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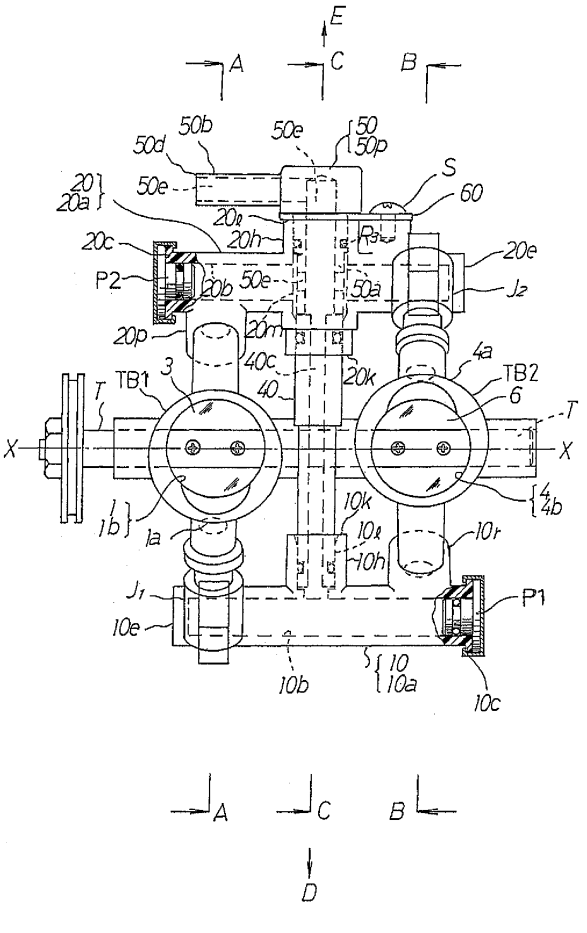
(54) **Throttle body in fuel injection apparatus**

(57) A productivity of a throttle body is improved by extremely easy fuel drawing in a first fuel distribution pipe holding a first fuel injection valve to one side wall of a first air intake passage, and a second fuel distribution pipe holding a second fuel injection valve to the other side wall of a second air intake passage. A first fuel distribution pipe (10) is provided with a first distribution tube portion (10a) in which a first fuel distribution path (10b) is provided, a first injection valve insertion tube portion (10d) having a first injection valve insertion hole (10g), and a first connection tube portion (10h) which is orthogonal to the first distribution tube portion (10a) and in which a first connection hole (10l) connected to the first fuel distribution path (10b) is provided. A second fuel distribution pipe (20) is provided with a second distribution tube portion (20a) in which a second fuel distribution path (20b) is provided, a second injection valve insertion tube portion (20d) having a second injection valve insertion hole (20g), and a second connection tube portion (20h) which is orthogonal to the second distribution tube portion (20a) and in which a second connection hole (20m) is provided.

FIG. 1



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Description

Technical Field

[0001] The present invention relates to a fuel injection apparatus structured such that fuel within a fuel tank is boosted by a fuel pump, and the boosted fuel is fed toward an engine via a fuel injection valve, and more particularly to a throttle body in which fuel injection valves are attached toward respective air intake passages, and a throttle body for a V-type engine in which a first fuel injection valve is arranged in one side wall of a first air intake passage, and a second fuel injectionvalve opposes to the first fuel injection valve and is arranged in the other side wall of a second air intake passage.

Background Art

[0002] Patent document 1 discloses a throttle body in which a plurality of air intake passages are adjacently arranged in parallel in a side portion, and a fuel injection valve is attached toward each of the air intake passages. In accordance with the patent document 1 mentioned above, the first fuel injection valve is held to one side wall of the throttle body by a first fuel distribution pipe screwed to one side wall of the throttle body, and the second fuel injection valve is held to the other side wall of the throttle body by a second fuel distribution pipe screwed to the other side wall of the throttle body. On the other hand, a first fuel connection pipe portion is formed in the first fuel distribution pipe so as to protrude from a first fuel passage boss portion toward the other side, and a second fuel connection pipe portion is formed in the second fuel distribution pipe so as to protrude from a second fuel passage boss portion toward one side. Further, the first fuel connection pipe portion and the second fuel connection pipe portion which are arranged so as to oppose to each other are connected by a fuel coupling pipe between opposing walls of the adjacent throttle bodies. In accordance with the structure mentioned above, fuel fed to the first fuel distribution pipe is fed toward the first fuel injection valve via a first fuel passage provided within the first fuel distribution pipe, and is fed to the second fuel injection valve via the first fuel passage, the fuel coupling pipe and a second fuel passage provided in the second fuel distribution pipe.

[0003] Patent Document 1: Japanese Unexamined Patent Publication No. 2006-200382

Disclosure of the Invention

Problem to be Solved by the Invention

[0004] In accordance with the fuel drawing structure of the first fuel distribution pipe and the second fuel distribution pipe in the conventional throttle body, an assembling characteristic of the throttle body is poor, and a productivity of the throttle body can not be improved. In other words, in the fuel coupling pipe, the first fuel distribution pipe is screwed to the one side wall of the throttle body, the second fuel distribution pipe is screwed to the other side wall of the throttle body, and one end of the fuel coupling pipe is inserted and connected to the first fuel connection pipe portion and the other end of the fuel coupling pipe is inserted and connected to the second fuel connection pipe portion, in a state in which both the fuel distribution pipes are firmly attached to the throttle body. Further, a first fastening member is connected to an outer periphery of the one end of the fuel coupling pipe toward the first fuel connection pipe portion in accordance with caulking, and a second fastening member is connected to an outer periphery of the other end of the fuel coupling pipe toward the second fuel connection pipe portion in accordance with caulking. In accordance with the structure mentioned above, the fuel coupling pipe is required to be inserted and connected to the first and second fuel connection pipe portions at a narrow space between opposing side walls of both the adjacent throttle bodies, and to connect the first and second fastening members toward the first and second fuel connection pipe portions in accordance with caulking by a caulking machine. A workability is thus hard and a lot of skills is required. Further, since the fuel coupling pipe is connected to the fuel connection pipe portions in accordance with caulking by the fastening members, it is necessary to detach the fastening members within a narrow space at a time of maintaining the fuel passage, and it is impossible to achieve an improvement of a maintenance performance.

[0005] A throttle body in a fuel injection apparatus in accordance with the present invention is made by taking the problem mentioned above into consideration, and an object of the present invention is to provide a throttle body in which a first air intake passage and a second air intake passage are adjacently arranged sideward in parallel, a first fuel injection valve is arranged in one side wall of the first air intake passage so as to be held via a first fuel distribution pipe, and a second fuel injection valve is arranged in the other side wall of the second air intake passage so as to be held via a second fuel distribution pipe, wherein fuel drawing of the first fuel distribution pipe and the second fuel distribution pipe can be achieved extremely easily, and a high productivity is achieved. Further, an object of the present invention is to improve a maintenance characteristic of a fuel system.

Means for Solving the Problem

[0006] In order to achieve the object mentioned above, in accordance with a first aspect of the present invention, there is provided a throttle body in a fuel injection apparatus for a V-type engine in which a first air intake passage and a second air intake passage are adjacently arranged sideward in parallel, a first throttle valve opening and closing the first air intake passage and a second throttle valve opening and closing the second air intake passage are attached to a throttle valve shaft cutting across the first

air intake passage and the second air intake passage, a first fuel injection valve open to the air intake passage at a downstream side of the first throttle valve is attached to one side wall of the first air intake passage, and a second fuel injection valve open to the air intake passage at a downstream side of the second throttle valve is attached to the other side wall of the second air intake passage, wherein a first fuel distribution pipe holding the first fuel injection valve toward one side wall of the first air intake passage is provided with a first distribution tube portion having a first fuel distribution path extending along a longitudinal axis of a throttle valve shaft, a first injection valve insertion tube portion protruding from the first distribution tube portion toward a rear end portion of the first fuel injection valve and having a first injection valve insertion hole connected to the first fuel distribution path from a protruding end portion, and a first connection tube portion protruding toward the other side orthogonally to the first distribution tube portion and having a first connection hole connected to the first fuel distribution path from a protruding end portion, a second fuel distribution pipe holding the second fuel injection valve toward the other side wall of the second air intake passage is provided with a second distribution tube portion having a second fuel distribution path extending along a longitudinal axis of the throttle valve shaft, a second injection valve insertion tube portion protruding from the second distribution tube portion toward a rear end portion of the second fuel injection valve and having a second injection valve insertion hole connected to the second fuel distribution path from a protruding end portion, and a second connection tube portion protruding from one side toward the other side orthogonally to the second distribution tube portion and having a second connection hole provided from one side protruding end portion toward the other side protruding end portion while cutting across the second fuel distribution path, the first fuel injection valve is held to one side wall of the first air intake passage by inserting the rear end portion of the first fuel injection valve to the first injection valve insertion hole of the first fuel distribution pipe, the first connection hole which is open at the protruding end portion of the first connection tube portion is arranged so as to be open toward an adjacent opposing space between the first air intake passage and the second air intake passage and toward the other side, the second fuel injection valve is held to the other side wall of the second air intake passage by inserting the rear end portion of the second fuel injection valve to the second injection valve insertion hole of the second fuel distribution pipe, the second connection hole which is open at the one side protruding end portion of the second connection tube portion is opposingly arranged so as to face to the first connection hole, then under the state mentioned above, the second fuel distribution path and the first fuel distribution path are communicated by inserting the fuel communication pipe from the other side protruding end portion of the second connection tube portion toward the first connection hole of the first connection tube portion via the second connection hole, and the second connection hole which is open at the other side protruding end portion of the second connection tube portion is closed by a fuel inflow joint provided with a fuel inflow path in which one end is open toward an external portion and the other end is open toward the second fuel distribution path.

[0007] Further, in accordance with a second aspect of the present invention, in addition to the first aspect, a hole diameter of the first connection hole provided in the first connection tube portion is made smaller than a hole diameter of the second connection hole provided in the second connection tube portion, the fuel communication pipe has, at one side end thereof, a small-diameter pipe portion to which a first annular ring is arranged so as to be fitted, and has, at the other side end thereof, a large-diameter pipe portion to which a second annular ring is arranged so as to be fitted, the small-diameter pipe portion provided with the first annular ring of the fuel communication pipe is arranged so as to be inserted to the first connection hole of the first connection tube portion, and the large-diameter pipe portion provided with the second annular ring is arranged so as to be inserted to the second connection hole of the second connection tube portion.

[0008] Further, in accordance with a third aspect of the present invention, in addition to the first aspect, a locking step portion facing to the protruding end portion of the first connection tube portion is formed in the first connection hole provided in the first connection tube portion, a fuel inflow path is provided in an inner side of the fuel inflow joint, an annular tube portion facing to one side is formed in the fuel inflow joint, and the fuel communication pipe arranged so as to be inserted into the first connection hole and the second connection hole is held by the locking step portion of the first connection hole and the one side end of the annular tube portion of the fuel inflow joint.

[0009] Further, in accordance with a fourth aspect of the present invention, there is provided a throttle body for a V-type engine in which a first air intake passage and a second air intake passage are arranged in the throttle body so as to be adjacently provided in parallel, a first throttle valve opening and closing the first air intake passage and a second throttle valve opening and closing the second air intake passage are arranged so as to be attached to a throttle valve shaft arranged so as to cut across the first air intake passage and the second air intake passage, a first fuel injection valve which is open to the air intake passage at a downstream side of the first throttle valve is attached to one side wall which is orthogonal to a longitudinal axis of the throttle valve shaft of the first air intake passage, and a second fuel injection valve which is open to the air intake passage at a downstream side of the second throttle valve is attached to the other side wall which is orthogonal to a longitudinal axis of the throttle valve shaft of the second air intake passage, wherein a fuel communication path is provided between opposing side walls of the first air intake passage and

the second air intake passage so as to be provided integrally with the throttle body, one end of the fuel communication path being open to one side orthogonally to the longitudinal axis of the throttle valve shaft through one side opening and the other end thereof being open to the other side orthogonally to the longitudinal axis of the throttle valve shaft through the other side opening, the second fuel distribution pipe is provided with a second fuel distribution path extending along the longitudinal axis of the throttle valve shaft, a fuel inflow hole connected to the second fuel distributionpath, a second fuel injection valve support hole branched from the second fuel distribution path so as to be open, and a first fuel communication hole branched from the second fuel distribution path so as to be open, the first fuel distribution pipe is provided with a first fuel distribution path extending along the longitudinal axis of the throttle valve shaft, a first fuel injection valve support hole branched from the second fuel distribution hole so as to be open, and a second fuel communication hole branched from the first fuel distribution path so as to be open, the second fuel injection valve is held by the second fuel injection valve support hole of the second fuel distribution pipe and the second fuel injection valve support hole provided in the other side wall of the second air intake passage by arranging the second fuel distribution pipe so as to be screwed toward the other side wall of the first air intake passage and the other side wall of the second air intake passage, the first fuel communication hole of the second fuel distribution pipe is connected with the other side opening of the fuel communication path through a flow path by a first communication member, the first fuel injection valve is held by the first fuel injection valve support hole of the first fuel distribution pipe and the first fuel injection valve support hole provided in one side wall of the first air intake passage by arranging the first fuel distribution pipe so as to be screwed toward one side wall of the first air intake passage and one side wall of the second air intake passage, and the second fuel communication hole of the first fuel distribution pipe is connected with one side opening of the fuel communication path through a flow path by a second communication member.

