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

(11) Publication number: **0 465 705 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **12.10.94** (51) Int. Cl.[5]: **F02M 27/04**

(21) Application number: **90113261.3**

(22) Date of filing: **11.07.90**

(54) **Device for conditioning of liquid fuel and liquid coolant.**

(43) Date of publication of application:
15.01.92 Bulletin 92/03

(45) Publication of the grant of the patent:
12.10.94 Bulletin 94/41

(84) Designated Contracting States:
BE DE FR GB IT SE

(56) References cited:
EP-A- 0 073 077
FR-E- 71 176
US-A- 3 951 807

(73) Proprietor: **Onyszczuk, Boleslaw**
ul. Marcinkowskiego 13
66-300 Miedzyrzecz Wlkp. (PL)

(72) Inventor: **Onyszczuk, Boleslaw**
ul. Marcinkowskiego 13
66-300 Miedzyrzecz Wlkp. (PL)

(74) Representative: **Füchsle, Klaus, Dipl.-Ing. et al**
Hoffmann, Eitle & Partner,
Patentanwälte,
Postfach 81 04 20
D-81904 München (DE)

EP 0 465 705 B1

Description

The subject of the present invention is a device for simultaneously conditioning liquid fuel and liquid coolant by means of the heterogenous magnetostatic field, applied especially to improve operation of internal combustion-, carburettor- or compression-ignition engines, as well as oil and gas burners.

Those skilled in the art know from the Polish patent application. PL-A-114283 that a device for conditioning liquids by means of magnetic field consists of a cylindrical housing or a ferromagnetic body in which a ferromagnetic roll is axially situated and surrounded by a set of annular magnets. Those magnets are separated and bound into a whole by means of ferromagnetic internal and central pole shoes and external pole shoes situated in their planes and adhered to the internal surface of the cylindrical body. Sections of pole shoes are similar to the section of the rivet whose neck sets the distance between two adjacent magnets.

The known devices designed for conditioning liquids comprise sets of magnets, which in most cases are permanent magnets, arranged along the channel of the liquid such as water, so that magnetic flux lines are perpendicular to the flowing direction of the liquid. From the specification of the Polish patent application no. P264 entitled "Method and device for purification of liquids in magnetic field" a method of water treatment and conditioning is known. The said method consists of passing the liquid through zones of different flowing velocities, different velocity gradients, different internal pressure gradients and different gradients and intensities of the magnetic field. The device according to this Polish patent application consists of a filter bed of packings having ferromagnetic properties and being suspended in the magnetic field generated by a set of arc magnets. The magnets are situated circumferentially around a metal tank having dia- or paramagnetic properties. The said magnets have magnetic poles on the concave and convex side of the arc and two of them are situated side by side with their monomial poles. Thus, pairs are formed with their unlike poles.

Those skilled in the art know from German patent application DE-A-3403797 a method of fuel combustion in an internal combustion engine and a device designed for that method. In that German patent, fuel presented in the fuel system of an internal combustion engine is subject to the effect of magnetic field. Owing to the improvement of combustion, specific fuel consumption can be reduced. The fuel system of the internal combustion engine for the method comprises fuel feeding devices, a device for supplying fuel to at least one cylinder, and pipes constituting fuel paths. The fuel flowing from the feeding device to the supplying device and then into the engine is subject to the effect of magnetic field.

From German patent application DE-A-2256379 a method of scattering liquid fuels by means of flux of magnetic field and interrupting action is known. Interaction of the magnetic field on fuel particles causes their charging and then their desintegration into microscopic, almost imperceptible petrol droplets. In the result thereof, combustion proceeds without any remainders, i.e., without production of toxic substances. Owing to operation of the device according to the aforesaid patent, the finest particles should be transformed into complete gasification in the result of continuous influence of intermittent magnetic fields.

