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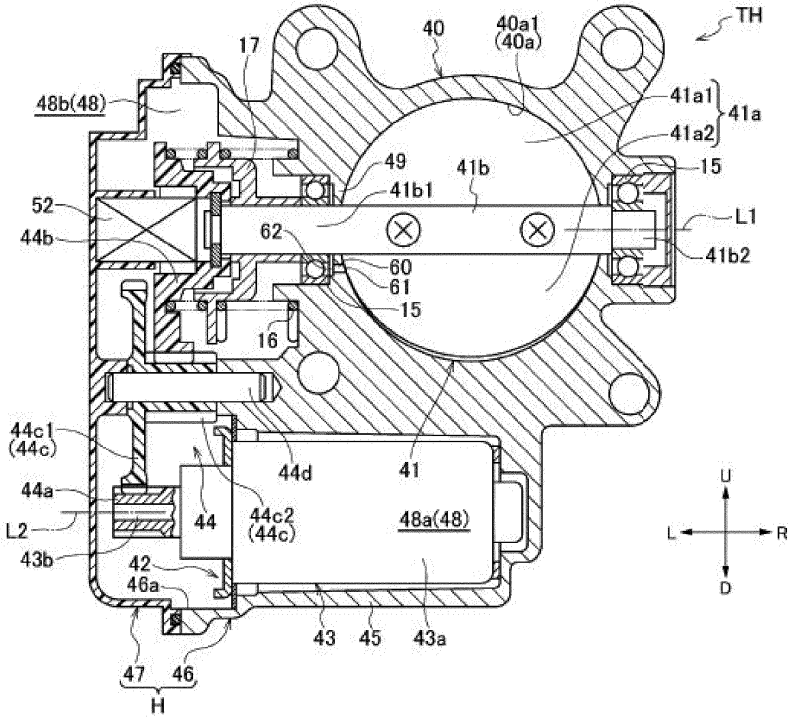
(54) THROTTLE DEVICE

(57) A throttle device (TH) includes a throttle body (40) that supports a throttle valve (41) configured to control a flow amount of air flowing through an intake passage (30), a drive device (42) that includes an actuator (43) configured to drive the throttle valve (41) and a transmission mechanism (44) configured to transmit a drive force of the actuator (43) to the throttle valve (41), and a housing (H) that includes an accommodation chamber (48) accommodating the transmission mechanism (44). A communication passage (60) configured to establish communication between the intake passage (30) and the accommodation chamber (48) is formed in the throttle body (40).

FIG.4



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Description

Technical Field

[0001] The present invention relates to a throttle device provided in an intake system of an internal combustion engine.

Background Art

[0002] There has been know a throttle device provided in an intake system of an internal combustion engine. The throttle device includes a throttle body that supports a throttle valve, a drive device that includes an actuator (for example, an electric motor) that drives the throttle valve and a transmission mechanism that transmits a drive force of the actuator to the throttle valve, and a housing that includes an accommodation chamber that accommodates the transmission mechanism, wherein a ventilation passage that establishes communication between an external space where external air surrounding the housing exists and the accommodation chamber is formed in the throttle body (for example, Patent Document 1).

[0003] In the throttle device described in Patent Document 1, an outer end opening of the ventilation passage that establishes communication between the accommodation chamber and the external space is opened on a lower outer surface facing vertically downward of an outer surface of the housing body and opened to a covered space that is covered by a covering wall from vertically lower side. The covering wall is connected to the housing body on an upstream side of the outer end opening in a covering region, so that adhering water flowing down from the lower outer surface does not flow into a covering space from an upstream side in the covering region. Therefore, water droplets flying to the housing body and adhering water that is adhered on the lower outer surface of the housing body and flows downward are prevented from entering the ventilation passage from the outer end opening.