[0010] Further, in accordance with a fifth aspect of the present invention, in addition to the fourth aspect, the first communication member and the second communication member are formed approximately in an L-shape by horizontal pipe portions which are orthogonal to the longitudinal axes of the first air intake passage and the second air intake passage, and inclined pipe portions which are formed to cross at a crossing angle with respect to the longitudinal axes, the first fuel injection valve support hole formed in the one side wall of the first air intake passage and the second fuel injection valve support hole formed in the other side wall of the second air intake passage are formed at the crossing angle with respect to the longitudinal axes of the air intake passage, and the first fuel communication hole and the second fuel injection valve support hole formed in the second fuel distribution pipe, and the second fuel communication hole and the first fuel injection valve support hole formed in the first fuel distribution pipe are formed at the crossing angle with respect to the longitudinal axes of the air intake passage.

[0011] Further, in accordance with a sixth aspect of the present invention, in addition to the fourth aspect, an idle speed air passage is provided from one side toward the other side orthogonally to the longitudinal axis of the throttle valve shaft so as to be in parallel to the fuel communication path provided in the throttle body, an idle speed control actuator is arranged in one side opening of the idle speed air passage, and an air intake port is arranged in the other side opening.

[0012] Further, in accordance with a seventh aspect of the present invention, in addition to the sixth aspect, the air intake port connected to the other side opening of the idle speed air passage and the fuel inflow hole connected to the second fuel distribution path of the second fuel distribution pipe are arranged at the other side orthogonally to the longitudinal axis of the throttle valve shaft.

Effect of the Invention

[0013] In accordance with the first aspect of the present invention, the first connection hole of the first fuel distribution pipe and the second connection hole of the second distribution pipe are arranged so as to oppose to each other, and the fist fuel distribution path of the first fuel distribution pipe and the second fuel distribution path of the second fuel distribution pipe are connected through the flow path by arranging the fuel communication pipe so as to insert to the first connection hole via the second connection hole. Further, the opening of the second connection hole of the second fuel distribution pipe is closed and retained by the fuel inflow joint provided with the fuel inflow path. Accordingly, since the fuel communication pipe and the fuel inflow joint are arranged so as to be inserted from the other side toward the one side on a straight line, and the fuel communication pipe and the fuel inflow joint can be inserted to the second connection hole and the first connection hole from the other side of the air intake passage which is open widely instead of the narrow adjacent opposing space between both the adjacent air intake passages, it is possible to greatly improve an assembling characteristic and it is possible to achieve a good productivity. Further, since the fuel inflow joint and the fuel communication pipe can be taken out in the same linear direction by detaching the fuel inflow joint at a time of maintaining a fuel system, it is possible to greatly improve a maintenance characteristic. Further, since the fuel inflow joint can have both of a function of feeding the fuel into each of the fuel distribution paths and a function of closing the opening to the other side of the second connection hole, it is possible to suppress an increase of the number of parts.

[0014] In accordance with the second aspect of the

present invention, an airtightness between the small-diameter pipe portion of the fuel communication pipe and the first connection hole of the first fuel distribution pipe can be well kept by the first annular ring without using the fastening member, and an airtightness between the large-diameter pipe portion of the fuel communication pipe and the second connection hole of the second fuel distribution pipe can be well kept by the second annular ring without using the fastening member. Further, at a time of inserting and arranging the small-diameter pipe portion of the fuel communication pipe provided with the first annular ring mentioned above within the first connection hole of the first fuel distribution pipe via the second connection hole of the second fuel distribution pipe, it is possible to insert and arrange it within the first connection hole without the first annular ring being compressed by the second connection hole. Accordingly, it is possible to improve an inserting workability of the fuel communication pipe, and it is possible to securely suppress the first annular ring from being damaged by the second connection hole.

[0015] In accordance with the third aspect of the present invention, the one side end of the fuel coupling pipe arranged so as to be inserted to the first connection hole of the first fuel distribution pipe is arranged so as to face to the locking step portion of the first connection hole, and the other side end of the fuel coupling pipe arranged so as to be inserted to the second connection hole of the second fuel distribution pipe is inserted to the second connection hole, and is arranged so as to face to the one side end of the annular tube portion formed in the fuel inflow joint screwed fixedly to the second fuel distribution pipe. In accordance with the structure mentioned above, the fuel coupling pipe can be held by the locking step portion of the first connection hole and the one side end of the annular tube portion of the fuel inflow joint, and it is not necessary to prepare any special member for fixing the fuel couplingpipe. Further, since the fuel coupling pipe itself is not provided with the firmly attaching member such as a screw or the like, the fuel coupling pipe may be arranged so as to be simply inserted to the first connection hole and the second connection hole, and the fuel coupling pipe can be detached immediately by detaching the fuel inflow joint.

[0016] In accordance with the fourth aspect of the present invention, the second fuel injection valve can be held by the second fuel distribution pipe and the other side wall of the second air intake passage by screwing the second fuel distribution pipe from the other side which is orthogonal to the longitudinal axis of the throttle valve shaft toward the other side walls of the first air intake passage and the second air intake passage, and the first fuel communication hole of the second fuel distribution pipe is connected to the other side opening of the fuel communication path through a flow path by the first communication member. Further, the first fuel injection valve can be held by the first fuel distribution pipe and the one side wall of the first air intake passage by screwing the first fuel distribution pipe from the one side which is orthogonal to the longitudinal axis of the throttle valve shaft toward the one side walls of the first air intake passage and the second air intake passage, and the second fuel communication hole of the first fuel distribution pipe can be connected to the one side opening of the fuel communication path through a flow path by the second communication member. In accordance with the structure mentioned above, since the installation of each of the fuel injection valves and the flow path connection between the second fuel distribution pipe and the first fuel distribution pipe can be completed only by arranging so as to screw the second fuel distribution pipe and the first fuel distribution pipe toward the throttle body, it is possible to greatly improve an assembling characteristic. Further, since the first and second fuel injection valves can be detached from the throttle body and the fuel communication path can be set to the open state, by detaching the first and second fuel distribution pipes from the throttle body, it is possible to improve a maintenance characteristic of the fuel injection valve, the fuel distribution path and the fuel communication path. Further, since the fuel communication path is formed integrally with the throttle body, it is not necessary to prepare any special new fuel communication pipe, the fuel communication path is not oscillated or bent due to oscillation of the engine, and it is possible to improve an outer appearance. Further, since the one side opening of the fuel communication path is open to one side which is orthogonal to the longitudinal axis of the throttle valve shaft, and the other side opening of the fuel communication path is open to the other side which is orthogonal to the longitudinal axis of the throttle valve shaft, it is possible to simultaneously form the fuel communication path in accordance with casting at a time of injection molding of the throttle body.

[0017] In accordance with the fifth aspect of the present invention, since there are formed at the same crossing angle the first fuel injection valve support hole and the second fuel injection valve support hole which are provided in the throttle body, the second fuel injection valve support hole and the first fuel communication hole which are provided in the second fuel distribution pipe, the first fuel injection valve support hole and the second fuel communication hole which are provided in the first fuel distribution pipe, the inclined pipe portion of the first communication member and the inclined pipe portion of the second communication member with respect to the longitudinal axis of the first and second air intake passages, it is possible to extremely easily and securely assemble and detach them.

[0018] In accordance with the sixth aspect of the present invention, the idle speed air passage can be formed in accordance with casting at the same time of injection molding of the throttle body. Further, since the first fuel injection valve, the second communication member, the first fuel distribution pipe and the idle speed control actuator are installed at the one side wall sides of the first air intake passage and the second air intake pas-

sage, and the second fuel injection valve, the first communication member, the second fuel distribution pipe and the air intake port are installed at the other side wall sides of the first air intake passage and the second air intake passage, it is possible to finish the assembly of the structure mentioned above by reversing the throttle body, and it is possible to improve an assembling characteristic.

[0019] In accordance with the seventh aspect of the present invention, since the air intake port connected to the idle speed air passage and the fuel inflow hole connected to the second fuel distribution path are arranged at the other side orthogonally to the longitudinal axis of the throttle valve shaft, it is possible to improve connection workability of an air conduit pipe connected to the air intake port and connection workability of a fuel conduit pipe connected to the fuel inflow hole in the structure in which the throttle body is arranged within a narrow V bank, particularly as in a V-type engine.

Brief Description of the Drawings

[0020]

Fig. 1 is a top plan view showing an embodiment of a throttle body in a fuel injection apparatus in accordance with the present invention;
Fig. 2 is a vertical sectional view of a main portion along a line A-A in Fig. 1;
Fig. 3 is a vertical sectional view of a main portion along a line B-B in Fig. 1;
Fig. 4 is a vertical sectional view of a main portion along a line C-C in Fig. 1;
Fig. 5 is a top plan view showing an embodiment of a throttle body for a V-type engine in accordance with the present invention;
Fig. 6 is a vertical sectional view of a main portion along a line B'-B' in Fig. 5;
Fig. 7 is a vertical sectional view of a main portion along a line A'-A' in Fig. 5;
Fig. 8 is a vertical sectional view of a main portion along a line C' -C' in Fig. 5; and
Fig. 9 shows another embodiment of the throttle body for the V-type engine in accordance with the present invention and is a vertical sectional view of a main portion in a section corresponding to the line C'-C' in Fig. 5.

Best Mode for Carrying Out the Invention

[0021] A description will be given below of an embodiment of a throttle body in a fuel injection apparatus in accordance with the present invention.

Embodiment 1

[0022] First, a description will be given of an embodiment of the throttle body in the fuel injection apparatus in accordance with the present invention with reference to Figs. 1 to 4. Fig. 1 is a top plan view. Fig. 2 is a vertical sectional view of a main portion along a line A-A in Fig. 1. Fig. 3 is a vertical sectional view of a main portion along a line B-B in Fig. 1. Fig. 4 is a vertical sectional view of a main portion along a line C-C in Fig. 1. Reference numeral 1 denotes a first air intake passage passing through a first throttle body TB1. The first air intake passage 1 is opened and closed by a first throttle valve 3 attached to a throttle valve shaft T which cuts across the first air intake passage 1 and is borne rotatably to the first throttle body TB1. Reference symbol J1 denotes a first fuel injection valve which is arranged in one side wall 1a of one side D (a lower side in Fig. 1) of the first air intake passage 1. A leading end portion of the first fuel injection valve J1 is arranged so as to be open toward an inner side of an air intake passage 1b at a downstream side of the first throttle valve 3. Reference numeral 4 denotes a second air intake passage passing through a second throttle body TB2. The second air intake passage 4 is opened and closed by a second throttle valve 6 attached to the throttle valve shaft T which cuts across the second air intake passage 4 and is borne rotatably to the second throttle body TB2. (In the present embodiment, the throttle valve shaft is formed by one shaft, however, the throttle valve shaft may be divided). Reference symbol J2 denotes a second fuel injection valve which is arranged in the other side wall 4a of the other side E (an upper side in Fig. 1) of the second air intake passage 4. A leading end portion of the second fuel injection valve J2 is arranged so as to be open toward an inner side of an air intake passage 4b at a downstream side of the second throttle valve 6. The first air intake passage 1 and the second air intake passage 4 are arranged adjacently in parallel sideward, and an adjacent opposing space K is formed between both the air intake passages 1 and 4. In other words, the adjacent opposing space K is formed along a longitudinal axis X-X of the throttle valve shaft T.

[0023] Reference numeral 10 denotes a first fuel distribution pipe holding the first fuel injection valve J1. The first fuel distribution pipe is formed as follows. Reference symbol 10a denotes a first distribution tube portion formed so as to extend to a side portion in Fig. 1. A first fuel distribution path 10b extending along the longitudinal axis X-X of the throttle valve shaft T is provided within the first distribution tube portion 10a, and the first fuel distribution path 10b open to a right side end 10c of the first distribution tube portion 10a is closed by a closing plug P1. Further, reference symbol 10d denotes a first injection valve insertion tube portion which is formed so as to protrude from a portion near a left side end 10e of the first distribution tube portion 10a toward a rear end portion J1a of the first fuel injection valve J1. A first injection valve insertion hole 10g is provided from the protruding end portion 10f toward the first fuel distribution path 10b. (The structure mentioned above is understood from Fig. 2.) Further, reference symbol 10h denotes a first connection tube portion which is formed in the middle of the first distribution portion 10a so as to protrude to-

ward the other side E in Fig. 1 orthogonally to the first distribution tube portion 10a approximately. A first connection hole 101 is provided from a protruding end portion 10k of the other side E toward the first fuel distribution path 10b. Further, a first attaching collar portion 10n in which an attaching hole 10m is provided is formed near a left side end of the first fuel distribution pipe 10 (this is well shown in Fig. 2), and a second attaching collar portion 10r in which an attaching hole 10p is provided is formed near a right side end thereof (this is well shown in Fig. 3).

