(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 508 307 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.07.2019 Bulletin 2019/28

(51) Int Cl.:
B24C 9/00 *(2006.01)* ***B24C 3/06*** *(2006.01)*
B08B 15/02 *(2006.01)* ***B05B 16/80*** *(2018.01)*

(21) Application number: **18150389.7**

(22) Date of filing: **05.01.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

(71) Applicant: **Pinovo AS**
5225 Nesttun (NO)

(72) Inventor: **Njaa, Torleiv**
5223 Nesttun (NO)

(74) Representative: **Plougmann Vingtoft a/s**
Strandvejen 70
2900 Hellerup (DK)

(54) **A FRAMELESS CONTAINMENT SYSTEM WITH MAGNETIC LOCKING MEANS**

(57) The present invention relates to a frameless containment system (1) with magnetic locking means (8).

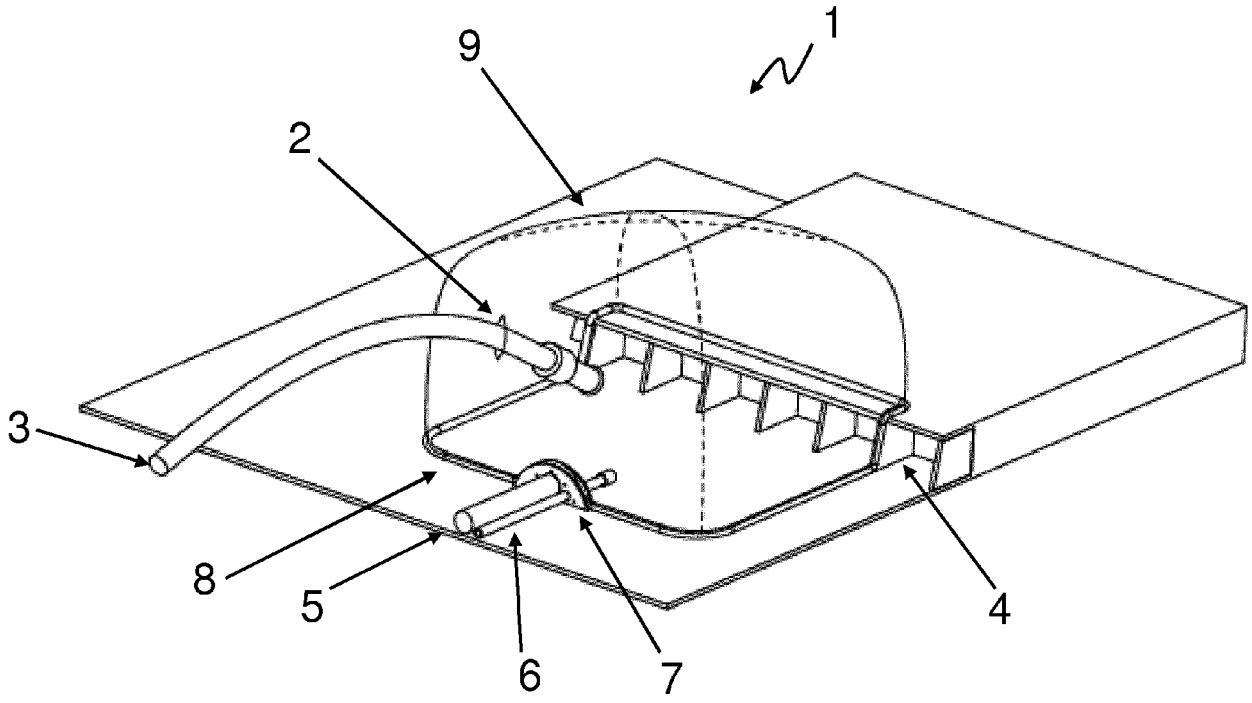


FIG. 1A

EP 3 508 307 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a frameless containment system with magnetic locking means.

BACKGROUND OF THE INVENTION

[0002] When performing maintenance work, such as abrasive blasting operations, it is often desirable to be able to reduce dissemination of particles, such as debris, dust or blasting media. To protect surrounding equipment, installations and nearby personnel, it is thus often necessary to build a containment system or enclosure around an area that needs to be maintained.

[0003] Enclosures of this type are often constructed from a large rigid frame covered by a membrane material. As an alternative to the use of rigid frames, flexible enclosure have shown better versatility.

However, ensuring substantially dust-tight connection along the edges of the working area protected by the enclosure have shown to be not straight forward. Abrasive blasting operations and other operations involving flying particles may also pose a serious liability to the operator performing the operation. Thus, tightness of the enclosure around the edges of the working area is rather crucial to avoid undesired distribution of particles in the vicinity of the working area. Unfortunately, the joining of the edges of these enclosures around the edges of the working area is very often not sufficient requiring more permanent additional sealing means to provide substantially dust-tight connection. However, more permanent additional sealing means reduce the versatility and the removal of the enclosure when blasting operations are terminated.

Furthermore, permanent additional sealing means, such as glue, has also the disadvantage that they may contaminate the working area leading eventually to a less efficient treatment of the working area.

[0004] Hence, there is a need for a system ensuring dust-tight connection between the enclosure and the edges of the working area defined by the enclosure.

[0005] Hence, an improved containment system would be advantageous, and in particular a containment system that ensure dust-tight connection between the edges of the working area and the areas surrounding the enclosure.

OBJECT OF THE INVENTION

[0006] An object of the present invention is to provide a dust tight containment system ensuring dust-tight connection between the edge of the containment system and the edge of the working area.

[0007] In particular, it may be seen as an object of the present invention to provide a frameless containment system that solves the above-mentioned problems of the prior art with a removable sealing mean.

[0008] An object of the present invention may be seen as to provide an alternative to the prior art.

SUMMARY OF THE INVENTION

[0009] Thus, the above described object and several other objects are intended to be obtained in a first aspect of the invention by providing a frameless containment system for providing a substantially dust-tight working space surrounding a work area, such as a work area on a ferritic or magnetic surface, the frameless containment system comprising: a flexible enclosure comprising one or more flexible sheets adapted to be placed around the work area, the one or more flexible sheets comprising an outlet for releasing gas and particles; one or more gas inlet devices; wherein the flexible enclosure when placed around the work area, defines a dust-tight working space through magnetic means, located, at least partially, within the edge of the flexible enclosure.

[0010] The flexible enclosure is adapted to be placed, positioned or assembled around the work area.

[0011] The outlet for releasing gas and particles may release gas vapors and material originated from the actions, such as surface treatments, performed underneath the flexible enclosure.

