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(54) **Exhaust gas recirculation**

Abgasrückführung

Recyclage des gaz d'échappement

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- **PATENT ABSTRACTS OF JAPAN vol. 1996, no. 11, 29 November 1996 (1996-11-29) -& JP 08 177649 A (SANWA SEIKI CO LTD), 12 July 1996 (1996-07-12) -& DATABASE WPI Section PQ, Week 199638 Derwent Publications Ltd., London, GB; Class Q53, AN 1996-373795 XP002238712 & JP 08 177649 A (MIWA SEIKI KK), 12 July 1996 (1996-07-12)**

EP 1 426 603 B2

Description

[0001] The present invention relates to exhaust gas recirculation (EGR) and in particular to cooling arrangements for exhaust gas recirculation.

[0002] It is known to recirculate exhaust gases back into the cylinders of an internal combustion engine, such an arrangement being referred to in the art as 'Exhaust Gas Recirculation' (EGR). One benefit of EGR is a reduction in peak combustion temperature, which in turn reduces the emission of oxides of nitrogen (No_x) into the atmosphere.

[0003] It is further known to control the combination of recirculated exhaust gas and intake gases entering the cylinder using an exhaust gas recirculation valve. Exhaust gases that pass through the EGR valve are at high temperatures and may raise the temperature of the valve itself to the extent that direct damage or reduced durability may be experienced.

[0004] The increasing use of exhaust gas recirculation valves having an integral body incorporating a gas passage and further including an integral actuator portion connected thereto can give rise to problems of heat transfer from the gases passing through the valve assembly. The gases can heat up the actuator portion either directly or possibly by heat transfer from parts of the body heated up by the gases passing therethrough. The actuator may comprise an electrical solenoid valve that could suffer damage from excess heat. Some prior art arrangements resort to providing cooling passages integrated into the valve assembly, but this can lead to complicated valve designs and/or installations.

[0005] In JP2000282964, a cooling arrangement is proposed for circulating engine cooling fluid around an EGR valve. In this arrangement, the valve assembly includes a valve portion that is integrated into a manifold and is operably connected to an actuator mounted on the same manifold. Exhaust gases passing through the recirculation passage defined in the manifold heat up the surrounding manifold material. Heat from the manifold may be transferred to the actuator and cooling passages are formed in such a manner as to circulate cooling water around a valve guide and around the inside of part of the actuator.

[0006] In JP11141411, an EGR valve is provided in which a valve body includes a cooling jacket formed as an integral part of that body. Cooling liquid is thereby circulated around inside the body of the EGR valve.

[0007] In either case, the actuator portion of the EGR valve is protected by cooling water circulating around inside parts of the valve assembly. In the first case, part of the valve assembly is integrated into a manifold which complicates casting and machining of the manifold and calls for sophisticated assembly work to get the valve mechanism installed. In the second case, a complicated valve design is called for with good internal sealing so as to circulate cooling liquid around its insides. Both of these proposals are therefore examples of expensive customised EGR valve installations. Neither arrangement lends itself to the use and cooling of some types of EGR valve that may be available at a lower overall cost, such as for example the general type of unit disclosed in US-6443135-B1.

[0008] In EP-1010887, a device for mounting an exhaust gas recirculation valve is proposed in which an EGR valve is buried in an engine block. The valve is fitted into a mounting hole in the engine block in the proximity of a conventional cooling passage that is there for cooling the engine.

[0009] It is an object of the present invention to provide an improved exhaust gas recirculation arrangement and in particular to provide an improved cooling arrangement for an exhaust gas recirculation valve.

[0010] Accordingly, the present invention provides an exhaust gas recirculation arrangement for an engine, the arrangement comprising an exhaust gas recirculation (EGR) valve having a body portion in which is housed a valve element moveable to control a flow of recirculated exhaust gas through said body portion and having an actuator portion connected to said body portion and operably connected to said valve element so as to control movement thereof, said arrangement further comprising an engine manifold adapted for mounting thereto of said exhaust gas recirculation valve and having at least one coolant passage defined therein, said body portion being in unit construction with said actuator portion, said exhaust gas recirculation valve being mounted to said manifold by substantially encasing at least a part of said body portion in a recess defined in said manifold and in use coolant being circulated through said coolant passage in such a manner that said coolant conducts heat away from a region of said manifold in which is defined said recess, characterised in that said coolant passage is routed around at least a portion of said recess.

[0011] The conduction of heat away from said recess region removes heat from the body portion and is thereby also preferably adapted to cool exhaust gas being recirculated through said body portion. The arrangement ensures low levels of heat build up from the recirculated exhaust gas in the actuator portion or similarly vulnerable parts of the valve such as a valve element, valve seat or a valve guide, i.e. heat transfer from the recirculated exhaust gases or via heat soak of the body portion and/or its surroundings. The problem of heat transfer is tackled close to its source, rather than letting the actuator portion get hot and then trying to reduce the effects. The result is achieved in a manner that enables the use of a simple valve design with no integral liquid cooling of its own called for.

[0012] Said coolant passage may be enclosed in a material forming said manifold and may be routed through said material at least in part around said recess.

[0013] At least a portion of said coolant passage may be defined in a material forming said manifold as an open coolant channel and said open coolant channel may be routed at least in part around said recess.

[0014] Said encased body portion may be separated from substantially direct fluid communication with coolant in said open coolant channel by the provision in said recess of a liner.

[0015] Said liner may comprise a wet liner, preferably substantially directly wetted in use by liquid from said open coolant channel.

[0016] Said arrangement may further comprise an exhaust gas cooler adapted to cool recirculated exhaust gas upstream of said exhaust gas recirculation valve.

[0017] Said encased body portion of said valve may be substantially cylindrical and said recess may be defined in said manifold as a substantially complementary bore.

[0018] The present invention also provides a method of cooling an exhaust gas recirculation (EGR) valve of an engine, the method including :

a) providing a manifold having a recess defined therein at least partially surrounded by at least one integrated coolant passage ;
b) substantially encasing at least a part of a body portion of a said exhaust gas recirculation valve in said recess ; and
c) passing coolant through said integrated coolant passage so as to conduct heat away from a region of said manifold in which is defined said recess.

[0019] The method may include providing a liner in said recess and may include wetting said liner substantially directly using coolant in said coolant passage. Said coolant may comprise a liquid coolant and may comprise a liquid coolant supplied from a cooling system of an engine.

[0020] The present invention will now be described by way of example only and with reference to the accompanying drawings, in which :

Figure 1 is a perspective view of a manifold incorporating an installation for an exhaust gas recirculation valve ;
Figure 2 is a further perspective view of the manifold of Figure 1, shown from a different angle ;
Figure 3 is a section through an exhaust gas recirculation arrangement that includes a manifold according to Figures 1 and 2 and that has an exhaust gas recirculation valve installed therein;
Figure 4 is a variation to the exhaust gas recirculation arrangement of Figure 3 ;
Figure 5 is a section through a variation to the exhaust gas recirculation arrangement of Figure 4 ; and
Figure 6 is a schematic diagram representing flow paths of coolant liquid and recirculated exhaust gas in an exhaust gas recirculation arrangement according to the present invention.

