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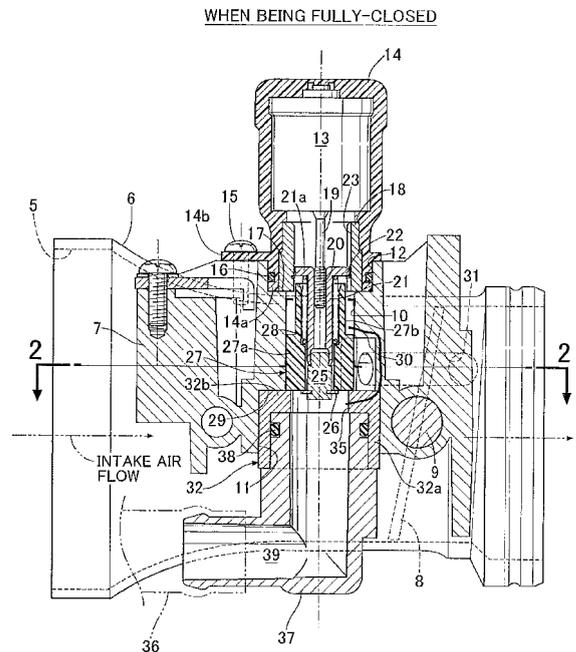
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(54) **Bypass air volume control system for throttle body**

(57) A bypass air volume control system for a throttle body includes a throttle body provided with: a valve-body guide hole into which a valve body is slidably fitted and into which atmospheric air is introduced; a flat surface formed by opening one end of the valve-body guide hole; and an air control groove which is opened at an inner periphery of the valve-body guide hole in such a manner as to be opened and closed by the valve body and which is opened at the flat surface, a blocking member being fixed to the throttle body and closing an opening end of the air control groove at the flat surface. The blocking member (32) is formed in such a manner that at least a portion thereof exists inside an inner periphery of the valve-body guide hole (10) on the plane including the flat surface (29), the blocking member (32) functioning as a stopper for restricting closing movement of the valve body (27) when the valve body (27) reaches a fully closed position where the opening of the air control groove (30) at the inner periphery of the valve-body guide hole (10) is fully closed. Accordingly, it is possible to achieve reduction in production cost by reducing the processing cost and reducing the number of operation steps.

FIG. 1



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DescriptionBACKGROUND OF THE INTENTIONFIELD OF THE INVENTION

[0001] The present invention relates to a bypass air volume control system for a throttle body, including: a throttle body which has an intake passage with a throttle valve disposed therein, to which drive means is fixed, and which is provided with a valve-body guide hole into which a valve body connected to the drive means is slidably fitted, and into which atmospheric air is introduced, a flat surface formed by opening one end of the valve-body guide hole to face a side opposite to the drive means and disposed along a plane perpendicular to an axis of the valve-body guide hole, an air control groove which is opened at an inner periphery of the valve-body guide hole in such a manner as to be opened and closed by the valve body and which is opened at the flat surface, and a downstream air passage having one end continuous with the air control groove and the other end continuous with the intake passage downstream of the throttle valve; and a blocking member which is fixed to the throttle body and which closes an opening end of the air control groove at the flat surface.

DESCRIPTION OF THE RELATED ART

[0002] A bypass air volume control system for a throttle body having the following configuration is known from Japanese Patent Application Laid-open No. 2007-132235. Specifically, an air control groove which is opened at an inner periphery of a valve-body guide hole provided to a throttle body and which is opened at a flat surface formed by opening one end of the valve-body guide hole is provided to the throttle body. A bushing which is a blocking member for closing an opening end of the air control groove at the flat surface is fixed to the throttle body by press-fitting. A valve-body guide hole coaxially continuous with and having the same diameter as the valve-body guide hole of the throttle body is provided in the bushing in such a manner as to fit on a portion of a valve body when fully closed.

