(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 543 846 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.01.2013 Bulletin 2013/02

(51) Int Cl.:
F02B 39/00 *(2006.01)*

(21) Application number: **11172550.3**

(22) Date of filing: **04.07.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) Supercharger for an industrial vehicle with improved connection characteristics to the cooling circuit and industrial vehicle comprising such supercharger

(57) The present invention relates to a supercharger (1) for an engine of an industrial or commercial vehicle with improved characteristics of connection to the hydraulic cooling circuit. According to the invention the supercharger comprises a supercharger body (5) and a head (6) connected to the body (5) . Said head (6) comprises at least a portion (11) defining a connection port (21) of an hydraulic connector (22) in order to allow the hydraulic connection between the cooling circuit of the supercharger (11) and a circulation line of the cooling liquid external to the supercharger (1).

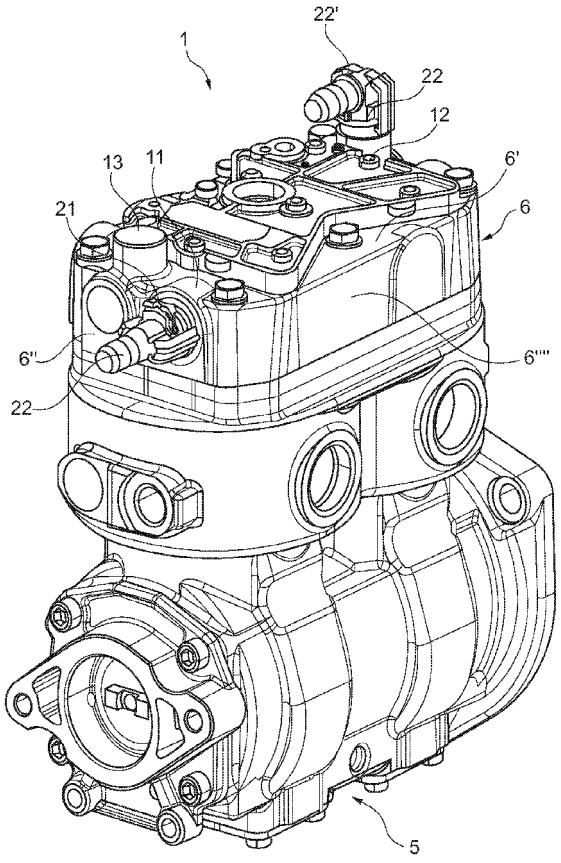

Fig. 1

EP 2 543 846 A1

Description

FIELD OF THE INVENTION

[0001] The present invention belongs to the field of the production of superchargers intended to be used in the automotive field and in particular in the field of the production of industrial and/or commercial vehicles with diesel or gasoline engines. In particular the present invention relates to a supercharger with improved connection characteristics to the hydraulic cooling circuit. The present invention relates also to an industrial vehicle comprising a supercharger according to the present invention.

DESCRIPTION OF THE PRIOR ART

[0002] As it is known, vehicles with diesel/gasoline engines use, in most cases, a supercharger to increase the pressure of the air addressed to the diesel engine. In case of turbo-supercharged engines, such supercharger is of the sliding-vane type and comprises a shaft mechanically driven by the shaft of a turbine driven, in its turn, by the exhaust gas produced by the engine. In particular applications, the shaft of the supercharger may be driven also by an electric motor.

[0003] It is also known that a supercharger for such applications comprises a supercharger body and a head usually connected to the supercharger body by means of stud bolts. The supercharger body defines a housing for the shaft of the supercharger, for the thrust mechanism connecting rod-crank-piston and for part of the cylinders of the supercharger. The structure of the cylinders is completed by the head which, together with the supercharger body, defines also the input of the air to be compressed, and the output of the compressed air.

[0004] A supercharger for applications in the automotive field usually comprises a cooling circuit wherein a liquid, usually water, circulates in order to dissipate the heat produced by the compression of the air, and thus in order to extend the life and the integrity of the internal organs. Such cooling circuit is connected, upstream, to at least a first circulation line of the liquid and, downstream, to a second circulation line of the same liquid. Such circulation lines, arranged on the vehicle, are external to the supercharger.

[0005] In most of the solutions, the head of the supercharger usually defines at least an iinput section and at least an output section for the cooling liquid. A first hydraulic port is screwed by one side to the head of the supercharger, in correspondence to the input section. A second side of the first port is connected to a second hydraulic connector which hydraulically connects the cooling circuit to the first circulation line external to the supercharger. Another hydraulic port is screwed in the same way to the output section of the cooling circuit and is connected, by means of another hydraulic connector, to the second circulation line.

[0006] Such connection mode of the supercharger cooling circuit to the circulation lines external to the supercharger has a number of drawbacks, the first of which is the complexity of the assembling. The latter, in fact, first requires the connection of the ports to the head of the supercharger, and then the connection of other hydraulic connectors to the ports. Such double operation remarkably affects the assembling costs and the overall manufacturing costs. In particular the threads realized on the head for screwing the ports are a critical factor. Another critical factor in terms of costs is represented by the ports themselves which have to be worked inside in order to allow the passage of the liquid: threaded on one side to screw in the head and appropriately shaped on the other side for connecting to the hydraulic connectors.