From the Polish patent application PL-A-273505 there is known a method of improving the efficiency of an internal combustion engine and device for conditioning liquid coolant and fuel for the internal combustion engine. According to the said patent application the method of improving the efficiency of both a carburettor engine and a compression-ignition engine by conditioning of liquid coolant and fuel, in which liquid coolant and fuel are subject to concurrent conditioning by means of magnetohydrodynamic method, consists of passing both these agents through a zone of the same magnetic field having the intensity of maximum about 2.8×10^5 A/m, magnetic field gradient of about 10^7 A/m^2 and velocity gradients in contractions. The magnetohydrodynamic treatment is conducted with simultaneously heating the fuel by the heat given up by liquid coolant. Besides, during magnetohydrodynamic treatment the flowing direction of the agents being treated changes in relation to the direction of magnetic flux lines.

The object of the present invention is to improve operation of an internal combustion engine, to reduce fuel consumption and to protect the environment.

SUMMARY OF THE INVENTION

The invention is as defined in the accompanying claims and in which Claim 1 and claim 6 have been divided into a two- part form based on the assumption that the aforesaid Polish patent application. PL-A-114 283 is the nearest state of the art.

The invention provides a device for the simultaneous conditioning of a fluid fuel and a fluid coolant with the use of a magnetic field.

The device comprises a body incorporating a set of permanent magnets separated by internal pole shoes. The internal pole shoes are placed opposite to external pole shoes abutted to the inner surface of the body. Said body comprises two circuits, one of which can be a liquid fuel condition-

ing circuit and the other can be a liquid coolant conditioning circuit.

The liquid fuel feeding conduit can be filled with a bed of ferromagnetic filings on which the magnetic field of the permanent magnets act.

An advantage of the invention is the simultaneous conditioning of two liquids by utilizing additional heat exchanged between the liquids.

According to the present invention, it is possible to condition liquid coolant and liquid fuels at the same time, as well as to condition engine fuels by simultaneously reheating the fuel with the heat given up in the process of engine cooling.

In the conditioning process of liquids and gases, permanent magnets are used for generating a magnetic field of flux density of at least 2000 gausses.

The subject of the present invention is shown as examples of its embodiment in the drawings, in which:

Fig.1 presents a longitudinal section of a device with a spiral fuel conduit for conditioning liquid fuel and liquid coolant;

Fig.2 is a sectional view of the device of Fig.1 along line A-A marked in Fig.1;

Fig.3 is a second example of the embodiment of the device of Fig.1 with a concentric fuel conduit situated in the axis of the device and filled with a bed of ferromagnetic fillings.

The device of Figs.1 and 2 comprises a cylindrical body 1 incorporating a set of concentrically and axially arranged annular permanent magnets 2 which are separated by ferromagnetic annular internal pole shoes 3 and connected by a tube 4. In order to increase the value and the gradient of the magnetic flux density, external pole shoes 12 are applied and situated opposite to the internal pole shoes 3 and abutted to the inner surface of the body 1.The body has two built-in independent flowing circuits for agents to be conditioned. The liquid coolant circuit is channels 5 between the wall of the body 1 and the set of magnets 2 with internal pole shoes 3 and connected by a liquid coolant feeding stub pipe 6 and a drain stub pipe 7 of said liquid collant. The fuel or gas circuit is formed by a paramagnetic or diamagnetic conduit 8 which is a coil pipe with odd numbers of coils. The fuel conduit 8 is situated outside of the set magnets 2 and the internal pole shoes 3 and in recesses 11 of said internal pole shoes 3 as shown in Fig.2. The fuel conduit 8 is terminated or connected with a fuel supply stub pipe 9 and a fuel drain stub pipe 10.The spiral or coil shape of the pipe or fuel conduit 8 enables multiplication of the number of remagnetizations of flowing fuel. The external pole shoes 12 are designed in such a way that they are in form of rings with a cross-section of half-ellipse. The external pole shoes 12 are placed opposite to the internal pole shoes 3 and in Fig. 1 they are shown suspended on distance ribs 13. As shown in Fig.2, ferromagnetic pole shoes 3 are in the form of disks having recesses 11 arranged symmetrically on the perimeters of said pole shoes 3. The recesses 11 are adapted to mount the spiral fuel conduit 8.

The second example of the embodiment of the present invention is shown in Fig.3. A fuel conduit 14 has an extent situated concentrically in the axis of the device and this extent is filled with a bed of packings 15 having ferromagnetic properties, preferably steel filings. Those filings 15 are suspended in the magnetic field of the annular permanent magnets 2 and mounted in the conduit 14.