[0003] However, in Japanese Patent Application Laid-open No. 2007-132235 disclosed above, after the bushing is press-fitted and fixed to the throttle body, the valve-body guide hole of the throttle body and the valve-body guide hole of the bushing are processed simultaneously. By processing the two members simultaneously, the center of the machining drill is likely to be deflected. This incurs an increase in the processing cost because the machining drill to be used needs to be made of a metal having a high hardness, for example. Additionally, during the processing, a burr or the like enters a joint surface between the throttle body and the bushing in some cases. Accordingly, a post-treatment such as high-pressure cleaning is required, and the number of operation steps

is increased. This incurs an increase in the production cost.

SUMMARY OF THE INVENTION

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[0004] The present invention has been made in view of such circumstances. An object of the present invention is to provide a bypass air volume control system for a throttle body, which achieves reduction in production cost by reducing the processing cost and reducing the number of operation steps.

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[0005] In order to achieve the object, according to the invention described in claim 1, there is provided a bypass air volume control system for a throttle body, including: a throttle body which has an intake passage with a throttle valve disposed therein, to which drive means is fixed, and which is provided with a valve-body guide hole into which a valve body connected to the drive means is slidably fitted, and into which atmospheric air is introduced, a flat surface formed by opening one end of the valve-body guide hole to face a side opposite to the drive means and disposed along a plane perpendicular to an axis of the valve-body guide hole, an air control groove which is opened at an inner periphery of the valve-body guide hole in such a manner as to be opened and closed by the valve body and which is opened at the flat surface, and a downstream air passage having one end continuous with the air control groove and the other end continuous with the intake passage downstream of the throttle valve; and a blocking member which is fixed to the throttle body and which closes an opening end of the air control groove at the flat surface, wherein the blocking member is formed in such a manner that at least a portion thereof exists inside the inner periphery of the valve-body guide hole on the plane including the flat surface, the blocking member functioning as a stopper for restricting closing movement of the valve body when the valve body reaches a fully closed position where the opening of the air control groove at the inner periphery of the valve-body guide hole is fully closed.

[0006] With the above configuration, the blocking member has a function as the stopper for restricting the closing movement of the valve body when the valve body reaches the fully closed position. The blocking member is formed in such a manner that at least a portion thereof exists inside the inner periphery of the valve-body guide hole for the throttle body on the plane including the flat surface. Thus, this eliminates the need to process and form a valve-body guide hole continuous with the valve-body guide hole in the blocking member. It is only necessary to form the valve-body guide hole just in the throttle body. Accordingly, a metallic machining drill having a high hardness does not have to be used in processing the valve-body guide hole, and an increase in the processing cost can be avoided. Moreover, a burr or the like does not enter a joint surface between the throttle body and the blocking member, and a post-treatment such as high-pressure cleaning is not required, either.

Hence, reductions in the number of operation steps and the production cost can be achieved.

[0007] According to the invention described in claim 2, in addition to the configuration of claim 1, a passage hole having a smaller diameter than the valve-body guide hole is provided in the blocking member in such a manner as to constitute a part of an upstream air passage for introducing atmospheric air to the one end of the valve-body guide hole.

[0008] With the above configuration, the passage hole having a smaller diameter than the valve-body guide hole for the throttle body is provided in the blocking member, the passage hole constituting a part of the upstream air passage for guiding atmospheric air to the one end of the valve-body guide hole. Accordingly, the blocking member can be utilized as a constituent member of the upstream air passage.

[0009] According to the invention described in claim 3, in addition to the configuration of claim 1 or 2, the blocking member is formed to have an annular appearance.

[0010] With the above configuration, the blocking member has an annular appearance. This enables press-fitting of the blocking member to the throttle body. Thus, further cost reduction is possible and a portion between the outer periphery of the blocking member and the throttle body is easily sealed.

[0011] According to the invention described in claim 4, in addition to the configuration of any one of claims 1 to 3, a pipe for guiding atmospheric air is fixed to the throttle body through the blocking member.

[0012] With the above configuration, the pipe for guiding atmospheric air is fixed to the throttle body through the blocking member. Thus, this increases the degree of freedom of the piping operation for introducing atmospheric air to the one end of valve-body guide hole.

[0013] According to the invention described in claim 5, in addition to the configuration of any one of claims 1 to 3, the blocking member is formed into a pipe-like shape to guide atmospheric air to the one end of the valve-body guide hole.