[0007] Moreover, the use of ports screwed to the head has proved to be disadvantageous, also in terms of bulk. In particular, the connectors emerge in a disadvantageous way with respect to the head of the supercharger, determining constraints to the positioning of the supercharger itself in the vehicle and complicating the connection of the cooling circuit with the external circulation lines. Moreover, it has been observed that using connectors screwed to the head affects negatively also the functionality of the hydraulic connection, limiting the rate flow in the cooling circuit. Obviously this has the negative effect of limiting the quantity of heat that is dissipated, which negatively affects the life and the reliability of the supercharger.

[0008] On the basis of these considerations, the need is evident for alternative technical solutions, which allow to overcome such drawbacks.

SUMMARY OF THE INVENTION

[0009] The main task of the present invention is to overcome all the drawbacks set forth above. In the scope of this task, a first aim of the present invention is to provide a supercharger whose cooling circuit can be connected easily and fast to the circulation lines of the cooling liquid external to the supercharger. Another aim of the present invention is to provide a supercharger whose connection between the cooling circuit and the circulation lines external to the supercharger is effective and functional in terms of flow rate of circulating liquid. A further aim of the present invention is to provide a supercharger whose connection between the cooling circuit and the circulation lines external to the supercharger is not a constraint for positioning the supercharger itself in the vehicle. Not least, the purpose of the present invention is to provide a supercharger which is reliable and easy to manufacture with competitive costs.

[0010] This task and these aims are achieved by means of a supercharger according to what stated in claim 1. According to the present invention, the connection port for the hydraulic connector is advantageously defined by a portion of the head of the supercharger, namely is defined in a single piece with the head itself.

This advantageously reduces connection time and costs, improving the functionality and the effectiveness of the connection. In other words, the hydraulic connector is directly connected to the head. This allows to minimize the bulk of the connection of the hydraulic connector, thus facilitating the positioning of the supercharger. Moreover the direct connection of the hydraulic connector allows a higher flow rate of circulating liquid in the cooling circuit.

Brief description of the Figures

[0011] Further purposes and advantages of this invention will become clear from the following detailed description of a preferred embodiment and from the drawings that are attached hereto that are merely illustrative and not limitative, in which:

- Figures 1 and 2 show respectively a first and a second perspective view of a supercharger according to the present invention;
- Figure 3 shows a plan view of the supercharger of Figure 1;
- Figure 4 shows a side view of the supercharger of Figure 1 comprising the section according to the line IV-IV of Figure 3;
- Figures 5 and 6 show perspective views respectively of a first part and of a second part of the supercharger of Figure 1;
- Figures 7 and 8 show respectively a first and a second view of details of the head of a supercharger according to the present invention.

[0012] In the figures the same reference numbers and letters identify the same elements or components.

Detailed description of preferred embodiments of the invention

[0013] With particular reference to the figures, the supercharger 1 that is object of the present invention comprises a supercharger body 5 and a closure head 6 (in the following called just head 6), realized in a body made by casting, which is connected to the supercharger body 5, for example by means of a plurality of stud bolts 56. The latter defines a seat for housing the mechanical parts that allow the compression of the air. In particular the supercharger body 5 defines a first side 5' from which a propeller shaft 55 projects. The latter may be driven by an electric motor, or, in the case of a turbo-supercharged engine, by a turbine.

[0014] The supercharger 1 comprises a cooling circuit which develops at least in part within the head 6 of the supercharger 1. In particular, in such cooling circuit a cooling liquid, such as water, is intended to circulate coming from a first circulation line external to the supercharger and addressed to at least a second circulation line external to the supercharger as well. As indicated, such cooling circuit develops at least in part within the head 6. The latter defines at least an input section and an output section of the cooling liquid (in the following called simply liquid) into/from the cooling circuit (in the following indicated also by internal circuit).

[0015] According to the present invention, the head 6 of the supercharger 1 comprises at least a first portion 11 defining a first connection port 21 (in the following "port") to which a first hydraulic connector 22 can be directly connected. Such first port 21 defines an input or output section of the cooling liquid from the cooling circuit of the supercharger. The first hydraulic connector 22 allows the communication between the cooling circuit and a first circulation line of the cooling liquid, external to the supercharger 1.

[0016] According to the present invention, the first connection port 21 is thus defined by a portion of the head 6, namely is made in a single piece with the head itself. Such solution allows to connect the cooling circuit of the supercharger 1 to an external circulation line by means of a single operation, namely by just connecting the first connector 22 to the first port 21. The first port 21, made in a single piece with the head 6, allows to minimize the bulk deriving from the assembling of the first hydraulic connector 22 and allows at the same time a higher flow rate of the liquid circulating in the internal circuit.

[0017] Figures 1 and 2 show perspective views of a supercharger 1 according to the present invention. The head 6 comprises a main surface 6' from which a first side 6" and a second side 6''' opposite to the first side 6'' develop, a third side 6'''' and a fourth side 6''''' which develop between said first side 6" and said second side 6''' in a position reciprocally opposed.

[0018] According to a preferred embodiment of the invention, the head 6 comprises a second portion 12 defining a second port 21' to which a second hydraulic connector 22' can be directly connected. In the embodiment shown in figures 1 and 2, the second portion 12 projects from the main surface 6' of the head 6 according to a direction substantially orthogonal to a lying plane P (indicated in Figure 4) defined by the main surface 6' itself. The first portion 11 of the head 6, defining the first port 21, emerges from one side of the head 6 (in particular from the first side 6") developing according to a direction parallel to the lying plane P indicated above.

