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(11) **EP 1 156 220 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.11.2001 Bulletin 2001/47

(51) Int Cl.7: **F04C 2/10, F04C 15/02**

(21) Application number: **01111179.6**

(22) Date of filing: **11.05.2001**

(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

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(30) Priority: **16.05.2000 IT TV000022 U**

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(54) **Internal gear pump**

(57) A pump (1), particularly for fuel oil burners, which comprises a body (2) provided with internal gears and with an external electric valve. A cover (12) which has connectors (15) for a pressure gauge and a vacuum gauge is associable with the body. The body (2) has at

least two outlets and a single inlet which are connected to a plurality of ducts for conveying the fuel oil. A user-activatable selection device (25) interacts with the ducts and is suitable to switch the direction of the circulation of the flow of the fuel oil as a function of the direction of rotation of the gears.

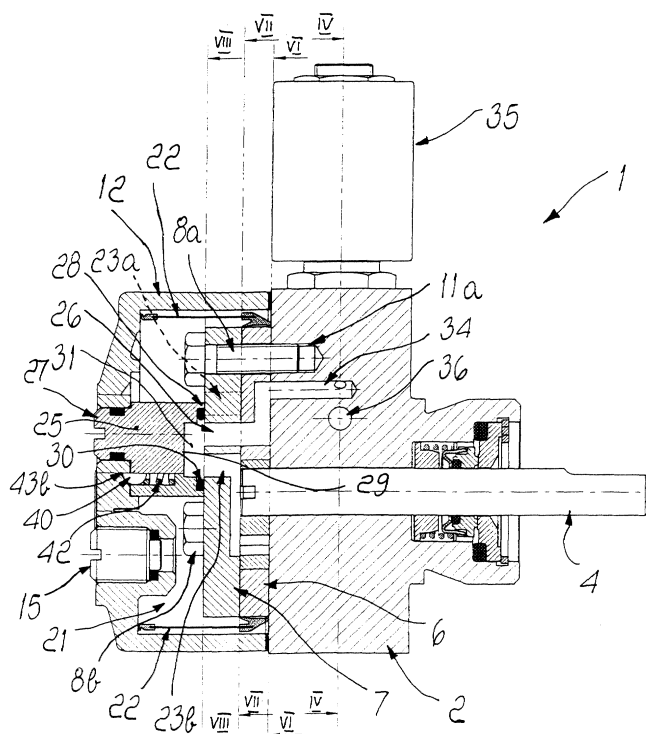


Fig. 5

Description

[0001] The present invention relates to a pump particularly usable for burners which use fuel oil and therefore, such as gas oil and kerosene.

[0002] In these burners, the combustion process entails that the flame is started and sustained by a mix of air and oil, which are appropriately metered and proportioned.

[0003] The fuel is thus drawn from a tank and pressurized by a pump, the function of which is to propel the fuel through a mechanical element, known as nozzle, which nebulizes it inside a stream of air coming for example from a fan.

[0004] In the prior art, the mix is formed inside a combustion chamber and therefore the pump, arranged inside the burner, must be capable of drawing the fuel from the tank, priming itself at startup and creating the necessary degree of suction in order to overcome the difference in level between the pump and the tank as well as the load losses along the piping.

[0005] Furthermore, the pump must bring the fuel to the intended pressure, which depends on the operating conditions, by way of an internal regulator, and then interrupt the inflow of fuel to the combustion chamber by means of a safety device which is built into the pump and is therefore, for example, an electric valve.

[0006] Depending on these requirements, pumps having the most disparate constructive geometries are known. In fact the market offers burners which are manufactured so that they can be associated with a pump arranged on the right side or on the left side as well as burners which use pumps which rotate clockwise and pumps which rotate counterclockwise.

[0007] This variety of known types of pump entails, for the manufacturer and the spare parts dealer, the need to manufacture and have available four fundamental pump types, i.e., first pumps which rotate clockwise and have right-side delivery, second pumps which rotate clockwise and have left-side delivery, third pumps which rotate counterclockwise and have right-side delivery, and fourth pumps which rotate counterclockwise and have left-side delivery.

[0008] Therefore in view of the widespread use of fuel oil burners for industrial and civil applications, the field of spare parts and after-sales support has become extremely important, and the above noted drawbacks considerably affect the costs that the pump manufacturer and the spare parts dealer must sustain.

[0009] These drawbacks have partially been solved by Italian patent application no. TV98A000113, which relates to a pump, particularly for fuel oil burners, which comprises a body having internal gears and connectors for a pressure gauge, for a pressure regulator and for an electric valve.

[0010] A single inlet is present in the body of the pump and is connected to a plurality of ducts for conveying the fuel oil, with which user-activatable means interact se-

lectively, such means being suitable to preset the path of the fuel oil toward two separate outlets according to the intended direction of rotation of the gears.

[0011] The user-activatable means are conveniently constituted by two pairs of screws which interact with respective complementarily threaded cavities being connected to suitable paths for the fuel oil and suitable to be arranged in pairs so as to divert the path of the fuel oil, thus changing the direction of the rotation of the pump.

[0012] Although this conventional type of pump allows to alleviate the problem due to the fact of having to work with four different pumps, it has the drawback that the means for changing the direction of rotation are rather troublesome to activate and that the activation by the user can have margins of error (for example in an only partial screwing of the screws or in an incorrect selection of the screws to be screwed in).

[0013] Another disadvantage of the conventional type of pump is that its pressure regulator is arranged laterally of the pump body and this often causes a certain difficulty and awkwardness in reaching it.

[0014] The aim of the present invention is to solve the noted technical problems, and eliminate the drawbacks of the prior art by providing a pump which can be adapted rapidly and simply to any known kind of fuel oil burner.

[0015] Within this aim, an object of the present invention is to provide a pump which can be used in all known kinds of fuel oil burner and whose direction of rotation can be adjusted rapidly and with no possibility of error.

[0016] Another object of the invention is to provide a pump which is constructively very simple, reducing the number of components, with a consequent saving in terms of costs related to production, assembly and maintenance.

