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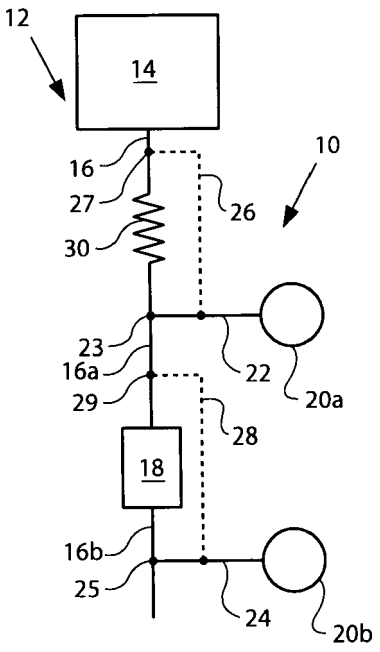
Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) Exhaust system

(57) An exhaust system (12) for a combustion engine (14) comprising an exhaust passage (16) having a first conduit port (23) and a first sensing portion (20a) configured to determine a parameter related to a pressure of exhaust gas in the exhaust passage, the first sensing portion (20a) being remote from the exhaust passage (16). A first conduit (22) extends between the first sensing portion (20a) and the first conduit port (23) for fluidly connecting the first sensing portion (20a) with the exhaust passage (16). A first bleed passage (26) extends between the first conduit (22) and a first bleed connection (27) for fluidly connecting the first bleed passage (26) with another portion of the exhaust system (12) enabling a substantially continuous flow of exhaust gas through at least a portion of the first conduit (22).

FIG. 3



EP 2 466 088 A1

Description

Technical Field

[0001] The present disclosure relates generally to an exhaust system.

Background

[0002] Exhaust gas systems for power units such as internal combustion engines nowadays tend to be of increasingly complex arrangements involving multiple subsystems and components for emission control such as exhaust gas recirculation (EGR) arrangements and aftertreatment arrangements. Exhaust gas is inherently dirty and potentially aggressive as it contains many constituents, including water, that together and potentially with other additional chemicals (such as for example urea) can form deposits in the systems thereby reducing or halting proper operation of the various components and/or systems. The current disclosure is aimed at alleviating some of such problems.

Summary

[0003] The present disclosure details an exhaust system for a combustion engine comprising an exhaust passage having a first conduit port, a first sensing portion configured to determine a parameter related to a pressure of exhaust gas in the exhaust passage, the first sensing portion being remote from the exhaust passage. Furthermore, a first conduit extends between the first sensing portion and the first conduit port for fluidly connecting the first sensing portion with the exhaust passage and a first bleed passage extends between the first conduit and a first bleed connection for fluidly connecting the first bleed passage with another portion of the exhaust system enabling a substantially continuous flow of exhaust gas through at least a portion of the first conduit.

Brief Description of the Drawings

[0004]

Fig. la is a schematic illustration of an exemplary exhaust system embodiment having at least one sensing portion according to the present disclosure.
Fig. lb is a schematic illustration of a variant of the embodiment of Fig. la.
Fig. 2a is an schematic illustration of an expanded variant of the embodiment of Fig. 1 a.
Fig. 2b is a schematic illustration of a variant of the embodiment of Fig. 2a.
Fig. 3 is a schematic illustration of an exemplary exhaust system embodiment having at least two sensing portions according to the present disclosure.
Fig. 4 is a schematic illustration of a variant of Fig. 3.
Fig. 5 is a schematic illustration of an exemplary exhaust system embodiment having at least two sensing portions with a single bleed line.
Fig. 6 is a is a schematic illustration of an exemplary exhaust system embodiment having two sensing portions as part of the same sensor.

Detailed Description

[0005] Figs. 1 to 6 are schematic illustrations of exemplary embodiments of a sensing arrangement 10 for an exhaust system 12 of a combustion engine 14 such as for example an internal combustion engine. An exhaust passage 16 may be fluidly connected to the combustion engine 14 to conduct exhaust gasses. In one embodiment the exhaust passage 16 may for example be an exhaust gas recirculation (EGR) passage to conduct exhaust gasses from an exhaust portion of the combustion engine 14 to an intake portion of the combustion engine 14. In one embodiment the exhaust passage 16 may additionally or alternatively be conducting exhaust gas from or to an aftertreatment arrangement and/or to the environment.

