



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.11.2008 Bulletin 2008/46

(51) Int Cl.:
F01M 11/06 ^(2006.01) **F01M 11/00** ^(2006.01)

(21) Application number: **07107616.0**

(22) Date of filing: **07.05.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(72) Inventor: **Morén, Mats**
417 19, Göteborg (SE)

(74) Representative: **Valea AB**
Lindholmspiren 5
417 56 Göteborg (SE)

(71) Applicant: **Ford Global Technologies, LLC**
Dearborn, MI 48126 (US)

(54) **Oil feeding system**

(57) Oil feeding system (10) for an oil pump (20) in a vehicle (30), which comprises two feed pipes (12,14) that each have an oil inlet (12a, 14a) and that are arranged to draw oil (16) from an oil pan (18) and feed it to an oil pump (20) when the oil feeding system (10) is mounted in a vehicle (30) and in use. One feed pipe (12) is arranged to draw oil from one part (S) of the oil pan (18) and the other feed pipe (14) is arranged to draw oil from another part (N) of the oil pan (18). The oil feeding system comprises a flow control means (22) that is arranged downstream of said oil inlets (12a, 14a). The flow control means (22) is arranged to remain in a first position

that allows oil to flow through both or either of said two feed pipes (12,14) when said vehicle (30) is not accelerating/decelerating/turning/tilting. The flow control means (22) is also arranged to be displaced, as a direct or indirect consequence of acceleration/deceleration/turning/tilting of said vehicle (30), to a second position in which it allows oil to flow only through the feed pipe (12) whose oil inlet (12a) is located in the part of the oil pan (18) to which oil will be displaced during acceleration/deceleration/turning/tilting of said vehicle (30) and in which position it simultaneously blocks the flow of oil through the other feed pipe (14).

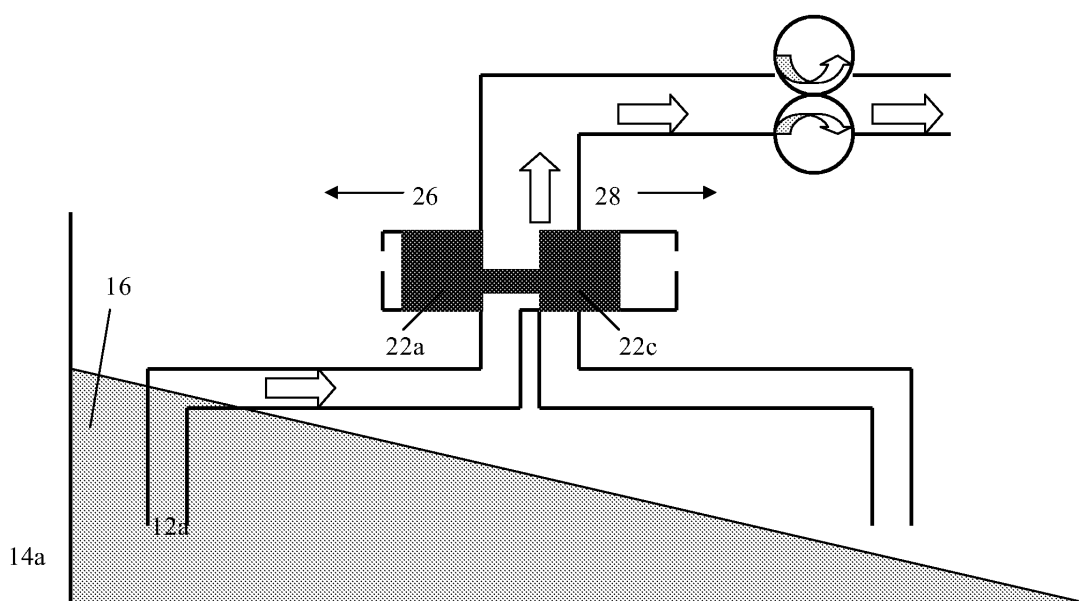


Fig. 2

Description

TECHNICAL FIELD

[0001] The present invention concerns an oil feeding system suitable for an oil pump in a vehicle. The present invention also concerns an oil pump assembly, a vehicle, a computer program product, an electronic control unit (ECU) and a method for feeding oil from an oil pan to an oil pump that is mounted in a vehicle.

BACKGROUND OF THE INVENTION

[0002] An oil pump in a vehicle is designed to supply pressurized oil to lubricate and cool parts of the vehicle's engine or transmission. Oil is, for example, supplied to a vehicle's pistons, so that they can slide easily in their cylinders, and to bearings that allow components like a vehicle's crankshaft and camshafts to rotate freely. In most vehicles, oil is sucked out of an oil pan, or oil sump, by an oil pump and then squirted under high pressure onto components such as cylinder walls and bearings. The oil then drains back down into the oil pan where it is collected again and the cycle repeats.

