



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.05.2021 Bulletin 2021/21

(51) Int Cl.:
F17C 5/02 (2006.01)

(21) Application number: **19210275.4**

(22) Date of filing: **20.11.2019**

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

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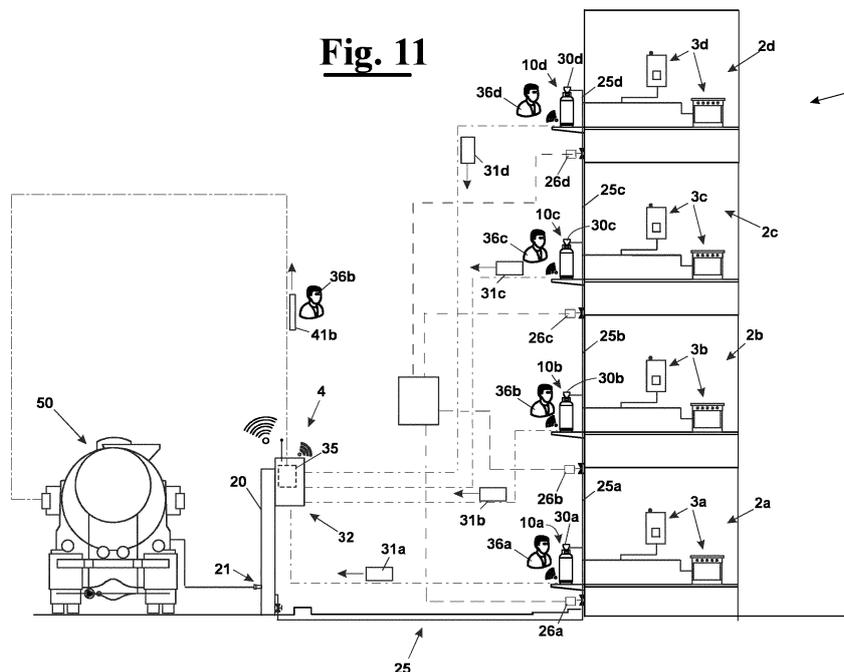
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(54) **A METHOD AND A SYSTEM FOR REFILLING GAS CYLINDERS IN A BUILDING**

(57) A method and a system for refilling a gas cylinder (10) arranged in a user area (2) of a building (1) and connected to at least a gas burning apparatus (3). The method comprises a step of arranging a refilling station (20) in an external area (4) outside of said building (1), said refilling station (20) providing a refilling socket (21) associated to the user area by a user code (36). A refilling circuit (25) is arranged to hydraulically connect the gas cylinder (10) to a refilling socket (21) of the refilling station (20). A sensor (30) is also provided configured to detect the quantity of gas present in the gas cylinder (10) and to generate a corresponding quantity signal (31). A process unit (32) compares the quantity signal (31) with a

refilling threshold value, generates a refilling signal (34) in case the quantity signal (31) is less than the refilling threshold value. The refilling signal (34) is transmitted by a transmission module (35) to a remote station (40), which is configured to receive the refilling signal (34) and to provide a refilling command (41) containing the user code to a refilling vehicle (50). Then, a refilling step is provided for refilling gas into the gas cylinder (10) by hydraulically connecting the refilling vehicle (50) to the refilling station (20) by the refilling socket (21), which is hydraulically connected to the gas cylinder (10) through the refilling circuit (25).

Fig. 11



Description

Field of the invention

[0001] The present invention relates to a method for refilling gas cylinders, in particular LPG (Liquefied Petroleum Gas) cylinders positioned in a building.

[0002] Furthermore, the present invention relates to a system for refilling LPG cylinders positioned in a building.

Background of the invention

[0003] As well known, there are a lot of cities in the world, in particular in the developing countries, where the access to the modern energy services is very difficult. In these cities it is very difficult and expensive, in particular in the old town centre, to create a network of ducts for supplying the fuel necessary for heating a building and cooking.

[0004] People living in these cities have therefore the need to use LPG (Liquefied Petroleum Gas) cylinders for cooking and heating their houses. However, the LPG cylinders have the problem that periodically have to be recharged and therefore the user has to bring the LPG cylinder at a refilling station, with a consequent great loss of time.

[0005] In WO2013002505 an example of a refilling machine is described. In particular, the refilling machine described in WO2013002505 is configured to partially refill the LPG cylinders in order to allow the user to purchase LPG in the desired quantity and verify the actual amount of LPG purchase.

[0006] The LPG refilling machine described in WO2013002505 comprises load cell, jig mechanism, Irish code reader, mechanical spindle and control unit. The load cell is for placing and weighing the consumer cylinder, jig mechanism holds the consumer cylinder, Irish code reader identifies the unique identity code of the consumer cylinder and the control unit stores information of consumer and vendor cylinders into an internal memory.

[0007] Even though the refilling machine described in WO2013002505 has some advantages, in particular because it allows to customize the quantity and the costs for refilling the LPG cylinders, however this machine does not seem to be a real solution to the above disclosed problems, in particular, because the user has, anyway, to disengage the LPG cylinder from the apparatuses for cooking and/or for heating the house, and to transport the gas cylinder where the refilling machine is positioned, with consequent loss of time and physical efforts for the user.

[0008] In addition to the above, during the disengagement and transport operations, there is the risk of damaging the building, and of injuring for the user because if there is still inflammable gas inside the LPG cylinder and the user does not correctly proceed during the disengagement operations, for example because he forgets

to close the valve of which it is provided of, or because he damages the same, it is possible that, in presence of a free flame, the LPG, or any other inflammable gas, can cause an explosion, starting a fire that can spread to all the building where the LPG cylinder is arranged.

Summary of the invention.

[0009] It is therefore an object of the present invention to provide a method for refilling a gas cylinder, in particular a LPG cylinder, in a building without displacing the same from the user area where is arranged for feeding at least a gas burning apparatus, such as a kitchen or a burner.

[0010] It is another object of the present invention to provide a method for refilling a gas cylinder that can guarantee the user that the gas cylinder does not completely empty.

[0011] It is a further object of the present invention to provide a method for refilling a gas cylinder that is completely automated and does not require the user intervention for requesting the refilling of the cylinder, or that the user is present during the refilling operation.

[0012] It is also an object of the present invention to provide a system for refilling a gas cylinder in a building having the above mentioned advantages with respect to the prior art solutions.

[0013] These and other objects are achieved by the method, according to the invention, for refilling a method for refilling a gas cylinder arranged in a user area of a building and connected to at least a gas burning apparatus, the method comprising the steps of:

- providing a refilling station in an external area outside of said building, said refilling station providing at least a refilling socket associated to said user area by a user code;
- hydraulically connecting by a refilling circuit said gas cylinder to said, or each, refilling socket;
- detecting by a sensor the quantity of gas present in said gas cylinder, said sensor being associated to said user code;
- transmitting a corresponding quantity signal to a processing unit;
- comparing by said processing unit said quantity signal with a refilling threshold value;
- generating by said processing unit a refilling command containing said user code, in case said quantity signal is less than said refilling threshold value;
- transmitting by a transmission module said refilling command containing said user code to a refilling vehicle;
- hydraulically connecting said refilling vehicle to said refilling socket of said refilling station associated to said user code;
- feeding gas into said gas cylinder through said hydraulic circuit.

[0014] According to another aspect of the present invention, a system for refilling a gas cylinder positioned in a user area of a building and connected to at least a gas burning apparatus, said system for refilling comprising:

- a refilling station arranged in an external area positioned outside of said building, said refilling station providing at least a refilling socket associated to said user area by a user code;
- a refilling circuit arranged to hydraulically connect said gas cylinder to said, or each, refilling socket;
- a sensor configured to detect the quantity of gas present in said gas cylinder and to transmit a corresponding quantity signal, said sensor being associated to said user area by said user code;
- a processing unit configured to compare said quantity signal with a refilling threshold value, and to provide a refilling command containing said user code in case said quantity signal is less than said refilling threshold value;
- a transmission module configured to transmit said refilling command containing said user code to a refilling vehicle, the refilling vehicle configured to be hydraulically connected to said refilling socket associated to said user code in such a way to introduce gas into said gas cylinder arranged in said user area through said refilling circuit.

[0015] Other features of the invention and related embodiments are set out in the dependent claims.

[0016] In particular, the building can comprise a plurality of gas cylinders arranged in respective user areas.

[0017] Advantageously, a plurality of refilling circuits and refilling sockets can be provided. More in detail, each refilling circuit is arranged to connect a respective gas cylinder of the plurality of gas cylinders to a respective refilling socket of the plurality of refilling sockets, in such a way to provide a hydraulic connection between said respective gas cylinder and said respective refilling socket through said respective refilling circuit.

[0018] In particular, a plurality of sensors can be provided, each configured to determine a quantity signal that is responsive to a quantity of gas contained in a respective gas cylinder. More in particular, each sensor of the plurality of sensors is associated to a respective user area by a respective user code.

Brief description of the drawings

[0019] Further characteristic and advantages of the present invention will be made clearer with the following description of an exemplary embodiment thereof, exemplifying but not limitative, with reference to the attached drawings, in which:

- Fig. 1 shows a block diagram depicting a first sequence of steps provided by the method, according

to the invention, for refilling gas cylinders in a building;

- Fig. 2A diagrammatically shows the main features of the system according to the invention for refilling gas cylinders in a building;
- Figures 2B and 2C diagrammatically shows the main features of alternative embodiments of system of figure 2A;
- Fig. 3 diagrammatically shows a sequence of steps alternative to the sequence of figure 1;
- Figures 4 and 5 diagrammatically show two alternative embodiments provided by the invention for the system carrying out the steps of the method of figure 3;
- Fig. 6 diagrammatically shows a flowsheet of the main steps provided by the method of figures 1 and 3;
- Fig. 7 diagrammatically shows a flowsheet of the main steps provided by an embodiment alternative to the flowsheet of figure 6;
- Figures 8 and 9 diagrammatically show other alternative embodiments of the system of figure 2A for refilling gas cylinders in a building;
- Fig. 10 diagrammatically shows a sequence of possible steps of the method according to the invention alternative to the sequences of figures 1 and 3;
- Figures 11 and 13 diagrammatically show other embodiments of the system according to the invention for refilling gas cylinders in a building.

30 Description of the preferred embodiments

[0020] With reference to figures 1 and 2, a first sequence 200 of steps of the method, according to the invention, for refilling at least a gas cylinder 10 arranged in a user area 2 of a building 1 and connected to at least a gas burning apparatus 3, such as a kitchen, or a burner, or any other apparatus requiring to be fed of fuel in order to work, comprises the steps of providing a refilling station 20 positioned in an external area 4 outside of the building 1 where the gas cylinder 10 is arranged. In particular, the refilling station is provided with at least a refilling socket 21, block 201. More in particular, the, or each, refilling socket 21 is associated to the respective user area 2 by a user code 36. This, advantageously, contains data related to the building 1 and/or the specific user area 2 where the gas cylinder 10 is arranged and/or the refilling station 20, in particular the address, and/or the user owner of the user area 2, in particular the user name. A step is, also, provided of hydraulically connecting the gas cylinder 10 to the refilling station 20, more in detail to the, or each, refilling socket 21, through a refilling circuit 25, block 202. Furthermore, a detection step is carried out by a sensor 30 for detecting the quantity of gas present in the gas cylinder 10, and for generating a corresponding quantity signal 31, block 203. In particular, the sensor 30 can be a pressure sensor, or a weight sensor, for example a load cell, or a level sensor.

