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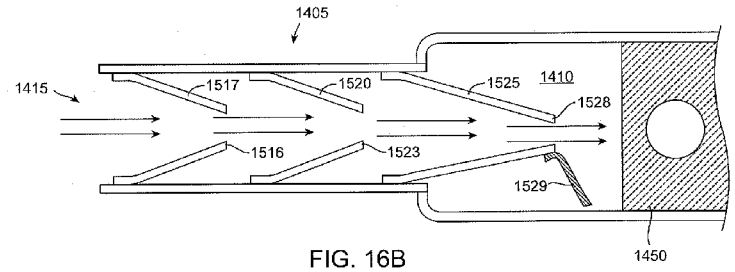

FIG. 16B

(57) Abstract: Disclosed is an inflation valve that enables a user to quickly inflate and deflate an inflatable object. The inflation valve can include an inflation chamber that is an adequate size to capture a breath of air blown by a user from a distance away from an outside opening of the inflation chamber. This allows surrounding air into the area of low pressure created by the moving air, thereby greatly increasing the amount of air entering the inflatable object. To prevent air from escaping the inflatable object, the inflation valve can include a non-invertible one-way valve and/or an invertible one-way valve. Each valve can prevent air from escaping the inflation chamber until adequate pressure is applied from the outside opening of the inflation chamber, for example, as a result of a user blowing air into the inflation chamber. The invertible one-way valve can be inverted to reverse the properties of the valve.

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INFLATION VALVE ALLOWING FOR RAPID INFLATION AND DEFLATION OF AN INFLATABLE OBJECT

BACKGROUND

1. Technical Field

The present disclosure relates to inflation valves and more specifically to an inflation valve that allows for rapid inflation and deflation of an inflatable object.

2. Introduction

Numerous types of objects are currently available as inflatable objects that can be inflated prior to use and deflated when not needed. For example, chairs, mattresses, pool toys, pools, etc., are all available as inflatable objects. Inflatable objects are advantageous because, when deflated, they can be easily stored and transported. For example, a large inflatable object, such as a mattress, can be stored in a much smaller space when it is deflated. This makes inflatable objects ideal for travel, such as camping, because they can be easily transported and stored when deflated.

While inflatable objects provide many advantages, traditional inflation valves used to inflate inflatable objects provide numerous challenges. To prevent air from escaping the inflatable object between breaths, many inflation valves are made small to limit the amount of air that can exit the inflatable object. The small size of these inflation valves also allows a user to place the valve in their mouth while inflating, further limiting the amount of air that can escape between breaths. While effective at preventing air from escaping, these valves also limit the amount of air that can be blown into the inflatable object and can be unsanitary.

Some inflation valves include an internal valve that closes the inflation valve to prevent air from escaping an inflatable object. These types of internal valves are often perpendicular to the opening of the inflation valve and require substantial force to open. For example, these valves can require a user to pinch the inflation valve to open the internal valve and allow the user to inflate the inflatable object. These types of internal valves generally require a user to place their mouth on the inflation valve because the small size of the inflation valve makes it difficult to blow air into the inflation valve from a distance away from the inflation valve and air can easily escape the inflatable object when the internal valve is opened.

Alternatively, some internal valves require a pump to open the internal valve to allow inflation of the inflatable object. While some of these types of inflation valves provide for a larger conduit by which air can enter the inflatable object and do not require a user to place the inflation valve in the user's mouth, these types of valve do require the use of a pump, which reduces the portability of the inflatable object. Accordingly, there is a need for an improved inflation valve.

SUMMARY

Additional features and advantages of the disclosure will be set forth in the description which follows, and in part will be obvious from the description, or can be learned by practice of the herein disclosed principles. The features and advantages of the disclosure can be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features of the disclosure will become more fully apparent from the following description and appended claims, or can be learned by the practice of the principles set forth herein.

Disclosed is an inflation valve that enables a user to quickly inflate and deflate an inflatable object. To accomplish this, the inflation valve can include at least one one-way valve attached within an inflation chamber that is attached to an inflatable object. The one-way valve can be designed to open when adequate pressure is applied to the one-way valve from one direction, while remaining closed when adequate pressure is applied to the one-way valve from the opposite direction. Adequate pressure to open the one-way valve can be created by a user blowing into the one-way valve and adequate pressure to close the one-way valve can be created by the air trapped inside the inflatable object. Thus the one-way valve can allow air blown by the user to enter the inflatable object while preventing the air trapped in the inflatable object from escaping the inflatable object.

The one-way valve also allows for larger inflation chambers because the user is not required to place their mouth over the inflation chamber to force air into the inflatable object or prevent air from escaping the inflatable object. This can increase the amount of air that can enter and/or exit the inflatable object. Further, low pressure created by the fast moving air being blown into the inflation chamber can cause surrounding air to be drawn into the inflation chamber from the area between the user and the inflation chamber, thereby greatly increasing the speed at which the inflatable object can be inflated.

The inflation chamber can be open at opposing ends to provide a large conduit by which air can enter and/or exit the inflatable object. In some embodiments, the inflation chamber can be an adequate size to capture a breath of air blown by a user from a distance away from an outside opening of the inflation chamber. The fast blowing air being blown into the inflation chamber by the user can create an area of low pressure around the air stream. The low pressure can draw in surrounding air into the area of low pressure from the space between the user and the inflation chamber, thereby greatly increasing the amount of air entering the inflatable object.

To prevent air from escaping the inflatable object, the inflation valve can include a non-invertible one-way valve and/or an invertible one-way valve. The non-invertible one-way valve can be positioned in the inflation chamber such that the non-invertible one-way valve opens when adequate pressure is applied to the non-invertible one-way valve from the outside opening of the inflation chamber, for example, as a result of a user blowing air into the inflation chamber. An invertible one-way valve can be inverted, allowing a user to invert the properties of the invertible one-way valve. Thus, an invertible one-way valve positioned to open when adequate air pressure is applied to the invertible one-way valve from the outside of the inflation chamber, can be inverted to open when adequate air pressure is applied to the invertible one-way valve from inside the inflatable object.

In some embodiments, the inflation valve can include a non-invertible one-way valve and an invertible one-way valve. In this type of embodiment, the invertible one-way valve can be designed such that, when inverted to allow air to escape the inflatable object, the invertible one-way valve rests between the ends of the non-invertible one-way valve, causing the non-invertible one-way valve to open when the invertible one-way valve opens. This can allow the inflatable object to be rapidly deflated.

In various embodiments, an inflatable air pad may include an inflation chamber comprising one or more non-invertible one-way valves and/or one or more invertible one-way valves. In certain embodiments, a user may blow air into the inflation chamber in order to inflate the inflatable air pad. As air is added to the inflation chamber, the one or more one-way valves may prevent or impede air from escaping the inflatable air pad. The inflation valve may then be rolled up to force any air present within the inflation chamber into the body portion of the inflatable air pad. According to certain embodiments, a user may invert the one or more invertible one-way valves in order to allow air to escape from the inflatable air pad. Inverting the one or more invertible one-way valves may prevent

the one or more non-invertible one-way valves from closing and therefore preventing air from escaping the inflatable air pad.

In various embodiments, an air bag may comprise an inflation chamber comprising one or more one-way valves. In certain embodiments, a user may blow air through an inflation opening into the inflation chamber in order to inflate the air bag. As air is added to the inflation chamber, the one or more one-way valves may prevent or impede air from escaping the air bag. In various embodiments, the air bag may include a compression assembly configured to allow a user to decrease the volume of the air bag while maintaining a constant amount of air inside the air bag. The air bag may also include an access opening near the inflation opening that may allow a user to insert or remove one or more objects from the air bag. The access opening may include a fastening assembly to prevent air from escaping the air bag when the access opening is sealed. In various embodiments, a user may open the access opening in order to release any air trapped within the interior of the air bag.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to describe the manner in which the above-recited and other advantages and features of the disclosure can be obtained, a more particular description of the principles briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only exemplary embodiments of the disclosure and are not therefore to be considered to be limiting of its scope, the principles herein are described and explained with additional specificity and detail through the use of the accompanying drawings in which:

FIG. 1 illustrates an exemplary embodiment of an inflation valve including an inflation chamber;

FIG. 2 illustrates surrounding air being drawn into an inflatable object;

FIGS. 3A-3D illustrate an exemplary embodiment of a non-invertible one-way valve;

FIGS. 4A-4D illustrate an exemplary embodiment of an invertible one-way valve;

FIGS. 5A-5D illustrate an inflation valve including a non-invertible one-way valve and an invertible one-way valve;

FIGS. 6A-6D illustrate an inflation valve where the inflation chamber and the invertible one-way valve are one continuous object;

FIGS. 7A-7B illustrate an inflation chamber being rolled up to seal an inflatable object;

FIG. 7C illustrates an inflatable object with an inflation chamber and traditional inflation valve;

FIG. 8 illustrates an inflation chamber can be sealed at the outside open end;

FIGS. 9A and 9B illustrate an inflation chamber that can be used as a storage bag for the inflatable object;

FIG. 10 illustrates an embodiment in which the inflation chamber does not protrude from the inflatable object;

FIG. 11 illustrates an exemplary embodiment of an inflation valve including a covering;

FIG. 12 illustrates an exemplary embodiment of using a fan along with the inflation valve;

FIGS. 13A and 13B illustrate an embodiment of an inflatable valve including a secondary valve;

FIGS. 14A-14C illustrate an embodiment of an inflation valve in which the inflation chamber has two non-invertible valves;

FIGS. 15A and 15B illustrate an embodiment of an air pad including an inflation chamber;

FIGS. 16A-16D illustrate an embodiment of an air pad during various states of operation;

FIGS. 17A and 17B illustrate the exterior of an embodiment of an air pad with integrated inflation valve;

FIG. 18 illustrates an embodiment of an air pad that has the inflation valve of the present invention attached to its longest side;

FIGS. 19A-19C illustrate an air pad while the inflation chamber is being rolled up;

FIGS. 20A and 20B illustrate an embodiment of a billows foot pump;

FIGS. 21A-21C illustrate an embodiment of an air pad being rolled up;

FIGS. 22A-22F illustrate an embodiment of an air bag; and

FIG. 23 illustrates an embodiment of an air bag being used in combination with an air pad.

DETAILED DESCRIPTION

Various embodiments of the disclosure are discussed in detail below. While specific implementations are discussed, it should be understood that this is done for illustration purposes only. A person skilled in the relevant art will recognize that other components and configurations may be used without parting from the spirit and scope of the disclosure.

The present disclosure addresses the need in the art for an inflation valve that allows for an inflatable object to be rapidly inflated and/or deflated. Traditional inflation valves include internal valves that cannot be opened by blowing into the inflation valve from a distance. The user must physically open the internal valve by, for example, pinching the internal valve. Further, these internal valves allow air to escape when open, thus requiring a user to place the inflation valve in their mouth while inflating to force air into the inflatable object or and prevent air from escaping the inflatable object. As a result, inflating and/or deflating an inflatable object with a traditional inflation valve can be time consuming and unsanitary and/or require the use of additional devices such as pumps.

Disclosed is an inflation valve that enables a user to quickly inflate and deflate an inflatable object. To accomplish this, the inflation valve can include at least one one-way valve attached within an inflation chamber that provides a conduit to inflate an inflatable object. The one-way valve can be designed to open when adequate pressure is applied to the one-way valve from one direction, while remaining closed when adequate pressure is applied to the one-way valve from the opposite direction. Adequate pressure to open the one-way valve can be created by a user blowing into the one-way valve and/or using a pump to blow air into the one-way valve. Adequate pressure to close the one-way valve can be created by the air trapped inside the inflatable object. Thus the one-way valve can

allow air blown by the user to enter the inflatable object while preventing the air trapped in the inflatable object from escaping the inflatable object.

The one-way valve also allows for larger inflation chambers because the user is not required to place their mouth over the inflation chamber to prevent air from escaping the inflatable object. This can increase the amount of air that can enter and/or exit the inflatable object. Further, low pressure created by the fast moving air being blown into the inflation chamber can cause surrounding air to be drawn into the inflation chamber from the area between the user and the inflation chamber, thereby greatly increasing the speed at which the inflatable object can be inflated.

The inflation chamber can be open at opposing ends to provide a large conduit by which air can enter and/or exit the inflatable object. In some embodiments, the inflation chamber can be an adequate size to capture a breath of air blown by a user from a distance away from an outside opening of the inflation chamber. The fast blowing air being blown into the inflation chamber by the user can create an area of low pressure around the air stream. The low pressure can draw surrounding air into the area of low pressure from the space between the user and the inflation chamber, thereby greatly increasing the amount of air entering the inflatable object.

To prevent air from escaping the inflatable object, the inflation valve can include a non-invertible one-way valve and/or an invertible one-way valve. The non-invertible one-way valve can be positioned in the inflation chamber such that the non-invertible one-way valve opens when adequate pressure is applied to the non-invertible one-way valve from the outside opening of the inflation chamber, for example, as a result of a user blowing air into the inflation chamber. An invertible one-way valve can be inverted, allowing a user to invert the properties of the invertible one-way valve to allow air to flow through the valve in the opposite direction and out of the inflation chamber. Thus, an invertible one-way valve positioned to open when adequate air pressure is applied to the invertible one-way valve from the outside of the inflation chamber can be inverted to open when adequate air pressure is applied to the invertible one-way valve from inside the inflatable object.

In some embodiments, the inflation valve can include a non-invertible one-way valve and an invertible one-way valve. In this type of embodiment, the invertible one-way valve can be positioned such that, when inverted to allow air to escape the inflatable object, the invertible one-way valve rests between the ends of the non-invertible one-way

valve, causing the non-invertible one-way valve to open when the invertible one-way valve opens. This can allow the inflatable object to be rapidly deflated.

FIG. 1 illustrates an exemplary embodiment of inflation valve 100 designed to inflate inflatable object 110. As illustrated, inflation chamber 105 can be attached to inflatable object 110 such that inflation chamber 105 protrudes from inflatable object 110. Inflation chamber 105 can include outside opening 115 and inside opening 120 which provide a conduit by which air can enter and\or exit inflation chamber 105. A user can inflate inflatable object 110 by blowing air into outside opening 115 which travels through inflation chamber 105 and into inflatable object 110 through inside opening 120.

In some embodiments, inflation chamber 105 can be of an adequate size to receive a full breath of air blown by a user while the user is a distance away from inflation chamber 105. This can maximize the amount of air blown by the user that is captured by inflation chamber 105 and also allow for surrounding air to enter inflation chamber 105, thus increasing the speed by which inflatable object 110 is inflated.

FIG. 2 illustrates surrounding air being drawn into inflatable object 110 when a user blows into inflation chamber 105 from a distance away from inflation chamber 105. As shown, a user can be positioned an adequate distance away from inflation chamber 105 to allow surrounding air to travel between inflation chamber 105 and the user. When the user blows air into inflation chamber 105, the fast moving air creates an area of low pressure around the air stream entering inflation chamber 105. As a result of this low pressure, surrounding air can be drawn into the area of low pressure from the space between the user and inflation chamber 105. The air blown by the user and the air drawn in from the low pressure can then enter inflatable object 110, thereby greatly increasing the speed at which inflatable object 110 is inflated.

In some embodiments, inflation chamber 105 can include a one-way valve that prevents air from escaping inflatable object 110. The one-way valve can be attached inside inflation chamber 105 such that air must travel through the one-way valve to enter and/or exit inflatable object 110.

A one-way valve can be designed to open when adequate air pressure is applied to the one-way valve from outside opening 115. For example, adequate air pressure can be applied as a result of a user or pump blowing air into inflation chamber 105 from outside opening 115, causing the one-way valve to open to allow air to enter inflatable object 110.

Further, the one-way valve can be designed to close when adequate pressure is applied to the one-way valve from the opposite end, for example from the air trapped inside inflatable object 110. Thus, the one-way valve can open to allow air to enter inflatable object 110 when a user blows into inflation chamber 105 from outside opening 115, and close from the air pressure inside inflatable object 110 when the user stops blowing. By automatically trapping the air between each of the user's breaths, the user can repeatedly blow into inflation chamber 105, adding additional air into inflatable object 110 until inflatable object 110 is adequately full.

To accomplish this, the one-way valve can include an outer open end and an inner open end, through which air can travel when the one-way valve is open. The one-way valve can be attached to the inside of inflation chamber 105 such that the outer open end of the one-way valve is positioned closer to outside opening 115 than the inner open end of the one-way valve is positioned to outside opening 115. The one-way valve can be attached to the inside of inflation chamber 105 along the entirety of the outer open end of the one-way valve to create a seal that forces all air to travel through the one-way valve to enter and/or exit inflatable object 110. Air inside inflatable object 110 can occupy the space between inflation chamber 105 and the inner end of the one-way valve, causing adequate air pressure to close the one-way valve when adequate pressure to open the one-way valve is not being applied from the opposite direction. To accomplish this, the one-way valve may be long enough that the inner end can adequately close the one-way valve.

In some embodiments, the one-way valve can be a non-invertible one-way valve that remains in a fixed position within inflation chamber 105. Alternatively, in some embodiments, the one-way valve can be an invertible one-way valve that can be inverted to reverse the direction of the invertible one-way valve. Thus, when inverted, an invertible one-way valve can close when adequate pressure is applied from outside opening 115 of inflation chamber 105, and open when adequate air pressure is applied from inside of inflatable object 110.

FIGS. 3A – 3D illustrate an exemplary embodiment of a non-invertible one-way valve. FIG. 3A shows non-invertible one-way valve 305 alone, without inflation chamber 105. As illustrated, non-invertible one-way valve 305 includes outer open end 310 and inner open end 315. Non-invertible one-way valve 305 further includes left edge 320 spanning from point A to point B, and right edge 325 spanning from point C to point D.

FIG. 3B illustrates non-invertible one-way valve 305 attached to the inside of inflation chamber 105. As shown, non-invertible one-way valve 305 is attached to the inside of inflation chamber 105 so that outer open end 310 of non-invertible one-way valve 305 is positioned closer to outside opening 115 and inner open end 315 of non-invertible one-way valve 305 is positioned closer to inside opening 120.

Non-invertible one-way valve 305 can be attached to the inside of inflation chamber 105 along left edge 320 and right edge 325, which can prevent non-invertible one-way valve 305 from being inverted.

Non-invertible one-way valve 305 can further be attached to the inside of inflation chamber 105 along the edge, or near the edge, of outer open end 310. This can create a seal between non-invertible one-way valve 305 and inflation chamber 105 that forces all air to travel through non-invertible one-way valve 305 to enter and/or exit inflatable object 110.

While adequate pressure to open non-invertible one-way valve 305 is not being applied, non-invertible one-way valve 305 can be closed from adequate air pressure applied from air inside inflatable object 110, thus preventing air from entering or escaping inflatable object 110. Adequate pressure to open non-invertible one-way valve 305 can be applied using manual force, such as a user using their hand to open non-invertible one-way valve 305, or alternatively, by applying adequate air pressure, such as when a user or pump blows air into outside opening 115 of inflation chamber 105.

FIG. 3C illustrates a side sectional view of non-invertible one-way valve 305 attached to inflation chamber 105. As shown, non-invertible one-way valve 305 is attached to inflation chamber 105 along outer open end 310 to create a seal that prevents air from traveling in and/or out of inflatable object 110 while non-invertible one-way valve 305 is closed.

As shown, inner open end 315 of non-invertible one-way valve 305 is closed, thus preventing air from traveling in and/or out of inflatable object 110. Air blown into inflatable object 110 can fill spaces 321 and 322 between inner open end 315 and inflation chamber 305, and apply pressure to inner open end 315 that closes non-invertible one-way valve 315 while adequate pressure to open non-invertible one-way valve 305 is not being applied. Adequate pressure can be applied by a user reaching into inflation chamber 105 and manually opening inner open end 315.

Alternatively adequate pressure can be applied by a user blowing into outside opening 115 of inflation chamber 105. While adequate air pressure is applied to non-invertible one-way valve 305 from outside opening 115, i.e. while a user is blowing into outside opening 115, inner open end 315 can open, allowing air to enter inflatable object 110. When the air pressure is removed from non-invertible one-way valve 305, i.e., when the user stops blowing into outside opening 115, the air inside inflatable object 110 can apply pressure to non-invertible one-way valve 305, causing at least inner open end 315 to close, thus preventing air from entering and/or exiting inflatable object 110.

FIG. 3D illustrates a second side sectional view of non-invertible one-way valve 305 attached to inflation chamber 105. As shown, air pressure applied to non-invertible one-way valve 305 from outside opening 115 has opened inner open end 315, allowing air to enter inflatable object 110. Open end 315 can close when the air pressure is no longer applied to non-invertible one-way valve 305, i.e. when a user is no longer blowing into open end 115. Thus air blown into inflatable object 110 will not escape when the user has adequately filled inflatable object 305 or pauses in between breaths.

