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(54) **THERMOSTATIC VALVE FOR FUEL SYSTEMS**

THERMOSTATISCHES VENTIL FÜR BRENNSTOFFSYSTEME

VALVE THERMOSTATIQUE POUR CIRCUITS DE COMBUSTIBLE

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(73) Proprietor: **Zertan, S.A.**
31132 Villatuerta (Navarra) (ES)

(72) Inventors:
• **DÍEZ GARCÍA, Sergio**
E-31151 Obanos (ES)

• **SAN JULIÁN GARCÍA, Diego**
E-31001 Pamplona (Navarra) (ES)

(74) Representative: **Intès, Didier Gérard André et al**
Cabinet Beau de Loménie
158, rue de l'Université
75340 Paris Cedex 07 (FR)

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DescriptionField of the Art

[0001] The present invention relates to the thermal conditioning of the supply of fuel to vehicle diesel engines, proposing a valve which allows determining, according to the temperature of the fuel which is sent towards the engine, a distribution of the return of hot fuel from the injection pump towards the passage filter of the fuel which is sent to the engine and towards the tank from which the fuel is supplied.

State of the Art

[0002] In diesel engine vehicles there is the problem that the paraffins contained in the fuel gel below certain temperatures, which can cause the clogging of the filter and failures in the operation of the engine system.

[0003] To prevent this problem it is necessary for the fuel to acquire a certain temperature, for which two known heating systems are applied:

- By means of an electric heater, intercalating a device of this type in the fuel circuit, before the inlet to the filter.
- By means of a thermostatic valve, arranging a valve of this type to divert, when the temperature of the fuel is low, a flow of the hot fuel returning from the injection pump to the circuit for the cold fuel which is sent towards the engine, thus exploiting the heat generated by the injection pump; such that when the fuel reaches a determined temperature, a bimetal element changes the circulation of the return hot fuel towards the fuel tank.

[0004] The electric heating system has the advantage of efficiency under any condition of room temperature but, however, it significantly affects the electrical balance of the vehicle of application, ultimately increasing CO₂ emissions. And, furthermore, it is a comparatively more expensive system due to its complex construction.

[0005] The thermostatic valve system has, in contrast, the advantage of simplicity and the optimal exploitation of the energy, since it recycles the heat produced by the internal friction of the injection pump.

[0006] The thermostatic valves known for said application generally have constructive structures which make the design non-compact, resulting in several embodiments which are too bulky and therefore contrary to the increasingly demanding requirements of space reduction, and all the embodiments generally have a formation having external joints, such as welds or others, through which the fuel circulating therein may leak. Thermostatic valves according to the state of the art are disclosed in FR 2 386 692 A and EP 1 270 925.

Object of the invention

[0007] According to the invention, a thermostatic valve is proposed for the mentioned application in the fuel circuit of vehicle diesel engines, with a constructive embodiment of said valve which improves the constructive and functional qualities thereof.

[0008] This valve object of the invention comprises a compact casing having two outwardly projecting tubes, one for the connection to the return of the injection pump and the other one for the connection to a conduit for communication with the fuel tank.

[0009] The compact casing houses therein a functional assembly which is intercalated between an outlet for communication with the filter of the fuel circuit and the mouths of the tubes for the connection with the return of the injection pump and with the conduit for communication with the fuel tank, said functional assembly determining a central chamber communicated with the inner mouth of the tube for the connection with the return of the injection pump and which is separated, by means of respective check valves, with respect to the outlet for communication with the filter and with respect to the inner mouth of the tube for the connection with the conduit for communication with the fuel tank.

[0010] Said functional assembly of the valve includes a bimetal arranged in relation to the outlet for communication with the filter, so that, according to the temperature of the fuel, said bimetal opens or closes this outlet for communication with the filter, establishing two modes of operation, in one of which the hot fuel from the injection pump return is distributed between this outlet for communication with the filter and the outlet through the tube for communication with the fuel tank, whereas in the other mode of operation all the hot fuel from the injection pump return exits through this tube for communication with the fuel tank.

[0011] A valve is thus obtained which determines, according to the temperature of the fuel circulating towards the engine to which it is applied, a flow control of the hot fuel returning from the injection pump, between a direction towards the fuel tank and another one towards the filter of the fuel circuit, by means of an assembly which is easy to mount, in which a bimetal with a large diameter can be used, thus reducing the pressure drops which are generated in the filter of application when the fuel passes.

[0012] Furthermore, the outer casing of the valve forms a single part cover, without interruption as in other already known embodiments, which in the arrangement of application is attached at its lower edge, by means of welding, over the filter to which it is applied, determining a completely closed mounting in which the functional assembly is concealed inside the outer casing, without impervious joints present in other already known valves, the possibility of fuel leaks to the exterior thus being reduced.

[0013] Therefore, the proposed valve has truly advantageous features, acquiring its own identity and a preferred character with respect to known valves with the

same function.

Description of the Drawings

[0014]

Figure 1 shows a perspective exploded view of the assembly forming a thermostatic valve according to the invention.

Figure 2 is a diametric section view of the mounted valve.

Figure 3 is a perspective view of the valve with a side cut which allows observing the inner elements.

Figure 4 is a sectioned view of the valve in the operational position when the fuel of the engine is hot.

Figure 5 is a view of the sectioned valve in the operational position when the fuel of the engine is cold.

Figure 6 is a partial sectioned view of the lower part of the valve, the closure for retaining the functional assembly in the outer casing being observed in more detail.

Figure 7 is a sectioned view of the valve according to another practical embodiment with a different configuration of the parts but with the same functional concept.

Detailed Description of the Invention

[0015] The object of the invention relates to a thermostatic flow distributing valve, intended to be incorporated with respect to the filter of fuel circuits in diesel engine vehicles, in relation to the hot fuel return from the injection pump.

