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

(11) EP 1 655 484 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.05.2006 Bulletin 2006/19

(21) Application number: **05024087.8**

(22) Date of filing: **04.11.2005**

(51) Int Cl.:
F02M 69/04 *(2006.01)* ***F02M 61/14*** *(2006.01)*
F02M 69/32 *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **04.11.2004 JP 2004320254**

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(54) **Vehicle**

(57) The present invention relates to a Vehicle comprising an introduction port, through which air is introduced to an intake chamber, an intake passage, which includes an opening opened into the intake chamber and through which an air in the intake chamber is led from the opening to an engine, fuel feed device having an injector that jets a fuel toward the opening from between the introduction port and the opening in the intake chamber, and a tubular jet protection member arranged between the injector and the opening in the intake chamber to protect a fuel jetted from the injector and passing therethrough toward the opening.

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a vehicle, and in particular to a fuel feed device that feeds a fuel to an engine, and a vehicle provided with the same.

[0002] Conventionally, a fuel injection type engine provided with an injector is known. Usually, an engine of this type comprises an intake passage directed toward a combustion chamber of the engine from an air cleaner, and an injector (referred below to as a downstream injector) provided on a downstream side of the intake passage. Since the downstream injector is arranged in a position close to the combustion chamber, however, a fuel jetted from the downstream injector flows, in some cases, into the engine while being not adequately atomized.

[0003] On the other hand, a fuel feed device is also known, in which an injector is provided on an upstream side of an intake passage (for example, see JP-A-10-196494 and JP-A-2004-100632). With the fuel feed device disclosed in these documents, an upstreamside opening of the intake passage is opened in an air cleaner, and the injector (referred below to as an upstream injector) is provided in a position away from the opening in the air cleaner.

[0004] With the fuel feed device disclosed in these documents, an improvement in engine performance is achieved by making use of the upstream injector, as by using the upstream injector to replenish a fuel injection quantity, which is short only with the downstream injector.

[0005] By the way, when an upstream injector is to be arranged, it must be taken account of that a fuel jetted from the upstream injector is scattered outside an intake passage (this phenomenon is referred below to as "blowing-over") due to turbulence of an air flow in, for example, an air cleaner. Hereupon, it is conceivable as a method of restricting blowing-over to restrict a quantity of a fuel jetted from the upstream injector.

[0006] When a quantity of a fuel jetted from the upstream injector is restricted, however, there is a fear that a quantity of a fuel fed to a combustion chamber becomes short. Therefore, it is difficult to achieve a sufficient improvement in engine performance.

[0007] The invention has been thought of in view of the matter and has its object to restrict blowing-over of a fuel from an upstream injector while achieving a sufficient improvement in engine performance.

[0008] This objective is solved in an inventive manner by a vehicle comprising an introduction port, through which air is introduced to an intake chamber, an intake passage, which includes an opening opened into the intake chamber and through which an air in the intake chamber is led from the opening to an engine, fuel feed device having an injector that jets a fuel toward the opening from between the introduction port and the opening in the intake chamber, and a tubular jet protection member arranged between the injector and the opening in the intake chamber to protect a fuel jetted from the injector and passing therethrough toward the opening.

[0009] Preferably, the tubular member includes a downstream end positioned toward the intake passage, and wherein an outside diameter of the downstream end is smaller than an inside diameter of the opening of the intake passage.

[0010] Further, preferably the injector includes a nozzle portion formed with a jet port, through which a fuel is jetted. Therein, the tubular member might include an upstream end positioned toward the injector, wherein an inside diameter of the upstream end of the tubular member is larger than an outside diameter of the nozzle portion. Therein, the upstream end of the tubular member further might be formed to be bell-mouth-shaped.

[0011] Still further, preferably the nozzle portion is surrounded by the tubular member.

[0012] Yet further, preferably the tubular member and the intake passage are separable from or separated from each other.

[0013] According to another embodiment, the opening of the intake passage is formed to be bell-mouth-shaped.

[0014] According to still another embodiment, the tubular member includes an upstream end positioned toward the injector, and wherein both, the upstream end of the tubular member and the opening of the intake passage, are formed to be bell-mouth-shaped.

[0015] In the following, the present invention is explained in greater detail with respect to several embodiments thereof in conjunction with the accompanying drawings, wherein:

Fig. 1 is a side view showing a motorcycle,

Fig. 2 is a cross sectional view showing a fuel feed device,

Fig. 3 is a cross sectional view showing the fuel feed device,

Fig. 4 is a plan view showing an interior of the fuel feed device,

Fig. 5 is a conceptual view showing a part of a fuel feed device according to a modification,

Fig. 6 is a conceptual view showing a part of a fuel feed device according to a further modification.

Fig. 7 is a conceptual view showing a part of a fuel feed device according to a further modification, and

Fig. 8 is a conceptual view showing a part of a fuel feed device according to a further modification.

[0016] An embodiment will be described in detail with reference to the drawings.

[0017] As shown in Fig. 1, a motorcycle 100 comprises an air intake port 1, through which an air is taken in, an air cleaner 5, an engine body 13, and a muffler 17. The air intake port 1 and the air cleaner 5 are connected to each other through an intake duct 3. The air cleaner 5 and combustion chambers 13c (see Fig. 2, not shown in Fig. 1) of the engine body 13 are connected to each other through intake passages 9. The combustion chambers 13c and the muffler 17 are connected to each other through an exhaust passage 15. Upstream injectors 7 are arranged inside the air cleaner 5 and downstream injectors 11 are arranged inside the intake passages 9. The engine 13 is a parallel 4-cylinder engine and the four intake passages 9 are provided along in a vehicle breadth direction (a front-back surface direction in Fig. 1).

