamber wall, the second chamber wall, the first connecting wall and the second connecting wall.

10

11. The syringe of claim 10, wherein the first and second connecting wall extend tangentially from the first chamber wall and tangentially from the second chamber wall.

15

12. The syringe of claim 11, wherein the first and second connecting wall each have an outer planar surface.

20

13. The syringe of claim 11, wherein the first and second connecting wall each have an outer surface that corresponds to a cylinder segment.

14. The syringe of claim 13, wherein the first and second connecting wall in combination with a portion of the first chamber wall and a portion of the second chamber wall, forms a cylindrical outer cartridge surface.

25

15. The syringe of any of the preceding claims comprising two empty blank chambers.

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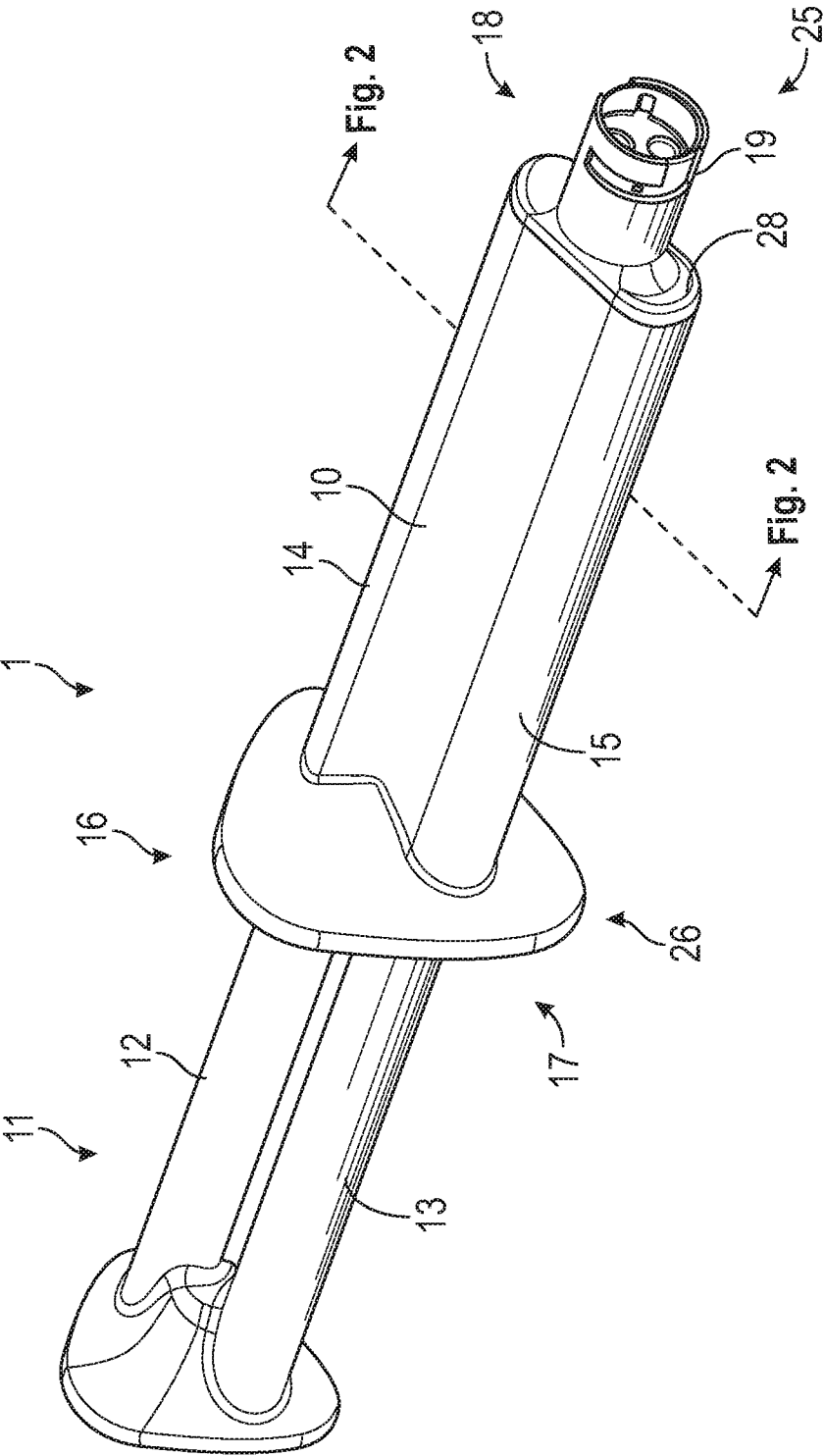


