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

(11) EP 1 111 306 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.06.2001 Bulletin 2001/26

(51) Int Cl.[7]: **F23N 1/00**

(21) Application number: **00311464.2**

(22) Date of filing: **20.12.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **20.12.1999 GB 9930060**

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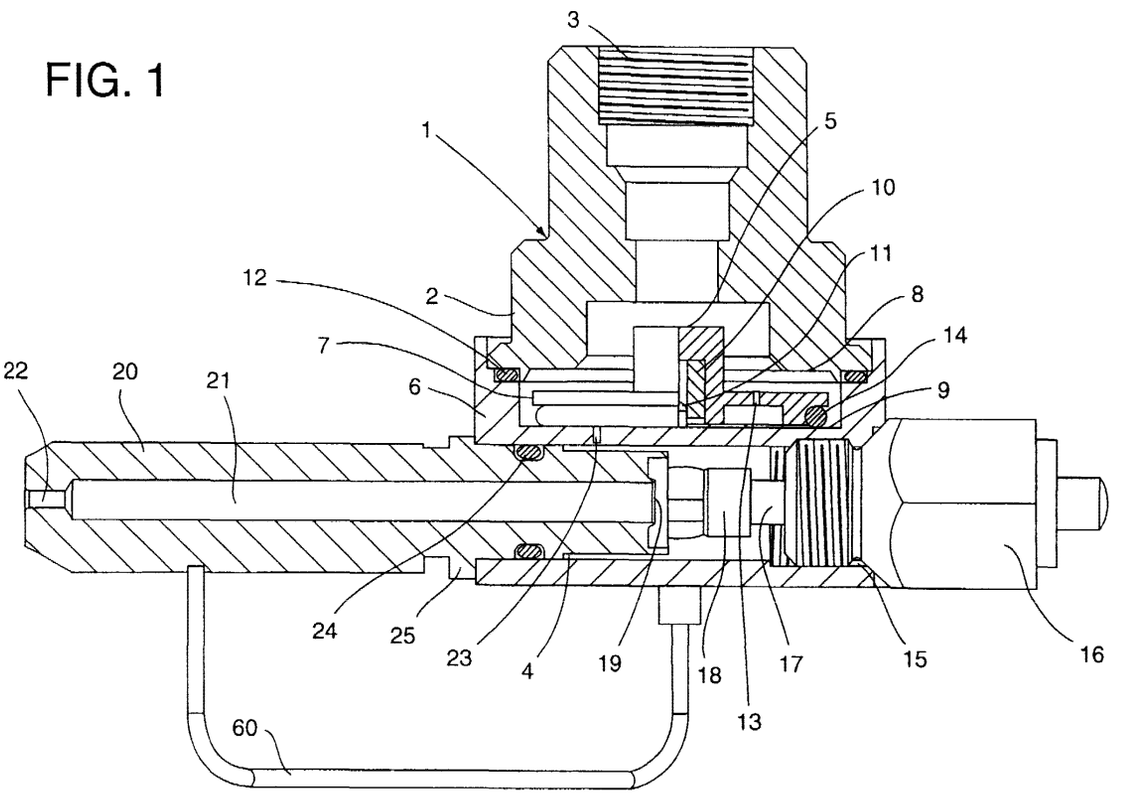
(54) Improvements in gas burner valve devices

(57) A gas flow device comprises a body (1,2) having a gas inlet (3) linked to a gas outlet (4) via a passageway housing a flame failure member that is movable between two fixed positions, in the first of which gas flow through the device is restricted or shut off completely and in the second of which it is unrestricted, wherein the device also incorporates in addition to a standard bypass hole (13) allowing sufficient gas flow to establish a pilot light, at least one auxiliary bypass hole (23).

FIG. 1



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Description

[0001] This invention relates to improvements in gas burner valve devices.

[0002] Gas burner valve devices are used to generate controllable flames from combustible gas/air mixtures. Typically such devices are to be found in, for example, domestic gas cookers and will typically consist of a valve/nozzle assembly having a solenoid on/off valve linked in series with a secondary valve member whose function is to provide an initial low flow of fuel via a bleed or bypass hole. This low flow of fuel exits the device via a nozzle and is used to establish a pilot light which typically heats up a fluid-containing phial that is connected to the secondary valve member. The fluid in the phial expands as it warms and this expansion moves the position of the secondary valve member within the device to enable the fuel flow through the device to rise to the desired level. The nozzle and bypass hole of the burners described above all suffer from the problem that the aperture size of the bypass hole (which is located within the valve/nozzle assembly), and the size of the nozzle bore need to be different for different types of gas supply. For example a gas burner that requires a natural gas supply requires a bypass aperture and nozzle bore size greater than a gas burner that uses a liquid petroleum gas (LPG) supply.