[0018] As shown in Fig. 2, a fuel feed device according to the embodiment comprises the air cleaner 5, the upstream injectors 7, cylinders 23, second funnels 25, the intake passages 9, and the downstream injectors 11.

[0019] The air cleaner 5 comprises a lower bowl-shaped casing 4 opened upward, and an upper bowl-shaped casing 2 opened downward. The upper casing 2 and the lower casing 4 are joined together in a state, in which mutual peripheral edges are butted against each other. Thereby, an intake chamber 12 is compartmented inside the upper casing 2 and the lower casing 4. An element 8 is arranged inside the intake chamber 12 to remove dust and impurities contained in the air.

[0020] An introduction port 10, through which an air is introduced, is formed on a front side (the left side in Fig. 2) of the lower casing 4. Also, four through-holes 22 aligned in the vehicle breadth direction are formed on a rear portion of a bottom surface of the lower casing 4.

[0021] As described above, the four intake passages 9 aligned in the vehicle breadth direction are formed in the engine. The respective intake passages 9 comprise a first funnel 24 fitted into the through-hole 22, a throttle body 26 fitted into the first funnel 24, a joint member 36 connected to a downstream end of the throttle body 26, and an intake port 13f connected to a downstream end of the joint member 36. The first funnel 24 is opened into the intake chamber 12 to form openings of the intake passages 9. A throttle valve 28 is provided inside the throttle body 26.

[0022] The intake port 13f is communicated to the combustion chamber 13c. Arranged in the intake port 13f is an intake valve 13b driven by an intake cam 13a. Also, an exhaust passage 15 (not shown in Fig. 2, see Fig. 1) is communicated to the combustion chamber 13c. Provided in an exhaust port (not shown) of the exhaust passage 15 is an exhaust valve 13e driven by an exhaust cam 13d.

[0023] A mount 26b, to which the downstream injector 11 is mounted, is formed on a portion of the throttle body 26 downstream of the throttle valve 28. The downstream injector 11 is mounted to the mount 26b and a nozzle 11 a of the downstream injector 11 is extended inside the intake passage 9. Accordingly, the downstream injector 11 jets a fuel downstream of the throttle valve 28.

[0024] A separate chamber cover 14 is mounted to an inner surface of a rear portion of the upper casing 2. A separate chamber 16 is compartmented between the separate chamber cover 14 and the upper casing 2, and the upstream injectors 7 are arranged in the separate chamber 16. However, nozzles 7a of the upstream injectors 7 extend through the separate chamber cover 14 to extend to the intake chamber 12. The upstream injector 7 is arranged so as to jet a fuel inside the first funnel 24.

[0025] An obliquely upwardly projecting support base 18 is formed on the bottom surface of the rear portion of the lower casing 4. The support base 18 mounts thereto support rods 19 extending in parallel to a direction, in which the first funnels 24 are opened. A support plate 20 extending in the vehicle breadth direction (a front-back surface direction in Fig. 2) is fixed to upper ends of the support rods 19 with bolts 21. As shown in Fig. 4, four second funnels 25 aligned in the vehicle breadth direction are fixed to the support plate 20.

[0026] Like the first funnels 24, the second funnels 25 comprise a cylindrical-shaped body, an upper end of which is formed to be bell-mouth-shaped. In the embodiment, the second funnels 25 are substantially the same in inside diameter as the first funnels 24. Also, the second funnels 25 are substantially the same in outside diameter as the first funnels 24. However, the first funnels 24 and the second funnels 25 may be different in inside or outside diameter from each other.

[0027] The second funnels 25 are arranged between the nozzles 7a of the upstream injectors 7 and upstream ends of the first funnels 24. Also, the second funnels 25 are arranged on extensions of the first funnels 24. That is, the second funnels 25 are arranged to be coaxial with the first funnels 24. The second funnels 25 are arranged in positions away from the first funnels 24, and clearances are defined between the upstream ends of the first funnels 24 and the downstream ends of the second funnels 25.

[0028] Cylinders 23 made of aluminum are inserted inside the second funnels 25. The cylinders 23 are also arranged between the nozzles 7a of the upstream injectors 7 and the upstream ends of the first funnels 24. The cylinders 23 are arranged to be coaxial with the first funnels 24 and the second funnels 25. The cylinders 23 have a length substantially equal to a distance between the upstream ends of the first funnels 24 and the downstream ends of the second funnels 25.

[0029] As described later, the cylinders 23 are freely moved in an axial direction. Specifically, the cylinders 23 are moved between positions (see Fig. 2), in which lower ends thereof are fitted into the first funnels 24, and positions (see Fig. 3), in which the lower ends thereof are away from the first funnels 24.

[0030] The cylinders 23 have an outside diameter substantially equal to an inside diameter of the second funnels 25. Therefore, no clearances are substantially formed between the cylinders 23 and the second funnels 25. Accordingly, while the cylinders 23 are freely moved axially, the cylinders 23 and the second funnels 25 are contiguous to each other.

[0031] Also, the cylinders 23 have an outside diameter substantially equal to an inside diameter of the first funnels 24. Therefore, when the cylinders 23 are fitted into the first funnels 24, the cylinders 23 are made contiguous to the first funnels 24. Irrespective of positions of the cylinders 23, the cylinders 23 are contiguous to the second funnels 25. Accordingly, when the cylinders 23 are fitted into the first funnels 24, the first funnels 24 and the second funnels 25 are made contiguous to each other through the cylinders 23, so that intake paths become longer than the intake passages 9.