FIG. 1

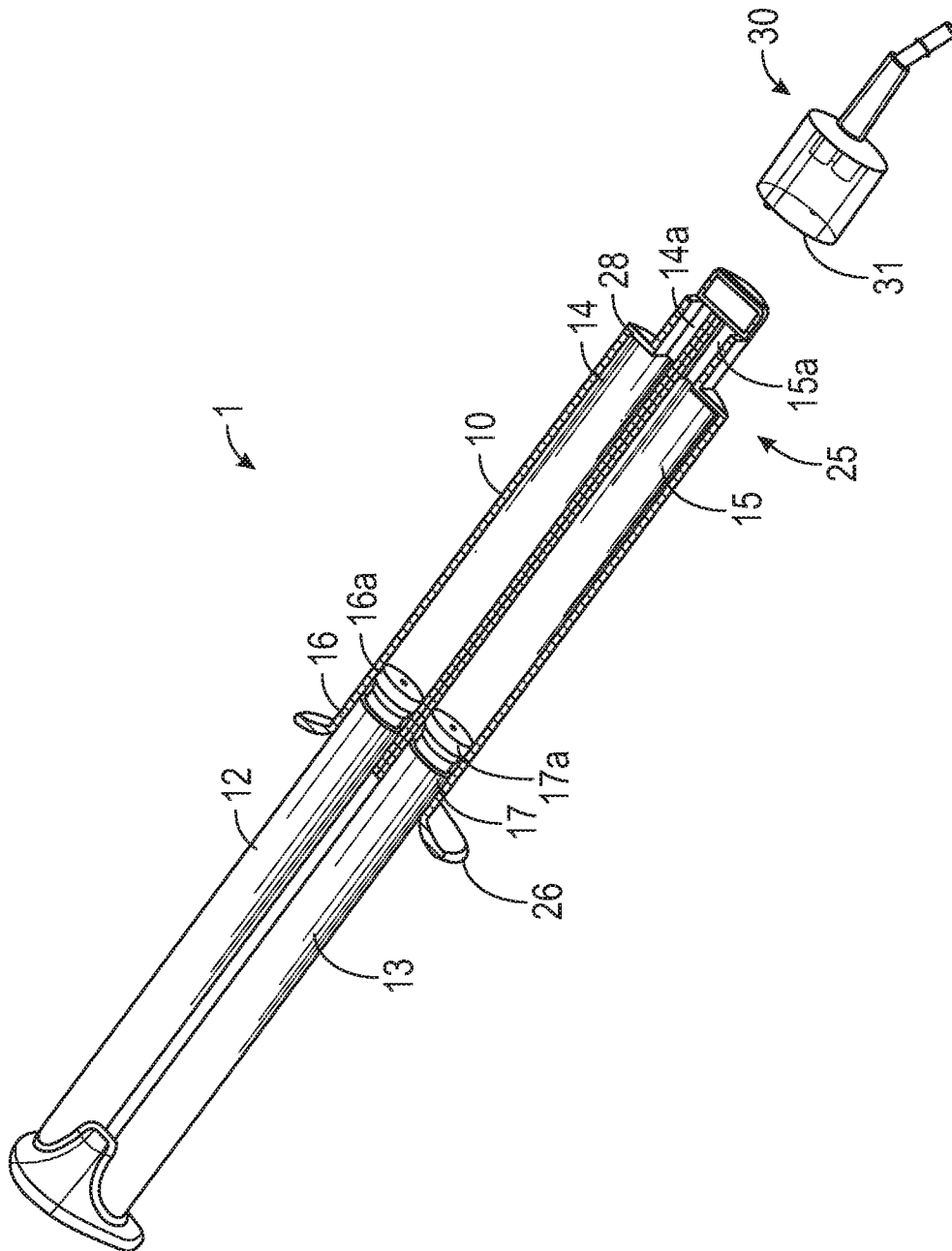


Fig. 2

