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

(11) EP 2 578 838 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.04.2013 Bulletin 2013/15

(51) Int Cl.:
F01P 11/02 *(2006.01)* *F01P 7/16* *(2006.01)*

(21) Application number: **11183658.1**

(22) Date of filing: **03.10.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) Cooling system for an engine

(57) A cooling system for a vehicle engine (1) comprises an expansion tank (2), a water pump (3) and a radiator (4), wherein the water pump (3) is connected upstream the engine (1) and downstream the radiator (4). The engine (1) further comprises a second coolant outlet (5) connected to a cabin heater (6) and an air relief valve (7) connected downstream said second coolant outlet (5) and upstream said cabin heater (6) on the cabin heater pipe (8). The air relief valve (7) is connected to the expansion tank (2) with a degas line (9), the expansion tank outlet (10) is connected upstream the water pump (3).

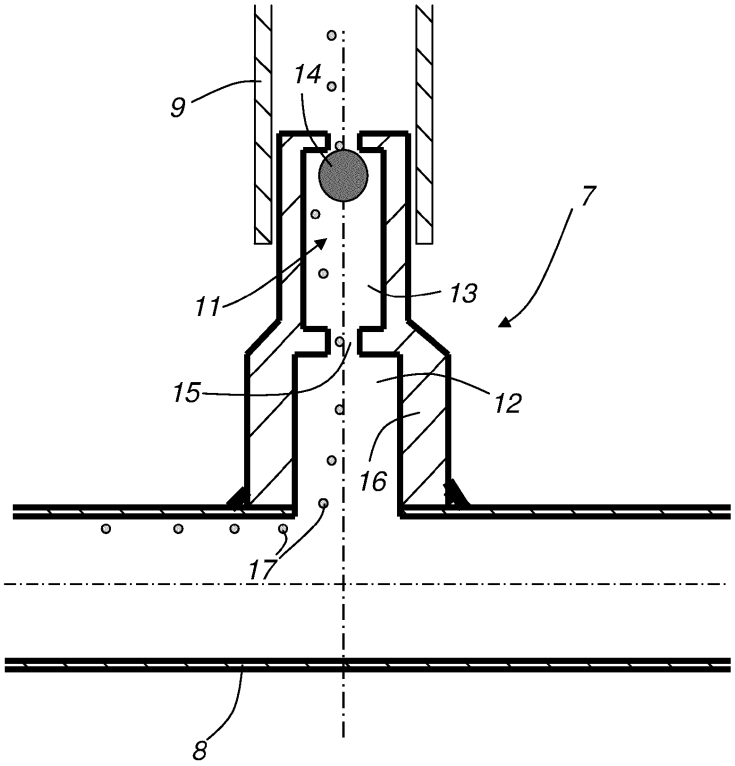

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a cooling system for a vehicle engine, the system comprising an expansion tank, a water pump and a radiator, wherein the water pump is connected upstream the engine and downstream the radiator.

BACKGROUND

[0002] Friction from a vehicle engine's operation results in extremely high temperatures. To avoid the overheating of engines, automakers install cooling systems in automobiles. As larger and more powerful engines are getting manufactured, however, the cooling system technology needed to adapt to the demands of these new engines. In turn, some car-manufacturing companies created new cooling components. A clear example of such is the expansion tank.

[0003] An expansion tank is a container that provides extra storage space for the expansion of a coolant, a fluid used to dissipate heat. An expansion tank hose ensures the optimum flow of coolant as it connects the vehicle's radiator with an expansion tank. An expansion tank is sometimes called coolant reservoir or overflow canister.

[0004] When engines heat up, the coolant consequently expands. Without the expansion tank, however, the coolant will just flow out of the cooling system and get displaced to the ground. Expansion tank hoses are crucial in engine cooling systems. Without these components, coolant is not delivered to overflow canisters and cooling systems become very ineffective.