Prior Art Document

Patent Document

[0004] Patent Document 1: JP-A-2010-196599

Summary of Invention

Problems to be Solved by Invention

[0005] However, in the throttle device described in Patent Document 1, since the ventilation passage is provided in the housing and the accommodation chamber is in communication with the external space via the ventilation passage, it is difficult to completely suppress intrusion of foreign matters such as dust and water into the accommodation chamber from the outer end opening, and there is a room for improvement.

[0006] The present invention provides a throttle device that allows flowing of air into the accommodation chamber while suppressing intrusion of the foreign matters such as dust and water into the accommodation chamber.

Means for Solving the Problems

[0007] The present invention provides the following aspects.

[0008] According to a first aspect, there is provided a throttle device including:

a throttle body that supports a throttle valve configured to control a flow amount of air flowing through an intake passage;
a drive device that includes an actuator configured to drive the throttle valve, and a transmission mechanism configured to transmit a drive force of the actuator to the throttle valve; and
a housing that includes an accommodation chamber accommodating the transmission mechanism,
wherein a communication passage configured to establish communication between the intake passage and the accommodation chamber is formed in the throttle body.

[0009] According to a second aspect, in the throttle device of the first aspect,
the intake passage includes an upstream side intake passage that is located on an upstream side of the throttle valve and a downstream side intake passage that is located on a downstream side of the throttle valve, and
the communication passage is opened to the upstream side intake passage.

[0010] According to a third aspect, in the throttle device of the first aspect,
the intake passage includes an upstream side intake passage that is located on an upstream side of the throttle valve and a downstream side intake passage that is located on a downstream side of the throttle valve, and
the communication passage is opened to the downstream side intake passage.

[0011] According to a fourth aspect, in the throttle device of the second aspect,
the throttle valve includes an upper half body and a lower half body with a rotation shaft serving as a center,
the drive device is configured to control the throttle valve to a valve closed state where the throttle valve closes the intake passage and to a valve open state where the intake passage is opened by rotating the throttle valve around the rotation shaft such that either one of the upper half body and the lower half body protrudes in the upstream side intake passage and the other one protrudes in the downstream side intake passage, and
when the intake passage is divided into four regions as

seen in an rotation shaft direction by a first virtual plane passing through the rotation shaft and extending in parallel to the intake passage and a second virtual plane passing through the rotation shaft and orthogonal to the first virtual plane, the communication passage is opened to a region where the throttle valve in the valve open state protrudes in the upstream side intake passage.

[0012] According to a fifth aspect, in the throttle device of the third aspect,
the throttle valve includes an upper half body and a lower half body with a rotation shaft serving as a center,
the drive device is configured to control the throttle valve to a valve closed state where the throttle valve closes the intake passage and to a valve open state where the intake passage is opened by rotating the throttle valve around the rotation shaft such that either one of the upper half body and the lower half body protrudes in the upstream side intake passage and the other one protrudes in the downstream side intake passage, and
when the intake passage is divided into four regions as seen in an rotation shaft direction by a first virtual plane passing through the rotation shaft and extending in parallel to the intake passage and a second virtual plane passing through the rotation shaft and orthogonal to the first virtual plane, the communication passage is opened to a region opposite to a region where the throttle valve in the valve open state protrudes in the downstream side intake passage with the first virtual plane sandwiched therebetween.

[0013] According to a sixth aspect, in the throttle device of any of the first to third aspects,
the communication passage is opened above the rotation shaft of the throttle valve.

[0014] According to a seventh aspect, in the throttle device of any of the first to third aspects,
an intake passage side opening of the communication passage on an intake passage side is smaller than an accommodation chamber side opening on an accommodation chamber side.

[0015] According to an eighth aspect, in the throttle device of any of the first to seventh aspects,
the communication passage is formed to be inclined upward from an intake passage side opening on an intake passage side toward an accommodation chamber side opening on an accommodation chamber side.

