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(54) **Engine fluid pump and timing gear housing**

(57) A fluid pump may be provided for an engine, comprising a first housing part formed contiguously with a gear housing. The gear housing can be configured to at least partially enclose one or more engine gears. A

second housing part can be connected with the first housing part and can be configured to at least partly define a pump chamber between the first housing part and the second housing part. An impeller can be provided in the pump chamber.

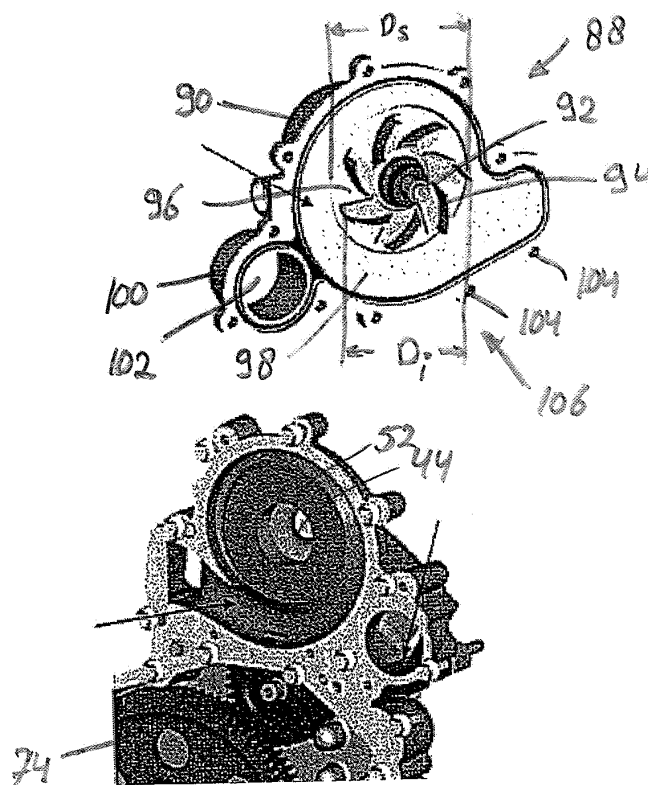


Fig 5

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Description

Technical Field

[0001] The present disclosure relates generally to a fluid pump and, more specifically, to a fluid pump comprising first and second housing parts.

Background

[0002] Engines such as internal combustion engines comprise an engine block and a coolant circuit for cooling the engine block and the various parts included therein, such as pistons and drive shafts. A fluid pump will be included in the cooling circuit for circulating a coolant through the cooling circuit. It is commonly known to mount a coolant pump to a front end of an engine. The coolant pump will have a housing separate from the engine block and be fluidly connected to the engine block and radiator of the engine by appropriate tubing. An impeller within a housing of the pump can be driven by the crank shaft through a pulley and belt or chain, such that coolant will be pumped through the engine and radiator when the engine is running.

[0003] In United States Patent 6 109 221 (the "221 patent) a coolant pump is disclosed having a pump cavity formed as an integral part of the engine block of a vertical V-type engine. To that end the cavity is formed in a top face of the engine block. A pump cover is provided, closing off the pump cavity and enclosing an impeller in the pump cavity. A pump inlet port and pump outlet port are integrally formed with the pump cavity. In this arrangement the coolant pump is generally positioned between an end face of the engine block and a flywheel.

[0004] In this known arrangement the pump cavity is cast into the engine block and subsequently machined in order to obtain the finishing necessary for proper fixture and sealing of the tubing and for proper running of the coolant pump. By positioning the coolant pump between the end of the engine block and the fly wheel, the overall height of the engine can be reduced relative to a commonly known vertical V-type engine. Moreover, by casting the pump cavity into the engine block the engine can have a reduced weight.

[0005] Although this known engine block has the advantage of reduced weight and building height, the casting of the engine block is relatively cumbersome, whereas the die for casting shall be complicated. Machining of the cast engine block can be difficult because of the volume and weight.

[0006] The disclosed fluid pump, timing gear case and combustion engine are directed to improving prior systems.

Summary of the Invention

[0007] In one aspect the disclosure is directed to a fluid pump for an engine. The fluid pump can comprise a first

housing part formed contiguously with a gear housing configured to at least partially enclose one or more engine gears. Furthermore the fluid pump can comprise a second housing part connected with the first housing part and configured to at least partly define a pump chamber between the first housing part and the second housing part. An impeller is provided in the pump chamber.

