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(54) Title: METHOD FOR MANUFACTURING OF URINARY CATHETERS

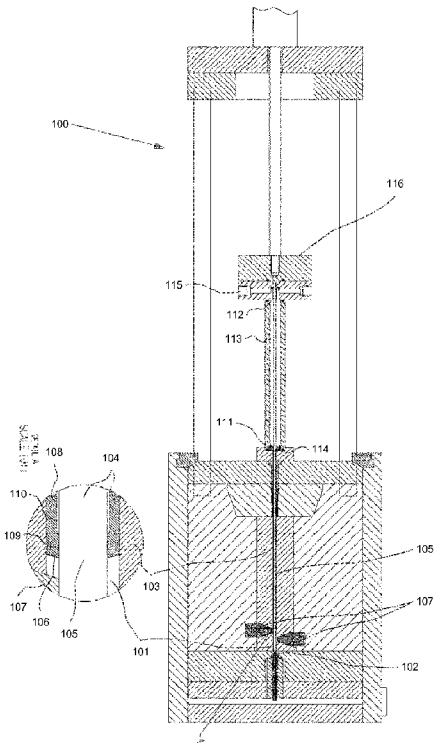


Fig. 1

(57) Abstract: A method for manufacturing an elongated element (200) is disclosed. The method comprises arranging a molding cavity (101), defined by a mold (103) and a mold insert (104), said mold insert (104) comprising a mold core (105). A liquid material is then injected into a proximal end (102) of the molding cavity (101), and the material is solidified, such that the elongated element (200) is formed. The elongated element (200) and mold insert (104) are removed from said mold (103), and the elongated element (200) is removed from said mold insert (104), wherein said removal of said elongated element (200) from said mold insert (104) comprises injecting a fluid in the interface between the elongated element (200) and the mold core (105). A mold assembly for the manufacture thereof is also provided.

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METHOD FOR MANUFACTURING OF URINARY CATHETERS

Field of the Invention

This invention pertains in general to the field of injection molding of thin-walled, elongated, elements, with a tubular body and an optionally substantially closed end. More particularly the invention relates to a catheter, such as a urinary catheter, with an elongated tubular portion and a tip portion. Furthermore, the present invention pertains to a method of manufacturing such elements and catheters, and an assembly for forming a molding cavity.

Background of the Invention

Urinary catheters are widely used by persons who have problems with respect to unintentional/intentional emptying of the urinary bladder. A wide variety of different types of urinary catheters is available to individuals or medical professionals, which are specifically designed for a specific use, such as intermittent catheters or permanent/long term catheters, such as Foley catheters.

Intermittent catheters are for example used by individuals who are paralyzed, where the urinary bladder is emptied in regular intervals. These individuals are often capable of inserting the intermittent catheter without assistance. The use of permanent or long-term catheters is usually linked to an individual's hospital stay or at least where the individual is under regular observation of medical professionals, as permanent catheters are not well adapted for self catheterization since they are usually very flexible and have a larger diameter than intermittent catheters. This calls for insertion by medical professionals under relatively clean or even sterile conditions.

Urinary catheters are generally known to comprise a tubular portion for providing a fluid pathway from the urinary bladder to the outside of the body, a tip portion – often rounded – for facilitated insertion of the catheter into the urethra, and drainage openings for facilitating the entering of urine into the tubular portion. At the other end of the tubular portion in relation to the tip portion, a connecting portion may be provided for connection to a urinary bag or other urine discarding means.

The most common method of producing urinary catheters, especially intermittent catheters, is to extrude a tubular portion in a plastic material, and in separate stages providing the tubular portion with the tip portion and drainage openings, and optionally also a connecting portion, such as a portion with somewhat larger diameter, for example a conical portion, at the other end of the tubular portion in relation to the tip portion and drainage openings. Catheters that are manufactured using the extrusion

process have a uniform and constant diameter on both the external and the internal surface from end to end, and therefore have a constant thickness of material throughout the entire length of the catheter tube.

Lately, urinary catheters have been injection molded for the omission of unnecessary manufacturing steps. Injection molding of urinary catheters is however accompanied with several obstacles. Due to the delicate dimensions of a urinary catheter, such as small tube diameter and wall thickness while being relatively long, also the mold insert/core, forming the lumen of the tubular portion, needs to be thin and long. When the molten plastic material enters the molding cavity, often under high pressure, the plastic material will whirl in the cavity. Due to the whirling the insert/core will vibrate during the molding process, whereby the diameter of the lumen and the wall not will be unitary along the length of the urinary catheter. This renders the separation of the molded catheter and the insert/core almost impossible, naturally resulting in useless manufacturing in an industrial scale.

GB 2230702 discloses a method for the production of an intermittent urethral catheter, said method comprising injection molding, wherein pins, forming the drainage openings, also stabilize the insert/core in the injection molding cavity.

However, even though the insert/core is somewhat stabilized, still the insert/core along its length from the drainage openings to the end of molding cavity, which normally constitutes approximately 90 % of its length, may vibrate. Additionally, even though the stabilization of the insert/core helps the formation of a tubular wall with unitary dimensions, it may be very difficult to separate the insert/core from the molded catheter, due to the large contact surface between the insert/core and the plastic material. This problem is specifically significant when the injected material is a plastic material with high adherence properties, which is often the case with plastic materials with well-suited flexibility properties for the intended purpose. Such materials may for example be polyurethanes.