[0003] Typically the way to overcome this problem is simply to make a plurality of types of gas burner valve device, each respective type possessing an appropriately sized aperture for the type of gas supply available in the area where the gas burner is to be used. However, this is expensive, not only to produce, but also to store, with the inevitable consequence that some gas burners are fitted for the wrong type of gas supply.
Replacement usually requires the services of a skilled engineer with the inevitable cost of call out, labour and replacement parts.

[0004] An alternative approach is to design a gas burner valve so that it is convertible between different fuels. United States Patent specifications 4718448 and 5413141 reflect such an approach.

[0005] According to a first aspect of the present invention, this problem is alleviated by the provision, in a gas burner valve device comprising a body having a gas inlet linked to a gas outlet via a passageway housing a flame failure member that is movable between two fixed positions, in the first of which gas flow through the device is restricted or shut off completely and in the second of which it is unrestricted, wherein the device also incorporates a standard bypass hole allowing sufficient gas flow to establish a pilot light, of at least one auxiliary bypass hole.

[0006] Preferably, the combined sizes of the bypass holes (when they are arranged in parallel) are sufficient to enable a natural gas pilot light to be established when the only flow of gas through the device is the bypass holes.

[0007] Preferably, one of the bypass holes is located within the flame failure member.

[0008] In an alternative embodiment, the two bypass holes may be arranged in series, one in the main body of the valve and the other in the nozzle member itself, the latter determining the pilot gas flow and thus automatically ensuring that if the correct nozzle is fitted, the correct pilot flow is guaranteed. This construction also has the advantage that the bypass hole in the main body of the valve can be relatively large, so making manufacture easier, and enabling a single valve block member containing one bypass hole to be used to form a valve/nozzle assembly which is tailored to the fuel to be burnt.

[0009] The gas burner valve device of the present invention also possesses means to house a gas flow shut off member which member once fitted is capable of movement within the device between two positions: in the first gas flow through the device can occur and in the second gas flow through the device cannot. The location of the means is preferably immediately prior to the gas outlet.

[0010] According to a second aspect of the present invention there is provided a kit of parts comprising:

1) a gas burner valvedevice as specified above;

2) a natural gas nozzle adapted for use with the gas burner valve device; and

3) an LPG nozzle comprising a sealing means used to establish a gas tight seal with the device when the nozzle is inserted into the device, the seal being so designed as to shut off the flow of gas through one of the bypass holes.

[0011] Preferably, the sealing means comprises at least one "O" ring.

[0012] According to a third aspect of the present invention there is provided a nozzle for use with a gas valve device of the type specified above comprising a sealing means receiving member and wherein the nozzle is provided with a valve seat across its proximal end.

[0013] Preferably the nozzle is provided with a chamfer at its distal end.

[0014] Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which Figures 1 to 4 show diagrammatic sections through four embodiments of gas burner valve/nozzle assemblies in accordance with the present invention.

[0015] Referring to Figure 1, this illustrates a valve/nozzle assembly 1 suitable for use in a domestic cooker. It comprises an upper body portion 2 having a gas inlet socket 3 and a lower body portion 6 having a gas outlet socket 4. A number of passageways link the inlet socket 3 to the outlet socket 4 to enable, in use, gas from a gas supply (not illustrated) that is connected to the inlet socket 3, to reach the outlet socket 4. In one of the pas-

sageways lies a valve assembly generally referenced 5. The main feature of the assembly 5 is a valve closure member 7 that is designed to move between two fixed positions, the first fixed position being defined by a surface 8 of upper body portion 2 and the second fixed position being defined by a surface 9 of lower body portion 6, each respective surface 8 and 9 acting as an end stop for the valve closure member 7.

[0016] The valve closure member 7 comprises a sleeve 10 in which a pin 11 is a close sliding fit. The pin 11 is able both to grip the sleeve 10 to cause it to move with no initial sliding of the pin 11 in sleeve 10, but can also subsequently slide relative to the sleeve 10 when necessary, as the pin 11 and sleeve 10 are in a close fitting arrangement. The pin 11 forms part of a valve actuator (not illustrated). The valve actuator is a standard component, for example consisting of a bellows or diaphragm portion mounted in lower body portion 6, the interior of which may be pressurised by water vapour, increasing internal pressure causing the diaphragm to bow upwardly and the pin 11 to move upwards. The increase in internal pressure in the valve actuator is achieved in that the actuator is connected to a phial of water via a capillary tube 60, the phial being located adjacent to or in an area occupied by a flame when the burner is lit. The phial can be, if desired, any other standard type, e.g. just gas-filled or a standard mercury in copper/stainless steel type.

