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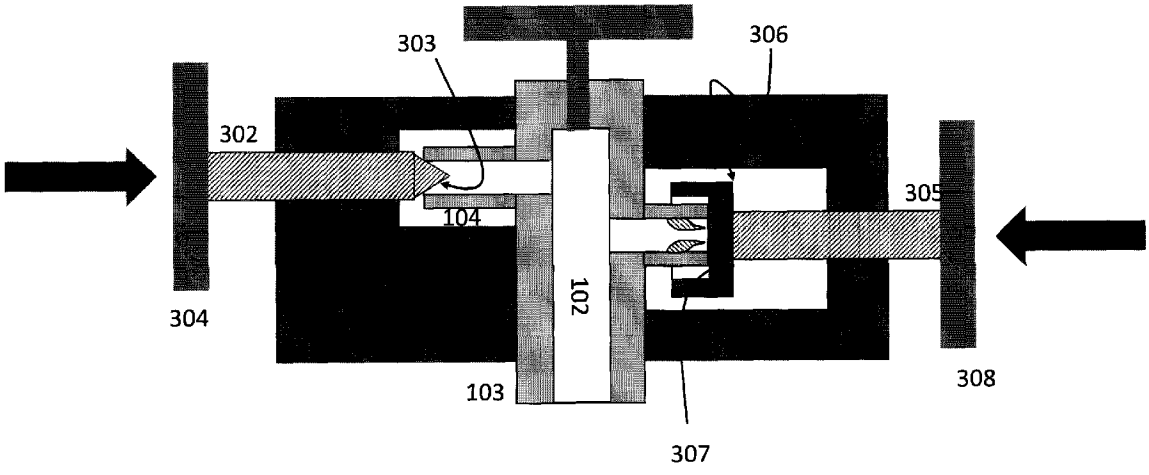
(54) Titre : PROCEDE D`ENCAPSULATION D`UN ROBINET DE BOUTEILLE
(54) Title: METHOD FOR CAPPING A CYLINDER VALVE



(57) Abrégé/Abstract:
A method for capping a cylinder valve having an emergency gas outlet including, affixing an emergency capping device having an emergency gas outlet blocking screw to the cylinder valve, and engaging the emergency gas outlet blocking screw, thereby blocking the valve emergency outlet.

Abstract

A method for capping a cylinder valve having an emergency gas outlet including, affixing an emergency capping device having an emergency gas outlet blocking screw to the cylinder valve, and engaging the emergency gas outlet blocking screw, thereby blocking the valve emergency outlet.

METHOD FOR CAPPING A CYLINDER VALVE

Technical Field

This relates to a method for capping a cylinder valve having an emergency gas outlet with a non-resetting pressure relief device.

Background

Most cylinders or manifolded cylinder packs are fitted with a relief device. In a situation where excess pressure is encountered, this is designed to discharge cylinder contents either completely or only discharge the excess pressure. Discharge of a pressure relief device will be accompanied by a high-pitched noise and a jet of gas at high speed.

There are three types of commonly used pressure relief devices.

The burst disc is the most common. In the event of overpressure, this is designed to burst, leaving an open passage for gas contents to escape completely. For example, Carbon Dioxide (CO2) cylinders are typically fitted with a burst disc that operates at approximately 207 bar and is fitted on the cylinder valve.

A burst disc (or rupture disc) is a type of sacrificial part because it has a one-time-use membrane that fails at a predetermined differential pressure, either positive or vacuum. The membrane is usually made out of metal, but nearly any material (or different materials in layers) can be used to suit a particular application. Rupture discs provide instant response (within milliseconds) to an increase or decrease in system pressure, but once the disc has ruptured, it will not reseal. It is not possible to set an accurate pressure value at which the disc will burst. Major advantages of the application of rupture discs compared to using pressure relief valves include leak-tightness and cost.

The next type of pressure relief device is the fusible plug. A fusible plug is a threaded metal cylinder, usually of bronze, brass, or gunmetal, with a tapered hole drilled completely through its length. This hole is sealed with a metal of low melting point that flows away if a pre-determined, high temperature is reached. A typical application for the fusible plug is for tanks transporting corrosive gases. For example, acetylene cylinders are typically fitted with fusible plugs that melt at approximately 100°C. The temperature rating of the fusible metal is stamped onto the face of the device.

Date Reçue/Date Received 2020-05-27

The last type of pressure relief device is the pressure relief valve. This type of device might be used for LPG. A spring-loaded valve opens when the cylinder pressure exceeds the pressure setting of the spring to discharge contents. Once the cylinder pressure decreases to the valve's pressure setting, the valve will normally reseat without leakage.

Ordinarily, when such a non-resetting pressure relief valve fails, the contents of the cylinder are simply allowed to vent in situ. However, often this is not a desirable result, especially if the cause of the rupture is a fire in the immediate area and the cylinder contains an oxidant. Another consideration would be the cost of the lost gas. There exists a need in the industry for a device to contain the gases within a cylinder with a venting pressure safety relief device.

Summary

A method for capping a cylinder valve having an emergency gas outlet including, affixing an emergency capping device having an emergency gas outlet blocking screw to the cylinder valve, and engaging the emergency gas outlet blocking screw, thereby blocking the valve emergency outlet.

A method for capping a cylinder valve having an emergency gas outlet with a non-resetting pressure relief device including, experiencing an overpressure event in cylinder valve, thereby causing the non-resetting pressure relief device to activate, affixing an emergency capping device having an emergency gas outlet blocking screw to the cylinder valve after experiencing the overpressure event, and engaging the emergency gas outlet blocking screw, thereby blocking the valve emergency outlet.

In an embodiment the non-resetting pressure relief device comprises a rupture disc.

In an embodiment the non-resetting pressure relief device comprises a fusible plug.

In an embodiment the emergency gas outlet blocking screw further comprises a blocking plug configured to contain the emergency gas outlet and provide a seal.

In an embodiment the blocking plug further comprises a guide.

Date Reçue/Date Received 2020-05-27

In an embodiment the guide is configured to hold a sealing means, and wherein the sealing means is configured to seal against the emergency gas outlet.

In an embodiment the emergency gas outlet blocking screw is manually engaged.

In an embodiment the emergency gas outlet blocking screw comprises an actuator selected from the group consisting of a handwheel, a knob, a crank, or a speed ball handle.

In an embodiment the cylinder valve further comprising a valve outlet, and the emergency capping device further comprising a valve outlet blocking screw, the method comprising:

- engaging the valve outlet blocking screw and the emergency gas outlet blocking screw, thereby blocking the valve outlet and the emergency gas outlet.

In an embodiment the valve outlet blocking screw comprises an actuator selected from the group consisting of a handwheel, a knob, a crank, or a speed ball handle.

Brief Description of the Drawings

For a further understanding of the nature and aspects for the present invention, reference should be made to the following detailed description, taken in conjunction with the accompanying drawings, in which like elements are given the same or analogous reference numbers and wherein:

Figure 1 is a schematic representation of typical medical gas valve with the pressure relief device intact.

Figure 2 is a schematic representation of a typical medical gas valve after an overpressure condition has been encountered, with the pressure relief device ruptured.

Figure 3 is a schematic representation of one embodiment of the present invention, in the unsealed position.

Figure 4 is a schematic representation of one embodiment of the present invention in the sealed position.

Date Reçue/Date Received 2020-05-27

Figure 5 is another schematic representation of a valve with the pressure relief device intact.