[0021] More in particular, the sensor 30 can be asso-

ciated to the user area 2 where it is arranged by the user code 36. A processing unit 32 is, furthermore, provided communicating with the sensor 30 and adapted to compare the quantity signal 31 generated and transmitted by sensor 30 with a predetermined refilling threshold value, block 204. In particular, the refilling threshold value can be set between 10% and 50% of the gas cylinder capacity, advantageously between 15% and 30% of the gas cylinder 10 capacity.

[0022] In particular, the processing unit 32 can be positioned at a remote position 5 (figure 2A), at a position near the user area 2, for example at the refilling station 20 (figure 2B) or at a local position, advantageously the user area 2 (figure 2C). More in particular, the processing unit 32 and the sensor 30 can communicate with each other through a wireless communication such as Bluetooth, WI-FI, or radio waves. In this case, a transmission module 35 can be advantageously provided that is able to transmit the quantity signal 31 to the processing unit 32.

[0023] In an alternative embodiment of the invention the sensor 30 and the processing unit 32 can communicate with each other through electric wire connection.

[0024] If the quantity signal 31 is less than the refilling threshold value, the processing unit 32 is arranged to generate a refilling command 41 containing the user code 36, or a part of the data associated to the same, such as the address of the user area 2, block 205. Then a transmitting step is provided for transmitting the refilling command 41 to a refilling vehicle 50 remote station, block 206. In particular the communication between the processing unit 32 and the refilling vehicle 50 can be carried out through a network, preferably via internet (figures 2B and 2C).

[0025] Then, the refilling vehicle 50 is hydraulically connected to the refilling station 20 through the refilling socket 21 associated to the user code 36, block 207.

[0026] Therefore, the refilling step of the gas cylinder 10 can be carried out through a hydraulic circuit 25 connecting the refilling socket 21, and therefore the refilling vehicle 50, to the gas cylinder 10, block 208.

[0027] In an alternative embodiment diagrammatically shown in figures 3 and 4, the processing unit 32, in particular arranged at a local position, for example the user area 2 as diagrammatically illustrated in figure 2C, can be arranged to carry out the above mentioned step of comparing the quantity signal 31 with the refilling threshold value and to generate a refilling signal 34, block 204b. Then the refilling signal 34 is transmitted, for example via internet, to a remote station 40, block 204c. This particular solution allows to reduce the data to be processed by remote server 40, which can be arranged to process the refilling signal 34 in order to extract information about the user and/or the building 1 and/or the user area 2.

[0028] In particular, in this case it is, advantageously, the remote station 40 to generate and transmit the refilling command 41 to the refilling vehicle 50, blocks 205 and 206 of flow diagram shown in figure 3. Advantageously,

the remote station 40 can be arranged to retrieve from a database 45 only some data associated to the user code 36 and to generate the refilling command 41 containing only the retrieved data, for example only the address of building 1, for reasons of privacy.

[0029] As diagrammatically shown in figure 5, according to another embodiment of the invention, the remote server 40 can be arranged to select among a plurality of refilling vehicles, for example 3 refilling vehicles 50a, 50b and 50c, the refilling vehicle closer to the gas cylinder 10 to be refilled and to transmit only to this refilling vehicle, for example refilling vehicle 50a the refilling command 41.

[0030] The logic scheme of the main steps carried out by the processing unit 32 only, or by the processing unit 32 and the remote station 40 is diagrammatically shown in figure 6.

[0031] According to an alternative embodiment of the invention that is diagrammatically shown in figures 7, 8 and 9, the processing unit 32 can be, furthermore, configured to compare the quantity signal 31 with a predetermined urgent threshold value, which is, in particular, less than the predetermined threshold value. More precisely, if the quantity signal 31 is less than the above mentioned predetermined urgent threshold value, the processing unit 32 is arranged to provide directly an urgent refilling command 41', case not shown in the figures for reasons of simplicity, or an urgent refilling signal 34' that is transmitted to remote server 40, which, then, provides and transmits an urgent refilling command 41'. Advantageously, the urgent refilling threshold value can be less than 20% of the gas cylinder 10 capacity, preferably less than 10% of the gas cylinder 10 capacity. The logic scheme of this alternative processing operation carried out by the processing unit 32 alone, or by the processing unit 32 and the remote station 40, is diagrammatically shown in figure 7. This particular processing operation carried out by the processing unit 32 can be very useful, for example, in order to determine a priority order in case of simultaneous multiple refilling signals 34 received by remote station 40 and provided by a plurality of buildings 1, or a plurality of user areas 2 arranged at the same building 1.

[0032] In still another alternative embodiment of the invention, diagrammatically shown in figures 8 and 9, in the same user area 2 a plurality of gas cylinders, for example two gas cylinders 10 and 10' can be arranged. More in detail, the two gas cylinders 10 and 10' can be hydraulically connected with each other, for example by a connection valve 15, in such a way that a first gas cylinder 10 works as main gas cylinder, whilst the second gas cylinder 10' works as a secondary gas cylinder. In this case, a first sensor 30 and a second sensor 30' can be provided arranged to detect the quantity of a respective gas cylinder 10 and 10' and to generate a first quantity signal 31 and a second quantity signal 31', respectively. In this way, if the first quantity signal 31 is less the predetermined threshold value, but the second quantity signal 31' is higher than the predetermined threshold value,

the processing unit 32 transmits directly a refilling command 41 to the refilling vehicle 50, or a refilling signal 34 to the remote station, which then transmits the refilling command 41 to the refilling vehicle 50. Instead, if both the first and the second quantity signals 31 and 31' are less than the predetermined threshold value, the processing unit 32 transmits directly an urgent refilling command 41' to the refilling vehicle 50, or an urgent refilling signal 34' to remote station 40, which accordingly send an urgent refilling command 41' to the refilling vehicle 50.

[0033] In an alternative embodiment of the invention, diagrammatically shown in figures 10 to 13, an alternative sequence of steps of the method for refilling gas cylinders provides, in particular, to arrange a plurality of gas cylinders 10 in a plurality of user areas 2, block 301. More in particular, in the embodiment of figure 11, a plurality of gas cylinders 10a-10d are arranged in respective areas 2a-2d of a same building 1. In the alternative embodiment diagrammatically shown in figure 12, the plurality of gas cylinders 10, for example 3 gas cylinders 10a-10c, are arranged in respective areas 2a-2c of different buildings 1a-1c.

[0034] Advantageously, at least a gas cylinder 10a-10d, or 10a-10c, is provided at each user area 2a-2d, 2a-2c, respectively. Each user area 2a-2d, or 2a-2c, is associated to a respective user code 36a-36d, or 36a-36c. However, as described in detail below, it is also foreseen to position two gas cylinders 10 and 10' at each user area 2 (see for example figures 8, 9 and 13).

[0035] Then a step is provided of connecting, through respective branches, or ducts, of a refilling circuit 25, each gas cylinder 10a-10d to the refilling station 20, block 302. In particular, as diagrammatically shown in figure 11, the gas cylinder 10a-10d arranged in the user areas 2a-2d of the same building 1, can be advantageously connected through a circuit 25 to the same refilling station 20. Analogously, in the case of figure 12, the gas cylinder 10a-10c arranged in the respective user areas 2a-2c of different buildings 1a-1c, can be advantageously connected to the same refilling station 20 through respective circuits 25a-25c.

[0036] A plurality of sensors 30a-30d, or 30a-30c, are provided associated to a plurality of user areas 2a-2d, or 2a-2c, by a plurality of user codes 36a-36d, or 36a-36c, block 303. A detecting step is, furthermore, provided for detecting the quantity of gas present in each gas cylinder 10a-10d, or 10a-10c, by a respective sensor 30a-30d, or 30a-30c. Each sensor 30a-30d, or 30a-30c is, as above described with reference to figures 1 to 9, is arranged to detect the quantity of gas present in the respective gas cylinder 10a-10d, or 10a-10c, and to generate a corresponding quantity signal 31a-31d, or 31a-31c, block 304. In particular, each sensor 30a-30d, or 30a-30c, is associated to a respective user area 2a-2d, or 2a-2c, by a respective user code 36a-36d, or 36a-36c. Then, analogously to what above described with reference to figure 1, the processing unit 32 compares each quantity signal

31a-31d, or 31a-31c, to the refilling threshold value, block 305, and generates at least a refilling command 41a-41d, 41a-41c (figures 10 and 11), or a refilling signal 34a-34d, or 34a-34c, that is transmitted to a remote server 40 (figure 12), in case at least one of the above disclosed quantity signals 31a-31d, or 31a-31c, is less than the refilling threshold value, block 306. Then a transmitting step is provided for transmitting the, or each, refilling command 41a-41d, or 41a-41c, to the refilling vehicle 50, block 307.

[0037] As above disclosed with reference to figures 3 to 5, if a remote server 40 is provided, the refilling signal 34a-34d, or 34a-34c is processed by the remote server 40 which then transmits the refilling command 41 to the refilling vehicle 50. In particular, the refilling command 41a-41d, or 41a-41c, contains the user code 36a-36d, or 36a-36c, or some data contained in the same, associated to the sensor 30a-30d, or 30a-30c, that has detected a quantity of gas less than the predetermined threshold value.

[0038] The refilling vehicle 50 is, then, connected to the refilling station 20 and, therefore, to the gas cylinder 10a-10d, or 10a-10c, to be refilled, block 308, in order to introduce gas in the gas cylinder 10a-10d, or 10a-10c, to be refilled, block 309.

[0039] More in detail, the refilling station 20 can be provided with only a refilling socket 21 which is hydraulically connected to the gas cylinders 10a-10d through respective branches, or ducts, of the same hydraulic circuit 25 (figure 11). A plurality of valves 26a-26d are then provided for hydraulically connecting, or disconnecting, each gas cylinder 10a-10d to the refilling socket 21. More in detail, the plurality of valves 26a-26d is arranged to hydraulically connect the, or each, gas cylinder 10a-10d associated to the user code 36a-36d contained in the refilling command 41a-41d, and to disconnect the others. More in detail, the valves 26a-26d can be opened or close in order to hydraulically connect, or disconnect, the respective branch, or ducts, 25a-25d of circuit 25 with refilling socket 21. Advantageously, the valves 26a-26d can be electro-valves and can be opened or closed by a selection device 46 on the basis of the user code 36a-36d contained in the refilling command 41a-41d.

