



(43) International Publication Date
7 September 2012 (07.09.2012)

- (51) International Patent Classification:
F17C 13/00 (2006.01) *G08B 25/10* (2006.01)
G08B 13/00 (2006.01)
- (21) International Application Number:
PCT/EP2011/053034
- (22) International Filing Date:
1 March 2011 (01.03.2011)
- (25) Filing Language: English
- (26) Publication Language: English
- (71) Applicant (for all designated States except US): **JOINT ANALYTICAL SYSTEMS GMBH** [DE/DE]; Carl-Zeiss-Straße 49, 47445 Moers (DE).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **GERSTEL, Joachim** [DE/DE]; Burgacker 17, 45475 Mülheim a.d. Ruhr (DE).
- (74) Agent: **WEISSE, Renate**; Bleibtreustr. 38, 10623 Berlin (DE).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- of inventorship (Rule 4.17(iv))

Published:

- with international search report (Art. 21(3))

(54) Title: SECURITY DEVICE FOR GAS CYLINDERS

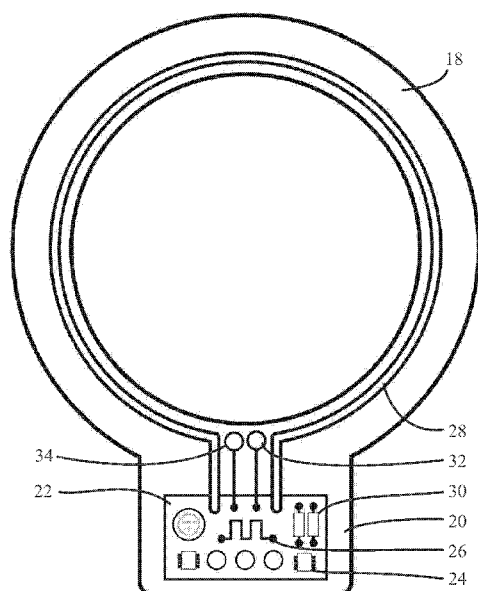


Fig. 5

(57) Abstract: A security device for gas cylinders or crates of gas cylinders, comprises a carrier adapted to be fixed to the gas cylinder or crate; a RFID-tag provided on said carrier having a storage for storing an expiry date or any other data regarding the durability of the gas contained in said gas cylinder; a processor for checking the durability; and a display indicating the durability and/or passing of the expiry date. The security device may have a closed electric circuit with a current- or voltage supply adapted to be switched off; and means for generating an optic-, acoustic- and/or wireless transmittable alarm signal upon disruption of the electric circuit.

5

Security Device for Gas Cylinders

10

Technical Field

The invention relates to a security device for gas cylinders. Gas cylinders are, in particular, metal containers containing, for example, pressurized technical gases or gas mixtures, such as noble gases, oxygen or hydrogen. The gases may serve as gas for calibration purposes. With such applications it is important to have a known consistency and purity. The consistency and the purity of the gases may change with time. Therefore, the gases contained in such gas cylinders have a limited durability, which may be expressed as an expiry date. Especially with expensive gases and gas mixtures there is a risk, that the gas cylinders are stolen.

20

Prior Art

It is known to fix an expiry date to gas cylinders in printed form. It is, however, disadvantageous that such an expiry date may easily be manipulated or removed.

25

Disclosure of the invention

It is an object of the invention to improve the security of gas cylinders. It is also an object of the invention to provide a security device for gas cylinders which shows the expiry date with higher security regarding manipulation or removal.

30

According to one aspect of the invention this object is achieved by a security device, comprising:

- (a) a carrier adapted to be fixed to the gas cylinder;
- 5 (b) a RFID-tag provided on said carrier having a storage for storing an expiry date or any other data regarding the durability of the gas contained in said gas cylinder;
- (c) a processor for checking the durability; and
- (d) a display indicating the durability and/or passing of the expiry date.

10 With such a device the expiry date is electronically stored. The display will indicate if the expiry date is exceeded. In such a way a manipulation of the expiry date is not easily possible. With the display it can be recognized at once if the expiry date is exceeded or not.

15 Preferably the carrier comprises an annular security strip adapted to be installed around the gas cylinder neck and means are provided for generating a signal upon removal of the security strip. This makes it difficult not only to manipulate the expiry date but also to remove the device. The signal can be generated in the form of an optical signal on the display. However, instead or additionally acoustic signals may be generated indicating
20 the removal of the security device. Further to optical and/or acoustic signals an alarm signal can be sent to a server with a reader by the RFID-tag upon removal or manipulation of the device.

In particular, means for removing stored data and/or destroying the RFID-Tag upon
25 removal of the security strip may be provided. Thereby it is avoided that a security device with a valid expiry date is fixed to a gas cylinder having an invalid expiry date. A manipulation of the expiry date by exchanging RFID-tags is, therefore, impossible.

In a particularly simple embodiment of the invention the display is an assembly of 1 to 3
30 LEDs having different colors and illuminated depending on the remaining durability. For example, three LEDs may be used having the colors red, yellow and green. Like a traffic light they can easily indicate the durability of the gas. Red means, that the expiry date has been exceeded. Green means, that the expiry date is not yet reached with sufficient time

difference. Yellow means that the expiry date will be reached in the near future. It is understood that obviously only one LED may be used instead of three LEDs, the one LED having the capability of illuminating with three different colors. Also, the yellow LED must not necessarily be used.

5

In a further modification of the invention the display generates a signal which is variable in time depending on the remaining durability. This enables also the display to be read by color-blind persons. The signal can be formed by flashing, for example. Simple flashes mean that there is a sufficient durability. Three flashes mean, that the expiry date has been exceeded. Two flashes mean, that the expiry date is reached in the near future. This embodiment is particularly useful if only one LED with different colors is used.

10

The security device may be provided with an internal clock or a receiver for receiving a clock signal. The clock may be a receiver for radio signals or other time signals, for example emitted in a WLAN (Wireless local area network).

15

In a further modification of the invention the RFID-tag is an active tag with its own energy supply, the RFID-tag frequently emitting a signal containing information about the durability of the gas, theft and/or manipulation. In particular, the RFID tag may be remote controlled. The signals may be received by a suitable receiver and evaluated. Thereby, logistics is facilitated. The data stored in the RFID tag may also be read out on demand by means of a reader and evaluated at a server.

20

For securing the gas cylinder against theft an acceleration sensor, a tilting sensor and/or an analog signal sensor such as a flow sensor or a pressure sensor may be provided. Movements which are not intended are indicated on the display or an alarm signal is emitted. If the gas cylinder is intended to be moved or any other handling of the gas cylinder is intended the sensors may be switched off. A temperature sensor may be provided in order to determine if the temperature is outside a given temperature range.

25

30

The invention also relates to a security device for gas cylinders which are characterized by

(a) a carrier adapted to be fixed to the gas cylinder or crate;

- (b) a RFID-tag provided on said carrier;
- (c) a processor;
- (d) a closed electric circuit with a current- or voltage supply adapted to be switched off; and
- 5 (e) means for generating an optic-, acoustic- and/or wireless transmittable alarm signal upon disruption of the electric circuit.

