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(54) **SYSTEMS AND METHODS FOR LEAK DETECTION AND REMOTE, NON-INTRUSIVE,
AUTOMATIC SHUTOFF IN RESIDENTIAL REGULATORS**

SYSTEME UND VERFAHREN ZUR LECKERKENNUNG UND ZUM FERNGESTEUERTEN,
NICHTINTRUSIVEN AUTOMATISCHEN ABSCHALTEN IN HEIMREGLERN

SYSTÈMES ET MÉTHODES DE DÉTECTION DE FUITE ET RÉGULATEURS D'HABITATION
D'ARRÊT AUTOMATIQUE À DISTANCE, ET DE FAÇON NON INTRUSIVE

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Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Indian Provisional Patent Application No. 201711032823 filed September 16, 2017 and titled "SYSTEMS AND METHODS FOR LPG LEAK DETECTION AND REMOTE, NON-INTRUSIVE, AUTOMATIC SHUTOFF IN RESIDENTIAL LPG REGULATORS."

FIELD

[0002] The present invention relates generally to regulators and leak detection. More particularly, the present invention relates to systems and methods for leak detection and remote, non-intrusive, automatic shutoff in residential regulators.

BACKGROUND

[0003] Millions of households use liquid petroleum gas (LPG) and other similar gas and liquid fuels for cooking and other applications. LPG is a clean fuel. Nevertheless, if a fuel leak in a home is not detected and controlled or rectified within a timely manner, then the fuel leak could lead to a safety hazard, including property loss or death of occupants in the home.

[0004] Some systems and methods for detecting such a leak and known in the art include a user output device, such as an annunciator (buzzer) or a light (LED), notifying an occupant of an ambient region about the leak. However, such systems and methods do not have connectivity outside of the ambient region. Accordingly, the occupant will not be notified about the leak if he is outside of the ambient region. Furthermore, such systems and methods prompt the occupant to manually turn off a regulator to control or rectify the leak, which is high risk, unsafe, and a fire hazard.

[0005] In view of the above, there is a continuing, ongoing need for improved systems and methods. Prior art documents related to the invention are patent documents US 4 629 157 A, US 2012/132838 A1 and US 2014/264111 A1. US 4 629 157 A is concerned with a shut-off device for valves of gas containers. US 2012/132838 A1 discloses a shut-off device for pipeline valves comprising a wireless transceiver for remote control. US 2014/264111 A1 discloses the concept of an automatic actuator apparatus for a manual valve wherein the control assembly is configured to ascertain the state (or position) of the valve (hard stop at closed, hard stop at full open).

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

FIG. 1 is a perspective view of a shutoff device in

accordance with disclosed embodiments;

FIG. 2 is a perspective view of a shutoff device coupled to or mounted on a fuel cylinder in accordance with disclosed embodiments;

FIG. 3 is front view of a shutoff device coupled to or mounted on a fuel cylinder in accordance with disclosed embodiments;

FIG. 4 is a top view of a shutoff device coupled to or mounted on a fuel cylinder in accordance with disclosed embodiments;

FIG. 5 is a top view of a shutoff device in accordance with disclosed embodiments;

FIG. 6 is a perspective view of a shutoff device in accordance with disclosed embodiments; and

FIG. 7 is a block diagram of a gateway module and a control module in accordance with disclosed embodiments.

DETAILED DESCRIPTION

[0007] Embodiments disclosed herein can include systems and methods for fuel leak detection and remote, non-intrusive, automatic shutoff in residential fuel regulators, such as LPG regulators. For example, in accordance with disclosed embodiments, a shutoff device can be coupled to or mounted on a regulator at an end of a cylinder or a supply container of LPG or other fuel, can detect a leak, and responsive thereto, can automatically shut off a valve of the regulator to stop the leak.

[0008] In some embodiments, the shutoff device disclosed herein can sense, detect, or determine a current position of a knob of the regulator that controls the valve. For example, the shutoff device can determine that the current position of the knob is indicative of the valve being on or open. Responsive thereto, responsive to detecting the leak, or responsive to receiving a control signal instructing the shutoff device to shut off the valve, the shutoff device can cause the knob to turn until the shutoff device senses, detects, or determines that the current position of the knob is indicative of the valve being off or closed.

[0009] The shutoff device disclosed herein includes a transceiver device for communicating with a remote device. The communication may take place via a mobile software application running on the remote device via the Internet or a local area network. Furthermore, in some embodiments, another device, for example, a sensor device, can detect the leak and transmit a detection signal to the remote device or the mobile software application. Responsive to the detection signal, the remote device or the mobile software application can transmit the control signal to the shutoff device, and responsive to the control signal, the shutoff device can shut off the valve to stop the leak. Additionally or alternatively, in some embodiments, the shutoff device can transmit a status report or an incident report to the remote device or the mobile software application identifying a status of the shutoff device or the regulator or identifying incidents of the leak being

detected or the valve being shut off to stop the leak.

[0010] In some embodiments, the shutoff device disclosed herein can be programmed to shut off the valve to prevent the fuel from being dispensed at a predetermined time. For example, in some embodiments, the shutoff device can be programmed to shut off the valve at a first predetermined time, for example, at night, and turn the valve back on at a second predetermined time, for example, in the morning, so that the fuel is not dispensed overnight. Additionally or alternatively, in some embodiments, the shutoff device can be programmed to shut off the valve when an occupant of an ambient region is scheduled to or is leaving the ambient region. In some embodiments, the shutoff device can be programmed via the mobile software application in communication with the shutoff device.

