



(51) International Patent Classification:

F16J 15/10 (2006.01) *F16J 15/02* (2006.01)
F02M 11/00 (2006.01) *F16J 15/12* (2006.01)
F02M 35/104 (2006.01) *F16J 15/3268* (2016.01)

(21) International Application Number:

PCT/SE2017/050233

(22) International Filing Date:

10 March 2017 (10.03.2017)

(25) Filing Language:

Swedish

(26) Publication Language:

English

(30) Priority Data:

1650338-5 14 March 2016 (14.03.2016) SE

(71) Applicant: SCANIA CV AB [SE/SE]; 151 87 Södertälje (SE).

(72) Inventors: LARSSON, Max; Fiskaruddsvägen 5, 144 62 Rönninge (SE). ERSVIK, Erik; Larsbergs Parkväg 1, 181 39 Lidingö (SE).

(74) Agent: WALLIN, Ulf; Scania CV AB, 151 87 Södertälje (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: SEALING ARRANGEMENT AND SEALING FOR AN AIR INTAKE PIPE AT N INTERNAL COMBUSTION ENGINE

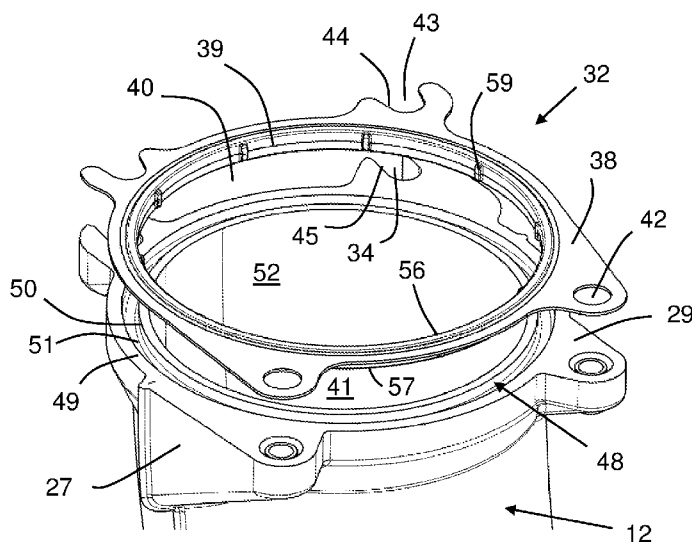


Fig. 5

(57) Abstract: A sealing arrangement (32) for an air inlet pipe (12) at a combustion engine comprising a recess (48) for a sealing ring and a sealing ring (39). The recess of adapted at an end surface (29) of one of two flanges that can be fitted in connection with each other in a flanged joint and extend around an air passage opening (52). The sealing ring (39) is equipped with a protrusion (59) adapted to be pressed into the recess (48) at assembly and is connected with a support means (38) with a through hole (40) matching the air inlet pipe's (12) flowing area (41) and a number of mounting holes (42, 43) through which attachment means are adapted to extend to facilitate correct positioning of the sealing ring (39) in the recess (48).

Sealing arrangement and sealing for an air intake pipe at an internal combustion engine

5 TECHNICAL FIELD

The present invention pertains to a sealing arrangement for an air inlet pipe at a combustion engine, a seal for a sealing arrangement and a vehicle comprising a sealing arrangement according to the enclosed patent claims.

10

BACKGROUND AND PRIOR ART

Turbochargers in vehicles generally comprise a turbine operated by the exhausts from a combustion engine and a compressor which compresses air which is led to the combustion engine to increase fuel efficiency and the power in the engine by forcing additional air into the combustion chamber of the engine. The combustion engine may also comprise an EGR system where exhausts are recirculated and mixed with the air that is intended to be supplied to the combustion engine. By mixing the recirculated exhausts with air which is led to the combustion engine, the combustion temperature in the combustion chambers may be reduced and thus also the level of nitrogen oxides (NO_x) formed during the combustion engine's combustion processes. However, to achieve the desired result, no leakage must be present along the air inlet pipe between an air inlet and the respective combustion chamber and/or along the recirculation pipe for exhausts. Such a leak may entail that the compressor compresses air which, with or without exhaust interference, cannot be used for improved combustion. This may in turn lead to noise, reduced motor power, increased fuel consumption or poorer emission control. If a leak arises where there is an under-pressure, e.g., before the turbocharger, there is a risk that dirt may be sucked into the air inlet pipe and reach the combustion engine which may give rise to engine damage.

30

It is prior art to connect an air inlet pipe with a recirculation pipe for exhausts or with an inlet manifold on the combustion engine with, e.g., a flanged joint at which a seal, e.g., an o-ring, is arranged to prevent leakage. The seal may be partly embedded in a guide track. One problem with such arrangements is that it may be difficult to verify whether the seal is in the correct sealing position between the flanges in the flanged joint after the flanges have been pressed against each other with a screw joint or if the

35

seal has slipped out of the guide track and ended up in a position where the sealing ability is poorer, especially in case of refitting after a repair or similar since the flanged joint may be placed relatively inaccessibly.

5 SUMMARY OF THE INVENTION

One purpose of the present invention is to provide a sealing arrangement and a seal for an air inlet pipe at a combustion engine, which sealing arrangement and seal ensure that the seal is kept in place in the correct position in connection with assembly.