[0006] In one embodiment the sensing arrangement 10 may include a first sensing portion 20a. In another embodiment the sensing arrangement may include at least a first sensing portion 20a and a second sensing portion 20b. The sensing arrangement 10 may be configured to determine parameters relating to an exhaust gas pressure. The first and second sensing portions 20a and 20b may for example be individual pressure sensors such as absolute pressure sensors. Alternatively, the first and second sensing portions 20a and 20b may actually be portions of a single sensor such as a Δp ("delta-pressure") sensor.

[0007] First sensing portion 20a may be remote from the exhaust passage 16 and may be fluidly connected to the exhaust passage 16 via a first conduit 22. The fluid connection of the first conduit 22 with the exhaust passage 16 will from hereon be referred to as first conduit port 23. Similarly, second sensing portion 20b may be remote from the exhaust passage 16 and may be fluidly connected to the exhaust passage 16 via a second conduit 24. The fluid connection of the second conduit 24 with the exhaust passage 16 will from hereon be referred to as second conduit port 25.

[0008] A first bleed passage 26 may extend from the first conduit 22 to a portion of the exhaust system 12 to fluidly connect them together. The fluid connection of the first bleed passage 26 with the portion of the exhaust system 12 it fluidly connects to will from hereon be referred to as the first bleed connection 27. In one embodiment the first bleed passage 26 may extend from the first conduit 22 to the exhaust passage 16 and the first bleed connection 27 is then the fluid connection between the first bleed passage 26 and the exhaust passage 16.

[0009] Similarly, a second bleed passage 28 may extend from the second conduit 24 to a portion of the exhaust system 12 to fluidly connect them together. The

fluid connection of the second bleed passage 28 with the portion of the exhaust system 12 it fluidly connects to will from hereon be referred to as the second bleed connection 29. In one embodiment the second bleed passage 28 may extend from the second conduit 24 to the exhaust passage 16 and the second bleed connection 29 is then the fluid connection between the second bleed passage 28 and the exhaust passage 16.

[0010] It is to be understood that the first and/or second bleed passages 26 and 28 may have cross-sectional diameters, or orifices with such a cross-sectional diameter, which are small compared to the exhaust passage 16 such that the flow through the first and/or second bleed passages 26 and 28 may be little or even insignificant compared to the flow flowing through the exhaust passage 16.

[0011] The exhaust passage 16 may have a restriction 18 therein, dividing the exhaust passage 16 in an upstream portion 16a and a downstream portion 16b. In one embodiment the restriction 18 may be a restrictor having a fixed cross-sectional opening such as for example a fixed venturi. In another embodiment the restriction 18 may have a variable cross-sectional opening therethrough such as for example a valve arrangement including a moveable valve member.

[0012] The location of the first bleed connection 27 and/or the second bleed connection 29 in the exhaust system may be chosen as suitable. For example the first bleed connection 27 may be located on upstream portion 16a, on downstream portion 16b, on a portion of the exhaust passage 16 upstream of the first conduit port 23 or on a portion of the exhaust passage 16 downstream of the first conduit port 23. The second bleed connection 29 may be located on upstream portion 16a, on downstream portion 16b, on a portion of the exhaust passage 16 upstream of the second conduit port 25 or on a portion of the exhaust passage 16 downstream of the second conduit port 25.

[0013] Figs. 3 and 4 show exemplary embodiments in which an additional restricting element 30 may be present in the exhaust passage. The restricting element 30 may be anything that provides resistance to the gas flow and may for example include a components such as a turbocharger or a valve, but may also be a just a bend or narrowing in the conduit for example. The characteristic of the restricting element 30 is that the gas flow therethrough is restricted such that there is a gas pressure differential across the restricting element 30.