[0011] FIG. 1 is a perspective view of the shutoff device 20 in accordance with disclosed embodiments, FIG. 5 is a top view of the shutoff device 20 in accordance with disclosed embodiments, and FIG. 6 is a side view of the shutoff device 20 in accordance with disclosed embodiments. As seen in FIG. 1, FIG. 5, and FIG. 6, the shutoff device 20 can include an actuator 22, a mounting bracket 24, and a linking device 26.

[0012] FIG. 2 is a perspective view of the shutoff device 20 coupled to or mounted on a fuel storage container 28 in accordance with disclosed embodiments, FIG. 3 is a front view of the shutoff device 20 coupled to or mounted on the fuel storage container 28 in accordance with disclosed embodiments, and FIG. 4 is a top view of the shutoff device 20 coupled to or mounted on the fuel storage container 28 in accordance with disclosed embodiments. As seen in FIG. 2, FIG. 3, and FIG. 4, the fuel storage container 28 can include a cylinder 30 at one end thereof, a regulator 32, a valve 34 of the regulator 32, and a knob 33 of the valve 34. The shutoff device 20 can be mounted to the cylinder 30 via the mounting bracket 24 to physically support the shutoff device 20 proximate the regulator 32, and the shutoff device 20 can be coupled to the valve 34 via the linking device 26 and the knob 33. When activated, the actuator 22 can cause the linking device 26 to rotate, which rotate the knob 33 until the shutoff device 20 senses, detects, or determines that a current position of the knob 33 has moved from a first (open) position indicative of the valve 34 being on to a second (closed) position indicative of the valve 34 being off.

[0013] FIG. 7 is a block diagram of a control module 36 of a gateway module 46 in accordance with disclosed embodiments. For example, in some embodiments, the control module 36 can be part of the shutoff device 20, and in some embodiments, the control module 36 can be part of the actuator 22. As seen in FIG. 7, the control module 36 can include a wireless communications module 38, a motor block 40, a position sensor 42, and control circuits 44. In some embodiments, the wireless communications module 38 can include a Bluetooth low energy device, and the control circuits 44 can be integrated therewith. The wireless communications module 38 can

receive a control signal, and responsive thereto, the control circuits 44 can activate components of the motor block 37, for example, a motor driver and a stepper motor, to rotate the linking device 26 to rotate the knob 33 to move the valve 34 from the first (open) position to the second (off) position. For example, in some embodiments, the position sensor 42 can determine that a current position of the valve 33 is indicative of the first (open) position and, responsive thereto, can transmit the control signal to the control circuits 44.

[0014] As seen in FIG. 7, the gateway module 46 can be separate and/or remote from the control module 36 and can include a sensor block 48, a wireless communications module 50 that communicates via a first wireless communications medium, control circuits 51, and a wireless communications module 52 that communicates via a second wireless communications medium that is different from the first wireless communications medium. For example, in some embodiments, the wireless communications module 50 can include a Bluetooth low energy device that communicates via Bluetooth, and the wireless communications module 52 can include a Wi-Fi device that communicates via Wi-Fi. The sensor block 48 can include sensor components known in the art for detecting a fuel leak. Accordingly, in some embodiments, responsive to the sensor block 48 detecting the fuel leak, the control circuits 51 can transmit the control signal to the control module 36 via the wireless communications module 50 and the wireless communications module 38. Additionally or alternatively, responsive to the sensor block 48 detecting the fuel leak, the control circuits 51 can transmit a detection signal to a remote device via the wireless communications module 52 and a first wireless communications module of the remote device. In some embodiments, the remote device can transmit the control signal to the control module 36 via the wireless communications module 38 and a second wireless communications module of the remote device that uses a wireless communications medium compatible with the wireless communications module 38. Additionally or alternatively, in some embodiments, the remote device can transmit the control signal to the gateway module 46 via the wireless communications module 52 and the first wireless communications module of the remote device and the control circuits 51 can forward the control signal to the control module 36 via the wireless communications module 50 and the wireless communications module 38.

[0015] Although a few embodiments have been described in detail above, other modifications are possible. For example, the logic flows described above do not require the particular order described or sequential order to achieve desirable results. Other steps may be provided, steps may be eliminated from the described flows, and other components may be added to or removed from the described systems. Other embodiments may be within the scope of the invention.

Claims

1. A shutoff device (20) comprising:

a mounting bracket (24) that mounts on a fuel storage container (28), **characterized in that** it comprises;
 a linking device (26) that couples to a knob (33) of a valve (34) of a regulator (32) of the fuel storage container (28);
 a first wireless communications module (50) that communicates via a first wireless communications medium for receiving the control signal and a second wireless communications module (52) that communicates via a second wireless communications medium that is different from the first communications medium; and
 an actuator (22), responsive to a control signal, that automatically rotates the linking device (26), which rotates the knob (33), which rotates the valve (34) from an on to an off position;
 wherein the first wireless communication module (50) is configured to receive the control signal from a remote device and transmitting the control signal to the actuator (22); and
 the second wireless communications module (52) is configured to transmit a status report to the remote device.

2. The shutoff device (20) of claim 1 further comprising: a position sensor (42) that determines whether a current position of the valve (34) is indicative of the on position and, responsive thereto, transmits the control signal to the actuator (22).

