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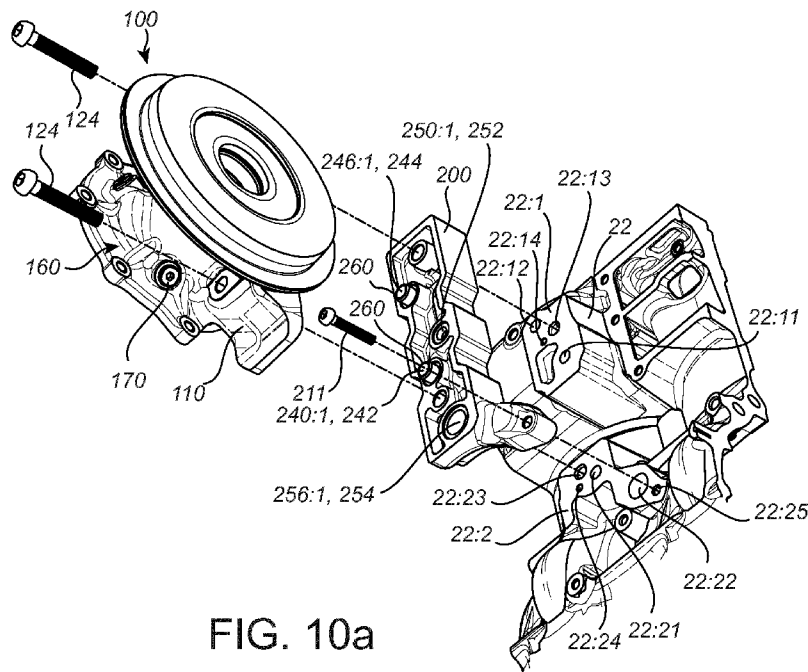


FIG. 10a

(57) Abstract: The invention relates to an engine structure (200) forming an adapter for connecting a turbocharger unit (100) to a cylinder block (22) of an internal combustion engine (10). The engine structure (200) comprises a set of attachment means (220) for fastening the turbocharger unit (100) to the cylinder block (22) via the engine structure (200) such that the engine structure (200) is positioned in between the turbocharger unit (100) and the cylinder block (22). The engine structure (200) comprises at least one fluid channel (240:1, 246:1, 250:1, 256:1) extending in a bent manner from a first surface (202) of said engine structure (200) to a second surface (204) of said engine structure (200).



A turbocharger unit

TECHNICAL FIELD

The invention relates to a turbocharger unit for an internal combustion engine. More particularly the present invention relates to a turbocharger unit configured to be attached
5 to the internal combustion engine via an engine structure, as well as to such engine structure.

The invention can be applied in heavy-duty vehicles, such as trucks, buses and construction equipment. Although the invention will be described with respect to a truck,
10 the invention is not restricted to this particular vehicle, but may also be used in other applications utilizing turbocharger units such as aero or marine systems.

BACKGROUND

A turbocharger unit is a vehicle component used together with an associated internal
15 combustion engine, typically a diesel or gasoline engine. The turbocharger unit is configured to recover a part of the energy of the exhaust gas and to use that energy to compress intake air flowing into the combustion chamber of the internal combustion engine. Turbocharger units are commonly provided for increasing the efficiency and power of the internal combustion engine.

20

A turbocharger unit has three main components; a turbine for converting energy of the exhaust gas flow to a rotational movement of the turbine, a compressor rotationally connected to the turbine for compressing intake air, and a housing enclosing the turbine and the compressor as well as a rotating shaft, bearings, etc.

25

During operation the turbocharger unit is mounted to the cylinder head by connecting an exhaust gas inlet of the turbine side with a manifold of the internal combustion engine. One such example is shown in US2003005694, wherein the manifold has a flange for cooperation with a corresponding flange surface of the turbocharger unit. Sleeves are
30 extending from the manifold flange, arranged at one side of the manifold, to the opposite side of the manifold, in which sleeves fastening screws are guided for the fastening of the turbocharger unit. The solution proposed in US2003005694 is taught to provide a simple and easily accessible mounting or demounting of the turbocharger unit. US2009/0184229

describes an isolation mounting apparatus for use when mounting the turbocharger via the bearing housing.

However, the turbocharger unit must not only receive exhaust gas flow from the internal
5 combustion engine in order to operate, but fluid connections are also necessary for
providing lubrication, and in some cases also cooling, of the rotating parts within the
turbocharger unit. For this the housing of the turbocharger unit has one or more fluid ports
which must be connected to corresponding ports of the internal combustion engine. Since
US2003005694 and US2009/0184229 are completely silent of how to solve this, there is a
10 need for an improved turbocharger unit, as well as an improved engine structure, with
respect to mounting and demounting of the turbocharger unit.

SUMMARY

An object of the invention is to provide a turbocharger unit overcoming the above
15 mentioned drawbacks of prior art units. A further object of the invention is to provide an
engine structure for cooperation with a turbocharger unit.

According to a first aspect the object is achieved by an engine structure according to
claim 1. According to a second aspect the object is achieved by an engine structure
20 according to claim 6. According to a third aspect the object is achieved by a turbocharger
unit according to claim 44. According to a fourth aspect the object is achieved by a
turbocharger unit according to claim 46. According to a fifth aspect the object is achieved
by a turbocharger unit according to claim 58. According to a sixth aspect the object is
achieved by a turbocharger unit according to claim 66. According to a seventh aspect the
25 object is achieved by an exhaust system according to claim 77. According to an eight
aspect the object is achieved by an internal combustion engine according to claim 78.
According to a ninth aspect the object is achieved by a vehicle according to claim 84.
According to a tenth aspect the object is achieved by a method according to claim 85.
According to an eleventh aspect the object is achieved by a method according to claim
30 86. According to a twelfth aspect the object is achieved by a method according to claim
87.

An engine structure forming an adapter for connecting a turbocharger unit to a cylinder
block of an internal combustion engine is provided. The engine structure comprises a set
35 of attachment means for fastening the engine structure to the cylinder block via the engine

structure such that the engine structure is positioned in between the turbocharger unit and the cylinder block. The engine structure comprises at least one fluid channel extending in a bent manner, or curvilinear, from a first surface of said engine structure to a second surface of said engine structure.

5

According to an embodiment the first surface is configured to bear on the cylinder block, and/or the second surface is configured to bear on the turbocharger unit.

According to an embodiment the first surface is arranged in a first plane, the second
10 surface is arranged in a second plane, wherein the first plane is parallel with the second plane.

According to an embodiment the engine structure comprises at least one fluid channel
15 extending in a bent manner from a first surface of said engine structure to a second surface of said engine structure, wherein the second surface is configured to bear on the turbocharger unit or on the cylinder block, and the first surface is distinct from a surface configured to bear on the turbocharger unit and from a surface configured to bear on the turbocharger unit.

20 According to an embodiment said set of attachment means comprises at least one bore for engagement with a fastener, and extending from a surface of the engine structure, and wherein said bore is either a through-hole for allowing the fastener to engage with a corresponding bore of the cylinder block or the turbocharger unit, or a threaded bore for allowing the fastener to either secure the turbocharger unit to the engine structure, or to
25 secure the engine structure to the cylinder block.

An engine structure forming an adapter for connecting a turbocharger unit to a cylinder block of an internal combustion engine is also provided. The engine structure comprises a set of attachment means for securely attaching a bearing housing of the turbocharger unit
30 to said cylinder block via the engine structure such that the engine structure is positioned in between the turbocharger unit and the cylinder block and such that at least one fluid inlet and/or a fluid outlet of the engine structure, forming part of a fluid channel extending in a bent manner from a first surface of said engine structure to a second surface of said engine structure, is aligned with a corresponding fluid inlet and/or fluid outlet of the
35 bearing housing or of the cylinder block.

According to an embodiment the first surface is configured to bear on the cylinder block, and/or the second surface is configured to bear on the turbocharger unit.

- 5 According to an embodiment the first surface is arranged in a first plane, the second surface is arranged in a second plane, wherein the first plane is parallel with the second plane.

10 According to an embodiment the engine structure comprises at least one fluid channel extending in a bent manner, or curvilinear, from a first surface of said engine structure to a second surface of said engine structure, wherein the second surface is configured to bear on the turbocharger unit, and the first surface is distinct from a surface configured to bear on the turbocharger unit.

- 15 According to an embodiment said engine structure is integrally formed with a bearing housing of said turbocharger unit. According to another embodiment said engine structure (200) is integrally formed with said cylinder block.

20 According to an embodiment said engine structure is releasably connectable to the turbocharger unit as well as to the cylinder block.

According to an embodiment said engine structure further comprises a set of attachment means for securely attaching the engine structure to the cylinder block.

- 25 According to an embodiment the set of attachment means for attaching the turbocharger unit to the cylinder block via the engine structure comprises at least one bore for engagement with a fastener and extending from a surface of the engine structure such that the bore is accessible when the engine structure is fastened to the cylinder block.

- 30 According to an embodiment the at least one fluid channel comprises a coolant outlet and/or a lubricant outlet for alignment with a corresponding coolant inlet and a lubricant inlet of the bearing housing, and/or a coolant inlet and/or a lubricant inlet for alignment with a corresponding coolant outlet and a lubricant outlet of the bearing housing.

According to an embodiment the at least one fluid channel comprises a coolant outlet and/or a lubricant outlet for alignment with a corresponding coolant inlet and a lubricant inlet of the cylinder block, and/or a coolant inlet and/or a lubricant inlet for alignment with a corresponding coolant outlet and a lubricant outlet of the cylinder block.

5

According to an embodiment the at least one fluid outlet, and/or fluid inlet, comprises a pipe extending out from the engine structure.

According to an embodiment the at least one fluid inlet or fluid outlet comprises a dam.

10

According to an embodiment the second surface configured to bear on the turbocharger unit is provided with divider means for preventing coolant fluid to mix with lubricating fluid during disassembly of the turbocharger unit from the engine structure.

15 According to an embodiment the divider means is provided as a protrusive ridge extending from an upper part of said surface to a lower part of said surface, whereby the lubricant ports are arranged on one lateral side of the divider, while the coolant ports are arranged on the other lateral side of the divider.

20 According to an embodiment the divider means is formed by providing the second surface with a V-shaped profile such that the thickness of the engine structure is largest at a specific line, and whereby the lubricant ports are arranged on one lateral side of the specific line, while the coolant ports are arranged on the other lateral side of the specific line.

25

According to an embodiment the first surface configured to bear on the cylinder block is provided with divider means for preventing coolant fluid to mix with lubricating fluid during disassembly of the turbocharger unit from the cylinder block.

30 According to an embodiment the divider means is provided as a protrusive ridge extending from an upper part of said surface to a lower part of said surface, whereby the lubricant ports are arranged on one lateral side of the divider, while the coolant ports are arranged on the other lateral side of the divider.

According to an embodiment the divider means is formed by providing the first surface with a V-shaped profile such that the thickness of the engine structure is largest at a specific line, and whereby the lubricant ports are arranged on one lateral side of the specific line, while the coolant ports are arranged on the other lateral side of the specific
5 line.

According to an embodiment the engine structure further comprises an additional fluid channel having a lubricant inlet and/or a coolant inlet such that the additional fluid channel forms a coolant channel from a coolant supply to the turbocharger unit, and/or a lubricant
10 channel from a lubricant supply to the turbocharger unit.

According to an embodiment said coolant inlet forms an open connection between a coolant outlet of the cylinder block and the engine structure.

15 According to an embodiment said coolant inlet is closed such that it forms a shut off connection between a coolant outlet of the cylinder block and the engine structure.

According to an embodiment said lubricant inlet forms an open connection between a lubricant outlet of the cylinder block and the engine structure.

20

According to an embodiment said lubricant inlet is closed such that it forms a shut off connection between a lubricant outlet of the cylinder block and the engine structure.

According to an embodiment the set of attachment means for connecting the turbocharger
25 unit to the cylinder block via the engine structure further comprises at least one guiding pin or recess for mating engagement with a corresponding guiding recess or pin of the bearing housing and/or of the cylinder block.

According to an embodiment the set of attachment means for securely attaching the
30 engine structure to the cylinder block further comprises at least one guiding pin or recess for mating engagement with a corresponding guiding recess or pin of the cylinder block.

According to an embodiment the bearing housing, when attached to the engine structure, covers the set of attachment means for securely attaching the engine structure to the
35 cylinder block.

According to an embodiment the bearing housing, when attached to the engine structure, does not cover the set of attachment means for securely attaching the engine structure to the cylinder block.

5

According to an embodiment the engine structure further comprises a support onto which the bearing housing may rest during mounting.

According to an embodiment the engine structure further comprises an actuator being
10 releasably attached to the engine structure.

According to an embodiment the actuator is configured to receive coolant directly from the engine structure or from an associated bearing housing, and to return coolant directly to the engine structure or to the associated bearing housing.

15

According to an embodiment the actuator is provided with a plug for draining fluid from said actuator.

According to an embodiment the engine structure is configured to provide electrical
20 connection between the cylinder block and the turbocharger unit.

According to an embodiment said set of attachment means for connecting the turbocharger unit to the cylinder block via the engine structure comprises at least one through hole which extends to a back side of the engine structure facing the cylinder
25 block, and wherein said engine structure comprises a depression at least partly surrounding said through hole.

According to an embodiment said set of attachment means for connecting the turbocharger unit to the cylinder block via the engine structure comprises at least one
30 through hole which extends to a front side of the engine structure facing the turbocharger unit, and wherein said engine structure comprises a depression at least partly surrounding said through hole.

According to an embodiment said set of attachment means for securely attaching the
35 engine structure to the cylinder block comprises at least one through hole which extends

to a back side of the engine structure facing the cylinder block, and wherein said engine structure comprises a depression at least partly surrounding said through hole.

According to an embodiment the at least one depression extends from an outer portion of
5 the engine structure towards the through hole, such that a support face is formed between the through hole and the depression.

According to an embodiment the depression surrounds said through hole.

10 According to an embodiment said depression partly surrounds said through hole, and the depression is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the engine structure, such that the depression of the engine structure and the depression of the contacting surface forms a joint depression surrounding the entire through hole.

15

A turbocharger unit is also provided, comprising a bearing housing having means for fastening the turbocharger unit to an engine structure attached to a cylinder block of an internal combustion engine via an engine structure as described above.

20 According to one embodiment, the engine structure is integrally formed with the bearing housing.

A turbocharger unit is also provided, comprising a bearing housing having means for fastening the turbocharger unit to a cylinder block of an internal combustion engine via an
25 engine structure as described above. The bearing housing comprises at least one drain plug for draining coolant fluid from said bearing housing and from said engine structure.

According to an embodiment said drain plug is in fluid communication with a coolant jacket of said bearing housing.

30

According to an embodiment said coolant jacket has two fluid ports, for allowing coolant fluid to enter and exit said coolant jacket, wherein at least one of said fluid ports is provided on an end face of said bearing housing facing said engine structure.

According to an embodiment said coolant jacket has two fluid ports for allowing coolant fluid to enter and exit said coolant jacket, wherein each one of said fluid ports is provided on an end face of said bearing housing facing said engine structure.

- 5 According to an embodiment said bearing housing is further provided with at least one lubrication fluid port arranged vertically below at least one of said coolant fluid ports.

According to an embodiment the bearing housing comprises at least one fluid port for alignment with a corresponding fluid port of the engine structure, and wherein said fluid
10 port of the bearing housing is configured to seal against a pipe extending out from the fluid port of the engine structure.

According to an embodiment the bearing housing comprises an additional fluid port for alignment with a corresponding fluid port of the engine structure, and wherein said fluid
15 port of the bearing housing is configured to seal against a pipe extending out from the fluid port of the engine structure.

According to an embodiment at least one of said fluid ports of the bearing housing is provided with an O-ring forming a sealing means.
20

According to an embodiment at least one of said fluid ports of the bearing housing is provided with tight fit configuration forming a sealing means.

According to an embodiment said means for fastening the turbocharger unit to a cylinder
25 block of an internal combustion engine via the engine structure comprises at least one through hole which extends to a back side of the bearing housing facing the engine structure, and wherein said bearing housing comprises a depression at least partly surrounding one through hole.

30 According to an embodiment the at least one depression extends from an outer portion of the bearing housing towards the through hole such that a support face is formed between the through hole and the depression.

According to an embodiment said depression surrounds said through hole.
35

According to an embodiment said depression partly surrounds said through hole, wherein the depression is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the turbocharger unit, such that the depression of the turbocharger unit and the depression of the contacting surface forms a joint depression
5 surrounding the entire through hole.

A turbocharger unit is also provided, comprising a bearing housing having means for fastening the turbocharger unit to a cylinder block of an internal combustion engine via an engine structure as described above. The bearing housing comprises at least one fluid
10 port for alignment with a corresponding fluid port of the engine structure, wherein said fluid port of the bearing housing is configured to seal against a pipe extending out from the fluid port of the engine structure.

According to an embodiment the bearing housing comprises an additional fluid port for
15 alignment with a corresponding fluid port of the engine structure, wherein said fluid port of the bearing housing is configured to seal against a pipe extending out from the fluid port of the engine structure.

According to an embodiment at least one of said fluid ports of the bearing housing is
20 provided with an O-ring forming a sealing means.

According to an embodiment at least one of said fluid ports of the bearing housing is provided with tight fit configuration forming a sealing means.

25 According to an embodiment said means for fastening the turbocharger unit to a cylinder block of an internal combustion engine via the engine structure comprises at least one through hole which extends to a back side of the bearing housing facing the engine structure, and wherein said bearing housing comprises a depression at least partly surrounding one through hole.

30

According to an embodiment the at least one depression extends from an outer portion of the bearing housing towards the through hole such that a support face is formed between the through hole and the depression.

35 According to an embodiment said depression surrounds said through hole.

According to an embodiment said depression partly surrounds said through hole, wherein the depression is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the turbocharger unit, such that the depression of the turbocharger unit and the depression of the contacting surface forms a joint depression surrounding the entire through hole.

A turbocharger unit is also provided, comprising a bearing housing having means for fastening the turbocharger unit to a cylinder block of an internal combustion engine via an engine structure as described above. Said means for fastening the turbocharger unit to the cylinder block of the internal combustion engine via the engine structure comprises at least one through hole which extends to a back side of the bearing housing facing the engine structure or the cylinder block, wherein said bearing housing comprises a depression at least partly surrounding one through hole.

