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(54) **DUAL GAS PRESSURE REGULATOR FOR A HOUSEHOLD APPLIANCE**

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G05D 16/06 (2006.01)

(52) **U.S. Cl.**
USPC **137/505.14**; 137/505.41

(58) **Field of Classification Search**
USPC 137/495, 505.14, 505.41
See application file for complete search history.

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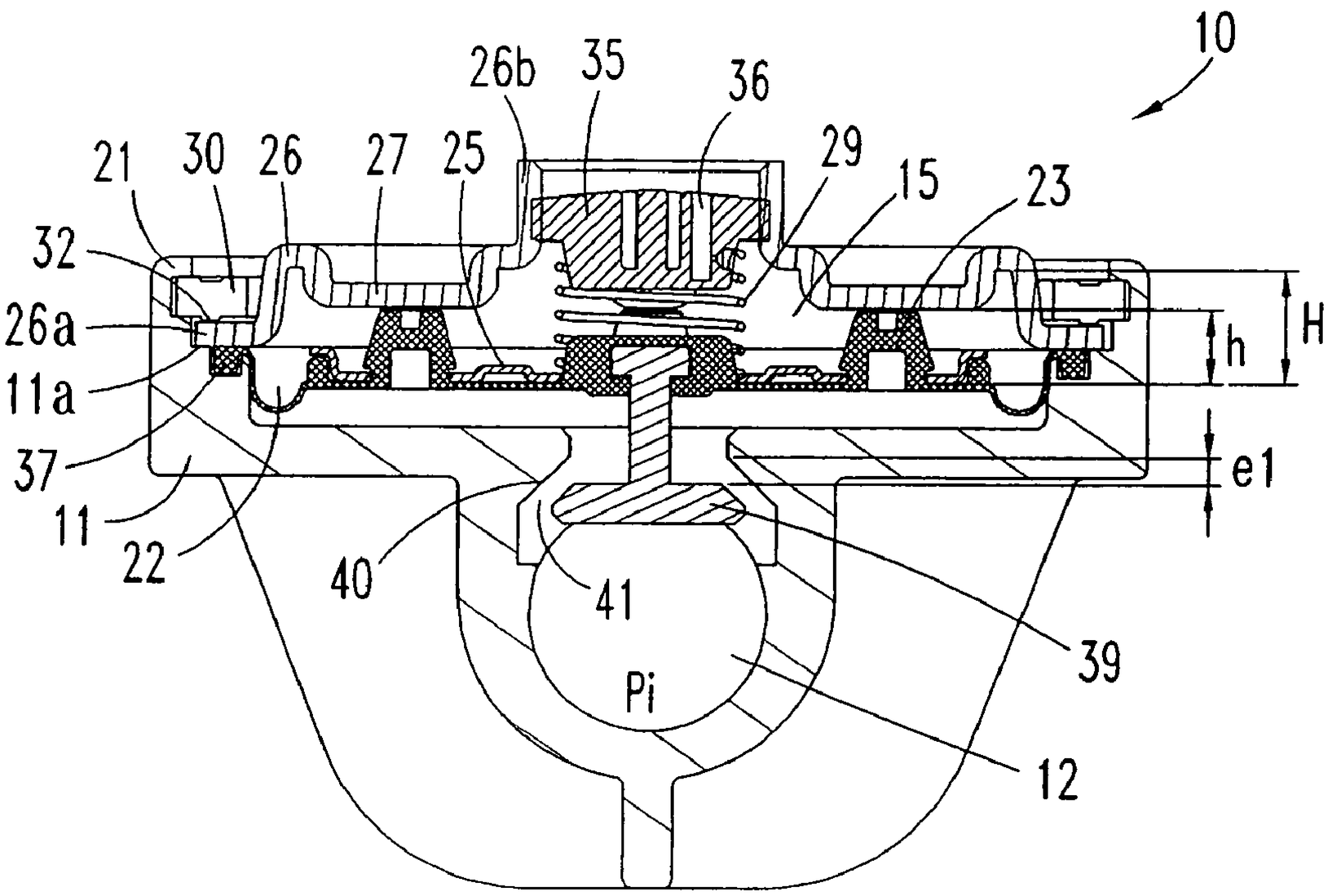
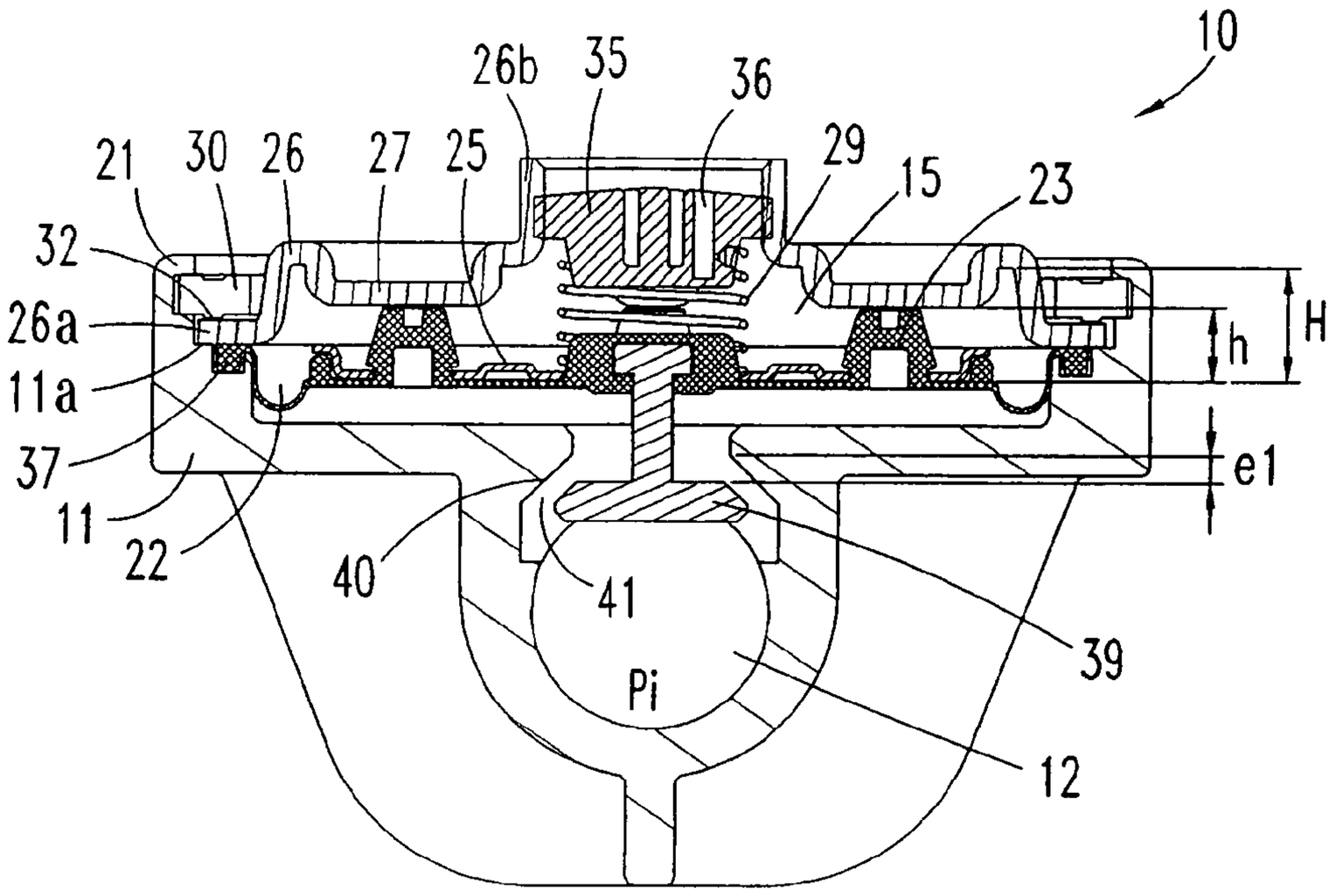
(57) **ABSTRACT**

