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(54) Title: ADAPTOR OF A RECIPIENT

(57) Abstract: An adaptor of a recipient for build material of a 3D printer system comprises a first flange, a second flange and a first channel. The first flange is configured to be connected to an inlet nozzle of the recipient and the second flange is configured to be connected to an outlet nozzle of the build material reservoir. The first channel extends from the second flange to the first flange and is configured to guide a build material flow from the outlet nozzle through the adaptor to the inlet nozzle. The second flange comprises means for opening a valve of the outlet nozzle of the build material reservoir.

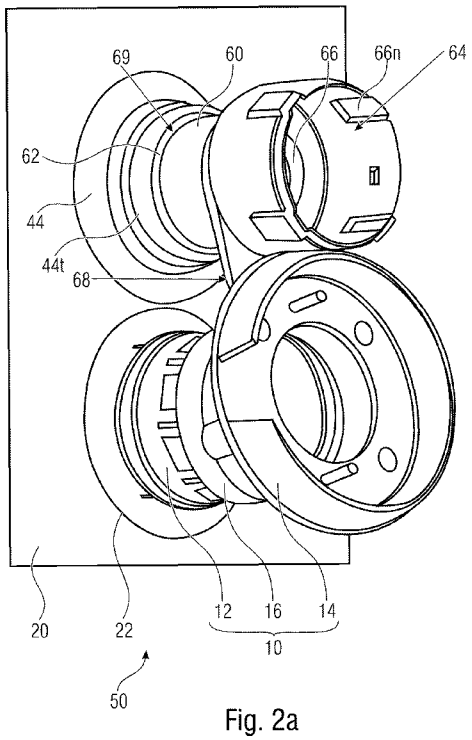


Fig. 2a

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ADAPTOR OF A RECIPIENT

Background

[0001] A 3D printer system is typically comprises a printer that prints the parts in a print bucket and a post-processing unit, where this printer bucket is moved in order to separate parts from the power not cured that same can be recycled.

[0002] In the post-processing unit comprises a mixer where the fresh powder (or in general the build material) is mixed with the recycled powder. Sometimes, the mixer is emptied, e.g., when the mix ratio (fresh powder against recycled powder) is changed or when the system is cleaned.

[0003] An adaptor of a recipient for build material (like powder) of a 3D printer system comprises a first flange, a second flange and a first channel extending from the first flange to the second flange. The first flange is configured to be connected to an inlet nozzle of the recipient. The second flange is configured to be connected to an outlet nozzle of the build material reservoir of the 3D printer system. The first channel is configured to guide a build material flow from the outlet nozzle through the adaptor to the inlet nozzle. The second flange comprises means for opening a valve of the outlet nozzle of the build material reservoir. This adaptor enables to connect a recipient for storing the build material to a build material reservoir, e.g., the mixer of the 3D printer system, such that the probability of build material loss, e.g., powder spill or powder cloud generation, can be reduced. The means for opening the valve enable to just open the valve when the second flange is (properly) connected to the outlet nozzle.

Brief Description of the Drawings

[0004] Figs. 1a to 1c show block diagrams of an example adaptor which makes use of the present disclosure.

[0005] Figs. 2a to 2f show block diagrams of other examples of adaptors which makes use of an enhanced present disclosure.

[0006] Figs. 3a and 3b show block diagrams of a basic example of an adaptor according to the present disclosure together with a system using the adapter.

[0007] Figs. 3a to 3d illustrate exemplarily the process of emptying a powder reservoir of a 3D printer system.

Detailed Description

[0008] Fig. 1a shows an example adaptor 10 having a first flange 12, a second flange 14 and a channel 16 extending from the first flange 12 to the second flange 14. A real implementation of this adaptor 10 is shown by Fig. 1b with focus on the second flange 14. Fig. 1c shows a real implementation of a substantially comparable adaptor 10 with focus on the first flange 12.

[0009] The adaptor 10 may have a shape of short piping having two different connectors 12 and 14 on the different sides. According to the disclosure the adaptor 10 may be round. Here, the diameters of the flanges 12 and 14 can differ from each other. For example, the flange 14 may have a larger diameter when compared to the diameter of the flange 12.

[0010] The adaptor 10 is used in combination with a recipient, like a bag (not shown). This situation is illustrated by the Figs. 4a to 4c. Fig. 4a shows a bag 20 having a so-called inlet nozzle 22. The adaptor 10 is coupled to the inlet nozzle 22, as illustrated by Fig. 4b. This connection is done using the first flange 12.

[0011] After that the second flange 14 is connected with an outlet nozzle of a build material reservoir, like a mixer or post processing unit of a 3D printer system. For the sake of completeness it should be noted that a 3D printer system may comprise a powder management station, e.g. comprising the post-processing unit, and the printer itself or may alternatively be realized as one 3D printer system including the discussed entities. In this illustration the build material reservoir of the 3D printer system can be connected using a tube, like a flexible tube 30. The tube has at its outlet nozzle 32 a valve which is closed when no adaptor is connected to the nozzle 32.

[0012] After the outlet nozzle 32 is clipped for the second flange 14, the valve will be opened. This valve opening is induced by means of opening a valve of the outlet nozzle. These means are marked by the reference numeral 18. For example, the means for opening the valve 18 comprise one or more pins extending axially along the adaptor. As illustrated by

Fig. 1b, the pins - two pins 18a and 18b - could be arranged on a plane surface 14s of the flange 14. The positioning of the pins 18a and 18b on the surface 14s can be arbitrary. The other pins may be configured to open the valve of the outlet nozzle when the adaptor 10 is connected to the outlet nozzle comprising the counterpart for the pins 18a and 18b. This part 18 enables that the mixer is open when the adaptor is connected to same, such that the powder (build material) is emptied into the external recipient, wherein the probability of powder cloud generation and powder spill is reduced. The exact interaction of the connecting means 18 and the valve will be exemplarily discussed with respect to Fig. 2f.

[0013] According to another disclosure the second flange 14 comprises connecting means which are configured to fix the adaptor to the outlet nozzle. For example, the connecting means may comprise a recess 14r defining a rotational position between the adaptor and the outlet nozzle. Expressed in other words, this means that the recess 14r is a feature to clip the mixer nozzle.

[0014] According to the disclosure of Fig. 1a, the recess 14r may be implemented as follows: The flange 14 comprises the plane surface 14s extending circular around the channel 16. The surface 14s is limited by a rim 14e protruding from the surface 14s. The rim 14e forms a cylinder which is partially recessed by the recess 14r. The rim 14e enables to avoid an axial displacement of the outlet nozzle and the adaptor 10 while the recess 14r enables to fix the adaptor 10 against the outlet nozzle with respect to a rotation.

[0015] Alternatively or additionally, the flange 14 may comprise one or more magnets 14m. The magnets 14m are, for example, arranged on the plane surface 14s of the flange 14 and configured to fix the axial position between the adaptor 10 and the outlet nozzle. Due to the three fixing elements 14r, 14e and 14m, the outlet nozzle can be connected to the adaptor 10 in a stable manner. Instead of the magnets 10m a hook or other (mechanical) fixing means may be used. This stable connection helps to seal the outlet nozzle against the adaptor 10, such that the entire powder (production material) is guided through the channel 16 and could not get lost.

[0016] According to an additional disclosure, the second flange may comprise means to connect the adaptor to an unpacking nozzle of another build material reservoir. This feature to clip the unpacking nozzle is marked by the reference numeral 14u. Here, the unpacking

nozzles 14u are implemented as small recesses arranged along the edge forming the transition between the surface 14s and the channel 16. The elements 14u enable the double usage of the adaptor, namely for emptying a power reservoir of a 3D printer system (as described above) and for unpacking fresh powder (build material).