The outlet for releasing gas and particles may be connected to a suction hose so as to allow removal of gas and particles by suction.

[0012] The flexible enclosure may be composed by one or more flexible sheets having a plurality of edges adapted to be assembled providing a main body section. The plurality of edges of the flexible sheets may be adapted for being assembled around structures extending in and out of the working space. The magnetic means may be located, at least partially, within the edge of the flexible enclosure defined by the boundaries or plurality of edges of the one or more flexible sheets.

[0013] In some embodiments, the one or more flexible sheets are made from a transparent polymer-based material. It is thus possible to see through the flexible enclosure during operation of the blasting nozzle or the like positioned inside the enclosure. More specifically the material may be a polyethylene composition comprising flame-retardants and/or antistatic agents. Antistatic or electrically dissipative properties may prevent dust from attaching to the inside of the flexible enclosure, hence, preserving visibility.

[0014] In some further embodiments, the one or more flexible sheets are made of different materials.

[0015] In some embodiments, the one or more gas inlet devices are adapted to introduce compressed fluids, such as gas or liquids, into the flexible enclosure, thereby keeping the frameless containment erected. The containment is thus kept erected without the need of a frame.

[0016] In some further embodiments, the one or more gas inlet devices are adapted to introduce compressed fluids, such as gas or liquids, and particles, thereby al-

lowing for introduction of materials suitable for surface treatment within the work area.

[0017] The one or more gas inlet devices may thus be used for both keeping the frameless containment system erected and for introducing materials to perform surface treatment.

[0018] In some embodiments, the one or more gas inlet devices comprise a second gas inlet device which is adapted to keep the frameless containment system erected.

[0019] In some embodiments, the work area is a surface to be subjected to a surface treatment such as abrasive blasting or painting.

[0020] In some further embodiments, the outlet for releasing gas and particles is configured for connecting a vacuum device for drawing gas and particles out of the flexible enclosure.

Thus, the outlet may be configured for connecting to a suction hose.

[0021] In some embodiments, the frameless containment system further comprising a vacuum device connected to the outlet for releasing gas and particles, the vacuum device suitable for drawing gas and particles out of the flexible enclosure.

[0022] In some further embodiments, the magnetic means comprise permanent magnets arranged in a chain structure.

[0023] For example, the permanent magnets may be block-shaped permanent magnets arranged in a chain structure.

[0024] In some embodiments, the magnetic means comprises electromagnets.

[0025] The chain structure may comprise nonmagnetic materials.

[0026] In some embodiments, the magnetic means are attached to the edge of the flexible enclosure.

[0027] The magnetic means maybe within the edge of the flexible enclosure or attached to or within the plurality of edges of the flexible sheets.

[0028] In some embodiments, the magnetic means are located within sleeves at the edge of the flexible enclosure.

[0029] The sleeves may comprise metallic materials, such as metallic braids.

[0030] The sleeves may also comprise plastic, rubber or other materials.

[0031] In some embodiments, the magnetic means has a magnetic strength between 0.3 N/mm to 30 N/mm, such as between 1 N/mm and 5 N/mm.

[0032] The force measured when pulling the magnets from the surface, depends on the strength of the magnet and the distance from the magnet to the ferritic surface or to another magnet. The strength of the magnet depends on the quality of material and the size and shape of the magnet. The distance is defined by the thickness of the braid, such as a metallic braid, the sheeting thickness and the thickness of the surface treatment, such as the paint, or other surface substances, such as the one produced by corrosion. The resultant pull force is defined in N/mm, wherein the length measurement relates to the length of the magnetic means, such as a magnetic chain. In practical use, the wanted pull force is typically between 0.3 N/mm to 2 N/mm. As distance between the magnets and the ferritic surface or another magnet, can typically differ from 0.1 mm to 15 mm depending on the thickness of the paint, braid and sheeting, the magnet force of the magnets measured when pulling the magnets from a plane steel surface, 5 mm thick, can differ between 0.3 N/mm to 30 N/mm, when measured on a row of magnets from 50 to 100 mm long.

[0033] Magnets come in different temperature classes, and for work on hot surfaces a suitable temperature class should be chosen.

[0034] The magnets are assembled with alternated polarity.

[0035] The magnetic means has a magnetic strength between 1 N/mm and 5 N/mm when measured on a 5 mm thick steel plate with a roughness of 0-100 μm, wherein the length measurement relates to the length of the magnetic means, such as a magnetic chain.

[0036] The specific magnetic strength between 0.3 N/mm to 30 N/mm, such as between 1 N/mm and 5 N/mm, is necessary so as to allow for keeping the flexible enclosure attached to the work area during operation and at the same time allowing for removal after use.

In that, it is an optimized range in relation to the needs of the flexible enclosure, i.e. tight during operation but removable upon pulling action from the user.

[0037] Thus, the magnetic means may comprise a row of permanent block shaped magnets placed inside a metallic braided sleeve. The ends of the sleeves may be closed with tape. The magnetic means are thus flexible and can be bent and can be attached and removed easily. This in turn allows for efficient fastening of the frameless containment system to magnetic/ferrous structures with complex structures.

[0038] In some further embodiments, the frameless containment system further comprises an inlet opening, such as a blasting hole, suitable for introducing compressed gas and particles.

[0039] The particles may be blasting media or paint, thus blasting may be achieved through a separate line via the inlet opening.

[0040] In some embodiments, when the frameless containment system is assembled, the flexible enclosure comprises one or more wedge shaped elements between the magnetic means and the working area.

[0041] In some further embodiments, the one or more wedge shaped elements comprise the outlet for releasing gas and particles and the one or more gas inlet devices.

[0042] The one or more wedge shaped elements may comprise magnetic materials.

[0043] The one or more wedge may thus be part of the magnetic locking system and provide a robust structure for the location of the outlet for releasing gas and particles and the one or more gas inlet devices.

[0044] The edges of the one or more flexible sheets may be adapted to be joined onsite during assembly of the flexible enclosure around the work area. Additionally, some of the edges, such as the edges of the parts of the flexible sheets defining the lower funnel-shaped section, may be pre-joined prior to delivery of the flexible enclosure.

[0045] The edges may also be adapted for being assembled around structures extending in and out of the working space, for example via magnetic means, such as one or more magnets or components comprising magnetic materials, located within the edges, to provide a substantially dust-tight connection.

In some embodiments, magnetic means may comprise additional magnetic means, such as one or more magnets located, at least partially, along the edges of the openings of the flexible enclosure so as to provide substantially dust-tight connection between the pipe and the flexible sheets.