Gas pressure regulator valve adapted to a household appliance for the supply of a flow of NG or LPG gas that comprises a valve body (**11**) with an inlet conduit (**12**), an outlet conduit (**13**) of the gas at a nominal pressure, a pressurised chamber (**14**) connecting both conduits through a regulation valve (**39**,**40**), a diaphragm (**22**) connected to the valve member (**39**), a closure cap (**26**) and means (**26-29**,**19**,**23**,**35**) for the adjusting of the nominal pressure for NG or LPG gas. The adjusting means include a prestressed adjusting screw (**35**) on the diaphragm (**22**), a guide means (**28**) of the rotation on the cap (**26**) and a stopper means of the rotation on the body (**11**). The pressure value is adjusted by the rotation of the cap between two positions.

41 Claims, 3 Drawing Sheets

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26b
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26a
11a
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22
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39
Pi
12
h
H
e1

FIG. 2

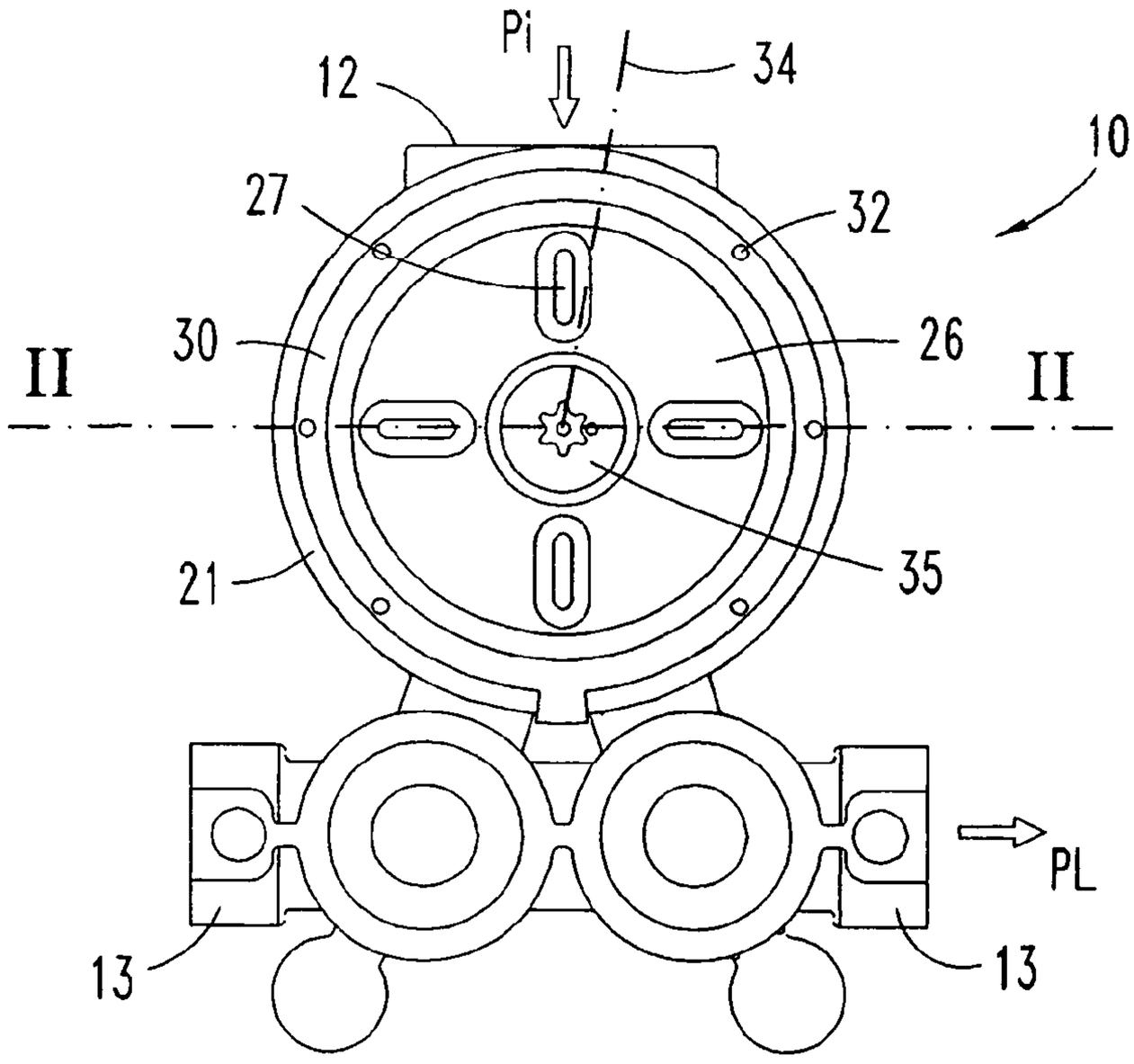
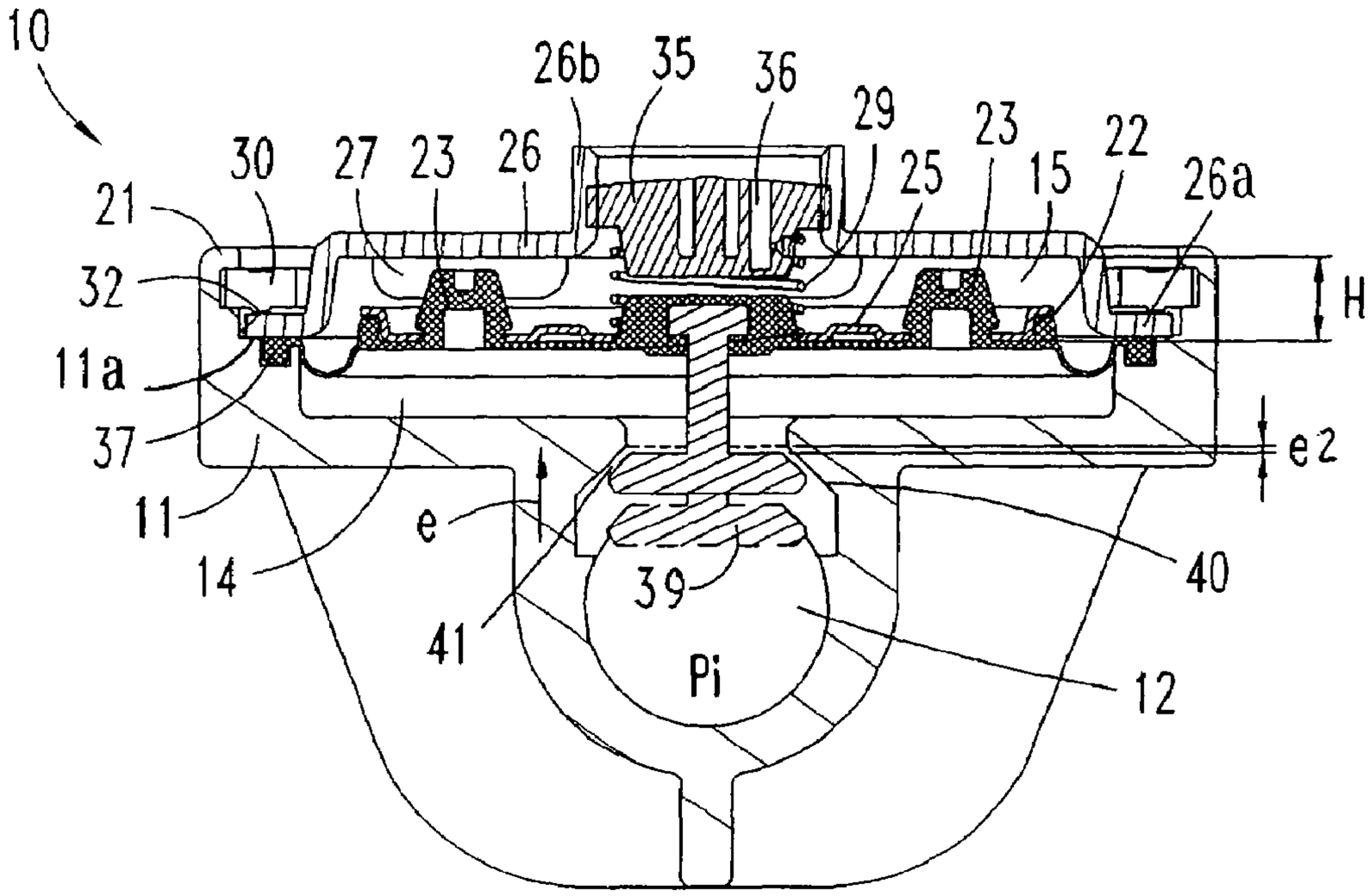