[0017] According to a disclosure, the first flange 12 may comprise a thread configured to be connected to the inlet nozzle (22, cf. Fig. 4a) of the recipient (20) by screwing the adaptor 10 into the inlet nozzle (22). The thread to screw the adaptor 10 to the recipient is marked by the reference numeral 12t. The screw 12t may be implemented as an external thread, as illustrated by the example of Fig. 1a, or as an internal thread, as illustrated by the example of Fig. 1c. In the implementations as shown by Fig. 1a or Fig. 1c, the first flange 12 is round and substantially smaller than the second flange 14. The thread 12t, according to the disclosure of Fig. 1a, extends around the flange, i.e., around the outer face of the cylinder shaped adaptor 10, wherein the thread 12t, according to the disclosure of Fig. 1c, extends at the inner face formed by the channel 16. The thread 12t enables a secure and sealed connection to the recipient (20) for the production material. The thread 12t, in combination with the other fixing means (cf. reference numeral 14, 14r, 14e, 14m), supports the user such that the user's hands are free to help to empty the mixer pipe by moving it back as connected. This situation is illustrated by Fig. 4d.

[0018] According to another disclosure, the adaptor comprises a third flange, a fourth flange and a second channel. The third flange is configured to be connected to a vacuum nozzle of the recipient, wherein the fourth flange is configured to be connected to a vacuum source. This example is shown by Figs. 2a to 2f.

[0019] Fig 2a shows an adaptor 50. The adaptor 50 is formed by a combination of two adaptors being connected to each other. Here, the adaptor 50 is exemplarily shown in combination with a recipient 20 to which the adaptor 50 is connected.

[0020] The adaptor 50 comprises the adaptor 10 including the first and second flanges 12 and 14 as well as another adaptor 60 including a third flange 62 and a fourth flange 64. Between the third flange 62 and the fourth flange 64 parallel channel 66 (is arranged.

[0021] Since both adaptors 10 and 60 are coupled to the recipient 20, the two channels 16 and 66 extend substantially (up to +- 15° or up to +- 25°) in parallel to each other. According to a disclosure, the two adaptors 10 and 60 may be formed by a common unit (cf. reference numeral 50) or may be connected to each other using a bridge which is marked by the reference numeral 68. The exact implementation (whether the two adaptors 10 and 60 are fixedly connected to each other or can be unconnected) depends on the realization of the flanges, especially of the flanges 12 and 62.

[0022] For the sake of completeness, it should be noted that the flange 12 is connected to the recipient 20 and (in detail) to a so-called inlet nozzle which is marked by the reference numeral 22. The flange 62 is connected to a so-called vacuum nozzle 44 of the recipient 20. Both the openings 22 and 44 of the recipient 20 lie side-by-side to each other. According to a possible variant of the recipient 20, same can be implemented as plastic bag, i.e., does not have a firm wall. In such a case, the connection 68 of the two adaptors 10 and 60 improve the handling since the recipient 20 can be held by the adaptor 10.

[0023] The second adaptor 60 has the purpose to enable a vacuum source to be coupled to the recipient 20 providing a low pressure at the vacuum nozzle 44 such that an air flow through the recipient 20 (from the adaptor 10 into the recipient 20 and out of the vacuum nozzle 44) is induced. The air flow enables to support the emptying process as will be discussed with respect to Figs. 4a to 4d.

[0024] According to another disclosure, the second channel may comprise one or more openings which are marked by the reference numeral 69 and are configured to enable an air flow from a surrounding to the adaptor into the second channel. The providing of the openings 69 enables to not vacuum the bag and get the powder again into the system. Here, the opening 69 is realized in that way such that the adaptor 60 is just held by the bridge 68 before the vacuum nozzle 44 of the recipient 20. Here, the transition from the vacuum nozzle 44 to the third flange 60 is not sealed so as to form the opening 69.

[0025] Regarding the flange 66 it should be noted that this is realized as a plug-on flange in which the vacuum source 32 or part of a vacuum source 32 can be inserted. The flange 64 is formed as a cylinder liner having axial extending notches which are marked by the

reference numeral 66. According to another disclosure, the flange 66 may be realized differently, e.g. as illustrated by Figs. 2c and 2d.

[0026] Fig. 2c shows an adaptor 50' comprising the adaptor 10 as well as an adaptor 60', wherein the two adaptors 10 and 60' are connected to each other by the bridge 68. The adaptor 60' differs from the adaptor 60 with regard to the fourth flange 66. Here, the flange 66' comprises axial extending lugs 66l' instead of the notches 66n. Consequently, the nozzle of the vacuum source 17 (here 32') does not comprise the lugs but notches (cf. Fig. 2d).

[0027] Fig. 2f shows the outlet nozzle 80 of the production material reservoir of the 3D printer system. The outlet nozzle 80 is adapted to the second flange 14. The outlet nozzle has a round cylinder shape 82 which substantially complies or is slightly smaller than the bridge 14e of the flange 14. On the outside of the cylinder surface a protrusion 84 is arranged which is adapted to the recess 14r of the flange 14. On the plane bottom side of the nozzle 18 the nozzle 18 comprises a plurality of magnets or magnetic elements 82 which are configured to be connected to the elements 14m.

[0028] In the center of the bottom side of the nozzle 18, a valve 86, in more detail an opening 86, comprising a valve is arranged. The valve 86 is operated using the activators 86a. Here, the activators are realized as buttons arranged on the bottom side, wherein its position is adapted to the position of the means 18 for activating the valve 86. Expressed in other words, this means that the activator means 86a form the counter-part to the means 18 for activating the valve 86.

[0029] With respect to Fig. 2a, it should be noted that the vacuum nozzle 44 may comprise coupling means, here, an outside thread which is marked by the reference numeral 44t. The outside thread 44t may be adapted to the inside thread of the first flange 12 (cf. Fig. 1c) such that the first flange 12 can be coupled to the vacuum nozzle 44. This has the purpose that production material (powder) can be refilled to the system such that the production material stored within the bag can be reused. Although this feature has been described in context of an outside thread 44t adapted to the inside thread 12t of Fig. 1c, the implementation may be different. In general, the first flange may - according to another disclosure - additionally comprise means for connecting the vacuum nozzle to another opening of the recipient, in order to enable a reintroduction of the production material to the system.

[0030] With respect to Figs. 3a and 3b, two basic examples for the adaptor 10 (here 10'') and for a system comprising the adaptor 10'' may be described.

[0031] Fig. 3a shows the adaptor 10'' comprising the first flange 12'' which may be realized by a thread, by a bayonet nut connector or by a spring plug. The second flange 14'' is arranged on opposite sides and may also be realized by a bayonet nut connector, a spring lock or another kind of connector. As illustrated by the hedge lines, the channel 16 extends from the first flange 12'' to the second flange 14''.

[0032] It should be noted that although the adaptor 10'' has been described in the context of an adaptor having a cylinder shape, the adaptor 10'' may also be formed as a square-shaped elements. The adaptor 10'' may extend directly linear from the first flange 12'' to the second flange 14'' but can also be bent.

[0033] Regarding the system of Fig. 3b, it should be noted that, according to another disclosure, the adaptor 10 may be integrated into the bag 20''.

[0034] Fig. 3b shows a system comprising the recipient 20'', here realized as a plastic bag, in combination with the adaptor 10''. The adaptor 10'' is coupled using the flange 12'' to an inlet nozzle 22''. Additionally, the recipient 20'' comprises another opening, e.g., an air value of the vacuum nozzle which is marked by the reference numeral 24''. The second opening 24'' ensures the air goes out of the bag while the powder goes in.

[0035] According to the disclosure, a system is provided comprising the bag 20'' and the adaptor 10''. The bag 10'' and the adaptor 10'' may be enhanced by one of the above discussed features (feature of the mixer nozzle, pins to open the mixer nozzle valve, magnets to keep the mixer nozzle connected, thread to screw the tool to a bag with a thread, features to clip the vacuum nozzle, etc.).

[0036] With respect to Figs. 4a to 4d, the usage of the above discussed adaptor will be discussed.

[0037] The adaptor should be used in combination with the plastic bag 20 having the inlet nozzle 22 (cf. Fig. 4a). The adaptor 10 is screwed to the plastic bag 20 or to the inlet nozzle 22 (cf. Fig. 4b). As seen by Figs. 4a and 4b the bag 20 comprises the second opening marked by the reference numeral 24.

