(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 496 497 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **18.01.95** (51) Int. Cl.[6]: **F01N 3/22**, G05D 7/00

(21) Application number: **92300137.4**

(22) Date of filing: **08.01.92**

(54) **Gas flow control valve.**

(30) Priority: **19.01.91 GB 9101247**

(43) Date of publication of application:
29.07.92 Bulletin 92/31

(45) Publication of the grant of the patent:
18.01.95 Bulletin 95/03

(84) Designated Contracting States:
DE FR GB

(56) References cited:
US-A- 3 433 242
US-A- 3 950 943
US-A- 4 037 406
US-A- 4 139 983

(73) Proprietor: **FORD MOTOR COMPANY LIMITED**
Eagle Way
Brentwood
Essex (GB)
(84) Designated Contracting States:
GB

(73) Proprietor: **FORD-WERKE AKTIENGESELLSCHAFT**

D-50725 Köln (DE)
(84) Designated Contracting States:
DE

(73) Proprietor: **FORD FRANCE S. A.**
B.P. 307
F-92506 Rueil-Malmaison Cédex (FR)
(84) Designated Contracting States:
FR

(72) Inventor: **Ransom, Keith**
30 Elm View Road
Benfleet,
Essex SS7 5AS (GB)

(74) Representative: **Messulam, Alec Moses et al**
A. Messulam & Co.
24 Broadway
Leigh on Sea
Essex SS9 1BN (GB)

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Rank Xerox (UK) Business Services
(3.10/3.09/3.3.3)

Description

The present invention relates to gas flow control valves and in particular to a valve for controlling a modulated flow of gas in one direction.

In internal combustion engine exhaust systems with catalytic converters, in order to assist catalyst light-off, air may be pumped to the exhaust manifold of the engine so that the air will react with the engine gases to preheat the catalyst. In such systems, air is pumped into the exhaust manifold for several minutes after starting the engine and must then be shut down quickly. In order to avoid possible damage to the pump, for example melting of hoses or plastic components, it is essential to ensure that there is no backflow of hot exhaust gases from the exhaust system. Furthermore, the amount of air mixed with the exhaust gases is critical, too little air prolonging the warming up period and too much air over heating the catalyst so that there is a risk that it will melt. As the volume of exhaust gases will depend upon the engine speed, it is desirable that the flow of air to the exhaust manifold is modulated to maintain optimum proportions of air and exhaust gases at all engine speeds. Hitherto, this has been achieved by controlling the speed of the pump requiring a sophisticated pump motor and control system.

US-A-3,433,242 discloses a fluid valve having a pair of fluid-tight chambers coaxial with a valve housing, a diaphragm being provided in one chamber to control movement of a valve member and a diaphragm controlled plunger being provided in the other chamber to control pressure differential across the first diaphragm. The diaphragm controlled plunger is sensitive to inlet pressure, so that when inlet pressure rises above a selected value, pressure will be applied to one side of the diaphragm in said one chamber causing the valve member to close communication between the inlet and an outlet and to dump fluid to atmosphere.

The present invention provides a gas flow control valve which will provide modulation of gas flow and will also prevent reversal of flow.

According to one aspect of the present invention a gas flow control valve comprises a valve housing with an inlet and an outlet, the inlet and outlet being interconnected by a valve chamber, said valve chamber defining a valve seat intermediate of the inlet and outlet, the diameter of the valve chamber increasing away from the valve seat; a valve member slidably mounted coaxially of the valve chamber, the valve member having a stem and valve head, said valve head being adapted at one extreme of movement of the valve member to engage and close the valve seat; a first gas-tight chamber is provided coaxially of the valve chamber at the end thereof remote from the valve seat, the valve stem extending coaxially of said first chamber, a first diaphragm being attached at its inner periphery to the valve stem and at its outer periphery to a wall of the first chamber, to divide the first chamber into a pair of gas-tight compartments; a second gas-tight chamber is provided coaxially of the first at the end thereof remote from the valve housing, a second diaphragm being mounted at its inner periphery to a plunger located coaxially within said second chamber and at its outer periphery to a wall of the second chamber, to divide the second chamber into a pair of gas-tight compartments, resilient means being provided to urge the plunger towards the first chamber and an inlet being provided to the second chamber by which a pressure differential may be applied across the second diaphragm which will apply a load to the plunger opposing that applied by the resilient means; characterised in that the valve stem extends through the first chamber into the second chamber, the resilient means biasing the plunger into engagement with the end of the valve stem; one compartment of the first chamber being connected to the inlet and the other compartment of the first chamber being connected to the outlet, such that when pressure at the inlet is in excess of that at the outlet, the pressure differential across the first diaphragm will apply a load to the valve member urging it out of engagement with the valve seat and when the pressure at the outlet is in excess of that at the inlet, the pressure differential across the first diaphragm will apply a load to the valve member urging it into engagement with the valve seat.