[0046] The first, and other aspects of the present invention may each be combined with any of the other aspects and embodiments. These and other aspects and embodiments of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE FIGURES

[0047] The frameless containment system according to the invention will now be described in more detail with regard to the accompanying figures. The figures show one way of implementing the present invention and is not to be construed as being limiting to other possible embodiments falling within the scope of the attached claim set.

Figure 1A is a drawing of the frameless containment system comprising the magnetic means according to some embodiments of the invention.

Figure 1B is a drawing of the frameless containment system comprising the magnetic means according to some other embodiments of the invention.

Figure 2 is a drawing of the frameless containment system comprising the magnetic means according to some embodiments of the invention applied to working area having a complex geometry.

Figures 3A and 3B are the front view and the perspective view of two flexible sheets assembled around a pipe structure according to some embodiments of the invention.

Figures 4A and 4B are the perspective view and the front view of a frameless containment system assembled so as to surround a closed pipe structure according to some other embodiments of the invention.

Figure 5 is the perspective view of two flexible sheets assembled around a complex structure according to some further embodiments of the invention.

Figure 6 is a magnetic chain comprising a row of permanent block shaped magnets providing flexibility to the magnetic means according to some embodiments of the invention.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0048] Figure 1A is a drawing of the frameless containment system 1 comprising a magnetic chain 8 contained within the sleeves at the edge of the flexible enclosure 9. The presence of the flexible magnetic chain allow for a dust tight environment around the working area, in this example characterized by the presence of structure 4.

The frameless containment system 1 further comprises an inlet opening 2 suitable for introducing compressed gas and particles or fluids via a blasting hose 3.

The frameless containment system 1 is characterized by the presence of a wedge shaped element 7 ensuring magnetic bond between the magnetic chain 8 and the underneath edge of the working area. The wedge shaped element 7 comprises the outlet 5 for releasing gas and particles configured for connecting a vacuum device for drawing gas, thus suitable for connecting to a suction hose.

The wedge shaped element 7 also comprises the gas inlet device 6 adapted to introduce compressed fluids, such as gas or liquids, into the flexible enclosure.

Figure 1B is a drawing of the frameless containment system 19 comprising a magnetic chain 20 contained within the sleeves at the edge of the flexible enclosure 21. The presence of the flexible magnetic chain allow for a dust tight environment around the working area, in this example characterized by the presence of structure 22.

The frameless containment system 19 further comprises an inlet opening 23 suitable for introducing compressed gas and particles or liquids via a blasting hose 24.

The frameless containment system 19 is characterized by the presence of a suction hose 25 entering the frameless containment system 19 at the edge between the magnetic chain 20 and the working area surface. The inlet 26 for introducing the gas inlet device is separated from the suction hose 25 and located in a different position on the frameless containment system 19.

[0049] Figure 2 is a drawing of the frameless containment system 13 comprising the magnetic means 14 fastening the frameless containment system 13 around a working area having a complex structure 18.

The frameless containment system 13 comprises an inlet opening suitable for introducing compressed gas and particles via a blasting hose 10.

The frameless containment system 13 comprises also a funnel-shaped section 15. By a funnel-shaped section of the flexible enclosure is meant that the sides of the flexible enclosure are inclined and gradually incline toward each other when seen in the direction towards the outlet opening. The sides of the flexible enclosure thus provides a funnel or V-shaped hollow terminating in the outlet opening 12.

The gas inlet device 11 adapted to introduce compressed fluids, such as gas or liquids into the flexible enclosure enters the frameless containment system 13 also via the funnel-shaped section 15.

Figures 3A and 3B are the front view and the perspective view of two flexible sheets 27 and 30 assembled around a pipe structure 31.

This embodiment shows how two flexible sheets can be used to create a flexible enclosure defining a dust-tight working space around a pipe structure 31.

In this configuration, the magnetic chains 28 and 29 are attached to each other, thus this allow for the formation of a frameless containment system also around non-magnetic pipe structures, avoiding the need of other sealing means such as straps or tape.

In this configuration only one flexible enclosure, i.e. 27 has opening for suction hose 33, blasting hose 32 and gas inlet device 34.

Figures 4A and 4B are the perspective view and the front view of a frameless containment system 35 assembled so as to surround a closed pipe structure 36.

In this embodiment, the flexible enclosure 37 is assembled so as to define a dust tight working area around the closed pipe structure 36. In order to do so, the magnets of the magnetic chain 38 are partially attached to each other and partially attached to the closed pipe structure 36. This configuration allows also for defining a dust tight working area around pipes that are not metallic as the magnets are, at least partially, attached to each other.

[0050] Figure 5 is the perspective view of two flexible sheets 39 and 40 assembled around a complex structure 41. The magnets of the magnetic chains 42 and 43 are partially attached to each other and partially attached to the surface of the working area. The suction hose and the gas inlet device are present but not shown for the sake of simplicity.

This configuration can also be used in combination with the funnel-shaped section as shown in figure 2 or with separate openings within the sheets for the suction hose and the gas inlet device.

[0051] Figure 6 is a magnetic chain 17 comprising a row of permanent block shaped magnets 16 connected together and showing high degree of flexibility.

[0052] Although the present invention has been described in connection with the specified embodiments, it should not be construed as being in any way limited to the presented examples. The scope of the present invention is set out by the accompanying claim set. In the context of the claims, the terms "comprising" or "comprises" do not exclude other possible elements or steps. Also, the mentioning of references such as "a" or "an" etc. should not be construed as excluding a plurality. The use of reference signs in the claims with respect to elements indicated in the figures shall also not be construed as limiting the scope of the invention. Furthermore, individual features mentioned in different claims, may possibly be advantageously combined, and the mentioning of these features in different claims does not exclude that a combination of features is not possible and advantageous.

Claims

1. A frameless containment system for providing a substantially dust-tight working space surrounding a work area, said frameless containment system comprising:

   - a flexible enclosure comprising one or more flexible sheets adapted to be placed around said work area, said one or more flexible sheets comprising an outlet for releasing gas and particles;
   - one or more gas inlet device;

   wherein said flexible enclosure when placed around said work area, defines a dust-tight working space through magnetic means, located, at least partially, within the edge of said flexible enclosure.

2. A frameless containment system according to claim 1, wherein said one or more gas inlet devices is adapted to introduce compressed fluids, such as gas or liquids, into said flexible enclosure, thereby keeping the frameless containment erected.

