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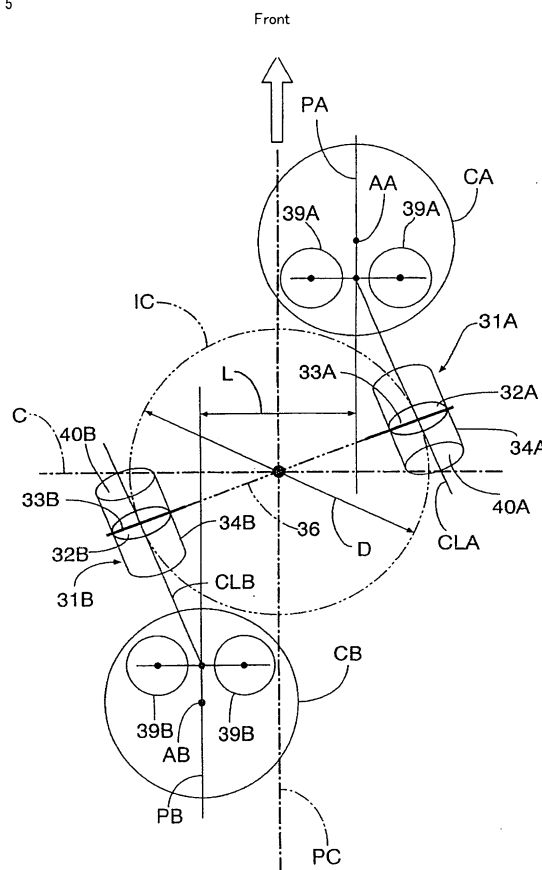
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(54) Intake system of V-type engine for vehicle

(57) To enable reducing intake resistance in an intake passage (40A, 40B) in an intake passage component (31A, 31B) and to facilitate the enhancement of the output of the engine in an intake system of a V-type engine for a vehicle where a pair of front and rear banks are arranged in a V type in a plane perpendicular to the axis of a crankshaft (C) and the intake passage components (31A, 31B) at least provided with a throttle body (34A, 34B) and individually corresponding to each cylinder (CA, CB) are arranged between both banks and are connected to each inside surface of cylinder heads (22A, 22B).

Plural throttle shafts (33A, 33B) supported by each throttle body (34A, 34B) so that the throttle shafts can be turned are coaxially arranged so that they cross the axis (C) of a crankshaft in a top view and center lines (CLA, CLB) of intake passages (40A, 40B) which each intake passage component (31A, 31B) forms are arranged on each straight line perpendicular to the axes of the throttle shafts (33A, 33B) in the top view.

Fig. 5



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Description

[0001] The present invention relates to an intake system of a V-type engine for a vehicle where a pair of front and rear banks are arranged in a V type in a plane perpendicular to the axis of a crankshaft and intake passage components at least provided with a throttle body for supporting a throttle shaft to which a throttle valve is fastened so that the throttle shaft can be turned and individually corresponding to each cylinder are connected onto the inside surface of a cylinder head of each bank and are arranged between both banks.

[0002] An intake system where intake passage components provided with a throttle body in each intermediate part and individually corresponding to each cylinder of each bank are arranged between a pair of banks in a V-type engine for a vehicle is known in a patent document 1 for example.

[Patent Document 1] JP-A No. 204969/2000

[0003] However, in the above-mentioned conventional type, a throttle shaft of each throttle body is arranged in a mutually offset position so that each throttle shaft has an axis parallel to a crankshaft and in such structure, an intake passage from each throttle body to a cylinder head is required to be curved, intake resistance is relatively large, and it is difficult to enhance the output of an engine.

[0004] The invention is made in view of such a situation and the object is to provide an intake system of a V-type engine for a vehicle where intake resistance in an intake passage in an intake passage component can be reduced and the enhancement of the output of the engine is facilitated.

[0005] To achieve the object, the invention according to Claim 1 is based upon an intake system of a V-type engine for a vehicle where a pair of front and rear banks are arranged in a V type in a plane perpendicular to the axis of a crankshaft and intake passage components at least provided with a throttle body for supporting a throttle shaft to which a throttle valve is fastened so that the throttle shaft can be turned and individually corresponding to each cylinder are connected onto the inside surface of a cylinder head of each bank and are arranged between both banks, and is characterized in that plural throttle shafts supported by each throttle body so that the throttle shaft can be turned are coaxially arranged so that they cross the axis of the crankshaft in a top view and a center line of an intake passage which each intake passage component forms is arranged on a straight line perpendicular to the axis of the throttle shaft in the top view.

[0006] The invention according to Claim 2 is characterized in that in addition to the configuration of the invention according to Claim 1, each bank is provided with a cylinder head to which plural intake valve openings per cylinder are provided and a center line of the intake passage passes an intermediate part of the plural intake valve openings with which each cylinder is provided in the top view.

[0007] The invention according to Claim 3 is charac-

terized in that in addition to the configuration of the invention according to Claim 1 or 2, a fuel injection valve located on the reverse side to a cylinder head of a bank corresponding to each throttle body is attached to each throttle body.

[0008] Further, the invention according to Claim 4 is characterized in that in addition to the configuration of the invention according to Claim 3, the fuel injection valve respectively corresponding to both banks provided with only one cylinder is attached to each throttle body in arrangement that a connector for connecting a conductor of the fuel injection valve is directed toward the side of the vehicle.

[0009] According to the invention disclosed in Claim 1, intake resistance in the intake passage is inhibited to be a small value by linearizing the intake passage in each intake passage component in the top view and contribution to enhancing the output of the engine is enabled.