Pi
34
12
10
27
32
30
26
II
II
21
35
PL
13
13

FIG. 1


10
26b
35
36
29
23
22
30
27
23
26
25
15
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21
32
H
11a
37
e2
11
e
40
14
39
41
Pi
12

FIG. 4

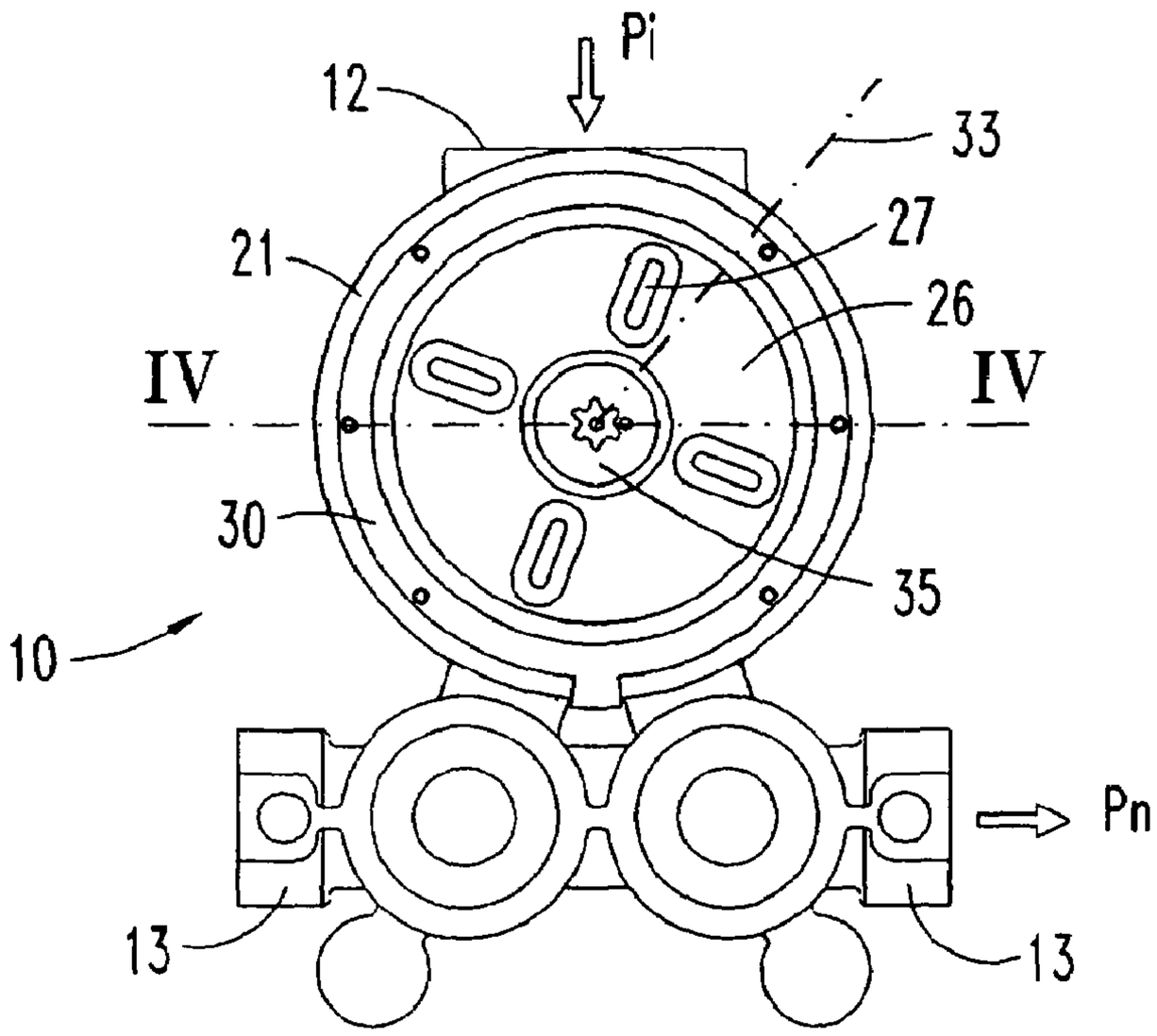
Pi
12
33
21
27
26
IV
IV
30
35
10
Pn
13
13

