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(54) Check valve bypass

(57) The present invention relates to an oil control system (1) for controlling the flow of oil between an opening (3) for receiving oil and one more exits (4,5,6) to be connected to an oil operate device, wherein the system (1) is provided with an oil control valve (20) and a filter (7) for filtering the oil upstream of the oil control valve (20), whereby the system is provided with bypass means (10) for allowing the flow of oil towards the oil control valve (20) passed the filter (7).

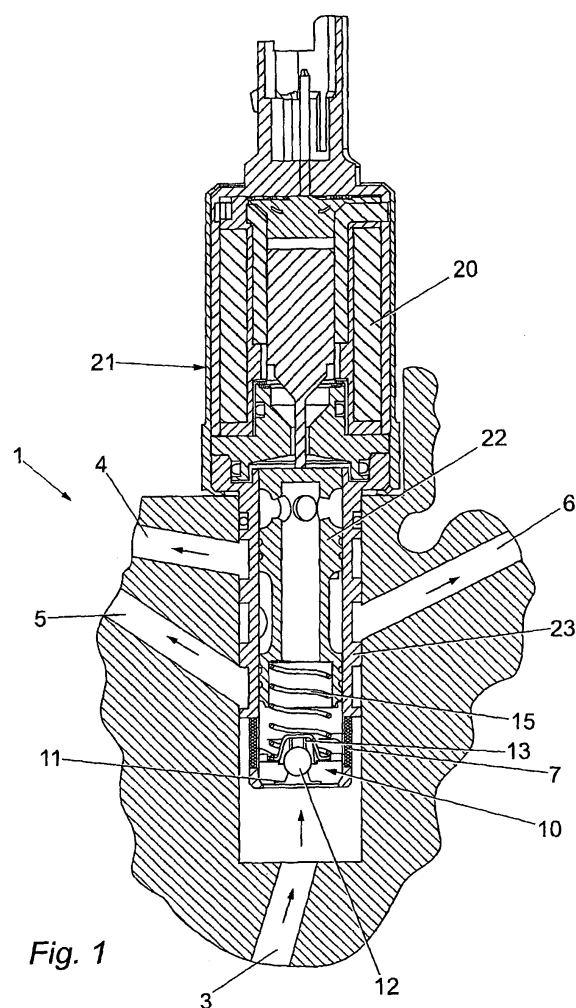


Fig. 1

EP 1 728 977 A1

Description

[0001] The present invention relates to an oil control system for controlling the flow of oil between an opening for receiving oil and one or more exits to be connected to an oil operated device, wherein the system is provided with an oil control valve and a filter for filtering the oil upstream of the oil control valve.

[0002] The oil control system according to the application can be used for a variable cam phasing system. The filter used in the oil control system is typically a fine filter with a mesh of 0.1 mm. This fine mesh is needed to prevent chips or other contaminants to enter the oil control valve and to cause malfunction. According to the prior art, the use of such a fine filter may create problems at a cold start of an engine. With very low temperatures, such as -30°C, the oil viscosity reaches levels which significantly reduce the oil flow through the filter. As a result, this cold temperature conditions are typically defined as "no-fly-zones", in which the cam phaser is simply not activated.

[0003] With the ever increasing requirements for economy and emissions the existence of the mentioned "no-fly-zones", as described above, are less and less acceptable. With respect being made to the disadvantages of the existing oil control systems, the object of the present invention is to provide an oil control system which allows the use of oil operated devices, such as a variable cam phasing system, to operate also at a cold start. According to the invention, this object is achieved in that the oil control system is provided with bypass means for allowing the flow of oil passed the filter.

[0004] The effect of having a bypass means that, under cold conditions, the bypass means can open and allow, for short time periods, an unfiltered operation of the oil control valve and the connected systems.

[0005] According to the invention it is possible that the bypass means are pressure controlled, in order to allow the flow of oil through the bypass means in case the oil pressure upstream of the filter exceeds a threshold value.

[0006] The effect of this measure is that the bypass means automatically open at oil pressures that preside under cold conditions. When the engine warms up, the oil pressure declines and the bypass means automatically close to allow normal, filtered operations.

According to the invention, it is possible that the bypass means comprise a check valve, having a ball seat and a ball.