[0017] The upper body portion 2 is sealed to the lower body portion 6 via an "O" ring 12 to make the join gas tight.

[0018] A similar "O" ring 14 grips the base of the valve closure member 7 whose function is to act as a valve seal. Within the valve closure member 7 is a fixed diameter bypass hole 13 and within the lower body portion 6 and in parallel with the bypass hole 13 is another fixed diameter bypass hole 23.

[0019] The lower body portion 6 further comprises a threaded aperture 15 which in use, is designed to accommodate a solenoid 16. The solenoid 16 comprises a bar 17 that extends axially throughout the length of the solenoid 16 and which terminates in a rubber valve closure member 18, biassed toward the outlet socket 4 by a spring (not illustrated) located within the solenoid 16. The outlet socket 4 in use, accommodates a nozzle 20. The nozzle 20 is provided at its proximal end with a valve seat 19 complementary to the valve closure member 18. In addition, towards its proximal end, the nozzle 20 is provided with an "O" ring 24 that sits mostly within and grips an external groove in the exterior surface of the nozzle 20. The nozzle 20 is also provided with a concentric shoulder 25 and when, in use the nozzle 20 is inserted into the device 1 as illustrated, the protruding portion of the "O" ring 24 forms a gas tight seal with the inner wall of outlet socket 4 whilst the shoulder 25 acts as a stop to prevent the nozzle 20 being further inserted into the lower body portion 6.

[0020] The interior of the nozzle 20 is traversed by a substantially constant diameter bore 21 save at the distal end where the diameter of the bore 22 is the correct narrow size for the type of gas to be passed through the valve/nozzle assembly.

[0021] When the burner is first to be lit, the valve closure member 7 is initially in the position illustrated. When by means not shown, the solenoid is retracted pulling closure member 18 away from seat 19, gas may enter the assembly 1 through the inlet socket 3 and pass through the passages including the bypass holes 13 and 23, enter the nozzle 20 and finally exit the nozzle through a narrow bore 22 at the end of the nozzle 20. The gas mixes with air in the burner assembly, not shown, to form a combustible mixture which may then be lit, but only at a low flame as member 7 still lies against surface 9. The low flame, however, heats the phial, the contents of which via capillary tube 60 raise pin 11 and thus closure member 7, allowing full gas flow through the nozzle 20 to occur.

[0022] Should flame failure occur, e.g. due to the burner being subjected to a strong gust of air or flooded by overflowing liquid from something cooking, the phial temperature will drop and the diaphragm of the valve actuator will begin to move downwards. As it does so, the valve closure member 7 immediately begins to move towards surface 9. Once it reaches that surface 9, as a result of the close fitting sliding connection between the pin 11 and the sleeve 10, the downward movement of the valve actuator continues, now with a relative sliding action between the pin 11 and the sleeve 10 until it reaches its rest position as illustrated in Figure 1.

[0023] In this rest position, however, with member 7 abutting surface 9 only the majority of gas flow through the device is interrupted. Gas can still pass through both of the bypass holes 13 and 23 and as such the burner can still be re-lit, following which the phial warms up, expands the water within it, the diaphragm rises and the valve closure member 7 begins to move towards surface 8 again, thus re-establishing complete gas flow through the device 1 and full burner operation. However, if relighting is not attempted, the flow through bypass holes 13 and 23 is insufficient to be dangerous, i.e. to enable an explosive mixture to build up in the environs of the appliance.

[0024] Figure 2 illustrates the unit as in Figure 1 with a nozzle 30 in place of nozzle 20.

[0025] Cylindrical nozzle 30 is designed for use with LPG and is provided with two spaced external grooves, located towards its proximal end, each designed to accommodate an "O" ring 34 and 35. The nozzle 30 is shorter in length than nozzle 20 and possesses a narrower bore 32 than nozzle 20. Both nozzles 20 and 30 are chamfered at their distal ends.