[0032] In a state, in which the cylinders 23 are away from the first funnels 24, the upstream ends of the first funnels 24 serve as opened ends of the intake paths. On the other hand, in a state, in which the cylinders 23 are fitted into the second funnels 25, the upstream ends of the second funnels 25 serve as opened ends of the intake paths. Hereinbelow, a state (see Fig. 3), in which the cylinders 23 are away from the first funnels 24, is referred to a short state, and a state (see Fig. 2), in which the cylinders 23 are fitted into the first funnels 24, is referred to a long state. In addition, the cylinders 23 and the second funnels 25 in the short state correspond to tubular members of the embodiment.

[0033] As described above, the cylinders 23 are positioned between the nozzles 7a of the upstream injectors 7 and the first funnels 24. The nozzles 7a are arranged obliquely upward from the upstream ends of the cylinders 23. More specifically, the nozzles 7a are arranged in positions distant a predetermined distance from the upstream ends of the cylinders 23 in an axial direction of the cylinders 23. Also, the nozzles 7a are arranged centrally in openings of the cylinders 23 as viewed in the axial direction of the cylinders 23. That is, the nozzles 7a jet a fuel toward centers of the cylinders 23 from positions away from the upstream ends of the cylinders 23. In addition, a fuel jetted from the nozzles 7a pass through the cylinders 23 to flow into the intake passages 9. In this manner, the cylinders 23 are arranged in positions, in which a fuel jetted from the upstream injectors 7 is led to the intake passages 9.

[0034] The cylinders 23 project obliquely upward from the second funnels 25 in the short state (see Fig. 3). In the embodiment, the nozzles 7a are positioned obliquely upward from upper ends of the cylinders 23 in the short state. Accordingly, the nozzles 7a jet a fuel toward positions distant obliquely upwardly from the cylinders 23 at all times.

[0035] Also, the nozzles 7a jet a fuel in a manner to have the same spreading upstream of the upstream ends of the cylinders 23. Such configuration of jetting can be readily realized by appropriately setting a diameter of the nozzles 7a, a distance of the nozzles 7a from the cylinders 23, a jetting direction of the nozzles 7a, a jet velocity, etc.

[0036] Subsequently, an explanation will be given to a moving mechanism 40 that moves the cylinders 23. As shown in Fig. 4, a connection rod 27 extending in the vehicle breadth direction is mounted to the cylinders 23. The connection rod 27 extends through the respective cylinders 23 to connect the four cylinders 23 together. As shown in Fig. 2, slots 29 extending in the axial direction of the second funnels 25 are formed on both sides of the second funnels 25 in the vehicle breadth direction. The connection rod 27 is arranged in the slots 29.

[0037] A longitudinally central portion of the connection rod 27 is supported rotatably on one end of a lever 30 extending in a longitudinal direction (a left and right direction in Fig. 2). A cam bearing roller 31 projecting laterally is provided on the other end of the lever 30. A cam 32 and a motor 33 for rotation of the cam 32 are arranged on the other end side of the lever 30. The cam 32 is arranged above the cam bearing roller 31 to contact with the cam bearing roller 31. A middle portion of the lever 30 is supported rotatably on a support shaft 34, and a spring 35 is mounted on a rear side of the support shaft 34 to pull the other end of the lever 30 upward.

[0038] When the other end of the lever 30 is lifted by the spring 35, the cylinders 23 are pushed obliquely downward. As a result, the cylinders 23 are fitted into the first funnels 24 to put the intake paths in the long state. On the other hand, when the cam 32 rotates to push down the other end of the lever 30, the cylinders 23 are pushed obliquely upward. As a result, the cylinders 23 get out from the first funnels 24 and the intake paths are put in the short state.

[0039] In addition, the reference numeral 60 denotes a controller that controls injection of the upstream injectors 7 and the downstream injectors 11 and the moving mechanism 40.

[0040] Subsequently, an explanation will be given to a fuel feeding operation of the fuel feed device.

[0041] An air introduced from the introduction port 10 of the air cleaner 5 is purified by the element 8 and then sucked into the intake passages 9. At this time, when the intake paths are put in the long state, an air is sucked from the second funnels 25. On the other hand, when the intake paths are put in the short state, an air is sucked from the first funnels 24. More specifically, a part of the air passes through the second funnels 25 and the cylinders 23 and is then sucked into the first funnels 24, and the remainder of the air is sucked into the first funnels 24 through clearances between the first funnels 24 and the second funnels 25.

[0042] In the intake stroke of the engine body 13, the intake valves 13b are opened by the intake cams 13a and a fuel is jetted from one of the upstream injectors 7 and the downstream injectors 11.

[0043] A fuel jetted from the upstream injectors 7 passes inside the second funnels 25 and the cylinders 23 to flow into the intake passages 9 from the first funnels 24. A fuel inflowing from the first funnels 24 is fed to the combustion chambers 13c via the throttle bodies 26 and the intake ports 13f.

[0044] According to the embodiment, when the intake paths are put in the short state, blowing-over of a fuel from the upstream injectors 7 is restricted by the cylinders 23. That is, even when a fuel from the upstream injectors 7 is scattered outside due to turbulence of an air flow in the air cleaner 5, the fuel adheres to inner peripheral surfaces of the cylinders 23 and is then sucked into the intake passages 9. Accordingly, there is less fear that a fuel scattered blows over. Therefore, expediting atomization of a fuel and prevention of blowing-over of a fuel are made compatible with each other, so that it is possible to restrict blowing-over of a fuel while achieving a sufficient improvement in engine performance.

[0045] Also, the upstream ends of the cylinders 23 have an inside diameter larger than an outside diameter of the nozzles 7a. Therefore, when a fuel is jetted from the nozzles 7a, an air inflows from between edges of the upstream ends of the cylinders 23 and outer peripheries of the nozzles 7a. Thereby, spreading of a fuel from the nozzles 7a is suppressed by the inflowing air. Accordingly, blowing-over is restricted. Also, the inflowing air expedites atomization of a fuel.