With the gas flow control valve described above, when pressure at the outlet is in excess of pressure at the inlet, the pressure differential across the first diaphragm will close the valve and prevent flow of gases from outlet to inlet. When gas under pressure is supplied to the inlet and the pressure at the inlet is in excess of the pressure at the outlet, the pressure differential across the first diaphragm will apply a load to the valve member opposing that applied by the resilient means acting upon the plunger and will tend to open the valve member. The degree of opening may be controlled by the pressure differential across the second diaphragm which will oppose the load applied by the resilient means. Because of the varying diameter of the chamber between the inlet and outlet, the axial movement of the valve member will control the area of the opening and hence the flow rate of the gas from inlet to outlet. The pressure differential across the second diaphragm may be removed or even reversed, to ensure that the valve member is positively seated when delivery of gas under pressure to the inlet is disrupted.

The invention is now described, by way of example only, with reference to the accompanying

drawings in which:-

Figure 1 illustrates diagramatically a gas flow control valve in accordance with the present invention; and

Figure 2 shows a sectional elevation of an alternative form of air flow control valve in accordance with the present invention.

In the gas flow control valve 10 illustrated in Figure 1, a valve housing 11 defines a cylindrical valve chamber 12 having an inlet 14 and outlet 15. The valve chamber 12 defines a valve seat 13, the valve chamber 12 increasing in diameter from the valve seat 13 towards the inlet 14.

A valve member 16 is located coaxially of the valve chamber 12, a valve stem 17 being slidably mounted in a bearing 18 mounted at the end of the valve chamber 12 remote from outlet 15. A valve head 19 is located at the end of the valve stem 17 adjacent to the seat 13, so that the valve member 16 may be moved between a position in which the valve head 19 engages and closes the valve seat 13 and a position in which the valve head 19 is spaced axially away from the valve seat 13 towards the inlet 14.

A cylindrical gas-tight casing 20 is bolted to the valve housing 11 coaxially of the valve chamber 12. The end of the valve stern 17 remote from valve head 19 extends into the casing 20. The casing 20 is formed from two parts 22 and 23 which are clamped together in suitable manner. A flexible annular diaphragm 25 is mounted within the casing 20, an outer peripheral bead portion 26 being clamped between parts 22 and 23 of casing 20, to provide a gas-tight seal therebetween and the inner periphery 27 of diaphragm 25 being secured to the valve stem 19 at an axially fixed position. The diaphragm 25 thereby divides the casing 20 into two gas-tight compartments 30 and 31. Compartment 30 is connected to the inlet 14 by means of a bore 32 passing through the housing 11 and casing 20, and compartment 31 is connected via inlet 33, pressure tube 34 and bore 35 to the valve chamber 12 on the side of the seat 13 adjacent to outlet 15.

A second cylindrical gas-tight casing 40 is bolted to casing 20 with sealing means 41 and bearing 42 therebetween. An extension 43 is secured to the end of valve stem 17 in suitable manner and extends through the bearing 42 into casing 40. The casing 40 is formed from two parts 44 and 45, in similar manner to casing 20. The outer periphery 47 of a second diaphragm 46 is clamped between parts 44 and 45 of casing 40 and the inner periphery 48 is secured to a plunger 49 located coaxially within the casing 40. A helical compression spring 50 acts between the end of casing 40 and the plunger 49 to urge the plunger 49 into engagement with an abutment 51 on the end of the extension 43 of valve stem 17. The diaphragm 46 thereby divides the casing 40 into two gas-tight compartments 52 and 53. A port 54 is provided to compartment 52 by which it is connected to asmosphere and port 55 is provided to compartment 53 by which it may be connected to a controllable vacuum source.

The valve mechanism described above is suitable for use in a secondary air system for an internal combustion engine in which when the engine is started up, air is pumped to the engine's exhaust manifold in order to heat up the exhaust catalyst to its optimum operating temperature. The output of a positive displacement air pump is connected to the inlet 14 of valve 10 and the outlet 15 of valve 10 is connected to the exhaust manifold. The port 55 to compartment 53 is connected via an electronic vacuum regulator to a suitable source of vacuum.

Under normal operation of the engine when the exhaust catalyst is at its optimum operational temperature, the air pump is switched off and the electronic vacuum regulator connects compartment 53 to atmosphere. Compartments 52 and 53 will thus be at equal pressure and there will be no pressure differential across the diaphragm 46. The load of spring 50 acting upon plunger 49 will thus urge the valve member 16 downwardly so that the valve head 19 engages seat 13, as illustrated in Figure 1. The valve 10 will thus be positively closed preventing exhaust gases from flowing from the exhaust manifold to the pump.

When the engine is started from cold, the air pump is switched on and the electronic vacuum regulator connects compartment 53 to vacuum. The pump will deliver air under pressure to the inlet 14 and when the pressure P1 at inlet 14 and in compartment 30 is in excess of the pressure P2 at the outlet 15 and in compartment 31, the pressure differential across diaphragm 25 will apply a load to the valve stem 17 urging the valve member 16 upwardly. Furthermore, the vacuum in compartment 53 will produce a pressure differential across diaphragm 46 applying an upward load on plunger 49, this upward load opposing the downward load applied by spring 50. The load applied to the valve member 16 by diaphragm 25 will thus cause the valve member 16 to move upwardly against the resultant load applied by spring 50 less that applied by diaphragm 46. Upward movement of the valve member 16 will open the valve seat 13 and permit air to flow from inlet 14 through outlet 15 into the exhaust manifold. The degree of axial movement of the valve member 16 will depend upon the magnitude of the load applied to valve member 16 by diaphragm 25 and load applied to plunger 49 by diaphragm 46. The load applied to plunger 49 by diaphragm 46 may be controlled by