[0017] Another object of the present invention is to provide a pump which can be used with the known types of fuel oil burners.

[0018] Another object is to provide a pump in which the pressure regulator is advantageously arranged above the pump so that it is easily accessible to the user.

[0019] Another object is to provide a pump which is structurally simple and has low manufacturing costs.

[0020] This aim and these and other objects which will become better apparent hereinafter are achieved by a pump, particularly for fuel oil burners, comprising a body provided with internal gears and with an external electric valve and a cover which has connectors for a pressure gauge and a vacuum gauge, characterized in that said body has at least two outlets and a single inlet which are connected to a plurality of ducts for conveying said fuel oil with which a user-activatable selection device interacts which is suitable to switch the direction of the circulation of the flow of said fuel oil as a function of the direction of rotation of said gears.

[0021] Further characteristics and advantages of the pump according to the invention will become better apparent from the detailed description of a particular em-

bodiment thereof, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figures 1, 2 and 3 are respectively a front view, a side view and a top view of the pump according to the invention;

Figure 4 is a sectional front view of the pump according to the invention;

Figure 5 is a sectional side view of the pump according to the invention;

Figure 6 is a sectional rear view of the pump according to the invention, illustrating the cover;

Figure 7 is a sectional rear view of the pump according to invention, illustrating the main plate;

Figure 8 is a sectional rear view of the pump according to the invention, illustrating the rotor;

Figures 9 and 10 are schematic views, taken along multiple overlapping planes, i.e., a side one and a front one, of the pump of the invention respectively in the condition for counterclockwise rotation and for clockwise rotation imparted to the gears, said view being simplified in order to better visualize the path followed by the fuel oil.

[0022] With reference to the figures, the reference numeral 1 designates a pump which is particularly usable for burners using fuel oil such as gas oil and kerosene.

[0023] The pump is constituted by a body 2 which is partially hollow and internally comprises suitable gears, such as a rotor, designated by the reference numeral 3 and keyed on a motor shaft 4 which protrudes from the rear of the body 2, and a driven ring gear 5.

[0024] The ring gear 5 within which the rotor 3 is located in an eccentric position, is arranged inside an auxiliary plate, designated by the reference numeral 6, which is perforated and arranged at right angles to the motor shaft 4.

[0025] A main plate 7 can be arranged in front of the auxiliary plate 6 and associated with the auxiliary plate 6 and with the body 2 by means of appropriate first threaded screws, which in this embodiment are three in number, are designated by the reference numerals 8a, 8b and 8c, and pass through respective first holes 9a, 9b and 9c, and second holes 10a, 10b and 10c formed respectively in the main plate 7 and in the auxiliary plate 6.

[0026] The first screws 8a, 8b and 8c can be fastened, for example, within complementarily threaded first dead holes formed on the body 2, only one of which being shown at 11a in Figure 5.

[0027] A cover 12, which is advantageously box-like and hollow and is suitable to cover the main plate 7 and the auxiliary plate 6, can be conveniently arranged in front of the main plate.

[0028] The cover 12 is associable with the body 2, for example by means of a plurality of second screws: in the pump shown in the accompanying figures and described herein, the cover 12 is associable by means of

four second screws, each designated by the reference numeral 13, which are threaded so as to interact with complementarily threaded second dead holes 14 which are illustrated in Figure 4.

[0029] A first connector, designated by the reference numeral 15, is provided in the cover 12 and a device for measuring the vacuum generated by the rotation of the gear, such as a vacuum gauge, is associable at the connector.

[0030] Proximate to the first connector 15, on the cover 12 there is another access which forms a second connector 16 for connecting a pressure measurement device, for example a pressure gauge.

[0031] Under the body 2, appropriate openings form a single inlet 17 for fuel oil, next to which a suitable opening is formed which constitutes the return, or outlet, designated by the reference numeral 18, for the fuel oil.

[0032] The inlet 17 is connected to a first duct 19 for recovering the fuel oil that escapes from the gears of the pump along the motor shaft 4, both of which are connected to a second duct, designated by the reference numeral 20, for connection to the cavity, designated by the reference numeral 21, provided between the cover 12 and the body 2.

[0033] The fuel oil that flows within the cavity 21 advantageously flows through a filter, designated by the reference numeral 22, which is preferably cylindrical and is arranged between the body 2 and the cover 12, as shown in Figures 5, 9 and 10.

[0034] The main plate 7 has a pair of first holes, designated by the reference numerals 23a and 23b, for the passage of the fuel oil from the cavity 21 respectively to a third duct 24a and a fourth duct 24b formed on the rear surface of the plate 7.

[0035] A selection device, designated by the reference numeral 25, interacts with the pair of first holes 23a and 23b and with a third hole 26 which is also formed in the plate 7 proximate to the pair of first holes 23a and 23b, so as to connect the third hole 26 selectively with either hole of the pair of first holes 23a and 23b.

[0036] At the same time, the selection device 25 allows the passage of the fuel oil from the cavity 21 only within the hole, of the pair of first holes 23a and 23b, that does not interact with the selection device 25: in Figures 5 to 9, the free hole is the first hole 23a, while the first hole 23b is connected to the third hole 26.

[0037] The selection device 25 can be accessed at a first end 27, which is advantageously cylindrical and conveniently protrudes through the cover 12, so that it can be activated by the user through a rotation of the selection device 25 with respect to an axis which is perpendicular to the cover 12.

[0038] The selection device 25 has, at the perimetric edge 28 of a second end 29, which lies opposite the first end 27 and is advantageously oval, a sealing gasket 30 which is arranged in contact with the main plate 7.

[0039] Inside the perimetric edge 28 of the second end a recess, designated by the reference numeral 31,

is formed which is suitable to allow the passage of fuel oil from one of the two holes of the pair of first holes 23a and 23b to the third hole 26.

[0040] Depending on the position of the selection device 25, chosen by the user according to the direction of rotation of the electric motor, the direction of circulation of the flow of fuel oil is varied inside the gears and therefore between the rotor 3 and the ring 5.

[0041] The third hole 26, into which the pressurized fuel oil that arrives from the internal gears of the pump 1 is sent, acts as connection to a fifth duct 32, which is preferably formed in the rear face of the auxiliary plate 6.