[0046] Also, according to the embodiment, downstream ends of the cylinders 23 have an outside diameter smaller than an inside diameter of the upstream ends of the first funnels 24. Therefore, there is no fear that a fuel flowing downstream of the cylinders 23 scatters outside the first funnels 24, so that blowing-over is further restricted.

[0047] In addition, since the upstream ends of the second funnels 25 are formed to be bell-mouth-shaped, the inflowing air can be led smoothly and inflow of an air can be expedited by using the second funnels 25 as tubular members for prevention of blowing-over, in place of the cylinders 23 (see Fig. 5). Also, since the second funnels 25 makes it possible to suck an air from a relatively large region, scattering of a fuel as jetted can be suppressed by the inflowing air and blowing-over can be further effectively restricted. With the example shown in Fig. 5, upstream sides of both the tubular members (in this case, the second funnels 25) and the intake passages 9 are formed to be bell-mouth-shaped, so that the effect of smoothly leading an air is great.

[0048] Also, according to the embodiment, the cylinders 23 and the first funnels 24 separate completely from each other when the intake paths are put in the short state. Accordingly, as compared with the case where the cylinders 23 and the first funnels 24 are partially connected to each other, large opened areas of the intake passages 9 can be ensured to maintain the intake performance favorable.

[0049] In addition, according to the embodiment, the cylinders 23 are provided to axially move relative to the second funnels 25, and tubular members for prevention of blowing-over are formed by the cylinders 23. However, the tubular members are not limited to movable ones but may comprise of course ones that are stationary in fixed positions.

[0050] Also, the tubular members are not limited to round pipes but may comprise rectangular pipes. In addition, in the case where the tubular members, etc. are other than round pipes, a diameter means a hydraulic diameter. Further, the tubular members are not limited to pipes having a constant inside diameter but may comprise pipes having a inside diameter varying in an axial direction. For example, the tubular members may be cone-shaped or pyramid-shaped. Also, the tubular members may be a little curved as far as a fuel can be smoothly led to the intake passages 9.

[0051] According to the embodiment, the nozzles 7a of the upstream injectors 7 are separated obliquely upward from the upstream ends of the cylinders 23. As shown in Fig. 6, however, the nozzles 7a may get inside the tubular members 50. Thereby, blowing-over of a fuel is further restricted.

[0052] According to the embodiment, the cylinders 23 and the first funnels 24 separate from each other when the intake paths are put in the short state. As shown in, for example, Fig. 7, however, the tubular members 50 and the intake passages 9 may be partially connected to each other. That is, the tubular members 50 and the intake passages 9 may be made integral with each other. In addition, a configuration, in which the tubular members 50 and the intake passages 9 are connected to each other, is not especially limitative.

[0053] Also, as shown in Fig. 8, the tubular members 50 and the intake passages 9 may be made integral with each other and openings 51 thereof may be formed to be bell-mouth-shaped. Thereby, inflow of an air from the openings 51 can be made smooth.

[0054] In addition, the engine according to the embodiment comprise the upstream injectors 7 and the downstream injectors 11, and is a so-called twin injector type engine. However, the engine according to the invention may be one provided with only the upstream injectors 7.

[0055] According to the embodiment, the upstream injectors 7 are arranged inside the air cleaner 5. However, the upstream injectors 7 may be arranged outside the air cleaner 5 as far as a fuel is jetted inside the intake chamber 12.

[0056] The vehicle according to the embodiment comprises a motorcycle 100. However, the vehicle according to the embodiment is not limited to a motorcycle. In addition, a motorcycle referred herein includes a scooter, etc. in addition to a so-called motorbike.

[0057] As described above, the teaching of the embodiment is useful for a fuel feed device and a vehicle provided with the same.

[0058] The description above discloses (amongst others) an embodiment of a fuel feed device which comprises an intake chamber having an introduction port, through which an air is introduced, an intake passage, which includes an opening opened into the intake chamber and through which an air in the intake chamber is led from the opening to an engine, an injector that jets a fuel toward the opening from between the introduction port and the opening in the intake chamber, and a tubular member arranged between the injector and the opening in the intake chamber to permit a fuel jetted from the injector to pass therethrough toward the opening.

[0059] With the fuel feed device, a jet flow from the injector is surrounded by the tubular member. Therefore, blowing-over of a fuel is restricted by the tubular member. Accordingly, even when the injector is not made close to the opening of the intake chamber, it is possible to restrict blowing-over. Therefore, with the fuel feed device, it is possible to expedite atomization of a fuel and prevent blowing-over of a fuel in a compatible manner.

[0060] According to this embodiment, it is possible to restrict blowing-over of a fuel while achieving a sufficient improvement in engine performance.

[0061] According to a preferred embodiment, the tubular member includes a downstream end positioned toward the intake passage, and an outside diameter of the downstream end is smaller than an inside diameter of the opening of the intake passage.

[0062] According to a further preferred embodiment, the tubular member includes an upstream end positioned toward the injector, the injector includes a nozzle portion formed with a jet port, through which a fuel is jetted, and an inside diameter of the upstream end of the tubular member is larger than an outside diameter of the nozzle portion.

[0063] Therein, the upstream end of the tubular member may be formed to be bell-mouth-shaped.

[0064] According to another preferred embodiment, the injector includes a nozzle portion formed with a jet port, through which a fuel is jetted, and the nozzle portion is surrounded by the tubular member.

[0065] According to still another preferred embodiment, the tubular member and the intake passage are separated from each other.

[0066] According to yet another preferred embodiment, the opening of the intake passage is formed to be bell-mouth-shaped.

[0067] Further, preferably the tubular member includes an upstream end positioned toward the injector, and both the upstream end of the tubular member and the opening of the intake passage are formed to be bell-mouth-shaped.