[0038] After that, the adaptor is connected to the entity of the 3D printer system comprising the production material (powder) to the mixer. During the connection procedure, the valve of the outlet nozzle 32 is opened. This is illustrated by Fig. 4c.

[0039] Then the mixer can be emptied without the need to use hands. As user hands are free, the user can help to process by shaking the mixer pipe (cf. reference numeral 30) to ensure no powder is remaining on it. An inclination may be given to the pipe 30 to avoid any horizontal area so powder cannot remain there. During this procedure, the air goes out of the air outlet 24. In order to speed up the process, the secondary hole 24 for the air outlet in the bag 20 can be used to connect to a vacuum. This is illustrated by Fig. 4d. Here, the vacuum source (cf. reference numeral 32) is attached to the air outlet 24 (not shown) in parallel to the connection tube 30. As can be seen, the adaptor 50, as discussed with respect to Fig. 2, would improve the handling.

[0040] According to the disclosure a method is provided which comprises “connecting an outlet nozzle of a build reservoir of a 3D printer system to a recipient like a bag using the above described adaptor” and “providing a vacuum to improve the emptying procedure”.

[0041] Although some aspects have been described in the context of an apparatus, it is clear that these aspects also represent a description of the corresponding method, where a block or device corresponds to a method step or a feature of a method step. Analogously, aspects described in the context of a method step also represent a description of a corresponding block or item or feature of a corresponding apparatus. Some or all of the method steps may be executed by (or using) a hardware apparatus, like for example, a microprocessor, a programmable computer or an electronic circuit. In some examples, some one or more of the most important method steps may be executed by such an apparatus.

[0042] The above described examples are merely illustrative for the principles of the present disclosure. It is understood that modifications and variations of the arrangements

and the details described herein will be apparent to others skilled in the art. It is the intent, therefore, to be limited only by the scope of the impending patent claims and not by the specific details presented by way of description and explanation of the examples herein.

Claims

1. An adaptor of a recipient for build material of a 3-D printer system, the adaptor comprising:

a first flange configured to be connected an inlet nozzle of the recipient; and

a second flange configured to be connected to an outlet nozzle of the build material reservoir of the 3-D printer system; and

a first channel extending from the second flange to the first flange configured to guide a build material flow from the outlet nozzle through the adaptor to the inlet nozzle,

wherein the second flange comprises means for opening a valve of the outlet nozzle of the build material reservoir.

2. The adaptor according to claim 1, wherein the means for opening the valve comprises one or more pins extending axially along the adaptor.

3. The adaptor according to claim 1, wherein the second flange comprises connecting means configured to fix the adaptor to the outlet nozzle.

4. The adaptor according to claim 3, wherein the connecting means comprises a recess defining a rotational position between the adaptor and the outlet nozzle.

5. The adaptor according to claim 3, wherein the means comprises one of more magnets configured to fix an axial position between the adaptor and the outlet nozzle.

6. The adaptor according to claim 1, wherein the first flange comprises a thread configured to be connected to the inlet nozzle by screwing the adaptor into the inlet nozzle.

7. The adaptor according to claim 1, wherein the second flange comprises means to connect the adaptor to an unpacking nozzle of another build material reservoir.

8. The adaptor according to claim 1, wherein the adaptor comprises a third flange, a fourth flange and a second channel,

wherein the third flange is configured to be connected to a vacuum nozzle of the recipient, wherein the fourth flange is configured to be connected to a vacuum source and

wherein the second channel extends from the third flange to the fourth flange and is configured to enable an air flow from the vacuum nozzle through the adaptor to the vacuum source.

9. The adaptor according the claim 8, wherein the second channel extends in parallel or substantially in parallel to the first channel.

10. The adaptor according to claim 8, wherein the second channel comprises one or more openings, configured to enable an air flow from a surrounding of the adapter, into the second channel.

11. The adaptor according to claim 1, wherein the second flange is configured to be connected to a vacuum nozzle of the recipient.

12. A system comprising a recipient for storing a build material of a 3-D printer system and an adaptor,

wherein the adaptor comprises:

a first flange configured to connect an inlet nozzle of the recipient; and

a second flange configured to be connected to an outlet nozzle of the build material reservoir of the 3-D printer system, wherein the second flange comprises means for opening a valve of the outlet nozzle of the build material reservoir;

a first channel extending from the second flange to the first flange configured to guide a build material flow from the outlet nozzle through the adaptor to the inlet nozzle,

wherein the recipient comprises an inlet nozzle and an air valve or an inlet nozzle and vacuum nozzle.

13. The system according to claim 12, wherein the adaptor comprises a third flange, a fourth flange and a second channel,

wherein the third flange is configured to be connected to a vacuum nozzle of the recipient, wherein the fourth flange is configured to be connected to a vacuum source and wherein the second channel extends from the third flange to the fourth flange and is configured to enable an air flow from the vacuum nozzle through the adaptor to the vacuum source.

14. The system according to claim 12, wherein the adaptor is integrated into the recipient.

15. A method for emptying build material from a build material reservoir of a 3-D system using an adapter, which comprises:

a first flange configured to connect an inlet nozzle of a recipient; and

a second flange configured to be connected to an outlet nozzle of the build material reservoir of the 3-D printer system, wherein the second flange comprises means for opening a valve of the outlet nozzle of the build material reservoir; and

a first channel extending from the second flange to the first flange configured to guide a build material flow from the outlet nozzle through the adaptor to the inlet nozzle,

the method comprises:

connecting a recipient to the build material reservoir using the adaptor; and

providing a vacuum to the recipient in order to cause an air flow from a volume of the recipient through a vacuum nozzle.