[0040] In the alternative embodiment diagrammatically shown in figure 12, the refilling station 20 provides a plurality of refilling sockets 21a-21c, which are respectively connected to the different gas cylinders 10a-10c through respective hydraulic circuits 25a-25c. These can, in particular, comprise a plurality of ducts, each connecting a different gas cylinder, or a plurality of gas cylinders arranged in the same user area, to a respective refilling socket of the plurality of refilling sockets 21a-21c. Advantageously, each refilling socket 21a-21c can be associated to a respective storing device, for example a counter, advantageously a digital counter, each of which associated to a different user area.

[0041] In this case the refilling vehicle 50 is connected to the gas cylinder 10a-10c to be refilled by connecting to the respective refilling socket 21a-21c.

[0042] As diagrammatically shown in figure 13, each user area 2a-2d, for example each provided with a first gas cylinder 10a-10d and with a second gas cylinder 10'a-10'd, or a greater number of the same, can be connected through a respective duct 25a-25d, in particular provided with a plurality of valves, to the same refilling socket 21 (case shown in figure 13) or to a respective refilling socket 21a-21c. More in detail, each duct 25a-25d can be associated to a respective storing device 121a-121c, advantageously arranged at the refilling station 20, for example a counter, advantageously a digital counter, for storing the data related to the amount of gas refilled to each user area 2a-2d. These data can be used both by the Company that supplies the gas and by the user for controlling the amount of gas refilled to each gas cylinder, in particular in order to avoid mistakes.

[0043] As a skilled person in the art can easily understand all the different embodiments and related features above disclosed with reference to figures 1 to 9 can be also applied to the case diagrammatically shown in figures 10 to 13, in which a plurality of gas cylinders are provided in the same building 1 or distributed in a predetermined number of buildings 1a-1c.

[0044] The foregoing description exemplary embodiments of the invention will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such embodiment without further research and without parting from the invention, and, accordingly, it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiments. The means and the materials to realize the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology that is employed herein is for the purpose of description and not of limitation.

Claims

1. A method for refilling a gas cylinder (10) arranged in a user area (2) of a building (1) and connected to at least a gas burning apparatus (3), the method comprising the steps of:

- providing a refilling station (20) in an external area (4) outside of said building (1), said refilling station (20) providing at least a refilling socket (21) associated by a user code to said user area (2);
- hydraulically connecting by a refilling circuit (25) said gas cylinder (10) to said, or each, refilling socket (21);
- detecting by a sensor (30) the quantity of gas present in said gas cylinder (10), said sensor (30) being associated to said user code;

- transmitting a corresponding quantity signal (31) to a processing unit (32);
- comparing by said processing unit (32) said quantity signal (31) with a refilling threshold value;
- generating by said processing unit (32) a refilling command (41) containing said user code, in case said quantity signal (31) is less than said refilling threshold value;
- transmitting by a transmission module (35) said refilling command (41) containing said user code to a refilling vehicle (50);
- hydraulically connecting said refilling vehicle (50) to said refilling socket (21) of said refilling station (20) associated to said user code;
- feeding gas into said gas cylinder (10) through said hydraulic circuit (25).

2. The method for refilling a gas cylinder (10) according to claim 1 wherein said processing unit (32) is arranged in a position selected from the group consisting of:

- said user area (2);
- said refilling station (20);
- a remote station (40);

or a combination thereof.

3. The method for refilling a gas cylinder (10) according to claim 1, or 2, wherein said processing unit (32) is arranged in said user area (2), or in said refilling station (20) and wherein the following steps are furthermore provided:

- generating by said processing unit (32) a refilling signal (34) in case said quantity signal (31) is less than said predetermined threshold value;
- transmitting said refilling signal (34) to a remote station (40);
- transmitting from said remote station (40) said refilling command (41) to said refilling vehicle (50).

4. The method for refilling a gas cylinder (10) according to claim 1 furthermore providing the steps of:

- arranging a plurality of gas cylinders (10a-10d) in a plurality of user areas (2a-2d), in such a way that at least a gas cylinder (10a-10d) is provided at each user area (2a-2d);
- connecting through a respective refilling circuit (25a-25d) each gas cylinder (10) of said plurality to said refilling station (20), the refilling station (20) providing at least a refilling socket (21), associated by a plurality of user codes (36a-36d) to said plurality of user areas (2a-2d);
- providing a plurality of sensors (30a-30d), each

sensor associated to a respective user area (2a-2d) and configured to detect the quantity of gas present in the gas cylinder (10a-10d) positioned in said respective user area (2a-2d) and to generate a corresponding quantity signal (31a-31d), each sensor (30a-30d) being associated to a respective user code (36a-36d) of said plurality of user codes (36a-36d);

- comparing by the processing unit (32) each said quantity signals (31) with the refilling threshold value, and generating a corresponding refilling command (41a-41d) containing a respective user code (36a-36d), in case at least one of said quantity signals (31a-31d) is less than said refilling threshold value;

- transmitting by a transmission module (35) said refilling command (41a-41d) containing said user code (36a-36d) to a refilling vehicle (50);

- refilling by the refilling vehicle (50) the gas cylinder (10) to be refilled, said refilling step being carried out hydraulically connecting the refilling vehicle to the refilling socket (21) of said refilling station (20) associated to said plurality of user codes (36a-36d) contained in said refilling command (41a-41d).

5. A system for refilling a gas cylinder (10) positioned in a user area (2) of a building (1) and connected to at least a gas burning apparatus (3), said system for refilling comprising:

- a refilling station (20) arranged in an external area (4) positioned outside of said building (1), said refilling station (20) providing at least a refilling socket (21) associated by a user code to said user area (2);

- a refilling circuit (25) arranged to hydraulically connect said gas cylinder (10) to said, or each, refilling station (20);

- a sensor (30) configured to detect the quantity of gas present in said gas cylinder (10) and to transmit a corresponding quantity signal (31), said sensor (30) being associated to said user area by said user code;

- a processing unit (32) configured to compare said quantity signal (31) with a refilling threshold value, and to provide a refilling command (41) containing said user code (36) in case said quantity signal (31) is less than said refilling threshold value;

- a transmission module (35) configured to transmit said refilling command (41) containing said user code (36) to a refilling vehicle (50), the refilling vehicle (50) configured to be hydraulically connected to said refilling socket (21) associated to said user code in such a way to introduce gas into said gas cylinder (10) arranged in said user area (2) through said refilling circuit (25).

6. The system for refilling a gas cylinder (10) according to claim 5, furthermore providing:

- a plurality of gas cylinders (10a-10d) arranged in a plurality of user areas (2a-2d), in such a way that at least a gas cylinder (10a-10d) is provided at each user area (2a-2d);

- at least a refilling socket (21) associated to a plurality of user areas (2a-2d) by a plurality of user code (36a-36d);

- a plurality of refilling circuits (25a-25d), each refilling circuit (25a-25d) of said plurality arranged to hydraulically connect at least a respective gas cylinder (10a-10d) to said refilling station (20);

- a plurality of sensors (30a-30d), each sensor (30a-30d) of said plurality associated to a respective user code (36a-36d) of said plurality of user codes (36a-36d), and configured to detect the quantity of gas present in the respective gas cylinder (10a-10d) and to generate a corresponding quantity signal (31a-31d);

wherein said processing unit (32) is arranged to compare each said quantity signals (31a-31d) with the refilling threshold value, and to generate a corresponding refilling command (41a-41d) containing a respective user code (36a-36d), in case at least one of said quantity signals (31a-31d) is less than said refilling threshold value; wherein said transmission module (35) is arranged to transmit said refilling command (41a-41d) containing said user code (36a-36d) to a refilling vehicle (50);

and wherein said refilling vehicle (50) is arranged to introduce the gas into the gas cylinder (10a-10d) to be refilled by hydraulically connecting the refilling vehicle (50) to the refilling socket (21) of said refilling station (20) associated to said plurality of user codes (36a-36d) contained in said refilling command (41a-41d).

7. The system for refilling a gas cylinder (10) according to any claim from 3 to 6, wherein a first gas cylinder (10') and at least a second gas cylinder (10'') are arranged at the same user area (2), and hydraulically connected to each other.

8. The system for refilling a gas cylinder (10) according to any claim from 3 to 7, wherein said, or each sensor (30) is selected from the group consisting of:

- a weight sensor, in particular a load cell;
- a pressure sensor;
- a level sensor;

or a combination thereof.

9. The system for refilling a gas cylinder (10) according

to any claim from 3 to 8, wherein said refilling threshold value is set between 10% and 50% of the gas cylinder capacity.

10. The system for refilling a gas cylinder (10) according to claim 7, wherein said first and said second gas cylinders (10') are associated to at least a sensor (30) arranged to detect the quantity of gas present in said first and second gas cylinders (10', 10'').
11. The system for refilling a gas cylinder (10) according to any claim from 3 to 10, wherein said processing unit (32) is, furthermore, configured to compare said, or each, quantity signal (31) with a predetermined urgent threshold value and to provide an urgent refilling signal (34') in case said, or each, quantity signal (31) is less than said predetermined urgent refilling threshold value, said urgent refilling threshold value being less than said refilling threshold value, said transmission module (35) transmitting said urgent refilling signal (34') to said remote station (40), which provides an urgent refilling command (41') to said refilling vehicle (50).
12. The system for refilling a gas cylinder (10) according to claim 11, wherein said predetermined urgent refilling threshold value is less than 20% of the gas cylinder capacity, in particular said predetermined urgent refilling threshold value is less than 10% of the gas cylinder capacity.
13. The system for refilling a gas cylinder (10) according to claim 6, wherein said first gas cylinder (10') is associated to a first sensor (30') arranged to detect the quantity of gas present in said first gas cylinder (10') and to generate a corresponding first quantity signal (31), and said second gas cylinder (10'') is associated to a second sensor (30'') arranged to detect the quantity of gas present in said second gas cylinder (10'') and to generate a corresponding second quantity signal (31'), and wherein said processing unit (32) is configured to compare both said first quantity signal (31) and said second quantity signal (31') with said predetermined threshold value and to generate a refilling signal (34), in case said first quantity signal (31) is less than said predetermined threshold value, and said second quantity signal is higher than said threshold value, and an urgent refilling signal (34') if both said first and said second quantity signals (31, 31') are less than said predetermined threshold value.
14. The system for refilling a gas cylinder (10) according to any claim from 6 to 13, wherein said refilling station (20) provides a plurality of refilling sockets (21a-21d), each refilling socket (21a-21d) of said plurality being associated to a user code (36a-36d) of said plurality of user codes (36a-36d).

15. The system for refilling a gas cylinder (10) according to any claim from 6 to 13, wherein said refilling station (20) provides:

- a refilling socket (21) associated to a plurality of user codes (36a-36d); and
- a selection device (46) arranged to open, or close, at least one valve (26a-26d) provided along said refilling circuit (25) in order to hydraulically connect through said refilling circuit (25) said refilling socket (21) only to the gas cylinder (10a-10d) of said plurality of gas cylinders (10a-10d) to be refilled and associated to said user code (36a-36d) contained in said refilling command (41).