[0068] The description also refers to a vehicle comprising the fuel feed device according to any one of the above embodiments.

[0069] In order to restrict blowing-over of a fuel while achieving a sufficient improvement in engine performance in a fuel feed device provided with an injector, which jets a fuel from an upstream side of an intake passage, the description discloses, as a particularly preferred embodiment, a fuel feed device which comprises an air cleaner 5 formed inside with an intake chamber 12, an intake passage 9 including a first funnel 24 opened to the intake chamber 12, an upstream injector 7 that jets a fuel to a position away from the first funnel 24, and a cylinder 23 arranged between the upstream injector 7 and the first funnel 24. The cylinder 23 is arranged in a position, in which a fuel jetted from the upstream injector 7 is led to the intake passage 9.

[0070] The description above still further discloses an embodiment of an engine comprising an engine body having a combustion chamber, an intake chamber having an introduction port, through which an air is introduced, an intake passage, which includes an opening opened into the intake chamber and through which the air in the intake chamber is led from the opening to the combustion chamber, an injector that jets a fuel between the introduction port and the opening, an exhaust passage, through which combustion gases are led from the combustion chamber, and a control mechanism that makes use of pressure waves generated in at least one of the intake passage and the exhaust passage to vary torque characteristics so as to eliminate valleys in a torque characteristic curve indicating a change in torque relative to a change in engine speed.

[0071] Preferably, the control mechanism varies the torque characteristics at a larger rate than that, at which the torque characteristics varies due to fuel injection of the injector.

[0072] The description yet further discloses an embodiment of an engine comprising an engine body having a combustion chamber, an intake chamber having an introduction port, through which an air is introduced, an intake passage, which includes an opening opened into the intake chamber and through which the air in the intake chamber is led from the opening to the combustion chamber, an injector that jets a fuel between the introduction port and the opening, and a control mechanism that exercises control to synchronize phase of pressure waves generated in the intake passage and timing of intake of the combustion chamber with each other.

[0073] The description above still further provides an embodiment of the engine comprising an engine body having a combustion chamber, an intake chamber having an introduction port, through which an air is introduced, an intake passage, which includes an opening opened into the intake chamber and through which the air in the intake chamber is led from the opening to the combustion chamber, an injector that jets a fuel between the introduction port and the opening, and a control mechanism that exercises control to synchronize phase of pressure waves generated in the exhaust passage and timing of exhaust of the combustion chamber with each other.

[0074] With the engine according to the above embodiment, an air flowing through the intake passage is evaporated and cooled by a fuel, which is jetted from the injector, over a relatively long period of time. Therefore, the air density is increased and the volumetric efficiency of the engine is enhanced. In addition, with the engine, the control mechanism adjusts the torque characteristics so as to eliminate valleys in a torque characteristic curve. Therefore, although injection of a fuel from the injector varies the period of pulsation waves in the intake passage, a decrease in torque is restricted. Accordingly, it is possible to demonstrate the effect of an increase in volumetric efficiency, produced by the injector, to the maximum, and so a great improvement in engine performance is achieved.

[0075] Accordingly, since the effect of an increase in volumetric efficiency, produced by the injector, can be demonstrated to the maximum, it is possible to greatly improve the engine performance.

Claims

1. Vehicle comprising
an introduction port, through which air is introduced to an intake chamber,
an intake passage, which includes an opening opened into the intake chamber and through which an air in the intake chamber is led from the opening to an engine,
fuel feed device having an injector that jets a fuel toward the opening from between the introduction port and the opening in the intake chamber, and
a tubular jet protection member arranged between the injector and the opening in the intake chamber to protect a fuel jetted from the injector and passing therethrough toward the opening.

2. Vehicle according to claim 1, wherein the tubular member includes a downstream end positioned toward the intake passage, and wherein an outside diameter of the downstream end is smaller than an inside diameter of the opening of the intake passage.

3. Vehicle according to claim 1 or 2, wherein the injector includes a nozzle portion formed with a jet port, through which a fuel is jetted.

4. Vehicle according to claim 3, wherein the tubular member includes an upstream end positioned toward the injector, and wherein an inside diameter of the upstream end of the tubular member is larger than an outside diameter of the nozzle portion.