[0010] According to the invention disclosed in Claim 2, even if the cylinder head of each bank is provided with the plural intake valve openings, intake air is uniformly distributed to the intake valve opening and the center line of the intake passage can be linearly arranged in the top view reasonably.

[0011] According to the invention disclosed in Claim 3, the fuel injection valve is arranged in relatively large space made between the cylinder head and the throttle body and work for attaching and detaching the fuel injection valve to/from the throttle body can be facilitated.

[0012] Further, according to the invention disclosed in Claim 4, work for connection and disconnection to/from the connector for connecting the conductor with which the fuel injection valve is provided is facilitated, and ease of assembly and maintainability can be enhanced.

Fig. 1 is a side view showing a motorcycle;

Fig. 2 is a plan showing a part of a body frame and a V-type engine;

Fig. 3 is an enlarged view showing a main part in Fig. 2;

Fig. 4 is a drawing viewed from a direction shown by an arrow 4 in Fig. 3;

Fig. 5 is a conceptual plan showing a state in which cylinders of a pair of banks and intake passage components are connected; and

Fig. 6 shows an ignition cycle of two cylinders.

[0013] Referring to attached drawings, one embodiment of the invention will be described below.

[0014] Figs. 1 to 6 show one embodiment of the invention, Fig. 1 is a side view showing a motorcycle, Fig. 2 is a plan showing a part of a body frame and a V-type engine, Fig. 3 is an enlarged view showing a main part in

Fig. 2, Fig. 4 is a drawing viewed from a direction shown by an arrow 4 in Fig. 3, Fig. 5 is a conceptual plan showing a state in which cylinders of a pair of banks and an intake passage component are connected, and Fig. 6 shows a two-cylinder ignition cycle.

[0015] First as shown in Fig. 1, the body frame F of the motorcycle is provided with a head pipe 12 for supporting a front fork 11 for supporting a front wheel WF so that the front fork can be steered, a pair of right and left main frames 13 ... extended backward in a downward-slanting state from the head pipe 12, pivot plates 14 ... connected to the main frames 13 ... in a downward-hanging state from the rear ends of both main frames 13 ..., a pair of right and left down tubes 15 ... provided between the head pipe 12 and both pivot plates 14 ... under both main frames 13 ... and seat rails 16 ... extended backward in an upward-slanting state from the rears of the main frames 13 ..., a front half 15a of the down tube 15 is inclined so that the front half is extended backward from the head pipe 12 in a downward-slanting state, and a rear half 15b of the down tube 15 is extended substantially horizontally between the rear end of the front half 15a and the pivot plate 14.

[0016] A fuel tank 17 is mounted over both main frames 13, and a tandem seat 18 arranged at the back of the fuel tank 17 is supported by the seat rails 16 The front ends of a pair of right and left swing arms 19 ... are supported by the pivot plates 14 ... so that the swing arm can be rocked and a rear wheel WR is supported by the rears of both swing arms 19

[0017] The body 20 of the two-cylinder V-type engine E is mounted on the body frame F under the fuel tank 17, and motive power output from an output shaft 23 of a transmission (not shown) built in a crankcase 21 of the body 20 of the engine is transmitted to the rear wheel WR via chain transmission means 27 configured by a driving sprocket 24 fixed on the output shaft 23, a driven sprocket 25 fixed on an axle 28 of the rear wheel WR and a chain without an end 26 wound on both sprockets 24, 25.

[0018] The body 20 of the engine is mounted on the body frame F so that the axis of a crankshaft 30 rotatably supported in the crankcase 21 is along a cross direction of the body frame F, is provided with a first bank BA on the front side along a longitudinal direction of the motorcycle and a second bank BB on the rear side, and the banks BA, BB are arranged in a V type in a plane perpendicular to the axis of the crankshaft 30.

[0019] As shown in Figs. 2 to 4, the downstream ends of intake passage components 31A, 31B at least provided with each throttle body 34A, 34B for turnably supporting each throttle shaft 33A, 33B to which each throttle valve 32A, 32B is fastened and individually corresponding to cylinders CA, CB of both banks BA, BB are connected onto the inside surfaces of cylinder heads 22A, 22B in both banks BA, BB, and the upstream ends of both intake passage components 31A, 31B are connected to an air cleaner 35 (see Fig. 1) arranged over both

banks BA, BB in common so that the upstream ends are covered with the fuel tank 17.

[0020] Both throttle bodies 34A, 34B are mutually connected to be a unit. In addition, a throttle drum 37 is fixed to the outer end of the throttle shaft 33B turnably supported by the throttle body 34B forming a part of the intake passage component 31B on the side of the second bank BB, throttle wire not shown is wound and coupled on/to the throttle drum 37. Besides, a sensor unit 38 including a throttle sensor and an intake temperature sensor respectively not shown is attached to the throttle body 34A forming a part of the intake passage component 31A on the side of the first bank BA so that the sensor unit is opposite to the outer end of the throttle shaft 33A.

[0021] Next, to explain intake passage structure according to the invention referring to Fig. 5, first, a virtual cylinder IC having an arbitrary diameter D different from distance L between both planes PA, PB is set with a center line formed by crossing a vertical plane passing the axis C of the crankshaft 30 and a central plane PC passing a center between planes PA, PB including the axes AA, AB of cylinders of both banks BA, BB and perpendicular to the axis C of the crankshaft 30 as a central axis. The diameter D of the virtual cylinder IC is equivalent to distance between the centers of bores of the throttle bodies 34A, 34B and in this embodiment, a case that the distance between the centers of the bores of the throttle bodies 34A, 34B is larger than the distance L between both planes PA, PB will be described, however, the diameter D has only to be different from the distance L and the distance between the centers of the bores of the throttle bodies 34A, 34B may be also smaller than the distance L.