[0014] With the above configuration, the blocking member is formed into a pipe-like shape for guiding atmospheric air. Accordingly, the number of components is reduced and further cost reduction is possible.

[0015] Here, a step motor 13 of embodiments corresponds to the drive means of the present invention.

[0016] The above and other objects, characteristics and advantages of the present invention will be clear from detailed descriptions of the preferred embodiments which will be provided below while referring to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a longitudinal cross-sectional view of a bypass air volume control system of a first embodiment

in a fully closed state, the cross-sectional view taken along a line 1-1 in FIG. 2; FIG. 2 is a cross-sectional view taken along a line 2-2 in FIG. 1; FIG. 3 is a longitudinal cross-sectional view corresponding to FIG. 1, showing the bypass air volume control system in a fully opened state; and FIG. 4 is a longitudinal cross-sectional view of a second embodiment corresponding to FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings.

[0019] A first embodiment of the present invention will be described with reference to FIGS. 1 to 3. First, referring to FIGS. 1 and 2, a pair of throttle bodies 6, 6 respectively having intake passages 5, 5 extending parallel to each other are disposed in parallel and connected to each other through a connecting portion 7 integrally formed with the throttle bodies 6. Butterfly throttle valves 8, 8 for controlling the opening degree of the intake passages 5 are fixed to a throttle valve shaft 9 which traverses the intake passages 5 and is rotatably movably supported on the throttle bodies 6.

[0020] The connecting portion 7 integrally formed with the two throttle bodies 6 includes: a valve-body guide hole 10 extending in an up-and-down direction and having one end at the lower end position; a fitting hole 11 formed to have a larger diameter than the valve-body guide hole 10 and being continuous with the one end (lower end) of the valve-body guide hole 10; and an attachment hole 12 formed to have a larger diameter than the valve-body guide hole 10 and being continuous with the other end (upper end) of the valve-body guide hole 10. The valve-body guide hole 10, the fitting hole 11, and the attachment hole 12 are coaxially provided in such a manner that outer ends of the fitting hole 11 and the attachment hole 12 are opened to the outside.

[0021] On an upper portion of the connecting portion 7, a step motor 13 is fixedly provided which is drive means for generating a driving force in an axial direction of the valve-body guide hole 10. The step motor 13 is covered with a cover 14 which has a cylindrical portion 14a fitted into the attachment hole 12. The cover 14 has flange portions 14b fastened to the connecting portion 7 with screw members 15. Thereby, the step motor 13 is fixed to the connecting portion 7 integrally formed with the throttle bodies 6 at the side of the other end of the valve-body guide hole 10. Moreover, an annular first seal member 16 which is resiliently in contact with an inner periphery of the attachment hole 12 is attached to an outer periphery of the cylindrical portion 14a.

[0022] Meanwhile, an annular step portion 17 facing the step motor 13, i.e., upward is formed between the other end of the valve-body guide hole 10 and the attachment hole 12. A cylindrical sleeve 18 is inserted in and fixed to the cylindrical portion 14a in such a manner that

the cylindrical sleeve 18 together with a tip end of the cylindrical portion 14a comes into contact with the annular step portion 17. The sleeve 18 is formed to have a smaller inner diameter than the valve-body guide hole 10.

[0023] The step motor 13 has a motor shaft 19 disposed in the sleeve 18 coaxially with the axis of the valve-body guide hole 10. A male screw 20 provided on an outer periphery of the motor shaft 19 is screwed into a cylindrical nut 21 coaxially disposed in the valve-body guide hole 10. Moreover, a flange portion 21a is provided on an end portion, on the step motor 13 side, of the nut 21, the flange portion 21a protruding outward in a radial direction of the nut 21 and being slidably fitted in the sleeve 18. A protruding portion 22 protruding from the outer periphery of the flange portion 21a engages with a locking groove 23 which is provided on an inner periphery of the sleeve 18 and which extends in an axial direction of the sleeve 18. This inhibits rotation of the nut 21, but the nut 21 can move in the axial direction as the motor shaft 19 rotates in accordance with an operation of the step motor 13.