[0019] Figures 3 and 4 are respectively a plan view and a side view that allow to observe the arrangement described above of the ports 21 and 21', each one of them defining a section (input or output) of the circuit internally defined in the head 6 of the supercharger 1. In this sense the first port 21 may define, for example, the input section of the internal circuit, while the second port 21' may define the output section of the same internal circuit.

[0020] With particular reference to figures 5 and 6, in the embodiment shown in the figures, the head 6 may advantageously comprise also a third portion 13 and a fourth portion 14 arranged to define a third port and a

fourth port (not shown in the figures) to which a third hydraulic connector and a fourth hydraulic connector (not shown in the figures) can be respectively connected. In other words, according to this aspect of the invention, the head 6 comprises a plurality of portions 11, 12, 13, 14 each one of them is arranged to define, if necessary, a connection port to which an hydraulic connector 22, 22' can be connected. Each one of such possible ports may define in its turn an input or an output section of the cooling liquid from the cooling circuit. Thus the number of ports defined by the head 6' may vary according to how the internal circuit of the supercharger 1 must be connected to the circulation lines of the liquid external to the supercharger itself.

[0021] According to a possible operating configuration, the first port 21 of the gripping head 6 may define an input section of the cooling circuit, while the second port 21' and a possible third port may define each one an output section of the internal circuit. In other words, according to this solution the liquid coming out from the cooling circuit may be sent, by means of the second port 21' and of the third port to two different external circulation lines downstream of the cooling circuit.

[0022] In particular, in the solution shown in the figures, the third portion 13 emerges from the main surface 6' according to a direction substantially orthogonal to the lying plane P defined above (see figure 4). It can be observed that preferably the third portion 13 is near the first portion 11. The fourth portion 14 emerges preferably from the second side 6''' of the head 6 opposite to the first side 6' from which the second port 21' emerges. Obviously, also in case, alternative arrangement of the portions 11, 12, 13 and 14 of the head 6 are to be considered as included in the scope of the present invention.

[0023] Figures 7 and 8 are views that allow to observe in detail a preferred shape of the ports 21, 22 of the head 6 of the supercharger 1 according to the present invention. For the sake of simplicity, only the first port 21 is described in the following, but the considerations are valid also for the second port 21' and for the other ports, if any, that can derive from the third 13 or the fourth portion 14. The first port 21 comprises a cylindrical segment 31' which develops according to a longitudinal direction 101 corresponding to a direction of connection of the first hydraulic connector 22. The cylindrical segment 31' develops from a base surface 4, defined by the first portion 11 of the head 6 and is axially delimited, along the longitudinal direction 101, by a cylindrical end 31'' whose diameter D2 is higher than the diameter D1 of the cylindrical segment 31'. The cylindrical end 31'' defines a stopping shoulder 23 of said first hydraulic connector 22.

[0024] With reference to Figure 8, the cylindrical end 31'' of the first port 21 defines an input 8 or an output section of the cooling liquid from the cooling circuit. The first port 21 defines a cylindrical internal recess 33 within which it is possible to insert an end 22' of the first hydraulic connector 22. Such internal recess 33 is hydraulically communicating with the cooling circuit, in order to allow the passage of the cooling liquid.

[0025] Figure 7 shows a possible embodiment of the first hydraulic connector 22 that can be directly connected to the first port 21 of the head 6 of the supercharger 1. As shown in the figure, the first hydraulic connector 22 is substantially "I"-shaped, comprising an elongated hollow body 34 which develops between a first end 42, that can be inserted in the cylindrical recess 33 of the first port 21, and a second end 42' that can be connected to a circulation line of a cooling liquid not shown in the figures.

[0026] The first hydraulic connector 22 further comprises a grommet 35 for the seal of the cooling liquid, once the first end 42 is inserted in the internal recess 33 of the first port 21. The first hydraulic connector 22 comprises also at least a pair of lateral portions 38 diametrically opposed which develop from the body 34 of the first connector 22 in a parallel way with respect to the axis of the connector itself. Each one of said connecting portions 38 comprises a connection end 38' which develops radially towards the body 34 of the first connector 22. In particular, the connection ends 38' are shaped in order to define a coupling of the "snap-fit" type which a stopping shoulder 23 defined by the cylindrical end 31' of the first port 21. Such connection can be easily seen for example from the side perspective view in Figure 5.

[0027] Figures 1, 2, 3 and 6 also show the embodiment of a second hydraulic connector 22' that can be connected to one of the ports 21,22 defined by the head 6. In particular, in such figures the second hydraulic connector 22' is connected to the second port 21'. The second hydraulic connector 22' is different from the first hydraulic connector 22 because the body of the connector is substantially "L"-shaped, so that the two ends of the same body develop according to a reciprocally orthogonal direction. It can be observed that such "L"-shape of the connector allows to further reduce the bulk of the supercharger according to the direction orthogonal to the main surface 6' of the head 6. Of course, if the available space is particularly limited on the sides 6'', 6''' of the head 6 of the supercharger 1, then the L-shaped hydraulic connector may be connected to the first port 21. In the same way, the "I"-shaped hydraulic connector described above may be connected also to the second port 21' if the space available on the sides of the head 6 allows such connection.