3. A frameless containment system according to any of the preceding claims, wherein said one or more gas inlet devices is adapted to introduce compressed fluids, such as gas or liquids, and particles, thereby allowing for introduction of materials suitable for surface treatment within said work area.

4. A frameless containment system according to any of the preceding claims, wherein said outlet for releasing gas and particles is configured for connecting a vacuum device for drawing gas and particles out of said flexible enclosure.

5. A frameless containment system according to any of the preceding claims, further comprising a vacuum device connected to said outlet for releasing gas and particles, said vacuum device suitable for drawing gas and particles out of said flexible enclosure.

6. A frameless containment system according to any of the preceding claims, wherein said magnetic means comprise permanent magnets or electromagnets arranged in a chain structure.

7. A frameless containment system according to any of the preceding claims, wherein said magnetic means are attached to said edge of said flexible enclosure.

8. A frameless containment system according to any

of the preceding claims, wherein said magnetic means are located within sleeves at said edge of said flexible enclosure.

9. A frameless containment system according to claim 8, wherein said sleeves comprise metallic materials, such as metallic braids.

10. A frameless containment system according to any of the preceding claims 8 and 9, wherein said sleeves comprise plastic, rubber or any other materials.

11. A frameless containment system according to any of the preceding claims, wherein said magnetic means has a magnetic strength between 0.3 N/mm to 30 N/mm, such as between 1 N/mm and 5 N/mm

12. A frameless containment system according to any of the preceding claims, further comprising an inlet opening, such as a blasting hole, suitable for introducing compressed gas and particles.

13. A frameless containment system according to any of the preceding claims, wherein, when assembled, said flexible enclosure comprises one or more wedge shaped elements between said magnetic means and said working area.

14. A frameless containment system according to any of the preceding claims, wherein said one or more wedge shaped elements comprise said outlet for releasing gas and particles and said one or more gas inlet devices.

15. A frameless containment system according to claim 14, wherein said one or more wedge shaped elements comprise magnetic materials.