[0042] The fifth duct 32 is connected to a fourth hole, designated by the reference numeral 33, which is formed in the main plate 7, advantageously in a symmetrical position with respect to the third hole 26, at the second connector 16 for measuring the pressure at the delivery.

[0043] The fifth duct 32 is also connected to a sixth duct 34 which is conveniently controlled by an electric valve 35 for the opening and closing thereof; the sixth duct 34 is suitable to convey the pressurized fuel oil into a seventh duct, designated by the reference numeral 36.

[0044] The seventh duct 36, advantageously arranged horizontally along the entire width of the body 2, can be accessed from outside by means of two outlets, designated by the reference numerals 37a and 37b, which are advantageously threaded and arranged on the opposite faces of the pump 1, in order to allow to choose which of the two to use to send the fuel oil to the burner according to the arrangement and convenience of installation on the part of the engineer.

[0045] The outlet of the pair of outlets 37a and 37b that is not used can be easily closed, during installation, for example by using a complementarily threaded screw, designated by the reference numeral 38 in Figure 2.

[0046] The sixth duct 34, for conveying the fuel oil toward the seventh duct 36, is conveniently connected, between the fifth duct 32 and the electric valve 35, to an eighth duct 38 which is in turn controlled by a pressure regulator of a known type, designated by the reference numeral 39.

[0047] The pressure regulator 39, which advantageously protrudes upward from the body 2, so that it can be easily accessed from outside, is adjustable to reduce or increase the choke formed along the eighth duct 38, thus facilitating or hindering the return of the excess fuel oil toward the outlet 18.

[0048] Finally, the selection device 25 has, at its surface that faces the internal surface of the cover 12, appropriate means for selective and temporary locking, so as to facilitate the use of the selection device 25.

[0049] The locking means are advantageously constituted by a ball, designated by the reference numeral 40, which partially protrudes from a respective seat 41 which is formed inside the selection device 25, so that it can optionally slide, in contrast with an underlying

spring 42, fully into the seat 41.

[0050] Two hollows 43a and 43b, shaped complementarily to said ball 40, are formed on the internal surface of the cover 12 so as to allow to temporarily accommodate the ball 40 at the connection between the third hole 26 and, respectively, the first hole 23a or 23b of the pair of first holes.

[0051] It is otherwise possible to arrange the selection device 25 inside the cover 12 and along the same axis as the first connector 15 for vacuum measurement.

[0052] In this manner, the selection device 25 can be accessed by removing the closure screw of the first connector 15 and by inserting therein a tool, such as a screwdriver, which is suitable to turn the selection device 25.

[0053] This allows to simplify the production of the cover 12 and in particular reduces the number of holes to be formed in the cover 12.

[0054] Operation is therefore as follows: with reference to Figures 9 and 10, the fuel oil enters through the inlet 17 and flows along the second duct 20 until it enters the cavity 21 which is formed between the body 2 and the cover 12 and in which the main plate 7 is also arranged.

[0055] While the pump 1 is running idle, it is possible to measure from the outside the degree of vacuum that can be obtained, simply by connecting to the first connector 15, which is connected to the cavity 21, an appropriate measurement instrument, for example a vacuum gauge.

[0056] The user can furthermore measure the delivery pressure during operation, advantageously by means of a pressure gauge which is connected to the second connector 16 and is connected, at its other end, to the fourth hole 33 of the main plate 7.

[0057] The personnel assigned to the installation of the pump 1, or the spare parts dealer, can switch the direction of circulation of the flow of the fuel oil according to the direction of rotation of the gears simply by acting from the outside on the first end of the selection device 25, so as to connect the third hole 26 respectively to the first hole 23b, with a clockwise rotation of the rotor 3, or to the first hole 23a, with a counterclockwise rotation.

[0058] In this manner, the hole of the pair of first holes 23a and 23b that remains connected to the cavity 21, i. e., the hole 23a in Figure 9 and the hole 23b in Figure 10, acts as an inlet for the fuel oil toward the rotor 3.

[0059] At the delivery, the pressurized fuel oil is diverted by the recess 31 formed in the second end 29 of the selection device 25 toward the third hole 26 and from there along the fifth duct 32 and the sixth duct 34.

[0060] Along the sixth duct 34, part of the fuel oil, depending on the requirements of the burner, can be diverted toward the eighth duct 38 and from there toward the outlet 18, by virtue of the passage through the pressure regulator 39.

[0061] The connection for sending the fuel oil to the burner can be performed, as convenient, at one of the

pair of outlets 37a and 37b, which are connected to the sixth duct 34 by means of a seventh connecting duct 36.

[0062] It has thus been found that the invention has achieved the intended aim and objects, a pump having been provided which can be adapted rapidly and simply to any known type of fuel oil burner, allowing to switch the direction of rotation easily and with no possibility of error.

[0063] Moreover, the pump is constructively very simple, since the selection device is constituted by a single component, with consequent low costs for production, assembly and maintenance.

[0064] The materials used, as well as the dimensions that constitute the individual components of the invention, may of course be more pertinent according to requirements.

[0065] The disclosures in Italian Utility Model Application No. TV2000U000022 from which this application claims priority are incorporated herein by reference.