The carrier may comprise an annular security strip with a conductor, said conductor forming a portion of the closed electric circuit. If the security strip is cut or broken, as it
10 is the case when it is removed or tampered with, the circuit is interrupted. The signal generated thereby is converted to an alarm signal which may be, for example, wireless transmitted. The electric circuit may also extend through the gas cylinder by two electric contact points. The removal of the carrier is detected by the disruption of the contacts.

15 Further modifications of the invention are subject matter of the subclaims. An embodiment is described below in greater detail with reference to the accompanying drawings.

Brief description of the drawings

20

Fig.1 is a perspective view of the upper portion of a gas cylinder with a valve and a security strip.

Fig.2 is a side view of the assembly of figure 1.

25

Fig.3 is a cross sectional view of the assembly of figure 2.

Fig.4 is a top view of the security strip of the assembly of figure 1 with a miniboard.

30

Fig.5 is a cross sectional view of the security strip of figure 4.

Fig.6 is a perspective view of a gas cylinder with a security strip without a threaded collar.

Fig.7 shows the gas cylinder of figure 6 with a threaded collar where the security strip is clamped between the threaded collar and the shoulder of the gas cylinder and a key of a key and slot connection for securing the threaded collar.

Fig.8 shows the gas cylinder of figure 6 and 7 with a valve installed on the neck of the gas cylinder.

Fig.9 illustrates an alternative embodiment during screwing the security strip on the threaded collar of a gas cylinder.

Fig.10 shows the embodiment of figure 9 with a security strip and a cap readily screwed on.

Detailed description of a preferred embodiment

Figures 1 to 3 show a gas cylinder generally denoted with numeral 10. Such a gas cylinder is a pressurized container for transporting and storing gases and mixtures of gases. Typical gas cylinders have volumes of up to 150 litres. The gases may have a very high pressure of up to 300 bar. Depending on its content and the purity gas cylinders typically are made of alumina, stainless steel or tempered steel. The gases are used in the industrial production, in medical applications, for chemical and pharmaceutical purposes and in many other applications. For many applications it is important that the properties are known, such as content, composition, producer, production- and expiry date, purity, admitted application, storage position, storage temperature, required safety measures and the like. Furthermore, it is important to be able to track the gas cylinders and to prevent theft.

The gas cylinder 10 is provided with a neck 12. The neck 12 is an integrated portion of the gas cylinder 10. This can be seen in figure 6. A threaded collar 13 is mounted on the

neck 12. The threaded collar 13 has an outer thread. The threaded collar 13 is secured with a key 36 in an axial direction the key engaging in a corresponding slot. this can be seen in Figure 7. A valve 14 is inserted in the neck 12 which is used to take a desired amount of gas. With such an assembly the threaded collar may be replaced if the thread
5 of the threaded collar 13 is used up. A cap 16 shown, for example, in figures 2,3 and 10 secures the valve 14 in usual way by screwing the cap on the threaded collar.

An annular security strip 18 is positioned around the neck 12 on the shoulder of the gas cylinder 10. The security strip 18 is clamped between the lower edge of the threaded
10 collar 13 and the shoulder of the gas cylinder 10. The security strip 18 is separately shown in Figures 4 and 5.

In an alternative embodiment the security strip is provided with an inner thread. The security strip is then screwed onto the threaded collar 13 until it is positioned resting on
15 the shoulder of the gas cylinder 10. This is shown in the embodiment illustrated by Figures 9 and 10.

The security strip 18 consists of plastic material and has a tongue 20. A miniboard 22 with processors 24 is arranged on the tongue 20. The processors 24 serve to control the
20 functionality of the security device formed by the security strip 18 and the miniboard 22. An active RFID-tag 26 is provided on the miniboard 22. The RFID-tag stores information regarding content, composition, producer, production- and expiry date, purity, admitted applications, storage position, storage temperature, required safety precautions, and various codes. The RFID-tag 26 frequently emits such data. The
25 emitted signals are received by a server and evaluated. The data may also read out on demand by a reader or an emission may be triggered by a remote control.

A conductor 28 extends along the annular security strip 18. A weak electric power source
30 30 is provided on the miniboard 22. The electric power source is connected with the metal surface of the gas cylinder through two contacts 32 and 34. The coating of the gas cylinder is removed at the contact points 32 and 34. In such a way a closed electric circuit is formed through the gas cylinder 10 and the contacts 32 and 34 with the electric power source 30. If the security strip 18 is removed, by, for example, theft or for

manipulation purposes, the contacts 32 or 34 and thereby the electric circuit is interrupted. In this case, an alarm signal is generated and converted by the processors 24. The alarm signal is emitted by the RFID tag. It may be detected by a receiver thereby enabling to instantly take suitable measures for securing the gas cylinder. The conductor
5 28 also forms a closed electrical circuit. If this circuit is interrupted by, for example, cutting the security strip, this will cause an alarm in a similar way as with the first electric circuit.

A server with a reader is provided in the receiving range of the RFID-tag. The reader
10 serves to read out information on the RFID-tag. The RFID-tag frequently sends status information to the server. If the signal is missing or is interrupted an alarm is generated. Such signals may be missing due to defects, destruction or removal of the security device or the entire gas cylinder outside the reading range of the reader.

Three LEDs having the colors green, yellow and red are provided on the miniboard 22. It
15 is frequently checked by the processors 24 if the expiry date is reached. A clock is provided on the miniboard 22 for this purpose. If the expiry date is reached the red LED flashes. If the expiry date is reached in the near future, the yellow LED is illuminated. If the expiry date is in the far future, the green LED is illuminated.

20 The security device described above may easily store and provide any information relating to the gas cylinder. It enables quality control of the system during manufacturing. The gas cylinder can be tracked, found and secured with the RFID-tag in addition to having a display indicating the expiry date.

25 The embodiments were described above in great detail. It is, however, understood, that many variations and changes may be applied to the invention without deviating from the general idea of the underlying invention. The described details only serve for illustration purposes and are by no means meant to limit the scope of protection which is defined by
30 the appending claims only.

5

Claims

1. Security device for gas cylinders or crates of gas cylinders, comprising
 - (a) a carrier adapted to be fixed to the gas cylinder or crate;
 - (b) a RFID-tag provided on said carrier having a storage for storing an expiry
10 date or any other data regarding the durability of the gas contained in said gas cylinder;
 - (c) a processor for checking the durability; and
 - (d) a display indicating the durability and/or passing of the expiry date.
- 15 2. Security device according to claim 1, **characterized in that** the carrier comprises an annular security strip adapted to be installed around the gas cylinder neck and means are provided for generating a signal upon removal of the security strip.
- 20 3. Security device according to claim 2, **characterized by** means for removing stored data and/or destroying the RFID-Tag upon removal of the security strip.
- 25 4. Security device according to any of the preceding claims, **characterized in that** the display is formed by 1 to 3 LEDs shining with different colors depending on the remaining durability and/or passing of the expiry date.
5. Security device according to any of the preceding claims, **characterized in that** the display generates a signal which is variable in time depending on the remaining durability.
- 30 6. Security device according to any of the preceding claims, **characterized by** an internal clock or a receiver for receiving a clock signal.