Effect of Invention

[0016] According to the first aspect, air can flow in the accommodation chamber via the communication passage that is in communication with the intake passage through which air having passed through an air cleaner flows, and influence due to temperature change and pressure change in the accommodation chamber can be suppressed. Further, the communication passage is formed in the throttle body so as to be in communication with the intake passage through which air having passed through the air cleaner flows, so that intrusion of foreign matters such as dust and water into the accommodation chamber can be suppressed compared with a case where the communication passage is provided in a cover so as to be in communication with an outside.

[0017] According to the second aspect, the communication passage is opened to the upstream side intake passage, so that influence on flowing of air flowing through the downstream side intake passage can be suppressed.

[0018] According to the third aspect, the communication passage is opened to the downstream side intake passage and the throttle valve is closed when the engine is stopped, so that intrusion of water vapor into the accommodation chamber can be suppressed even in a case where humidity of external air is high.

[0019] According to the fourth aspect, since the communication passage is opened to a position where the flow of the air passing through the intake passage is slow, influence on flowing of air in the intake passage can be suppressed.

[0020] According to the fifth aspect, since the communication passage is opened to a position where the flowing of the air passing through the intake passage is slow, influence on the flow of air in the intake passage can be suppressed.

[0021] According to the sixth aspect, even in a case where foreign matters such as dust and dirt enter the intake passage during assembly or maintenance, since the communication passage is opened above the rotation shaft, foreign matters accumulated below the intake passage can be prevented from entering the communication passage when the engine is stopped and the throttle valve is closed.

[0022] According to the seventh aspect, since the communication passage is formed such that an intake passage side opening on the intake passage side is smaller than the accommodation chamber side opening on the accommodation chamber side, influence on flowing of air in the intake passage can be suppressed.

[0023] According to the eighth aspect, even in a case where foreign matters such as dust and dirt enter the intake passage during assembly or maintenance, since the communication passage is formed to be inclined upward from the intake passage side opening on the intake passage side toward the accommodation chamber side opening on the accommodation chamber side, intrusion of foreign matters into the accommodation chamber can be suppressed.

Brief Description of Drawings

[0024]

Fig. 1 is a left side view of a motorcycle including a throttle device according to an embodiment of the present invention.

Fig. 2 is a left side view showing a partial cross section of a configuration around an engine of the mo-

torcycle of Fig. 1.

Fig. 3 is a side view of the throttle device while a cover is removed.

Fig. 4 is a cross-sectional view taken along a line A-A in Fig. 3.

Fig. 5 is a cross-sectional view of a throttle passage for describing a position of a communication passage.

Fig. 6 is an enlarged cross sectional view of the communication passage for describing a modification of the communication passage.

Fig. 7 is an enlarged cross sectional view of the communication passage for describing another modification of the communication passage.

Description of Embodiments

[0025] Hereinafter, a throttle device according to an embodiment of the present invention will be described. A motorcycle including the throttle device according to the embodiment of the present invention will be described first with reference to the drawings. Incidentally, the drawings should be seen based on a direction of reference numerals. In the following description, front, rear, left, right, upper, and lower directions are described according to a view from a driver. In the drawings, a front side of the vehicle is denoted by Fr, a rear side is denoted by Rr, a left side is denoted by L, a right side is denoted by R, an upper side is denoted by U, and a lower side is denoted by D.

[0026] As shown in Fig. 1, a motorcycle V mainly includes a vehicle body frame 1, a front wheel 2, a front fork 3 rotatably supporting the front wheel 2, a handle 4 coupled to the front fork 3, an engine 20 swingably coupled to the vehicle body frame 1, an air cleaner 5, an intake passage 30 connecting the air cleaner 5 and the engine 20, a throttle device TH provided in the intake passage 30, a rear wheel 6 which is a driving wheel, a power transmission device 7 connected to the engine 20 and rotatably supporting the rear wheel 6, a rear cushion 8, a driver riding seat 91, an accommodation box 92 disposed below the seat 91, a fuel tank 93, a body cover 94 covering the vehicle body frame 1, a front fender 95, and a rear fender 96.

