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(54) Motorcycle oil filter assembly with bypass valve

(57) An oil filter assembly (28) for diverting oil to an oil cooler (30) and comprising a housing adapted to be mounted on an engine. The housing (34) includes an inlet port (52) for receiving oil from the engine, an outlet port (90) for returning oil to the engine, and a bypass passage (68) that leads to an oil cooler. An oil filter (38) is secured to the housing, and a temperature-sensitive valve assembly (36) is located within the housing and is movable from a cold position to a hot position.

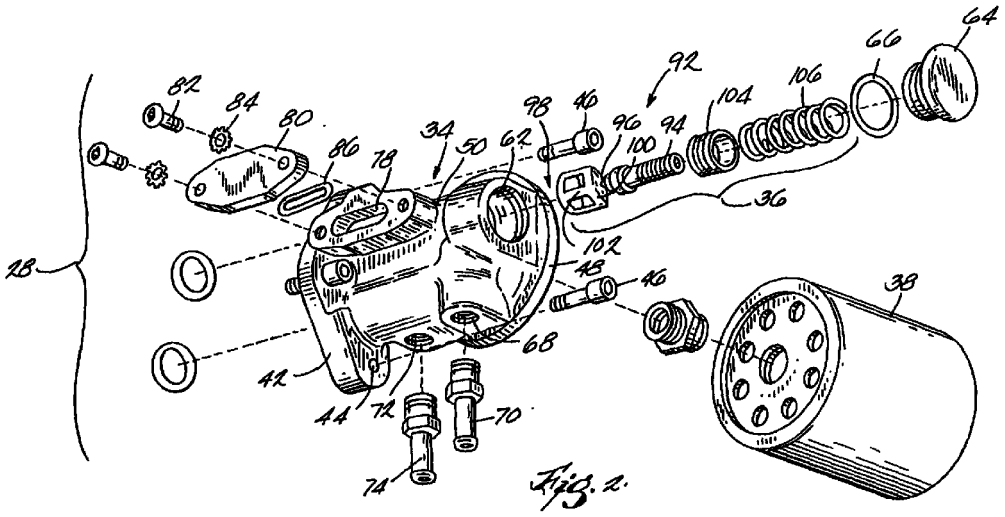

Fig. 2.

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the cooling of lubricating oil in a motorcycle engine. More particularly, the present invention relates to oil cooler bypass valve assemblies of the type utilizing a thermally responsive element to effect valve actuation.

BACKGROUND OF THE INVENTION

[0002] An internal combustion engine, as commonly used to propel a motorcycle, generates a great deal of heat as a product of the cumulative combustion events and friction. Lubrication of the engine can become a challenge when the oil that provides the lubrication becomes overheated and loses some of its characteristic viscosity.

[0003] It is well known to provide an oil cooler for motorcycle engines. Such oil coolers exchange heat between the oil and a cooling medium (e.g., external air) to lower the temperature of the oil. Passing the oil through an oil cooler is undesirable when the oil is below a certain temperature (e.g. during start-up). In this regard, a valve assembly, such as the one disclosed in U.S. Patent No. 4,190,198 (Casuga et al.), can be used to divert the oil to the oil cooler only when the oil needs to be cooled. This valve assembly provides a temperature sensitive mechanism that operates in a first position when the oil is below a threshold temperature, and moves to a second position when the oil reaches the threshold temperature. In the second position, the valve assembly diverts the oil flow to the oil cooler and provides a return path from, the cooler to the engine. Unfortunately, the valve assembly occupies additional space in the engine compartment, and requires additional wiring and hoses when added as an aftermarket feature to the engine.

SUMMARY OF THE INVENTION

[0004] The present invention provides a temperature-sensitive valve assembly that is incorporated into an oil filter assembly and is configured to divert oil to an oil cooler when the oil in the filter assembly reaches a certain temperature. Because the valve assembly is contained within the oil filter assembly, no additional engine compartment space is needed to accommodate the valve assembly. Also, positioning the valve assembly in the oil filter assembly reduces the number of separate parts attached to the motorcycle, provides protection to the valve assembly, and improves the aesthetics of the motorcycle.

[0005] More specifically, the present invention provides an oil filter assembly comprising a housing including an inlet port for receiving oil from the engine, an outlet port for returning oil to the engine, and a bypass passage adapted to be connected to an oil cooler. An oil filter is secured to the housing to complete a main oil path between the inlet port and the outlet port. A temperature-sensitive valve assembly is located within the main oil path and movable from a cold position to a hot position. The valve assembly is oriented to bypass oil from the main oil path to the bypass passage when in the hot position. Preferably, the filter assembly further includes a return passage in communication with the main oil path and adapted to return oil from the oil cooler to the housing.

[0006] In one embodiment, the housing further includes a cavity interconnecting the inlet port with the outlet port and at least partially defining the main oil path. The valve assembly is located within the cavity and is movable between the hot position and the cold position in a direction substantially parallel to an outlet axis defined by the direction oil travels when passing through the outlet port. Preferably, the movement of the valve assembly is also substantially parallel to an inlet axis defined by the direction oil travels when passing through the inlet port. It is also desirable to position the oil filter such that oil entering the oil filter flows along a filter axis that is substantially perpendicular to the outlet axis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] These and other features, aspects and advantages of the present invention will become better understood with regard to the following description, claims, and accompanying drawings.

