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(54) Sensor mounting structure for engine

(57) In an example, an engine 1 has a crankcase 2, a crankshaft supported with the crankcase 2 to rotate around an axis 3 extending approximately in the horizontal direction, a cylinder 6 supported on a top of the crankcase 2, and a sensor 25, mounted to an outer wall 11 of the crankcase 2, for detecting engine driving conditions. The sensor 25 is mounted to the outer wall 11 of the crankcase 2 below the axis 3 of the crankshaft. A

cover member 29 for covering the sensor 25 from the outside is integrally formed to protrude outward from the outer wall 11 of the crankcase 2 in the direction along the outer surface of the crankcase 2.

Such an arrangement can prevent a sensor mounted to an outer wall of a crankcase from being subjected to radiant heat generated by a cylinder and exhaust pipes, and to facilitate works including mounting of the sensor to the crankcase and the sensor maintenance.

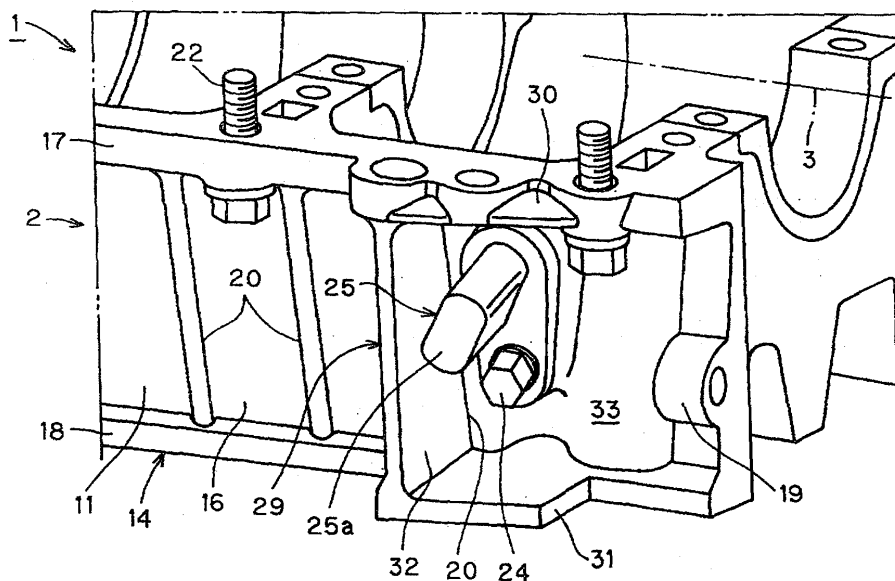


FIG. 1

Description

[0001] This invention relates to a sensor mounting structure for an engine. In preferred examples, a sensor is mounted to an outer wall of a crankcase.

[0002] A conventional sensor mounting structure for an engine is disclosed in JP-A-Hei 6-288329. According to the publication, the engine has a crankcase, a crankshaft supported with the crankcase to rotate around an axis extending approximately in the horizontal direction, a cylinder supported on a top of the crankcase, and a sensor mounted to an outer wall of the crankcase for detecting engine driving conditions.

[0003] The sensor, a crank angle detecting sensor, is mounted to the outer wall of the crankcase above the axis of the crankshaft. The sensor includes a protrusion that protrudes outward from the outer wall of the crankcase. The protrusion of the sensor is provided in a space between an outer surface of the crankcase and an inner surface of a flywheel fixedly attached to an end of the crankshaft.

[0004] In the engine driving, the sensor detects a crank angle and ignition timing is determined generally based on the output signal so that the engine can obtain a desired driving condition.

[0005] The sensor described in the above prior art is mounted to the outer wall of the crankcase above the axis of the crankshaft. This results in the sensor being placed closer to the outer wall of the cylinder. In addition to that, the protrusion of the sensor protrudes outward from the outer wall of the crankcase, facing the cylinder.

The cylinder is heated to high temperature due to the engine driving. In an area adjacent to the outer side of the crankcase and the cylinder, exhaust pipes extending from the cylinder are generally provided. The protrusion of the sensor faces the exhaust pipes which are also heated to high temperature. This causes the protrusion of the sensor to tend to be subjected to high radiant heat generated by the cylinder and the exhaust pipes, which may involve a problem with sensor service life.