[0021] Referring to the drawings and for the moment in particular to Figures 1 to 3, an exhaust gas recirculation (EGR) arrangement includes a mounting for installation therein of an exhaust gas recirculation (EGR) valve 10. The EGR valve mounting comprises an integral part of a manifold 12, the manifold 12 usually being connected in use to an engine (not illustrated).

[0022] Turning for the moment to details of the EGR valve 10, one non-limiting example of an EGR valve assembly that may prove suitable for use in embodying the present invention is available from Pierburg AG of Neuss, Germany. Constructional and functional details of such an EGR valve assembly are provided in US-6443135-B1, the disclosure of which is incorporated herein by way of reference.

[0023] The EGR valve 10 illustrated in section in the examples discussed herein may be considered generally similar to the type of EGR valve disclosed in US-6443135-B1. In use, the EGR valve 10 is installed into the manifold 12 and comprises an inlet port 102 and an outlet port 104. The inlet port 102 is constructed as a valve seat and gas flow from the inlet port 102 to the outlet port 104 is controlled by movement of a poppet valve 106 on and off its seat 102 by variable degrees. The poppet valve 106 runs in a valve guide 108 and is opened and closed under the control of an actuator portion 110.

[0024] The inlet port / valve seat 102, outlet port 104, valve guide 108 and gas contacting portion of the poppet valve 106 may all be housed in a casing of the EGR valve assembly 10, which will be referred to for convenience as the EGR valve's body portion 112. The EGR valve body portion 112 may be substantially cylindrical in shape and may have extending radially outwards of an upper part thereof a mounting flange 114. The actuator portion 110 is mounted onto and connected with the body portion 112 in unit construction, by which the two parts 110, 112 of the EGR valve 10 are integrated together such that they are supplied and fitted as one piece and are substantially inseparable in use.

[0025] Turning now to the manifold 12, it may be formed in one piece by a casting or moulding technique and a suitable material for at least one casting technique may be aluminium or an alloy thereof. The EGR valve mounting is formed integrally with the manifold 12 and may include a boss 14 rising from the manifold 12 and having a flat outer mounting face 16 adapted for connection with the mounting flange 114 of the EGR valve 10. The boss 14 rises from an EGR supply tract 18 of the manifold 12 and has a recess 20 defined through its mounting face 16. The recess 20 is preferably in the form of a substantially parallel bore provided with a chamfer around its outer rim and is most preferably substantially complementary to the outer profile of the body portion 112 of the EGR valve 10.

[0026] The mounting face 16 may be provided with a set of fixing holes 22 for attachment of the EGR valve mounting flange 114 to that outer face 16. The fixing holes 22 may comprise threaded holes and the fixings used may comprise threaded fasteners such as machine

screws or bolts (none illustrated).

[0027] The EGR supply tract 18 is connected via a first flange 24 to an EGR cooler 26 upstream of the EGR valve 10. The recess 20 extends down through the manifold 12 to the EGR supply tract 18, the EGR supply tract 18 defining an EGR inlet passage 28 that provides a path for recirculated exhaust gas 60 to move between the EGR cooler 26 and the inlet port 102 of an EGR valve 10 installed in the recess 20.

[0028] The manifold 12 defines an opening 30 in the side of the material defining the recess 20, the opening 30 being substantially aligned with the outlet port 104 of the EGR valve 10 when that is installed into the recess 20. The manifold 12 further defines an EGR intake tract 32, which runs from the opening 30 to a charge air intake tract 34 that forms a branch of the manifold 12. The manifold 12 may be adapted for fitting to an engine having forced induction and the charge air intake tract 34 may be fed in use with pressurised charge air by a supercharger of the engine, such as a turbo-charger connected to an upstream end thereof by a flanged turbo-charger connection 36. Any recirculated exhaust gas passed through the EGR valve 10 and along the EGR intake tract 32, joins the charge air passing along the charge air intake tract 34 and exits the manifold 12 in combination with the intake air through an intake connection 38 that forms part of a connection between the manifold 12 and one or more downstream portions of an engine intake system (not illustrated further).

[0029] A coolant inlet passage 40 and a coolant outlet passage 42 are defined and enclosed in the manifold 12, the coolant outlet 42 being disposed by way of example above the coolant inlet 40 when the manifold 12 is in its in-use position. The coolant passages 40, 42 pass through the length of the EGR manifold 12 from the first flanged connection 24 to an opposing (second) flanged connection 44. The opposing flanged connection 44 provides a connection between a coolant branch 46 of the manifold 12 and a cooling system (not illustrated further), such as a liquid based cooling system of the engine.

[0030] The coolant passages 40, 42 are integral to the manifold 12 and are surrounded by the material forming the manifold 12. The passages 40, 42 are routed around at least a portion of the recess 20, such that coolant passing in use along those passages 40, 42 conducts heat away from the manifold material in which is defined the recess 20. This provides cooling for the body 112 of the EGR valve 10 and further provides a route for coolant 48 to enter 50 and exit 52 respectively EGR cooler pipework 54. The route followed by the coolant passages 40, 42 around the recess 20 may be substantially circumferential and the EGR coolant passages 40, 42 may be interconnected by a by-pass passage 56, e.g. in the region of the second flanged connection 44.

[0031] The path illustrated for the coolant passages 40, 42 as one 42 above the other 40 may be found reversible and other configurations are possible depending on the general layout of the manifold 12. One equivalent layout may comprise a side-by-side relationship with the inlet 40 and outlet 42 splitting off and passing either side of the recess 20 to pass at least partially circumferentially around it. This layout is used for convenience in the schematic diagram of Figure 5 to illustrate the general concepts of coolant flow possible around the recess 20 in many embodiments of the present invention.

[0032] Referring for the moment in particular to Figure 6, a schematic representation of coolant flow is illustrated in which the EGR cooler pipe-work 54 may comprise a series of coolant passages running alongside and possibly also partially defining a gas duct 58. The gas duct 58 provides a passage for recirculated exhaust gases 60 to enter into the EGR inlet passage 28 defined by the EGR supply duct 18 of the EGR manifold 12. The direction of coolant flow along the coolant passages 40, 42 is preferably running away from the upstream end 62 of the cooler 26 and therefore runs alongside the gas duct 58 in a direction heading towards the manifold 12, as illustrated by the coolant flow arrows 64 in Figure 5. The direction 64 of coolant flow is preferably arranged in this manner so as to provide maximum cooling at the upstream end 62 of the coolant duct 58, where the recirculated exhaust gases 60 will be at their hottest. This means that the coolant supply inlet 66 of the EGR cooler 26 may be routed outboard of the main EGR cooler pipe-work 54 and feed into an inlet point 68 on a rear portion of that EGR coolant pipe-work 54.

[0033] In the example illustrated in Figure 3, it will be noted that the cooling passages 40, 42 are defined in the manifold 12 in a fully enclosed form and cool at least part of the material that defines the recess 20. These cooling passages 40, 42 may be formed during a casting process using a lost core technique, or by an equivalent. In Figure 4, a variation to the EGR arrangement is illustrated by way of further non-limiting example. In the example of Figure 4, manufacture of the manifold 12 is modified such that the cooling passages 40, 42 extend further around the recess 20 than in the previous example. It will be noted that the differences between the variations of Figures 3 and 4 are structural, but the essence of the EGR valve 10 mounting arrangement is unchanged and equivalent parts have been given the same reference numerals in both Figures 3 and 4.