[0024] Reference symbol 20 denotes a second fuel distribution pipe holding the second fuel injection valve J2. The second fuel distribution pipe 20 is formed as follows. Reference symbol 20a denotes a second distribution tube portion formed so as to extend to a side portion in Fig. 1. A second fuel distribution path 20b extending along the longitudinal axis X-X of the throttle valve shaft T is provided within the second distribution tube portion 20a, and the second fuel distribution path 20b open to a left side end 20c of the second distribution tube portion 20a is closed by a closing plug P2. Further, reference symbol 20d denotes a second injection valve insertion tube portion which is formed so as to protrude from a portion near a right side end 20e of the second distribution tube portion 20a toward a rear end portion J2a of the second fuel injection valve J2. A second injection valve insertion hole 20g is provided from the protruding end portion 20f toward the second fuel distribution path 20b (the structure mentioned above is understood from Fig. 3.) Further, reference symbol 20h denotes a second connection tube portion which is formed in the middle of the second distribution portion 20a so as to protrude toward the other side E from the one side D in Fig. 1 orthogonally to the second distribution tube portion 20a approximately. A second connection hole 20m is provided through from one side protruding end portion 20k thereof toward the other side protruding end portion 201. In this case, the second connection hole 20m cuts across the second fuel distribution path 20b and is communicated with the second fuel distribution path 20b. Further, a first attaching collar portion 20p in which an attaching hole 20n is provided is formed near a left side end of the second fuel distribution pipe 20 (this is well shown in Fig. 2) , and a second attaching collar portion 20s in which an attaching hole 20r is provided is formed near a right side end thereof (this is well shown in Fig. 3).

[0025] Reference numeral 40 denotes a fuel communication pipe. The fuel communication pipe 40 is formed as follows. The fuel communication pipe 40 is formed in a tubular shape, and is structured such that a flow path 40c is provided through from one side end 40a toward the other side end 40b, a first annular ring R1, for example, a rubber O-ring, a rubber square ring or the like is arranged so as to be fitted to an outer periphery near the one side end 40a, and a second annular ring R2 having the same structure as mentioned above is arranged so as to be fitted to an outer periphery near the other side end 40b.

[0026] Further, reference numeral 50 denotes a fuel inflow joint. The fuel inflow joint 50 is provided with an annular tube portion 50a protruding toward the one side D, and a joint portion 50b protruding toward an outer side, and is also provided with a fuel inflow path 50e in which one side is open to one side end 50c of the annular tube portion 50a and a side wall of the annular tube portion 50a, and the other side is open to an outer end 50d of the joint portion 50b. In this case, reference symbol R3 denotes a third annular ring which is arranged so as to be fitted to an outer periphery of the annular tube portion 50a.

[0027] Further, the first fuel distribution pipe 10, the second fuel distribution pipe 20, the fuel communication pipe 40 and the fuel joint 50 are assembled with the throttle body in accordance with the following manner. In this case, the first air intake passage 1 and the second air intake passage 4 are arranged adjacently in parallel sideward, and an adjacent opposing space K is formed between side walls in which both the air intake passages 1 and 4 are opposed to each other. First, a leading end portion J1b of the first fuel injection valve J1 is arranged so as to be inserted to the one side wall 1a of the first air intake passage 1, the first injection valve insertion hole 10g provided in the first injection valve insertion tube portion 10d of the first fuel distribution pipe 10 is arranged so as to be inserted to a rear end portion J1a thereof, a screw S is screwed to the first throttle body TB1 via the attaching hole 10m provided in the first attaching collar portion 10n, and a screw S is screwed to the second throttle body TB2 via the attaching hole 10p provided in the second attaching collar portion 10r, under the state mentioned above. In accordance with the structure mentioned above, the first fuel distribution pipe 10 is screwed fixedly to the first throttle body TB1 and the second throttle body TB2. Accordingly, the first fuel injection valve J1 is held by the one side wall 1a of the first air intake passage 1 and the first fuel distribution pipe 10 (this is well shown in Fig. 2). Further, both the first fuel distribution path 10b and the first distribution tube portion 10a of the first fuel distribution pipe 10 are arranged along the longitudinal axis X-X of the throttle valve shaft T at this time. Further, the first connection tube portion 10h formed so as to be orthogonal to the first distribution tube portion 10a is arranged within the adjacent opposing space K, and the protruding end portion 10k of the first connection tube portion 10h is arranged toward the other side E. Accordingly, the first connection hole 101 provided in the first connection tube portion 10 h is arranged so as to be orthogonal to the longitudinal axis X-X of the throttle valve shaft T and be open toward the other side E (an upper side in Fig. 1).

[0028] Next, a leading end portion J2b of the second fuel injection valve J2 is arranged so as to be inserted to the other side wall 4a of the second air intake passage 4, the second injection valve insertion hole 20g provided in the second injection valve insertion tube portion 20d

of the second fuel distribution pipe 20 is arranged so as to be inserted to the rear end portion J2a thereof, a screw S is screwed to the first throttle body TB1 via the attaching hole 20n provided in the first attaching collar portion 20p, and a screw S is screwed to the second throttle body TB2 via the attaching hole 20 r provided in the second attaching collar portion 20s, under the state mentioned above. In accordance with the structure mentioned above, the second fuel distribution pipe 20 is screwed fixedly to the first throttle body TB1 and the second throttle body TB2. Accordingly, the second fuel injection valve J2 is held by the other side wall 4a of the second air intake passage 4 and the second fuel distribution pipe 20 (this is well shown in Fig. 3) . Further, both the second fuel distribution path 20b and the second distribution tube portion 20a of the second fuel distribution pipe 20 are arranged along the longitudinal axis X-X of the throttle valve shaft T at this time. Further, the second connection tube portion 20h formed so as to protrude from the one side D toward the other side E orthogonally to the second distribution tube portion 20a is arranged within the adjacent space K, and the one side protruding end portion 20k of the second connection tube portion 20h is oppositely arranged so as to face to the protruding end portion 10k of the first connection tube portion 10h. In accordance with the structure mentioned above, the second connection hole 20m provided from the one side protruding end portion 20k of the second connecting tube portion 20h of the second fuel distribution pipe 20 toward the other side protruding end portion 201 and the first connection hole 101 provided so as to be open to the protruding end portion 10k of the first connection tube portion 10h of the first fuel distribution pipe 10 are concentrically arranged on a line Y-Y.

[0029] Next, the first fuel distribution pipe 10 and the second fuel distribution pipe 20 which are arranged in the state of being screwed fixedly with respect to the first air intake passage 1 and the second air intake passage 4 are fuel-wise communicated in accordance with the following manner. The fuel communication pipe 40 is inserted from the second connection hole 20m open to the other side protruding end portion 201 of the second connection tube portion 20h toward the first connection hole 101 open to the protruding end portion 10k of the first connection tube portion 10h. In accordance with the insertion mentioned above, the one side end 40a of the fuel communication pipe 40 is arranged so as to be inserted to the first connection hole 101, and the other side end 40b of the fuel communication pipe 40 is arranged so as to be inserted to the second connection hole 20m. At this time, airtightness between the outer periphery of the one side end 40a of the fuel communication pipe 40 and the first connection hole 101 is kept by the first annular ring R1, and airtightness between the outer periphery of the other side end 40b of the fuel communication pipe 40 and the second connection hole 20m is kept by the second annular ring R2. Next, the annular tube portion 50a of the fuel inflow joint 50 is arranged so as to be inserted into the second connection hole 20m which is open to the other side protruding end portion 201 of the second connection tube portion 20h, and the opening to the other side protruding end portion 201 of the second connection hole 20m is closed by a head portion 50p. Further, under the state mentioned above, the attaching plate 60 arranged so as to be fitted to the fuel inflow joint 50 is screwed fixedly to the second fuel distribution pipe 20 by a screw S.

[0030] The assembly of the fuel system in accordance with the first fuel distribution pipe 10 and the second fuel distribution pipe 20 is finished as mentioned above, the first connection hole 101 of the first fuel distribution pipe 10 is connected to the second connection hole 20m of the second fuel distribution pipe 20 by the fuel communication pipe 40, and the second connection hole 20m open to the other side protruding end portion 201 of the second connection tube portion 20h of the second fuel distribution pipe 20 is closed by the fuel inflow joint 50 provided with the fuel inflow path 50e.

[0031] Further, in the fuel system mentioned above, when fuel is fed to the fuel inflow path 50e via the joint portion 50b of the fuel inflow joint 50, the fuel within the fuel inflow path 50e is first fed into the second fuel distribution path 20b via the second connection hole 20m and the fuel is fed to the second fuel injection valve J2. Further, the fuel within the fuel inflow path 50e is secondly fed into the first fuel distribution path 10b of the first fuel distribution pipe 10 via the flow path 40c of the fuel communication pipe 40, and the fuel is fed to the first fuel injection valve J1.

[0032] In accordance with the throttle body of the present invention mentioned above, it is possible to easily carry out the fuel-wise communication work between the first fuel distribution pipe 10 and the second fuel distribution pipe 20 in an extremely short time, and it is possible to greatly improve a productivity. This is because the fuel communication pipe 40 and the fuel inflow joint 50 are arranged so as to be inserted to the first connection hole 101 and the second connection hole 20m on one straight line Y-Y without necessity of any caulking work, the fuel communication pipe 40 and the fuel inflow joint 50 are inserted from the second connection hole 20m (specifically the second connection hole 20m open to the other side protruding end portion 201) open to the other side E having no obstacle without passing through the narrow adjacent opposing space K, and the second connection hole 20m open to the other side protruding end portion 201 is closed by the fuel inflow joint 50 provided with the fuel inflow path 50e. Further, in accordance with the present invention, it is possible to improve a maintenance workability of the fuel system. In particular, it is possible to take out the fuel joint 50 and the fuel communication pipe 40 onto one straight line Y-Y by loosening the screw S attaching the fuel joint 50. Accordingly, it is possible to keep the first fuel distribution path 10b in the open state via the first connection hole 101, and it is possible to keep the second fuel distribution path 20b in the open state

via the second connection hole 20m.

[0033] A description will be given by returning to Fig. 4. A hole diameter d1 of the first connection hole 101 is made smaller than a hole diameter d2 of the second connection hole 20m, a small-diameter pipe portion 40s inserted to the first connection hole 101 is formed at the one side end 40a of the fuel communication pipe 40, and a large-diameter pipe portion 40r inserted to the second connection hole 20m is formed at the other side end 40b. Further, the first annular ring is arranged so as to be fitted to the small-diameter pipe portion 40s, and the second annular ring R2 is arranged so as to be fitted to the large-diameter pipe portion 40r. In the case of using the first fuel distribution pipe 10 provided with the first connection hole 101, the second fuel distribution pipe 20 provided with the second connection hole 20m, and the fuel communication pipe 40 provided with the small-diameter pipe portion 40s and the large-diameter pipe portion 40r, the first annular ring R1 arranged so as to be fitted to the small-diameter pipe portion 40s is not compressed by the second connection hole 20m at a time of inserting the small-diameter pipe portion 40s of the fuel communication pipe 40 to the first connection hole 101 via the second connection hole 20m. Accordingly, it is possible to inhibit the first annular ring R1 from being damaged and bitten as well as it is possible to improve an inserting workability of the fuel communication pipe 40 to the first and second connection holes 101 and 20m, and it is possible to maintain airtightness keeping performance good.

[0034] Further, reference symbol 10v denotes a locking step portion which is formed toward the other side E so as to face to the protruding end portion 10k of the first connection tube portion 10h. The locking step portion 10v is formed at a lower side in Fig. 4 of the first connection hole 101. Further, the one side end 40a of the fuel communication pipe 40 arranged so as to be inserted to the first connection hole 101 and the second connection hole 20m is arranged so as to oppose to the locking step portion 10v, and the one side end 50c of the annular tube portion 50a of the fuel inflow joint 50 which closes the second connection hole 20m open to the other side protruding end portion 201 and is screwed to the second fuel distribution pipe 20 is arranged so as to oppose to the other side end 40b of the fuel communication pipe 40. In accordance with the structure mentioned above, the movement in the longitudinal direction of the fuel communication pipe 40 can be regulated by the locking step portion 10v formed in the first fuel distribution pipe 10 and the one side end 50c of the annular tube portion 50a of the fuel inflow joint 50, and it is not necessary to prepare any special new regulating member.

[0035] Further, the fuel inflow joint 50 simultaneously has three functions including a fuel feeding function of feeding the fuel into the fuel distribution pipe, a second connection hole closing function of closing the opening toward the atmospheric air side of the second connection hole 20m, and a movement suppressing function of regulating the movement of the fuel communication pipe 40, and it is possible to achieve an integration of the parts.