10 Another purpose is to provide a sealing arrangement and a seal which is easy to assemble. Another purpose is to provide a sealing arrangement and a seal which may be used together with conventional guide tracks for, e.g., O-rings. These and other purposes are achieved through the features described in the claims below.

15 By using the invention, the risk of leakages at an air inlet pipe for a combustion engine is reduced. This means that the air which the compressor compresses may be used for improved combustion in an efficient manner. The protrusions ensure that the sealing ring is in the correct position during an assembly process and the support means ensures that the sealing ring does not move from the correct position when the flanges
20 in the flanged joint are pressed against each other.

In one embodiment, the sealing ring is adapted with radially outward protrusions and radially inwards protrusions and in another embodiment the distance between two adjacent protrusions in the sealing ring's circumferential direction is of a specified
25 size. By so doing, the contact surface between the sealing ring and the recess side walls is limited which in turn limits the power required to press the sealing ring down into the recess at the same time as the protrusions are still able to retain the sealing-ring ring in the recess.

30 In one embodiment, the protrusions are arranged facing each other which ensures that the sealing ring presses equally against each side wall and does not bend in the recess.

In one embodiment, the sealing ring has a substantially rectangular cross-section and in another embodiment the recess has a cross-section which substantially matches the
35 sealing ring's cross-section. By so doing, a wide sealing surface and a stability in the sealing ring is obtained, preventing it from turning in the recess.

In one embodiment, the support means comprises two sides and one protruding part from each side, which ensures that the sealing ring is compressed at assembly and fills up the recess in a sealing-efficient manner.

5

According to the embodiment, at least two mounting holes are designed with an outward open slit which is the same as a corresponding outward open slit in the flange when the sealing ring is correctly assembled. The slits and the attachment means make it easier to position the sealing ring in relation to the recess during an assembly process and ensure that the sealing ring is assembled in the correct position and does not move from the correct position when the flanges in the flanged joint are pressed against each other.

10

Other features and advantages of the invention are set out in the claim, the description of the example embodiment and the enclosed drawings.

15

BRIEF DESCRIPTION OF THE DRAWINGS

Below is a description, by way of example, of preferred embodiments of the invention with reference to the enclosed drawings, in which:

20

Fig. 1 shows a vehicle with a combustion engine and an air inlet.

Fig. 2 shows schematically an overloaded combustion engine with an EGR system where exhausts are recirculated and mixed with the air that is intended to be supplied to the combustion engine.

25

Fig. 3 shows a joint between an air inlet pipe and an inlet manifold at a combustion engine.

30

Fig. 4 shows a perspective view of an air inlet pipe and an inlet manifold at a combustion engine and a sealing arrangement arranged between these according to one embodiment.

Fig. 5 shows a perspective view of an air inlet pipe with a sealing arrangement according to one embodiment.

35

Fig. 6 shows a seal with a sealing ring and support means for a sealing arrangement according to one embodiment.

- 5 Fig. 7 shows a cross-section through a seal with a sealing ring and support means for a sealing arrangement according to one embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS ACCORDING TO THE INVENTION

10

Fig. 1 shows a motor vehicle 1 with a vehicle frame 2 at which a combustion engine 3 is arranged. An air inlet 4 is arranged at an air channel 5 to supply the combustion engine 3 with air. The motor vehicle 1 may be a heavy goods vehicle, e.g. a truck or a bus or a lighter vehicle, e.g. a passenger car. The combustion engine 3 may e.g. be a diesel engine or an otto engine. In case of alternative embodiments, the combustion engine 3 may be intended for industrial or marine use, e.g. in a ship.

15

Fig. 2 shows schematically an overloaded combustion engine 3 with an EGR system 22 where exhausts are recirculated and mixed with the air that is intended to be supplied to the combustion engine 3. By mixing recirculated exhausts with air which is led to the combustion engine 3, the combustion temperature in the combustion engine's 3 cylinders may be reduced and thus also the level of nitrogen oxides (NO_x) formed during the combustion engine's 3 combustion processes.

20

25 In this example, the combustion engine 3 is a straight six-cylinder engine. Exhausts from the combustion engine's 3 cylinders are led via an exhaust collector 6 and an exhaust pipe 7 to a turbine 8 in a turbocharger 9. The exhausts leaving the combustion engine 3 have an overpressure and as a result they expand through the turbine 8. The turbine 8 thus obtains a power that is transferred via a connection to a compressor 10 in the turbocharger 9. The compressor 10 compresses air which is sucked into an air inlet pipe 12 via the air inlet 4, the air channel 5 (fig. 1) and an air filter 11. The compressed air in the air inlet pipe 12 is cooled in an intercooler 13 before it is led to the combustion engine 3. An exhaust return conduit 14 extends between the exhaust pipe 7 and the air inlet pipe 12 to recirculate a part of the exhausts in the exhaust pipe 7. The return conduit 14 may comprise an EGR-valve 15 with which it is possible to control the flow of exhausts through the return conduit 14. A control device 16 may be

30

35

adapted to control the EGR valve 15 with the help of information on the combustion engine's 3 current operating mode so that the desired amount of exhausts is recirculated to the combustion engine 3. The return conduit 14 may comprise an EGR cooler 17 in which the exhausts are chilled and a mixing device 18 whose task is to
5 mix the recirculated exhausts in the return conduit 14 with the air in the air inlet pipe 12. The mixing device 18 may be fitted at a first joint 19 between the return conduit 14 and the air inlet pipe 12. Once the recirculated exhausts have been mixed with the compressed air in the air inlet pipe 12, the mixture is led via an inlet manifold 20 to the combustion engine's 3 respective cylinders. The air inlet pipe 12 may be connected at
10 the inlet manifold 20 with a second joint 21. In an alternative embodiment without an EGR-system, the air inlet pipe 12 may extend from the intercooler 13 to the second joint 21 at the inlet manifold 20 without the intermediate first joint 19.