[0034] In Figure 5, an example of a further variation of the present invention is illustrated, in which the fully enclosed cooling passages 40, 42 of the version illustrated in Figure 4 are replaced by open-sided coolant passages embodied in the form of an open-sided coolant inlet channel 400 and an open-sided coolant outlet channel 420. The open-sided channels 400, 420 are preferably formed during manufacture of the manifold 12, e.g. during a casting or moulding process. In a casting process, producing open coolant channels 400, 420 offers an advantage over use of enclosed coolant passages 40, 42 in that their open sides make it easier to remove the core material or die section. This simplifies the casting/moulding process for manifold manufacture.

[0035] In the version disclosed with particular reference to Figure 5, the open side of the coolant channels 400, 420 faces in towards the recess 20 and it is preferable to include a sleeve/liner 70 in the recess 20, i.e. between the coolant channels 400, 420 and the body portion 112 of an installed EGR valve 10. The liner 70 preferably comprises a wet liner 70, which may be wetted in use substantially directly by coolant from the coolant channels 400, 420. The version with a liner 70 may be found to be particularly advantageous in cases where the manifold 12 is made from a material such as aluminium or an alloy thereof. Such a material often has a high coefficient of expansion and may therefore be prone to leakage under some circumstances if an EGR vale 10 is installed directly into the recess 20 with no liner 70.

[0036] By isolating a part and preferably the bulk of the wet liner 70 from the manifold 12, potential problems of expansion can be dealt with at a limited number of contact points. The liner 70 may be machined and or heat treated as necessary in a separate process, e.g. so as to obtain good surface finish and substantially constant wall thickness for optimum heat transfer and sealing of water or gas paths. With some manifold materials, however, a version with no liner 70 may be possible and such an embodiment is not excluded from the present invention.

[0037] In each version of the present invention, coolant passing in use along the cooling channels 40, 42 ; 400, 420 conducts heat away from a region of the manifold in which is defined the recess 20. In the open channel version 400, 420, cooling is also directly provided at least substantially directly to the wet liner 70. The cooling in any version removes heat which has been transferred to the valve body 112 from the recirculated exhaust gases 60 and has then been transferred in turn to the manifold material surrounding the recess 20 and/or the liner 70 as the case may be.

[0038] The arrangement of the present invention is most useful in a manifold 12 or manifold/liner arrangement 12, 70 that is produced from one or more materials that are heat conductive and therefore able to absorb heat from the valve body 112. In that way, there is a reduced likelihood of heat damage being inflicted on the actuator portion 110 of the EGR valve 10 by heat transfer from either the manifold 12 and/or the valve body portion 112. The heat may arise by direct heating from the recirculated exhaust gases passing through the EGR valve 10 itself, via conduction from the body 112, from thermal gradients in the material defining the recess 20 or from heat soak. Recirculated exhaust gas 60 may be further cooled during its passage through the manifold and EGR valve assembly 10, 12.

[0039] Longevity, reliability and consistency of performance of the EGR valve 10 should thereby be improved over that of some existing arrangements. By integration of the cooling channels 40, 42 ; 400, 420, EGR valve durability may be improved when using certain types of EGR valve 10 in particular, e.g. those types of EGR valve 10 having no in-built cooling ducts and/or generally similar in principal to the type of unit construction EGR valve disclosed in US-6443135-B1. Furthermore, the present invention optimises space utilisation and is economic to implement.

[0040] By substantially directly cooling an integral body 112 of an exhaust gas recirculation valve 10 or at least its surroundings, an arrangement according to the present invention therefore removes heat from the valve body 110 and thereby from exhaust gases being recirculated through that valve body. This reduces the opportunity for heat transfer from the recirculated gases into the valve guide 108 or actuator portion 110, e.g. directly and/or via the valve body 112. The problem of heat transfer is tackled at source, rather than letting the valve guide 108 or actuator portion 110 get hot and then trying to reduce the effects, e.g. with cooling passages internal to the EGR valve 10. This form of exhaust gas cooling is additional to any cooling of recirculated exhaust gas that might take place upstream of the EGR valve 10, such cooling not necessarily being designed for reducing the effects of heat transfer to the EGR valve 10. In addition, provision of a manifold 12 having integrated cooling passages/channels 40, 42 ; 400, 420 may mean that the choice of EGR valve design is greater, as there is a reduced need to worry about heat damage to the actuator portion and no need to provide cooling passages internal to the valve.

Claims

1. An exhaust gas recirculation arrangement for an engine, the arrangement comprising an exhaust gas recirculation (EGR) valve (10) having a body portion (112) in which is housed a valve element (106) moveable to control a flow of recirculated exhaust gas (60) through said body portion and having an actuator portion (110) connected to said body portion and operably connected to said valve element so as to control movement thereof, said arrangement further comprising an engine manifold (12) adapted for mounting thereto of said exhaust gas recirculation valve and having a coolant inlet passage (40; 400) and a coolant outlet passage (42; 420) defined therein, said body portion (112) being in unit construction with said actuator portion (110), said exhaust gas recirculation valve (10) being mounted to said manifold (12) by substantially encasing at least a part of said body portion in a recess (20) defined in said manifold and in use a coolant (48) being circulated through said coolant passages (40, 42 ; 400, 420) in such a manner that said coolant conducts heat away from a region of said manifold in which is defined said recess, **characterised in that** said coolant passages (40, 42 ; 400, 420) pass through said engine manifold (12) from a first flange (24) which is configured for connection of said coolant passages to an exhaust gas recirculation cooler (26), to a second

flange (44) which is configured for connection of said coolant passages to a cooling system of the engine, said coolant passages being routed around at least a portion of said recess (20).

2. An arrangement according to claim 1, wherein the route followed by said coolant passages (40, 42 ; 400, 420) around said recess (20) is substantially circumferential.

3. An arrangement according to claim 1 or claim 2, wherein said coolant inlet passage (40, 400) and said coolant outlet passage (42, 420) are disposed one above the other.

4. An arrangement according to claim 1 or claim 2, wherein said coolant inlet passage (40, 400) and said coolant outlet passage (42, 420) are disposed in a side-by-side relationship.

5. An arrangement according to claim 4, wherein said coolant inlet passage (40, 400) and said coolant outlet passage (42, 420) split off and pass either side of said recess (20).

6. An arrangement according to any preceding claim, wherein said coolant inlet passage (40, 400) and said coolant outlet passage (42, 420) are interconnected by a by-pass passage (56).

7. An arrangement according to any preceding claim, wherein said coolant passages (40, 42; 400, 420) are enclosed in a material forming said manifold (12) and are routed through said material at least in part around said recess (20).

8. An arrangement according to any preceding claim, wherein at least a portion of said coolant passages (40, 42 ; 400, 420) is defined in a material forming said manifold (12) as an open coolant channel and said open coolant channels are routed at least in part around said recess (20).

9. An arrangement according to claim 8, wherein said encased body portion (112) is separated from substantially direct fluid communication with said coolant (48) in said open coolant channels by the provision in said recess (20) of a liner (70).

