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(54) Title: CONVEYING UNIT FOR CONVEYING REDUCING AGENT

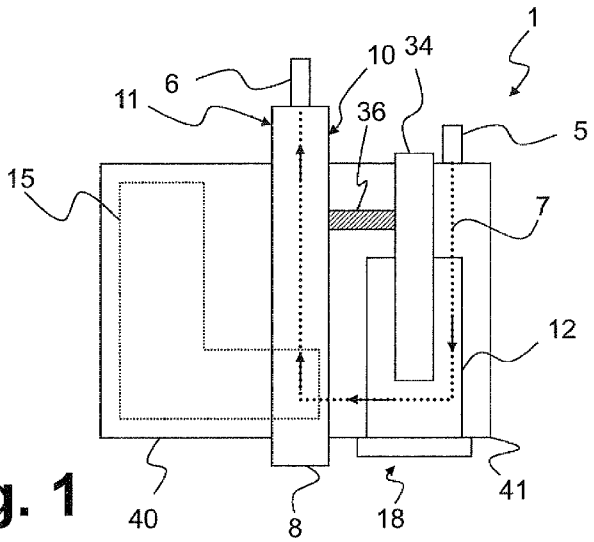

Fig. 1

(57) Abstract: The invention relates to a conveying unit (1) for conveying reducing agent from a tank (2) to an exhaust gas treatment device (3) for cleaning the exhaust gases from an internal combustion engine (4), wherein the conveying unit (1) comprises a flange (8) defined at least by a first side (10) and by a second side (11). The first side (10) and the second side (11) are arranged so as to be mutually opposed, at least in part. At least a filter (12), a biased ice pressure compensation means (13) and/or a flexible ice pressure compensation means (14) is/are arranged on the first side (10). At least a pump (15), a pressure sensor (16) and/or a temperature sensor (17) is/are arranged on the second side (11).

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Conveying unit for conveying reducing agent

The invention relates to a conveying unit for conveying reducing agent from a tank to an exhaust gas treatment device which is adapted to clean the exhaust gases from an internal combustion engine.

Exhaust gas treatment processes in which a reducing agent is fed to the exhaust gas have been used increasingly in recent years. In particular, the process of selective catalytic reduction (SCR process) has often been employed until now. With this process nitrogen oxide compounds in the exhaust gas are reduced with the aid of a reducing agent. For example, the process is used to clean the exhaust gases from motor vehicles, and in particular of commercial vehicles. For this purpose, ammonia in particular is used as a reducing agent. The reducing agent is often added not directly to the exhaust gas, but in the form of a reducing agent precursor which reacts in the exhaust gas to form the actual reducing agent. Urea-water solution is a reducing agent precursor which is often used for ammonia. A urea-water solution with a urea content of 32.5 % is widely available under the trade name AdBlue®. For the sake of simplicity, the term "reducing agent" will also be used hereinafter for reducing agent precursor and reducing agent precursor solutions.

In the case of a conveying unit for reducing agent, it should be ensured that the supply of reducing agent is as reliable and as precisely metered as possible so that as far as possible the precise amount of reducing agent required to reduce the nitrogen oxide compounds contained is supplied to the exhaust gas. A problem arises in that aqueous reducing agents may freeze when used at low temperatures. For example, the above described 32.5 % urea-water solution freezes at temperatures of -11 °C. Such temperatures can easily occur, in particular in exhaust gas treatment devices in motor vehicles, for example during idle periods in winter. In this context, the term "freeze" describes the phase transition of the reducing agent from liquid to solid. When a reducing agent freezes, the volume increases if the reducing agent is an aqueous reducing agent. In the case of a conveying unit for reducing agent, it must therefore be ensured that this increase in volume does not destroy the conveying unit. In addition, a conveying unit should be ready to convey

again as soon as possible after reducing agent contained in the conveying unit was frozen.

Starting from the foregoing it is accordingly the object of the invention to overcome or mitigate, in a particularly advantageous manner, the described technical problems. In particular, a conveying unit for reducing agent is to be proposed which is particularly reliable and cost-effective, the conveying unit being freeze-proof in particular.

These objects are achieved by a conveying unit having the features of claim 1. Further advantageous configurations of the conveying unit are disclosed in the dependent claims. The features recited individually in the claims can be combined in any technologically feasible manner and can be supplemented by explanatory facts from the description, further variants of the invention being illustrated.

The invention relates to a conveying unit for conveying reducing agent from a tank to an exhaust gas treatment device for cleaning the exhaust gases from an internal combustion engine, wherein the conveying unit comprises a flange limited at least by a first side and by a second side, wherein the first side and the second side are arranged so as to be mutually opposed, at least in part, wherein at least one of the following components is arranged on the first side:

- a filter,
- a biased ice pressure compensation means, and
- a flexible ice pressure compensation means,

and at least one of the following components is arranged on the second side:

- a pump,
- a pressure sensor, and
- a temperature sensor.

The conveying unit is, in particular, a conveying unit which is arranged externally from or outside a reducing agent tank and the reducing agent is drawn from the tank via an intake pipe. In particular, the conveying unit is not arranged in a tank or directly on a tank. There is preferably a distance of at least 20 cm (centimetres), preferably even at least 50 cm and particularly preferably at least 1 m (metre) between the conveying unit and the reducing agent tank. This distance is bridged by the intake pipe. The pressure of the reducing agent is then increased to a defined

pressure in the conveying unit. The pressurised reducing agent can be conveyed from the conveying unit to an injector via an injector pipe. The injector can be adapted to supply the reducing agent to an exhaust gas treatment device.

There is preferably an intake fitting and an outlet fitting on the conveying unit. The intake pipe can be connected to the intake fitting. The injector pipe is adapted for connection to the outlet fitting. A conveyance path can be provided in the conveying unit between the intake fitting and the outlet fitting. The reducing agent is conveyed along this conveyance path from the intake fitting to the outlet fitting and, in the process, passes (preferably all) the above-mentioned individual components. The configuration of the conveyance path and the individually recited components together defines a volume filled with reducing agent in the conveying unit.

The central element of the conveying unit is the flange. "A flange" is taken to mean, in particular, a plate-like formation. The flange is preferably made of metal, is particularly preferably made of aluminium and exhibits high thermal conductivity. Heat in the conveying unit or flange can thus be quickly distributed and the conveying unit can thus be heated particularly effectively. Reducing agent ducts which interconnect the individual components of the conveying unit are preferably provided in the flange. For example, ducts which connect a filter to a pump and the pump to a pressure sensor may be provided in the flange. These ducts form the conveyance path through the conveying unit, at least in part.

The individual components which may be arranged on the flange in the conveying unit according to the invention will each be described hereinafter.

A reducing agent filter is provided in order to retain contaminants in the reducing agent. Contaminants may cause damage in further components of the conveying unit and in the injector for supplying reducing agent to an exhaust gas treatment device. A filter is therefore arranged in the conveying unit, preferably directly after an intake fitting. Furthermore (additionally or alternatively) a screen may be provided within an intake fitting and/or within an outlet fitting, with which at least one component of the conveying unit and/or following the conveying unit (i. e. the injector) is protected against (rough) contaminations. Therefore, maintaining

intervals for these components can be extended and/or the risk of clogging of the injector can be reduced.