In some embodiments, inflation valve 100 can include an invertible one-way valve in addition to or instead of non-invertible one-way valve 305, which can prevent air from entering and/or exiting inflatable object 110. An invertible one-way valve can be similar to non-invertible one-way valve 305 except it can be inverted, whereas non-invertible one-way valve 305 cannot be inverted.

Inverting the invertible one-way valve can cause the properties of the invertible one-way valve to reverse such that the invertible one-way valve will open when adequate air pressure is applied to the inverted invertible one-way valve from inside inflatable object 110, rather than when adequate air pressure is applied to the invertible one-way valve from outside of inflatable chamber 105. This can allow a user to change the properties of the invertible one-way valve to accommodate either inflating or deflating inflatable object 110.

FIGS. 4A-4D illustrate an exemplary embodiment of an invertible one-way valve. FIG. 4A shows invertible one-way valve 405 alone, without inflation chamber 105. As shown, invertible one-way valve 405 includes outer open end 410 and inner open end 415.

FIG. 4B illustrates invertible one-way valve 405 attached to the inside of inflation chamber 105. As shown, invertible one-way valve 405 is attached to the inside of inflation

chamber 105 along the edge, or near the edge, of outer open end 410. This can create a seal between invertible one-way valve 405 and inflation chamber 105 that forces all air to travel through invertible one-way valve 405 to enter and/or exit inflatable object 110.

Unlike non-invertible one-way valve 305, invertible one-way valve 405 is not attached to the inside of inflation chamber 105 along the edges of invertible one-way valve 405, thus allowing invertible one-way valve 405 to be inverted by a user. As shown, invertible one-way valve 405 is positioned similar to non-invertible one-way valve 305 such that outer open end 410 is closer to outside opening 115 than inner open end 415 is to outside opening 115.

In this configuration, invertible one-way valve 405 acts similarly to non-invertible one-way valve 305 in that it prevents air from escaping inflatable object 110 when invertible one-way valve 405 is closed, and invertible one-way valve 405 opens to allow air into inflatable object 110 when adequate air pressure is applied to invertible one-way valve 405 from outside opening 115.

To invert invertible one-way valve 405, a user can reach into invertible one-way valve 405 and pull inner open end 415 towards outside opening 115. Inverting invertible one-way valve 405 in this way reverses the properties of invertible one-way valve 405. For example, when inverted, invertible one-way valve 405 will open when adequate air pressure is applied to invertible one-way valve 405 from inside opening 120 for example, from the pressure applied from air trapped inside inflatable object 110.

A user can leave invertible one-way valve 405 in its original un-inverted position to inflate inflatable object 110. This can allow air blown by the user into outside opening 115 to enter inflatable object 110 without being able to escape. When the user wishes to deflate inflatable object 110, the user can invert invertible one-way valve 405. Inverting invertible one-way valve 405 allows the pressure created by the air trapped inside inflatable object 110 to open invertible one-way valve 405, thus deflating inflatable object 110.

FIG. 4C illustrates a side sectional view of invertible one-way valve 405 in an inverted position. As shown, invertible one-way valve 405 is attached to inflation chamber 105 at outer open end 410. Further, inner open end 415 had been pulled through outer open end 410 to invert invertible one-way valve 405. Air pressure inside inflatable object

110 can then cause invertible one-way valve 405 to open and deflate invertible one-way valve 405.

FIG. 4D illustrates an embodiment of invertible one-way valve 405 including an attachment element to maintain the position of invertible one-way valve 405. When air pressure inside inflatable object 110 increases to a sufficient point, it can cause invertible one-way valve 405 to invert. To prevent this from happening, in some embodiments, invertible one-way valve 405 can include a first attachment element 420 that can be used to hold invertible one-way valve 405 in the desired position. As shown, the first attachment element 420 can be attached to a second attachment element 425 to hold invertible one-way valve 405 in the desired position. The first and second attachment elements 420, 425 can be any type of attachment elements known in the art, such as a hook and loop fastener, button, hook, magnet, etc. To invert invertible one-way valve 405 in this type of embodiment, a user can first detach the first attachment element 420 from the second attachment element 425 and then manually invert invertible one-way valve 405.

In some embodiments, an inflation valve can include both a non-invertible one-way valve and an invertible one-way valve. This type of embodiment is illustrated in FIGS. 5A – 5D.

FIG. 5A shows inflation valve 500 including both non-invertible one-way valve 305 and invertible one-way valve 405. As shown, non-invertible one-way valve 305 is positioned closer to outside opening 115 and invertible one-way valve 405 is positioned closer to inside opening 120. Further, a portion of invertible one-way valve 405 is extended into inflatable object 110.

Both non-invertible one-way valve 305 and invertible one-way valve 405 are positioned to open when adequate air pressure is applied from outside opening 115, and to remain closed when adequate pressure is not being applied from outside opening 115. Thus, a user can inflate inflatable object 110 by blowing into inflation valve 500 at outside opening 115.

FIG. 5B illustrates a sectional cross view of inflation valve 500. As illustrated, both non-invertible one-way valve 305 and invertible one-way valve 405 are closed, preventing air from entering and/or escaping inflatable object 110. Air inside inflatable object 110 at spaces 505 and 510 can provide pressure to inner open end 415 and cause

invertible one-way valve 405 to remain closed. Likewise, air trapped in air pocket 515 between non-invertible one-way valve 305 and invertible one-way valve 405 can provide pressure to inner open end 315 and cause non-invertible one-way valve 305 to remain closed.

In some embodiments, invertible one-way valve 305 can include vent holes 520 that can be used to release air trapped in air pocket 515. For example, if a user has inflated inflatable object 110 to a desired pressure, air trapped in air pocket 515 can be released through vent holes 520 rather than being forced into inflatable object 110. Alternatively, a user can release the air trapped in air pocket 515 by manually opening non-invertible one-way valve 305, for example, by using their hand to open inner open end 315.

As illustrated in FIG. 5C, adequate air pressure applied from outside opening 115 can cause both non-invertible one-way valve 305 and invertible one-way valve 405 to open and allow air into inflatable object 110.

FIG. 5D illustrates invertible one-way valve 405 inverted to deflate inflatable object 110. As shown, inner open end 415 of invertible one-way valve 405 has been inverted through outer open end 410 of invertible one-way valve 405. Further, inner open end 415 is positioned between inner open end 310 of non-invertible one-way valve 305. This can cause non-invertible one-way valve 305 to open when invertible one-way valve 405 is opened. For example, adequate air pressure applied to invertible one-way valve 405 from inside inflatable object 110 can cause invertible one-way valve 405 to open, which in turn causes non-invertible one-way valve 305 to open, thus allowing air in inflatable object 110 to escape. Air trapped in air pockets created between invertible one-way valve 405 and non-invertible one-way valve 305 can be released through vent holes 520.

While FIGS. 5A-5D illustrate inflation chamber 105 and invertible one-way valve 405 as separate objects attached to each other, this is just one possible embodiment and is not meant to be limiting. In some embodiments, inflation chamber 105 and invertible one-way valve 405 can be one continuous object. FIGS. 6A-6D illustrate an inflation valve where the inflation chamber and the invertible one-way valve are one continuous object. FIG. 6A shows inflation valve 600 unassembled. As shown inflation valve 600 can include first and second outer plies 605 and 610 and first and second inner plies 615 and 620. When attached to each other, first and second outer plies 605 and 610 can form inflation chamber 105 and invertible one-way valve 405. First and second inner plies 615 and 620

can form non-invertible one-way valve 305 when attached to each other and to outer plies 605 and 610. Inner plies 605 and 610 can include vent holes 520.

FIG. 6B illustrates inflation valve 600 assembled. As shown, first and second outer plies 605 and 610, and first and second inner plies 615 and 620 can be attached to each other along left edge 625 and right edge 630. Further, non-invertible one-way valve 305 can be attached to inflation chamber 105 along the edge of outer open end 310, thus creating a seal between inflation chamber 105 and non-invertible one-way valve 305.

As shown in FIG. 6C, inflation valve 600 can be attached to inflatable object 110 so that a portion of inflation valve 600 is within inflatable object 110, thus creating invertible one-way valve 450. A stiff material can be affixed to the edge of the opening to make it easier for the inflation chamber to be held open and also rolled up.

FIG. 6D illustrates a side sectional view of inflation valve 600. As illustrated, inflation valve 600 can be attached to inflatable object 110 so that a portion of inflation valve 600 is within inflatable object 110, thus creating invertible one-way valve 450.

FIGS. 7A and 7B illustrate inflation chamber 105 being rolled up to seal inflatable object 110 to further prevent air from escaping inflatable object 110. As shown in FIG. 7A, inflation chamber 105 can be rolled from outside opening 115 towards inflatable object 110. Rolling inflation chamber in this manner can further inflate inflatable object 110 by forcing any air in inflation chamber 105 into inflatable object 110.

In some embodiments, inflation chamber 105 can be secured after being completely rolled, to keep inflation chamber 105 in the rolled position. For example, loop 705 and strap 710 can be attached to inflatable object 110 on either side of inflation chamber 105 and used to secure inflation chamber 105 after it has been rolled to seal inflatable object 110.

FIG. 7B illustrates strap 710 placed through loop 705 to secure inflation chamber 105 after it has been rolled. In some embodiments, strap 710 can be secured after being placed through loop 705. For example, strap 710 can be made of a loop and fastener material that can secure strap 710 after it has been placed through loop 705.

In some embodiments, inflation chamber 105 can be used primarily to deflate inflatable object 110. For example, as illustrated in FIG. 7C, inflatable object 110 can include traditional inflation valve 715 in addition to inflation chamber 105. A user can use

traditional inflation valve 715 to inflate inflatable object 110 and use inflation chamber 105 to quickly deflate inflatable object 110.

In various embodiments, inflation chamber 105 can be rolled up to provide a seal that prevents air from escaping inflatable object 110. To deflate inflatable object 110, a user can unroll inflation chamber 105 and allow air to escape inflatable object 110. Because inflation chamber 105 may be used primarily to deflate inflatable object 110 in the embodiment shown in Fig 7C, a one-way valve is not necessary, although one can be included. In such an embodiment, a user can use traditional inflation valve 715 to inflate inflatable object 110, and use inflation chamber 105 to deflate inflatable object 110.

FIG. 8 illustrates an embodiment in which inflation chamber 105 can be sealed at outside open end 115. For example, the inside of inflation chamber 105 can include sealing element 805 designed to seal inflation chamber 105. Sealing element 805 can be any type of sealing element known in the art. For example, sealing element 805 can be a Ziploc type sealer, toothed zipper, hook and loop, snaps, buttons, threaded screw closure, bail and gasket closure, snap lid closure, etc.

FIGS. 9A and 9B illustrate an embodiment in which inflation chamber 105 can be used as a storage bag for inflatable object 110 when inflatable object 110 is deflated. As shown in FIG. 9A, inflation chamber 105 can include sealing element 905 on the outside of inflation chamber 105, near outside opening 115. When inflatable object 110 is deflated, a user can invert inflation chamber 105 to create a storage bag and place inflatable object 110 into the storage bag.

FIG. 9B shows inflation chamber 105 inverted to be used as a storage bag. When inflation chamber 105 is inverted, sealing element 905 will be located on the inside of the resulting storage bag, thus allowing a user to seal the storage bag after placing inflatable object 110 into the storage bag.

FIG. 10 illustrates an embodiment in which the inflation chamber 105 does not protrude from the inflatable object 110. As shown, inflation chamber 1005 is designed within inflatable object 110 such that outside opening 115 is flush with the edge of inflatable object 110. While inflation chamber 1005 does not protrude from inflatable object 110, it still functions as a conduit by which air can enter and/or exit inflatable object 110 through inside opening 120. As previous embodiments, one or more one-way valves

can be attached to inflation chamber 1005 to prevent air from escaping inflatable object 110.

FIG. 11 illustrates an exemplary embodiment of an inflation valve including a covering. In some embodiments, an inflatable object 110 such as a mattress can be filled with loose insulation such as down feathers. The loose insulation may provide additional comfort to the inflatable object 110. As illustrated, inflation valve 1105 includes covering 1110 covering inside opening 120 of inflation chamber 105. Covering 1110 can be designed to allow air to flow through covering 1110 to enter and/or exit an inflatable object 110, while preventing objects of a certain size from entering and/or escaping an inflatable object 110.

In some embodiments, covering 1110 can be made of a flexible plastic or cloth mesh material so that use of the inflation chamber is not affected. For example, a user can still roll up inflation chamber 105, the inflatable object 110, invert an invertible one-way valve, etc.

The size of the openings in the mesh material used to create covering 1110 can be varied depending on the size of the objects that are to be prevented from entering and/or exiting an inflatable object 110. For example, a finer mesh with smaller holes can be used to prevent smaller objects from entering and/or exiting an inflatable object.

FIG. 12 illustrates an exemplary embodiment of using a fan along with the inflation valve. As illustrated, fan 1205 can be attached to inflation chamber 105 via attachment piece 1210. Attachment piece 1210 can be designed to allow air from the surrounding areas to be drawn into inflation chamber 105 as fan 1205 is blowing air into inflation chamber 105.

In some embodiments, attachment piece 1210 can be rigid such as a metal or plastic cage. This can keep fan 1205 in a fixed position in relation to inflation chamber 105. Alternatively, in some embodiments, attachment piece 1210 can be made of a soft flexible material such as a flexible plastic or cloth mesh material.

FIGS. 13A and 13B illustrate an embodiment in which an inflatable object includes a secondary valve. As shown in FIG. 13A, inflatable object 1305 includes secondary valve 1310 in addition to inflation chamber 1315, which allows for an additional feature for inflating inflatable object 1305. In some embodiments, secondary valve 1310 can be used to deflate inflatable object 1305 or to transfer air from inflatable object 1305 to a second

object 1320. For example secondary valve 1310 can be a traditional inflation valve. A user can thus select to inflate or deflate inflatable object 1305 using inflation valve 1315 or secondary valve 1310.

In some embodiments, secondary valve 1310 can be used to inflate a second inflatable object. For example, secondary valve 1310 can be designed to attach to a hose, tube or other conduit that can be used to inflate the second inflatable object.

FIG. 13B shows inflatable object 110 and second inflatable object 1320. As shown, an air conduit 1325, such as a hose, may connect inflatable object 110 to second inflatable object 1320 via a secondary valve 1310. A user can thus use inflatable object 110 to inflate second inflatable object 1320. For example, a user can squeeze inflatable object 110 to force air in inflatable object 100 through air conduit 1325 and into second inflatable object 1320.

Although FIGS. 13A and 13B illustrates inflatable object 110 including only one secondary valve, this is only one embodiment and is not meant to be limiting. One skilled in the art would recognize that an inflatable object 110 can include any number of secondary valves, and this disclosure acknowledges any and all such embodiments.

INFLATABLE AIR PAD UTILIZING A ONE-WAY VALVE

According to various embodiments, the inflation chambers described herein may be adapted for use with an inflatable mattress or air pad (herein "air pad"). As an example, FIG. 14A shows an inflatable air pad 1400 having an inflation chamber 1405 configured to enable a user to quickly inflate, deflate, and pack up the air pad 1400 (e.g., without using any external devices or objects such as pumps or stuff sacks). In the illustrated embodiment, the air pad 1400 comprises a body portion 1410 that comprises a plurality of baffles 1450, and may be constructed with, or attached to an inflation valve comprising an inflation chamber 1405. As shown in FIG. 14A, the body portion may be generally rectangular, and the baffles may extend along a portion of the length of the body portion 1410 parallel to the edges of the body portion, leaving a head space 1452 near an end of the body portion 1410. In various embodiments, the head space 1452 may expand such that the body portion 1410 does not maintain a uniform thickness along the entire length of the body portion 1410 to create an integrated pillow feature at the head space 1452. The head space 1452 may additionally allow a portion of the inflation chamber 1405 or valves,

explained in greater detail herein, to extend into the body portion 1410 of the air pad 1400. In various embodiments, the inflation chamber 1405 may comprise the same or similar structure to the inflation chamber 105 described above. In certain embodiments, the inflation chamber 1405 may be elongated and sized such that a user's face and head does not block the entirety of the opening during inflation, even with the user's face located near the inflation chamber. As previously described, fast moving air blown into the inflation chamber 1405 creates zones of low pressure that draw surrounding air into the inflation chamber 1405, thereby greatly increasing the amount of air entering the air pad 1400.

As shown in FIG. 14B, the body portion 1410 may comprise various chambers 1451 separated by the one or more baffles 1450. The one or more baffles 1450 may be attached to the upper and lower shell layers 1505, 1506, described in greater detail herein. As shown in FIG. 14C, the baffles 1450 may include one or more holes 1455 to allow air to easily pass between the various chambers 1451.

In certain embodiments, such as those exemplified by FIG. 15A, the inflation chamber 1405 and body portion 1410 may be constructed from one or more continuous piece of material. The exploded view of the air pad 1400 shown in FIG. 15A shows the inflation chamber 1405 may be formed continuously with an air pad 1400 as shown in FIG. 15A such that upper and lower shell layers 1505, 1506 used to construct the air pad 1400 may each include a narrow end portion that, when assembled, form inflation chamber 1405. In various embodiments, upper and lower shell layers 1505, 1506 may be constructed from a pliable and durable material such as a combination of a heat sealable material and plastic. For example, the upper and lower shell layers 1505, 1506 may be constructed from a polyester fabric and polyurethane laminate. The upper and lower non-invertible valve layers 1518, 1519 used to make a first non-invertible one-way valve 1517, upper and lower non-invertible valve layers 1521, 1522 used to make a second non-invertible one-way valve 1520, and the upper and lower invertible valve layers 1526, 1527 used to make the invertible one-way valve 1525 can be made from a lightweight and pliable material such as a polyurethane film with a matte finish or matte surface texture. Although not necessary in all embodiments, using a material with a matte finish may ensure that the material will not stick to itself or to other surfaces, thereby allowing air to freely move between adjacent layers. A matte surface texture may also prevent a person's skin from sticking to the material when inserted into the inflation chamber 1405 to deflate

the air pad 1400. As will be understood by one skilled in the art, the same or similar materials may be used in other configurations, such as embodiments in which the inflation chamber 1405 and air pad 1400 are made from separate pieces of material. In addition, in various embodiments, the inflation chamber 1405 may only a first non-invertible one-way valve 1517 and invertible one-way valve 1525.

As shown in FIG 15A, upper and lower glossy layers 1530, 1531 may, in various embodiments, be positioned near outside opening 1415 on the interior of inflation chamber 1405. When pressed together, the upper and lower glossy layers 1530, 1531 may prevent or impede air from escaping the inflation chamber 1405. In various embodiments, the upper and lower glossy layers 1530, 1531 may be constructed of a glossy or adhesive material such as a polyurethane film with a glossy surface texture that may prevent or impede air from escaping the inflation chamber's opening when the inflation chamber 1405 is rolled up.

The edge of the outside opening 1415 may have an edge guard 1515 affixed near the outer opening 1415 to facilitate holding the inflation chamber 1405 open during inflation. The edge guard may comprise one or more separate pieces that may be affixed between the upper glossy layer 1530 and upper shell layer 1505, and between lower glossy layer 1531 and lower shell layer 1506. The edge guard 1515 may be constructed of a stiff material, such as a resilient plastic. The edge guard 1515 may also prevent the outer edge of the inflation chamber 1405 from wrinkling and may facilitate the rolling of inflation chamber 1405.

FIG 15B shows an assembled air pad 1400, with a portion of the upper shell layer 1505 cutaway. In various embodiments, the components of the air pad 1400 and inflation chamber 1405 are substantially similar to the inflatable object 110 and inflation chamber 105 described above. The various components may be attached using a variety of means such as by sewing or heat sealing the various components together.

According to one embodiment, the edge guard 1515 may be affixed near the outer opening 1415 by placing the edge guard 1515 between the glossy layers 1530, 1531 and the shell layers 1505, 1506 and attaching the gloss layers 1530, 1531 to the shell layers 1505, 1506. The outer edge of the shell layers 1580 may likewise be attached to the glossy layers 1530, 1531 at edge 1545. The shell layers 1505, 1506 may also be attached to both the outer open end of the first and second non-invertible one-way valves 1517, 1520 and

the glossy layers 1530, 1531 at edge 1550. As shown, a portion of one or both of the glossy layers 1530, 1531 may extend beyond the outer edge of the upper and lower shell layers 1580 to serve as a grip and to further restrict air from exiting the opening 1415, when the inflation chamber 1405 is rolled up. Alternatively, the edge guard 1515 may be attached to only one of the shell layers 1505, 1506. In various embodiments, the edge guard 1515 may be attached to the outside of one or both of the shell layers 1505, 1506.