[0005] Aside from containing the coolant that has expanded with heat, the expansion tank also makes the cooling system more efficient by eliminating the air bubbles from the coolant. Coolant without air bubbles absorbs heat much faster. When the engine is sufficiently cooled, a vacuum in the cooling system sucks back the coolant through the expansion tank hose. A properly functioning cooling system does not lose any coolant as the tank hose completes it as a virtually closed system. Even if the level of coolant in the expansion tank rises and falls, the radiator remains full all the time.

[0006] However, initially when heating up an engine power is used to increase the temperature of the coolant.

SUMMARY OF THE INVENTION

[0007] The object of the present invention is to provide a cooling system which decreases the amount of coolant that needs to be used and thus heated.

[0008] These objects are achieved by the cooling system as set forth in the appended claims.

[0009] According to the present invention a cooling system for a vehicle engine is provided. The system comprises an expansion tank, a water pump and a radiator, wherein the water pump is connected upstream the engine and downstream the radiator. Further, the engine comprises a second coolant outlet connected to a cabin heater and an air relief valve connected downstream said second coolant outlet and upstream said cabin heater on the cabin heater pipe. The air relief valve is connected to the expansion tank with a degas line, and the expansion tank outlet is connected upstream the water pump.

[0010] Thus, by introducing the air relief valve the coolant in the expansion tank need not be heated under normal conditions. This of course saves fuel. Measurements made on one setup have shown that the fuel consumption is 0.4% lower with a blocked flow in engine deaeration. This does not mean that all flow is blocked, an air relief valve should let gas/air through but stop or at least minimize the flow of coolant through the valve.

[0011] Preferably, the air relief valve comprises a ball valve. If gas/air is present in the coolant tests have shown that the air leakage is about 50 times greater than compared to the leakage of coolant. Further, the tests have also shown that when there is only coolant left in the system, the valve is tight. The situation with air/gas in the coolant generally arises when coolant is filled into the cooling system which with a normally functioning system is very seldom.

[0012] According to one aspect of the present invention the air relief valve further comprises a first volume part upstream of the ball holding volume. This volume functions as a "calm room" which catches the gas/air-bubbles. Preferably this first volume of the air relief valve has a cylindrical shape, a major reason being the advantage from a production point of view. Further, the length of the first volume is between 5 and 15 mm and also preferred is to have the diameter of the first volume between 5 and 10 mm.

[0013] According to a further aspect of the invention the ball in the ball valve is a steel ball. One of the advantages is the relatively low cost of steel and another being that it is easy to produce. Preferably, the ball has a diameter between 2 and 5 mm and more preferably the ball has a diameter between 2,5 and 3,5 mm.

[0014] The ball valve holding the ball has according to another aspect of the present invention a cylinder shaped part with a diameter between 2,5 and 6,5 mm. Further, the volume holding the ball has according to yet another aspect of the present invention a length between 5 and 60 mm.

[0015] According to yet another aspect of the present invention the opening between the first volume and the ball holding volume has a diameter between 1 and 4 mm.

[0016] Preferably, the housing of the air relief valve is made of a plastic material. Using a plastic material is beneficial from both a cost perspective and from a manufacturing point of view.

[0017] According to a further aspect of the present invention the opening in the cabin heater pipe for the air relief valve has a diameter between 6 and 11 mm.

[0018] Also preferred is that the air relief valve is ar-

ranged perpendicular to the flow in the cabin heater pipe.

BRIEF DESCRIPTION OF FIGURES

[0019] The cooling system according to the present invention is explained below in more detail with reference to the figures.

Figure 1 is a cross section of an air relief valve according to the present invention.
Figure 2 is a schematic layout of an engine with a cooling system according to the present invention.

DISCLOSURE OF PREFERRED EMBODIMENTS

[0020] The cooling system according to the present invention will be explained with reference made to the enclosed figures. The examples are chosen in order to facilitate the reading and understanding of the invention.