5. Vehicle according to claim 4, wherein the upstream end of the tubular member is formed to be bell-mouth-shaped.

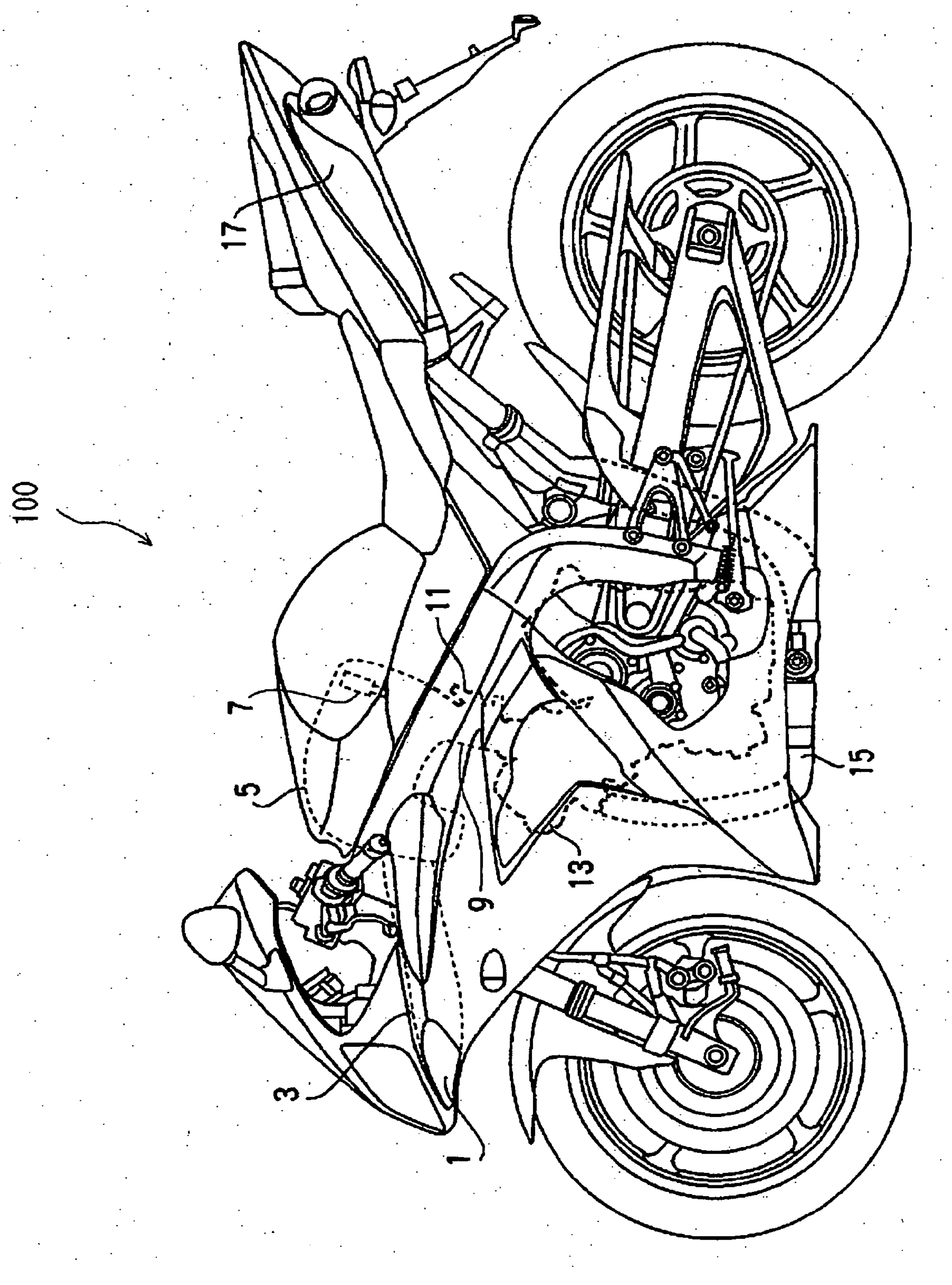
6. Vehicle according to one of the claims 3 to 5, wherein the nozzle portion is surrounded by the tubular member.

7. Vehicle according to one of the claims 1 to 6 , wherein the tubular member and the intake passage are separable from or separated from each other.

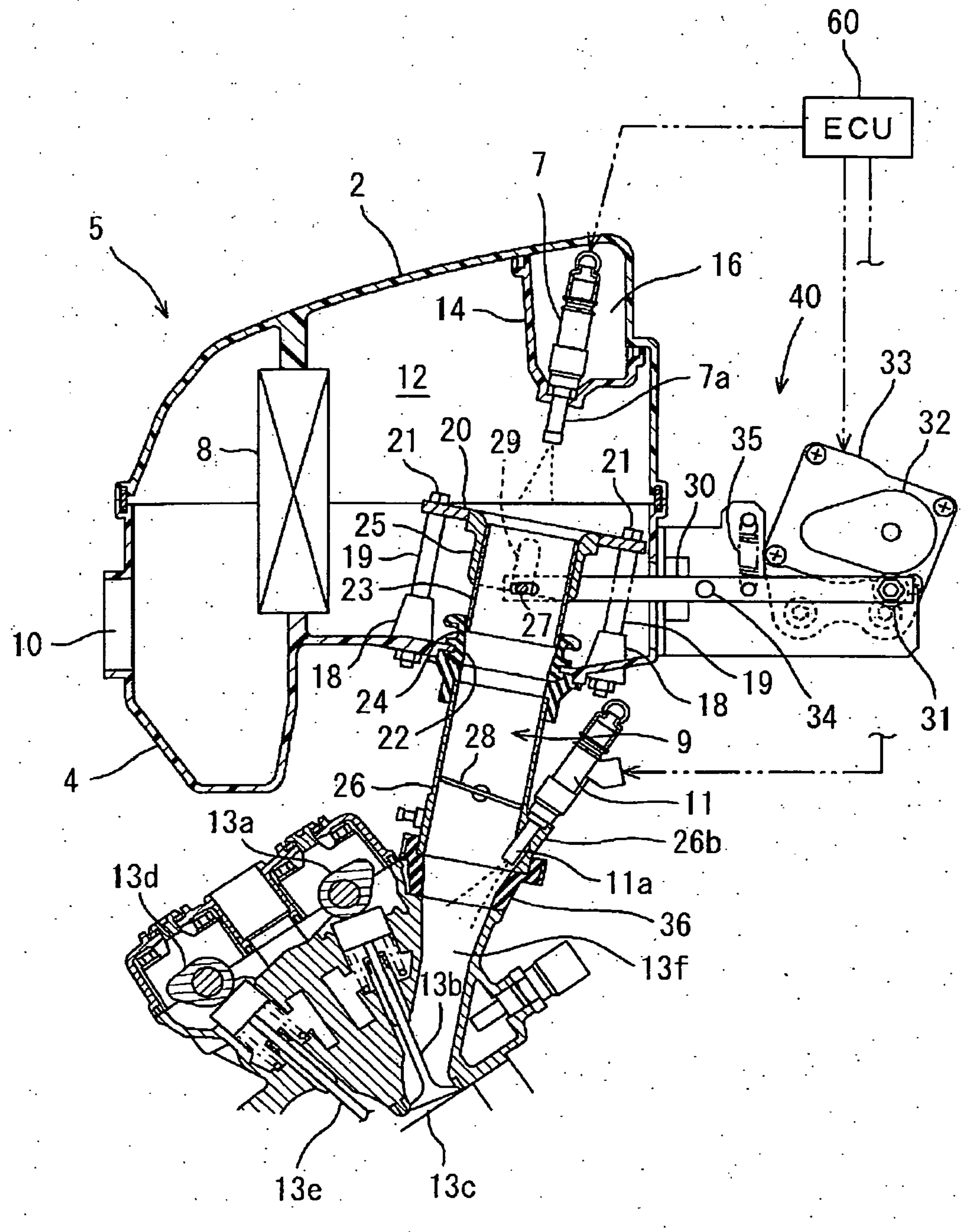
8. Vehicle according to one of the claims 1 to 7, wherein the opening of the intake passage is formed to be bell-mouth-shaped.