[0016] Said valve comprises an outer casing (1), from which two tubes (2 and 3) emerge towards the exterior, one of them (3) for being connected to the return of the injection pump of the engine, whereas the other tube (2) is for being connected to a conduit of communication with the fuel tank.

[0017] Inside that outer casing (1) a functional assembly is housed which is intercalated between an end outlet (4) and the inner mouths of the tubes (2 and 3), that functional assembly determining a central chamber (5), which communicates through openings (6) with a peripheral chamber (7) into which the tube (3) for connection with the injection pump return opens out, whereas at the ends of said central chamber (5) there are arranged respective check valves (8 and 9) which, pushed by respective springs (10), close that central chamber (5), respectively, with respect to a chamber (11) into which the tube (2) for the connection with the communication to the fuel tank opens out and with respect to a chamber (12) communicating with the end outlet (4).

[0018] In front of the end outlet (4) a bimetal (13) is also arranged at the inner part, which bimetal opens or closes said end outlet (4) according to the temperature.

[0019] Thus, in the practical application the valve is arranged over the filter of the fuel circuit of application,

with the end outlet (4) in communication with the inside of said filter and the tubes (2 and 3) connected to the conduit for communication with the fuel tank and to the injection pump return, respectively, such that the hot fuel from the injection pump return enters through the tube (3) in the peripheral chamber (7) and from the latter through the openings (6) in the central chamber (5), from where, according to the position of the bimetal (13), two possible outlet circulations are determined in the following modes:

- When the fuel circulating through the filter exceeds a certain temperature level, the bimetal (13) takes a position closing the end outlet (4) of the valve, whereby all the hot fuel from the injection pump return exits through the chamber (11) through the tube (2) towards the fuel tank, as shown in Figure 4.
- When the fuel circulating through the filter has a temperature below a certain level, the bimetal (13) takes a position leaving the end outlet (4) of the valve open, whereby the hot fuel from the injection pump return is distributed, as shown in Figure 5, a part thereof exiting through the chamber (11) through the tube (2) towards the fuel tank, whereas another part exits through the chamber (12) through the end outlet (4) towards the filter, this part of the hot fuel being mixed with the cold fuel circulating through the filter, raising the temperature thereof.

[0020] The thermostatic valve thus formed determines a compact structural assembly, the functional assembly being housed within the outer casing (1), which is formed by a single part without interruption, determining a cavity in which the functional assembly is closed, by means of a cover (14), on the mentioned outer casing (1), the end outlet (4) of the valve being determined through said cover (14).

[0021] Thus, the assembly of the thermostatic valve is easy to mount, it being possible to previously mount a partial assembly formed by a body (15) and a receptacle (16) which are coupled to one another with a snap-fitting interlock (17), including therein the valve (9) which establishes the closure with respect to the chamber (12) for communication with the end outlet (4), so that said partial assembly can later be incorporated, as a single mounting element, together with the valve (8) for closing the central chamber (5) on the other side, with the bimetal (13) and with the cover (14) for closing the entire assembly, within the outer casing (1).

[0022] The retention of the closure is established, according to an embodiment, by means of a ring (18) with an inclined edge, which allows a forced insertion in the outer casing (1), determining an interlock which prevents retreat and therefore dismantling, as observed in Figure 6, a sealing gasket (19) being incorporated between said ring (18) and the cover (14).

[0023] Without the concept of the thermostatic valve according to the invention being altered, said closure of

the functional assembly can be established with other solutions for retaining the mounting, for example by means of the engagement of the cover (14) itself with fingers or flanges in its periphery, in an annular housing or multiple corresponding housings, of the inner face of the outer casing (1).

[0024] In the installation of application the thermostatic valve is fixed by means of welding at the edge of the mouth of the outer casing (1) on the filter to which it is applied, so that the functional assembly is closed with complete leak tightness, without any possibility of fuel leaks through joints in the valve formation.

[0025] Figure 7 depicts a practical embodiment of the thermostatic valve, with component parts of a different configuration, but which complies with the same functional concept, incorporating an additional sealing gasket (20) between the functional assembly, the cover (14) and the outer casing (1), the retention of the cover (14) being established by means of a spring ring (21).

Claims

1. A thermostatic valve for fuel circuits, of the type intended to establish a distribution of the circulation of the hot fuel of the injection pump return of an engine, between the filter of the circuit for supplying fuel to the engine and a conduit towards the fuel tank, the thermostatic valve comprising an outer casing (1) from which extend respective tubes (2 and 3) for connecting to the injection pump return and to the conduit towards the fuel tank, there being, within said casing (1), a functional assembly determining a central chamber (5) with which the tube (3) for the connection to the injection pump return communicates, and **characterized in that** said central chamber (5) is closed at the ends by means of respective check valves (8 and 9) with respect to a second chamber (11) into which the tube (2) for connection towards the fuel tank opens out, and with respect to a third chamber (12) communicating with an end outlet (4) for communication with the filter of the fuel circuit, and **in that** a bimetal (13) is internally arranged, within said third chamber (12), facing said end outlet (4), which bimetal determines the closing and opening thereof according to the temperature.
2. The thermostatic valve for fuel circuits according to claim 1, **characterized in that** the outer casing (1) is structured in a single part, determining a continuous covering on the functional assembly, without out-er joints.
3. The thermostatic valve for fuel circuits according to claim 1, **characterized in that** the functional assembly is secured and closed in the mounting arrangement by means of a cover (14) which is established in an axial retention, by means of a ring (18) or with

its own conformations, with respect to the outer casing (1).

