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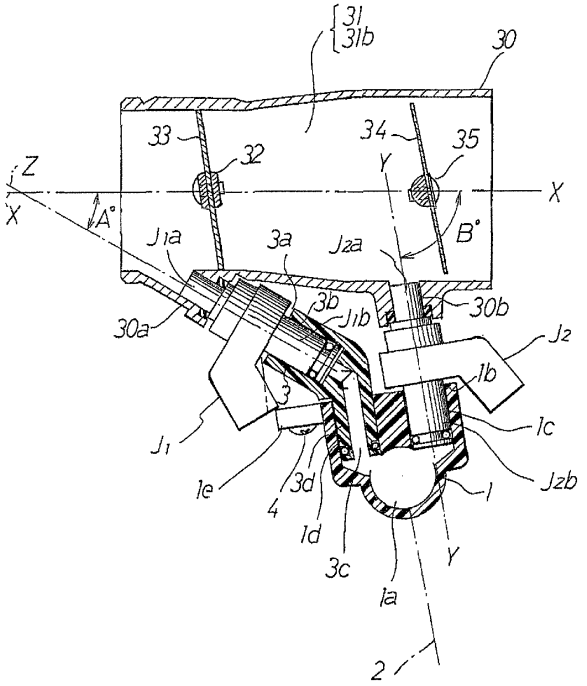
(54) Fuel supply pipe structure in two fuel injection valve type throttle body

(57) A fuel connection pipe (3) is provided with a first and a second fuel injection valve insertion hole (3b), which is concentric to a longitudinal axis (Z-Z) of the first respective the second fuel injection valve (J1) so as to be open, at one end (3a), and is provided with a connection flow path (3e) from the first fuel injection valve insertion hole (3b) toward another end (3c) of an insertion pipe portion (3d) as well as the insertion pipe portion (3d) is formed in parallel to the longitudinal axis (Y-Y) of the second fuel injection valve (J2), at the other end (3c). A rear end portion (J1b) of the first fuel injection valve (J1) is inserted into the first fuel injection valve insertion hole (3b) of the fuel connection pipe (3), and the insertion pipe portion (3d) is inserted into the connection hole (1d) of the fuel distribution pipe (1). A rear end portion (J2b) of the second fuel injection valve (J2) is inserted into to the second fuel injection valve insertion hole (1c) of the fuel distribution pipe (1). In the state mentioned above, the fuel distribution pipe (1) is screwed to the throttle body (30).

FIG. 1



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Description

Technical Field

[0001] The present invention relates to a fuel injection apparatus injecting and supplying fuel toward an internal combustion engine from a fuel injection valve attached to a throttle body, and more particular to a fuel supply pipe structure in a two fuel injection valve type throttle body in which a first fuel injection valve and a second fuel injection valve are attached to a single throttle body.

Background Art

[0002] A conventional fuel supply pipe structure in a throttle body provided with two fuel injection valves is disclosed in Fig. 2.

[0003] Reference numeral 30 denotes a throttle body in which an intake passage 31 is provided in an inner portion so as to laterally pass through. The intake passage 31 is opened and closed by a throttle valve 33 attached to a throttle valve shaft 32, and an auxiliary throttle valve 34 is attached to an auxiliary throttle valve shaft 35 in an upstream side of the throttle valve 33 so as to open and close the intake passage 31.

[0004] The throttle valve 33 controls an amount of air flowing to an internal combustion engine (not shown), and the auxiliary throttle valve 34 controls an amount of air flowing to the throttle valve 33.

[0005] Reference symbol J1 denotes a first fuel injection valve injecting and supplying fuel into an intake passage 31a at a downstream side of the throttle valve 33. The first fuel injection valve J1 bears a fuel supply region at a time when the internal combustion engine is under a low opening degree operation and under a middle opening degree operation.