Fig. 1 is a perspective view of a motorcycle showing an oil filter assembly and an oil cooler.

Fig. 2 is an exploded perspective view of the oil filter assembly.

Fig. 3 is a right side view of the housing of the oil filter assembly.

Fig. 4 is a front view of the housing of the oil filter assembly.

Fig. 5 is a left side view of the housing of the oil filter assembly.

Fig. 6 is a rear view of the housing of the oil filter assembly.

Fig. 7 is a bottom view of the housing of the oil filter assembly.

Fig. 8 is a cross-sectional view of the housing taken along line 8-8 in Fig. 4.

Fig. 9 is a cross-sectional view of the housing taken along line 9-9 in Fig. 3.

Fig. 10 is a cross-sectional view of the housing taken along line 10-10 in Fig. 7.

Fig. 11 is a cross-sectional view of the housing taken along line 11-11 in Fig. 7.

Fig. 12 is a cross-sectional view of the housing taken along line 12-12 in Fig. 5.

Fig. 13 is a sectional view of the oil filter assembly

taken generally along line 13-13 in Fig. 11, and showing oil flow when the valve assembly is in the cold position.

Fig. 14 is the sectional view of Fig. 13 showing oil flow when the valve assembly is in the hot position.

DETAILED DESCRIPTION

[0008] Fig. 1 illustrates a motorcycle 20 having a front wheel, a frame 24 supported by the front wheel 22, and engine 26 supported by the frame 24, an oil filter assembly 28 that filters engine oil, and an oil cooler 30 that cools engine oil. The oil filter assembly 28 and the oil cooler 30 are interconnected with a pair of oil conduits 32. It should be appreciated that, although the oil filter assembly is illustrated mounted to the front of the engine 26, the oil filter assembly 28 could be mounted in any appropriate location on the motorcycle 20.

[0009] Referring to Fig. 2, the oil filter assembly 28 generally includes a housing 34 adapted to be mounted to a motorcycle 20, and a temperature-sensitive valve assembly positioned within the housing 34 and adapted to divert oil to the oil cooler 30 when necessary. The housing 34 is designed to interconnect with an oil filter 38 having a filter element 40.

[0010] The specifics of the housing 34 are best seen in Figs. 2-12. The housing 34 includes a base portion 42 having multiple openings 44 designed to receive fasteners 46 to facilitate securing the housing 34 to the engine 26. The housing 34 further includes a filter portion 48 designed to support the oil filter, and a body portion 50 interconnecting the base portion 42 with the filter portion 48.

[0011] A series of passages directs oil through the housing 34. An inlet port 52 received oil from the motorcycle 20 and an inlet passage 54 directs the oil to the oil filter (Figs. 6, 8, 10, and 12). More specifically, the inlet passage extends from the inlet port 52 to a filter entrance passage 56, which leads to the entrance side of the filter element. The inlet passage 54 includes an irregular-shaped portion 58 to prevent the inlet passage 54 from intersecting other passages. In the illustrated embodiment, the irregular-shaped portion 58 is D-shaped.

[0012] A filter exit passage 60 provides communication between the exit side of the filter element 40 and a primary cavity 62 (Figs. 4, 8-11, 13, and 14). The primary cavity 62 is partially defined by a primary plug 64 that is threaded into the housing 34. A primary gasket 66 provides a seal. The primary cavity 62 provides a location for the valve assembly 36.

[0013] A bypass passage 68 provides a pathway from the primary cavity to a bypass fitting 70 (Figs. 2, 7-9, 11, 13, and 14) that is adapted to be connected to one of the conduits 32 (Fig. 1). The bypass passage 68 bypasses oil to the oil cooler 30, as described below. A return passage 72 provides a pathway from a return fitting 74 back to the primary cavity 62 (Figs. 2, 7-10, 13, and 14). The return passage 72 returns oil from the oil cooler 30 to the primary cavity 62, as described below. The bypass passage 68, conduits 32, oil cooler 30, and return passage 72 are collectively referred to as the bypass circuit.

[0014] The housing 34 further includes a secondary passage 76 and secondary cavity 78 (Figs. 2, 3, 9, 13, and 14) that allow oil to travel past the valve assembly 36 under certain conditions, as described below. The secondary cavity 78 is partially defined by a secondary cap 80 that is secured to the housing 34 by fasteners 82 and washers 84. A secondary gasket 86 provides a seal.

[0015] An outlet passage 88 provides communication from the primary cavity 62 to an outlet port 90, which is in communication with the engine 26 (Figs. 1, 4, 6, 8, 9, and 11-14).

[0016] For reference purposes, the path that the oil follows between the inlet port 52 and the outlet port 90 is referred to as the main oil path.