Figure 6 is a schematic representation of a top view of an emergency capping device body in accordance with one embodiment of the present invention.

Figure 7 is a schematic representation of a side view of an emergency capping device body in accordance with one embodiment of the present invention.

Figure 8 is a schematic representation a valve outlet locking screw in accordance with one embodiment of the present invention

Figure 9 is a schematic representation an emergency gas outlet blocking screw in accordance with one embodiment of the present invention

Figure 10 is a schematic representation an emergency gas outlet blocking screw plug in accordance with one embodiment of the present invention

Figure 11 is a schematic representation an emergency gas outlet sealing means in accordance with one embodiment of the present invention

Figure 12 is a schematic representation an emergency gas outlet blocking screw plug assembly in accordance with one embodiment of the present invention

Figure 13 is another schematic representation of one embodiment of the present invention, in the unsealed position.

Figure 14 is another schematic representation of one embodiment of the present invention in the sealed position.

Detailed Description of Preferred Embodiments

Element Numbers

101 = valve body

102 = valve body internal passage

103 = valve body inlet

104 = valve body outlet

105 = valve emergency outlet

106 = pressure relief device (rupture disc or fusible plug)

107 = compressed gas inlet flow

108 = gas outlet flow

109 = emergency gas outlet flow

110 = medical gas cylinder

301 = emergency capping device body

302 = valve outlet blocking screw

303 = valve outlet blocking screw tapered end

304 = valve outlet blocking screw actuator (hand wheel)

305 = emergency gas outlet blocking screw

306 = emergency gas outlet blocking screw plug

307 = emergency gas outlet blocking screw plug cavity

308 = emergency gas outlet blocking screw actuator

309 = first internal thread (configured to receive valve outlet blocking screw)

310 = second internal thread (configured to receive emergency gas outlet blocking screw)

311 = device body wall

312 = device body valve body channel

313 = emergency gas outlet blocking screw locking groove

314 = emergency gas outlet blocking screw blunt end

315 = third internal thread (configured to receive emergency gas outlet blocking screw)

316 = first connector (roll pin, spring pin, screw, bolt, etc.)

317 = emergency gas outlet sealing means (crush gasket)

318 = guide (configured to mate with emergency gas outlet blocking screw plug)

319 = second connector (screw, rivet, etc.)

320 = sealing means holder

All cryogenic liquids produce large volumes of gas when they vaporize. For example, one volume of liquid oxygen at atmospheric pressure vaporizes to 860 volumes of oxygen gas at 68°F (20°C). A cryogenic liquid cannot be indefinitely maintained as a liquid even in well-insulated containers. If these liquids are vaporized in a sealed container, they can produce enormous pressures that could rupture the container. For this reason, pressurized cryogenic containers are normally protected

with multiple devices for over-pressure prevention. Common pressure-relief devices are a pressure-relief valve for primary protection and a rupture disc for secondary protection.

Medical gas cylinder valves have three ports when manufactured according to an industry standard (for example, the Compressed Gas Association (CGA) 870 or 540). One port is screwed into the gas cylinder, a second port is where the regulator or gas delivery is attached, and the third port contains a pressure relief safety burst disc. Pressure-relief devices are installed on most cylinders to prevent the rupture of a normally pressurized cylinder when it is inadvertently exposed to fire, high temperatures, or overfilling.

Turning to Figure 1, a schematic representation of typical medical gas valve is presented. The actuator mechanism and the details of the valve stem, seat, packing, etc. are not directly pertinent to the present invention, so these are not shown in detail in any of the instant drawings. Valve body **101** has a valve body inlet **103** that is typically attached to the medical gas cylinder **110**, allowing compressed gas inlet flow **107** enter valve body internal passage **102**. Under normal operating conditions, valve emergency outlet **105** is sealed, and no flow passes through pressure relief device **106**. Pressure relief device **106** may be a rupture disc, a fusible plug, a combination of the two, or any other non-resetting device known to the art. Again, under normal operating conditions, gas outlet flow **108** exits valve body outlet **104** under conditions controlled by the valve mechanism itself.

Turning to Figure 2, the same valve is schematically represented after an overpressure condition has been encountered. In this situation, pressure relief device **106** has failed, and emergency gas outlet flow **109** occurs. In this situation, gas outlet flow **108** will likely stop completely, as the gas will encounter less pressure drop through the now open valve emergency outlet **105**. At this time, closing the valve itself will not stop the flow of gas from valve emergency outlet **105**.

Turning to Figures 3 and 4, schematic representations of one embodiment of the present invention is provided. Emergency capping device body **301** is placed adjacent to valve body **101** and is partially surrounding it. Emergency capping device body **301** includes valve outlet blocking screw **302** and emergency gas outlet blocking screw **305**.

Valve outlet blocking screw **302** may have a tapered end **303** that is configured contact valve body outlet **104** and block any flow. Emergency capping device body **301** has internal threads that are configured to engage with the external threads on valve outlet blocking screw **302**, allowing valve outlet blocking screw tapered end **303** to be moved toward or away from valve body outlet **104** by the use of valve outlet blocking screw actuator **304**. Valve outlet blocking screw actuator **304** may be a knob, a handwheel, a crank, a speed ball handle, or any type of manual actuator known to the art. Valve outlet blocking screw actuator **304** may be a pneumatic, hydraulic, or any other actuator type known to the art.

Emergency gas outlet blocking screw **305** has a plug **306** that is configured contact valve emergency outlet **105** and block any flow. Plug **306** may, for example, have a cavity **307** into which valve emergency outlet is contained. Emergency capping device body **301** has internal threads that are configured to engage with the external threads on emergency gas outlet blocking screw **305**, allowing plug **306** to be moved toward or away from valve emergency outlet by the use of emergency gas outlet blocking screw actuator **308**. Emergency gas outlet blocking screw actuator **304** may be a knob, a handwheel, a crank, a speed ball handle, or any type of manual actuator known to the art. Emergency gas outlet blocking screw actuator **304** may be a pneumatic, hydraulic, or any other actuator type known to the art.

Turning to Figure 5, another schematic representation of a medical gas valve in accordance with one embodiment of the present invention is presented. The actuator mechanism and the details of the valve stem, seat, packing, etc. are not directly pertinent to the present invention, so these are not shown in detail in any of the instant drawings. Valve body **101** has a valve body inlet **103** that is typically attached to the medical gas cylinder (not shown). Under normal operating conditions, valve emergency outlet **105** is sealed, and no flow passes through pressure relief device **106** (which is internal in this embodiment and thus not explicitly represented). Pressure relief device **106** may be a rupture disc, a fusible plug, a combination of the two, or any other non-resetting device known to the art. Again, under normal operating conditions, gas outlet flow **108** exits valve body outlet **104** under conditions controlled by the valve mechanism itself.

Turning to Figures 6 and 7, another schematic representation of an emergency capping device body **301** in accordance with one embodiment of the present invention is presented. Emergency capping device body **301** has first internal threads **309** that are configured to engage with the external threads on valve outlet blocking screw **302**. Emergency capping device body **301** has second internal threads **310** that are configured to engage with the external threads on emergency gas outlet blocking screw **305**. Emergency capping device body **301** has device body valve body channels **312** that are configured to accommodate valve body **101**. As illustrated in Figure 7, emergency capping device body **301** has a device body wall **311** that defines the rear boundary of device body valve body channels **312**.