15

According to an embodiment the at least one depression extends from an outer portion of the bearing housing towards the through hole such that a support face is formed between the through hole and the depression.

20 According to an embodiment said depression surrounds said through hole.

According to an embodiment said depression partly surrounds said through hole, wherein the depression is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the turbocharger unit, such that the depression of the turbocharger unit and the depression of the contacting surface forms a joint depression surrounding the entire through hole.

According to an embodiment the bearing housing is provided with divider means for preventing coolant fluid to mix with lubricating fluid during disassembly of the turbocharger unit from the cylinder block.

According to an embodiment the divider means is provided as a recessive groove extending from an upper part of the bearing housing to a lower part of bearing housing, whereby the lubricant ports are arranged on one lateral side of the divider, while the coolant ports are arranged on the other lateral side of the divider.

According to an embodiment the divider means is formed by providing the bearing housing with a V-shaped profile such that the thickness of the bearing housing is largest at a specific line, and whereby the lubricant ports are arranged on one lateral side of the
5 specific line, while the coolant ports are arranged on the other lateral side of the specific line.

According to an embodiment the turbocharger unit further comprises an actuator being releasably attached to the bearing housing.

10

According to an embodiment the actuator is configured to receive coolant directly from the bearing housing or from an associated engine structure, and to return coolant directly to the bearing housing or to the associated engine structure.

15 According to an embodiment the actuator is provided with a drain plug.

According to an embodiment the bearing housing further comprises a lifting eye arranged at the center of the turbocharger unit.

20 An exhaust system for an internal combustion engine is also provided. The exhaust system comprises a turbocharger unit in accordance with any one of the aspects presented above, and an engine structure according to any one of the aspects presented above for attaching said turbocharger unit to a cylinder block of said internal combustion engine.

25

An internal combustion engine is also provided, comprising a cylinder block and an engine structure according to any one of the aspects presented above.

According to an embodiment said cylinder block having means for fastening the
30 turbocharger unit to the cylinder block via an engine structure according to any one of the aspects presented above, wherein said means comprises at least one through hole which extends from a front side of the cylinder block facing the engine structure, and wherein said cylinder block comprises a depression at least partly surrounding one through hole.

According to an embodiment the at least one depression extends from an outer portion of the cylinder block towards the through hole such that a support face is formed between the through hole and the depression.

- 5 According to an embodiment said depression surrounds said through hole.

According to an embodiment said depression partly surrounds said through hole, wherein the depression is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the cylinder block, such that the depression of the cylinder block
10 and the depression of the contacting surface forms a joint depression surrounding the entire through hole.

According to an embodiment said engine structure is formed integrally with the cylinder block.

15

A vehicle is also provided, comprising an internal combustion engine according to any one of the aspects presented above.

A method for attaching a turbocharger unit to a cylinder block is also provided, comprising
20 the steps of attaching an engine structure to the cylinder block, providing at least one gasket, or O-ring, between the engine structure and the bearing housing and/or between the engine structure and the cylinder block, and securely attaching a bearing housing of the turbocharger unit to the engine structure, whereby the bearing housing forms part of means for securely attaching the turbocharger unit to said engine structure such that at
25 least one fluid inlet and/or fluid outlet of the bearing housing is aligned with a corresponding fluid outlet and/or fluid inlet of the engine structure, wherein said at least one fluid inlet and/or fluid outlet forms part of a fluid channel extending in a bent manner in said engine structure.

30 A method for removing a turbocharger unit from a cylinder block is also provided. The turbocharger unit comprises a bearing housing being attached to an engine structure and sealed by means of at least one gasket, or O-ring, between the engine structure and the bearing housing, and/or between the engine structure and the cylinder block, such that at least one fluid outlet and/or fluid inlet of the engine structure is aligned with a
35 corresponding fluid inlet and/or fluid outlet of the bearing housing, wherein said at least

one fluid inlet and/or fluid outlet forms part of a fluid channel extending in a bent manner in said engine structure. The method comprises the step of removing the turbocharger unit from the engine structure without removing the engine structure from the cylinder block.

5

A method for replacing a turbocharger unit is also provided. The method comprises the step of removing a turbocharger unit according to aspect presented above, and the step of securely attaching a bearing housing of the turbocharger unit to the engine structure, whereby the bearing housing forms part of means for securely attaching the turbocharger
10 unit to said engine structure such that at least one fluid inlet and/or fluid outlet of the bearing housing is aligned with a corresponding fluid outlet and/or fluid inlet of the engine structure.

Additional aspects of an engine structure, a turbocharger unit, an exhaust system, an
15 internal combustion engine, and methods for attaching, removing, and replacing a turbocharger unit are presented below.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a more detailed description of
20 embodiments of the invention cited as examples.

In the drawings:

Fig. 1 is a side view of a vehicle according to an embodiment,
25

Fig. 2 is a schematic view of an internal combustion engine according to an embodiment,

Fig. 3 is an isometric view of a turbocharger unit being attached to a cylinder block via an engine structure according to an embodiment;

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Figs. 4a-b are front views of a turbocharger unit according to different embodiments;

Fig. 5 is a cross-sectional view of a cylinder block and a turbocharger unit according to an embodiment;

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Fig. 6 is a front view of an engine structure according to an embodiment;

Figs. 7a-b are side cross-sectional views of an engine structure according to different embodiments;

5

Fig. 8 is a side cross-sectional view of a turbocharger unit, having an actuator, and being attached to an engine structure according to an embodiment;

Fig. 9 is a side cross-sectional view of a turbocharger unit, having a lifting eye, and being
10 attached to an engine structure according to another embodiment;

Fig. 10a is an exploded view of a turbocharger unit, an engine structure, and parts of a cylinder block according to an embodiment;

15 Fig. 10b is an exploded view of a turbocharger unit, an engine structure, and parts of a cylinder block according to an embodiment;

Fig. 10c is an exploded view of a turbocharger unit, an engine structure, and parts of a cylinder block according to an embodiment;

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Fig. 11 is a cross-sectional view of the configuration shown in Fig. 10a;

Fig. 12 is a different cross-sectional view of the configuration shown in Fig. 10a;

25 Fig. 13 is an exploded view of a turbocharger unit and an engine structure according to an embodiment;

Fig. 14a shows an engine structure according to an embodiment, viewed from the engine side;

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Fig. 14b is an isometric view of an engine structure according to another embodiment;

Fig. 15 is an exploded and cross-sectional view of an engine structure according to the embodiment shown in Fig. 14a; and

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Figs. 16a-c are schematic views of methods according to embodiments.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS OF THE INVENTION

Starting with Fig. 1 a vehicle 1 is shown. The vehicle 1, which is illustrated as a truck, has
5 an internal combustion engine 10 for driving the vehicle 1. As will be further explained below the internal combustion engine 10 of the vehicle 1 is provided with a turbocharger unit 100 according to various embodiments. The vehicle 1 may have additional propulsion units, such as electric drives etc. as long as it has at least one engine providing a flow of exhaust gases interacting with the turbocharger unit 100. Hence the vehicle 1 is not
10 exclusively a truck but may also represent various vehicles such as buses, constructional equipment, etc.

In Fig. 2 an example of an internal combustion engine 10 is shown. The internal combustion engine 10 includes a plurality of cylinders 20 operated to combust fuel, such
15 as diesel or gasoline, whereby the motion of pistons reciprocating in the cylinders 20 is transmitted to a rotation movement of a crank shaft 30. The crank shaft 30 is further coupled to a transmission (not shown) for providing a torque to driving elements (not shown). In case of a heavy vehicle, such as a truck, the driving elements are wheels; however the internal combustion engine 10 may also be used for other equipment such as
20 construction equipment, marine applications, etc.

The internal combustion engine 10 further comprises an exhaust gas system 40, which system 40 serves the purpose of recovering at least some of the energy in the exhaust gas flow to improve the performance of the internal combustion engine 10. In the shown
25 example the exhaust gas exits the cylinders 20 and enters an exhaust manifold 42 which is further connected to an exhaust inlet 102 of a turbocharger unit 100. The exhaust gas flow causes a turbine 104a arranged inside a turbine housing 104b to rotate, which rotation is translated via a shaft 105 to a corresponding rotation of a compressor 106a arranged inside a compressor housing 106b and being used to compress incoming air
30 before it is introduced in the cylinders 20. The basic structural as well as functional specifications of a turbocharger unit 100 are well known in the art and will not be described in full details.

Now turning to Fig. 3 an embodiment of a turbocharger unit 100 is shown. The
35 turbocharger unit 100 is attached to a cylinder block 22 of an internal combustion engine

10 via an engine structure 200. The turbocharger unit 100 comprises a turbine arranged inside a turbine housing 104b, a compressor arranged inside a compressor housing 106b, and a shaft (not shown) connecting the compressor with the turbine such that rotation of the turbine causes a corresponding rotation of the compressor. A bearing housing 110, preferably being integrally formed, is provided between the turbine housing 104b and the compressor housing 106b. The bearing housing 110, the turbine, the shaft, and the compressor forms a centre housing rotating assembly which is connected at opposite axial ends to the turbine housing 104b and to the compressor housing 106b. The turbocharger unit 100 further comprises an exhaust inlet at the turbine housing 104b as well as an air inlet at the compressor housing 106b. The bearing housing 110 further forms a support for bearings, in order to allow the shaft to rotate with a minimum of friction and vibration.

As can be seen in Fig. 3 the turbocharger unit 100 is connected to the internal combustion engine 10 by means of the engine structure 200. The engine structure 200 forms an adapter, i.e. an interface between the bearing housing 110 of the turbocharger unit 100 and the cylinder block 22 of the internal combustion engine 10. In addition to this the exhaust inlet of the turbocharger unit 100 is connected to an exhaust outlet (not shown) of a manifold, e.g. by means of flexible joints such as bellows, lipseal, etc.

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Now turning to Figs. 4a-b schematic views of a turbocharger unit 100 is shown, comprising a bearing housing 110 enclosing the turbine shaft 105, as well as the turbine housing 104b enclosing the turbine 104a and the compressor housing 106b enclosing the compressor 106a. The turbocharger unit 100 further comprises fastening means 120 provided for fastening the turbocharger unit 100 to the engine structure 200 (see Fig. 3) and to the cylinder block 22. As can be seen in Fig. 4a the fastening means 120 comprises a plurality of openings 122 in the bearing housing 110 for receipt of fasteners, such as screws, bolts, or studs. Preferably the openings 122 extend in a transverse direction in relation to an axial direction of the shaft 105 and towards the engine structure 200. With reference to the embodiment of Fig. 4a showing four openings 122, all openings 122 are positioned axially between the turbine housing 104b and the compressor housing 106b and on opposite sides of the shaft 105, preferably being arranged close to equal distance from the upper openings and the lower openings shown in Fig. 4a. The openings 122 extend in parallel and form through holes in the bearing housing 110. Hence, the openings 122 has a first end on a first side of the bearing housing 110, which first side is

configured to face the engine structure 200, and a second end on a second side of the bearing housing 110, which second side is on an opposite side of the bearing housing 110 in relation to the first side. The turbocharger unit 100 may thus be attached to the cylinder block 22 via the premounted engine structure 200 by using fasteners, such as screws, studs, bolts, etc received in said openings 122.

Fig. 4b shows a further embodiment of a turbocharger unit 100, wherein the fastening means 120 comprises two openings 122 being arranged on opposite sides of the shaft 105 extending axially inside the bearing housing 110. The two openings 122 are provided for attaching the bearing housing 110 to the engine structure 200. Openings 210 are provided for attaching the engine structure 200 to the cylinder block 22.

Fig. 5 shows a cross-sectional view of a turbocharger unit 100 being attached to a cylinder block 22 of an internal combustion engine via an engine structure 200. The openings 122 are formed as through holes such that bolts 124 may be inserted into the openings 122 and further into the engine structure 200 for urging the turbocharger unit 100 towards the engine structure 200.

Now turning to Fig. 6 and Fig. 7a an embodiment of an engine structure 200 is shown. The engine structure 200 has a first side 202 to bear on the cylinder block 22 of the internal combustion engine 10, and a second side 204 opposite the first side 202 to bear on the bearing housing 110 of the turbocharger unit 100. The engine structure 200 comprises a first set of attachment means 210 for fastening the engine structure 200 to the cylinder block 22, and a second set of attachment means 220 for fastening the turbocharger unit 100 to the engine structure 200. The first attachment means 210 comprises at least one screw or bolt 211, which may be screwed into a mating recess of the cylinder block 22. In addition to this the first attachment means 210 may further comprise one or more pins or recesses 212, for engagement with corresponding recesses or pins of the cylinder block 22.

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The second attachment means 220 comprises at least one bore for receiving a stud or a screw being insertable through the openings 122 of the turbocharger unit 100, such that the turbocharger unit 100 will be urged towards the engine structure 200 when tightening the stud nuts or screws. The second attachment means 220, i.e. the one or more bores for receiving studs or screws, may be through holes, as indicated in Fig. 7a such that the

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screws or studs are further engaging with aligned bores of the cylinder block 22 (see Fig. 5). In other embodiments the bores of the second attachment means 220 ends within the engine structure 200. Tightening may thus be allowed by providing the one or more bores with internal threads.

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Further to this the second attachment means 220 may comprise one or more pins or recesses 222, for engagement with corresponding recesses or pins of the bearing housing 110 of the turbocharger unit 100. As an option, or in addition the first attachment means 210 may comprise one or more pins or recesses, for engagement with
10 corresponding recesses or pins of the cylinder block 22.

The engine structure 200 may further comprise a support 230, extending from the lower portion of the second side 204 away from the engine structure 200. The support 230 is provided for allowing the turbocharger unit 100 to rest onto the support 230 during
15 mounting.

Fig. 6 shows a number of fluid ports; a coolant inlet 240 is provided at the lower end of the engine structure 200 and extends to a coolant outlet 242 for alignment with a corresponding coolant inlet of the bearing housing 110 of the turbocharger unit 100. A
20 secondary coolant inlet 244, for receiving coolant such as water flowing out from a corresponding coolant outlet of the bearing housing 110, is provided and ends at a coolant outlet 246 on an upper side of said engine structure 200. Hence, fluid for cooling the rotating parts of the turbocharger unit 100 will flow from below and upwards.

25 A lubricant inlet 250 is provided at the upper end of a lateral side of the engine structure 200 and extends to a lubricant outlet 252 for alignment with a corresponding lubricant inlet of the bearing housing 110 of the turbocharger unit 100. A secondary lubricant inlet 254, for receiving lubricant such as oil flowing out from a corresponding lubricant outlet of the bearing housing 110, is provided and ends at a lubricant drainage 256 on a lower side of
30 said engine structure 200.

Hence, the engine structure 200 may be connected with fluid supplies, e.g. supplying coolant and/or lubricants, by hoses or other connections. The fluid inlets 240, 250 may be arranged on the upper side of the engine structure 200, the lower side of the engine
35 structure 200, and/or the lateral sides of the engine structure 200.

In a further embodiment, shown in Fig. 7b, the coolant inlet (not shown) and the coolant outlet 246 of the engine structure 200 are facing the cylinder block 22. Such embodiments may be particularly advantageous for cylinder blocks 22 having a lid 24 for cooling liquid
5 (see e.g. Fig. 3), whereby holes may be drilled in the lid 24 at positions being aligned with the coolant inlet 240 and the coolant outlet 246. Fluid channels may also be drilled in the cylinder block 22, in case no lid 24 is provided. The engine structure 200 may be sealed against the cylinder block 22 by means of one or more gaskets, O-rings, etc. (not shown).

10 In a yet further embodiment, shown also in Fig. 10 as will be described later, the engine structure 200 is attached to the cylinder block 22 such that the lubricant inlet 250 and the lubricant drainage 256 are facing the cylinder block 22. Similarly to what has been described above with respect to the cooling and Fig. 7b, holes may be drilled in a portion
15 of the cylinder block 22 defining a part of an oil conduit or an oil reservoir. The holes should be aligned with the lubricant inlet 250 and the lubricant drainage 256 of the engine structure 200. The engine structure 200 may be sealed against the cylinder block 22 by means of one or more gaskets, O-rings, etc. (not shown).

Fig. 7a shows a cross-sectional view of the embodiment shown in Fig. 6, taken along the
20 dashed line. A pipe 260 is provided for preventing coolant to escape into the lubricant return during disassembly. For a similar purpose, i.e. to prevent contamination and undesired mix of fluids, a dam 258 is provided at the lubricant return, i.e. at the lubricant inlet 254, for preventing coolant to mix with the lubricant during disassembly. Various embodiments may be realized for forming a dam function. Different designs are possible
25 depending on the positions of the lubricant ports 252, 254 in relation to the coolant ports 242, 244. For example, a divider may be formed as a protrusive ridge extending from an upper part of surface 204 to a lower part of surface 204, whereby the lubricant ports 252, 254 are arranged on one lateral side of the divider, while the coolant ports 242, 244 are arranged on the other lateral side of the divider. In other embodiments the divider function
30 may be provided by having a non-planar surface 204 of the engine structure 200, such that the thickness of the engine structure 200 is largest at a center line. A divider is consequently not formed by a protrusive ridge, but instead as a V-shaped profile whereby the entire surface 204 protrudes towards its center. For the embodiments described above with respect to the divider function, a corresponding shape of the bearing housing

110 is preferred for providing a tight interface between the engine structure 200 and the bearing housing 110.

The pipe 260 may also be used as part of the second attachment means 220, whereby it provides facilitated alignment with the turbocharger unit 100. The pipe 260 will also seal during disassembly of the turbocharger unit 100. This will reduce the risk of fluid mixing. As an option, or in addition, shoulders may be provided at the engine structure for mating with corresponding structures of the cylinder block 22 and/or the bearing housing 110.

10 A dam function may also be provided for the interface formed between the engine structure 200 and the cylinder block 22, especially for the embodiment described with reference to Fig. 7b in order to prevent that lubricant and coolant are mixed in the engine when dismantling the engine structure 200 from the cylinder block 22. Similarly to what has been described above a divider may be formed as a protrusive ridge extending from 15 an upper part of surface 202 to a lower part of surface 202. In other embodiments the divider function may be provided by having a non-planar surface 202 of the engine structure 200, such that the thickness of the engine structure 200 is smallest at a center line. A divider is consequently not formed by a protrusive ridge, but instead as a V-shaped profile whereby the entire mating surface to 202 of the cylinder block 22 protrudes 20 towards its center. For the embodiments described above with respect to the divider function, the cylinder block 22 and the engine structure 200 should preferably be provided with mating structures for providing a tight interface between the engine structure 200 and the cylinder block 22.