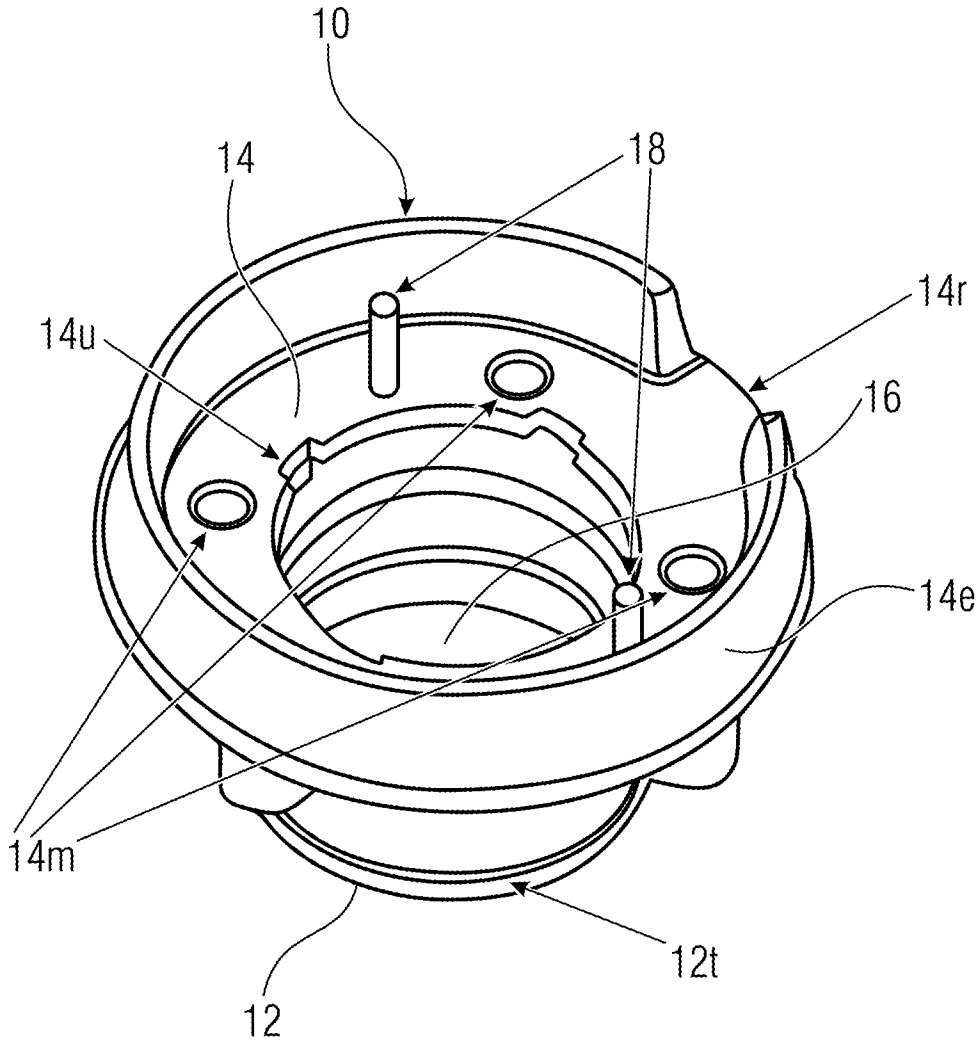


Fig. 1a

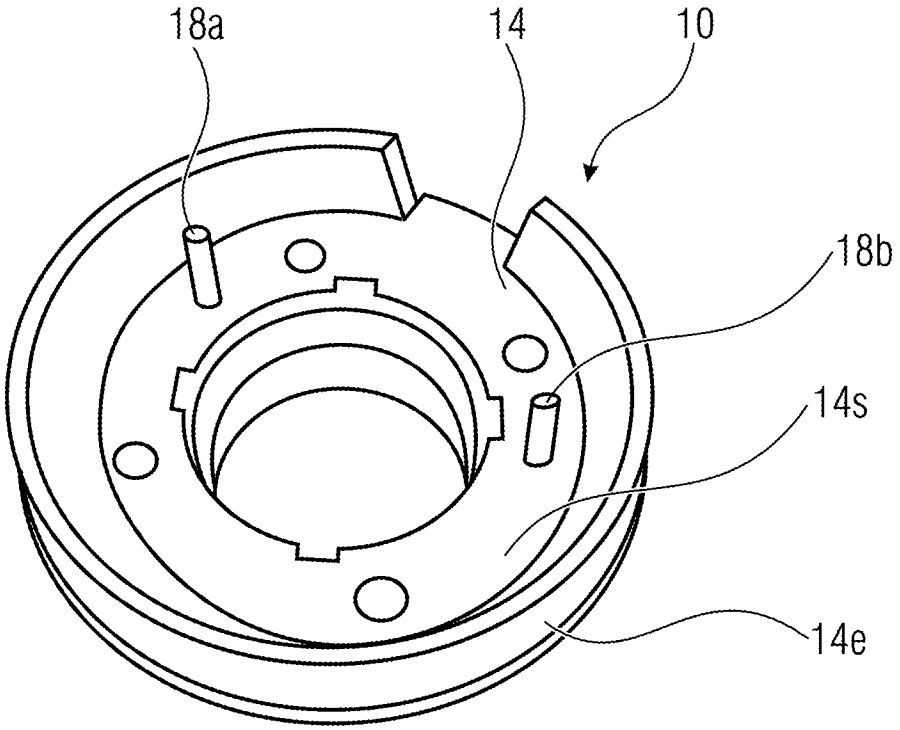


Fig. 1b

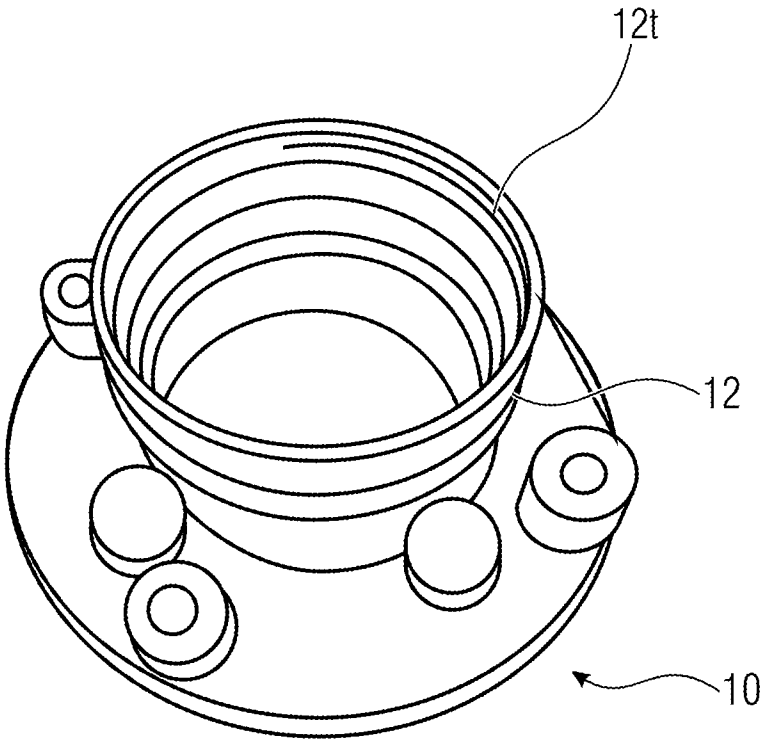


Fig. 1c

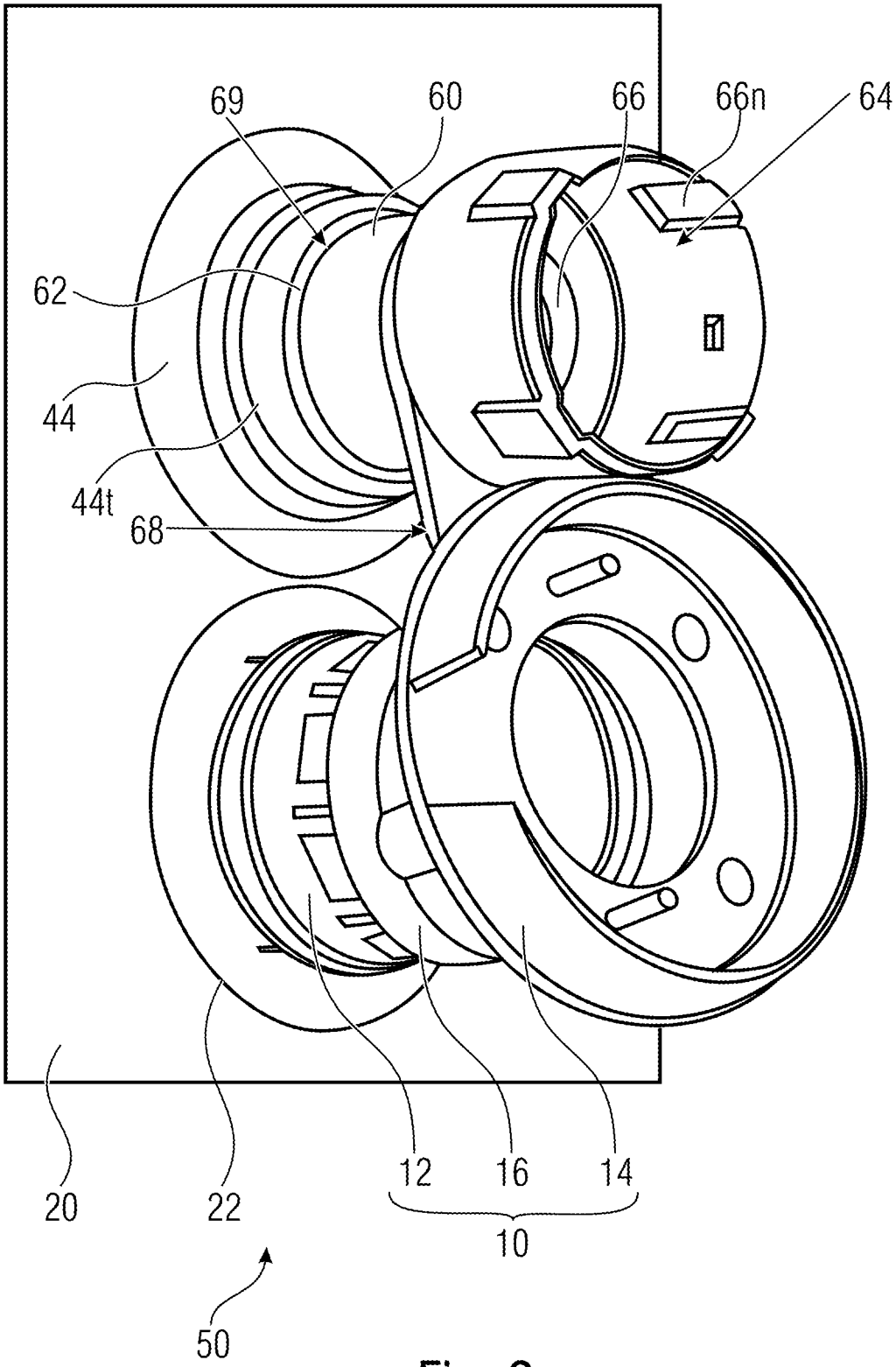


Fig. 2a

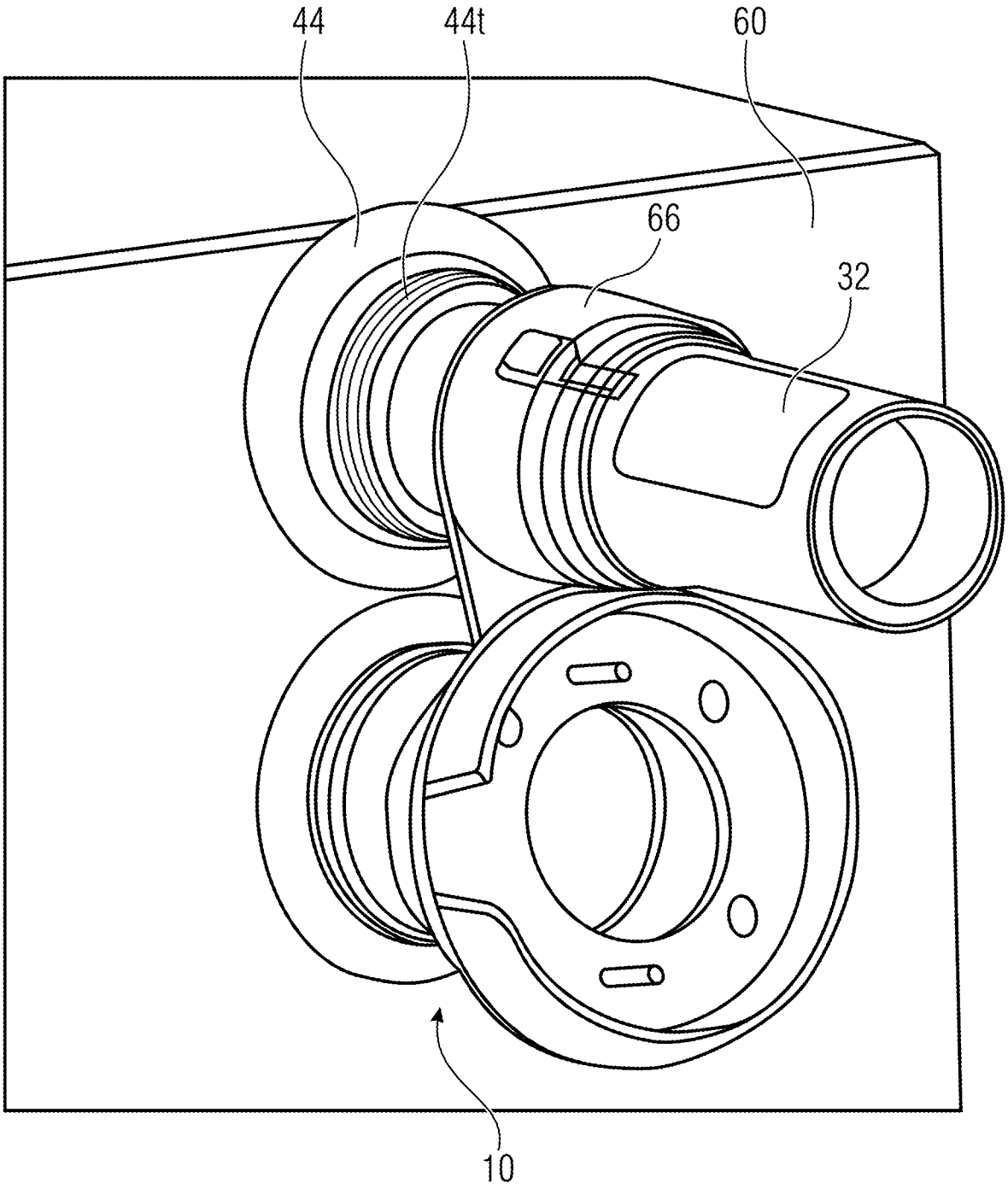


Fig. 2b

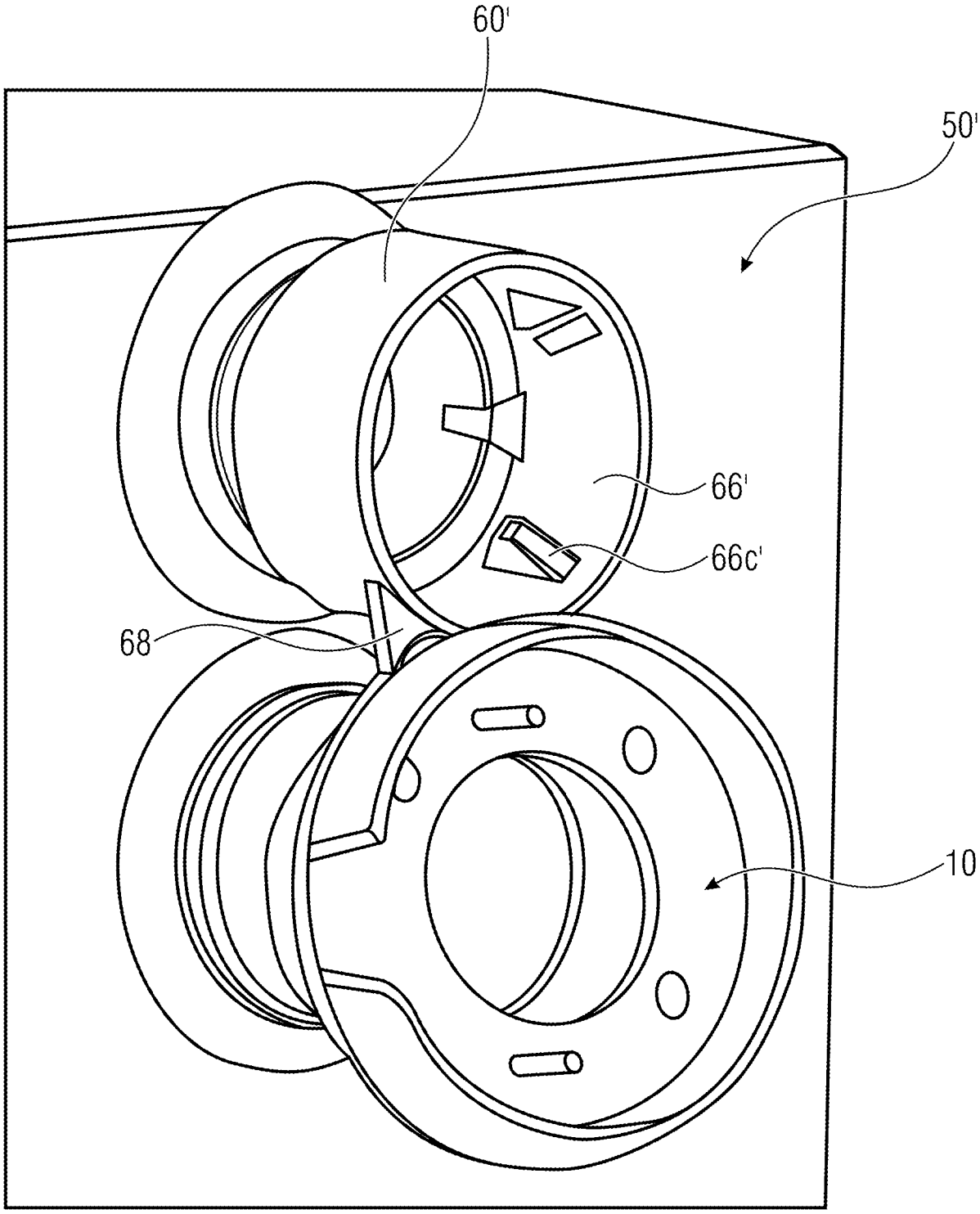


Fig. 2c

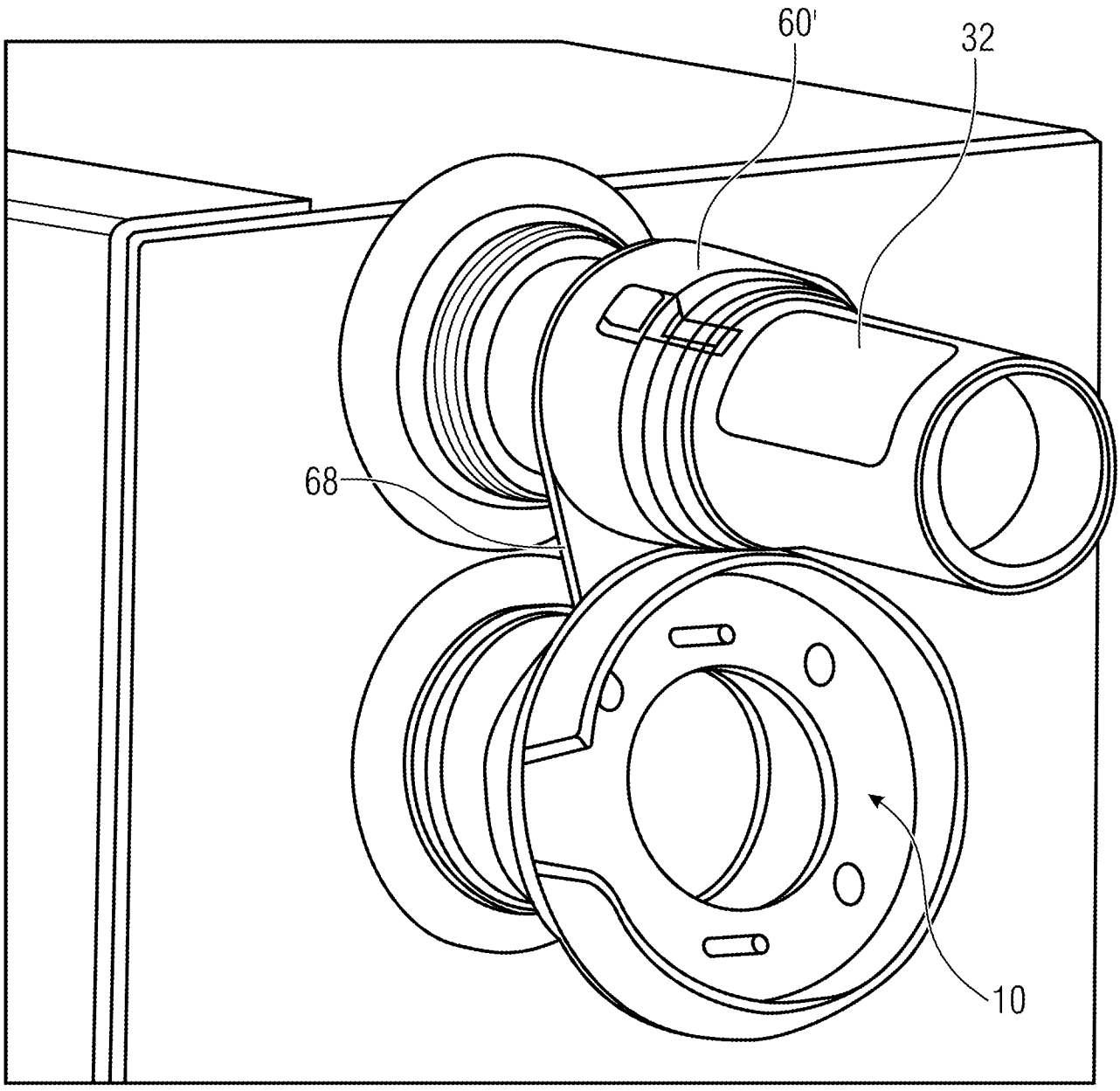


Fig. 2d

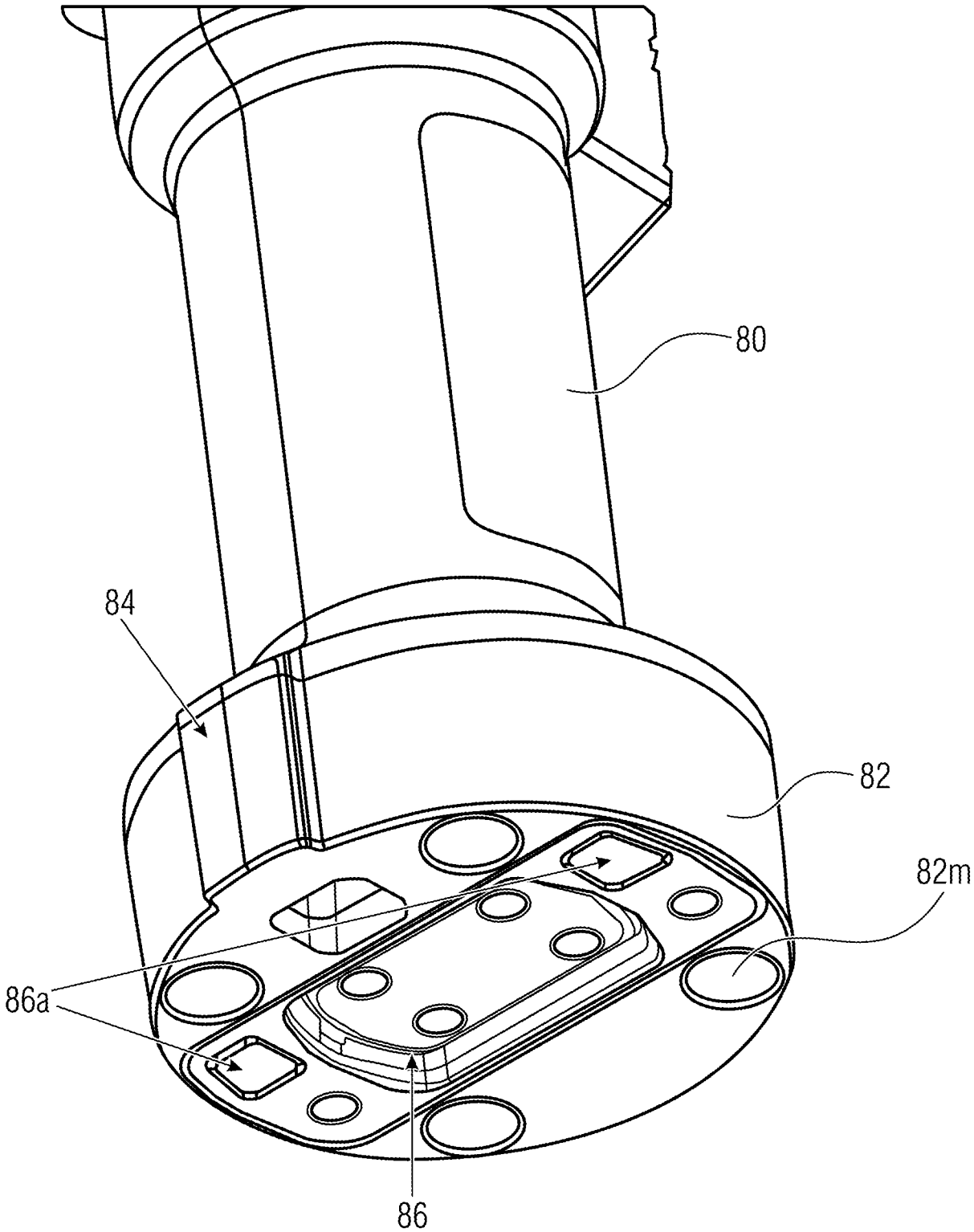