[0066] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

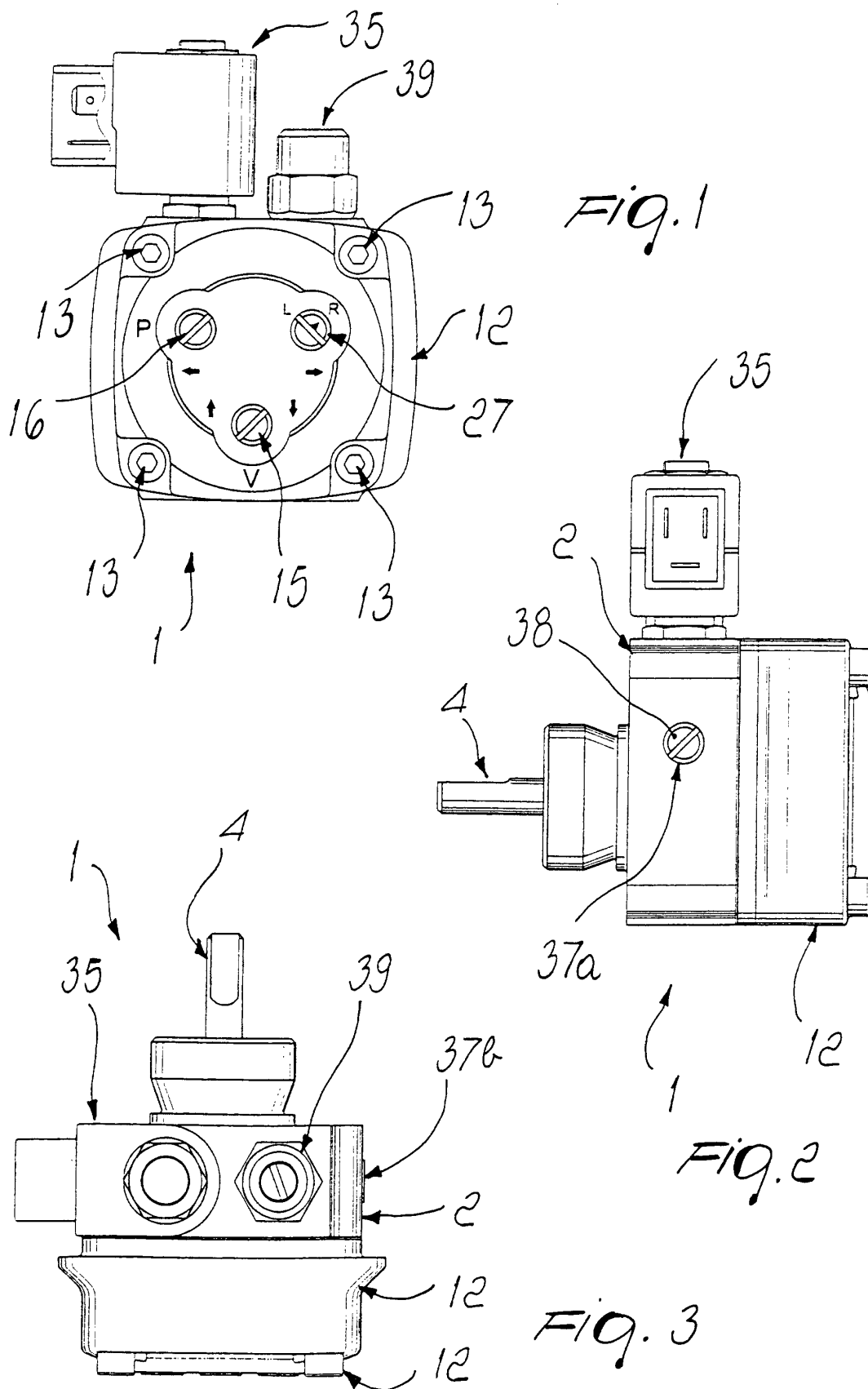
1. A pump, particularly for fuel oil burners, comprising a body provided with internal gears and with an external electric valve and a cover which has connectors for a pressure gauge and a vacuum gauge, **characterized in that** said body has at least two outlets and a single inlet which are connected to a plurality of ducts for conveying said fuel oil with which a user-activatable selection device interacts which is suitable to switch the direction of the circulation of the flow of said fuel oil as a function of the direction of rotation of said gears.
2. The pump according to claim 1, wherein said internal gears are constituted by a rotor which is keyed on a motor shaft and is arranged eccentrically with respect to a ring gear which is external and driven, **characterized in that** said fuel oil inlet is formed on the underside of said body, an opening being formed laterally to it and constituting a return or drain for said fuel oil.
3. The pump according to claims 1 and 2, wherein said inlet is connected to a first duct for recovering the fuel oil that escapes from said internal gears along said motor shaft, **characterized in that** said inlet and said first duct are connected to a second duct for connection to a cavity which is formed between said cover and said body.
4. The pump according to claims 1 and 3, wherein a main plate is associated, in a front region, with a perforated auxiliary plate in which said ring gear is arranged, **characterized in that** said main plate has a pair of first holes for the passage of the fuel oil from said cavity respectively to a third duct and a fourth duct, for connection to said internal gears, formed on the rear surface of said main plate.
5. The pump according to claims 1 and 4, **characterized in that** said selection device interacts with said pair of first holes and with a third hole which is also formed in said main plate proximate to said pair of first holes, so as to connect said third hole selectively to one or the other of the holes of said pair of first holes.
6. The pump according to claims 1 and 5, **characterized in that** said selection device allows the passage of the fuel oil from said cavity only into the hole of said pair of first holes that does not interact with said selection device.
7. The pump according to claim 6, **characterized in that** said selection device is constituted by a first end, which is cylindrical and protrudes through said cover, and a second end, which lies opposite said first end and is oval.
8. The pump according to claim 7, **characterized in that** said first end of said selection device is accessible from outside, so that it can be activated by the user by virtue of a rotation of said first end with respect to an axis which is approximately perpendicular to said cover.
9. The pump according to claims 1 and 8, **characterized in that** said selection device has, at a perimetric edge of said second end, a sealing gasket for contact with said main plate.
10. The pump according to one or more of the preceding claims, **characterized in that** a recess is provided inside said perimetric edge of said second end and allows the passage of fuel oil from one of the two holes of said pair of first holes to said third hole.
11. The pump according to claim 4, **characterized in that** said selection device, depending on the rotation applied by said motor shaft to said rotor, switches the direction of flow through said third and fourth ducts.
12. The pump according to claim 11, **characterized in that** said third hole, into which the pressurized fuel oil arriving from said internal gears is sent, acts as connection to a fifth duct which is formed in the rear

face of said auxiliary plate.