[0024] An end portion of the nut 21 opposite from the step motor 13 is joined by crimping to a valve-body supporting member 25 in the shape of a short cylinder. A retaining ring 26 is fitted and attached to an outer periphery of the valve-body supporting member 25.

[0025] A valve body 27 made of a synthetic resin is slidably fitted into the valve-body guide hole 10. The valve body 27 integrally has a large diameter portion 27a whose outer periphery slides on and contacts an inner periphery of the valve-body guide hole 10, and a small diameter portion 27b continuous with the large diameter portion 27a in such a manner as to be inserted in the sleeve 18. The valve body 27 is formed in such a dented cylindrical shape that the valve body 27 coaxially surrounds the nut 21 except for the flange portion 21a thereof and coaxially surrounds the valve-body supporting member 25 above the retaining ring 26.

[0026] Further, a coiled spring 28 is provided in a compressed state between the flange portion 21a of the nut 21 and the valve body 27, the coiled spring 28 surrounding a portion of the nut 21. The valve body 27 is biased by the spring 28 in such a manner that a lower end of the valve body 27 is received by the retaining ring 26. Thereby, when the step motor 13 rotates to a side where the nut 21 and the valve-body supporting member 25 are lowered, the valve body 27 is lowered accompanying the nut 21 and the valve-body supporting member 25 by a spring biased force of the spring 28. When the step motor 13 rotates to a side where the nut 21 and the valve-body supporting member 25 are elevated, the valve body 27 is pushed up by the retaining ring 26 and elevated.

[0027] The connecting portion 7 is provided with an annular flat surface 29 between the one end of the valve-body guide hole 10 and the fitting hole 11 along a plane perpendicular to the axis of the valve-body guide hole 10. The annular flat surface 29 is an annular step portion facing a side opposite to the step motor 13, i.e., down-

ward. In addition, the connecting portion 7 is provided with: a pair of air control grooves 30, 30 opened at the inner periphery of the valve-body guide hole 10 and opened at the flat surface 29; and downstream air passages 31, 31 whose one ends are continuous with these air control grooves 30 and whose other ends are continuous with the intake passages 5 of the two throttle bodies 6 downstream of the throttle valves 8, respectively.

[0028] Opening ends of the air control grooves 30 at the flat surface 29 are closed by a blocking member 32. When the valve body 27 reaches a fully closed position where the openings of the air control grooves 30 at the inner periphery of the valve-body guide hole 10 are fully closed, this blocking member 32 functions as a stopper for restricting closing movement of the valve body 27 side. The blocking member 32 is formed in such a manner that at least a portion thereof exists inside the inner periphery of the valve-body guide hole 10 on the plane including the flat surface 29.

[0029] As shown in FIG. 1, while the downward movement of the valve body 27 is restricted by being in contact with the blocking member 32, the opening ends of the air control grooves 30 at the valve-body guide hole 10 are fully closed by the valve body 27. When the valve body 27 is elevated as shown in FIG. 3, the opening ends of the air control grooves 30 at the valve-body guide hole 10 are in a fully opened state. Thus, the valve body 27 is lowered and elevated between the fully closed position and the fully opened position.

[0030] The blocking member 32 is formed to have a flange portion 32b integrally at an end portion, on the valve-body guide hole 10 side, of a cylindrical portion 32a thereof, the flange portion 32b protruding inward in a radial direction of the blocking member 32. An inner periphery of the flange portion 32b forms a passage hole 35 having a smaller diameter than the valve-body guide hole 10. In other words, the passage hole 35 having a smaller diameter than the valve-body guide hole 10 is provided, for example, in a central portion of the blocking member 32.

[0031] Furthermore, the cylindrical portion 32a is formed in a cylindrical shape, which makes the blocking member 32 have an annular appearance. By, for example, press-fitting, the blocking member 32 is fitted in and fixed to the fitting hole 11 in such a manner that the opening ends of the air control grooves 30 at the flat surface 29 are closed by the flange portion 32b.