In the embodiment shown in FIG 15B, the inner edge of the upper and lower glossy layers 1530, 1531 may be attached to the upper and lower layers of the non-invertible one-way valve 1521, 1522 at edge 1555. In various configurations, the glossy layers 1530, 1531 may overlap the outer-most one-way valve, such as the first invertible one-way valve 1517. Alternatively, the inflation chamber 1405 can be made longer, and the inner edge of the glossy layers can instead be heat sealed to the shell layers 1505, 1506.

The shell layers 1505, 1506 may be affixed to the outer open end of each non-invertible valve 1520 at edges 1550, 1560. Likewise, the shell layers 1505, 1506 may be attached to the outer open end of the invertible one-way valve 1525 at edge 1565. The side edges of both upper and lower invertible valve layers 1526, 1525 that comprise the invertible one-way valve may also be attached at edge 1575. The side edges of the layers constructing the non-invertible valves 1517, 1520 may be attached together and attached to the shell layers 1505, 1506 along the entire length of the non-invertible one-way valves 1517, 1520 at edge 1570. In various embodiments, the user engagement feature 1529 may be constructed from a heat sealable material, such as a polyester fabric laminated with polyurethane, and can be attached to one edge of the lower invertible valve layer 1527 using the attachment means described above.

Referring back to FIG. 14A, in various embodiments, the width of the inflation chamber, W_1 can be large enough that a user's face, even if held against the opening 1415, does not block the entire opening 1415 and surrounding air can still be drawn into the inflation chamber 1405 around the user's face and head when the user blows air into the inflation chamber 1405. The width of the inflation chamber W_1 may be sized such that air blown into the outside opening 1415 creates zones of low pressure around the created air stream that pull surrounding air into the inflation chamber 1405. In various embodiments, the inflation chamber 1405 can be one-third the width of the inflatable object W_2. This would allow the air pad 1400 to be folded lengthwise inwardly such that the folded air pad

1400 is the same width as the inflation chamber 1405. This enables the folded air pad 1400 to be rolled onto the inflation chamber 1405 such that the inflation chamber 1405 wraps around the rolled up air pad 1400. In various embodiments, the security assembly can be used to secure the rolled up air pad 1400. Alternatively, a separate security assembly unconnected to the air pad 1400 comprising, for example, hook and loop fasteners may be used to secure the rolled up air pad 1400.

FIGS. 16A-16D show one embodiment of an inflation chamber 1405 at various states during operation. As shown in FIG. 16A, when the air pad 1400 and inflation chamber 1405 do not contain air, the various components of the inflation chamber 1405 may be deflated. As air is blown into the air pad 1400, the various components of the inflation chamber 1405 may expand, and the one or more included one-way valves 1520, 1525 open such that air can enter the air pad 1400. Once the air pad 1400 is inflated, the one or more one-way valves 1520, 1525 close such that air cannot escape from the air pad 1400. In various embodiments, an invertible one-way valve 1525 located near the air pad 1400 may be inverted in order to allow air to flow out of the air pad 1400, as shown in FIG. 16D. The invertible valve 1525 may be sized such that, when inverted, the invertible valve prevents the included non-invertible one-way valves 1517, 1520 from closing. As shown in FIGS. 16A- 16D, the one or more user engagement features 1529 can be attached to the inside edge 1528 of the invertible one-way valve 1525 located closest to the air pad 1400 to facilitate inverting the invertible one-way valve 1525. In various embodiments, the user engagement feature 1529 may comprise a pull-tab, handle, strap or other features capable of being grasped by a user. In various embodiments, the user engagement feature 1529 can be made from a different material than the invertible one-way valve 1525 to allow a user to reach inside of the inflation chamber 1405 and locate the user engagement feature 1529 by touch. For example, the user engagement feature 1529 may be constructed of a material having a different texture than that of the invertible one-way valve 1525. Additionally, the user engagement feature 1529 may have a coloration different from the materials used to construct the various valves 1517, 1520, 1525 and body inflation chamber 1405 such that a user may easily determine whether the invertible valve 1525 is in its inverted position. In various embodiments, the length of the user engagement feature 1529 can be made such that it is easily graspable by one hand and is long enough to extend outside of the inflation chamber's opening 1415 when the invertible one-way valve 1525 has been inverted for deflation, as shown in FIG. 16D.

With a portion of the user engagement feature 1529 extended outside of the inflation chamber 1405, a user may determine that the air pad 1400 is ready to be deflated without looking inside of the inflation chamber 1405. In such a configuration, the inflation chamber 1405 may comprise more than two one-way valves as shown in FIGS. 16A-16D. In various embodiments, the inflation chamber 1405 may comprised two non-invertible one-way valves 1517, 1520 and one invertible one-way valve 1525.

FIGS. 17A and 17B show a top and bottom view of one embodiment of an air pad 1400, respectively. In various embodiments, the inflation chamber 1405 extends away from air pad 1400 with a length L, such that it provides a seal preventing or impeding air from escaping air pad 1400 when the inflation chamber 1405 is rolled up. In various embodiments, the inflation chamber length L extends away from air pad 1400 such a distance that inflation chamber 1405 can be rolled onto itself at least once, but preferably a plurality of times. In various embodiments, the inflation chamber 1405 may be secured from unrolling utilizing a security assembly. As shown in FIGS. 17A and 17B, the security assembly may comprise first security feature 1700, such as rings or loops, and second security features 1710, such as straps and hooks, attached at various locations on the air pad 1400 such that when the second security features 1710 engage the corresponding first security features 1700, the inflation chamber 1405 may be prevented from unrolling. Additionally, the air pad 1400 may comprise a third security feature 1715, such as fabric loops or rings, that may engage the second security features 1710 when the inflation chamber 1405 is rolled around a deflated and compacted air pad 1400 to secure the inflation chamber 1405 around the air pad 1400. Alternatively, the rolled up inflation chamber 1405 can be secured from unrolling through a variety of fasteners such as a hook and eye or grommet, snaps, clamps, clips, or the like.

As will be understood by one skilled in the art, the inflation chamber 1405 may be attached to an air pad 1400 at various orientations, and more than one inflation chamber 1405 may be used with any one air pad 1400. For example, as shown in FIG. 18, the inflation chamber 1405 may be attached along the longest side of an air pad 1400.

METHOD OF USE – INFLATING AND CLOSING AIR PAD

To inflate the air pad 1400 a user can hold open the outer opening 1415 and blow air into the inflation chamber 1405. When blowing into the inflation chamber 1405, the

user may hold the outer opening 1415 near the user's mouth. The user then blows into the opening 1415. This process may be repeated until the air pad 1400 has been filled. Next, the user may press down on the first air chamber 1605 to force air trapped inside into the air pad 1400.

Each time the user blows into opening 1415 and additional air is added to the inflation chamber 1405 and air pad 1400, the pressure inside air chambers 515, 1605 and air pad 1400 increases, causing the one or more non-invertible valves 1517, 1520 and one or more invertible valves 1525 to close and prevent air from escaping the air pad 1400. Eventually the pressure inside of the air chambers 515, 1605 and air pad 1400 is such that a person blowing into the opening cannot add more air.

As shown in FIGS. 19A-19B, with the air removed from the first chamber 1605, the user can begin rolling up the inflation chamber 1405. If the user wishes to achieve a higher pressure inside of the air pad 1400 then air can be repeatedly blown into the first air chamber 1605 to fill it and passed into the air pad 1400 by compressing the first air chamber 1605. By repeatedly blowing into and then pressing down on the first air chamber 1605, the user can increase the air pressure inside of the air pad 1400. As the inflation chamber 1405 is rolled toward the body portion 1410, the remaining air trapped within the inflation chamber 1405 is forced into the body portion 1410, thus increasing the pressure within the body portion 1410. As shown in FIG. 19B, the user may then utilize the security assembly to prevent the inflation chamber 1405 from unrolling by engaging the first and second security features 1700, 1710. As shown in FIG. 19C, the air forced into the inflation chamber 1405 is then enclosed in the body portion 1410.

Alternatively, a user may use the fan 1205, or other air movement devices such as an electric air pump or compressor, hand or foot pump, bag pump, or billows pump 2020 to blow air into the inflation chamber 1405, as shown in FIGS. 20A-20B. By causing the air to exit the air movement device through a small opening or tapered nozzle 2030 the air can be made to exit the air movement device at an increased velocity. The high velocity results in a low pressure stream of air entering inflation chamber 1405, which draws in more of the surrounding air, and thereby allows more air to be blown into the inflation chamber 1405 with each pumping action.

As shown in FIGS. 20A and 20B the cage 2025 can be configured to maintain the tapered nozzle 2030 in such a position that the air movement device blows air into the center of the inflation chamber 1405. The cage 2025 may also hold open the inflation chamber 1405 without obstructing a one-way valve from closing. As shown in FIG. 12C, the cage 2025 may be configured to allow the tapered nozzle 2030 and an air transfer conduit 2023, such as a hose, to be positioned at various locations within the cage 2025. For example, the tapered nozzle 2030 and air transfer conduit 2023 may be moved closer to the inflation chamber 1405 without moving the cage 2025. In various embodiments, the cage 2025 and tapered nozzle 2030 can be made as a single piece or separate pieces and can be built into an air movement device or made as a separate component to fit existing air movement devices.

METHOD OF USE – DEFLATING AND PACKING AIR PAD

To deflate the air pad 1400, the user may disengage the security assembly, and allow the inflation chamber 1405 to unroll. Next the user may reach inside of the inflation chamber 1405 and invert the invertible valve 1525 by pulling the user engagement feature 1529 out of the inflation chamber 1405 (as shown in FIG. 16D). A portion of the user engagement feature 1529 may extend outside of the outer opening 1415 to serve as an indication that the air pad 1400 is ready to be deflated.

As shown in FIGS. 21A-21C, the air pad 1400 can be packed up by rolling up the body portion 1410 towards the inflation chamber 1405. As the user rolls up the body portion 1410 towards the inflation chamber 1405, the air still trapped in the air pad 1400 can easily exit the outer opening 1415. Once the air pad 1400 has been rolled up to the inflation chamber 1405, the user may then fold the sides of the rolled up air pad 1400 inward, toward the center of the air pad 1400. In various embodiments, the sides may be folded such that they overlap and the inflatable object is at least substantially folded into thirds. With the rolled up inflatable object folded, the user may continue rolling the folded air pad 1400 over the inflation chamber 1405. This will result in the inflation chamber 1405 wrapping around the rolled up air pad 1400. The inflation chamber 1405 is then secured around the rolled up air pad 1400 using a security assembly.

Alternatively, the user can also pack up the air pad 1400 by first folding the long edges of the air pad 1400, towards the center as shown in FIG. 21C. Then the user can roll

up the air pad 1400 towards the inflation chamber 1405 and continue rolling up the air pad 1400 so that the inflation chamber wraps around the outside of the rolled up air pad 1400. The security assembly may be used to secure the rolled up air pad 1400 from unrolling.

INFLATABLE AIR BAG UTILIZING A ONE-WAY VALVE

According to various embodiments, the inflation chambers described herein may be adapted for use with an inflatable air bag. As an example, FIGS. 22A-22F show an air bag 2200 having an inflation chamber 2205 configured to enable a user to quickly inflate the air bag 2200 that may be used alone or in combination with an air pad 1400. The air bag 2200 may include an inflation chamber 2205 substantially similar to the inflation chambers 105 and 1405. As shown in FIGS. 22C-22D, the inflation chamber 2205 may include one or more one-way valves similar to those described above. In various embodiments, the one-way valve 2206 comprises upper and lower valve layers 2220, 2225 that may be assembled using those methods described above in relation to the air pad 1400 described above. Like the inflation chamber 1405 described above, the inflation chamber 2205 has a width W_3 such that air blown into the inflation opening 2215a creates zones of low pressure around the created air stream that pull surrounding air into the inflation chamber 2205.

In various embodiments, the air bag 2200 may be configured to hold various objects for storage and transportation. As shown in FIGS. 22D-22F, the top edge of the air bag may comprise a first and second edge 2203, 2210 along an access opening 2215b that may be opened to allow objects to be placed inside the bag. In various embodiments, a fastening assembly, such as a hook and eye or grommet, snaps, clamps, clips, or the like, may be located along the interior of the first and second edge 2203, 2210 of the access opening 2215b. Certain embodiments may also include glossy layers near the first and second edge 2203, 2210 to prevent or impede air from escaping the bag when inflated.

As shown in FIG. 22E, the inflation chamber 2205 may be located along the second edge 2210 of the access opening 2215b, intermediate the first and second sides 2201, 2202. When the fastening assembly secures the first and second edges 2203, 2210, the upper and lower edges 2210a, 2210b of the inflation opening 2215a may still be separated in order to force air into the inflation chamber 2205, as shown in FIG. 22F.

The air bag 2200 may additionally include a compression assembly that may be used to decrease the interior volume of the air bag 2200 and thereby increase the pressure within the air bag 2200 without introducing additional air to the interior of the air bag 2200. For example, as shown in FIG. 22A, the compression assembly may comprise first and second attachment devices 2250, 2255 attached to a first side and a second side 2201, 2202 of the air bag 2200, respectively, near the top edges 2203, 2210 of the air bag 2200. After inflating the air bag 2200, the top edges 2203, 2210 may be rolled or folded towards the center of the air bag 2200 to decrease the interior volume of the air bag 2200 and increase the air pressure inside. The first attachment device 2250 may then engage the second attachment device 2255, as shown in FIG. 22B, to maintain the decreased interior volume even when an external force is applied to the air bag 2200. In various embodiments, the first and second attachment devices 2250, 2255 may comprise attachment mechanisms such as clips, straps, hook and eye fasteners, or other attachment mechanisms. The air bag 2200 may also include a fabric tail 2260 that may be used to secure the air bag 2200 below another object.

As shown in FIG. 23, the air bag 2200 may be placed under a portion of an air pad 1400 with the fabric tail 2260 outstretched under a second portion of the air pad 1400. When a downward force is applied to the top surface of the air pad 1400, the air pad 1400 may deform such that a portion of the air pad 1400 is elevated over the air bag 2200, and a portion of the air pad 1400 is in contact with the fabric tail 2260. The resulting frictional force between the air pad 1400 and fabric tail 2260 thus prevents the fabric tail 2260 and attached air bag 2200 is from sliding away from the air pad 1400.

CONCLUSION

The various embodiments described above are provided by way of illustration only and should not be construed to limit the scope of the disclosure. For example, the disclosed inflation valve can be used to inflate any type of inflatable object such as a mattress, pool toy, chair, neck pillow, inflatable tents or structures, rafts, or other inflatable objects. Those skilled in the art will readily recognize various modifications and changes that may be made to the principles described herein without following the example embodiments and applications illustrated and described herein, and without departing from the spirit and scope of the disclosure.

CLAIMS

We claim:

1. An inflation valve comprising:

a first one-way valve that:

opens to allows air to enter an inflatable object when adequate pressure is applied to the first one-way valve from an outer end of the first one-way valve, and

closes to prevent air from escaping the inflatable object when:

adequate pressure is applied to the first one-way valve from an inner end of the first one-way, and

adequate pressure to open the first one-way valve is not being applied from the outer end of the first one-way valve.

2. The inflation valve of claim 1, further comprising:

an inflation chamber coupled to the inflatable object at an inside end of the inflation chamber such that the inflation chamber protrudes from the inflatable object from the inside end, wherein the inflation chamber is open at the inside end and an outside end, opposite to the inside end, to provide a conduit for air to travel in and out of the inflation chamber.

3. The inflation valve of claim 2, wherein:

the first one-way valve is attached to the inside of the inflation chamber along the outer end of the first one-way valve to create a seal between the outer end of the first one-way valve and the inflation chamber,

at least a portion of the inner end of the first one-way valve is not attached to the inflation chamber, and

a first distance measured from the outside end of the inflation chamber to the outer end of the first one-way valve is shorter than a second distance measured from the outside end of the inflation chamber to the inner end of the first one-way valve.

4. The inflation valve of claim 1, wherein air blown into the first one-way valve from a distance away from the outer end of the one-way valve creates adequate pressure to open the first one-way valve.

5. The inflation valve of claim 1, wherein air trapped inside the inflatable object pressing against the inner end of the first one-way valve creates adequate pressure to close the first one-way valve.

6. The inflation valve of claim 3, wherein the first one-way valve is further attached to the inside of the inflation chamber along at least a portion of a first edge of the first one-way valve, the first edge of the first one-way valve spanning from the outer end of the first one-way valve to the inner end of the first one-way valve.

7. The inflation valve of claim 6, further comprising:

a second one-way valve attached to the inside of the inflation chamber between the first one-way valve and the inflatable object, wherein the second one-way valve:

opens to allows air to enter the inflatable object when adequate pressure is applied to the second one-way valve from an outer end of the second one-way valve, and

closes to prevent air from escaping the inflatable object when:

adequate pressure is applied to the second one-way valve from an inner end of the second one-way, and

adequate pressure to open the second one-way valve is not being applied from the outer end of the second one-way valve.

8. The inflation valve of claim 7, wherein the first one-way valve includes at least one vent hole that allows air to travel through the first one-way valve while the first one-way valve is closed.

9. The inflation valve of claim 7, wherein:

the second one-way valve is attached to the inside of the inflation chamber along the outer end of the second one-way valve to create a seal between the outer end of the second one-way valve and the inflation chamber,

the inner end of the first one-way valve is not attached to the inflation chamber, and

a first distance measured from the outside end of the inflation chamber to the outer end of the second one-way valve is shorter than a second distance measured from the outside end of the inflation chamber to the inner end of the second one-way valve.

10. The inflation valve of claim 9, wherein at least a portion of the second one-way valve is within the inflatable object.

11. The inflation valve of claim 9, wherein, when the second one-way valve is inverted through the outer end of the second one-way valve, the second one-way valve opens when adequate pressure is applied to the second one-way valve from the outer end of the second one-way valve.

12. The inflation valve of claim 11, wherein, when the second one-way valve is inverted through the outer end of the second one-way valve, the inner end of the second one-way valve is positioned within the inner end of the first one-way valve, and the second one-way valve causes the first one-way valve to open when the second one-way valve opens.

13. The inflation valve of claim 2, wherein the inflation chamber can be rolled to seal the inflation chamber.

14. The inflation valve of claim 13, further comprising:

a loop attached to the inflatable object; and

a strap attached to the inflatable object, wherein the strap can be placed through the loop to secure the inflation chamber in a rolled position.

15. The inflation valve of claim 2, wherein the inflation chamber includes a sealing element along the inside of the outside end of the inflation chamber that detachably seals the outside end of the inflation chamber.

16. The inflation valve of claim 2, wherein the inflation chamber includes a sealing element along the outside of the outside end of the inflation chamber that detachably seals the outside end of the inflation chamber when the inflation chamber is inverted.

17. The inflation valve of claim 16, wherein the inflatable object fits within the inflation chamber when the inflation chamber is inverted and the inflatable object is deflated.

18. The inflation valve of claim 1, further comprising a covering element attached to the inside end of the inflation chamber, the covering element including at least one hole that prevent objects larger than the at least one hole from entering and/or exiting the inflation chamber.

19. The inflation valve of claim 2, further comprising a fan detachably attached to the outside end of the inflation chamber, wherein air blown by the fan into the inflation chamber creates adequate pressure to open the first one-way valve.

20. The inflation valve of claim 19, wherein the fan is attached to the inflation chamber via an attachment element that allows surrounding air to be drawn into the inflation chamber from space between the fan and the outside end of the inflation chamber.