[0008] In an other aspect the disclosure is directed to a timing gear case. The timing gear case can comprise an engine block engaging portion and a gear housing portion. A first part of a coolant pump housing can be made integrally with the gear housing portion.

[0009] In a still another aspect the disclosure is directed to a combustion engine. The engine can comprise an engine block having opposite first and second ends. A timing gear case can be connected to one of the first and second ends. The engine can comprise a coolant circuit and a coolant pump, connected to the coolant circuit. The coolant pump can comprise a pump chamber and an impeller provided in the pump chamber. The pump chamber can be provided at least partly in the timing gear case and can be covered by at least a pump housing part. The pump housing part can include a drive unit for the impeller.

Brief Description of the Drawings

[0010] Fig. 1 is schematically a side view of an engine with a timing gear case;

[0011] Fig. 2 is schematically in front view a gear case;

[0012] Fig. 3 is schematically in rear view the gear case of fig. 2;

[0013] Fig. 4 is schematically a perspective front view of a timing gear case, partly assembled;

[0014] Fig. 5 is schematically a perspective front view of part of the gear case of fig. 4, with a disassembled a pump housing part in rear view; and

[0015] Fig. 6 is schematically in perspective rear view the part of the timing gear case of fig. 5, once with a cover mounted and once with the cover removed.

Detailed Description

[0016] In the description the same or similar features or elements have the same or corresponding reference signs. The embodiments shown are only shown and discussed by way of examples and should not be construed as limiting the disclosure.

[0017] In this description engine has to be understood as including internal combustion engines, such as but not limited to gasoline engines, petrol engines, natural gas engines and biofuel engines. In this description engines will only be described as far as necessary for understanding the disclosure.

[0018] Fig. 1 shows, by way of example, schematically an engine 10 comprising an engine block 12 (shown in dashed lines) and a timing gear case 14. The engine block 12 has a first end 16 and an opposite end 18. The

timing gear case 14 is connected to the first end 16. The engine block 12 comprises a coolant circuit 20, schematically indicated by dotted lines 22, and a fluid pump 24, provided at the first end 16 and in fluid connection with the coolant circuit 20. The fluid pump 24 can be referred to as a coolant pump. In an embodiment the timing gear case 14 can comprise a gear housing portion 26 and an engine block engaging portion 28. The engine block engaging portion 28 can be part of the gear housing portion 26. The timing gear case 14 can be connected to the engine block 12 by the engine block engaging portion 28. The timing gear case 14 can be connected to the engine block 12 by bolts 30. A timing gear cover 32 can be removably placed on the gear housing portion 26. Timing gears 34 can be provided in the space 36 enclosed between at least the gear housing portion 26 and the timing gear cover 32. The gear housing portion 26 can be cast. In an embodiment the gear housing portion 26 can be die cast. In another embodiment the gear housing portion 26 can be sand cast. The fluid pump 24 can at least partly be formed in or be integrated with the timing gear case 14. In an embodiment at least one part of the fluid pump 24 can be integrated with the gear housing portion 26. Such integration can reduce the number of parts and can reduce manufacturing costs. Such integration can further reduce overall volume and weight of the engine 10. Moreover, such integration can simplify mounting and connecting of fluid pump connections.

[0019] As is schematically shown in fig. 2 and 3, a first housing portion 38 of the fluid pump 24 can be integrated with the gear housing portion 26. The gear housing portion 26 and the first housing portion 38 can be made contiguously. The first housing portion 38 can be positioned spaced apart from the engine block engaging portion 28. In an embodiment the engine block engaging portion 28 can be at least partly delimited by a surface area 40 at a second side 42 of the gear case 14, configured to engage a seal (not shown) at the first end 16 of the engine block 12. In an embodiment the gear housing portion 28 can be cast integrally with the first housing portion 38. In an embodiment the distance D_p between the first pump housing portion 38 and the surface area 40 closest to the portion 38 can be more than 10 mm, such that the water pump 24 can be spaced apart from the engine block 12.