[0006] Further, a leading end J1a of the first fuel injection valve J1 is inserted to a first insertion hole 30a of the throttle body 30, a rear end J1b is inserted to a first fuel injection valve insertion hole 36a of a first fuel distribution pipe 36, and the first fuel injection valve J1 is pinched by the throttle body 30 and the first fuel distribution pipe 36 screwed to the throttle body 30 by a screw 41.

[0007] At this time, a longitudinal axis Z-Z of the first fuel injection valve J1 is arranged at a crossing angle (A degree) with respect to a longitudinal axis X-X of the intake passage 31.

[0008] Further, a first fuel inflow path 36b connected to the first fuel injection valve insertion hole 36a is provided in an inner portion of the first fuel distribution pipe, and the first fuel inflow path 36b is connected to a fuel source such as a fuel pump (not shown) or the like by a first fuel piping 40.

[0009] Reference symbol J2 denotes a second fuel injection valve injecting and supplying the fuel into an intake passage 31b at an upstream side of the throttle valve 33. The second fuel injection valve J2 bears a fuel supply region at a time when the internal combustion engine is under middle and high opening degree operations.

[0010] Further, a leading end J2a of the second fuel injection valve J2 is inserted to a second insertion hole 30b of the throttle body 30, a rear end J2b is inserted to a second fuel injection valve insertion hole 37a of a second fuel distribution pipe 37, and the second fuel injection valve J2 is pinched by the throttle body 30 and the second fuel distribution pipe 37 screwed to the throttle body 30 by a screw 43.

[0011] At this time, a longitudinal axis Y-Y of the second fuel injection valve J2 is arranged at a crossing angle B degree with respect to the longitudinal axis X-X of the intake passage 31.

[0012] Further, a second fuel inflow path 37b connected to the second fuel injection valve insertion hole 37a is provided in an inner portion of the second fuel distribution pipe 37, and the second fuel inflow path 37b is connected to the fuel source such as the fuel pump (not shown) or the like by a second fuel piping 42.

[0013] In this case, the crossing angel A degree between the first fuel injection valve J1 and the intake passage 31 is formed at an acute angle in comparison with the crossing angle B degree between the second fuel injection valve J2 and the suction passage 31.

[0014] In other words, a relation "crossing angle A degree < crossing angle B degree" is established.

[0015] As mentioned above, the crossing angle a degree of the first fuel injection valve J1 is formed at the acute angle in comparison with the crossing angle B degree of the second fuel injection valve J2, for the purpose of supplying the fuel injected by the first fuel injection valve J1 to the engine along the air stream within the intake passage 31 in a parallel state as much as possible, at a time when the engine is under the low and middle opening degree operations.

[0016] On the other hand, the crossing angle B degree of the second fuel injection valve J2 is formed at an obtuse angle in comparison with the crossing angle A degree of the first fuel injection valve J1, for the purpose of preventing the second fuel injection valve J2 from protruding to a right side in the drawing so as to make the entire of the throttle body compact. Even if the crossing angle B degree of the second fuel injection valve J2 is made at the obtuse angle as mentioned above, the air stream flowing within the intake passage 31 is fast particularly at a time of the operation under the high opening degree of the throttle valve. Accordingly, the injected fuel can flow well along the air stream.

Disclosure of the Invention

[0017] In accordance with the conventional throttle body provided with two fuel injection valves, the first fuel inflow path 36b of the first fuel distribution pipe 36 is connected to a fuel pump discharge path (not shown) by the first fuel piping 40, and the second fuel inflow path 37b of the second fuel distribution pipe 37 is connected to the pump discharge path by the second fuel piping 42.

[0018] Accordingly, a part of the fuel boosted by the fuel pump is supplied to the first fuel injection valve J1 installed to the first fuel distribution pipe 36 via the first fuel piping 40, and the other part of the fuel boosted by the fuel pump is supplied to the second fuel injection valve J2 attached to the second fuel distribution pipe 37 via the second fuel piping 42.

[0019] In accordance with the conventional fuel supply pipe structure as mentioned above, two long first and second fuel pipings are necessary between the throttle body 30 and the fuel pump.