Fig. 3 shows that the second joint 21 may consist of a flanged joint 25 with a first
15 flange 26 adapted at a first element, in this example the inlet manifold 20 and a second flange 27 adapted at a second element, in this example the air inlet pipe 12. The first joint 19 (fig. 2) may be adapted in a similar way with a first flange adapted at a first element, in this example the exhaust return conduit 14 and a second flange adapted at the second element, in this example the air inlet pipe 12.

20 Fig. 4 shows that the first flange 26 has a first end surface 28 which is turned facing and adapted to abut against a corresponding second end surface 29 in the second flange 27 following assembly. The first end surface 28 may be plane, as showed in the figure, while the second end surface 29 may comprise a track for a sealing ring, which is
25 described below. In an alternative embodiment, the second end surface 29 may be plane and the first end surface 28 may comprise a track for the sealing ring. A sealing arrangement 32 is arranged between the first flange 26 and the second flange 27. The sealing arrangement 32 may be adapted to be compressed to a sealing action by way of the second end surface 29 being pressed against the first end surface 28 with a number
30 of attachment means 33 e.g. in the form of screws 33 which are adapted to stretch through holes 34 in the second flange 27 and into a corresponding hole 35 in the first flange 26.

Fig. 5 shows that the sealing arrangement 32 comprises a seal which comprises a
35 support means 38 and a sealing ring 39. The support means 38 may be made of metal e.g. steel or some other material suitable for the purpose, e.g. composite such a carbon

fibre. The sealing ring 39 may be made of rubber or some other elastic compressible material and may have a substantially rectangular cross-section. In alternative embodiments, the sealing ring 39 may have another cross-section, e.g. square, circular or oval. The support means 38 is adapted with a through hole 40 which correspond to the air inlet pipe's 12 flow area 41 and a number of through mounting holes 42, 43. The sealing ring 39 extends around the through hole 40 and is attached to the support means 38 in an appropriate manner, e.g. by way of a casting process or vulcanization. A screw 33 (fig. 4) is adapted to extend through each of the mounting holes 42, 43. To facilitate assembly of the air inlet pipe 12 at the inlet manifold 20 (fig. 4), at least one but preferably two mounting holes 43 in the support means 38 are adapted with an outward open slit 44 which is adapted to match a corresponding outward open slit 45 adapted in the second flange 27, when the sealing ring 39 is correctly placed. Two slits 44, 45 facing each other are thus adapted to receive a screw 33 (fig. 4). At assembly, as showed at fig. 4, two screws 33 are placed in the holes 35 in the first flange 26, following which the air inlet pipe 12 is moved toward s the inlet manifold 20 and the shanks of the respective screws 33 are moved into the two slits 44, 45 abutting against each other (fig. 5) with the result that the sealing ring ends up in the correct position between the air inlet pipe 12 and the inlet manifold 20. Subsequently, the screws 33 are placed in the other holes 34, 35 following which the air inlet pipe 12 is pulled toward the inlet manifold 20.

Fig. 5 shows that the second flange's 27 end surface 29 is adapted with a ring-shaped recess 48 o receive the sealing ring 39. The recess 48 extends around an air passage opening 52 and is adapted with a first contact surface 49 which is adapted to constitute a radial outer side wall in the recess 48 and a second contact surface 50 which is adapted to constitute a radial inner side wall in the recess 48 and a third contact surface 51 which is adapted to constitute a bottom wall in the recess 48. The recess 48 may have a width corresponding to the desired width of the sealing ring 39. The recess 48 may be 3 - 6 mm wide and 3 - 6 mm deep, but preferably 4.5 mm wide and 4 mm deep and may have a cross-section which substantially matches the sealing ring's 39 cross section.

Fig. 7 shows a cross-section through the support means 38 and the sealing ring 39. The support means 38 comprises a first side 54 adapted to face one end surface 28, 29 (fig. 4) in his example against the plane first end surface 28 and a second side 55 adapted to face the second end surface 28, 29 in this example the end surface 29 (fig. 5) in which

the recess 48 is adapted. The sealing ring 39 is arranged in the through hole 40 and comprises a first sealing part 56 which extends out from the support means' 38 first side 54 and is adapted to be brought to sealing abutment against an end surface 28, 29 in the example against the first end surface 28 (fig. 4) and a second sealing part 57
5 which extends from the support means' 38 second side 55 and is adapted in connection with assembly to be inserted into the recess 48 (fig. 5) for sealing abutment against the third contact surface 51 of the recess 48, i.e. against the bottom wall of the recess 48. In one advantageous embodiment, the first sealing part 56 in an unassembled state may extend from the first side 54 0.2 - 2 mm but preferably 0.5 mm. The second sealing
10 part 57 may in one advantageous embodiment and in unassembled state extend out from the second side 55 2 - 10 mm by preferably 5 mm.