4. The thermostatic valve for fuel circuits according to claim 1, **characterized in that** the functional assembly comprises a body (15) and a receptacle (16) which are coupled to one another with a snap-fitting interlock (17), forming an independent partial mounting assembly which is incorporated as a single element in the insertion of the functional assembly with respect to the outer casing (1).
5. A fuel circuit comprising a filter and a thermostatic valve according to any one of claims 1-4 arranged over said filter, with said end outlet (4) in communication with the inside of the filter, wherein an edge of a mouth of said outer casing (1) of the thermostatic valve is fixed to said filter by means of welding.
6. The fuel circuit of claim 5, further comprising a fuel tank and a fuel injection pump, the tube (2) for connecting the thermostatic valve to the fuel tank being connected to said fuel tank, and the tube (3) for connecting the thermostatic valve to the injection pump return being connected to said fuel injection pump.
7. A method for assembling a thermostatic valve according to any one of claims 1-4, comprising the steps of:
 - mounting a partial assembly formed by a body (15) and a receptacle (16) coupled to one another with a snap-fitting interlock (17), including therein the check valve (9) for closing the central chamber (5) with respect to the third chamber (12);
 - incorporating said partial assembly, as a single mounting element, together with the check valve (8) for closing the central element (5) with respect to the second chamber (11), with the bimetal (13) and with a cover (14), the end outlet (4) of the valve being determined through said cover (14).

Patentansprüche

1. Thermostatventil für Kraftstoffkreisläufe des Typs, der dazu bestimmt ist, eine Verteilung der Zirkulation des heißen Kraftstoffs des Injektionspumpenrücklaufs einer Maschine zwischen dem Filter des Kreislaufs zum Zuführen von Kraftstoff zu der Maschine und einer Leitung zu dem Kraftstofftank herzustellen, wobei das Thermostatventil ein äußeres Gehäuse (1) aufweist, von dem sich jeweilige Röhren (2 und 3) zum Verbinden des Injektionspumpenrücklaufs und der Leitung zu dem Kraftstofftank erstrecken, wobei innerhalb des Gehäuses (1) eine Funk-

- tionsbaugruppe besteht, die eine zentrale Kammer (5) festlegt, mit der die Röhre (3) zum Verbinden des Injektionspumpenrücklaufs kommuniziert, und **dadurch gekennzeichnet, dass** die zentrale Kammer (5) an den Enden mittels jeweiliger Rückschlagventile (8 und 9) in Bezug auf eine zweite Kammer (11) geschlossen ist, in die die Röhre (2) zum Verbinden mit dem Kraftstofftank mündet, und in Bezug auf eine dritte Kammer (12), die mit einem Endauslass (4) zur Kommunikation mit dem Filter des Kraftstoffkreislaufs kommuniziert, und dadurch, dass ein Bimetall (13) innerhalb der dritten Kammer (12), dem Endauslass (4) zugewandt, eingerichtet ist, wobei das Bimetall das Schließen und das Öffnen in Abhängigkeit von der Temperatur bestimmt.
2. Thermostatventil für Kraftstoffkreisläufe gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das äußere Gehäuse (1) in einem einzigen Teil strukturiert ist, das eine kontinuierliche Abdeckung auf der Funktionsbaugruppe ohne äußere Dichtungen festlegt.
3. Thermostatventil für Kraftstoffkreisläufe gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Funktionsbaugruppe in der Montageanordnung mittels einer Abdeckung (14) gesichert und geschlossen ist, die in einer axialen Rückhaltung mittels eines Rings (18) oder mit ihren eigenen Ausbildungen in Bezug auf das äußere Gehäuse (1) erstellt ist.
4. Thermostatventil für Kraftstoffkreisläufe gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Funktionsbaugruppe einen Körper (15) und eine Aufnahme (16) aufweist, die miteinander mit einer Schnappverriegelung (17) gekuppelt sind, indem eine unabhängige teilweise Montagebaugruppe gebildet wird, die als ein einzelnes Element bei dem Einfügen der Funktionsbaugruppe in Bezug auf das äußere Gehäuse (1) eingebaut ist.
5. Kraftstoffkreislauf, der ein Filter und ein Thermostatventil gemäß einem der Ansprüche 1 bis 4 aufweist, das über dem Filter mit dem Endauslass (4) in Kommunikation mit dem Inneren des Filters angeordnet ist, wobei eine Kante einer Öffnung des äußeren Gehäuses (1) des Thermostatventils an dem Filter durch Schweißen befestigt ist.
6. Kraftstoffkreislauf nach Anspruch 5, der ferner einen Kraftstofftank und eine Kraftstoffinjektionspumpe aufweist, wobei die Röhre (2) zum Verbinden des Thermostatventils mit dem Kraftstofftank an dem Kraftstofftank befestigt ist und die Röhre (3) zum Verbinden des Thermostatventils dem Injektionspumpenrücklauf mit der Kraftstoffinjektionspumpe verbunden ist.
7. Verfahren zum Zusammenbauen eines Thermostat-

ventils gemäß einem der Ansprüche 1 bis 4, das die folgenden Schritte aufweist:

- Montieren einer teilweisen Baugruppe, die aus einem Körper (15) und einer Aufnahme (16), die miteinander mit einer Schnappverriegelung (17) gekuppelt sind, in der das Rückschlagventil (9) zum Schließen der zentralen Kammer (5) in Bezug auf die dritte Kammer (12) enthalten ist, ausgebildet ist,
- Einbauen der teilweisen Baugruppe als ein einziges Montageelement gemeinsam mit dem Rückschlagventil (8) zum Schließen des zentralen Elements (5) in Bezug auf die zweite Kammer (11), mit dem Bimetall (13) und mit einer Abdeckung (14), wobei der Endauslass (4) des Ventils durch die Abdeckung (14) festgelegt ist.