Summary of the Invention

Accordingly, the present invention preferably seeks to mitigate, alleviate or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination and solves at least the above mentioned problems by providing a method for manufacturing an elongated element, comprising the steps of: arranging a molding cavity, defined by a mold and a mold insert, said mold insert comprising a mold core; injecting a liquid material into a proximal end of the molding

cavity; solidifying said liquid material, such that the elongated element is formed; removing said elongated element and mold insert from said mold; and removing said elongated element from said mold insert, wherein said removal of said elongated element from said mold insert comprises injecting a fluid in the interface between the elongated element and the mold core. A mold assembly for realizing such method is also provided.

Further advantageous embodiments of the present invention are embodied in the appended patent claims.

Brief Description of the Drawings

These and other aspects, features and advantages of which the invention is capable of will be apparent and elucidated from the following description of embodiments of the present invention, reference being made to the accompanying drawings, in which

Fig. 1 is across-sectional view of a mold assembly according to one embodiment of the present invention;

Fig. 2 is a side-view of an elongated tubular member according to one embodiment of the present invention;

Fig. 3 is a cross-sectional view of a mold assembly according to one embodiment of the present invention;

Fig. 4 is a cross-sectional view of a mold assembly according to one embodiment of the present invention; and

Fig. 5 is a cross-sectional view of a mold assembly according to one embodiment of the present invention.

Description of embodiments

The following description focuses on an embodiment of the present invention applicable to an elongated element, and in particular to a urinary catheter, and more specifically an intermittent urinary catheter. However, it will be appreciated that the invention is not limited to this application but may be applied to many other elongated elements, such as Foley catheters or test tubes, etc.

In the context herein the terms "proximal" and "distal", and analogues thereof, are used in relation to body on which the end product is to be used, while the terms "lateral" and "central" are used in relation to the longitudinal as well as the

proximodistal extension of the end product. This means that also with respect of molds and mold assemblies these terms are used in relation to the end product characteristics.

In Fig. 1 a mold assembly 100 for the manufacturing of a urinary catheter, according to an embodiment is disclosed. Fig. 1 illustrates a start position for the manufacturing of a urinary catheter. A material hopper (not shown) is connected in fluid communication with an injection ram or screw-type plunger (not shown), and a heating unit (not shown), in a known manner with respect of injection molding. The injection ram or screw plunger is in turn in fluid communication with a mold cavity 101 via an injection sprout 102. In this way, a material intended to constitute the urinary catheter may be placed in the material hopper, and then being processed to be injected in a fluid form into the mold cavity 101 via the injection sprout 102. A material being well-functioning for urinary catheters and to possible to use during manufacturing of a urinary catheter according to the methods according to the present invention is polyurethane, despite the stickiness of polyurethanes with regard to metal parts, such as metal mold parts.

The injection sprout 102 is positioned at the proximal end of the mold cavity 101. The injection sprout is positioned such that it delivers the material in the proximodistal direction into the mold cavity 101 from the proximal apex of the mold cavity 101. The mold cavity is defined by a mold 103 and a mold insert 104. The mold insert 104 comprises a mold core 105 and a displaceable mold cavity wall 106. The displaceable mold cavity wall 106 may be displaced distally into an end position, in which the mold cavity corresponds in form to the full catheter. In the start position, as illustrated in Fig. 1, the displaceable mold cavity wall 106 will be positioned and be in contact with the inner mold cavity wall and the mold core 105. At the proximal zone of the mold cavity 101 pins 107 extend transversally into contact with the mold core 105, to form drainage openings in the injection molded catheter. These pins 107 further aids in stabilizing the core during injection molding, even though they aid in a limited way when the end position is reached.

The mold 103 and the mold insert 104 forms a mold cavity 101 which allows for the production of an injection molded urinary catheter 200 with a tubular body portion 201with a rounded or slanting proximal tip portion 202 and an enlarged distal connecting portion 203, in accordance with Fig. 2. The tip portion 201 is rounded or slanting to ease insertion of the catheter 200 into the urethra. The enlarged distal connecting portion 203 is configured to allow for connection to a hose or urine evacuator. The tubular body portion 201 is thus positioned in between the proximal tip

portion 202 and the enlarged distal connecting portion 203. At the proximal end zone of the catheter 200 drainage openings or drainage eyes 204 are positioned. The drainage openings 204 are preferably positioned on opposite sides of the tubular body portion, such that liquid, such as urine, may enter the catheter 200 from different directions. Due to the configuration of the mold assembly 100 a catheter with monolithically formed parts may be injection molded. This means that catheter 200 monolithically comprises the tubular body portion 201with the rounded or slanting proximal tip portion 202, the enlarged distal connecting portion 203, said tubular body portion 201 being provided with at least one drainage opening 204 at its proximal end zone, since the catheter 200 may be injection molded in the mold assembly 100, thus eliminating the need for subsequent steps of adding a connecting portion or drainage openings. In this context "monolithic"/"monolithically" means that there is no interface, seam, weld, post-fabricated joint between the individually identified parts. Additionally, the obtained catheter 200 may have an angle between a central axis of the tubular body portion 201 and the wall of the tubular body portion 201, in a cross section along said central axis, that is below 0.5 degrees, such as cylindrical. The variation with regard to the wall thickness over the tubular body portion 201 may be kept as low as below 1/50 mm, due to the decreased vibrations of the mold core during injection.

The mold cavity 101 of the mold 103 is elongated in the proximodistal direction, with a circular transversal cross-section, and a negatively rounded or concave proximal end (bottom), while the mold core 105 also is elongated in proximodistal direction and cylindrical, i.e. a circular transversal cross-section. The difference in diameter between the diameter of the mold cavity 101 transversal cross-section and the mold core cylinder corresponds to the thickness of the catheter wall, and the diameter of the mold cavity 101 transversal cross-section corresponds to the outer circumferential catheter diameter.

