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(54) ELECTRICAL GENERATOR BASED ON LIQUEFIED PETROLEUM GAS

ELEKTRISCHER GENERATOR AUF DER BASIS VON FLÜSSIGERDGAS

GÉNÉRATEUR ÉLECTRIQUE À BASE DE GAZ DE PÉTROLE LIQUÉFIÉ

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Description

Object of the invention

[0001] The present invention relates to the development of an electric generator that integrates in a single frame one or more liquefied petroleum gas (LPG) fuel tanks and a generator set, thus obtaining an electric generator powered by LPG with a great compactness that allows the frequent relocation of said generator since a reduction in the logistics necessary for its transfer and installation is achieved.

Background of the invention

[0002] The long-term stability and growth of an economy requires an adequate supply of energy, and in particular, electrical energy. In many of the cases in which a power supply is required, it needs to be highly reliable, not allowing power outages in locations with high requirements, such as hospitals, data and telecommunications centers, continuous production industries, etc.

[0003] In this sense, the use of generator sets is essential for the development of emergency systems that make it possible to make up for deficiencies or outages in power supply, as well as the absence thereof, thus ensuring continuity in the operation of electrical equipment.

[0004] Currently, most of the generator sets developed are oversized to deliver the power demanded, which is why low levels of energy efficiency, high operating costs and fuel consumption and polluting emissions are achieved, in addition to incurring in high costs derived from the maintenance of equipment.

[0005] Among the latest technologies implemented in the generator sets, there are pieces of equipment with a speed variator that allow the generation of electric current to be adapted to the power demanded at each moment, which are considered high efficiency alternatives. Other technologies implemented, such as electronic control or automatic voltage regulator, allow the equipment to operate autonomously and remotely, optimizing the variables of the equipment based on demand and allowing the management of equipment operation and component maintenance through different telecommunication systems.

[0006] Among the generator sets intended for rental applications (also called rental applications), the most widespread and used generators are electric generators with diesel engines, which have the following drawbacks:

High operating costs: Diesel electric generators require periodic maintenance operations at intervals of 250 hours of operation, there appearing new generators with longer intervals, reaching up to 500 hours between maintenance. The high price of diesel compared to fuel alternatives such as natural gas or LPG must be added to this cost. Liquefied petroleum gas is the mixture of liquefied gases present in natural gas or dissolved in petroleum.

High polluting emissions: The combustion of diesel entails a high emission of polluting compounds and particles over the combustion of natural gas and its derivatives.

High noise level: The acoustic emissions associated with the operation of diesel electric generators limit their application and location.

[0007] Within the gas-based electric generators, all of them have external fuel tanks, which require their corresponding transportation and installation in each work location, including the logistics associated with said activities. The fuel is stored in pressurized tanks that are very sensitive to both high temperatures and sparks that can initiate any gas leakage.

[0008] Due to the safety characteristics of gas tanks and the conditions of the generator sets, the gas tanks where the fuel is stored for its operation are independent elements from the generator sets themselves, so the complete transport involves the use of two vehicles and two trailers, or a large transport vehicle which implies the establishment of complex and expensive logistics.

[0009] In addition, the installation of the electric generators in each location requires both the installation of the generator set, the installation of the gas tank and the gas pipes necessary to carry the fuel to the engine of the generator set.

[0010] Thus, considering the products available on the market, versatile and robust solutions that combine the characteristics demanded by the use of gas-based electric generators for the rental sector have not yet been developed, since there are compact electric generators that use liquefied petroleum gases as fuel, but all of them have gas storage tanks as elements unrelated to the generator itself.

[0011] Therefore, there is a fervent demand in the field of gas-based electric generators for the rental application sector for the development of an electric generator that integrates a generator set and gas tanks in the same structure in order to facilitate the relocation of said electric generators without having to transport two different pieces of equipment, thus avoiding the use of two towing vehicles or equipment transport vehicles for the generator set and for the fuel tank. One such genset can be found in CN 205 243 648 U.

[0012] The present invention satisfies this demand.

Description of the invention

[0013] The electric generator according to the present invention arises from the high inefficiency associated with the relocation of the generator sets powered by LPG, used in the rental applications sector. Due to the characteristics of the sector, in which generator sets are rented to provide energy for different events and applica-

tions, in different locations that require the transfer of the elements that allow electricity generation, which mainly include the generator set and the fuel tank(s).

[0014] In a first aspect, the present invention relates to an electric generator comprising a frame defining a first compartment and a second compartment. The generator comprises a generator set established in the first compartment. Innovatively, the electric generator comprises at least one tank of liquefied petroleum gas, LPG, established in the second compartment and a liquid-phase feed gas train that connects said tank to the generator set for the supply of LPG.

[0015] Thus, the present invention consists of new electrical generation equipment supplied entirely with liquefied petroleum gases LPG in which the LPG tank itself is integrated with the generator set in the same single structure or frame.

[0016] The exclusive use of a gaseous fuel source requires that the tank be pressurized and, therefore, the generator can include auxiliary systems to condition said fuel.