Revendications

1. Soupape thermostatique pour des circuits de carburant, du type prévu pour établir une distribution de la circulation du carburant chaud du retour de pompe à injection d'un moteur, entre le filtre du circuit destiné à délivrer du carburant au moteur et une conduite vers le réservoir de carburant, la soupape thermostatique comportant un boîtier extérieur (1) duquel s'étendent des tubes respectifs (2 et 3) pour le raccordement au retour de pompe à injection et à la conduite vers le réservoir de carburant, avec, dans ledit boîtier (1), un ensemble fonctionnel déterminant une chambre centrale (5) avec laquelle le tube (3) pour le raccordement au retour de pompe à injection communique, et **caractérisée en ce que** ladite chambre centrale (5) est fermée aux extrémités au moyen de clapets anti-retour respectifs (8 et 9) par rapport à une deuxième chambre (11) dans laquelle s'ouvre le tube (2) pour le raccordement vers le réservoir de carburant, et par rapport à une troisième chambre (12) qui communique avec une sortie d'extrémité (4) pour communication avec le filtre du circuit de carburant, et **en ce qu'un** bimétal (13) est disposé de manière interne, à l'intérieur de ladite troisième chambre (12), en faisant face à ladite sortie d'extrémité (4), lequel bimétal détermine sa fermeture et son ouverture en fonction de la température.
2. Soupape thermostatique pour des circuits de carburant selon la revendication 1, **caractérisée en ce que** le boîtier extérieur (1) est structuré dans une partie unique, déterminant un capotage continu de l'ensemble fonctionnel, sans joints externes.
3. Soupape thermostatique pour des circuits de carburant selon la revendication 1, **caractérisée en ce que** l'ensemble fonctionnel est fixé et fermé dans l'agencement de montage au moyen d'un capot (14)

qui est établi dans une retenue axiale, au moyen d'une bague (18) ou avec ses propres conformations, par rapport au boîtier extérieur (1).

4. Soupape thermostatique pour des circuits de carburant selon revendication 1, **caractérisée en ce que** l'ensemble fonctionnel comporte un corps (15) et un réceptacle (16) qui sont reliés l'un à l'autre avec une liaison à encliquetage (17), formant un ensemble de montage partiel indépendant qui est incorporé comme un élément unique dans l'insertion de l'ensemble fonctionnel par rapport au boîtier extérieur (1). 5
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5. Circuit de carburant comportant un filtre et une soupape thermostatique selon l'une quelconque des revendications 1 à 4 disposée au-dessus dudit filtre, avec ladite sortie d'extrémité (4) en communication avec l'intérieur du filtre, dans lequel un bord d'une embouchure dudit boîtier extérieur (1) de la soupape thermostatique est fixé sur ledit filtre au moyen d'une soudure. 15
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6. Circuit de carburant selon la revendication 5, comportant en outre un réservoir de carburant et une pompe à injection de carburant, le tube (2) destiné à relier la soupape thermostatique au réservoir de carburant étant relié audit réservoir de carburant, et le tube (3) destiné à relier la soupape thermostatique au retour de pompe à injection étant relié à ladite pompe à injection de carburant. 25
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7. Procédé d'assemblage d'une soupape thermostatique selon l'une quelconque des revendications 1 à 4, comportant les étapes consistant à : 35
 - monter un ensemble partiel formé par un corps (15) et un réceptacle (16) reliés l'un à l'autre avec une liaison à encliquetage (17), comprenant un clapet anti-retour (9) destiné à fermer la chambre centrale (5) par rapport à la troisième chambre (12) ; 40
 - incorporer ledit ensemble partiel, comme unique élément de montage, avec le clapet anti-retour (8) destiné à fermer l'élément central (5) par rapport à la deuxième chambre (11), avec le bimétal (13) et avec un couvercle (14), la sortie d'extrémité (4) de la soupape étant déterminée à travers ledit couvercle (14). 45