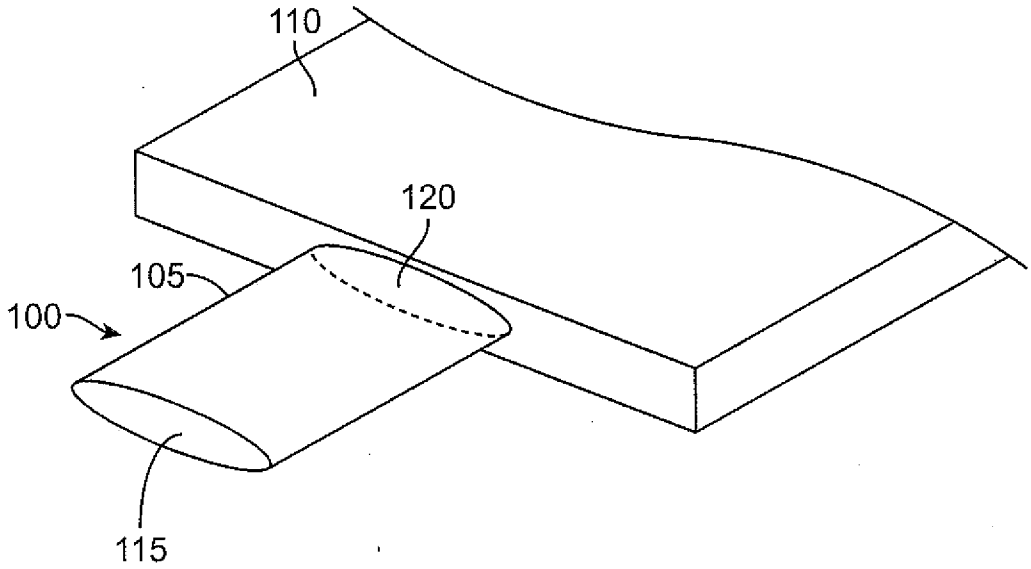

FIG. 1

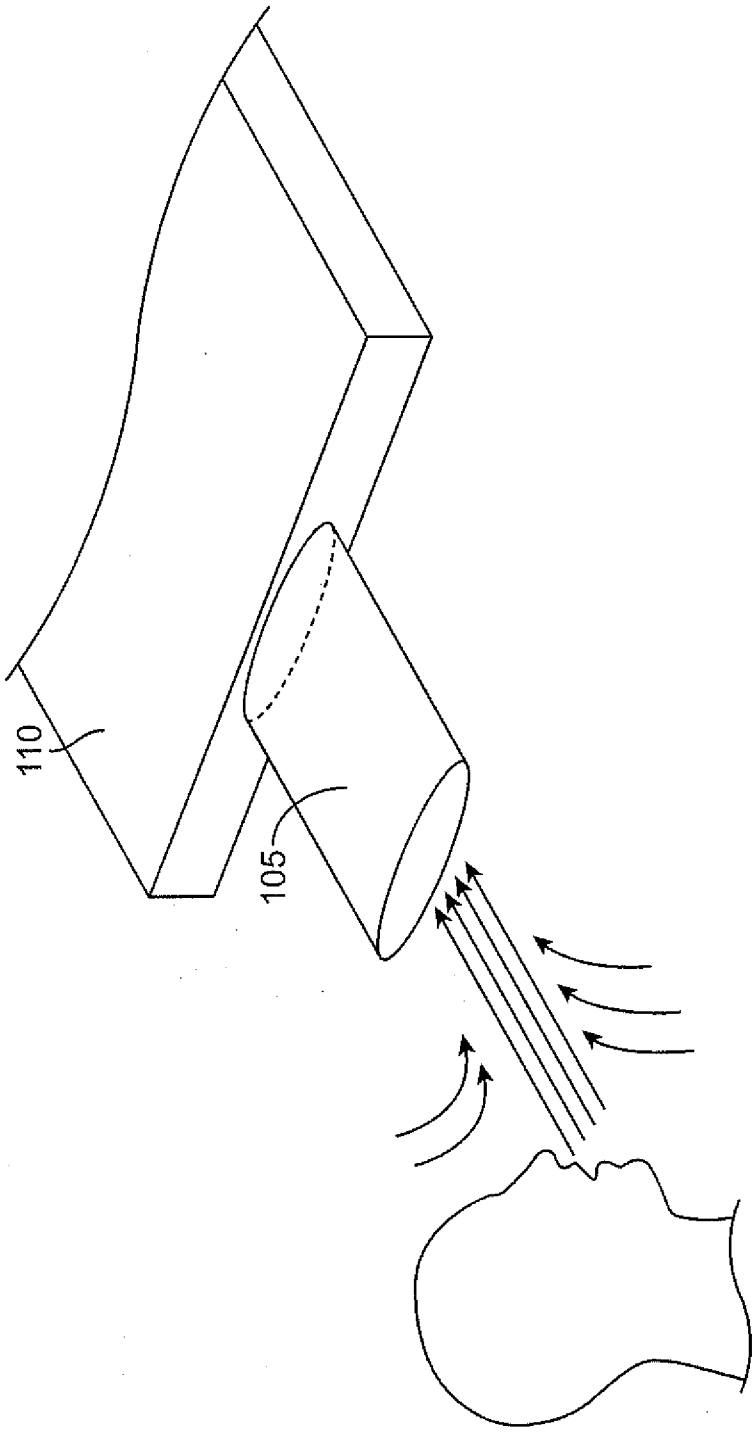

FIG. 2

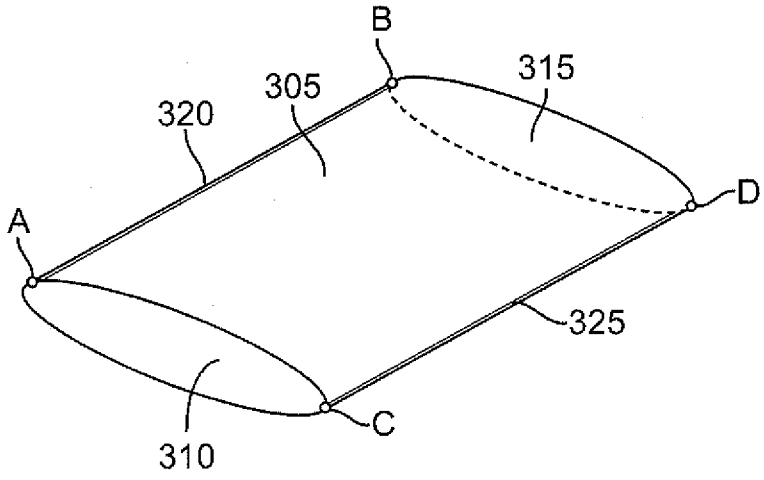

FIG. 3A

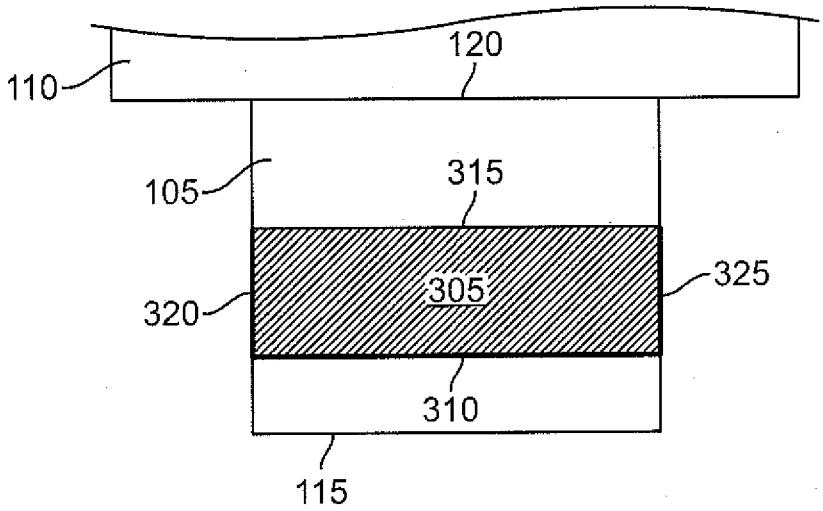

FIG. 3B

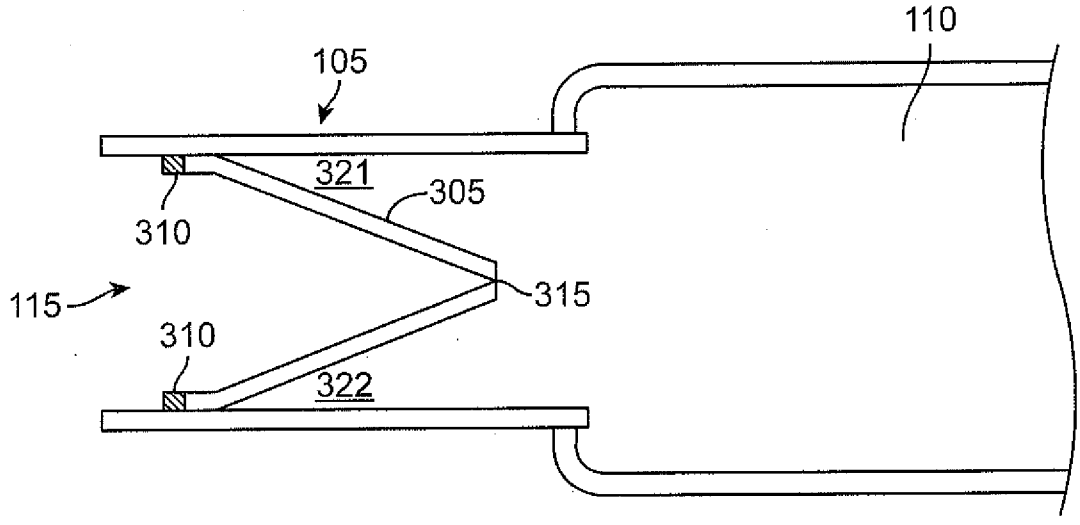

FIG. 3C

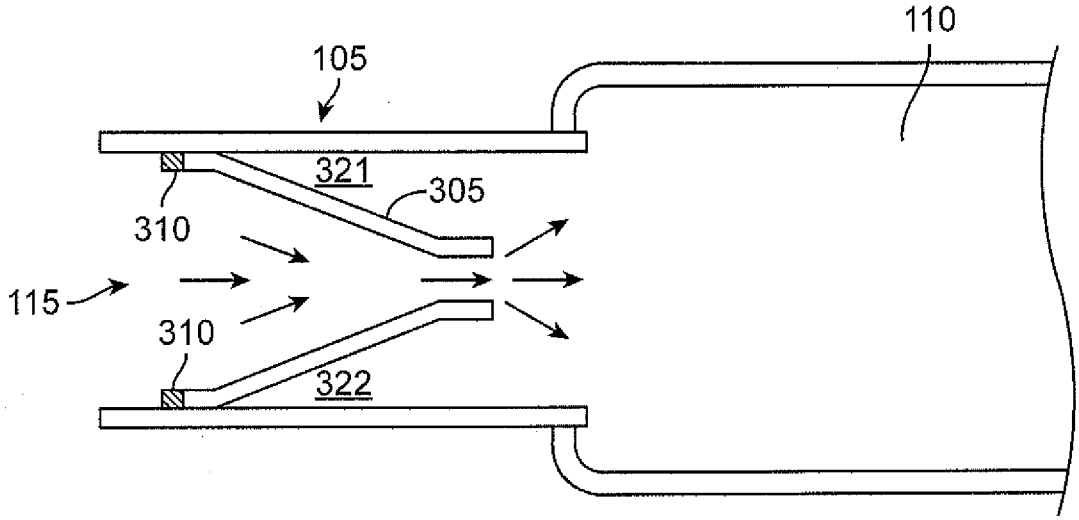

FIG. 3D

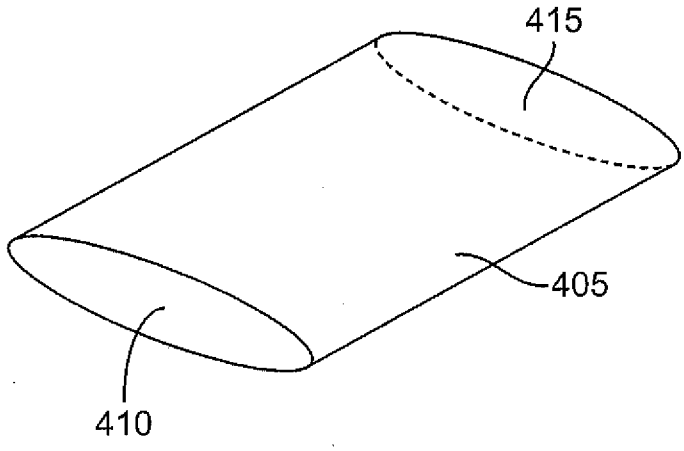

FIG. 4A

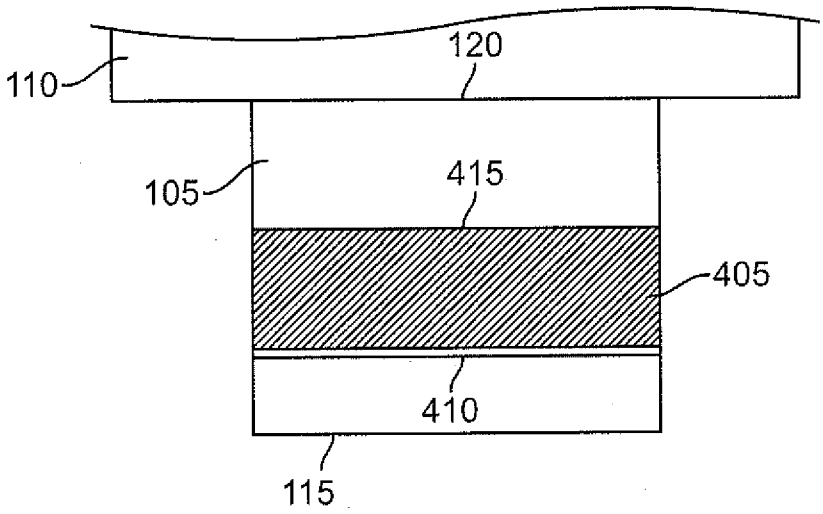

FIG. 4B

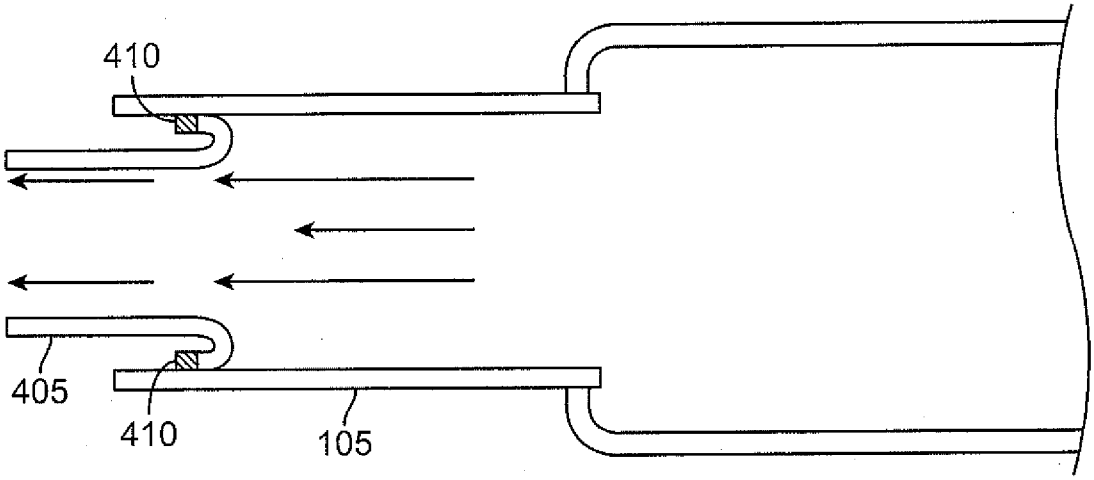

FIG. 4C

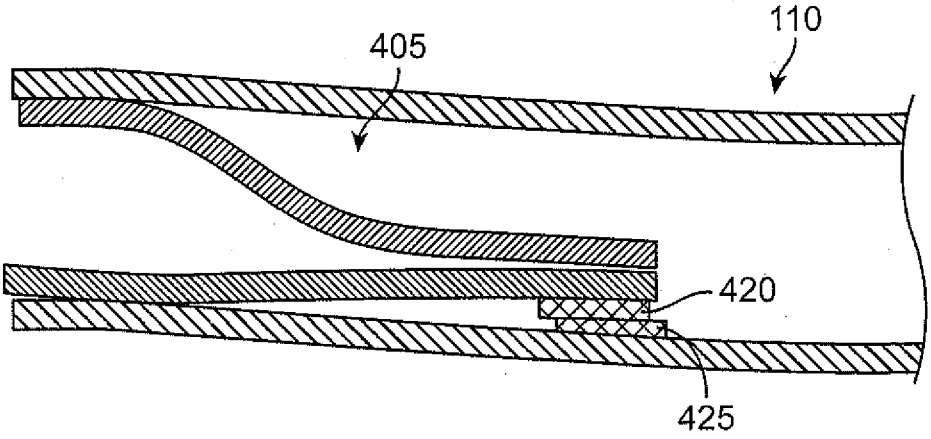

FIG. 4D

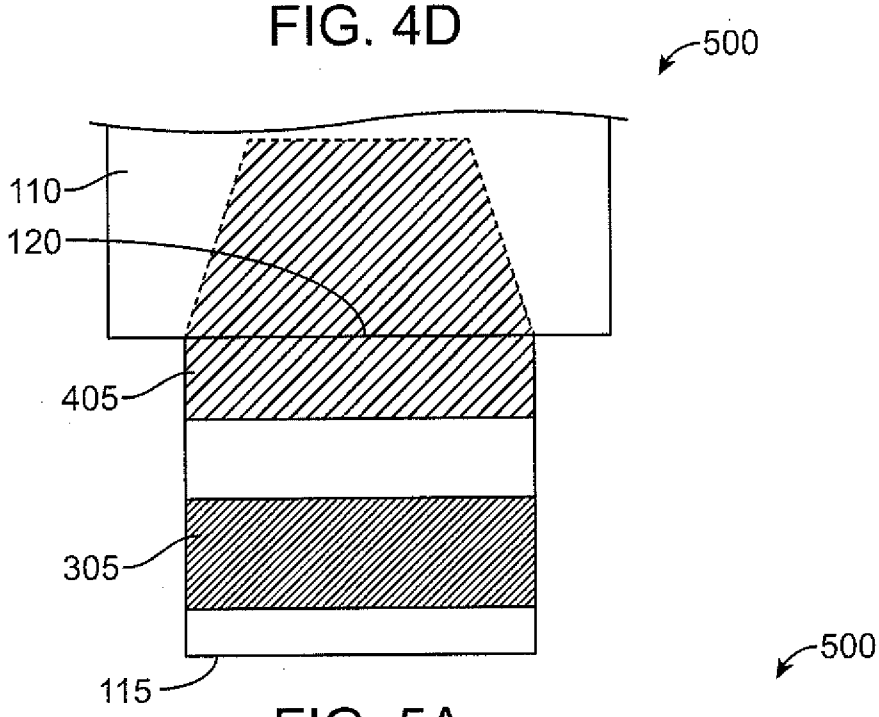

FIG. 5A

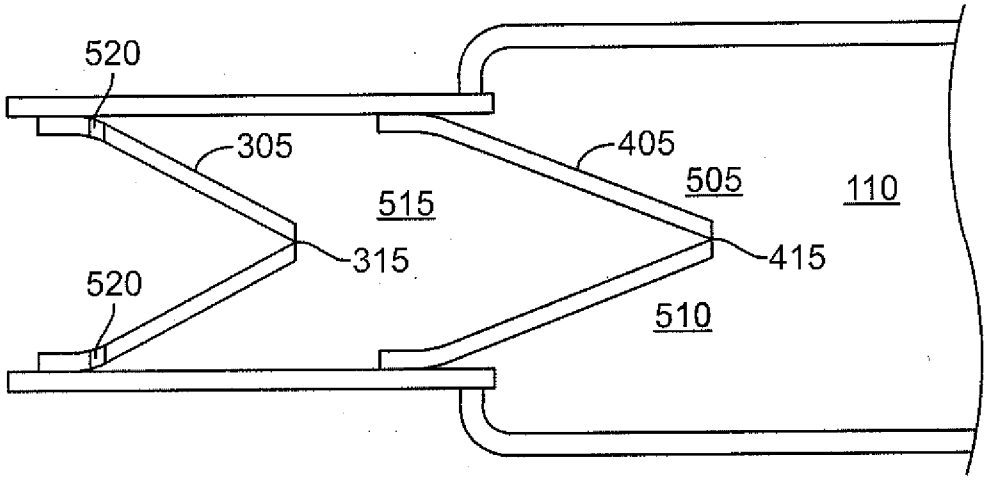

FIG. 5B