9. Vehicle according to one of the claims 1 to 8, wherein the tubular member includes an upstream end positioned toward the injector, and wherein both, the upstream end of the tubular member and the opening of the intake passage, are formed to be bell-mouth-shaped.

[Fig. 1]



[Fig. 2]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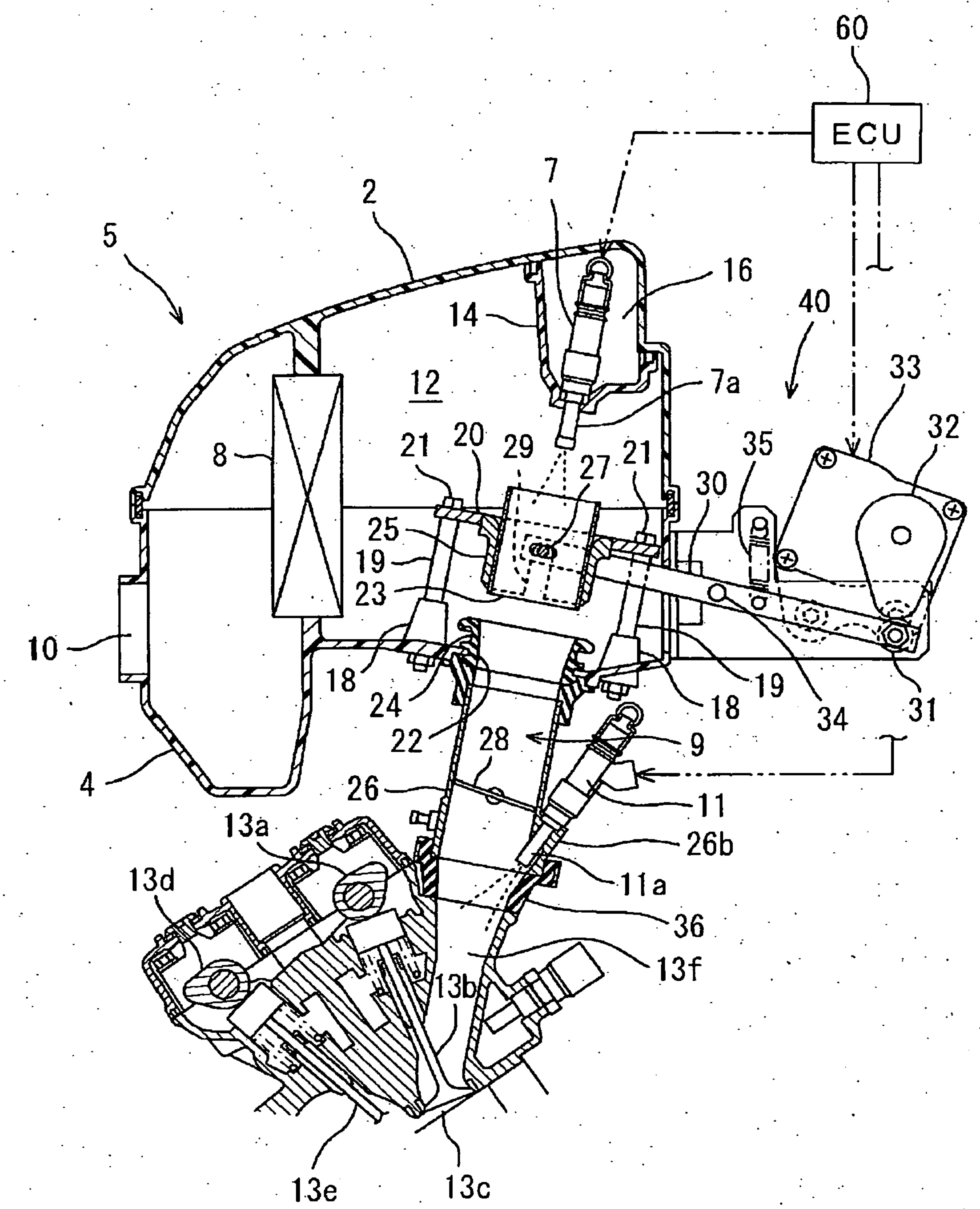
13c