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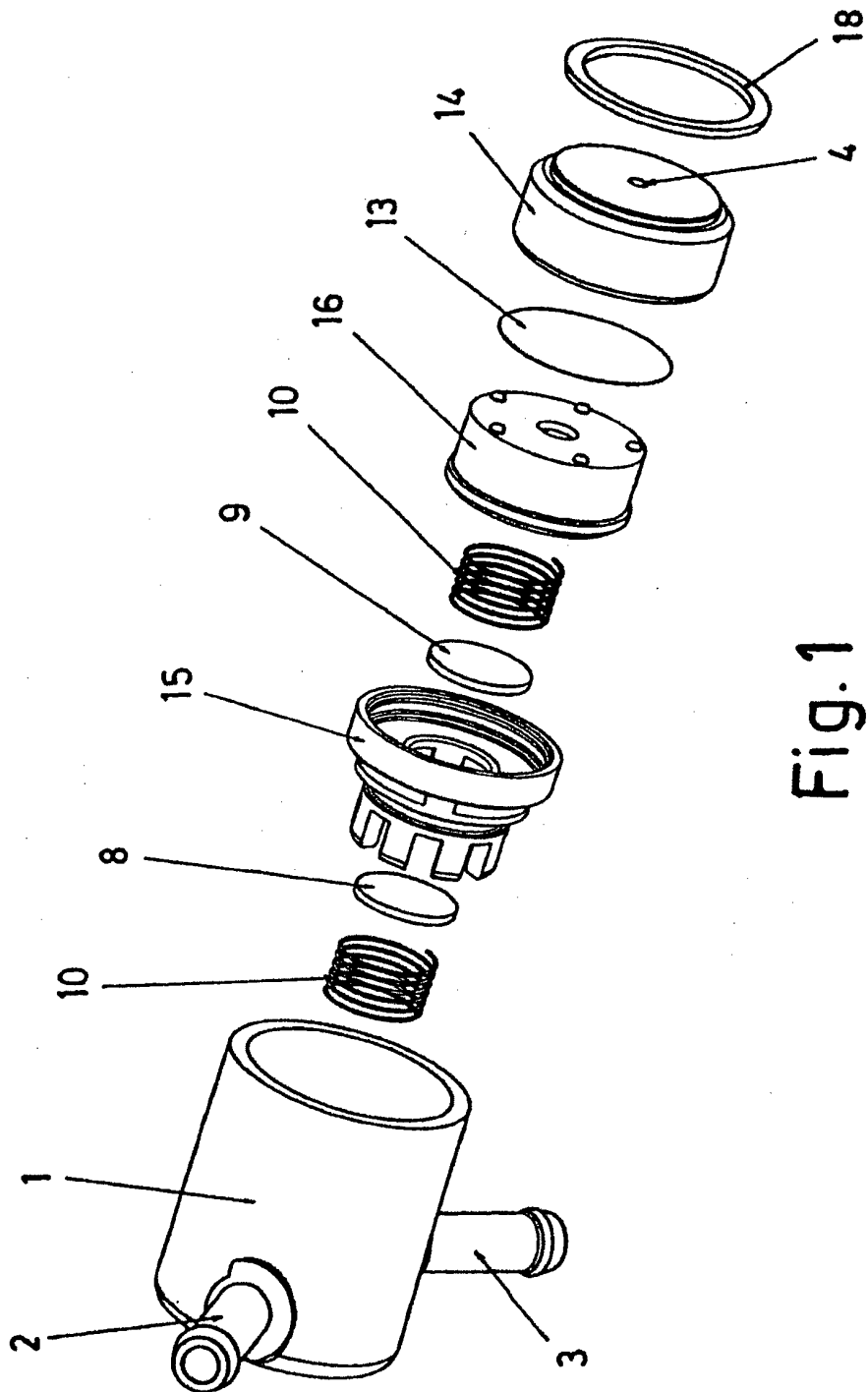