Fig. 6 shows that the sealing ring 39 is equipped with a number of radial outward protrusions 58 which are adapted to abut against the first contact surface 49 in the
15 recess 48 (fig. 5) when the sealing ring 39 is assembled and a number of radial inward protrusions 59 which are adapted to abut against the second contact surface 50 in the recess 48 when the sealing ring 39 is assembled to ensure that the seal is kept in place in a correct position in connection with assembly. The outward protrusions 58 and the inward protrusions 59 may be arranged facing each other and the distance between two
20 adjacent protrusions 58, 59 in the sealing ring's 39 circumferential direction may be 20-50 mm but preferably 35 mm.

The invention is not limited to the embodiments described above, but numerous possible modifications thereof are obvious to a person skilled in the area, without such
25 person departing from the spirit of the invention as defined by the claims.

CLAIMS

1. Sealing arrangement for an air inlet pipe (12) at a combustion engine (3) which sealing arrangement (32) comprises a recess (48) for a sealing ring and a sealing ring (39) which recess is adapted at an end surface (28, 29) in one of two flanges that can be assembled in connection with each other (26, 27) in a flanged joint (25) and which extend around an air passage opening wherein the sealing ring (39) is equipped with protrusions (58, 59) adapted to be pressed down into the recess (48) at assembly, *characterised in that* the sealing ring (39) is fixedly connected with a support means (38) with a through hole (40) which matches the air inlet pipe's (12) flow area and a number of mounting holes (42, 43) through which attachment means (33) are adapted to extend to facilitate correct positioning of the sealing ring (39) in the recess (48) whereat at least two mounting holes (43) are adapted with an outward open slit (44) which is adapted to match a corresponding outward open slit (45) in one of the flanges (26, 27) when the sealing ring (39) is correctly placed in the recess (48).
2. Sealing arrangement according to claim 1, *characterised in that* the sealing ring (39) is equipped with a number of radial outward protrusions (58) which are adapted to abut against a first contact surface (49) in the recess (48) and a number of radial inward protrusions (59) which are adapted to abut against a second contact surface (50) in the recess (48), to ensure that the sealing ring (39) is keep in place in the correct position in connection with assembly.
3. Sealing arrangement according to claim 2, *characterised in that* the outward protrusions (58) and the inward protrusions (59) are arranged facing each other.
4. Sealing arrangement according to any of the previous claims, *characterised in that* the recess (48) has a cross-section which substantially matches the cross-section of the sealing ring (39).
5. Sealing arrangement according to any of claims 1 - 4, *characterised in that* the support means (38) comprises a first side (54) and a second side (55) and that the sealing ring (39) comprises a first sealing part (56) which extends away from the first side (54) for sealing abutment against one of the flanges (26, 27) and a second sealing part (57) which extends away from the second side (55) for sealing abutment against the second flange (26, 27).

6. Sealing arrangement according to any of claims 1 - 5, *characterised in that* the recess (48) is adapted at a flange joint (25) between the air inlet pipe (12) and an inlet manifold (20) at the combustion engine (3).

5

7. Sealing arrangement according to any of claims 1 - 6, *characterised in that* the recess (42) is adapted at a flanged joint (25) between the air inlet pipe (12) and an exhaust return pipe (14) at the combustion engine (3).

10 8. Sealing arrangement according to any of claims 6 or 7, *characterised in that* the recess (48) is adapted at the end surface (29) of a flange (27) at the air inlet pipe (12).

9. Sealing arrangement according to claim 8, *characterised in that* the recess is adapted at the end surface (28) of a flange (26) at the inlet manifold (20).

15

10. Vehicle comprising a sealing arrangement according to any of the claims 1-9.

11. Seal for a sealing arrangement (32) for an air inlet pipe (12) at a combustion engine (3), which sealant comprises a support means (38) adapted with a through hole (40) which is adapted to match the air inlet pipe's (12) flow area and a sealing ring (39) fixedly connected with the support means, extending around the through hole (40) and which is adapted to be arranged at a recess (48) adapted at an end surface (28, 29) in one of two flanges (26, 27) that can be assembled in connection with each other in a flanged joint (25) wherein *characterised in that* the sealing ring (39) is equipped with a number of protrusions (58, 59) adapted to be pressed down into the recess (48) at assembly and *characterised in that* the support means (38) is adapted with a number of mounting holes (42, 43) through which attachment means (33) are adapted to extend to facilitate correct positioning of the sealing ring (39) in the recess (48) wherein at least two mounting holes (43) are adapted with an outward open slit (44) to facilitate assembly.

30

12. Seal according to claim 11, *characterised in that* the sealing ring (39) is equipped with a number of radial outward protrusions (58) and a number of radial inward protrusions (59).

35

13. Seal according to claims 12, *characterised in that* the outward protrusions (58) and the inward protrusions (59) are arranged facing each other.

5 14. Seal according to any of claims 11 - 13, *characterised in that* the sealing ring (39) has a substantially rectangular cross-section.

10 15. Seal according to any of claims 11 - 14, *characterised in that* the support means (38) comprises a first side (54) and a second side (55) and that the sealing ring (39) comprises a first sealing part (56) extending away from the first side (54) and a second sealing part (57) extending away from the second side (55).

16. Seal according to any of claims 11 - 15, *characterised in that* at least two a mounting holes (43) are adapted with an outward open slit (44) to facilitate assembly.