3. The shutoff device (20) of claim 1 or claim 2 further comprising: the first wireless communications module (50) for receiving the control signal from a gateway module (46) and transmitting the control signal to the actuator (22).

4. The shutoff device (20) of claim 3 wherein the gateway module (46) includes: a leak sensor for detecting a presence of a fuel leak, such as from fuel contained in the fuel storage container (28) and; the second wireless communications module (52) for, responsive thereto, transmitting the control signal to the first wireless communications module (50).

5. The shutoff device (20) of claim 4 wherein the first wireless communications module (50) includes a first Bluetooth low energy device and the second wireless communications module (52) includes a second Bluetooth low energy device.

6. The shutoff device (20) of claim 1 wherein the remote device includes the second wireless communica-

tions module (52) and a third wireless communications module (38), receives a detection signal via the second wireless communications module (52) responsive to a leak sensor detecting a presence of a fuel leak, and responsive to the detection signal, transmits the control signal to the first wireless communications module (50) via the third wireless communications module (38).

7. The shutoff device (20) of claim 6 wherein the first wireless communications module (50) includes a first Bluetooth low energy device, the second wireless communications module (50) includes a Wi-Fi device, and the third wireless communications module (38) includes a second Bluetooth low energy device.

8. The shutoff device (20) of any of claims 1 to 7 further comprising: a processor for transmitting the control signal to the actuator (22) at a predetermined time.

9. A method comprising:

mounting a mounting bracket (24) of a shutoff device (20) on a fuel storage container (28), **characterized in that** it comprises;
 coupling a linking device (26) of the shutoff device (20) to a knob (33) of a valve (34) of a regulator (32) of the fuel storage container (28);
 communicating a control signal via a first wireless communications module (50) in the shutoff device that communicates via a first wireless communications medium wherein the first wireless communications medium is different than a second wireless communications medium in the shutoff device communicating via a second wireless communications module (52); and
 responsive to a control signal, an actuator (22) of the shutoff automatically rotating the linking device (26), which rotates the knob (33), which rotates the valve (34) from an on position to an off position.

10. The method of claim 9 further comprising: a position sensor (42) of the shutoff device (20) determining whether a current position of the valve (34) is indicative of the on position and, responsive thereto, transmitting the control signal to the actuator (22).

11. The method of claim 9 or claim 10 further comprising: the first wireless communications module (50) of the shutoff device receiving the control signal from a gateway module (46) and transmitting the control signal to the actuator (22).

12. The method of claim 11 further comprising:

a leak sensor of the gateway module detecting a presence of a fuel leak, such as from fuel in the fuel storage container (28); and responsive to the leak sensor detecting the presence of the fuel leak, the second wireless communications module (52) of the gateway module (46) transmitting the control signal to the first wireless communications module (50).

13. The method of claim 12 wherein the first wireless communications module (50) includes a first Bluetooth low energy device and the second wireless communications module (52) includes a second Bluetooth low energy device.

Patentansprüche

1. Absperrvorrichtung (20), umfassend:

eine Montagehalterung (24), die an einem Brennstoff-Vorratsbehälter (28) angebracht ist, **dadurch gekennzeichnet, dass** sie Folgendes umfasst;

eine Verbindungsvorrichtung (26), die an einen Knopf (33) eines Ventils (34) an einem Regler (32) des Brennstoff-Vorratsbehälters (28) gekoppelt ist;

ein erstes drahtloses Kommunikationsmodul (50), das über ein erstes drahtloses Kommunikationsmedium zum Empfang des Steuersignals kommuniziert, und ein zweites drahtloses Kommunikationsmodul (52), das über ein zweites drahtloses Kommunikationsmedium kommuniziert, das sich vom ersten Kommunikationsmedium unterscheidet; und

einen Aktuator (22), der auf ein Steuersignal anspricht und automatisch die Verbindungsvorrichtung (26) dreht, welche den Knopf (33) dreht, der das Ventil (34) von einer Einschalt- in eine Ausschaltposition dreht;

wobei das erste drahtlose Kommunikationsmodul (50) konfiguriert ist, um das Steuersignal von einer entfernten Vorrichtung zu empfangen und das Steuersignal an den Aktuator (22) zu senden; und wobei

das zweite drahtlose Kommunikationsmodul (52) konfiguriert ist, um einen Statusbericht an die entfernte Vorrichtung zu senden.

2. Absperrvorrichtung (20) nach Anspruch 1, ferner umfassend:

einen Positionssensor (42), der bestimmt, ob eine aktuelle Position des Ventils (34) die Einschaltposition anzeigt, und ansprechend darauf das Steuersignal an den Aktuator (22) sendet.

3. Absperrvorrichtung (20) nach Anspruch 1 oder 2, fer-

ner umfassend:

das erste drahtlose Kommunikationsmodul (50) zum Empfang des Steuersignals von einem Gateway-Modul (46) und zum Senden des Steuersignals an den Aktuator (22).

4. Absperrvorrichtung (20) nach Anspruch 3, wobei das Gateway-Modul (46) Folgendes beinhaltet: einen Lecksensor zum Erfassen des Vorhandenseins eines Brennstofflecks, beispielsweise eines Lecks von Brennstoff, der im Brennstoff-Vorratsbehälter (28) enthalten ist, und; das zweite drahtlose Kommunikationsmodul (52), das als Reaktion darauf das Steuersignal an das erste drahtlose Kommunikationsmodul (50) sendet.