Fig. 1

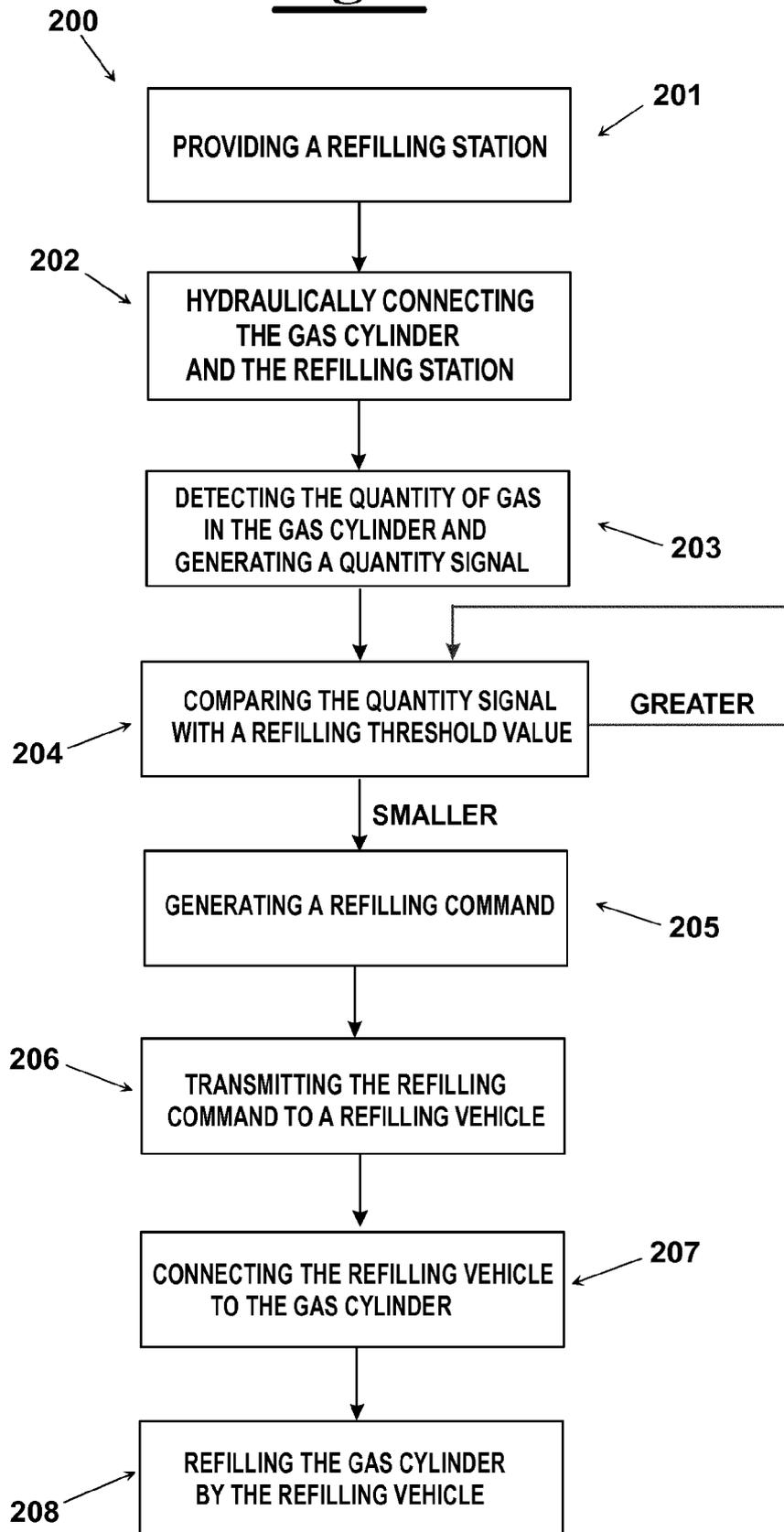


Fig. 2A

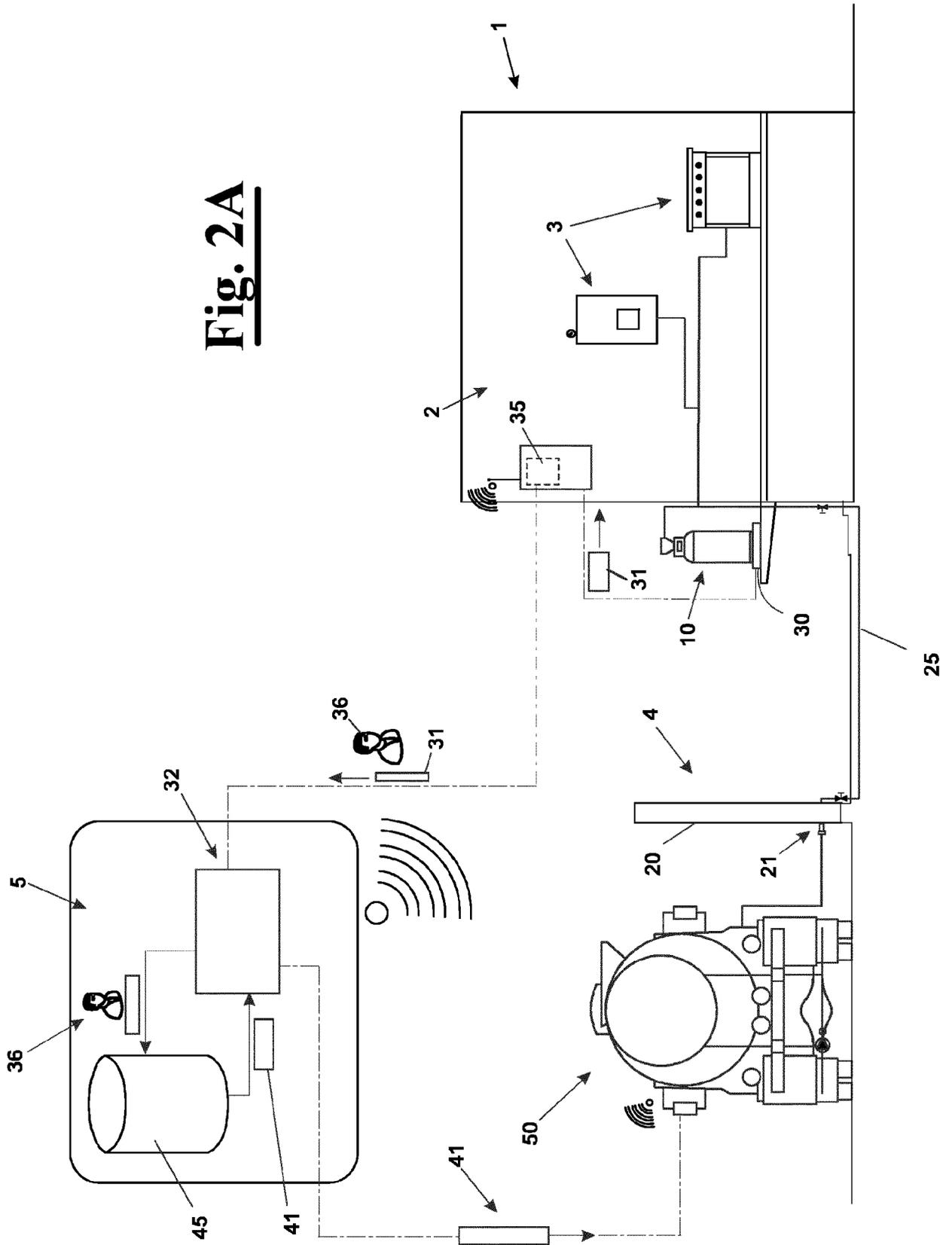
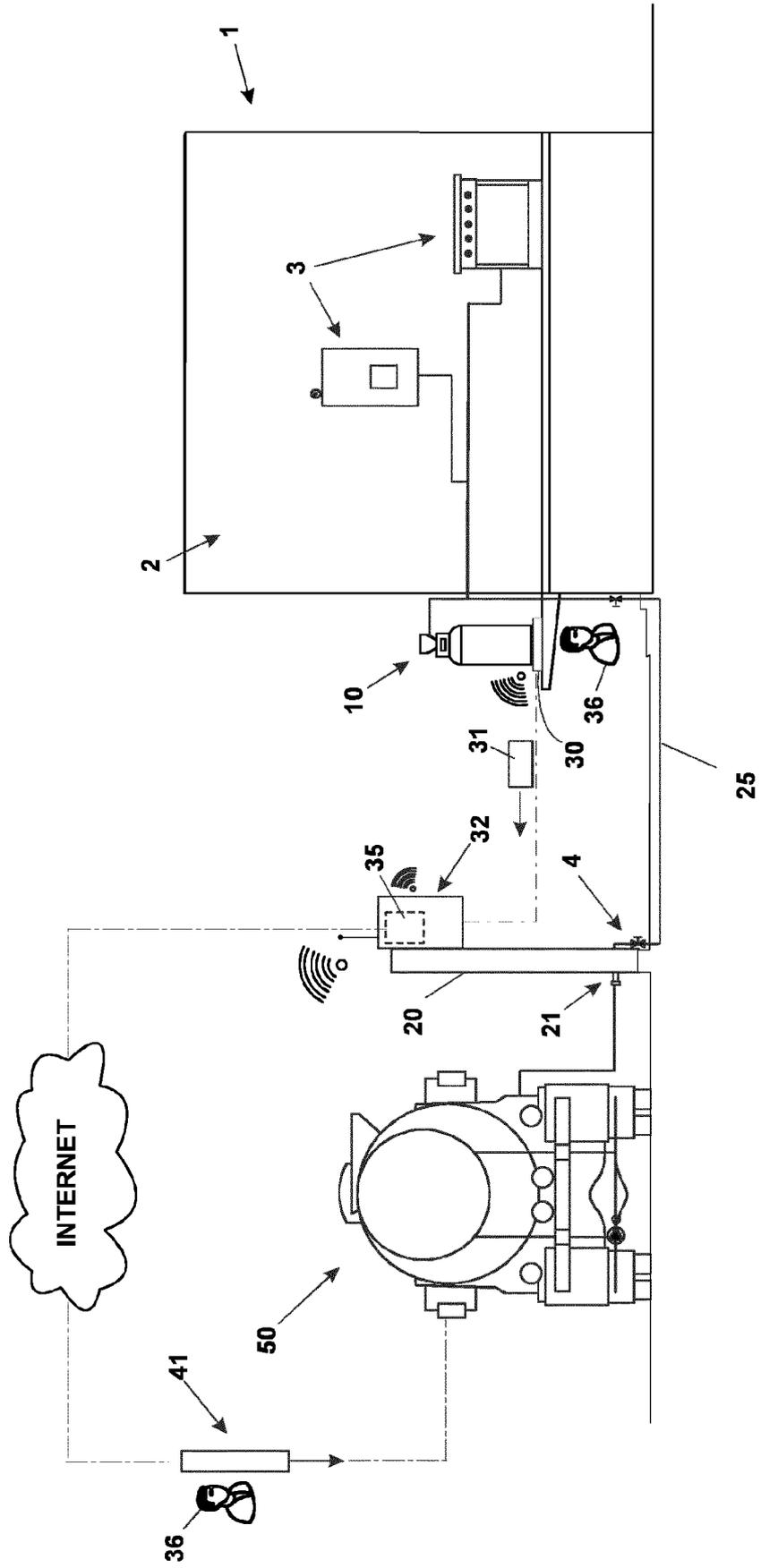