[0007] According to the invention, it is possible that the control valve comprises a control element, the movement whereof is constrained by means of a control spring, wherein the ball seat of the check valve is used as a retainer for the control spring. This measure will improve packaging.

[0008] According to a further aspect of the invention, the invention relates to a variable cam phasing system, provided with an oil control system according to the invention.

[0009] Below the invention is described with to the figure, which shows in cross section an oil control valve with an integrated oil filter, according to the invention.

[0010] Figure 1 shows an oil control system 1 according to the invention.

The oil control system 1 comprises an oil control valve 20 for controlling the oil flow from an opening 3, for receiving oil, towards exits 4, 5 and 6. The exits 4, 5 and 6 can be connected to an oil operated device, such as a variable cam phasing system (not shown).

[0011] The oil control valve 20 comprises a first part 21 provided with control means to operate the movement of a control element 22 in the tubular part 23 of the oil control valve 20. The position of the control element 22 in the tubular part 23 will determine the flow of oil from the opening 3 towards one or more of the exits 4, 5 and 6. The control element 22 and the movement thereof in the tubular part 23 by means of the control means in the first part 21 is known in the prior art and will not be described in detail.

[0012] The oil control valve 20, according to the invention is provided with an integral oil filter 7. The filter 7 is integral with the oil control valve 20 for packaging and cost reasons and also to be as close as possible to the oil control valve 20. During normal operation of the oil control system 1, oil will flow from the opening 3 through the filter 7 towards the control element 22 and thereafter towards the exits 4, 5 and 6. The filter 7 is a fine filter with typically a mesh of 0.1 mm. The filter 7 is applied to prevent chips or other contaminants to enter the oil control valve 20 and cause malfunction. A potential problem of using the fine filter 7, in an oil control valve, used in combination with for instance a variable cam phasing system, is at cold start. At very low temperatures, such as -30°C, the oil viscosity reaches levels which significantly reduce the oil flow through the filter. That means that since the filter is not able to allow enough flow through the filter, the connected variable cam phasing system can not be operated during the cold start of the system.

[0013] Because of the ever increasing requirements for fuel economy and emissions, not using a variable cam phasing system is less and less acceptable.

As shown in Figure 1, the oil control system 1 is provided with bypass means, in the form of a check valve 10. The check valve 10 is provided with a ball seat 11 and a ball 12. In case the oil pressure under the ball 12 exceeds a threshold value, the ball 12 will be moved upwards, towards the ball seat 11, thereby creating an opening for allowing oil to flow directly towards the oil control valve, without being filtered. By using the engine, the temperature of the oil will increase. That means that the viscosity will decrease and that the filter 7 will be able to allow an increased amount of oil to pass through. The pressure difference across the ball 12 will drop, thereby allowing the ball 12 to return to its initial position.

[0014] In case the unfiltered operation of the oil control system would only be allowed for a limited amount of time, this unfiltered operation is acceptable and will not

adversely effect the operation of the oil control system 1, nor the connected oil operated cam phasing device.

[0015] In Figure 1, it is shown that the movement of the control element 22 in the tubular element 23 is restricted by means of a spring 15. The spring 15 is at the underside thereof restrained by the ball seat 11. That means that the ball seat 11 is used not only to guide the movement of the ball 12 but also as a spring retainer.