the electronic vacuum regulator thereby controlling movement of the valve member 16 which, because of the varying diameter of valve chamber 12 will vary the degree of opening of the valve seat 13 and thus the flow rate of gas from inlet 14 to outlet 15. If the engine should backfire while air is being supplied to the exhaust manifold and P2 becomes greater than P1, the pressure in compartment 31 will then be in excess of that in compartment 30 and the pressure differential across diaphragm 25 will move the valve member 16 downwardly, so that the valve head 19 will engage and close the valve seat 13, thereby preventing exhaust gases from being fed back to the pump. Similarly, if the pump is switched off or should fail, the pressure P1 will fall below pressure P2 so that the pressure differential across diaphragm 25 will again close the valve 10 irrespective of the state of the electronic vacuum regulator.

The valve described above will thus provide a variable flow of air to the exhaust manifold whilst positively preventing blow back of exhaust gases to the air pump. Plastics materials may consequently be used in the air pump and/or in the hoses therefrom. Moreover, the sensitivity of the valve to backflow is such that the valve itself may include plastic moulded components, as the establishment of back pressure upon closure of the valve will prevent the exhaust gases from reaching the valve.

The valve illustrated in Figure 2 is of moulded plastic construction. Identical reference numerals to those used in Figure 1 have been used in Figure 2 for similar components. The housing of the valve 10 illustrated in Figure 2 is formed from four plastic mouldings 60, 61, 62 and 63. The mouldings 60, 61, 62 and 63 are held together by angularly spaced clip formations 64 on mouldings 61, 62 and 63 which engage through apertures 65 in the adjoining moulding 60, 61 and 62.

Moulding 60 defines the outlet 15, valve seat 13 and a frustoconical lower portion of valve chamber 12. Moulding 61 which is connected to moulding 60 with a sealing element 66 therebetween, defines the upper part of valve chamber 12, inlet 14 and a bearing formation 67. Moulding 61 also defines the lower part of cylindrical casing 20, bore 32 being provided in the wall between the upper part of valve chamber 12 and lower part of casing 20. Moulding 62 which defines the upper part of casing 20 and lower part of casing 40 is secured to moulding 61 with the outer periphery 26 of diaphragm 25 clamped therebetween to produce a seal. Similarly, moulding 63 which defines the upper part of casing 40 is clamped to moulding 62 with the outer periphery 47 of diaphragm 46 clamped therebetween.

A tubular plastic valve stem 70 is slidingly located through bearing formation 67 to locate valve member 16 coaxially of valve chamber 12 and compartments 30, 31, 52 and 53. A moulded plastic valve head 71 is located on the lower end of valve stem 70 and elastomeric O-ring 72 being provided around the periphery of the valve head 71 to provide sealing engagement with the valve seat 13. The inner periphery of diaphragm 25 is secured to a flange formation 73 mounted on valve stem 70 within the casing 20. A radial bore 74 is provided through the wall of valve stem 70 so that it opens into chamber 31. A cap 75 closes the end of valve stem 70 remote from valve head 71 and is abutted by the plunger 49. A diaphragm 76 is trapped at its inner periphery between the end of valve stem 70 and the cap 75 and is secured at its outer periphery to a portion of moulding 62 defining the top of casing 20 and the bottom of casing 40, thereby sealing compartment 31 from compartment 52.

The valve described above will operate in the same manner as that described with reference to Figure 1, compartment 30 being connected to the inlet 14 by bore 32, compartment 31 being connected to outlet 15 via radial bore 74, and the bore of tubular valve stem 70, and port 55 being connected to an electronic vacuum regulator.

Various modifications may be made without departing from the invention. For example, while in the above embodiments compartment 52 is connected to atmosphere while compartment 53 is controllably connected to vacuum, compartment 53 may alternatively be connected to atmosphere while compartment 52 is controllably connected to a source of gas under pressure.

Claims

1. A gas flow control valve (10) comprising a valve housing (11) with an inlet (14) and an outlet (15), the inlet (14) and outlet (15) being interconnected by a valve chamber (12), said valve chamber (12) defining a valve seat (13) intermediate of the inlet (14) and outlet (15), the diameter of the valve chamber (12) increasing away from the valve seat (13); a valve member (16) slidably mounted coaxially of the valve chamber (12), the valve member (16) having a stem (17; 70) and valve head (19; 71), said valve head (19; 71) being adapted at one extreme of movement of the valve member (16) to engage and close the valve seat (13); a first gas-tight chamber (30, 31) is provided coaxially of the valve chamber (12) at the end thereof remote from the valve seat (13), the valve stem (17; 70) extending coaxially of said first chamber (30, 31), a first diaphragm (25) being attached at its inner periphery to the valve stem (17; 70) and at its outer periphery (27) to a wall of the first cham-