[0021] Figure 1 is a cross section of an air relief valve 7 arranged on a cabin heater pipe 8 and further connected downstream to a degas line 9. The air relief valve 7 comprises a ball valve part 11 and upstream the ball valve 11 a calm room 12. Gas or air bubbles 17 are caught in the calm room 12 after having flowed through an opening in the cabin heater pipe 8. In one embodiment the diameter of the opening in the cabin heater pipe 8 is 8,5 mm as well as the diameter of the calm room 12. If present, the bubbles 17 flows through the length of the calm room 12 which in one embodiment is 10 mm and thereafter passes through an opening 15 with a diameter of 2 mm. The bubbles now enter the ball valve 11 wherein the volume 13 holding the ball 14 has a diameter of 4 mm. The ball 14 is in this case a steel ball with a diameter of 3 mm.

[0022] Figure 2 shows a cooling system for a vehicle engine 1. The system comprises an expansion tank 2, a water pump 3 and a radiator 4, wherein the water pump 3 is connected upstream the engine 1 and downstream the radiator 4. The engine 1 further comprises a second coolant outlet 5 connected to a cabin heater 6 and an air relief valve 7 connected downstream said second coolant outlet 5 and upstream said cabin heater 6 on the cabin heater pipe 8. The air relief valve 7 is connected to the expansion tank 2 with a degas line 9 and the expansion tank outlet 10 is connected upstream the water pump 3.

[0023] In figure 2 there is also shown a fuel operated heater 18, a further valve 19 and an electric water pump (start/stop) 20 in connection with the air relief valve 7 and the cabin heater 6. In the engine 1 area there is a turbo 21, oil cooler 22 and thermostat 23 for the oil cooler. Upstream the radiator 4 there is a further thermostat 24 and with the radiator there is shown a sub cooler 25 and charge air cooler 26, the sub cooler further being connected to a transmission oil cooler 27. The thermostat 23 is connected to an electric water pump 28 and then to exhaust gas recirculation 29. In connection with the second coolant outlet 5 there is also a coolant temperature sensor.

[0024] The foregoing is a disclosure of an example practicing the present invention. However, it is apparent that method incorporating modifications and variations will be obvious to one skilled in the art. Inasmuch as the foregoing disclosure is intended to enable one skilled in the art to practice the instant invention, it should not be construed to be limited thereby, but should be construed to include such modifications and variations as fall within the scope of the claims. For instance, the relative dimensions of the ball 14 and the diameter of the ball holding volume 13 could vary.

Claims

1. A cooling system for a vehicle engine (1), the system comprising an expansion tank (2), a water pump (3) and a radiator (4), wherein the water pump (3) is connected upstream the engine (1) and downstream the radiator (4),
characterised in
that the engine (1) further comprises a second coolant outlet (5) connected to a cabin heater (6) and an air relief valve (7) connected downstream said second coolant outlet (5) and upstream said cabin heater (6) on the cabin heater pipe (8), the air relief valve (7) being connected to the expansion tank (2) with a degas line (9), the expansion tank outlet (10) being connected upstream the water pump (3).

2. A cooling system according to claim 1, wherein the air relief valve (7) comprises a ball valve (11).

3. A cooling system according to claim 2, wherein the air relief valve (7) further comprises a first volume part (12) upstream of the ball holding volume (13).

4. A cooling system according to claim 3, wherein the first volume (12) of the air relief valve (7) has a cylindrical shape.

5. A cooling system according to any of the claims 3 and 4, wherein the length of the first volume (12) is between 5 and 15 mm.

6. A cooling system according to any of the claims 3 to 5, wherein the diameter of the first volume (12) is between 5 and 10 mm.