Turning to Figure 8, a schematic representation of one embodiment of valve outlet blocking screw **302** is provided. Valve outlet blocking screw **302** may have a tapered end **303** that is configured contact valve body outlet **104** and block any flow. Other means of blocking the outlet flow of valve body outlet **104** that are known to the art may be used. Emergency capping device body **301** has internal threads that are configured to engage with the external threads on valve outlet blocking screw **302**, allowing valve outlet blocking screw tapered end **303** to be moved toward or away from valve body outlet **104** by the use of valve outlet blocking screw actuator **304**. Valve outlet blocking screw actuator **304** may be a knob, a handwheel, a crank, a speed ball handle, or any type of manual actuator known to the art. Valve outlet blocking screw actuator **304** may be a pneumatic, hydraulic, or any other actuator type known to the art.

Turning to Figure 9, a schematic representation of one embodiment of emergency gas outlet blocking screw **305** is provided. Emergency gas outlet blocking screw **305** may have a segment on the end that is unthreaded. The unthreaded portion may include a locking groove **313** that is configured to receive one or more first connector pins **316** (below). The unthreaded portion may also include a blunt end **314** that is configured to nestle into a receiving pocket in emergency gas outlet blocking screw plug **306** (below). Emergency capping device body **301** has internal threads that are configured to engage with the external threads on emergency gas outlet blocking screw **305**, allowing blunt end **304** to be moved toward or away from valve emergency

outlet **105** by the use of emergency gas outlet blocking screw actuator **308**. Emergency gas outlet blocking screw actuator **308** may be a knob, a handwheel, a crank, a speed ball handle, or any type of manual actuator known to the art. Emergency gas outlet blocking screw actuator **308** may be a pneumatic, hydraulic, or any other actuator type known to the art.

Turning to Figure 10, a schematic representation of one embodiment of emergency gas outlet blocking screw plug **306** is provided. In one embodiment, plug **306** has a cavity **307** that is configured to fit over and around valve emergency outlet **105**, thereby stopping the flow. Plug **306** has an internal passageway **315** configured to receive emergency gas outlet blocking screw rounded end **315**. Plug **306** has one or more holes that are sized and located to accommodate first connector pins **316**, which then engage locking groove **313**. Plug **306** has at least two holes that are sized and located to accommodate second connectors **319**, which then engage guide **318** (below).

Turning to Figure 11, a schematic representation of emergency gas outlet sealing means **317** is provided. Sealing means **317** locking groove **313** may be a gasket, a crush gasket, an o-ring, or any sealing means known to the art.

Turning to Figure 12, a schematic representation of the emergency gas outlet blocking screw plug assembly is provided. Guide **318** is attached to plug **306** by means of second connectors **319**. Second connectors **319** may be screws, rivets, bolts, or any connecting means known to the art. Guide **318** has sealing means holder **320** that allows sealing means **317** to be properly located on the face of plug **306** and ultimately deposited on device valve body **101**, around valve emergency outlet **105**. Guide **318** is held in place on both sides of plug **306**, by means of second connectors **319**. Second connectors **319** may be screws, rivets, bolts, or any suitable means known in the art.

Turning to Figure 13, a schematic representation of one embodiment of the present invention is provided. The actuator mechanism and the details of the valve stem, seat, packing, etc. are not directly pertinent to the present invention, so these are not shown in detail in any of the instant drawings. Valve body **101** has a valve body inlet **103** that is typically attached to the medical gas cylinder (not shown). Under normal operating conditions, valve emergency outlet **105** is sealed, and no flow passes through pressure relief device (internal to valve emergency outlet **105** and not shown in

this figure). The pressure relief device may be a rupture disc, a fusible plug, a combination of the two, or any other non-resetting device known to the art. Again, under normal operating conditions, gas exits valve body outlet **104** under conditions controlled by the valve mechanism itself.

Emergency capping device body **301** is placed adjacent to valve body **101** and is partially surrounding it. Emergency capping device body **301** has first internal threads **309** that are configured to engage with the external threads on valve outlet blocking screw **302** (below). Emergency capping device body **301** has second internal threads **310** that are configured to engage with the external threads on emergency gas outlet blocking screw **305** (below). Emergency capping device body **301** has device body valve body channels **312** that are configured to accommodate valve body **101**.

Emergency capping device body **301** includes valve outlet blocking screw **302** and emergency gas outlet blocking screw **305**. Valve outlet blocking screw **302** may have a tapered end **303** that is configured contact valve body outlet **104** and block any flow. Emergency capping device body **301** has internal threads that are configured to engage with the external threads on valve outlet blocking screw **302**, allowing valve outlet blocking screw tapered end **303** to be moved toward or away from valve body outlet **104** by the use of valve outlet blocking screw actuator **304**. Valve outlet blocking screw actuator **304** may be a knob, a handwheel, a crank, a speed ball handle, or any type of manual actuator known to the art. Valve outlet blocking screw actuator **304** may be a pneumatic, hydraulic, or any other actuator type known to the art. When emergency capping device body **301** is in the proper position valve outlet blocking screw **302** is aligned with valve body outlet **104**, and emergency gas outlet blocking screw **305** is aligned with valve emergency outlet **105**.

Emergency gas outlet blocking screw **305** has a plug **306** that is configured contact valve emergency outlet **105** and block any flow. In one embodiment, plug **306** has a cavity **307** that is configured to fit over and around valve emergency outlet **105**, thereby stopping the flow. Plug **306** has an internal passageway **315** configured to receive emergency gas outlet blocking screw rounded end **315**. Plug **306** has one or more holes that are sized and located to accommodate first connector pins **316**, which then engage locking groove **313**. Plug **306** has at least two holes that are sized and

located to accommodate second connectors **319**, which then engage guide **318** (below). Sealing means **317** locking groove **313** may be a gasket, a crush gasket, an o-ring, or any sealing means known to the art.

Guide **318** is attached to plug **306** by means of second connectors **319**. Second connectors **319** may be screws, rivets, bolts, or any connecting means known to the art. Guide **318** has sealing means holder **320** that allows sealing means **317** to be properly located on the face of plug **306** and ultimately deposited on device valve body **101**, around valve emergency outlet **105**. Guide **318** is held in place on both sides of plug **306**, by means of second connectors **319**. Second connectors **319** may be screws, rivets, bolts, or any suitable means known in the art.

Emergency capping device body **301** has internal threads that are configured to engage with the external threads on emergency gas outlet blocking screw **305**, allowing plug **306** to be moved toward or away from valve emergency outlet by the use of emergency gas outlet blocking screw actuator **308**. Emergency gas outlet blocking screw **305** may have a segment on the end that is unthreaded. The unthreaded portion may include a locking groove **313** that is configured to receive one or more first connector pins **316** (below). The unthreaded portion may also include a blunt end **314** that is configured to nestle into a receiving pocket in emergency gas outlet blocking screw plug **306** (below). Emergency capping device body **301** has internal threads that are configured to engage with the external threads on emergency gas outlet blocking screw **305**, allowing blunt end **304** to be moved toward or away from valve emergency outlet **105** by the use of emergency gas outlet blocking screw actuator **308**. Emergency gas outlet blocking screw actuator **308** may be a knob, a handwheel, a crank, a speed ball handle, or any type of manual actuator known to the art. Emergency gas outlet blocking screw actuator **308** may be a pneumatic, hydraulic, or any other actuator type known to the art.