5. Absperrvorrichtung (20) nach Anspruch 4, wobei das erste drahtlose Kommunikationsmodul (50) eine erste Bluetooth-Niedrigenergie-Vorrichtung beinhaltet und das zweite drahtlose Kommunikationsmodul (52) eine zweite Bluetooth-Niedrigenergie-Vorrichtung beinhaltet.

6. Absperrvorrichtung (20) nach Anspruch 1, wobei die entfernte Vorrichtung das zweite drahtlose Kommunikationsmodul (52) und ein drittes drahtloses Kommunikationsmodul (38) beinhaltet, ein Erfassungssignal über das zweite drahtlose Kommunikationsmodul (52) empfängt, das auf einen Lecksensor anspricht, welcher ein Vorhandensein eines Brennstofflecks erfasst, und das auf das Erfassungssignal anspricht und das Steuersignal über das dritte drahtlose Kommunikationsmodul (38) an das erste drahtlose Kommunikationsmodul (50) sendet.

7. Absperrvorrichtung (20) nach Anspruch 6, wobei das erste drahtlose Kommunikationsmodul (50) eine erste Bluetooth-Niedrigenergie-Vorrichtung beinhaltet, das zweite drahtlose Kommunikationsmodul (50), eine WLAN-Vorrichtung beinhaltet und das dritte drahtlose Kommunikationsmodul (38) eine zweite Bluetooth-Niedrigenergie-Vorrichtung beinhaltet.

8. Absperrvorrichtung (20) nach einem der Ansprüche 1 bis 7, ferner umfassend: einen Prozessor zum Senden des Steuersignals an den Aktuator (22) zu einem vorbestimmten Zeitpunkt.

9. Verfahren, Folgendes umfassend:

Anbringen einer Montagehalterung (24) einer Absperrvorrichtung (20) an einem Brennstoff-Vorratsbehälter (28), **gekennzeichnet dadurch, dass** sie Folgendes umfasst; Koppeln einer Verbindungsvorrichtung (26) der Absperrvorrichtung (20) an einen Knopf (33) eines Ventils (34) an einem Regler (32) des

- Brennstoff-Vorratsbehälters (28);
Mitteilen eines Steuersignals über ein erstes drahtloses Kommunikationsmodul (50) in der Absperrvorrichtung, das über ein erstes drahtloses Kommunikationsmedium kommuniziert, wobei sich das erste drahtlose Kommunikationsmedium von einem zweiten drahtlosen Kommunikationsmedium in der Absperrvorrichtung unterscheidet, das über ein zweites drahtloses Kommunikationsmodul kommuniziert (52); und ansprechend auf ein Steuersignal, dreht ein Aktuator (22) der Abschaltung automatisch die Verbindungsvorrichtung (26), die den Knopf (33) dreht, welcher das Ventil (34) von einer Einschalt- in eine Ausschaltposition dreht.
10. Verfahren nach Anspruch 9, ferner umfassend:
einen Positionssensor (42) der Absperrvorrichtung (20), der bestimmt, ob eine aktuelle Position des Ventils (34) die Einschaltposition anzeigt, und ansprechend darauf das Steuersignal an den Aktuator (22) sendet.
11. Verfahren nach Anspruch 9 oder 10, das ferner Folgendes umfasst:
das erste drahtlose Kommunikationsmodul (50) der Absperrvorrichtung, welches das Steuersignal von einem Gateway-Modul (46) empfängt und das Steuersignal an den Aktuator (22) sendet.
12. Verfahren nach Anspruch 11, ferner umfassend:
einen Lecksensor des Gateway-Moduls, der das Vorhandensein von Brennstofflecks erfasst, beispielsweise Lecks von Brennstoff im Brennstoff-Vorratsbehälter (28); und
das zweite drahtlose Kommunikationsmodul (52) des Gateway-Moduls (46), das ansprechend auf den Lecksensor, der ein Vorhandensein eines Brennstofflecks erkennt, das Steuersignal an das erste drahtlose Kommunikationsmodul (50) sendet.
13. Verfahren nach Anspruch 12, wobei das erste drahtlose Kommunikationsmodul (50) eine erste Bluetooth-Niedrigenergie-Vorrichtung beinhaltet und das zweite drahtlose Kommunikationsmodul (52) eine zweite Bluetooth-Niedrigenergie-Vorrichtung beinhaltet.
- Revendications**
1. Dispositif d'arrêt (20) comprenant :
un support de montage (24) qui se monte sur un réservoir de stockage de carburant (28), **caractérisé en ce qu'il** comprend :
- un dispositif de liaison (26) qui se couple à un bouton (33) d'une soupape (34) d'un régulateur (32) du réservoir de stockage de carburant (28) ;
un premier module de communication sans fil (50) qui communique via un premier support de communication sans fil pour recevoir le signal de commande, et un deuxième module de communication sans fil (52) qui communique via un second support de communication sans fil, différent du premier support de communication ; et
un actionneur (22), sensible à un signal de commande, qui fait tourner automatiquement le dispositif de liaison (26), qui fait tourner le bouton (33), qui fait tourner la soupape (34) d'une position ouverte à une position fermée ;
dans lequel le premier module de communication sans fil (50) est configuré pour recevoir le signal de commande d'un dispositif distant et pour transmettre le signal de commande à l'actionneur (22) ; et
le deuxième module de communication sans fil (52) est configuré pour transmettre un rapport d'état au dispositif distant.
2. Dispositif d'arrêt (20) selon la revendication 1, comprenant en outre :
un capteur de position (42) qui détermine si une position actuelle de la soupape (34) indique la position ouverte et qui, en conséquence, transmet le signal de commande à l'actionneur (22).
3. Dispositif d'arrêt (20) selon la revendication 1 ou la revendication 2, comprenant en outre :
le premier module de communication sans fil (50) pour recevoir le signal de commande d'un module de passerelle (46) et pour transmettre le signal de commande à l'actionneur (22).
4. Dispositif d'arrêt (20) selon la revendication 3, dans lequel le module de passerelle (46) comprend : un capteur de fuite permettant de détecter la présence d'une fuite de carburant, par exemple du carburant contenu dans le réservoir de stockage de carburant (28) ; et le deuxième module de communication sans fil (52) pour, en conséquence, transmettre le signal de commande au premier module de communication sans fil (50).
5. Dispositif d'arrêt (20) selon la revendication 4, dans lequel le premier module de communication sans fil (50) comprend un premier dispositif Bluetooth basse consommation et le deuxième module de communication sans fil (52) comprend un second dispositif Bluetooth basse consommation.
6. Dispositif d'arrêt (20) selon la revendication 1, dans lequel le dispositif distant comprend le deuxième module de communication sans fil (52) et un troisième