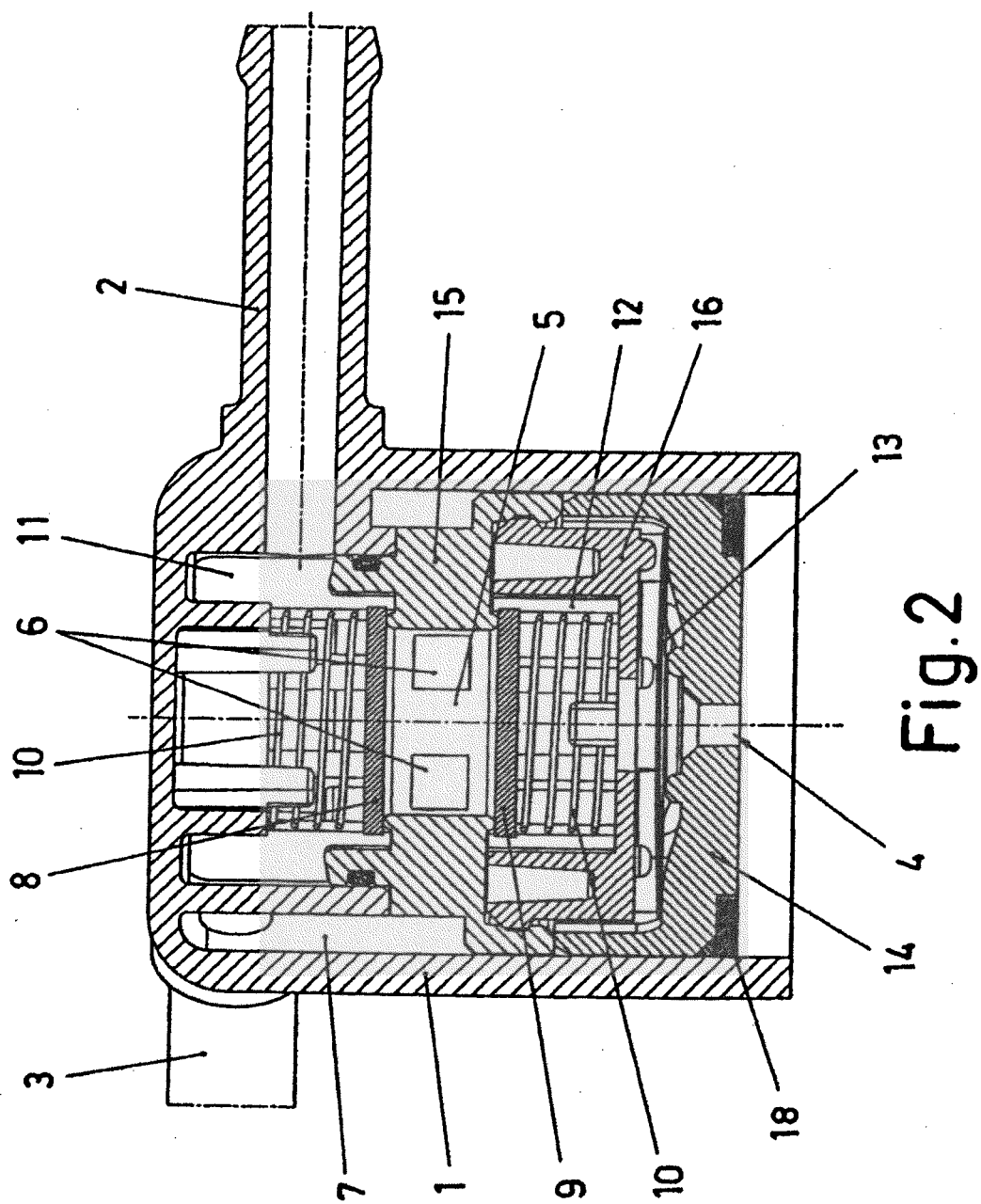
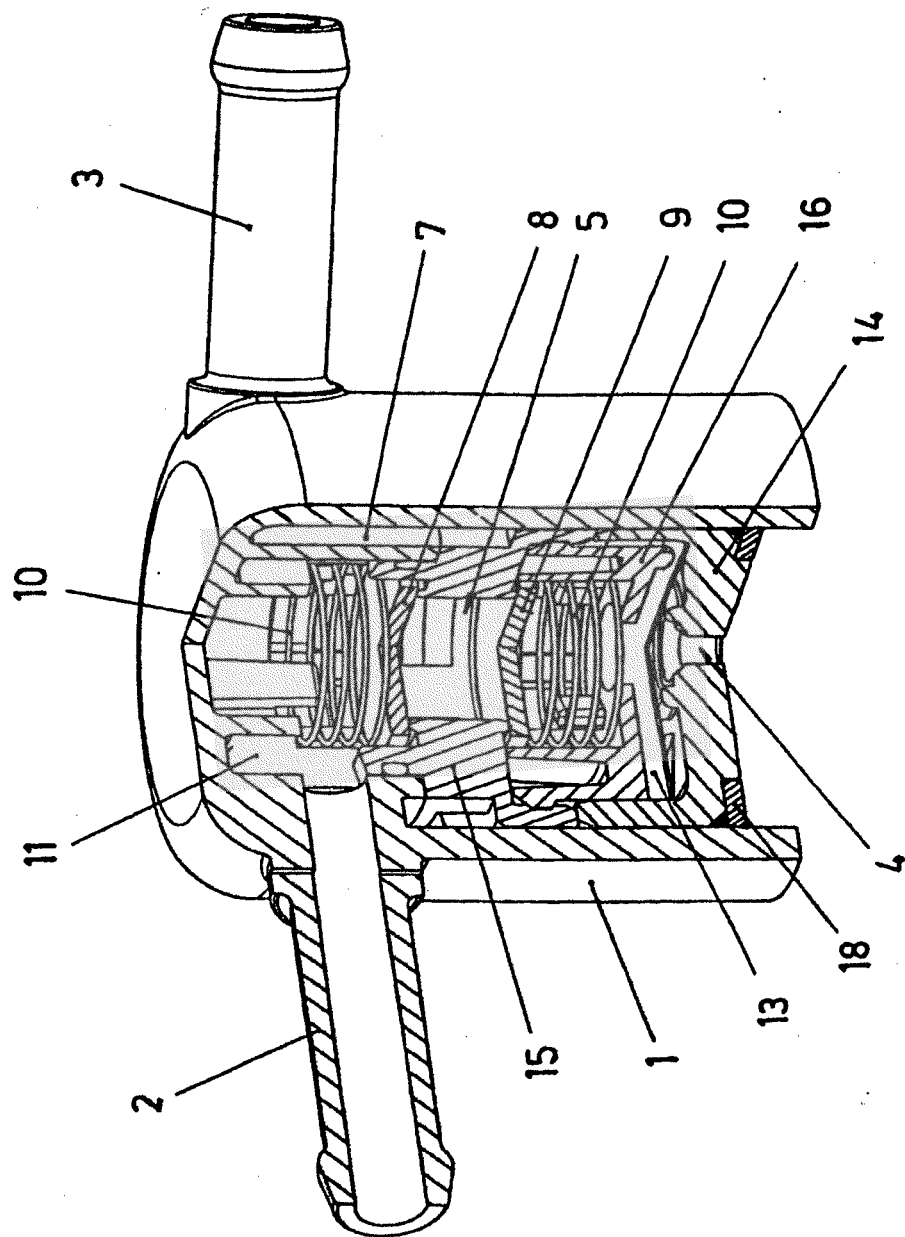