[0020] The first housing portion 38 can comprise an inlet 44 and a volute 46 at a first side 48 of the gear case 14. A substantially flat, ring shaped bottom area 50 can be provided surrounding the inlet 44. The volute 46 can comprise a channel 52 extending spiraling away from the inlet 44 or the bottom area 50 in the direction of an outlet 54 of the channel 52. The cross sectional dimensions of the channel 52 can increase from the inlet 44 in the direction of the outlet 54. The inlet 44 can extend from the first side 48 to the second side 42. The outlet 54 can extend from the first side 48 to the second side 42. An opening 56 can be provided in the gear housing portion 26, spaced apart from the first housing portion 38, ex-

tending from the first side 48 to the second side 42. At the second side 42 a first part 58 of a connecting channel 60 can be provided, for fluidly connecting the opening 56 with the inlet 44. The first part 58 of the channel 60 can be delimited by a wall 62 extending around the inlet 44 and the opening 56 at the second side 42. The wall 62 can have a sealing surface 64.

[0021] The gear housing portion 26 can have a bottom surface 66 and a peripheral wall 68 at the first side 48, defining at least part of the space 36. Through the bottom surface 66 a first opening 70 is provided for a hub 72 connected to the engine block 12, as is shown in fig. 4. An idler gear 74 is born on the hub 72 and can rotate freely. A second opening 76 is provided for a camshaft (not shown) to extend through. A camshaft gear 78 can be mounted on the camshaft and can be in engagement with the idler gear 74 within the space 36. A third opening 80 can be provided for a power take off (here shown as a left hand side power take off) in which opening a pump or compressor 82 can be fitted from a rear side 42 of the gear house portion 26, driven by the idler gear 74. A fuel injection pump opening 84 can be provided above the first opening 70. A crank shaft opening 86 can be provided. The crank shaft opening 86 can be provided below the idler gear 74. A crank shaft 114 (shown in fig. 1) can extend from the engine block 12 through the crank shaft opening 86. A main gear (not shown) can be mounted on the crank shaft, within the gear housing portion 26, for driving the idler gear 74.

[0022] A second housing part 88 can be provided, for cooperation with the first housing part 38, as is schematically shown in fig. 4 and 5. The second housing part 88 can comprise a drive unit 90 including a motor (not shown) with an axis 92. An impeller 94 is connected to the axis 92. The impeller 94 can have a diameter D_i similar or slightly smaller than the diameter D_a of the bottom area 50. The second housing part 88 can have a central bottom surface 96 having a diameter D_s slightly bigger than the diameter D_i of the impeller 94. The diameter D_s can be approximately the same as the diameter D_a . A volute area 98 can surround at least part of the bottom surface 96. Separated from the volute area 98 a pipe element 100 can be provided having a opening 102 extending there through. Bolt openings 104 can be provided surrounding at least the volute area 98 and the pipe element 100. The axis 92 can extend from the first side 106 of the second housing part 88 to the opposite, second side 108 thereof. A pulley 110 can be mounted to the axis 92 at the opposite side, as shown in fig. 1, whereas a second pulley 112 can be mounted to the crank shaft 114. A belt 116 can be led over the pulley 110 and second pulley 112, guided by a support wheel 118. In another embodiment the water pump 24 can be driven by a gear, driven directly or indirectly by the idler gear 74.

[0023] Fig. 6 shows part of the gear housing 14, from the second side 42. On the left side of fig. 6 it is shown with a cover 120 mounted on the wall 64, sealing against the sealing surface 64 and enclosing the channel 58. On

the right side of fig. 6 it is shown with the cover 120 removed. The cover 120 can be bolted by bolts 122 to the gear housing portion 26.

[0024] As is shown in fig. 1 and 4, the second housing part 88 can be fitted to the first housing part 38, such that the volute areas 52 and 98 face each other. A pump chamber 124 can be enclosed between the first 38 and second housing part 88. The impeller 92 can be provided in the pump chamber 124. As is shown in fig. 1, a first end 126 of the coolant circuit 20 can be connected to the opening 56. A second end 128 of the coolant circuit 20 can be connected to the outlet 54. The pump chamber 124 and the channel 58 are thus included in the coolant circuit 20.