7. Security device according to any of the preceding claims, **characterized in that** the RFID-tag is an active tag with its own energy supply, the RFID-tag frequently emitting a signal containing information about the durability of the gas, theft and/or manipulation.
- 5
8. Security device according to any of the preceding claims, **characterized in that** an acceleration sensor, a tilting sensor and/or an analog signal sensor such as a flow sensor or a pressure sensor and/or a temperature sensor is provided.
- 10
9. Security device for gas cylinders or crates of gas cylinders, **characterized by**
- (a) a carrier adapted to be fixed to the gas cylinder or crate;
 - (b) a RFID-tag provided on said carrier;
 - (c) a processor;
 - (d) a closed electric circuit with a current- or voltage supply adapted to be
 - 15 switched off; and
 - (e) means for generating an optic-, acoustic- and/or wireless transmittable alarm signal upon disruption of the electric circuit.
- 20
10. Security device for gas cylinders according to claim 9, **characterized in that** the carrier is an annular security strip with a conductor, said conductor forming a portion of the closed electric circuit.
- 25
11. Security device for gas cylinders according to claim 9 or 10, **characterized in that** the electric circuit extends through the gas cylinder by two electric contact points.
- 30
12. Method for securing gas cylinders against theft and/or manipulation, with the steps:
- (a) providing a RFID-tag
 - (b) storing information about the gas cylinder on said RFID-tag;
 - (c) frequently transmitting said stored information or portions thereof from said
 - RFID-tag to a remote server;
 - (d) generating an alarm signal at said remote server if said transmission is interrupted.