[0017] The present invention focuses on applications of generator sets that use LPG as fuel for electricity generation for the rental sector, which is strongly driven by aspects such as noise pollution, engine efficiency, gas emissions and eventual increase in energy demand. Thus, the present invention relates to an electric generator that allows reducing the logistics necessary for uses and applications involving frequent relocation.

[0018] In this way, the electric generator according to the present invention intends to respond to the needs of the rental sector by developing compact generator equipment that integrates the LPG fuel tanks in the same equipment, maintaining the conditions of safety, autonomy and compactness and increasing ease of transfer while reducing the logistics required for relocation.

[0019] In two preferred embodiments, the generator sets according to the present invention comprise four different powers, one of 25, 40, 70 and 110 kVA, which allow their application to be validated within the ranges of the range intended for the rental sector.

[0020] In a preferred embodiment, the generator comprises three LPG tanks with a useful capacity of 450 liters. The LPG tanks are sized to ensure autonomy of at least 26 hours in the preferred embodiment of 70 kVA, operating at a normal regime of 75% of the nominal load of the generator set of the electric generator.

[0021] The electric generator includes a single filling point for the three tanks. The electric generator includes a system for external feeding both in liquid phase and in vapor phase.

[0022] Additionally for the gaseous phase, the electric generator may comprise a second gas train that connects a gas source external to the electric generator to the generator set for the supply of LPG.

[0023] In addition, the electric generator accepts motorization and generators for both 50 Hz and 60 Hz.

[0024] The electric generator comprises a frame that defines two compartments which can be divided by a rock wool partition or the like in a first embodiment and by a sub-frame in a second embodiment.

[0025] The electric generator comprises at least two gas sensors, one in each compartment of the frame to increase safety. The generator can be programmed to stop its operation immediately after detecting a presence of gas above the established limit.

[0026] The electric generator includes safety valves and conduits that evacuate the gas to the outside of the generator set in the event that excess pressure is detected inside the fuel tanks.

Description of the drawings

[0027] To complement the description that is being made and in order to help a better understanding of the features of the electric generator, according to a preferred example of its practical embodiment, a set of drawings is attached as an integral part of said description, wherein by way of illustration and not limitation, the following has been represented:

Figure 1 shows an electric generator according to the present invention.
Figure 2A shows the frame of the electric generator according to the present invention.
Figure 2B shows the generator set and the LPG fuel tanks of the electric generator according to the present invention.
Figure 3 shows the gas-phase feed gas train of the electric generator according to the present invention.
Figure 4 shows a diagram of the connections of the electric generator according to the present invention where the liquid-phase feed gas train can be seen.

Preferred embodiment of the invention

[0028] The electric generator (100) shown in Figure 1 powered by LPG comprises a single frame (110) which is shown in its entirety in Figure 2A. The electric generator (100) also comprises a generator set (120) and a set of pressurized LPG tanks or reservoirs (130), in particular, three LPG tanks, which are shown in Figure 2B. The electric generator (100) of Figure 1 has a power of 25 kVA. In other preferred embodiments, the electric generator (100) can have powers of 40, 70 and 110 kVA. The three LPG tanks or reservoirs (130) have a useful capacity of 450 liters, which may require 15 minutes to be fully refueled.

[0029] With regard to the frame (110), it comprises inside a first part or compartment (110a) and a second part or compartment (110b) as can be seen in Figure 2A. The frame (110) of the electric generator (100) includes a separation partition or barrier (150) and a casing (112) as well as ventilation means (114). The first compartment (110a) is adapted to house the generator set (120). The second compartment (110b) is adapted to house the LPG

tanks or reservoirs (130). Thus, the frame (110) of Figure 2A is a single indivisible frame that forms two compartments (110a, 11b): one for the generator set (120), that is, for motorization and electricity generation, and another for LPG tanks or reservoirs (130).

[0030] Additionally, the frame (110) includes bulkhead fittings for fuel lines, sensors and electronics. The bulkhead fittings and flexible pipes prevent vibrations caused by the operation of the generator set. In addition, the electric generator (100) can comprise two gas detectors per compartment (110a, 110b) to speed up the detection of potential leaks.

[0031] In addition, the frame (110) includes openings at the bottom of the frame (110) to vent potentially explosive accumulations inside the bodywork.

[0032] The electric generator (100) comprises a liquid-phase feed gas train (140) which is shown in Figure 4 and which connects the three LPG tanks or reservoirs (130) of the electric generator (100) to the generator set (120) for the supply of LPG to the generator set (120). The liquid-phase feed gas train (140) for feeding the generator set (120) with LPG gas stored in the LPG tanks may include a manual valve, a particulate filter, a primary pressure regulator, a solenoid valve, a vaporizer, a low pressure switch and pressure gauges for the inlet and outlet of the gas train (140).

[0033] The three LPG tanks or reservoirs (130) established in the second compartment (110b) are independently isolated from the generator set (112) and from the necessary pipes and elements by means of a separation partition or barrier (150) that may comprise rock wool.

[0034] Also seen is a second gas-phase feed gas train 160 shown in Figures 2B and 3 which is established in frame compartment 110a. The second gas-phase feed gas train (160) connects an external gas source to the generator set (120) for the supply of LPG or NG (Natural Gas) to the generator set (120).