Fig. 2B



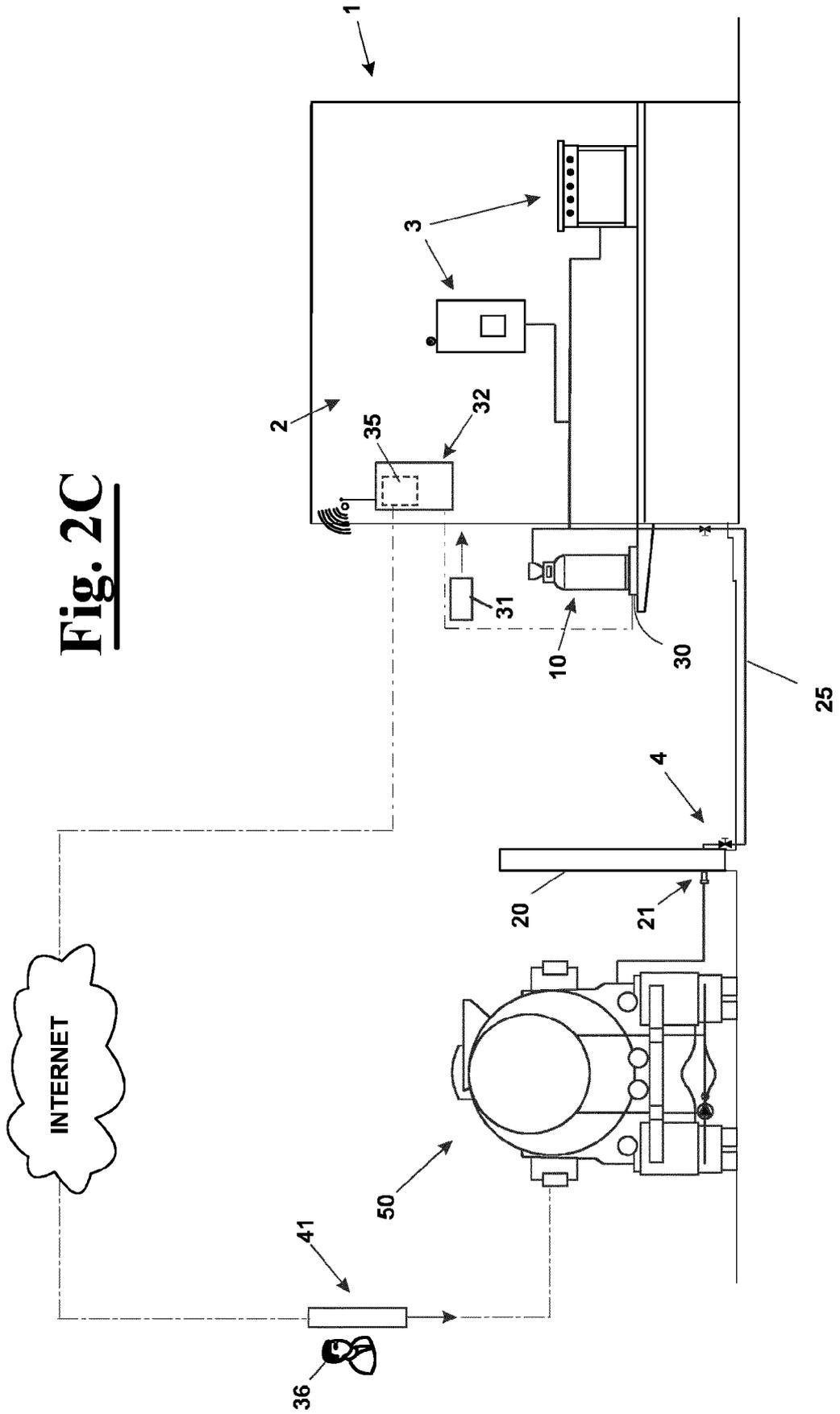
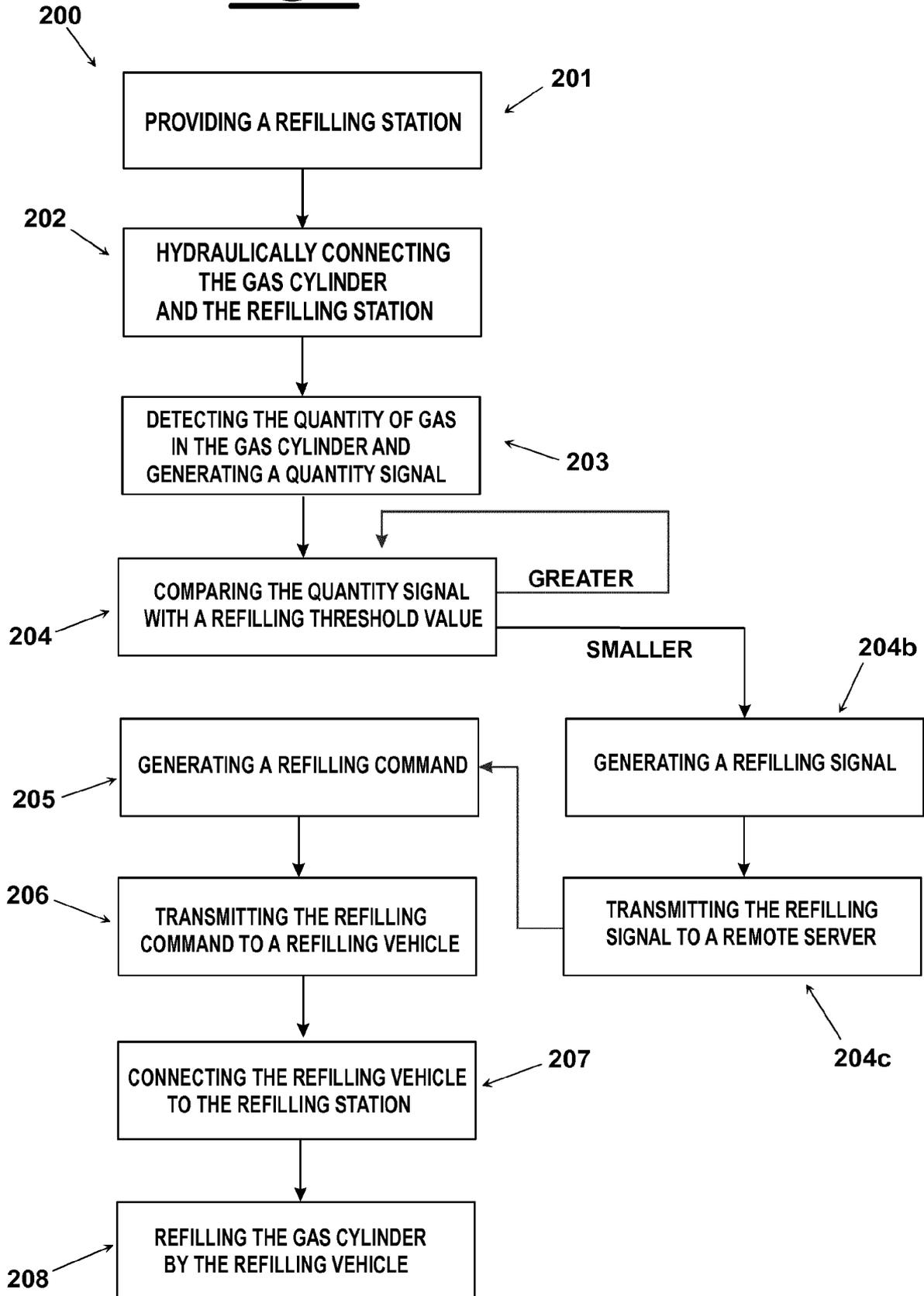