Turning to Figure 13, one embodiment of the present method is provided. Valve **101** is attached to a cylinder of compressed gas (not shown). An overpressure condition is encountered, and the pressure relief device (internal to valve emergency outlet **105**, and not shown in this figure, but clearly indicated in prior figures) ruptures or otherwise activates in order to relieve the pressure. Most, if not all, of the gas flow that

had been exiting through valve body outlet **104** stops, and most, if not all, of the gas now exits through valve emergency outlet **105**.

The operator responds by removing the outlet line, tubing, or conduit from valve body outlet **104**, and placing emergency capping device body **301** around valve body **101**. When emergency capping device body **301** is in the proper position valve outlet blocking screw **302** is aligned with valve body outlet **104**, and emergency gas outlet blocking screw **305** is aligned with valve emergency outlet **105**.

Emergency capping device body **301** will have valve outlet blocking screw **302** threaded into first internal thread **309**, and emergency gas outlet screw **305** threaded into second internal thread **309**. Plug assembly, which includes guide **318** attached to two sides of plug **306** by means of second connector **319**, will have emergency gas outlet sealing means **317** securely in place. Plug assembly will be attached to the unthreaded end of emergency gas outlet screw **305**, with the first connectors **316** holding plug **306** in place by way of emergency gas outlet blocking screw locking groove **313**.

The operator then rotates valve outlet blocking screw actuator **304**, thereby moving valve outlet blocking screw tapered end **303** toward valve body outlet **104**. The ultimate blocking position for valve outlet blocking screw tapered end is indicated in Figure 14. In this position, gas flow from valve body outlet **104** will cease.

The operator then rotates emergency gas outlet blocking screw actuator **308**, thereby moving plug **306** toward valve emergency outlet **105**. The ultimate blocking position for valve outlet blocking screw tapered end is indicated in Figure 14. In this position, gas flow from valve emergency outlet **105** will cease.

It will be understood that many additional changes in the details, materials, steps and arrangement of parts, which have been herein described in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims. Thus, the present invention is not intended to be limited to the specific embodiments in the examples given above.

What is claimed is:

1. A method for capping a cylinder valve comprising an emergency gas outlet comprising a non-resetting pressure relief device, the method comprising:

- experiencing an overpressure event in cylinder valve, thereby causing the non-resetting pressure relief device to activate,
- affixing an emergency capping device comprising an emergency gas outlet blocking screw to the cylinder valve after experiencing the overpressure event, and
- engaging the emergency gas outlet blocking screw, thereby blocking the emergency gas outlet.

2. The method of claim 1, wherein the non-resetting pressure relief device comprises a rupture disc.

3. The method of claim 1, wherein the non-resetting pressure relief device comprises a fusible plug.

4. The method of any one of claim 1 to claim 3, wherein the emergency gas outlet blocking screw further comprises a blocking plug configured to contain the emergency gas outlet and provide a seal.

5. The method of claim 4, wherein the blocking plug further comprises a guide.

6. The method of claim 5, wherein the guide is configured to hold a sealing means, and wherein the sealing means is configured to seal against the emergency gas outlet.

Date Reçue/Date Received 2020-05-27

7. The method of any one of claim 1 to claim 6, wherein the emergency gas outlet blocking screw is manually engaged.

8. The method of any one of claim 1 to claim 7, wherein the emergency gas outlet blocking screw comprises an actuator selected from the group consisting of a handwheel, a knob, a crank, or a speed ball handle.

9. The method of any one of claim 1 to claim 8, the cylinder valve further comprising a valve outlet, and the emergency capping device further comprising a valve outlet blocking screw, the method comprising:

- engaging the valve outlet blocking screw and the emergency gas outlet blocking screw, thereby blocking the valve outlet and the emergency gas outlet.

10. The method of claim 9, wherein the valve outlet blocking screw comprises an actuator selected from the group consisting of a handwheel, a knob, a crank, or a speed ball handle.