15

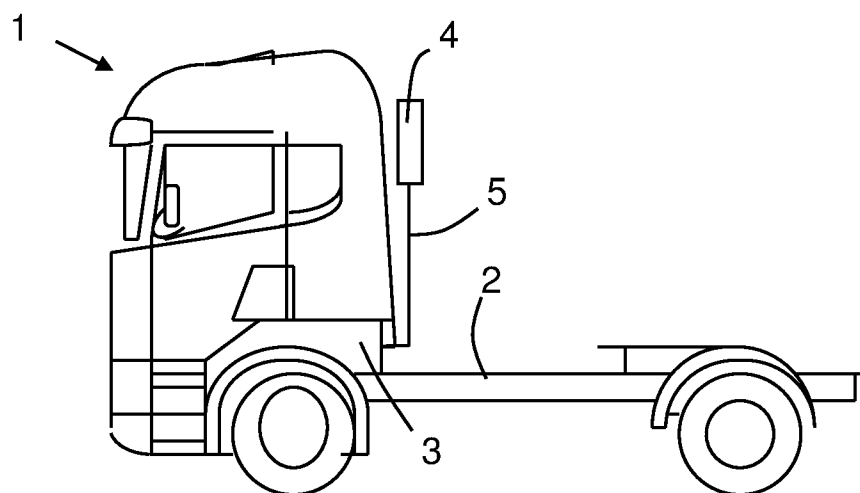


Fig. 1

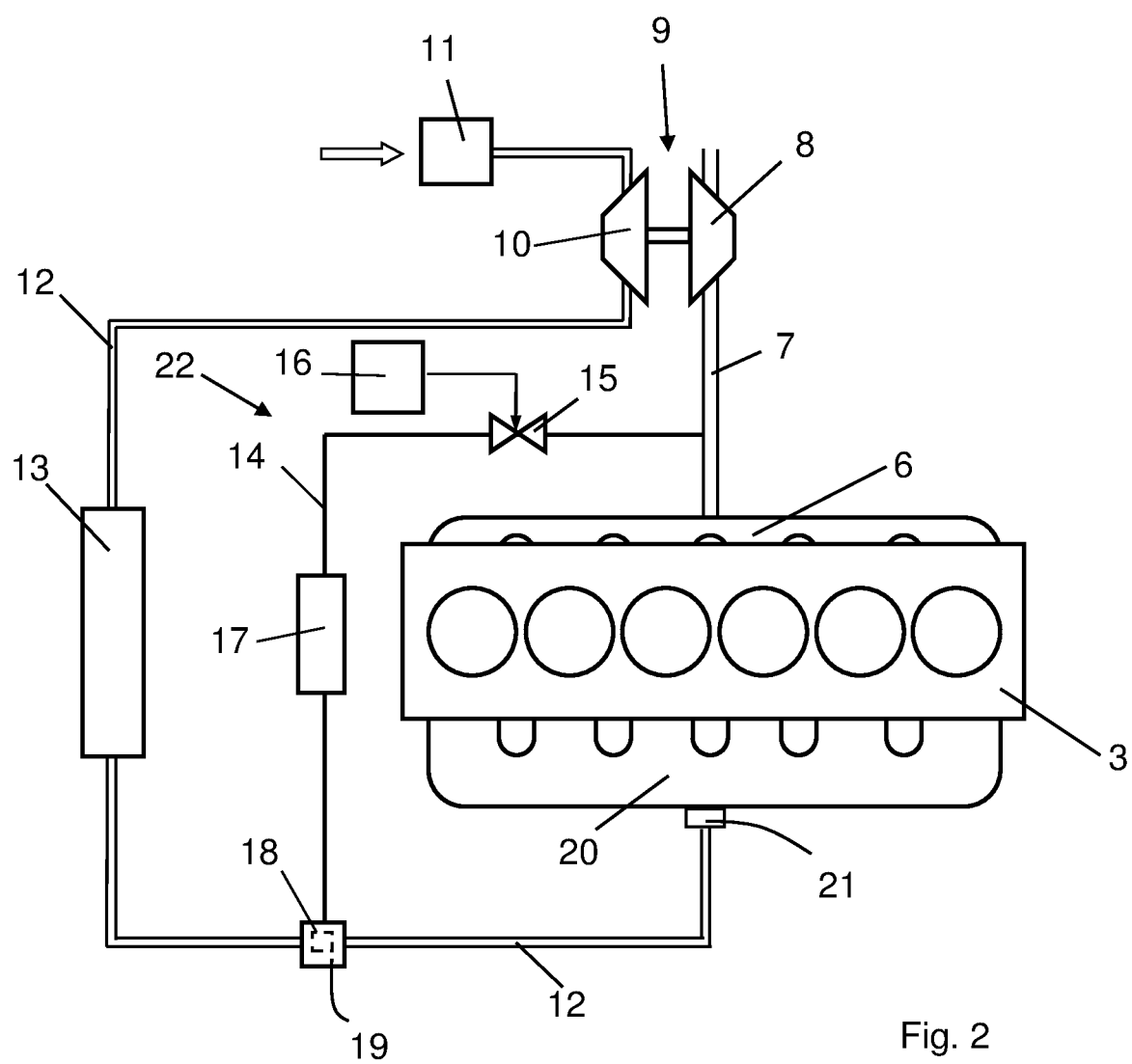


Fig. 2

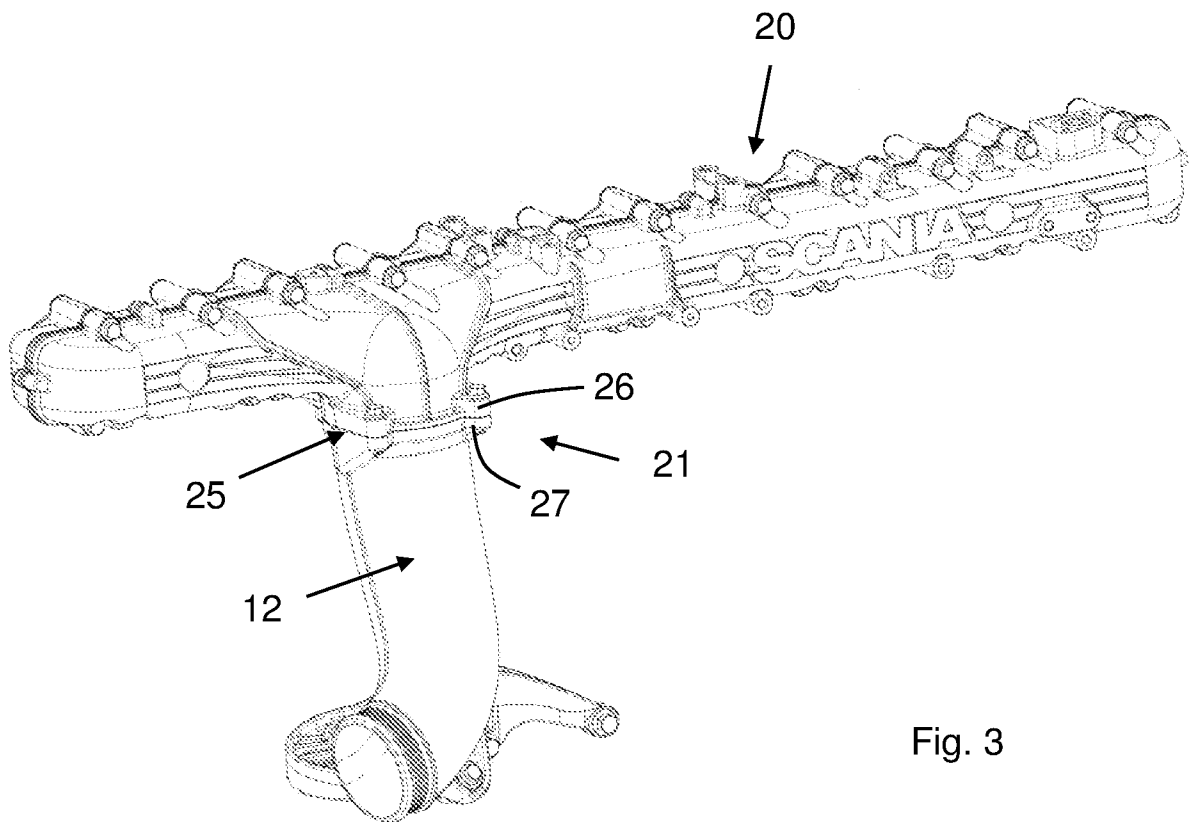


Fig. 3

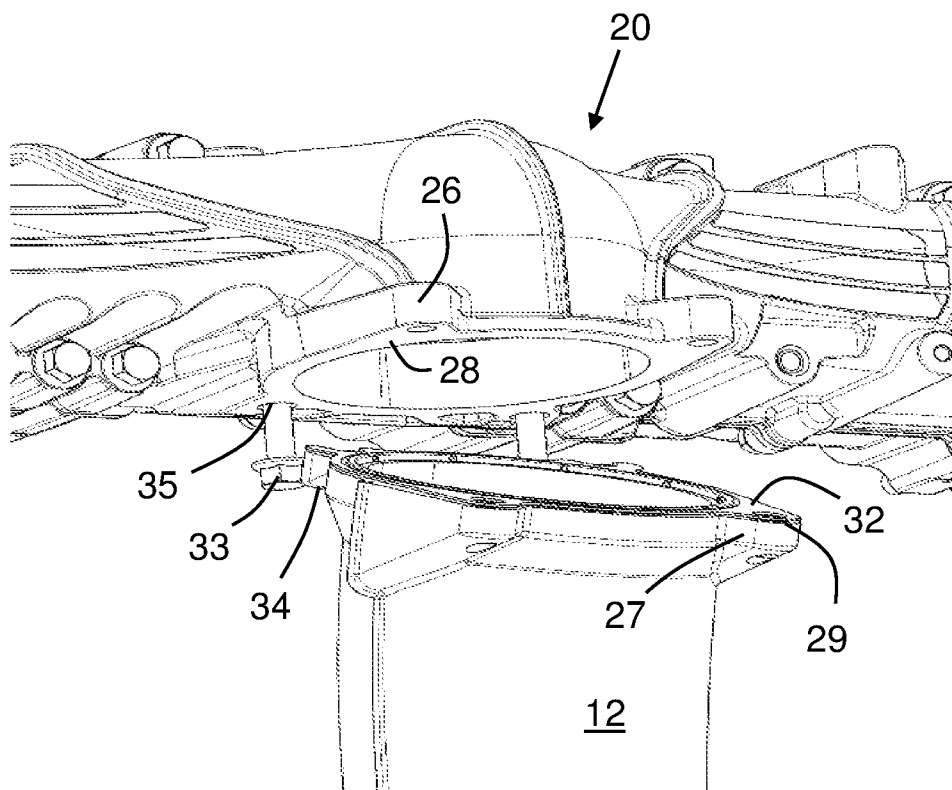


Fig. 4

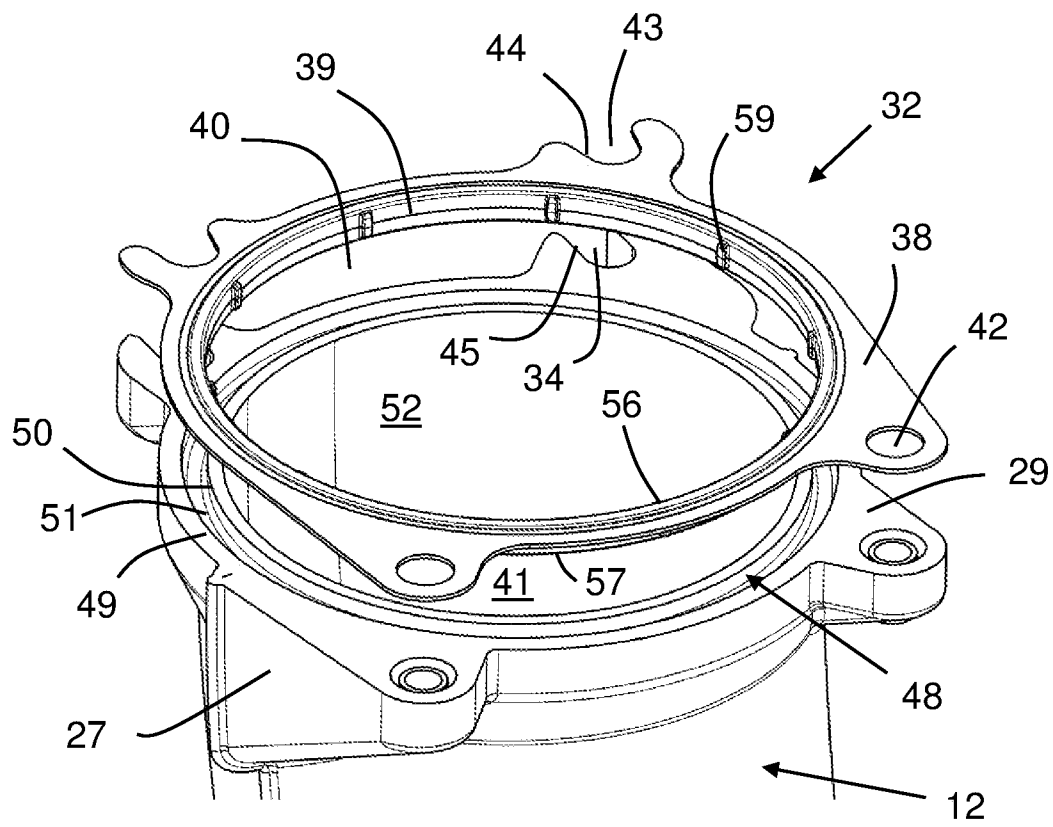


Fig. 5

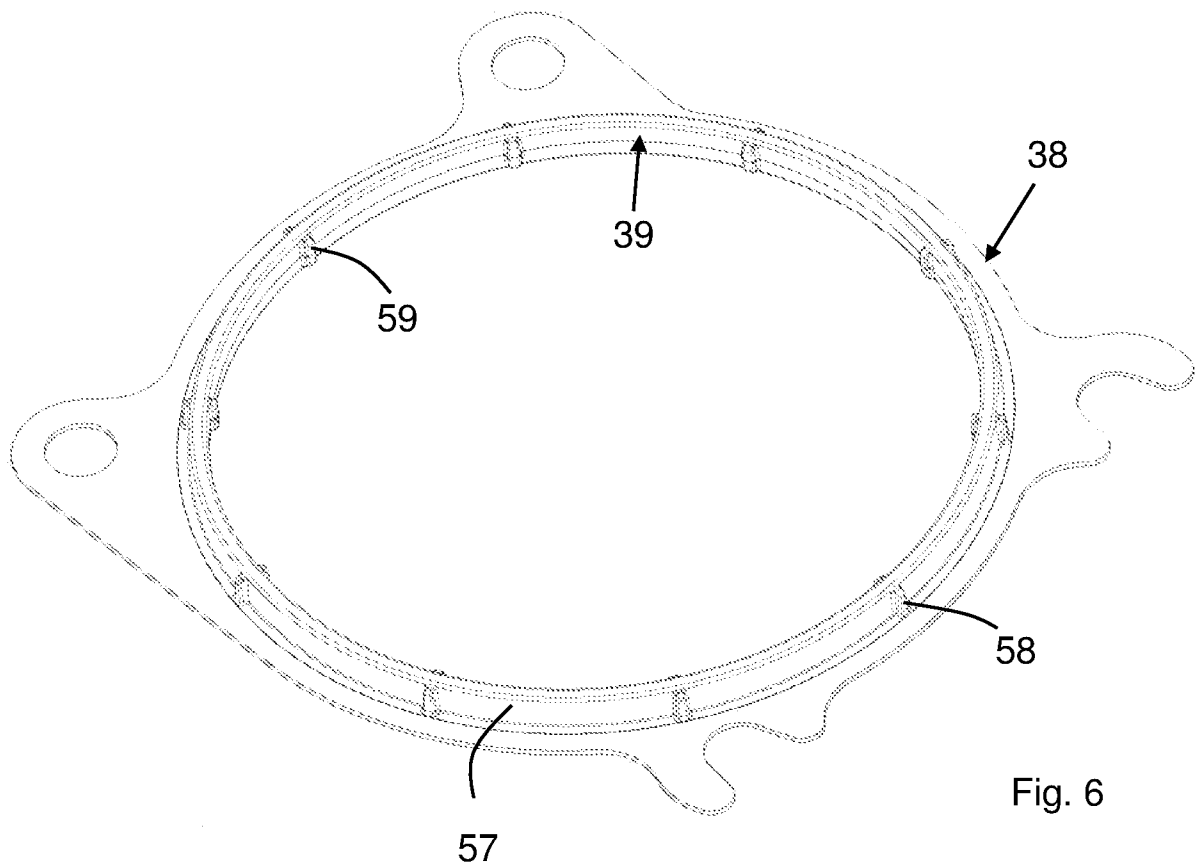


Fig. 6

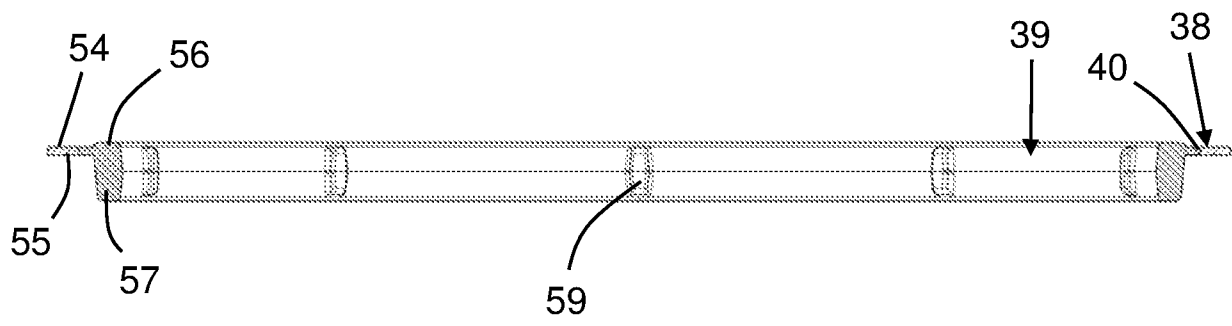


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2017/050233

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: F02M, F16J

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

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20040056429 A1 (OKAZAKI NOBUMITSU ET AL), 25 March 2004 (2004-03-25); paragraphs [0061], [0093]; figure 3 --	1-16