[0027] The engine 20 is a mover of the motorcycle V and is mounted in a substantially center portion of the vehicle body in the front-rear direction. The engine 20 is a so-called unit swing engine that is swingably coupled to the vehicle body frame 1 via a link member 11.

[0028] As shown in Fig. 2, the engine 20 mainly includes a cylinder head cover 21, a cylinder head 22, a cylinder block 23, and a crankcase 24 to form an outer shape. The cylinder head cover 21 is located on a front side of the vehicle, and the crankcase 24 is located on a rear side of the vehicle. Specifically, the engine 20 is disposed such that an axis line of the cylinder block 23 is substantially horizontal.

[0029] The intake passage 30 includes a connecting tube 31 connected to the air cleaner 5 and an intake pipe 32 connected to the intake port 25 of the cylinder head 22. The connecting tube 31 and the intake pipe 32 are connected via the throttle device TH. Accordingly, external air taken in from the air cleaner 5 through the connecting tube 31 is supplied to a combustion chamber of the engine 20 as combustion air after passing through the throttle device TH and the intake pipe 32 sequentially.

[0030] Referring to Figs. 3 to 5, the throttle device TH includes a throttle body 40 forming a throttle passage 40a which is a part of the intake passage 30, a throttle valve 41 that is movably (rotatably in this embodiment) supported by the throttle body 40 and is disposed in the throttle passage 40a, and a housing H that accommodates a drive device 42. The throttle passage 40a includes an upstream side intake passage 40a1 located on an upstream side (an air cleaner 5 side) of the throttle valve 41, and a downstream side intake passage 40a2 located on a downstream side (an engine 20 side) of the throttle valve 41.

[0031] The throttle body 40 that is formed of a metal or synthetic resin (an aluminum alloy herein) is connected to the connecting tube 31 at one end portion 40b and is connected to the intake pipe 32 at the other end portion 40c.

[0032] The throttle valve 41 that is a butterfly valve includes a disk-shaped valve plate 41a disposed in the throttle passage 40a, and a rotation shaft 41b that is fixed to the valve plate 41a and extends across the throttle passage 40a. The valve plate 41a includes an upper half body 41a1 located above the rotation shaft 41b and a lower half body 41a2 with the rotation shaft 41b sandwiched therebetween. The rotation shaft 41b is supported by the throttle body 40 via bearings 15 at both axial end portions 41b1, 41b2 and is supported movably (rotatably herein) around a rotation center line L1 serving as a throttle axis line.

[0033] In the throttle body 40, an adjusting screw 18 is provided, and the adjusting screw 18 is abutted against a transmission body 17 that is attached to the axial end portion 41b1 of the rotation shaft 41b to adjust a transmission degree of a spring force of a return spring 16 to the rotation shaft 41b so as to adjust an idle opening degree of the throttle valve 41.

[0034] The drive device 42 includes an electric motor 43 as an actuator that is attached to throttle body 40, and a transmission mechanism 44 that transmits a drive force of the electric motor 43 to the throttle valve 41. The electric motor 43 includes a motor body 43a, and a motor output shaft 43b that is a rotation shaft protruding from the motor body 43a and has a rotation center line L2 parallel to the rotation center line L1. The motor body 43a includes a drive mechanism that is controlled by a control device and rotatably drives the motor output shaft 43b. The motor body 43a is fixed to a drive unit accommodation portion 45 in a state where the entire motor body 43a is substantially accommodated in a drive unit accommodation chamber 48a formed by the drive unit accommo-

dation portion 45 provided integrally with the throttle body 40.

[0035] The electric motor 43 is controlled by the control device to which a detection signal is input from detection units including an acceleration detection unit for detecting an acceleration operation amount, a throttle opening degree detection unit 52 for detecting an opening degree of the throttle valve 41, and an operation state detection unit for detecting an operation state including a vehicle speed as a running state and an engine operation state of the engine 20.