[0006] The sensor described in the prior art is also covered from the outside with the flywheel, which interferes with works including mounting of the sensor to the crankcase and sensor maintenance. This causes these works to be more complicated.

[0007] This invention is made in view of the preceding circumstances, and the object of examples is to provide a sensor mounting structure to prevent the sensor mounted to the outer wall of the crankcase from being subjected to radiant heat generated by the cylinder and the exhaust pipes, and to facilitate works including mounting of the sensor to the crankcase and the sensor maintenance.

[0008] In order to seek to solve the foregoing problems, a sensor mounting structure for an engine according to an aspect of the present invention is as follows. Reference numerals denoting the terms herein are not

to be interpreted as a limitation of the technical scope of the present invention to the descriptions of embodiments of the invention to be discussed later, or as a limitation in any way.

[0009] According to an aspect of the invention there is provided a sensor mounting structure for an engine having a crankcase 2, a crankshaft 4 supported with the crankcase 2 to rotate around an axis 3 extending approximately in the horizontal direction, a cylinder 6 supported on a top of the crankcase 2, and a sensor 25, mounted to an outer wall 11 of the crankcase 2, for detecting engine driving conditions;

wherein the sensor 25 is mounted to the outer wall 11 of the crankcase 2 below the axis 3 of the crankshaft 4, and;

a cover member 29 for covering the sensor 25 from the outside is integrally formed to protrude outward from the outer wall 11 of the crankcase 2 in the direction along the outer surface of the crankcase 2.

[0010] Preferably the engine has exhaust pipes 10 provided in an area adjacent to the outer side of the crankcase 2,

wherein the cover member 29 is provided between the exhaust pipes 10 and the sensor 25.

[0011] Preferably the cover member 29 is placed so as to cover the sensor 25 from below.

[0012] Preferably the engine has the crankcase 2 including upper and lower cases 13 and 14 which are separated approximately relative to the axis 3 of the crankshaft 4, the lower case 14 having the outer wall 11 comprising a vertical wall 16 extending vertically, upper and lower outward flanges 17 and 18 formed integrally with upper and lower edges of the vertical wall 16, respectively, and ribs 20 formed integrally with an outer surface of the vertical wall 16 and vertically extending;

wherein at least any one of the upper and lower outward flanges 17 and 18, and the rib 20 integrally extends outward from the crankcase 2 to form the cover member 29.

[0013] A broad aspect of the invention provides a sensor mounting arrangement for an engine having a crankcase and a crankshaft mounted for rotation about an axis, wherein the arrangement includes means for mounting a sensor on an outer wall of the crankcase below the axis of the crankshaft.

[0014] Preferably the arrangement further includes a cover for covering at least a part of the sensor, the cover extending from an outer wall of the crankcase.

[0015] A further aspect of the invention provides a sensor mounting arrangement for an engine, the arrangement includes means for mounting a sensor on an outer wall of the crankcase and means for reducing the heat reaching the sensor from a component of the engine.

[0016] A further aspect of the invention provides a sensor mounting arrangement for an engine having a cylinder and a crankcase, wherein the arrangement includes means for mounting a sensor on an outer wall of

the crankcase remote from the cylinder.

[0017] The invention extends to methods and/or apparatus substantially as herein described with reference to the accompanying drawings.

[0018] Any feature in one aspect of the invention may be applied to other aspects of the invention, in any appropriate combination. In particular, method aspects may be applied to apparatus aspects, and vice versa.

[0019] Preferred features of the present invention will now be described, purely by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view showing a part of a lower case of a crankcase.

Fig. 2 is a side view of an engine.

Fig. 3 is a sectional view showing a front part of the engine.

[0020] In the drawings, reference numeral 1 designates a multi-cylinder (four-cylinder) four-cycle engine (internal combustion engine) mounted on a vehicle such as an automobile.

[0021] The engine 1 has a crankcase 2 supported on a vehicle body, a crankshaft 4 supported with the crankcase 2 to rotate around an axis 3 extending approximately in the horizontal direction, a cylinder 6 integrally attached to and supported with the top of the crankcase 2, an oil pan 8 attached to and supported with the bottom of the crankcase 2, intake pipes 9 extending outward in the radial direction of the crankshaft 4 from one side of the cylinder 6, and exhaust pipes 10 extending outward from the other side of the cylinder 6 and then extending downward.