module de communication sans fil (38), reçoit un signal de détection via le deuxième module de communication sans fil (52) en réponse à la détection de la présence d'une fuite de carburant par un capteur de fuite et en réponse au signal de détection, transmet le signal de commande au premier module de communication sans fil (50) via le troisième module de communication sans fil (38).

7. Dispositif d'arrêt (20) selon la revendication 6, dans lequel le premier module de communication sans fil (50) comprend un premier dispositif Bluetooth à basse consommation, le deuxième module de communication sans fil (50) comprend un dispositif Wi-Fi et le troisième module de communication sans fil (38) comprend un second appareil Bluetooth basse consommation.

8. Dispositif d'arrêt (20) selon l'une quelconque des revendications 1 à 7 comprenant en outre : un processeur permettant de transmettre le signal de commande à l'actionneur (22) à un instant prédéfini.

9. Procédé comprenant : le montage d'un support de montage (24) d'un dispositif d'arrêt (20) sur un réservoir de stockage de carburant (28), **caractérisé en ce qu'il** comprend :

le couplage d'un dispositif de liaison (26) du dispositif d'arrêt (20) à un bouton (33) d'une soupape (34) d'un régulateur (32) du réservoir de stockage de carburant (28) ;

la communication d'un signal de commande via un premier module de communication sans fil (50) dans le dispositif d'arrêt qui communique via un premier support de communication sans fil, le premier support de communication sans fil étant différent d'un second support de communication sans fil dans le dispositif d'arrêt communiquant via un deuxième module de communication sans fil (52) ; et

en réponse à un signal de commande, un actionneur (22) de l'arrêt fait tourner automatiquement le dispositif de liaison (26), qui fait tourner le bouton (33), qui fait tourner la soupape (34) d'une position ouverte à une position fermée.

10. Procédé selon la revendication 9 comprenant en outre :

un capteur de position (42) du dispositif d'arrêt (20) déterminant si une position actuelle de la soupape (34) indique la position ouverte et, en conséquence, transmet le signal de commande à l'actionneur (22).

11. Procédé selon la revendication 9 ou 10, comprenant en outre : la réception, par le premier module de communi-

tion sans fil (50) du dispositif d'arrêt, du signal de commande d'un module de passerelle (46) et la transmission du signal de commande à l'actionneur (22).

12. Procédé selon la revendication 11 comprenant en outre :

un capteur de fuite du module de passerelle détectant la présence d'une fuite de carburant, par exemple du carburant dans le réservoir de stockage de carburant (28) ; et en réponse à la détection par le capteur de fuite de la présence de la fuite de carburant, la transmission du signal de commande au premier module de communication sans fil (50) par le deuxième module de communication sans fil (52) du module de passerelle (46).

13. Procédé selon la revendication 12, dans lequel le premier module de communication sans fil (50) comprend un premier dispositif Bluetooth basse consommation et le deuxième module de communication sans fil (52) comprend un second dispositif Bluetooth basse consommation.