[0017] The valve assembly 36 includes a thermostat 92 having a main portion 94 and a plunger 96 that is movable relative to the main portion 94 (Figs. 2, 13, and 14). The position of the plunger 96 relative to the main portion 94 is dependent on the temperature of the thermostat 92, which is dependent on the temperature of the oil surrounding the main portion 94 of the thermostat 92. The illustrated thermostat 92 is a hot wax thermostat that is commercially available, from Caltherm of Bingham Farms, Michigan.

[0018] The plunger 96 of the thermostat 92 is engaged with a spacer 98 having a central support portion 100 and several leg portions 102 (Figs. 2, 13, and 14). The spacer 98 provides support to the plunger 96 and spaces the plunger 96 away from the outlet port 90 so that oil can flow around the plunger 96 and to the outlet port 90. Because the plunger 96 is, in essence, held in place by the spacer 98, movement of the plunger 96 relative to the main portion 94 (i.e., corresponding with a change in temperature of the oil in the housing 34) will result in movement of the main portion 94.

[0019] A valve member 104 is engaged with and moves with the main portion 94 (Figs. 2, 13, and 14). The valve member is designed to move between a cold position that blocks the bypass circuit (Fig. 13) and a hot position that blocks the main circuit (Fig. 14). When in the cold position, the bypass circuit is blocked by blocking the return passage 72. When in the hot position, the main circuit is blocked by blocking the secondary passage 76. A spring 106 biases the valve member 104 and thermostat 92 toward the outlet passage 88 to maintain contact between the plunger 96 and the spacer 98.

[0020] As used herein, the term "block" is used as a relative term, and is not meant to require complete obstruction. For example, when it is stated that the bypass circuit is blocked, it is intended to mean that the bypass circuit is obstructed to a greater extent when the

valve assembly 36 is cold compared to when the valve assembly is hot. Similarly, when it is stated that oil is "bypassed", it is intended to mean that a larger amount of oil passes through the bypass circuit when the valve assembly 36 is hot compared to when the valve assembly 36 is cold.

[0021] In operation, oil from the engine 26 enters through the inlet port 52 and travels through the inlet passage 54 and filter entrance passage 56 to the filter element 40. After being filtered, the oil passes through the filter exit passage 60 and into the primary cavity 62. At this point, the path of the oil is dependent on the position of the valve assembly. If the temperature of the oil is relatively low, the valve assembly 36 will be in a cold position with the valve member 104 blocking the return passage 72 (Fig. 13). In this configuration, the oil will pass through the secondary passage 76, into the secondary cavity 78, and back to the primary cavity 62, where the oil will exit through the outlet passage 88, the outlet port 90, and back to the engine 26. In contrast, if the temperature of the oil is relatively high, the valve assembly 36 will be in a hot position with the valve member 104 blocking the secondary passage 76 (Fig. 14). This forces the oil to travel from the primary cavity 62 to the bypass passage 68, which leads to the oil cooler 30. After being cooled, the oil passes through the return passage 72 and back to the primary cavity 62, where it will exit through the outlet passage 88, the outlet port 90, and back to the engine 26.

[0022] The foregoing description of the present invention has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the above teachings, and the skill or knowledge of the relevant art, are within the scope of the present invention. The embodiments described herein are further intended to explain best modes known for practicing the invention and to enable others skilled in the art to utilize the invention in such, or other, embodiments and with various modifications required by the particular applications or uses of the present invention. It is intended that the appended claims be construed to include alternative embodiments to the extent permitted by the prior art.

Claims

1. An oil filter assembly for filtering oil from an engine, said filter assembly comprising:

a housing including:

an inlet port for receiving oil from the engine;
an outlet port for returning oil to the engine; and
a bypass passage;

an oil filter secured to said housing, wherein said housing and said oil filter collectively define a main oil path between said inlet port and said outlet port; and

a temperature-sensitive valve assembly located within said main oil path and movable from a cold position to a hot position, said valve assembly being oriented to bypass oil from said main oil path to said bypass passage when in the hot position.

2. An oil filter assembly as claimed in claim 1, wherein said main oil path is substantially blocked when said valve assembly is in the hot position.

3. An oil filter assembly as claimed in claim 1, further comprising a return passage in communication with said main oil path.

4. An oil filter assembly as claimed in claim 3, wherein said return passage is substantially blocked by said valve assembly when in the cold position.

5. An oil filter assembly as claimed in claim 1, wherein said valve assembly comprises a hot wax thermostat.

6. An oil filter assembly as claimed in claim 1, wherein said housing further includes a cavity that at least partially forms said main oil path, said valve assembly being positioned in said cavity.

7. An oil cooler bypass assembly comprising:

a housing including:

an inlet port for receiving oil from an engine;
an outlet port for returning oil to the engine, said outlet port defining an outlet axis in a direction that oil flows when passing through said outlet port;
a cavity interconnecting said inlet port with said outlet port, said cavity at least partially defining a main oil path between said inlet port and said outlet port; and
a bypass passage; and

a temperature-sensitive valve assembly located within said cavity and movable from a cold position to a hot position, said valve assembly being oriented to divert oil from the oil path to said bypass passage when in the hot position, said valve assembly being movable between said hot position and said cold position in a direction substantially parallel to said outlet axis.