Fig. 3



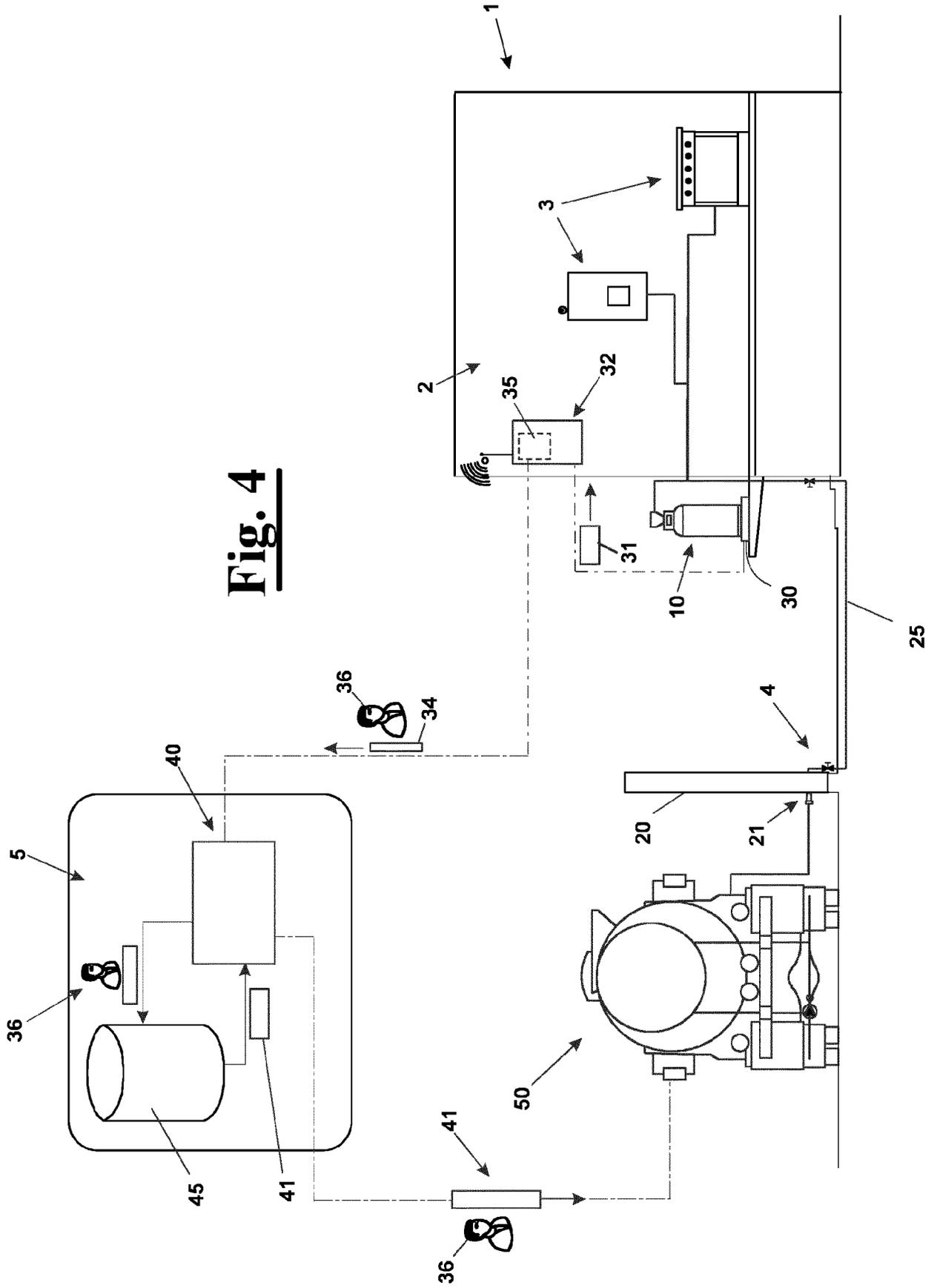


Fig. 4

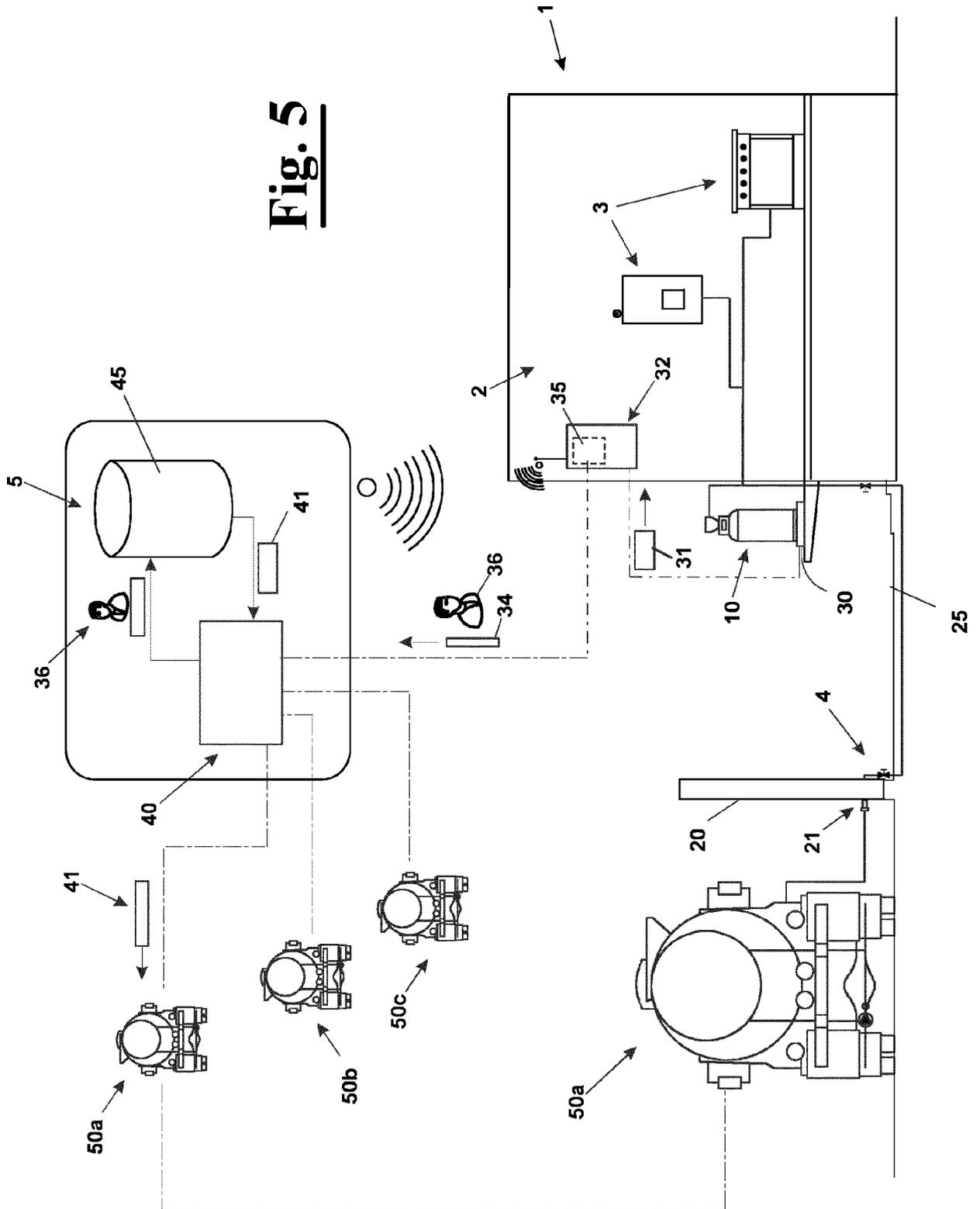


Fig. 5

Fig. 6

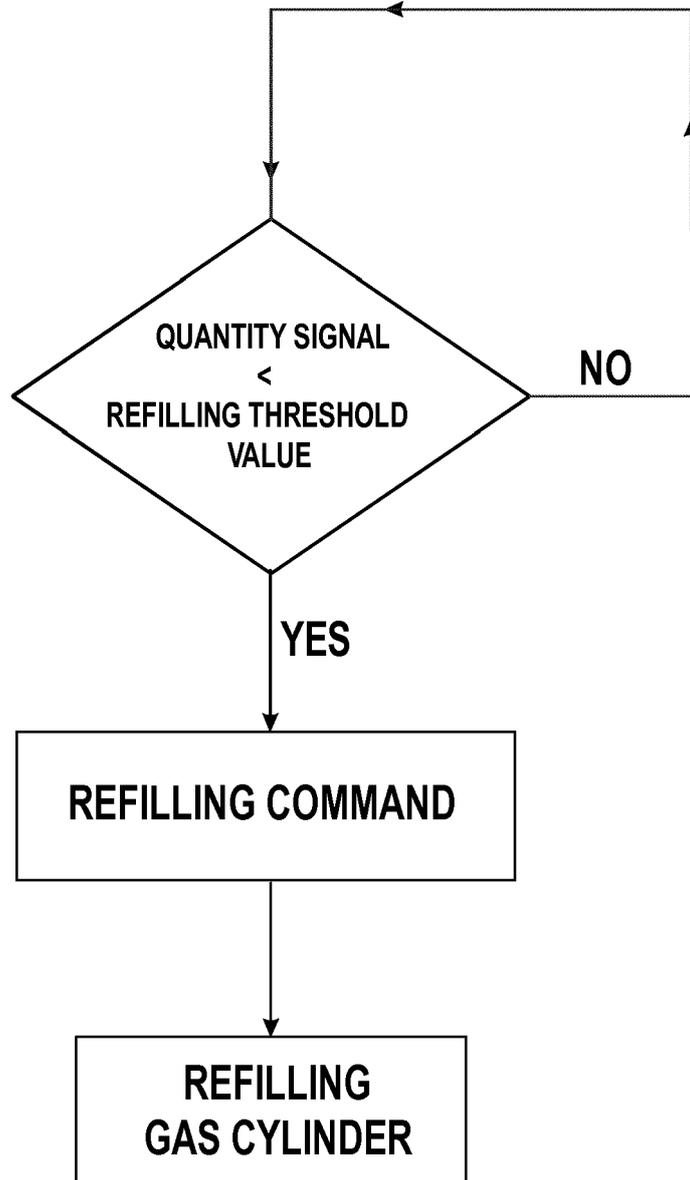