[0028] The present invention relates also to a vehicle comprising a supercharger 1 according to what indicated above. In particular the vehicle according to the invention comprises a first circulation line and a second circulation line of a cooling liquid hydraulically connected upstream and downstream of the cooling circuit of the supercharger 1. The vehicle according to the invention comprises at least a first hydraulic connector 22 connected to a first port 21 defined by a first portion 11 of the head 6 of the supercharger 1. Such first hydraulic connector 22 connects the supercharger cooling circuit 1 to said first circulation line of the cooling liquid, external to the super-

charger. The vehicle according to the invention comprises preferably also a second hydraulic connector 22' connected to a second port 21' defined by a first portion of the head itself 6. Such second hydraulic connector 22' connects the cooling circuit 1 to said second cooling line, external to the supercharger 1.

[0029] The technical solutions adopted for the supercharger according to the invention allow to completely fulfil the task and the purposes set. The supercharger according to the invention, can be subjected to numerous variations or modification, without departing from the scope of the invention; moreover all the details may be replaced by others technically equivalent. In practice, the material used and also the dimensions and the shapes may be any, according to the needs and to the state of the art.

Claims

1. Supercharger (1) for an engine of and industrial or commercial vehicle, said supercharger (1) comprising:

   - a supercharger body (5);
   - a closing head (6) connected to said supercharger body (5) and made in a single casting body;
   - a cooling circuit defined at least in part in said head (6), said cooling circuit comprising at least an input section and an output section of a cooling liquid,

   wherein said head (6) comprises at least a first portion (11) defining a first port (21) to which a first hydraulic connector (22) is directly connected in order to connect said cooling circuit to a first circulation line of said cooling liquid external to said supercharger (1), said first port (21) defining one of said sections of said cooling circuit.

2. Supercharger (1) according to claim 1, comprising a second portion (12) defining a second port (21') to which a second hydraulic connector (22') can be directly connected in order to connect said cooling circuit to a second circulation line of said cooling liquid external to said supercharger (1), said second port (21') defining the other one of said sections of said cooling circuit.

3. Supercharger according to claim 1, wherein said at least a first port (21) comprises a cylindrical segment (31') which develops according to a longitudinal direction (101) connecting said first hydraulic connector (22) to said first port (21), said cylindrical segment (31') being delimited along said longitudinal section (101) by a cylindrical end (31'') whose diameter is larger than said first cylindrical segment (31') in order to define a stopping shoulder (23) of said first hydraulic connector (22).

4. Supercharger according to any of the claims from 1 to 3, wherein said head (6) comprises a main surface (6') from which a first side (6'') and a second side (6''') opposite to the first side (6'') develop, a third side (6'''') and a fourth side (6''''') which develop between said first side (6") and said second side (6''') in a position reciprocally opposed, said first portion (11) emerging from said main surface (6') of from one of said sides (6'', 6''', 6'''', 6''''').

5. Supercharger according to claim 2, wherein said head (6) comprises a third portion defining a further port to which a further hydraulic connector can be directly connected in order to connect said cooling circuit to a further circulation line of said cooling liquid external to said supercharger (1), said further port defining an input or an output section of said cooling liquid from said cooling circuit.

6. Industrial or commercial vehicle **characterized in that** it comprises a supercharger (1) according to any of the claims from 1 to 5, said vehicle comprising a first circulation line and a second circulation line of said cooling liquid external to said supercharger (1), said vehicle comprising at least a first connector (22) connected to said first port (21) and connected to one of said circulation lines of said cooling liquid.