Owing to the risk of freezing, it is preferable to provide various compensation means in the conveying unit to compensate for expansion of the reducing agent during freezing by increasing the volume of the conveying unit filled with reducing agent. Ice pressure compensation elements of this type are constructed, for example, as resilient elements which can enlarge regions of the conveying unit filled with reducing agent when freezing occurs. A distinction is made between biased ice pressure compensation means and flexible ice pressure compensation means. Biased ice pressure compensation means only make it possible to enlarge the volume in the conveying unit when a specific threshold pressure is exceeded. Ice pressure compensation means of this type may be constructed, for example, as sliding elements which are biased against a stop by a spring. Flexible ice pressure compensation means enlarge the interior of the conveying unit filled with reducing agent when the pressure in the interior increases continuously. Flexible ice pressure compensation means of this type may be constructed, for example, as rubber inserts in the pipes of the conveying unit.

A pump is used for increasing pressure and for conveying in the conveying unit. A piston pump or diaphragm pump is preferably used, which is basically characterised in that it comprises a pump chamber which regularly increases and decreases when reducing agent is conveyed. At least one inlet valve and at least one outlet valve are preferably arranged on the pump chamber. The conveying direction of the pump is determined by the configuration of the valves. The reducing agent can (only) flow into the pump chamber through the inlet valve. The reducing agent can (only) flow out of the pump chamber through the outlet valve.

A pressure sensor is preferably provided in the conveying unit as a further component. The conveying pressure generated by the pump can be monitored by a pressure sensor. The pump may be adjusted in such a way that the pressure measured by the pressure sensor reaches a specific value. The pressure sensor is preferably arranged after the pump in a conveying direction along a conveyance path. The pressure generated by the pump can thus be monitored by the pressure sensor.

A temperature sensor may be provided as a further component. For example, a temperature sensor can monitor whether the reducing agent in the conveying unit is liquid or frozen. Heating of the conveying unit can thus be adjusted. The temperature sensor preferably determines the temperature of a region of the flange so that conclusions about the temperature of the reducing agent and/or the components may be drawn.

A filter is typically provided first along a conveyance path from an intake fitting of the conveying unit to an outlet fitting of the conveying unit. The pump follows next. The pressure sensor and optionally the temperature sensor are preferably arranged after the pump in the conveyance path. The biased ice pressure compensation means and the flexible ice pressure compensation means are each preferably arranged at the point where the ice pressure produced during freezing of reducing agent in the conveying unit is particularly high. Furthermore, an advantageous arrangement of the pump and the components of the conveying unit is to be realised along the conveyance path, so that air bubbles in the reducing agent can be shrinked easily, can be gathered at predetermined places and/or can be conveyed out of the conveying unit. Thus, it is preferred, that the conveyance path from the pump to the outlet fitting is provided substantially straight (in particular aligned) and/or that the conveyance path is provided vertically upwards (against gravity) in the mounted state.

In the conveying unit according to the invention, the arrangement of the components on the first side and on the second side of the flange is preferably divided in such a way that the components without electrical fittings are arranged on the first side, whilst the components with electrical fittings are arranged on the second side. The components with electrical fittings are, for example, the pump and the sensors. These components cooperate, for example, with a control device of the conveying unit. Therefore it is not necessary for electrical lines or signal lines to extend through the flange and/or round the flange.

The conveying unit according to the invention preferably comprises no return pipe from the conveying unit back to the reducing agent tank.

In a particularly advantageous development, the conveying unit according to the invention comprises a filter constructed as a removable filter cartridge comprising at least one of the following features:

- at least a snap closure which can lock the filter cartridge to the conveying unit,
- at least an opening which can be closed by a closure and via which the filter cartridge can be emptied without being removed from the conveying unit, and
- at least a flexible ice pressure compensation means.

The filter cartridge preferably comprises all the above-mentioned features.

The filter is the component of the conveying unit which has to be most frequently serviced or replaced since this is where contaminants in the reducing agent collect. A snap closure for locking a filter cartridge to the conveying unit is therefore particularly advantageous. A snap closure can be quickly opened and closed. Reducing agent can be removed from the filter cartridge through an opening with a closure before the entire filter cartridge is removed from the conveying unit. Reducing agent can thus be prevented from escaping uncontrollably from the conveying unit when the filter cartridge is removed. The filter cartridge may be formed as a disposable component which is thrown away when the filter is no longer functional. The filter cartridge is generally fixed indirectly to the flange. A filter holder or else a cartridge holder can be fixed to the flange, in which holder the filter cartridge can be locked via the described snap closure.

In a further advantageous development of the conveying unit according to the invention, the conveying unit comprises a filter through which a conveyance path extends, wherein at least one bypass duct for bypassing the filter is formed and is closed by an air-permeable diaphragm.

This idea can also be applied independently of the other features of the present invention. In particular, a conveying unit for conveying a reducing agent from a tank to an exhaust gas treatment device for cleaning the exhaust gases from an internal combustion engine is also proposed, wherein the conveying unit comprises a conveyance path from an intake fitting to an outlet fitting which extends through

a filter, wherein at least one bypass duct for bypassing the filter is provided and is closed by an air-permeable diaphragm.

It has proven to be problematic if air bubbles collect in the filter during operation. An air bubble of this type often cannot be drawn in by a pump owing to the geometry of the filter, and instead remains in front of the filter. A relatively large space which ensures that the reducing agent is distributed over the entire filter area of the filter is generally arranged in front of the filter. A defined bypass duct for bypassing the filter makes it possible to ensure that an air bubble of this type does not remain in front of the filter, but is conveyed from the filter or a space surrounding the filter. The diaphragm prevents the reducing agent from flowing through the bypass duct and thus prevents unfiltered reducing agent from reaching further components of the conveying unit. An air-bypass duct of this type may be a constituent of a replaceable filter cartridge. However, a bypass duct of this type may also be produced in a filter holder.

At least one bypass duct is preferably arranged above the filter. This can be ensured by a suitable configuration of the conveying unit and a corresponding assembly of the conveying unit. The air bubbles typically collect at the highest point of the space in front of the filter. It is therefore particularly advantageous to provide the bypass duct precisely here.

Furthermore, a bleeder screw or an equivalent ventilation means can be provided, with which the conveyance path in the conveying unit can be (at least partially) vented, in particular the ventilation means is placed next to the filter. In this way it can be secured that in case of preparing maintenance or the exchange of the filter reducing agent keeps on flowing (i.e. from the tank), when the conveying unit is opened.

In a further advantageous development, the conveying unit according to the invention comprises at least a biased ice pressure compensation means containing a movable element which is biased against a stop by a spring-loaded element, the movable element being sealed by a V-ring seal. A V-ring seal is V-shaped and typically comprises two flanks positioned at an angle to one another. The angle becomes more acute when the flanks are pressed together. The angle increases when the flanks are relieved of pressure. A particularly good (axial) seal between

movable elements can be achieved with a V-ring seal of this type since the flanks of the V-ring seal can follow the movement of the movable element, at least in part.

In a further advantageous development of the conveying unit according to the invention the conveying unit comprises a pressure sensor and a pump, wherein the pressure sensor is arranged after the pump along a conveyance path through the conveying unit and a flexible ice pressure compensation means is arranged on the pressure sensor at a first distance of less than 20 mm, preferably less than 10 mm and particularly preferably in a range between 2 mm [millimetres] to 6 mm from the pressure sensor.

This idea can also be applied independently of the other features of the present invention. In particular, a conveying unit for conveying reducing agent from a tank to an exhaust gas treatment device for cleaning the exhaust gases from an internal combustion engine is therefore also proposed, wherein the conveying unit comprises a pressure sensor and a pump, wherein the pressure sensor is arranged after the pump along a conveyance path through the conveying unit and a flexible ice pressure compensation means is arranged on the pressure sensor at a first distance of less than 20 mm [millimetres].