Embodiment 2

[0036] Next, a description will be given of an embodiment of a throttle body for a V-type engine in accordance with the present invention with reference to Figs. 5 to 9. Fig. 5 is a top plan view. Fig. 6 is a vertical sectional view in a line B'-B' in Fig. 5. Fig. 7 is a vertical sectional view in a line A' -A' in Fig. 5. Fig. 8 is a vertical sectional view in a line C'-C' in Fig. 5. A throttle body TB' is formed as follows. Reference numeral 101 denotes a first air intake passage provided from an upper side toward a lower side in Fig. 6, and reference numeral 102 denotes a second air intake passage provided from an upper side toward a lower side and arranged so as to be adjacently in parallel to the first air intake passage 101. In other words, the first air intake passage 101 and the second air intake passage 104 are adjacently provided in parallel from the upper side toward the lower side in the throttle body TB' . Reference numeral 103 denotes a single throttle valve shaft which is rotatably borne to the throttle body TB' so as to cut across the first air intake passage 101 and the second air intake passage 104. A throttle drum TD' attached to an upper end of a throttle valve shaft T' in Fig. 5 is connected to an accelerator grip (not shown) by a wire (not shown), and when a driver operates the accelerator grip, the throttle valve shaft T' is mechanically rotated. Further, the first throttle valve 103 is attached to the throttle valve shaft T' cutting across within the first air intake passage 101 by a screw, and the first air intake passage 101 is opened and closed by the first throttle valve 103. Further, a second throttle valve 106 is attached to the throttle valve shaft T' cutting across within the second air intake passage 104 by a screw, and the second air intake passage 104 is opened and closed by the second throttle valve 106. Further, a first air intake passage 101a at a downstream side of the first throttle valve 103 and a second air intake passage 104a at a downstream side of the second throttle valve 106 are connected to an illustrated V-type engine. Reference numeral 107 denotes a fuel communication path which is integrally provided in the throttle body TB' between respective opposing side walls 101e and 104e of the first air intake passage 101 and the second air intake passage 104. The fuel communication path 107 is constituted by a linear hole with one end being open to one side D' which is orthogonal to a longitudinal axis X' -X' of a throttle valve shaft T' shown in Fig. 5 through one side opening 107a, and the other end being open to the other side E' which is orthogonal to the longitudinal axis X' -X' through the other side opening 107b. The fuel communication passage 7 is well shown in Figs. 5 and 8. Describing again about the throttle body TB' by Fig. 6, reference numeral 108 denotes a second fuel injection valve support hole provided in the other side wall 104a of the second air intake passage 104. The second fuel injection valve support hole 108 is provided such that a right oblique upper side

thereof in Fig. 6 is open toward the air intake passage 104b at the downstream side of the second throttle valve 106. Further, the second fuel injection valve support hole 108 is provided at a crossing angle αwith respect to a longitudinal axis Y2-Y2 of the second air intake passage 104. Reference symbol 109a denotes a first fuel distribution pipe fastening thread hole formed in the other side wall 104a of the second air intake passage 104. The thread hole 109a is provided toward a right oblique upper side at the same angle of incline as the crossing angle α. Reference symbol 109b denotes a second fuel distribution pipe fastening thread hole formed in the one side wall 104d of the second air intake passage 104. The thread hole 109b is also provided toward a left oblique upper side at the same crossing angle α with respect to the longitudinal axis Y2-Y2 of the second air intake passage 104. Further, a description will be given of the throttle body TB' with reference to Fig. 7. Reference numeral 111 denotes a first fuel injection valve support hole provided in the one side wall 101a of the first air intake passage 101. The first fuel injection valve support hole 111 is provided such that a left oblique upper side thereof in Fig. 7 is open toward the air intake passage 101b at the downstream side of the first throttle valve 103. Further, the first fuel injection valve support hole 111 is provided at the same crossing angle α as that mentioned above with respect to a longitudinal axis Y1-Y1 of the first air intake passage 101. Reference symbol 109c denotes a second fuel distribution pipe fastening thread hole formed in the one side wall 101a of the first air intake passage 101. The thread hole 109c is provided toward a left oblique upper side at the same angle of incline as the crossing angle α. Reference symbol 109ddenotes a first fuel distribution pipe fastening thread hole formed in the other side wall 101c of the first air intake passage 101. The thread hole 109d is also provided toward a right oblique upper side at the same crossing angle α as that mentioned above with respect to the longitudinal axis Y1-Y1 of the first air intake passage 101. In this case, the longitudinal axes Y1-Y1 and Y2-Y2 are positioned on the longitudinal axis X' -X' of the throttle valve shaft T' .

[0037] Next, a description will be given of a second fuel distribution pipe 120. The second fuel distribution pipe 120 is structured such that a second fuel distribution path 120b extending along (being in parallel to) the longitudinal axis X' -X' of the throttle valve shaft T' is provided in an inner portion thereof, a fuel inflow hole 116 constituted by a joint is connected to a lower end of the second fuel distribution path 120b in Fig. 5, a second fuel injection valve support hole 117 is branched so as to be open at the upper side, and a first fuel communication hole 118 is branched so as to be open in the middle. The second fuel injection valve support hole 117 is disclosed in Fig. 6, and the second fuel injection valve support hole 117 is formed so as to be open toward a right oblique upper side at the same crossing angle α as that mentioned above with respect to the longitudinal axis Y2-Y2 of the second air intake passage 104. Further, the first fuel communication hole 118 is disclosed in Fig. 8, and the first fuel communication hole 118 is formed so as to be open toward a right oblique upper side at the same crossing angle α as that mentioned above with respect to the longitudinal axis Y2-Y2 of the second air intake passage 104. In this case, reference symbol 119a denotes a first attaching collar portion formed so as to extend toward a side direction from the second fuel distribution pipe 120 near the second fuel injection valve support hole 117, and reference symbol 120p denotes a first attaching collar portion formed so as to extend toward a side direction from the second fuel distribution pipe 120 near the fuel inflow hole 116.

[0038] Next, a description will be given of the first fuel distribution pipe 110. The first fuel distribution pipe 110 is structured such that a first fuel distribution path 110b extending along (being in parallel to) the longitudinal axis X' -X' of the throttle valve shaft T' is provided in an inner portion thereof, an upper end opening of the first fuel distribution pipe 110 in Fig. 5 is closed by a closing plug P', a first fuel injection valve support hole 122 is branched so as to be open at the lower side, and a second fuel communication hole 123 is branched so as to be open in the middle. The first fuel injection valve support hole 122 is disclosed in Fig. 7, and the first fuel injection valve support hole 122 is formed so as to be open toward a left oblique upper side at the same crossing angle α as that mentioned above with respect to the longitudinal axis Y1-Y1 of the first air intake passage 101. Further, the second fuel communication hole 123 is disclosed in Fig. 8, and the second fuel communication hole 123 is formed so as to be open toward a left oblique upper side at the same crossing angle α as that mentioned above with respect to the longitudinal axis Y1-Y1 of the first air intake passage 101. In this case, reference symbol 120s denotes a second attaching collar portion formed so as to extend toward a side direction from the first fuel distribution pipe 110 near the first fuel injection valve support hole 22, and reference symbol 110r denotes a second attaching collar portion formed so as to extend toward a side direction from the upper end of the first fuel distribution pipe 110.

[0039] Next, a description will be given of a first communication member 130 connecting the other side opening 107b of the fuel communication path 107 and the first fuel communication path 118 of the second fuel distribution pipe 120 through a flow path with reference to Fig. 8. The first communication member 130 is formed in an approximately L-shape by a horizontal pipe portion 130a and an inclined pipe portion 130b, the horizontal pipe portion 130a is formed in a direction which is orthogonal to the longitudinal axis Y2-Y2 of the second air intake passage 104 (in other words, in a horizontal direction) , and the inclined pipe portion 130b is formed so as to cross and be connected to the horizontal pipe portion 130a at the same crossing angle α as that mentioned above with respect to the longitudinal axis Y2-Y2 of the second air intake passage 104. The inclined pipe portion 130b of the first communication member 130 is formed

from a left end of the horizontal pipe portion 130b toward a left oblique lower side in Fig. 8.

[0040] Next, a description will be given of a second communication member 131 connecting the one side opening 107a of the fuel communication passage 107 and the second fuel communication hole 123 of the first fuel distribution pipe 110 through a flow path with reference to Fig. 8. The second communication member 131 is formed in an approximately L-shape by the horizontal pipe portion 131a and the inclined pipe portion 131b, the horizontal pipe portion 131a is formed in a direction which is orthogonal to the longitudinal axis Y2-Y2 of the second air intake passage 104 (in other words, in a horizontal direction), and the inclined pipe portion 131b is formed so as to cross and be connected to the horizontal pipe portion 131a at the same crossing angle α as that mentioned above with respect to the longitudinal axis Y2-Y2 of the second air intake passage 104. The inclined pipe portion 131b of the second communication member 131 is formed from a right end of the horizontal pipe portion 131b toward a right oblique lower side in Fig. 8.

[0041] Further, each of the structures mentioned above is assembled in accordance with the following manner. First, the first fuel injection valve J1' , the second fuel injection valve J2', the first communication member 130, and the second communication member 131 are attached to the throttle body TB' in the following manner. A leading end portion J1b' of the first fuel injection valve J1' is arranged so as to be inserted in a liquid tight manner to the first fuel injection valve support hole 111 which is open toward a right oblique lower side of the one side wall 101a of the first air intake passage 101 by an O-ring or the like (this is disclosed in Fig. 7). Further, the horizontal pipe portion 131a of the second communication member 131 is arranged so as to be inserted in a liquid tight manner to the one side opening 107a of the fuel communication path 107 via an O-ring or the like, and the inclined pipe portion 131b is arranged toward a right oblique lower side at this time (this is disclosed in Fig. 8). Next, a leading end portion J2b' of the second fuel injection valve J2' is arranged so as to be inserted in a liquid tight manner to the second fuel injection valve support hole 117 which is open toward a left oblique lower side of the other side wall 104a of the second air intake passage 104 by an O-ring or the like (this is disclosed in Fig. 6) . Further, the horizontal pipe portion 130a of the first communication member 130 is arranged so as to be inserted in a liquid tight manner to the other side opening 107b of the fuel communication path 107 via an O-ring or the like, and the inclined pipe portion 130b is arranged toward a left oblique lower side at this time (this is disclosed in Fig. 8).

[0042] Next, the second fuel distribution pipe 120 and the first fuel distribution pipe 110 are screwed toward the throttle body TB' . First, a rear end portion J2a' of the second fuel injection valve J2' is inserted in a liquid tight manner into the second fuel injection valve support hole 117 of the second fuel distribution pipe 120 by an O-ring or the like (this is disclosed in Fig. 6), and a lower end of the inclined pipe portion 130b of the first communication member 130 is inserted in a liquid tight manner to the first fuel communication hole 118 by an O-ring or the like (this is disclosed in Fig. 8). Further, in the state mentioned above, the first attaching collar portion 120p of the second fuel distribution pipe 120 is screwed to the first fuel distribution pipe fastening thread hole 109d provided at the other side wall 101c side of the first air intake passage 101 of the throttle body TB' via the screw S, and the second attaching collar portion 120s is screwed to the first fuel distribution pipe fastening thread hole 109a provided at the other side wall 104a side of the second air intake passage 104 of the throttle body TB' via the screw S. In accordance with the structure mentioned above, the second fuel injection valve J2' is held by the second injection valve support hole 108 of the throttle body TB' and the second fuel injection valve support hole 117 of the second fuel distribution pipe 120. On the other hand, the first communication member 130 communicates the first fuel communication hole 118 (in other words, the second fuel distribution path 120b) of the second fuel distribution pipe 120 with the fuel communication path 7. Next, the rear end portion Ja' of the first fuel injection valve J1' is inserted in a liquid tight manner into the first fuel injection valve support hole 122 of the first fuel distribution pipe 110 by an O-ring or the like (this is disclosed in Fig. 7), and the lower end of the inclined pipe portion 131b of the second communication member 131 is inserted in a liquid tight manner to the second fuel communication hole 123 by an O-ring or the like (this is disclosed in Fig. 8). Further, in the state mentioned above, the second attaching collar portion 110r of the first fuel distribution pipe 110 is screwed to the second fuel distribution pipe fastening thread hole 109b provided at the one side wall 104d side of the second air intake passage 104 of the throttle body TB' via a screw S' , and the first attaching collar portion 110n is screwed to the second fuel distribution pipe fastening thread hole 109c provided at in the one side wall 101a side of the first air intake passage 101 of the throttle body TB' via the screw S'. In accordance with the structure mentioned above, the first fuel injection valve J1' is held by the first injection valve support hole 111 of the throttle body TB' and the first fuel injection valve support hole 122 of the first fuel distribution pipe 110. On the other hand, the second communication member 131 communicates the second fuel communication hole 123 (in other words, the first fuel distribution path 110b) of the first fuel distribution pipe 110 with the fuel communication path 107.