[0022] The exhaust pipes 10 each have an extending portion provided across an area adjacent to the outer side of the other side of the cylinder 6, and an area adjacent to the outer side of the outer wall 11 of the crankcase 2 and continuing below the other side of the cylinder 6. The extending portions of the respective exhaust pipes 10 are provided in the axial direction of the crankshaft 4 in an area adjacent to the outer side of an approximate midsection between the crankcase 2 and the cylinder 6.

[0023] The crankcase 2 includes an upper case 13 and a lower case 14 which are separated approximately relative to the axis 3 of the crankshaft 4. The crankshaft 4 is supported between the upper case 13 and the lower case 14. The lower case 14 is a bulkhead or rudder frame. The outer wall 11 of the lower case 14 comprises a vertical wall 16 extending vertically, upper and lower outward flanges 17 and 18 integrally formed with upper and lower edges of the vertical wall 16 respectively, an edge outward flange 19 integrally formed with an edge of the vertical wall 16 in the axial direction of the crankshaft 4, and plural ribs 20 integrally formed with the outer surface of the vertical wall 16 and vertically extending to reinforce the vertical wall 16.

[0024] The bottom of the upper case 13 and the upper

outward flange 17 of the lower case 14 are fastened to each other with a fastener 22. To the lower outward flange 18 of the lower case 14 is fastened a top of the oil pan 8 with a fastener 23 so that the oil pan 8 is supported with the bottom of the crankcase 2.

[0025] The engine 1 comprises a sensor 25 mounted to the outer wall 11 of the crankcase 2 with a fastener 24 for detecting engine driving conditions, and a disc-shaped detected element 26 to be detected by the sensor 25, which rotates with the crankshaft 4. The sensor 25, a crank angle detecting sensor, uses a magnetic sensor or an optical sensor. On an outer circumferential surface of the detected element 26 are formed multiple detected teeth. When the detected element 26 rotates with the crankshaft 4, the sensor 25 outputs an electrical pulse signal as a detection signal every time each detected tooth approaches the sensor 25. In other words, the sensor 25 outputs a crankshaft angle detection signal. Ignition timing is determined based on the detection signal, which allows the engine 1 to be driven under desired conditions.

[0026] The sensor 25 is mounted to the vertical wall 16 of the outer wall 11 of the lower case 14 provided below the axis 3 of the crankshaft 4. The sensor 25 is mounted to the end on the edge outward flange 19 in the axial direction of the crankshaft 4. The sensor 25 includes a protrusion 25a protruding outward from the vertical wall 16 of the outer wall 11 of the lower case 14.

[0027] A cover member 29 for covering the protrusion 25a of the sensor 25 from the outside is integrally formed to protrude outward from the outer wall 11 of the lower case 14 in the direction along the outer surface of the outer wall 11 of the crankcase 2.

[0028] The cover member 29 comprises upper and lower cover members 30 and 31 formed by integrally extending outer peripheries of the upper and lower outward flanges 17 and 18 outward from the lower case 14 of the crankcase 2, and a side cover member 32 formed by extending an outer periphery of one of the ribs 20, which is adjacent to the edge outward flange 19 in the axial direction of the crankshaft 4.

[0029] The sensor 25 is provided in a space 33 enclosed by the edge outward flange 19, the upper cover member 30, the lower cover member 31, and the side cover member 32. The space 33 is opened to the outside of the lower case 14 of the crankcase 2. The sensor 25 can be inserted in the space 33 through its opening. The space 33 is used as a part of the working space to mount the sensor 25 to the lower case 14 and maintain the sensor 25.

[0030] According to the structure described above, the sensor 25 is mounted to the outer wall 11 of the crankcase 2 below the axis 3 of the crankshaft 4.

[0031] This allows the sensor 25 to be placed apart from and further below the cylinder 6 heated to high temperature, which differs from the conventional art in which the sensor 25 is mounted to the outer wall 11 of the crankcase 2 above the axis 3 of the crankshaft 4. The

protrusion 25a of the sensor 25 is therefore prevented from being subjected to radiant heat generated by the cylinder 6, which is preferable to the sensor 25 for its service life.