[0020] This is particularly because the fuel pump is arranged within a fuel tank existing at a position away from the engine, or near the fuel tank, and the throttle body 30 is arranged near the internal combustion engine.

[0021] In accordance with the structure mentioned above, in a two-wheeled vehicle or the like in which the internal combustion engine, the throttle body 30 and the fuel tank are arranged so as to be directly exposed to the atmospheric air, two fuel pipings 40 and 42 are also directly exposed to the atmospheric air. Accordingly, a degree of freedom for designing two long fuel pipings is limited in the two-wheeled vehicle or the like having a narrow accommodating space, as well as an outer appearance is deteriorated.

[0022] Further, the first and second fuel distribution pipes 36 and 37 are prepared as the fuel distribution piping, and they are independently screwed to the throttle body 30. In accordance with this structure, screwing work man-hours are increased.

[0023] A fuel supply pipe structure in a two fuel injection valve type throttle body in accordance with the present invention is made by taking the problems mentioned above into consideration, and an object of the present invention is to provide such a fuel supply pipe structure that a mounting property to a two-wheeled vehicle can be enhanced a degree of freedom for designing a fuel piping can be improved and an outer appearance of the two-wheeled vehicle can be improved, by changing a number of the long fuel piping coupling a fuel pump and a fuel distribution pipe from conventional two to one, and that an installation characteristic to a throttle body can be improved, by setting the fuel distribution pipe single.

Summary of the Invention

[0024] In accordance with the present invention, in order to achieve the obj ect mentioned above, there is provided a fuel supply pipe structure in a two fuel injection valve type throttle body, the two fuel injection valve type throttle body comprising:

a first fuel injection valve J1 arranged at a crossing angle (A degree) with respect to a longitudinal axis X-X of an intake passage, toward the intake passage at a downstream side from a throttle valve opening and closing the intake passage; and

a second fuel injection valve arranged at a crossing angle (B degree) larger than the above mentioned crossing angle, toward an intake passage at an upstream side from the throttle valve,

wherein a fuel distribution pipe, in which a fuel distribution path is provided in an inner portion and the fuel distribution path is connected to a fuel source, is provided with a second fuel injectionvalve insertion hole, which is concentric to a longitudinal axis Y-Y of the second fuel injection valve and in which one end is open at an end portion and another end is open to the fuel distribution path, and a connection hole, which is in parallel to the second fuel injection valve insertion hole and in which one end is open at the end portion and another end is open to the fuel distribution path,

wherein a fuel connection pipe is provided with a first fuel injection valve insertion hole, which is concentric to a longitudinal axis Z-Z of the first fuel injection valve so as to be open, at one end, and is provided with a connection flow path from the first fuel injection valve insertion hole toward another end of an insertion pipe portion as well as the insertion pipe portion is formed in parallel to the longitudinal axis Y-Y of the second fuel injection valve, in the other end, and

wherein a rear end portion of the first fuel injection valve is inserted so as to be connected to the first fuel injection valve insertion hole of the fuel connection pipe, a rear end portion of the second fuel injection valve is inserted so as to be connected to the second fuel injection valve insertion hole of the fuel distribution pipe, and the insertion pipe portion of the fuel connection pipe is inserted so as to be connected to the connection hole.

[0025] In accordance with the fuel supply pipe structure in the two fuel injection valve type throttle body on the basis of the present invention, the single fuel distribution pipe is prepared, the first fuel injection valve is connected to the fuel distribution pipe via the fuel connection pipe, the second fuel injection valve is directly connected to the fuel distribution pipe, the fuel boosted by the fuel pump is supplied to the fuel distribution path of the fuel distribution pipe from the single fuel piping, a part of the fuel is supplied to the first fuel injection valve via the fuel connection pipe, and the other of the fuel is directly supplied to the second fuel injection valve.

[0026] In accordance with the present invention, since it is sufficient that the single fuel distribution pipe is prepared, it is possible to easily execute a screwing work of the fuel distribution pipe to the throttle body.