Industrial Applicability

[0025] A timing gear case 14, including at least a first housing part 38 of a fluid pump 24 is made. The timing gear case 14 can be cast and then machined. A second housing part 88 of the fluid pump 24 can be made separately. The second housing part 88 can then be mounted to the first housing part 38, forming the pump chamber 124. The pipe element 100 is thereby connected to the opening 56, such that the opening 56 is in fluid connection with the opening 102. The cover 120 can be bolted to the wall 62, forming the channel 58. The timing gear case 14 can be mounted to the engine block 12, such that the engine block engaging portion 28 is connected to the end 16. The timing gear cover 32 can be mounted to the timing gear case 14. Pulleys 110 and 112 can be mounted to the axis 92 and the crank shaft 114 respectively and the belt 116 can be positioned on the pulleys 110, 112. The first end 126 of the coolant circuit can be connected to the pipe element 100. The second end 128 of the coolant circuit 20 can be connected to the outlet 54.

[0026] The fluid pump 24 is positioned spaced apart from the engine block 12, providing for easy access to the fluid pump 24. Moreover, the overall length of the engine 10 can be slightly reduced. Air can flow freely around the fluid pump 24. Since at least the first housing part 38 can be integrated in and made contiguous with the timing gear case 14, the number of mounting steps can be reduced.

[0027] Before operation of the engine 10, the coolant circuit 20 can be filled with a coolant, including the channel 58 and the pump chamber 124. During operation of the engine 10 the belt 116 will be driven by the second pulley 112, driven by the crank shaft 114. The belt can drive the pulley 110, rotating the axis 92 and the impeller 94 in the pump chamber 124. The impeller 94 can pressurize the coolant in the pump chamber 124 and force the coolant out of the pump chamber 124 through the outlet 54, in to the coolant circuit 20 through the second end 128 thereof. By pumping the coolant out of the outlet 54 a pressure in the pump chamber 124 will be reduced, sucking coolant in to the pump chamber 124 through the channel 58, the opening 56 and the opening 102, from

the first end 126 of the coolant circuit 20. This will provide for a flow of coolant through the coolant circuit 20. A radiator or other type of cooling device can be provided (not shown) connected to or incorporated in the coolant circuit 20, for cooling the coolant.

[0028] For maintenance purposes the second housing part 88 can be easily removed from the timing gear case 14, separating it from the first housing part 38. The pump chamber 124 is thereby opened, exposing the impeller 94 and the volute areas 52, 98. This enables easy access of the pump chamber 124 for inspection and repair. Moreover the second pump housing part 88 can easily be exchanged.

[0029] Although exemplary embodiments have been shown of an engine and timing gear case, these should not be construed as limiting the scope of protection sought in any way. All kinds of modifications and alterations are possible within the scope as defined by the claims.

Claims

1. A fluid pump for an engine, comprising:

- a first housing part formed contiguously with a gear housing configured to at least partially enclose one or more engine gears;
- a second housing part connected with the first housing part and configured to at least partly define a pump chamber between the first housing part and the second housing part;
- an impeller provided in the pump chamber.

2. A fluid pump according to claim 1, wherein the pump chamber comprises at least an inlet and an outlet, wherein at least one of the inlet and the outlet is formed by the first housing part.

3. A fluid pump according to claim 1 or 2, wherein the first housing part comprises a volute configured for guiding a flow of fluid during operation of the pump.

4. A fluid pump according to claim 3, wherein the volute extends between an inlet and an outlet of the pump chamber.

5. A fluid pump according to any one of claims 1 - 4, wherein the first housing part is provided at a first side of the gear housing, the first housing part comprising:

- part of the pump chamber; and
- an inlet extending from a second side of the gear housing, opposite the first side, into the pump chamber; and