10. An arrangement according to claim 9, wherein said liner (70) comprises a wet liner, preferably substantially directly wetted in use by liquid from said open coolant channels (40, 42 ; 400, 420).

11. An arrangement according to any preceding claim, further comprising an exhaust gas cooler (26) adapted to cool recirculated exhaust gas (60) upstream of said exhaust gas recirculation valve (10).

12. A method of cooling an exhaust gas recirculation (EGR) valve of an engine, the method including:

a) providing an engine manifold (12) having a recess (20) defined therein at least partially surrounded by an integrated coolant inlet passage (40; 400) and an integrated coolant outlet passage (42; 420), said passages passing through the said engine manifold (12) from a first flange (24) which is configured for connection of said coolant passages to an exhaust gas recirculation cooler (26), to a second flange (44) which is configured for connection of said coolant passages to a cooling system of the engine ;
b) substantially encasing at least a part of a body portion (112) of a said exhaust gas recirculation valve (10) in said recess ; and
c) passing coolant (48) through said integrated coolant passages (40; 42 , 400; 420) so as to conduct heat away from a region of said manifold in which is defined said recess.

Patentansprüche

1. Abgasrückführanordnung für einen Motor, die ein Abgasrückführungsventil (10) (EGR-Ventil) mit einem Körperteil (112) umfasst, in dem ein Ventilelement (106) untergebracht ist, das zur Steuerung eines Stroms von rückgeführtem Abgas (60) durch den Körperteil beweglich ist und einen Stellgliedteil (110) aufweist, der mit dem Körperteil verbunden und mit dem Ventilelement wirkverbunden ist, um dessen Bewegung zu steuern, wobei die Anordnung weiterhin einen Motorkrümmer (12) umfasst, an dem das Abgasrückführungsventil befestigt werden kann und der einen darin definierten Kühlmitteleinlasskanal (40; 400) und einen Kühlmittelauslasskanal (42; 420) aufweist, wobei der Körperteil (112) einteilig mit dem Stellgliedteil (110) ausgebildet ist, wobei das Abgasrückführungsventil (10) durch im Wesentlichen Einschließen mindestens eines Teils des Körperteils in einer in dem Krümmer definierten Aussparung (20) an dem Krümmer (12) angebracht ist und im Gebrauch ein Kühlmittel (48) durch die Kühlmittelkanäle (40, 42; 400, 420) zirkuliert wird, so dass das Kühlmittel Wärme aus einem Bereich des Krümmers ableitet, in dem die Aussparung definiert ist, **dadurch gekennzeichnet, dass** sich die Kühlmittelkanäle (40, 42; 400, 420) durch den Motorkrümmer (12) von einem ersten Flansch (24), der zur Verbindung der Kühlmittelkanäle mit einem Abgasrückführungskühler (26) konfiguriert ist, zu einem zweiten Flansch (44), der zur Verbindung der Kühlmittelkanäle mit einem Kühlsystem des Motors konfiguriert ist, erstrecken, wobei die Kühlmittelkanäle um mindestens einen Teil der Aussparung (20) herumgeführt werden.

2. Anordnung nach Anspruch 1, bei der der Weg, in dem sich die Kühlmittelkanäle (40, 42; 400, 420) um die Aussparung (20) herum erstrecken, im Wesentlichen um den Umfang verläuft.

3. Anordnung nach Anspruch 1 oder Anspruch 2, bei der der Kühlmitteleinlasskanal (40, 400) und der Kühlmittelauslasskanal (42, 420) übereinander angeordnet sind.

4. Anordnung nach Anspruch 1 oder Anspruch 2, bei der der Kühlmitteleinlasskanal (40, 400) und der Kühlmittelauslasskanal (42, 420) in nebeneinander liegender Beziehung angeordnet sind.

5. Anordnung nach Anspruch 4, bei der sich der Kühlmitteleinlasskanal (40, 400) und der Kühlmittelauslasskanal (42, 420) teilen und auf jeder Seite der Aussparung (20) vorbeiführen.

6. Anordnung nach einem der vorhergehenden Ansprüche, bei der der Kühlmitteleinlasskanal (40, 400) und der Kühlmittelauslasskanal (42, 420) durch einen Umgehungskanal (56) miteinander verbunden sind.

7. Anordnung nach einem der vorhergehenden Ansprüche, bei der die Kühlmittelkanäle (40, 42; 400, 420) in einem Material eingeschlossen sind, das den Krümmer (12) bildet, und zumindest teilweise um die Aussparung (20) herum durch das Material geführt werden.

8. Anordnung nach einem der vorhergehenden Ansprüche, bei der mindestens ein Teil der Kühlmittelkanäle (40, 42; 400, 420) in einem Material definiert wird, das den Krümmer (12) als einen offenen Kühlmittelkanal definiert, und die offenen Kühlmittelkanäle zumindest teilweise um die Aussparung (20) herumgeführt werden.

9. Anordnung nach Anspruch 8, bei der der eingeschlossene Körperteil (112) durch Vorsehen einer Auskleidung (70) in der Aussparung (20) von im Wesentlichen direkter Strömungsverbindung mit dem Kühlmittel (48) in den offenen Kühlmittelkanälen getrennt ist.

10. Anordnung nach Anspruch 9, bei der die Auskleidung (70) eine nasse Auskleidung umfasst, die im Gebrauch vorzugsweise durch Flüssigkeit von den offenen Kühlmittelkanälen (40, 42; 400, 420) im Wesentlichen direkt benetzt wird.

11. Anordnung nach einem der vorhergehenden Ansprüche, die weiterhin einen Abgaskühler (26) umfasst, der zur Kühlung von rückgeführtem Abgas (60) stromaufwärts des Abgasrückführungsventils (10) ausgeführt ist.

12. Verfahren zur Kühlung eines Abgasrückführungsventils (EGR-Ventils) eines Motors, wobei das Verfahren Folgendes umfasst:

a) Bereitstellen eines Motorkrümmers (12) mit einer darin definierten Aussparung (20), die zumindest teilweise von einem integrierten Kühlmitteleinlasskanal (40; 400) und einem integrierten Kühlmittelauslasskanal (42; 420) umgeben ist; wobei sich die Kanäle durch den Motorkrümmer (12) von einem ersten Flansch (24), der zur Verbindung der Kühlmittelkanäle mit einem Abgasrückführungskühler (26) konfiguriert ist, zu einem zweiten Flansch (44), der zur Verbindung der Kühlmittelkanäle mit einem Kühlsystem des Motors konfiguriert ist, erstrecken;
b) im Wesentlichen Umschließen mindestens eines Teils eines Körperteils (112) des Abgasrückführungsventils (10) in der Aussparung; und
c) Leiten von Kühlmittel (48) durch die integrierten Kühlmittelkanäle (40; 42, 400; 420), um Wärme aus einem Bereich des Krümmers abzuleiten, in dem die Aussparung definiert wird.