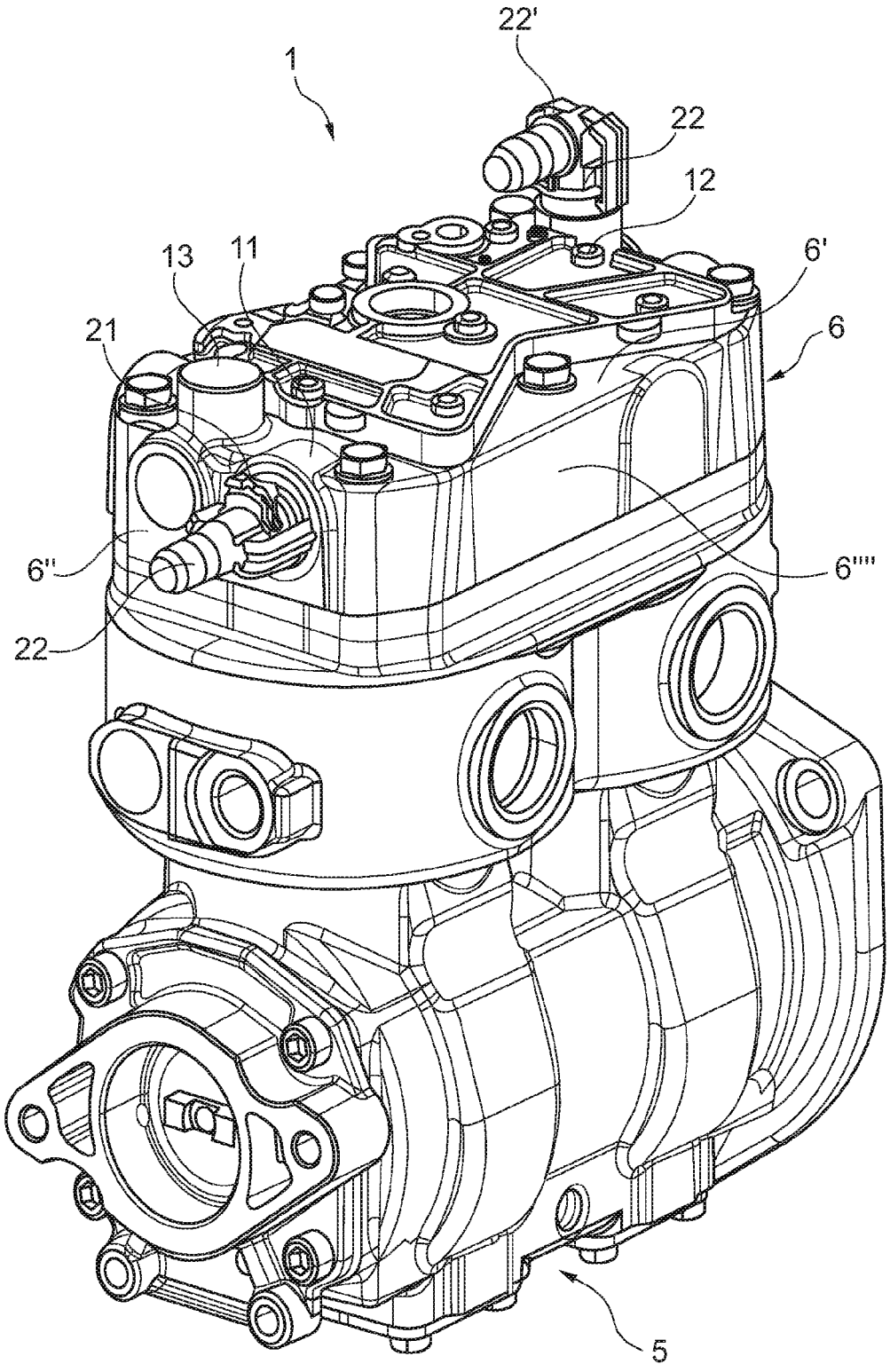

Fig. 1

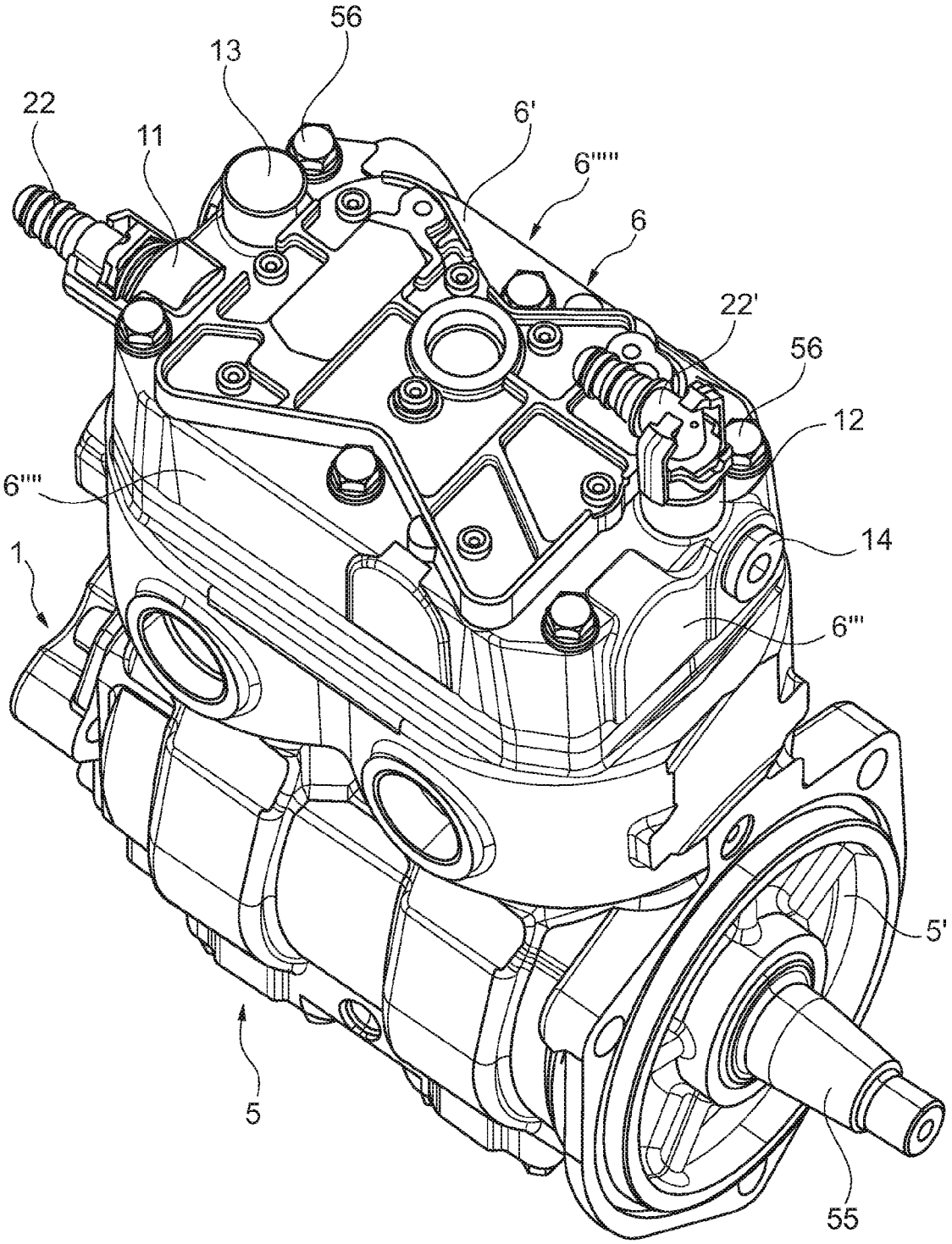

Fig. 2

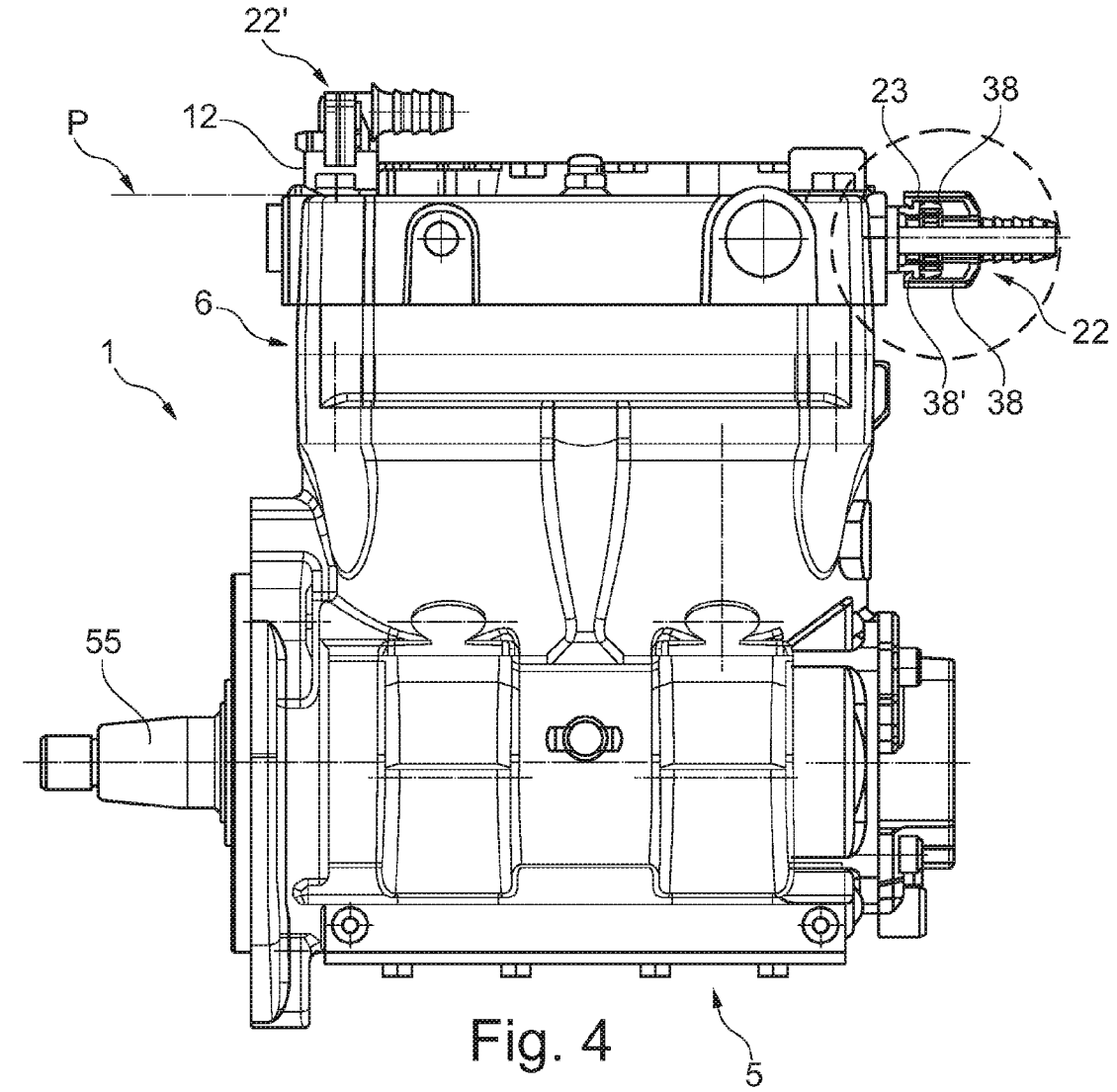

Fig. 4

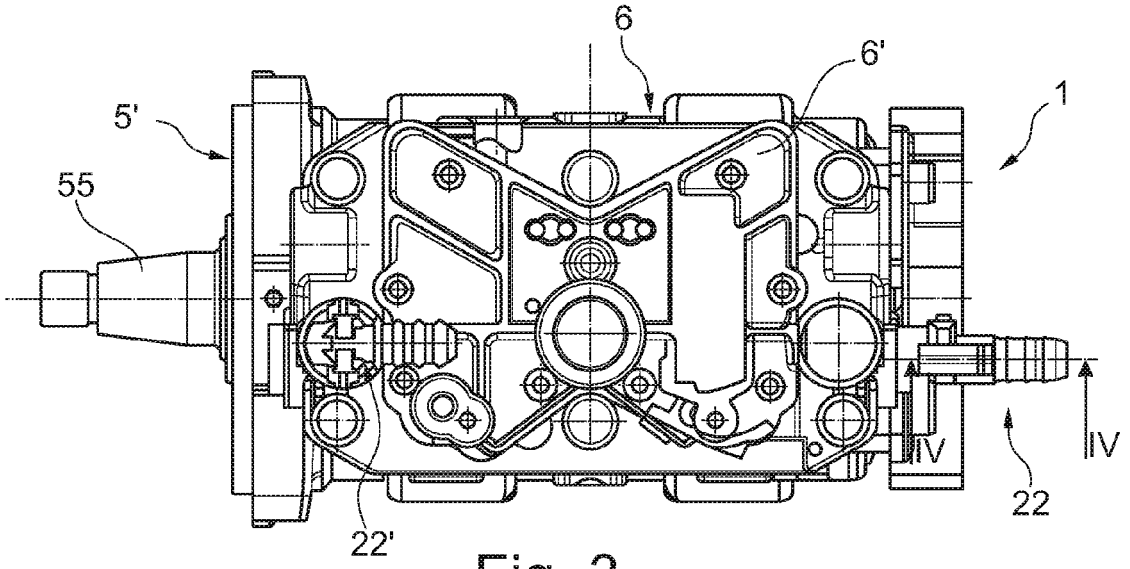