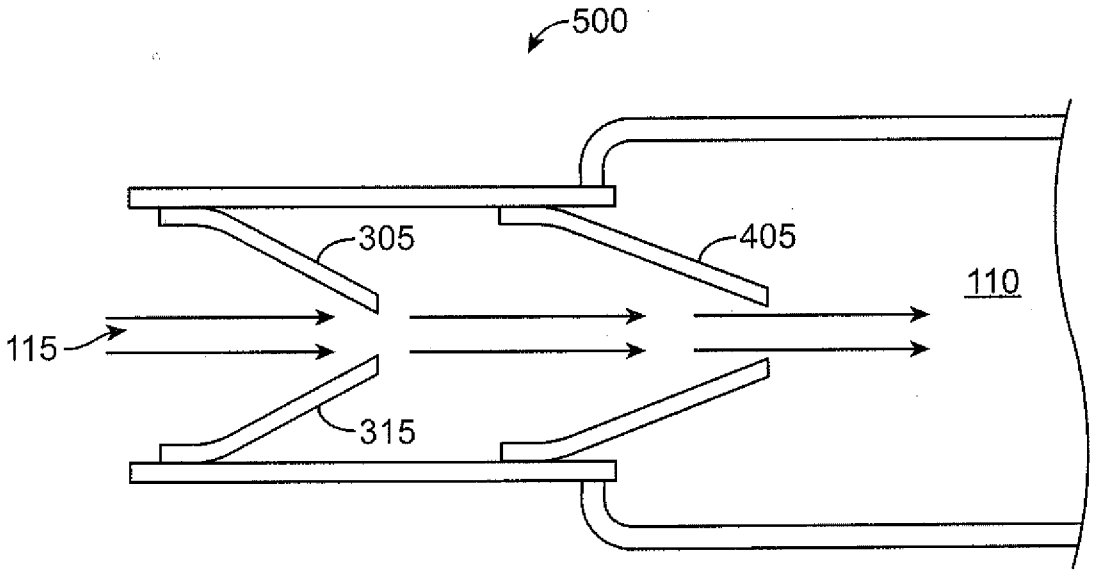

FIG. 5C

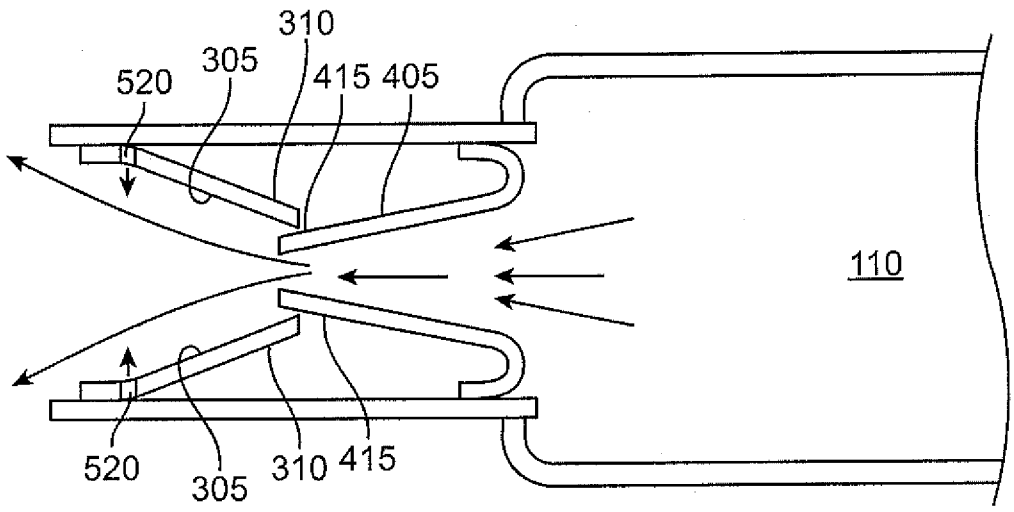

FIG. 5D

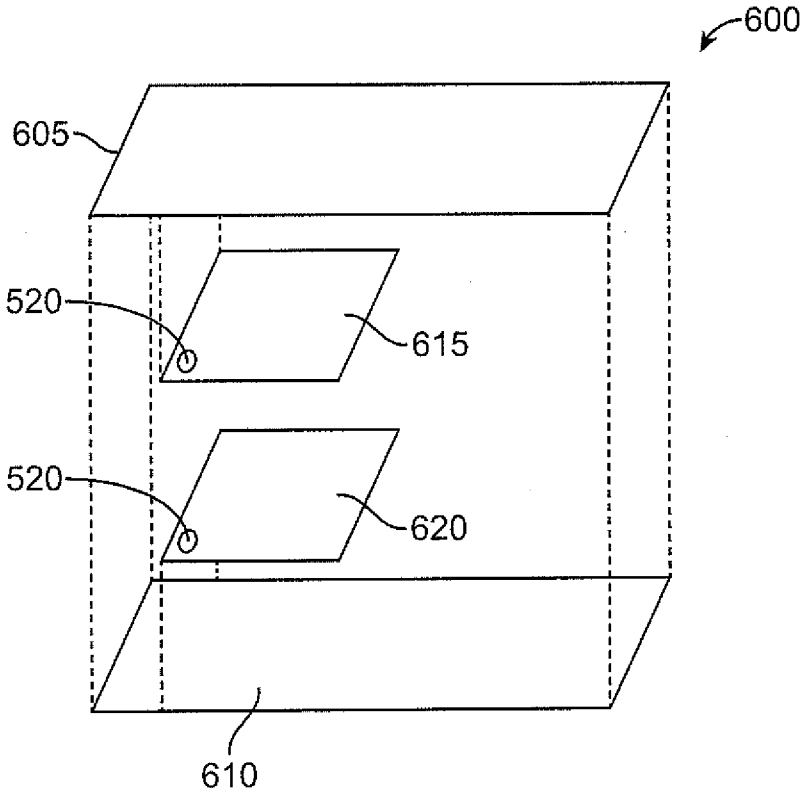

FIG. 6A

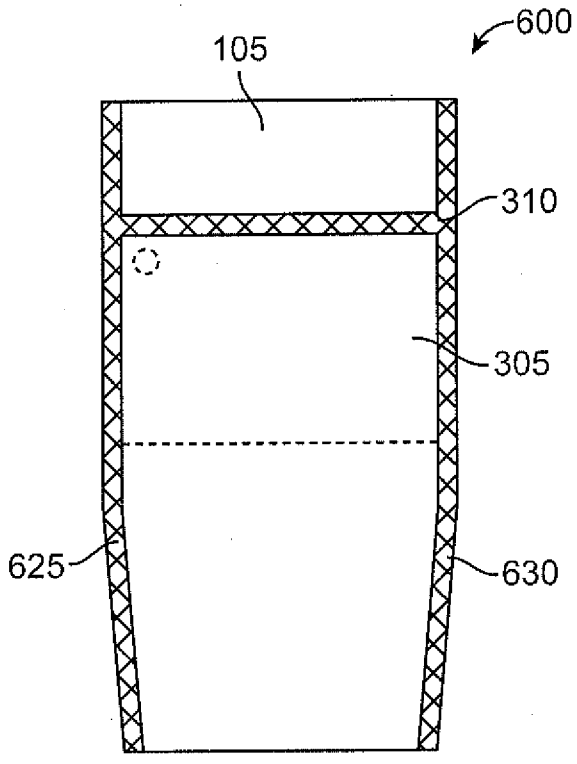

FIG. 6B

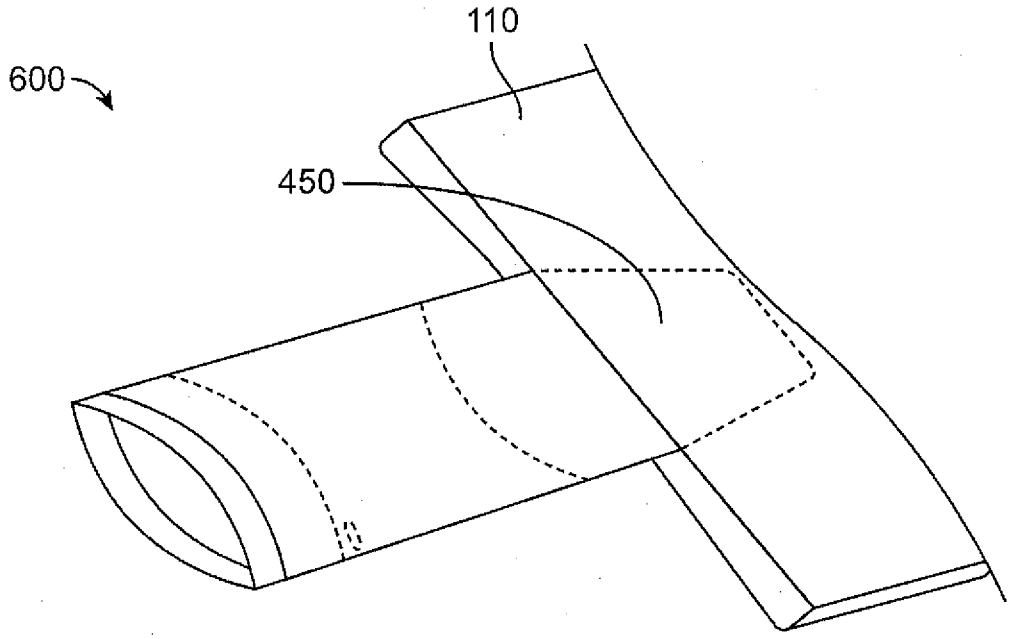

FIG. 6C

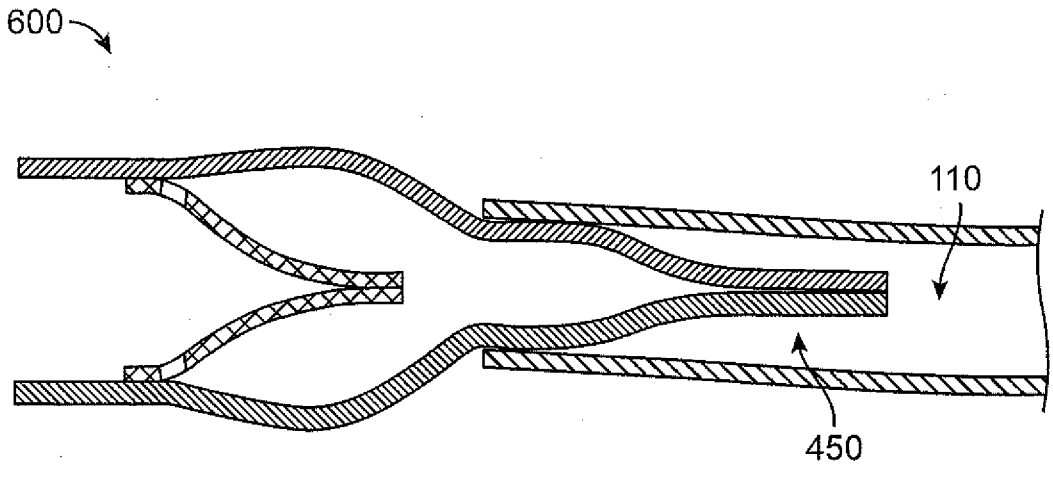

FIG. 6D

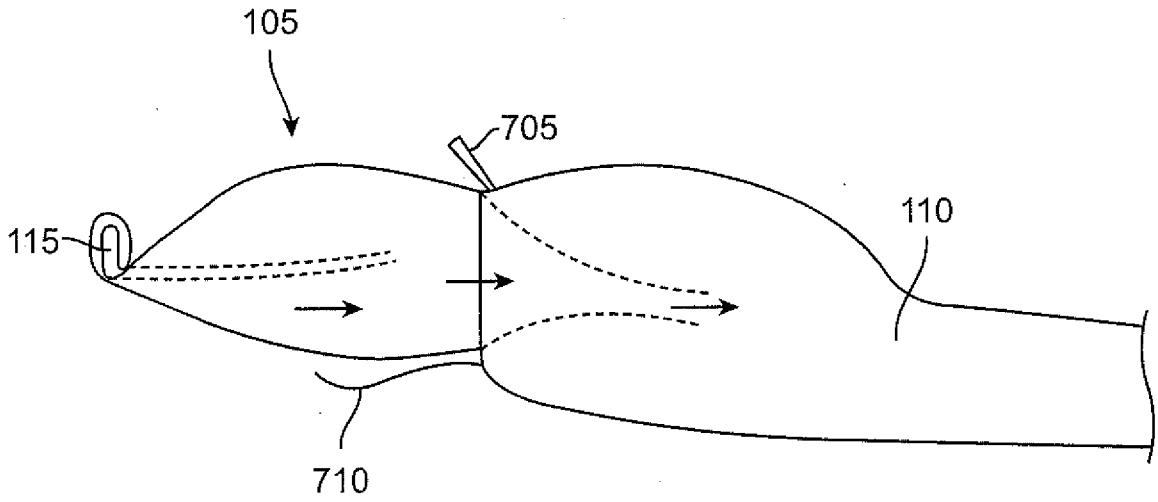

FIG. 7A

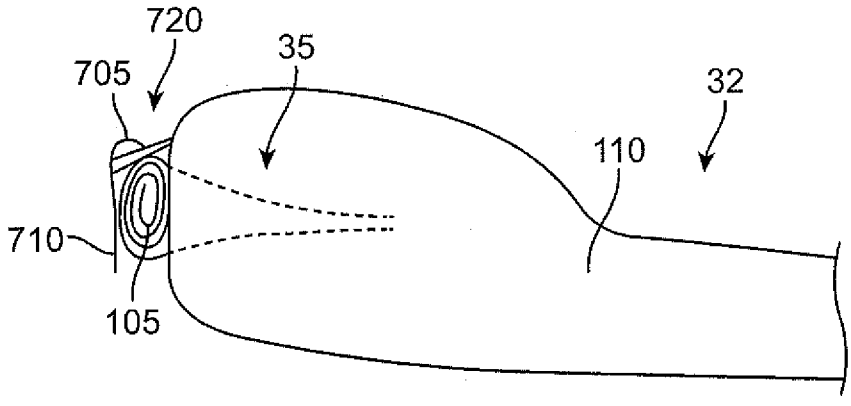

FIG. 7B

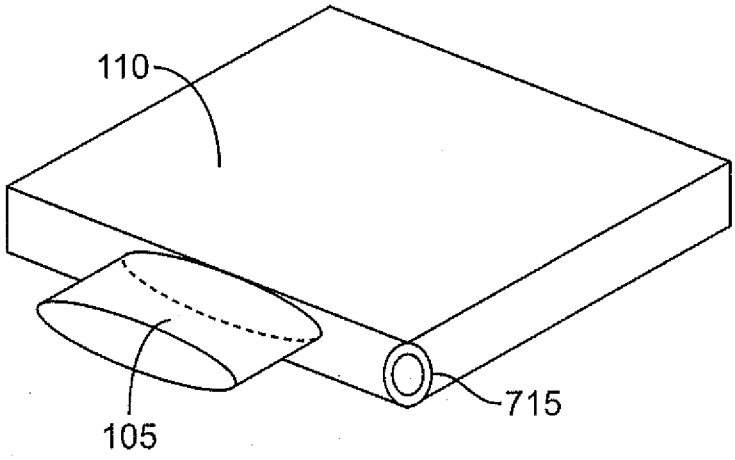

FIG. 7C

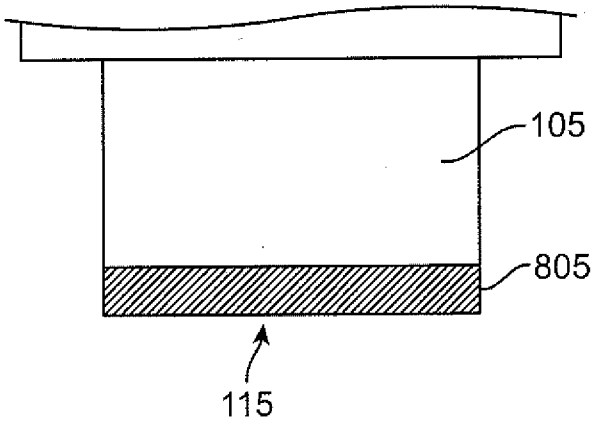

FIG. 8

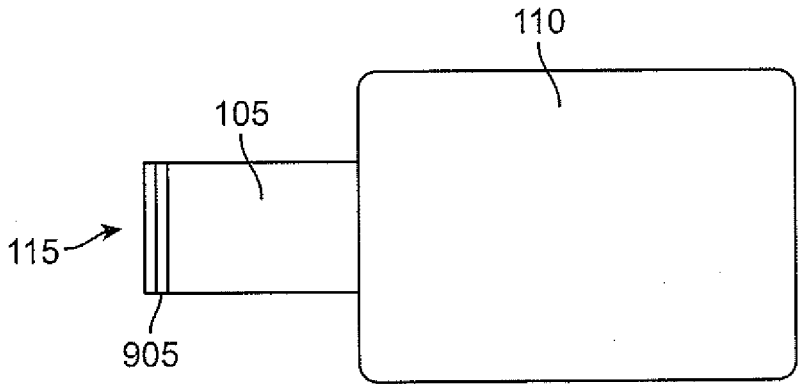

FIG. 9A

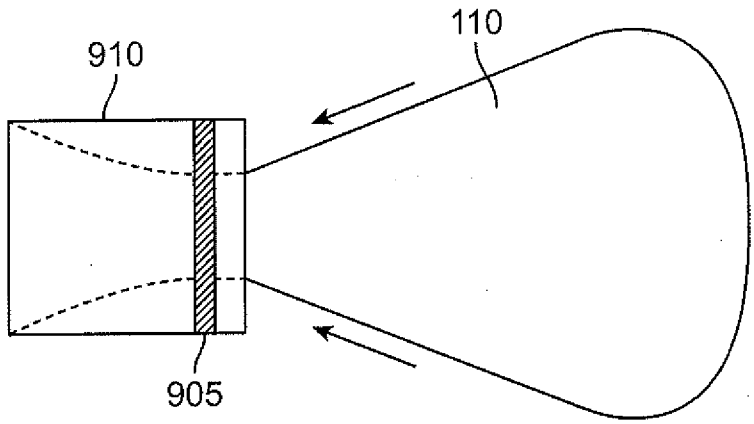

FIG. 9B