[0003] Conventional oil feeding systems for supplying oil to parts of a vehicle's engine or transmission comprise a feed pipe that extends from the oil pan to an oil pump. The oil inlet of the feed pipe is usually placed at the centre of the oil pan. Problems may occur when the oil level inside the oil pan temporarily falls below the oil inlet of the feed pipe due to the vehicle accelerating or decelerating (in which cases oil in the oil pan is displaced to the rear or to the front of the oil pan respectively), or due to the vehicle turning to the left or right (in which cases the oil in the oil pan is displaced to one side of the oil pan) or due to the vehicle tilting backwards, forwards or to the side when travelling along a sloping or uneven surface. When a vehicle is accelerating, decelerating, turning or tilting air may therefore be sucked up through the feed pipe instead of oil and a sufficient quantity of oil will consequently not be fed from the oil pan to the desired parts of the vehicle's engine or transmission.

[0004] This problem may be avoided by ensuring that the oil level in the oil pan is high enough so that air will not be sucked into an oil pump even when a vehicle is accelerating or decelerating, turning or tilting. A disadvantage with this solution is that a larger quantity of oil is needed to fill the oil pan, which increases service costs and means that the oil pan has to be made large and deep enough to hold the larger quantity of oil, which limits a vehicle manufacturer's design options, increases manufacturing costs and decreases the fuel efficiency of the vehicle (due to the increased weight of the oil pan and oil). Additionally, a lot of oil may splatter and hit the vehicle's crankshaft, raising the temperature of the oil and decreasing the performance of the vehicle at high engine speeds.

[0005] Furthermore, since an oil pan is often placed

under an engine, if the oil pan is dimensioned to be deep and narrow, rather than shallow and wide, this may result in the vehicle having a lower ground clearance and/or it may mean that the engine has to be placed higher up in the vehicle. A more highly placed engine raises the vehicle's centre of gravity and consequently decreases its stability, and it may also adversely affect the vehicle's aerodynamics (since a higher hood-line may be necessary), which results in reduced fuel efficiency and increased wind noise and buffeting.

[0006] The abstract of Japanese patent application no. JP 58093911 discloses an oil feeding device, for feeding oil from an oil pan to an oil pump, which comprises two suction ports located at the front and the rear of the oil pan. The end of each suction port is provided with a ball valve that comprises a dead weight that moves along a trough-shaped guide and that is opened and closed in accordance with the inclination of the oil level at each suction port end. When a vehicle in which the oil feeding device is mounted is travelling along a declined surface, oil is sucked only from the suction port at the front of the oil pan. A disadvantage with such an oil feeding device is that if the valve at the end of the suction port that should be feeding oil to the oil pump when the vehicle is tilted gets blocked, which is quite probable since impurities in the oil collect at the bottom the oil pan, oil may be completely prevented from flowing to the oil pump.

SUMMARY OF THE INVENTION

[0007] An object of the present invention is to provide an oil feeding system that effectively supplies oil to an oil pump that is mounted in a vehicle during all operating conditions of the vehicle, i.e. irrespective of whether the vehicle is accelerating, decelerating, turning or tilting.

[0008] This object is achieved by an oil feeding system according to claim 1, namely an oil feeding system for an oil pump in a vehicle, which system comprises a pair of feed pipes with each feed pipe having an oil inlet. The feed pipes are arranged to draw oil from an oil pan and feed it to an oil pump when the oil feeding system is mounted in a vehicle and in use. One feed pipe of said pair of feed pipe is arranged to draw oil from one part of the oil pan and the other feed pipe is arranged to draw oil from another part of the oil pan. The oil feeding system comprises a flow control means that is arranged downstream of the oil inlets. The flow control means is arranged to remain in a first position that allows oil to flow through either or both of the two feed pipes of when the vehicle is not accelerating, decelerating, turning or tilting. The flow control means is arranged to be displaced, as a direct or indirect consequence of the acceleration, deceleration, turning, or tilting of the vehicle, to a second position in which it allows oil to flow only through the feed pipe whose oil inlet is located in the part of the oil pan to which oil will be displaced during the acceleration, deceleration, turning or tilting of the vehicle and in which position it simultaneously blocks the flow of oil through the

other feed pipe. Such an oil feeding system requires less oil in the oil pan to ensure that the feed pipes will supply oil (and not air) to the oil pump in a vehicle during all operating conditions of the vehicle.

[0009] It should be noted that the oil feeding system of the present invention is intended for use particularly, but not exclusively in a wet sump in which an oil pump sucks oil from an oil pan and then pumps it to parts of a vehicle's engine. The oil feeding system may equally be used in a dry sump. In a dry sump extra oil is stored in a tank outside the engine rather than in an oil pan under the engine. There are at least two oil pumps in a dry sump; one draws oil from the sump and sends it to the tank, and the other takes oil from the tank and sends it to lubricate the vehicle's engine. The minimum amount of oil possible remains in the engine. The expression "oil pan" in the appended claims is therefore intended to mean any oil container, which may be located anywhere in a vehicle and from which oil is drawn and fed to an oil pump.

[0010] According to an embodiment of the invention the flow control means comprises a sliding valve, such as a piston, that is arranged to be displaced as a direct or indirect consequence of forces acting on the vehicle during the acceleration/deceleration/turning/tilting of the vehicle. It should be noted that the expression "piston" is intended to mean a sliding member of any shape, not necessarily a cylindrical member.

[0011] According to an alternative embodiment of the invention the flow control means comprises a sliding valve, such as a piston, that is arranged to be displaced as a consequence of suction depression that arises due to the displacement of oil in the oil pan during acceleration/deceleration/turning/tilting of the vehicle.