[0035] The gas-phase feed gas train (160) for the external supply of the generator set (120) with LPG or NG gas may include a manual valve, a particulate filter, a primary pressure regulator, a double solenoid valve, a low and high pressure switch and pressure gauges for the inlet and outlet of the gas train (140).

[0036] To manage these three possibilities of fuel supply to the generator, there is an optional selector on the control panel with three positions depending on the option chosen: supply from internal LPG tanks in liquid phase, external supply of LPG in gaseous phase or external supply in gaseous phase of NG.

[0037] With regard to the thermal management of the LPG tanks or reservoirs (130), they are isolated, thus avoiding excessive heating of the reservoirs. Figure 2B shows the installation of the LPG tanks or reservoirs (130) in the lower part of the generator set (120), in the part farthest from the main heat sources. Two critical points in heat generation are identified: Peaks of maximum power requirements continued over time, and after stopping the generator set engine, at which time the cooling system stops working and heat continues to be emitted from the hot spots of the system. Thus, to increase the thermal insulation between the compartments (110a, 110b), the separation partition or barrier (150) of the frame (110) shown in Figure 2A comprises rock wool between the first compartment (110a) and second compartment (110b) of the frame (110).

[0038] The LPG tanks or reservoirs (130) have been isolated in the second compartment (110b) of the frame (110) and are independent of the generator set (120) established in the first compartment (110a) of the frame (110). The first and second compartments (110a, 110b) comprise direct outlets to the outside for possible gas leaks.

[0039] The first and second compartments (110a, 110b) comprise gas sensors. The compartment (110b) comprises passive ventilation for the LPG tanks or reservoirs (130) directly with the outside and ducts for the overpressure valves that expel the gas directly to the outside of the frame (110b).

[0040] In another preferred embodiment, the frame (110) comprises a subframe between the two compartments (110a, 110b) where the generator set (120) and the LPG tanks or reservoirs (130) are located, replacing the partition with rock wool. This subframe allows greater insulation than the separation partition or barrier (150) with rock wool in the event of an increase in the power of the electric generator (100) from 25 kVA to 110 kVA in a second preferred embodiment.

[0041] The frame (110) comprises means of access (116) to the generator set (120) and to the LPG tanks or reservoirs (130) shown in Figures 1 and 2A for disassembling parts of the generator set (116) for maintenance, and for access to the fuel tanks without the need to disassemble the entire generator set.

Claims

1. An electric generator (100) operating on liquefied petroleum gas, LPG, comprising:

   a frame (110) comprising a first compartment (110a) and a second compartment (110b), and
   a generator set (120) driven by LPG established in the first compartment (110a), and
   wherein the electric generator (100) comprises at least one LPG tank (130) established in the second compartment (110b); and
   a first liquid-phase feed gas train (140) connecting the at least one LPG tank (130) to the generator set (120) for supplying LPG to the generator set (120), and
   characterized by a first gas leak sensor in the first compartment (110a) of the frame (110) and a second gas leak sensor in the second compartment (110b) of the frame (110).

2. The electric generator (100) according to claim 1, further comprising a second gas-phase feed gas train (160) that connects a gas source external to the electric generator to the generator set (120) for supply of LPG to the generator set (120).

3. The electric generator (100) according to the any of the preceding claims, wherein the frame (110) comprises ventilation means (114).

4. The electric generator (100) according to the any of the preceding claims, wherein the frame (110) comprises anchoring means for the installation of the electric generator (100) on a transporter trailer.

5. The electric generator (100) according to the any of the preceding claims, comprising three LPG fuel tanks (130).

6. The electric generator (100) according to any of the preceding claims, wherein the frame (110) comprises a barrier (150) with rock wool, and
wherein the first compartment (110a) and the second compartment (110b) are divided by the barrier (150) with rock wool.

7. The electric generator (100) according to claims 1 to 5, wherein the frame (110) comprises a subframe, and
wherein the first compartment (110a) and the second compartment (110b) are divided by the subframe.

8. The electric generator (100) according to the any of the preceding claims, wherein the frame (110) comprises means of access (116) to the generator set (120) and to the LPG tanks or reservoirs (130).

9. The electric generator (100) according to the any of the preceding claims, wherein the frame (110) comprises a casing (112).

10. The electric generator (100) according to claims 2 to 9, wherein the electric generator (100) comprises an electrical panel with a fuel selector comprising three positions:

a first position for internal feeding in liquid phase from the at least one LPG tank (130) through the first gas train (140);
a second position for external gas-phase feeding from the external gas source that stores LPG through the second gas train (160); and
a third position for external gas-phase feeding from the external gas source that stores natural gas, NG through the second gas train (160).