[0036] The control device performs feedback control of the opening degree of the throttle valve 41 based on an actual opening degree of the throttle valve 41 detected by the throttle opening degree detection unit 52 such that a basic set opening degree determined in advance by using an acceleration operation amount detected by the acceleration detection unit as a parameter is modified as necessary to a set opening degree according to an operation state detected by the operation state detection unit.

[0037] The motor output shaft 43b is disposed on one side of the throttle body 40 together with the transmission mechanism 44. The transmission mechanism 44 is a gear mechanism configuring a speed reduction mechanism and includes a driving gear 44a provided on the motor output shaft 43b, a driven gear 44b provided on the axial end portion 41b1 of the rotation shaft 41b, and an intermediate gear 44c forming a drive force transmission path between the driving gear 44a and the driven gear 44b. The intermediate gear 44c is rotatably supported by a support shaft 44d held by a case 46 and a cover 47 of the housing H and includes a large gear 44c1 that meshes with the driving gear 44a and a small gear 44c2 that meshes with the driven gear 44b and rotates together with the large gear 44c1.

[0038] The housing H includes the case 46 that is integrally provided on the throttle body 40 and the cover 47 that is coupled to the case 46 so as to cover an housing opening 46a formed by the case 46.

[0039] The electric motor 43, the transmission mechanism 44, the throttle opening degree detection unit 52, the return spring 16, and the transmission body 17 are accommodated in the accommodation chamber 48 formed by the case 46 and the cover 47. The accommodation chamber 48 includes a drive unit accommodation chamber 48a that accommodates the motor body 43a of the electric motor 43, and a transmission mechanism accommodation chamber 48b that accommodates the transmission mechanism 44, the throttle opening degree detection unit 52 and the return spring 16 and that is in communication with the drive unit accommodation chamber 48a.

[0040] In the throttle device TH configured as above, when the electric motor 43 controlled by the control device is in a non-drive state, the throttle valve 41 is controlled to a valve closed state where the intake passage 30 is closed as indicated by a solid line in Fig. 5, and when the electric motor 43 is in a drive state, the throttle valve 41 is controlled to a valve open state where the intake passage 30 is opened by rotating the throttle valve 41 around the rotation shaft 41b such that, as indicated by a dotted line in Fig. 5, the upper half body 41a1 of the throttle valve 41 protrudes to the upstream side intake passage 40a1 and the lower half body 41a2 protrudes to the downstream side intake passage 40a2. A rotation direction of the throttle valve can be changed according to a shape of the intake passage and is not limited to the above rotation direction. The throttle valve may be controlled to a valve open state where the intake passage 30 is opened by rotating the throttle valve 41 around the rotation shaft 41b such that the upper half body 41a1 of the throttle valve 41 protrudes to the downstream side intake passage 40a2 and the lower half body 41a2 protrudes to the upstream side intake passage 40a1. In Fig. 5, the throttle valve 41 in the valve closed state is drawn to be located on a second virtual plane P2 (which is to be described later) orthogonal to the throttle passage 40a so as to completely close the throttle passage 40a, but in fact, in order to prevent occurrence of galling, a state where the valve is slightly opened from the second virtual plane P2, for example several degrees, is set as the valve closed state.

[0041] Here, the throttle body 40 is formed with a communication passage 60 that establishes communication between the throttle passage 40a which is a part of the intake passage 30 and the transmission mechanism accommodation chamber 48b of the accommodation chamber 48. Specifically, as shown in Fig. 4, the upstream side intake passage 40a1 of the throttle passage 40a and the transmission mechanism accommodation chamber 48b are separated by a partition wall 49 that defines the throttle passage 40a, and the communication passage 60 is formed in the partition wall 49. Therefore, air can flow in the accommodation chamber 48 via the communication passage 60 that is in communication with the intake passage 30 through which air having passed through the air cleaner 5 flows, and influence due to temperature change and pressure change in the accommodation chamber 48 can be suppressed. Accordingly, the communication passage 60 is formed in the throttle body 40 so as to be in communication with the intake passage 30 through which air having passed through the air cleaner 5 flows, so that intrusion of foreign matters such as dust and water into the accommodation chamber 48 can be suppressed compared with a case where the communication passage 60 is formed in a cover 47 so as to be in communication with an outside.