[0032] The cover member 29 for covering at least a part of the sensor 25 from the outside is integrally formed to protrude outward from the outer wall 11 of the crankcase 2 in the direction along the outer surface of the crankcase 2.

[0033] The cover member 29 can therefore prevent the radiant heat generated by the cylinder 6 and the exhaust pipes 10 in the direction along the outer surface of the crankcase 2 from reaching the protrusion 25a of the sensor 25. This can avoid the protrusion 25a of the sensor 25 from being subjected to the radiant heat more reliably.

[0034] The cover member 29 covers the protrusion 25a of the sensor 25 as described above, which also prevents the sensor 25 from being accidentally subjected to external forces generated by objects external to the sensor 25 during assembly and the deliveries of the engine 1. The sensor 25 is therefore protected from these external forces, and from damage.

[0035] In addition, the cover member 29 integrally protrudes outward from the outer wall 11 of the crankcase 2, which differs from the conventional art in which the sensor 25 is covered from the outside. This can prevent the cover member 29 from interfering with works, including mounting of the sensor 25 to the outer wall 11 of the crankcase 2 and maintenance of the sensor 25, to be performed from the outside of the crankcase 2, which facilitates these works.

[0036] As described above, in the engine having the exhaust pipes 10 provided in the area adjacent to the outer side of the crankcase 2, the upper cover member 30 and the side cover member 32 of the cover member 29 are provided between the exhaust pipes 10 and the protrusion 25a of the sensor 25.

[0037] This allows the upper cover member 30 and the side cover member 32 of the cover member 29 to more reliably prevent the protrusion 25a of the sensor 25 from being subjected to the radiant heat generated by the exhaust pipes 10.

[0038] Also as described above, the lower cover member 31 of the cover member 29 is placed so as to cover the sensor 25 from below.

[0039] Thus, in the engine 1 mounted to a vehicle; for example, the lower cover member 31 of the cover member 29 prevents small stones thrown up by the wheels while driving from hitting the sensor 25, which avoid damage to the sensor 25.

[0040] Also as described above, the cover member 29 is formed by allowing the upper and lower outward flanges 17 and 18, and the ribs 20 to integrally extend outward from the crankcase 2.

[0041] The cover member 29 is formed with the upper and lower outward flanges 17 and 18, and the ribs 20. This means that the sensor 25 can be prevented from

being subjected to heat and being damaged by the simply-structured cover member 29.

[0042] In addition, the upper and lower outward flanges 17 and 18, and the ribs 20 have high strength for their functions. Accordingly, the cover member 29 formed with them can readily have high strength. Therefore, the cover member 29 can more reliably prevent the sensor 25 from being damaged due to external forces.

[0043] The lower outward flange 18 and the lower cover member 31 have the respective bottom surfaces flush with each other. During the engine 1 assembly, when the lower case 14 is fixed to a workbench with cramps, the lower cover member 31 of the cover member 29 is placed on the workbench. This allows the lower cover member 31 to be used to fix the lower case 14 thereto with the cramps.

[0044] Unlike the above embodiment exemplified by the accompany drawings, the sensor 25 may be mounted to the outer wall 11 constituting an end face of the crankcase 2 in the axial direction of the crankshaft 4. The cover member 29 may be provided separately from the upper and lower outward flanges 17 and 18, and the ribs 20.

[0045] The protrusion 25a of the sensor 25, which protrudes from the outer wall 11 of the crankcase 2, may be smaller in dimension than that of the cover member 29. This can more reliably prevent the protrusion 25a of the sensor 25 from being subjected to the external radiant heat and being damaged due to the external forces.

[0046] Effects of preferred features of the invention are as follows.

[0047] An aspect of the present invention provides a sensor mounting structure for an engine having a crankcase, a crankshaft supported with the crankcase to rotate around an axis extending approximately in the horizontal direction, a cylinder supported on a top of the crankcase, and a sensor, mounted to an outer wall of the crankcase, for detecting engine driving conditions; wherein the sensor is mounted to the outer wall of the crankcase below the axis of the crankshaft.