Fuel passes through zones of different intensities of the magnetic field and of different gradients of this field, with its changing velocity, gradient of the velocity and internal pressures. The said different parameters are obtained owing to the influence of heterogenity of the magnetic field on the zones corresponding to the packings or filings 15 of ferromagnetic properties and of different dimensions and shapes as they are stochastically arranged in relation to one another. In the slots formed within the packings, depending on the shape and contact area of these packings, a high intensity of magnetic field is obtained. In the slots of high flow velocity and low internal pressure fuel degassing proceeds quickly; while in the slots of low flow velocity and high intensity of magnetic field gas particles stop and accumulate into bubbles and are entreined by the fuel flow.

In the external zone of the cooling water flow there is also an influence of magnetic field with variable intensity and variable gradients of this intensity.

These two systems, as of independent flows of fuel and water, gas and water, cooling air and fuel, cooling air and gas, form at the same time a common hybrid system for conditioning of liquid and gas by the magnetic field. The device does not require any additional filter on the liquid coolant circuit.

An advantage of the solution according to the invention is almost 100% efficiency of cleaning the cooling system from boiler scale with the application of water as a coolant and at least 5% fuel efficienty or gas saving, depending on the type of the engine, the burner and the fuel.

The device may be included in the cooling system and the feeding system in internal combustion or gas engines. During their operation the flowing liquid coolant and fuel are subject to simultaneous magnetohydrodynamic influence. In the said process of the liquid collant, polymers with surface activity are formed, which cause removal of impurities from the cooling system, especially boil-

er scale. Moreover, the whole cooling system for improving the engine operation is protected against corrosion.

As the result of the influence of the magnetic field and the heating, great amount of fine air bubbles with double layers are produced in the fuel. The fuel polymers are put in order. This process intensifies the results of the flowing fuel at various velocities in zones of variable gredients of the magnetic field intensity. As the result of production of linear polymers, they will be broken up in the process of spraying the fuel in the carburettor. A change of the structure of the hydrocarbon chains under the effect of applying the treatment with the magnetic field will improve antiknock properties of the fuel, i.e. will raise the octane number.

The application of the device according to the invention enables to improve the efficiency of the cooling system in almost 100% thereby protecting the system against corrosion, and enables to reduce the fuel consumption by at least 5%, depending on the type of the carburettor engine or compression-ignition engines and to reduce the fuel combustion at idle running of the engine. It also increases the engine idling speed at an adjustment by about 10% and improves the acceleration and the maximum speed of the vehicle. Further it ensures steady running of the engine immediately after cold starting, i.e. considerably better starting at low temperature and considerably quicker and smoother reaching of high engine speed at low temperatures and under load. Moreover, it reduces the deposit on electrodes of the spark plugs and the emission of black smoke from the exhaust pipe, especially at a cold engine thereby considerably prolonging the service life of the exhaust system, e.g. emission of toxic substances such as CO, CO_2,nitric oxide and hydrocarbons in exhaust gases. Improvement of the combustion of carcinogenic benzene in lead-free petrol will considerably prolong the catalysts life owing to the better combustion of the fuel and completely eliminate or considerably reduce the engine clashing by virtue of increasing the octane number of the fuel when low-octane or lead-free petrol is used. When used in turbo-diesel engines, gelation temperature in adjacent zones of the device at cold starting of the engine varies from -14°C to -18°C, improved operation of the combustion. Besides, the application of the device does not require any additional electric energy.

Claims

1. Device for conditioning of fluid fuel and fluid coolant with the use of magnetic field, comprising a cylindrical body (1); a set of permanent annular magnets (2) situated co-axially in said body (1), and separated by a plurality of annular ferromagnetic internal pole shoes (3), the adjacent permanent annular magnets (2) having monomial poles facing each other; a plurality of external annular pole shoes (12) abutting to the internal surface of the body (1) and located co-axially around the annular internal pole shoes (3), each of the annular external pole shoes (12) being located co-axially to one corresponding annular internal pole shoe (3); and a fluid coolant conditioning circuit (5) situated within the body (1), passing through a magnetic field generated by the set of permanent, annular magnets (2), perpendicular to the direction of magnetic flux lines, characterized in that it comprises a fluid fuel conditioning circuit (8) located within the body (1), passing through the same magnetic field generated by the set of permanent annular magnets (2), perpendicular to the direction of magnetic flux lines.