[0026] In use of the valve, closure member 7, shown in Figure 2 in its starting or "flame failure detected" position, permits LPG entering the device through the inlet socket 3 only to pass through one of the bypass holes, hole 13. However LPG cannot pass through the bypass

hole 23 located in the lower body portion 6 in this particular embodiment because of the seals created by "O" rings 34 and 35 to either side of the hole 23. Bypass hole 13 located in the valve closure member 7 is sized correctly for LPG i.e. bypass hole 13 is of sufficient diameter to enable enough LPG to pass through it to establish a pilot flame, whereafter the full burner operation occurs as described above.

[0027] Figure 3 illustrates an alternative embodiment showing a valve/nozzle assembly 1, in diagrammatic section. In this embodiment, the threaded socket 15 for the solenoid (not illustrated) is located within the upper body portion 2 of the device. The socket 15 is terminated by a valve seat 53 surrounding an outlet port 54, the outlet port 54 leading via the main passageway within the device to the part of the housing containing the valve closure member 7. In this embodiment a spring 50 biases the valve closure member 7 against the surface 9 and a valve actuator 52 (of the type described above) comprises a diaphragm portion 51 on the centre of which the pin 11 is set.

[0028] In use, the solenoid fitted into the socket 15 has an actuation arm bearing a sealing disc biassed toward the valve seat 53, e.g. under the influence of a spring within the solenoid.

[0029] When it is desired to light the burner, the cooker control is actuated and this operates the solenoid to withdraw the actuation arm and thus allow gas to pass from inlet 3 to outlet port 54. Initially, valve closure member 7 is in the position shown, but gas can flow either through one or both bypass holes 13, 23 (depending on which nozzle 20, 30 is fitted to outlet 4) and thus out of the nozzle 20, 30 into a burner assembly (not illustrated). A standard electrical ignition means (not illustrated) located adjacent the burner assembly, ignites the gas/air mixture thereby produced and thus generates a small flame which is fed by the gas flow and which begins to heat the water filled phial connected to the capillary tube 60. As soon as the heating is sufficient to raise diaphragm portion 51, pin 11 moves up and lifts valve member 7, thus allowing the gas flow to increase, and the burner to start operating fully. Once again (as hereinbefore described), initially, there is no relative movement between pin 11 and sleeve 10 until a spring ring on top of member 7 contacts surface 8. Again, upon flame failure, the valve phial temperature drops and the diaphragm portion 51 of the actuator 52 begins to move downwards. As it does so, valve closure member 7 immediately begins to move towards surface 9. Once it reaches that surface, as a result of the close fitting sliding connection between the pin 11 and sleeve 10, the downward movement of the diaphragm portion 51 on the actuator 52 continues with relative sliding action between the pin 11 and the sleeve 10, until it reaches its rest position as shown in Figure 3.

[0030] In practice, each nozzle/valve assembly may be sold as a bare unit with one nozzle 20 and one nozzle 30. If the assembly is to be used in a natural gas system, nozzle 20 is inserted into socket 4, if with an LPG supply, socket 30 is so inserted. In the former case, the combined area of both holes 13 and 23 are sufficient to enable a natural gas pilot flame to be established for initial lighting or during relighting if there has been a flame failure causing an almost but not quite total interruption of gas flow through the device 1.

[0031] The advantage of the construction shown in Figures 1 and 2 is than the main means of interrupting the gas flow through the device is by the solenoid 16. Its valve closure member 18 engaging valve seat 19 of either nozzle 20 or 30 interrupts all gas flow through the device substantially just prior to the point of entry of the gas into the nozzle 20 or 30. Locating the total interruption of flow point at essentially the point of exit of the gas from the device, means that any leak checking specified by the authorities is easier. The gas burner system shown can be checked for leaks all the way, from gas entering the device to its point of entry into the nozzle without the solenoid 16 having to be removed and its connection port blanked off. In alternative embodiments (not illustrated), the solenoid 16 can be replaced by a simple spring operated plunger that is designed purely to shut off the supply of gas to the outlet 4 during leak checking. In such an arrangement, the cooker control when actuated would operate a suitable valve mechanism (not illustrated) that is located further upstream from the inlet socket 3 to allow gas to pass from inlet 3 to the outlet.

[0032] It should be noted that one of the bypass holes does not need to be through the valve closure member 7 but can be located anywhere in the assembly where the same effect of the invention will be achieved. Depending on the type of gas supply, the length of the nozzle will vary. This is because it is the nozzle length that determines the position of the out flowing jet of gas which in turn determines the amount of air drawn into the mixing venturi (not illustrated) downstream of the nozzle i.e the aeration of the gas/air mix. In the illustrated examples LPG requires more air than natural gas and as such nozzle 30 is shorter in length than nozzle 20.