[0022] The cylinders CA, CB of both banks BA, BB are provided with plural, for example, a pair of intake valve openings 39A ..., 39B ..., center lines CLA, CLB are set so that they come in contact with the virtual cylinder IC from each intermediate part between each pair of intake valve openings 39A ..., 39B ..., and a straight line tying contact points at which the center lines CLA, CLB are in contact with the virtual cylinder IC is set as central axes of the throttle shafts 33A, 33B.

[0023] Hereby, a pair of throttle shafts 33A, 33B supported by each throttle body 34A, 34B so that the throttle shaft can be turned are coaxially arranged so that they cross the axis C of the crankshaft 30 in the top view. Each intake passage component 31A, 31B respectively forms the intake passages 40A, 40B communicating with the intake valve openings 39A ..., 39B ... and the center lines CLA, CLB are set as center lines of the intake passages 40A, 40B. Hereby, the center lines CLA, CLB of the intake passages 40A, 40B which each intake passage component 31A, 31B forms are perpendicular to the axes of the throttle shafts 33A, 33B in the top view and are respectively arranged on a straight line passing an intermediate position between the corresponding intake valve openings 39A ..., 39B

[0024] Even if distance between the centers of the

bores of the throttle bodies 34A, 34B is different depending upon a shape of an engine, the V-type engine E where the intake passages 40A, 40B are linear in the top view and the intake resistance is inhibited to be a small value can be acquired by such intake passage structure.

[0025] The inner ends of both throttle shafts 33A, 33B are coupled via interlocking/coupling means 36. The throttle drum 37 is fixed to the outer end of the throttle shaft 33B supported by the throttle body 34B on the side of the second bank BB so that the throttle shaft can be turned and the throttle shafts 33A, 33B of both throttle bodies 34A, 34B, that is, the throttle valves 32A, 32B are turned in interlock by turning the throttle drum 37 by throttle wire not shown.

[0026] Fuel injection valves 41A, 41B for injecting fuel into the intake passages 40A, 40B are attached to each throttle body 34A, 34B, in addition, each fuel injection valve 41A, 41B is attached to each throttle body 34A, 34B so that the fuel injection valves are located on the reverse side to the cylinder heads 22A, 22B of the banks BA, BB corresponding to the throttle bodies 34A, 34B to which the fuel injection valves 41A, 41B are attached, the fuel injection valve 41A is attached to the throttle body 34A on the side of the first bank BA on the side of the cylinder head 22B of the second bank BB, and the fuel injection valve 41B is attached to the throttle body 34B on the side of the second bank BB on the side of the cylinder head 22A of the first bank BA. Further, each fuel injection valve 41A, 41B is attached to each throttle body 34A, 34B in arrangement that connectors for connecting a conductor 42A, 42B of the fuel injection valves 41A, 41B are directed toward the side of the motorcycle.

[0027] A connection member 43 provided with an inlet-side connection pipe 43a for attaching a fuel hose (not shown) for leading fuel from a fuel pump not shown and a connection pipe for junction 43b communicating with the fuel hose is installed at the rear end (the upper end) of the fuel injection valve 41A on the side of the first bank BA, and a connection member 44 provided with an inlet-side connection pipe 44a is installed at the rear end (the upper end) of the fuel injection valve 41B on the side of the second bank BB. The connection pipe for junction 43b and the inlet-side connection pipe 44a are connected via a junction hose 45, fuel from the fuel pump is supplied to the fuel injection valve 41A on the side of the first bank BA, and is also supplied to the fuel injection valve 41B on the side of the second bank BB via the junction hose 45.

[0028] Besides, a fast idle control valve 47 is provided to the throttle body 34A corresponding to the first bank BA so that the fast idle control valve is located on the reverse side to the fuel injection valve 41A attached to the throttle body 34A, that is, on the side of the first bank BA.

[0029] One ends of connecting pipes 48A, 48B such as a hose for leading the intake pressure of the intake passages 40A, 40B which the intake passage components 31A, 31B form are connected to the throttle bodies

34A, 34B in both intake passage components 31A, 31B so that one ends communicate with the intake passages 40A, 40B on the downstream sides of the throttle valves 32A, 32B, the other ends of both connecting pipes 48A, 48B are made to communicate with a collecting pipe member 49 formed substantially in a T type for example in common, and the collecting pipe member 49 is connected to a single intake pressure sensor 51 supported by the main frame 13 on the right side next to the throttle body 34A on the side of the first bank BA for example via a pipe 50.

[0030] As shown in Fig. 6(a), the ignition timing of the cylinders CA, CB of both banks BA, BB is set so that the cylinder CB on the side of the second bank BB is ignited in a short firing interval T1 after the ignition of the cylinder CA on the side of the first bank BA and further, the cylinder CA on the side of the first bank BA is ignited in a long firing interval T2 (> T1) after the ignition of the cylinder CB on the side of the second bank BB, and the length of the connecting pipe 48B one end of which communicates with the intake passage 40B of the cylinder on the side ignited later out of the two cylinders CA, CB the firing intervals of which are the shortest, that is, the cylinder CB on the side of the second bank BB is set so that the length is longer than the length of the other connecting pipe, that is, the connecting pipe 48A one end of which communicates with the intake passage 40A of the cylinder CA on the side of the first bank BA.

[0031] Next, to explain the action of this embodiment, as the throttle shafts 33A, 33B turnably supported by the throttle bodies 34A, 34B forming at least a part of the intake passage components 31A, 31B individually corresponding to the cylinders CA, CB of both banks BA, BB are coaxially arranged so that they cross the axis C of the crankshaft 30 in the top view, are interlocked and coupled and in addition, the center lines CLA, CLB of the intake passages 40A, 40B which each intake passage component 31A, 31B forms are arranged on the straight lines perpendicular to the axes of the throttle shafts 33A, 33B in the top view, intake resistance in the intake passages 40A, 40B is inhibited to be a small value and contribution to enhancing the output of the engine is enabled.