[0014] As best seen in Fig. 3 in one embodiment the first bleed connection 27 may be located in a portion of the exhaust passage 16 upstream of the restricting element 30 whilst the first conduit port 23 is located in a portion of the exhaust passage 16 downstream of the restricting element 30. The second bleed connection 29 may be located in a portion of the exhaust system upstream of the restriction 18 whilst the second conduit port 25 is located in a portion of the exhaust passage 16 downstream of the restriction 18. It is to be understood that the restricting element 30 may be omitted.

[0015] As best seen in Fig. 4, in one embodiment the first bleed connection 27 may be located in a portion of the exhaust passage 16 downstream of the restriction 18 whilst the first conduit port 23 maybe located in a portion of the exhaust passage 16 upstream of the restriction 18. The second bleed connection 29 may be located in a portion of the exhaust system downstream of the restricting element 30 whilst the second conduit port 25 may be located in a portion of the exhaust passage 16 upstream of the restricting element 30. It is to be understood that the restricting element 30 may be omitted.

[0016] As best seen in Figs. 5 and 6, the first and second bleed connections 27 and 29 may actually be fluidly connected together such that the first and the second bleed passages 26 and 28 are merged.

[0017] It is to be understood that the aforementioned embodiments are exemplary only and not intended to be limiting. Individually, or as part of a combination, any of the first conduit port 23, the second conduit port 25, the fist bleed connection 27 and the second bleed connection 29 may be located as suitable. For example, it may be desirable to have exhaust gas flow predominantly from the first bleed passage 26 to the first bleed connection 27 or vice versa. Similarly, it may be desirable to have exhaust gas flow predominantly from the second bleed passage 28 to the second bleed connection 29 or vice versa.

Industrial Applicability

[0018] For exemplary purposes only the system will be described as being operational as an EGR loop with the exhaust passage 16 being fluidly connectable to an intake portion of the engine. During operation of the EGR loop exhaust gas produced by combustion engine 14 may flow through the exhaust passage 16 and through restriction 18, which in this case may be regarded as an EGR valve. The restriction 18 may be controlled to regulate the amount of EGR and may even be closed fully. In the example of the exhaust system 12 being a portion of an EGR loop it may be desirable to determine various gas pressure related parameters upstream and downstream of the restriction 18 to aid in determining or estimating the EGR mass flow. However, it may be undesirable or just not practical to have the first and/or second sensing portions 20a and 20b in immediate proximity of the main exhaust flow in the exhaust passage 16 and therefore the first and second conduits 22 and 24 may enable the first and second sensing portions 20a and 20b to be located remotely from the exhaust passage 16. Gas flowing through the exhaust passage 16 will act on the remote first and second sensing portions 20a and 20b. As without the first and/or second bleed passages 26, 28 the first and second conduits 22 and 24 are basically dead ends, the flow of gas may stagnate to an extent in the first and second conduits 22 and 24. By providing a first bleed passage 26 extending between the first conduit

22 and a first bleed connection 27 for fluidly connecting the first bleed passage 26 with another portion of the exhaust system 12 enables a substantially continuous flow of exhaust gas through at least a portion of the first conduit 22. Similarly, providing a second bleed passage 28 extending between the second conduit 24 and a second bleed connection 29 for fluidly connecting the second bleed passage 28 with another portion of the exhaust system 12 enables a substantially continuous flow of exhaust gas through at least a portion of the second conduit 24.

[0019] By changing the flow characteristics through at least portions of the first and second conduits 22 and 24, build up of deposits or the forming of condensation in the first and second conduits 22 and 24 and especially near the first and second conduit ports 23 and 25 may be reduced. By using existing pressure differentials upstream and downstream of the first and second conduit ports 23 and 25 predominant flow directions can be achieved. For example, by fluidly connecting the first bleed passage 26 to a portion of the exhaust system 12 where a relatively higher exhaust gas pressure exists than in the first conduit 22, any gas flow will then predominantly take place from the first bleed connection 27, through the first bleed passage 26, through at least a portion of the first conduit 22 and subsequently through the first conduit port 23. Of course the reverse order applies when the exhaust gas pressure in the first conduit 22 is relatively higher than the exhaust gas pressure at the first bleed connection 27. It may for example be preferred to have the flow directed in such a manner to move any deposits away from the first sensing portion 20a rather than towards it. Of course this equally applies to the portion of the system including the second sensing portion 20b, the second bleed connection 29 and its associated second bleed passage 28.