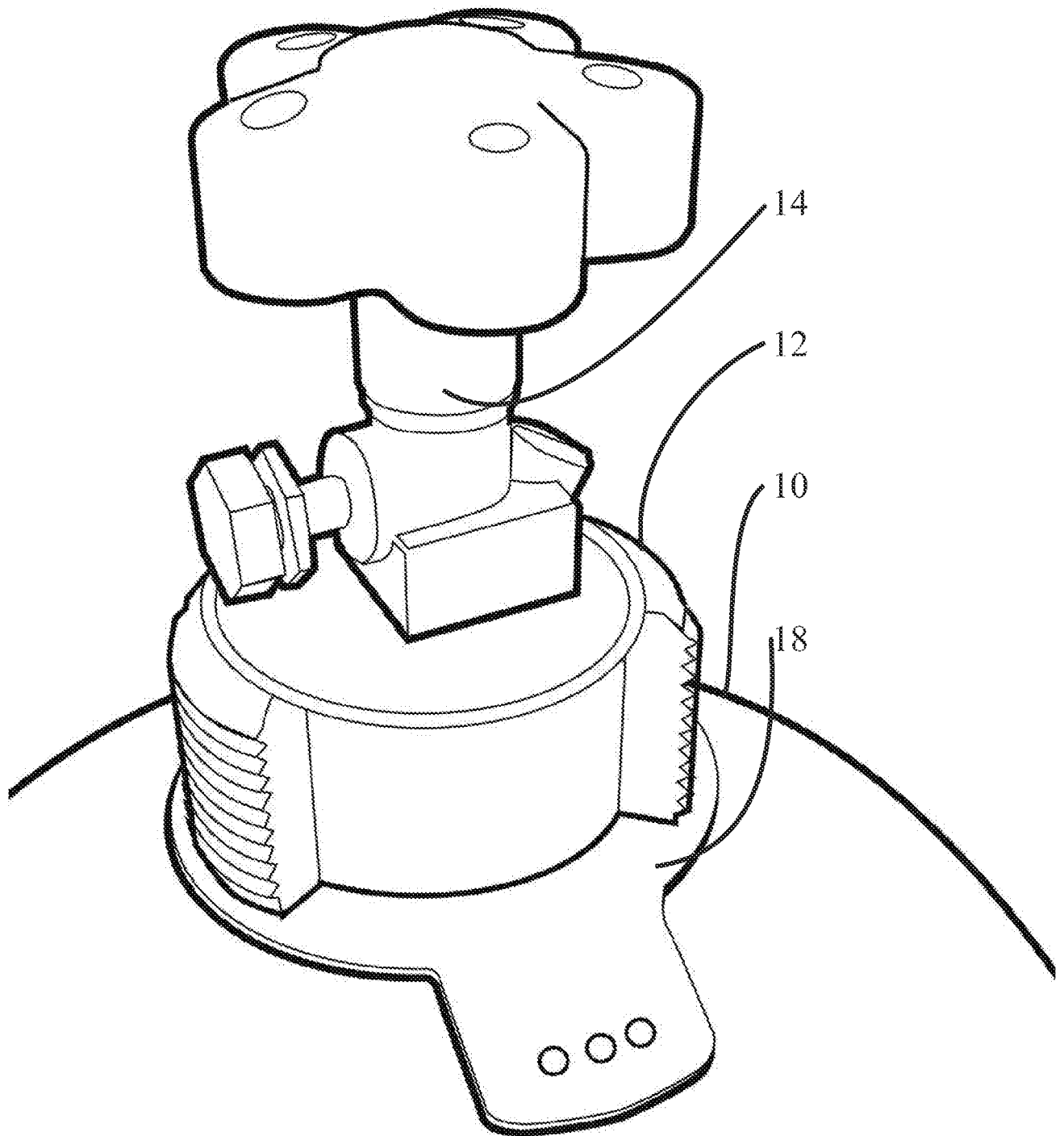


Fig. 1

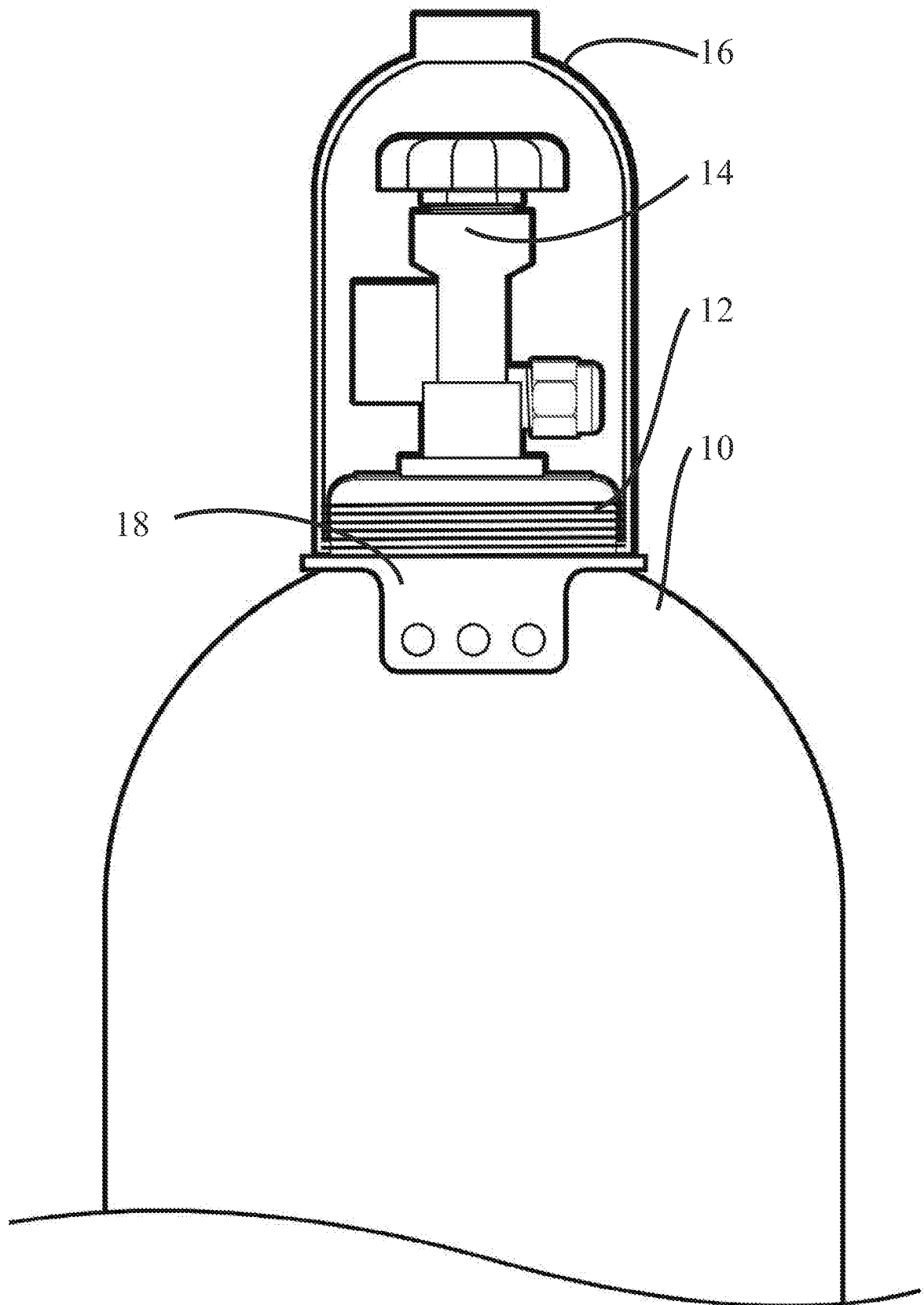


Fig. 2

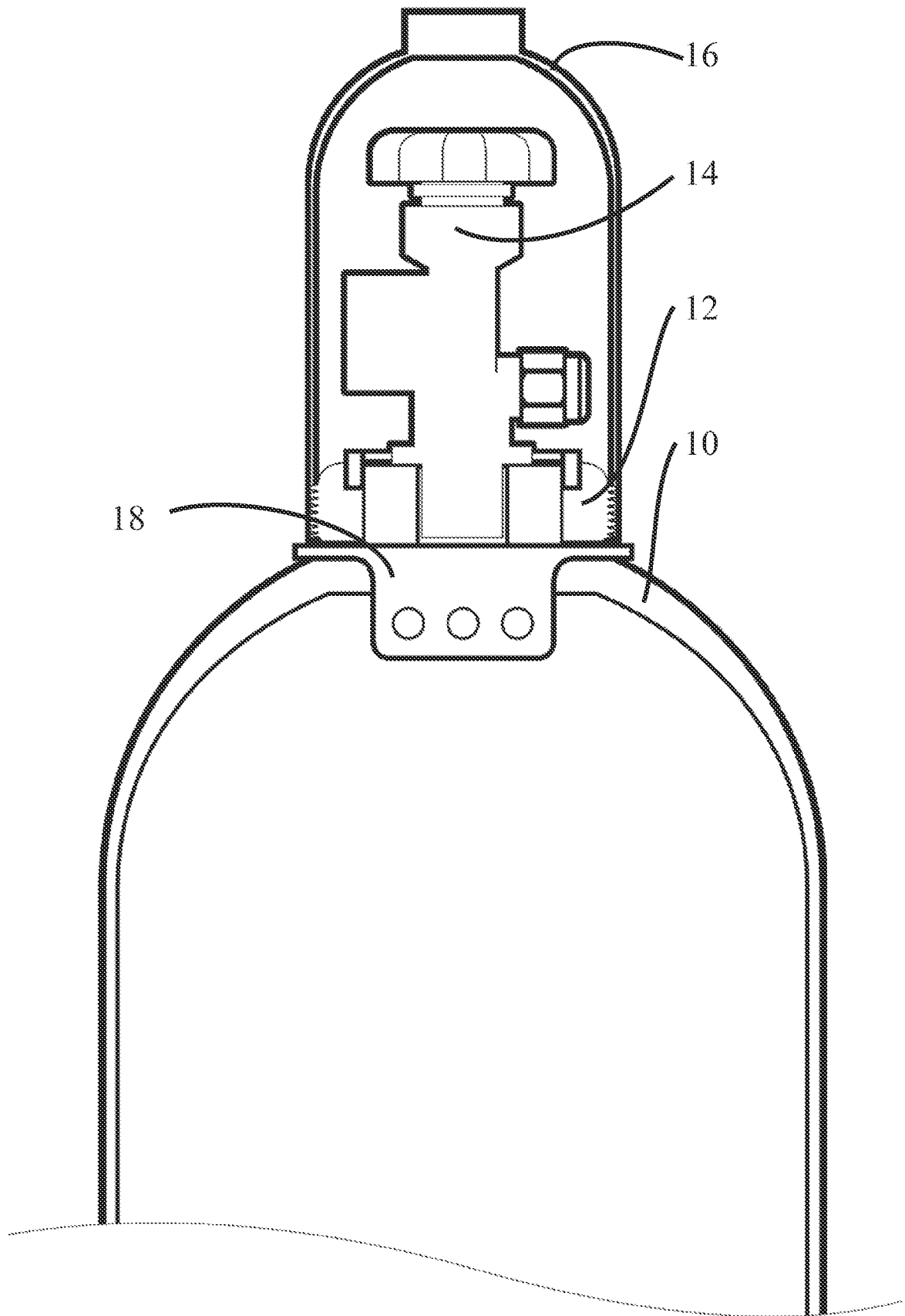


Fig. 3

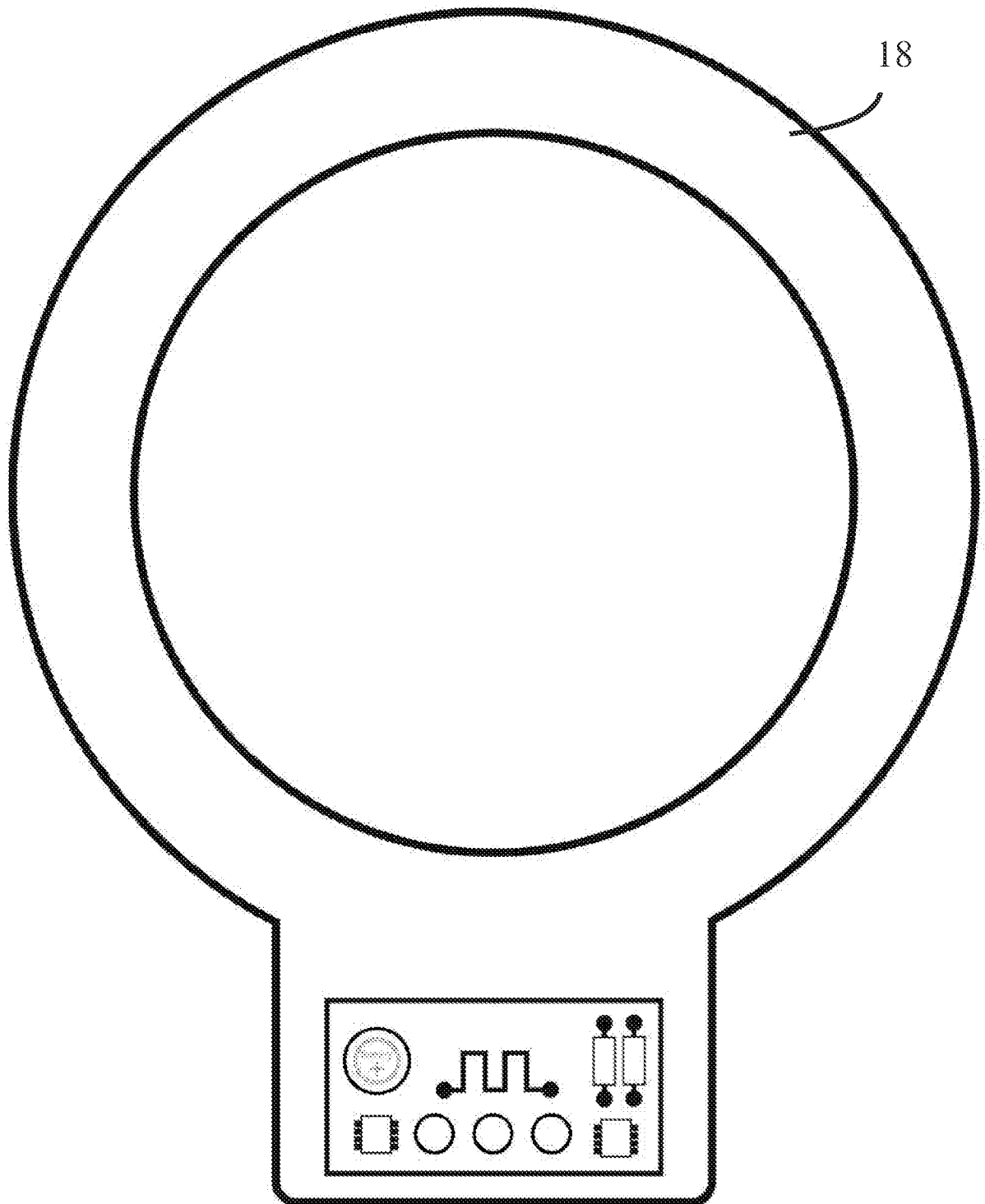


Fig. 4

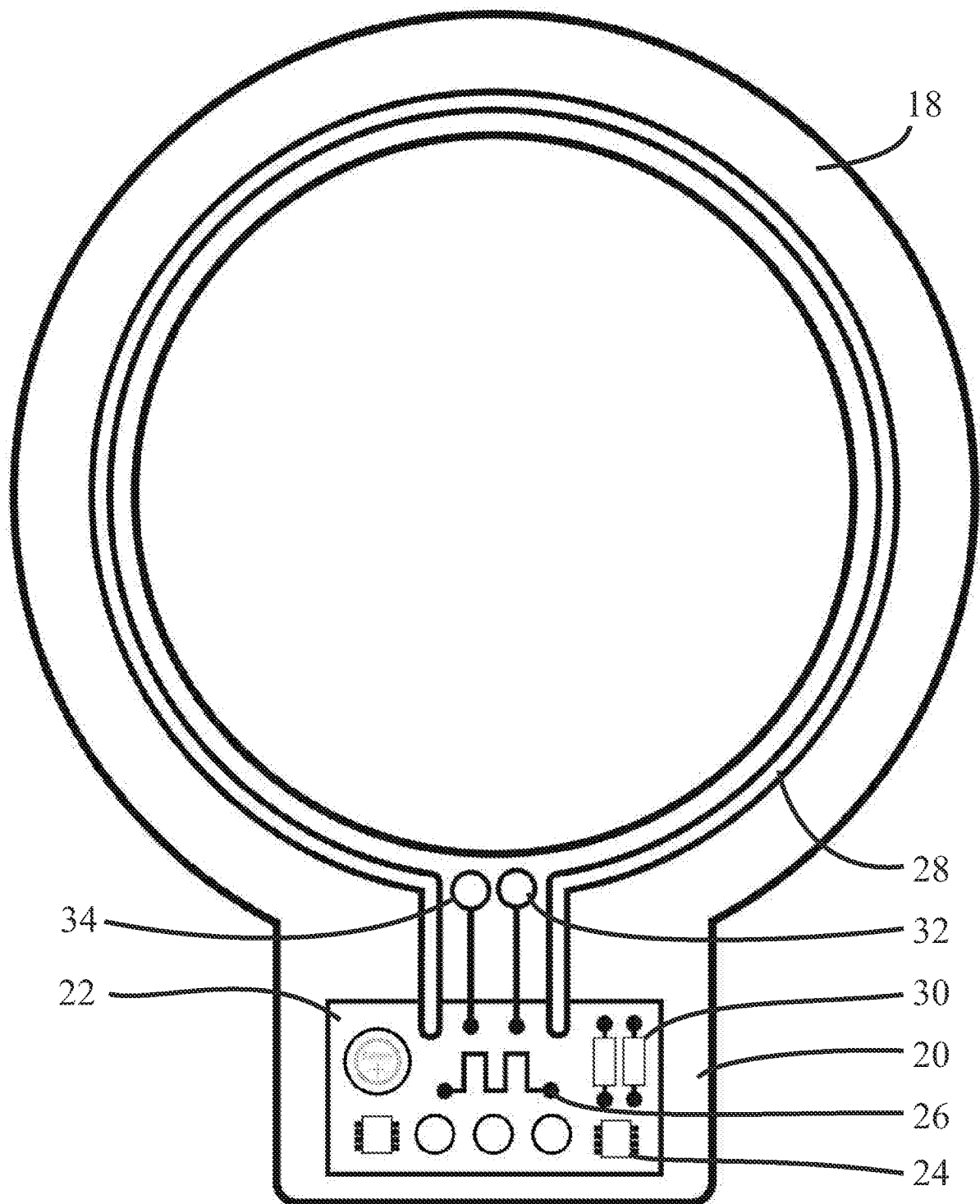


Fig. 5

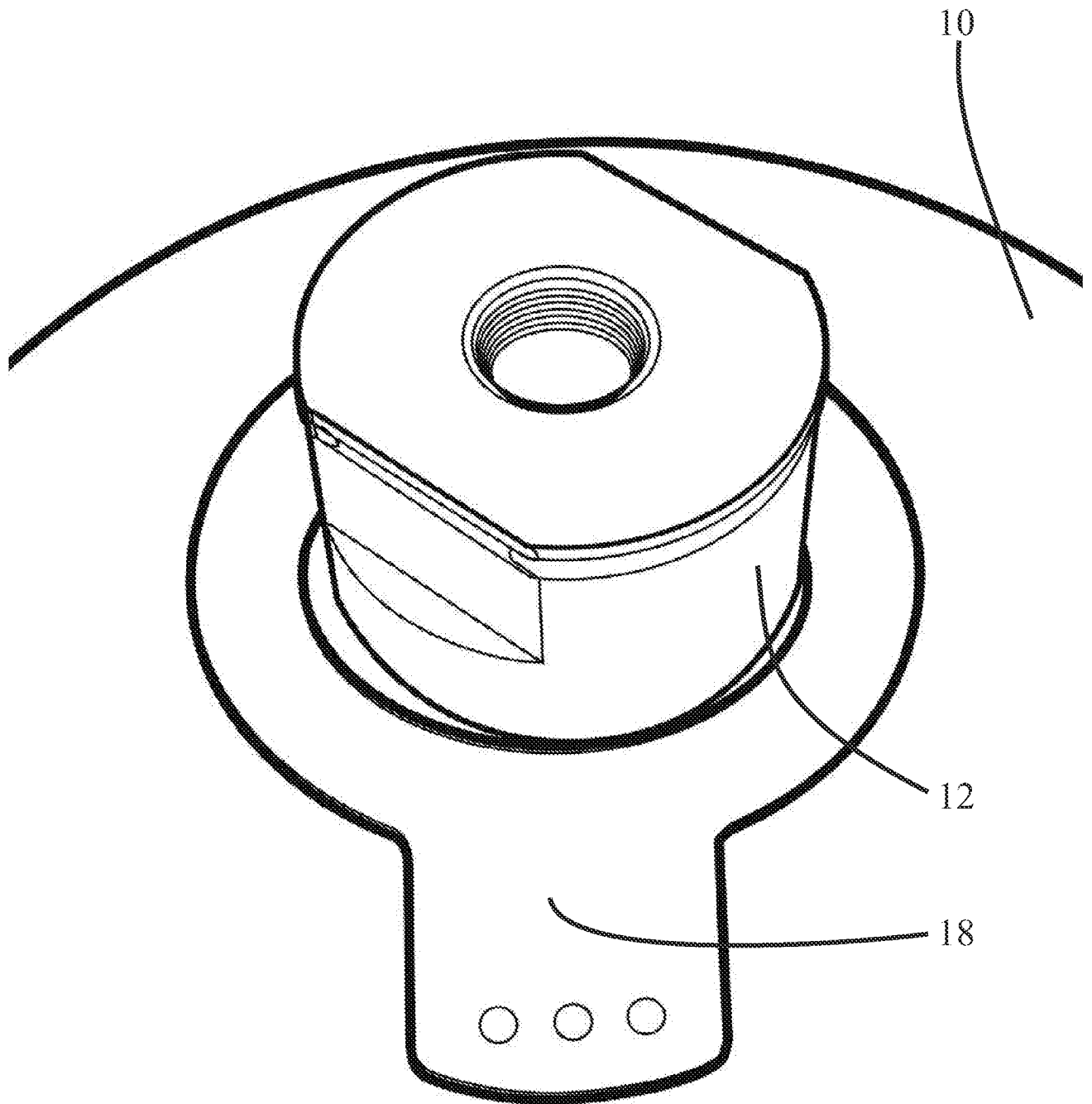


Fig. 6

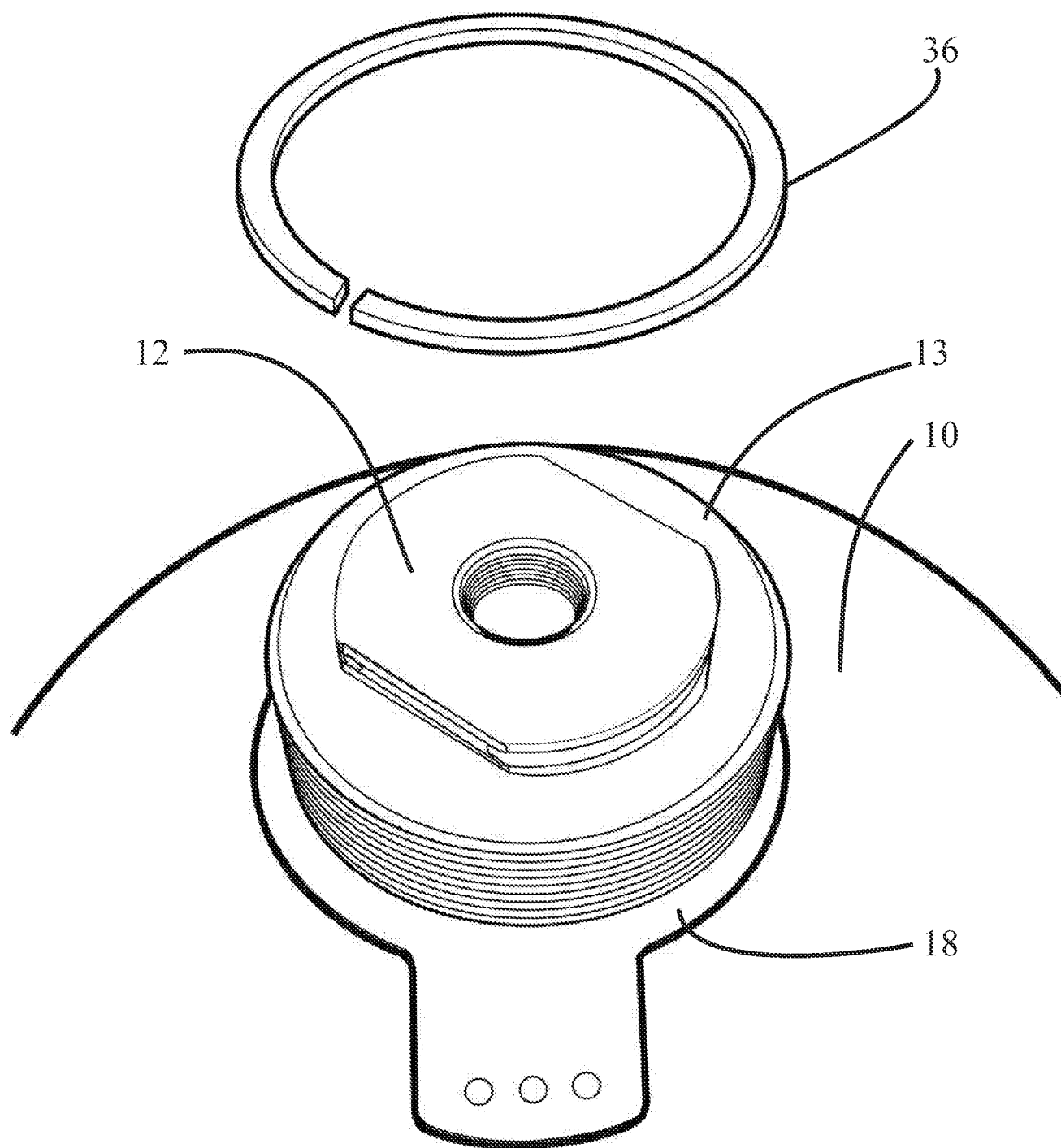


Fig. 7

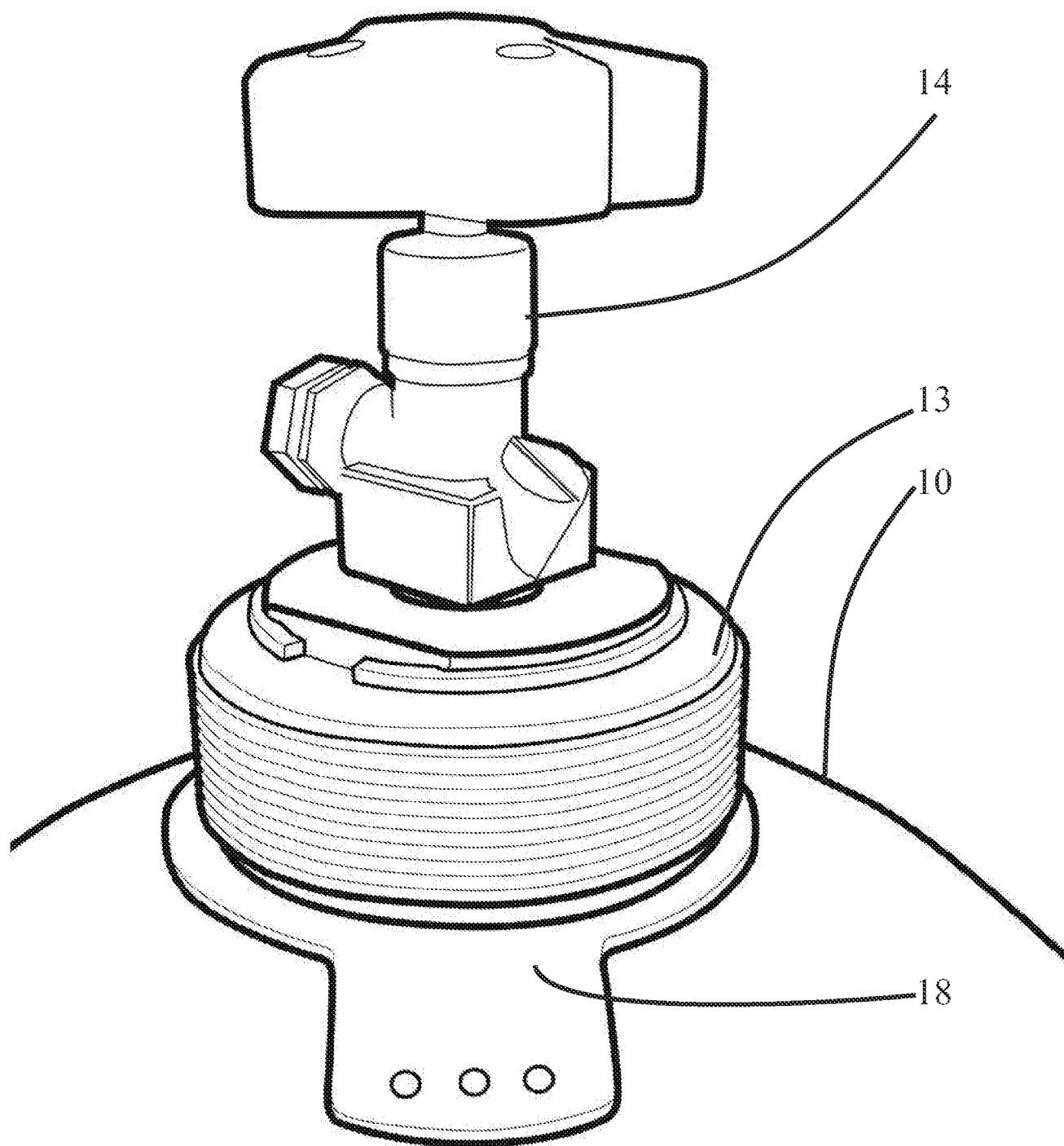


Fig. 8

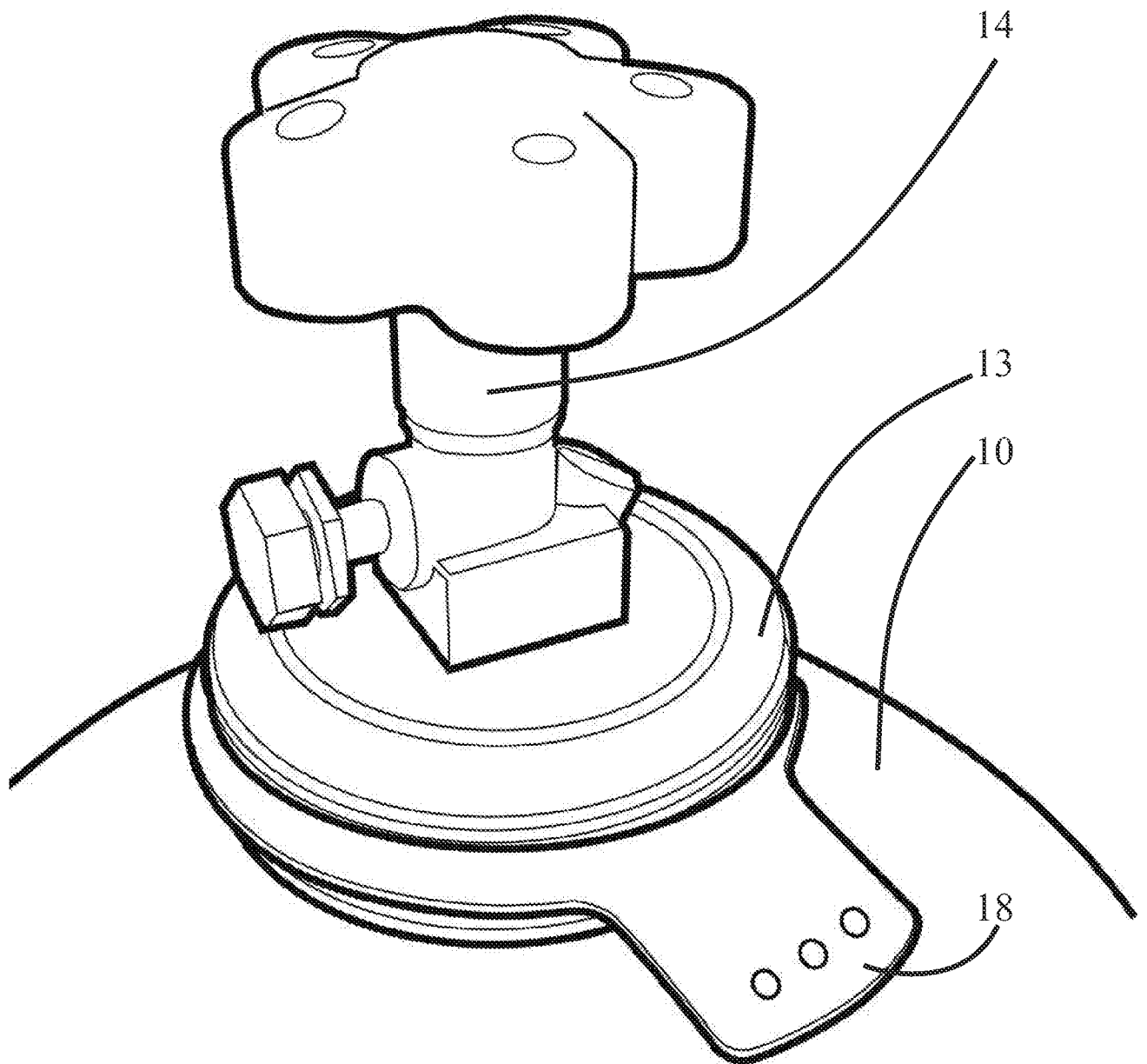


Fig. 9

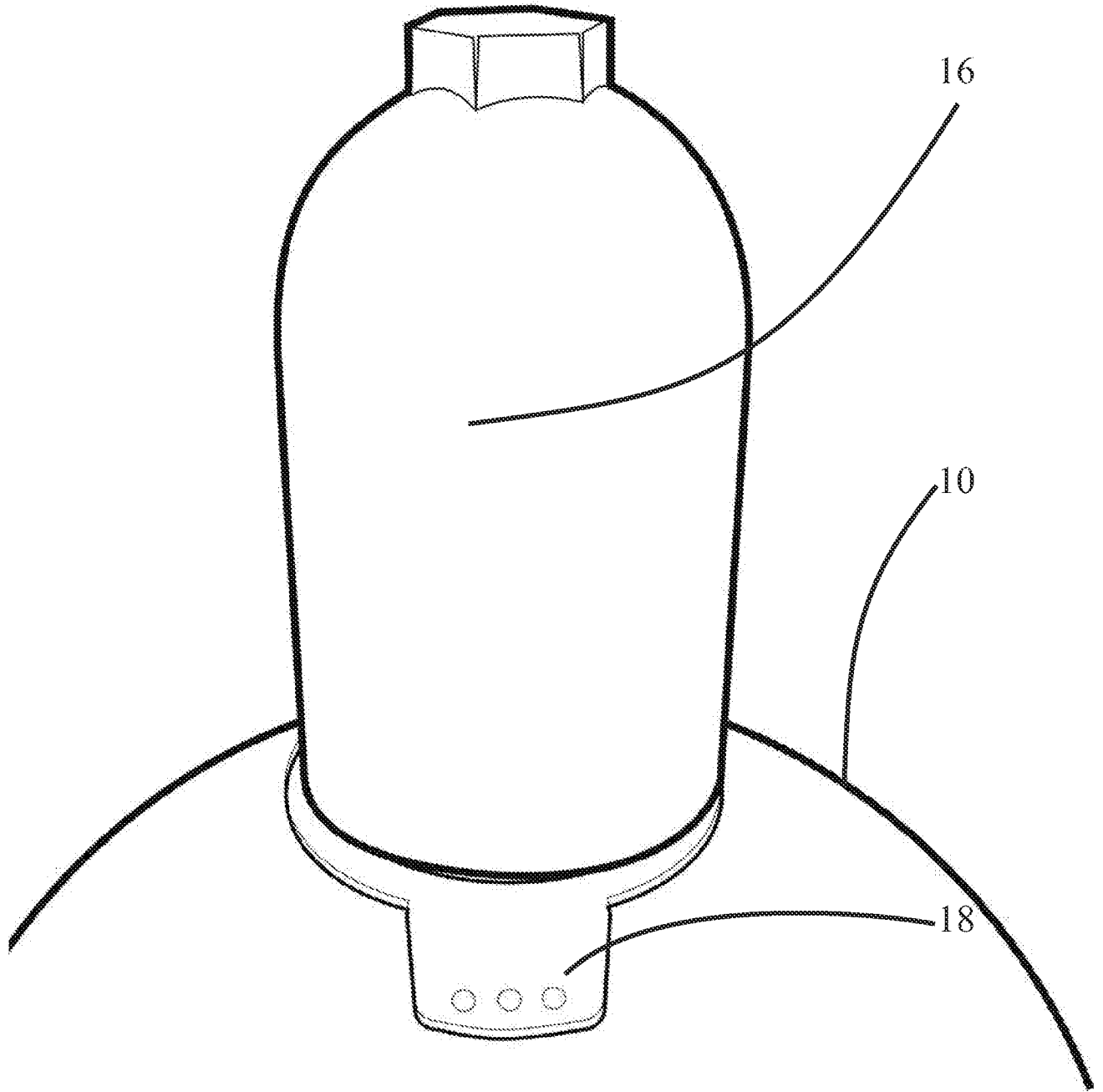


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/053034

A. CLASSIFICATION OF SUBJECT MATTER
INV. F17C13/00 G08B13/00 G08B25/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F17C G08B