[0042] The communication passage 60 can be formed at an arbitrary position as long as the communication passage establishes communication between the throttle passage 40a and the accommodation chamber 48. As shown in Fig. 5, when the throttle passage 40a is divided into four regions, as seen in an direction of the rotation shaft of the throttle valve 41, by a first virtual plane P1 passing through the rotation center line L1 of the rotation

shaft 41b and extending in parallel to the throttle passage 40a and a second virtual plane P2 passing through the rotation center line L1 of the rotation shaft 41b and orthogonal to the first virtual plane P1, the communication passage 60 may be opened to any of the following, i.e. to the upstream side intake passage 40a1 and above the rotation shaft 41b (hereinafter, referred to as a first quadrant S1), to the downstream side intake passage 40a2 and above the rotation shaft 41b (hereinafter, referred to as a second quadrant S2), to the downstream side intake passage 40a2 and below the rotation shaft 41b (hereinafter, referred to as a third quadrant S3), and to the upstream side intake passage 40a1 and below the rotation shaft 41b (hereinafter, referred to as a fourth quadrant S4).

[0043] When the throttle valve 41 is in the valve open state, air flowing in the vicinity of the throttle valve 41 flows downward from an upper side along an inclined direction of the throttle valve 41, so that the air flows rapidly in the fourth quadrant S4 and the third quadrant S3 and flows slower in the first quadrant S1 and the second quadrant S2 than in the fourth quadrants S4 and the third quadrants S3.

[0044] In a case where an intake passage side opening 61 which is an opening of the communication passage 60 on the intake passage side is provided in the first quadrant S1 or the second quadrant S2, the intake passage side opening 61 is located above the rotation shaft 41b of the throttle valve 41, so that even in a case where foreign matters such as dust and dirt enter the intake passage 30 during assembly or maintenance, the foreign matters accumulated below the throttle passage 40a, which is a part of the intake passage 30, can be prevented from entering the communication passage 60 when the engine is stopped and the throttle valve 41 is closed.

[0045] In a case where the intake passage side opening 61 of the communication passage 60 is provided in the second quadrant S2 or the third quadrant S3, the intake passage side opening 61 is located in the downstream side intake passage 40a2. Therefore, since the throttle valve 41 is closed when the engine is stopped, intrusion of water vapor into the accommodation chamber 48 can be suppressed even in a case where humidity of the external air is high.

[0046] In a case where the intake passage side opening 61 of the communication passage 60 is provided in the first quadrant S1, that is, in a case where the intake passage side opening 61 is opened to a region where the upper half body 41a1 of the throttle valve 41 in a valve open state protrudes in the upstream side intake passage 40a1, the communication passage 60 is opened to a position where flowing of air passing through the throttle passage 40a is slow, so that influence on the flowing of air in the throttle passage 40a can be suppressed.

[0047] In a case where the intake passage side opening 61 of the communication passage 60 is provided in the second quadrant S2, that is, in a case where the intake passage side opening 61 is opened to a region opposite to a region where the lower half body 41a2 of the throttle valve 41 in a valve open state protrudes in the downstream side intake passage 40a2 with the first virtual plane P1 sandwiched therebeween, the communication passage 60 is also opened to a position where flowing of air passing through the throttle passage 40a is slow in this case, so that influence on the flowing of air in the throttle passage 40a can be suppressed.

[0048] In a case where the throttle valve 41 is rotated around the rotating shaft 41b such that the upper half body 41a1 of the throttle valve 41 protrudes to the downstream side intake passage 40a2 and the lower half body 41a2 protrudes to the upstream side intake passage 40a1, air flowing in the vicinity of the throttle valve 41 flows upward from a lower side along the throttle valve 41 when the throttle valve 41 is in a valve open state, so that the air rapidly flows in the first quadrant S1 and the second quadrant S2 and flows slower in the third quadrant S3 and the fourth quadrant S4 than in the first quadrant S1 and the second quadrant S2.