This flexible ice pressure compensation means has a volume preferably of less than 500 mm^3, particularly preferably less than 200 mm^3 and in particular less than 100 mm^3 at ambient pressure.

In order to achieve a high precision of metering by the conveying unit, it is generally advantageous if merely biased ice pressure compensation means are provided after the pump along a conveyance path through the conveying unit. With biased ice pressure compensation means, the volume filled with reducing agent in the conveying unit does not change with pressure variations within the normal operating pressure range. Thus, preferably the volume is very small (almost 0 mm^3) at usual working pressure and at usual working temperature. Due to this bias the ice pressure compensation means does not move during usual operation, so that friction and wear can be avoided. This is advantageous for metering precision. This is not the case with flexible ice pressure compensation means, which change the volume filled with reducing agent in the conveying unit even in the case of pressure variations within the normal operating pressure range. However, it has been found

that the pressure sensor is particularly sensitive to ice pressure. It is therefore advantageous to provide a flexible ice pressure compensation means at a very short distance from the pressure sensor. It is particularly advantageous if no further flexible ice pressure compensation means are provided in addition to this one (individual) flexible ice pressure compensation means after a pump along the conveyance path.

In a particularly advantageous development of the conveying unit according to the invention the pressure sensor is arranged on a spur duct, which branches from a conveyance path through the conveying unit, and the flexible ice pressure compensation means extends into the spur duct. A configuration of this type makes it possible to arrange the flexible ice pressure compensation means particularly close to the pressure sensor. A biased ice pressure compensation means is also preferably provided in the vicinity of the pressure sensor. This means can also be constructed as a diaphragm which is biased against a stop by a resilient element. It is particularly advantageous if this diaphragm is made of rubber, plastics material or natural rubber. A diaphragm of this type may be very thin so the compressibility of the diaphragm can be disregarded. However, an extension which forms the flexible ice pressure compensation means may be integrally moulded or cast locally on this diaphragm. The extension preferably consists of the same material as the diaphragm. However, it is also possible for the extension to be a separate component and/or made of a different material.

In a further advantageous development, the conveying unit according to the invention comprises a heater which extends into a filter of the conveying unit. A heater of this type can be operated with the cooling water of an internal combustion engine or with electric energy. A heater of this type is preferably a constituent of a filter holder for a filter cartridge. This heater is preferably the only heater in the conveying unit according to the invention. A heat-conducting structure can be provided between the heater and the flange, via which structure heat emitted by the heater can be introduced into the flange and/or from which the heat can be distributed to the individual components of the conveying unit.

The invention and the technical field will be described in greater detail hereinafter with reference to the figures. The figures show particularly preferred embodiments, although the invention is not limited thereto. In particular it is pointed out that the

figures and, in particular, the dimensions shown are merely schematic. In the figures,

Fig. 1 shows a first variant of the conveying unit,

Fig. 2 shows a second variant of the conveying unit,

Fig. 3 shows a filter holder for a conveying unit,

Fig. 4 shows a first variant of a biased ice pressure compensation element,

Fig. 5 shows a second variant of a biased ice pressure compensation element,

Fig. 6 shows a detail of a flange of a conveying unit,

Fig. 7 shows a motor vehicle comprising a conveying unit,

Fig. 8 is a section through a conveying unit,

Fig. 9 shows a detail of the view in Fig. 8,

Fig. 10is a first exploded view of Fig. 8,

Fig. 11is a second exploded view of Fig. 8,

Fig. 12is a further section through a conveying unit,

Fig. 13shows a detail of Fig. 12,

Fig. 14shows a further detail of Fig. 12,

Fig. 15is a first exploded view of Fig. 12, and

Fig. 16is a second exploded view of Fig. 12.

Figs 1 and 2 each illustrate a conveying unit 1 which comprises a flange 8, with a filter 12 provided on a first side 10 of said flange and a pump 15 provided on a second side 11 of said flange. A conveyance path 7 extends through the conveying unit 1 from an intake fitting 5 to an outlet fitting 6. The filter 12 is preferably arranged in a removable filter cartridge 18. The pump 15 is disposed in the pump head 40. The pump 15 conveys reducing agent along the conveyance path 7. The filter cartridge 18 with the filter 12 is inserted into the filter holder 41, which is attached to the flange 8 on the first side 10. The filter 12 is thus indirectly fixed to the first side 10 via the filter holder 41 and the filter cartridge 18. A (electric) heater 34 extends into the filter 12. A heat-conducting structure 36 extends from the heater 34 to the flange 8.

The variant illustrated in Fig. 2 basically corresponds to the features of the variant illustrated in Fig. 1. In Fig. 2 at least a biased ice pressure compensation means 13 and a flexible ice pressure compensation means 14 are provided on the first side 10 as additional components. A pressure sensor 16 and a temperature sensor 17 are provided on the second side 11. The pressure sensor 16 and the temperature sensor 17 are preferably arranged on the second side 11 in such a way that they are covered by the pump head 40. The entire electronic system, which is required to evaluate the signals from the pressure sensor 16 and from the temperature sensor 17 and to control the pump 15, can thus be protected by the pump head 40. The pump head 40 is preferably shell-shaped and comprises an opening which is placed against the flange 8. A seal is provided between the pump head 40 and the flange 8 so the opening in the pump head 40 can be closed tightly by the flange 8.

Fig. 3 shows a filter holder 41 for a conveying unit. A filter cartridge 18 is inserted into the filter holder 41 with the aid of a snap closure 19. The filter 12, which in this instance is constructed as a hollow cylinder made of a filter material, is disposed in the filter cartridge 18. The filter cartridge 18 is preferably inserted into the filter holder 41 with the aid of filter seals 42 in such a way that reducing agent flowing along the conveyance path 7 cannot flow round the filter 12 and no reducing agent escapes from the conveying unit 1. The filter seals 42 may be O-ring seals or V-ring seals. A bypass duct 22 for air is also provided in the filter cartridge 18 and is closed by a permeable diaphragm 23. The air filter may be surrounded by the bypass duct 22. A heater 34 extends into the filter 12. The heater 34 is preferably a constituent of the filter holder 41.

Figs 4 and 5 each show a biased ice pressure compensation means 13 constructed with a movable element 24 which is biased against a stop 26 by a spring-loaded element 25. The movable element 24 is sealed from the flange 8 with the aid of a seal. In Fig. 4 this seal is a V-ring seal 30. In Fig. 5 this seal is an O-ring seal 43. A V-ring seal 30 has the advantage that it deforms when the movable element 24 moves. Linear contact is thus produced in each case between the V-ring seal 30 and the flange 8, and between the V-ring seal 30 and the movable element 24. The position of this linear contact does not change when the movable element 24 moves since the V-ring seal 30 can deform in order to compensate for the movement of the movable element 24.

By contrast, the O-ring seal 43 according to Fig. 5 moves relative to the flange 8 when the movable element 24 moves, in such a way that the O-ring seal 43 slides over a surface of the flange 8. This may impair the sealing effect in the variant according to Fig. 5. It is therefore advantageous also to provide V-ring seals 30 at suitable locations, in particular for seals on movable elements.

As an additional feature, the compensation means according to Fig. 5 comprises an opening in a holding structure 44 for the spring-loaded element 25, the opening directly connecting the outer face 28 of the movable element 24 to the environment 29. Pressure in a chamber between the outer face 28 and the holding structure 44 can thus be prevented from changing the action of the resilient element 25. As a result of different ambient temperatures, a pressure could otherwise build up between the movable element 24 and the holding structure 44, which would interfere with and distort the action of the spring-loaded element 25.