[0020] In situations where fouling and/or condensation issues tend to mainly concentrate near the first conduit port 23, the fluid connection between first conduit 22 and the first bleed passage 26 may be located relatively close to the first conduit port 23, e.g. within 50 or even within 25 millimeters from the first conduit port 23. This of course applies equally to the second conduit 24, the second conduit port 25 and the second bleed passage 28.

[0021] In one embodiment at least one of the fluid connections between the first conduit 22 and the first bleed passage 26, and between the second conduit 24 and the second bleed passage 28 may be located adjacent the associated sensing portion 20a and 20b respectively.

[0022] It will be apparent to those skilled in the art that various modifications and variations can be made in the disclosed linkage arrangement. Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the disclosed embodiments herein. It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims.

Claims

1. An exhaust system (12) for a combustion engine (14) comprising:

an exhaust passage (16) having a first conduit port (23);
a first sensing portion (20a) configured to determine a parameter related to a pressure of exhaust gas in the exhaust passage, the first sensing portion (20a) being remote from the exhaust passage (16);
a first conduit (22) extending between the first sensing portion (20a) and the first conduit port (23) for fluidly connecting the first sensing portion (20a) with the exhaust passage (16);
a first bleed passage (26) extending between the first conduit (22) and a first bleed connection (27) for fluidly connecting the first bleed passage (26) with another portion of the exhaust system (12) enabling a substantially continuous flow of exhaust gas through at least a portion of the first conduit (22).

2. An exhaust system (12) according to claim 1, further including
a restriction (18) in the exhaust passage (16);
a second conduit port (25) in the exhaust passage (16);
a second sensing portion (20b) configured to determine a parameter related to a pressure of exhaust gas in the exhaust passage (16), the second sensing portion (20b) being remote from the exhaust passage (16);
a second conduit (24) extending between the second sensing portion (20b) and the second conduit port (25) for fluidly connecting the second sensing portion (20b) with the exhaust passage (16);
a second bleed passage (28) extending between the second conduit (24) and a second bleed connection (29) for fluidly connecting the second bleed passage (28) with another portion of the exhaust system (12) enabling a substantially continuous flow of exhaust gas through at least a portion of the second conduit (24) wherein the first conduit port (23) is located in a portion of the exhaust passage (16a) upstream of the restriction (18) and the second conduit port (25) is located in a portion of the exhaust passage (16b) downstream of the restriction (18).

3. An exhaust system (12) according to claim 2 wherein said first and second sensing portions (20a, 20b) are portions of a single Δp sensor.

4. An exhaust system (12) according to claim 2 wherein the first sensing portion (20a) is a first pressure sensor and the second sensing portion (20b) is a second pressure sensor.

5. An exhaust system (12) according to any of the preceding claims wherein the restriction (18) is a venturi.

6. An exhaust system (12) according to any of claims 1 to 4, wherein the restriction (18) is an EGR valve.

7. An exhaust system (12) according to any of claims 2 to 6, wherein the first and second bleed connections (27, 29) are fluidly connected to each other.

8. An exhaust system (12) according to any of the preceding claims, wherein at least one of the first and second bleed connections (27, 29) is located in the exhaust system (12) such that exhaust gas tends to flow predominantly from the bleed passage (26, 28) to the associated bleed connection (27,29).

9. An exhaust system (12) according to any of the preceding claims, wherein at least one of the first and second bleed connections (27, 29) is located in the exhaust system (12) such that exhaust gas tends to flow predominantly from the bleed connection (27, 29) to the associated bleed passage (26, 28).

10. An exhaust system (12) according to any of claims 2 to 6 wherein both the first and second bleed connections (27, 29) are located in a portion of the exhaust passage (16a) upstream of the restriction (18).

11. An exhaust system (12) according to any of claims2 to 6 wherein both the first and second bleed connections (27, 29) are located in a portion of the exhaust passage (16b) downstream of the restriction (18).