[Fig. 3]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11a
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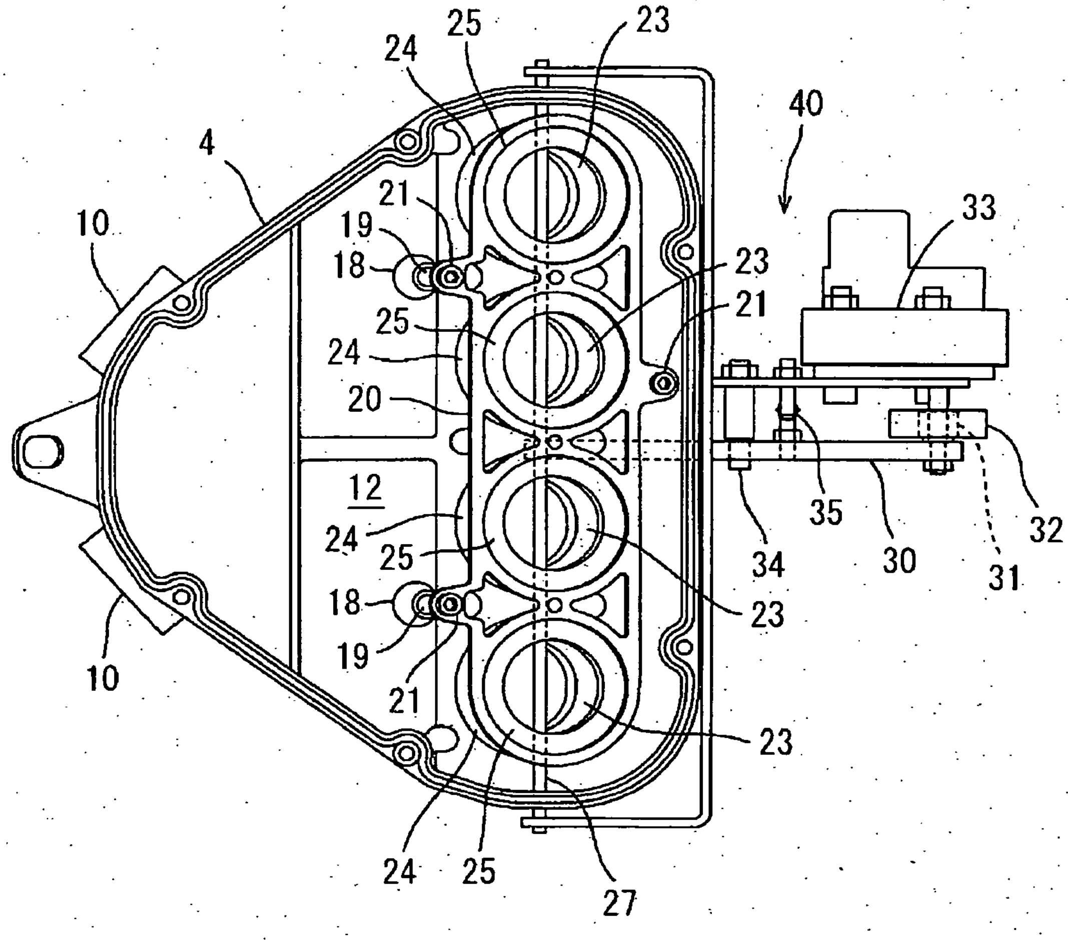
[Fig. 4]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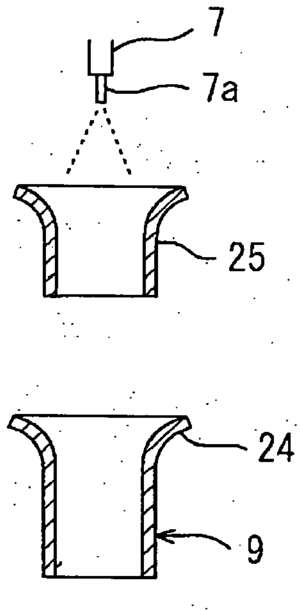
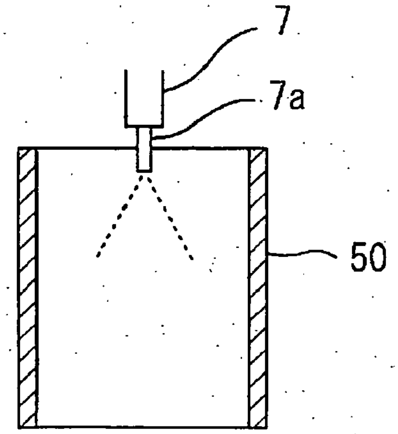
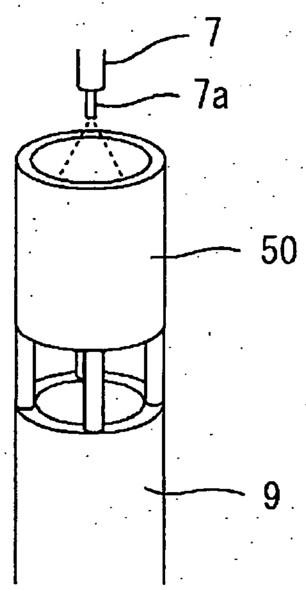
[Fig. 5]



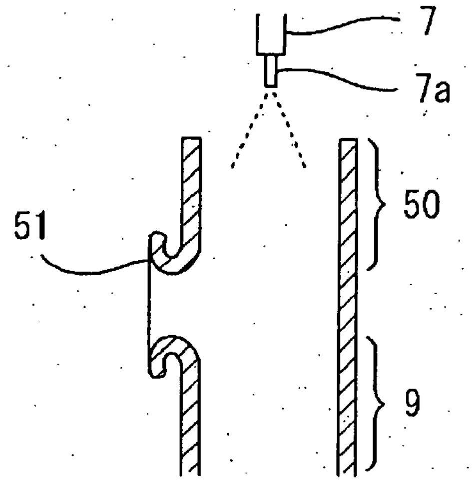
[Fig. 6]



[Fig. 7]



[Fig. 8]



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Application Number
EP 05 02 4087

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Place of search	Date of completion of the search	Examiner
Munich	1 December 2005	Etschmann, G

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