[0048] This allows the sensor to be placed apart from and further below the cylinder heated to high temperature, which differs from the conventional art in which the sensor is mounted to the outer wall of the crankcase above the axis of the crankshaft. The sensor is therefore prevented from being subjected to radiant heat generated by the cylinder, which is preferable to the sensor for its service life.

[0049] The cover member for covering the sensor from the outside is preferably integrally formed to protrude outward from the outer wall of the crankcase in the direction along the outer surface of the crankcase.

[0050] A cover member can therefore prevent the radiant heat generated by the cylinder and the exhaust pipes in the direction along the outer surface of the crankcase from reaching the sensor. This can avoid the sensor from being subjected to the radiant heat more reliably.

[0051] The cover member preferably covers the sensor as described above, which also prevents the sensor from being accidentally subjected to external forces generated by objects external to the sensor during engine assembly and the deliveries. The sensor is therefore protected from these external forces, and from damage.

[0052] In addition, the cover member preferably integrally protrudes outward from the outer wall of the crankcase, which differs from the conventional art in which the sensor is covered from the outside. This can prevent the cover member from interfering with works, including mounting of the sensor to the outer wall of the crankcase and maintenance of the sensor, to be performed from the outside of the crankcase, which facilitates these works.

[0053] Preferably the engine has exhaust pipes provided in an area adjacent to the outer side of the crankcase;

wherein the cover member is provided between the exhaust pipes and the sensor.

[0054] The cover member can therefore avoid the sensor from being subjected to the radiant heat generated by the exhaust pipes more reliably.

[0055] Preferably in the sensor mounting structure for an engine, the cover member is placed so as to cover the sensor from below.

[0056] Thus, in the engine mounted to a vehicle, for example, the cover member prevents small stones thrown up by the wheels while driving from hitting the sensor, which avoid damage to the sensor.

[0057] Preferably in the sensor mounting structure for an engine, in which the engine has the crankcase including upper and lower cases which are separated approximately relative to the axis of the crankshaft, the lower case having the outer wall comprising a vertical wall extending vertically, upper and lower outward flanges formed integrally with upper and lower edges of the vertical wall, respectively, and ribs formed integrally with an outer surface of the vertical wall and vertically extending;

wherein at least any one of the upper and lower outward flanges, and the rib integrally extends outward from the crankcase to form the cover member.

[0058] The cover member is preferably formed with the upper and lower outward flanges, and the ribs. This means that the sensor can be prevented from being subjected to heat and being damaged by the simply-structured cover member.

[0059] In addition, the upper and lower outward flanges, and the ribs preferably have high strength for their functions. Accordingly, the cover member formed with them can readily have high strength. Therefore, the cover member can more reliably prevent the sensor from being damaged due to external forces.

[0060] In a preferred example, an engine 1 has a crankcase 2, a crankshaft supported with the crankcase 2 to rotate around an axis 3 extending approximately in

the horizontal direction, a cylinder 6 supported on a top of the crankcase 2, and a sensor 25, mounted to an outer wall 11 of the crankcase 2, for detecting engine driving conditions. The sensor 25 is mounted to the outer wall 11 of the crankcase 2 below the axis 3 of the crankshaft. A cover member 29 for covering the sensor 25 from the outside is integrally formed to protrude outward from the outer wall 11 of the crankcase 2 in the direction along the outer surface of the crankcase 2.

[0061] Such an arrangement can prevent a sensor mounted to an outer wall of a crankcase from being subjected to radiant heat generated by a cylinder and exhaust pipes, and to facilitate works including mounting of the sensor to the crankcase and the sensor maintenance.

[0062] It will be understood that the present invention has been described above purely by way of example, and modification of detail can be made within the scope of the invention.

Explanation of Reference Numerals

[0063]

1:	engine
2:	crankcase
3:	axis
4:	crankshaft
6:	cylinder
10:	exhaust pipe
11:	outer wall
13:	upper case
14:	lower case
16:	vertical wall
17:	upper outward flange
18:	lower outward flange
19:	edge outward flange
20:	rib
22:	fastener
23:	fastener
24:	fastener
25:	sensor
25a:	protrusion
26:	detected element
29:	cover member
30:	upper cover member
31:	lower cover member
32:	side cover member
33:	space

Claims

1. A sensor mounting structure for an engine having a crankcase, a crankshaft supported with the crankcase to rotate around an axis extending approximately in the horizontal direction, a cylinder supported on a top of the crankcase, and a sensor,

mounted to an outer wall of the crankcase, for detecting engine driving conditions,

wherein the sensor is mounted to the outer wall of the crankcase below the axis of the crankshaft, and

wherein a cover member for covering the sensor from the outside is integrally formed to protrude outward from the outer wall of the crankcase in the direction along the outer surface of the crankcase.