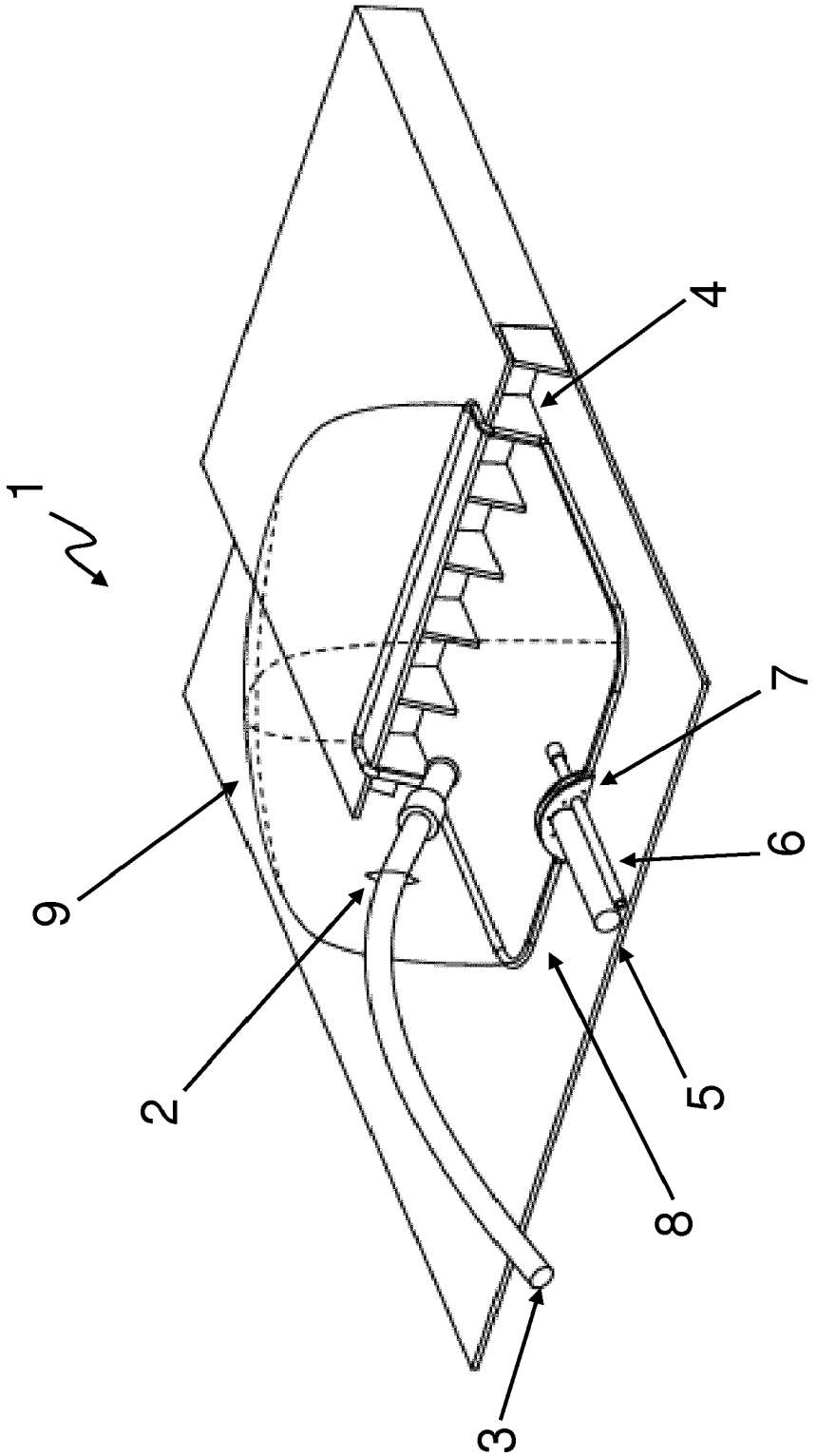


FIG. 1A

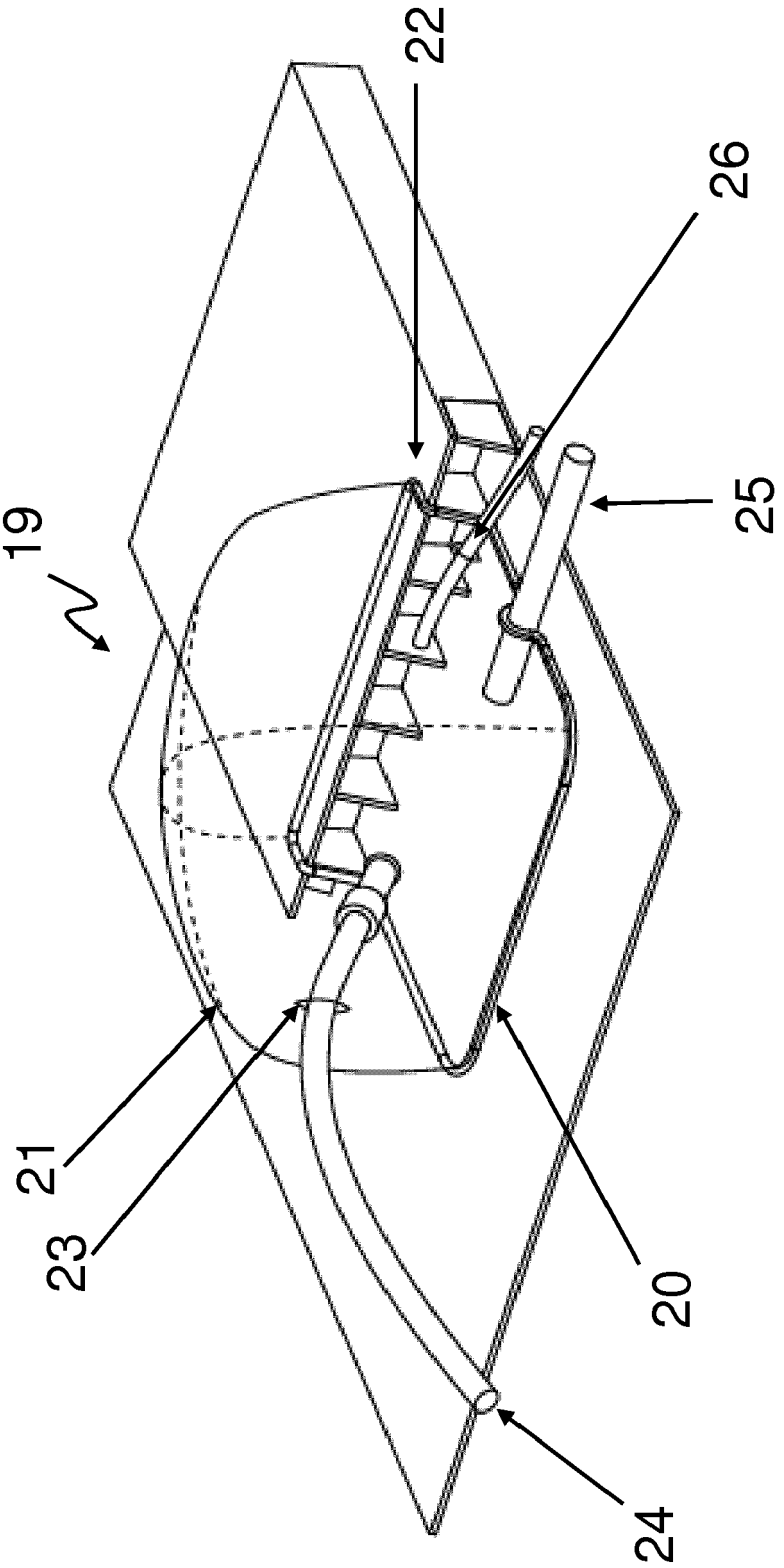


FIG. 1B

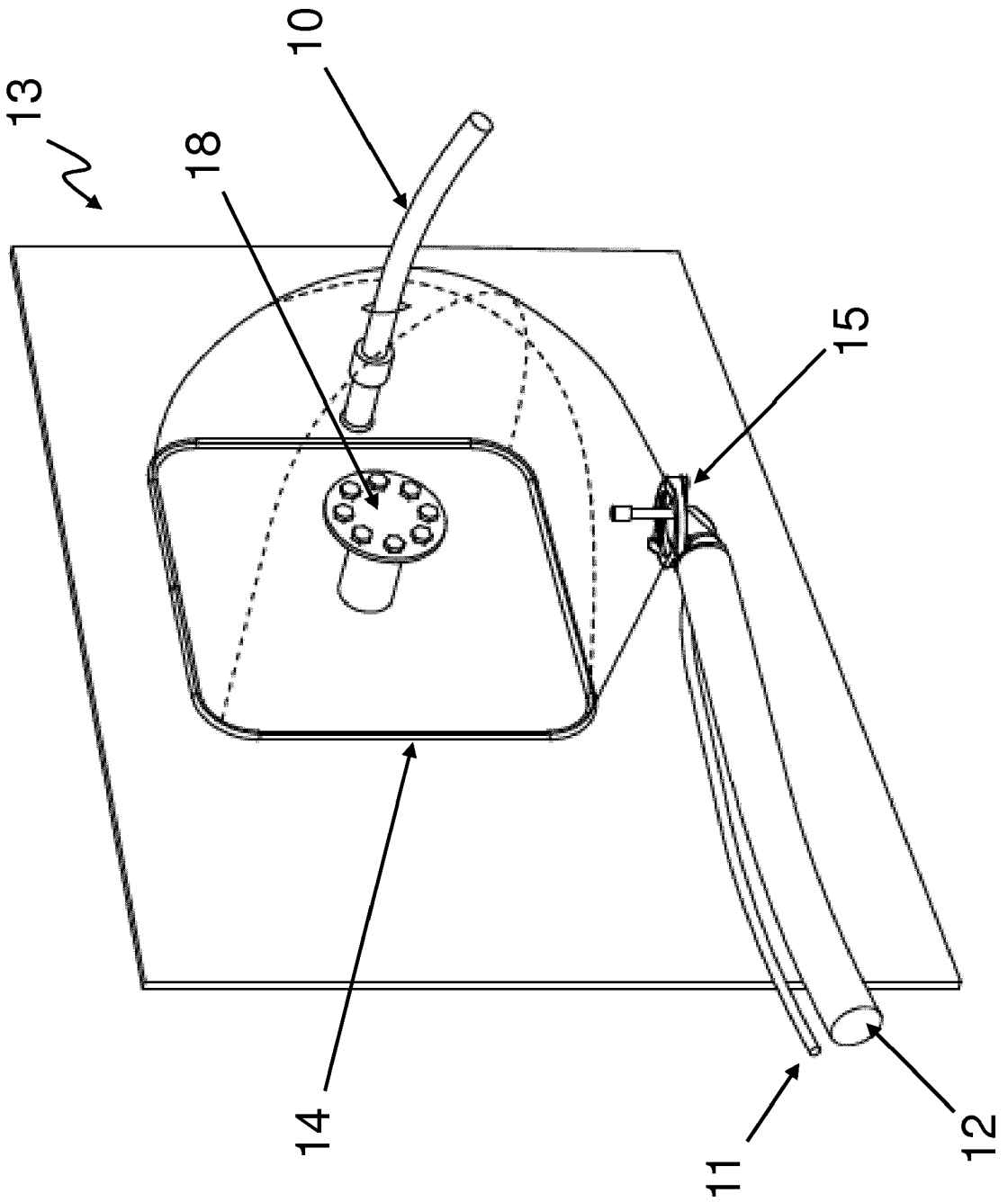