[0043] In accordance with the steps mentioned above, the first fuel injection valve J1', the second fuel injection valve J2' , the second fuel distribution pipe 120 and the first fuel distribution pipe 110 can be attached to the throttle body TB' , and fuel within the fuel tank (not shown) is fed to the first and second fuel injection valves J1' and J2' in the following manner. The fuel within the fuel tank is regulated to a predetermined pressure by a pressure

control valve as well as being boosted by an electric fuel pump, and the fuel having regulated pressure is fed to the second fuel distribution path 120b of the second fuel distribution pipe 120 via a fuel piping F' (the fuel tank, the fuel pump and the pressure control valve are not illustrated). Further, the fuel within the second fuel distribution path 120b is first fed to the second fuel injection valve J2' via the second fuel injection valve support hole 117, and is fed by injection into the air intake passage 104b at a downstream side of the second throttle valve 106 from an injection hole which is open at the leading end portion J2b' . On the other hand, a part of the fuel fed into the second fuel distribution path 120b is fed to the fuel communication path 107 via the first fuel communication hole 118 of the second fuel distribution pipe 120 and the first communication member 130, and the fuel within the fuel communication path 107 is further fed to the first fuel injection valve J1' via the second communication member 131, the second injection communication hole 123 of the first fuel distribution pipe 110, the first fuel distribution path 110b, and the first fuel injection valve support hole 122, and is fed by injection into the air intake passage 101b at the downstream side of the first throttle valve 103 from an injection hole which is open at the leading end portion J1b'.

[0044] In accordance with the structure mentioned above, the first fuel injection valve J1' and the second fuel injection valve J2' can be held toward the throttle body TB' by respectively attaching the second fuel distribution pipe 120 and the first fuel distribution pipe 110 to the side walls at the one side D' and the other side E' of the throttle body TB' , and the second fuel distribution path 120b of the second fuel distribution pipe 120 can be connected through a flow path to the first fuel distribution path 110b of the first fuel distribution pipe 110 via the first communication member 130, the fuel communication path 107 integrally provided in the throttle body TB' and the second communication member 131. Accordingly, it is possible to greatly improve an assembling characteristic, particularly of the fuel system. Further, since the first and second fuel injection valves J1' andJ2' and the first and second communication members 130 and 131 can be immediately detached from the throttle body TB' by detaching the second fuel distribution pipe 120 and the first fuel distribution pipe 110 from the throttle body TB', it is possible to improve a maintenance characteristic of the fuel injection valves J1' and J2' and the fuel communication path 107 provided in the throttle body. Further, since the fuel communication path 107 connecting the second fuel distribution pipe 120 and the first fuel distribution pipe 110 through a flow path is integrally provided within the throttle body TB' , any particular new fuel communication pipe is not necessary, and the fuel communication path 107 is neither oscillated nor bent due to oscillation of an engine. Further, it is possible to improve an outer appearance of the throttle body including the fuel communication path. Further, it is possible to improve toughness with respect to collision of a foreign material with the fuel communication path 107. Further, since the fuel communication path 107 integrally provided in the throttle body TB' is formed such that the one end is open to the one side D' which is orthogonal to the longitudinal axis X'-X' of the throttle valve shaft T' through the one side opening 107a, and the other end is open to the other side E' which is orthogonal to the longitudinal axis X'-X' through the other side opening 107b on one straight line, it is possible to cast the fuel communication path 107 at the same time of injection molding of the throttle body TB'. Accordingly, it is possible to inexpensively manufacture the coupling structure for fuel.

[0045] Further, since all of the crossing angle α of the inclined pipe portion 130b of the first communication member 130 and the inclined pipe portion 131b of the second communication member 131 with respect to the respective longitudinal axes Y1-Y1 and Y2-Y2 of the air intake passages 100 and 104, the crossing angle α of the first fuel injection valve support hole 111 and the second fuel injection valve support hole 117 provided in the throttle body TB' with respect to the respective longitudinal axes Y1-Y1 and Y2-Y2 of the air intake passages 100 and 104, and the crossing angle α of the first fuel communication hole 118 and the second fuel injection valve support hole 117 formed in the second fuel distribution pipe 120, and the second fuel communication hole 123 and the first fuel injection valve support hole 122 formed in the first fuel distribution pipe 110 with respect to the respective longitudinal axes Y1-Y1 and Y2-Y2 of the air intake passages 100 and 104 are set identical, it is possible to insert and connect the first and second fuel injection valves J1' and J2' and the respective inclined pipe portions 130b and 131b of the first and second communication members 130 and 131 on the basis of a single work by moving the second fuel distribution pipe 120 and the first fuel distribution pipe 110 in the direction of the throttle body TB' along the crossing angle α. Accordingly, it is possible to achieve a great improvement of an assembling characteristic. Further, in accordance with the first communication member 130 and the second communication member 131 mentioned above, common use can be achieved by preparing a single kind of communication members and reversing one of them at 180 degree, and it is possible to prevent erroneous assembly without increasing the kind of the parts.

[0046] Next, a description will be given of another embodiment in accordance with the present invention with reference to Fig. 9. The other embodiment is structured such that an idle speed air passage is provided in the embodiment shown in Fig. 5. Fig. 9 corresponds to the vertical sectional view along the line C-C' in Fig. 5, and an explanation of the same structure portions as those in Fig. 5 will be omitted by using the same reference numerals. Reference numeral 170 denotes an idle speed air passage provided in the throttle body TB' . The idle speed air passage 170 is formed as follows. The idle speed air passage 170 is provided in parallel to the fuel communication path 107 provided in the throttle body TB'

and in a linear shape, and one side opening 170a thereof is open toward the one side D' orthogonally to the longitudinal axis X'-X' of the throttle valve shaft T' and the other side opening 170b is open toward the other side E' orthogonally to the longitudinal axis X'-X'. Further, an idle speed control actuator AC' is attached to the one side opening 170a of the idle speed air passage 170 by a screw (not shown) or the like. The idle speed control actuator AC' mentioned above is disclosed, for example, in Japanese Unexamined Patent Publication No. 2004-211612 or the like, and is constituted by a stepping motor M', a slider 171 which protrudes from a left end of a guide tube portion Ma' of the stepping motor M' and converting a rotation of a rotor (not shown) in an inner portion of the stepping motor M' into a linear motion so as to output, and a control valve body 173 which is attached to a left end of the slider 171 and controls an opening area of a first idle air distribution path 172a and a second idle air distribution path 172b which are open at the side wall of the idle speed air passage 170, to the idle speed air passage 170. In this case, a downstream side of the first idle air distribution path 172a is communicated with the air intake passage 101b at the downstream side of the first throttle valve 103, and a downstream side of the second idle air distribution path 172b is communicated with the air intake passage 104b at the downstream side of the second throttle valve. Further, an air intake port 174 (formed by a pipe joint) is attached to the other side opening 170b of the idle speed air passage 170. Since the idle speed air passage 170 having the idle speed control actuator AC' is provided, the slider 171 moves in the axial direction in correspondence to the rotation of the stepping motor M' in a state in which an engine atmospheric temperature is low, and the control valve body 173 can properly control the opening areas of the first and second idle air distribution paths 172a and 172b in correspondence to the engine temperature state, the air flowing into the idle speed air passage 170 from the air intake port 174 can be properly controlled by the control valve body 173, and the idle speed air can be fed into the air intake passage 101b at the downstream side of the first throttle valve 103 from the first idle air distribution path 172a and fed into the air intake passage 104b at the downstream side of the second throttle valve 106 from the second idle air distribution path 172b, whereby it is possible to rise the engine idle speed.

[0047] In this case, since the idle speed air passage 170 integrally provided in the throttle body TB' is formed in parallel to the fuel communication passage 107, the one side opening 170a is open at the one side D' orthogonally to the longitudinal axis X' -X' of the throttle valve shaft T', and the other side opening 170b is open at the other side E' orthogonally to the longitudinal axis X'-X', it is possible to form the idle speed air passage 170 simultaneously with the fuel communication path 107 in accordance with casting at the same time of injection molding the throttle body TB' , and it is possible to reduce a manufacturing cost. Further, in accordance with the structure mentioned above, since the idle speed control actuator AC' is arranged in addition to the first fuel injection valve J1' , the second communication member 131 and the first fuel distribution pipe 110 in the one side walls 101a and 104d of the first and second air intake passages 100 and 104, and the air intake port 174 is arranged in addition to the second fuel injection valve J1', the first communication member 130 and the second fuel distribution path 120b in the other side walls 101c and 104a of the first and second air intake passages 100 and 104, it is possible to assemble the structures always from one side by reversing the throttle body TB' , and it is possible to greatly improve an assembling characteristic. Further, in accordance with the structure mentioned above, since both of the fuel inflow hole 116 attached to the second fuel distribution pipe 120 and the air intake port 174 attached to the other side opening 170b of the idle speed air passage 170 are arranged at the other side E' orthogonally to the longitudinal axis X'-X' of the throttle valve shaft T', the fuel inflow hole and the air intake port 174 can be arranged in the same direction at a time of arranging the throttle body TB' within the V bank of the V-type engine. Accordingly, it is possible to greatly improve a connection workability of an air conduit pipe 180 connected to the air intake port 174 and a connection workability of a fuel conduit pipe F' connected to the fuel inflow hole 116 . In this case, the idle speed air passage 170 shown in Fig. 9 is arranged at the lower position of the fuel communication passage 107 in Fig. 9, however, may be arranged at an upper position of the idle speed air passage 170.

Claims

1. A throttle body in a fuel injection apparatus for a V-type engine in which a first air intake passage and a second air intake passage are adjacently arranged sideward in parallel, a first throttle valve opening and closing the first air intake passage and a second throttle valve opening and closing the second air intake passage are attached to a throttle valve shaft cutting across the first air intake passage and the second air intake passage, a first fuel injection valve open to the air intake passage at a downstream side of the first throttle valve is attached to one side wall of the first air intake passage, and a second fuel injection valve open to the air intake passage at a downstream side of the second throttle valve is attached to the other side wall of the second air intake passage, wherein a first fuel distribution pipe (10) holding the first fuel injection valve (J1) toward one side wall (1a) of the first air intake passage (1) is provided with a first distribution tube portion (10a) having a first fuel distribution path (10b) extending along a longitudinal axis (X-X) of a throttle valve shaft (T), a first injection valve insertion tube portion (10d) protruding from the first distribution tube portion

(10a) toward a rear end portion (J1a) of the first fuel injection valve (J1) and having a first injection valve insertion hole (10g) connected to the first fuel distribution path (10b) from a protruding end portion (10f), and a first connection tube portion (10h) protruding toward the other side (E) orthogonally to the first distribution tube portion (10a) and having a first connection hole (101) connected to the first fuel distribution path (10b) from a protruding end portion (10k), a second fuel distribution pipe (20) holding the second fuel injection valve (J2) toward the other side wall (4a) of the second air intake passage (4) is provided with a second distribution tube portion (20a) having a second fuel distribution path (20b) extending along a longitudinal axis (X-X) of the throttle valve shaft (T), a second injection valve insertion tube portion (20d) protruding from the second distribution tube portion (20a) toward a rear end portion (J2a) of the second fuel injection valve (J2) and having a second injection valve insertion hole (20g) connected to the second fuel distribution path (20b) from a protruding end portion (20f), and a second connection tube portion (20h) protruding from one side (D) toward the other side (E) orthogonally to the second distribution tube portion (20a) and having a second connection hole (20m) provided from one side protruding end portion (20k) toward the other side protruding end portion (201) while cutting across the second fuel distribution path (20b), the first fuel injection valve (J1) is held to one side wall (1a) of the first air intake passage (1) by inserting the rear end portion (J1a) of the first fuel injection valve (J1) to the first injection valve insertion hole (10g) of said first fuel distribution pipe, the first connection hole (101) which is open at the protruding end portion (10k) of the first connection tube portion (10h) is arranged so as to be open toward an adjacent opposing space (K) between the first air intake passage (1) and the second air intake passage (4) and toward the other side (E) , the second fuel injection valve (J2) is held to the other side wall (4a) of the second air intake passage (4) by inserting the rear end portion (J2a) of the second fuel injection valve (J2) to the second injection valve insertion hole (20g) of said second fuel distribution pipe, the second connection hole (20m) which is open at the one side protruding end portion (20k) of the second connection tube portion (20h) is opposingly arranged so as to face to said first connection hole (101), the second fuel distribution path (20b) and the first fuel distribution path (10b) are communicated by inserting the fuel communication pipe (40) from the other side protruding end portion (201) of the second connection tube portion (20h) toward the first connection hole (101) of the first connection tube portion (10h) via the second connection hole (20h), and the second connection hole (20m) which is open at the other side protruding endportion (201) of the second connection tube portion (20h) is closed by a fuel inflow joint (50) provided with a fuel inflow path (50e) in which one end is open toward an external portion and the other end is open toward the second fuel distribution path (20b).

2. A throttle body in a fuel injection apparatus as claimed in claim 1, wherein a hole diameter (d1) of the first connection hole (101) provided in said first connection tube portion is made smaller than a hole diameter (d2) of the second connection hole (20m) provided in the second connection tube portion (20h), said fuel communication pipe has, at one side end (40a) thereof, a small-diameter pipe portion (40s) to which a first annular ring (R1) is arranged so as to be fitted, and has, at in the other side end (40b) thereof, a large-diameter pipe portion (40r) to which a second annular ring (R2) is arranged so as to be fitted, the small-diameter pipe portion (40s) provided with the first annular ring (R1) of the fuel communication pipe (40) is arranged so as to be inserted to the first connection hole (101) of the first connection tube portion (10h), and the large-diameter pipe portion (40r) provided with the second annular ring (R2) is arranged so as to be inserted to the second connection hole (20m) of the second connection tube portion (20h) .