Fig. 6 shows a detail of a flange 8 of a conveying unit 1. A conveyance path 7 extends through the flange 8 in a duct 45. A pressure sensor 16 is provided on the second side 11 of the flange 8. A biased ice pressure compensation element 13 is disposed on the first side 10 of the flange 8 opposite the pressure sensor 16. The biased ice pressure compensation element 13 is constructed with a first diaphragm 32, which is biased against a stop by a spring-loaded element 25 and a holding structure 44. An integrally moulded or cast extension is disposed on the first membrane 32 and forms a flexible ice pressure compensation element 14. This flexible ice pressure compensation element 14 extends into a spur duct 33 which

branches from the duct 45 or the conveyance path 7 and leads to the pressure sensor 16. In accordance with Fig. 6, the flexible ice pressure compensation element 14 is arranged at a very short distance 31 from the pressure sensor 16. In accordance with Fig. 6, the entire device is disposed after a pump 15 along the conveyance path 7.

Fig. 7 shows a motor vehicle 35 comprising an internal combustion engine 4 and an exhaust gas treatment device 3 for cleaning the exhaust gases from the internal combustion engine 4. The motor vehicle 35 comprises a tank 2 for storing reducing agent, in particular an aqueous urea solution. Reducing agent can be conveyed through an intake pipe 39 from the tank 2 to the conveying unit 1, and from there through an injector pipe 38 to an injector 37. The injector 37 supplies reducing agent to the exhaust gas treatment device 3.

Fig. 8 shows a flange 8 for a conveying unit according to the invention with some accessories. For example, the outlet fitting 6 can be seen.

Fig. 9 shows a detail from Fig. 8 which is designated by IX. In this instance a duct 45 can be seen, through which the conveyance path 7 of the conveying unit 1 extends. A pressure sensor 16 is arranged on the duct 45. A biased ice pressure compensation means 13 is disposed opposite the pressure sensor 16. Fig. 9 basically shows the technical configuration as described with reference to Fig. 6.

Fig. 10 is an exploded view of the flange 8 according to Fig. 8. It can be seen how the biased ice pressure compensation means 13 is mounted on the flange 8 via the first diaphragm 32. The outlet fitting 6 is also shown in Fig. 10 for orientation purposes. In Fig. 10 it can also be seen that a duct 45 in the flange 8 may also be located on the surface of the flange 8, the duct being closable by an accessory 46 which is sealed against the flange 8 by an O-ring seal 43.

In Fig. 11 it is possible to see how a temperature sensor 17 and a pressure sensor 16 are attached to the flange 8. An O-ring seal 43 is additionally provided on the flange 8, surrounds the temperature sensor 17 and the pressure sensor 16, and can be used to form a splash-proof seal between the flange 8 and a cover. This cover may be formed by a pump head (not shown). A pump chamber 9 can also be seen in Fig. 11. The pump chamber 9 is a constituent of the flange 8. A diaphragm (not

shown) can be placed over the pump chamber 9. This diaphragm can be moved by a drive (also not shown) in order to convey reducing agent. The drive is preferably disposed in the pump head (not shown).

Fig. 12 is a further sectional view through a conveying unit 1 with a flange 8. Details XIII and IXV are shown here and are illustrated on an enlarged scale in Figs 13 and 14.

Figs 13 and 14 each show a detail from Fig. 12. Valves 47 of a pump of the conveying unit which are inserted into the flange 8 through a passage can be seen in Fig. 13. The valves 47 are biased in the passage by a resilient element constructed as a spring. The valves 47 are thus movable when the pressure in the conveying unit exceeds a threshold pressure. A biased ice pressure compensation element 13 is thus formed. The valves 47 communicate with the pump chamber 9 via a duct.

Fig. 14 illustrates the outlet fitting 6, which is also fixed by a spring-loaded element constructed as a spring in a passage in the flange 8. The outlet fitting 6 is thus also movable when the pressure in the conveying unit 1 exceeds a threshold pressure. A biased ice pressure compensation element 13 is thus also formed on the outlet fitting 6.

Figs 15 and 16 are respective exploded views, showing how the valves 47 or the outlet fitting 6 are inserted into the flange 8. The pump chamber 9 formed on the flange 8 can also be seen.

In summary, the above description therefore relates to a conveying unit for conveying reducing agent from a tank to an exhaust gas treatment device for cleaning the exhaust gases from an internal combustion engine, wherein the conveying unit comprises a flange defined at least by a first side and by a second side. The first side and the second side are arranged so as to be mutually opposed, at least in part. At least a filter, a biased ice pressure compensation means and/or a flexible ice pressure compensation means is/are arranged on the first side. At least a pump, a pressure sensor and/or a temperature sensor is/are arranged on the second side.

List of reference numerals

1	conveying unit
2	tank
3	exhaust gas treatment device
4	internal combustion engine
5	intake fitting
6	outlet fitting
7	conveyance path
8	flange
9	pump chamber
10	first side
11	second side
12	filter
13	biased ice pressure compensation means
14	flexible ice pressure compensation means
15	pump
16	pressure sensor
17	temperature sensor
18	filter cartridge
19	snap closure
20	opening
21	closure
22	bypass duct
23	permeable diaphragm
24	movable element
25	spring-loaded element
26	stop
27	inner face
28	outer face
29	environment
30	V-ring seal
31	first distance
32	first diaphragm
33	spur duct
34	heater

35 motor vehicle
36 heat-conducting structure
37 injector
38 injector pipe
39 intake pipe
40 pump head
41 filter holder
42 filter seal
43 O-ring seal
44 holding structure
45 duct
46 accessory
47 valve

Claims

1. Conveying unit (1) for conveying reducing agent from a tank (2) to an exhaust gas treatment device (3) for cleaning the exhaust gases from an internal combustion engine (4), wherein the conveying unit (1) comprises a flange (8) defined at least by a first side (10) and by a second side (11), wherein the first side (10) and the second side (11) are arranged so as to be mutually opposed, at least in part, wherein at least one of the following components is arranged on the first side (10):
   - a filter (12),
   - a biased ice pressure compensation means (13), and
   - a flexible ice pressure compensation means (14),

   and at least one of the following components is arranged on the second side (11):
   - a pump (15),
   - a pressure sensor (16), and
   - a temperature sensor (17).

2. Conveying unit (1) according to claim 1, wherein the conveying unit (1) comprises a filter (12) constructed as a removable filter cartridge (18) which comprises at least one of the following features:
   - at least a snap closure (19) which can lock the filter cartridge (18) to the conveying unit (1),
   - at least an opening (20) which can be closed by a closure (21) and via which the filter cartridge (18) can be emptied without being removed from the conveying unit (1), and
   - at least a flexible ice pressure compensation means (14).

3. Conveying unit (1) according to any one of the preceding claims, wherein the conveying unit (1) comprises a filter (12) through which a conveyance path (7) extends, wherein at least one bypass duct (22) for bypassing the filter (12) is provided and is closed by an air-permeable diaphragm (23).

4. Conveying unit (1) according to any one of the preceding claims, wherein the conveying unit (1) comprises at least a biased ice pressure compensation means (13) containing a movable element (24) which is biased against a stop

(26) by a spring-loaded element (25), the movable element (24) being closed by a V-ring seal (30).