The transversal cross-sections of the mold cavity 101 and the mold core 105 may of course have other shapes than circular, such as oval, triangular, square, or multi-angular, if a specific usage calls for such other transversal cross-sections.

The mold core 105 extends proximally to the proximal apex of the mold cavity 101 to a distance from the proximal apex corresponding to the catheter thickness of the tip portion 202 of the urinary catheter to be produced. The displaceable mold cavity wall 106 is arranged between the mold 103 and the mold core 105 as a part of the mold insert 104, such that it may be displaceable distally and proximally along the surfaces thereof. The displaceable mold cavity wall 106 is slanting distally in the lateral

direction. In the starting position the displaceable mold cavity wall 106 is positioned in close proximity of a proximal tip of the mold core 105, as illustrated in Fig. 1.

The displaceable mold cavity wall 106 is the proximal end wall of a mold core runner 108. The mold core runner 108 is displaceable along the cylindrical wall of the mold core 105 and the tubular wall of the mold cavity 101, said tubular part corresponding to the tubular body portion 201 of the catheter 200. The mold core runner 108 runs at the cylindrical wall of the mold core 105 via a running flange 109. Distally of the running flange 109, laterally of the mold core 105 and centrally of the mold core runner 108, a column or cavity 110 extends distally. This column/cavity 110 allows for low friction between the mold core 105, mold core runner 108 and mold 103. Also, the column/cavity 110 is in fluid communication with a pressure chamber (not shown). Once the urinary catheter has been injection molded and the mold insert 104 and molded catheter thereon are removed from the mold cavity 103, the pressure chamber may expel gas through the column/cavity 110 into the catheter, to facilitate removal of the catheter from the mold insert 104. This will be explained in more detail below, with respect of the finalization of the manufacturing process of the urinary catheter.

During manufacturing of the catheter, the plastic material, such as polyurethane, is injected into the mold cavity 101, with a mold 103 and a mold insert 104, said mold insert comprising a mold core 105 and mold core runner 108, and said mold 103, mold insert 104 with said mold core 105 and said mold core runner 108 being in said start position in accordance with Fig. 1. In Fig. 1 the injection molding start position with a start volume of the mold cavity 101 is thus illustrated. The plastic material then fills the proximal start volume of the mold cavity 101 in said start position. In this position the mold core 105 is stabilized by the mold core runner 108, due to the interaction between the running flange 109 of the mold core runner 108 and the mold core 105 and mold 103, respectively. In this way vibration of the mold core 105 due to whirling of the plastic material may be decreased or minimized.

When the start volume is filled with plastic material and plastic material still is introduced through the injection sprout 102, the plastic material will displace the mold core runner 108 distally along the mold core 105 and the mold cavity wall of the mold 103. In this way the mold cavity 101 is continuously increased while the mold cavity 101 is filled with plastic material. Hence, the plastic material will aid in stabilizing the mold core 105 during the injection molding on the proximal side of the displaceable mold cavity wall 106 while the mold core runner 108 stabilizes the mold core 105 on the distal side of the displaceable mold cavity wall 106, and since there is no plastic

material distally of the displaceable mold cavity wall 106 vibrations of the mold core 105 on this location will not affect the quality of the final product.

In accordance with Fig. 3, the displaceable mold cavity wall 106 will be displaced distally until the distal end of a stop plate 111 on the mold core runner 108 hits a distal end wall 112 of a carrying cylinder 113, at the end position, in the volume of which the mold core runner 108 runs on the mold core 105. Likewise, the proximodistal extension of the cylinder 113 corresponds to the length of the catheter to be molded, such that when the stop plate 111 hits a proximal end wall 114 of the carrying cylinder 113, the mold core runner 108 will be in the start position.

The volume of the carrying cylinder 113 may be sealed of, and connected to a valve 115. The resistance of the valve 115 may be suitably selected in relation to the injection force of the injected plastic material, such that the mold core runner 108 will run smoothly and in appropriate speed for the plastic material to fill the mold cavity 101 from the start position to the end position.

In accordance with Fig. 4, at a distal end section of the mold cavity 101 the transversal cross-section of the mold cavity increases laterally in a distal mold part 116 corresponding to the connecting portion 203. The distal mold part 116 comprises two mold halves 116a, 116b. The mold halves 116a, 116b are slidingly engaged with distal mold end block 117, such that the mold halves may be slid laterally after the catheter 200 and mold insert 104 has been retracted from the mold 103. The transversal cross-section first increases in the distal direction in a step wise into a tubular part of the connecting portion, and then continuously into a cone-shaped part of the connecting portion. In this way, it may be assured that the catheter is displaced distally from the mold cavity 101 together with the distal mold end block 117 and a conical mold end block protrusion 118, extending into the mold cavity 101.

In the distal mold part corresponding to the connecting portion 203, the mold core runner 108 will no longer bear on the mold 103 but only on the mold core 105. Additionally, the proximal end of the mold core runner 108 will reach the end position before reaching the distal end of the mold cavity 101. This means that the displaceable mold cavity wall 106 will be positioned proximally of the distal mold cavity surface of the mold end block 117 and the conical mold end block protrusion 118. The injected material will then be distributed between the mold core runner 108 and the mold 103, in form of the mold halves 116a, 116b at the distal end zone of the mold cavity 101. In this way a the distal portion of the molded element, i.e. the catheter, will be provided with the distal connecting portion with enlarged inner and outer diameter in relation to the

tubular body portion in between the proximal tip portion and the distal connecting portion. Also, a connecting portion may be obtained on the catheter without the use of a separate manufacturing step of fusing the catheter with a connecting portion, once the catheter has been injection molded.