[0049] Also in this case, in a case where the intake passage side opening 61 which is an opening of the communication passage 60 on the intake passage side is provided in the first quadrant S1 or the second quadrant S2, the intake passage side opening 61 is located above the rotation shaft 41b of the throttle valve 41. Therefore, even in a case where foreign matters such as dust and dirt enter the intake passage 30 during assembly or maintenance, foreign matters accumulated below the throttle passage 40a, which is a part of the intake passage 30, can be prevented from entering the communication passage 60 when the engine is stopped and the throttle valve 41 is closed.

[0050] Similarly, in a case where the intake passage side opening 61 of the communication passage 60 is provided in the second quadrant S2 or the third quadrant S3, the intake passage side opening 61 is located in the downstream side intake passage 40a2. Therefore, since the throttle valve 41 is closed when the engine is stopped, intrusion of water vapor into the accommodation chamber 48 can be suppressed even in a case where humidity of the external air is high.

[0051] Further, in a case of setting the rotation direction of the throttle valve opposite to the above, the intake passage side opening 61 of the communication passage 60 is provided in the fourth quadrant S4, that is, in a case where the intake passage side opening 61 is opened to a region where the lower half body 41a2 of the throttle valve 41 in a valve open state protrudes in the upstream side intake passage 40a1, the communication passage 60 is opened to a position where flowing of air passing through the throttle passage 40a is slow, so that influence on the flowing of air in the throttle passage 40a can be suppressed.

[0052] In a case where the intake passage side opening 61 of the communication passage 60 is provided in the third quadrant S3, that is, in a case where the intake passage side opening 61 is opened to a region opposite

to a region where the upper half body 41a1 of the throttle valve 41 in a valve open state protrudes in the downstream side intake passage 40a2 with the first virtual plane P1 sandwiched therebeween, the communication passage 60 is also opened to a position where flowing of air passing through the throttle passage 40a is slow in the case, so that influence on the flowing of air in the throttle passage 40a can be suppressed.

[0053] Further, regardless of the rotation direction of the throttle valve, the communication passage 60 may be a through hole having a uniform diameter or may be a penetration hole, as shown in Fig. 6, having a diameter gradually increasing from the intake passage side opening 61 toward an accommodation chamber side opening 62, which is an opening of the communication passage 60 on the accommodation chamber side, such that the intake passage side opening 61 is smaller than the accommodating chamber side opening 62. Since the communication passage 60 is formed such that the intake passage side opening 61 is smaller than the accommodation chamber side opening 62, influence on the flowing of air in the throttle passage 40a can be suppressed.

[0054] Further, as shown in Fig. 7, the communication passage 60 may be formed to be inclined upward from the intake passage side opening 61 toward the accommodation chamber side opening 62. Therefore, intrusion of foreign matters into the accommodation chamber 48 can be suppressed.

[0055] Although one embodiment of the present invention has been described above, the present invention is not limited thereto, and can be modified appropriately.

[0056] For example, a cross section of the communication passage 60 may be a circular shape, and can be arbitrarily set to a rectangular shape, an elliptical shape, or the like.

[0057] Further, the communication passage 60 can be provided at an arbitrary position as long as the passage establishes communication between the throttle passage 40a and the accommodation chamber 48, and an accommodation chamber side opening 62 is not limited to the transmission mechanism accommodation chamber 48b and may be opened to the drive unit accommodation chamber 48a.

[0058] The present application is based on a Japanese patent application (Japanese

[0059] Patent Application No. 2016-053284) filed on March 17, 2016, the contents of which are incorporated herein by reference.