25 With reference to Fig. 8 a further embodiment of a turbocharger unit 100 is shown when attached to an engine structure 200. Similarly to what has been described with reference to Figs. 4-7, the engine structure 200 is attached to the cylinder block 22 of the internal combustion engine 10, and the turbocharger unit 100 is subsequently attached to the engine structure 200. For the embodiments shown in Fig. 8 and Fig. 9, the turbocharger 30 unit 100 is a variable geometry turbocharger unit requiring actuation of turbine housing vanes in order to change the geometry. Hence, an actuator 300 is provided. In Fig. 8 the actuator 300 is arranged below the bearing housing 110 and screwed onto the turbocharger unit 100 axially between the turbine housing 104b and the compressor housing 106b. The actuator 300 is connected to the coolant inlets and outlets of the 35 engine structure 200 by means of associated channels within the bearing housing 110 for

guiding coolant into the actuator 300. Also, a drain plug 310 may be provided for emptying the engine coolant. The bearing housing 110 is provided with a lifting eye 112 for facilitating handling of the turbocharger unit 100. This is possible due to available space on the upper side of the bearing housing 110 which in prior art systems is occupied by fluid connections. The lifting eye 112 may be a permanent structure, or being provided as a screwed in eye temporarily inserted into a threaded hole of the bearing housing 110. The lifting eye 112 may also be provided as one or more structures arranged at the bearing housing 110, the turbine housing 104b, and/or the compressor housing 106b.

10 A yet further embodiment of an actuator 300 is shown in Fig. 9, in which the actuator 300 is arranged on an opposite side of the bearing housing 110 than the engine structure 200. Hence, the bearing housing 110 of the turbocharger unit 100 is arranged between the engine structure 200 and the actuator 300.

15 In further embodiments the actuator 300 may be attached to the engine structure 200, instead of the bearing housing 110. The actuator 300 may be configured to receive coolant directly from the engine structure 200.

As can be seen in Fig. 8, the second attachment means 220 for attaching the turbocharger unit 100 to the engine structure 200 may be through holes (indicated by dashed lines), whereby threaded bores may be provided in the cylinder block 22 for receiving screws or studs inserted through the openings 122 of the bearing housing 110.

As for all embodiments so far, it may be desired to arrange the first attachment means 210, i.e. the means used for securely attaching the engine structure 200 to the cylinder block 22, at a predetermined position that will be hidden once the bearing housing 110 of the turbocharger unit 100 is attached to the engine structure 200. It will consequently not be possible to access the first attachment means 210 without dismounting the turbocharger unit 100 from the engine structure 200.

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In the description above different configurations of fluid ports has been discussed for providing fluid connection to the turbocharger unit 100 via the engine structure 200. In addition to this the engine structure 200 may also provide electrical connection between the cylinder block 22, or other parts of the vehicle, and the turbocharger unit 100. Such electrical connections may e.g. include cables for transmitting signals, such as turbine

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speed sensor signals, actuator signals, and/or signals relating to the operation of an associated electrical waste gate. The electrical connections may also include power cables, e.g. for transmitting power to the speed sensor, the actuator, and/or the waste gate. Electrical connections may interface directly with the cylinder block 22 or via
5 contacts arranged on the side of the engine structure 200.

An embodiment of a configuration for attaching a turbocharger unit 100 to a cylinder block 22 via an engine structure 200 is shown in Figs. 10-15. Starting in Fig. 10a, the cylinder block 22 has two support plateaus 22:1, 22:2, each support plateau 22:1, 22:2 forming a
10 planar support surface for the engine structure 200. The upper support plateau 22:1 has two openings 22:11, 22:12 forming a coolant inlet port 22:11 and a coolant outlet port 22:12, respectively. Hence, the two openings 22:11, 22:12 allows for coolant fluid, such as water, to flow from the cylinder block 22 to the engine structure 200, as well as from the engine structure 200 back to the cylinder block 22.

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Further, the upper support plateau 22:1 has a threaded bore 22:13 for receiving a screw 124; the screw 124 being used to securely tighten the turbocharger unit 100 to the cylinder block 22 via the engine structure 200. The upper support plateau 22:1 also has at least one recess 22:14 for receiving a guiding pin 212 of the engine structure 200. Hence,
20 as the guiding pin 212 is received by the recess 22:14 an accurate positioning of the engine structure 200 relative the upper support plateau 22:1 is achieved.

The lower support plateau 22:2 has two openings 22:21, 22:22 forming a lubricant inlet port 22:21 and a lubricant outlet port 22:22, respectively. Hence, the two openings 22:21,
25 22:22 allows for lubricant fluid, such as oil, to flow from the cylinder block 22 to the engine structure 200, as well as from the engine structure 200 back to the cylinder block 22.

Further, the lower support plateau 22:2 has a threaded bore 22:23 for receiving a screw 124; the screw 124 being used to securely tighten the turbocharger unit 100 to the
30 cylinder block 22 via the engine structure 200. The lower support plateau 22:2 also has at least one recess 22:24 for receiving a guiding pin 212 of the engine structure 200. Hence, as the guiding pins 212 are received by the recesses 22:24, 22:14 an accurate positioning of the engine structure 200 relative the cylinder block 22 is achieved. The lower support plateau 22:2 also has an additional threaded bore 22:25 for receiving a screw 211 used
35 for attaching the engine structure 200 to the cylinder block 22.

In some embodiments the guiding pins 212 may be provided as sleeves arranged around the bores for receiving the screws.

5 When mounting the turbocharger unit 100 to the cylinder block 22, the engine structure 200 is firstly aligned with the cylinder block 22 by positioning the engine structure 200 such that the pins 212 of the engine structure 200 are received by the recesses 22:14, 22:24 of the cylinder block 22. Thereafter the screw 211 is tightened, such that the engine structure 200 is at least to some extent fixated to the cylinder block 22. At this stage, the
10 fluid ports 22:11, 22:12, 22:21, 22:22 of the cylinder block 22 are aligned with corresponding fluid ports of the engine structure 200. The use of a connection block 200 in accordance with the description herein it is possible to bridge a non-planar surface of the cylinder block 22 to a preferably planar surface of the bearing housing 110 of the turbocharger unit 100.

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Better shown in Fig. 13 the back side of the engine structure 200, i.e. the side facing the cylinder block 22, has a coolant inlet 240 for alignment with the coolant port 22:11 of the cylinder block 22. A coolant outlet 246 is also provided for returning coolant back to the cylinder block 22 via the coolant port 22:12.

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The back side of the engine structure 200 further comprises a lubricant inlet 250 for alignment with the lubricant port 22:21 of the cylinder block 22, as well as a lubricant outlet 256 for alignment with the lubricant port 22:22 of the cylinder block 22.

25 The engine structure 200 also has two through-holes 220 for guiding the screws 124 into the threaded bores 22:13, 22:23 of the cylinder block 22, as well as the pins 212 as described above.

Now returning back to Fig. 10a the coolant inlet 240 forms part of a coolant fluid supply
30 channel 240:1 extending in a bent manner, or curvilinear, inside the engine structure 200, and ending at a coolant outlet 242 at the side of the engine structure 200 facing the turbocharger unit 100. In a similar manner the coolant outlet 246 forms part of a coolant fluid return channel 246:1 extending in a bent manner, or curvilinear, inside the engine structure 200, starting at a coolant inlet 244 at the side of the engine structure 200 facing
35 the turbocharger unit 100. The coolant fluid supply channel 240:1 thus provides coolant

flow from the cylinder block 22 to the turbocharger unit 100, while the coolant fluid return channel 246:1 provides coolant flow from the turbocharger unit 100 back to the cylinder block 22.

- 5 The lubricant inlet 250 forms part of a lubricant fluid supply channel 250:1 extending in a bent manner, or curvilinear, inside the engine structure 200, and ending at a lubricant outlet 252 at the side of the engine structure 200 facing the turbocharger unit 100. In a similar manner the lubricant outlet 256 forms part of a lubricant fluid return channel 256:1 extending in a bent manner, or curvilinear, inside the engine structure 200, starting at a
- 10 lubricant inlet 254 at the side of the engine structure 200 facing the turbocharger unit 100. The lubricant fluid supply channel 250:1 thus provides lubricant flow from the cylinder block 22 to the turbocharger unit 100, while the lubricant fluid return channel 256:1 provides lubricant flow from the turbocharger unit 100 back to the cylinder block 22.
- 15 The use of an engine structure 200 having fluid channels 240:1, 246:1, 250:1, 256:1 extending curvilinear, or in a bent manner, the engine structure 200 provides an extremely efficient adapter for fitting various types of turbocharger units 100 to a cylinder block 22 without using external fluid hoses. In particular, the cylinder block 22 may allow fluid ports at specific positions, while the turbocharger unit normally requires fluid ports also at
- 20 predetermined positions. As the fluid ports of the turbocharger unit 100 normally does not fit with the fluid ports of the cylinder block 22 it has previously been required to arrange hoses between the turbocharger unit 100 and the cylinder block 22. However, by the provisions of the curvilinear fluid channels 240:1, 246:1, 250:1, 256:1 the engine structure 200 will in fact allow perfect alignment of the fluid ports of the turbocharger unit 100 with
- 25 the fluid ports of the cylinder block 22.

Fig. 10b shows an embodiment where the engine structure 200 is integrally formed with the bearing housing 110. Fig. 10c shows an embodiment where the engine structure 200 is integrally formed with the cylinder block 22.

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- An example is shown in Figs. 11 and 12, wherein Fig. 11 shows the lubrication channels 250:1, 256:1 of the engine structure 200. As can be seen in Fig. 11 the turbocharger unit 100 has a lubrication supply channel 150:1 extending at the center of the turbocharger unit 100. The inlet 150 of the lubrication supply channel 150:1 is displaced relative the
- 35 lubrication outlet port 22:21 of the cylinder block 22, however the lubrication fluid flows

perfectly into the lubrication supply channel 150:1 of the turbocharger unit 100 via the engine structure 200. Further to this, the lubrication outlet 156 of the turbocharger unit 100 is displaced relative the lubrication inlet port 22:22 of the cylinder block 22, however the lubrication fluid flows perfectly into the lubrication inlet port 22:22 of the cylinder block 22
5 via the engine structure 200.

The same applies for the coolant flow. As is shown in particular in Fig. 12, the turbocharger unit 100 has a coolant supply channel 140:1 extending at a lower portion of the turbocharger unit 100. The inlet 140 of the coolant supply channel 140:1 is displaced
10 relative the coolant outlet port 22:11 of the cylinder block 22, however the coolant fluid flows perfectly into the coolant supply channel 140:1 of the turbocharger unit 100 via the engine structure 200. Further to this, the coolant outlet 146 of the turbocharger unit 100 is displaced relative the coolant inlet port 22:12 of the cylinder block 22, however the coolant fluid flows perfectly into the coolant inlet port 22:12 of the cylinder block 22 via the engine
15 structure 200.

The respective positions of the fluid ports 140, 146, 150, 156 of the turbocharger unit 100 relative the positions of the fluid ports 22:11, 22:12, 22:21, 22:22 of the cylinder block 22 are shown in Fig. 13, however the fluid ports of the cylinder block 22 are represented by
20 the corresponding fluid ports 240, 246, 250, 256 of the engine structure 200.

In Fig. 14a the engine structure 200 is further shown. As can be seen, all fluid channels i.e. the coolant fluid supply channel extending between ports 240, 242, the coolant fluid return channel extending between ports 244, 246, the lubrication fluid supply channel
25 extending between ports 250, 252, and the lubrication fluid return channel extending between ports 254, 256 are bent. This means that the fluid channels are not simply through holes, but in fact extend in height direction and/or width direction of the engine structure 200.

30 Another embodiment of an engine structure 200 is shown in Fig. 14b. Here, all fluid channels i.e. the coolant fluid supply channel extending between ports 240, 242, the coolant fluid return channel extending between ports 244, 246, the lubrication fluid supply channel extending between ports 250, 252, and the lubrication fluid return channel extending between ports 254, 256 are bent or curvilinear. This means that the fluid
35 channels are not simply through holes, but in fact extend in height direction and/or width

direction of the engine structure 200. However, the fluid port 246 is not provided on the surface facing the cylinder block 22, but is instead arranged as a pipe extending from a surface being distinct from the surface to be in contact with the cylinder block 22. It should be realized that the use of banjo fittings are not only possible for the coolant return, but it
5 could be used for any fluid connection between the engine structure 200 and the cylinder block 22.

Turning to Fig. 15, the bent manner of the fluid channels 240:1, 246:1, 250:1, 256:1 is further shown. A fluid channel extending in a bent manner should hence be interpreted as
10 a fluid channel of which the cross-sectional positions of the two ports, between which the fluid channel is extending, are different. In other words, a normal from the center axis of one of the ports is not identical as the normal from the center axis of the other port.

Should there be a need for replacing the turbocharger unit 100, it will be necessary to
15 dismount the turbocharger unit 100 from the engine structure 200. In order for facilitating this procedure, the turbocharger unit 100 is provided with some particular advantages. Firstly returning back to Fig. 10, the turbocharger unit 100 has a coolant jacket 160 arranged inside the bearing housing 110. The coolant jacket 160 forms a closed space in which coolant fluid flows. The coolant fluid enters the coolant jacket 160 from the coolant
20 fluid inlet port 140, and exits the coolant jacket 160 at the coolant fluid outlet port 146. When the vehicle is standing still having its engine shut off, there will be coolant fluid present in the coolant jacket 160 as well as in the engine structure 200. A drain plug 170 is therefore provided in the bearing housing 110 of the turbocharger unit 100. The drain plug 170 is positioned at a lower part of the cooling jacket 160 such that when the drain
25 plug 170 is removed (or partly open), coolant fluid present inside the cooling jacket 160 as well as inside the engine structure 200 will be drained. Opening of the drain plug 170 is preferably performed prior to dismounting the turbocharger unit 100 from the engine structure 200.

30 In Fig. 10 the coolant fluid ports 242, 244 of the engine structure 200 are provided with pipes 260 for preventing coolant fluid to escape into the lubrication fluid channels 250:1, 256:1 during disassembly of the turbocharger unit 100 from the engine structure 200. In order to ensure that no coolant fluid flows out from the turbocharger unit 100 until the turbocharger unit 100 is completely removed from the engine structure 200, the coolant
35 fluid ports 140, 146 of the bearing housing 110 are provided with means 148 for sealing

against the pipes 260. Each sealing means 148 may either be provided as an O-ring surrounding an associated pipe 260, or as a tight fit configuration of the dimensions of the ports 140, 146 for preventing leakage of coolant fluid.

5 Again returning to Fig. 13 the back side of the bearing housing 110, i.e. the side of the turbocharger unit 100 facing the engine structure 200 has sunken areas, or depressions 180 surrounding the through holes 122 used for receiving the screws 124. The depressions 180 are provided in order to reduce weight of the bearing housing 110, but more importantly to distribute the force applied when tightening the screws 124 to the
10 outer periphery of the bearing housing 110. Hence the depressions 180 extend from an outer portion of the bearing housing 110 towards the through holes 122, but ends just before reaching the through hole 122 so that a support surface is formed around the through hole 122. In this particular embodiment the support surface is circular, however other shapes may also be utilized such as rectangular etc. During tightening of the screws
15 124 a certain amount of force will be applied to the support surface surrounding the through hole 122, while the remaining force will be applied to the outer portion of the bearing housing 110. Preferably, each depression 180 surrounds the entire through hole 122. However, in an alternative embodiment the depression 180 only surrounds a part of the through hole 122, while a corresponding depression, arranged at the surface of the
20 engine structure 200 to be in contact with the bearing housing 100, is designed such that the two depressions form a joint depression surrounding the entire through hole 122. The depressions 180 are preferably dimensioned in relation to the frame, or outer portion of the bearing housing 110 in order to reduce the stresses at the through holes 122, and at the same time distribute the load outwards such that the turbocharger unit 100 will be
25 rigidly attached.

The provision of depressions 180 around the through holes 122 has a further advantage, namely that a sufficiently rigid attachment may be accomplished using only two screws/bolts. This fact provides an additional advantage, namely that the engine structure
30 200 may be relatively narrow thus reducing the required length of the turbine shaft inside the bearing housing 110. Journalling of the rotating components of the turbocharger unit 100 may thus be simplified, and weight will be reduced. Further to this, packaging is simplified.

The present disclosure thus presents the use of an engine structure 200 used for attaching the turbocharger unit 100 to the cylinder block 22. As has been described above, the engine structure 200 may either be a separate part or integrated with the bearing housing 110 of the turbocharger unit 100, or integrated with the cylinder block 22.

5 In the first case, where the engine structure 200 is a separate part the depressions 180 may be provided on one or two end faces of the engine structure 200, i.e. the side of the engine structure 200 facing the bearing housing 110 and/or the side of the engine structure 200 facing the cylinder block 22. In the other cases, where the engine structure 200 is integrated with either the bearing housing 110 or the cylinder block 22, the

10 depressions 180 are provided on the side of the engine structure 200 to be connected.

In any one of the above-mentioned alternatives, the depressions may be formed on two contacting surfaces of the turbocharger unit 100/cylinder block 22 interface. Hence, a depression may be jointly formed by a partial depression on the side of the engine

15 structure 22 facing the cylinder block 22, and an associated partial depression on the cylinder block 22. The similar applies to the side of the engine structure 200 facing the bearing housing 110 and the bearing housing 110 itself. These jointly formed depressions could also be provided by a fully surrounding depression on the cylinder block 22, on the engine structure 200, and/or the bearing housing.