Date Reçue/Date Received 2020-05-27

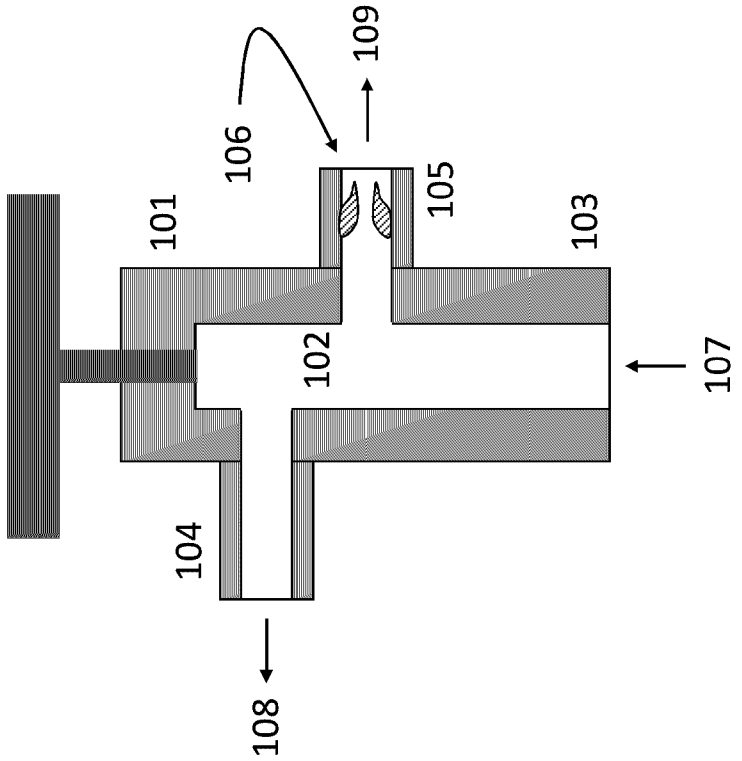


Figure 2

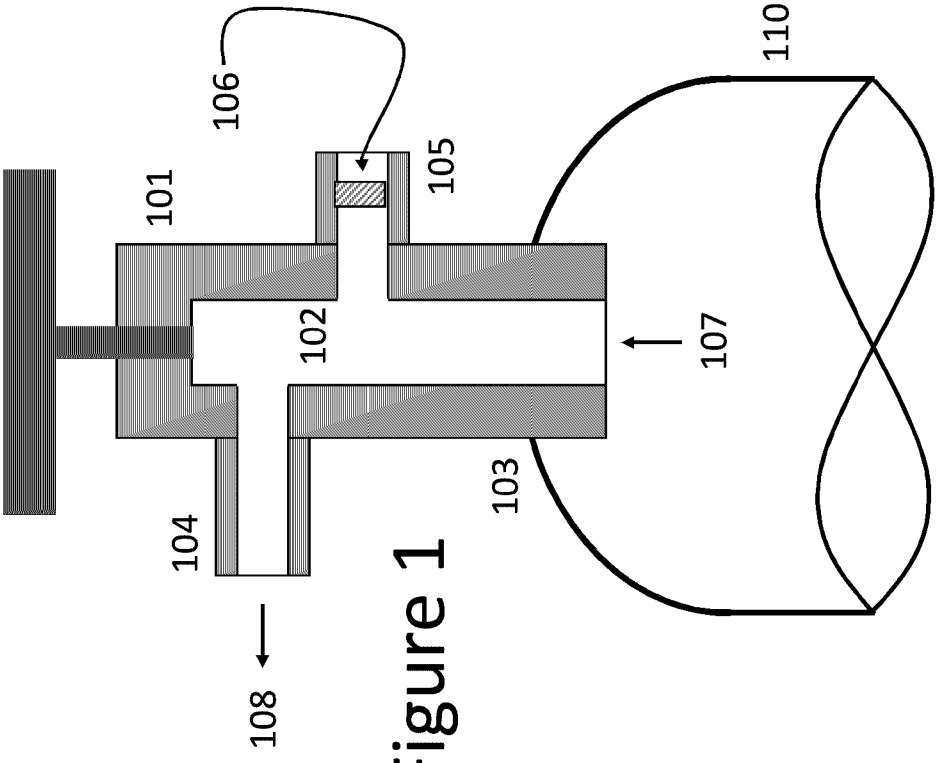


Figure 1

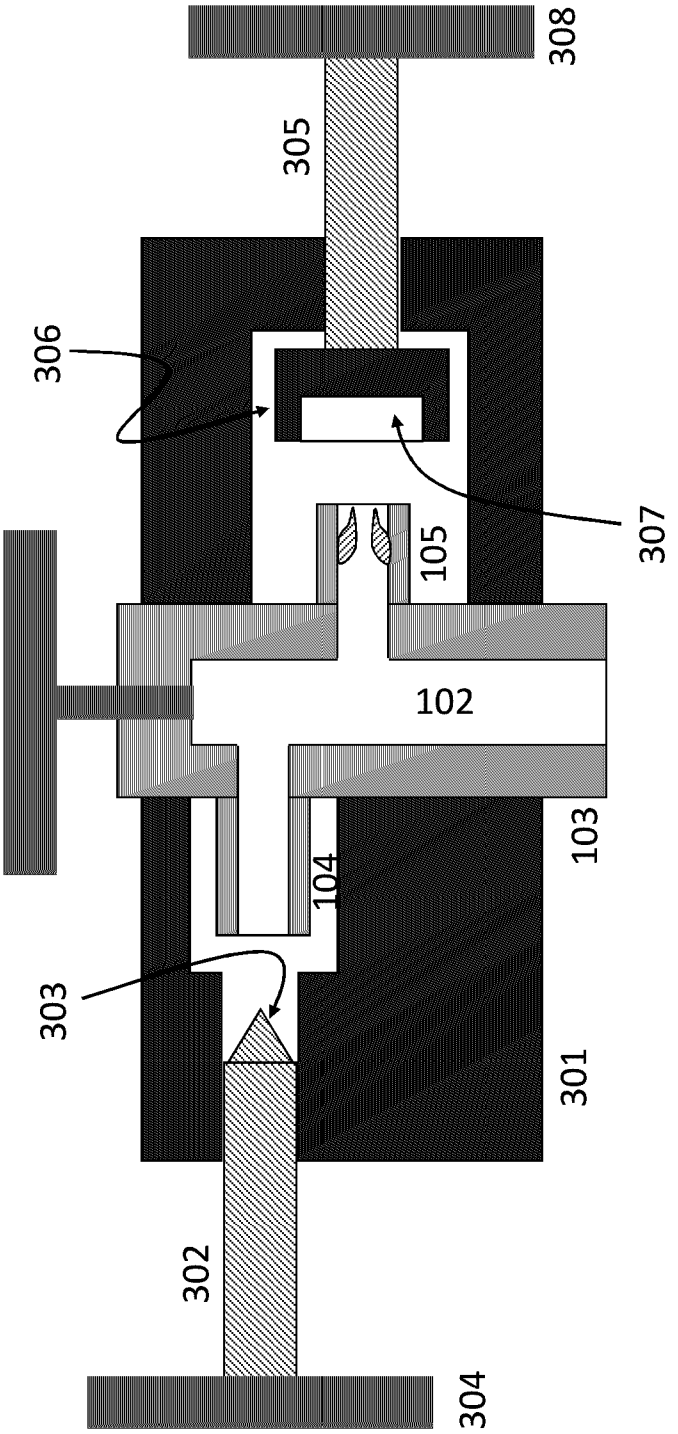


Figure 3

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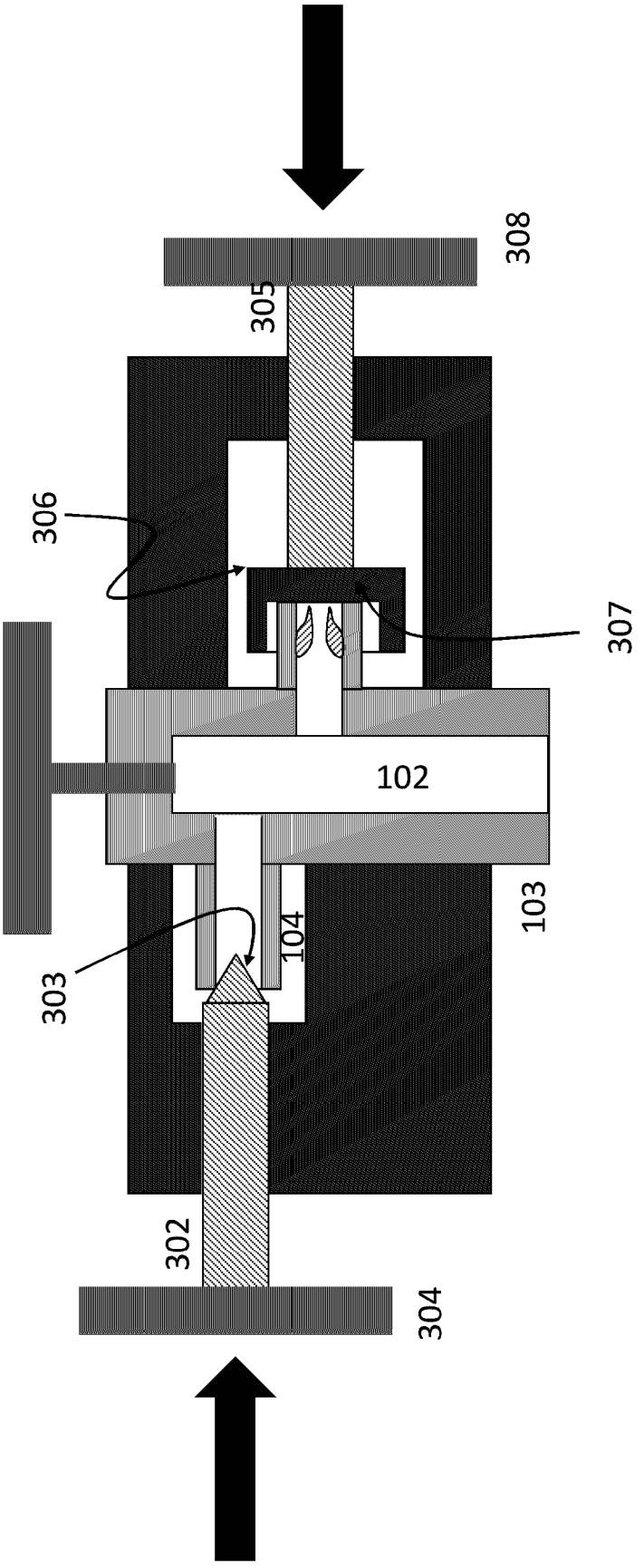