Fig. 2f

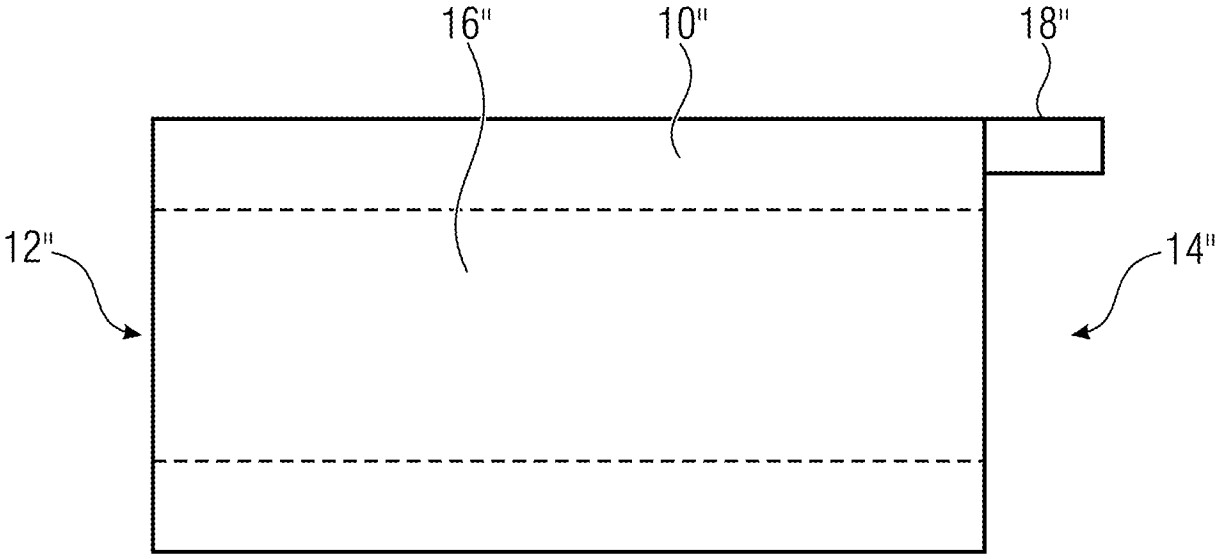


Fig. 3a

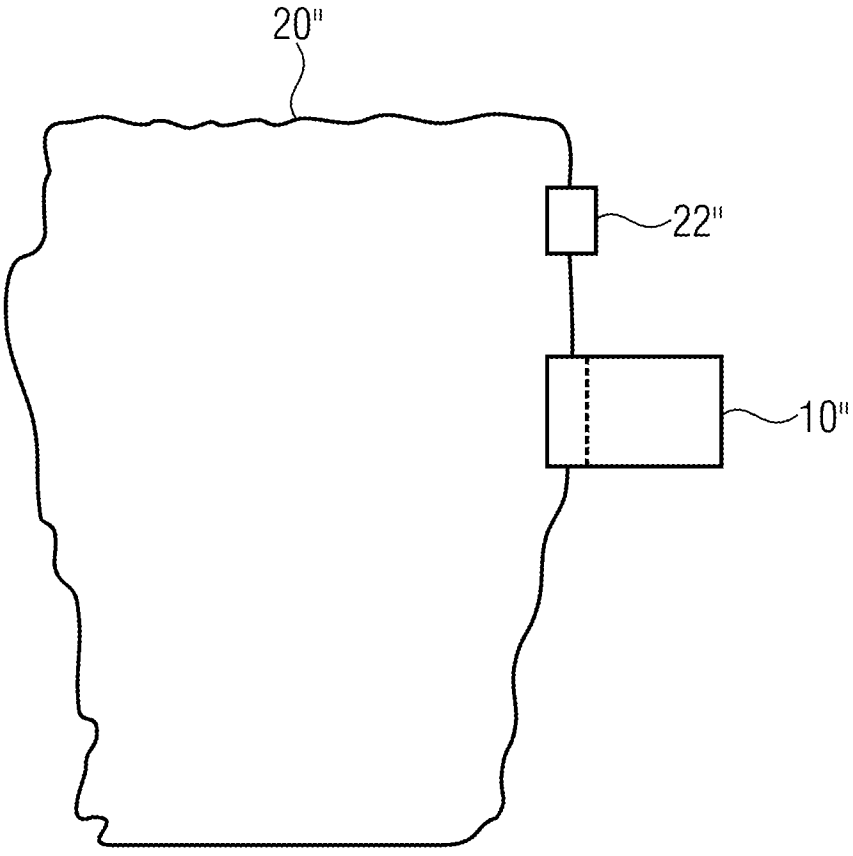


Fig. 3b

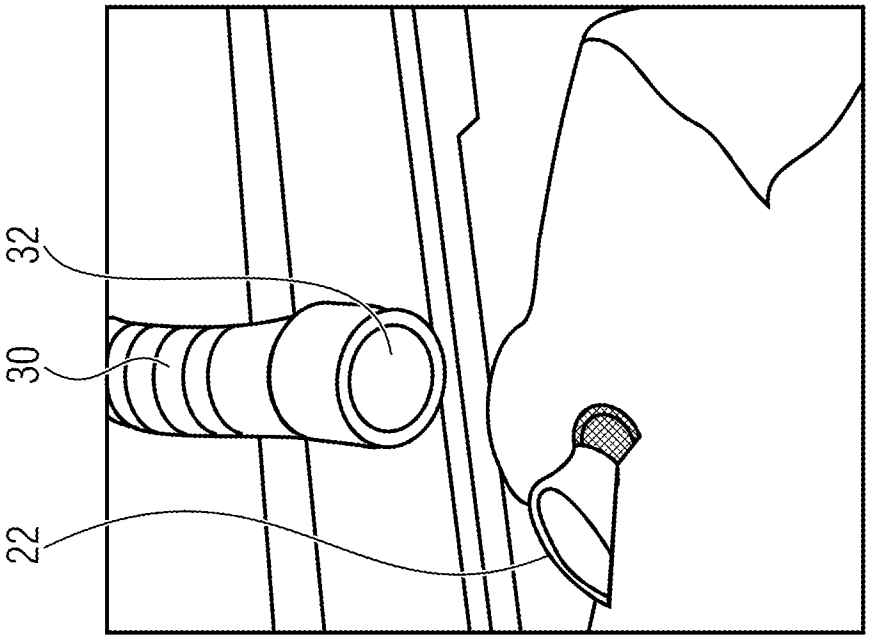


Fig. 4c

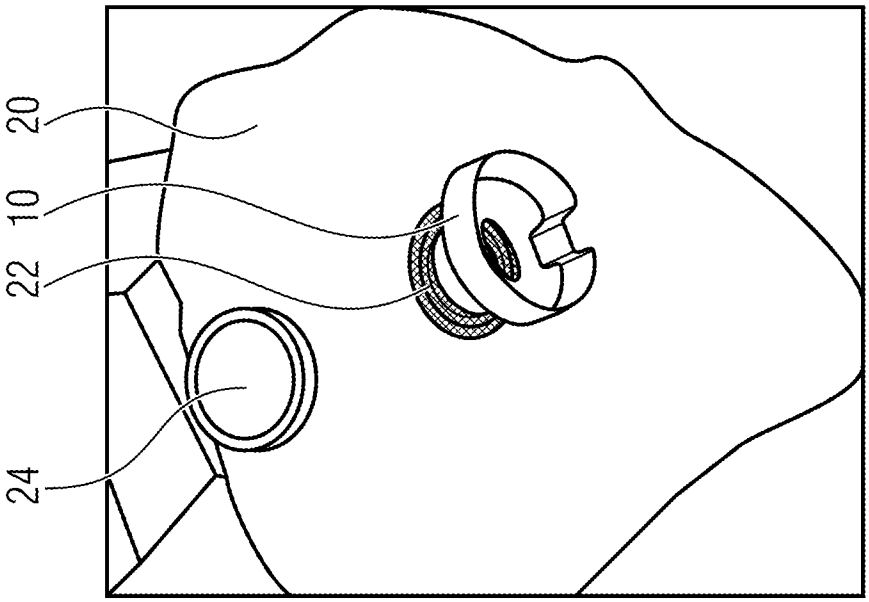


Fig. 4b

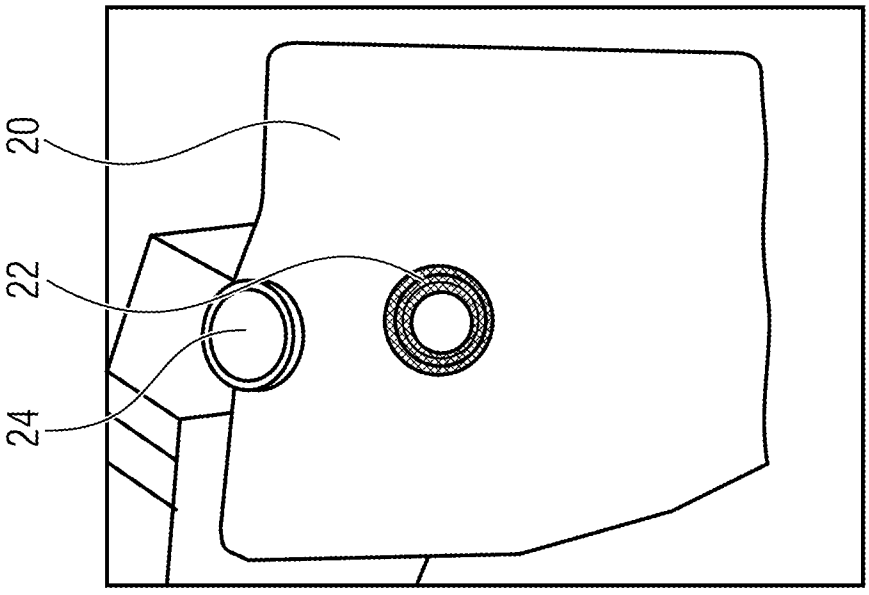


Fig. 4a

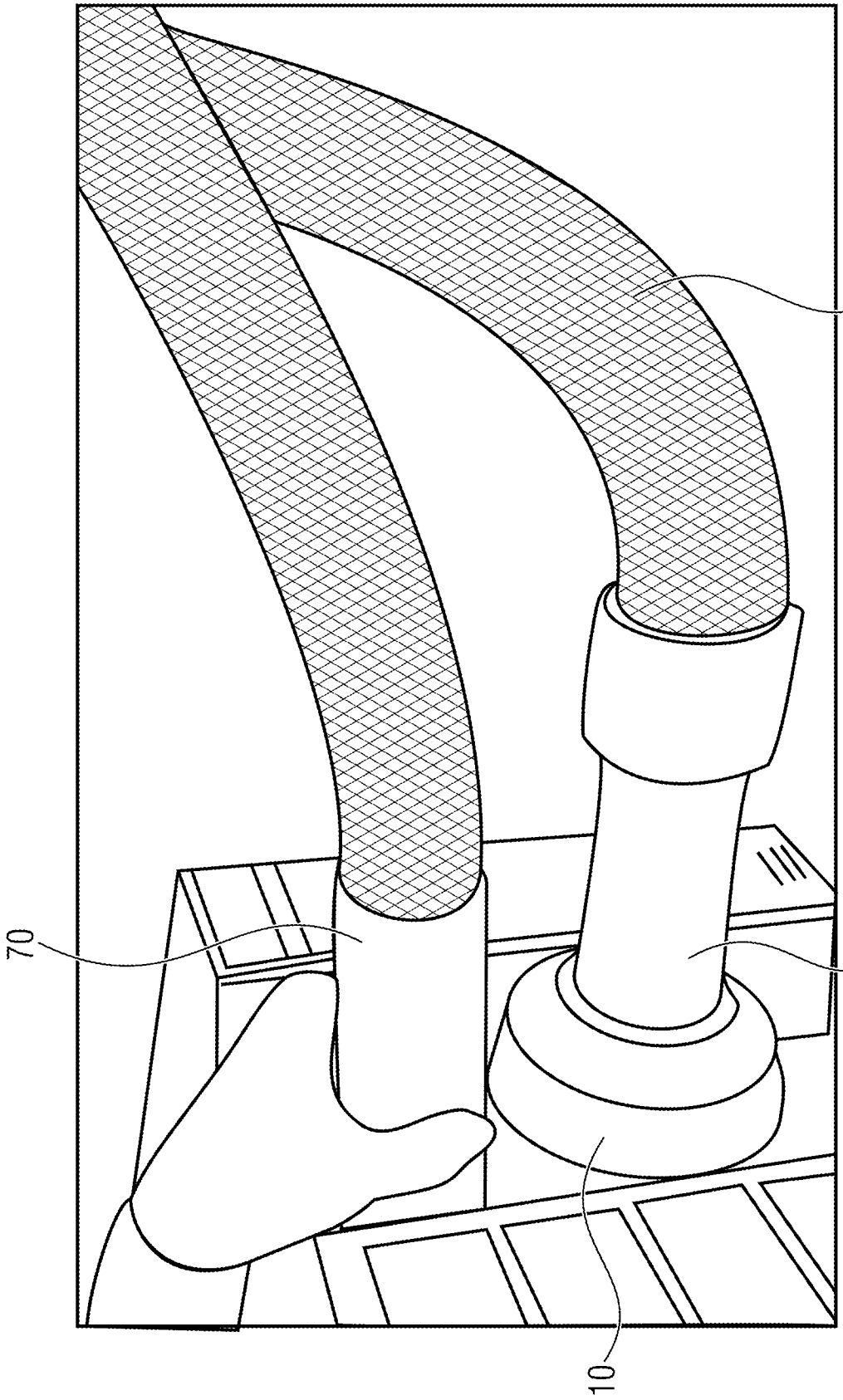


Fig. 4d

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 2017/029292

A. CLASSIFICATION OF SUBJECT MATTER