13. The pump according to one or more of the preceding claims, wherein said connectors formed in said cover are constituted by a first connector, at which it is possible to associate a device for measuring the vacuum produced by the rotation of the gear, for the connection of a pressure measurement device, such as a pressure gauge, **characterized in that** said fifth duct is connected to a fourth hole which is formed in said main plate at said second connector for measuring the pressure at the delivery. 5
14. The pump according to one or more of the preceding claims, **characterized in that** said fifth duct is connected to a sixth duct which is controlled by said electric valve which is suitable to open and close it. 10
15. The pump according to one or more of the preceding claims, **characterized in that** said sixth duct is connected, downstream of said electric valve, to a seventh duct which is arranged horizontally along the entire width of said body. 15
16. The pump according to claim 15, **characterized in that** said seventh duct is accessible from the outside by way of a pair of outlets which are threaded and arranged on the opposite faces of said pump, so as to allow to choose which of the two to use to send the fuel oil to said burner. 20
17. The pump according to claim 16, **characterized in that** the outlet of said pair of outlets that is not connected to said burner is closed, during installation, by using a complementarily threaded screw. 25
18. The pump according to claim 15, **characterized in that** said sixth duct for conveying the fuel oil toward said seventh duct is connected, between said fifth duct and said electric valve, to an eighth duct which is in turn controlled by a pressure regulator. 30
19. The pump according to claim 18, **characterized in that** said pressure regulator, which protrudes upward from said body, is adjustable so as to reduce or increase the choke formed along said eighth duct, facilitating or hindering the return of the excess fuel oil toward said outlet. 35
20. The pump according to one or more of the preceding claims, **characterized in that** said selection device has, at its surface that faces the internal surface of said cover, means for selective and temporary locking, so as to facilitate the use of said selection device. 40
21. The pump according to claim 20, **characterized in that** said locking means are constituted by a ball 45

which partially protrudes from a respective seat formed inside said selection device, so that it can slide, in contrast with an underlying spring, fully inside said seat.

22. The pump according to claim 21, **characterized in that** two hollows, shaped complementarily to said ball, are formed on the internal surface of said cover so as to allow to temporarily accommodate said ball at the connection between said third hole and each one of said pair of first holes. 50
23. The pump according to one or more of the preceding claims, **characterized in that** it provides for the positioning of said selection device inside said cover and along the same axis as said first connector for vacuum measurement. 55
24. The pump according to one or more of the preceding claims, **characterized in that** said selection device can be accessed by the user by removing the closure screw of said first connector and inserting therein a tool which is suitable to turn said selection device.