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2. The sensor mounting structure for an engine according to Claim 1, the engine having exhaust pipes provided in an area adjacent to the outer side of the crankcase,

wherein the cover member is provided between the exhaust pipes and the sensor.

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3. The sensor mounting structure for an engine according to Claim 1, wherein the cover member is placed so as to cover the sensor from below.

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4. The sensor mounting structure for an engine according to any one of Claims 1 through 3, the engine having the crankcase including upper and lower cases which are separated approximately relative to the axis of the crankshaft, the lower case having the outer wall comprising a vertical wall extending substantially vertically, upper and lower outward flanges formed integrally with upper and lower edges of the vertical wall, respectively, and ribs formed integrally with an outer surface of the vertical wall and substantially vertically extending,

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wherein at least any one of the upper and lower outward flanges, and the rib integrally extends outward from the crankcase to form the cover member.

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5. A sensor mounting arrangement for an engine having a crankcase and a crankshaft mounted for rotation about an axis, wherein the arrangement includes means for mounting a sensor on an outer wall of the crankcase below the axis of the crankshaft.

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6. An arrangement according to claim 5 further including a cover for covering at least a part of the sensor, the cover extending from an outer wall of the crankcase.

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7. A sensor mounting arrangement for an engine, the arrangement includes means for mounting a sensor on an outer wall of the crankcase and means for reducing the heat reaching the sensor from a component of the engine.

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8. A sensor mounting arrangement for an engine having a cylinder and a crankcase, wherein the arrangement includes means for mounting a sensor

on an outer wall of the crankcase remote from the cylinder.