FIG. 2

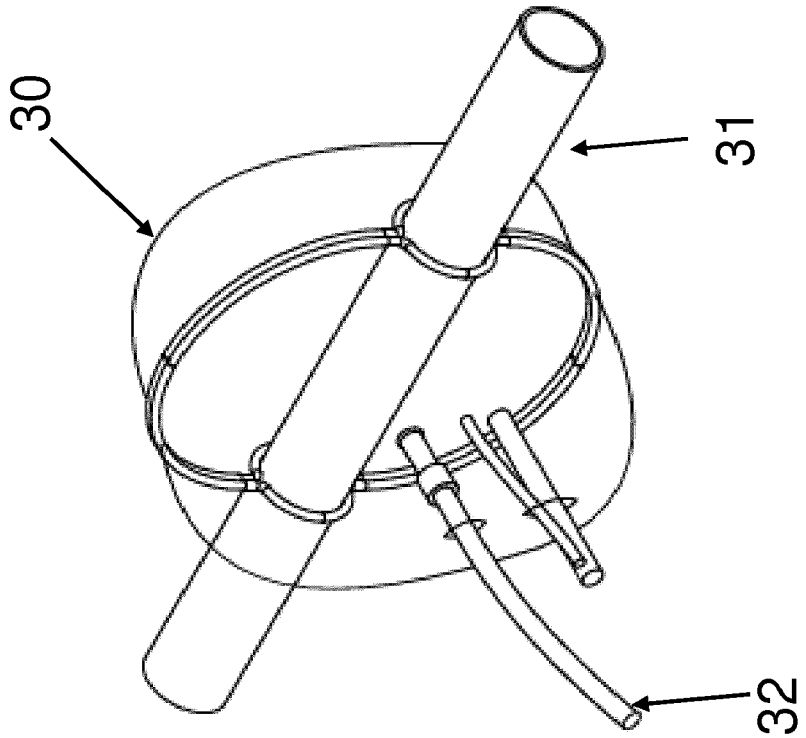


FIG. 3B

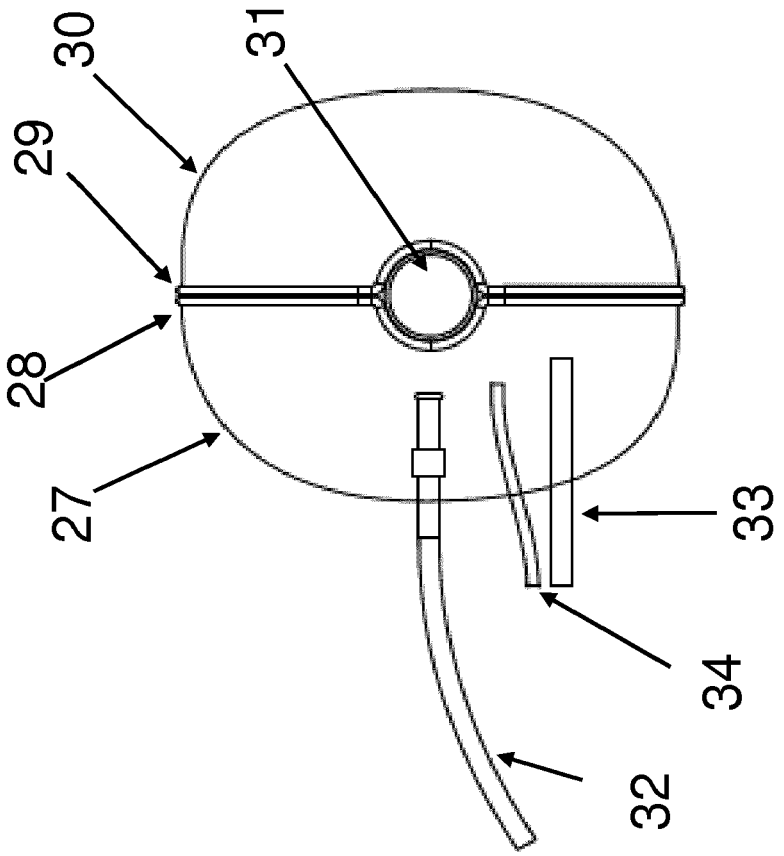


FIG. 3A