Fig. 7

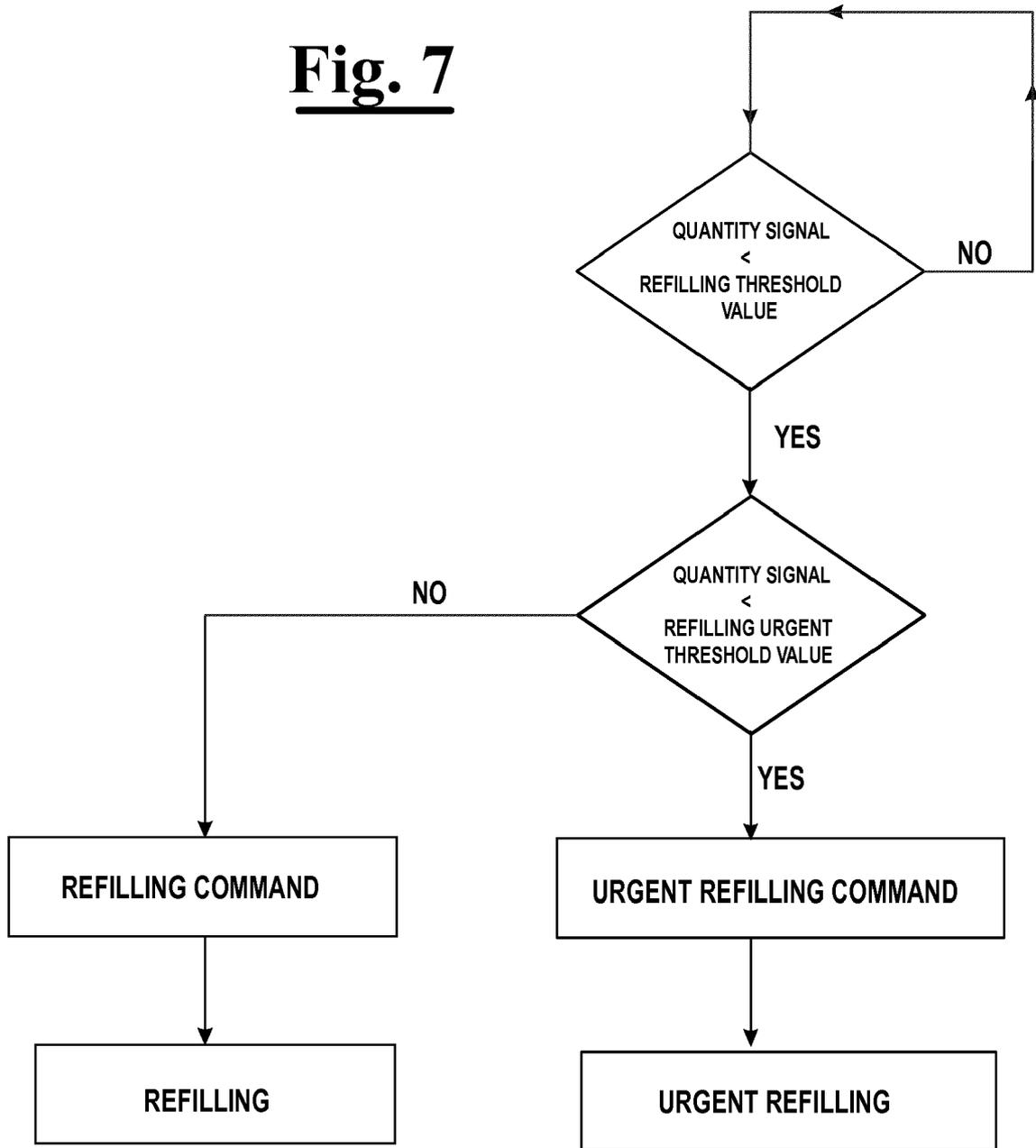


Fig. 8

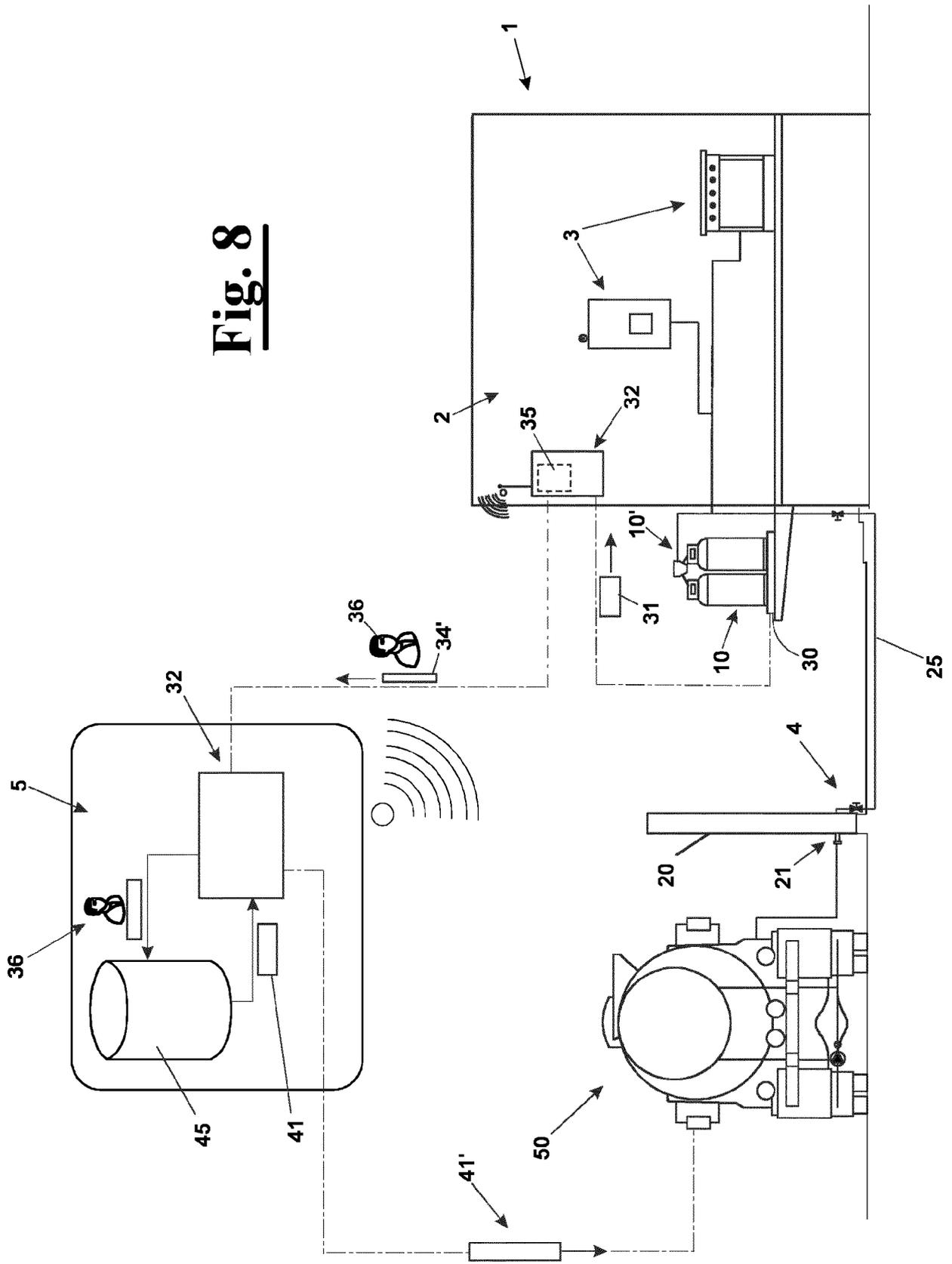
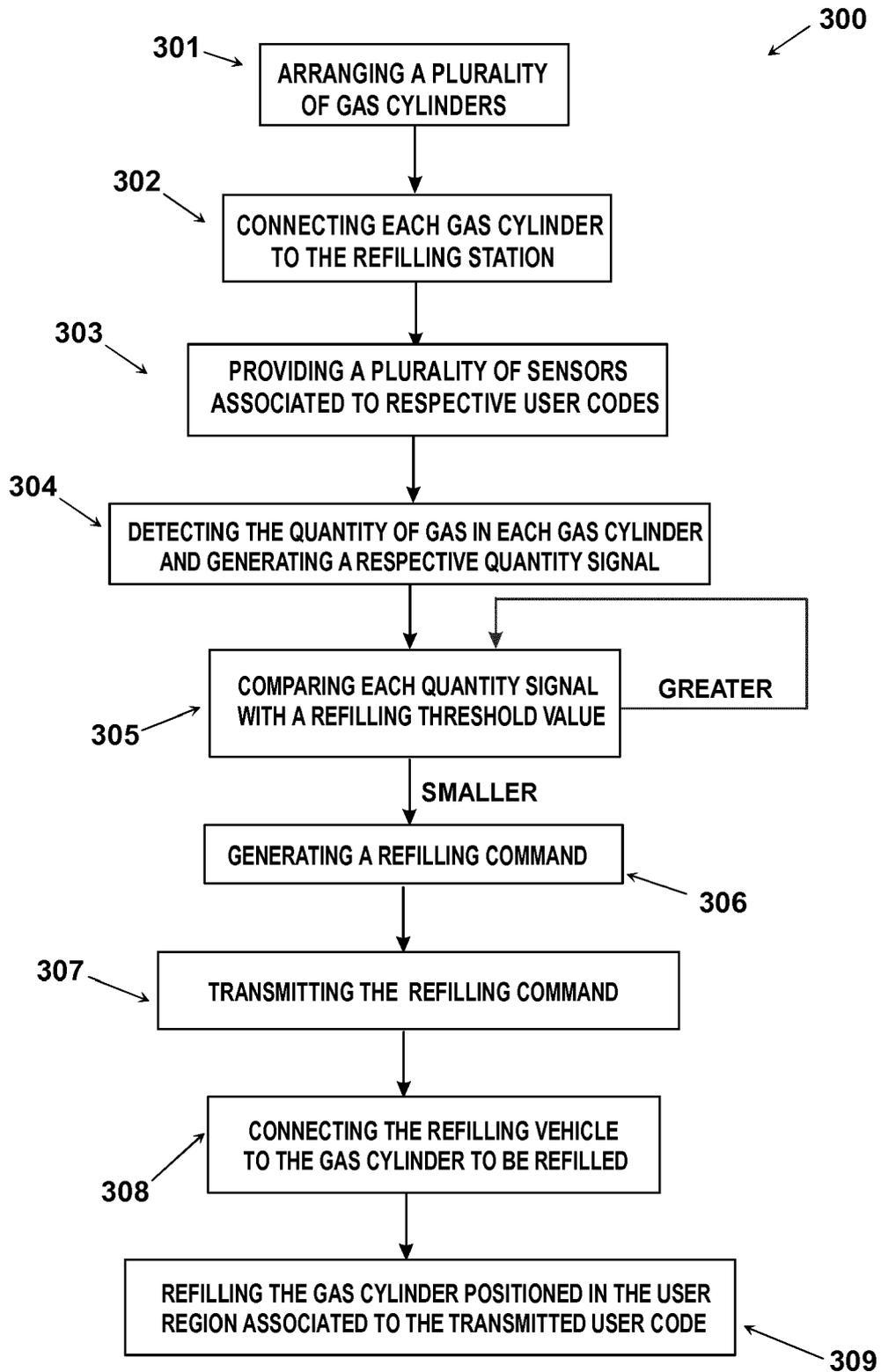