Revendications

1. Agencement de recyclage de gaz d'échappement pour un moteur, l'agencement comprenant une soupape de recyclage de gaz d'échappement (EGR) (10) comprenant une partie de corps (112) dans laquelle un élément de soupape (106) mobile est logé pour commander un écoulement de gaz d'échappement recyclé (60) à travers ladite partie de corps, et comprenant une partie d'actionneur (110) connectée à ladite partie de corps et connectée de façon opérationnelle audit élément de soupape de manière à commander le déplacement de celui-ci, ledit agencement comprenant en outre un collecteur de moteur (12) adapté pour le montage sur celui-ci de ladite soupape de recyclage de gaz d'échappement et comprenant un passage d'entrée d'agent de refroidissement (40; 400) et un passage de sortie d'agent de refroidissement (42; 420) définis dans celui-ci, ladite partie de corps (112) constituant une structure unitaire avec ladite partie d'actionneur (110), ladite soupape de recyclage de gaz d'échappement (10) étant montée sur ledit collecteur (12) en logeant essentiellement au moins une partie de ladite partie de corps dans un évidement (20) défini dans ledit collecteur et, en service, un agent de refroidissement (48) étant mis en circulation à travers lesdits passages d'agent de refroidissement (40, 42; 400, 420) de sorte que ledit agent de refroidissement évacue la chaleur hors d'une région dudit collecteur dans laquelle ledit évidement est défini, **caractérisé en ce**

que lesdits passages d'agent de refroidissement (40, 42; 400, 420) passent à travers ledit collecteur de moteur (12) depuis une première bride (24) qui est configurée de manière à connecter lesdits passages d'agent de refroidissement à un refroidisseur à recyclage de gaz d'échappement (26), jusqu'à une deuxième bride (44), qui est configurée de manière à connecter lesdits passages d'agent de refroidissement à un système de refroidissement du moteur, lesdits passages d'agent de refroidissement s'étendant autour d'au moins une partie dudit évidement (20).

2. Agencement selon la revendication 1, dans lequel la route suivie par lesdits passages d'agent de refroidissement (40, 42; 400, 420) autour dudit évidement (20) est sensiblement circonférentielle.

3. Agencement selon la revendication 1 ou 2, dans lequel ledit passage d'entrée d'agent de refroidissement (40, 400) et ledit passage de sortie d'agent de refroidissement (42, 420) sont disposés l'un au-dessus de l'autre.

4. Agencement selon la revendication 1 ou 2, dans lequel ledit passage d'entrée d'agent de refroidissement (40, 400) et ledit passage de sortie d'agent de refroidissement (42, 420) sont disposés dans une relation côte à côte.

5. Agencement selon la revendication 4, dans lequel ledit passage d'entrée d'agent de refroidissement (40, 400) et ledit passage de sortie d'agent de refroidissement (42, 420) se séparent et passent de part et d'autre dudit évidement (20).

6. Agencement selon l'une quelconque des revendications précédentes, dans lequel ledit passage d'entrée d'agent de refroidissement (40, 400) et ledit passage de sortie d'agent de refroidissement (42, 420) sont interconnectés par un passage en dérivation (56).

7. Agencement selon l'une quelconque des revendications précédentes, dans lequel lesdits passages d'agent de refroidissement (40, 42; 400, 420) sont pratiqués dans une matière formant ledit collecteur (12) et s'étendent à travers ladite matière au moins en partie autour dudit évidement (20).

8. Agencement selon l'une quelconque des revendications précédentes, dans lequel au moins une partie desdits passages de refroidissement (40, 42; 400, 420) est définie dans une matière formant ledit collecteur (12) comme un canal d'agent de refroidissement ouvert, et lesdits canaux d'agent de refroidissement ouverts s'étendent au moins en partie autour dudit évidement (20).

9. Agencement selon la revendication 8, dans lequel ladite partie de corps enveloppée (112) est séparée de toute communication fluidique essentiellement directe avec ledit agent de refroidissement (48) dans lesdits canaux d'agent de refroidissement ouverts par la présence d'une garniture (70) dans ledit évidement (20).

10. Agencement selon la revendication 9, dans lequel ladite garniture (70) comprend une garniture humide, de préférence essentiellement directement mouillée à l'usage par un liquide provenant desdits canaux d'agent de refroidissement ouverts (40, 42; 400, 420).

11. Agencement selon l'une quelconque des revendications précédentes, comprenant en outre un refroidisseur de gaz d'échappement (26) adapté pour refroidir un gaz d'échappement recyclé (60) en amont de ladite soupape de recyclage de gaz d'échappement (10).

12. Procédé pour refroidir une soupape de recyclage de gaz d'échappement (EGR) d'un moteur, le procédé comprenant les étapes suivantes:

a) prévoir un collecteur de moteur (12) comportant un évidement (20) défini dans celui-ci au moins partiellement entouré par un passage d'entrée d'agent de refroidissement intégré (40 ; 400) et un passage de sortie d'agent de refroidissement intégré (42 ; 420), lesdits passages passant à travers ledit collecteur de moteur (12) depuis une première bride (24) qui est configurée de manière à connecter lesdits passages d'agent de refroidissement à un refroidisseur à recyclage de gaz d'échappement (26), jusqu'à une deuxième bride (44), qui est configurée de manière à connecter lesdits passages d'agent de refroidissement à un système de refroidissement du moteur;
b) loger essentiellement au moins une partie d'une partie de corps (112) d'une dite soupape de recyclage de gaz d'échappement (10) dans ledit évidement; et
c) faire passer un agent de refroidissement (48) à travers lesdits passages d'agent de refroidissement (40; 42, 400; 420) intégrés de manière à évacuer la chaleur hors d'une région dudit collecteur dans lequel ledit évidement est défini.