12. An exhaust system (12) according to any of the preceding claims, wherein at least one of the fluid connections a) between the first conduit (22) and the first bleed passage (26) and b) between the second conduit (24) and the second bleed passage (28) is located within 50 millimeters from the first conduit port (23).

13. An exhaust system (12) according to any of the preceding claims, wherein at least one of the fluid connections between a) between the first conduit (22) and the first bleed passage (26) and b) between the second conduit (24) and the second bleed passage (28) is located within 25 millimeters from the first conduit port (23).

14. An exhaust system (12) according to any of claims 1 to 11, wherein at least one of the fluid connections a) between the first conduit (22) and the first bleed passage (26) and b) between the second conduit (24) and the second bleed passage (28) is located adjacent the associated sensing portion (20a, 20b)

15. An exhaust system (12) according to any of the preceding claims wherein at least one of the first and second bleed passages (26, 28) includes a portion having a small cross-sectional diameter relative to the exhaust passage (16) such that any flow through the at least one of the first and second bleed passages (26, 28) is little or insignificant compared through the flow flowing through the exhaust passage (16).

Amended claims in accordance with Rule 137(2) EPC.

1. An exhaust system (12) for a combustion engine (14) comprising:

an exhaust passage (16) having a first conduit port (23) and a second conduit port (25) in the exhaust passage (16);
a restriction (18) in the exhaust passage (16);
a first sensing portion (20a) configured to determine a parameter related to a pressure of exhaust gas in the exhaust passage, the first sensing portion (20a) being remote from the exhaust passage (16);
a second sensing portion (20b) configured to determine a parameter related to a pressure of exhaust gas in the exhaust passage (16), the second sensing portion (20b) being remote from the exhaust passage (16);
a first conduit (22) extending between the first sensing portion (20a) and the first conduit port (23) for fluidly connecting the first sensing portion (20a) with the exhaust passage (16);
a second conduit (24) extending between the second sensing portion (20b) and the second conduit port (25) for fluidly connecting the second sensing portion (20b) with the exhaust passage (16);
a first bleed passage (26) extending between the first conduit (22) and a first bleed connection (27) for fluidly connecting the first bleed passage (26) with another portion of the exhaust system (12) enabling a substantially continuous flow of exhaust gas through at least a portion of the first conduit (22); and
a second bleed passage (28) extending between the second conduit (24) and a second bleed connection (29) for fluidly connecting the second bleed passage (28) with another portion of the exhaust system (12) enabling a substantially continuous flow of exhaust gas through at least a portion of the second conduit (24) wherein the first conduit port (23) is located in a portion of the exhaust passage (16a) upstream of the restriction (18) and the second conduit port (25) is located in a portion of the exhaust passage

(16b) downstream of the restriction (18).

2. An exhaust system (12) according to claim 1, wherein said first and second sensing portions (20a, 20b) are portions of a single Δp sensor.

3. An exhaust system (12) according to claim 1, wherein the first sensing portion (20a) is a first pressure sensor and the second sensing portion (20b) is a second pressure sensor.

4. An exhaust system (12) according to any of the preceding claims wherein the restriction (18) is a venturi.

5. An exhaust system (12) according to any of claims 1 to 3, wherein the restriction (18) is an EGR valve.

6. An exhaust system (12) according to any of claims 1 to 5, wherein the first and second bleed connections (27, 29) are fluidly connected to each other.

7. An exhaust system (12) according to any of the preceding claims, wherein at least one of the first and second bleed connections (27, 29) is located in the exhaust system (12) such that exhaust gas tends to flow predominantly from the bleed passage (26, 28) to the associated bleed connection (27, 29).

8. An exhaust system (12) according to any of the preceding claims, wherein at least one of the first and second bleed connections (27, 29) is located in the exhaust system (12) such that exhaust gas tends to flow predominantly from the bleed connection (27, 29) to the associated bleed passage (26, 28).

9. An exhaust system (12) according to any of claims 1 to 5, wherein both the first and second bleed connections (27, 29) are located in a portion of the exhaust passage (16a) upstream of the restriction (18).