[0027] Further, since the fuel distribution pipe is single, it is possible to largely improve a degree of freedom for arranging the fuel distribution pipe.

[0028] Further, since it is sufficient that the fuel distribution pipe is connected to the fuel pump by the single fuel piping, it is possible to easily execute the arrangement of the fuel piping and the connecting work of the fuel piping, and it is possible to arrange the outer appearance neat.

Detailed Description of the Invention

[0029] A description will be given below of an embodiment of a fuel supply pipe structure in a two fuel injection valve type throttle body in accordance with the present invention with reference to Fig. 1.

[0030] In this case, a description of elements having the same structures as those in Fig. 2 will be omitted by using the same reference numerals.

[0031] Reference numeral 1 denotes a fuel distribution pipe. The fuel distribution pipe 1 is formed as follows.

[0032] Reference symbol 1a denotes a fuel distribution path provided in an inner portion of the fuel distribution pipe 1. The fuel distribution path 1a is connected to a fuel pump (not shown) by a fuel distribution piping 2, and a fuel boosted by the fuel pump is supplied into the fuel distribution path 1a via the fuel piping 2.

[0033] Further, one end of a second fuel injection valve insertion hole 1c is provided so as to be open at an end portion 1b (an upper end in Fig. 1) of the fuel distribution pipe 1, and another end is open to an inner side of the fuel distribution path 1a.

[0034] Further, a longitudinal axis of the second fuel injection valve insertion hole 1c is formed concentrically to a longitudinal axis Y-Y of a second fuel injection valve J2.

[0035] Further, one end of a connection hole 1d is provided so as to be open at the end portion 1b of the fuel distribution pipe 1, and the other end is open to an inner side of the fuel distribution path 1a.

[0036] Further, a longitudinal axis of the connection hole 1d is formed in parallel to the longitudinal axis of the second fuel injection valve insertion hole 1c.

[0037] In other words, the connection hole 1d is formed in parallel to the longitudinal axis Y-Y of the second fuel injection valve J2.

[0038] Summarizing the above, the second fuel injection valve insertion hole 1c and the connection hole 1d are provided in the single fuel distribution pipe 1 from the fuel distribution path 1a toward the one end 1b in parallel and along the longitudinal axis Y-Y of the second fuel injection valve J2.

[0039] Reference numeral 3 denotes a fuel connectionpipe. A first fuel injection valve insertion hole 3b, which is concentric to the longitudinal axis X-X of the first fuel injection valve J1, is provided so as to be open toward one end 3a in an upper side, and an insertion pipe portion 3d, which is inparallel to the longitudinal axis Y-Y of the second fuel injection valve J2 and is inserted into the connection hole 1d of the fuel distribution pipe 1, is formed toward another end 3c in a lower side thereof. Further, a connection flow path 3e is provided from a bottom portion of the first fuel injection valve insertion hole 3b toward the other end 3c of the fuel connection pipe 3.

[0040] Next, a description will be given of mounting of the fuel distribution pipe 3 to a throttle body 30 and support of the fuel injection valves J1 and J2.

[0041] First, a rear end portion J1b of the first fuel injection valve J1 is inserted into the first fuel injection valve insertion hole 3bof the fuel connection pipe 3. At this time, the longitudinal axis Z-Z of the first fuel injection valve J1 is arranged at a crossing angle (A degree) with respect to the longitudinal axis X-X of the intake passage 30, a leading end portion J1a thereof is arranged so as to be inserted to a first insertion hole 30a of the throttle body 30, and the rear end portion J1b is arranged so as to be inserted to the first fuel injection valve insertion hole 3b of the fuel connection pipe 3.

[0042] Secondly, a rear end portion J2b of the second fuel injection valve J2 is arranged so as to be inserted into the second fuel injection valve insertion hole 1c open at the end portion 1b of the fuel distribution pipe 1. Accordingly, the longitudinal axis Y-Y of the second fuel injection valve J2 is arranged at a crossing angle (B degree) with respect to the longitudinal axis X-X of the intake passage 30, a leading end portion J2a thereof is arranged so as to be inserted to a second insertion hole 30b of the throttle body 30, and the rear end portion J2b is arranged so as to be inserted to the second fuel injection valve insertion hole 1c of the fuel distribution pipe 1.