Fig. 10



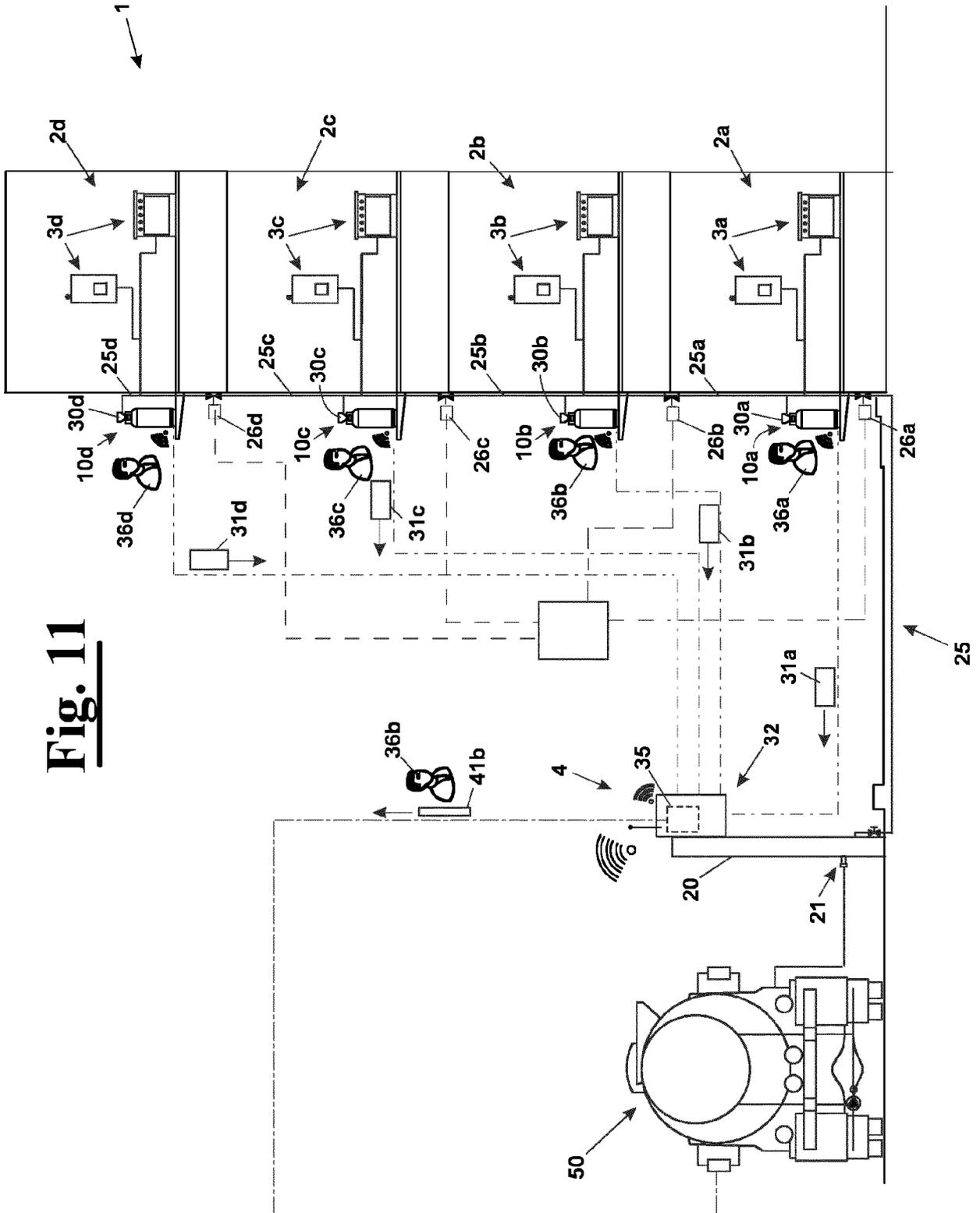


Fig. 11

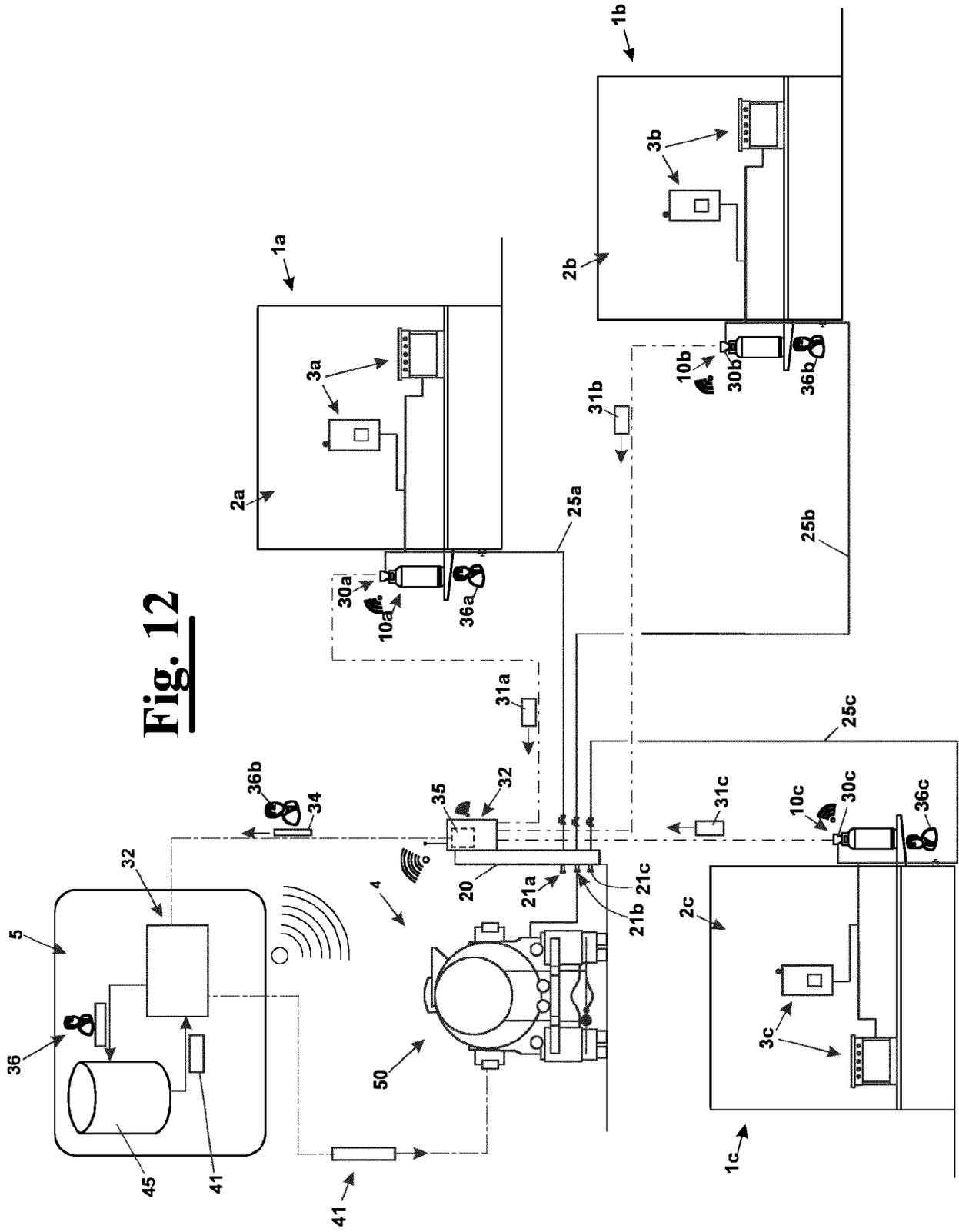


Fig. 12

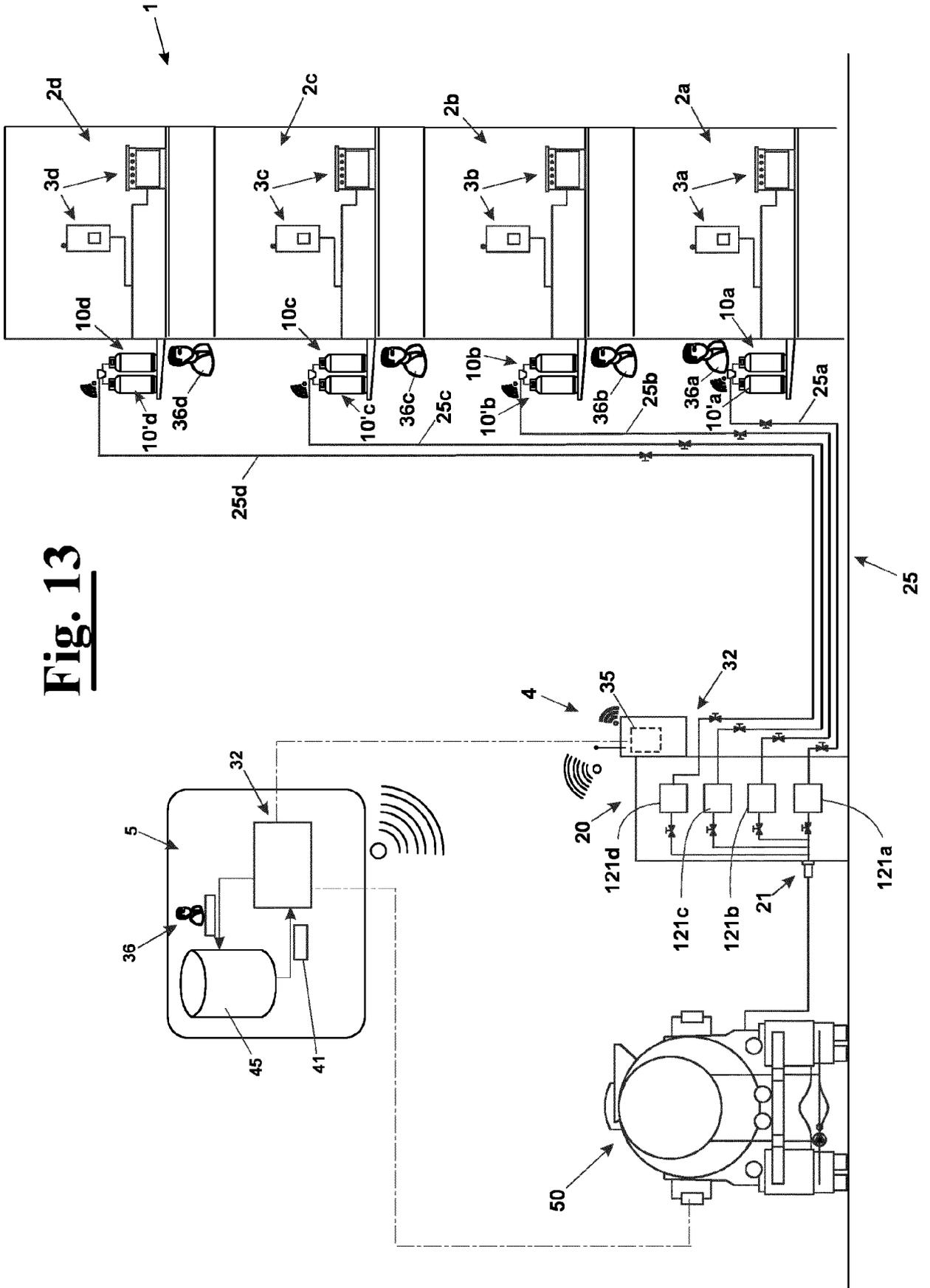


Fig. 13



EUROPEAN SEARCH REPORT

Application Number
EP 19 21 0275

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2012/316915 A1 (HUMPHREY RICHARD L [US]) 13 December 2012 (2012-12-13) * paragraph [0039]; figures 1-4,6 * -----	1-15	INV. F17C5/02
X	US 2015/059468 A1 (HUMPHREY RICHARD L [US]) 5 March 2015 (2015-03-05) * figures 1-5 * -----	1-15	
X	US 5 023 806 A (PATEL NARESH P [US]) 11 June 1991 (1991-06-11) * figure 1 * -----	1-14 15	
X	US 2010/001867 A1 (RODRIGUE MATTHEW [US] ET AL) 7 January 2010 (2010-01-07) * paragraphs [0038], [0057]; figure 3 * -----	1-14	
A	US 2013/293388 A1 (INGALSBE DARYL [US] ET AL) 7 November 2013 (2013-11-07) * paragraphs [0258], [0259], [0305], [0306] * -----	11,12	
			TECHNICAL FIELDS SEARCHED (IPC)
			F17C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 May 2020	Examiner Papagiannis, Michail
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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ON EUROPEAN PATENT APPLICATION NO.

EP 19 21 0275

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The members are as contained in the European Patent Office EDP file on
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14-05-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012316915 A1	13-12-2012	CA 2561963 A1	20-10-2005
		CN 1997873 A	11-07-2007
		EP 1751497 A2	14-02-2007
		US 2006015543 A1	19-01-2006
		US 2008033668 A1	07-02-2008
		US 2009248325 A1	01-10-2009
		US 2011173128 A1	14-07-2011
		US 2012316915 A1	13-12-2012
		WO 2005096771 A2	20-10-2005
		US 2015059468 A1	05-03-2015
US 2011247705 A1	13-10-2011		
US 2013275062 A1	17-10-2013		
US 2015059468 A1	05-03-2015		
US 5023806 A	11-06-1991	NONE	
US 2010001867 A1	07-01-2010	NONE	
US 2013293388 A1	07-11-2013	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2013002505 A [0005] [0006] [0007]