Figure 4

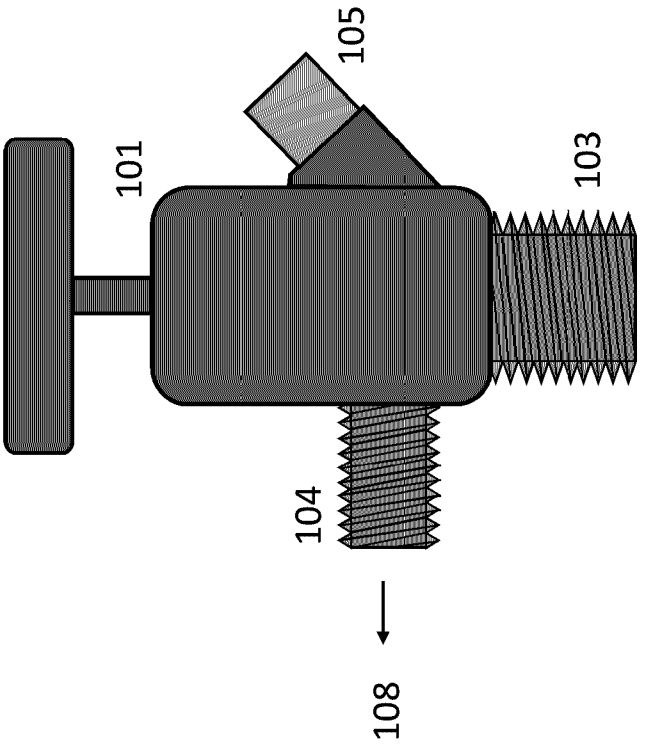


Figure 5

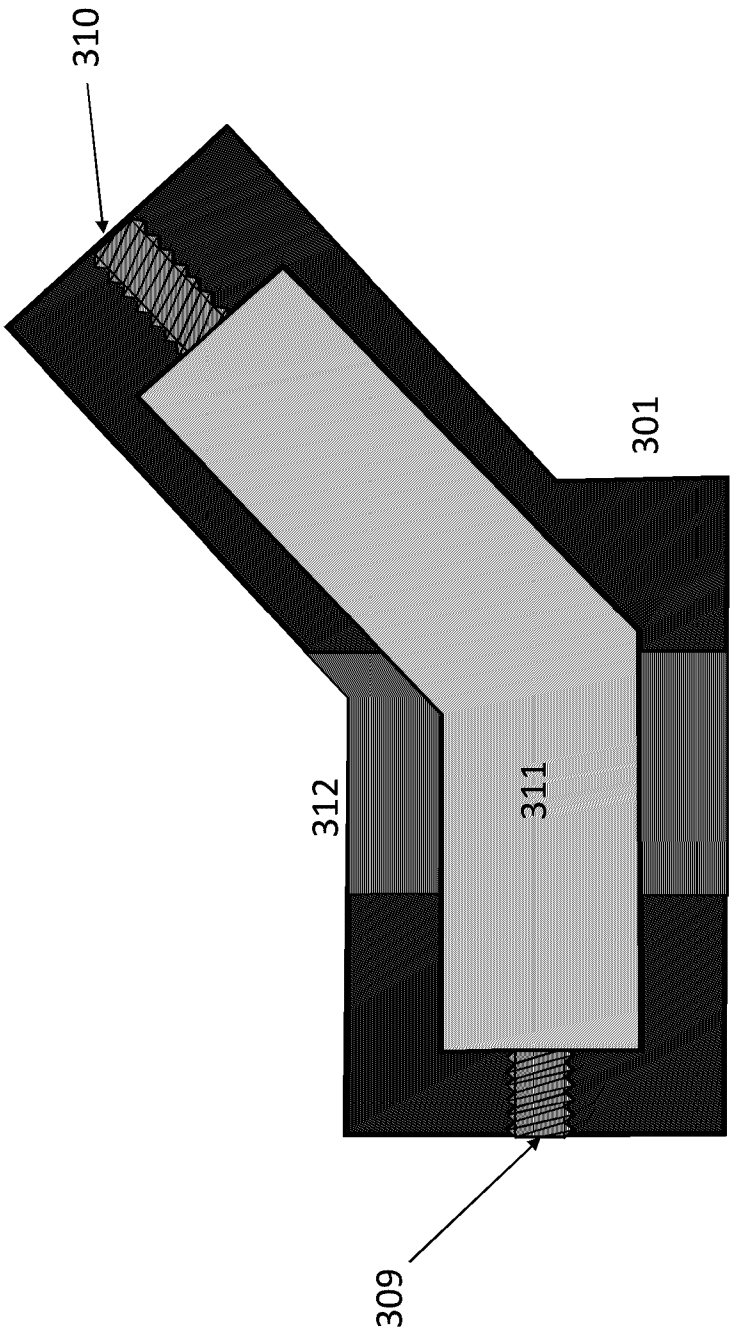


Figure 6

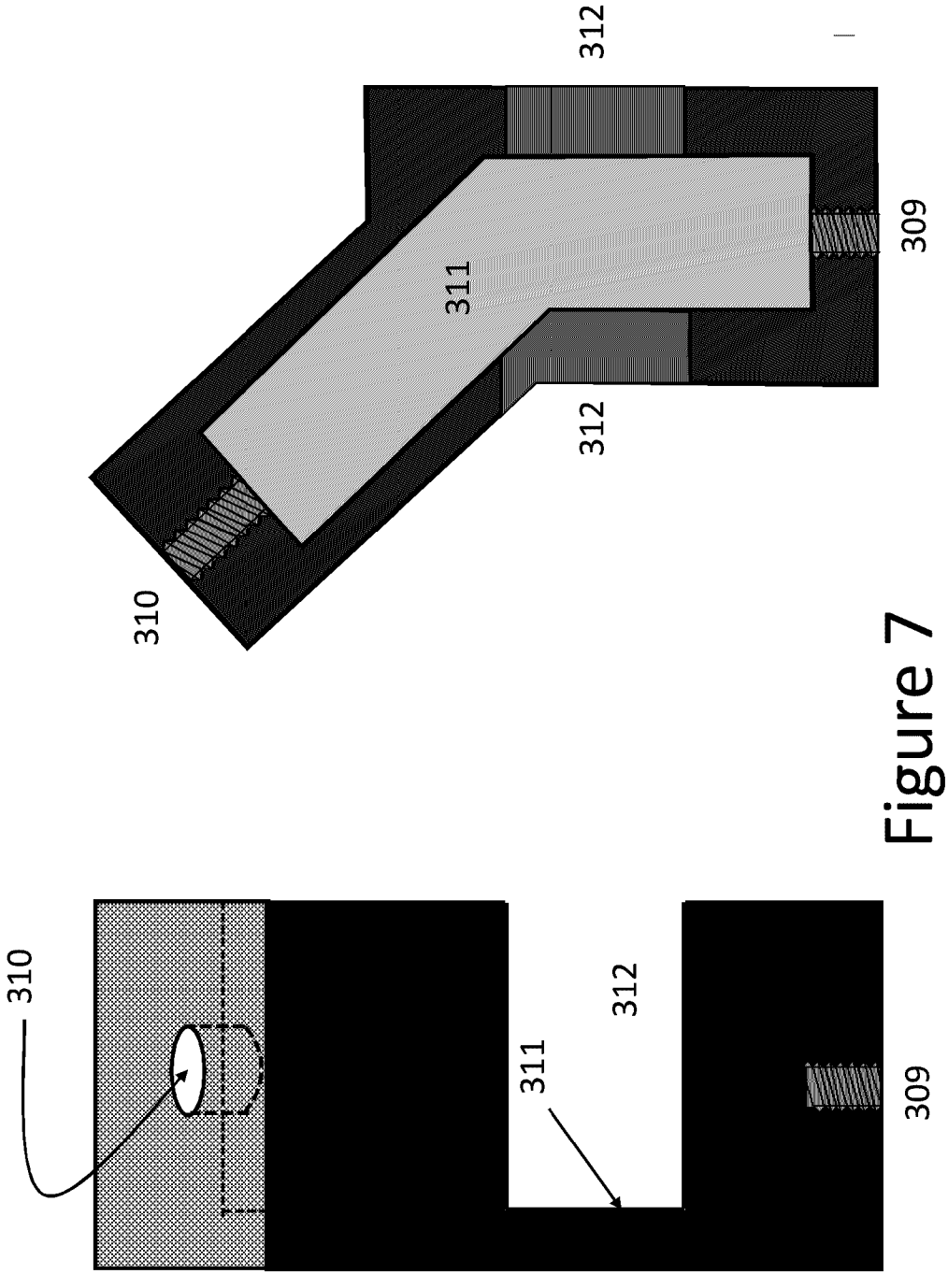


Figure 7

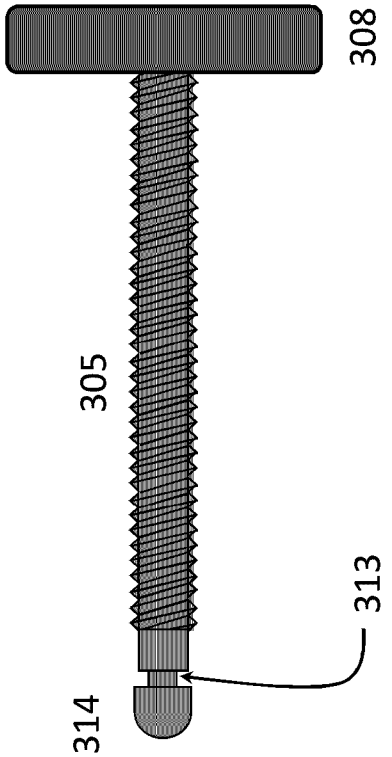


Figure 9