[0032] Besides, as the center lines CLA, CLB of the intake passages 40A, 40B pass the intermediate part between each pair of intake valve openings 39A ..., 39B ... with which each cylinder CA, CB is provided, intake air is also uniformly distributed to the intake valve openings 39A ..., 39B ... in a type that the cylinder heads 22A, 22B of each bank BA, BB are provided with each pair of plural intake valve openings 39A ..., 39B ... and the center lines CLA, CLB of the intake passages 40A, 40B can be linearly arranged reasonably in the top view.

[0033] Besides, as the fuel injection valves 41A, 41B located on the reverse sides to the cylinder heads 22A, 22B of the banks BA, BB corresponding to the throttle bodies 34A, 34B are attached to each throttle body 34A, 34B, the fuel injection valves 41A, 41B are arranged in relatively large space made between each cylinder head

22A, 22B and each throttle body 34A, 34B and work for attaching and detaching each fuel injection valve 41A, 41B to/from each throttle body 34A, 34B can be facilitated.

[0034] Besides, as the fuel injection valves 41A, 41B corresponding to both banks BA, BB respectively provided with only one cylinder are attached to each throttle body 34A, 34B in arrangement that the connectors for connecting a conductor 42A, 42B of the fuel injection valves 41A, 41B are directed toward the side of the motorcycle, work for connection and disconnection to/from the connectors for connecting a conductor 42A, 42B with which each fuel injection valve 41A, 41B is provided is facilitated, and ease of assembly and maintainability can be enhanced.

[0035] Further, one ends of the connecting pipes 48A, 48B for leading the intake pressure of the intake passages 40A, 40B are made to communicate with the intake passages 40A, 40B individually corresponding to each cylinder CA, CB and the single intake pressure sensor 51 is connected to the collecting pipe member 49 with which the other end of each connecting pipe 48A, 48B is made to communicate in common, however, both cylinders CA, CB are sequentially ignited at ignition timing at a firing interval in which two different firing intervals are mixed and the length of the connecting pipe 48B one end of which communicates with the intake passage 40B of the cylinder on the side ignited later out of the two cylinders the firing intervals of which are the shortest, that is, the cylinder on the side of the second bank BB is set so that the length is longer than the length of the other connecting pipe, that is, the connecting pipe 48A one end of which communicates with the intake passage 40A on the side of the first bank BA.

[0036] Therefore, an intake pressure pulse of the cylinder CB on the side ignited later out of the two cylinders ignited at the shortest firing interval acts on the intake pressure sensor 51 at an interval corresponding to the shortest firing interval T1 as shown by a chain line in case the length of the connecting pipes 48A, 48B is equal, while as shown by a full line in Fig. 6(b), the above-mentioned intake pressure pulse acts on the intake pressure sensor 51 at an interval longer than the shortest firing interval between an intake pressure pulse of the cylinder CA on the side ignited earlier out of the two cylinders ignited at the shortest firing interval and the above-mentioned intake pressure pulse as shown by a full line because the connecting pipe 48B for leading an intake pressure pulse is longer than the other connecting pipe 48A. Therefore, an interval between intake pressure pulses that act on the intake pressure sensor 51 is prevented from being too short and the intake pressure of each cylinder CA, CB can be detected satisfactorily.

[0037] In addition, as the length of the connecting pipe 48B of a part is different, the position of the collecting pipe member 49 to which both connecting pipes 48A, 48B are connected in common can be set relatively freely and a degree of freedom in the arrangement of the col-

lecting pipe member 49 can be enhanced.

[0038] In addition, as structure that the connecting pipes 48A, 48B are different in length is applied to the engine E the body 20 of which is formed in a V type, effect acquired by enhancing a degree of freedom in the arrangement of the collecting pipe member 49 is made more effective in the V-type engine in which the length of each connecting pipe 48A, 48B is often extended because of a constraint on a layout.

[0039] The embodiment of the invention has been described above, however, the invention is not limited to the embodiment and various design modifications without deviating from the invention disclosed in the scope of claims are allowed.

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22A, 22B	Cylinder head
30	Crankshaft
31A, 31B	Intake passage component
32A, 32B	Throttle valve
33A, 33B	Throttle shaft
34A, 34B	Throttle body
39A, 39B	Intake valve opening
40A, 40B	Intake passage
41A, 41B	Fuel injection valve
42A, 42B	Connector for connecting conductor
BA, BB	Bank
C	Axis of crankshaft
CA, CB	Cylinder
CLA, CLB	Center line of intake passage

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Claims

1. An intake system of a V-type engine for a vehicle where a pair of front and rear banks (BA, BB) are arranged in a V type in a plane perpendicular to the axis (C) of a crankshaft (30) and intake passage components (31A, 31B) at least provided with throttle bodies (34A, 34B) for turnably supporting throttle shafts (33A, 33B) to which throttle valves (32A, 32B) are fastened and individually corresponding to each cylinder (CA, CB) are connected onto an inside surface of a cylinder head (22A, 22B) of each bank (BA, BB) and are arranged between both banks (BA, BB), wherein:

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a plurality of throttle shafts (33A, 33B) supported by each throttle body (34A, 34B) so that the throttle shafts can be turned are arranged coaxially so that they are crossed with the axis (C) of the crankshaft (30) when they are viewed from the top; and
center lines (CLA, CLB) of intake passages (40A, 40B) which each intake passage component (31A, 31B) forms are arranged on straight lines perpendicular to the axes of the throttle shafts (33A, 33B) when they are viewed from the top.