Fig. 3

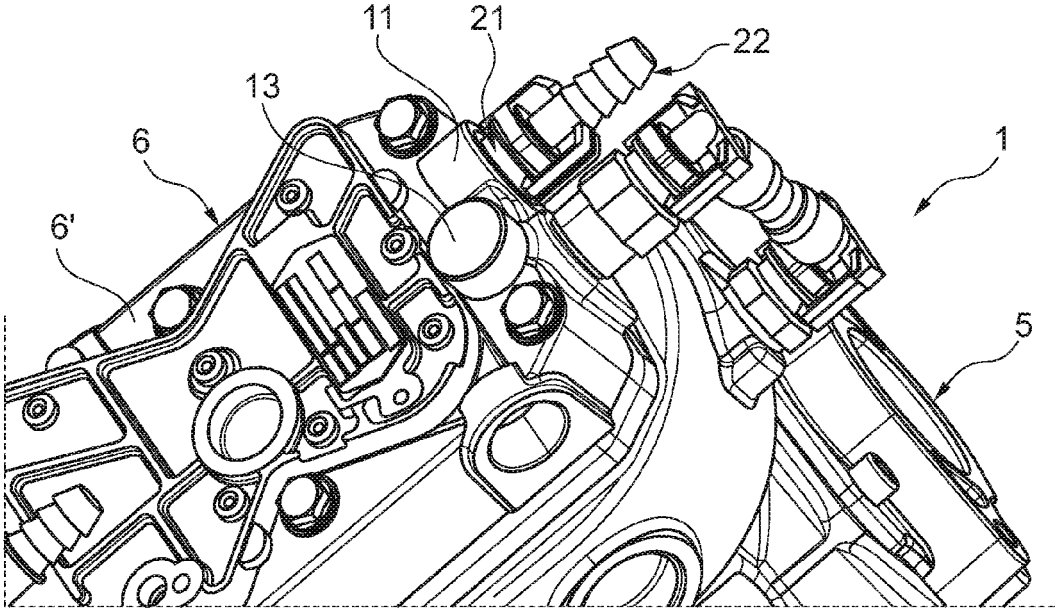

Fig. 5

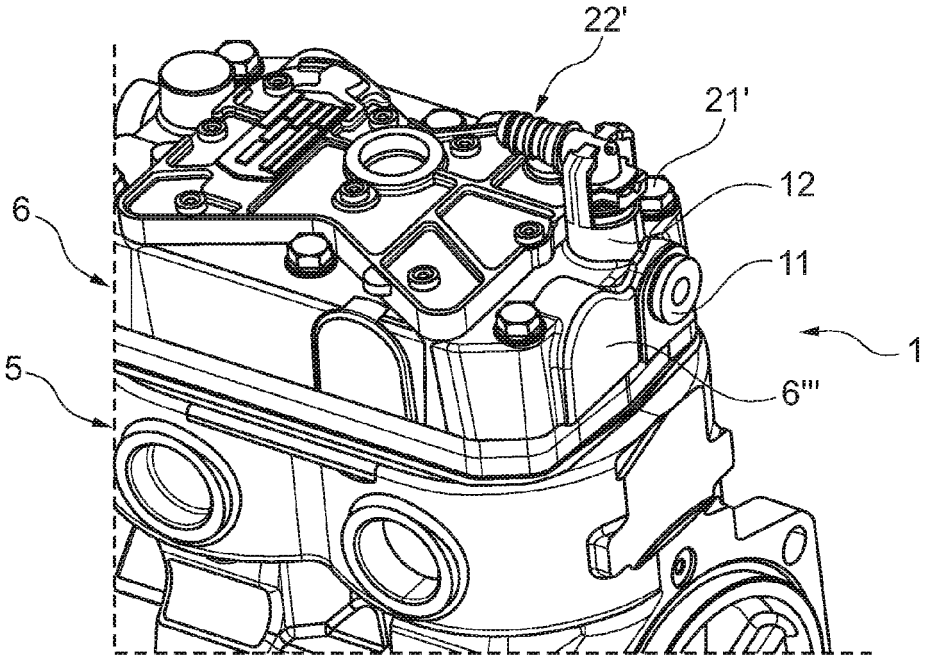

Fig. 6

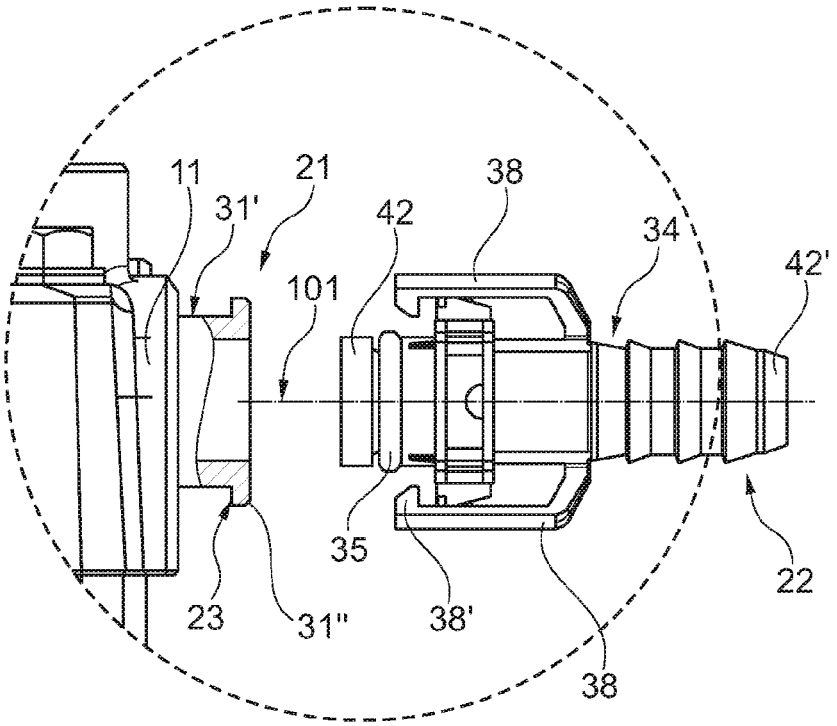

Fig. 7