[0033] A particularly preferred embodiment of the present invention is illustrated diagrammatically in Figure 4. This shows in section a valve base member 6 which as in the previous Figures has a port 3 for gas supply and a socket for the insertion of a suitable nozzle. In contrast to the previously described embodiments, a bypass passage 70 is provided not in closure member 7, but to one side of it, and actually formed in the wall of the nozzle-receiving socket. When a nozzle 80 is inserted, as shown, a passage 72 in the side wall of the nozzle comes to register with bypass hole 70. The size of hole 72 determines the pilot flow of gas, and this is chosen to match the nozzle type.

Claims

1. A gas burner valve device comprising a body having a gas inlet (3) linked to a gas outlet (4) via a passageway housing a flame failure member (5) that is movable between two fixed positions, in the first of which, gas flow through the device is restricted or shut off completely and in the second of which, it is unrestricted, wherein, the device also incorporates a standard bypass hole (13) allowing sufficient gas flow to establish a pilot light and is characterised by the provision of at least one auxiliary bypass hole (23).

2. A gas burner valve device as claimed in claim 1 wherein the combined sizes of the bypass holes are sufficient to enable a natural gas pilot light to be established when the only flow of gas through the device is through the bypass holes.

3. A gas burner valve device as claimed in claim 1 or 2 wherein one of the bypass holes (13) is located within the flame failure member.

4. A gas burner valve device as claimed in any one of the preceding claims and including means to house a gas flow shut off member (16,17,18) and wherein the means is located immediately prior to the gas outlet.

5. A kit of parts comprising a gas burner valve device as claimed in any one of the preceding claims, a natural gas nozzle adapted for use with the device and an LPG nozzle comprising a sealing means used to establish a gas tight seal with the device when the nozzle is inserted into the device, the seal being so designed as to shut off the flow of gas through one of the bypass holes.

6. A kit of parts as claimed in claim 5 wherein the sealing means comprises at least one "O" ring (24).

7. A nozzle for use with a gas burner valve device of the type claimed in any one of the preceding claims comprising a sealing means receiving member and wherein the nozzle is provided with a valve seat (19) across its proximal end.