2. The device according to Claim 1, wherein said liquid fuel conditioning circuit (8) is a diamagnetic or paramagnetic spiral conduit having an odd number of coils and being arranged between said internal (3) and external (12) pole shoes.

3. The device according to Claim 2, wherein said fuel conduit (8) is mounted within recesses (11) formed symmetrically on the perimeters of said internal pole shoes (3).

4. The device according to Claim 1, wherein said liquid coolant conditioning circuit (5) is constituted by channels between the inner surface of the body (1) and said internal pole shoes (3) and between said external and internal pole shoes.

5. The device according to Claim 1, wherein said external pole shoes (12) each has a cross-section of half an ellipse.

6. Device for conditioning of fluid fuel and fluid coolant with the use of magnetic field, comprising a cylindrical body (1); a set of permanent annular magnets (2) situated so-axially in said body (1), and separated by a plurality of annular ferromagnetic internal pole shoes (3), the adjacent permanent annular magnets (2) having monomial poles facing each other; a plurality of external annular pole shoes (12) abutting to the internal surface of the body (1) and located co-axially around the annular internal pole shoes (3), each of the annular external pole shoes (12) being located co-axially to one

corresponding annular internal pole shoe (3); and a fluid coolant conditioning circuit (5) situated within the body (1), passing through a magnetic field generated by the set of permanent annular magnets (2), perpendicular to the direction of magnetic flux lines, characterized in that it comprises a fluid fuel conditioning circuit (14) located within the body(1), passing through the magnetic field generated by the set of permanent annular magnets (2), the circuit (14) being filled with a bed of ferromagnetic fillings (15) and the permanent annular magnets being paired off.

Patentansprüche

1. Vorrichtung zum Aufbereiten von flüssigem Brennstoff und flüssigem Kühlmittel unter Benutzung eines magnetischen Feldes, mit einem zylindrischen Gehäuse (1); einer Gruppe von Permanentringmagneten (2), die koaxial in dem Gehäuse (1) angeordnet und durch eine Anzahl von ringförmigen, ferromagnetischen Innenpolschuhen (3) getrennt sind, wobei die nebeneinanderliegenden Permanentringmagneten (2) einander gegenüberliegende einfache Pole haben; einer Anzahl von ringförmigen Außenpolschuhen (12), die an die innere Oberfläche des Gehäuses (1) anstoßen und koaxial um die ringförmigen Innenpolschuhe (3) positioniert sind, wobei jeder der ringförmigen Außenpolschuhe (12) koaxial zu einem entsprechenden ringförmigen Innenpolschuh (3) positioniert ist; und mit einem in dem Gehäuse (1) angeordneten Flüssigkühlmittel-Aufbereitungskreislauf (5), der durch ein durch die Gruppe der Permanentringmagneten (2) generiertes Magnetfeld senkrecht zu der Richtung der Magnetflußlinien, hindurchläuft, dadurch **gekennzeichnet,** daß die Vorrichtung einen in dem Gehäuse (1) angeordneten Flüssigkraftstoff-Aufbereitungskreislauf (8) beinhaltet, der durch das gleiche durch die Gruppe der Permanentringmagneten (2) generierte Magnetfeld senkrecht zu der Richtung der Magnetflußlinien hindurchläuft.

2. Vorrichtung nach Anspruch 1, bei der der Flüssigkraftstoff-Aufbereitungskreislauf (8) einen diamagnetischen oder paramagnetischen spiralförmigen Kanal mit einer ungeraden Zahl von Spiralen aufweist und zwischen den Innen- (3) und Außenpolschuhen (12) angeordnet ist.

3. Vorrichtung nach Anspruch 2, bei der der Kraftstoffkreislauf (8) in Vertiefungen (11) angebracht ist, die symmetrisch an den Umfängen der Innenpolschuhe (3) eingeformt sind.