7. A cooling system according to any of the claims 2 to 6, wherein the ball (14) is a steel ball.

8. A cooling system according to any of the claims 2 to 7, wherein the ball (14) has a diameter between 2 and 5 mm.

9. A cooling system according to claim 8, wherein the ball (14) has a diameter between 2,5 and 3,5 mm.

10. A cooling system according to any of the claims 2 to 9, wherein the volume (13) of the ball valve (7) holding the ball comprises a cylinder shaped part with a diameter between 2,5 and 6,5 mm.

11. A cooling system according to claim 10, wherein the volume (13) holding the ball (14) has a length between 5 and 60 mm.

12. A cooling system according to any of the claims 3 to 11, wherein the opening (15) between the first volume (12) and the ball holding volume (13) has a diameter between 1 and 4 mm.

13. A cooling system according to any of the previous claims, wherein the housing (16) of the air relief valve (7) is made of a plastic material.

14. A cooling system according to any of the previous claims, wherein the opening (17) in the cabin heater pipe (8) for the air relief valve (7) has a diameter between 6 and 11 mm.

15. A cooling system according to any of the previous claims, wherein the air relief valve (7) is arranged perpendicular to the flow in the cabin heater pipe (8).

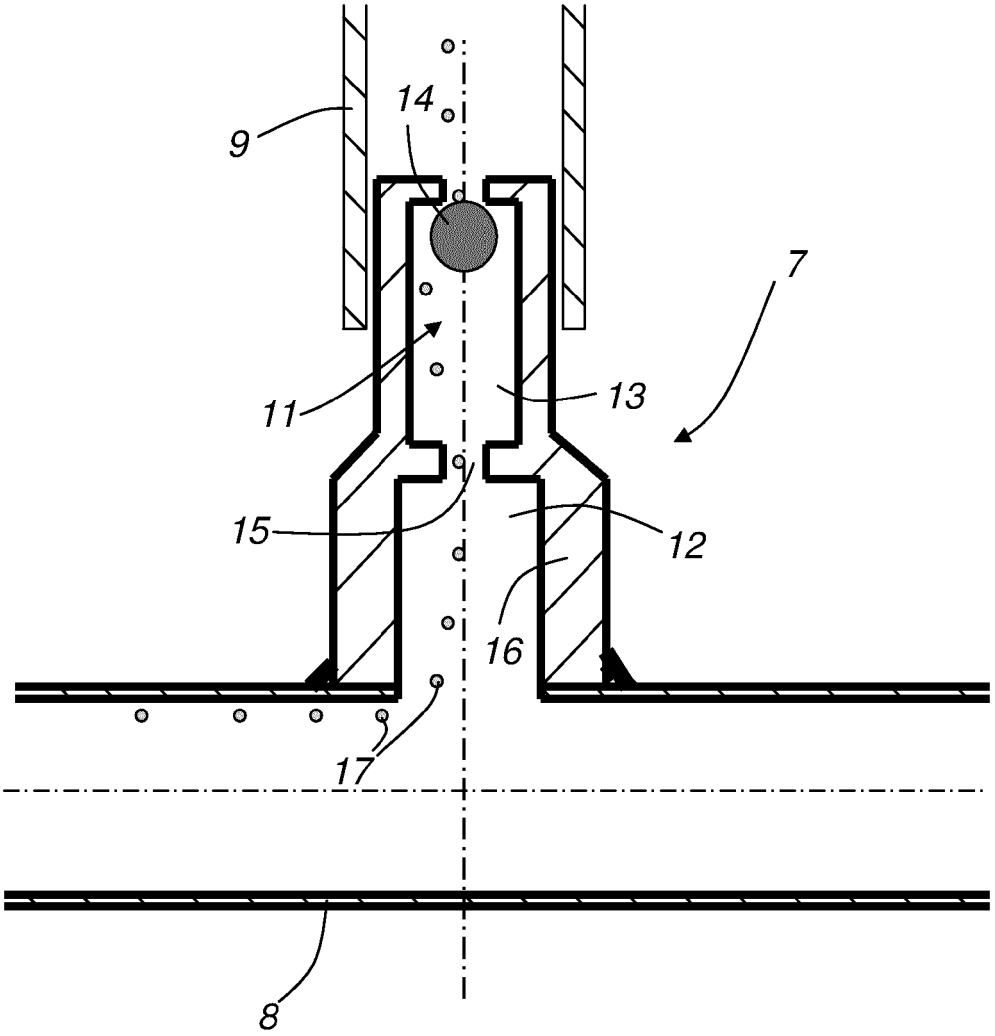

Fig. 1

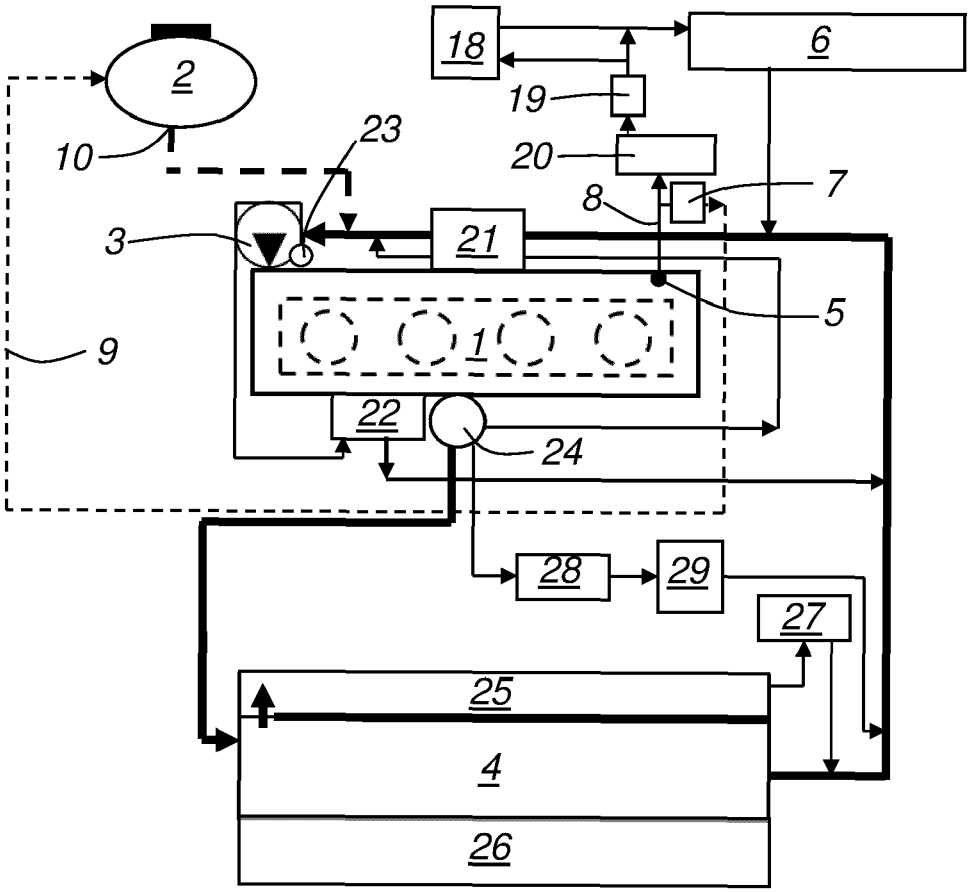

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 3658

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	FR 2 317 489 A1 (CITROEN SA [FR]) 4 February 1977 (1977-02-04) * page 3, line 11 - page 4, line 15 * * figures * -----	1-15	INV. F01P11/02 ADD. F01P7/16
Y	US 3 877 443 A (HENNING RICHARD ET AL) 15 April 1975 (1975-04-15) * column 3, lines 46-55 * * figures * -----	1-15	
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			TECHNICAL FIELDS SEARCHED (IPC) F01P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 March 2012	Matray, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 18 3658

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82