In Fig. 5 it is disclosed when the catheter 200 has been retracted from the mold cavity 101 by the aid of suitable hydraulics or a step motor. This step is initiated by releasing the mold end block 117, and thereby also the distal mold part 116 and the conical mold end block protrusion 118. The release of these components is realized by moving lock leaves 119 laterally and perhaps distally, said lock leaves 119 during injection between the start and end position locking the mold end block 117, and thereby also the distal mold part 116 and the conical mold end block protrusion 118 from distal movement as a result of the injection force. When the mold end block 117, the distal mold part 116 and the conical mold end block protrusion 118 are moved distally, a slanting passage in the mold end block 117 will be penetrated by guiding pins 120. The guiding pins 120 are also slanting centrally in the proximal direction, so as to force the mold parts 116a, 116b laterally and thereby free the catheter 200.

In this position a flow of fluid, such as a gas or a liquid, may be forced through the column/cavity 110 in the proximal direction. Since the mold core runner 108 in this position is located within the connecting portion 203, and simultaneously being sealed of from the environment and not being clamped between the mold core 105 and the mold 103, the fluid flow will force the fluid past the running flanges 109 and proximally along the mold core 105, such that the catheter is loosened from the mold core 105.

In one embodiment the mold insert does not have a mold core runner, such that the mold cavity is of a static volume. In such an embodiment, the mold core may be provided with an inner column/cavity, which in regard to all other aspects of the embodiments disclosed above is positioned in the same way and able to provide the same technical effects, with the mere difference that there is no displaceable distal end cavity wall.

In another embodiment the mold insert does not have a column/cavity for expelling a fluid into the catheter once the catheter has been separated from the mold cavity, such that the mold cavity still may be increased continuously from a start to an end position, in accordance with all other aspects of the embodiments disclosed above is positioned in the same way and able to provide the same technical effects.

Although the present invention has been described above with reference to specific embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the invention is limited only by the accompanying claims.

In the claims, the term "comprises/comprising" does not exclude the presence of other elements or steps. Furthermore, although individually listed, a plurality of means, elements or method steps may be implemented by e.g. a single unit or processor. Additionally, although individual features may be included in different claims, these may possibly advantageously be combined, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. In addition, singular references do not exclude a plurality. The terms "a", "an", "first", "second" etc do not preclude a plurality. Reference signs in the claims are provided merely as a clarifying example and shall not be construed as limiting the scope of the claims in any way.

CLAIMS

1. A method for manufacturing an elongated element (200), comprising the steps of:

arranging a molding cavity (101), defined by a mold (103) and a mold insert (104), said mold insert (104) comprising a mold core (105);

injecting a liquid material into a proximal end (102) of the molding cavity (101);

solidifying said liquid material, such that the elongated element (200) is formed;

removing said elongated element (200) and mold insert (104) from said mold (103); and

removing said elongated element (200) from said mold insert (104), wherein said removal of said elongated element (200) from said mold insert (104) comprises injecting a fluid in the interface between the elongated element (200) and the mold core (105).

2. The method according to claim 1, wherein the fluid is injected via a column or cavity (110) extending longitudinally in the mold insert (104), and the mold insert (104) is extending into a distal cavity or lumen of the elongated element (200), such that the fluid is injected within the elongated element (200).

3. The method according to claim 1 or 2, wherein said molding core (105) has an elongated longitudinal extension within said mold cavity (101).

4. The method according to any of the preceding claims, wherein said mold insert (104) comprises a mold core (105) and a displaceable mold cavity wall (106), said displaceable mold cavity wall (106) being arranged between the mold (103) and the mold core (105), such that the molding cavity has a start volume in a start position, displacing the displaceable mold cavity wall (106), in relation to and along with the mold (103) and the mold core (105), distally during said injection, to increase the molding cavity volume from the start volume into an end volume at an position, wherein the molding cavity (101) in said end position corresponds to the elongated element (200).

5. The method according to claim 4, wherein the displaceable mold cavity wall (106) is the proximal end wall of a mold core runner (108), which is displaceable along and in relation to the mold (103) and the mold core (105), said mold core runner (108) extending longitudinally along and circumferentially of the mold core (105).

6. The method according to claim 4 or 5, wherein the displaceable mold cavity wall (106) is slanting distally in the lateral direction.

7. The method according to any of claims 4, 5, or 6, further comprising positioning, in the start position, the displaceable mold cavity wall (106) in close proximity of a proximal tip of the mold core (105).

8. The method according to any of the preceding claims, further comprising the step of stabilizing the mold core (105) with pins (107) at the proximal zone of the mold cavity (101), said pins (107) extending transversally into contact with the mold core (105).

9. The method according to any of the preceding claims, wherein the elongated element (200) is a urinary catheter.

10. The elongated element according to claim 9, wherein the urinary catheter is an intermittent urinary catheter or a Foley catheter.

11. A mold assembly for forming an injection molding cavity for the manufacturing of an elongated element (200), comprising

a mold (103), having an elongated longitudinal mold cavity (101), defining an external surface of the elongated element (200);

an injection sprout (102) at the proximal end of the mold cavity (101) for injecting a liquid material into the mold cavity;

a mold insert (104), comprising a mold core (105) for providing the inner lumen of the elongated element (200), said mold core (105) being arranged in said mold cavity such that it has a distal fixed end outside the mold cavity (101) and a free proximal end close to the proximal end of the mold cavity (101);

wherein the mold insert (104) further comprises a proximal flange (109) in the distal zone of the mold cavity, said flange (109) being laterally displaceable upon a

distal fluid pressure in the proximal direction, such that the fluid may be injected into the interface between the mold insert (104) and the elongated element (200) via a column or cavity distally of the flange (109).