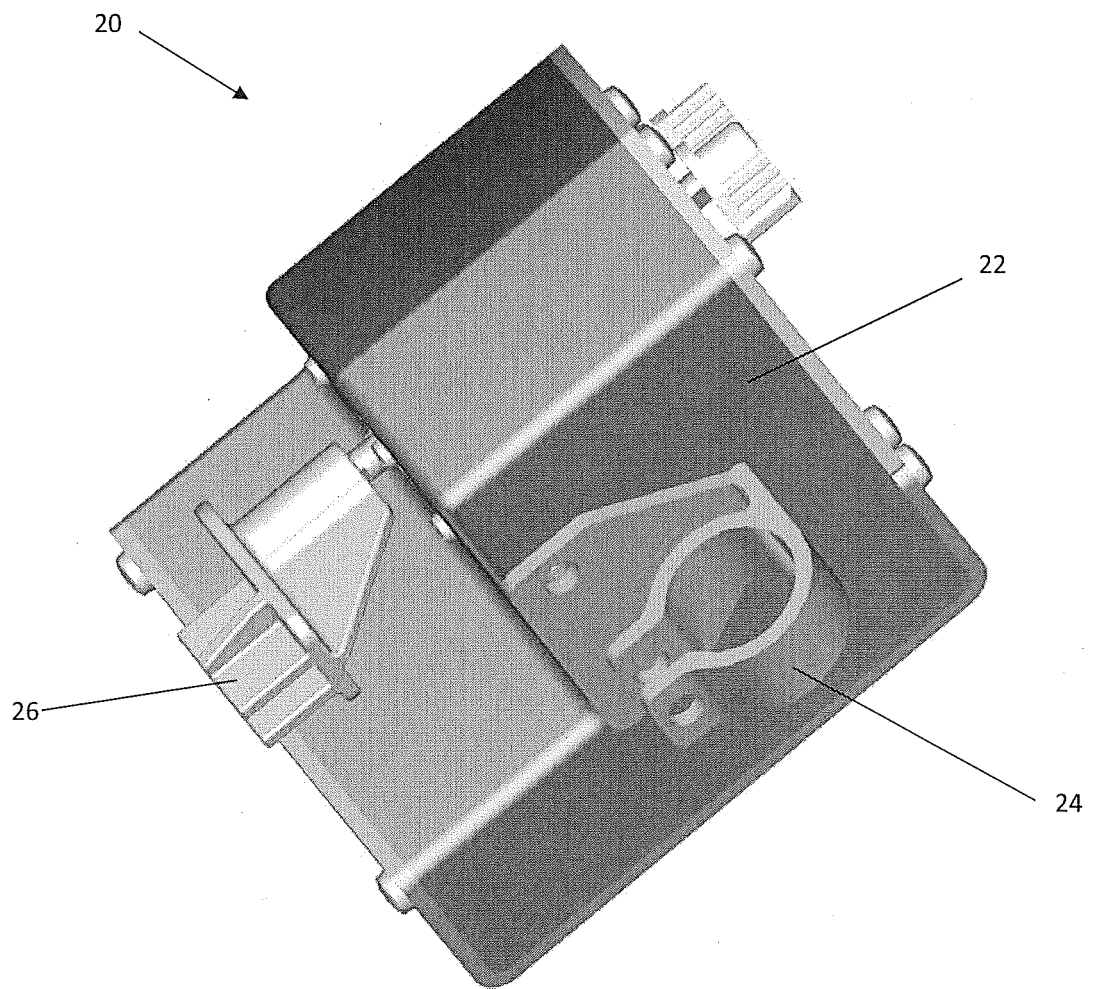


FIG. 1

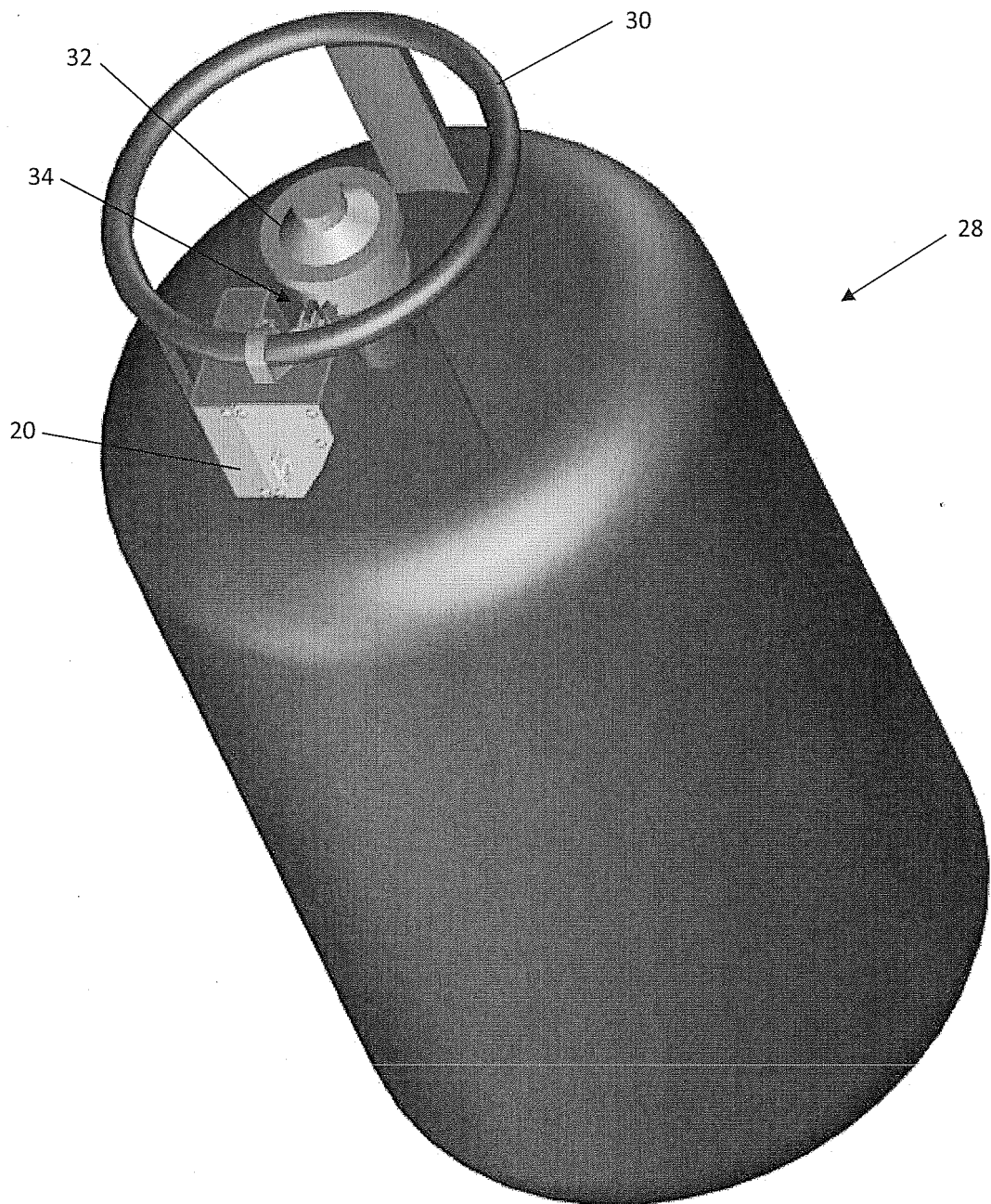