8. A nozzle as claimed in claim 7 wherein the nozzle is provided with a chamfer at its distal end.

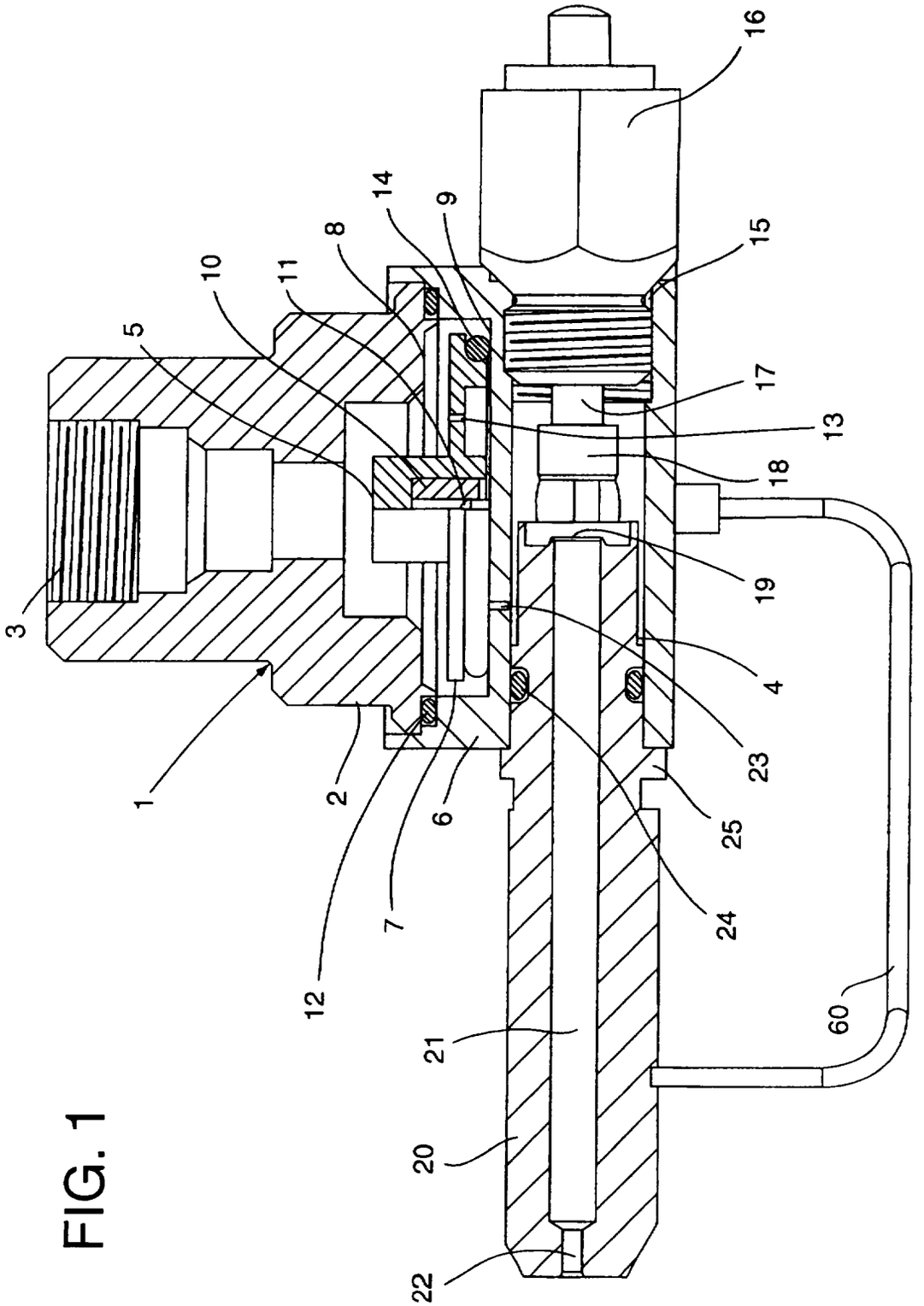

FIG. 1

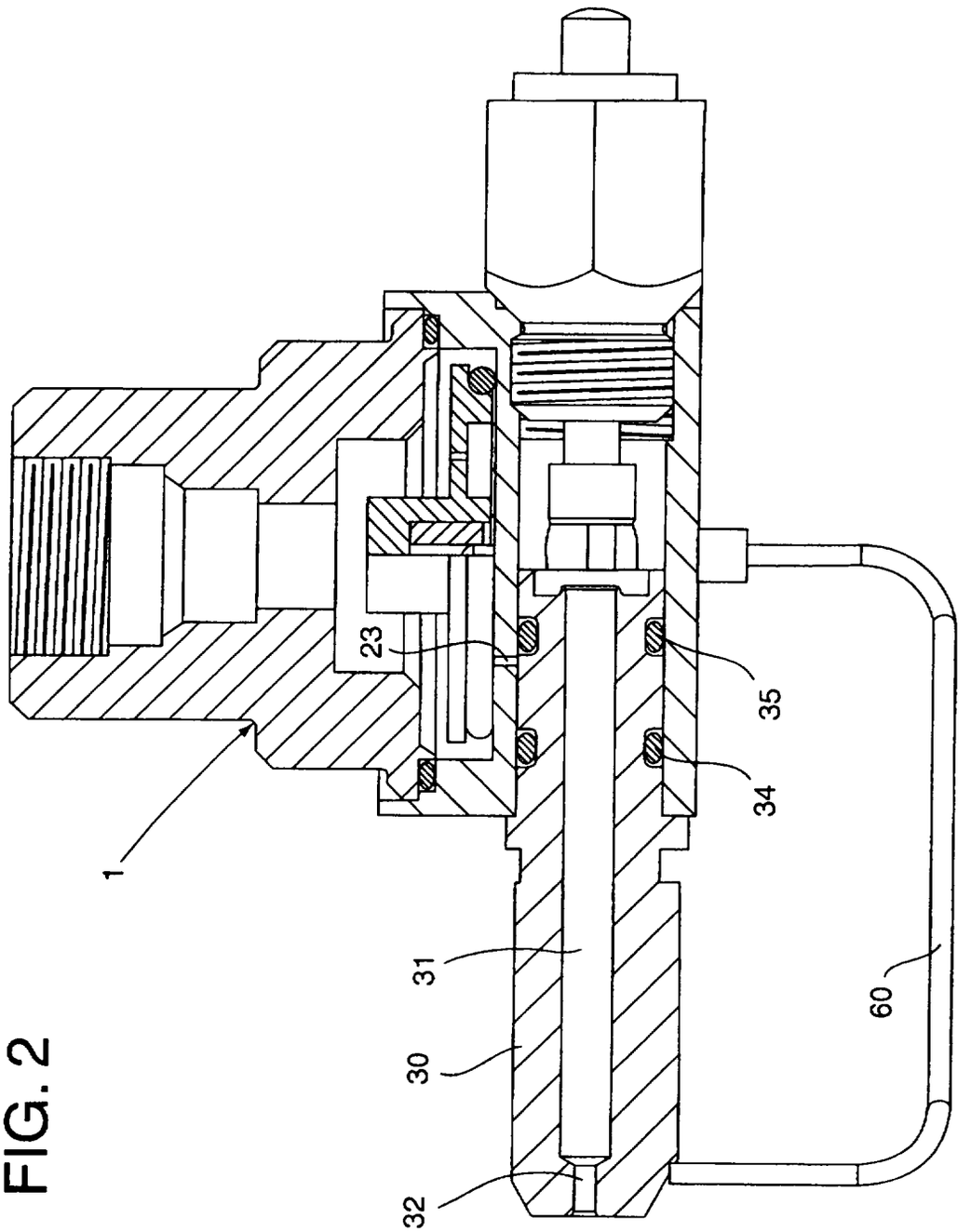

FIG. 2