[0012] According to an embodiment of the invention the oil inlets are arranged to be located on opposite parts or sides of the oil pan.

[0013] According to an embodiment of the invention the oil from one or both of the two feed pipes is ultimately arranged to be fed to the oil pump via a single pipe. The flow control means is for example arranged substantially at the point where the two feed pipes merge into the single pipe, i.e. within 20 cm of that point, preferably within 10 cm of that point.

[0014] According to another embodiment of the invention the oil feeding system comprises a plurality of pairs of feed pipes. The oil feeding system may comprise a flow control means arranged to control the flow of oil through only one pair of feed pipes or a flow control means that is arranged to control the flow of oil through a plurality of pairs of feed pipes.

[0015] According to a further embodiment of the invention the flow control means is arranged to remain in the first position when the vehicle in which the oil feeding device is mounted is not accelerating/decelerating/turning/tilting *substantially* and is arranged to be displaced during *substantial* acceleration/deceleration/turning/tilting of the vehicle. The expression "substantial accelera-

tion/deceleration/turning/tilting of the vehicle" is intended to mean an acceleration/deceleration/turning/tilting that will cause oil in the oil pan to be displaced to such an extent that one oil inlet will become located above the level of the oil. A vehicle manufacturer, knowing the size and shape of an oil pan and the level to which the oil pan will be filled during the operation of the vehicle, will of course be able to determine the magnitude of "substantial acceleration/deceleration/turning/tilting" and, on the basis of the present disclosure, construct the flow control means accordingly.

[0016] The present invention also concerns an oil pump assembly comprising an oil pump and an oil pan and an oil feeding system according to any of the embodiments of the invention for feeding oil from said oil pan to said oil pump.

[0017] The present invention further concerns a method of feeding oil from an oil pan to an oil pump that is mounted in a vehicle using an oil feeding system according to any of the embodiments of the invention. The method comprises the steps of determining whether the vehicle is accelerating/decelerating/turning/tilting at a rate/angle that exceeds a predetermined rate/angle and displacing the flow control means of the oil feeding system accordingly to ensure that oil, and not air, will be supplied to the oil pump.

[0018] The present invention also concerns a computer program product containing computer program code means arranged to cause a computer or a processor to carry out at least one of the steps of the method according to an embodiment of the invention, stored on a computer-readable medium or a carrier wave.

[0019] The present invention further concerns an ECU that comprises a computer program product according to an embodiment of the invention.

[0020] The present invention also concerns a vehicle, such as a car, boat, train or airplane, that comprises at least one oil feeding system, at least one oil pump assembly, a computer program product or an ECU according to any of the embodiments of the invention.

[0021] The present invention further concerns a vehicle comprising an E-W-mounted engine whereby one of the oil inlets is located at the E-side of the oil pan and the other oil inlet is located at the W-side of the oil pan or whereby one of said oil inlets is located at the N-side of said oil pan and the other oil inlet is located at the S-side of said oil pan.

[0022] According to an alternative embodiment of the invention the vehicle comprises an N-S-mounted engine whereby one of the oil inlets is located at the N-side of the oil pan and the other of the two oil inlets is located at the E-side of the oil pan or whereby one of said oil inlets is located at the N-side of said oil pan and the other oil inlet is located at the W-side of said oil pan.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The present invention will hereinafter be further

explained by means of non-limiting examples with reference to the appended schematic figures where;

- Figure 1 shows an oil feeding system according to a first embodiment of the invention in a vehicle that is travelling along a substantially flat surface and that is not accelerating/decelerating,
- Figure 2 shows the oil feeding system of figure 1 in a vehicle that is travelling along a substantially flat surface and that is accelerating/decelerating,
- Figure 3 shows an oil feeding system according to a second embodiment of the invention in a vehicle that is travelling along a substantially flat surface and that is not accelerating/decelerating,
- Figure 4 shows the oil feeding system of figure 3 in a vehicle in a vehicle that is travelling along a substantially flat surface and that is accelerating/decelerating,
- Figure 5 shows a vehicle that is travelling along an inclined surface.

[0024] It should be noted that the drawings have not been drawn to scale and that the dimensions of certain features have been exaggerated for the sake of clarity.

DETAILED DESCRIPTION OF EMBODIMENTS

[0025] Figure 1 shows an oil feeding system 10 for an oil pump mounted in a vehicle that is travelling along a substantially flat surface. The oil pump may be a gear pump driven by the vehicle's camshaft or crankshaft. The oil feeding system 10 comprises two feed pipes 12 and 14 that each have an oil inlet 12a and 14a. The feed pipes 12 and 14 are arranged to draw oil 16 from the bottom of an oil pan 18 and feed it to an oil pump 20 when the oil feeding system 10 is mounted in a vehicle and in use. The oil pan 18 may be a detachable mechanism made out of steel and bolted to the bottom of the vehicle's crankcase. It may be molded into a deeper section and mounted at the bottom of a vehicle's crankcase to serve as an oil reservoir to maximize its function. One oil inlet 14a is arranged to be located on the N-side of the oil pan 18 and the other oil inlet 12a is arranged to be located on the S-side of the oil pan.