5. Conveying unit (1) according to any one of the preceding claims, wherein the conveying unit (1) comprises a pressure sensor (16) and a pump (15), wherein the pressure sensor (16) is arranged after the pump (15) along a conveyance path (7) through the conveying unit (1) and a flexible ice pressure compensation means (14) is arranged on the pressure sensor (16) at a first distance (31) of less than 20 mm [millimetres] from the pressure sensor (16).

6. Conveying unit (1) according to claim 5, wherein the pressure sensor (16) is arranged on a spur duct (33), which branches from a conveyance path (7) through the conveying unit (1), and the flexible ice pressure compensation means (14) extends into the spur duct (33).

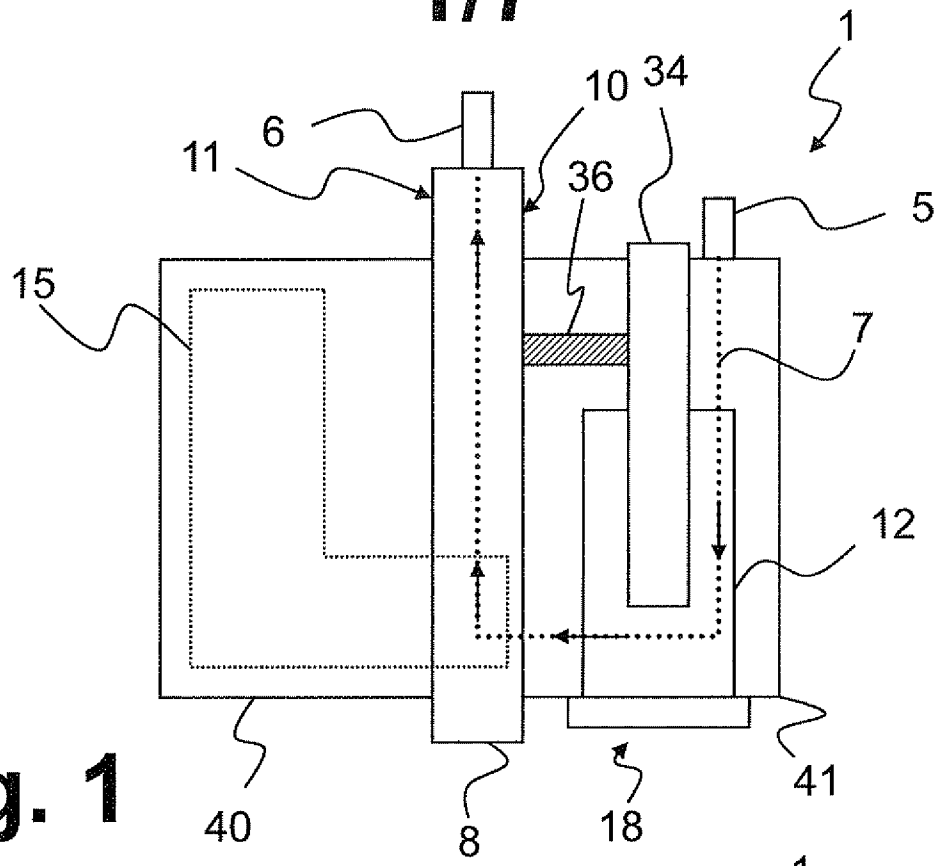
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Fig. 1

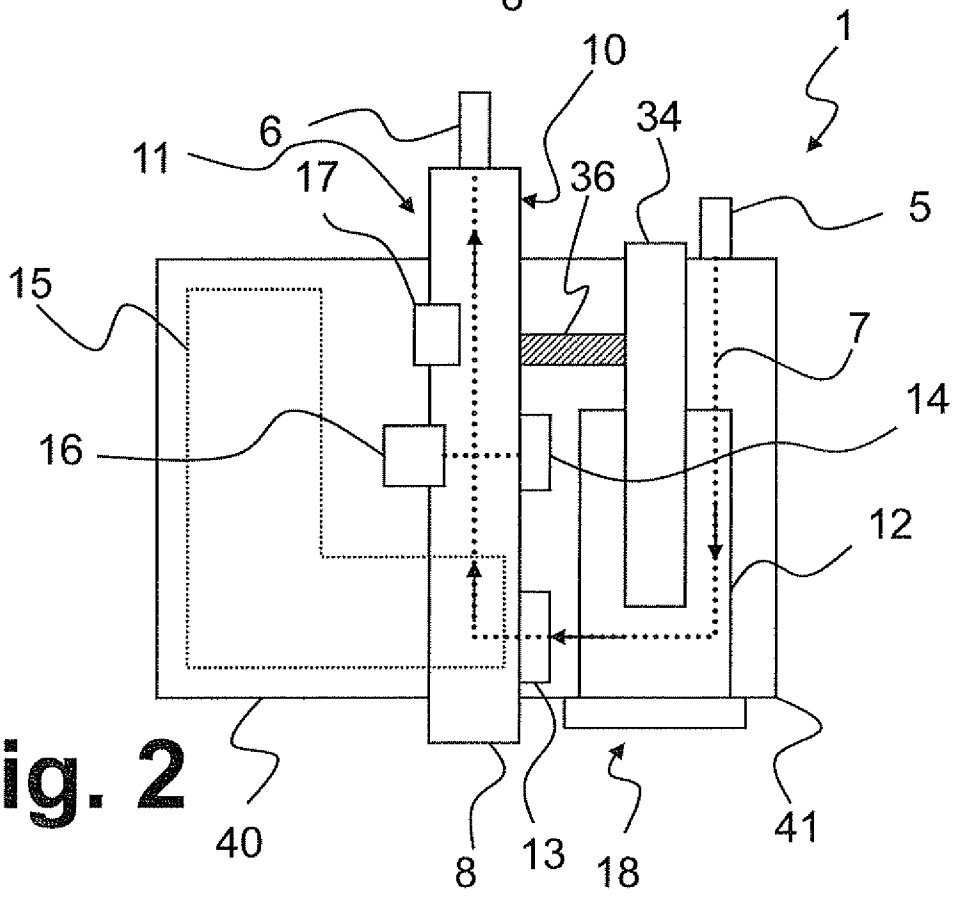
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Fig. 2