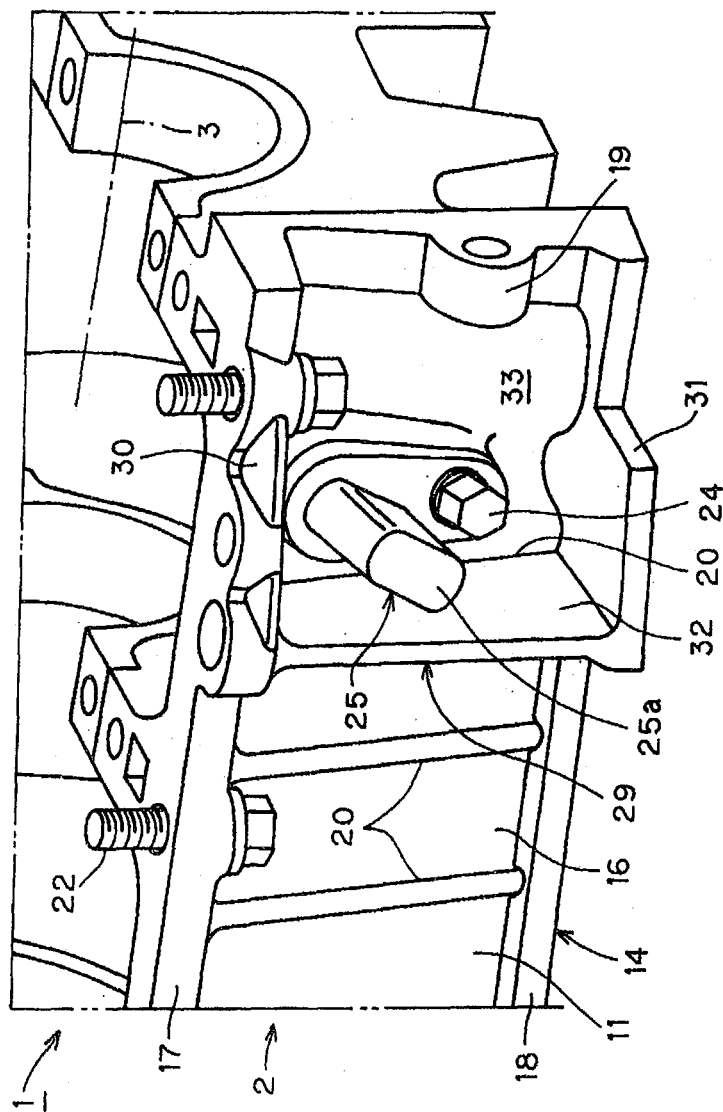


FIG. 1

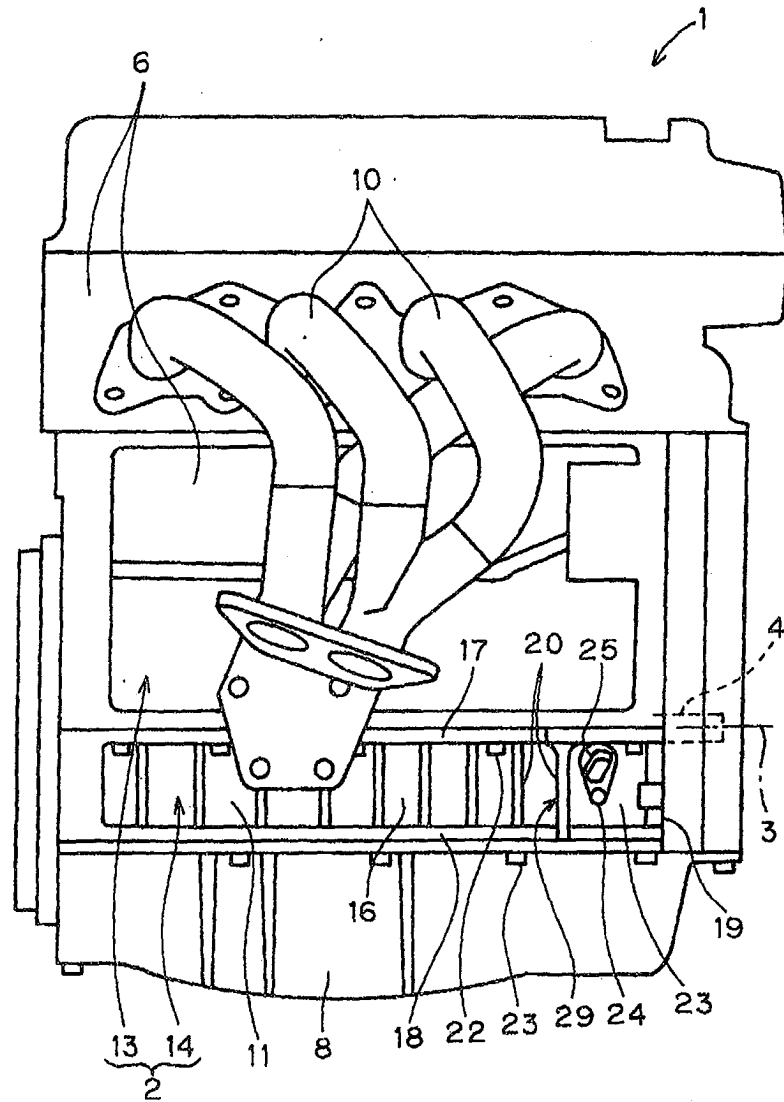


FIG. 2

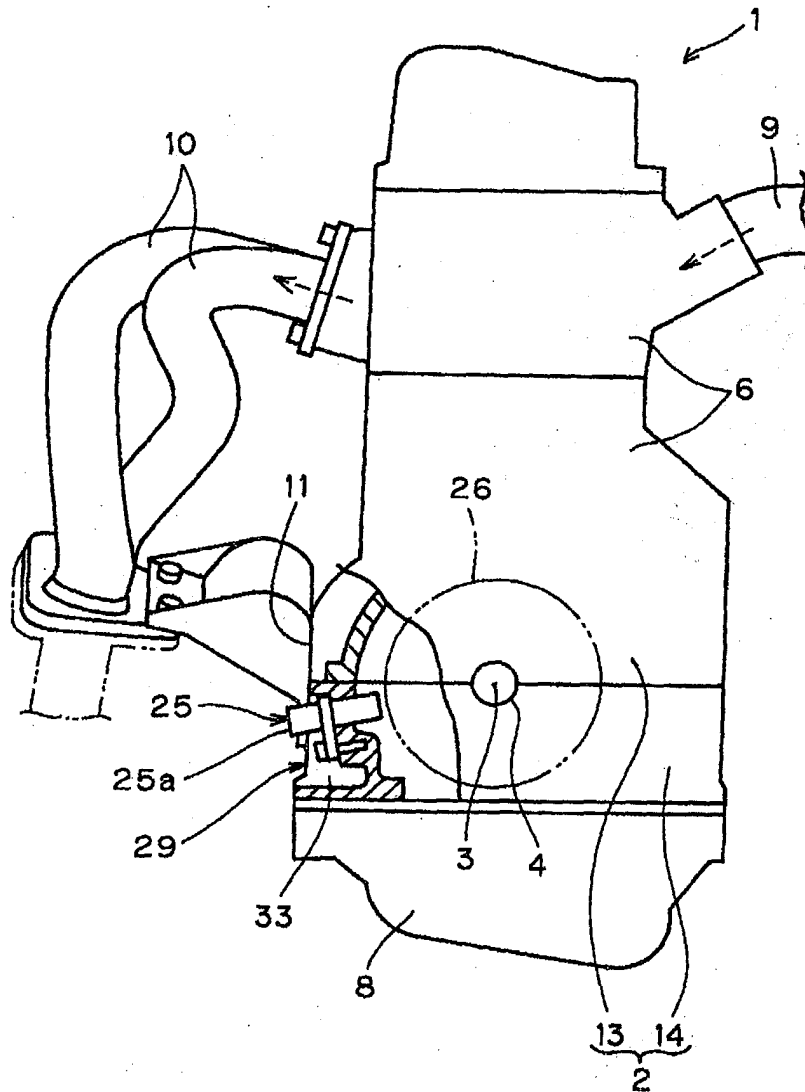


FIG. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 25 3156

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 2003/024299 A1 (FUJITA HIROYUKI ET AL) 6 February 2003 (2003-02-06) * figures 1-3 * * abstract * * claims 1-3 *	1-3	F02B77/00 F02B77/08 F02P7/067
A	----- US 5 184 590 A (HASHIMOTO ATSUKO ET AL) 9 February 1993 (1993-02-09) * figure 1 * * abstract *	1	
A	----- US 4 827 886 A (MAEDA SATOSHI) 9 May 1989 (1989-05-09) * figures 1-3 * * abstract *	1	
A	----- PATENT ABSTRACTS OF JAPAN vol. 2002, no. 12, 12 December 2002 (2002-12-12) & JP 2002 221040 A (SUZUKI MOTOR CORP), 9 August 2002 (2002-08-09) * abstract *	1	
A	----- PATENT ABSTRACTS OF JAPAN vol. 1997, no. 07, 31 July 1997 (1997-07-31) & JP 9 068053 A (SUZUKI MOTOR CORP), 11 March 1997 (1997-03-11) * abstract *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.7) F02B F02P F02F F01N
A	----- PATENT ABSTRACTS OF JAPAN vol. 2000, no. 07, 29 September 2000 (2000-09-29) & JP 2000 104593 A (SUZUKI MOTOR CORP), 11 April 2000 (2000-04-11) * abstract *	1	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 August 2004	Examiner Wassenaar, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 04 25 3156

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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25-08-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003024299 A1	06-02-2003	JP 2003027986 A	29-01-2003
US 5184590 A	09-02-1993	JP 2657005 B2	24-09-1997
		JP 4262068 A	17-09-1992
		JP 4292575 A	16-10-1992
		JP 4259665 A	16-09-1992
		JP 4259667 A	16-09-1992
		DE 4204131 A1	13-08-1992
		KR 9509971 B1	04-09-1995
US 4827886 A	09-05-1989	JP 63154828 A	28-06-1988
		DE 3742675 A1	30-06-1988
		GB 2198853 A ,B	22-06-1988
JP 2002221040 A	09-08-2002	NONE	
JP 9068053 A	11-03-1997	NONE	
JP 2000104593 A	11-04-2000	NONE	