wherein an opening is provided through the gear

- housing, spaced apart from the pump chamber, extending from the first side to the second side, further including a first part of a connecting channel at the second side of the gear housing, fluidly connecting the inlet with the opening. 5
6. A fluid pump according to claim 5, wherein the first part of the channel is formed in the gear housing and a second part of the channel is formed by a cover. 10
7. A fluid pump according to any one of claims 1- 6, wherein the gear housing is at least partly cast, integrally with the first housing part.
8. A fluid pump according to any one of claims 5 or 6, wherein the gear housing is at least partly cast, including the first housing part and the first part of the channel. 15
9. A fluid pump according to claim 7 or 8, wherein the gear housing is die-cast or sand-cast. 20
10. A fluid pump according to any one of claims 1 - 9, wherein the gear housing comprises an engine block engaging portion, the first housing part being spaced apart from the engine block engaging portion. 25
11. A timing gear case, comprising:
- an engine block engaging portion; and 30
 - a gear housing portion;
 - a first part of a coolant pump housing, which first part is made integrally with the gear housing portion. 35
12. A timing gear case according to claim 11, wherein the timing gear case, including the first part of the coolant pump housing is made by casting.
13. Timing gear case according to claim 11 or 12, wherein the timing gear case is substantially made of aluminum or aluminum alloy, of magnesium alloy, iron or iron alloy 40
14. Timing gear case according to any one of claims 11 - 13, wherein the gear housing portion and the first part of the coolant pump housing are provided at a first side of the timing gear case and the engine block engaging portion is provided at an opposite second side of the timing gear case. 50
15. Timing gear case according to claim 14, wherein the first part of the coolant pump housing is provided spaced apart from the gear portion, wherein an inlet is provided extending through the case from the first part of the coolant pump housing to the second side of the timing gear case, wherein an opening is provided in the timing gear case, spaced apart from the 55
- inlet and from the engine block engaging portion, a cover engaging portion surrounding the inlet, the opening and an intermediate portion between the inlet and the opening at the second side of the timing gear case.
16. Timing gear case according to any one of claims 11 - 15, wherein the first part of the coolant pump housing comprises a volute, extending at least partly around an inlet or outlet opening. 10
17. Combustion engine, comprising:
- an engine block having opposite first and second ends; and
 - a timing gear case connected to one of the first and second ends;
 - the engine further comprising a coolant circuit and a coolant pump, connected to the coolant circuit,
- wherein the coolant pump comprises:
- a pump chamber; and
 - an impeller provided in the pump chamber;
- wherein the pump chamber is at least partly provided in the timing gear case and covered by at least a pump housing part, the pump housing part including a drive unit for the impeller.
18. Combustion engine according to claim 17, wherein the timing gear case is connected to the engine by an engine block engaging portion, wherein the coolant pump is provided spaced apart from the engine block engaging portion, the coolant pump comprising:
- the pump chamber at a first side of the timing gear case, opposite the engine block engaging portion; and
 - a connecting channel at the side of the engine block engaging portion.
19. Method for forming a coolant pump for a combustion engine, comprising the steps of:
- casting a timing gear case, wherein a housing part of the coolant pump, including at least part of a pump chamber, is cast with the timing gear case, at a first side thereof;
 - providing a coolant pump cover with a drive unit and an impeller connected to the drive unit;
 - connecting the coolant pump cover to the timing gear case, thereby forming a pump chamber surrounding the impeller.
20. Method according to claim 19, wherein a through

bore is provided in the timing gear case, extending from the pump chamber through the timing gear case to a second side of the timing gear cover, further including the step of connecting a cover to the second side of the timing gear case, forming a channel 5 extending at the second side, in fluid connection with the through bore.