8. An oil cooler bypass assembly as claimed in claim 7, wherein said inlet port defines an inlet axis in a direction that oil flows when passing through said inlet port, and wherein said valve is movable between said hot position and said cold position in a direction substantially parallel to said inlet axis.

9. An oil cooler bypass assembly as claimed in claim 7, wherein said valve assembly comprises a hot wax thermostat.

10. An oil cooler bypass assembly as claimed in claim 7, further comprising an oil filter secured to said housing, said oil filter at least partially defining said main oil path.

11. An oil cooler bypass assembly as claimed in claim 10, wherein oil entering said oil filter flows along a filter axis that is substantially perpendicular to said outlet axis.

12. An oil cooler bypass assembly comprising:

a housing including:

an inlet port for receiving oil from an engine;
an outlet port for returning oil to the engine;
a primary cavity interconnecting said inlet port with said outlet port, said primary cavity at least partially defining a main oil path between said inlet port and said outlet port; and
a secondary cavity interconnected with said primary cavity and at least partially defining said main oil path; and

a temperature-sensitive valve assembly located within said primary cavity and movable from a cold position to a hot position where said secondary cavity is blocked.

13. An oil cooler bypass assembly as claimed in claim 12, wherein said secondary cavity is at least partially formed by a plug detachably secured to said housing.