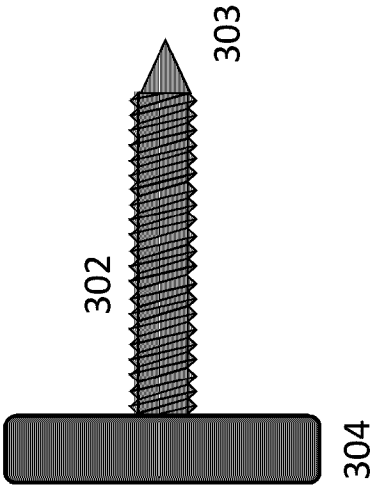


Figure 8

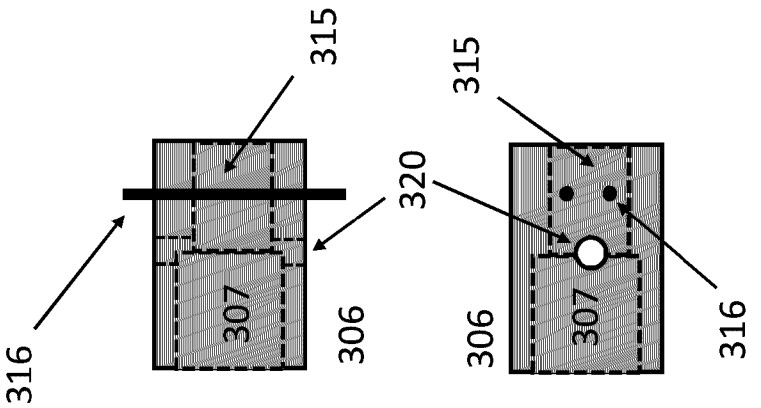


Figure 10

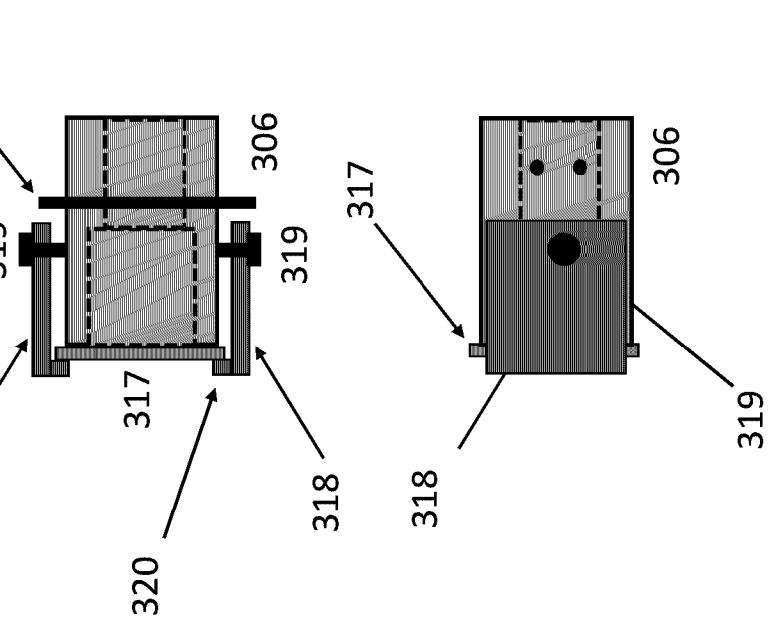


Figure 12

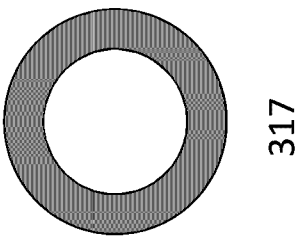


Figure 11

Figure 13