A	US 20030184025 A1 (MATSUKI KATSUNORI), 2 October 2003 (2003-10-02); paragraphs [0012]-[0013]; figures 1,2 --	1-16
A	US 20070024010 A1 (ROBERTS BRIAN ET AL), 1 February 2007 (2007-02-01); paragraphs [0015]-[0016], [0018]; figures 1-3 --	1-16
A	US 20040145121 A1 (FAURIEN DES PLACES FABRICE ET AL), 29 July 2004 (2004-07-29); paragraph [0032]; figure 2 -- -----	1-16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
10-05-2017

Date of mailing of the international search report
11-05-2017

Name and mailing address of the ISA/SE
Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Facsimile No. + 46 8 666 02 86

Authorized officer
Moa Emling
Telephone No. + 46 8 782 28 00

Continuation of: second sheet

International Patent Classification (IPC)

F16J 15/10 (2006.01)

F02M 11/00 (2006.01)

F02M 35/104 (2006.01)

F16J 15/02 (2006.01)

F16J 15/12 (2006.01)

F16J 15/3268 (2016.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2017/050233

US	20040056429 A1	25/03/2004	FR	2842272 A1	16/01/2004
			US	6981704 B2	03/01/2006
			WO	2004007937 A1	22/01/2004
US	20030184025 A1	02/10/2003	DE	10315286 A1	30/10/2003
			JP	2003287139 A	10/10/2003
			US	20070246896 A1	25/10/2007
			US	20060175764 A1	10/08/2006
			US	20050001387 A1	06/01/2005
US	20070024010 A1	01/02/2007	CN	101268269 A	17/09/2008
			EP	1910661 A2	16/04/2008
			JP	2009503405 A	29/01/2009
			JP	5066519 B2	07/11/2012
			KR	20080034176 A	18/04/2008
			KR	101256033 B1	18/04/2013
			US	8720906 B2	13/05/2014
			US	7306235 B2	11/12/2007
			US	20130009367 A1	10/01/2013
			US	20080042372 A1	21/02/2008
			US	8733763 B2	27/05/2014
			WO	2007016206 A3	10/05/2007
US	20040145121 A1	29/07/2004	AT	332440 T	15/07/2006
			DE	10100934 C1	28/02/2002
			DE	50110415 D1	17/08/2006
			EP	1350023 A1	08/10/2003
			US	7175183 B2	13/02/2007
			WO	02055859 A1	18/07/2002