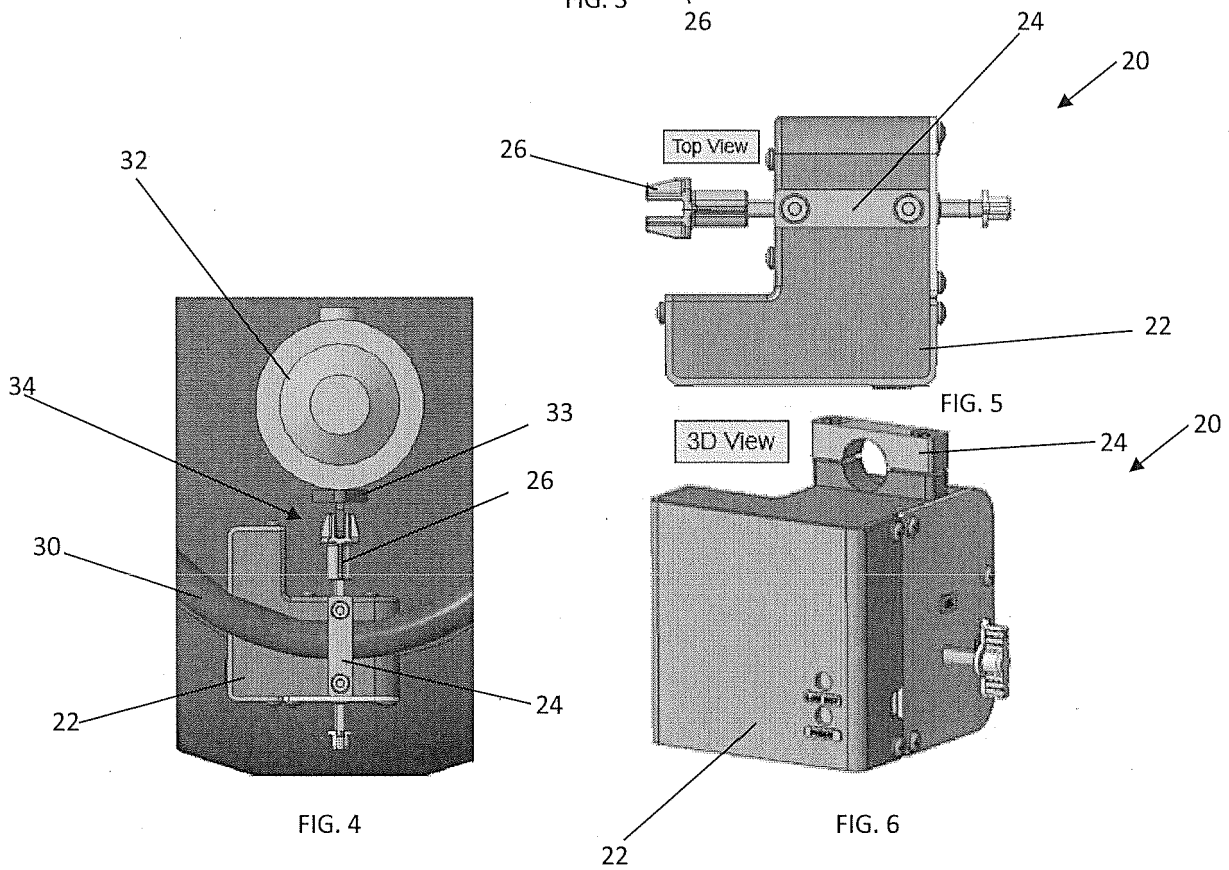
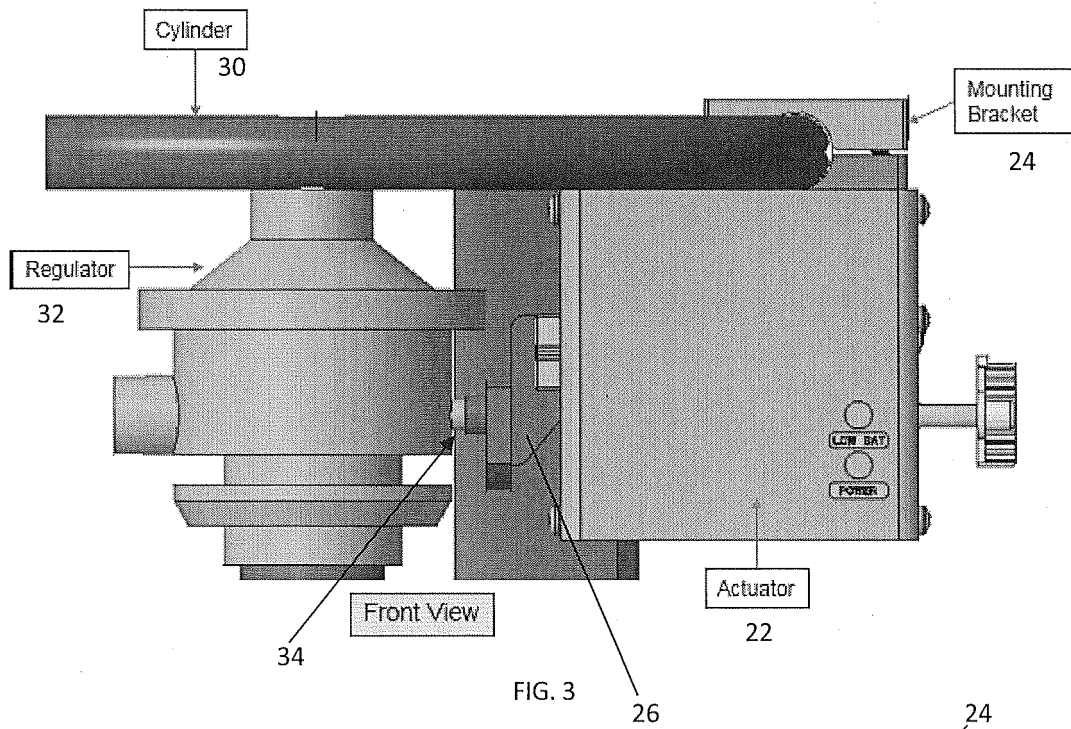