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2. The intake system of a V-type engine for a vehicle according to Claim 1, wherein:

each bank (BA, BB) is provided with each cylinder head (22A, 22B) in which a plurality of intake valve openings (39A, 39B) per cylinder (CA, CB) are provided; and
each center line (CLA, CLB) of the intake passages (40A, 40B) is arranged so that each center line passes an intermediate part of the plurality of intake valve openings (39A, 39B) with which each cylinder (CA, CB) is provided when each center line is viewed from the top.

3. The intake system of a V-type engine for a vehicle according to Claim 1 or 2, wherein:

a fuel injection valve (41A, 41B) located on the reverse side to a cylinder head (22A, 22B) of a bank (BA, BB) corresponding to each throttle body (34A, 34B) is attached to each throttle body (34A, 34B).

4. The intake system of a V-type engine for a vehicle according to any of the preceding claims, wherein:

the fuel injection valves (41A, 41B) corresponding to both banks (BA, BB) respectively provided with only one cylinder (CA, CB) are attached to each throttle body (34A, 34B) in arrangement that connectors for connecting a conductor (42A, 42B) of the fuel injection valves (41A, 41B) are directed toward the side of the vehicle.

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Fig. 1

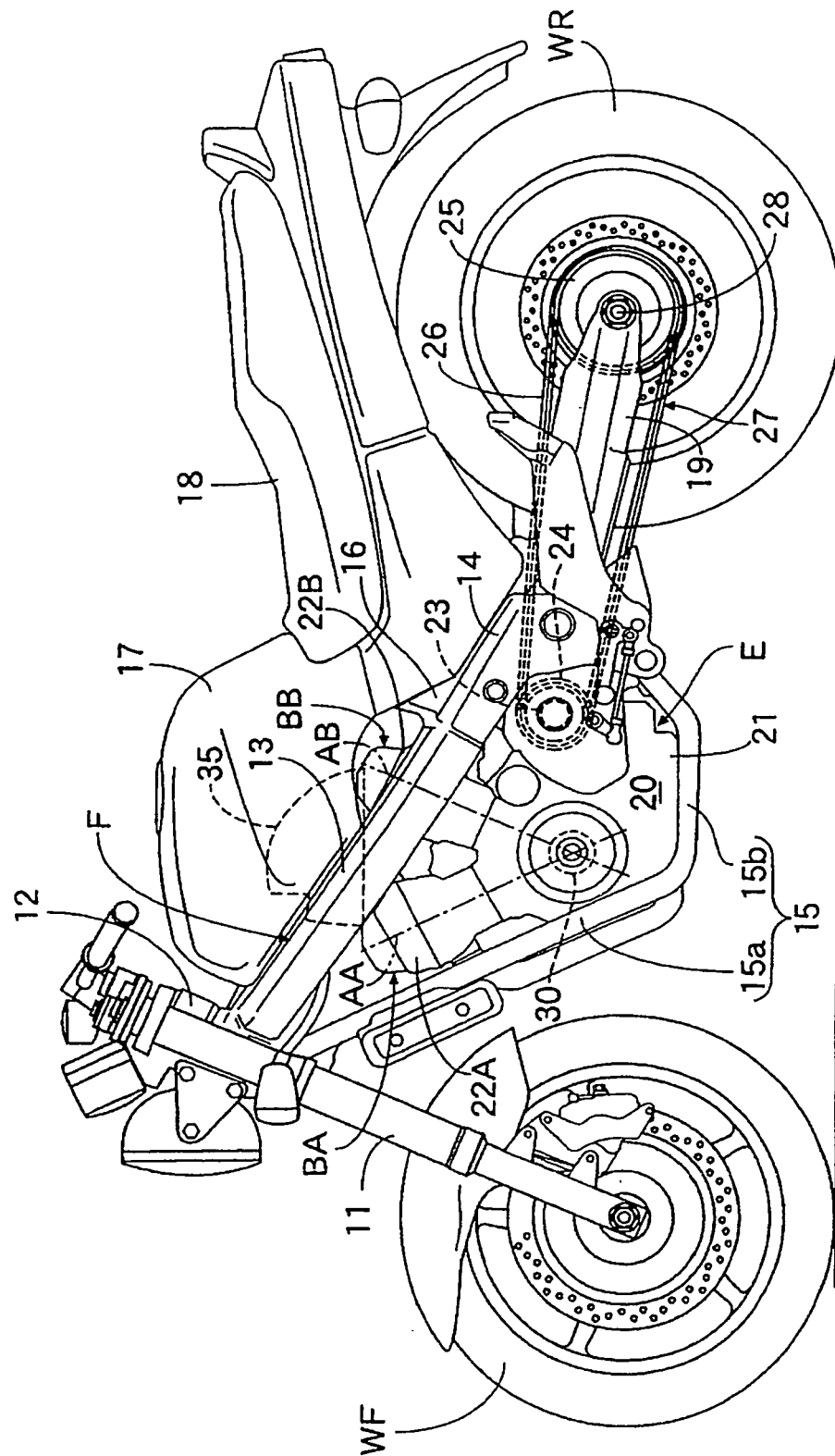


Fig. 2

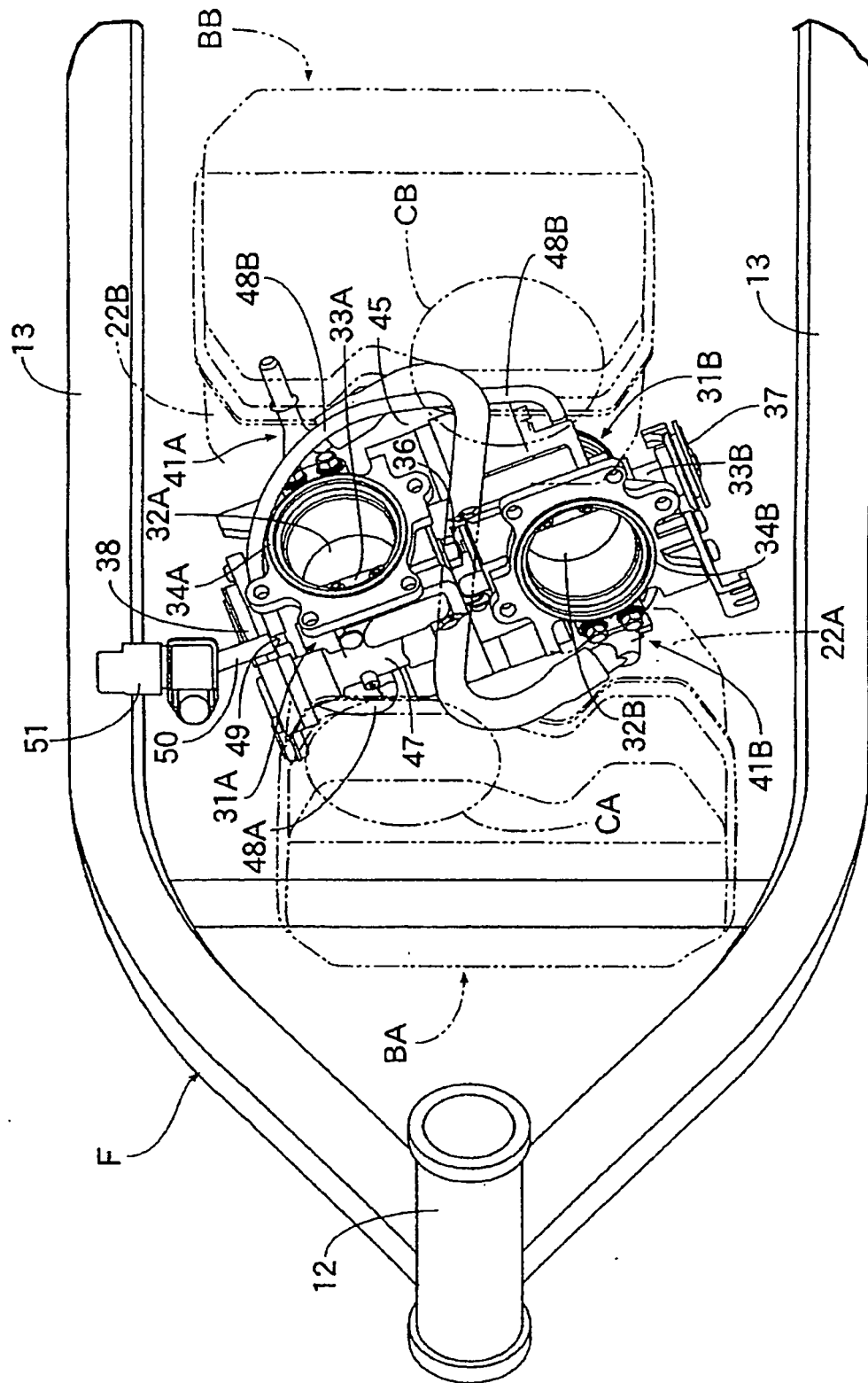


Fig. 3

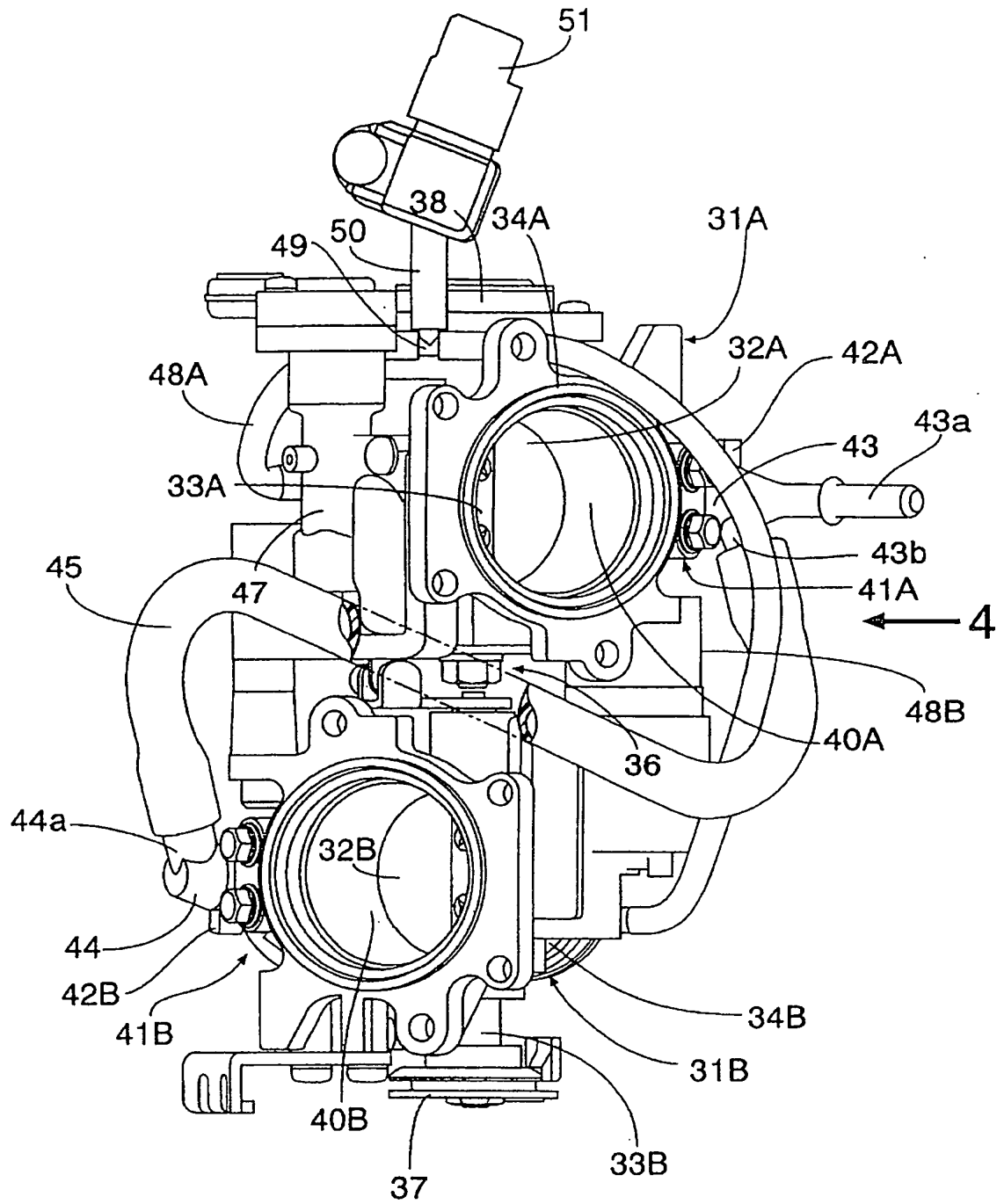


Fig. 4

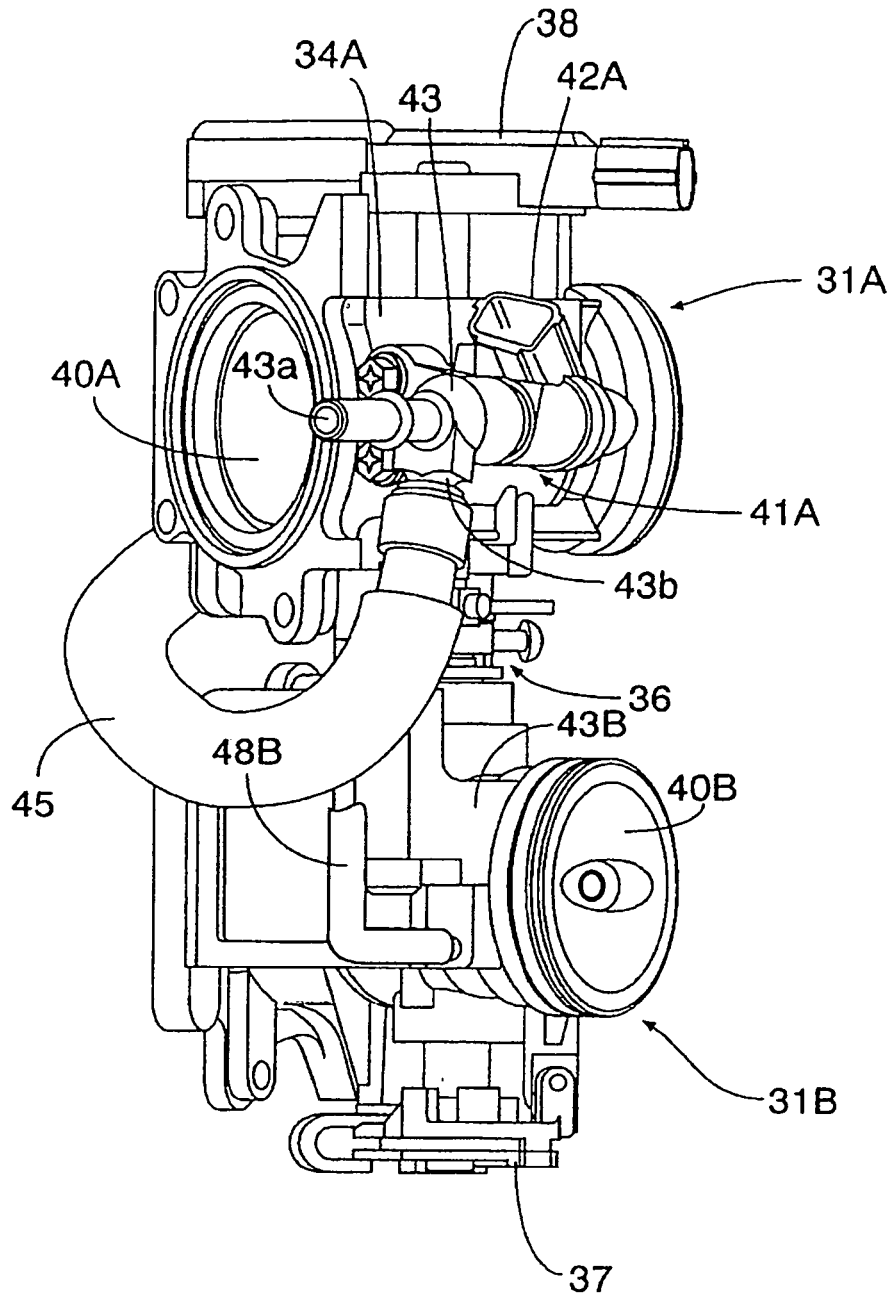


Fig. 5

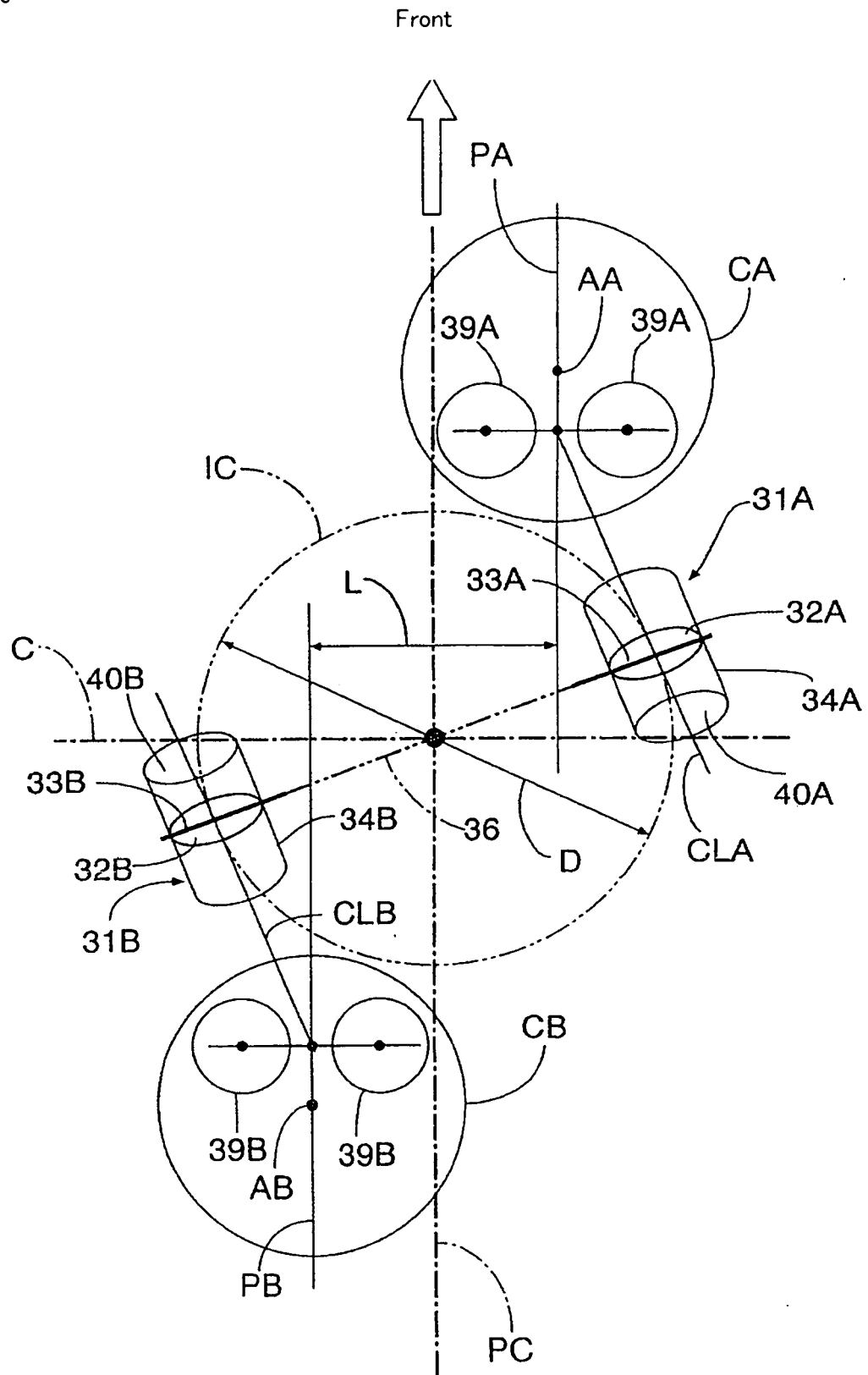
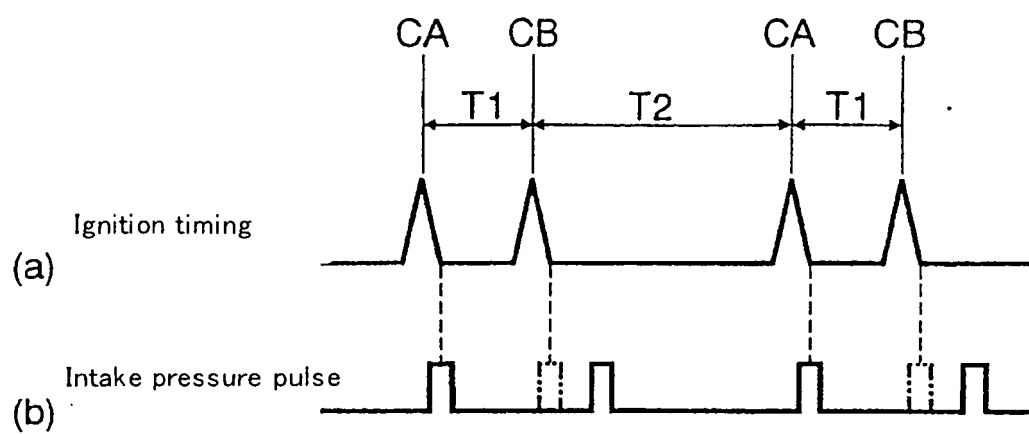


Fig. 6





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 05 00 9813

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 6 205 986 B1 (NOJIMA TETSUO ET AL) 27 March 2001 (2001-03-27) * the whole document *	1	F02B27/02 F02B75/22
D,A	----- PATENT ABSTRACTS OF JAPAN vol. 2000, no. 10, 17 November 2000 (2000-11-17) & JP 2000 204969 A (YAMAHA MOTOR CO LTD), 25 July 2000 (2000-07-25) * abstract * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F02B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 August 2005	Examiner Clasen, M
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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EPO FORM 1503 03.82 (F04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 05 00 9813

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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30-08-2005

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82