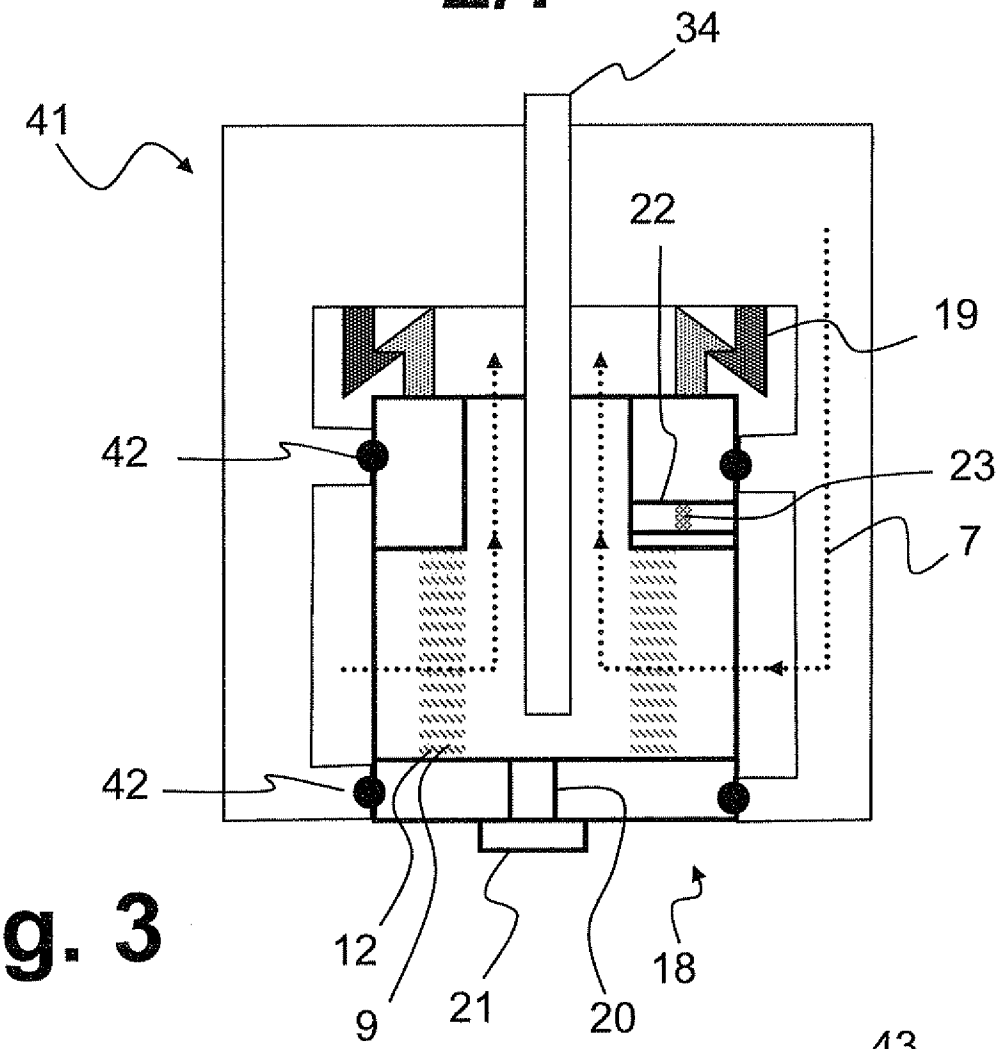

Fig. 3

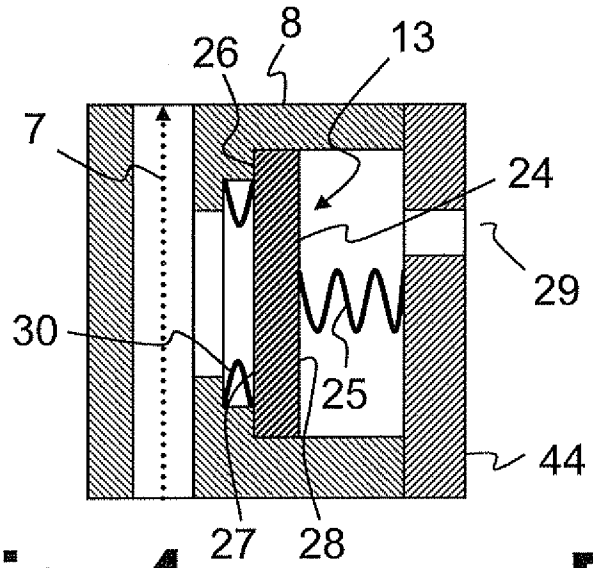

Fig. 4

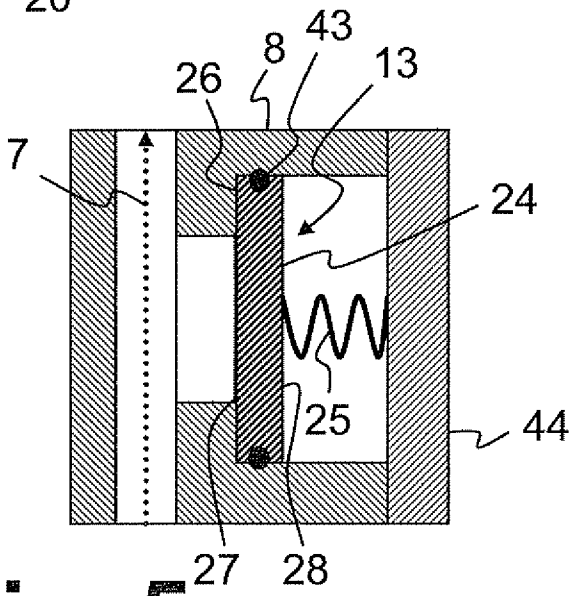

Fig. 5

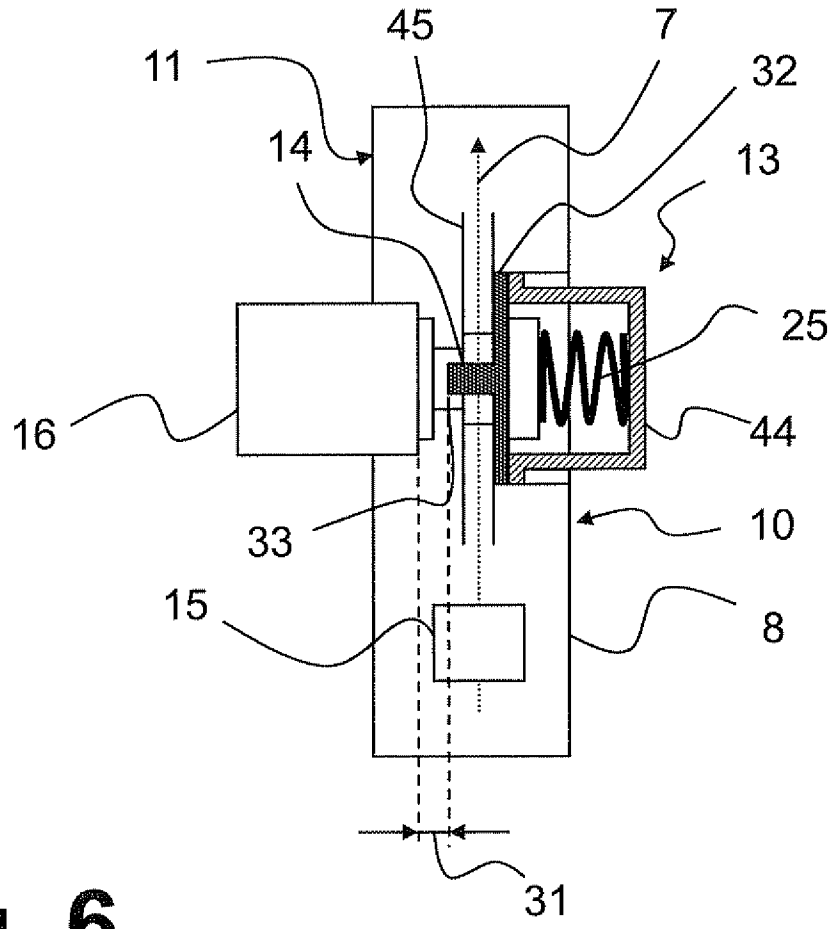

Fig. 6

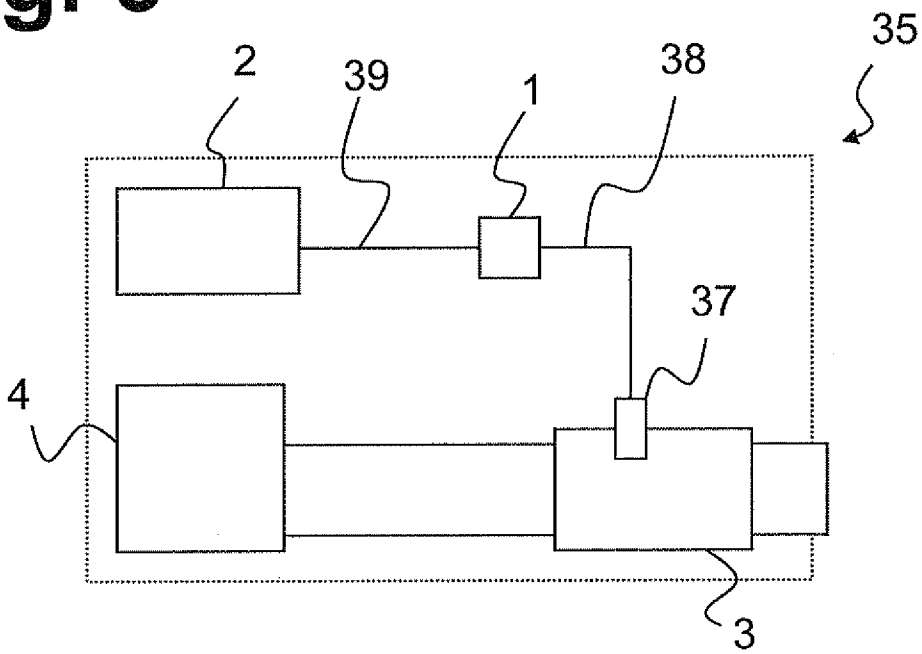

Fig. 7

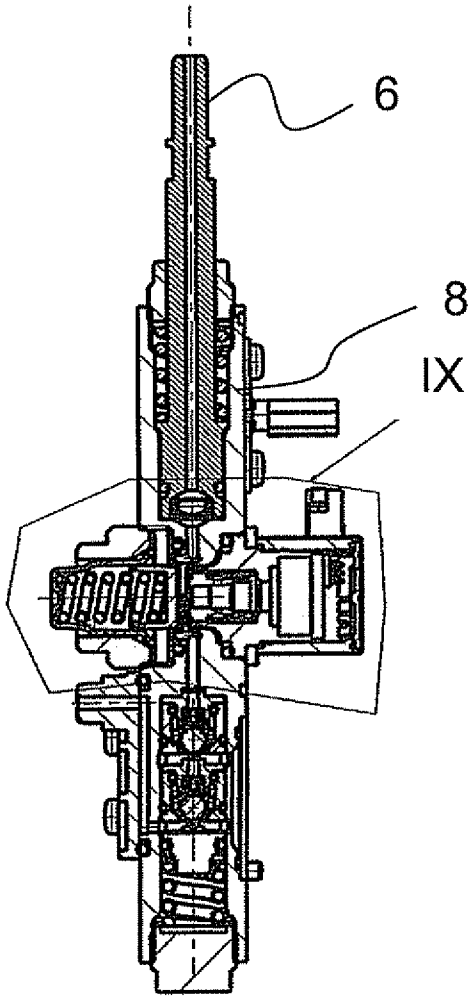

Fig. 8

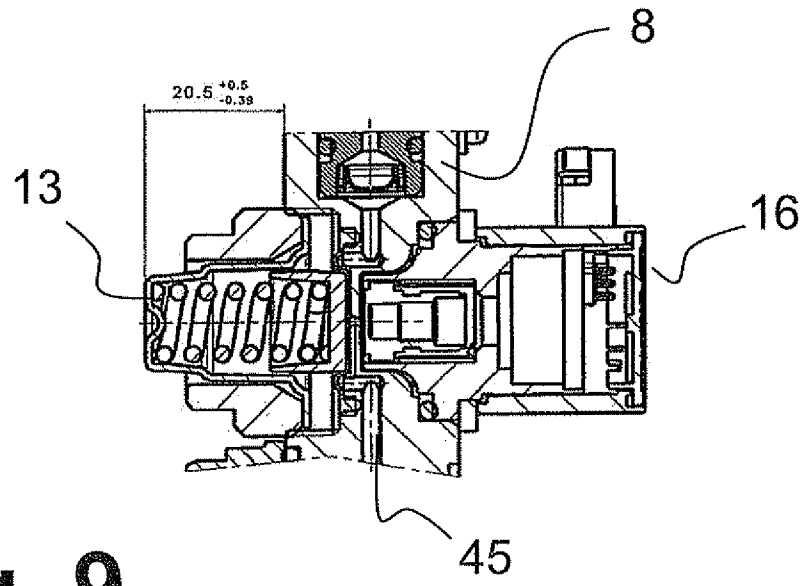

Fig. 9

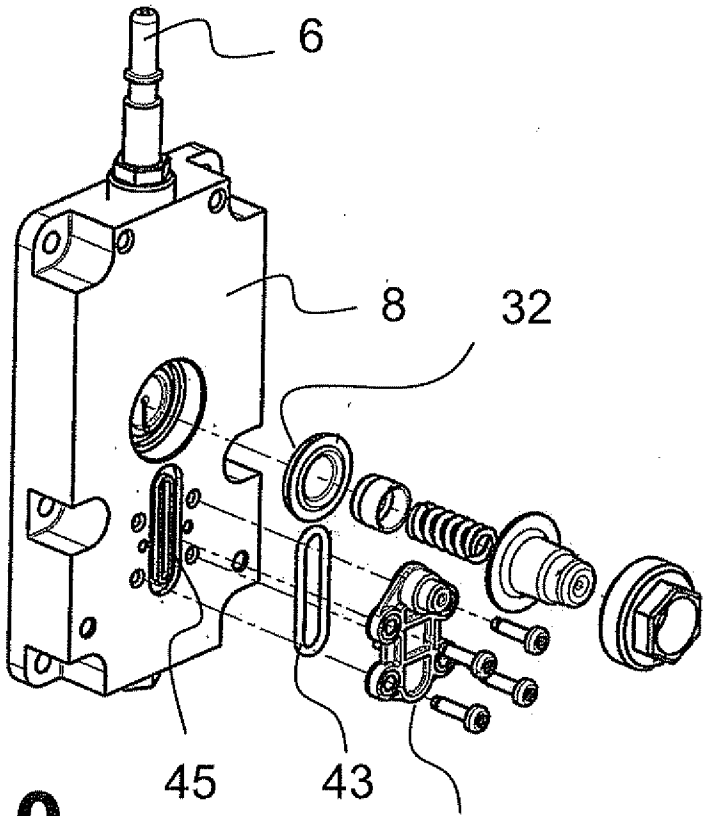

Fig. 10

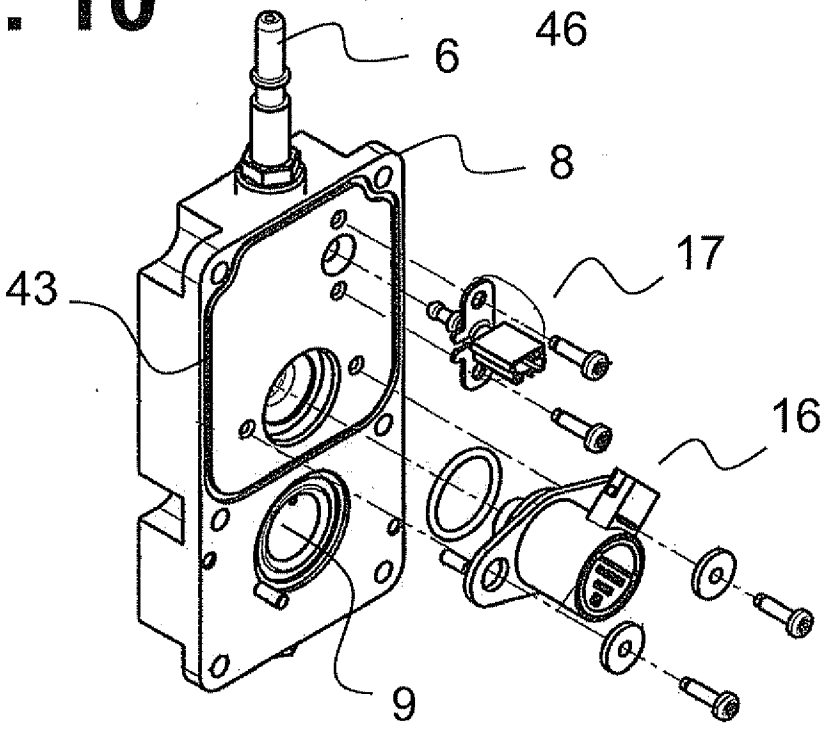

Fig. 11