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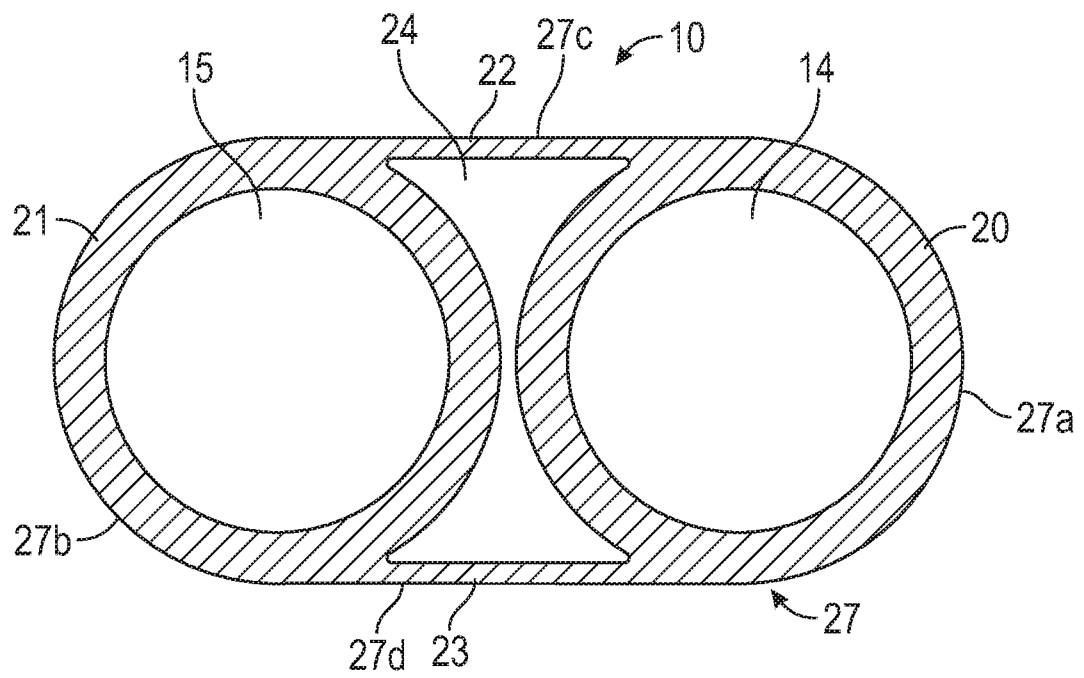