[0043] Further, the insertion pipe portion 3d of the fuel connection pipe 3 is arranged so as to be inserted into the connection hole 1d of the fuel distribution pipe 1.

[0044] Thirdly, a collar portion 1e extending in a side direction from the fuel distribution pipe 1 is screwed to the throttle body 30 by a screw 4.

[0045] In accordance with the structure mentioned above, the fuel distribution pipe 1 is screwed and fixed to the throttle body 30 by the screw 4, the first fuel injection valve J1 is pinched by the fuel distribution pipe 1, the fuel connection pipe 3 and the throttle body 30, and the second fuel injection valve J2 is pinched by the fuel distribution pipe 1 and the throttle body 30.

[0046] Further, the fuel boosted by the fuel pump is supplied to the fuel distribution path 1a of the fuel distribution pipe 1, a part of the fuel within the fuel distribution path 1a is supplied to the second fuel injection valve J2 via the second fuel injection valve insertion hole 1c, and the other portion of the fuel within the fuel distribution path 1a is supplied to the first fuel injection valve J1 via connection hole 1d, the connection flow path 3e of the fuel connection pipe 3, and the first fuel injection valve insertion hole 3b.

[0047] In accordance with the fuel supply pipe structure mentioned above, since the first fuel injection valve J1 is connected to the fuel distribution pipe 1 via the fuel connectionpipe 3, and the second fuel injection valve J2 is directly connected to the fuel distribution pipe 1, it is sufficient that the single fuel distribution pipe 1 is prepared.

[0048] Since the fuel distribution pipe 1 can be single, it is sufficient to prepare one fuel piping 2 for connecting the fuel distribution pipe 1 and the fuel pump by the flow path. Accordingly, it is possible to improve a degree of freedom for arranging the fuel piping 2 as well as it is

possible to improve a connecting workability of the fuel piping 2. Further, it is possible to improve an outer appearance.

[0049] Further, since the mounting between the fuel piping 2 and the throttle body 30 can be finished by only one mounting work, it is possible to improve a mounting workability of the fuel piping 2.

[0050] The above structure, in which the fuel distribution pipe 1 and the fuel piping 2 can be single, is particularly effective for a two-wheeled vehicle in which the throttle body 30 is arranged so as to be directly exposed to the atmospheric air and the accommodating space is limited narrow in comparison with the motor vehicle.

[0051] Further, since a maintenance work of the fuel injection valves J1 and J2 and the fuel distribution pipe 1 can be executed only by detaching the single fuel distribution pipe from the throttle body 30, it is possible to largely improve the workability.

[0052] The present embodiment is employed for the single throttle body, however, can be easily applied to a multiple type throttle body in which a plurality of throttle bodies are arranged in a side direction.

[0053] At this time, the structure may be made such that a fuel distribution path, which is made long in a side direction along the multiple type throttle body, is provided in the single fuel distribution pipe 1, and the connection holes and the second fuel injection valve insertion holes are provided so as to be open toward the first and second fuel injection valves installed to the respective throttle bodies.

[0054] Further, it is not necessary to always set the crossing angles (A degree and B degree) of the first and second fuel injection valves J1 and J2 with respect to the longitudinal axis X-X of the intake passage 31 so as to satisfy the relation "A degree < B degree", but the present invention can be applied to all the two fuel injection valves having different angles.

Brief Description of the Drawings

[0055]

Fig. 1 is a vertical sectional view of a main portion showing an embodiment of a fuel supply pipe structure in a two fuel injection valve type throttle body in accordance with the present invention; and

Fig. 2 is a vertical sectional view of a main portion showing a conventional fuel supply pipe structure in a two fuel injection valve type throttle body.