ber (30, 31), to divide the first chamber (30, 31) into a pair of gas-tight compartments (30 and 31); a second gas-tight chamber (52, 53) is provided co-axially of the first at the end thereof remote from the valve housing (11), a second diaphragm (46) being mounted at its inner periphery (48) to a plunger (49) located coaxially within said second chamber (52, 53) and at its outer periphery to a wall of the second chamber (52, 53), to divide the second chamber (52, 53) into a pair of gas-tight compartments (52 and 53), resilient means (50) being provided to urge the plunger (49) towards the first chamber and an inlet (55) being provided to the second chamber (52, 53) by which a pressure differential may be applied across the second diaphragm (46) which will apply a load to the plunger (49) opposing that applied by the resilient means (50), characterised in that the valve stem (17, 70) extends through the first chamber (30, 31) into the second chamber (52, 53), the resilient means (50) biasing the plunger (49) into engagement with the end of the valve stem (17, 70); one compartment (30) of the first chamber (30, 31) being connected to the inlet (14) and the other compartment (31) of the first chamber (30, 31) being connected to the outlet (15), such that when pressure at the inlet (14) is in excess of that at the outlet (15), the pressure differential across the first diaphragm (25) will apply a load to the valve member (16) urging it out of engagement with the valve seat (13) and when the pressure at the outlet (15) is in excess of that at the inlet (14), the pressure differential across the first diaphragm (25) will apply a load to the valve member (16) urging it into engagement with the valve seat (13).

2. A gas flow control valve according to Claim 1, characterised in that the valve head (19, 71) engages the valve seat (13) on the side thereof adjacent to the inlet (14), the compartment (30) of the first gas-tight chamber (30, 31) adjacent to the valve chamber (12) being connected to the valve chamber (12) on the side thereof adjacent the inlet (14) and the compartment (31) of the first gas-tight chamber (30, 31) remote from the valve chamber (12) being connected to the valve chamber (12) on the outlet side of the valve seat (13).

3. A gas flow control valve according to Claim 2, characterised in that the inlet (14) is connected to said compartment (30) defined in the first gas-tight chamber (30, 31) by means of a bore (32) through the valve housing (11).

4. A gas flow control valve according to Claim 2 or 3, characterised in that the outlet (15) is connected to said compartment (31) defined in the first gas-tight chamber (30, 31) by means of an external connection (34).

5. A gas flow control valve according to Claim 2 or 3, characterised in that the outlet (15) is connected to said compartment (31) defined in the first gas-tight chamber (30, 31) by means of an axially extending bore through the stem (70) of the valve member (16).

6. A gas flow control valve according to any one of the preceding claims characterised in that a helical compression spring (50) acts against the end of the second gas-tight chamber (52, 53) remote from the valve chamber (12) and the plunger (49), urging the plunger (49) into engagement with the end of the valve stem (17; 70).

7. A gas flow control valve according to any one of the preceding claims characterised in that the compartment (53) defined in the second gas-tight chamber (52, 53) on the side of the diaphragm (46) remote from the valve chamber (12) has an inlet (55) by which it may be connected to a controllable source of vacuum, the compartment (52) on the side of the second diaphragm (46) adjacent the valve chamber (12) being connected to atmosphere.

8. A gas flow control valve according to any one of the preceding claims characterised in that the valve chamber (12), first gas-tight chamber (30, 31) and second gas-tight chamber (52, 53) are formed from four plastics mouldings (60, 61, 62, 63).

9. A gas flow control valve according to Claim 8 characterised in that a first plastics moulding (60) defines the outlet (15), valve seat (13) and lower part of the valve chamber (12), a second plastics moulding (61) defines the inlet (14), upper part of valve chamber (12), a bearing formation (67) for the valve stem (70) and the lower part of the first gas-tight chamber (30, 31), a third plastics moulding (62) defines the upper part of the first gas-tight chamber (30, 31) and the lower part of the second gas-tight chamber (52, 53) and a fourth plastics moulding (63) defines the upper part of the second gas-tight chamber (52, 53).

10. A gas flow control valve according to Claim 8 or 9 characterised in that the valve member (16) is formed from a moulded plastic valve

stem (70), a moulded plastic valve head (71) being secured to the valve stem (70) at the end adjacent the valve seat (13) and a cap (75) closing the bore of the valve stem (70) at the end remote from the valve seat (13), a radial bore (74) extending through the wall of the valve stem (70) to provide communication between the outlet (15) and the compartment (31) of the first gas-tight chamber (30, 31) associated therewith.