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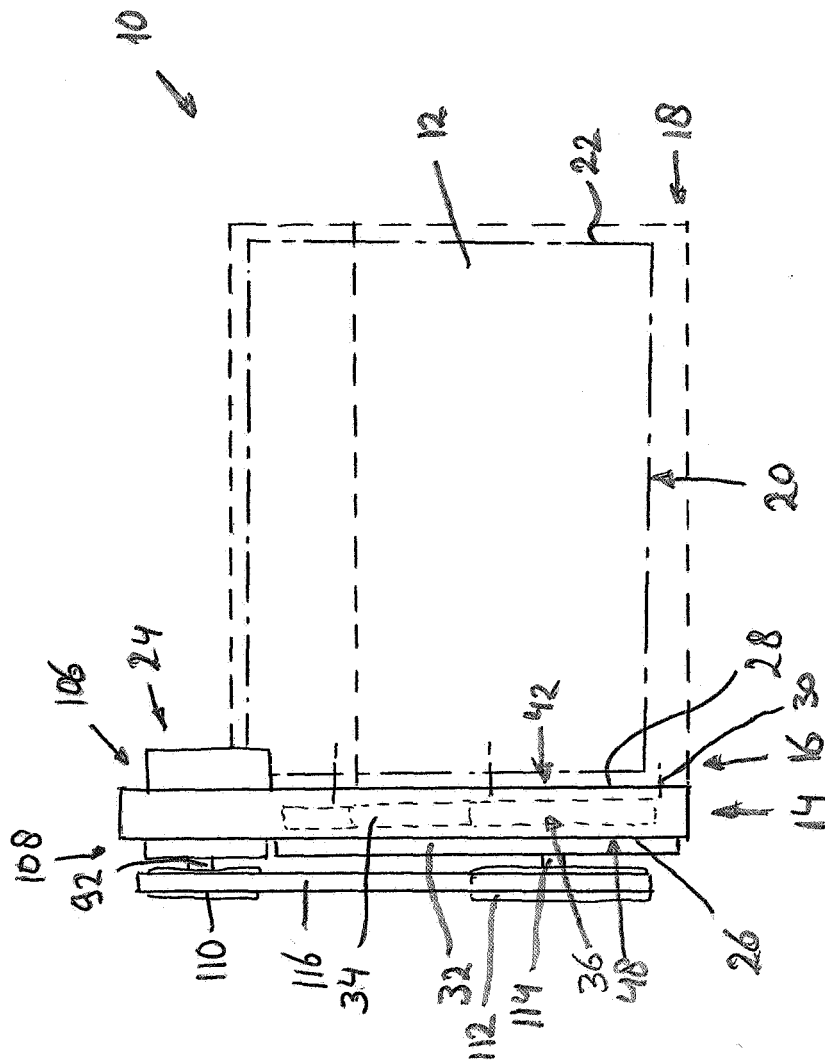
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