4. Vorrichtung nach Anspruch 1, bei dem der Flüssigkühlmittel-Aufbereitungskreislauf (5) durch zwischen der inneren Oberfläche des Gehäuses (1) und den Innenpolschuhen (3) und zwischen den Außen- und Innenpolschuhen liegenden Kanälen gebildet ist.

5. Vorrichtung nach Anspruch 1, bei dem jeder der Außenpolschuhe (12) einen halbellipsenförmigen Querschnitt aufweist.

6. Vorrichtung zum Aufbereiten von flüssigem Brennstoff und flüssigem Kühlmittel unter Benutzung eines magnetischen Feldes, mit einem zylindrischen Gehäuse (1); einer Gruppe von Permanentringmagneten (2), die koaxial in dem Gehäuse (1) angeordnet und durch eine Anzahl von ringförmigen, ferromagnetischen Innenpolschuhen (3) getrennt sind, wobei die nebeneinanderliegenden Permanentringmagneten (2) einander gegenüberliegende einfache Pole haben; einer Anzahl von ringförmigen Außenpolschuhen (12), die an die innere Oberfläche des Gehäuses (1) anstoßen und koaxial um die ringförmigen Innenpolschuhe (3) positioniert sind, wobei jeder der ringförmigen Außenpolschuhe (12) koaxial zu einem entsprechenden ringförmigen Innenpolschuh (3) positioniert ist; und mit einem in dem Gehäuse (1) angeordneten Flüssigkühlmittel-Aufbereitungskreislauf (5), der durch ein durch die Gruppe der Permanentringmagneten (2) generiertes Magnetfeld senkrecht zu der Richtung der Magnetflußlinien, hindurchläuft, dadurch **gekennzeichnet,** daß die Vorrichtung einen in dem Gehäuse (1) angeordneten Flüssigkraftstoff-Aufbereitungskreislauf (14) umfaßt, der durch das durch die Gruppe der Permanentringmagneten (2) generierte Magnetfeld hindurchläuft, wobei der Kreislauf (14) mit einem Bett von ferromagnetischen Füllungen (15) gefüllt ist und die Permanentringmagneten in Zweiergruppen eingeteilt sind.

Revendications

1. Dispositif de conditionnement de carburant liquide et de réfrigérant liquide avec l'utilisation d'un champ magnétique, comprenant un corps cylindrique (1); un jeu d'aimants permanents annulaires (2) situés suivant le même axe dans ledit corps (1) et séparés par une multitude de pièces polaires annulaires internes, ferromagnétiques (3), les aimants permanents annulaires contigus (2) ayant des pôles en monome en regard l'un de l'autre; une multitude de pièces polaires annulaires externes (12) en aboutement contre la surface interne du corps

(1) et placées suivant le même axe autour des pièces polaires annulaires internes (3), chacune des pièces polaires annulaires externes (12) étant située suivant le même axe par rapport à une pièce polaire annulaire interne correspondante (3); et un circuit (5) de conditionnement de réfrigérant liquide situé à l'intérieur du corps (1), traversant un champ magnétique produit par le jeu d'aimants permanents annulaires (2), perpendiculairement au sens des lignes du flux magnétique, caractérisé en ce qu'il comprend un circuit (8) de conditionnement de carburant liquide situé à l'intérieur du corps (1), traversant le même champ magnétique engendré par le jeu d'aimants permanents annulaires (2), perpendiculairement au sens des lignes du flux magnétique.

2. Dispositif selon la revendication 1, dans lequel ledit circuit (8) de conditionnement de carburant liquide est une conduite en spirale diamagnétique ou paramagnétique, ayant un nombre impair de serpentins et disposée entre lesdites pièces polaires internes (3) et externes (12).

3. Dispositif selon la revendication 2, dans lequel ladite conduite de carburant (8) est montée à l'intérieur d'évidements (11) ménagés symétriquement sur les périmètres desdites pièces polaires internes (3).

4. Dispositif selon la revendication 1, dans lequel ledit circuit (5) de conditionnement de réfrigérant liquide est constitué par des canaux entre la surface intérieure du corps (1) et lesdites pièces polaires internes (3) et entre lesdites pièces polaires externes et internes.