Patentansprüche

1. Gasstromregelventil (10) mit einem einen Einlaß (14) und einen Auslaß (15) aufweisenden Gehäuse (11), wobei der Einlaß (14) und der Auslaß (15) über eine Ventilkammer (12) miteinander verbunden sind, besagte Ventilkammer (12) zwischen dem Einlaß (14) und dem Auslaß (15) einen Ventilsitz (13) definiert, und der Durchmesser der Ventilkammer (12) von dem Ventilsitz (13) ausgehend ansteigt; einem verschiebbar koaxial in der Ventilkammer (12) eingebauten Ventilglied (16), wobei das Ventilglied (16) einen Schaft (17; 70) und einen Ventilkopf (19; 71) aufweist, wobei besagter Ventilkopf (19; 71) so ausgebildet ist, daß er in einer Bewegungsendstellung des Ventilgliedes (16) mit dem Ventilsitz (13) in Eingriff gelangt und diesen verschließt; einer ersten gasdichten Kammer (30, 31), die koaxial zur besagten Ventilkammer (12) an dem von dem Ventilsitz (13) entfernt liegenden Ende derselben angeordnet ist, wobei sich der Ventilschaft (17; 70) koaxial zur besagten ersten Kammer (30, 31) erstreckt, und eine erste Membran (25) mit ihrem Innenumfang am Ventilschaft (17; 70) und mit ihrem Außenumfang (27) an der Wand der ersten Kammer (30, 31) befestigt ist, so daß die erste Kammer (30, 31) in ein Paar gasdichte Abteile (30 und 31) geteilt wird; einer zweiten gasdichten Kammer (52, 53), die koaxial zur ersten Kammer an dem von dem Ventilgehäuse (11) entfernten Ende derselben angeordnet ist, wobei eine zweite Membran (46) mit ihrem Innenumfang (48) an einem Stößel (49) befestigt ist, der koaxial in besagter zweiter Kammer (52, 53) angeordnet ist, und mit ihrem Außenumfang an der Wand der zweiten Kammer (52, 53) befestigt ist, so daß die zweite Kammer (52, 53) in ein Paar gasdichte Abteile (52 und 53) geteilt wird, wobei federnde Mittel (50) vorgesehen sind, die den Stößel (49) in Richtung der ersten Kammer drängen, und ein Einlaß (55) in der zweiten Kammer (52, 53) vorgesehen ist, über welchen ein Differentialdruck an der zweiten Membran angelegt werden kann (46), welcher den Stößel (49) entgegen der Wirkung der federnden Mittel (50) belastet, dadurch gekennzeichnet, daß sich der Ventilschaft (17, 70) durch die erste Kammer (30, 31) hindurch in die zweite Kammer (52, 53) erstreckt, wobei die federnden Mittel (50) den Stößel (49) in Anlage an das Ende des Ventilschaftes (17, 70) drängen; daß ein Abteil (30) der ersten Kammer (30, 31) mit dem Einlaß (14) und das andere Abteil (31) der ersten Kammer (30, 31) mit dem Auslaß (15) verbunden ist, so daß, wenn der Druck am Einlaß (14) über dem des Auslasses (15) liegt, der Differentialdruck an der ersten Membran (25) das Ventilglied (16) in der Weise belastet, daß es außer Eingriff mit dem Ventilsitz (13) gelangt, und wenn der Druck am Auslaß (15) über dem des Einlasses (14) liegt, der Differentialdruck an der ersten Membran (25) das Ventilglied (16) in Anlage an den Ventilsitz (13) drängt.

2. Gasstromregelventil nach Anspruch 1, dadurch gekennzeichnet, daß der Ventilkopf (19, 71) mit dem Ventilsitz (13) auf der Seite desselben in Eingriff gelangt, die an den Einlaß (14) angrenzt, wobei die an der Ventilkammer (12) angrenzende erste gasdichte Kammer (30, 31) mit der Ventilkammer (12) auf der an den Einlaß (14) angrenzenden Seite derselben verbunden ist, und das von der Ventilkammer (12) entfernte Abteil (31) der ersten gasdichten Kammer (30, 31) auf der Auslaßseite des Ventilsitzes (13) mit der Ventilkammer (12) verbunden ist.

3. Gasstromregelventil nach Anspruch 2, dadurch gekennzeichnet, daß der Einlaß (14) über eine Bohrung (32) durch das Ventilgehäuse (11) hindurch mit besagtem in der ersten gasdichten Kammer (30, 31) gebildeten Abteil (30) verbunden ist.

4. Gasstromregelventil nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß der Auslaß (15) über eine externe Verbindung (34) mit dem besagten in der ersten gasdichten Kammer gebildeten Abteil (31) verbunden ist.

5. Gasstromregelventil nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß der Auslaß (15) über eine sich axial durch den Ventilschaft (70) und das Ventilglied (16) hindurch erstreckende Bohrung mit besagtem in der ersten gasdichten Kammer (30, 31) gebildetem Abteil (31) verbunden ist.

6. Gasstromregelventil nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß eine Schraubendruckfeder (50)

auf das eine, von der Ventilkammer (12) entfernte Ende der zweiten gasdichten Kammer (52, 53) und auf den Stößel (49) wirkt und den Stößel (49) in Anlage an das Ende des Ventilschaftes (17; 70) drückt.

7. Gasstromregelventil nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß das auf der von der Ventilkammer (12) entfernten Seite der Membran (46) in der zweiten gasdichten Kammer (52, 53) gebildete Abteil (53) einen Einlaß (55) aufweist, über welchen es an einer regelbaren Unterdruckquelle angeschlossen werden kann, wobei das Abteil (52) auf der an die Ventilkammer (12) angrenzenden Seite der zweiten Membran (46) mit der Atmosphäre verbunden ist.

8. Gasstromregelventil nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Ventilkammer (12), die erste gasdichte Kammer (30, 31) und die zweite gasdichte Kammer (52, 53) von vier Kunststoffgußteilen (60, 61, 62, 63) gebildet werden.

9. Gasstromregelventil nach Anspruch 8, dadurch gekennzeichnet, daß ein erstes Kunststoffgußteil (60) den Auslaß (15), den Ventilsitz (13) und einen unteren Teil der Ventilkammer (12) bildet, ein zweites Kunststoffgußteil (61) den Einlaß (14), den oberen Teil der Ventilkammer (12), eine Lagerausbildung (67) für den Ventilschaft (70) und den unteren Teil der ersten gasdichten Kammer (30, 31) bildet, ein drittes Kunststoffgußteil (62) den oberen Teil der ersten gasdichten Kammer (30, 31) und den unteren Teil der zweiten gasdichten Kammer (52, 53) bildet, und ein viertes Kunststoffgußteil (63) den oberen Teil der zweiten gasdichten Kammer (52, 53) bildet.