FIG. 3

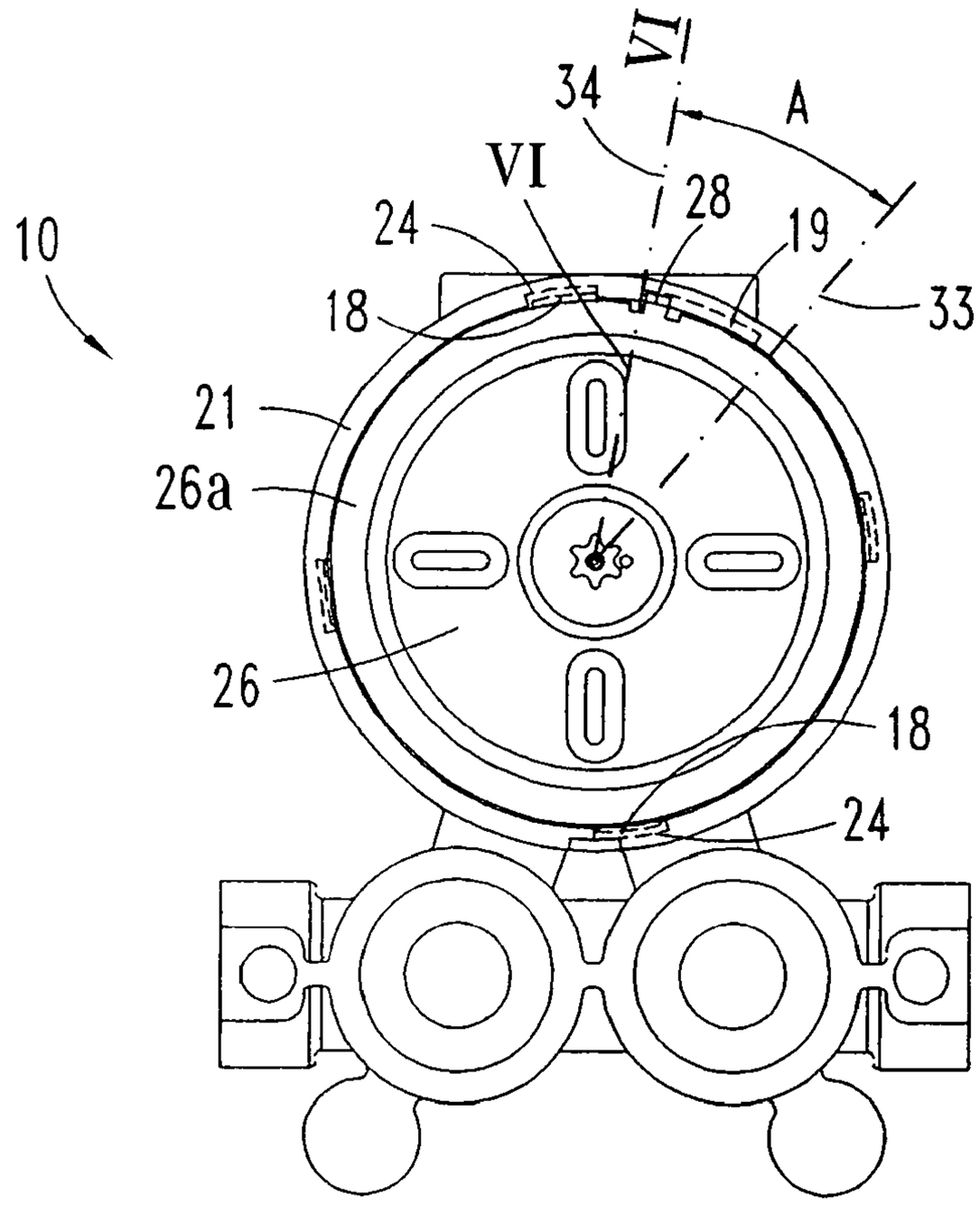
VI
34
A
VI
28
24
19
10
18
33
21
26a
26
18
24