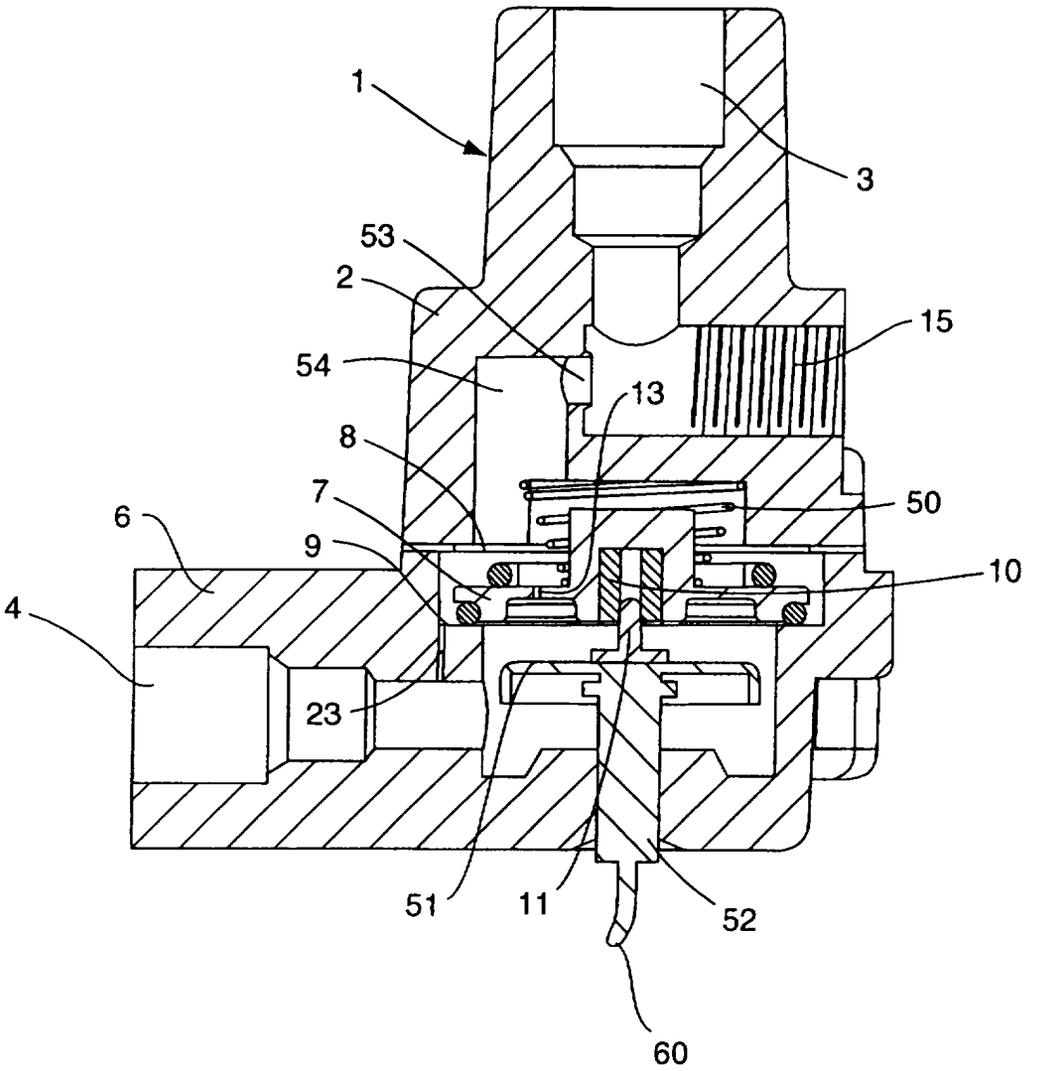

FIG. 3

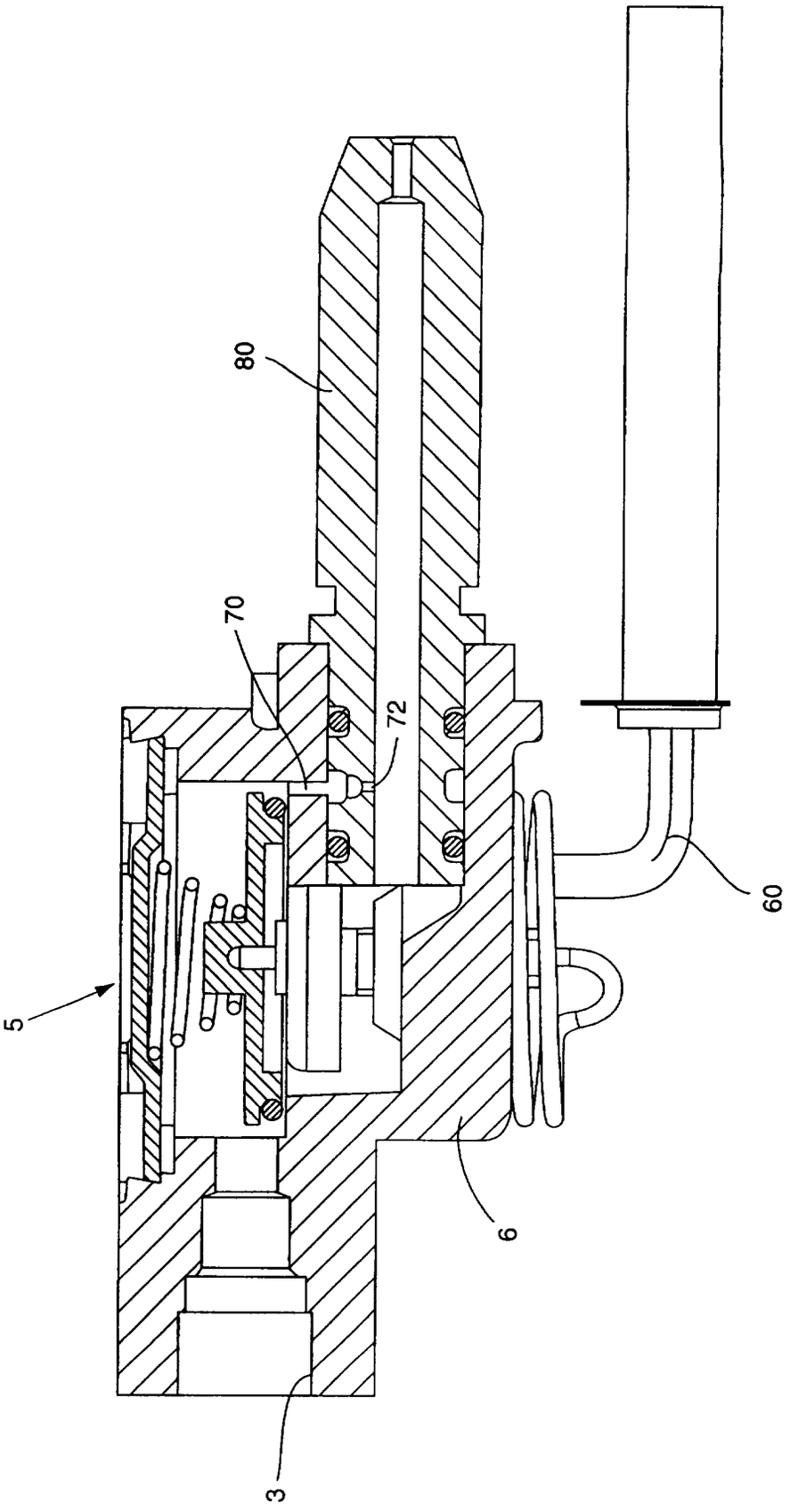

FIG. 4