[0026] The oil feeding system 10 comprises a flow control means 22, for example two pistons 22a and 22c interconnected by a cross bar 22b which are arranged to be displaced inside a piston chamber 22d as a direct or indirect consequence of forces acting on the vehicle during the acceleration/deceleration or during the tilting of the vehicle when it is travelling along an inclined/de-

clined/uneven surface. The flow control means 22 is arranged downstream of the oil inlets 12a and 14a at a point where the two feed pipes 12 and 14 merge into a single pipe 24. Figure 1 shows the flow control means 22 in a first position that allows oil 16 to flow through both of the feed pipes 12 and 14 when the vehicle is not accelerating/decelerating/tilting and when the oil level in the oil pan 18 is consequently substantially parallel to the bottom of the oil pan 18 when the vehicle is travelling along a substantially flat surface. In the first position, the body of each piston 22a and 22c is partly located in the piston chamber 22 and only partly obstructs the oil flowing through the feed pipes 12 and 14. In an alternative embodiment of the invention the body of each piston could be arranged so as not to obstruct the oil flowing the feed pipes 12 and 14 at all when the flow control means are in the first position. Furthermore, the flow control means 22 may be arranged to allow oil 16 to flow through just one of the feed pipes 12 and 14 when the vehicle is not accelerating/decelerating/tilting and when the flow control means 22 are in the first position.

[0027] According to an embodiment of the invention the oil pan 18 has a volume of 3-7 litres, the pistons 22a and 22c have a diameter of 2-7 cm, and the pistons 22a and 22c and the connecting rod 22b have a total weight of 200-500 g. The dimensions of the components of the oil feeding system will however vary depending on its application.

[0028] Figure 2 shows the oil feeding system 10 of figure 1 with the flow control means 22 in a second position after the flow control means 22 has been displaced in the direction of arrow 26 in figure 2 as a direct consequence of acceleration of the vehicle. Since the oil 16 in the oil pan 18 is subjected to the same forces as the flow control means 22, the flow control means 22 may be arranged to move simultaneously with the oil 16. The flow control means 22 has for example been automatically displaced by forces acting on the vehicle during its acceleration. In this second position the flow control means 22 allows oil 16 to flow only through the feed pipe 12 that has an oil inlet 12a located on the S-side of the oil pan 18 to which most oil 16 will be displaced during the acceleration of the vehicle.

[0029] When the flow control means 22 is in the position shown in figure 2 it blocks the flow of oil 16 through the feed pipe 14 whose oil inlet 14a is located on the N-side of the oil pan 18 since in the second position the body of piston 22c is blocks all oil flowing through feed pipe 14 whereas the body of piston 22a is located entirely in the piston chamber and does not obstruct oil flowing through feed pipe 12 at all. Once the vehicle stops accelerating the oil 16 in the oil pan 18 will return to the position shown in figure 1. The flow control means 22 will simultaneously be displaced back to its first position as shown in figure 1 and oil 16 will then be drawn from both feed pipes 12 and 14. Should the vehicle decelerate or travel along a declining surface, the flow control means 22 will be displaced in the direction of arrow 28 in figure 2.

[0030] Figures 3 and 4 show an oil feeding system according to a second embodiment of the invention in which the flow control means is arranged to be displaced as a consequence of suction depressure that arises in one of the feed pipes due to the displacement of oil in the oil pan during acceleration/deceleration/tilting of the vehicle. In the illustrated embodiment channels 22e and 22f connect the ends of the piston chamber 22d with the feed pipes 12 and 14 respectively, to transmit any depressure generated in the feed pipes 12 and 14.

[0031] Figure 3 shows the position of the flow control means 22 in the piston chamber 22d when the vehicle in which the oil feeding system 10 is mounted is not accelerating/decelerating or tilting and thus when the suction depressure in both feed pipes 12 and 14 is substantially the same. When the vehicle accelerates, oil 16 in the oil pan 18 will be displaced to the S-side of the oil pan 18 as shown in figure 4. Since the oil inlet 14a located at the N-side of the oil pan 18 will start to suck air (and not oil) into the feed pipe 14, less depressure will occur in that feed pipe 14, causing the flow control means 22 to move towards the suction pipe with the most depressure (the S-side to which most oil has been displaced). This will cause piston 22c to block the feed pipe 14 if air is sucked into its oil inlet 14a.

[0032] Figure 5 shows a passenger car 30 travelling along an inclined surface 32. The car 30 comprises an engine whose position is indicated by the dashed line 34 in figure 5. The engine 34 comprises at least one oil feeding system according to an embodiment of the present invention (not shown). The car 30 also comprises an ECU 36 that contains computer program code means arranged to cause a computer or a processor to determine whether the vehicle is accelerating/decelerating/turning/tilting at a rate/angle that exceeds a predetermined rate/angle, by analyzing data from an accelerometer or other sensors for example, and/or to send a signal to actuator means 38 that are arranged to displace the flow control means 22 of the oil feeding system accordingly.