Claims

1. A fuel supply pipe structure in a two fuel injection valve type throttle body, the two fuel injection valve type throttle body comprising:

a first fuel injection valve (J1) arranged at a crossingangle (Adegree) with respect to a longitudinal axis (X-X) of an intake passage, toward the intake passage at a downstream side from a throttle valve opening and closing the intake passage; and

a second fuel injection valve (J2) arranged at a crossing angle (B degree) larger than said crossing angle, toward an intake passage at an upstream side from the throttle valve,

wherein a fuel distribution pipe (1), in which a fuel distribution path (1a) is provided in an inner portion and said fuel distribution path is connected to a fuel source, is provided with a second fuel injection valve insertion hole (1c), which is concentric to a longitudinal axis (Y-Y) of the second fuel injection valve (J2) and in which one end is open at an end portion (1b) and another end is open to the fuel distribution path (1a), and a connection hole (1d), which is in parallel to said second fuel injection valve insertion hole and in which one end is open at the end portion (1b) and another end is open to the fuel distribution path (1a), wherein a fuel connection pipe (3) is provided with a first fuel injection valve insertion hole (3b), which is concentric to a longitudinal axis (Z-Z) of the first fuel injection valve (J1) so as to be open, at one end 3a, and is provided with a connection flow path (3e) from the first fuel injection valve insertion hole (3b) toward another end (3c) of an insertion pipe portion (3d) as well as the insertion pipe portion (3d) is formed in parallel to the longitudinal axis (Y-Y) of the second fuel injection valve (J2), in the other end (3c), and

wherein a rear end portion (J1b) of said first fuel injection valve is inserted so as to be connected to the first fuel injection valve insertion hole (3b) of the fuel connection pipe (3), a rear end portion (J2b) of the secondfuel injectionvalve (J2) is inserted so as to be connected to the second fuel injection valve insertion hole (1c) of the fuel distribution pipe (1), and the insertion pipe portion (3d) of the fuel connection pipe (3) is inserted so as to be connected to the connection hole (1d).