FIG. 5

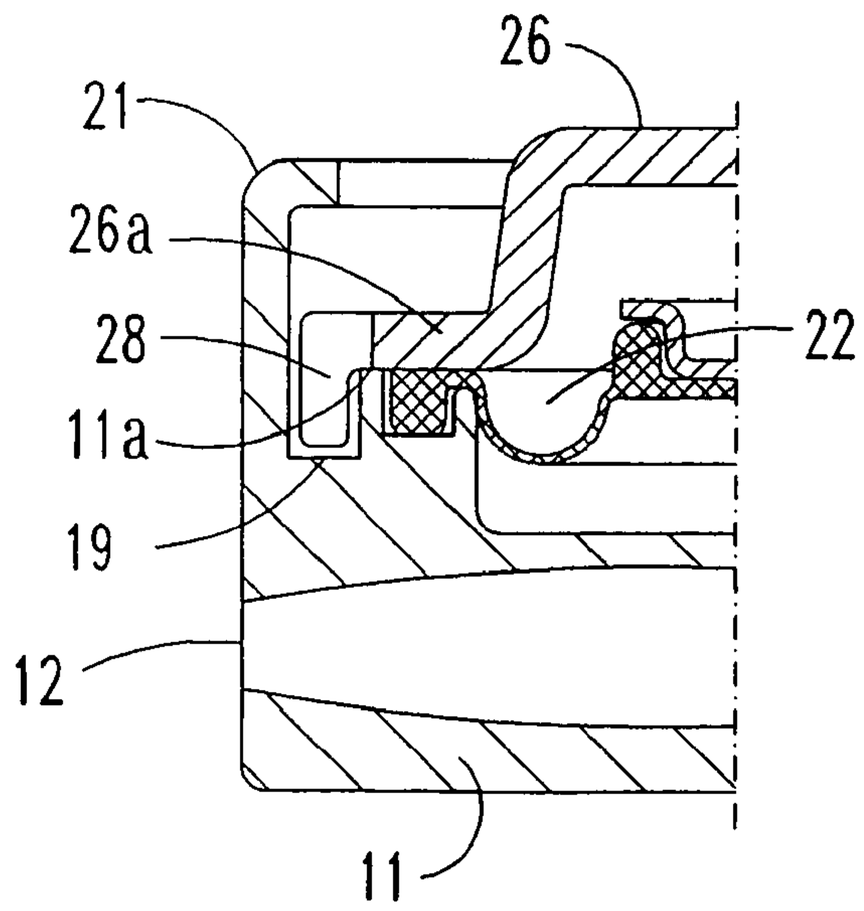
26
21
26a
28
22
11a
19
12
11

FIG. 6

DUAL GAS PRESSURE REGULATOR FOR A HOUSEHOLD APPLIANCE

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

The present invention relates to a diaphragm type gas pressure regulator valve adapted to a gas supply valve for a household appliance with interchangeable means according to the type of gas supplied, natural gas NG or liquefied petroleum gas LPG.

PRIOR ART

A pressure regulator of this type is used to adjust the gas pressure in a supply valve, regulating respectively either of two different pressure values for a household appliance which is supplied with natural gas (NG) or with liquefied petroleum gas (LPG). In order to adjust one or other pressure value, the pressure regulator is disposed with an interchangeable adjusting means which is fitted when the supply valve is installed in the household appliance.

Patent document U.S. Pat. No. 5,988,204 discloses an adjustable gas pressure regulator that can selectively adjust the input gas flow to one or other pressure value adapted to the different gas types, and comprises a valve body with a pressurised gas chamber, an inlet gas conduit and an outlet gas conduit both connected by said pressurised chamber, through a regulator valve activated by a diaphragm in response to pressure changes in the inlet gas conduit, a closure cap above the diaphragm screwed to the body, a first adjusting spring exerting a biasing force against the diaphragm for the adjusting of the output pressure and prestressed beneath the closure cap and a hollow screw threaded on said cap and aligned with the first pressure adjusting spring. The adjusting screw is detachable and includes an air ventilation hole that keeps an air chamber at the atmospheric pressure, being situated above said diaphragm and defined by the closure cap. When a specific pressure is required for the LPG gas in the outlet gas conduit, the adjusting screw on the cap is detached, and a disc with a second adjusting spring is assembled in its inner cavity, coaxial to the first spring, exerting an additional pressure against the diaphragm for the adjusting of a nominal value of the pressure of the NG gas in the valve. This regulation valve has the drawback of requiring different diaphragm adjusting means for a LPG gas or a NG gas, so that an adjusting piece must be interchanged for one or another type of gas. It also needs more than one adjusting spring depending on the type of gas.

DISCLOSURE OF THE INVENTION

The object of this invention is to provide a valve regulator pressure for the supply of a LPG or a NG gas flow at a nominal pressure to a household appliance, provided with a system for adjusting the nominal pressure actionable between two positions for the supply of either of both types of gas.

The gas pressure regulator valve according to the invention is provided with means for the adjusting of the nominal pressure for the two types of NG and LPG gas, by acting on the closure cap of the body and an adjusting screw, without the need to interchange any piece for the adaptation to one or other type of gas. The pressure regulator valve has the advantage of using equal adjusting means for one and another type of gas, the pressure value being adjusted by the rotation of the closure cap between two positions. The closure cap is assembled in a rotating manner in order to take up two positions respectively for the adjusting of NG or LPG, as a result of which the assembly means are adapted to the diaphragm and to the valve body. A retainer ring limits the displacement of the closure cap in an axial direction but bestows it with a degree of freedom of rotation, necessary to exchange its relative position to the diaphragm depending on the type of supplied gas. The same adjusting screw and the same pressure value adjusting spring remain assembled on the regulator valve even if the type of gas supplied changes.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a ground view of a gas pressure regulator valve according to the invention, shown with a pressure adjusting means for the regulation of a flow of liquefied petroleum gas LPG.

FIG. **2** is a sectional view of the gas pressure regulator valve according to the II-II line of FIG. **1**, showing the passage of LPG gas regulated by the adjusting means for the LPG gas regulation.

FIG. **3** is a ground view of the gas pressure regulator valve of FIG. **1**, shown with the adjusting means in the adjusting position for the regulation of a natural gas NG flow.

FIG. **4** is a sectional view of the gas pressure regulator valve according to the IV-IV line of FIG. **1**, showing the passage of gas regulated by the adjusting means for the regulation of a natural gas NG flow.

FIG. **5** is a ground view of the gas pressure regulator valve of FIG. **1**, showing an internal detail of the closure cap of the valve.

FIG. **6** is a partial sectional view of the gas pressure regulator valve according to the VI-VI line of FIG. **5**.

DETAILED DISCLOSURE OF THE INVENTION

In reference to FIGS. **1-6**, a preferred embodiment of a gas pressure regulator valve **10** is adapted for its connection to an NG or LPG gas flow distribution valve or directly to a household appliance, and comprises a valve body **11** with a inlet gas conduit **12** connected to a NG or LPG gas source and a outlet gas conduit **13** regulated at a respective nominal pressure Pn or Pi of the type of gas supplied, which is connected to a pressurised gas chamber **14** through a regulation valve **39**,**40** activated by a division diaphragm **22**, to which is fixed the valve member **39**. The diaphragm **22** separates the pressurised gas chamber **14** from an air chamber **15** at atmospheric pressure closed by a closure cap **26** of the valve body **11**, and is fixed onto a peripheral surface **11**a on the body **11**.

The closure cap **26** is provided with a peripheral rim **26**a for its assembly on the surface **11**a of the valve body **11** through an O-ring seal **37**. The closure cap **26** has a degree of freedom "A" for the rotation relative to the fixed diaphragm **22**, which enables the regulator valve **10** of a nominal pressure Pn or Pl of an NG or LPG gas supply fed into the inlet gas conduit **12** to be changed manually. Several fixing ribs **24** in the periphery of the diaphragm **22** are housed in grooves **18** on the peripheral surface **11**a of the valve body **11**, thus blocking the rotation of the fixed diaphragm **22**, shown in FIG. **5**.