12. The mold assembly according to claim 11, wherein the mold insert further comprises a displaceable mold cavity wall (106), said displaceable mold cavity wall (106) being arranged between the mold (103) and the mold core (105), such that the molding cavity has a start volume in a start position, wherein the displaceable mold cavity wall (106) is displaceably arranged in said mold cavity (101) such that it may be displaced distally from a start position to an end position.

13. The mold assembly according to claim 12, wherein the displaceable mold cavity wall (106) is slanting distally in the lateral direction.

14. The mold assembly according to any of claim 12 or 13, wherein the displaceable mold cavity wall (106) is the proximal end wall of a mold core runner (108).

15. The mold assembly according to claim 14, wherein the mold core runner (108) extends longitudinally along the mold core (105) in a displaceable manner.

16. The mold assembly according to claim 14 or 15, wherein the mold core runner (108) bears on the mold core (105) via the flange (109), which is a running flange (109) at the proximal end of the mold core runner (108).

17. The mold assembly according to claim 16, wherein the column or cavity (110) extends distally from the running flange (109), laterally of the mold core (105) and centrally of the mold core runner (108).

18. The mold assembly according to any of claims 14 to 17, wherein the mold core runner (108) is provided with a stop plate (111) at the distal end thereof, such that the mold core runner (108) may be displaced distally from the start position until the stop plate (111) hits a distal end wall (112) of a carrying cylinder (113), at the end position, said carrying cylinder supporting the mold core runner (108).

19. The mold assembly according to claim 18, wherein the proximodistal extension of the cylinder (113) corresponds to the length of the catheter to be molded, such that when the stop plate (111) hits a proximal end wall (114) of the carrying cylinder (113), the mold core runner (108) will be in the start position.

20. The mold assembly according to claim 18 or 19, wherein the volume of the carrying cylinder (113) is sealed of and connected to a valve (115).

21. The mold assembly according to any of claims 11 to 20, wherein the mold cavity (101) in the end position has a distal end section corresponding to a connecting portion (203) for connecting the elongated element (200) to a hose, said distal end section of the mold cavity (101) having an increased transversal cross-section in the lateral direction.

22. The mold assembly according to any of claims 11 to 21, wherein the mold (103) comprises a distal mold part (116) comprising two mold halves (116a, 116b), the mold cavity corresponding in proximodistal position to said distal mold part (116) having en enlarged cross-sectional area in the transversal plane to correspond to a connecting portion (203) of said elongated element (200).

23. The mold assembly according to claim 22, wherein the transversal cross-section of the mold cavity corresponding in proximodistal position to said distal mold part (116), in the distal direction, first being cylindrical with wave-shaped mold walls, and then increasing continuously into a cone-shaped part.

24. The mold assembly according to any of claims 11 to 23, further comprising pins (107) at the proximal zone of the mold cavity (101) extending transversally into contact with the mold core (105).