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Now turning to Figs. 16a-c methods according to various embodiments will be described. Starting with Fig. 16a, a method 400 for attaching a turbocharger unit 100 to a cylinder block 22 comprises a first step 402 of connecting an engine structure 200 to the cylinder block 22. This is preferably performed by optionally aligning the engine structure 200 with

25 the cylinder block 22, e.g. by means of pins/recesses, and tightening one or several screws for pressing the engine structure 200 towards the cylinder block 22. Further to this, an additional step 404 may be provided which includes connecting fluid ports, such as coolant inlets, coolant outlets, lubricant inlets, lubricant outlets of the engine structure 200 with associated fluid supplies; one or several gaskets, O-rings, etc. may be used to seal

30 the fluid ports. A subsequent step 406 is performed in which a bearing housing 110 of the turbocharger unit 100 is securely attached to the engine structure 200. Step 406 may be improved by providing a gasket, or O-rings between the bearing housing 110 and the engine structure 200. As described above, the bearing housing 110 forms part of means for securely attaching the turbocharger unit 100 to said engine structure 200 such that at

35 least one fluid inlet and/or fluid outlet of the bearing housing 110 is aligned with a

corresponding fluid outlet and/or fluid inlet of the engine structure 200. The method 400 may further include steps of providing electrical connections, between the cylinder block 22 and the engine structure 200 and/or between the engine structure 200 and the bearing housing 110. The electrical connections may be established automatically during step 402
5 and/or step 406.

In Fig. 16b a method 400' is schematically shown. The method 400' is performed in order to remove a turbocharger unit 100 from a cylinder block 22, which turbocharger unit 100 comprises a bearing housing 110 being attached to an engine structure 200 such that at
10 least one fluid outlet and/or fluid inlet of the engine structure 200 is aligned with a corresponding fluid inlet and/or fluid outlet of the bearing housing 110. The method comprises a single step 402' of removing the turbocharger unit 100 from the engine structure 200 without removing the engine structure 200 from the cylinder block 22. The engine structure 200 is arranged remotely from the exhaust inlet 102 of the turbocharger
15 unit 100.

In Fig. 16c a further method 400'' is schematically shown. The method 400'' is performed for replacing a turbocharger unit 100, and comprises a first step 402'' of removing the turbocharger unit 100 from the engine structure 200 without removing the engine structure
20 200 from the cylinder block 22, i.e. step 402' of method 400'. A subsequent step 404'' is thereafter performed in which a bearing housing 110 of a new turbocharger unit 100 is securely attached to the engine structure 200. As previously described, the bearing housing 110 forms part of means for securely attaching the turbocharger unit 100 to said engine structure 200 such that at least one fluid inlet and/or fluid outlet of the bearing
25 housing 110 is aligned with a corresponding fluid outlet and/or fluid inlet of the engine structure 200.

The general concept of attaching a turbocharger unit 100 to a cylinder block 22 via an engine structure 200, arranged remotely from the exhaust inlet 102 of the turbocharger
30 unit 100, provides a number of advantages. For example, such assembly will be more robust in terms of vibration, and in case of a variable geometry turbine the risk for vane sticking will be reduced. Such assembly will also provide better control of tip clearance when the weight of the turbocharger unit 100 is not carried by turbine housing 104b, but instead by the bearing housing 110 used for attaching the turbocharger unit 100 to the
35 engine structure 200. Further to this, such assembly also allows for new designs of

associated exhaust manifolds 42, since these may be made of thinner material which besides being of less weight, also are capable of withstanding higher temperatures.

One particular advantage is related to pipe routing. Pipes are required for connecting the turbocharger unit 100 with e.g. coolant and lubricant supplies. Instead of requiring these piping to be connected to the bearing housing 110 directly, these are instead connected to the engine structure 200. Hence, when replacing a turbocharger unit 100 the piping will not be subject for removal. This particular advantage is best illustrated in Figs. 14a and 14b described above. Since the engine structure 200 can be constructed in many various ways it allows for great flexibility of pipe routing. Pipe routing will be even simpler for the embodiments described with reference to Fig. 7b, in which at least some of the fluid ports of the engine structure 200 are in direct connection with corresponding ports of the cylinder block 22. The same advantages are also applicable for electrical connectors in accordance with the description above.

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In further embodiments the use of an engine structure 200 may be advantageous for providing a common interface for different turbocharger units. For example, cylinder blocks may be manufactured in a very few number of configurations, while the number of different turbocharger units is significantly higher. For a case in which the cylinder block allows for lubricant supply as well as coolant supply to the turbocharger unit, a specific engine structure may be chosen which provides fluid channels between the cylinder block and the turbocharger unit. However, should a selected turbocharger unit not be configured to allow for cooling a different kind of engine structure may be selected, for which the water ports are blinded or shut off. Hence the engine structure may provide lubricant channels, while at the same time providing a lid for the coolant ports of the cylinder block. Following this reasoning a few number of different engine structures may provide the required number of interfaces for connecting a very large number of different turbocharger units to a fewer number of cylinder blocks.

The above description includes different embodiments, all related to attaching a bearing housing of a turbocharger unit to a cylinder block via an engine structure. The engine structure, forming an adapter for the bearing housing/cylinder block interface, may either be a separate component or it may be integrated with the bearing housing or the cylinder block. For the embodiments in which the engine structure is a separate component it has been described to attach the engine structure to the cylinder block, and thereafter

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mounting the turbocharger unit to the engine structure. It may however also be possible to provide attachment means such that the engine structure is initially mounted to the bearing housing, and such that the engine structure/bearing housing assembly is subsequently mounted to the cylinder block.

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It is to be understood that the present invention is not limited to the embodiments described above and illustrated in the drawings; rather, the skilled person will recognize that many changes and modifications may be made within the scope of the appended claims.

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CLAIMS

1. An engine structure (200) forming an adapter for connecting a turbocharger unit (100) to a cylinder block (22) of an internal combustion engine (10), wherein said engine structure (200) comprises a set of attachment means (220) for fastening the turbocharger unit (100) to the cylinder block (22) via the engine structure (200) such that the engine structure (200) is positioned in between the turbocharger unit (100) and the cylinder block (22), **characterized in that** said engine structure (200) comprises at least one fluid channel (240:1, 246:1, 250:1, 256:1) extending in a bent manner from a first surface (202) of said engine structure (200) to a second surface (204) of said engine structure (200).
2. The engine structure according to claim 1, wherein the first surface (202) is configured to bear on the cylinder block (22), and/or the second surface (204) is configured to bear on the turbocharger unit (100).
3. The engine structure according to claim 2, wherein the first surface (202) is arranged in a first plane, the second surface is arranged in a second plane, wherein the first plane is parallel with the second plane.
4. The engine structure according to claim 1 or 2, comprising at least one fluid channel (240:1, 246:1, 250:1, 256:1) extending in a bent manner from a first surface (202) of said engine structure (200) to a second surface (204) of said engine structure (200), wherein the second surface (202, 204) is configured to bear on the turbocharger unit (100) or on the cylinder block (22), and the first surface is distinct from a surface (202) configured to bear on the cylinder block (22) and from a surface (204) configured to bear on the turbocharger unit (100).
5. The engine structure according to any one of the preceding claims, wherein said set of attachment means (220) comprises at least one bore (220) for engagement with a fastener and extending from a surface of the engine structure (200), and wherein said bore (220) is either a through-hole for allowing the fastener to engage with a corresponding bore of the cylinder block (22) or the turbocharger unit (100), or a threaded bore for allowing the fastener to either secure the turbocharger unit (100) to the engine structure (200), or to secure the engine structure (200) to the cylinder block (22).

6. An engine structure (200) forming an adapter for connecting a turbocharger unit (100) to a cylinder block (22) of an internal combustion engine, **characterized in that** the engine structure (200) comprises a set of attachment means (220) for securely attaching a bearing housing (110) of the turbocharger unit (100) to said cylinder block (22) via the
5 engine structure (200) such that the engine structure (200) is positioned in between the turbocharger unit (100) and the cylinder block (22) and such that at least one fluid inlet (244, 254) and/or a fluid outlet (242, 252) of the engine structure (200), forming part of a fluid channel (240:1, 246:1, 250:1, 256:1) extending in a bent manner from a first surface (202) of said engine structure (200) to a second surface (204) of said engine structure
10 (200), is aligned with a corresponding fluid inlet (140, 150) and/or fluid outlet (146, 156) of the bearing housing (110) or of the cylinder block (22).

7. The engine structure according to claim 5, wherein the first surface (202) is configured to bear on the cylinder block (22), and/or the second surface (204) is configured to bear
15 on the turbocharger unit (100).

8. The engine structure according to claim 7, wherein the first surface (202) is arranged in a first plane, the second surface is arranged in a second plane, wherein the first plane is parallel with the second plane.

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9. The engine structure according to claim 7 or 8, comprising at least one fluid channel (240:1, 246:1, 250:1, 256:1) extending in a bent manner from a first surface (202) of said engine structure (200) to a second surface (204) of said engine structure (200), wherein the second surface (204) is configured to bear on the turbocharger unit (100), and the first
25 surface is distinct from a surface (202) configured to bear on the cylinder block (22).

10. The engine structure according to any one of the preceding claims, wherein said engine structure (200) is integrally formed with a bearing housing (110) of said turbocharger unit (100).

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11. The engine structure according to any one of claims 1-9, wherein said engine structure (200) is integrally formed with said cylinder block (22).

12. The engine structure according to any one of claims 1-9, wherein said engine structure (200) is releasable connectable to the turbocharger unit (100) as well as to the cylinder block (22).

5 13. The engine structure according to claim 12, further comprising a set of attachment means (210) for securely attaching the engine structure (200) to the cylinder block (22).

14. The engine structure according to claim 12 or 13, wherein the set of attachment means (220) for attaching the turbocharger unit (100) to the cylinder block (22) via the
10 engine structure (200) comprises at least one bore (220) for engagement with a fastener and extending from a surface of the engine structure (200) such that the bore (220) is accessible when the engine structure (200) is fastened to the cylinder block (22).

15. The engine structure (200) according to any one of claims 11-14, wherein the at least
15 one fluid channel (240:1, 246:1, 250:1, 256:1)) comprises a coolant outlet (242) and/or a lubricant outlet (252) for alignment with a corresponding coolant inlet and a lubricant inlet of the bearing housing (110), and/or a coolant inlet (244) and/or a lubricant inlet (254) for alignment with a corresponding coolant outlet and a lubricant outlet of the bearing housing (110).

20

16. The engine structure (200) according to claim 10, wherein the at least one fluid channel (240:1, 246:1, 250:1, 256:1) comprises a coolant outlet (246) and/or a lubricant outlet (256) for alignment with a corresponding coolant inlet and a lubricant inlet of the cylinder block (22), and/or a coolant inlet (242) and/or a lubricant inlet (252) for alignment
25 with a corresponding coolant outlet and a lubricant outlet of the cylinder block (22).

17. The engine structure (200) according to claim 15 or 16, wherein at least one of the at least one fluid outlet (242, 246, 252, 256) and/or fluid inlet (240, 244, 250, 254) comprises a pipe (260) extending out from the engine structure (200).

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18. The engine structure (200) according to any one of claims 15-17, wherein the at least one fluid inlet (250, 254) or fluid outlet (252, 256) comprises a dam (258).

19. The engine structure (200) according to claim 11 or 12, wherein the second surface
35 (204) configured to bear on the turbocharger unit (100) is provided with divider means for

preventing coolant fluid to mix with lubricating fluid during disassembly of the turbocharger unit (100) from the engine structure (200).

20. The engine structure (200) according to claim 19, wherein the divider means is provided as a protrusive ridge extending from an upper part of said surface (204) to a lower part of said surface (204), whereby the lubricant ports (252, 254) are arranged on one lateral side of the divider, while the coolant ports (242, 244) are arranged on the other lateral side of the divider.

21. The engine structure (200) according to claim 19, wherein the divider means is formed by providing the second surface (204) with a V-shaped profile such that the thickness of the engine structure (200) is largest at a specific line, and whereby the lubricant ports (252, 254) are arranged on one lateral side of the specific line, while the coolant ports (242, 244) are arranged on the other lateral side of the specific line.

15

22. The engine structure (200) according to claim 10, wherein the first surface (202) configured to bear on the cylinder block (22) is provided with divider means for preventing coolant fluid to mix with lubricating fluid during disassembly of the turbocharger unit (100) from the cylinder block (222).

20

23. The engine structure (200) according to claim 22, wherein the divider means is provided as a protrusive ridge extending from an upper part of said surface (202) to a lower part of said surface (202), whereby the lubricant ports (250, 256) are arranged on one lateral side of the divider, while the coolant ports (240, 246) are arranged on the other lateral side of the divider.

24. The engine structure (200) according to claim 22, wherein the divider means is formed by providing the first surface (202) with a V-shaped profile such that the thickness of the engine structure (200) is largest at a specific line, and whereby the lubricant ports (250, 256) are arranged on one lateral side of the specific line, while the coolant ports (240, 246) are arranged on the other lateral side of the specific line.

25. The engine structure (200) according to any one of claims 15-24, further comprising an additional fluid channel (240:1, 246:1, 250:1, 256:1) having a lubricant inlet (250) and/or a coolant inlet (240) such that the additional fluid channel (240:1, 246:1, 250:1,

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256:1) forms a coolant channel from a coolant supply to the turbocharger unit (100), and/or a lubricant channel from a lubricant supply to the turbocharger unit (100).

26. The engine structure (200) according to claim 25, wherein said coolant inlet (240) forms an open connection between a coolant outlet of the cylinder block (22) and the engine structure (200).

27. The engine structure (200) according to claim 25, wherein said coolant inlet (240) is closed such that it forms a shut off connection between a coolant outlet of the cylinder block (22) and the engine structure (200).

28. The engine structure (200) according to any one of claims 25-27, wherein said lubricant inlet (250) forms an open connection between a lubricant outlet of the cylinder block (22) and the engine structure (200).

15

29. The engine structure (200) according to any one of claims 25-27, wherein said lubricant inlet (250) is closed such that it forms a shut off connection between a lubricant outlet of the cylinder block (22) and the engine structure (200).

30. The engine structure (200) according to any one of the preceding claims, wherein the set of attachment means (220) for connecting the turbocharger unit (100) to the cylinder block (22) via the engine structure (22) further comprises at least one guiding pin or recess (222) for mating engagement with a corresponding guiding recess or pin of the bearing housing (110) and/or the cylinder block (22).

25

31. The engine structure (200) according to claim 13, wherein the set of attachment means (210) for securely attaching the engine structure (200) to the cylinder block (22) further comprises at least one guiding pin or recess (212) for mating engagement with a corresponding guiding recess or pin of the cylinder block (22).

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32. The engine structure (200) according to claim 13, wherein the bearing housing (110), when attached to the engine structure (200), covers the set of attachment means (210) for securely attaching the engine structure (200) to the cylinder block (22).

32. The engine structure (200) according to claim 13, wherein the bearing housing (110), when attached to the engine structure (200), does not cover the set of attachment means (210) for securely attaching the engine structure (200) to the cylinder block (22).

5 33. The engine structure (200) according to any one of the preceding claims, further comprising a support (230) onto which the turbocharger unit (100) may rest during mounting.

34. The engine structure (200) according to any one of the preceding claims, further
10 comprising an actuator (300) being releasably attached to the engine structure (200).

35. The engine structure (200) according to claim 34, wherein the actuator (300) is configured to receive coolant directly from the engine structure (200) or from an associated bearing housing (110), and to return coolant directly to the engine structure
15 (200) or to the associated bearing housing (110).

36. The engine structure (200) according to claim 34 or 35, wherein the actuator (300) is provided with a plug (310) for draining fluid from said actuator (300).

20 37. The engine structure (200) according to any one of the preceding claims, wherein the engine structure (200) is configured to provide electrical connection between the cylinder block (22) and the turbocharger unit (220).

38. The engine structure (200) according to any one of the preceding claims, wherein said
25 set of attachment means (220) for connecting the turbocharger unit (100) to the cylinder block (22) via the engine structure (200) comprises at least one through hole (220) which extends to a back side of the engine structure (200) facing the cylinder block (22), and wherein said engine structure (200) comprises a depression at least partly surrounding said through hole (220).

30

39. The engine structure (200) according to any one of the preceding claims, wherein said set of attachment means (220) for connecting the turbocharger unit (100) to the cylinder block (22) via the engine structure (200) comprises at least one through hole (220) which extends to a front side of the engine structure (200) facing the turbocharger unit (100),

and wherein said engine structure (200) comprises a depression at least partly surrounding said through hole (220).

40. The engine structure (200) according to claim 13, wherein said set of attachment
5 means (210) for securely attaching the engine structure (200) to the cylinder block (22) comprises at least one through hole (210) which extends to a back side of the engine structure (200) facing the cylinder block (22), and wherein said engine structure (200) comprises a depression at least partly surrounding said through hole (210).

10 41. The engine structure (200) according to any one of claims 38-40, wherein the at least one depression extends from an outer portion of the engine structure (200) towards the through hole (210, 220) such that a support face is formed between the through hole (210, 220) and the depression.

15 42. The engine structure (200) according to any one of claims 38-41, wherein said depression surrounds said through hole (210, 220).

43. The engine structure (200) according to any one of claims 38-41, wherein said depression partly surrounds said through hole (210, 220), and wherein the depression is
20 dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the engine structure (200), such that the depression of the engine structure (200) and the depression of the contacting surface forms a joint depression surrounding the entire through hole (210, 220).

25 44. A turbocharger unit (200) comprising a bearing housing (110) having means (120) for fastening the turbocharger unit to a cylinder block (22) of an internal combustion engine (10) via an engine structure (200) according to any one of claims 1-43.

45. The turbocharger unit (200) according to claim 44, wherein said engine structure (200)
30 is integrally formed with said bearing housing (110).

46. A turbocharger unit (100) comprising a bearing housing (110) having means (120) for fastening the turbocharger unit to a cylinder block (22) of an internal combustion engine (10) via an engine structure (200) according to any one of claims 1-40, **characterized in**
35 **that** the bearing housing (110) comprises at least one plug (170) for draining coolant fluid

from said bearing housing (110) and from said engine structure (200), and wherein said plug (170) is in fluid communication with a coolant jacket (160) of said bearing housing (110).