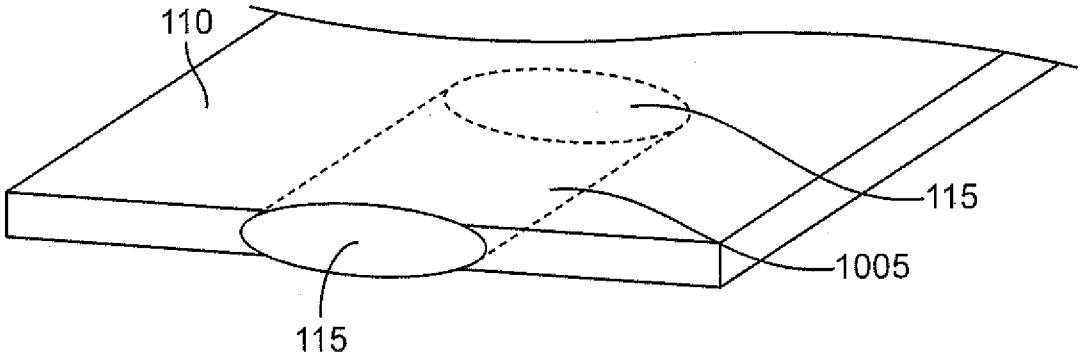

FIG. 10

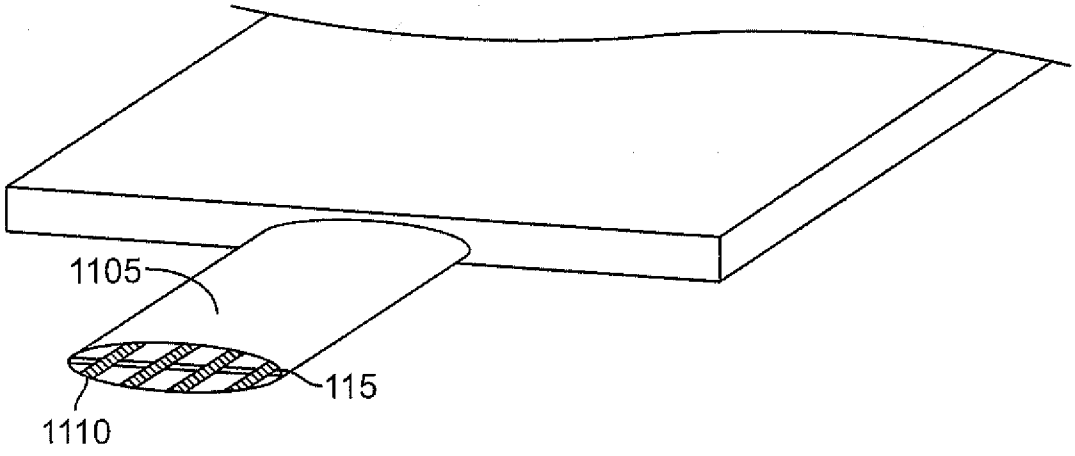

FIG. 11

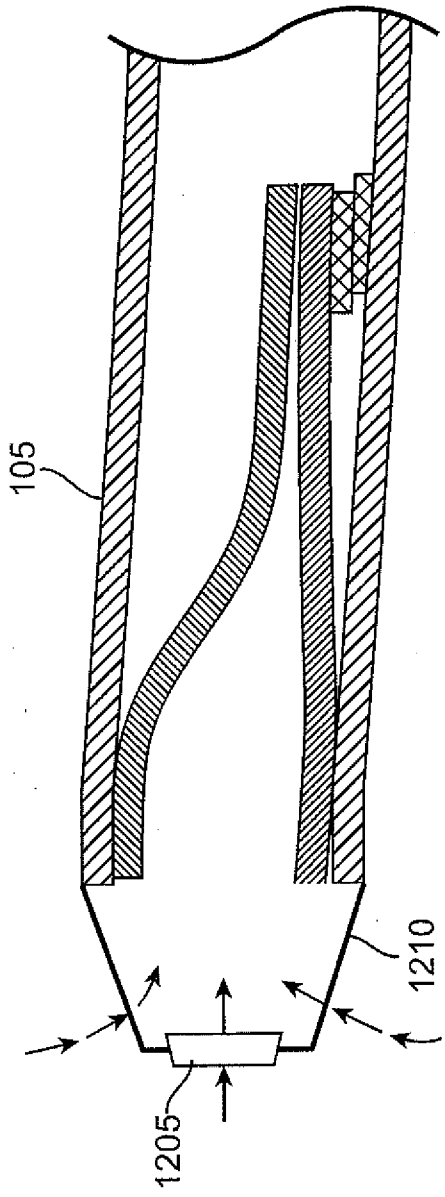

FIG. 12

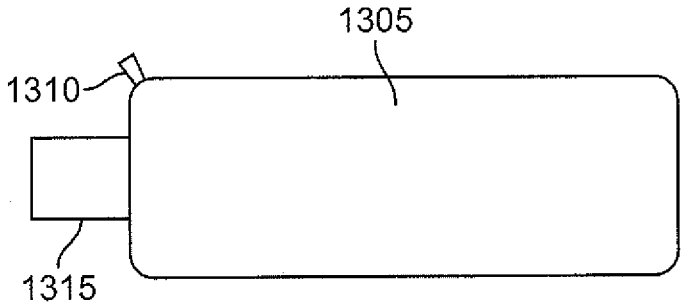

FIG. 13A

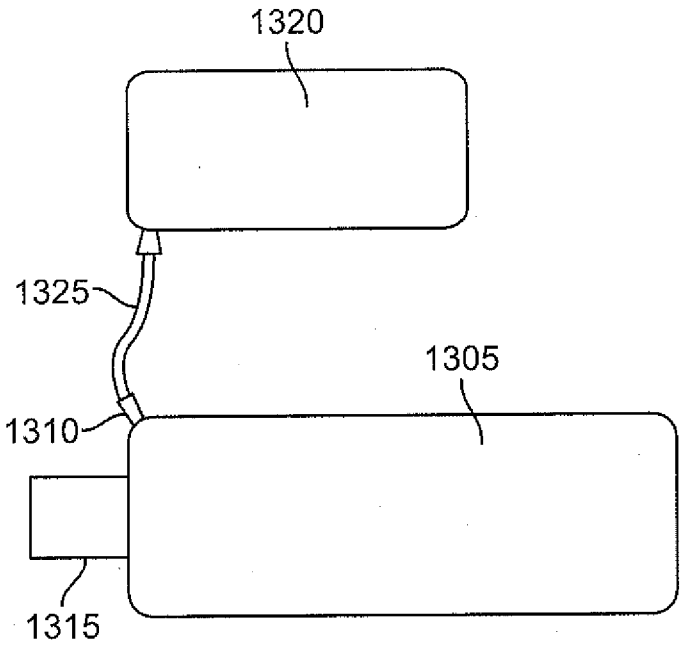

FIG. 13B

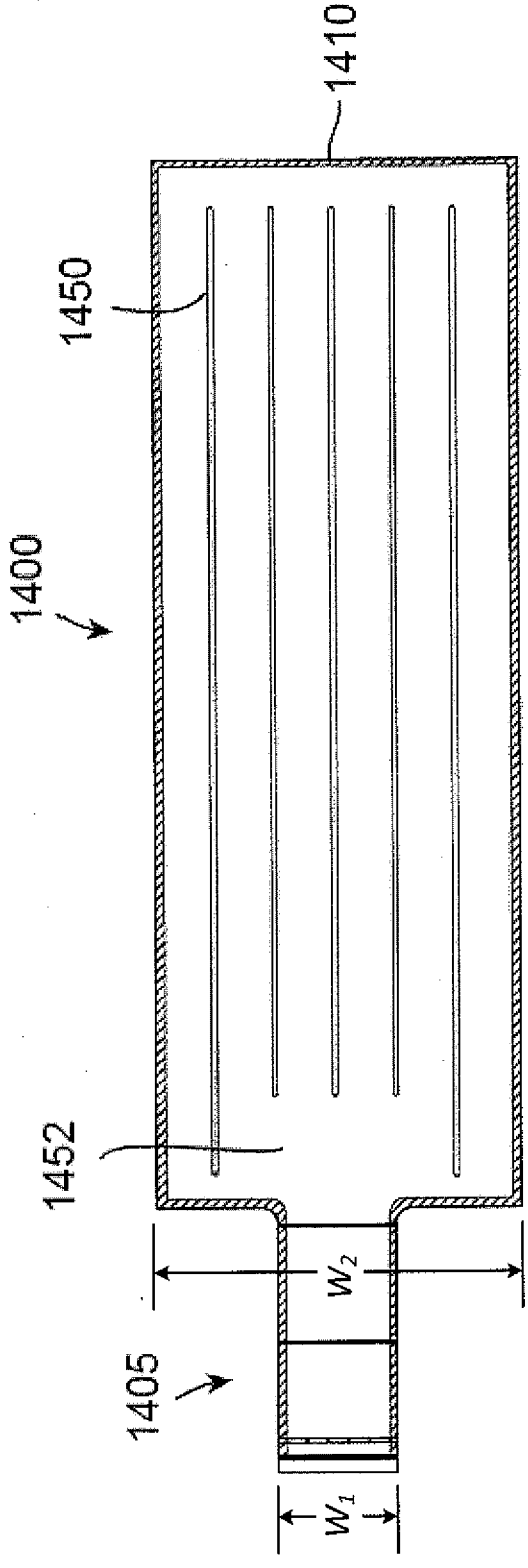

FIG. 14A

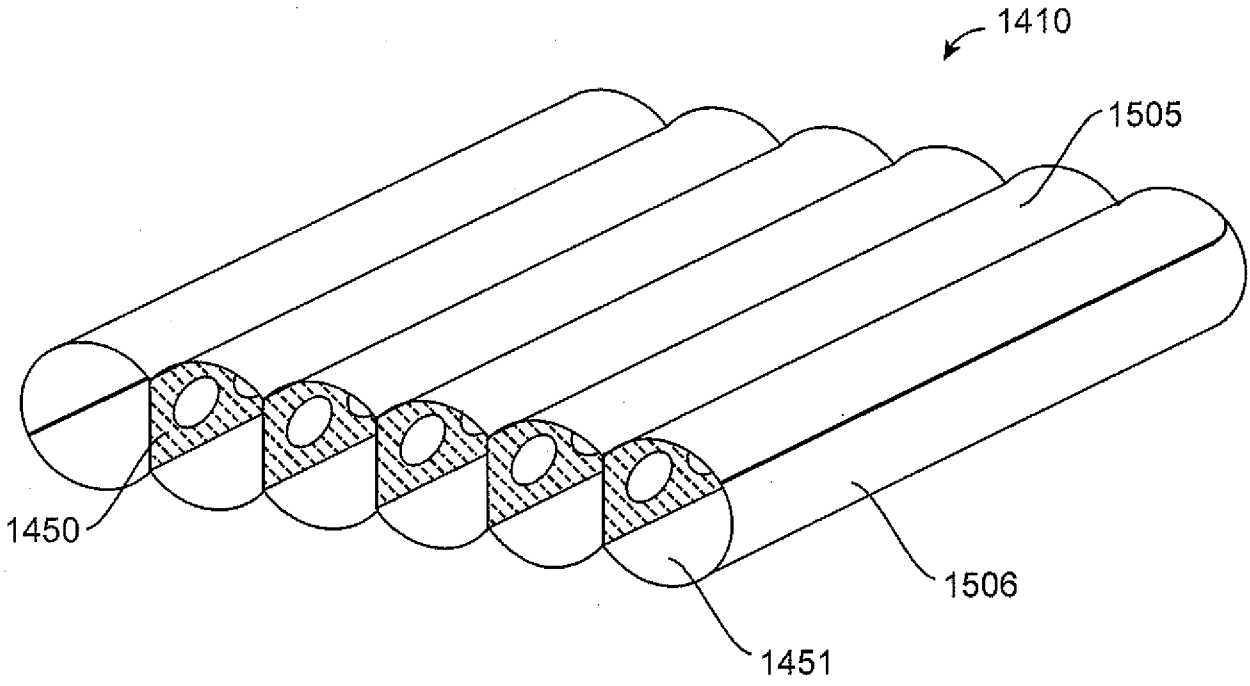

FIG. 14B

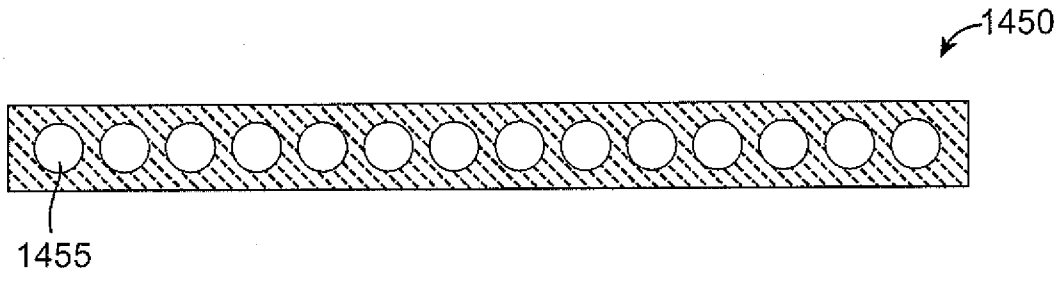

FIG. 14C

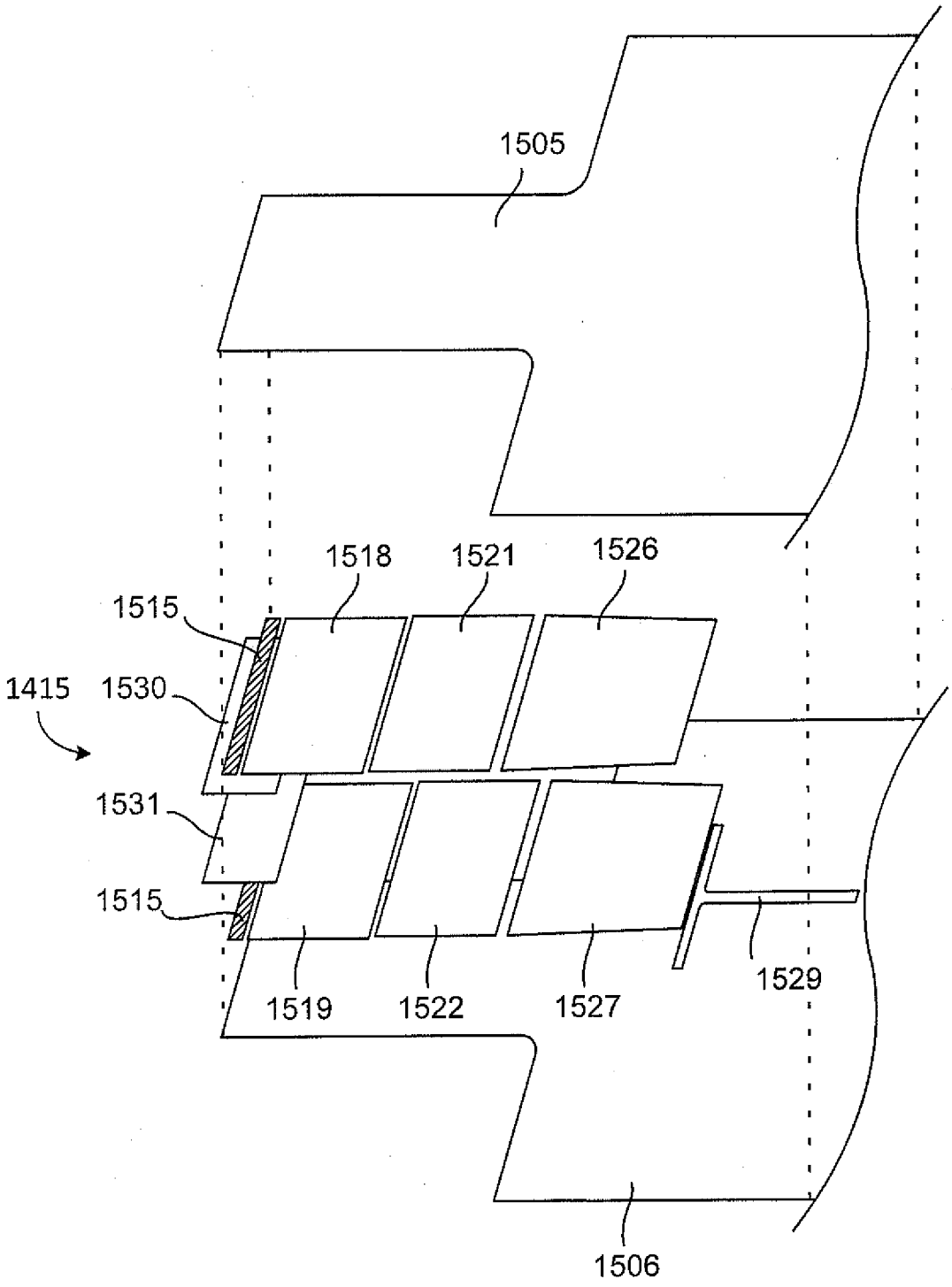
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FIG. 15A

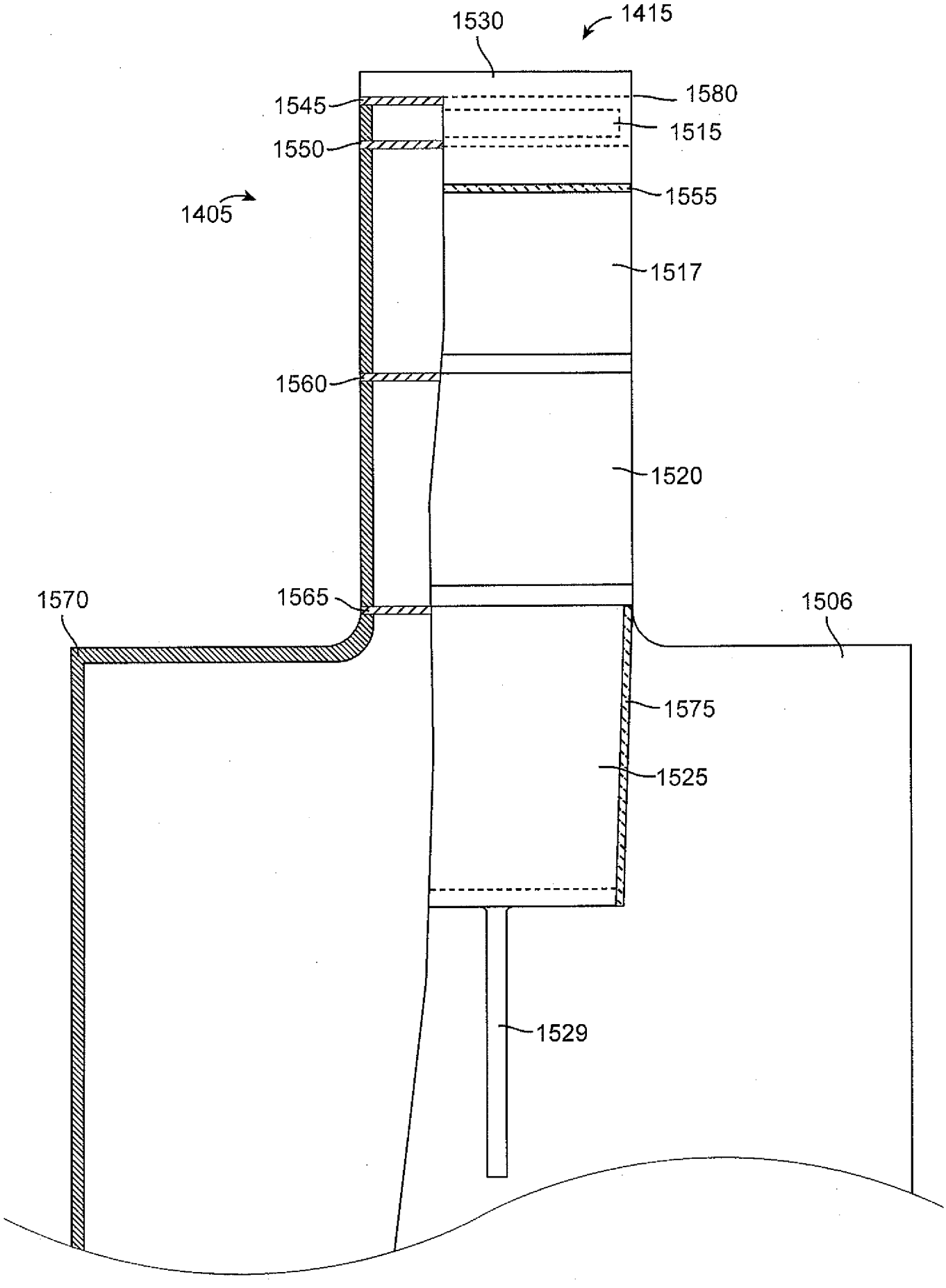
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FIG. 15B