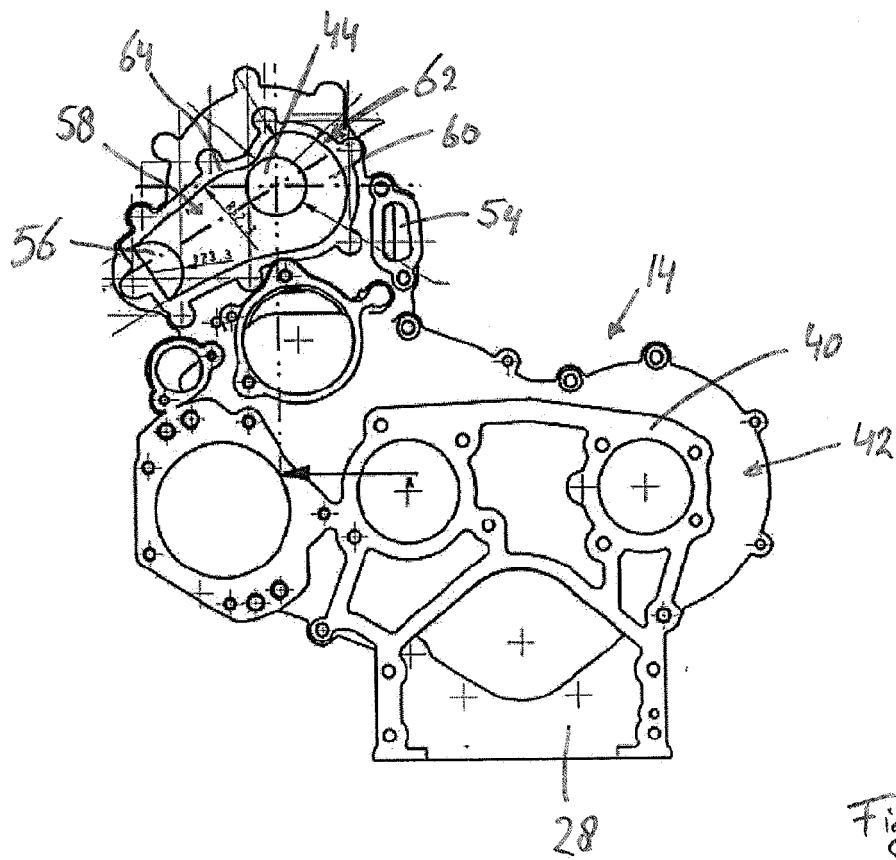
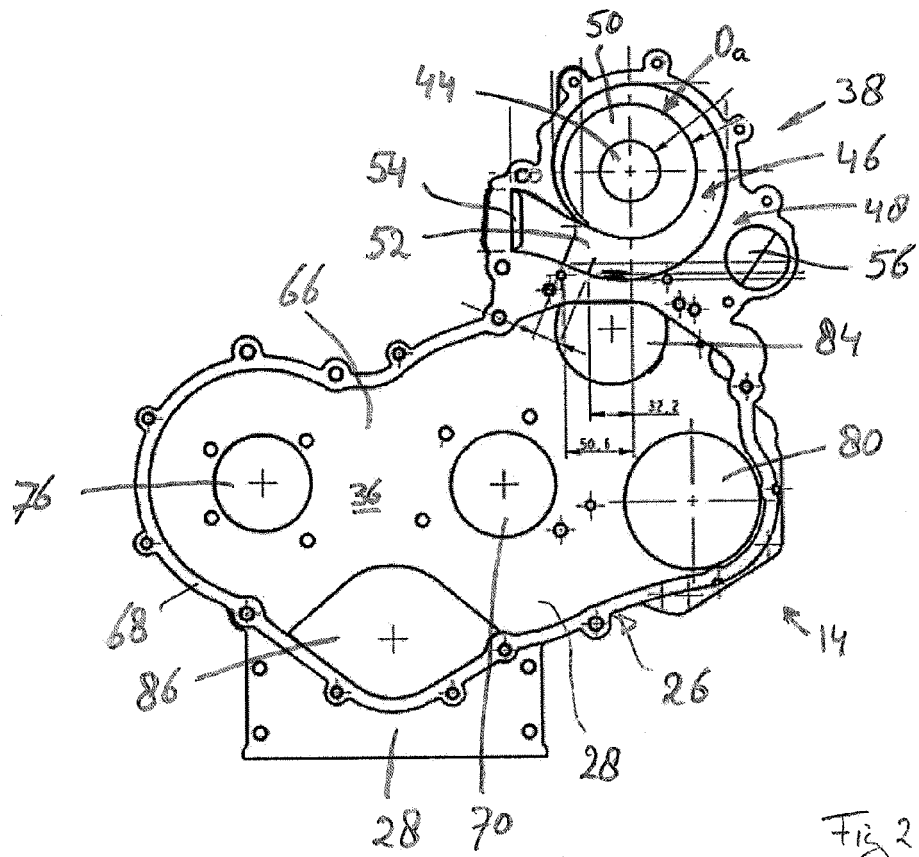
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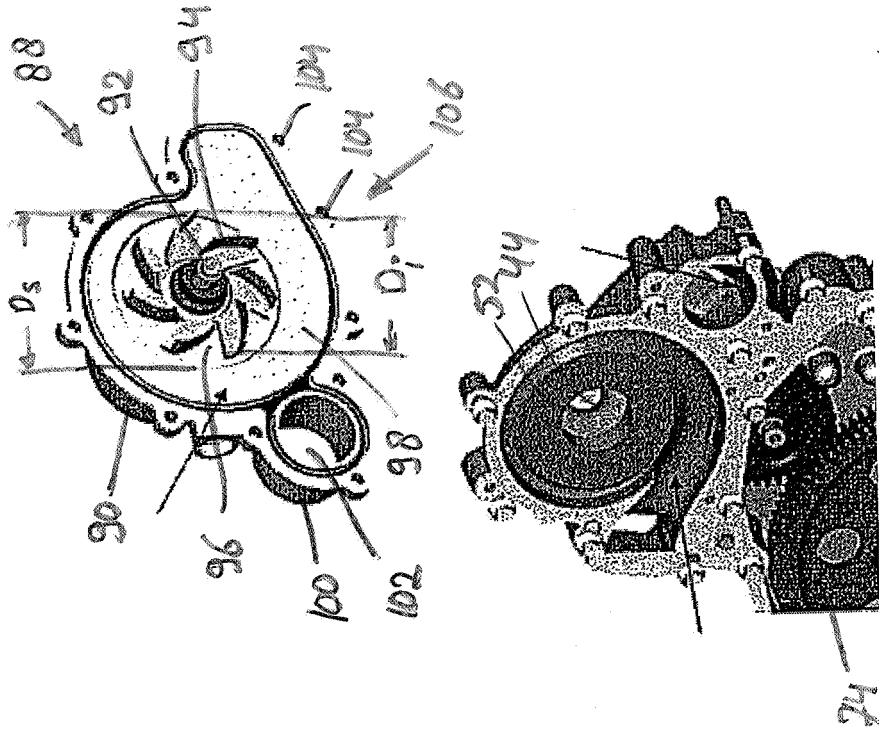