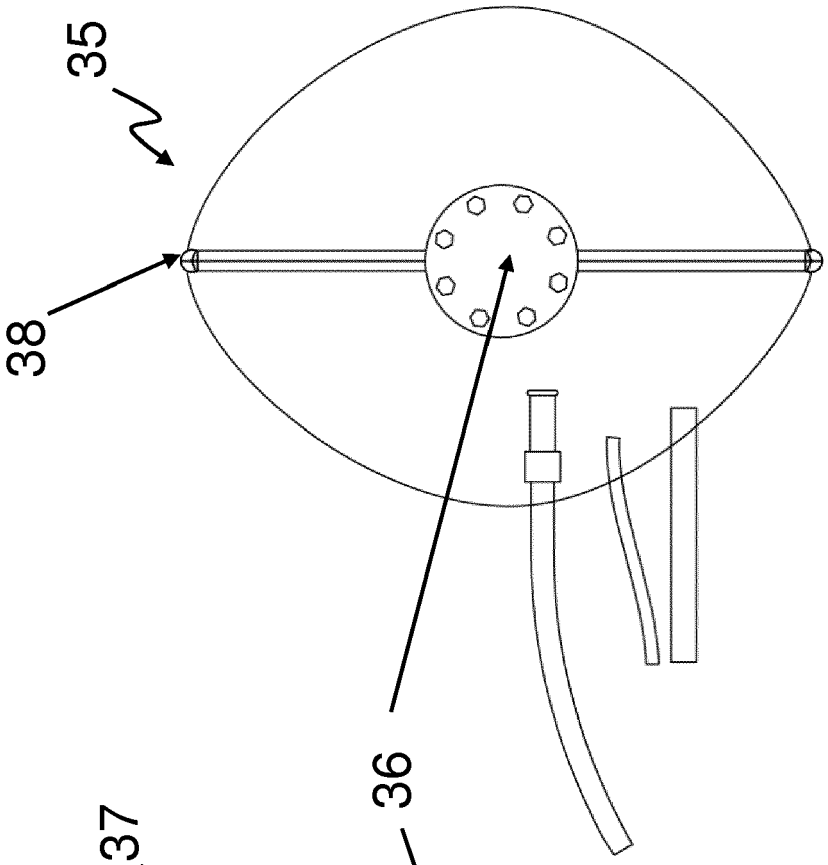


FIG. 4B

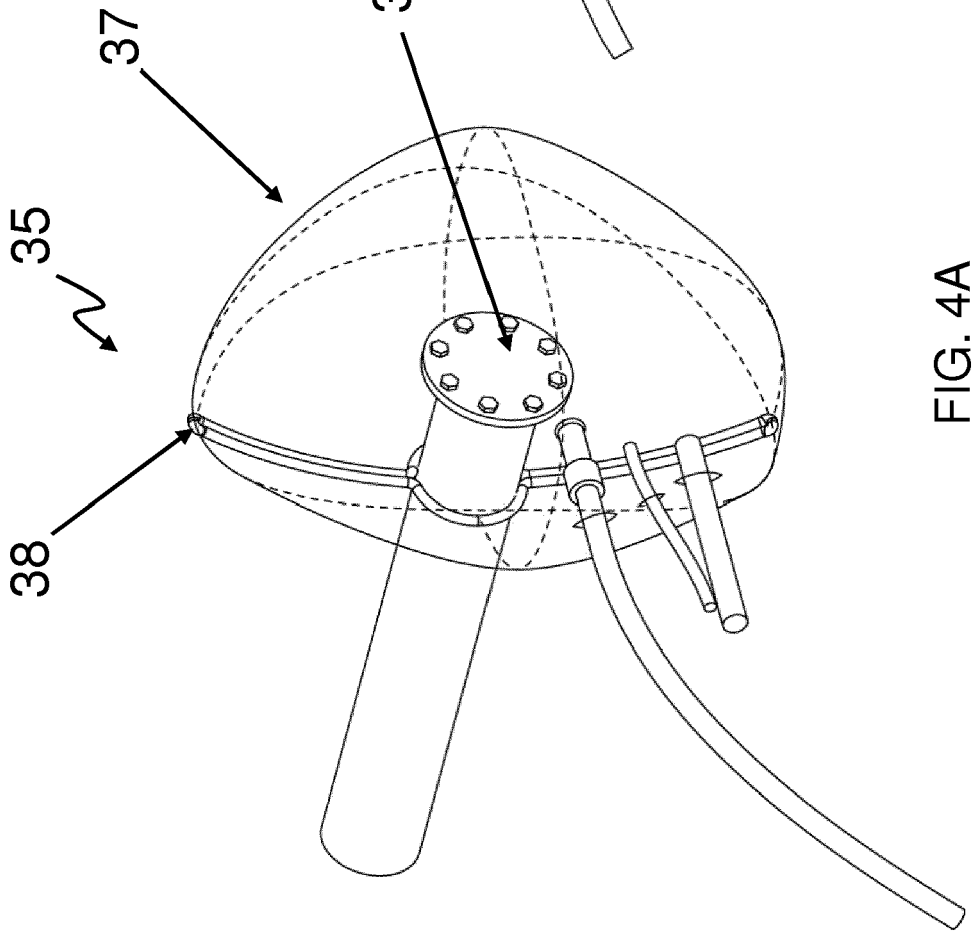
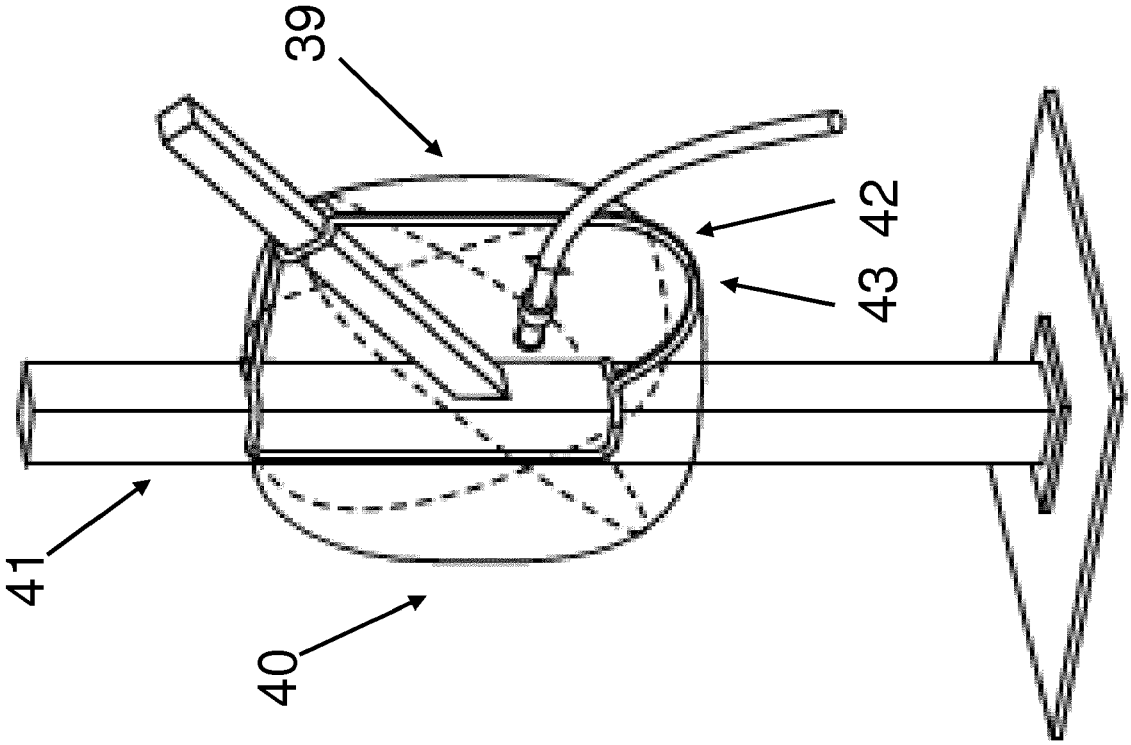