5. Dispositif selon la revendication 1, dans lequel lesdites pièces polaires externes (12) présentent chacune une section transversale en demi-ellipse.

6. Dispositif de conditionnement de carburant liquide et de réfrigérant liquide avec l'utilisation d'un champ magnétique, comportant un corps cylindrique (1); un jeu d'aimants permanents annulaires (2) situés suivant le même axe dans ledit corps (1), et séparés par une multitude de pièces polaires annulaires internes, ferromagnétiques (3), les aimants permanents annulaires contigus (2) ayant des pôles en monôme en regard l'un de l'autre; une multitude de pièces polaires annulaires externes (12) en aboutement contre la surface interne du corps (1) et placées suivant le même axe autour des pièces polaires annulaires internes (3), chacune des pièces polaires annulaires externes (12) étant située suivant le même axe par rapport à une pièce polaire annulaire interne correspondante (3); et un circuit (5) de conditionnement de réfrigérant liquide situé à l'intérieur du corps (1), traversant un champ magnétique produit par le jeu d'aimants permanents annulaires (2), perpendiculairement au sens des lignes du flux magnétique, caractérisé en ce qu'il comporte un circuit de conditionnement de carburant liquide (14) situé à l'intérieur du corps (1), traversant le champ magnétique produit par le jeu d'aimants permanents annulaires (2), le circuit (14) étant rempli d'un lit de charges ferromagnétiques (15) et les aimants permanents annulaires étant disposés par paires.

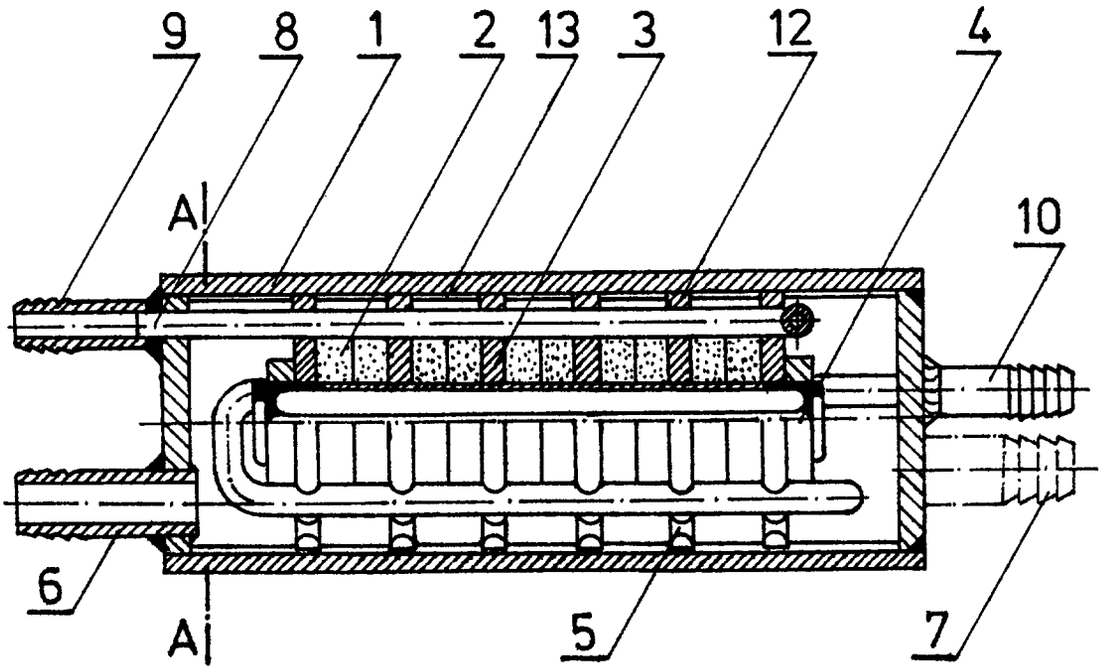

Fig.1.

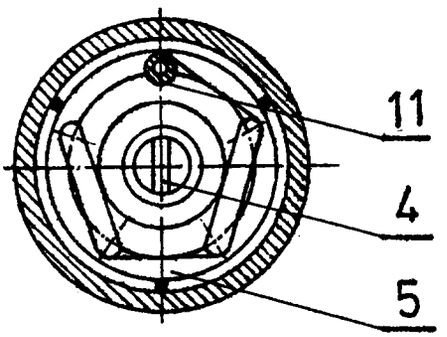

Fig.2.