[0033] Further modifications of the invention would be apparent to a skilled person. For example, although the claims are directed to an oil feeding system, it would be apparent to the skilled person that such a system could be used for feeding any liquid to any pump that is mounted in a vehicle. The inventive system could for example be used to supply a mixture of water and ethylene glycol (anti-freeze) to a pump that pumps said mixture to a radiator that is connected to channels running through a vehicle's engine and cylinder head, or to supply cleaning fluid to a windscreen washer pump.

Claims

1. Oil feeding system (10) for an oil pump (20) in a vehicle (30), which system comprises a pair of feed pipes (12,14) with each feed pipe having an oil inlet (12a, 14a), the feed pipes being arranged to draw

oil (16) from an oil pan (18) and feed it to an oil pump (20) when the oil feeding system (10) is mounted in a vehicle (30) and in use, whereby one feed pipe (12) of said pair of feed pipes is arranged to draw oil from one part (S) of the oil pan (18) and the other feed pipe (14) is arranged to draw oil from another part (N) of the oil pan (18), **characterized in that**

- the oil feeding system comprises a flow control means (22) that is arranged downstream of said oil inlets (12a, 14a),
- whereby the flow control means (22) is arranged to remain in a first position that allows oil to flow through both or either of said two feed pipes (12,14) when said vehicle (30) is not accelerating/decelerating/turning/tilting and
- said flow control means (22) is arranged to be displaced, as a direct or indirect consequence of acceleration/deceleration/turning/tilting of said vehicle (30), to a second position in which it allows oil to flow only through the feed pipe (12) whose oil inlet (12a) is located in the part of the oil pan (18) to which oil will be displaced during acceleration/deceleration/turning/tilting of said vehicle (30) and in which position it simultaneously blocks the flow of oil through the other feed pipe (14).

2. Oil feeding system (10) according to claim 1, **characterized in that** said flow control means (22) comprises a sliding valve, such as a piston, that is arranged to be displaced as a direct or indirect consequence of forces acting on said vehicle (30) during the acceleration/deceleration/turning/tilting of said vehicle (30).
3. Oil feeding system (10) according to claim 1, **characterized in that** said flow control means (22) comprises a sliding valve, such as a piston, that is arranged to be displaced as a consequence of suction depressure that arises due to the displacement of oil (16) in the oil pan (18) during acceleration/deceleration/turning/tilting of said vehicle (30).
4. Oil feeding system (10) according to claim 2 or 3, **characterized in that** said flow control means (22) comprise two pistons (22a, 22c) that are interconnected by a crossbar (22b) and which are arranged to be displaced in a piston chamber (22d).
5. Oil feeding system (10) according to any of the preceding claims, **characterized in that** said oil inlets (12a, 14a) are arranged to be located on opposite parts or sides (N, S) of the oil pan (18).
6. Oil feeding system (10) according to any of the preceding claims, **characterized in that** the oil from one or both of said two feed pipes (12,14) is ultimate-

- ly arranged to be fed to said oil pump (20) via a single pipe (24).
7. Oil feeding system (10) according to claim 6, **characterized in that** said flow control means (22) is arranged substantially at a point where said two feed pipes (12,14) merge into said single pipe (24). 5
 8. Oil feeding system (10) according to any of the preceding claims, **characterized in that** it comprises a plurality of pairs of feed pipes (12,14). 10
 9. Oil feeding system (10) according to claim 8, **characterized in that** it comprises a plurality of flow control means (22), whereby each flow control means is arranged to control the flow of oil through only one pair of feed pipes (12,14). 15
 10. Oil feeding system (10) according to claim 8, **characterized in that** it comprises a flow control means (22) that is arranged to control the flow of oil through a plurality of pairs of feed pipes (12,14). 20
 11. Oil feeding system (10) according to any of the preceding claims, **characterized in that** the flow control means (22) is arranged to remain in said first position when said vehicle (30) is not accelerating/decelerating/turning/tilting substantially and is arranged to be displaced during substantial acceleration/deceleration/turning/tilting of said vehicle (30). 25 30
 12. Oil pump assembly comprising an oil pump (20) and an oil pan (18), **characterized in that** it comprises an oil feeding system (10) according to any of the preceding claims for feeding oil from said oil pan (18) to said oil pump (20). 35
 13. Method of feeding oil (16) from an oil pan (18) to an oil pump (20) that is mounted in a vehicle (30) using an oil feeding system (10) according to any of claims 1-11, **characterized in that** it comprises the steps of determining whether said vehicle (30) is accelerating/decelerating/turning/tilting at a rate/angle that exceeds a predetermined rate/angle and displacing said flow control means (22) of said oil feeding system (10) accordingly. 40 45
 14. Computer program product, **characterized in that** it comprises a computer program containing computer program code means arranged to cause a computer or a processor to carry out at least one of the steps the method of claim 13, stored on a computer-readable medium or a carrier wave. 50
 15. Electronic control unit (ECU) (36), **characterized in that** it comprises a computer program product according to claim 14. 55
 16. Vehicle (30), **characterized in that** it comprises at least one oil feeding system (10) according to any of claims 1-11, at least one oil pump assembly according to claim 12, a computer program product according to claim 14 or an ECU (36) according to claim 15.
 17. Vehicle (30) according to claim 16, **characterized in that** it comprises an E-W-mounted engine (34) whereby one of said oil inlets (12a) is located at the E-side of said oil pan (18) and the other oil inlet (14a) is located at the W-side of said oil pan (18) or whereby one of said oil inlets (12a) is located at the N-side of said oil pan (18) and the other oil inlet (14a) is located at the S-side of said oil pan (18).
 18. Vehicle (30) according to claim 16, **characterized in that** it comprises a N-S-mounted engine (34) whereby one of said oil inlets (12a) is located at the N-side of the oil pan (18) and the other of said oil inlets (14a) is located at the S-side of the oil pan (18) or whereby one of said oil inlets (12a) is located at the E-side of said oil pan (18) and the other oil inlet (14a) is located at the W-side of said oil pan (18).