- 5 47. The turbocharger unit (100) according to claim 46, wherein said coolant jacket (160) has two fluid ports (140, 146) for allowing coolant fluid to enter and exit said coolant jacket (160), wherein at least one of said fluid ports (140, 146) is provided on an end face of said bearing housing (110) facing said engine structure (200).
- 10 48. The turbocharger unit (100) according to claim 46, wherein said coolant jacket (160) has two fluid ports (140, 146) for allowing coolant fluid to enter and exit said coolant jacket (160), wherein each one of said fluid ports (140, 146) is provided on an end face of said bearing housing (110) facing said engine structure (200).
- 15 49. The turbocharger unit (100) according to any one of claims 46-48, wherein said bearing housing (110) is further provided with at least one lubrication fluid port (150, 156) arranged vertically below at least one of said coolant fluid ports (140, 146).
- 20 50. The turbocharger unit (100) according to any one of claims 46-48, wherein the bearing housing (110) comprises at least one fluid port (140, 146) for alignment with a corresponding fluid port (242, 244) of the engine structure (200), and wherein said fluid port (140, 146) of the bearing housing (110) is configured to seal against a pipe (260) extending out from the fluid port (242, 244) of the engine structure (200).
- 25 51. The turbocharger unit (100) according to claim 50, wherein the bearing housing (110) comprises an additional fluid port (140, 146) for alignment with a corresponding fluid port (242, 244) of the engine structure (200), and wherein said fluid port (140, 146) of the bearing housing (110) is configured to seal against a pipe (260) extending out from the fluid port (242, 244) of the engine structure (200).
- 30 52. The turbocharger unit (100) according to claim 50 or 51, wherein at least one of said fluid ports (140, 146) of the bearing housing (110) is provided with an O-ring (148) forming a sealing means.

53. The turbocharger unit (100) according to any one of claims 50-52, wherein at least one of said fluid ports (140, 146) of the bearing housing (110) is provided with tight fit configuration (148) forming a sealing means.

5 54. The turbocharger unit (100) according to any one of claims 46-53, wherein said means (120) for fastening the turbocharger unit to a cylinder block (22) of an internal combustion engine (10) via the engine structure (200) comprises at least one through hole (122) which extends to a back side of the bearing housing (110) facing the engine structure (200) or the cylinder block (22), and wherein said bearing housing (110)
10 comprises a depression (180) at least partly surrounding one through hole (122).

55. The turbocharger unit (100) according to claim 54, wherein the at least one depression (180) extends from an outer portion of the bearing housing (110) towards the through hole (122) such that a support face is formed between the through hole (122) and
15 the depression (180).

56. The turbocharger unit (100) according to any one of claims 54-55, wherein said depression (180) surrounds said through hole (122).

20 57. The turbocharger unit (100) according to any one of claims 54-55, wherein said depression (180) partly surrounds said through hole (122), and wherein the depression (180) is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the turbocharger unit (100), such that the depression (180) of the turbocharger unit (100) and the depression of the contacting surface forms a joint
25 depression surrounding the entire through hole (122).

58. A turbocharger unit (100) comprising a bearing housing (110) having means (120) for fastening the turbocharger unit to a cylinder block (22) of an internal combustion engine (10) via an engine structure (200) according to any one of claims 1-40, **characterized in**
30 **that** the bearing housing (110) comprises at least one fluid port (140, 146) for alignment with a corresponding fluid port (242, 244) of the engine structure (200), and wherein said fluid port (140, 146) of the bearing housing (110) is configured to seal against a pipe (260) extending out from the fluid port (242, 244) of the engine structure (200).

59. The turbocharger unit (100) according to claim 58, wherein the bearing housing (110) comprises an additional fluid port (140, 146) for alignment with a corresponding fluid port (242, 244) of the engine structure (200), and wherein said fluid port (140, 146) of the bearing housing (110) is configured to seal against a pipe (260) extending out from the fluid port (242, 244) of the engine structure (200).

60. The turbocharger unit (100) according to claim 58 or 59, wherein at least one of said fluid ports (140, 146) of the bearing housing (110) is provided with an O-ring (148) forming a sealing means.

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61. The turbocharger unit (100) according to any one of claims 58-60, wherein at least one of said fluid ports (140, 146) of the bearing housing (110) is provided with tight fit configuration (148) forming a sealing means.

15 62. The turbocharger unit (100) according to any one of claims 58-61, wherein said means (120) for fastening the turbocharger unit to a cylinder block (22) of an internal combustion engine (10) via the engine structure (200) comprises at least one through hole (122) which extends to a back side of the bearing housing (110) facing the engine structure (200), and wherein said bearing housing (110) comprises a depression (180) at least partly surrounding one through hole (122).

20 63. The turbocharger unit (100) according to claim 62, wherein the at least one depression (180) extends from an outer portion of the bearing housing (110) towards the through hole (122) such that a support face is formed between the through hole (122) and the depression (180).

64. The turbocharger unit (100) according to any one of claims 62-63, wherein said depression (180) surrounds said through hole (122).

30 65. The turbocharger unit (100) according to any one of claims 62-63, wherein said depression (180) partly surrounds said through hole (122), and wherein the depression (180) is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the turbocharger unit (100), such that the depression (180) of the turbocharger unit (100) and the depression of the contacting surface forms a joint depression surrounding the entire through hole (122).

35

66. A turbocharger unit (100) comprising a bearing housing (110) having means (120) for fastening the turbocharger unit to a cylinder block (22) of an internal combustion engine (10) via an engine structure according to any one of claims 1-40, **characterized in that**
5 said means (120) for fastening the turbocharger unit to a cylinder block (22) of an internal combustion engine (10) via the engine structure (200) comprises at least one through hole (122) which extends to a back side of the bearing housing (110) facing the engine structure (200) or the cylinder block (22), and wherein said bearing housing (110) comprises a depression (180) at least partly surrounding one through hole (122).

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67. The turbocharger unit (100) according to claim 66, wherein the at least one depression (180) extends from an outer portion of the bearing housing (110) towards the through hole (122) such that a support face is formed between the through hole (122) and the depression (180).

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68. The turbocharger unit (100) according to any one of claims 66-67, wherein said depression (180) surrounds said through hole (122).

69. The turbocharger unit (100) according to any one of claims 66-67, wherein said
20 depression (180) partly surrounds said through hole (122), and wherein the depression (180) is dimensioned to be aligned with a corresponding depression of a surface contacting the surface of the turbocharger unit (100), such that the depression (180) of the turbocharger unit (100) and the depression of the contacting surface forms a joint depression surrounding the entire through hole (122).

25

70. The turbocharger unit (100) according to any one of claims 46-69, wherein the bearing housing (110) is provided with divider means for preventing coolant fluid to mix with lubricating fluid during disassembly of the turbocharger unit (100) from the cylinder block (22).

30

71. The turbocharger unit (100) according to claim 70, wherein the divider means is provided as a recessive groove extending from an upper part of the bearing housing (110) to a lower part of bearing housing (110), whereby the lubricant ports (150, 156) are arranged on one lateral side of the divider, while the coolant ports (140, 146) are arranged
35 on the other lateral side of the divider.

72. The turbocharger unit (100) according to claim 70, wherein the divider means is formed by providing the bearing housing (110) with a V-shaped profile such that the thickness of the bearing housing (110) is largest at a specific line, and whereby the lubricant ports (150, 156) are arranged on one lateral side of the specific line, while the coolant ports (150, 156) are arranged on the other lateral side of the specific line.

73. The turbocharger unit (100) according to any one of claims 46-72, further comprising an actuator (300) being releasably attached to the bearing housing (110).

10

74. The turbocharger unit (100) according to claim 73, wherein the actuator (300) is configured to receive coolant directly from the bearing housing (110) or from an associated engine structure (200), and to return coolant directly to the bearing housing (110) or to the associated engine structure (200).

15

75. The turbocharger unit (100) according to claim 73 or 74, wherein the actuator (300) is provided with a drain plug (310).

76. The turbocharger unit (100) according to any one of claims 46-75, wherein the bearing housing (110) further comprises a lifting eye (112) arranged at the center of the turbocharger unit (100).

77. An exhaust system (40) for an internal combustion engine, comprising a turbocharger unit (100) according to any one of claims 46-76, and an engine structure (200) according to any one of claims 1-42 for attaching said turbocharger unit (100) to a cylinder block (22) of said internal combustion engine (10).

78. An internal combustion engine (10), comprising a cylinder block (22) and an engine structure (200) according to any one of claims 1-42.

30

79. The internal combustion engine (10) according to claim 78, wherein said cylinder block (22) having means (22:13, 22:23) for fastening the turbocharger unit to the cylinder block (22) via an engine structure according to any one of claims 1-42, wherein said means (22:13, 22:23) comprises at least one through hole (22:13, 22:23) which extends from a front side of the cylinder block (22) facing the engine structure (200), and wherein

said cylinder block (22) comprises a depression at least partly surrounding one through hole (22:13, 22:23).

80. The internal combustion engine (10) according to claim 79, wherein the at least one
5 depression extends from an outer portion of the cylinder block (22) towards the through hole (22:13, 22:23) such that a support face is formed between the through hole (22:13, 22:23) and the depression.

81. The internal combustion engine (10) according to claim 79 or 80, wherein said
10 depression surrounds said through hole (22:13, 22:23).

82. The internal combustion engine (10) according to claim 79 or 80, wherein said depression partly surrounds said through hole (22:13, 22:23), and wherein the depression is dimensioned to be aligned with a corresponding depression of a surface contacting the
15 surface of the cylinder block (22), such that the depression of the cylinder block (22) and the depression of the contacting surface forms a joint depression surrounding the entire through hole (22:13, 22:23).

83. The internal combustion engine (10) according to claim 78, wherein said engine
20 structure (200) is formed integrally with the cylinder block (22).

84. A vehicle (1), comprising an internal combustion engine (10) according to any one of claims 78-83.

25 85. A method for attaching a turbocharger unit to a cylinder block, comprising the steps of:
attaching an engine structure to the cylinder block,
providing at least one gasket, or O-ring, between the engine structure and the bearing housing, and/or between the engine structure and the cylinder block, and
securely attaching a bearing housing of the turbocharger unit to the engine
30 structure, whereby the bearing housing forms part of means for securely attaching the turbocharger unit to said engine structure such that at least one fluid inlet and/or fluid outlet of the bearing housing is aligned with a corresponding fluid outlet and/or fluid inlet of the engine structure, wherein said at least one fluid inlet and/or fluid outlet forms part of a fluid channel extending in a bent manner in said engine structure.

86. A method for removing a turbocharger unit from a cylinder block, which turbocharger unit comprises a bearing housing being attached to an engine structure and sealed by means of at least one gasket, or O-ring, between the engine structure and the bearing housing, and/or between the engine structure and the cylinder block, such that at least
5 one fluid outlet and/or fluid inlet of the engine structure is aligned with a corresponding fluid inlet and/or fluid outlet of the bearing housing, wherein said at least one fluid inlet and/or fluid outlet forms part of a fluid channel extending in a bent manner in said engine structure, the method comprising the step of:

removing the turbocharger unit from the engine structure without removing the
10 engine structure from the cylinder block.

87. A method for replacing a turbocharger unit, comprising the step of removing a turbocharger unit according to claim 86, and the step of

securely attaching a bearing housing of the turbocharger unit to the engine
15 structure, whereby the bearing housing forms part of means for securely attaching the turbocharger unit to said engine structure such that at least one fluid inlet and/or fluid outlet of the bearing housing is aligned with a corresponding fluid outlet and/or fluid inlet of the engine structure.

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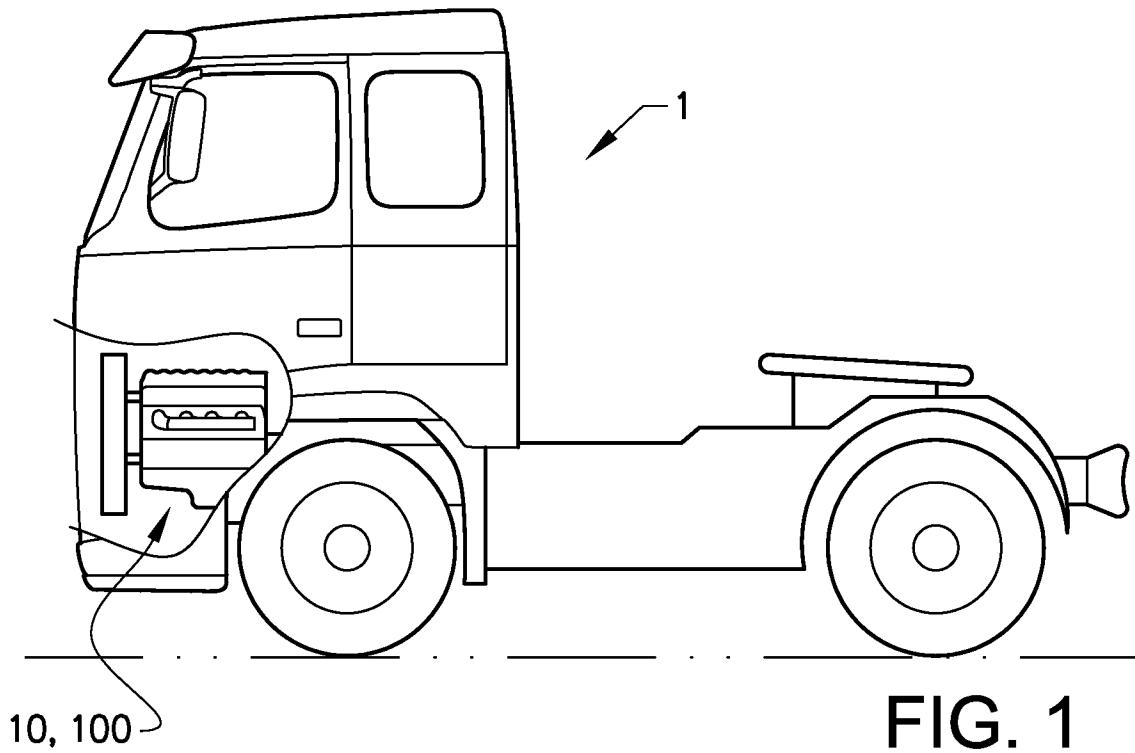


FIG. 1

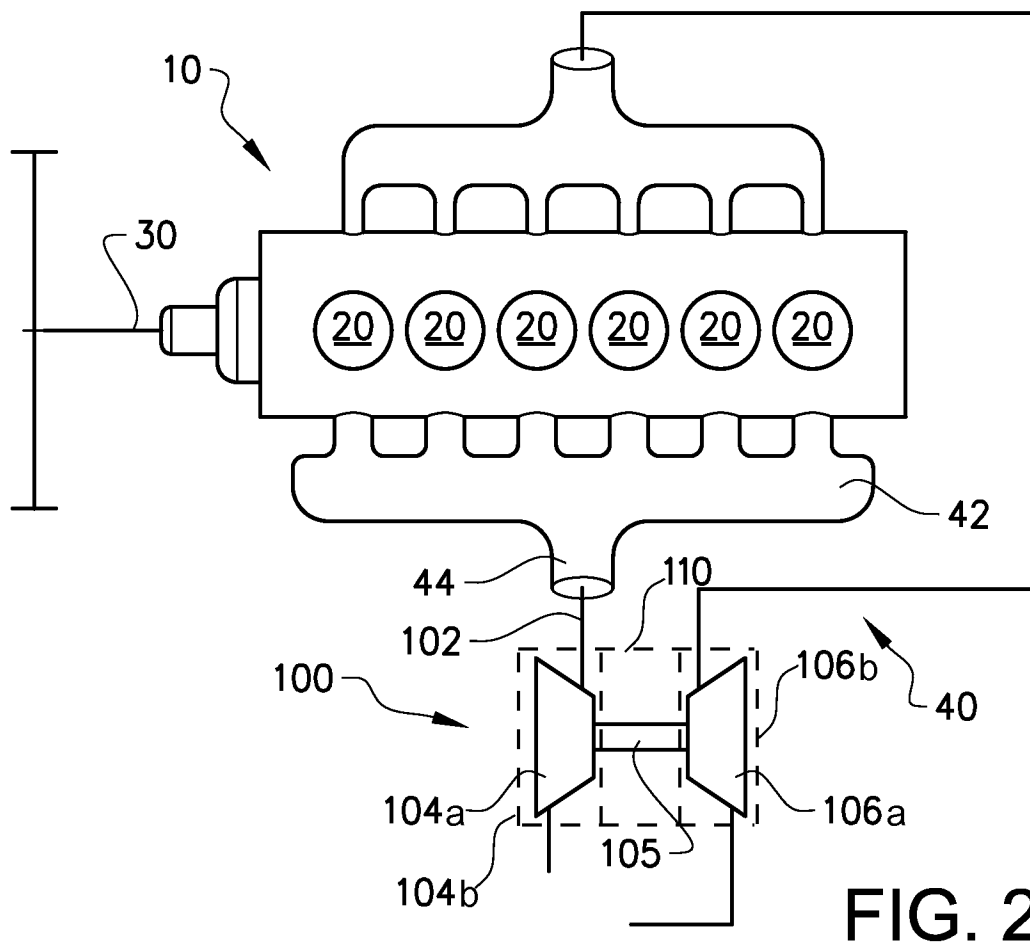


FIG. 2

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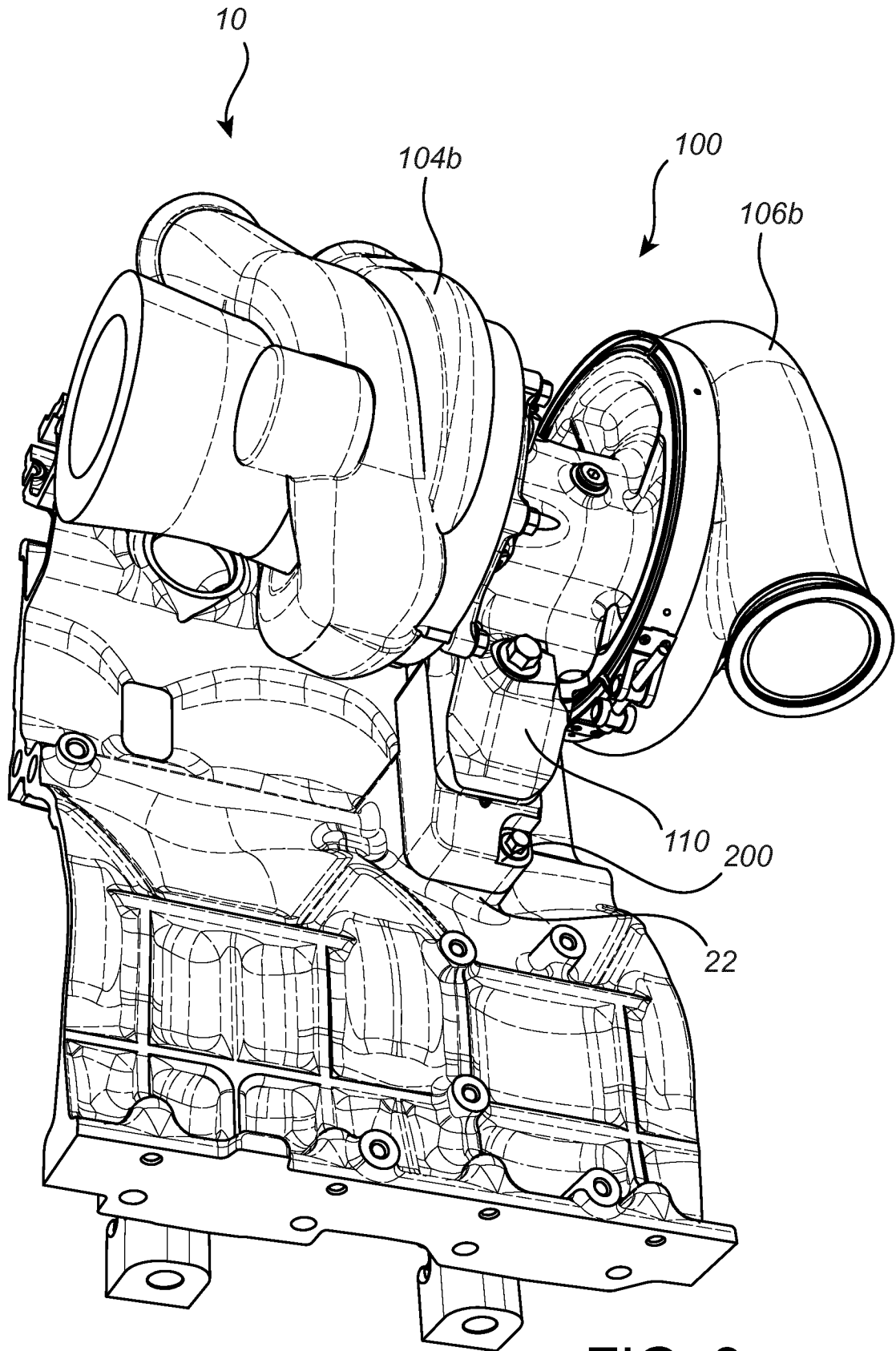