An adjusting screw **35** threaded on the closure cap **26** enables the adjusting of the nominal pressure Pl (FIG. **2**) or Pn (FIG. **4**) required in the gas chamber **14** connected to the outlet conduit **13**. As an example of the nominal pressure Pn value regulated for an NG gas flow, Pn is equal to 3½"-4½" of

H_2O, the pressure of the NG gas in the inlet conduit **12** of Pi being equal to 2½"-6" of H_2O. The nominal pressure Pl of LPG gas is not regulated because the LPG source itself keeps constant the pressure Pi=Pl in the inlet gas conduit **12**. A spring **29** compressed beneath the adjusting screw **35** threaded on the closure cap **26** is disposed as adjusting means. The spring **29** pushes against the division diaphragm **22** in order to displace the valve member **39** and to maintain said preset nominal pressure Pn or Pl with the variations in the gas pressure Pi.

The pressurised gas chamber **14** is defined in an inner cavity of the body **11** between the division diaphragm **22** and the regulation valve **39**,**40**. The air chamber **15** defined between the closure cap **26** and the diaphragm **22** communicates with the atmospheric pressure through a ventilation hole **36** drilled in the adjusting screw **35**. This screw is threaded into a neck **26**b of the closure cap **26**, inside which it can be displaced in order to compress the regulator spring **29** and to displace the valve member **39** to a specific measurement for the adjusting of the nominal pressure Pn or Pl.

The distance of separation "e**1**" (FIG. **2**) and "e**2**" (FIG. **4**) between the retainer valve **39** and its seating **40** determines the area of passage of the valve hole **41** adjusted for the regulation of the respective output pressure Pl or Pn from the pressure regulator valve **10**. Said initial openings "e**1**" and "e**2**" of the valve member **39** are prefixed by the rotation of the closure cap **26** to two respective angular positions **34** and **33**. This regulation of the nominal pressure Pl or Pn is normally performed once in the apparatus life, when the pressure adjusting valve **10** is installed initially in the apparatus. The adjusting screw **35** compresses the regulator screw **29** in the neck of the closure cap **26**b, in greater or smaller length, adjusted to oppose a specific resistance to the push of the pressure Pi on the valve member **39** and thus effect the regulation of the pressure. In the case of LPG gas (FIG. **2**) the valve member **39** remains stationary because the pressure Pl is constant.

The force exerted against the division diaphragm **22** by the spring **29**, contrary to the pressure Pi exerted by the incoming gas in the gas chamber **14**, regulates the displacement "e" of the valve member **39** in a stroke around a previous respective adjusting displacement "e**1**" or "e**2**".

A rigid disc **25** is fixed to the division diaphragm **22** concentric with it, so that it acts as a support base for the spring **29**, providing at the same time, the support to the diaphragm **22** itself. A retainer ring **30** for the closure cap **26** and the division diaphragm **22** is assembled on the peripheral rim **26**a of the closure cap **26**. The retainer ring **30** is secured to the valve body **11** through a fixing means **21** that includes a thin peripheral edge of the body **11** that is riveted against the retainer ring **30**. The thin peripheral edge of the body **11** may be replaced by screws that secure the retainer ring **30** to the valve body **11**.

The retainer ring **30** includes various inserts **32** that are supported on the closure cap **26** preventing friction between both pieces when the closure cap **26** is rotated. The axial movement of the closure cap **26** is thus restricted, and at the same time, its rotation of angle "A" between two positions **33** and **34** (FIG. **5**), necessary for effecting the adjustment of the nominal pressure Pn for natural gas NG or Pl for LPG respectively, is permitted.

In reference to FIGS. **1**-**2**, a gas pressure regulator valve **10** is shown, adjusted for its use with LPG. The air chamber **15** takes up a height "H" between the closure cap **26** and the base of the diaphragm **22**. The peripheral rim **26**a of the closure cap **26** provides said space of height "H" on the base of the diaphragm **22**. The closure cap **26** is provided with various inserts **27** oriented towards the diaphragm **22**, and the latter is provided with various protuberances or nipples **23** oriented towards the closure cap **26**. The inserts **27** in the closure cap **26** are spaced between them in the radial direction and maintain a relative position inside the circular area of the closure cap **26**. The protuberances **23** on the diaphragm **22** maintain an equal relative position in the radial direction to the inserts **27** in the cap **26**. The height "h" (FIG. **2**) between an insert **27** projecting out of the closure cap **26** and the base of the division diaphragm **22** is of such a dimension that it interferes with the opposite projecting height of a protuberance or nipple **23** on the diaphragm **22**, as a result of which once the rotation "A" of the cap **26** for the use of the pressure regulator **10** with liquefied petroleum gas LPG has been effected towards the angular position **34**, the inserts **27** are in a position where the protuberances **23** are on top of them, the diaphragm **22** and the valve member **39** thus being displaced for the adjusting opening "e**1**" of the regulation valve **39**,**40** shown in FIG. **2**.

In reference to FIGS. **3**-**4**, the gas regulator valve **10** is now shown adjusted for its use with natural gas NG. In this case, the closure cap **26** is oriented towards the angular position **33**. Due to the fact that the height "H" of the air chamber **15** between the cap **26** and the division diaphragm **22**, is greater than the height "h" of the protuberances **23** of the diaphragm **22**, in said position **33** the inserts **27** projecting from the closure cap **26** do not collide with the protuberances **23** of the diaphragm **22**, as a result of which the diaphragm **22** has a degree of freedom for the axial displacement, driven by the pressure Pn of the NG gas. The valve member **39** maintains said initial prefixed opening "e**2**" (FIG. **4**) by the adjusting of the screw **35** and the spring **29**. In the regulation regime, the pressure Pi in the inlet conduit **12** of gas tends to displace the diaphragm **22** and with it the valve member **39**, in the direction of closure of the hole **41** of the regulation valve. At the same time, the spring **29** exerts a force on the division diaphragm **22** in a direction opposite to said pressure Pi, tending to open the valve hole **41** inside a stroke "e**2**" of the valve member **39** for the purpose of maintaining a constant pressure Pn in the outlet gas conduit **13**.