B29C 64/255 *(2006.01)*
B29C 64/321 *(2006.01)*
B33Y 40/00 *(2015.01)*

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)

B29C 64/259, 64/321, G06F 19/00, G03F 7/20, B29C 67/00, 64/255, B33Y 40/00

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)

PatSearch (RUPTO internal), PubMed, NCBI, Rambler, Yandex

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2004/044816 A1 (OBJET GEOMETRIES LTD. et al.) 27.05.2004, fig. 1, 3-5, paragraphs [0028], [0032] - [0035], [0045]	1-4, 7-15 5, 6
Y	US 2004/008237 A1 (SILVERBROOK KIA) 15.01.2004, paragraphs [0317], [0318]	5
Y	US 2014/0085620 A1 (MAXIM LOBOVSKY et al.) 27.03.2014, paragraph [0020]	6
A	EP 3156217 A1 (BE3D S.R.O.) 19.04.2017	1-15
A	US 2016/0075089 A1 (MASSACHUSETTS INSTITUTE OF TECHNOLOGY) 17.03.2016	1-15
A	CN 105881906 A (GUANGZHOU JIEHE ELECTRONIC TECHNOLOGY CO., LTD.) 24.08.2016	1-15

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

☐ See patent family annex.

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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 November 2017 (15.11.2017)	30 November 2017 (30.11.2017)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37	Authorized officer A. Amelin Telephone No. (495)531-64-81