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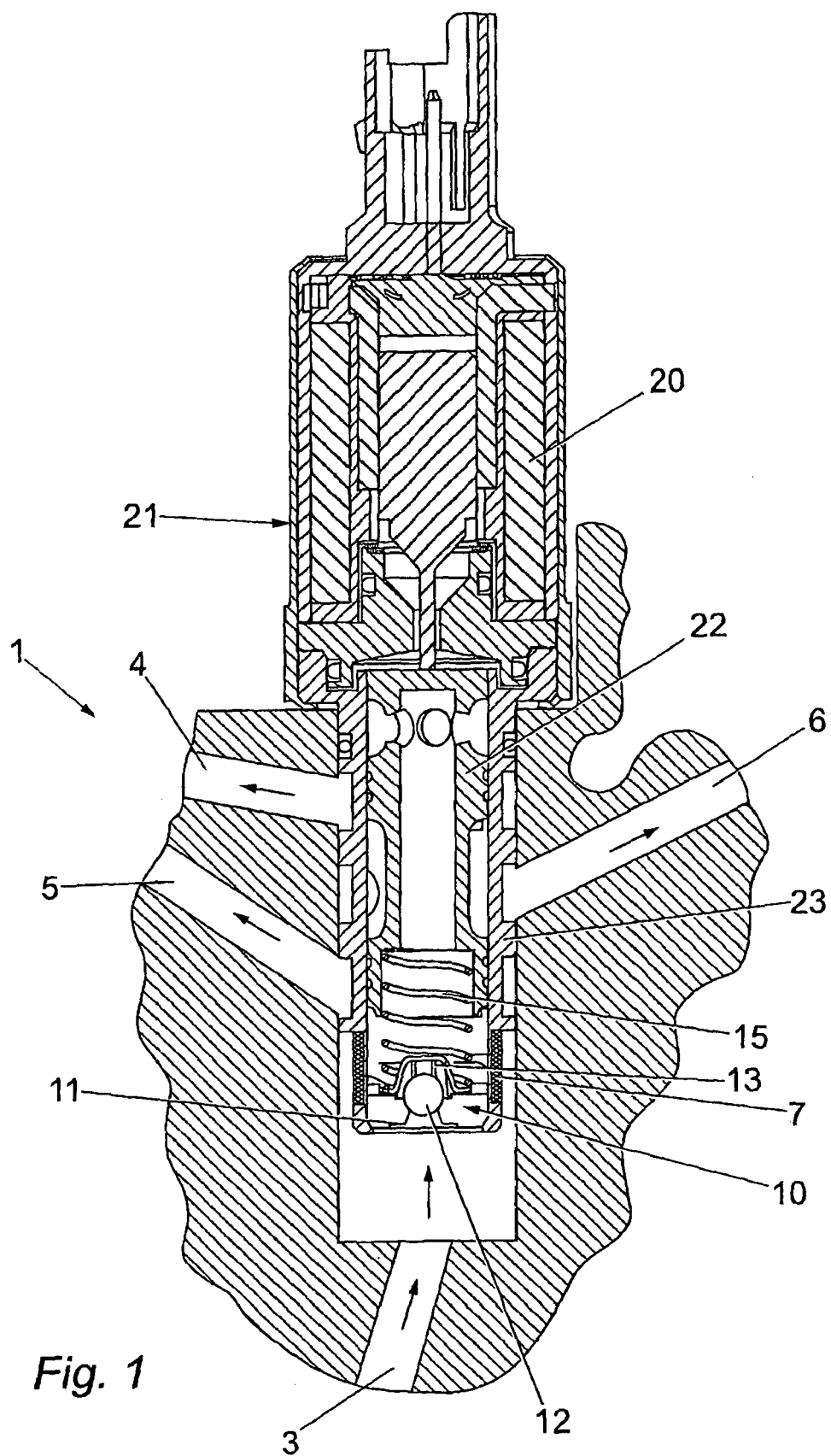
Claims

1. Oil control system for controlling the flow of oil between an opening for receiving oil and one or more exits to be connected to an oil operate device, wherein the system is provided with an oil control valve and a filter for filtering the oil upstream of the oil control valve, **characterized in that**, the system is provided with bypass means for allowing the flow of oil towards the oil control valve passed the filter. 20
2. System according to claim 1, wherein the bypass means are pressure controlled, in order to allow the flow of oil through the bypass means in case the oil pressure upstream of the filter exceeds a set threshold value. 25
3. System according to claim 1 or 2, wherein the bypass means comprise a check valve. 30
4. System according to claim 3, wherein the check valve comprises a ball seat and a ball. 35
5. System according to claim 4, wherein the control valve comprises a control element, the movement whereof is constrained by means of a control spring, wherein the ball seat of the check valve is used as a retainer for the control spring. 40
6. Variable cam phasing system, provided with an oil control system, according to one of the preceding claims. 45

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EUROPEAN SEARCH REPORT

Application Number
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 November 2005	Examiner Paquay, J
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EUROPEAN SEARCH REPORT

Application Number
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2
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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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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