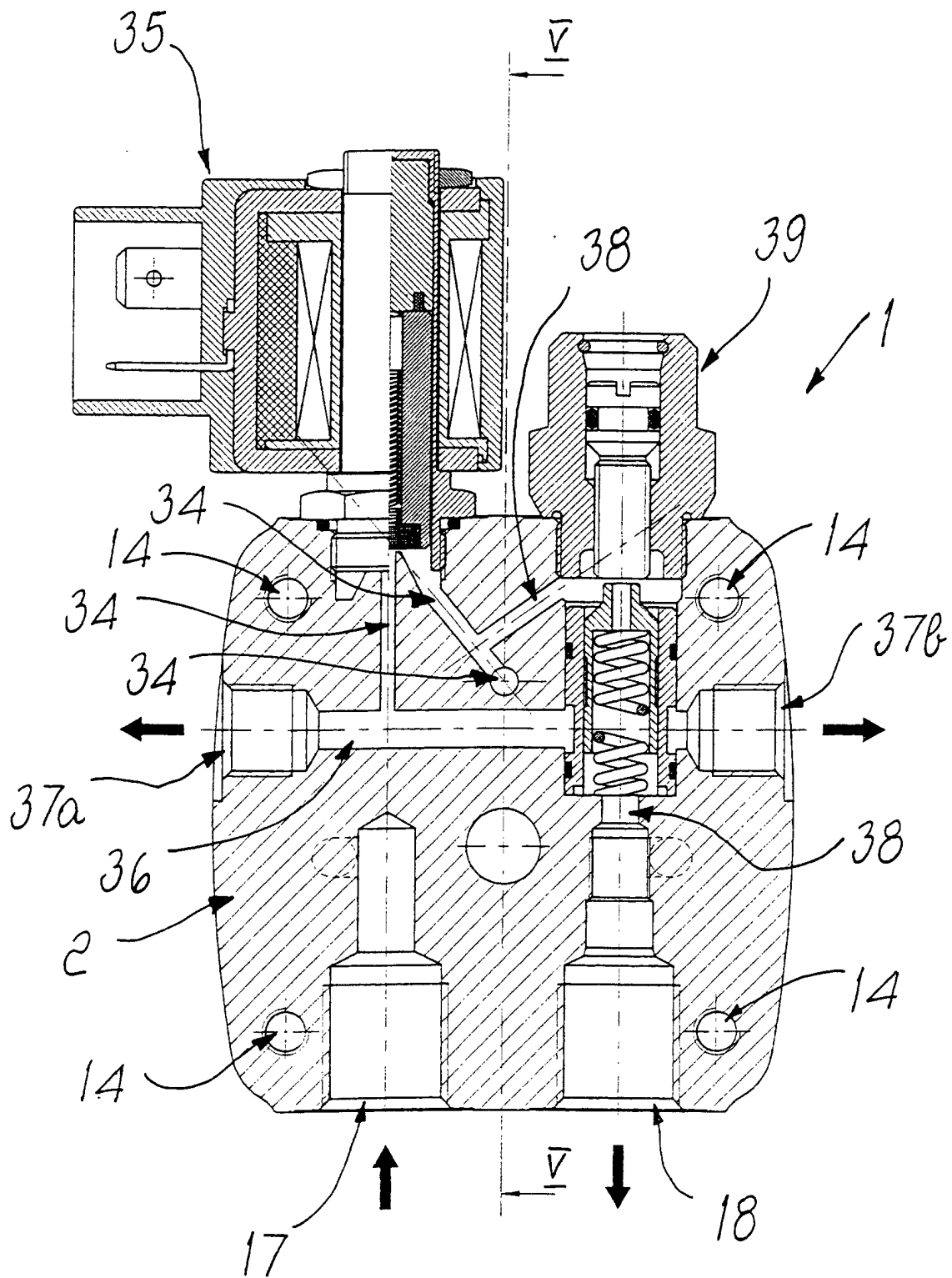


Fig. 4

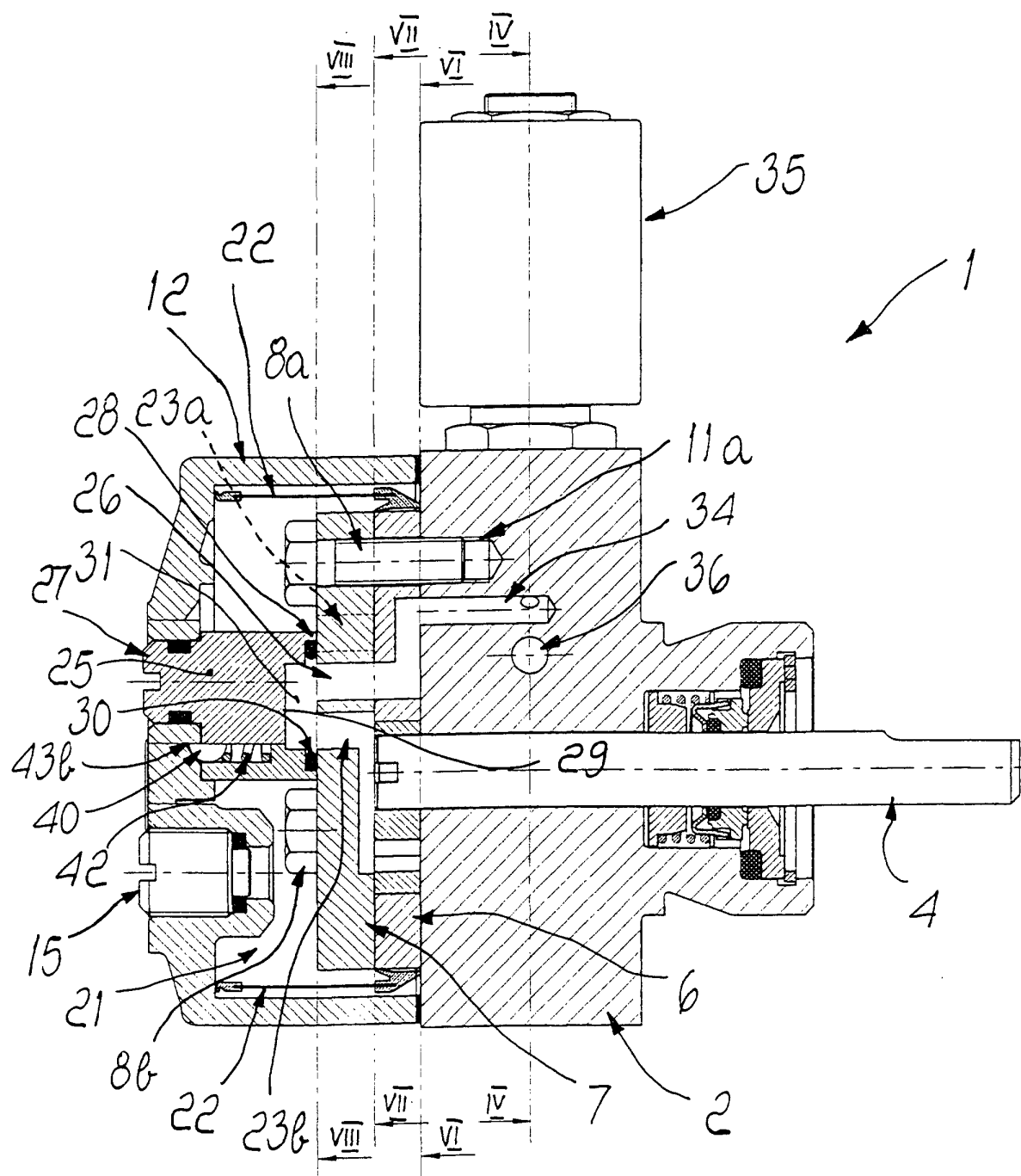