Patentansprüche

1. Stromgenerator (100), der mit verflüssigtem Erdgas, LPG, läuft, umfassend:

ein Gerüst (110), das ein erstes Kompartiment (110a) und ein zweites Kompartiment (110b) umfasst, und
einen Generatorsatz (120), der durch LPG angetrieben wird und sich im ersten Kompartiment (110a) befindet, und
wobei der Stromgenerator (100) wenigstens einen LPG-Tank (130) umfasst, der sich im zweiten Kompartiment (110b) befindet;
und eine erste Regelstrecke (140) für das Zufuhrgas in der flüssigen Phase, die den wenigstens einen LPG-Tank (130) mit dem Generatorsatz (120) verbindet, um dem Generatorsatz (120) LPG zuzuführen, und
gekennzeichnet durch einen ersten Gaslecksensor im ersten Kompartiment (110a) des Gerüsts (110) und einen zweiten Gaslecksensor im zweiten Kompartiment (110b) des Gerüsts (110).

2. Stromgenerator (100) gemäß Anspruch 1, weiterhin umfassend eine zweite Regelstrecke (160) für das Zufuhrgas in der Gasphase, die eine bezüglich des Stromgenerators externe Gasquelle mit dem Generatorsatz (120) verbindet, um dem Generatorsatz (120) LPG zuzuführen.

3. Stromgenerator (100) gemäß einem der vorstehenden Ansprüche, wobei das Gerüst (110) Ventilationseinrichtungen (114) umfasst.

4. Stromgenerator (100) gemäß einem der vorstehenden Ansprüche, wobei das Gerüst (110) Verankerungseinrichtungen für die Montage des Stromgenerators (100) auf einem Transporteranhänger umfasst.

5. Stromgenerator (100) gemäß einem der vorstehenden Ansprüche, umfassend drei LPG-Kraftstofftanks (130).

6. Stromgenerator (100) gemäß einem der vorstehenden Ansprüche, wobei das Gerüst (110) eine Sperre (150) mit Steinwolle umfasst und
wobei das erste Kompartiment (110a) und das zweite Kompartiment (110b) durch die Sperre (150) mit Steinwolle voneinander getrennt sind.

7. Stromgenerator (100) gemäß Anspruch 1 bis 5, wobei das Gerüst (110) ein Teilgerüst umfasst und
wobei das erste Kompartiment (110a) und das zweite Kompartiment (110b) durch das Teilgerüst voneinander getrennt sind.

8. Stromgenerator (100) gemäß einem der vorstehenden Ansprüche, wobei das Gerüst (110) Einrichtungen zum Zugang (116) zum Generatorsatz (120) und zu den LPG-Tanks oder -Reservoirs (130) umfasst.

9. Stromgenerator (100) gemäß einem der vorstehenden Ansprüche, wobei das Gerüst (110) ein Gehäuse (112) umfasst.

10. Stromgenerator (100) gemäß Anspruch 2 bis 9, wobei der Stromgenerator (100) eine elektrische Schalttafel mit einem Kraftstoffselektor umfasst, welcher drei Positionen umfasst:

eine erste Position zum internen Zuführen einer flüssigen Phase aus dem wenigstens einen LPG-Tank (130) durch die erste Gasregelstrecke (140);
eine zweite Position zum externen Zuführen einer Gasphase aus der externen Gasquelle, in der LPG gespeichert ist, durch die zweite Gasregelstrecke (160); und
eine dritte Position zum externen Zuführen einer Gasphase aus der externen Gasquelle, in der Erdgas (NG) gespeichert ist, durch die zweite Gasregelstrecke (160).

Revendications

1. Générateur électrique (100) alimenté au gaz de pétrole liquéfié, GPL, comprenant :

un châssis (110) comprenant un premier compartiment (110a) et un deuxième compartiment (110b), et
un groupe électrogène (120) fonctionnant au GPL établi dans le premier compartiment (110a), et
dans lequel le générateur électrique (100) comprend au moins un réservoir de GPL (130) établi dans le deuxième compartiment (110b) ; et
un premier train de gaz (140) d'alimentation en phase liquide raccordant l'au moins un réservoir de GPL (130) au groupe électrogène (120) pour alimenter en GPL le groupe électrogène (120), et
caractérisé par un premier capteur de fuite de gaz dans le premier compartiment (110a) du châssis (110) et un deuxième capteur de fuite de gaz dans le deuxième compartiment (110b) du châssis (110).

2. Générateur électrique (100) selon la revendication 1, comprenant en outre un deuxième train de gaz (160) d'alimentation en phase gazeuse qui raccorde une source de gaz externe au générateur électrique au groupe électrogène (120) pour l'alimentation en GPL du groupe électrogène (120).

3. Générateur électrique (100) selon l'une quelconque des revendications précédentes, dans lequel le châssis (110) comprend des moyens de ventilation (114).

4. Générateur électrique (100) selon l'une quelconque des revendications précédentes, dans lequel le châssis (110) comprend des moyens d'ancrage pour l'installation du générateur électrique (100) sur une remorque de transporteur.

5. Générateur électrique (100) selon l'une quelconque des revendications précédentes, comprenant trois réservoirs de carburant GPL (130).

6. Générateur électrique (100) selon l'une quelconque des revendications précédentes, dans lequel le châssis (110) comprend une barrière (150) avec de la laine de roche, et
dans lequel le premier compartiment (110a) et le deuxième compartiment (110b) sont divisés par la barrière (150) avec de la laine de roche.