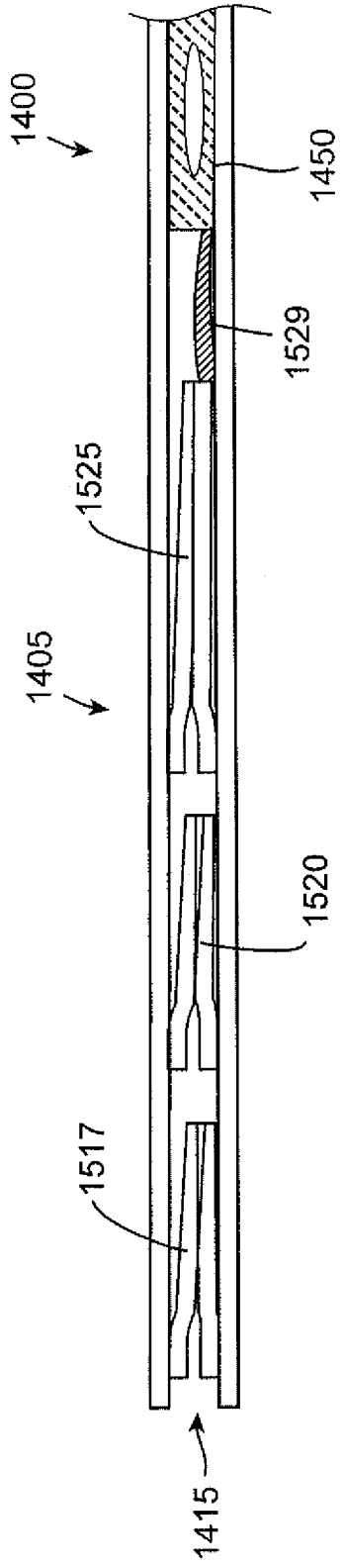

FIG. 16A

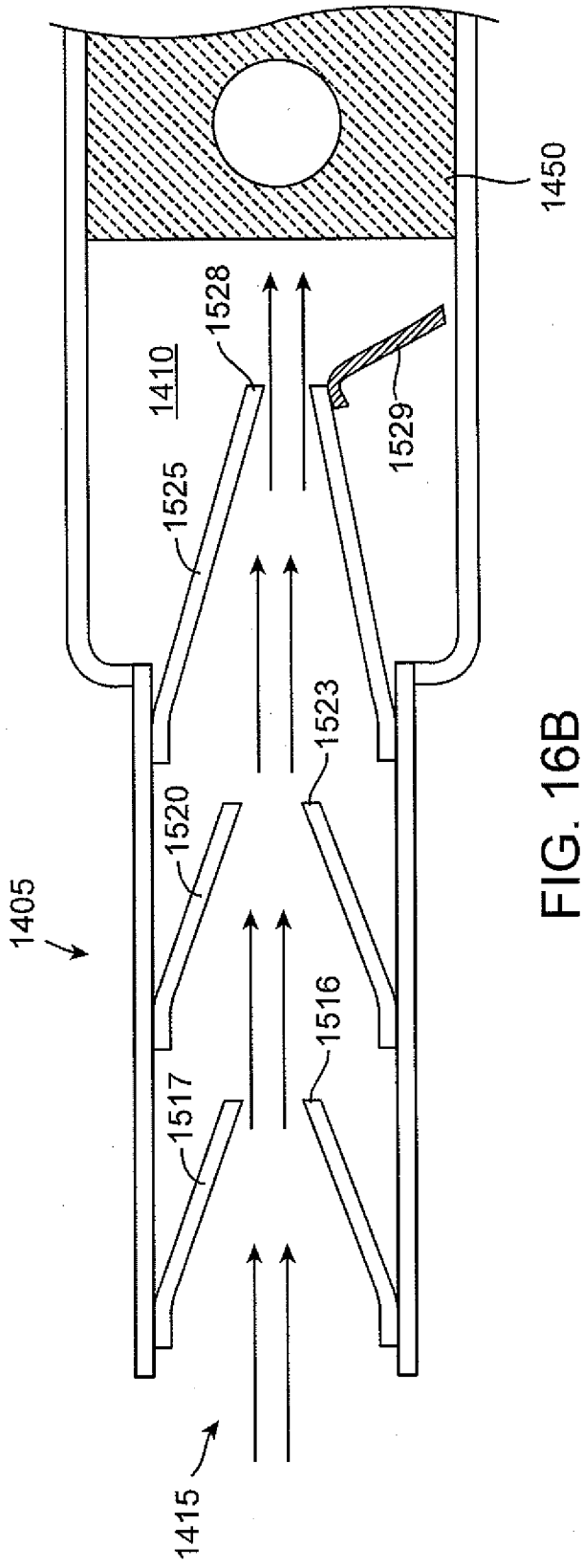

FIG. 16B

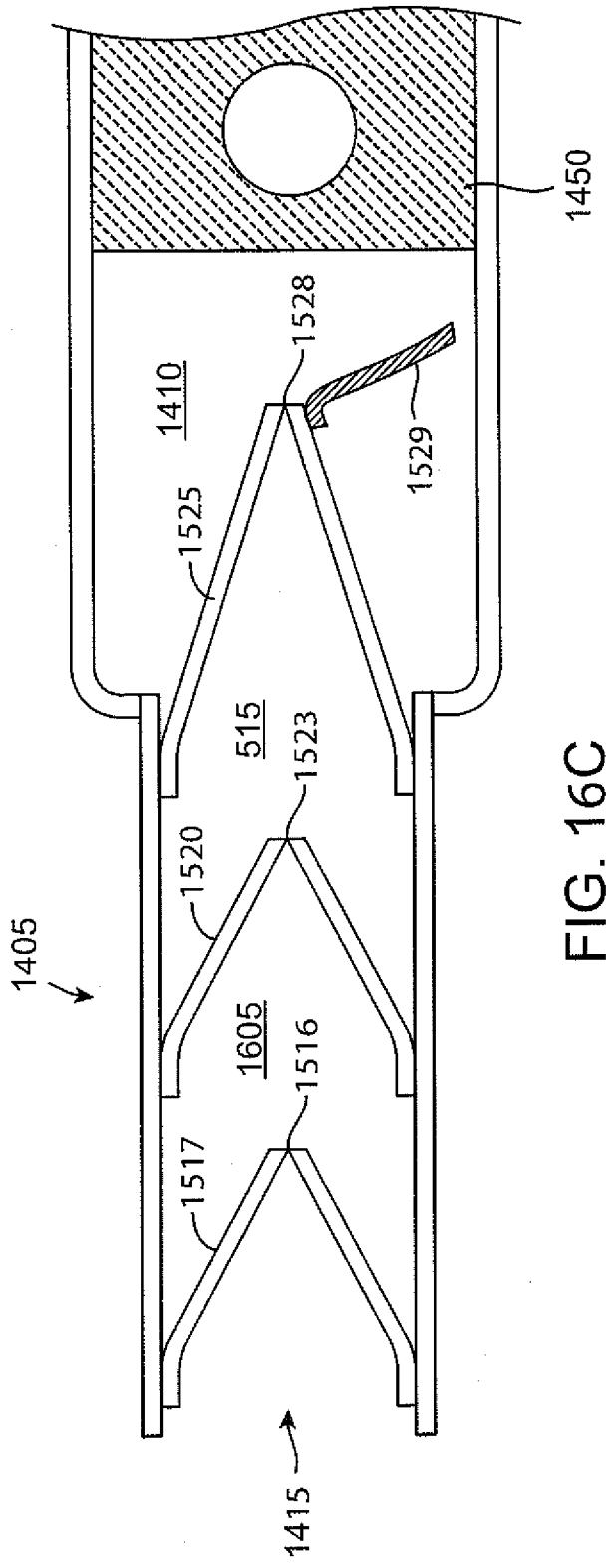
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FIG. 16C

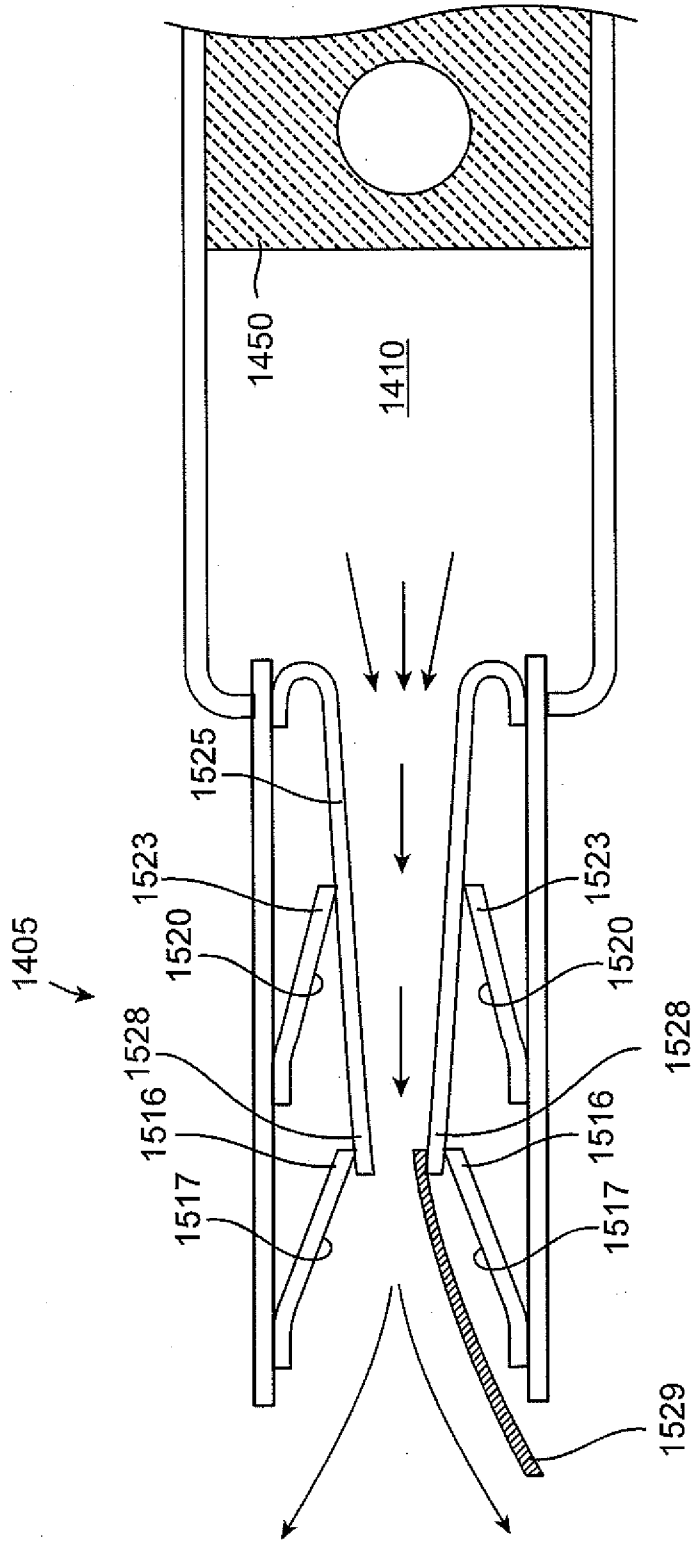
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FIG. 16D