FIG. 3

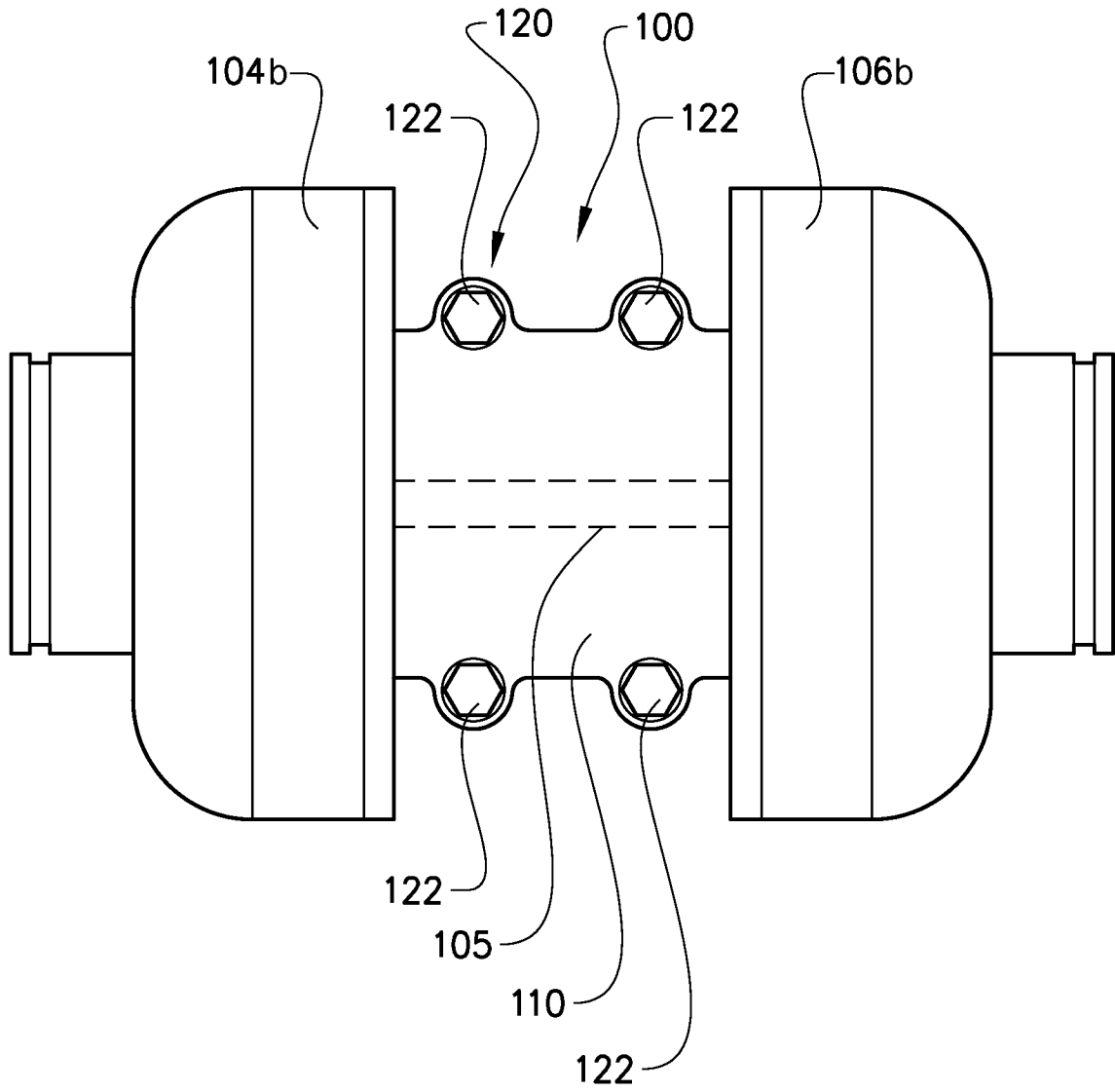


FIG. 4a

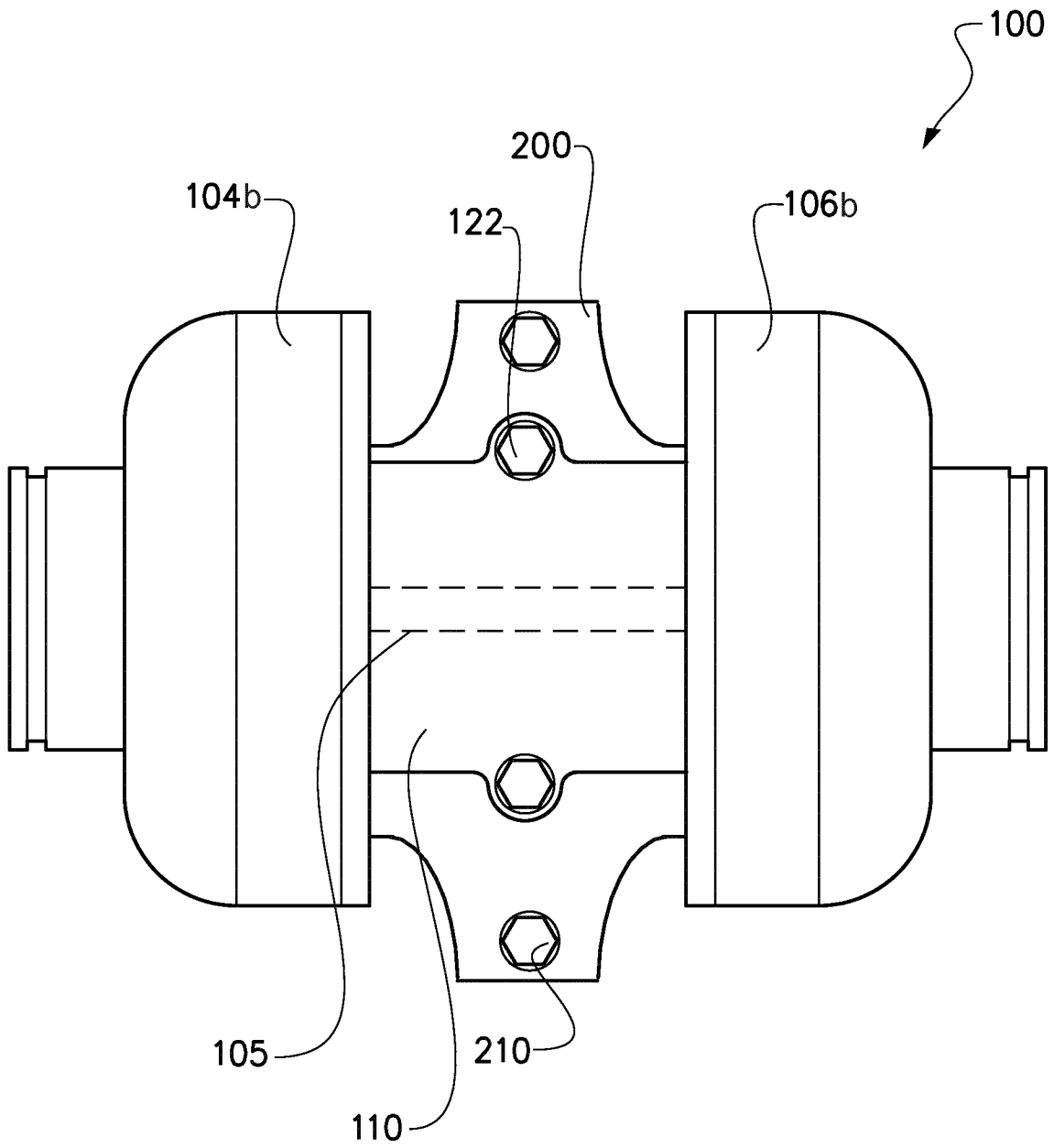


FIG. 4b

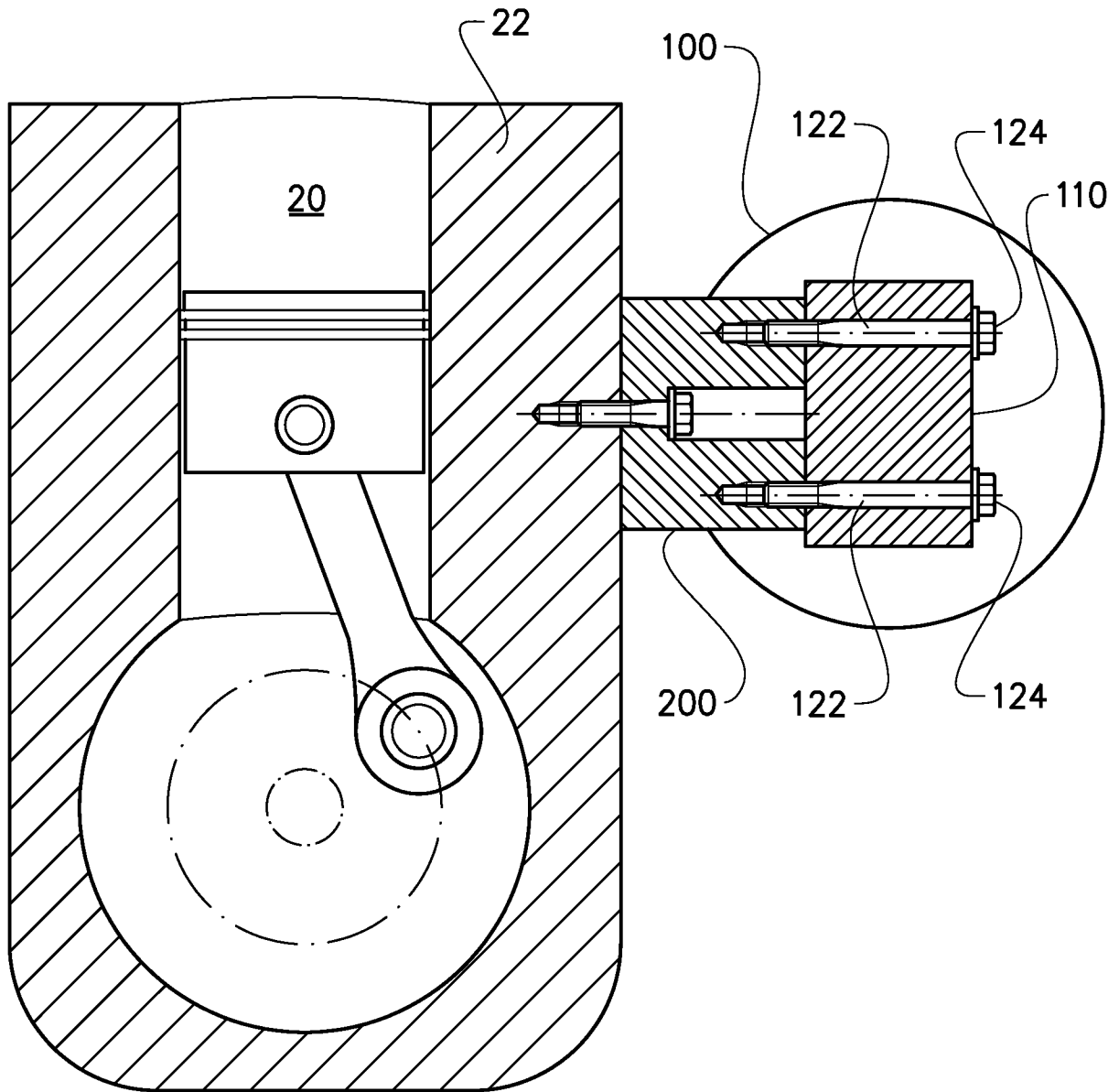


FIG. 5

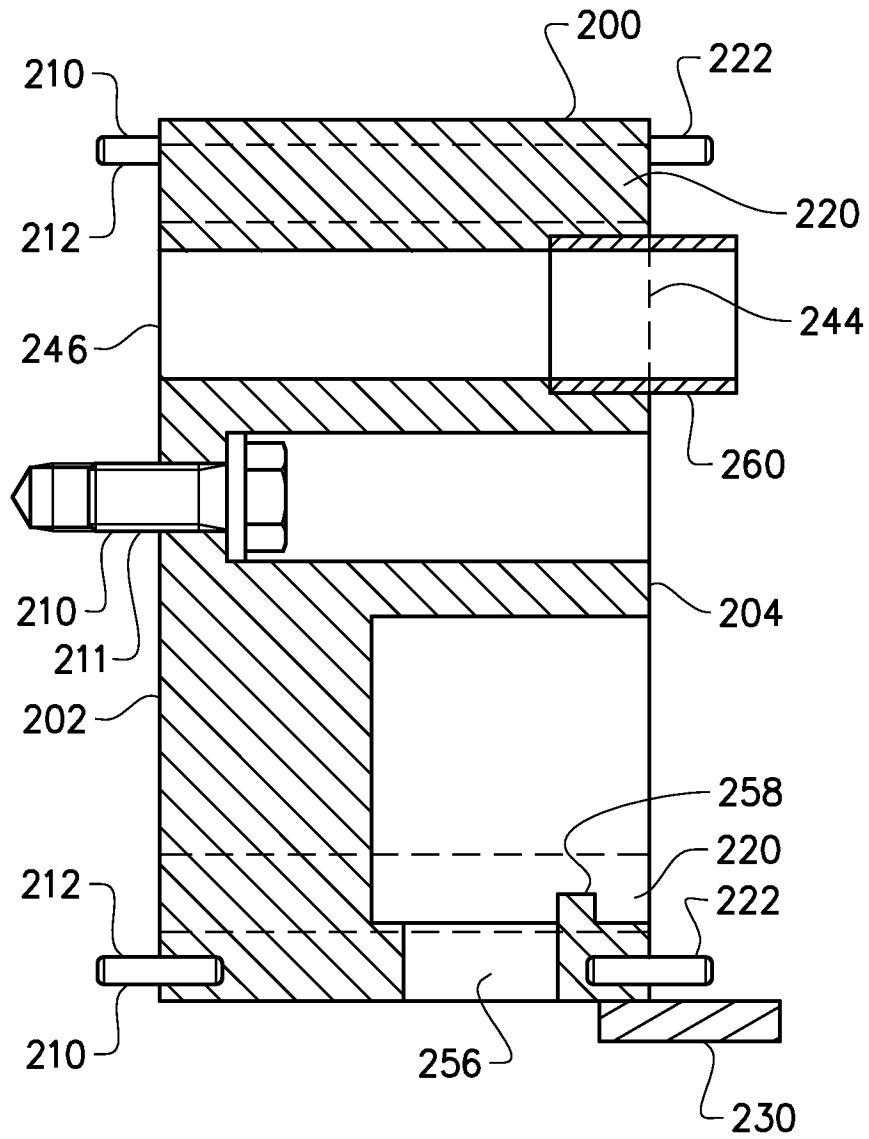


FIG. 7b

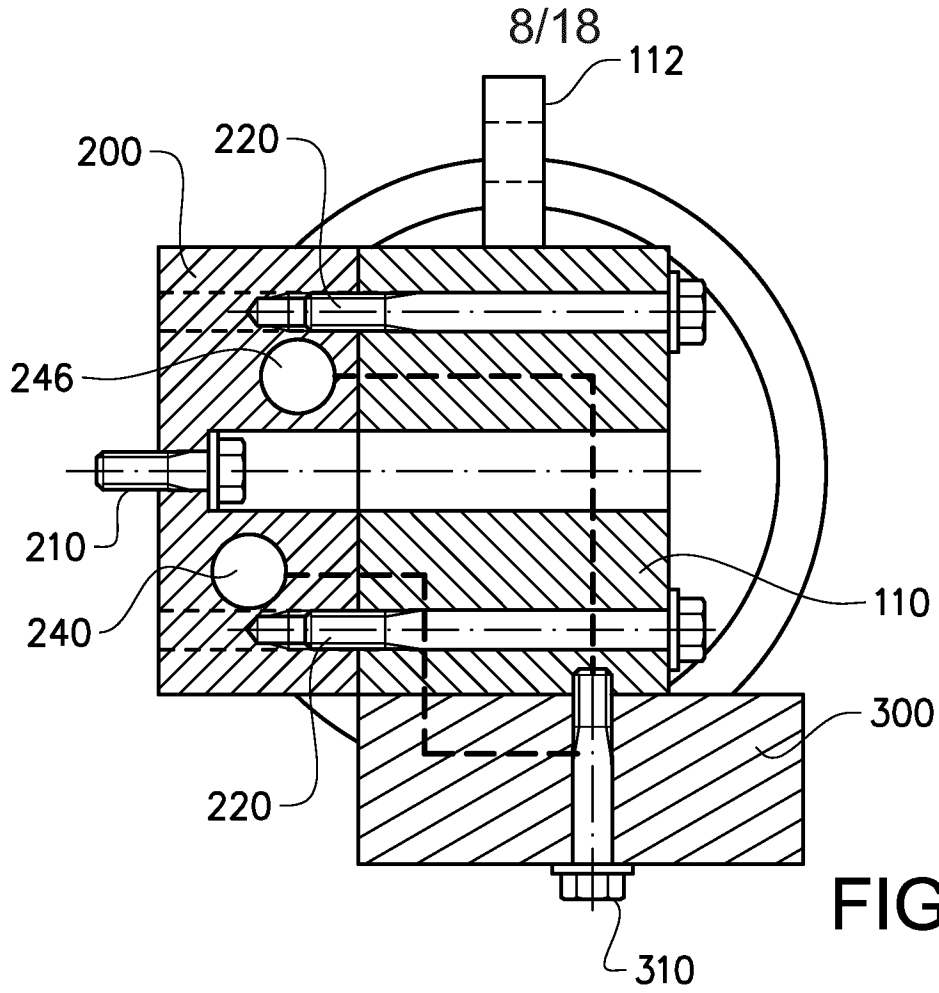


FIG. 8

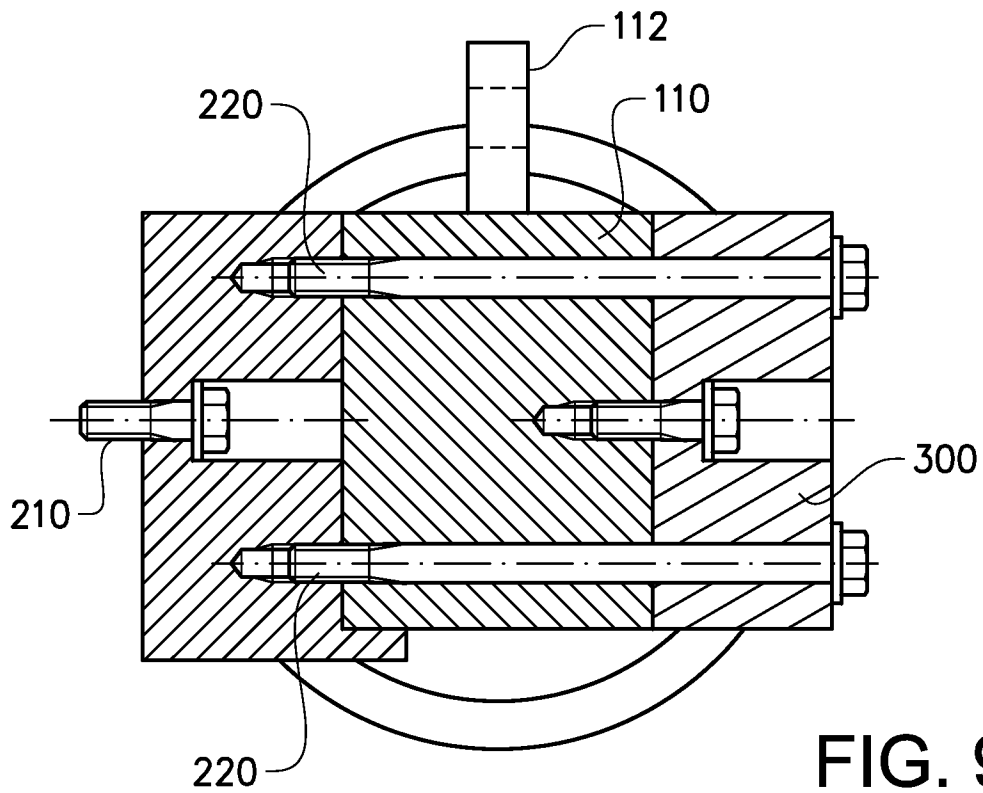


FIG. 9

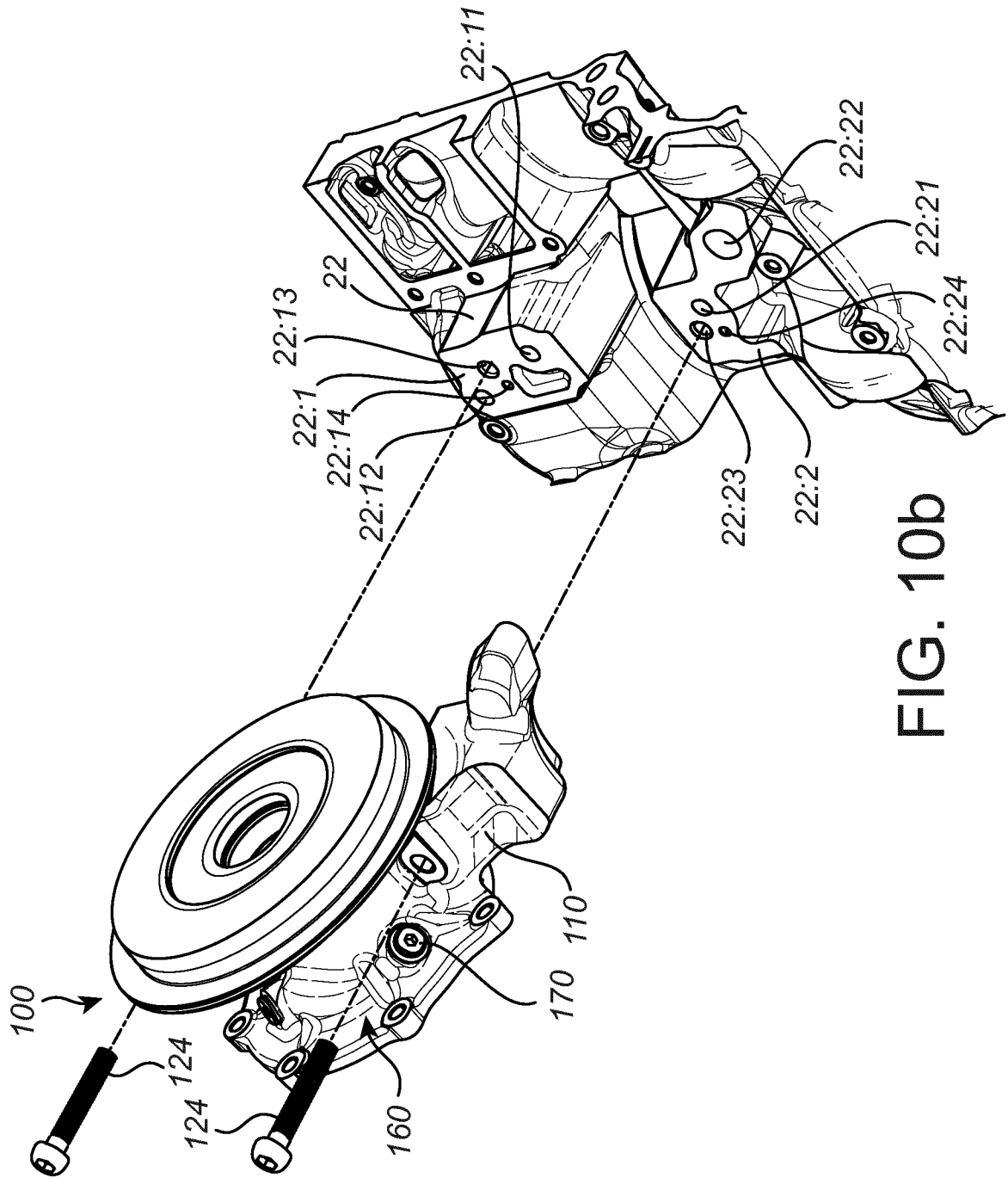


FIG. 10b

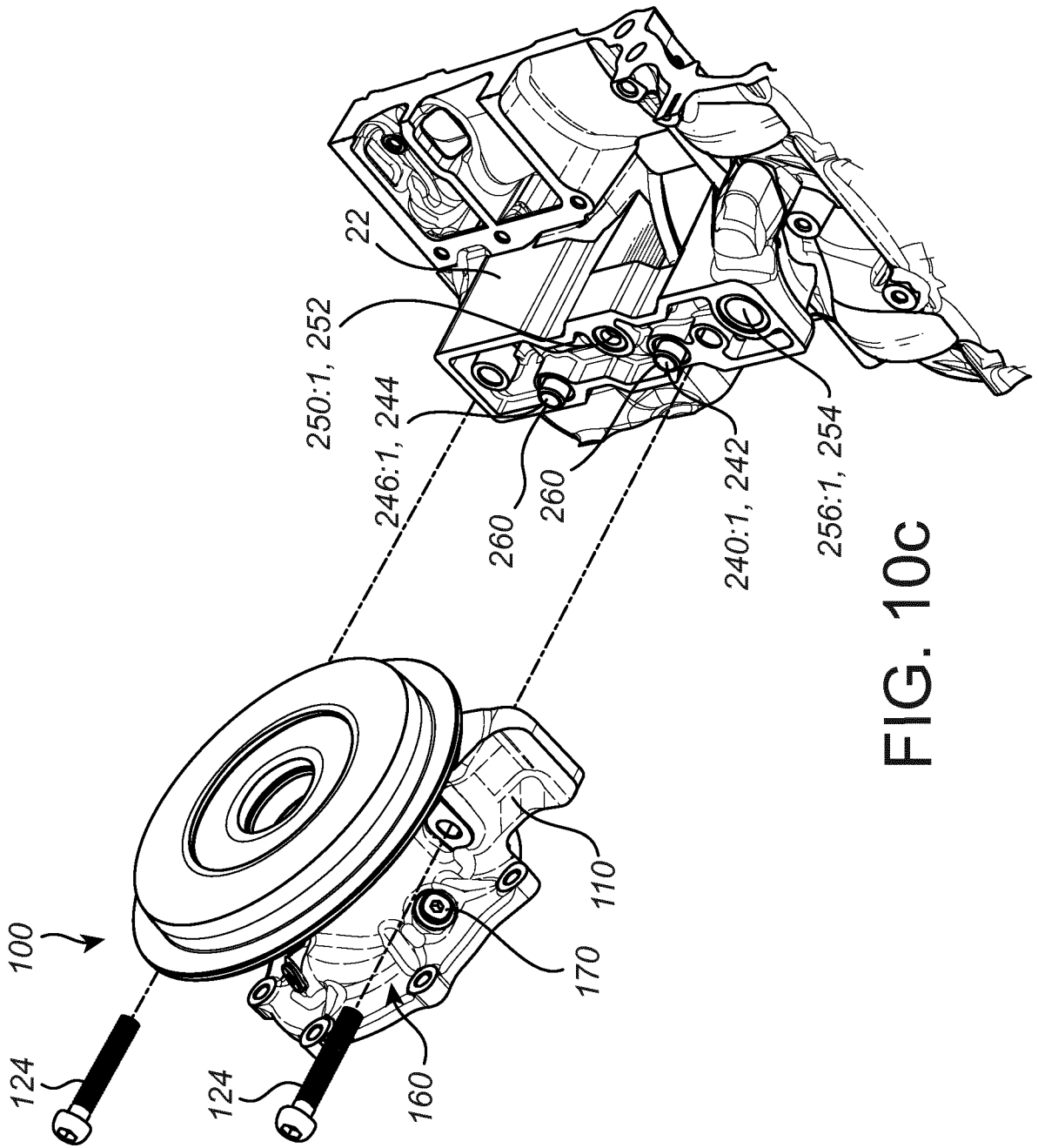


FIG. 10C

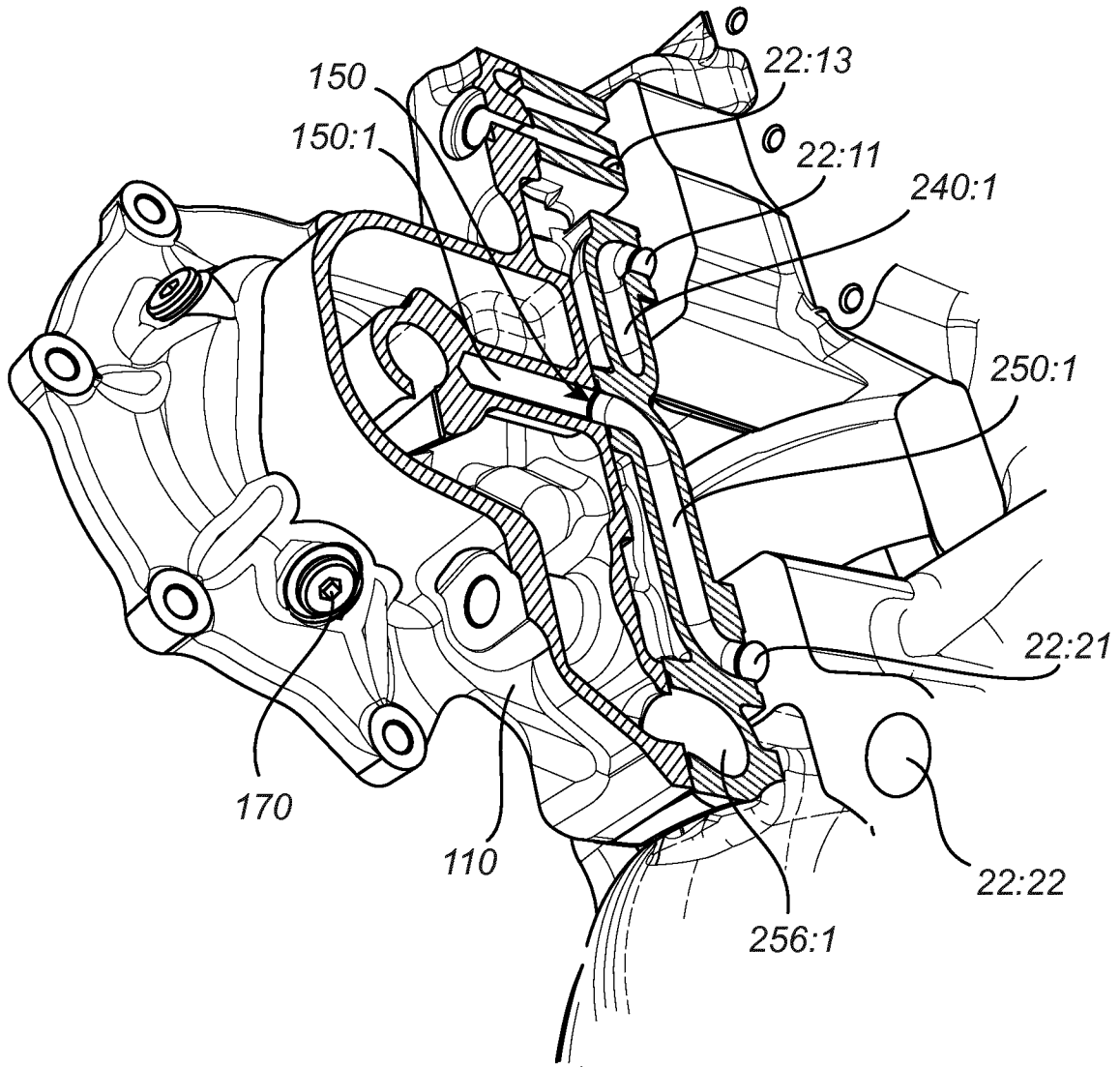


FIG. 11

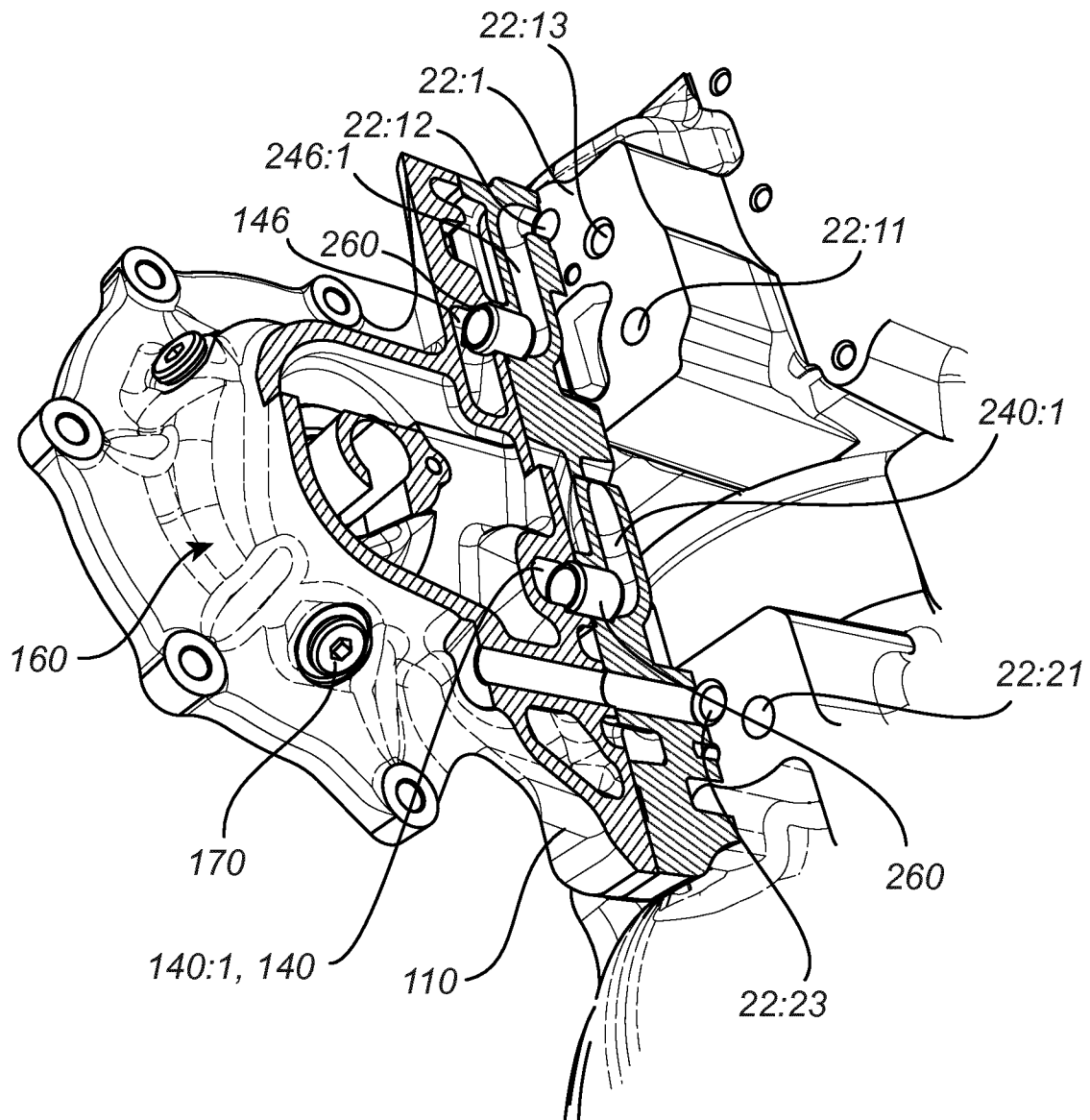


FIG. 12

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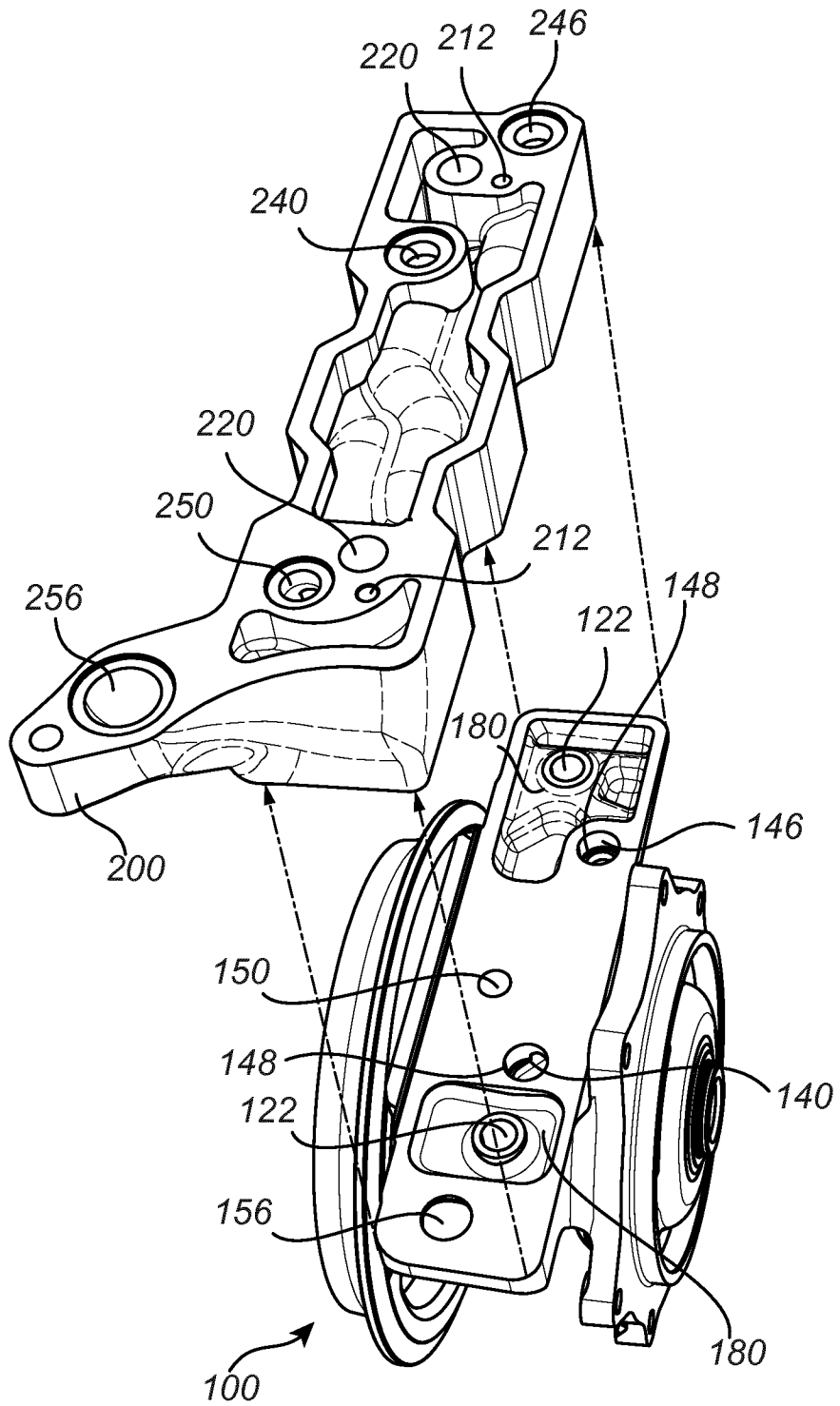


FIG. 13

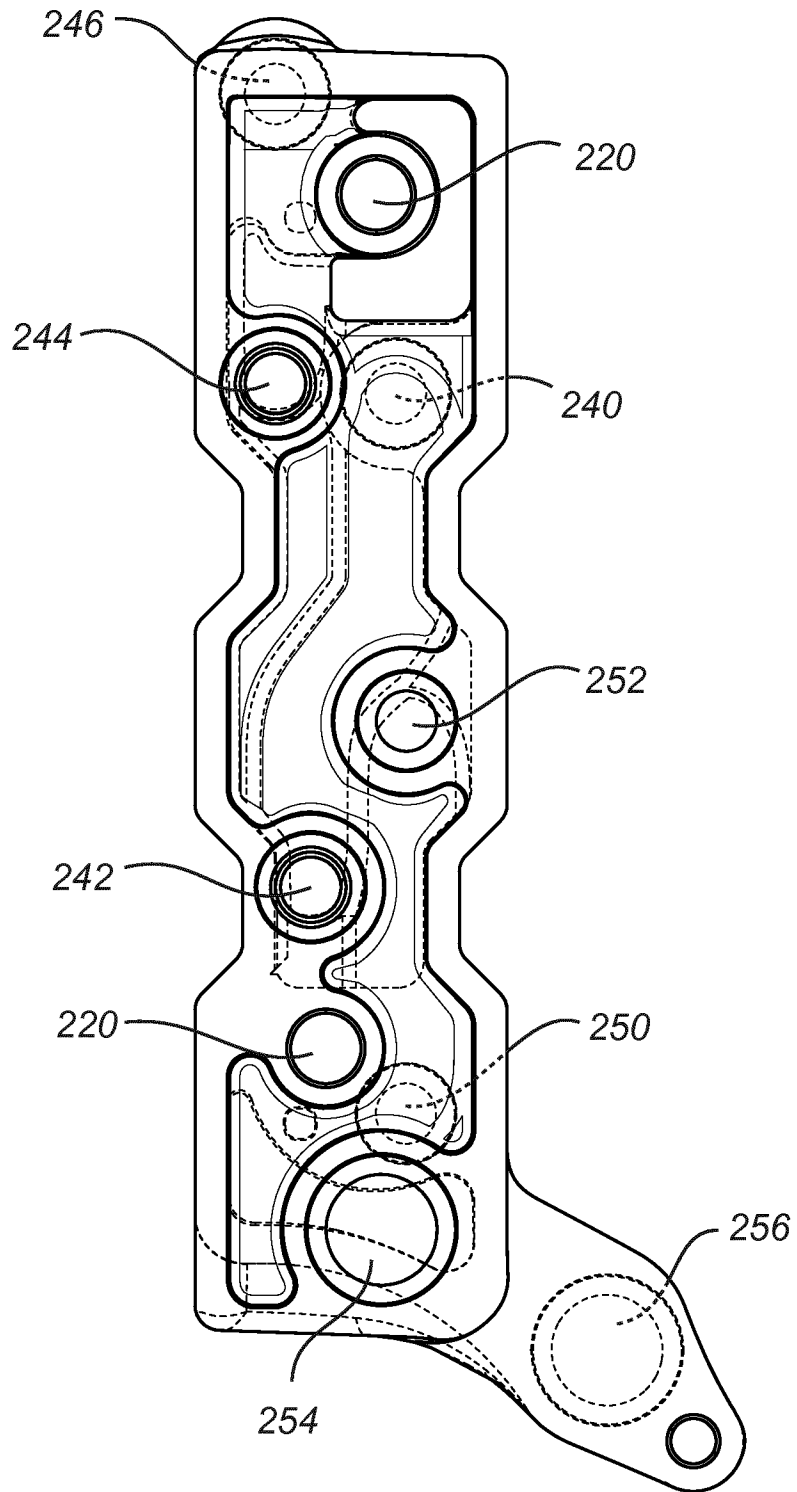


FIG. 14a