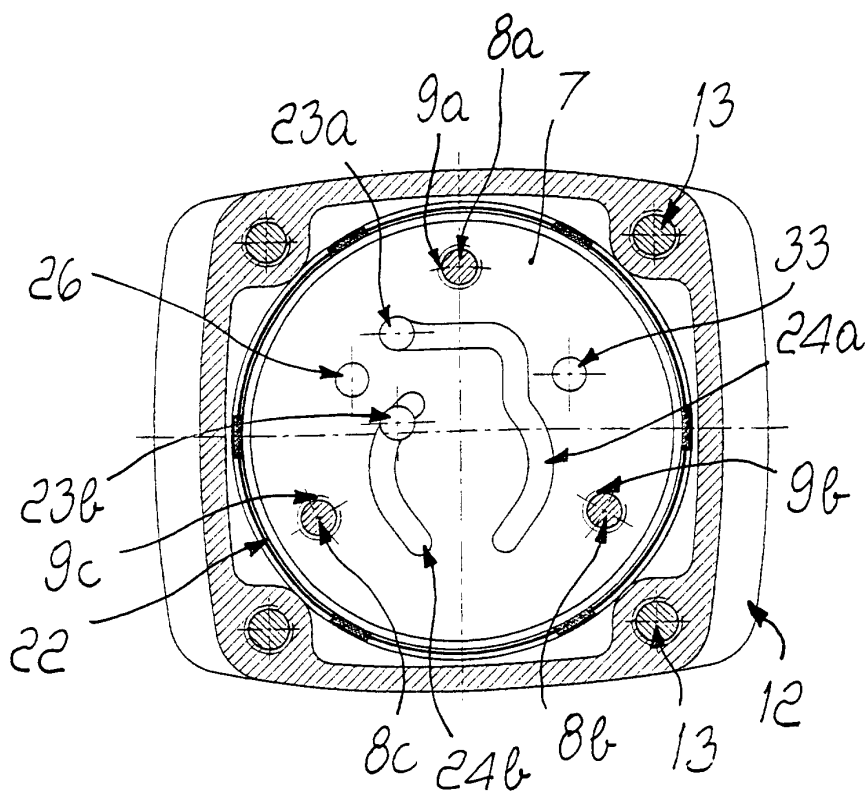
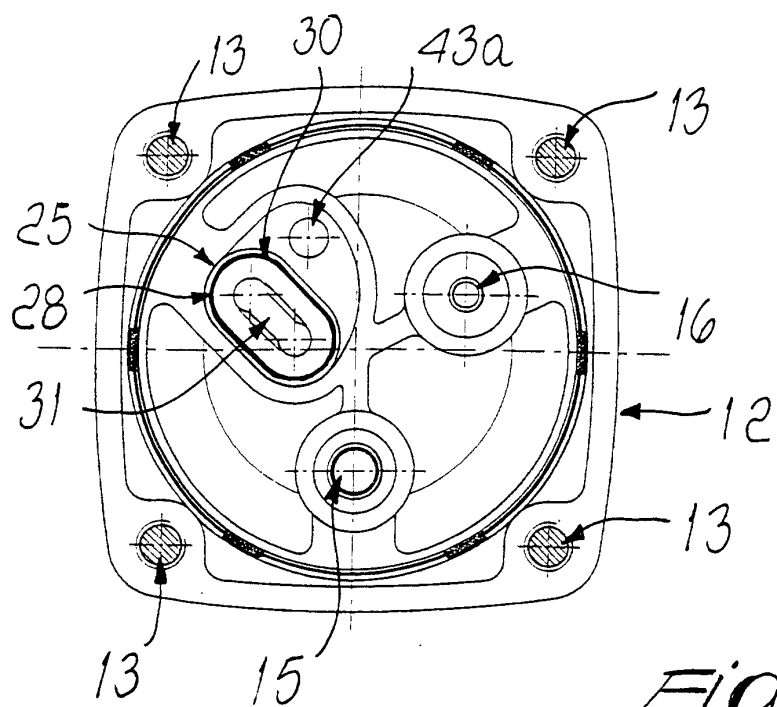