14. An oil cooler bypass assembly as claimed in claim 12, wherein said valve assembly comprises a hot wax thermostat.

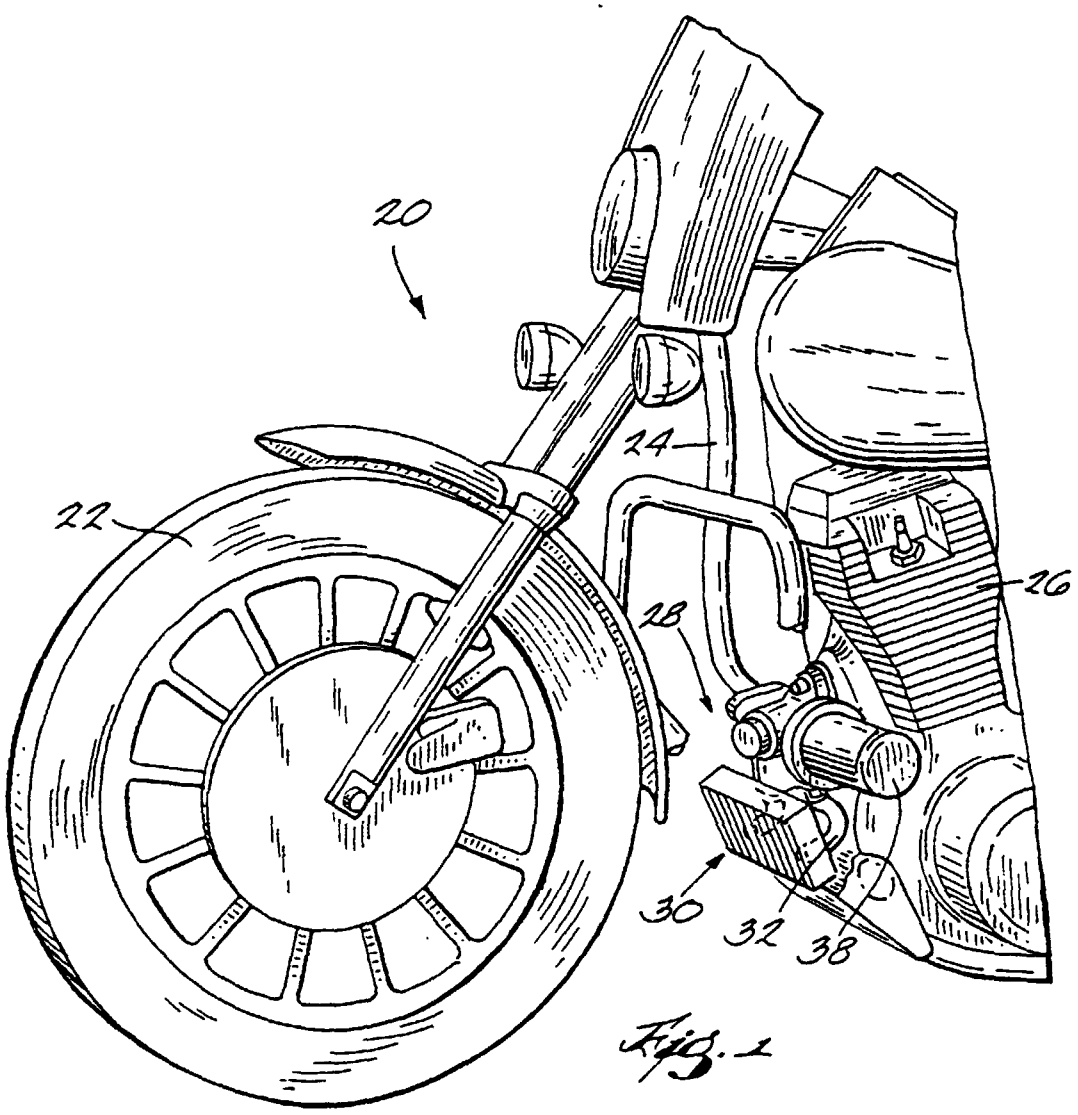

Fig. 1

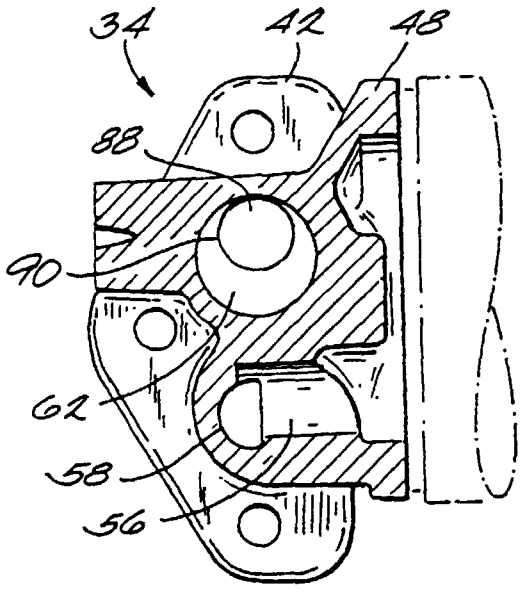

Fig. 12.

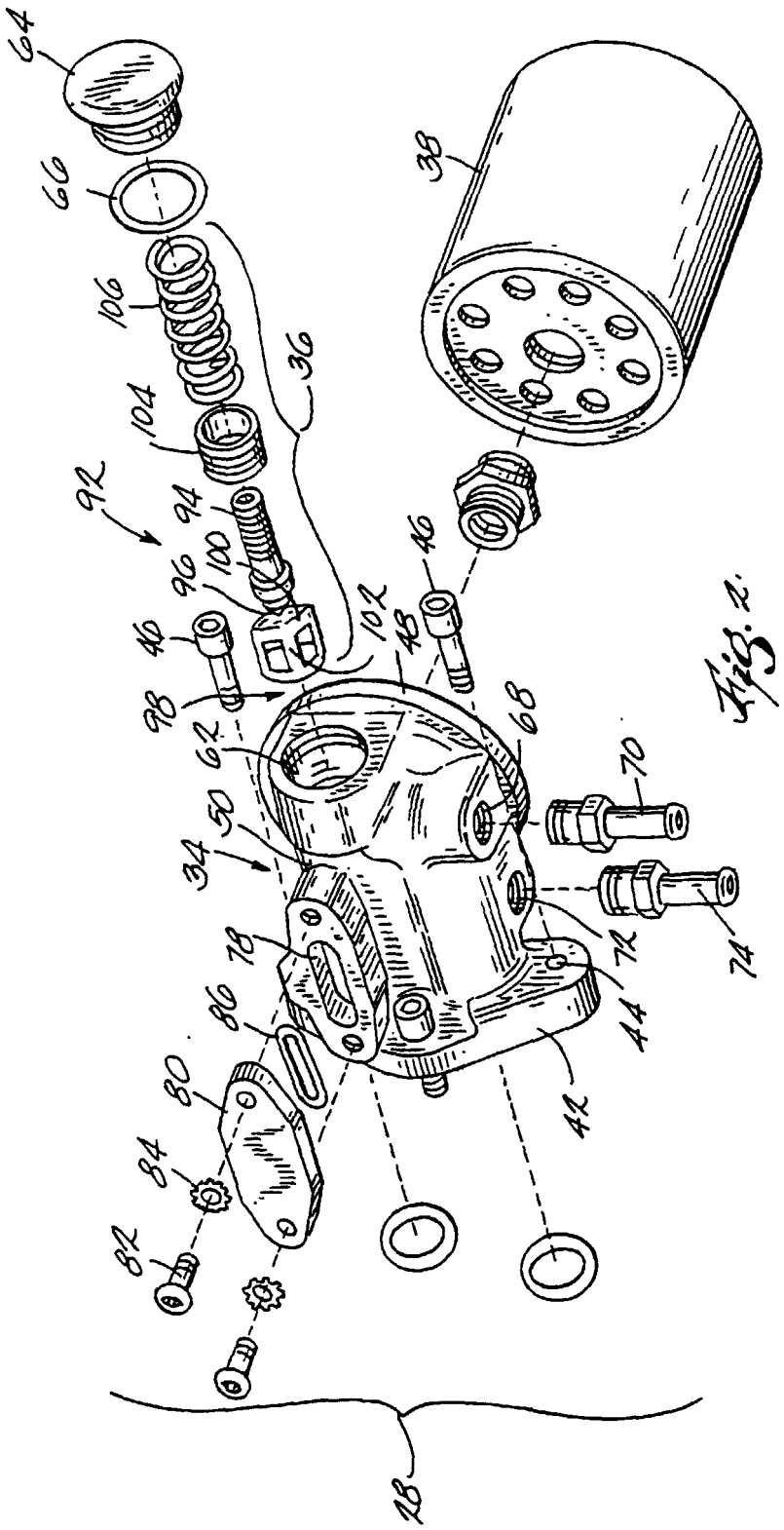
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Fig. 4.