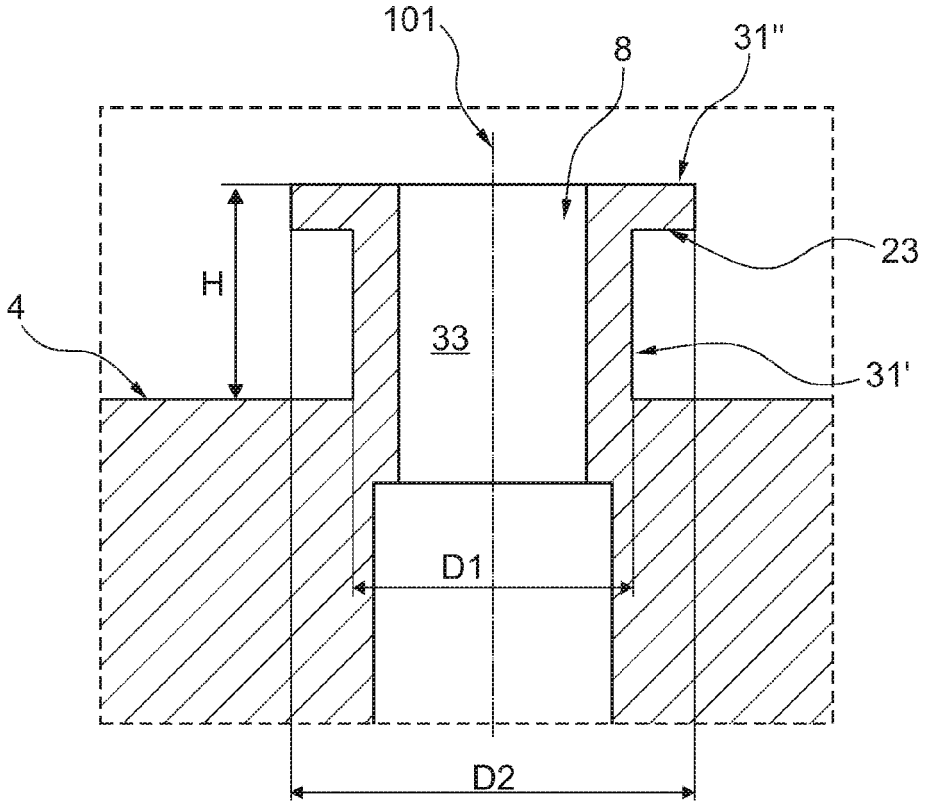

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 11 17 2550

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F02B
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 January 2012	Morales Gonzalez, M

CATEGORY OF CITED DOCUMENTS

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2

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