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	FR 2 868 186 A1 (AIR LIQUIDE ELECTRONICS SYS [FR]) 30 September 2005 (2005-09-30) the whole document	1-5,7,8 6
X	----- US 2009/050630 A1 (IIDA YASUYUKI [JP] ET AL) 26 February 2009 (2009-02-26) the whole document paragraphs [0041], [0063], [0069]	1-8
X	----- US 2009/140867 A1 (YIN WEN CHENG [TW] ET AL) 4 June 2009 (2009-06-04) the whole document	1-5,7,8
X	----- US 2008/084306 A1 (DURTSCHI FRANCK-STEPHANE [US] ET AL) 10 April 2008 (2008-04-10) paragraphs [0033], [0043]; claims 7,8 ----- -/-	1-5,7,8



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

20 May 2011

Date of mailing of the international search report

06/06/2011

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Nicol, Boris

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/053034

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/030921 A1 (SCOTT TECH INC [US]) 18 March 2010 (2010-03-18) the whole document -----	1-8
X	US 2008/150739 A1 (GAMARD STEPHAN C F [US]) 26 June 2008 (2008-06-26) the whole document -----	1-8
X	DE 10 2008 058995 A1 (MESSER GROUP GMBH [DE]) 17 June 2010 (2010-06-17) the whole document -----	9-11
Y		9-11
Y	US 5 646 592 A (TUTTLE JOHN R [US]) 8 July 1997 (1997-07-08) the whole document -----	9-11
X	US 6 085 805 A (BATES BENJAMIN G [US]) 11 July 2000 (2000-07-11) the whole document -----	12
A	WO 2005/004258 A2 (ULTRACELL CORP [US]; KAYE IAN W [US]; KASCHMITTER JAMES L [US]) 13 January 2005 (2005-01-13) the whole document -----	12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2011/053034