7. Générateur électrique (100) selon les revendications 1 à 5, dans lequel le châssis (110) comprend un sous-châssis, et
dans lequel le premier compartiment (110a) et le deuxième compartiment (110b) sont divisés par le sous-châssis.

8. Générateur électrique (100) selon l'une quelconque des revendications précédentes, dans lequel le châssis (110) comprend des moyens d'accès (116) au groupe électrogène (120) et aux réservoirs ou cuves de GPL (130).

9. Générateur électrique (100) selon l'une quelconque des revendications précédentes, dans lequel le châssis (110) comprend un boîtier (112).

10. Générateur électrique (100) selon les revendications 2 à 9, dans lequel le générateur électrique (100) comprend un tableau électrique avec un sélecteur de carburant comprenant trois positions :

une première position pour une alimentation interne en phase liquide à partir de l'au moins un réservoir de GPL (130) à travers le premier train de gaz (140) ;
une deuxième position pour une alimentation en phase gazeuse externe à partir de la source de gaz externe qui stocke du GPL à travers le deuxième train de gaz (160) ; et
une troisième position pour une alimentation en phase gazeuse externe à partir de la source de

gaz externe qui stocke du gaz naturel, GN, à travers le deuxième train de gaz (160).

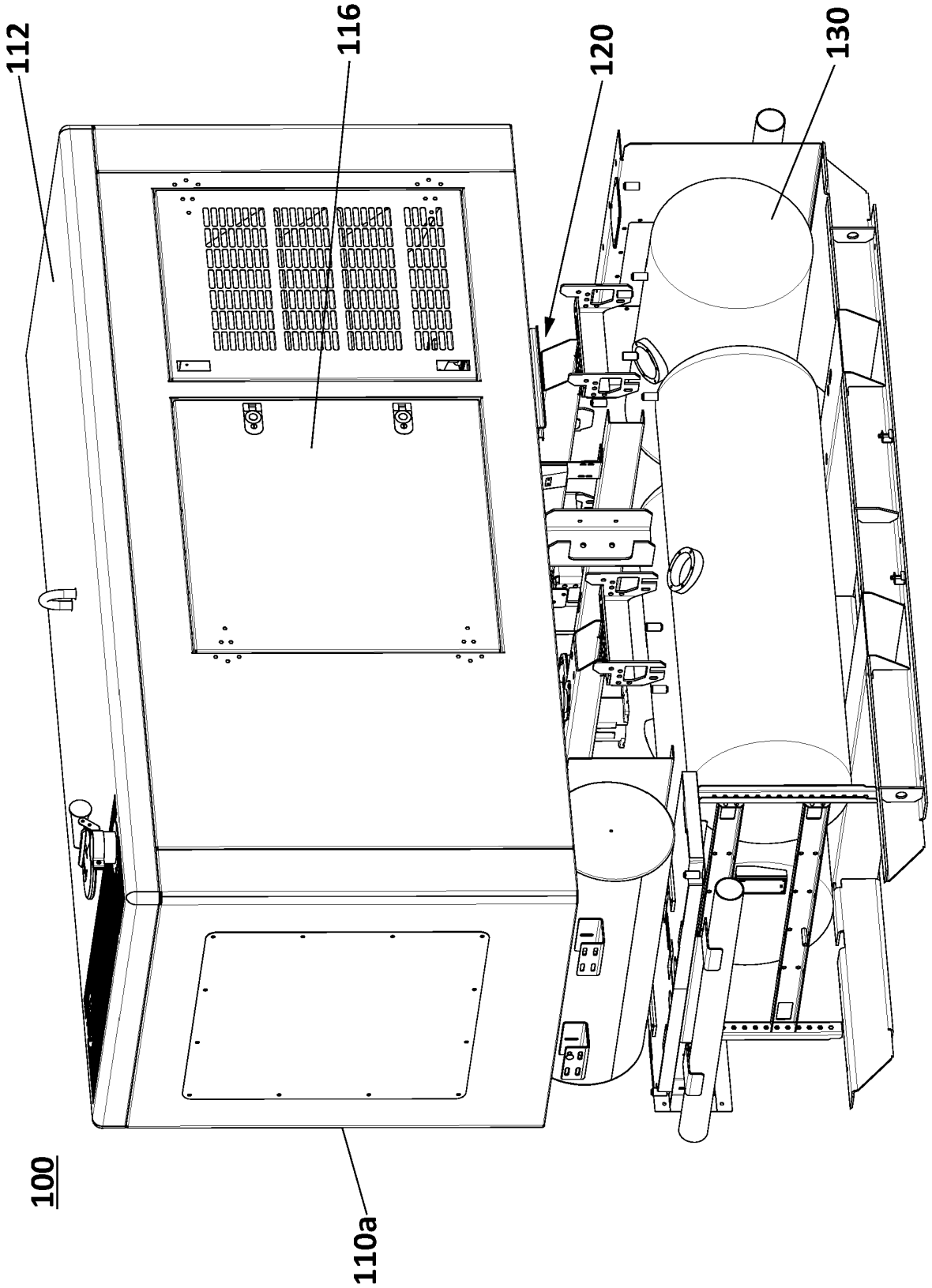

FIG. 1

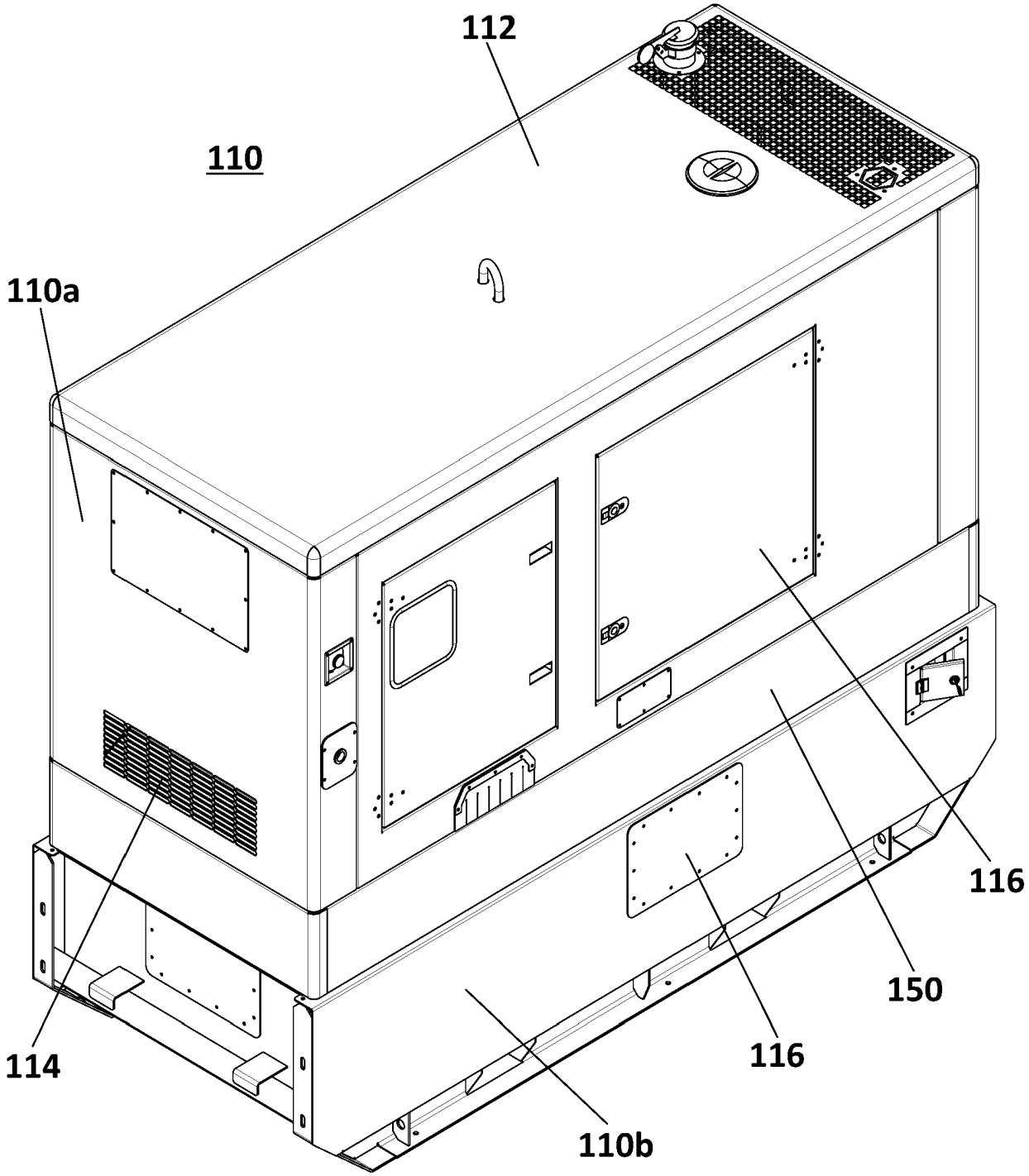

FIG. 2A

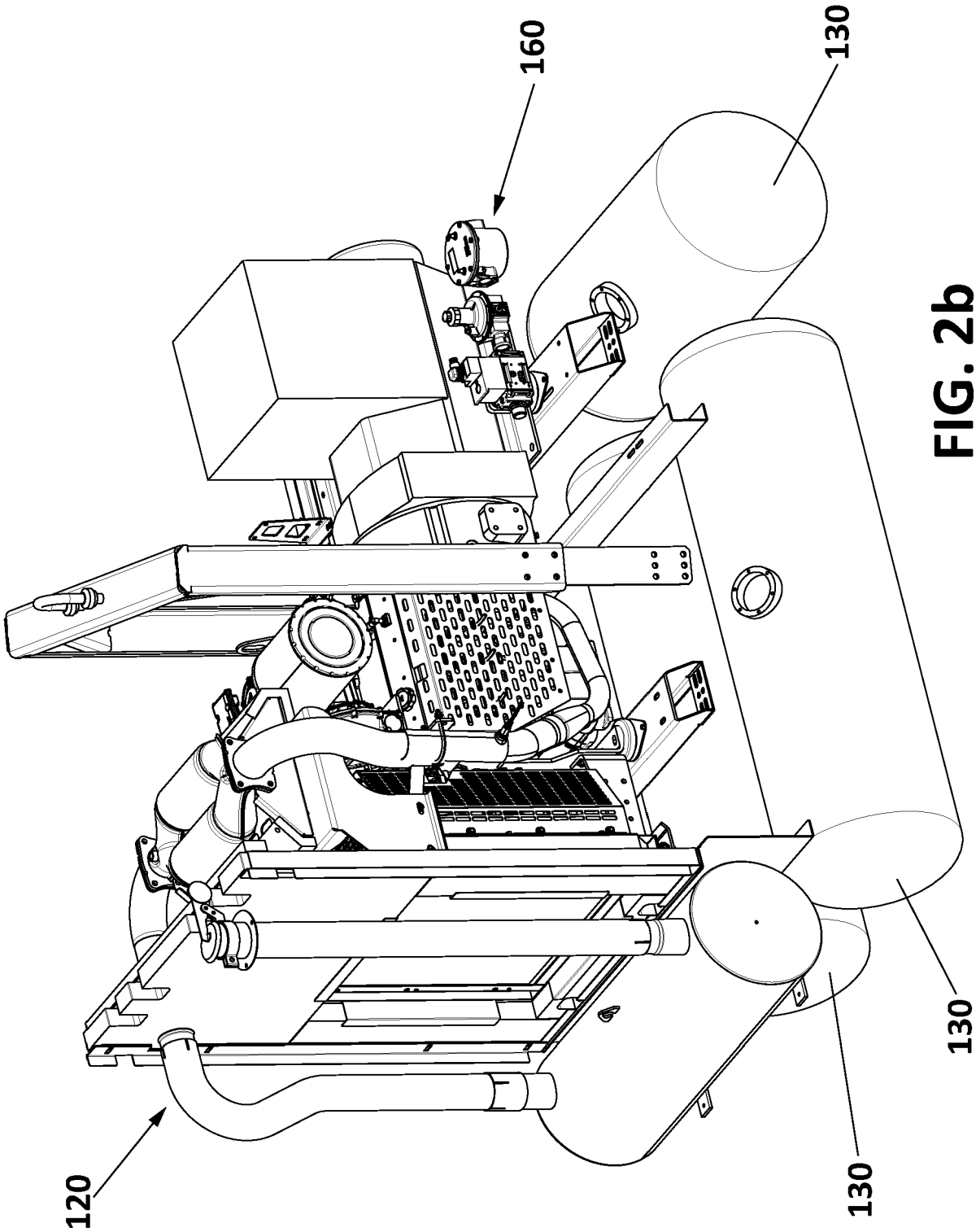

FIG. 2b

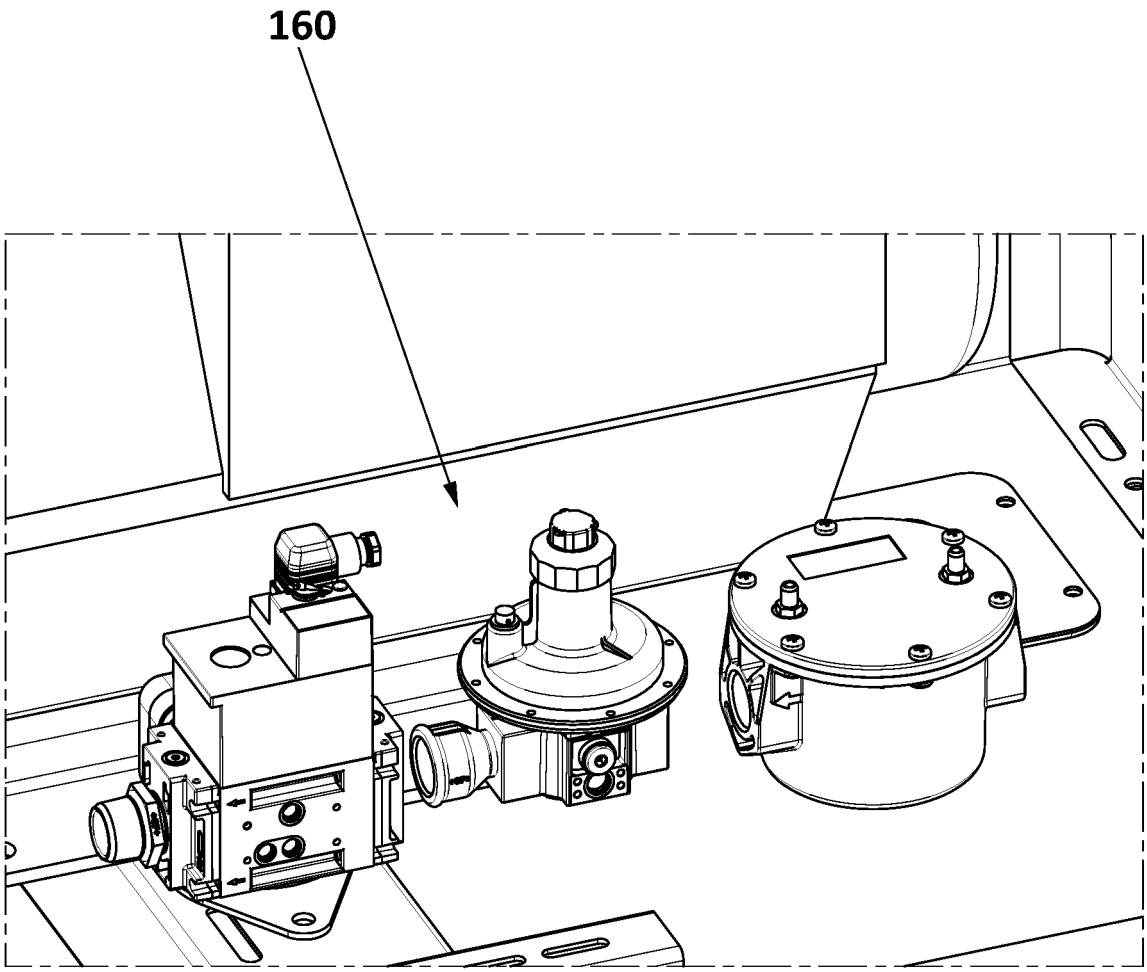

FIG. 3

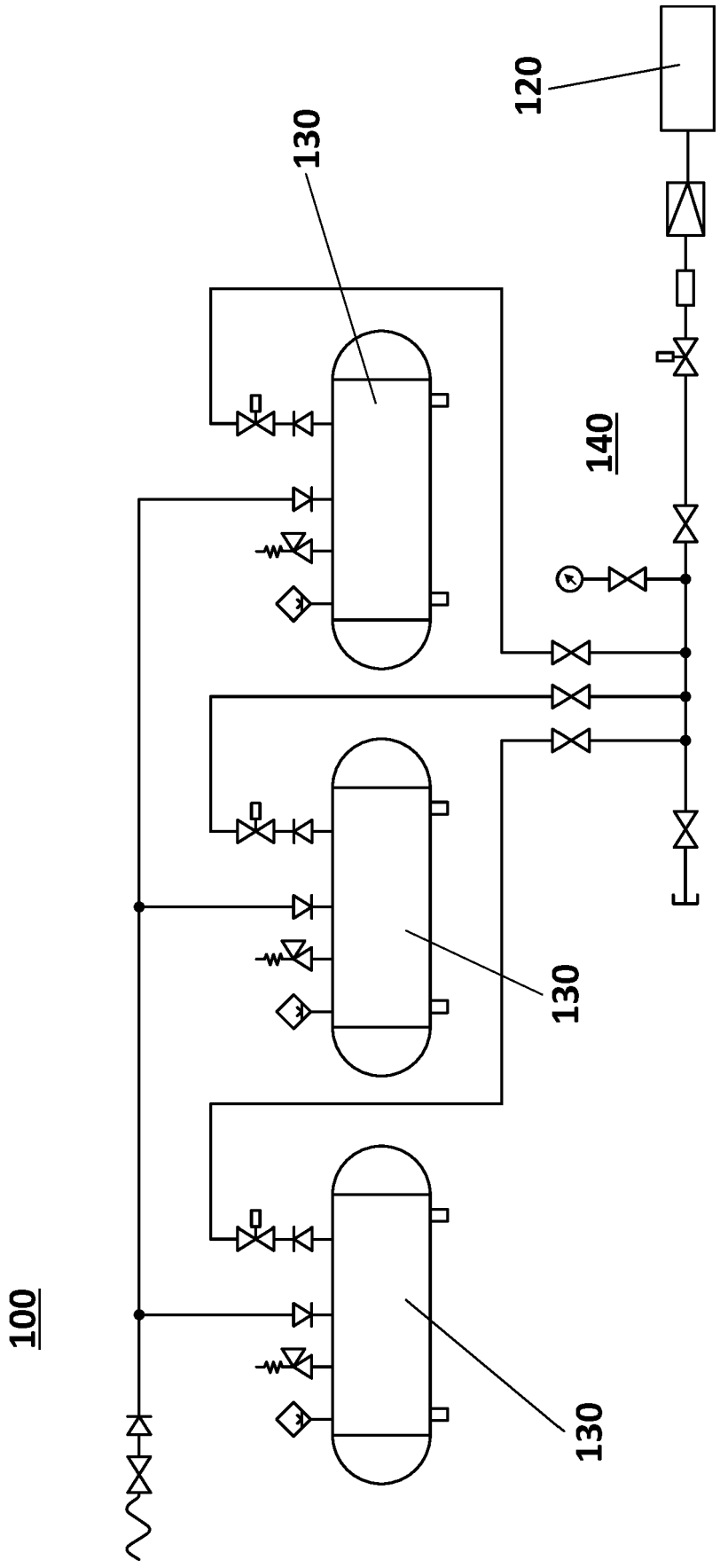

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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