FIG. 4A

FIG. 5



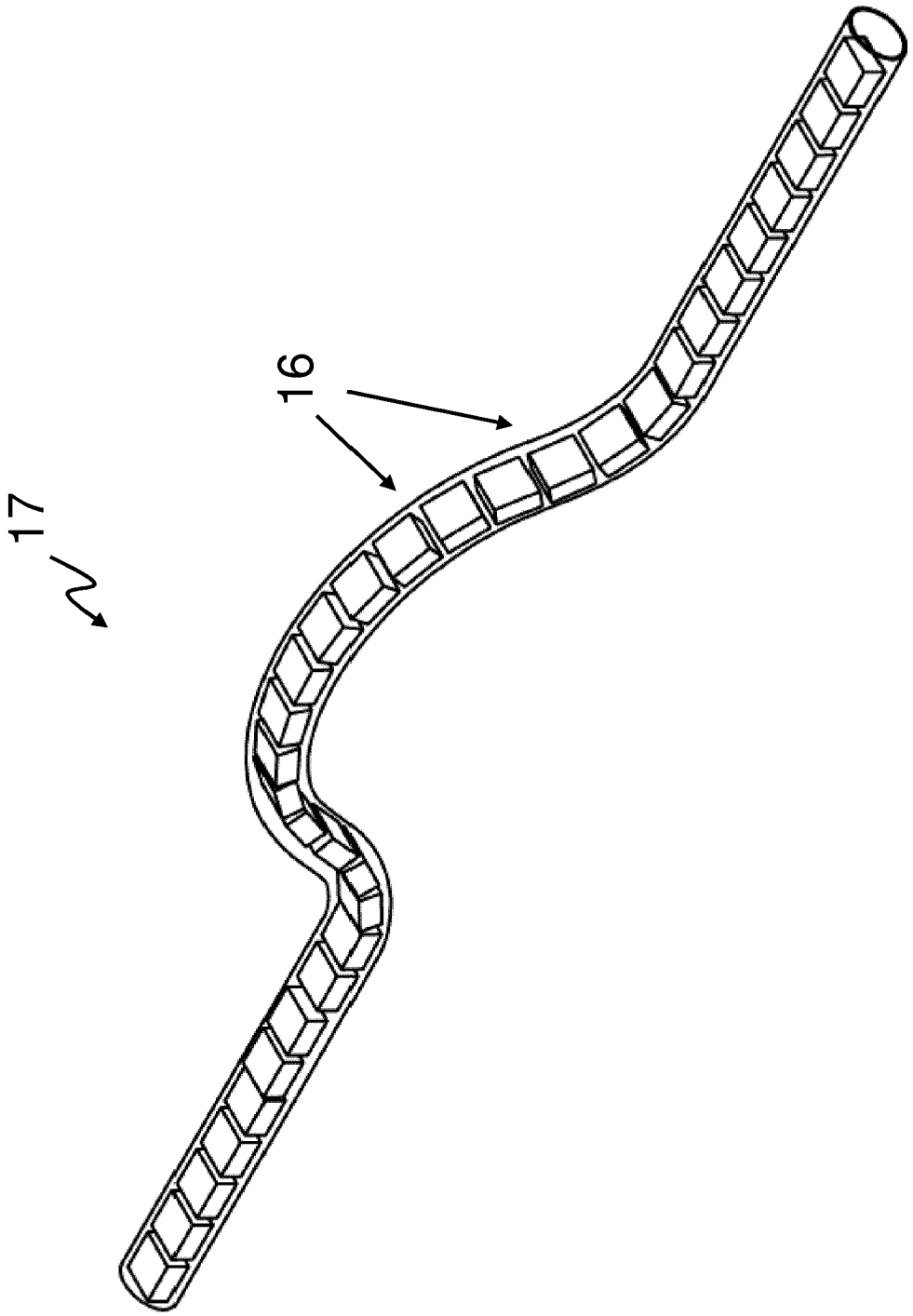


FIG. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 15 0389

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2016/198419 A1 (PINOVO AS [NO]) 15 December 2016 (2016-12-15) * page 3, line 33 - page 4, line 6; figures 4,5 * * page 10, line 5 - line 8 * * claim 7 *	1-5,7,8, 10-12 6	INV. B24C9/00 B24C3/06 B08B15/02 B05B16/80
X	AU 2016 201 665 A1 (STELLA IND PTY LTD) 10 November 2016 (2016-11-10) * paragraphs [0002], [0005], [0009], [0053], [0055], [0064], [0071], [0077], [0086] *	1-3,7,8, 10-12	
Y A	US 2002/182988 A1 (WILLIAMS WILLIAM A [US] ET AL) 5 December 2002 (2002-12-05) * paragraph [0043]; figure 9 *	6 1-5,7,8	
A	US 2012/186520 A1 (HILL ANDREW [AU]) 26 July 2012 (2012-07-26) * paragraphs [0035], [0073], [0076]; claim 3 *	1-7	TECHNICAL FIELDS SEARCHED (IPC)
A	DE 295 19 761 U1 (KILCIOGLU MEHMET ALI [DE]) 29 February 1996 (1996-02-29) * the whole document *	1,3	B24C B08B B05B
A	US 2014/075709 A1 (AGORICHAS THOMAS J [US]) 20 March 2014 (2014-03-20) * paragraph [0024]; figure 2 *	1	
A	US 3 984 944 A (MAASBERG WOLFGANG ET AL) 12 October 1976 (1976-10-12) * column 5, line 14 - line 15 *	6	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 July 2018	Carmichael, Guy

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 0389

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-07-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2016198419 A1	15-12-2016	AU 2016277321 A1	21-12-2017
		CN 107787261 A	09-03-2018
		EP 3307482 A1	18-04-2018
		NO 340623 B1	15-05-2017
		US 2018178347 A1	28-06-2018
		WO 2016198419 A1	15-12-2016
AU 2016201665 A1	10-11-2016	NONE	
US 2002182988 A1	05-12-2002	NONE	
US 2012186520 A1	26-07-2012	AU 2010281353 A1	29-03-2012
		US 2012186520 A1	26-07-2012
		WO 2011014913 A1	10-02-2011
DE 29519761 U1	29-02-1996	NONE	
US 2014075709 A1	20-03-2014	US 2013263403 A1	10-10-2013
		US 2014075709 A1	20-03-2014
US 3984944 A	12-10-1976	AR 207466 A1	08-10-1976
		BR 7503912 A	06-07-1976
		DE 2429838 A1	02-01-1976
		ES 438171 A1	16-02-1977
		GB 1502120 A	22-02-1978
		JP S5123996 A	26-02-1976
		US 3984944 A	12-10-1976

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82