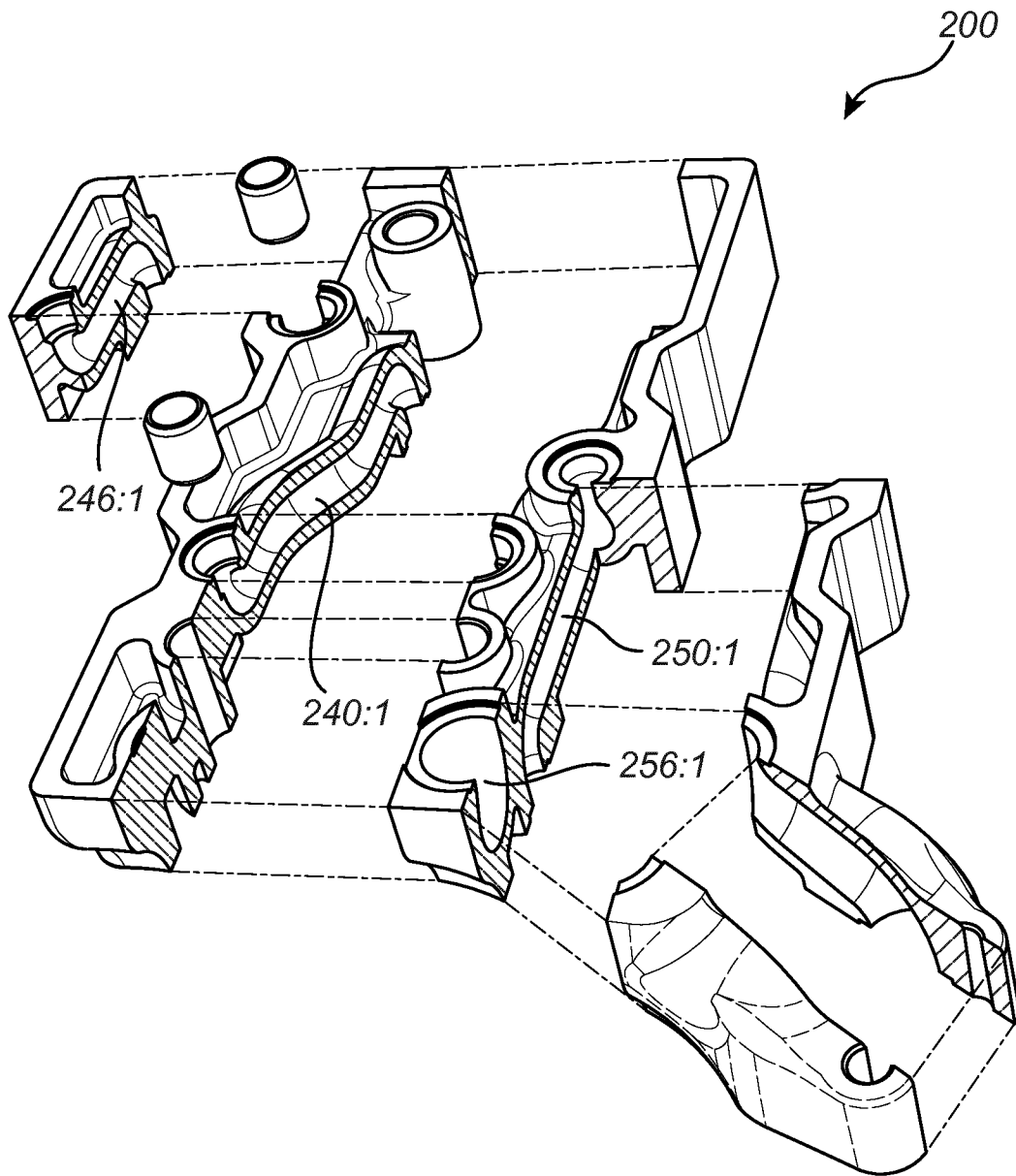


FIG. 15

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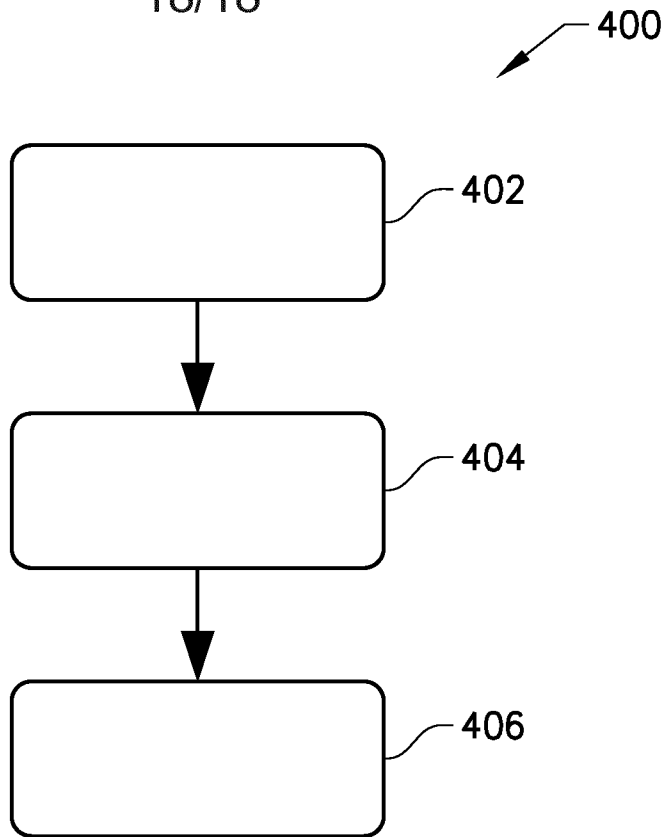


FIG. 16a

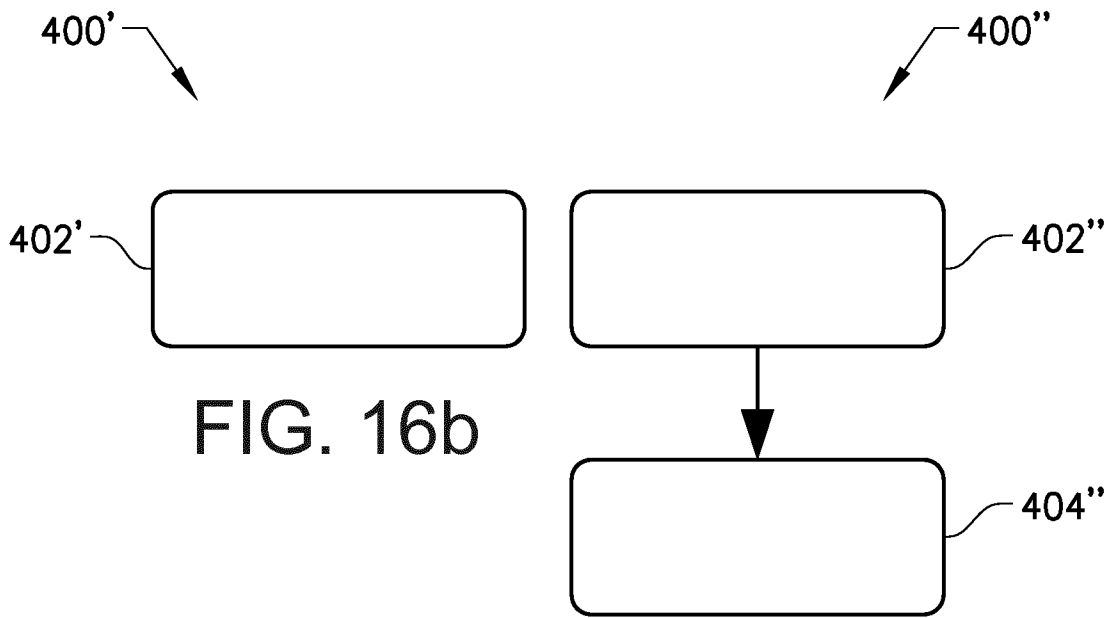


FIG. 16b

FIG. 16c

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/081014

A. CLASSIFICATION OF SUBJECT MATTER
 INV. F02C6/12 F02B39/14 F02B67/10 F01D25/28
 ADD.
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 F02C F02B F01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 5 392 604 A (NIKULA ARTO [FI] ET AL) 28 February 1995 (1995-02-28)	1,2, 5-44,79, 85
Y	figures 1-4 column 2, line 47 - column 4, line 33 claim 3	86-88
X	WO 2013/142090 A1 (HONEYWELL INT INC) 26 September 2013 (2013-09-26) figures 1-6 paragraphs [0026], [0027], [0034]	1-85
X	US 2009/184229 A1 (PELTIER JAMES D [US]) 23 July 2009 (2009-07-23)	1-79
Y	the whole document	86-88
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Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search 18 March 2016	Date of mailing of the international search report 29/03/2016
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Herbiet, J
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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X	----- US 2004/168441 A1 (DUMAS ERIC [FR] ET AL) 2 September 2004 (2004-09-02) figure 2 paragraphs [0046], [0047]	1,6,45, 47,59, 78,79,85
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