3. A throttle body in a fuel injection apparatus as claimed in claim 1, wherein a locking step portion (10v) facing to the protruding end portion (10k) of the first connection tube portion (10h) is formed in the first connection hole (101) provided in said first connection tube portion, a fuel inflow path (50e) is provided in an inner side of said fuel inflow joint, an annular tube portion (50a) facing to one side (D) is formed in said fuel inflow joint, and the fuel communication pipe (40) arranged so as to be inserted into said first connection hole and the second connection hole (20m) is held by the locking step portion (10v) of the first connection hole (101) and the one side end (50c) of the annular tube portion (50a) of the fuel inflow joint (50).

4. A throttle body for a V-type engine in which a first air intake passage and a second air intake passage are arranged in the throttle body so as to be adjacently provided in parallel, a first throttle valve opening and closing the first air intake passage and a second throttle valve opening and closing the second air intake passage are arranged so as to be attached to a throttle valve shaft arranged so as to cut across the first air intake passage and the second air intake passage, a first fuel injection valve which is open to the air intake passage at a downstream side of the first throttle valve is attached to one side wall which is orthogonal to a longitudinal axis of the throttle valve shaft of the first air intake passage, and a second fuel injection valve which is open to the air intake

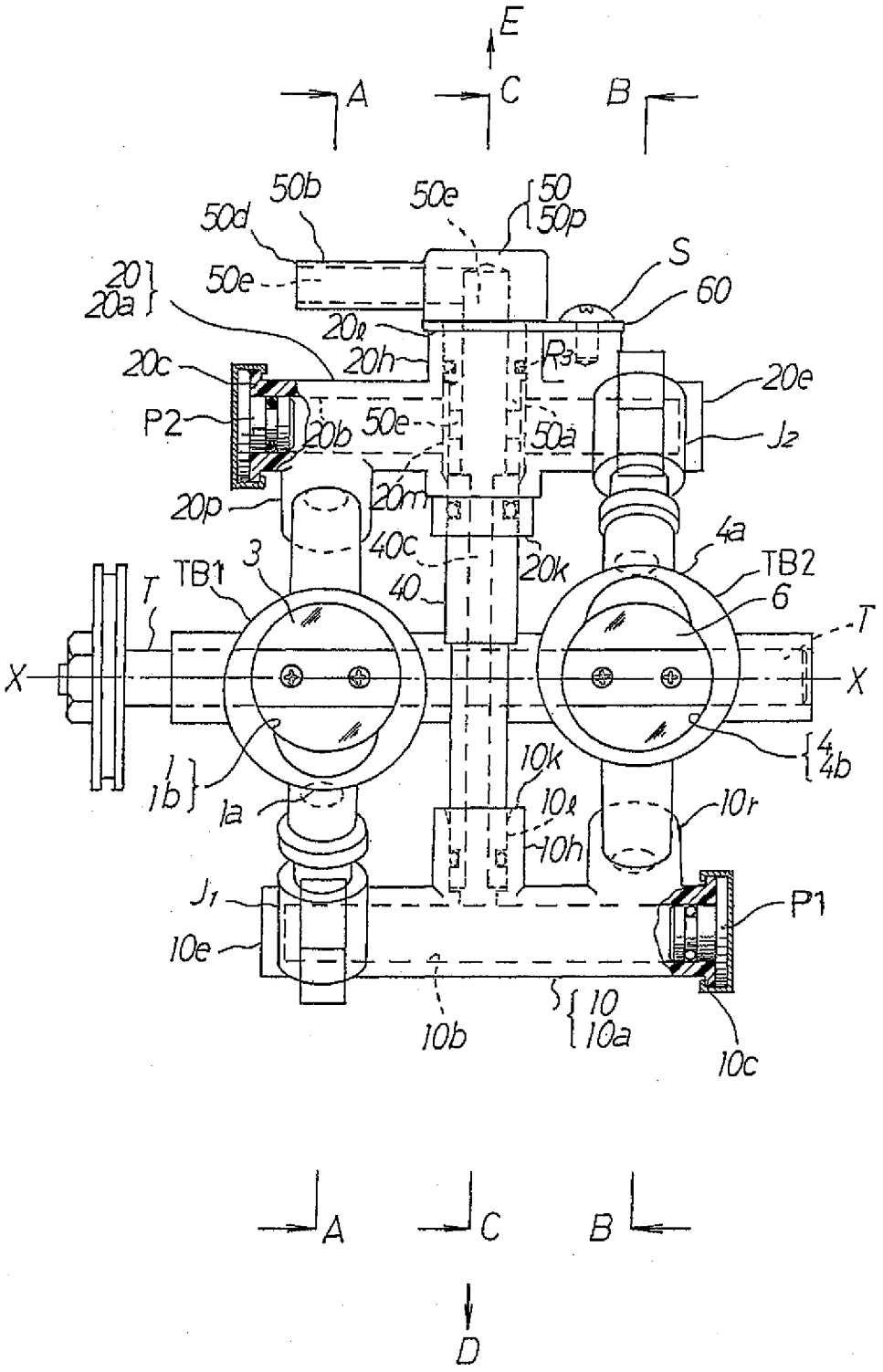
passage at a downstream side of the second throttle valve is attached to the other side wall which is orthogonal to a longitudinal axis of the throttle valve shaft of the second air intake passage, wherein a fuel communication path (107) is provided between opposing side walls (101a and 104a) of the first air intake passage (101) and the second air intake passage (102) so as to be provided integrally with the throttle body (TB'), one end of the fuel communication path being open to one side (D') orthogonally to the longitudinal axis (X'-X') of the throttle valve shaft (T') through one side opening (107a) and the other end thereof being open to the other side (E') orthogonally to the longitudinal axis (X' -X') of the throttle valve shaft (T') through the other side opening (107b), the second fuel distributionpipe (120) is provided with a second fuel distribution path (120b) extending along the longitudinal axis (X'-X') of the throttle valve shaft (T'), a fuel inflow hole (150e) connected to the second fuel distribution path (120b), a second fuel injection valve support hole (117) branched from the second fuel distribution path (120b) so as to be open, and a first fuel communication hole (118) branched from the second fuel distribution path (120b) so as to be open, the first fuel distribution pipe (110) is provided with a first fuel distribution path (110b) extending along the longitudinal axis (X'-X') of the throttle valve shaft (T'), a first fuel injection valve support hole (122) branched from the second fuel distribution hole (110b) so as to be open, and a second fuel communication hole (123) branched from the first fuel distribution path (110b) so as to be open, the second fuel injection valve (J2) is held by the second fuel injection valve support hole (117) of the second fuel distribution pipe (120) and the second fuel injection valve support hole (108) provided in the other side wall (104a) of the second air intake passage (2) by arranging said second fuel distribution pipe so as to be screwed toward the other side wall (101c) of the first air intake passage (101) and the other side wall (104a) of the second air intake passage (102), the first fuel communication hole (118) of the second fuel distribution pipe (120) is connected with the other side opening (107b) of the fuel communication path (107) through a flow path by a first communication member (130), the first fuel injection valve (J1') is held by the first fuel injection valve support hole (122) of the first fuel distribution pipe (110) and the first fuel injection valve support hole (111) provided in one side wall (101a) of the first air intake passage (1) by arranging the first fuel distribution pipe (110) so as to be screwed toward one side wall (101a) of the first air intake passage (101) and one side wall (104d) of the second air intake passage (102), and the second fuel communication hole (123) of the first fuel distribution pipe (110) is connected with one side opening (107a) of the fuel communication path (107) through a flow path by a second communication member (131).

5. A throttle body for a V-type engine as claimed in claim 4, wherein said first communication member (130) and the second communication member (131) are formed approximately in an L-shape by horizontal pipe portions (130a, 131a) which are orthogonal to the longitudinal axes (Y1-Y1, Y2-Y2) of the first air intake passage (101) and the second air intake passage (102), and inclined pipe portions (130b, 131b) which are formed to cross at a crossing angle (α) with respect to the longitudinal axes (Y1-Y1, Y2-Y2), the first fuel injection valve support hole (111) formed in the one side wall (101a) of the first air intake passage (101) and the second fuel injection valve support hole (108) formed in the other side wall (104a) of the second air intake passage (102) are formed at said crossing angle (α) with respect to the longitudinal axes (Y1-Y1, Y2-Y2) of said air intake passage, and the first fuel communication hole (118) and the second fuel injection valve support hole (117) formed in the second fuel distribution pipe (120b), and the second fuel communication hole (123) and the first fuel injection valve support hole (122) formed in the first fuel distribution pipe (110) are formed at said crossing angle (α) with respect to the longitudinal axes (Y1-Y1, Y2-Y2) of said air intake passage.

6. A throttle body for a V-type engine as claimed in claim 4, wherein an idle speed air passage (170) is provided from one side (D') toward the other side (E') orthogonally to the longitudinal axis (X'-X') of the throttle valve shaft (T') so as to be in parallel to the fuel communication path (107) provided in said throttle body, an idle speed control actuator (AC') is arranged in one side opening (170a) of said idle speed air passage (170), and an air intake port (174) is arranged in the other side opening (170b).

7. A throttle body for a V-type engine as claimed in claim 6, wherein the air intake port (174) connected to the other side opening (170b) of said idle speed air passage and the fuel inflow hole (150e) connected to the second fuel distributionpath (120b) of the second fuel distribution pipe (120) are arranged at the other side (E') orthogonally to the longitudinal axis (X'-X') of the throttle valve shaft (T').

FIG. 1


E
A
C
B
50b
50d
50e
50
50p
S
60
20
20a
20h
20c
P2
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20e
J2
20p
20m
40c
20k
4a
TB2
6
3
TB1
T
40
X
1
1b
1a
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10h
10r
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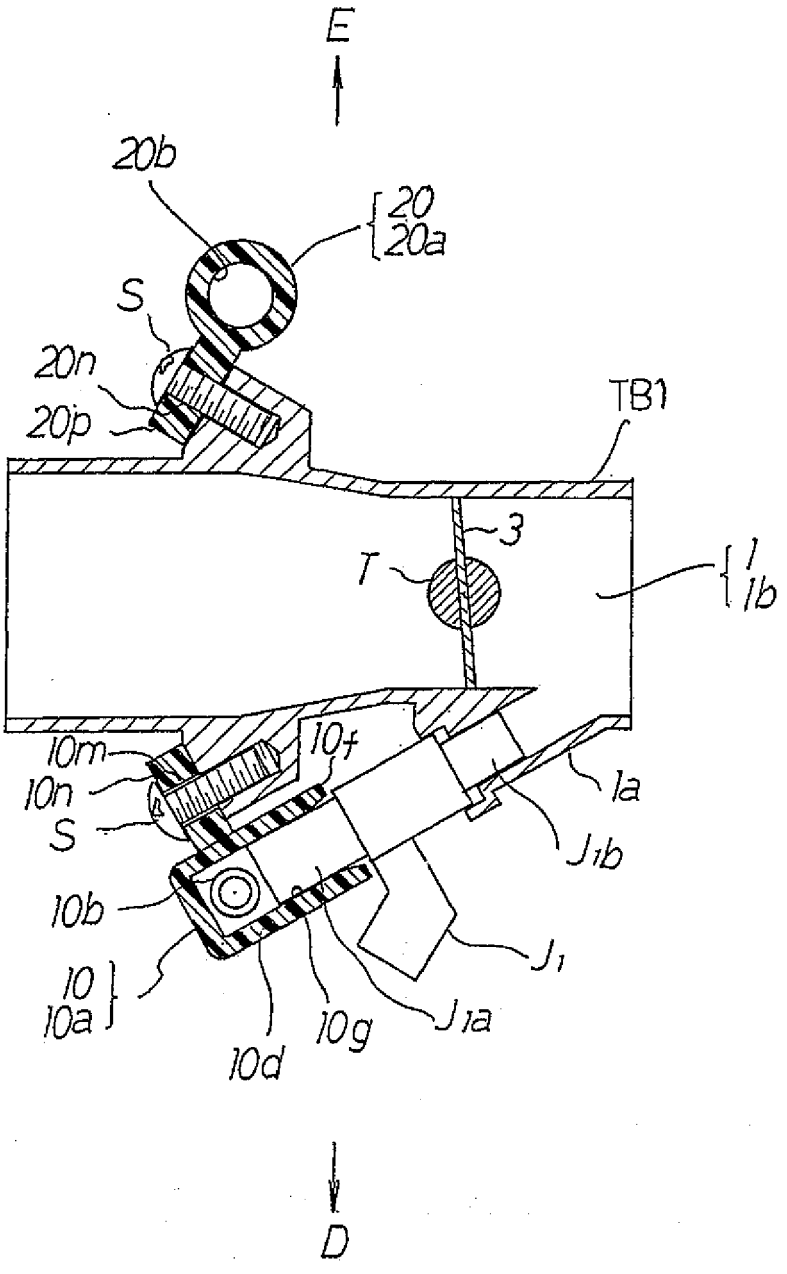
J1
10e
P1
10b
10
10a
10c
D

FIG. 2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20
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S
20n
20p
TB1
3
T
1
1b
10m
10n
S
10f
1a
J1b
10b
J1
10
10a
10d
10g
J1a
D