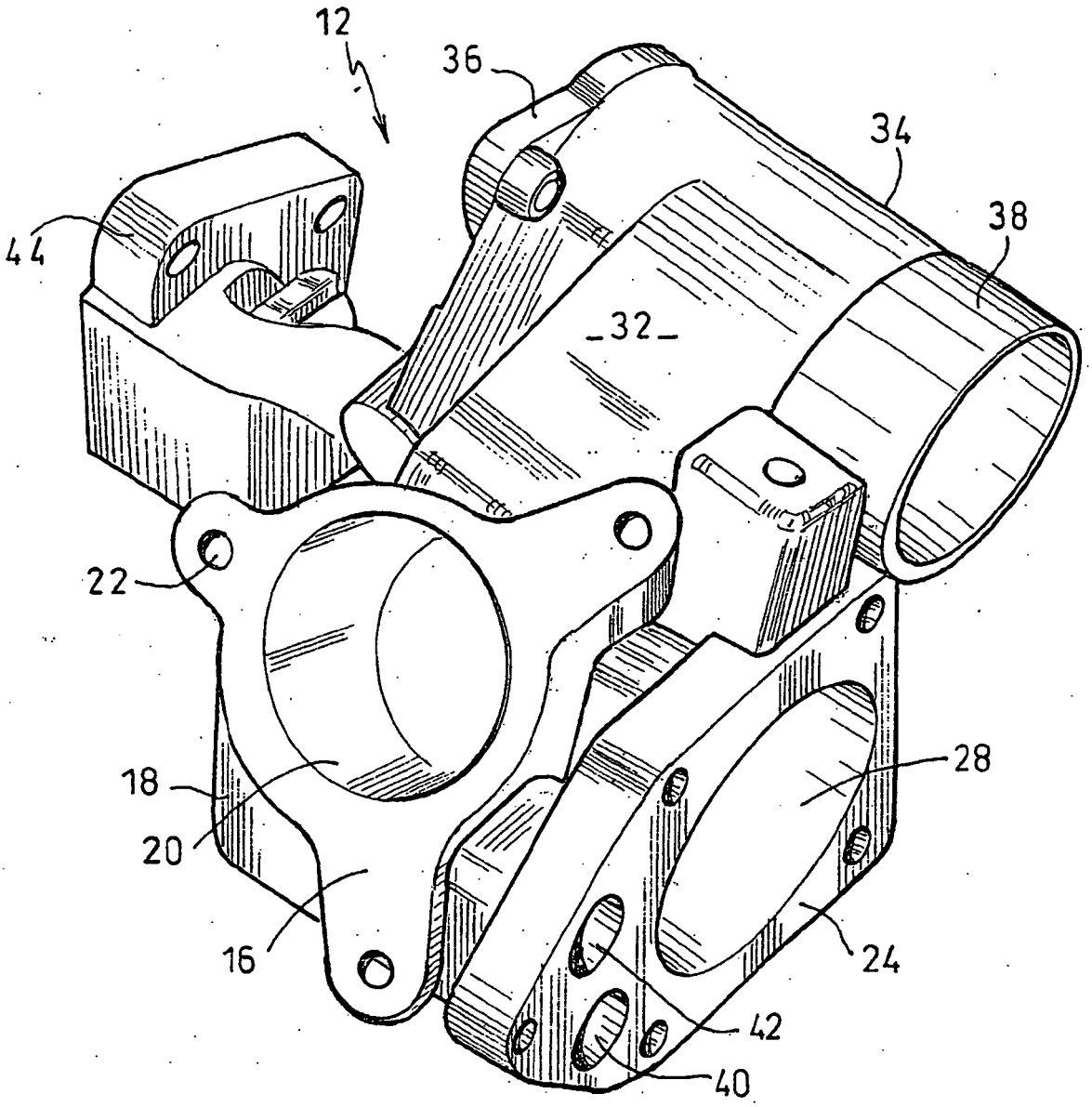


FIG.1

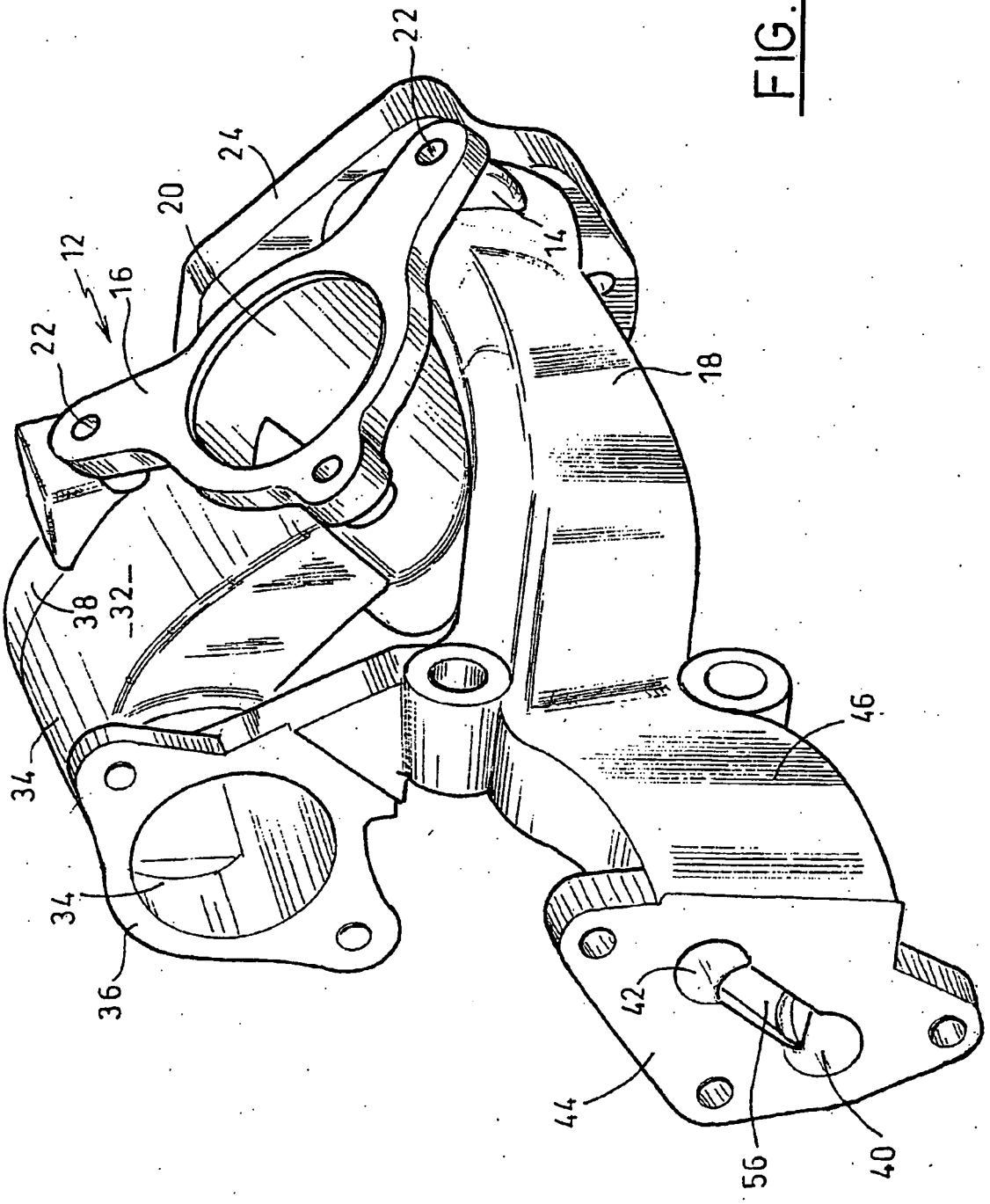


FIG.2

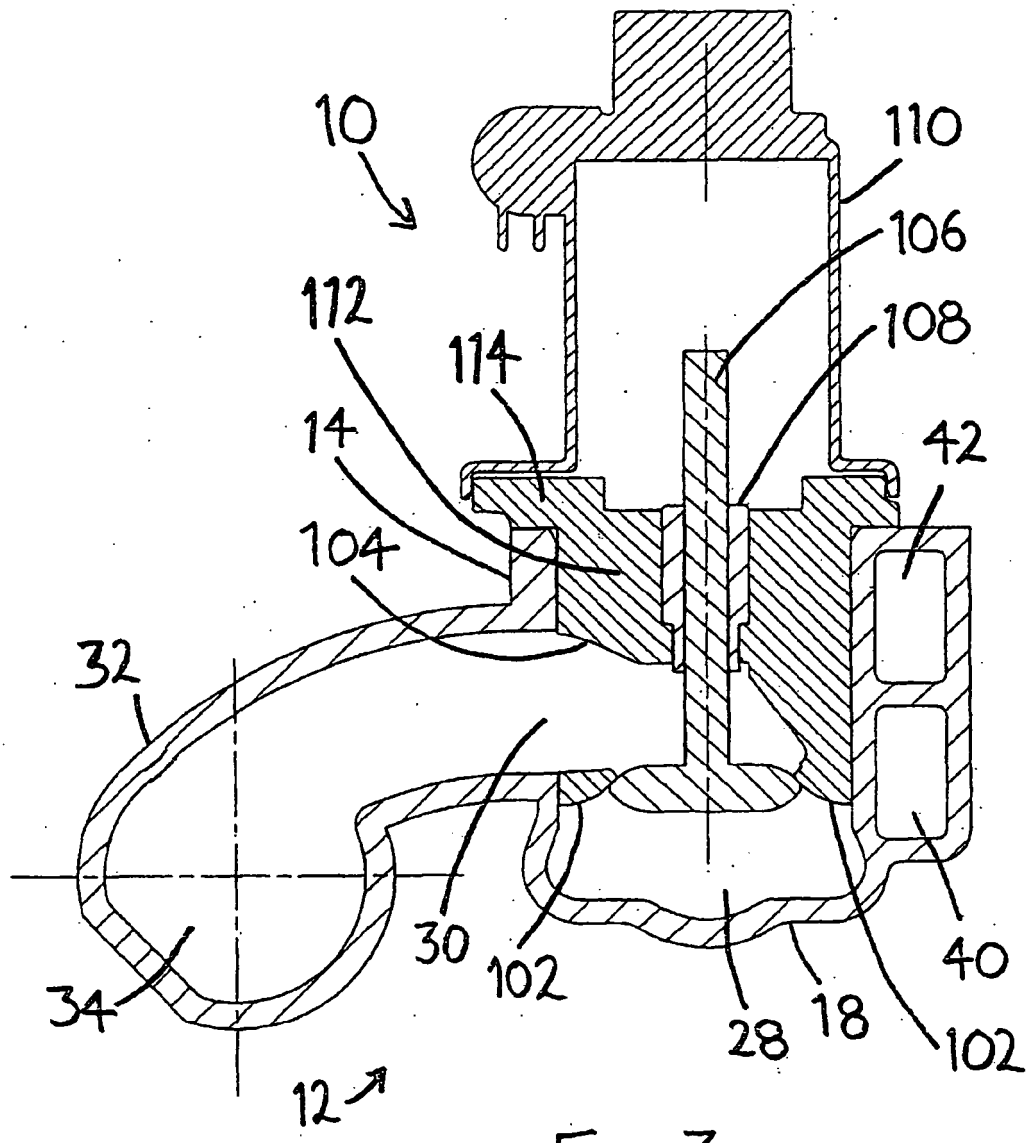


Fig. 3

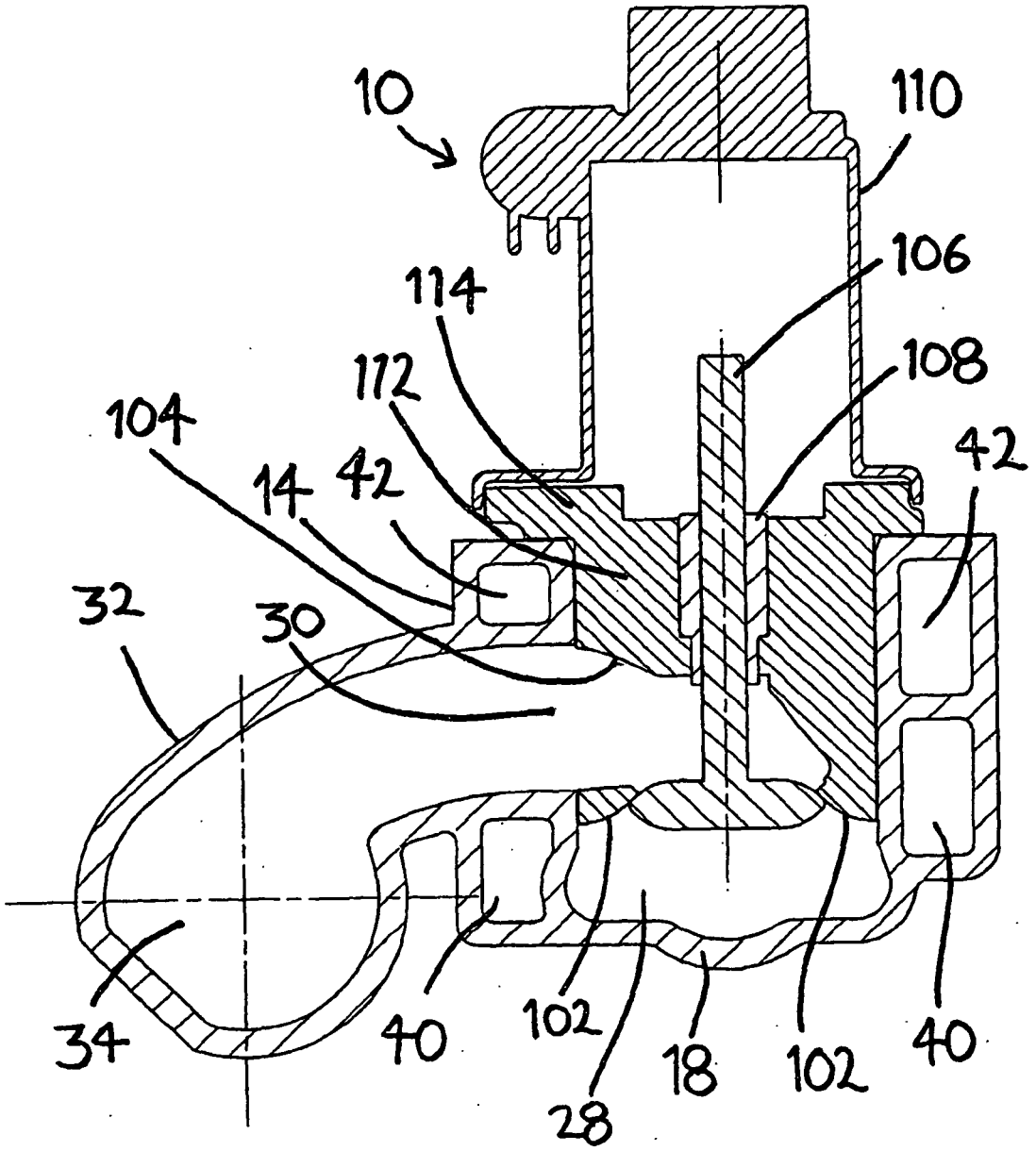