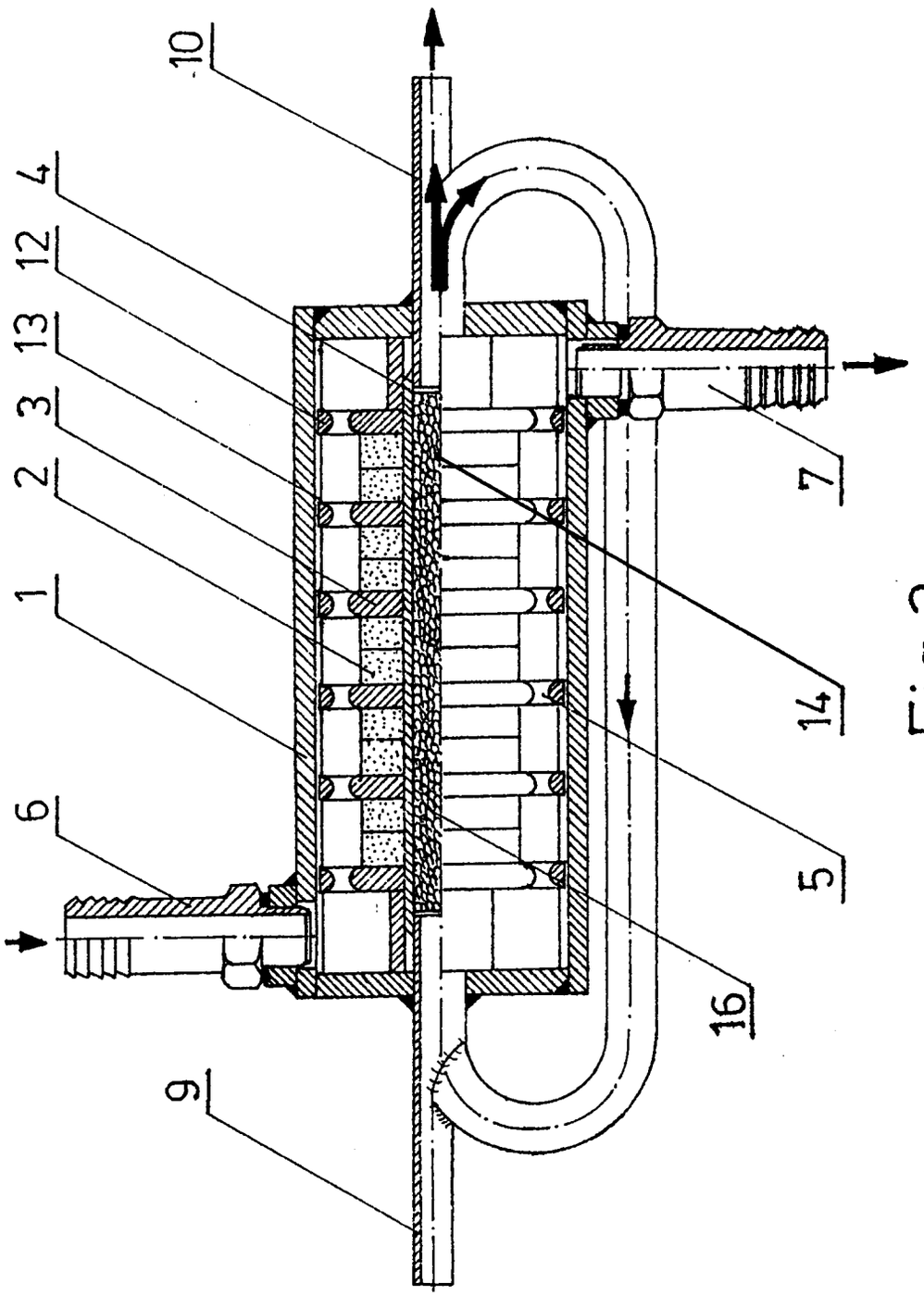

Fig.3.