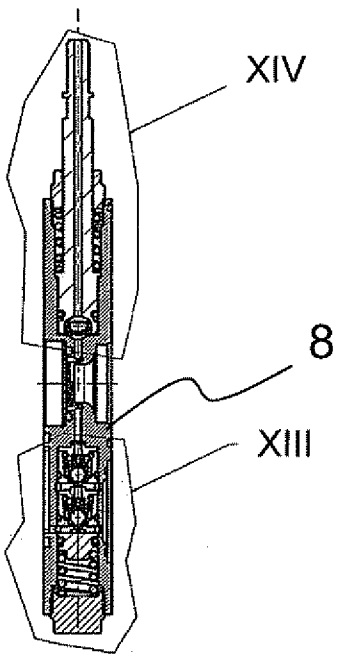

Fig. 12

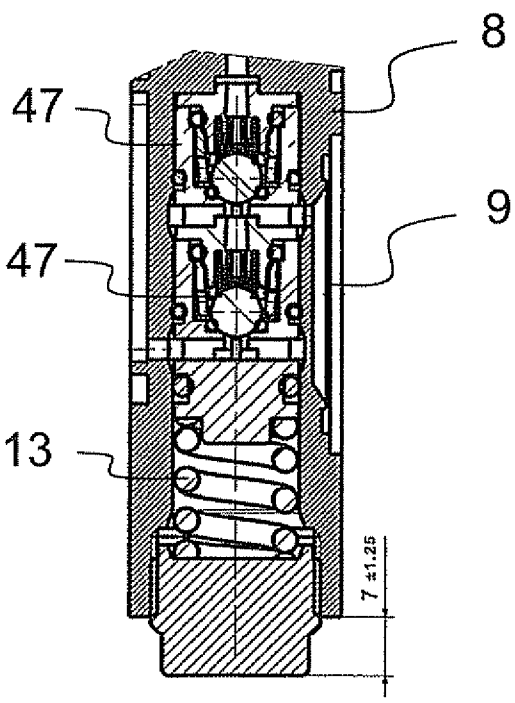

Fig. 13

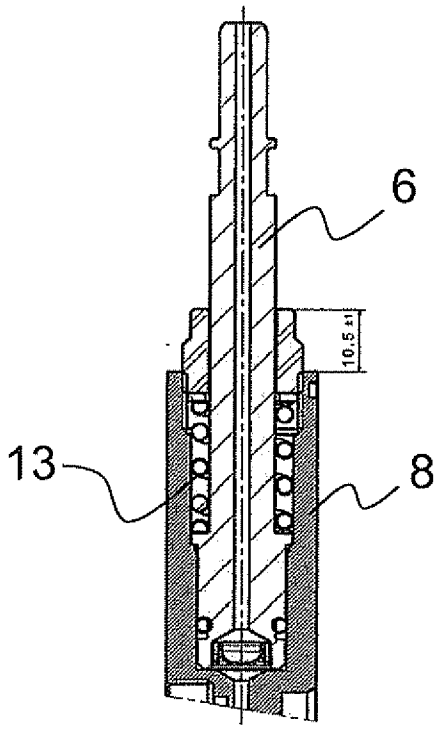

Fig. 14

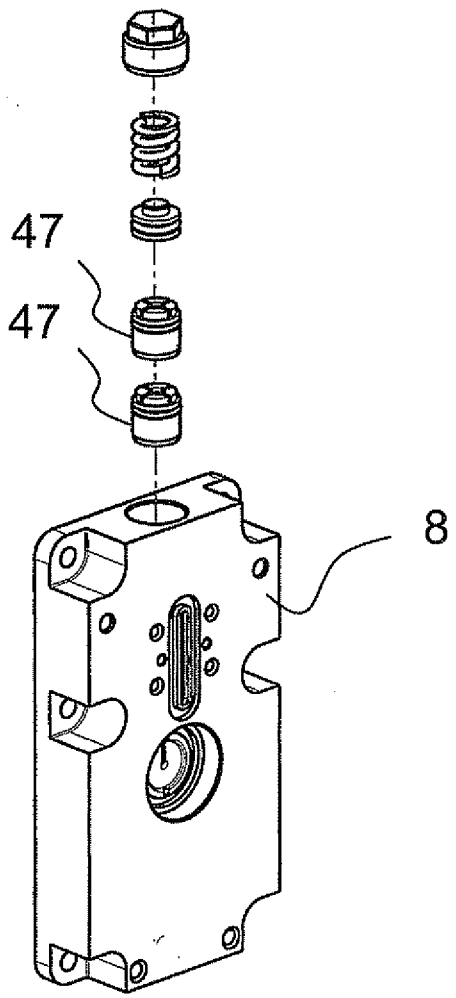

Fig. 15

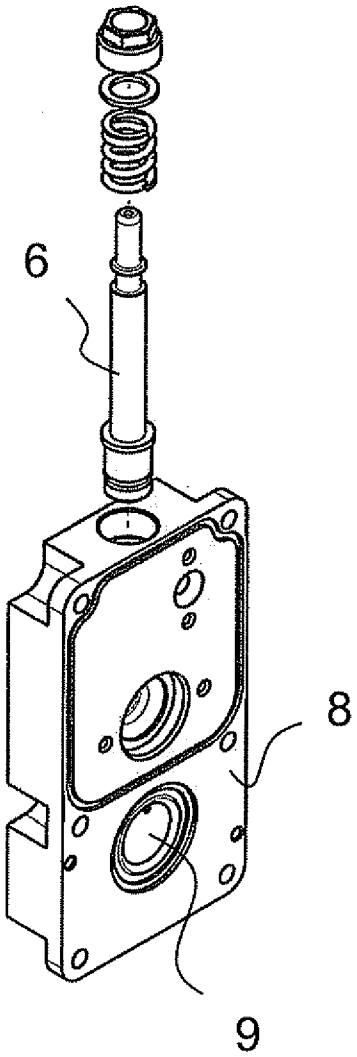

Fig. 16

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/051807

A. CLASSIFICATION OF SUBJECT MATTER
INV. F01N3/20
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 1 925 354 A1 (BOSCH GMBH ROBERT [DE]) 28 May 2008 (2008-05-28) figure 3 -----	1 2,3
Y	FR 2 915 185 A1 (COUTIER MOULAGE GEN IND [FR]) 24 October 2008 (2008-10-24) figures 1,2 -----	2,3
X	EP 2 182 190 A2 (TI GROUP AUTOMOTIVE SYS LLC [US]) 5 May 2010 (2010-05-05) figures 1-10 -----	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 April 2012	04/05/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Morales Gonzalez, M

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/051807

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