FIG. 3

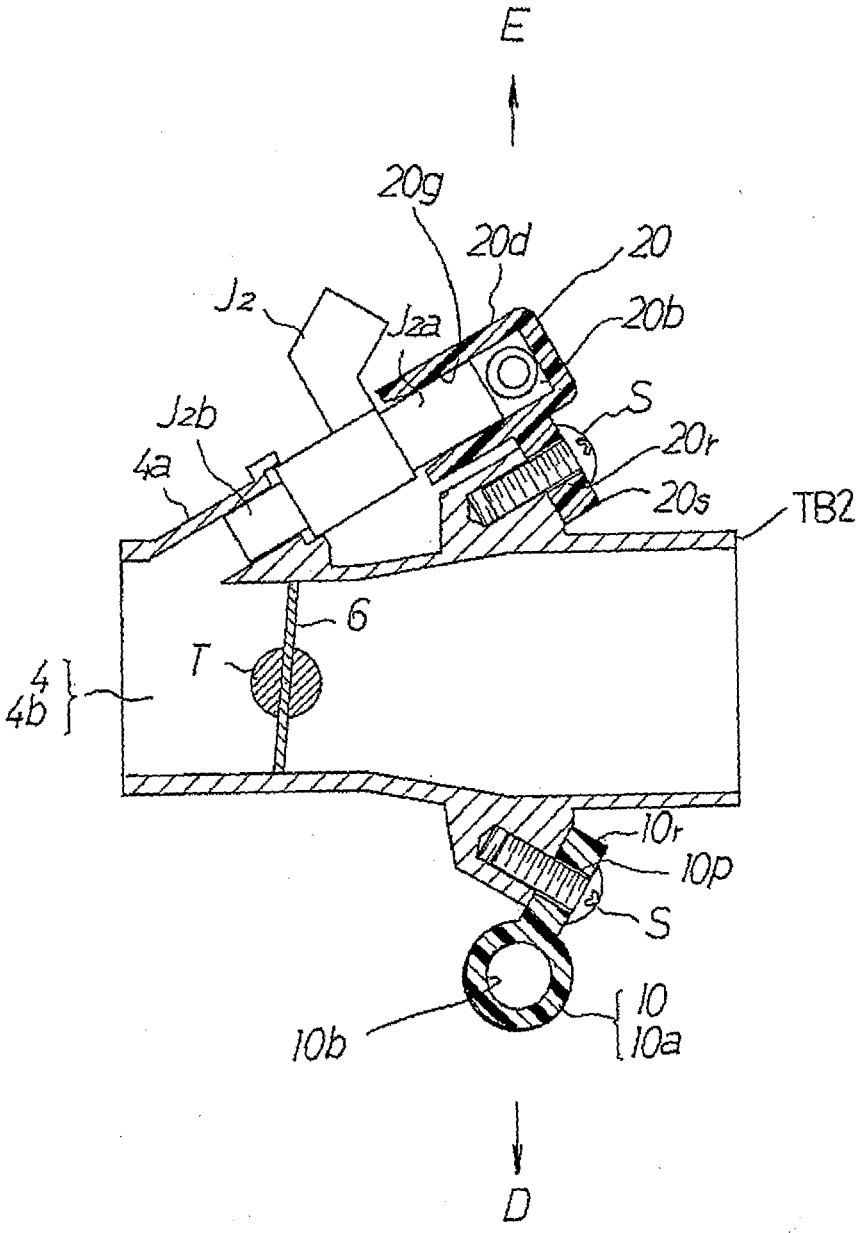

E
20g
20d
20
J2
J2a
20b
S
J2b
20r
4a
20s
TB2
6
T
4
4b
10r
10p
S
10
10a
10b
D

FIG. 4

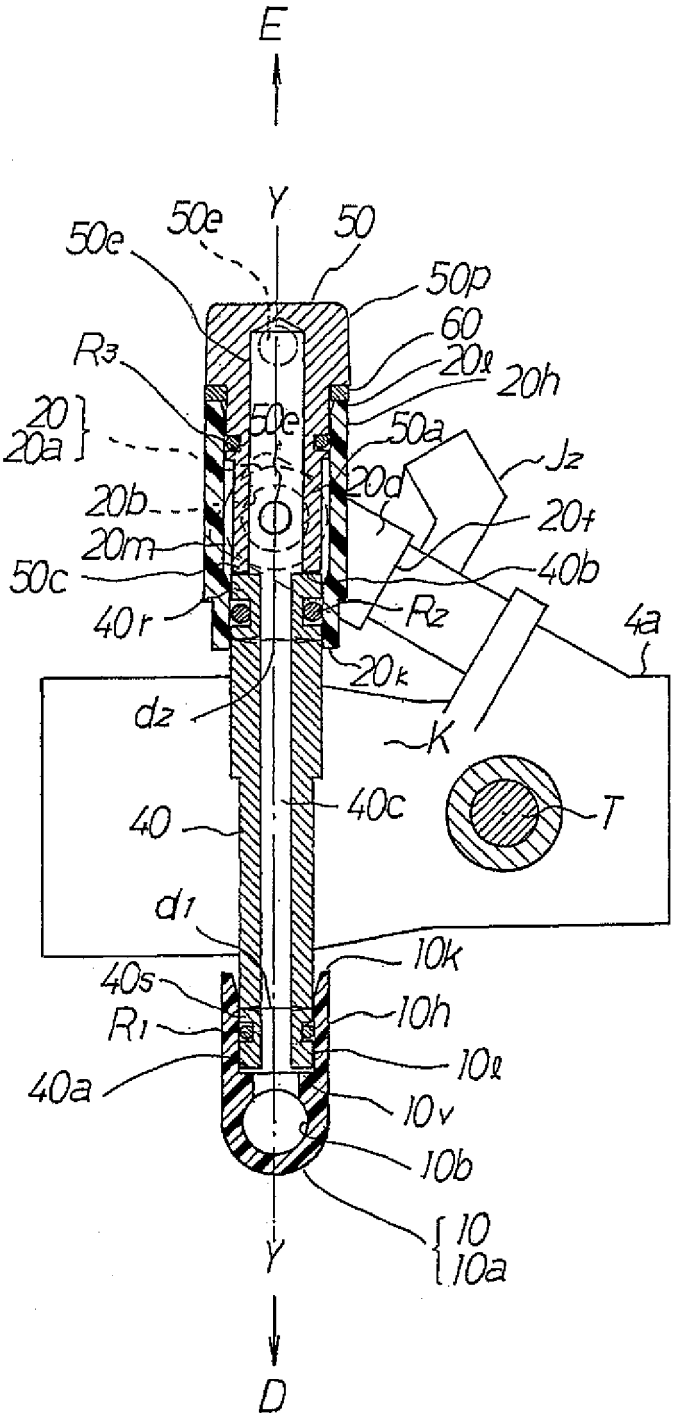

E
Y
50e
50e
50
50p
60
20l
20h
R3
20
20a
50e
50a
Jz
20d
20b
20f
20m
40b
50c
Rz
4a
40r
20k
dz
K
40
40c
T
d1
10k
40s
10h
R1
10l
40a
10v
10b
10
10a
Y
D

FIG. 5

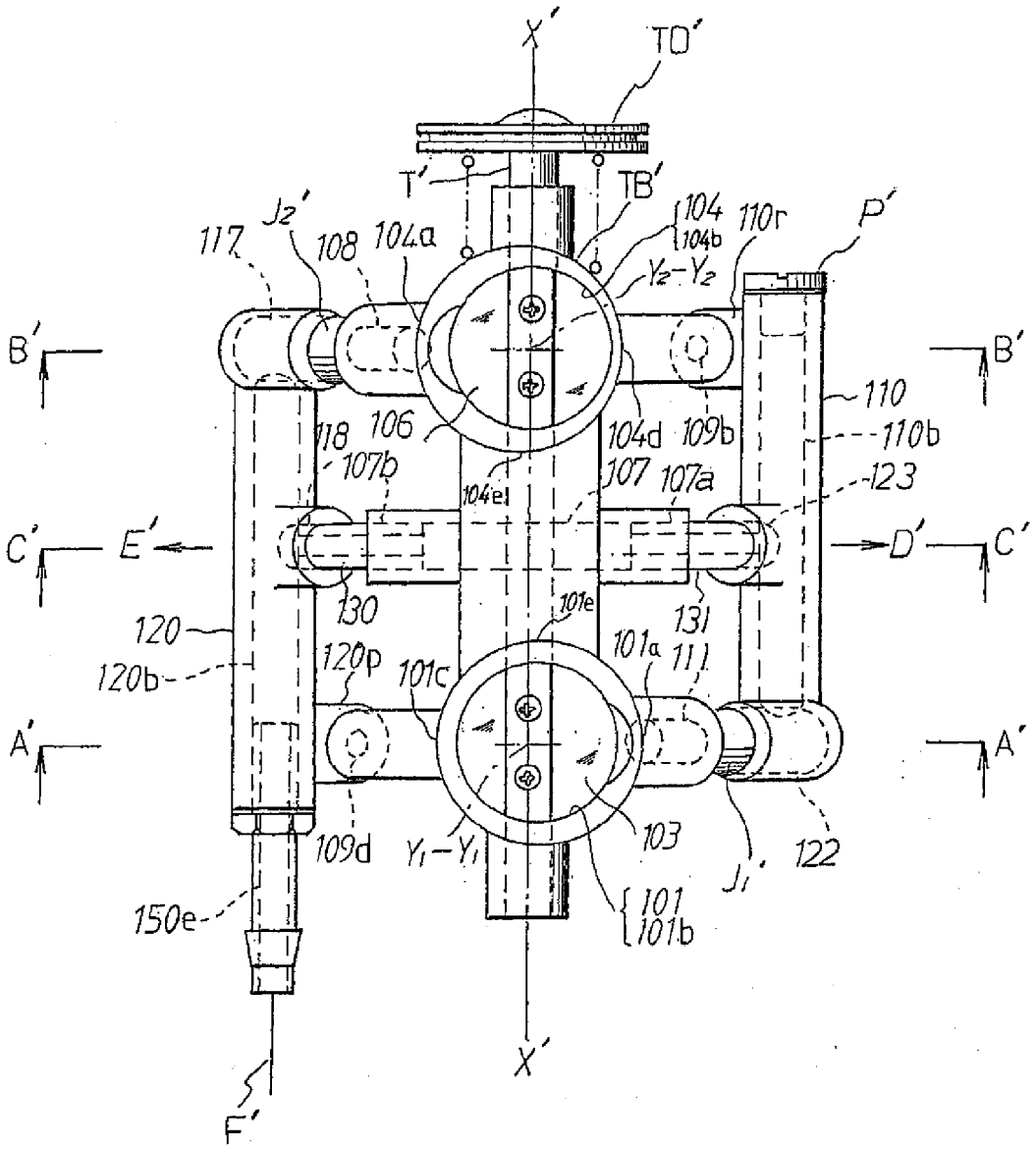

X'
TD'
T'
TB'
J2'
117
108
104a
104
104b
110r
P'
Y2-Y2
B'
B'
110
110b
118
106
104d
109b
107b
107
107a
123
104e1
C'
E'
D'
C'
130
101e
131
120
120b
120p
101c
101a
111
A'
A'
109d
Y1-Y1
103
122
J1
101
101b
150e
X'
F'

FIG. 6

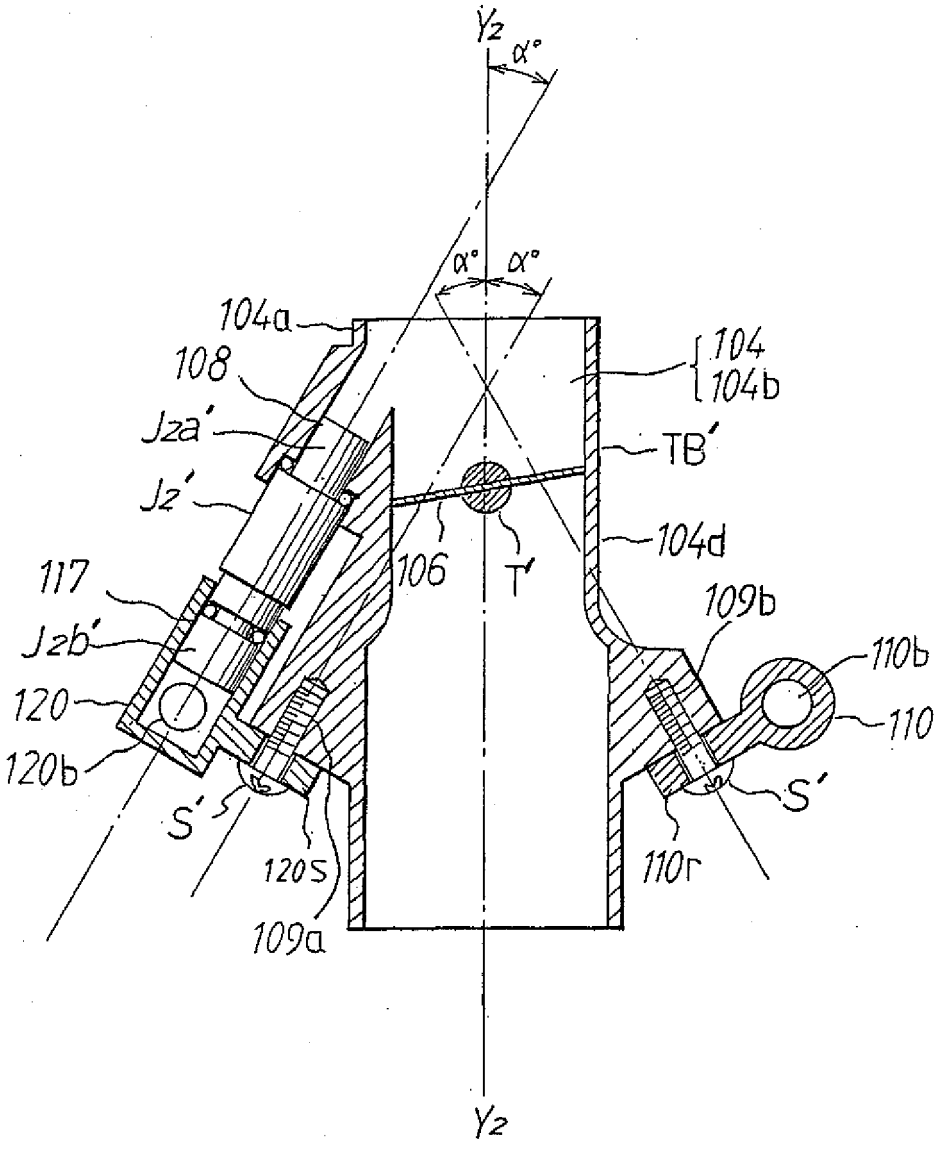

Y2
α°
α°
α°
104a
108
Jza'
Jz'
117
Jzb'
120
120b
S'
120S
109a
104
104b
TB'
104d
106
T'
109b
110b
110
S'
110r
Y2