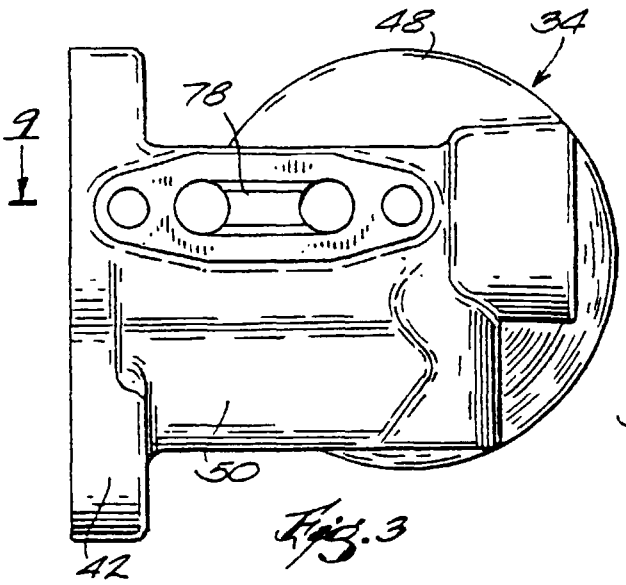

Fig. 3

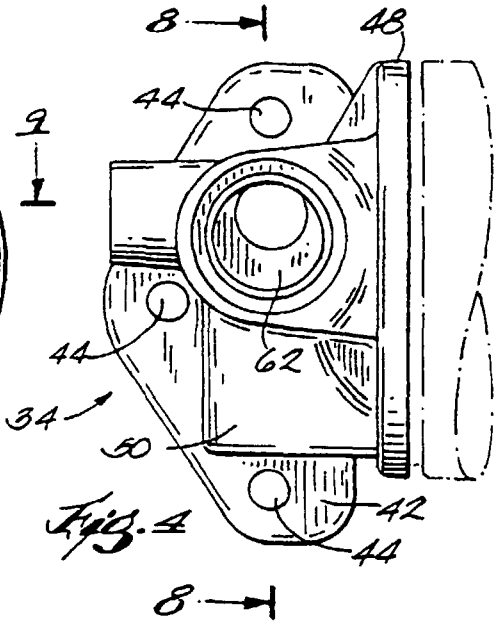

Fig. 4

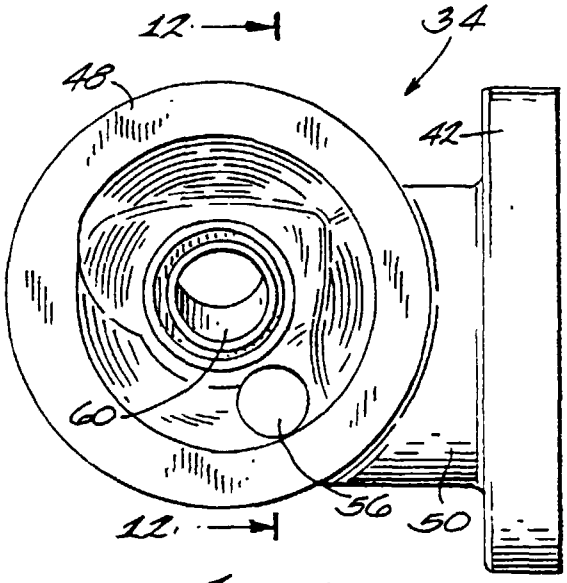

Fig. 5

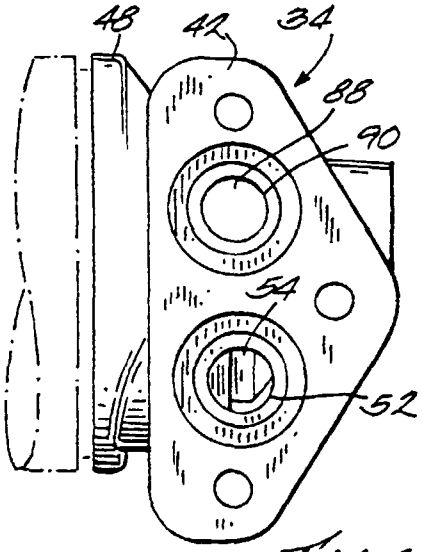

Fig. 6

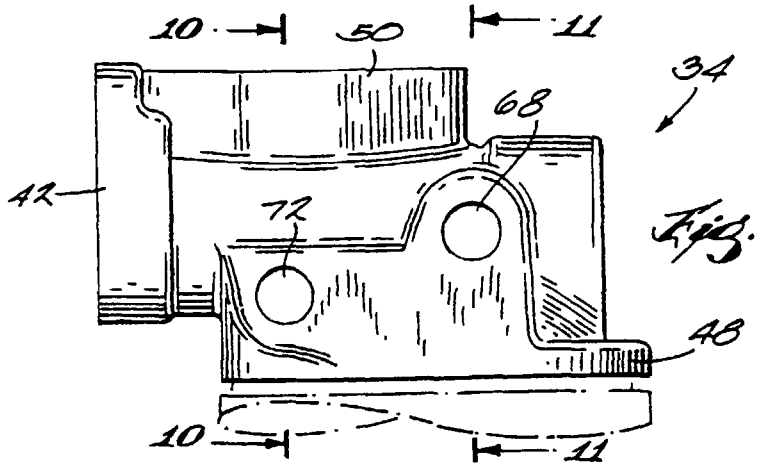

Fig. 7

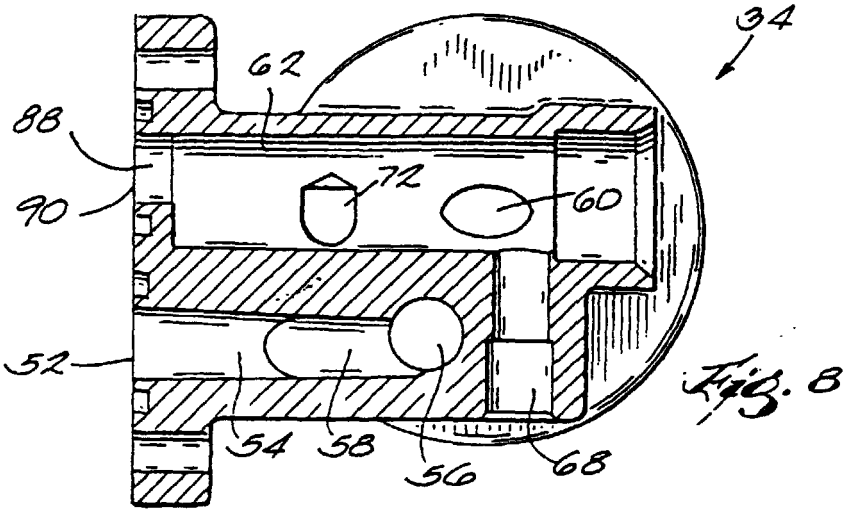