FIG. 3

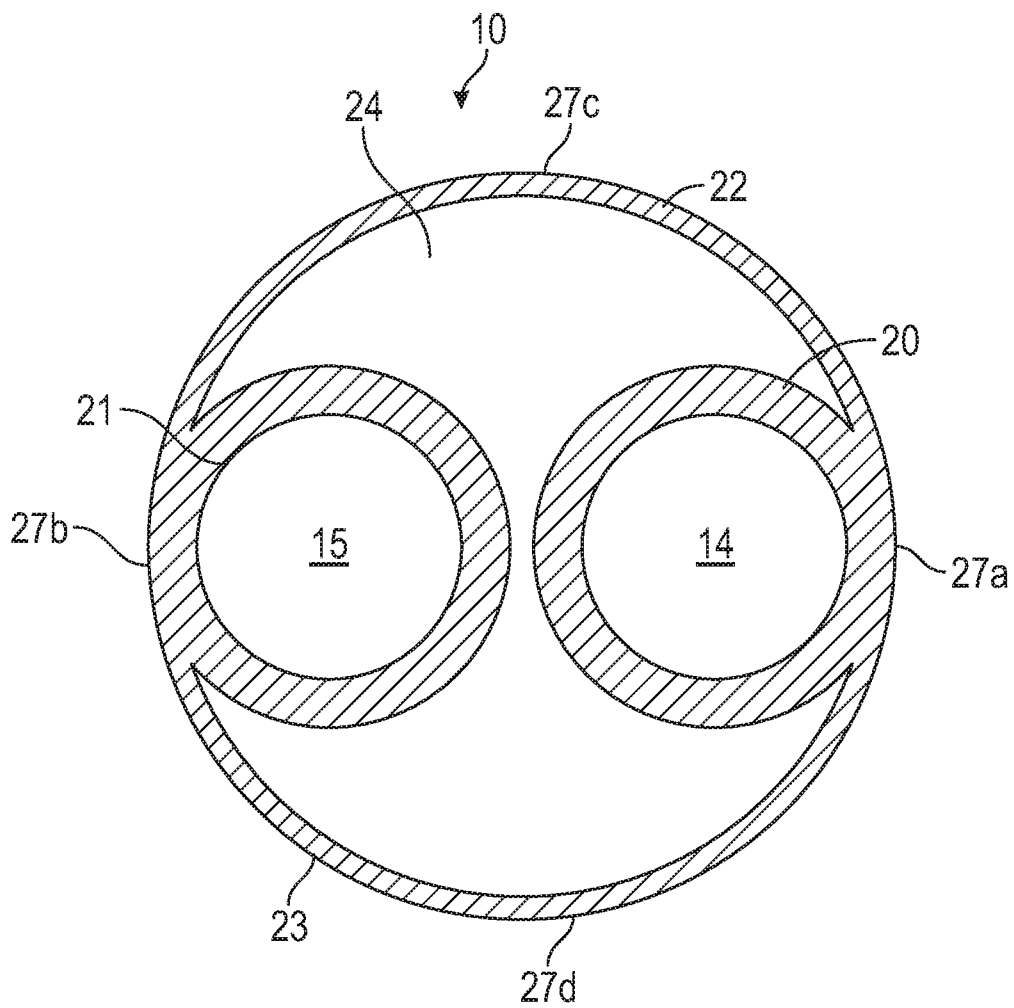


FIG. 4

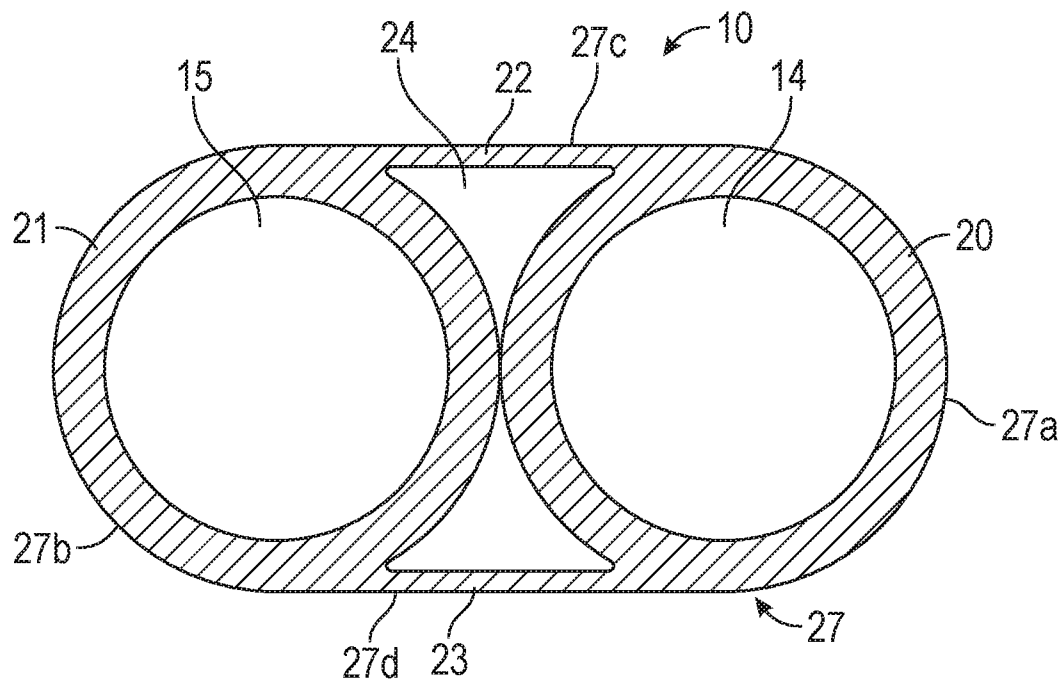


FIG. 5

# INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2019/060072

## A. CLASSIFICATION OF SUBJECT MATTER

INV. A61C9/00 A61M5/19  
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)

A61C A61M

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 practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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Date of mailing of the international search report

16/01/2020

Name and mailing address of the ISA/

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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