In reference to FIGS. **5**-**6**, where the gas pressure regulator valve **10** is shown without the retainer ring **30**, the closure cap **26** includes a guide means **28** of the rotation, such as a protrusion situated on its periphery as a flange bent towards the valve body **11**, being inserted in a slide groove **19** on the peripheral surface **11**a of the body valve **11**. The slide groove **19** extends an arc of "A", for example 25°, and limits the rotation of the closure cap **26** to the angle "A" between the two angular positions **33**,**34** (FIG. **5**). In the angular position **34** (FIG. **2**) corresponding to the adjusting of the regulator **10** for LPG-type gas, the protrusion **28** abuts against one of the ends of the slide groove **19**, whereas the protuberances **23** of the diaphragm **22** are biased by the inserts **27** of the closure cap **26**. On the other hand, in the angular position **33** (FIG. **4**) corresponding to the use of the regulator **10** with NG-type gas, the protrusion **28** abuts against the opposite end of the slide groove **19**, whereas the inserts **27** of the closure cap **26** do not interfere with the protuberances **23** of the diaphragm **22**, and as a result of this, the valve member **39** remains adjusted in the small opening "e**2**" prefixed by the adjusting screw **35**.

In order to carry out this operation of rotating the closure cap **26** to one of the two positions, **33** for NG and **34** for LPG, the user requires a tool fitted into the inserts **27** of the closure cap **26** by means of a small torque such as 100 Ncm. The use of an adjusting tool prevents incorrect or unintentional manipulation of the closure cap **26**.

They can be incorporated other embodiments of the closure cap **26** with a guide means for the different rotations of a peripheral protrusion **28**, as well as a different stopper means for the closure cap **26** rotation from the slide groove **19** on the surface **11**a of the valve body **11**. The retainer ring **30**, forming a fixed part with the valve body **11**, can incorporate, this way, said stopper means for two angular positions **33**,**34** of the cap **26** separated at an arc of 25° or similar.

What is claimed is:

[1. A gas pressure regulator valve adapted to a household appliance for the supply of a gas flow of any type of gas, natural NG or liquified LPG, comprising:

a valve body with an inlet gas conduit from a NG or a LPG source at a variable pressure Pi, an outlet gas conduit of NG or LPG gas supplied at a respective nominal adjusted pressure Pn or Pl of said two types of gas, and a peripheral assembly surface;

a pressurised gas chamber connecting both the inlet and outlet conduit through a regulation valve whose passage hole is adjustable,

a division diaphragm connected to the valve member and assembled securely on the valve body, through a flexible seal;

a rotatable closure cap assembled on the valve body and defining an air chamber above the diaphragm at the atmospheric pressure;

adjusting means of said nominal pressure value Pn or Pl of the gas acting on the diaphragm and the valve member to effect on the latter a prefixed adjusting displacement,

said adjusting means comprising an adjusting screw threaded in the closure cap, at least one adjusting spring, prestressed and acting on the diaphragm to keep said pressure Pn or Pl in the gas chamber constant, a rotation guide in the closure cap and a rotation stopper in the valve body engageable with the rotation guide, and the closure cap provided with a retainer that retains the closure cap on the valve body, in the axial direction of the closure cap and of the valve body, permitting a degree of freedom for the rotation of the closure cap in relation to the valve body between two angular positions, an arc (A) being spaced between them, and

wherein said adjusting means on the closure cap determines in conjunction with a feature on the diaphragm two displacements of the valve member different to each other, for the adjusting of said respective nominal pressures Pn and Pl.**]**

[2. The gas pressure regulating valve according to claim **1**, wherein said closure cap comprises a spacer that provides, in said air chamber, a space of separation of the closure cap on a base of the diaphragm and a peripheral rim that is positioned on said peripheral assembly surface on the valve body, for its sliding in rotation on said flexible seal, and a rigid retention ring of the closure cap secured to said valve body in such a way that the closure cap is conferred with said degree of freedom for the rotation (A).**]**

[3. The gas pressure regulating valve according to claim **1**, wherein said said feature on the diaphragm comprises at least a pair of protuberances on the diaphragm oriented towards said air chamber and said adjusting means comprises at least two inserts on the closure cap projecting towards the diaphragm from a relative position in the specific radial direction which, in one of said angular positions of the closure cap act on the diaphragm protuberances, displacing the valve member to a prefixed adjusting opening of the regulation valve.**]**

4. A gas pressure regulating valve comprising:

a valve body having a gas inlet and a gas outlet,

a valve seat located between the gas inlet and the gas outlet;

a cap rotatably coupled with the valve body, the cap rotatable between a first angular position and a second angular position,

a diaphragm fixed in the valve body,

a valve member coupled to the diaphragm, the valve member moveable with the diaphragm to modify the distance of separation between the valve member and the valve seat, the cap and diaphragm having cooperative parts that engage one another when the cap is in the first angular position to cause the valve member to assume a substantially fixed distance of separation relative to the valve seat, when the cap is in the second angular position the cooperative parts of the cap and the diaphragm do not engage one another to permit movement of the valve member relative to the valve seat,

a resilient member acting on the diaphragm and operatively coupled to the cap, the diaphragm moveable against the resilient member to effect the regulation of pressure at the gas outlet when the cap is in the second angular position.

5. A gas pressure regulator according to claim 4, wherein when the cap is in the first angular position the regulator is configured to maintain a first non-zero pressure at the gas outlet corresponding to a liquid propane gas, and in the second angular position the regulator is configured to maintain a second non-zero pressure at the gas outlet corresponding to a natural gas.

6. A gas pressure regulator according to claim 4, wherein the cooperative parts comprise one or more first projecting features of the cap oriented toward the diaphragm and one or more second projecting features of the diaphragm oriented toward the cap.

7. A gas pressure regulator according to claim 6, wherein the one or more first projecting features comprise one or more inserts in the cap.

8. A gas pressure regulator according to claim 6, wherein the one or more first projecting features comprise one or more inserts in the cap and the one or more second projecting features comprise one or more protuberances formed in the diaphragm.

9. A gas pressure regulator according to claim 4, wherein the valve seat is integral with the valve body.

10. A gas pressure regulator according to claim 4, wherein the diaphragm has a first side and an opposite second side, the first side of the diaphragm forming with the valve body a first chamber in fluid communication with the gas inlet and the gas outlet.

11. A gas pressure regulator according to claim 10, wherein the second side of the diaphragm forms a second chamber situated between the cap and the diaphragm.

12. A gas pressure regulator according to claim 11, wherein the second chamber is vented to the atmosphere.

13. A gas pressure regulator according to claim 4, wherein the resilient member is a spring.

14. A gas pressure regulator according to claim 4, further comprising a tension adjustment member that couples the resilient member with the cap, the tension adjustment member axially moveable relative to the cap to adjust the tension of the resilient member.

15. A gas pressure regulator according to claim 14, wherein the tension adjustment member is threaded with the cap and capable of achieving at least a first threaded position and a second threaded position.

16. A gas pressure regulator according to claim 10, further comprising a rigid member coupled to the second side of the

diaphragm in a region where the valve member is coupled to the diaphragm, the resilient member acting on the diaphragm via the rigid member.