[0032] One end portion of a pipe 37 bent into, for example, a substantially L shape is fitted in the cylindrical portion 32a of the blocking member 32 with an annular second seal member 38 therebetween while the other end portion of the pipe 37 is connected to a hose 36 for guiding air cleaned with an unillustrated air cleaner. The pipe 37 is fixed to the connecting portion 7 of the throttle bodies 6 through the blocking member 32.

[0033] Thus, atmospheric air cleaned by the air cleaner is introduced to the one end of the valve-body guide hole 10 through an upstream air passage 39. The upstream

air passage 39 includes the hose 36, the pipe 37, and the passage hole 35 in the blocking member 32. The passage hole 35 is provided, for example, in the central portion of the blocking member 32 in such a manner as to constitute a part of the upstream air passage 39.

[0034] Next, operations of this first embodiment will be described. When the valve body 27 reaches the fully closed position where the openings of the air control grooves 30 at the inner periphery of the valve-body guide hole 10 are fully closed, the closing movement of the valve body 27 is restricted by the blocking member 32 which closes the opening ends of the air control grooves 30 at the flat surface 29 having an opening at the one end of the valve-body guide hole 10. The blocking member 32 functioning as the stopper is formed in such a manner that at least a portion thereof exists inside the inner periphery of the valve-body guide hole 10 on the plane including the flat surface 29. Thus, this eliminates the need to process and form a valve-body guide hole continuous with the valve-body guide hole 10 in the blocking member 32. It is only necessary to form the valve-body guide hole 10 just in the connecting portion 7 integrally formed with the throttle bodies 6. Accordingly, a metallic machining drill having a high hardness does not have to be used in processing the valve-body guide hole 10, and an increase in the processing cost can be avoided. Moreover, a burr or the like does not enter a joint surface between the throttle bodies 6 and the blocking member 32, and a post-treatment such as high-pressure cleaning is not required, either. Hence, reductions in the number of operation steps and the production cost can be achieved.

[0035] Further, the passage hole 35 having a smaller diameter than the valve-body guide hole 10 is provided, for example, in the central portion of the blocking member 32 in such a manner as to constitute a part of the upstream air passage 39 for guiding atmospheric air to the one end of the valve-body guide hole 10. Thus, the blocking member 32 can be utilized as a constituent member of the upstream air passage 39.

[0036] Furthermore, in this embodiment, the valve-body guide hole 10 is provided in the connecting portion 7 in such a manner as to extend in the up-and-down direction. In addition, the passage hole 35 in the blocking member 32 is disposed at the uppermost portion of the upstream air passage 39 connected to the lower end of the valve-body guide hole 10. Accordingly, even if dust or the like enters the upstream air passage 39 by any chance, the gravity on the dust and the flow of fluid prevent the dust from adhering to an inner periphery of the passage hole 35 as much as possible. This makes it possible to avoid a situation where the dust or the like sandwiched between the valve body 27 and the blocking member 32 hinders the movement of the valve body 27 to the fully closed position. It can also suppress entering of the dust to the valve-body guide hole 10 as much as possible. This is desirable particularly when a flow amount is controlled finely during idle driving, for example.

[0037] In addition, since the blocking member 32 is formed to have an annular appearance, this enables press-fitting of the blocking member 32 to the connecting portion 7 integrally with the throttle bodies 6, and further cost reduction is possible.

[0038] Moreover, the pipe 37 for guiding atmospheric air is fixed to the connecting portion 7 integrally formed with the throttle bodies 6 through the blocking member 32. Thus, this increases the degree of freedom of the piping operation for introducing atmospheric air to the one end of the valve-body guide hole 10.

[0039] A second embodiment of the present invention will be described with reference to FIG. 4. The parts corresponding to those in the first embodiment are denoted by the same reference numerals and merely illustrated. Detailed description thereof will be omitted.

[0040] The opening ends of the air control grooves 30 at the annular flat surface 29 provided between the one end of the valve-body guide hole 10 and the fitting hole 11 is closed by a blocking member 41. When the valve body 27 reaches to the fully closed position where the openings of the air control grooves 30 at the inner periphery of the valve-body guide hole 10 are fully closed, this blocking member 41 functions as a stopper for restricting closing movement of the valve body 27. The blocking member 41 is formed in such a manner that at least a portion thereof exists inside the inner periphery of the valve-body guide hole 10 on the plane including the flat surface 29.