Fig.1





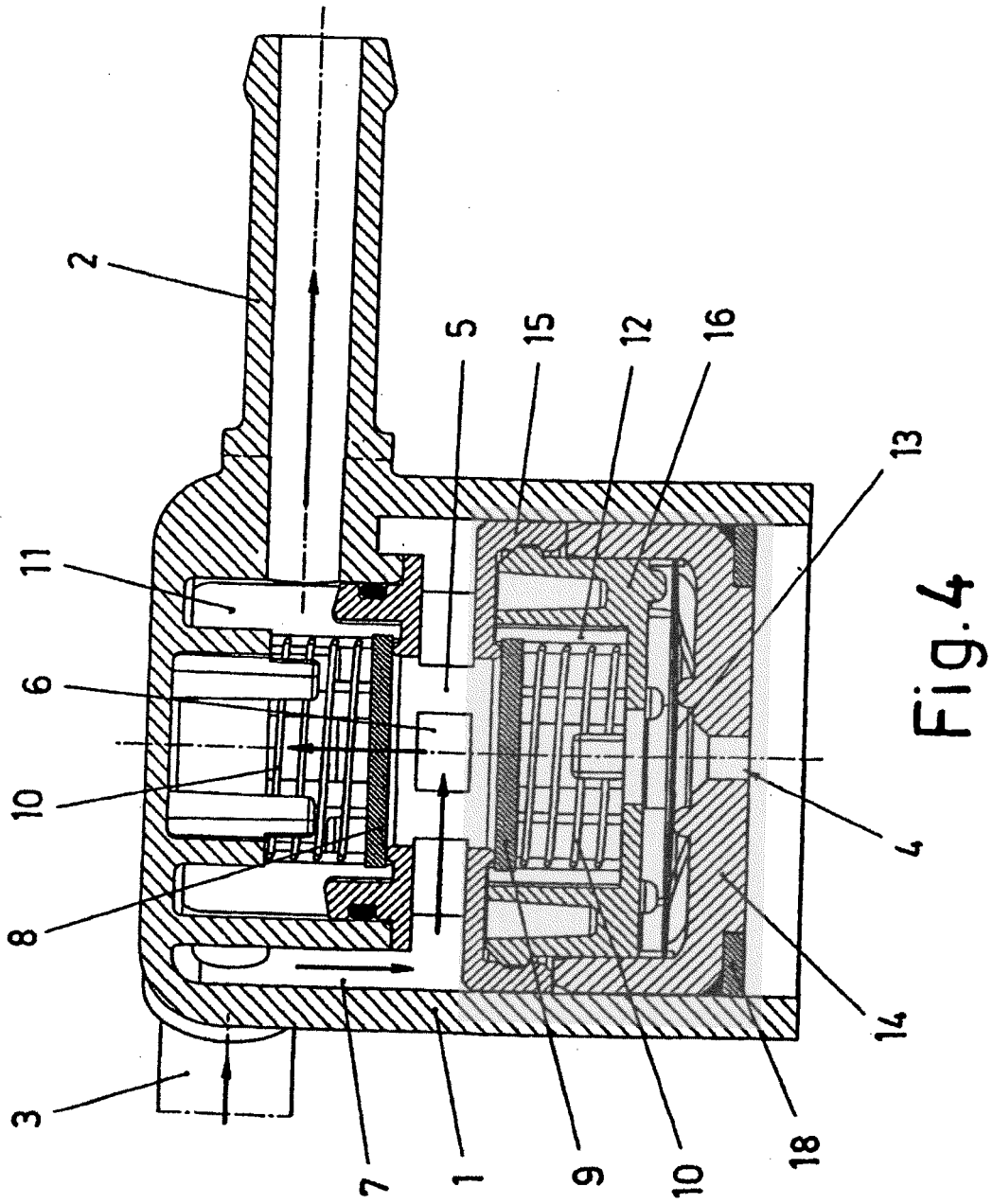


Fig. 4

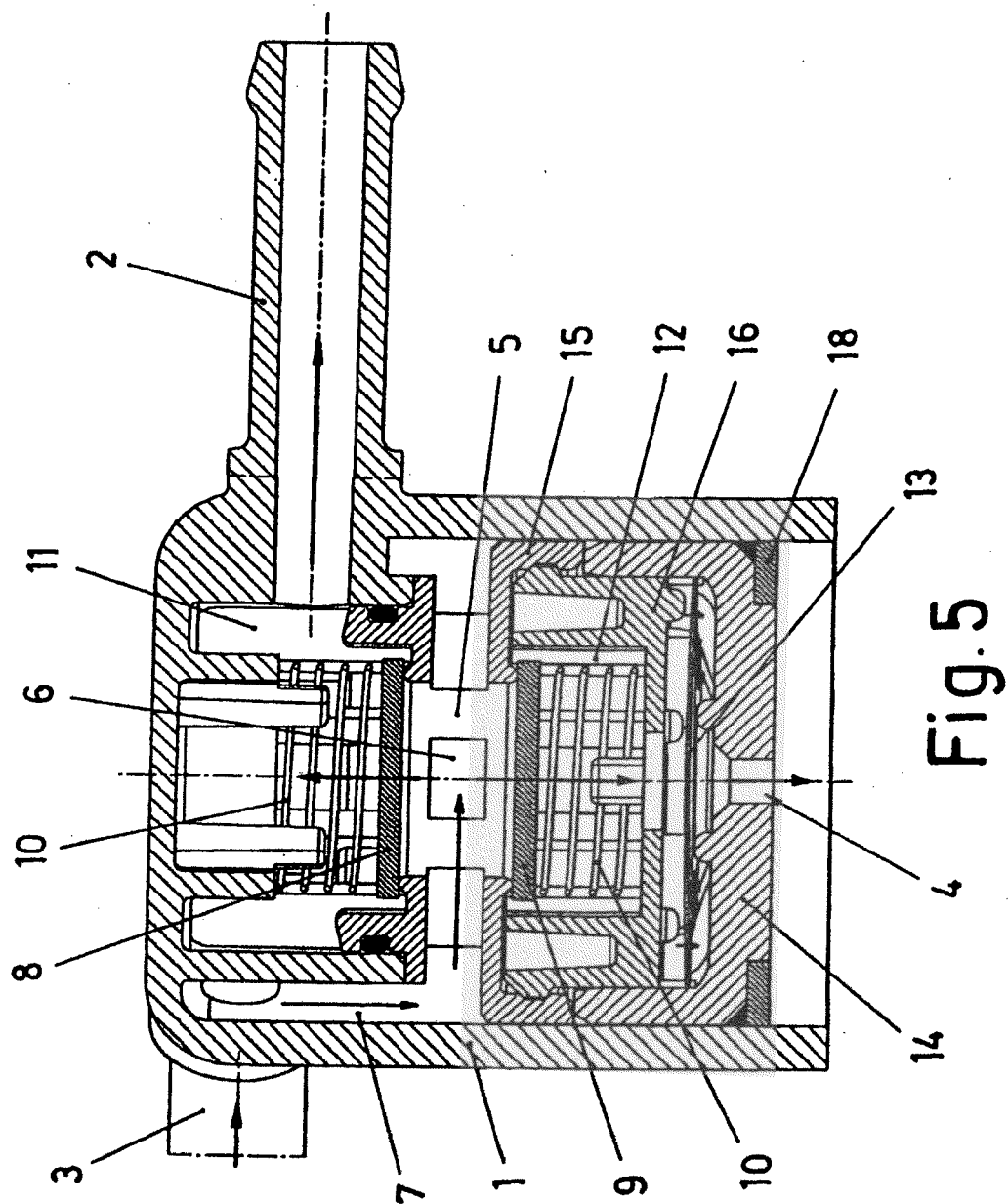


Fig. 5

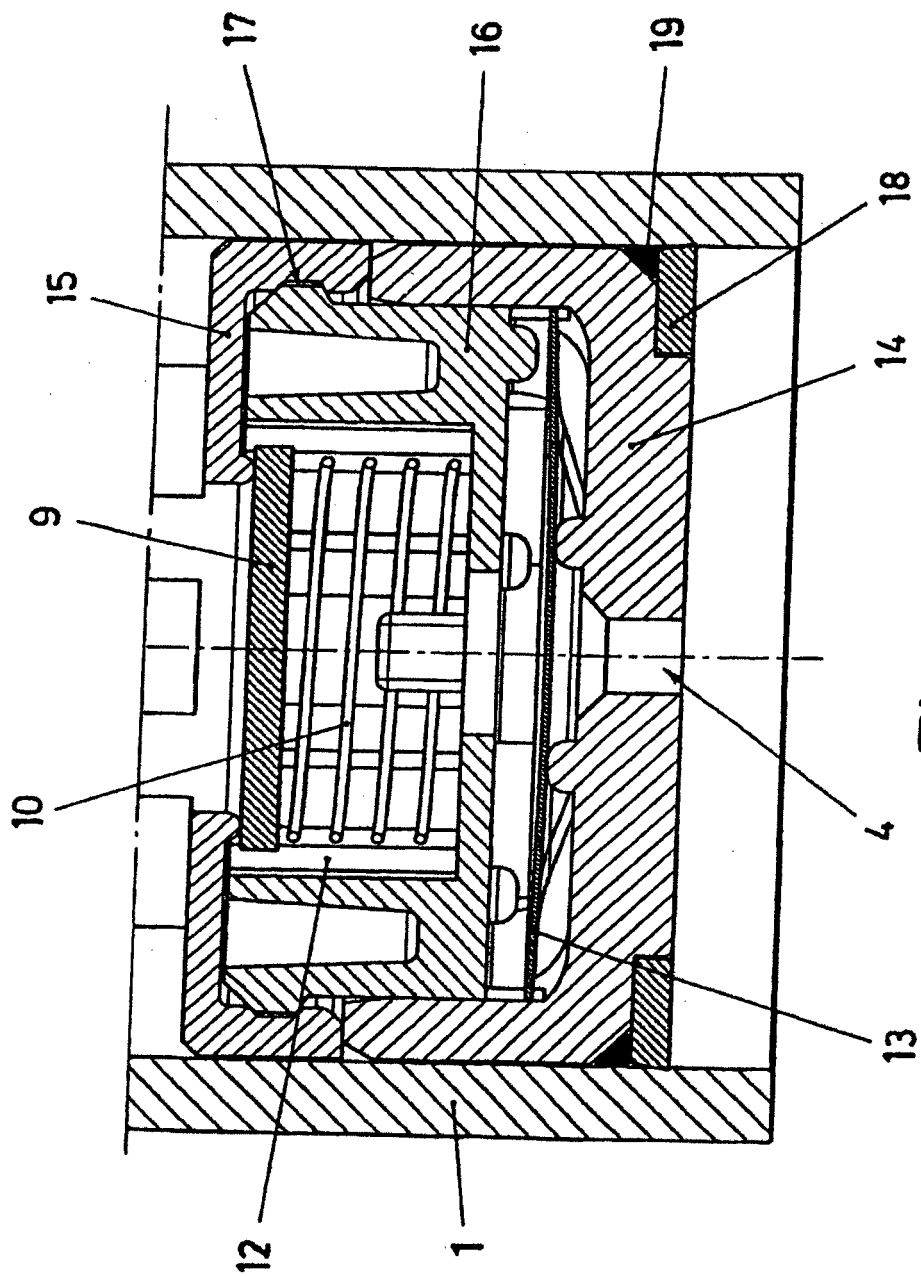