Fig.4

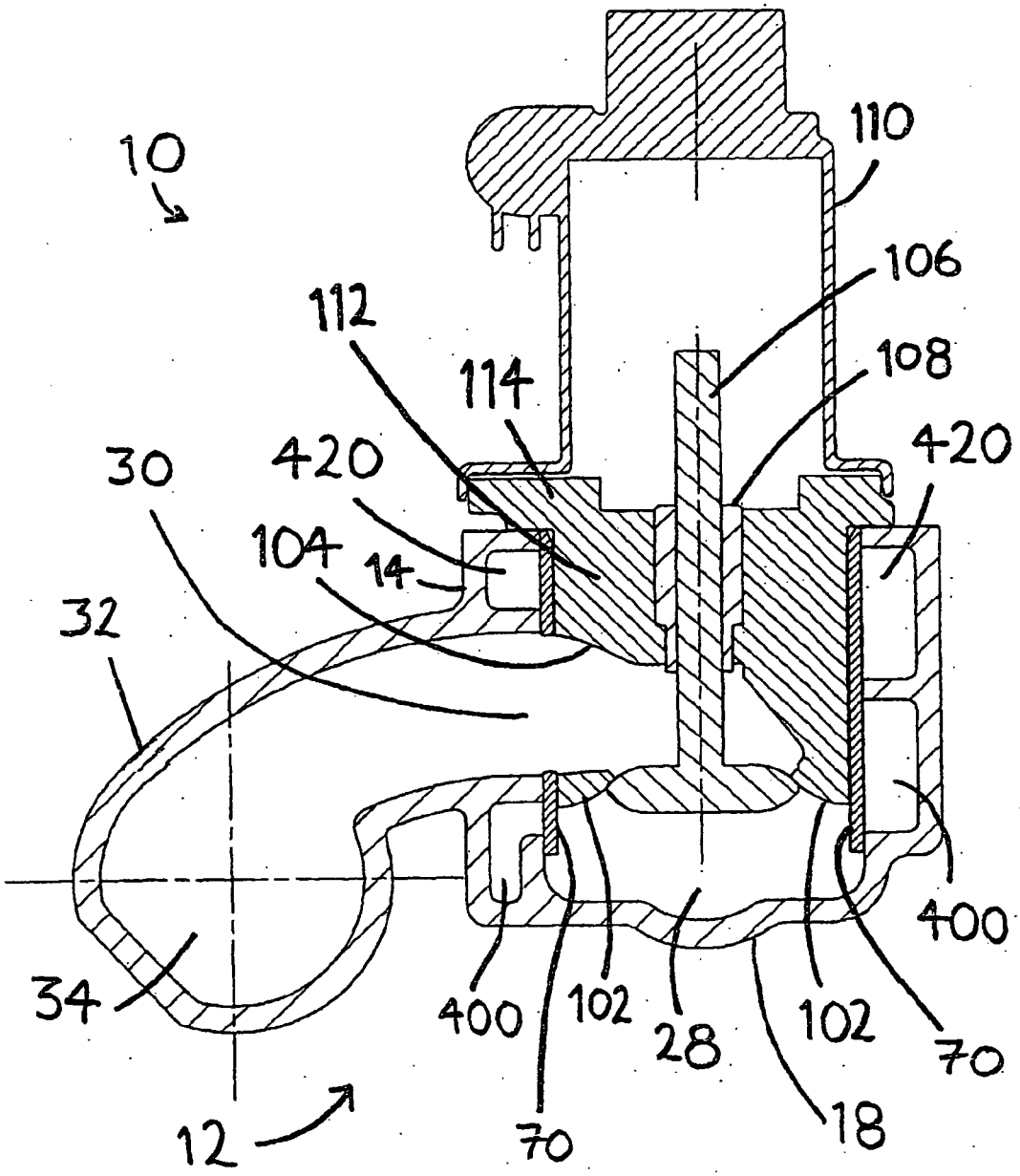

10
110
106
112
114
108
420
30
420
104
14
32
34
400
102
28
102
400
70
12
70
18

Fig.5

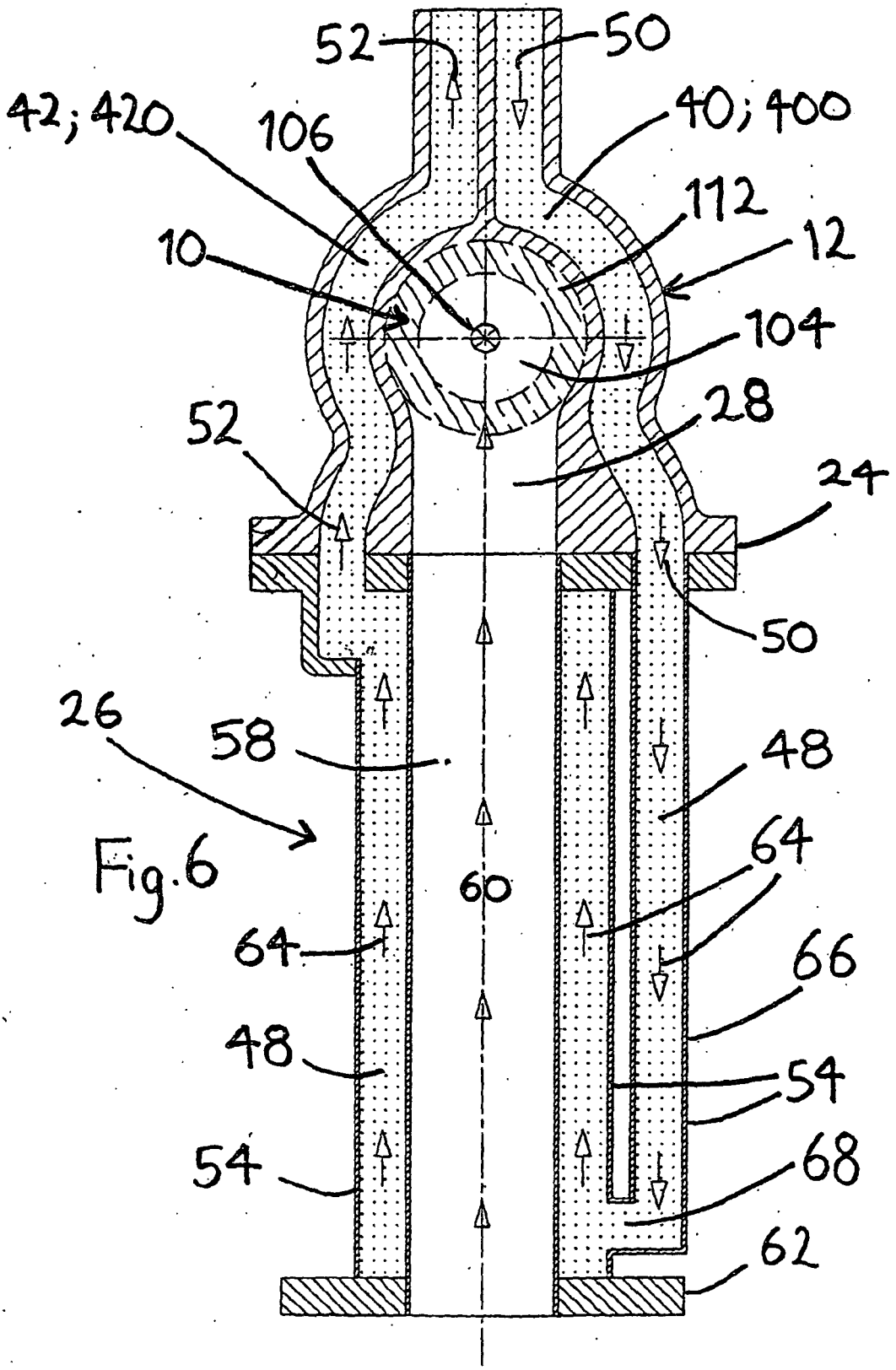

52
50
42; 420
106
40; 400
112
10
12
104
28
52
24
50
26
58
48
64
60
64
66
48
54
54
68
62

Fig.6

REFERENCES CITED IN THE DESCRIPTION

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