10. An exhaust system (12) according to any of claims 1 to 5, wherein both the first and second bleed connections (27, 29) are located in a portion of the exhaust passage (16b) downstream of the restriction (18).

11. An exhaust system (12) according to any of the preceding claims, wherein at least one of the fluid connections a) between the first conduit (22) and the first bleed passage (26) and b) between the second conduit (24) and the second bleed passage (28) is located within 50 millimeters from the first conduit port (23).

12. An exhaust system (12) according to any of the preceding claims, wherein at least one of the fluid connections between a) between the first conduit (22) and the first bleed passage (26) and b) between the second conduit (24) and the second bleed passage (28) is located within 25 millimeters from the first conduit port (23).

13. An exhaust system (12) according to any of claims 1 to 10, wherein at least one of the fluid connections a) between the first conduit (22) and the first bleed passage (26) and b) between the second conduit (24) and the second bleed passage (28) is located adjacent the associated sensing portion (20a, 20b)

14. An exhaust system (12) according to any of the preceding claims wherein at least one of the first and second bleed passages (26, 28) includes a portion having a small cross-sectional diameter relative to the exhaust passage (16) such that any flow through the at least one of the first and second bleed passages (26, 28) is little or insignificant compared through the flow flowing through the exhaust passage (16).

FIG. 2B

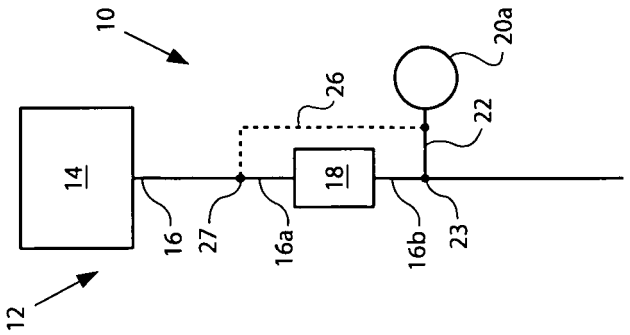


FIG. 2A

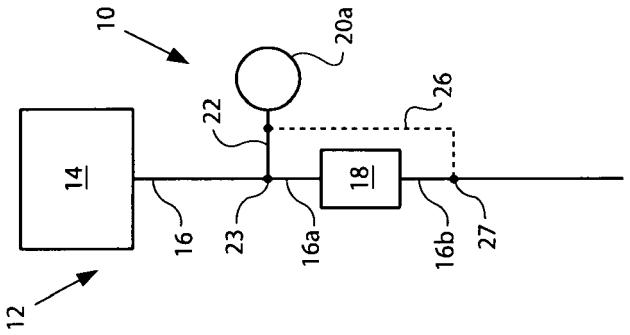


FIG. 1B

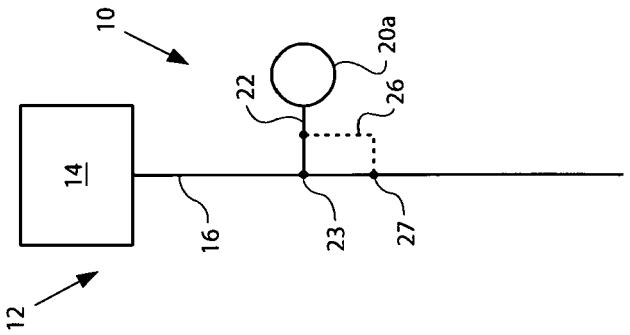


FIG. 1A

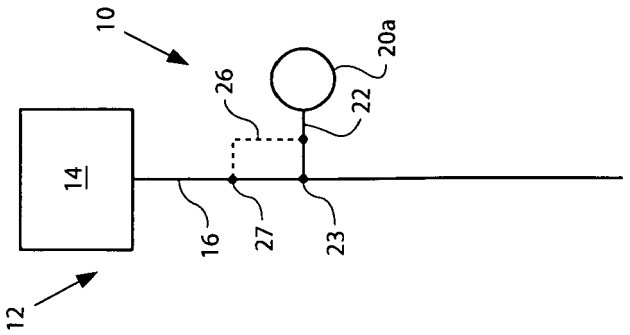


FIG. 6

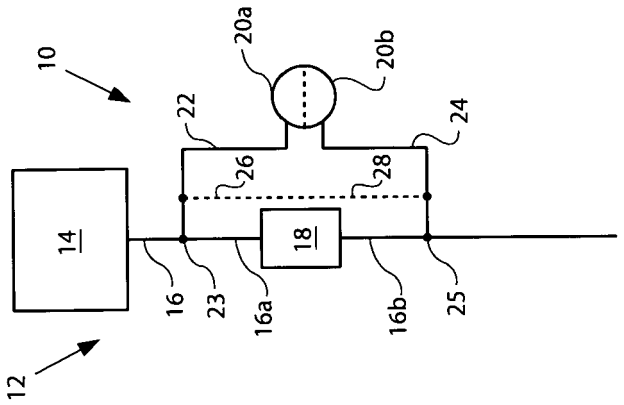


FIG. 5

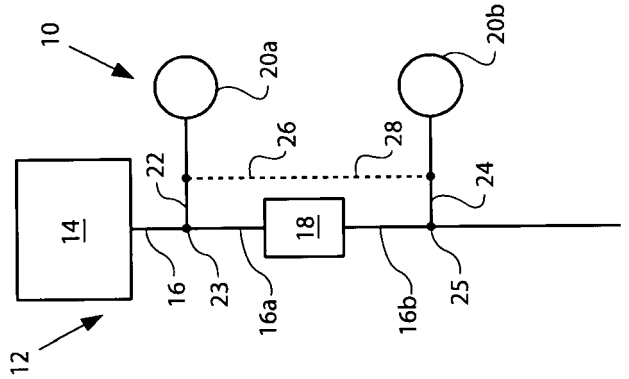


FIG. 4

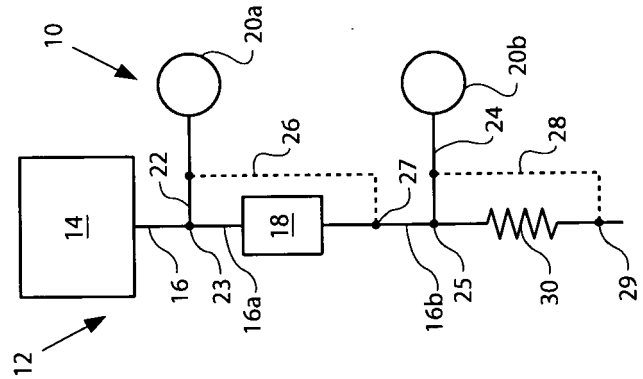
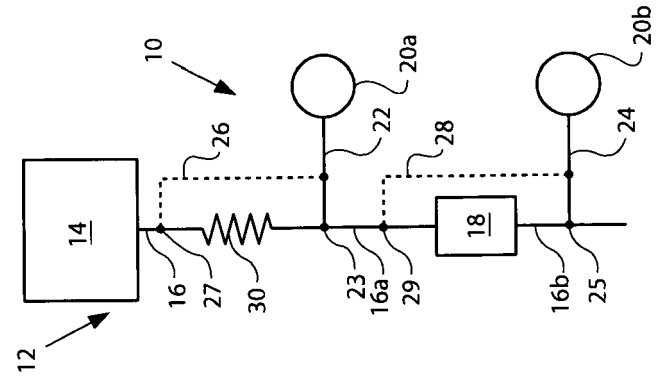


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 10 01 5613

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 2001/054309 A1 (OHMORI KENICHI [JP] ET AL) 27 December 2001 (2001-12-27) * paragraph [0034] - paragraph [0038]; figure 6 * * abstract *	1-15	
A	US 2005/005773 A1 (SHUTTY JOHN V [US] ET AL) 13 January 2005 (2005-01-13) * paragraph [0041]; figure 10 * * abstract *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)
F01N
F02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 April 2011	Hermens, Sjoerd

CATEGORY OF CITED DOCUMENTS

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1

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 01 5613

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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21-04-2011

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