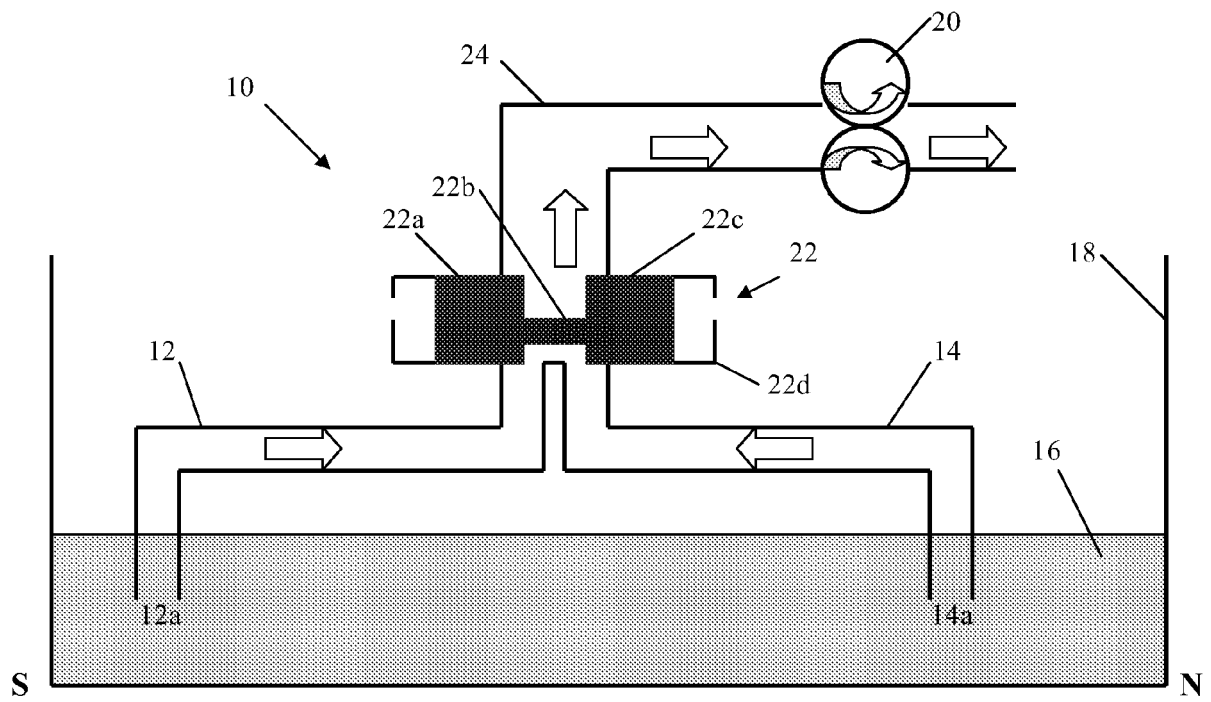


Fig. 1

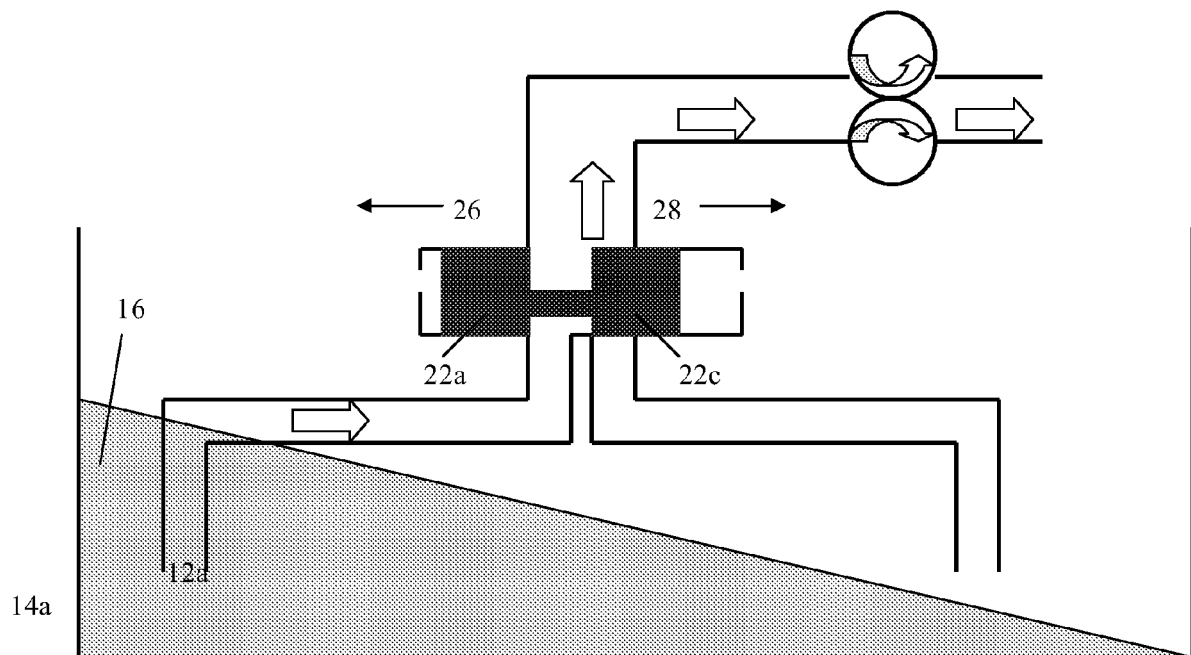


Fig. 2

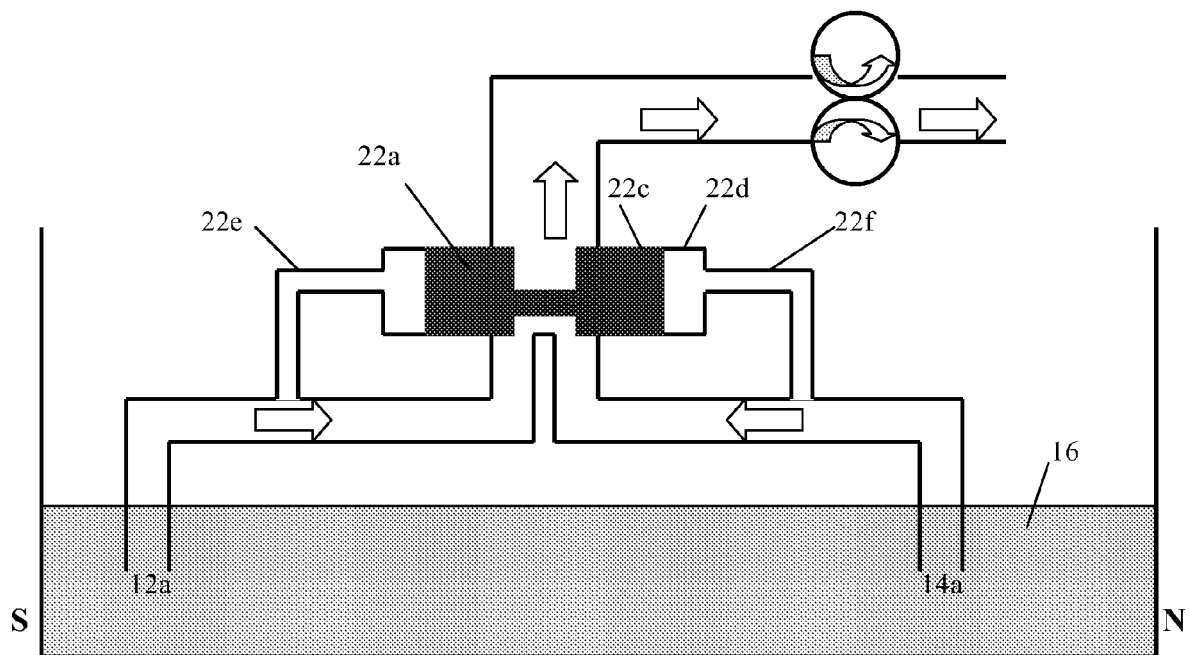


Fig. 3

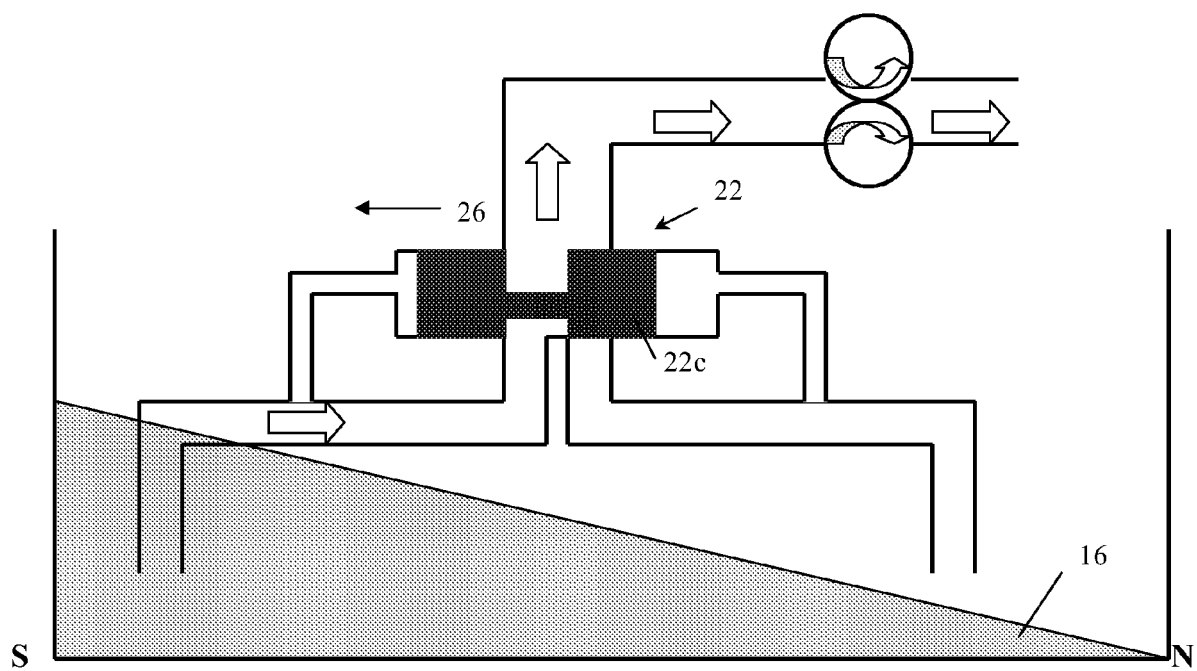


Fig. 4

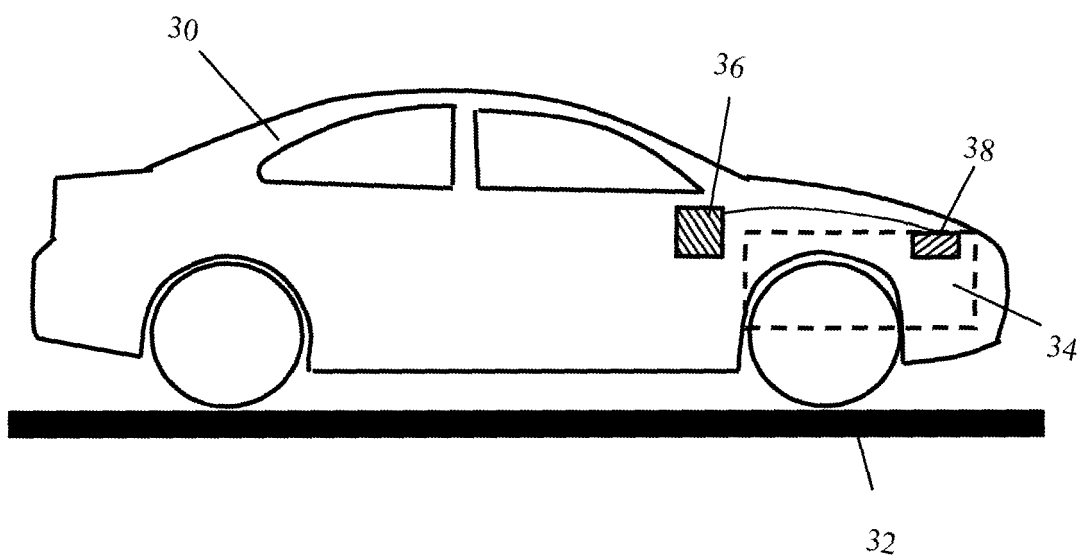


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 7616

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 860 548 A1 (RENAULT SA [FR]) 8 April 2005 (2005-04-08)	1,2,4-7, 11,12	INV. F01M11/06
A	* page 8, line 14 - page 10, line 4 * * page 12, line 23 - page 13, line 13 * * figures 1,2,7-12,19 *	3	ADD. F01M11/00
X	FR 2 196 004 A (LANCIA AUTOMOBILI [IT]) 8 March 1974 (1974-03-08)	1,2,4-12	
A	* page 6, line 27 - page 7, line 29 * * page 9, line 29 - page 11, line 13 * * figures 5-7,14-17 *	3	