FIG. 1

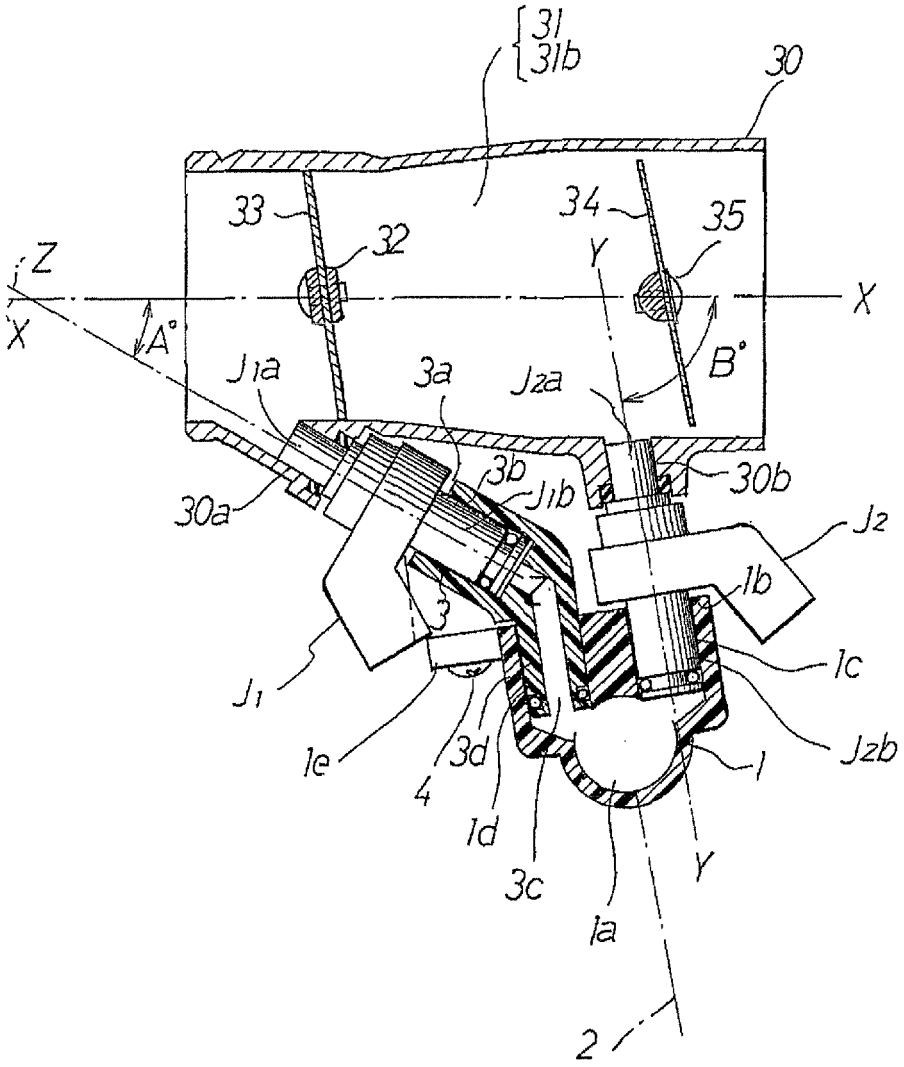
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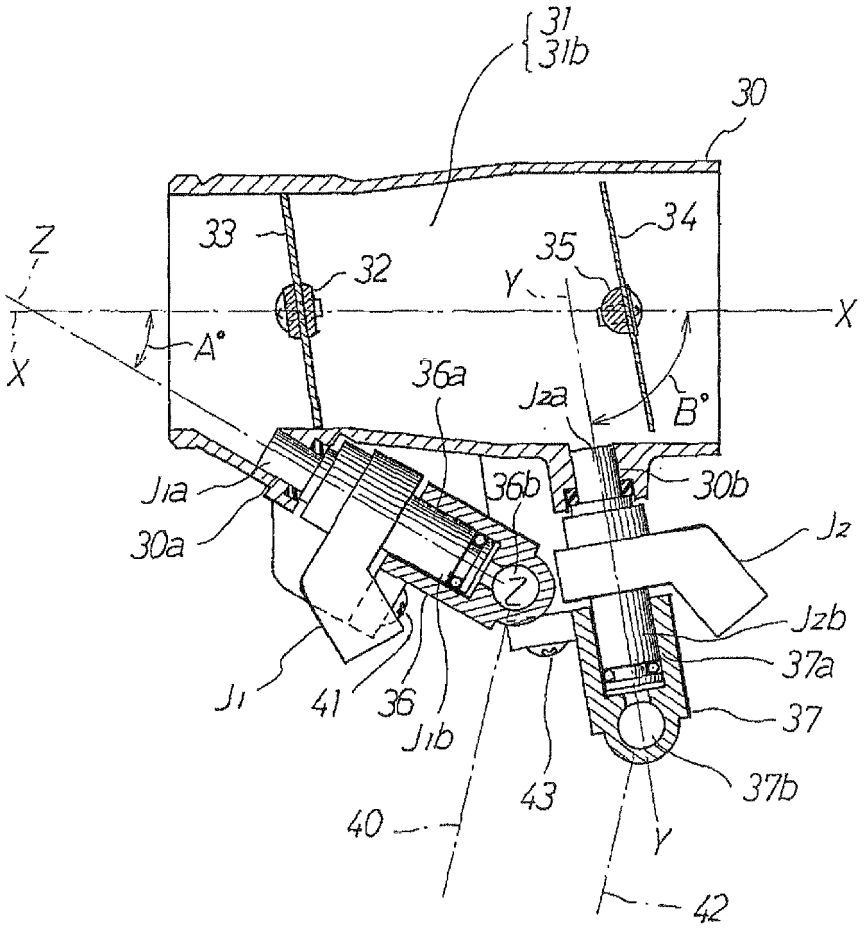
FIG. 2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