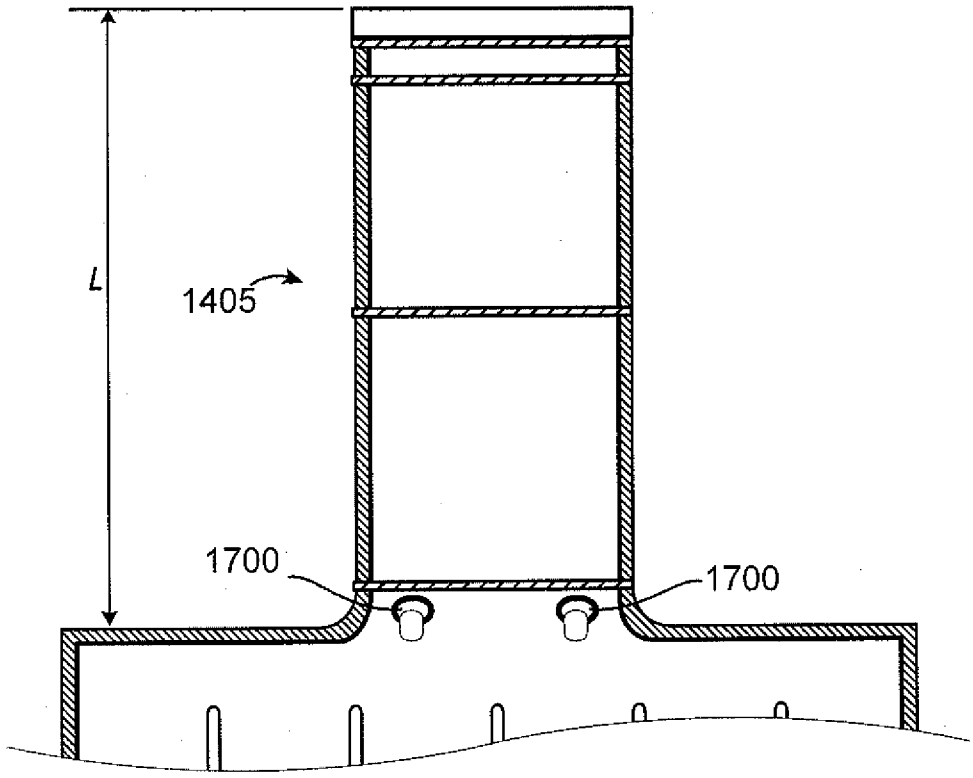

FIG. 17A

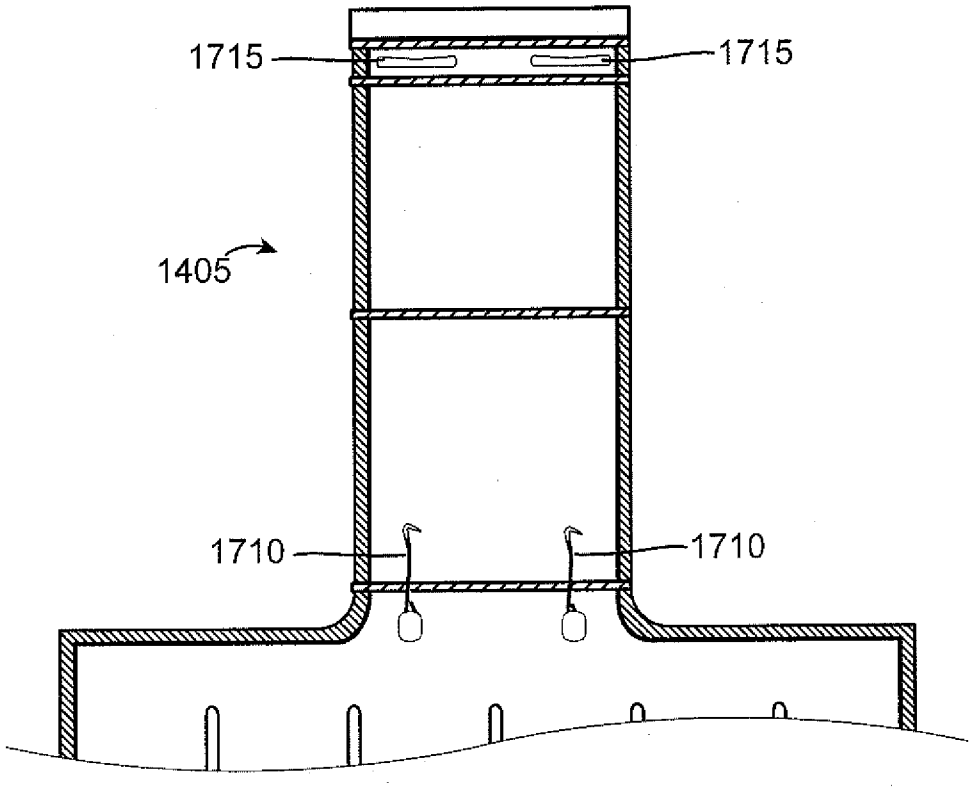

FIG. 17B

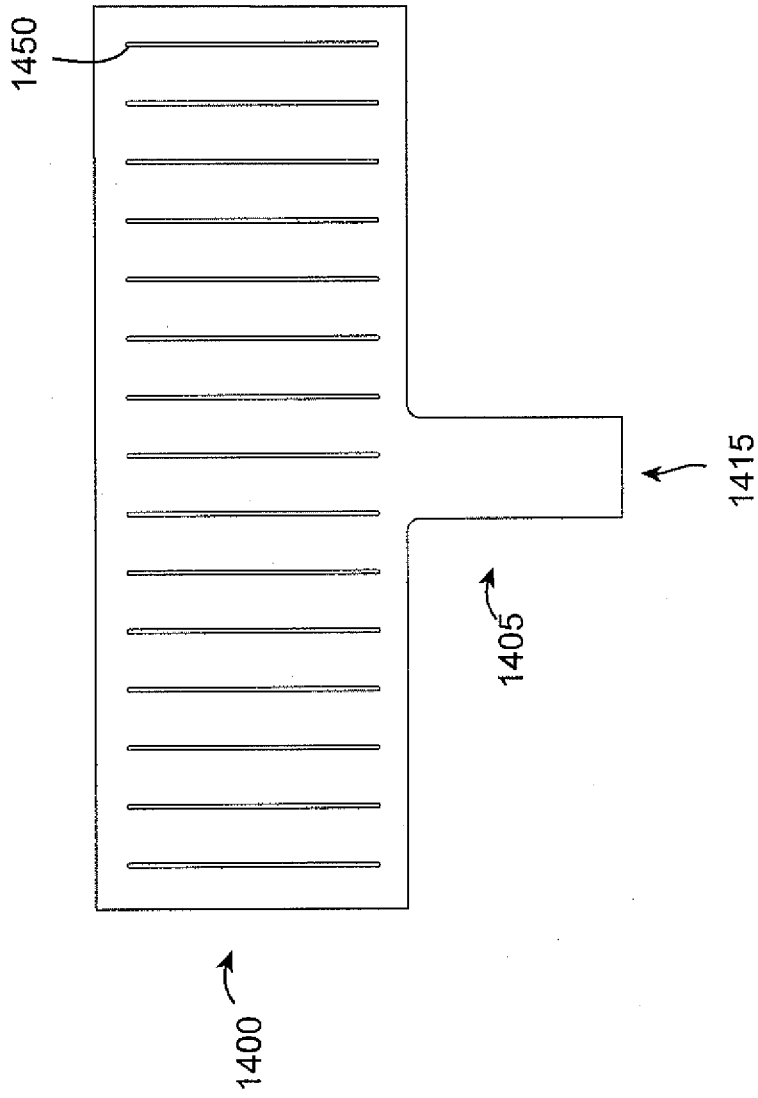

FIG. 18

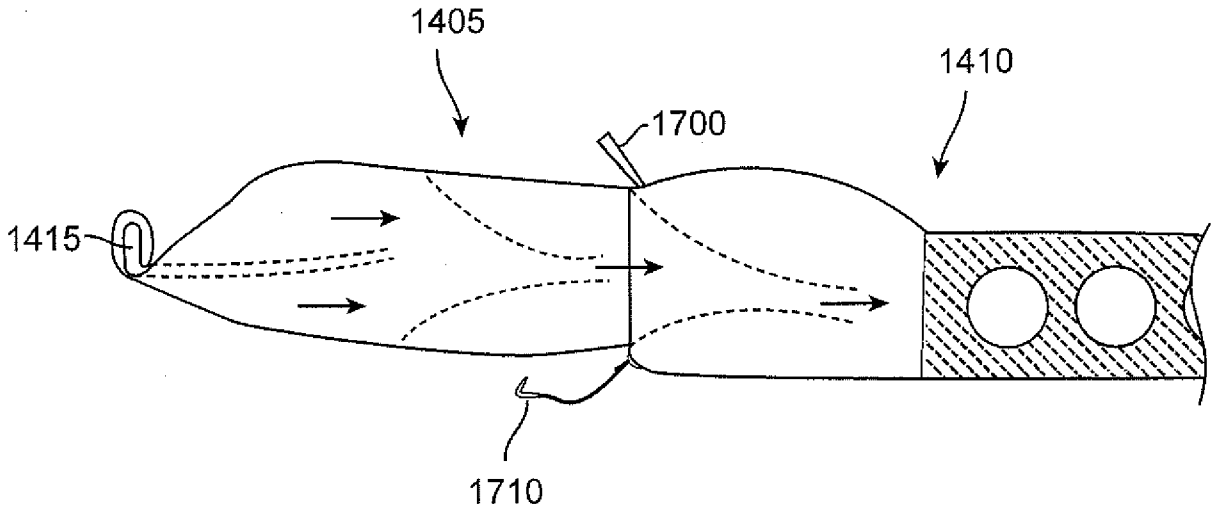

FIG. 19A

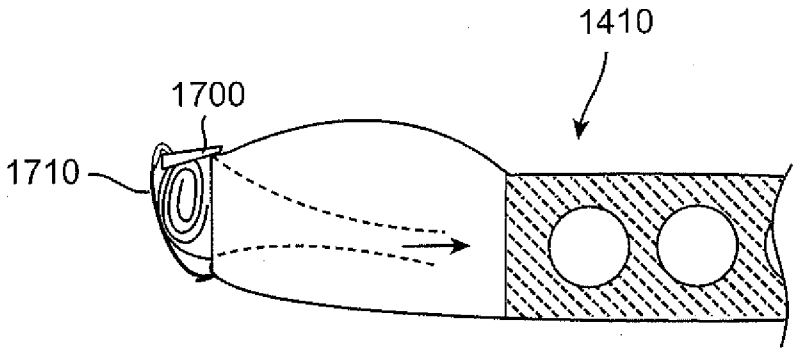

FIG. 19B

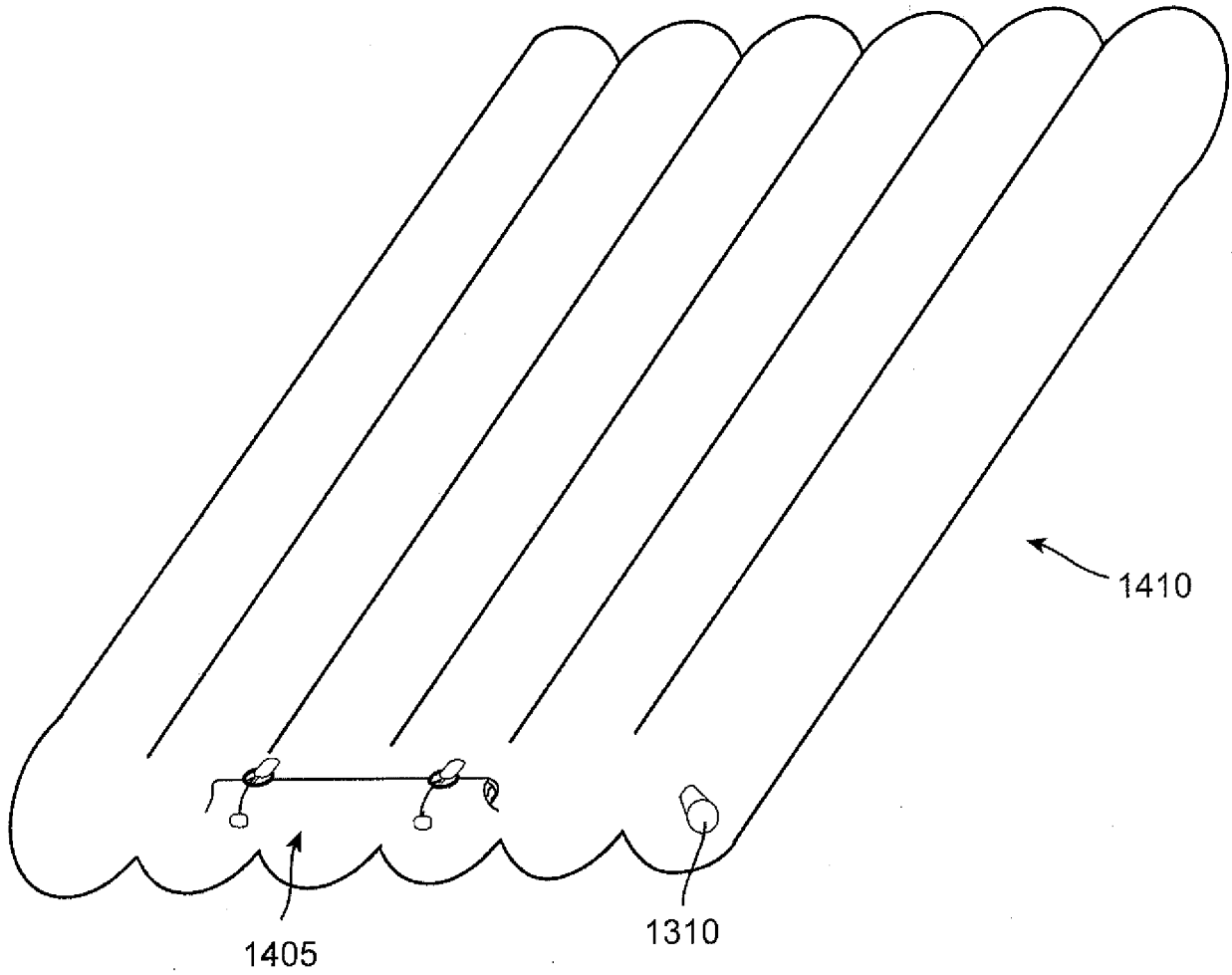

FIG. 19C

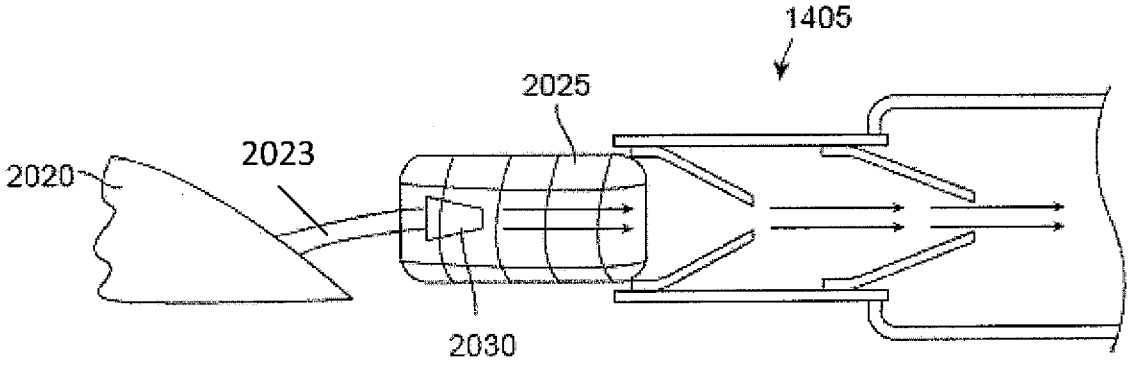

FIG. 20A

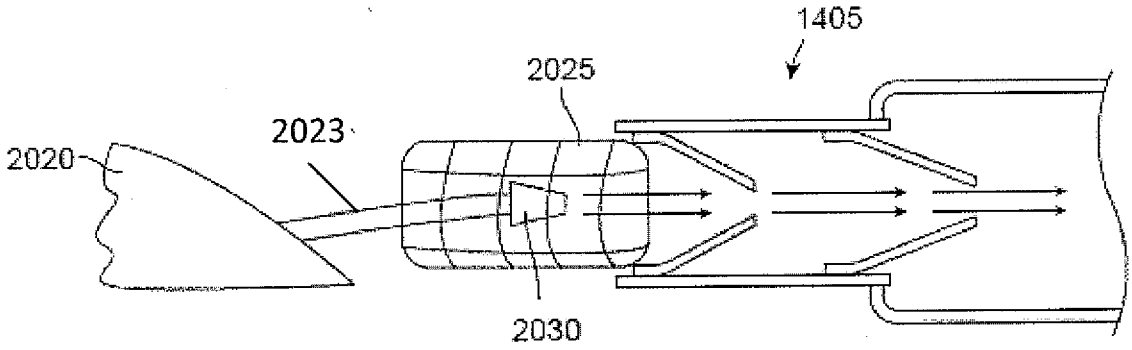

FIG. 20B

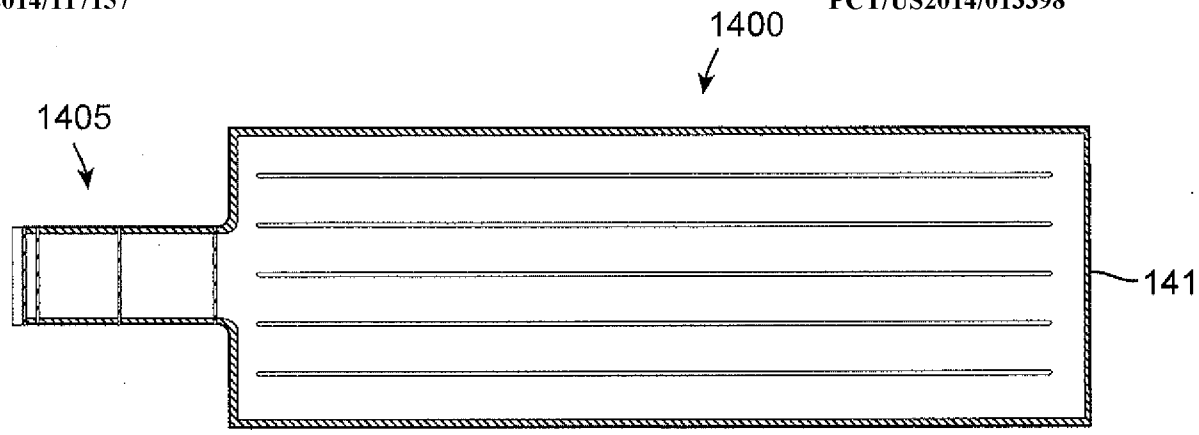

FIG. 21A

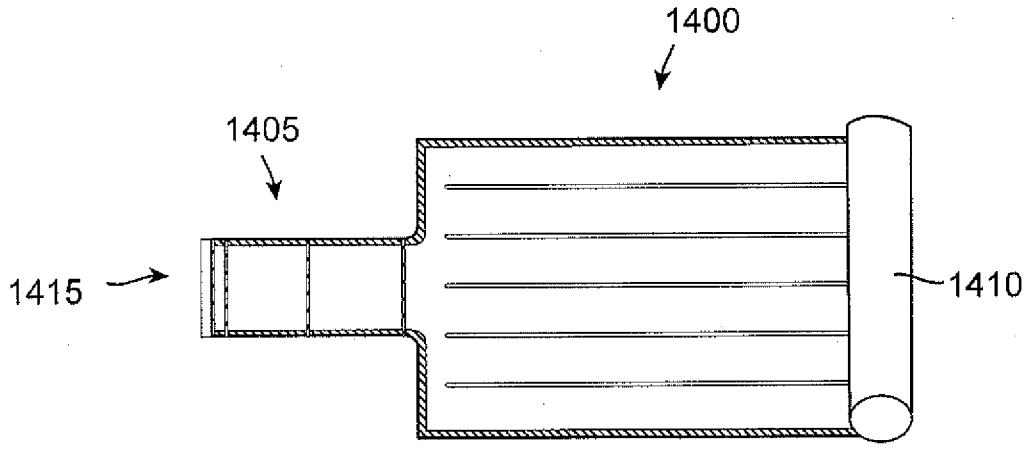

FIG. 21B

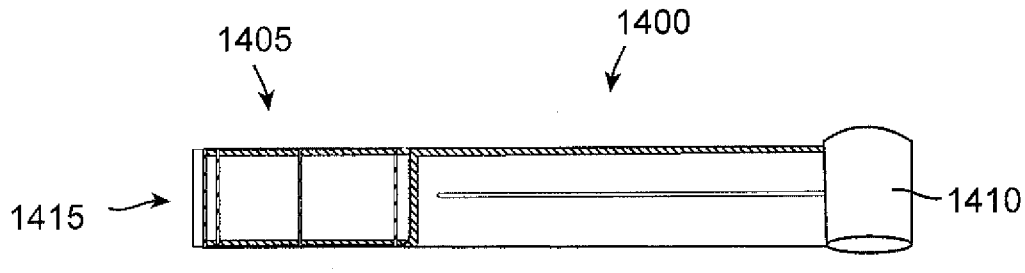

FIG. 21C

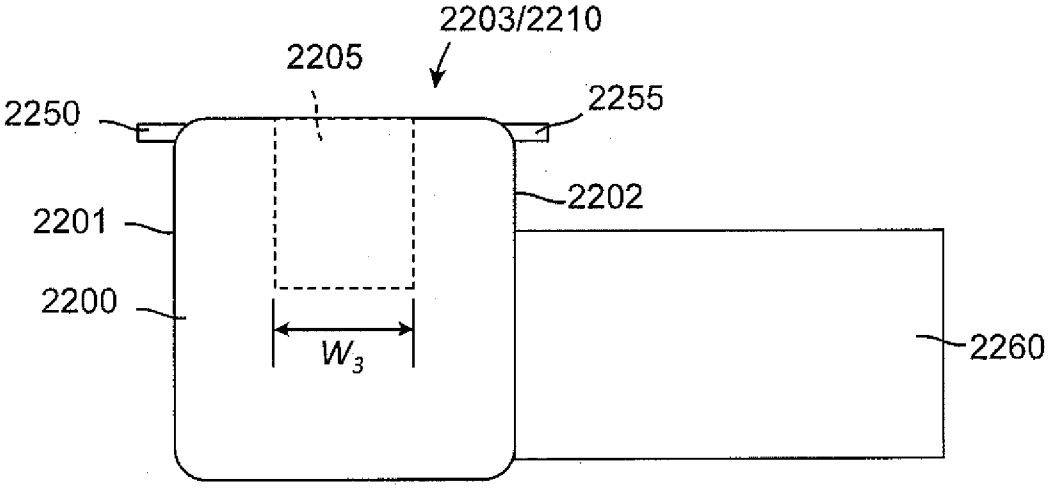

FIG. 22A

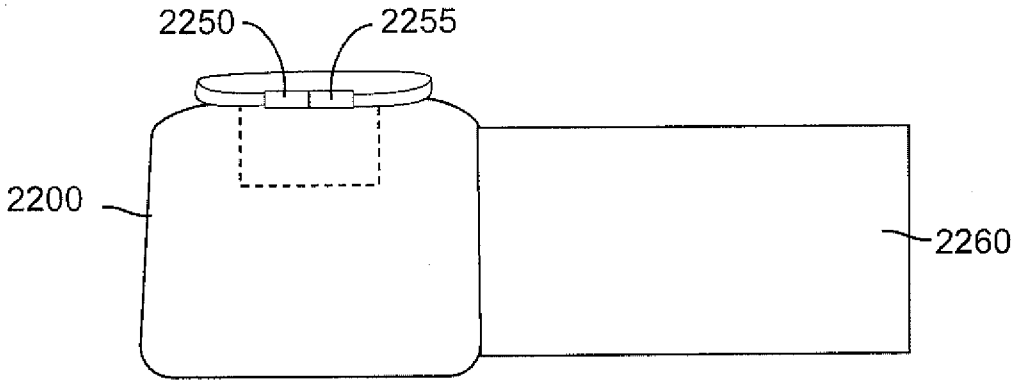

FIG. 22B

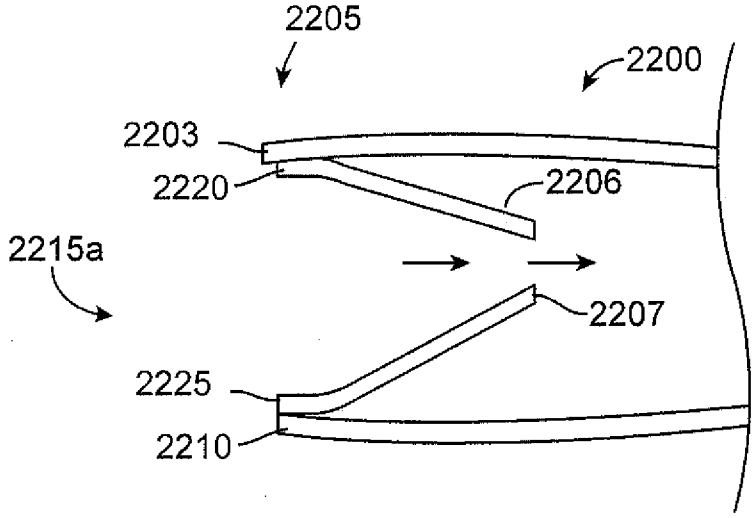

FIG. 22C

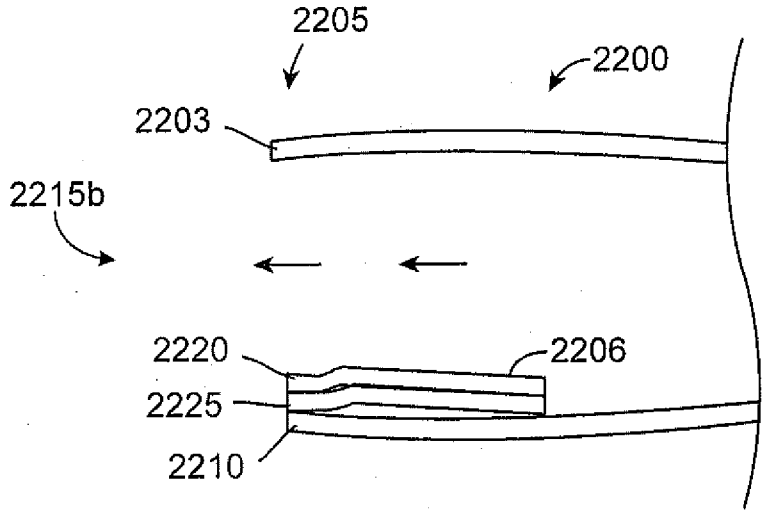

FIG. 22D

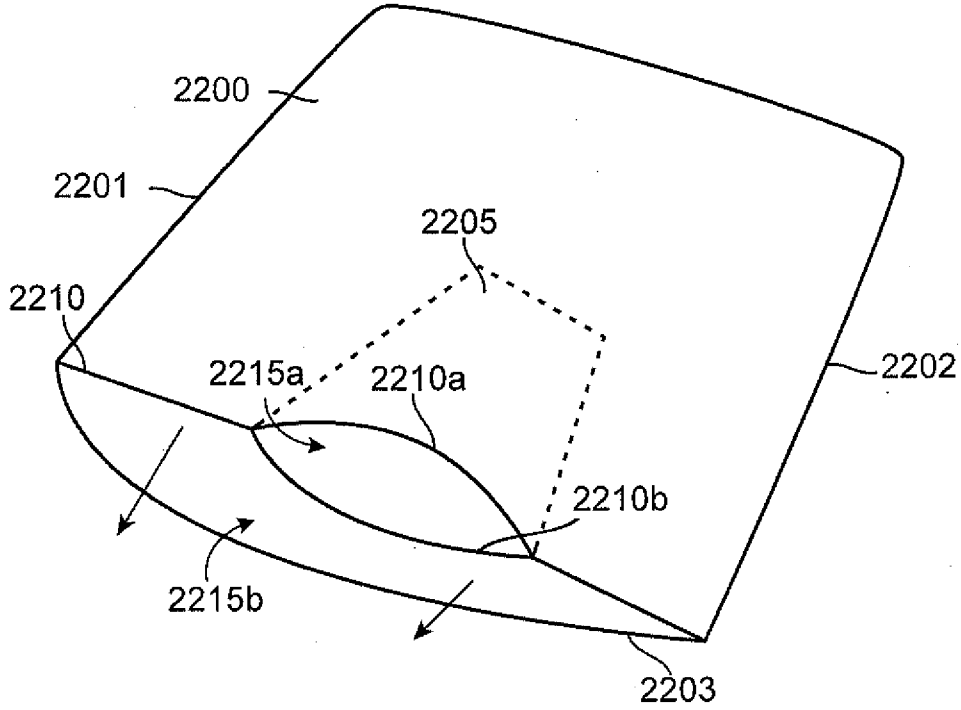

FIG. 22E

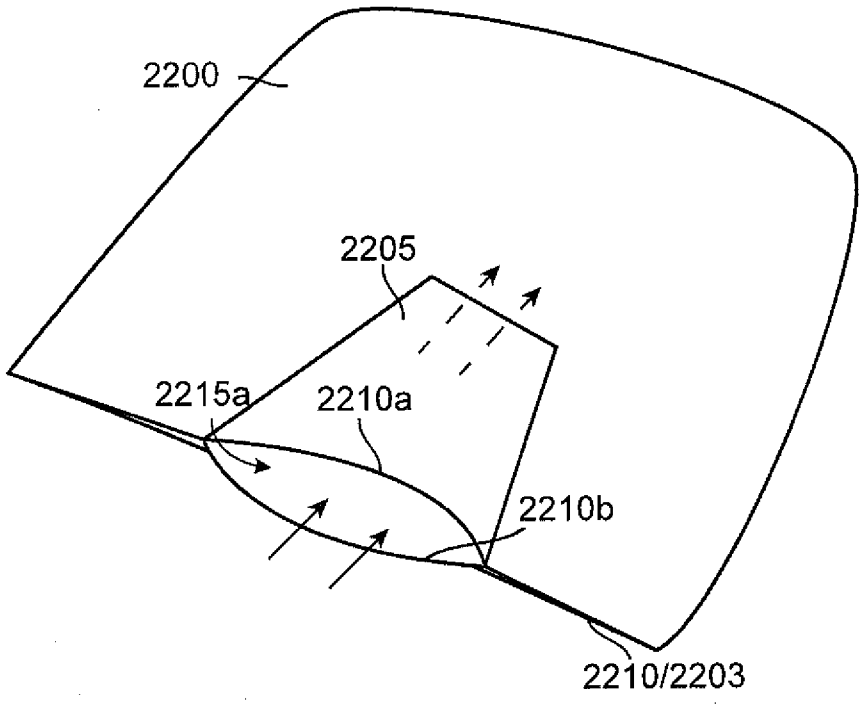

FIG. 22F

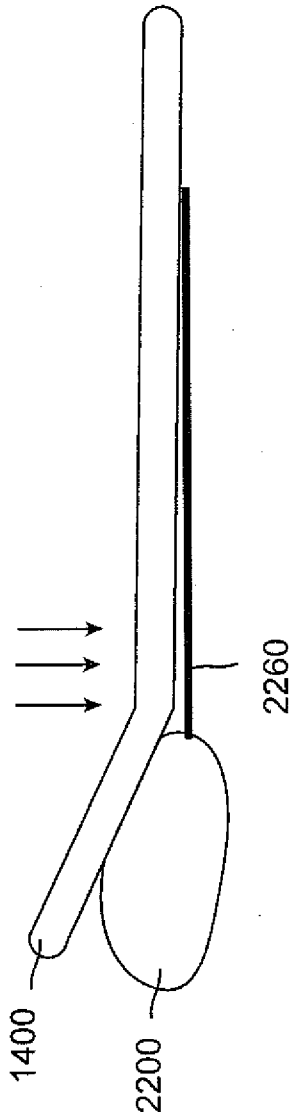

FIG. 23

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2014/013398

A. CLASSIFICATION OF SUBJECT MATTER

F16K 15/14 *(2006.01)*
F16K 15/20 *(2006.01)*

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)

F16K 15/14, 15/20, A63B 41/00

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), Espacenet, RUPTO, USPTO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	RU 2105221 C1 (TSENTR KOMPLEKSNOGO RAZVITIYA TEKHNOLOGII I ENERGOTEKHNOLOGICHESKIKH SISTEM "KORTES") 20.02.1998, p. 4, line 50 - p. 6, line 30, claim 1	1-18 19-20
X Y	RU 2146024 C1 (IRKUTSKAYA GOSUDARSTVENNAYA SELSKOKHOZYAISTVENNAYA AKADEMIYA) 27.02.2000, p. 3, lines 35-65, claim 1	1-18 19-20
Y	WO 1996/038642 A1 (SPIRONEF SOCIETE CIVILE et al.) 05.12.1996, claim 5	19-20

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

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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
23 May 2014 (23.05.2014)	10 June 2014 (10.06.2014)
Name and mailing address of the ISA/ FIPS Russia, 123995, Moscow, G-59, GSP-5, Berezhkovskaya nab., 30-1 Facsimile No. +7 (499) 243-33-37	Authorized officer A. Fedotov Telephone No. (495)531-64-81

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