10. Gasstromregelventil nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß das Ventilglied (16) von einem gegossenen Kunststoff-Ventilschaft (70) gebildet wird, wobei ein gegossener Kunststoff-Ventilkopf (71) an dem Ventilschaft (70) an dem dem Ventilsitz (13) unmittelbar benachbarten Ende desselben befestigt ist, und eine Haube (75) das Ende der Bohrung im Ventilschaft (70) an dem vom Ventilsitz (13) entfernten Ende verschließt, wobei sich eine radiale Bohrung (74) durch die Wand des Ventilschaftes (70) erstreckt, um so eine Verbindung zwischen dem Auslaß (15) und dem Abteil (31) der diesem zugeordneten ersten gasdichten Kammer (30, 31) herzustellen.

Revendications

1. Soupape de commande de flux gazeux (10) comprenant un logement de soupape (11) comportant un orifice d'entrée (14) et un orifice de sortie (15), l'orifice d'entrée (14) et l'orifice de sortie (15) étant interconnectés par une chambre de soupape (12), ladite chambre de soupape (12) définissant un siège de soupape (13) situé entre l'orifice d'entrée (14) et l'orifice de sortie (15), le diamètre de la chambre de soupape (12) augmentant en s'éloignant du siège de soupape (13), un élément de soupape (16) monté de manière coulissante coaxialement à la chambre de soupape (12), l'élément de soupape (16) ayant une tige (17, 70) et une tête de soupape (19, 71), ladite tête de soupape (19, 71) étant prévue pour une extrémité du déplacement, de l'élément de soupape (16) pour engager et fermer le siège de soupape (13), une première chambre étanche aux gaz (30, 31) est prévue coaxialement à la chambre de soupape (12) à son extrémité distante du siège de soupape (13), la tige (17, 70) se prolongeant coaxialement par rapport à ladite première chambre (30, 31), une première membrane (25) étant fixée à sa périphérie interne à la tige (17, 70) et à sa périphérie extérieure (27) à une paroi de la première chambre (30, 31) pour diviser la première chambre (30, 31) en une paire de compartiments étanches aux gaz (30, 31), une seconde chambre étanche aux gaz (52, 53) est prévue coaxialement à la première à son extrémité distante du logement de soupape (11), une seconde membrane (46) étant montée à sa périphérie interne (48) à un plongeur (49) placé coaxialement à l'intérieur de ladite chambre (52, 53) et à sa périphérie extérieure à une paroi de la seconde chambre (52, 53) pour diviser la seconde chambre (52, 53) en une paire de compartiments étanches aux gaz (52, 53), un moyen élastique (50) étant prévu pour pousser le plongeur (49) vers la première chambre et un orifice d'entrée (55) étant prévu dans la seconde chambre (53) par lequel une différence de pression peut être appliquée à travers la seconde membrane (46) qui appliquera une charge au plongeur (49) opposée à celle appliquée par le moyen élastique (50), caractérisé en ce que la tige de soupape (17, 70) s'étend à travers la première chambre (30, 31) dans la seconde chambre (52, 53), le moyen élastique (50) sollicitant le plongeur (59) en engagement avec l'extrémité de la tige de soupape (17, 70), un compartiment (30) de la première chambre (30, 31) étant raccordé à l'orifice d'entrée (14) et l'autre compartiment

(31) de la première chambre (30, 31) étant raccordé à l'orifice de sortie (15), de sorte que lorsque la pression à l'orifice d'entrée (14) dépasse celle à l'orifice de sortie (15), la différence de pression à travers la première membrane (25) appliquera une charge à l'élément de soupape (16) le poussant hors d'engagement avec le siège de soupape (13) et lorsque la pression à l'orifice de sortie (15) dépasse celle à l'orifice d'entrée (14), la différence de pression à travers la première membrane (25) appliquera une charge à l'élément de soupape (16) le poussant en engagement avec le siège de soupape (13).

2. Soupape de commande de flux gazeux selon la Revendication 1, caractérisé en ce que tête de soupape (19, 71) engage le siège de soupape (13) sur son côté contigu à l'orifice d'entrée (14), la première chambre étanche aux gaz (30,31) contigu à la chambre de soupape (12) étant reliée à cette dernière au niveau de son côté adjacent à l'orifice d'entrée (14) et le compartiment (31) de la première chambre étanche aux gaz (30,31) éloigné de la chambre de soupape (12), étant raccordé à la chambre de soupape (12) sur le côté orifice de sortie du siège de soupape (13).

3. Soupape de commande de flux gazeux selon la Revendication 2, caractérisée en ce que l'orifice d'entrée (14) est raccordé audit compartiment (30) défini par la première chambre étanche aux gaz (30, 31) au moyen d'un alésage (32) à travers le logement de soupape (11).

4. Soupape de commande de flux gazeux selon la Revendication 2 ou 3, caractérisée en ce que l'orifice de sortie (15) est raccordé audit compartiment (31) défini dans la première chambre étanche aux gaz (30, 31) au moyen d'un raccordement externe (34).