[0041] The blocking member 41 is formed to have an annular appearance in a pipe-like shape bent into a substantially L shape in such a manner that, for example, one end thereof is connected to the hose 36. The blocking member 41 is fitted in and fixed to the fitting hole 11 in such a manner that the opening ends of the air control grooves 30 at the flat surface 29 are closed by the one end of the blocking member 41. An annular third seal member 43 which is resiliently in contact with an inner periphery of the fitting hole 11 is attached to an outer periphery of the blocking member 41.

[0042] Furthermore, a passage hole 42 having a smaller diameter than the valve-body guide hole 10 is provided, for example, in a central portion of the blocking member 41. This passage hole 42 constitutes a part of an upstream air passage 44 for guiding atmospheric air to the one end of the valve-body guide hole 10.

[0043] According to this second embodiment, the operations as those in the first embodiment can be produced. Additionally, since the blocking member 41 is formed into the pipe-like shape to guide atmospheric air to the one end of the valve-body guide hole 10, the number of components is reduced and further cost reduction is possible. Moreover, using the third seal member 43 attached to the outer periphery of the blocking member 41 having an annular appearance, a portion between the outer periphery of the blocking member 41 and the connecting portion 7 integrally formed with the throttle bodies 6 is easily sealed.

[0044] Hereinabove, embodiments of the present invention have been described. However, the present invention is not limited to the above embodiments, and the design can be modified variously without departing from inventions described in claims.

[0045] For example, although the above embodiments have been described by taking the case where the pair of throttle bodies 6 are integrally connected to each other, the present invention is applicable to a single throttle body.

[0046] Moreover, in the above embodiments, atmospheric air is introduced to the one end of the valve-body guide hole 10. Nevertheless, as similar to the air control grooves 30 continuous with the downstream air passages 31, a control groove continuous with the upstream air passage for introducing atmospheric air may be provided in the inner periphery on the one end side of the valve-body guide hole 10.

Claims

1. A bypass air volume control system for a throttle body, including:

a throttle body (6) which has an intake passage (5) with a throttle valve (8) disposed therein, to which drive means (13) is fixed, and which is provided with

a valve-body guide hole (10) into which a valve body (27) connected to the drive means (13) is slidably fitted, and into which atmospheric air is introduced,

a flat surface (29) formed by opening one end of the valve-body guide hole (10) to face a side opposite to the drive means (13) and disposed along a plane perpendicular to an axis of the valve-body guide hole (10),

an air control groove (30) which is opened at an inner periphery of the valve-body guide hole (10) in such a manner as to be opened and closed by the valve body (27) and which is opened at the flat surface (29), and

a downstream air passage (31) having one end continuous with the air control groove (30) and the other end continuous with the intake passage (5) downstream of the throttle valve (8); and

a blocking member (32, 41) which is fixed to the throttle body (6) and which closes an opening end of the air control groove (30) at the flat surface (29),

wherein the blocking member (32, 41) is formed in such a manner that at least a portion thereof exists inside the inner periphery of the valve-body guide hole (10) on the plane including the flat surface (29), the blocking member (32, 41) functioning as a stopper for restricting closing

movement of the valve body (27) when the valve body (27) reaches a fully closed position where the opening of the air control groove (30) at the inner periphery of the valve-body guide hole (10) is fully closed.

2. The bypass air volume control system for a throttle body according to claim 1, wherein a passage hole (35, 42) having a smaller diameter than the valve-body guide hole (10) is provided in the blocking member (32, 41) in such a manner as to constitute a part of an upstream air passage (39, 44) for introducing atmospheric air to the one end of the valve-body guide hole (10).

3. The bypass air volume control system for a throttle body according to claim 1 or 2, wherein the blocking member (32, 41) is formed to have an annular appearance.

4. The bypass air volume control system for a throttle body according to any one of claims 1 to 3, wherein a pipe (37) for guiding atmospheric air is fixed to the throttle body (6) through the blocking member (32).