Fig. 8

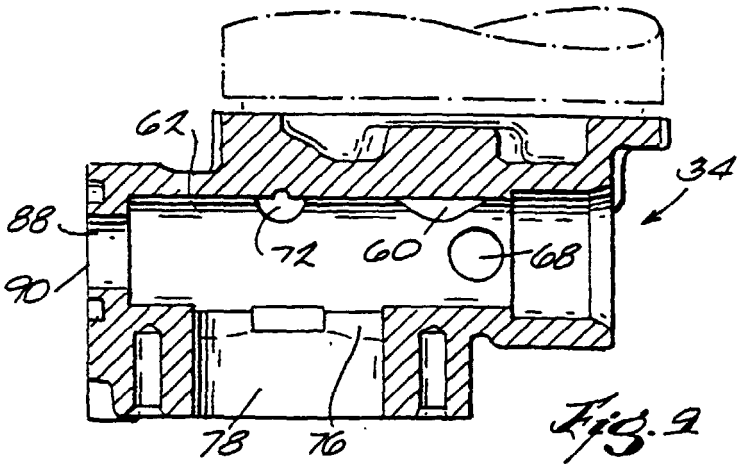

Fig. 9

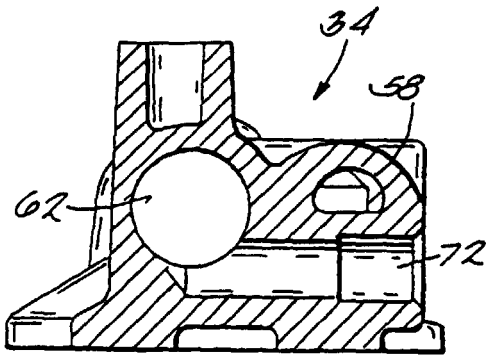

Fig. 10

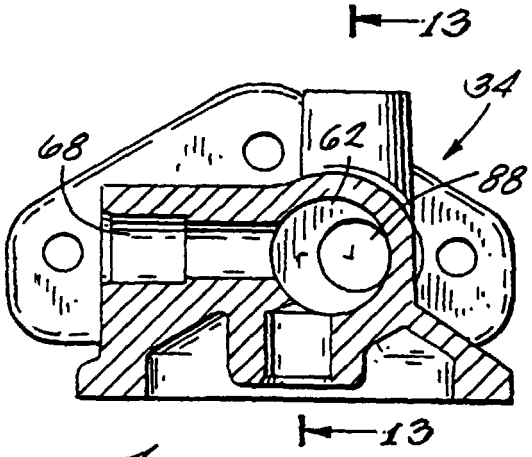

Fig. 11

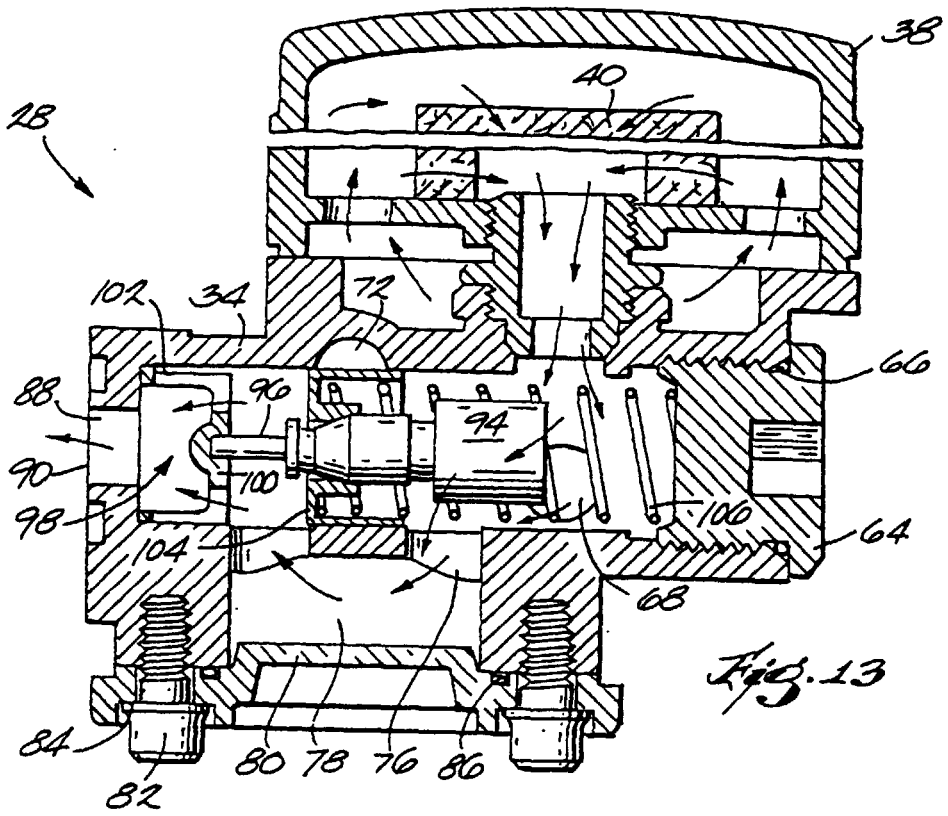
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Fig. 13

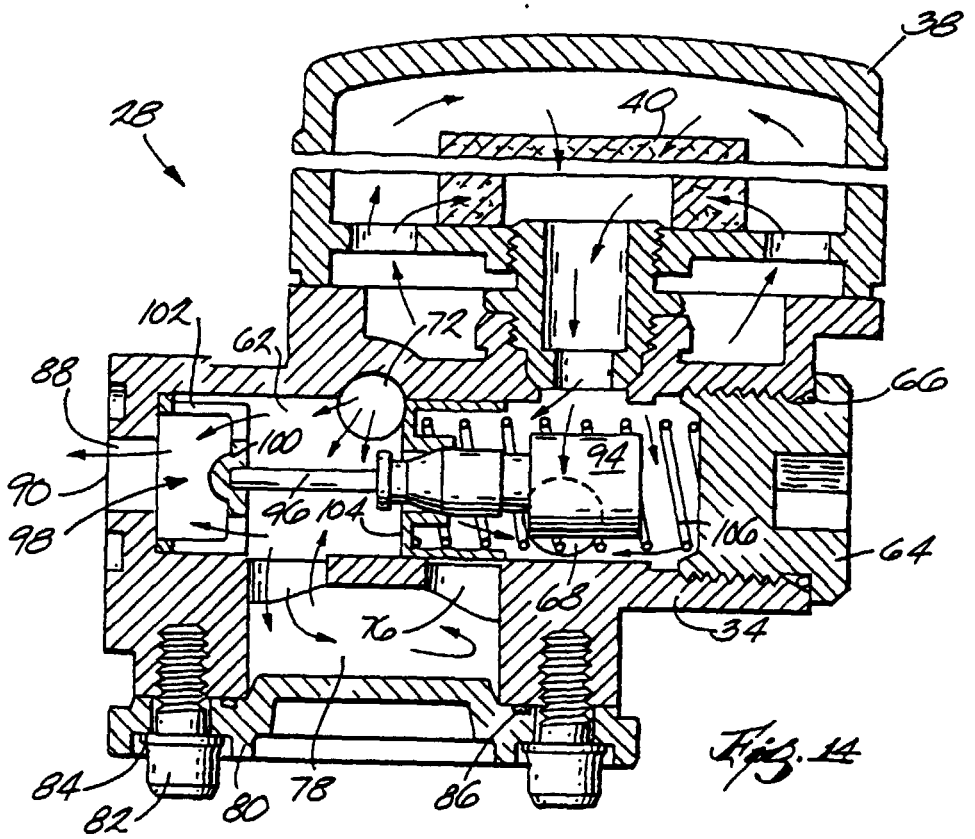
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Fig. 14

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 11 2005

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 October 1999	Mouton, J

CATEGORY OF CITED DOCUMENTS

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