5. Soupape de commande de flux gazeux selon la Revendication 2 ou 3, caractérisée en ce que l'orifice de sortie (15) est raccordé audit compartiment (31) défini dans la première chambre étanche aux gaz (30, 31) au moyen d'un alésage s'étendant axialement à travers la tige (70) de l'élément de soupape (16).

6. Soupape de commande de flux gazeux selon l'une quelconque des revendications précédentes, caractérisée en ce qu'un ressort de compression hélicoïdal (50) agit contre l'extrémité de la seconde chambre étanche aux gaz (52, 53) distante de la chambre de soupape (12) et du plongeur (49), poussant le plongeur (49) en engagement avec l'extrémité de la tige de soupape (17, 70).

7. Soupape de commande de flux gazeux selon l'une quelconque des revendications précédentes, caractérisée en ce que le compartiment (53) défini dans la seconde chambre étanche aux gaz (52, 53) sur le côté de la membrane (46) distant de la chambre de soupape (12) comporte un orifice d'entrée (55) par lequel il peut être raccordé à une source commandable de vide, le compartiment (52) sur le côté de la seconde membrane (46) contiguë à la chambre de soupape (12) étant raccordé à la pression atmosphérique.

8. Soupape de commande de flux gazeux selon l'une quelconque des revendications précédentes, caractérisée en ce que la chambre de soupape (12), la première chambre étanche aux gaz (30, 31) et la seconde chambre étanche aux gaz (52, 53) sont formées à partir de quatre moulages plastiques ou éléments moulés en plastique (60, 61, 62, 63).

9. Soupape de commande de flux gazeux selon la Revendication 8, caractérisée en ce qu'un premier élement moulé en plastique (60) définit l'orifice de sortie (15), le siège de soupape (13) et la partie inférieure de la chambre de soupape (12), un second élément moulé en plastique (61) définit l'orifice d'entrée (14), la partie supérieure de la chambre de soupape (12), une formation de palier (67) pour la tige de soupape (70) et la partie inférieure de la première chambre étanche aux gaz (30, 31), un troisième élément moulé en plastique (62) définit la partie supérieure de la première chambre étanche aux gaz (30, 31) et la partie inférieure de la seconde chambre étanche aux gaz (52, 53) et un quatrième élément moulé en plastique (63) définit la partie supérieure de la seconde chambre étanche aux gaz (52, 53).

10. Soupape de commande de flux gazeux selon la Revendication 8 ou 9, caractérisée en ce que l'élément de soupape (16) est formé à partir d'une tige de soupape en plastique moulé (70), une tête de soupape en plastique moulé (71) étant fixée à la tige de soupape (70) à l'extrémité contiguë au siège de soupape (13) et un chapeau (75) fermant l'alésage de la tige de soupape (70) à l'extrémité distante du siège de soupape (13), un alésage radial (74) s'étendant à travers la paroi de la tige de soupape (70) pour procurer la communication entre l'orifice de sortie (15) et le compartiment (31) de la première chambre étanche aux gaz (30, 31)

associée à celle-ci.