X	US 6 260 534 B1 (KAMPICHLER GUENTER [DE] ET AL) 17 July 2001 (2001-07-17)	1,2,5-8, 10-12	
A	* column 3, line 22 - column 4, line 12 * * figures 1-3 *	4,9	
X	US 1 866 280 A (WOOLSON LIONEL M) 5 July 1932 (1932-07-05)	1,2,5-7, 11,12	
	* page 2, lines 4-88 * * figures 1-5 *		
			TECHNICAL FIELDS SEARCHED (IPC)
			F01M
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 July 2007	Examiner Mallo López, Manuel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)



European Patent
Office

Application Number

EP 07 10 7616

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- see additional sheet(s)



European Patent
Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number

EP 07 10 7616

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-12

Oil feeding system for an oil pump in a vehicle comprising flow control means displaced between two positions during acceleration/deceleration/turning/tilting of said vehicle.

2. claims: 13-18

Determining wheather a vehicle is accelerating/decelerating/turning/tilting at a rate/angle that exceeds a predetermined rate/angle and displacing a flow control means accordingly.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 10 7616

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-07-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2860548	A1	08-04-2005	NONE	
FR 2196004	A	08-03-1974	DE 2339730 A1 IT 964897 B	28-02-1974 31-01-1974
US 6260534	B1	17-07-2001	DE 19860381 A1 WO 0039436 A1 EP 1058777 A1 JP 2002533611 T	29-06-2000 06-07-2000 13-12-2000 08-10-2002
US 1866280	A	05-07-1932	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 58093911 B [0006]