Fig. 5



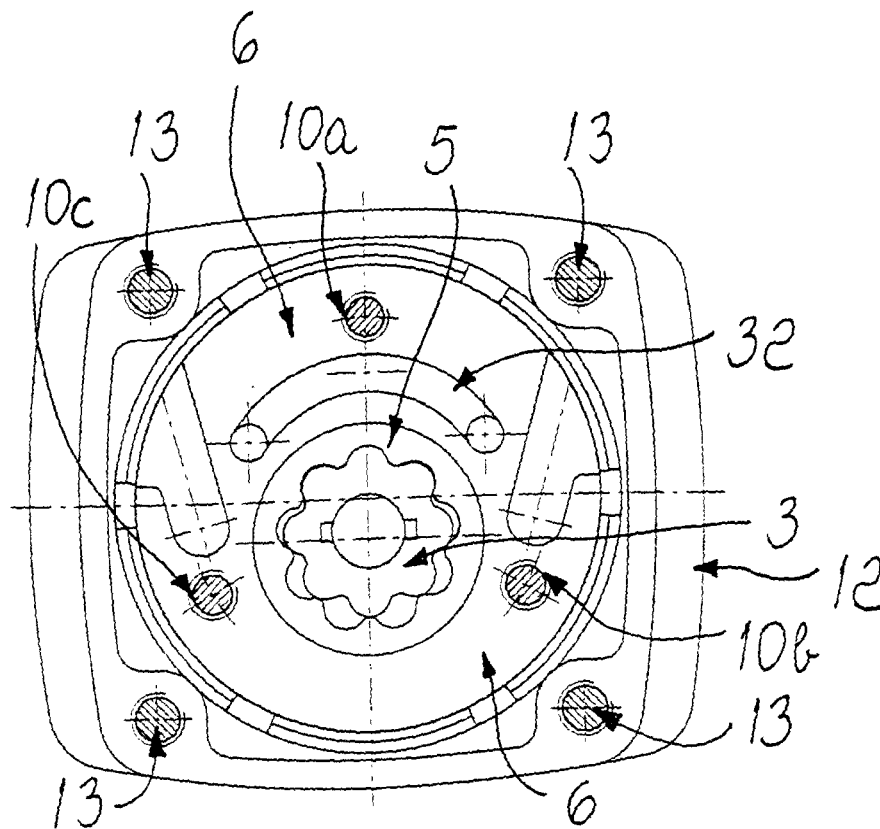


Fig. 8

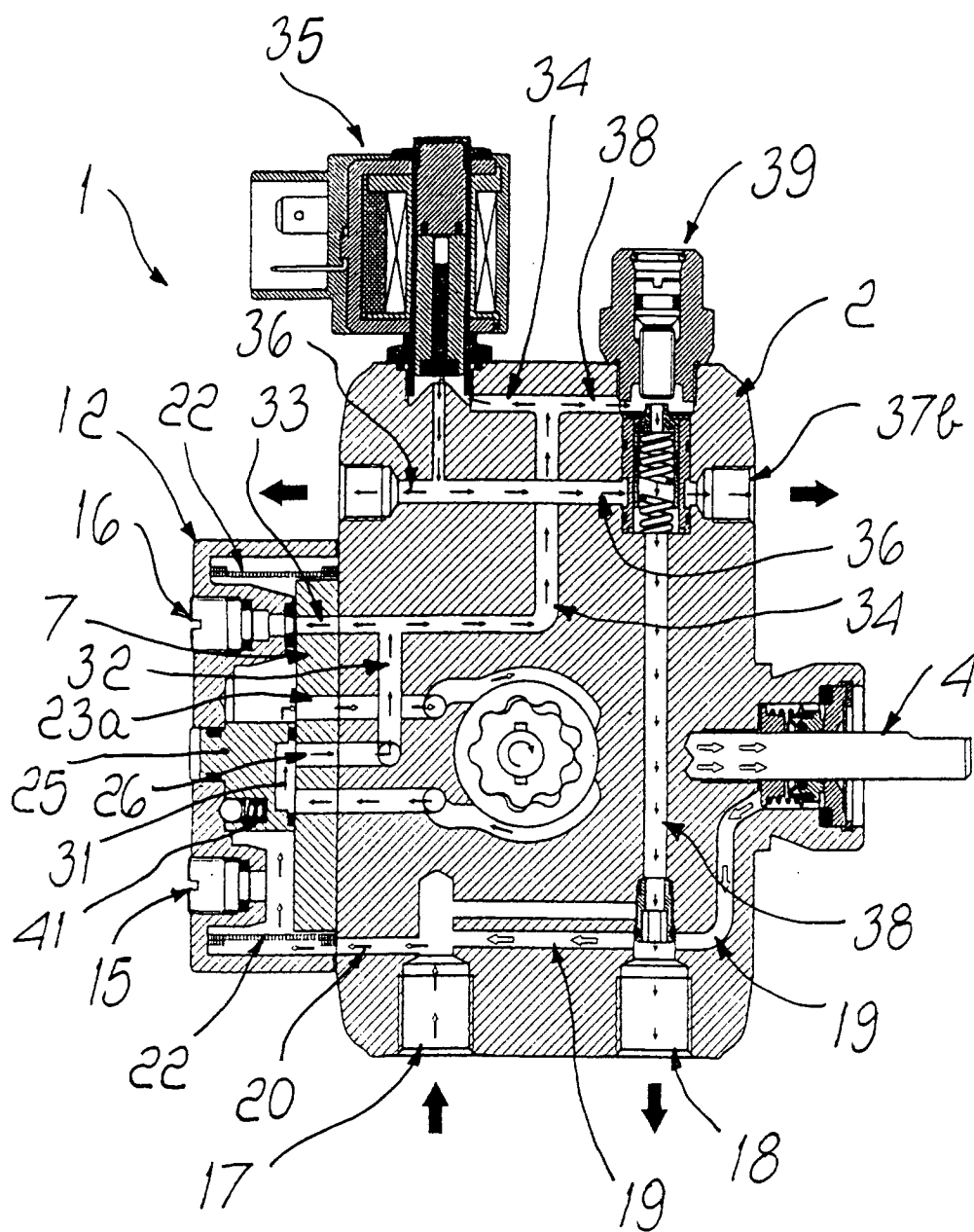


Fig. 9

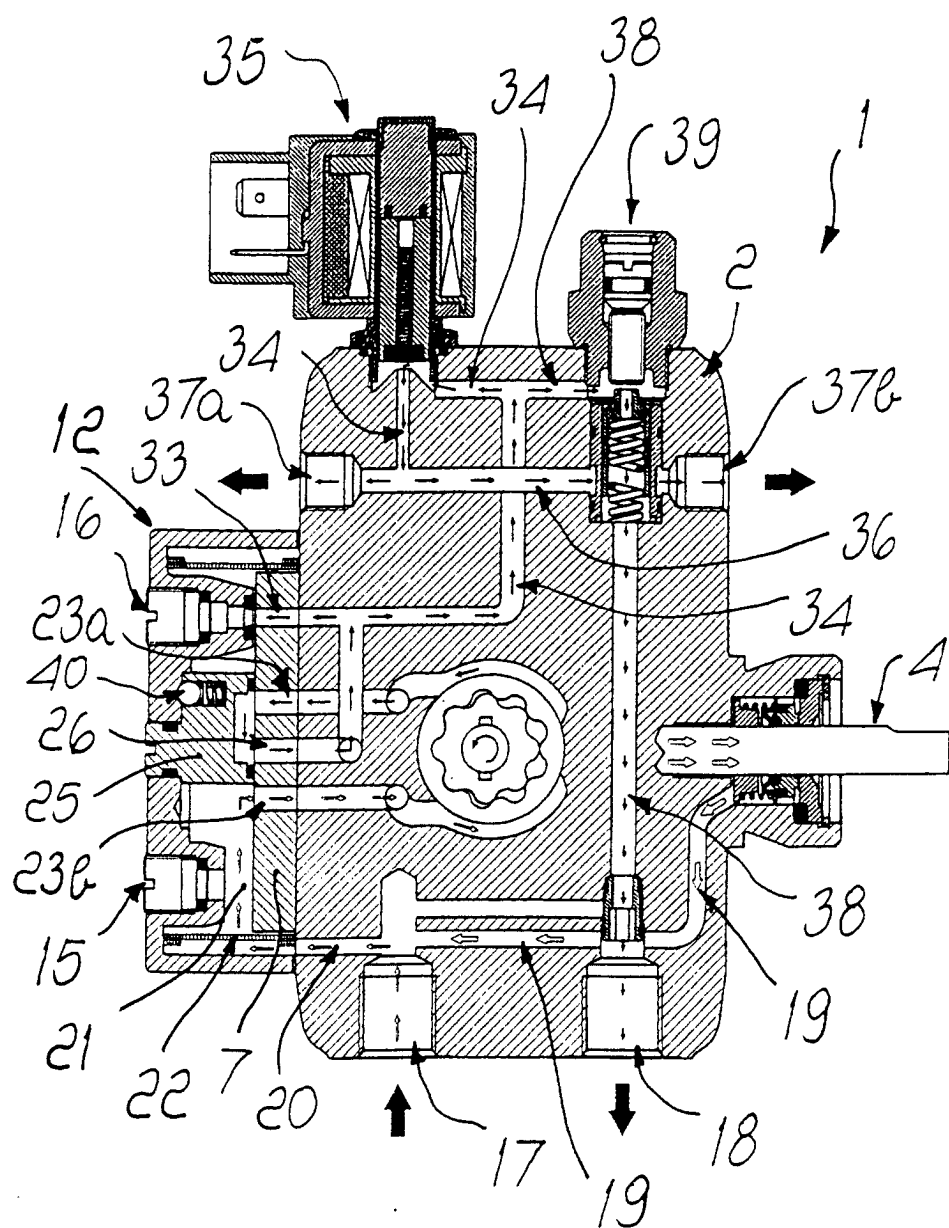


Fig. 10