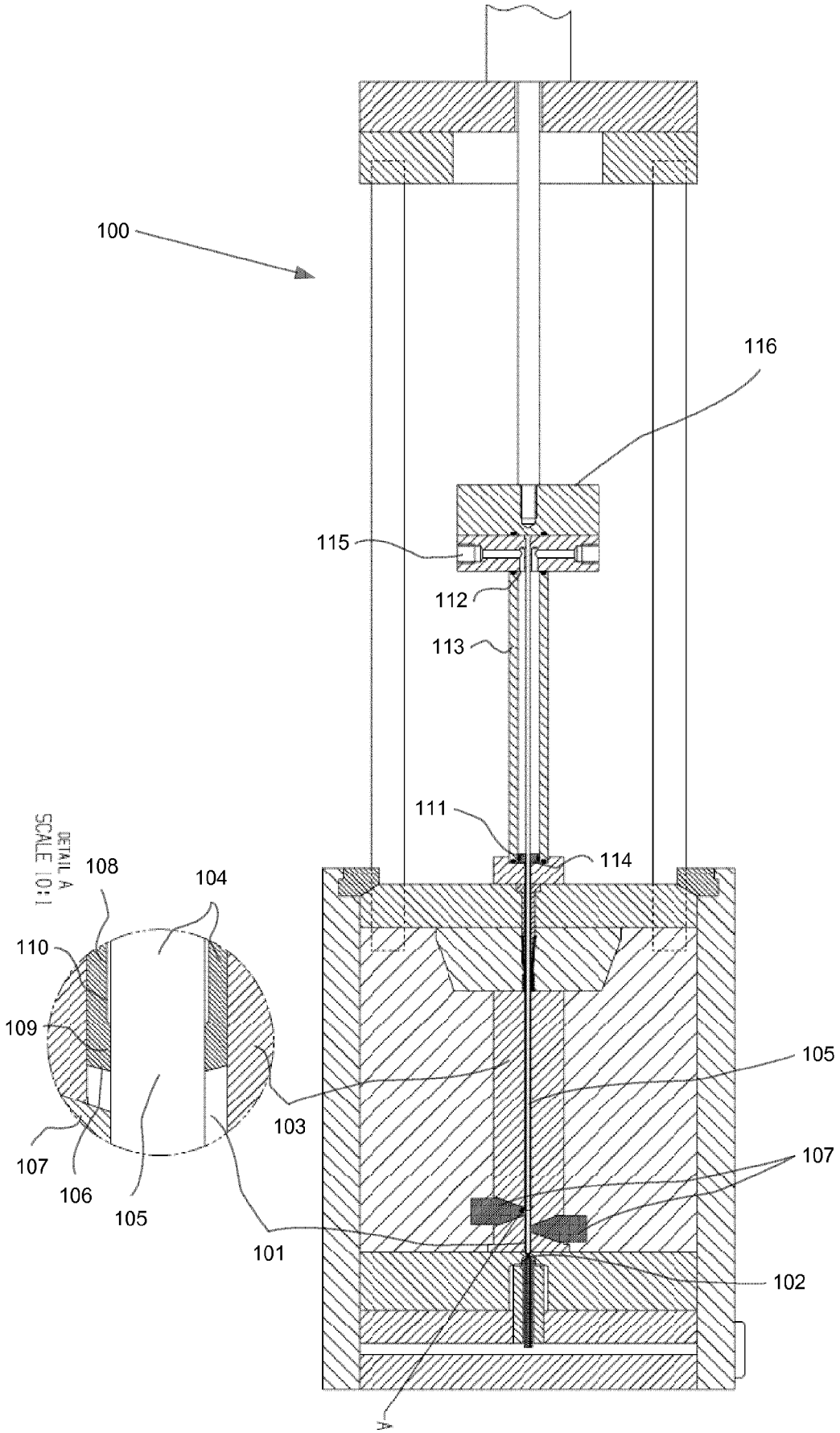

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Fig. 1

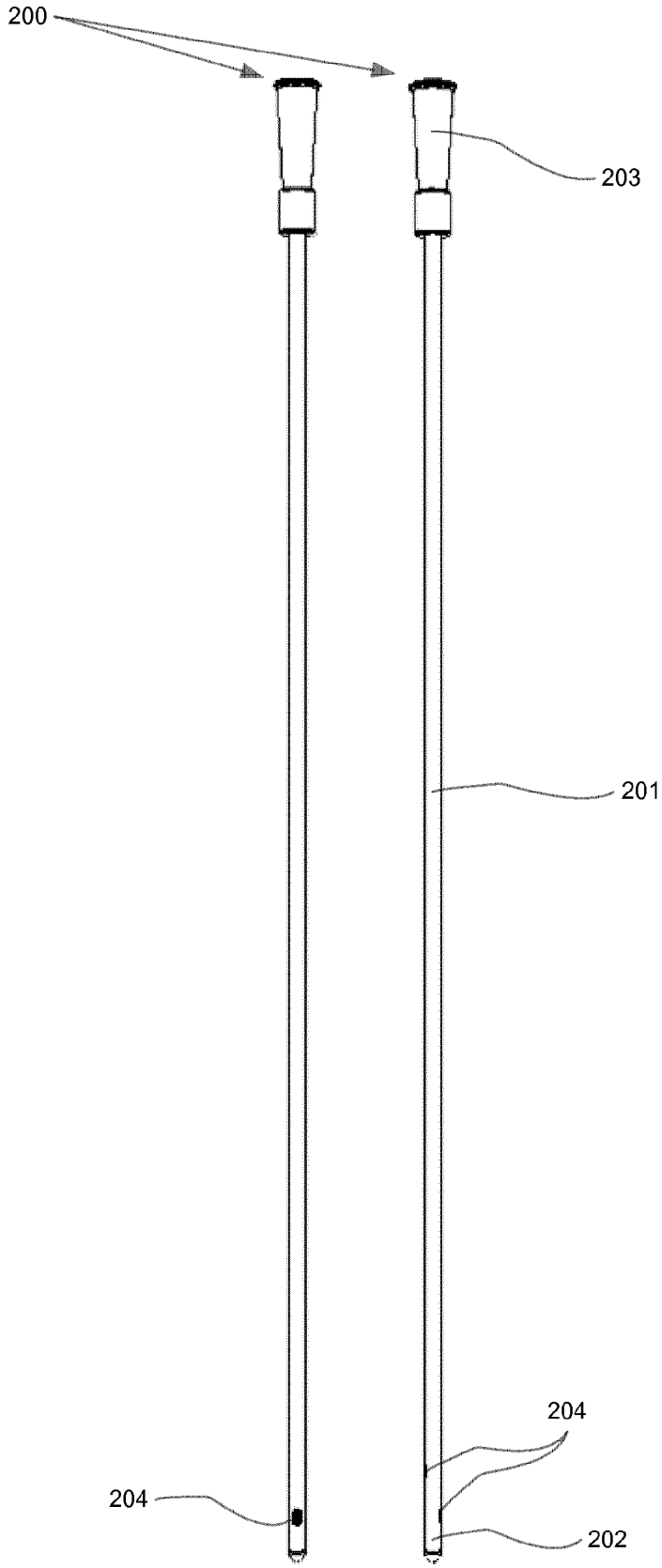


Fig. 2

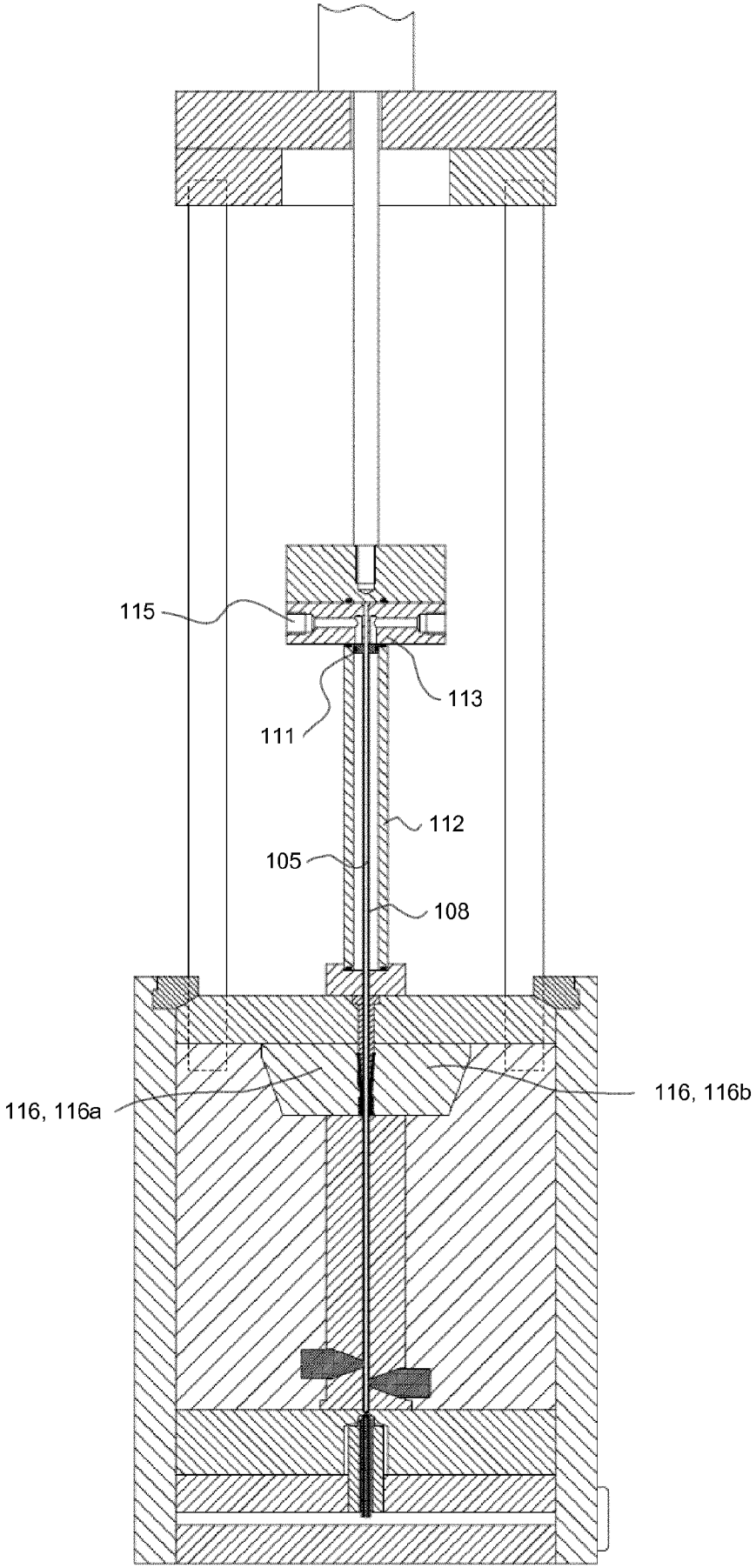


Fig. 3

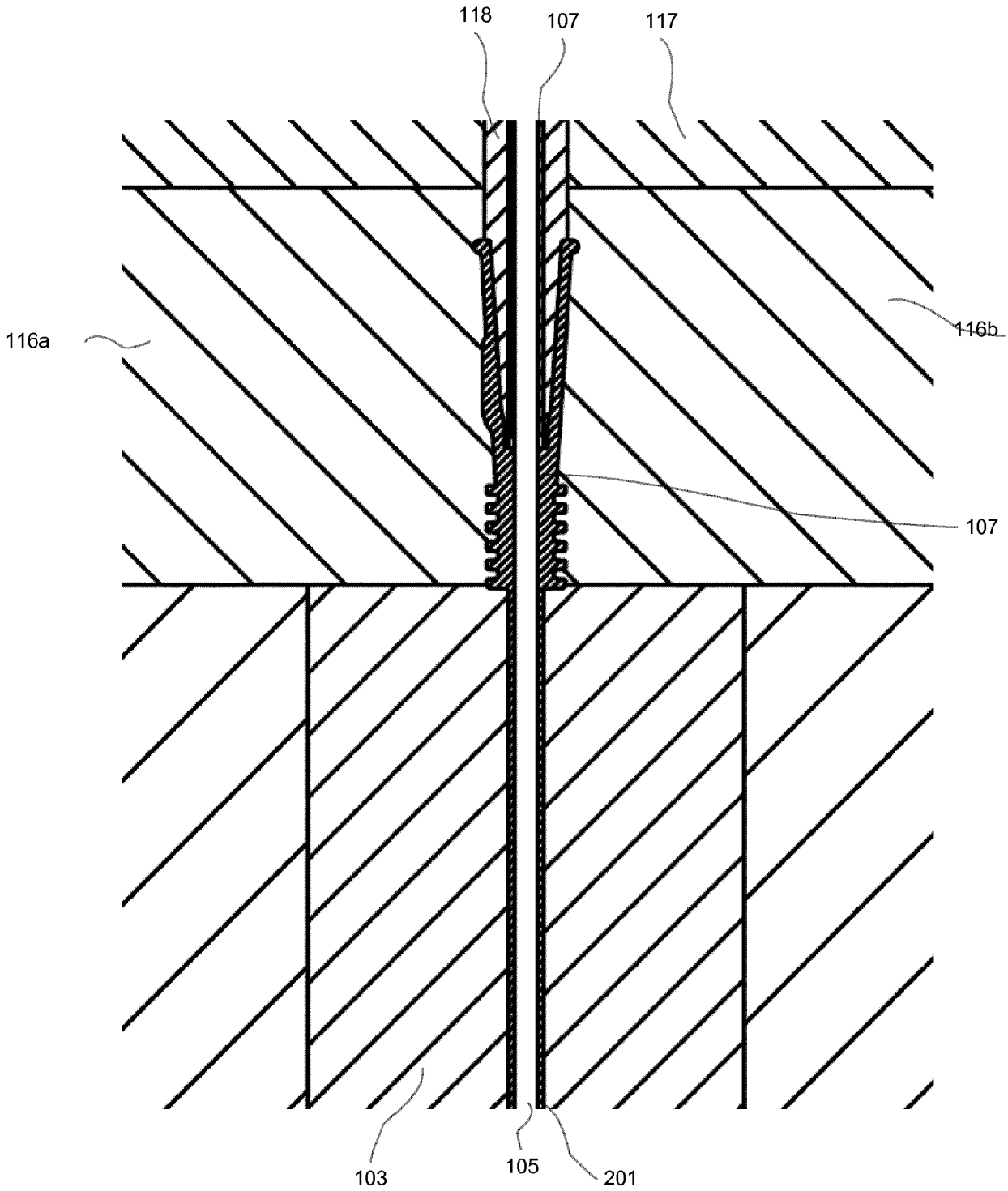


Fig. 4

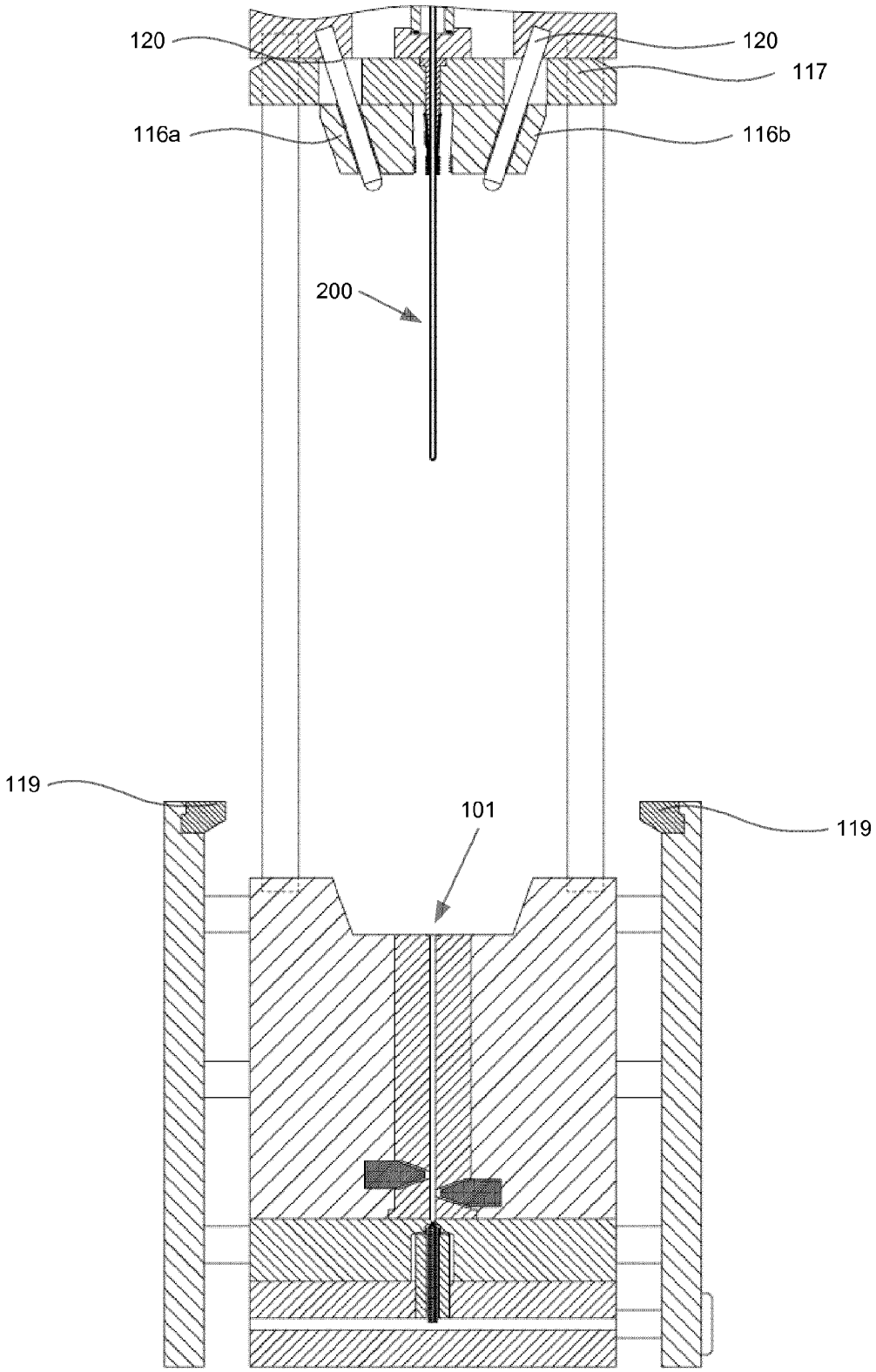


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/053675

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M25/00 B29C45/43 B29C45/26
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)
A61M B29C

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 901 965 A (HONEYMAN III HENRY W) 26 August 1975 (1975-08-26) column 3, line 21 - line 54; figure 1	1,11
A	WO 2010/149175 A1 (COLOPLAST AS) 29 December 2010 (2010-12-29) page 10, line 10 - line 18 page 12, line 17 - line 32 figure 5	1,11
A	US 2008/179792 A1 (TYCO HEALTHCARE) 31 July 2008 (2008-07-31) paragraph [0033]; figure 4	1,11
A	EP 1 504 870 A2 (BECTON DICKINSON CO) 9 February 2005 (2005-02-09) paragraph [0114]; figure 15	1,11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 April 2013	23/04/2013

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2013/053675

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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