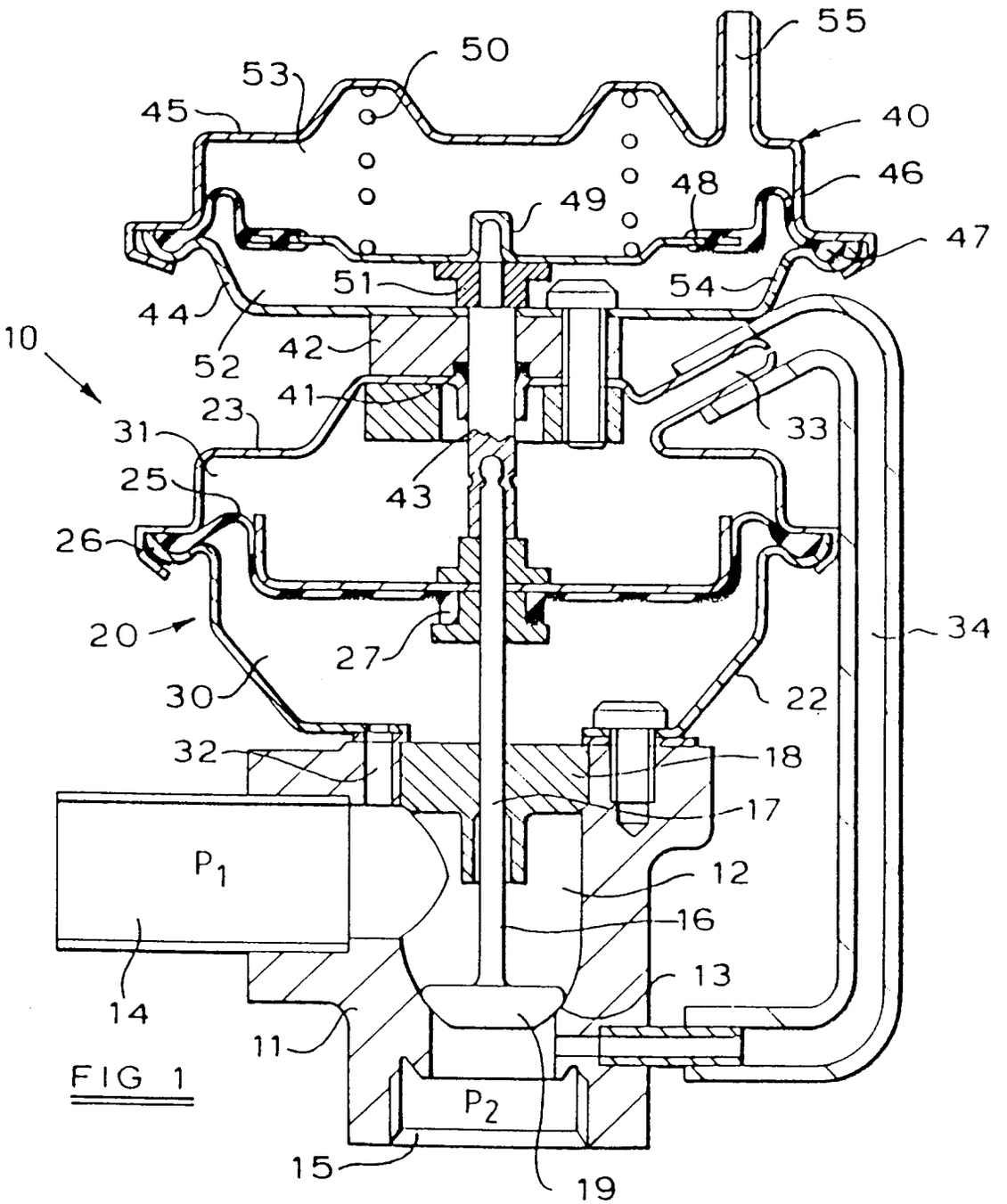

55
50
53
45
40
46
48
49
47
51
54
44
52
42
10
41
23
33
31
43
25
26
34
20
27
30
22
32
18
17
P1
12
16
13
14
11
P2
15
19

FIG 1

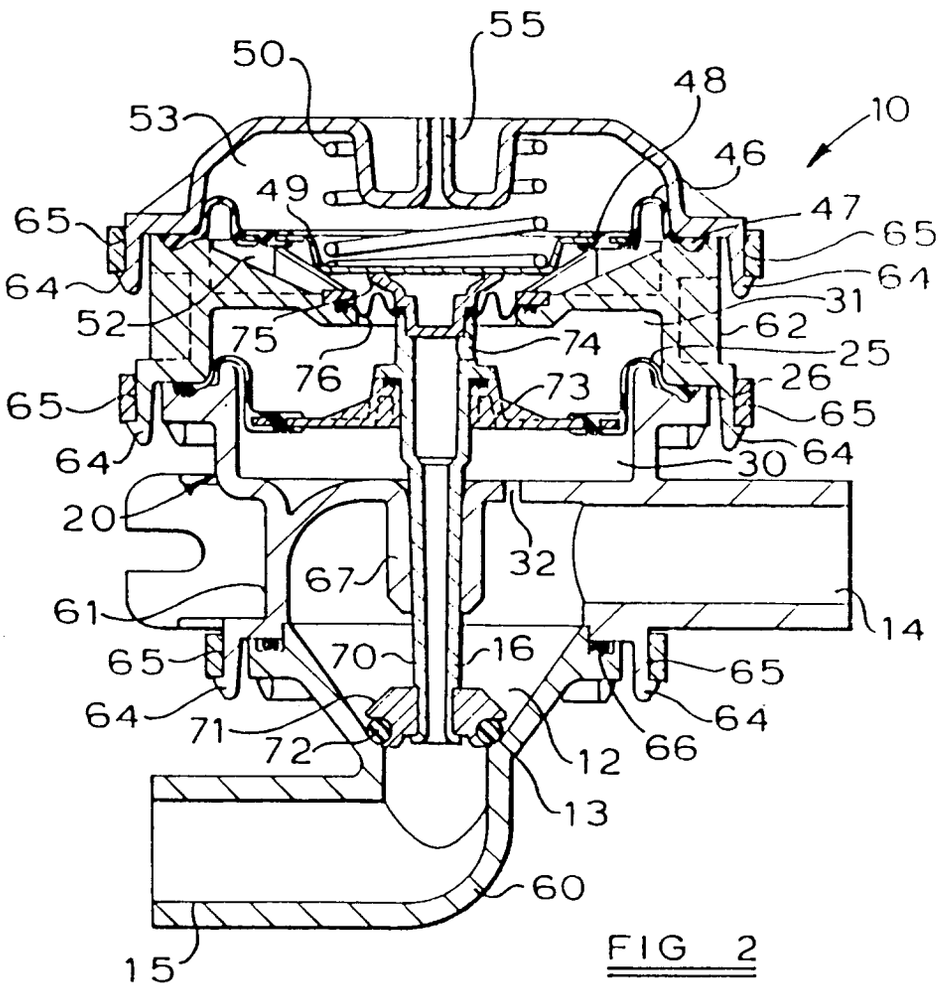

55
50
48
10
53
46
49
47
65
65
64
64
52
31
75
74
62
25
76
73
26
65
65
64
64
30
20
32
67
61
14
65
70
16
65
64
71
72
64
66
12
13
60
15

FIG 2