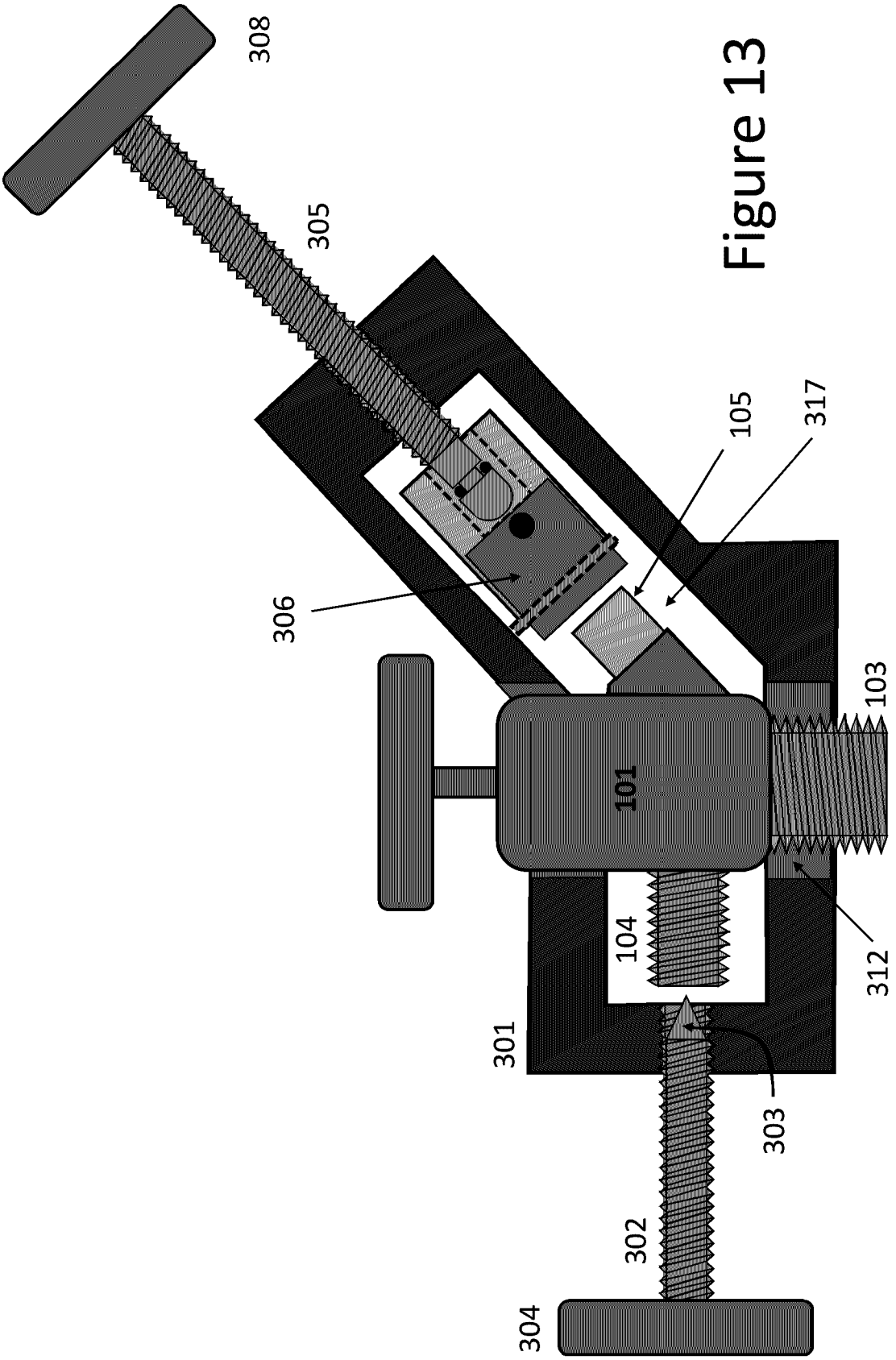
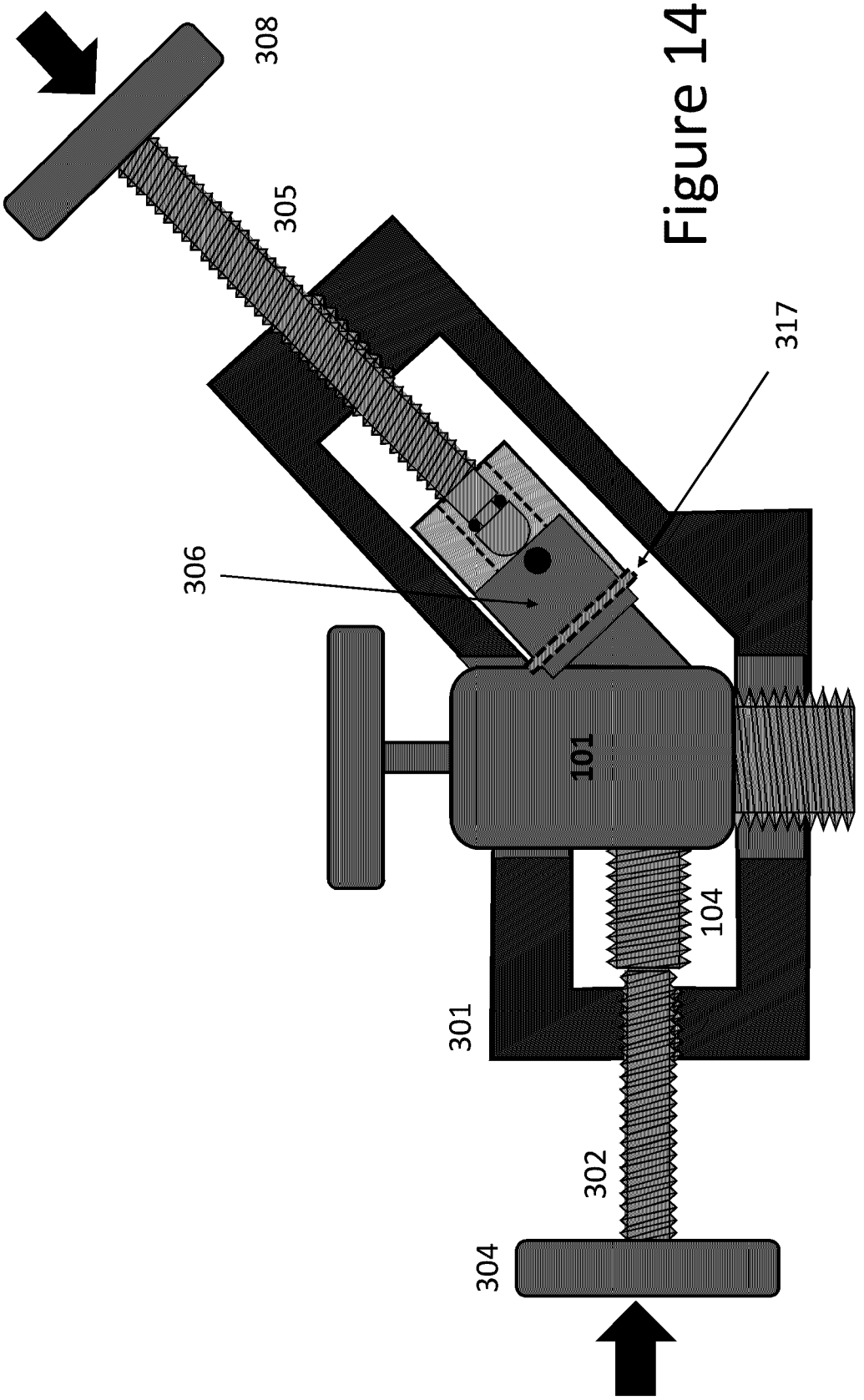
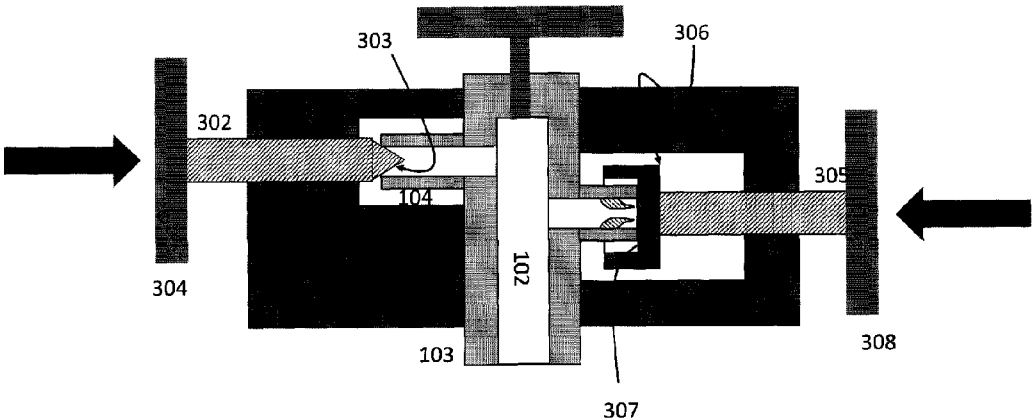


Figure 14



Date Reçue/Date Received 2020-05-27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