Fig. 6

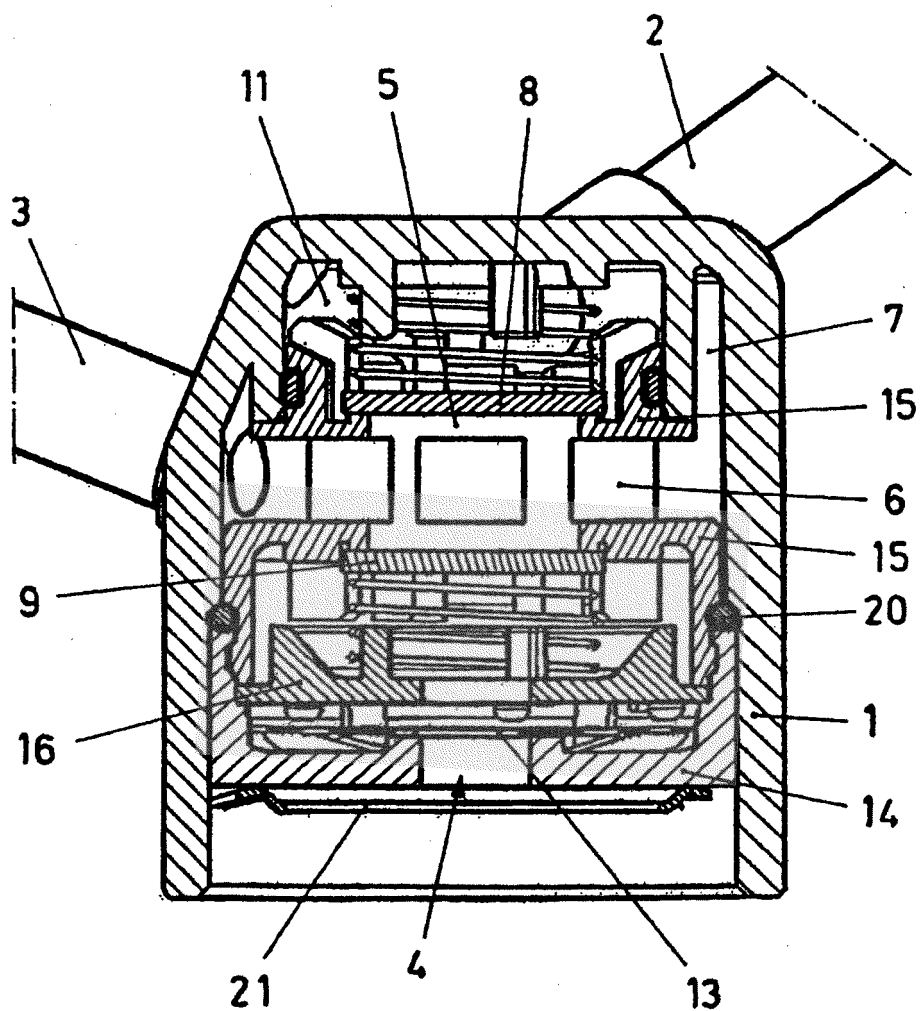


Fig.7

REFERENCES CITED IN THE DESCRIPTION

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