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8

Security device comprising a display indicating the durability and/or passing of the expiry date.

2. claims: 9-11

Security device comprising a closed electric circuit with a current- or voltage supply adapted to be switched off, and means for generating an optic-, acoustic- and/or wireless transmittable alarm signal upon disruption of the electric circuit.

3. claim: 12

Method for securing gas cylinders against theft and/or manipulation, with the steps of providing a RFID-tag, storing information about the gas cylinder on said RFID-tag, frequently transmitting said stored information or portions thereof from said RFID-tag to a remote server, generating an alarm signal at said remote server if said transmission is interrupted.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/053034

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2868186	A1	30-09-2005	NONE
US 2009050630	A1	26-02-2009	CN 101156022 A 02-04-2008 DE 112006000829 T5 14-02-2008 JP 2006293521 A 26-10-2006 WO 2006109757 A1 19-10-2006
US 2009140867	A1	04-06-2009	NONE
US 2008084306	A1	10-04-2008	NONE
WO 2010030921	A1	18-03-2010	CA 2736375 A1 18-03-2010 US 2010065146 A1 18-03-2010
US 2008150739	A1	26-06-2008	NONE
DE 102008058995	A1	17-06-2010	NONE
US 5646592	A	08-07-1997	NONE
US 6085805	A	11-07-2000	US 6024142 A 15-02-2000
WO 2005004258	A2	13-01-2005	EP 1641671 A2 05-04-2006 US 2008169207 A1 17-07-2008 US 2005008908 A1 13-01-2005