5. The bypass air volume control system for a throttle body according to any one of claims 1 to 3, wherein the blocking member (41) is formed into a pipe-like shape to guide atmospheric air to the one end of the valve-body guide hole (10).

FIG. 1

WHEN BEING FULLY-CLOSED

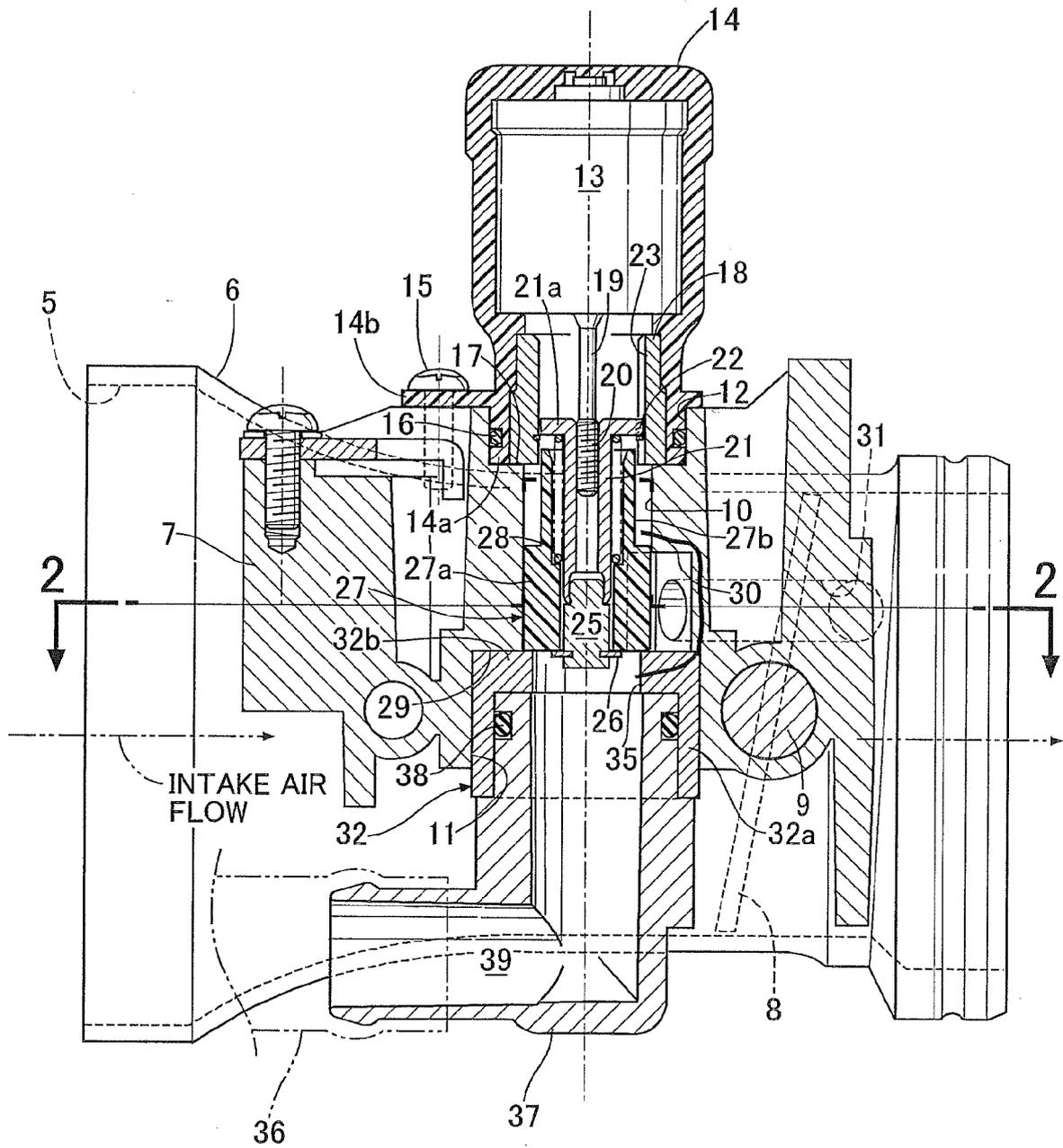
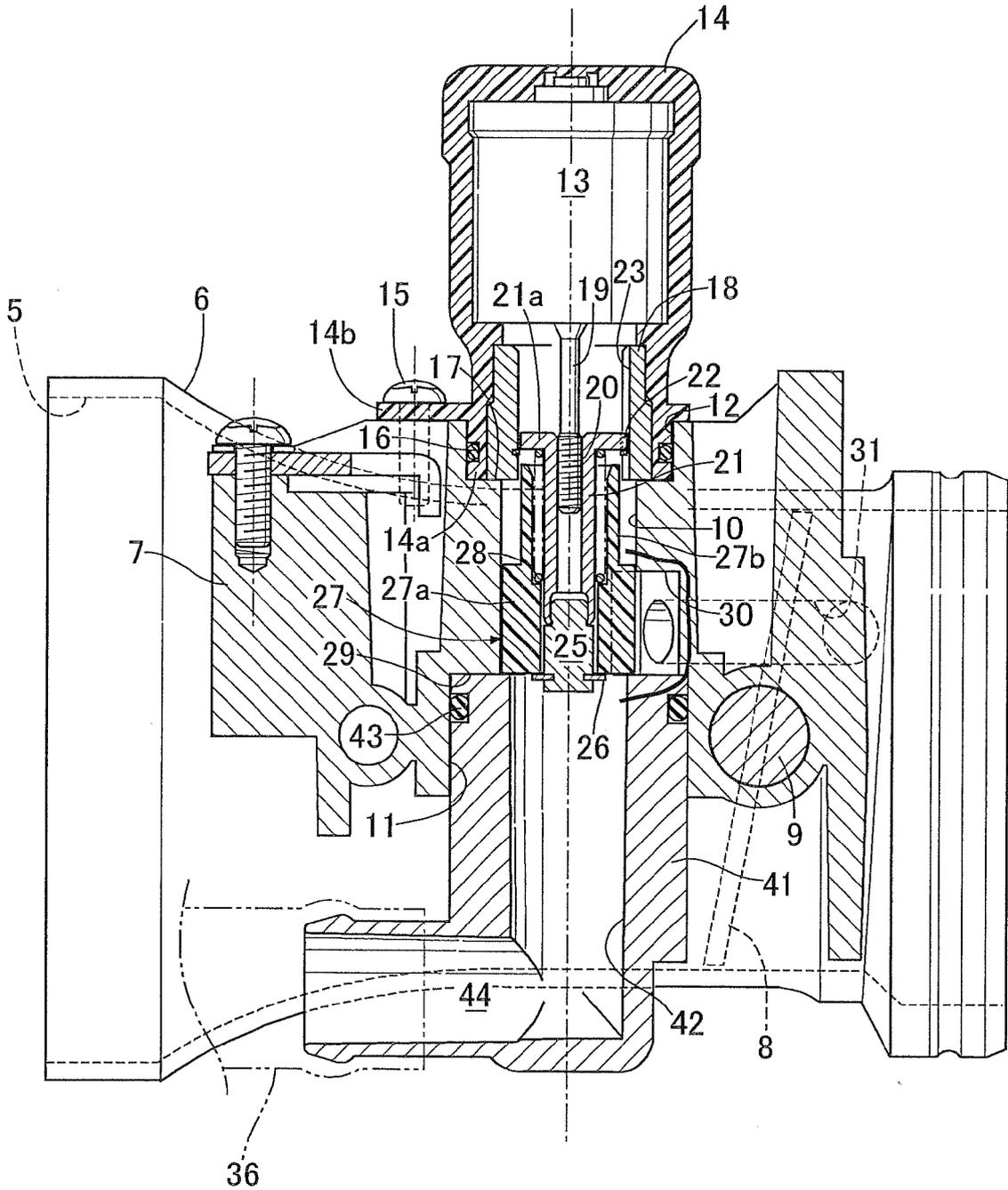


FIG.4

WHEN BEING FULLY-CLOSED





EUROPEAN SEARCH REPORT

Application Number
EP 11 18 7101

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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