17. A gas pressure regulator according to claim 4, wherein the diaphragm has a first side and an opposite second side, the first side of the diaphragm forming with the valve body a first chamber in fluid communication with the gas inlet and the gas outlet, the gas pressure regulator further comprising a tension adjustment member that couples the resilient member with the cap, the tension adjustment member axially moveable relative to the cap to adjust the tension of the resilient member acting on the second side of the diaphragm.

18. A gas pressure regulator according to claim 17, further comprising a rigid member coupled to the second side of the diaphragm in a region where the valve member is coupled to the diaphragm, the resilient member acting on the second side of the diaphragm via the rigid member.

19. A gas pressure regulator according to claim 4, wherein the cap comprises a peripheral rim situated on a peripheral surface of the valve body through a sealing member.

20. A gas pressure regulator according to claim 19, wherein the diaphragm comprises one or more fixing ribs housed in one or more recesses in the peripheral surface of the valve body.

21. A gas pressure regulator according to claim 19, wherein the valve body comprises an arc groove having a first end that delimits the first angular position and a second end that delimits the second angular position, the cap comprising a rotational guide situated in the groove.

22. A gas pressure regulator according to claim 19, wherein the peripheral rim of the cap comprises a first side situated adjacent the peripheral surface of the valve body and a second side opposite the first side, the gas pressure regulator further comprising a retainer ring situated adjacent the second side of the peripheral rim, the retainer ring coupled with the valve body.

23. A gas pressure regulator according to claim 22, wherein the retainer ring comprises a bottom surface adjacent the second side of the peripheral rim and a top surface opposite the bottom surface, the valve body comprising a peripheral edge that overlaps a top surface of the retainer ring to fix the retainer ring with the valve body.

24. A gas pressure regulator according to claim 22, wherein the retainer ring comprises one or more inserts supported on the cap to reduce friction between the retainer ring and cap during a rotation of the cap.

25. A gas pressure regulating valve comprising:

a valve body having a gas inlet and a gas outlet,

a valve member located between the gas inlet and the gas outlet;

a cap rotatably coupled with the valve body, the cap rotatable between a first angular position and a second angular position,

a diaphragm fixed in the valve body,

the valve member operatively coupled with the diaphragm, the valve member moveable with the diaphragm to modify the passage area between the gas inlet and the gas outlet, the cap and diaphragm having cooperative parts that engage one another when the cap is in the first angular position to cause the valve member to assume a substantially fixed position corresponding to a substantially fixed passage area between the gas inlet and the gas outlet, when the cap is in the second angular position the cooperative parts of the cap and the diaphragm do not engage one another to permit movement of the valve member,

a resilient member acting on the diaphragm and operatively coupled to the cap, the diaphragm moveable against the resilient member to effect the regulation of pressure at the gas outlet when the cap is in the second angular position.

26. A gas pressure regulator according to claim 25, wherein when the cap is in the first angular position the gas pressure regulator is configured to maintain a first non-zero pressure at the gas outlet corresponding to a liquid propane gas, and in the second angular position the regulator is configured to maintain a second non-zero pressure at the gas outlet corresponding to a natural gas.

27. A gas pressure regulator according to claim 25, wherein the cooperative parts comprise one or more first projecting features of the cap oriented toward the diaphragm and one or more second projecting features of the diaphragm oriented toward the cap.

28. A gas pressure regulator according to claim 27, wherein the one or more first projecting features comprise one or more inserts in the cap.

29. A gas pressure regulator according to claim 27, wherein the one or more first projecting features comprise one or more inserts in the cap and the one or more second projecting features comprise one or more protuberances formed in the diaphragm.

30. A gas pressure regulator according to claim 25, wherein the diaphragm has a first side and an opposite second side, the first side of the diaphragm forming with the valve body a first chamber in fluid communication with the gas inlet and the gas outlet.

31. A gas pressure regulator according to claim 30, wherein the second side of the diaphragm forms a second chamber situated between the cap and the diaphragm.

32. A gas pressure regulator according to claim 31, wherein the second chamber is vented to the atmosphere.

33. A gas pressure regulator according to claim 25, wherein the resilient member is a spring.

34. A gas pressure regulator according to claim 25, further comprising a tension adjustment member that couples the resilient member with the cap, the tension adjustment member axially moveable relative to the cap to adjust the tension of the resilient member.

35. A gas pressure regulator according to claim 34, wherein the tension adjustment member is threaded with the cap and capable of achieving at least a first threaded position and a second threaded position.

36. A gas pressure regulator according to claim 30, further comprising a rigid member coupled to the second side of the diaphragm in a region where the valve regulator is coupled to the diaphragm, the resilient member acting on the diaphragm via the rigid member.

37. A gas pressure regulator according to claim 25, wherein the diaphragm has a first side and an opposite second side, the first side of the diaphragm forming with the valve body a first chamber in fluid communication with the gas inlet and the gas outlet, the gas pressure regulator further comprising a tension adjustment member that couples the resilient member with the cap, the tension adjustment member axially moveable relative with the cap to adjust the tension of the resilient member acting on the second side of the diaphragm.

38. A gas pressure regulator according to claim 37, further comprising a rigid member coupled to the second side of the diaphragm in a region where the valve member is coupled to the diaphragm, the resilient member acting on the second side of the diaphragm via the rigid member.

39. A gas pressure regulator according to claim 25, wherein the cap comprises a peripheral rim situated on a peripheral surface of the valve body through a sealing member.

40. A gas pressure regulator according to claim 39, wherein the diaphragm comprises one or more fixing ribs housed in one or more recesses in the peripheral surface of the valve body.

41. A gas pressure regulator according to claim 39, wherein the valve body comprises an arc groove having a first end that delimits the first angular position and a second end that delimits the second angular position, the cap comprising a rotational guide situated in the groove.

42. A gas pressure regulator according to claim 39, wherein the peripheral rim of the cap comprises a first side situated adjacent the peripheral surface of the valve body and a second side opposite the first side, the gas pressure regulator further comprising a retainer ring situated adjacent the second side of the peripheral rim, the retainer ring coupled with the valve body.

43. A gas pressure regulator according to claim 42, wherein the retainer ring comprises a bottom surface adjacent the second side of the peripheral rim and a top surface opposite the bottom surface, the valve body comprising a peripheral edge that overlaps a top surface of the retainer ring to fix the retainer ring with the valve body.

44. A gas pressure regulator according to claim 42, wherein the retainer ring comprises one or more inserts supported on the cap to reduce friction between the retainer ring and cap during a rotation of the cap.

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