FIG. 7

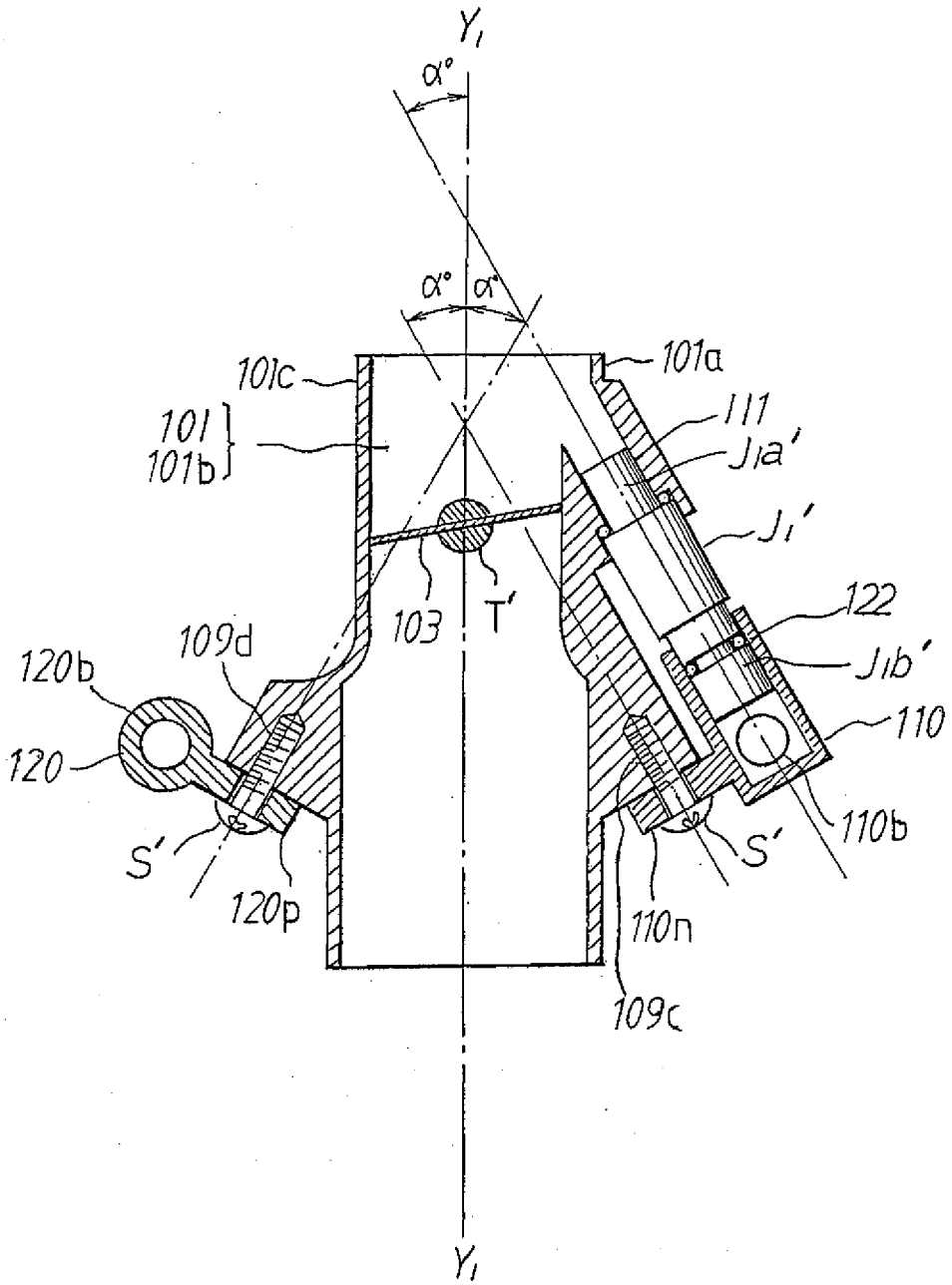

Y1
α°
α°
α°
101c
101a
101
101b
111
J1a'
J1'
122
J1b'
110
103
T'
109d
120b
120
S'
120p
110b
S'
110n
109c
Y1

FIG. 8

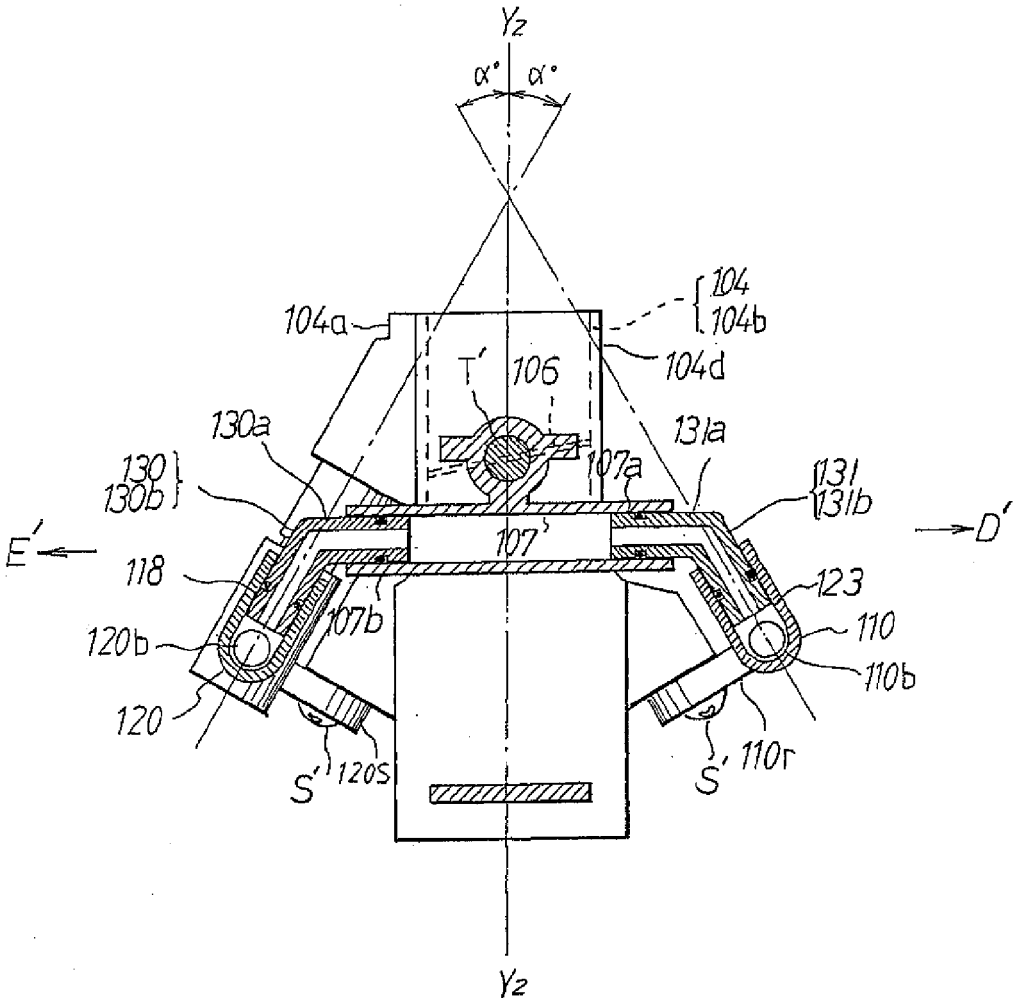
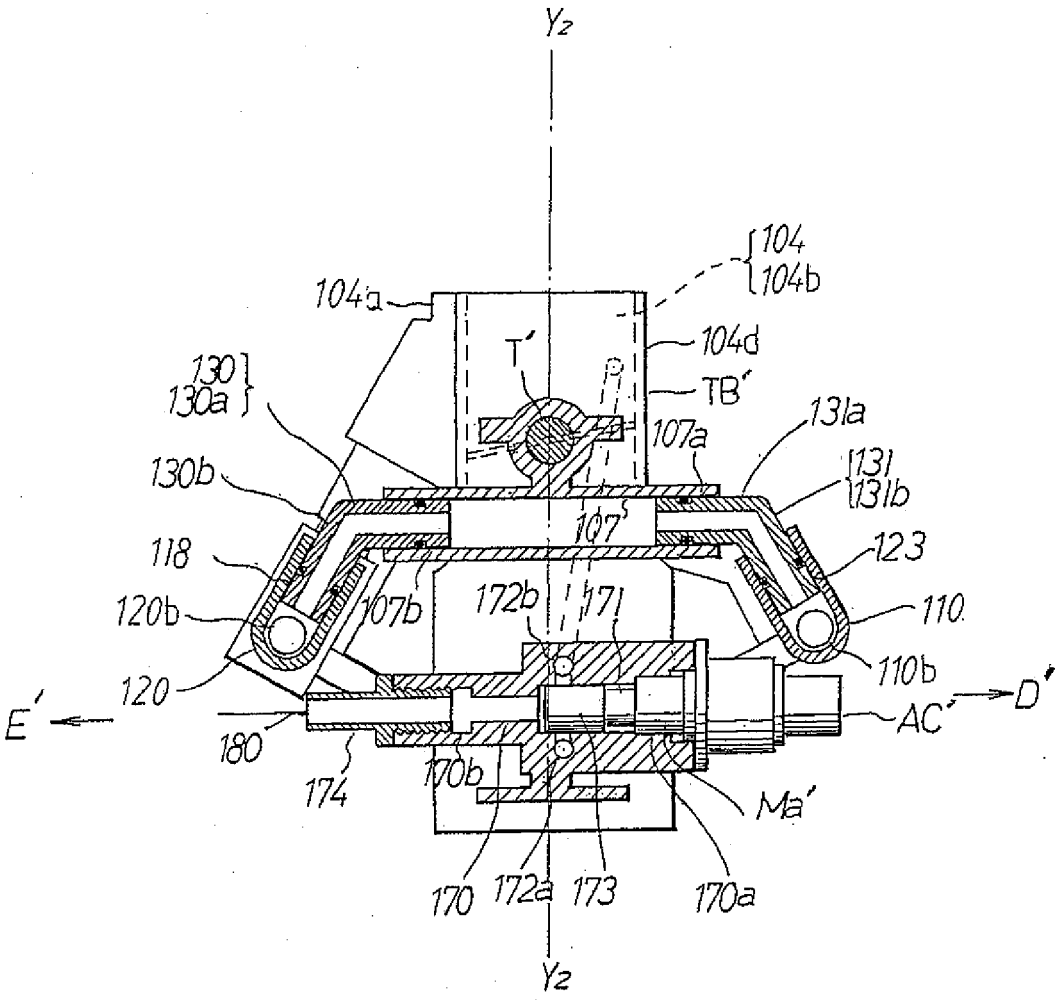

Y2
α°
α°
104
104b
104a
104d
T'
106
130a
131a
130
130b
107a
131
131b
E'
D'
107
118
123
107b
110
120b
110b
120
S'
120S
S'
110r
Y2

FIG. 9


Y2
104
104b
104a
104d
T'
P'
TB'
130
130a
131a
107a
130b
131
131b
107'
118
123
120b
107b
172b
171
110
110b
120
E'
D'
AC'
180
174
170b
Ma'
170
172a
173
170a
Y2

REFERENCES CITED IN THE DESCRIPTION

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- JP 2004211612 A **[0046]**