FIG. 2



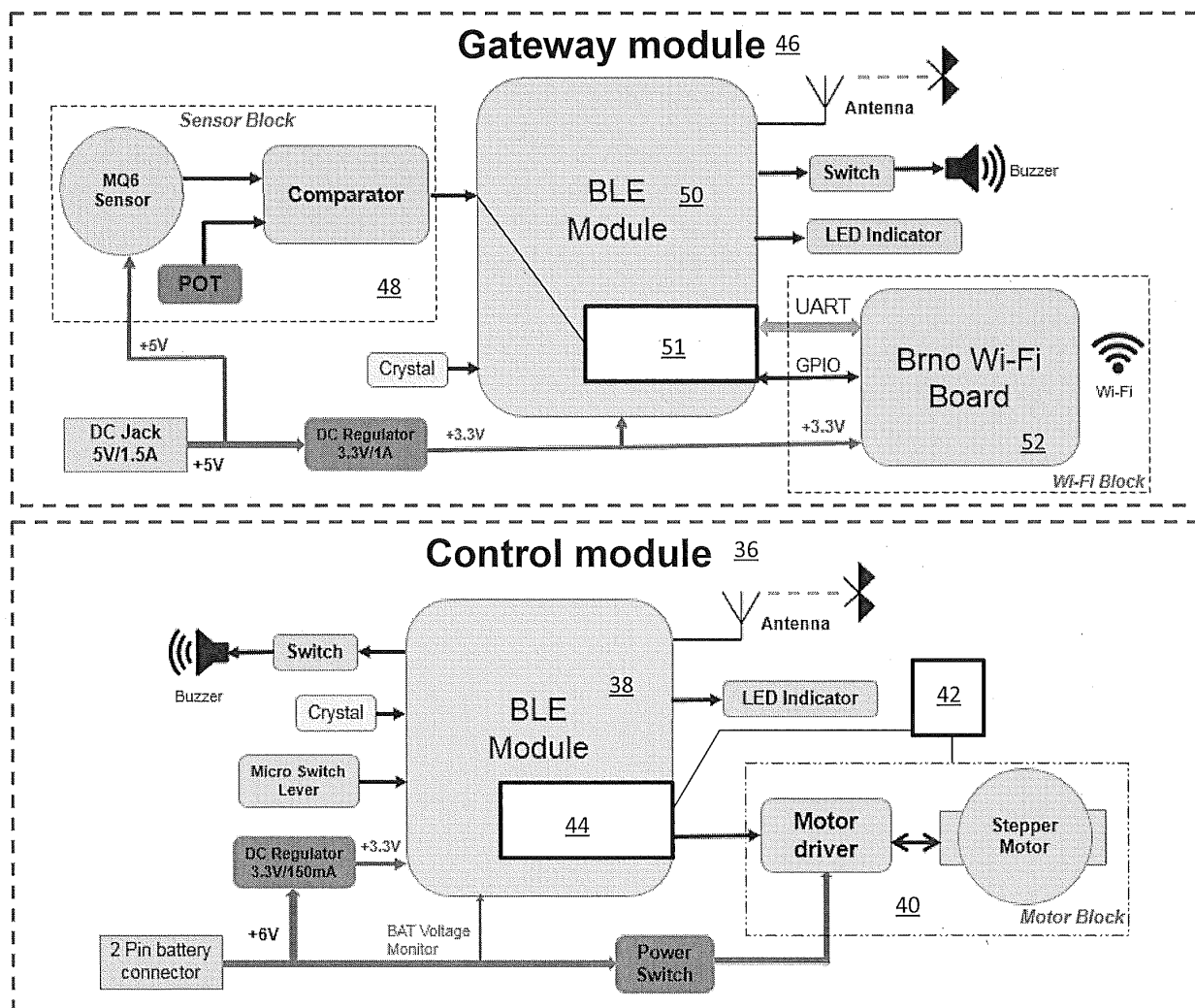


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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