Fig. 5

Fig. 4

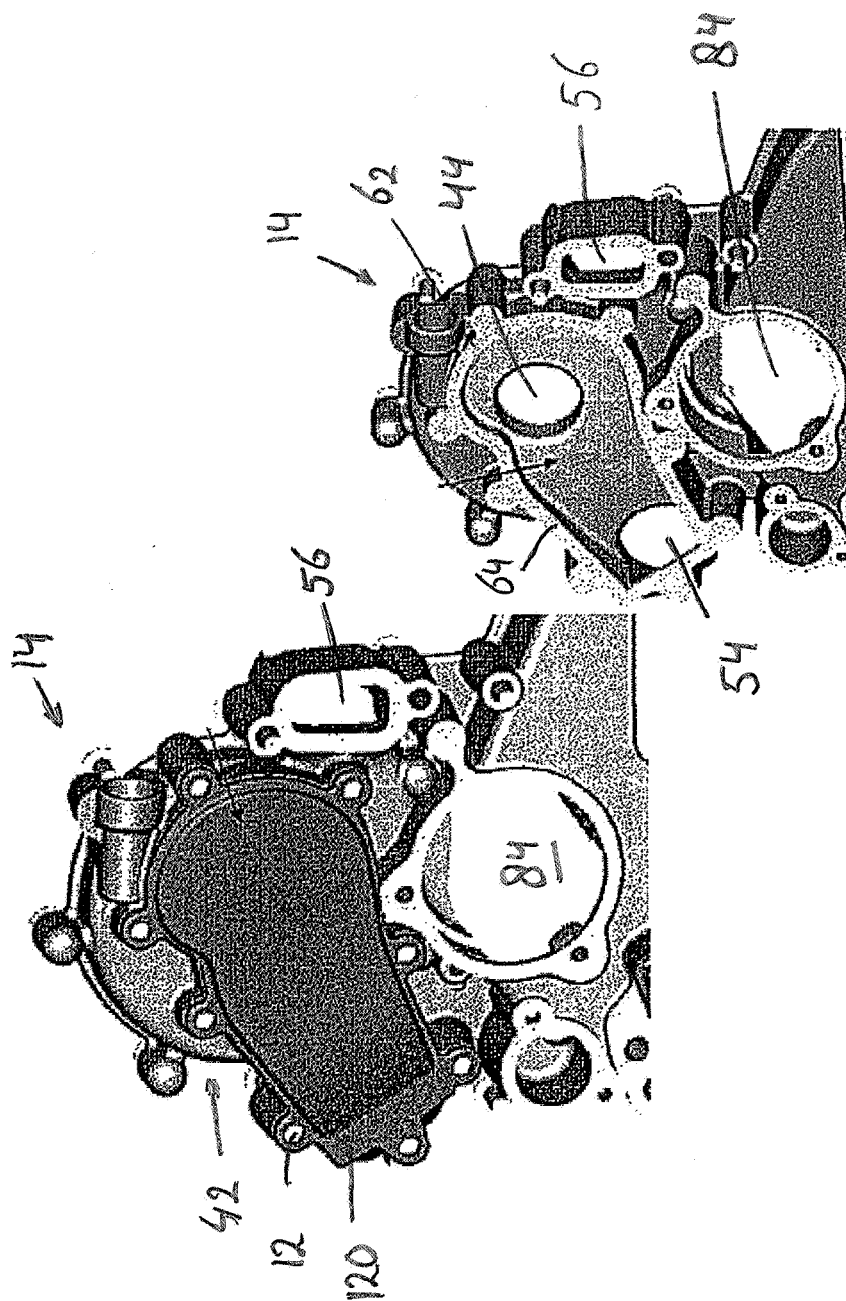


Fig 6



EUROPEAN SEARCH REPORT

Application Number
EP 08 15 7715

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	US 5 148 784 A (HIRAOKA TOYOKI [JP] ET AL) 22 September 1992 (1992-09-22) * column 2, lines 25-62 * * column 2, line 67 - column 3, line 7; figures 1-4 *	1-5,7-20	INV. F02F7/00
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			TECHNICAL FIELDS SEARCHED (IPC)
			F02F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 January 2009	Examiner Luta, Dragos
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EPO FORM 1503 03.82 (P04C01)

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

EP 08 15 7715

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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15-01-2009

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REFERENCES CITED IN THE DESCRIPTION

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