Description of Reference Numerals

[0060]

30	intake passage
40	throttle body
40a1	upstream side intake passage
40a2	downstream side intake passage
41	throttle valve
42	drive device
43	electric motor (actuator)
44	transmission mechanism
48	accommodation chamber
60	communication path
61	intake passage side opening
62	accommodation chamber side opening
H	housing
P1	first virtual plane
P2	second virtual plane
TH	throttle device

Claims

1. A throttle device (TH) comprising:

a throttle body (40) that supports a throttle valve (41) configured to control a flow amount of air flowing through an intake passage (30);
a drive device (42) that includes an actuator (43) configured to drive the throttle valve (41), and a transmission mechanism (44) configured to transmit a drive force of the actuator (43) to the throttle valve (41); and
a housing (H) that includes an accommodation chamber (48) accommodating the transmission mechanism (44),
wherein a communication passage (60) configured to establish communication between the intake passage (30) and the accommodation chamber (48) is formed in the throttle body (40).

2. The throttle device (TH) according to claim 1,
wherein the intake passage (30) includes an upstream side intake passage (40a1) that is located on an upstream side of the throttle valve (41), and a downstream side intake passage (40a2) that is located on a downstream side of the throttle valve (41), and
wherein the communication passage (60) is opened to the upstream side intake passage (40a1).

3. The throttle device (TH) according to claim 1,
wherein the intake passage (30) includes an upstream side intake passage (40a1) that is located on an upstream side of the throttle valve (41), and a downstream side intake passage (40a2) that is located on a downstream side of the throttle valve (41), and
wherein the communication passage (60) is opened to the downstream side intake passage (40a2).

4. The throttle device (TH) according to claim 2,
wherein the throttle valve (41) includes an upper half body and a lower half body with a rotation shaft serving as a center,
wherein the drive device (42) is configured to control

the throttle valve to a valve closed state where the throttle valve (41) closes the intake passage (30) and to a valve open state where the intake passage (30) is opened by rotating the throttle valve (41) around the rotation shaft such that either one of the upper half body and the lower half body protrudes in the upstream side intake passage (40a1) and the other one protrudes in the downstream side intake passage (40a2), and
wherein when the intake passage (30) is divided into four regions as seen in a rotation shaft direction by a first virtual plane (P1) passing through the rotation shaft and extending in parallel to the intake passage (30) and a second virtual plane (P2) passing through the rotation shaft and orthogonal to the first virtual plane (PI), the communication passage (60) is opened to a region where the throttle valve (41) in the valve open state protrudes in the upstream side intake passage (40a1).

5. The throttle device (TH) according to claim 3,
wherein the throttle valve (41) includes an upper half body and a lower half body with a rotation shaft serving as a center,
wherein the drive device (42) is configured to control the throttle valve to a valve closed state where the throttle valve (41) closes the intake passage (30) and to a valve open state where the intake passage (30) is opened by rotating the throttle valve (41) around the rotation shaft such that either one of the upper half body and the lower half body protrudes in the upstream side intake passage (40a1) and the other one protrudes in the downstream side intake passage (40a2), and
wherein when the intake passage (30) is divided into four regions as seen in the rotation shaft direction by a first virtual plane (P1) passing through the rotation shaft and extending in parallel to the intake passage (30) and a second virtual plane (P2) passing through the rotation shaft and orthogonal to the first virtual plane (PI), the communication passage (60) is opened to a region opposite to a region where the throttle valve (41) in the valve open state protrudes in the downstream side intake passage (40a2) with the first virtual plane (P1) sandwiched therebetween.

6. The throttle device (TH) according to any of claims 1 to 3,
wherein the communication passage (60) is opened above the rotation shaft of the throttle valve (41).

7. The throttle device (TH) according to any of claims 1 to 3,
wherein an intake passage side opening (61) of the communication passage (60) on an intake passage side is smaller than an accommodation chamber side opening (62) on an accommodation chamber side.

8. The throttle device (TH) according to any of claims 1 to 7,
wherein the communication passage (60) is formed to be inclined upward from an intake passage side opening (61) on an intake passage side toward an accommodation chamber side opening (62) on an accommodation chamber side.

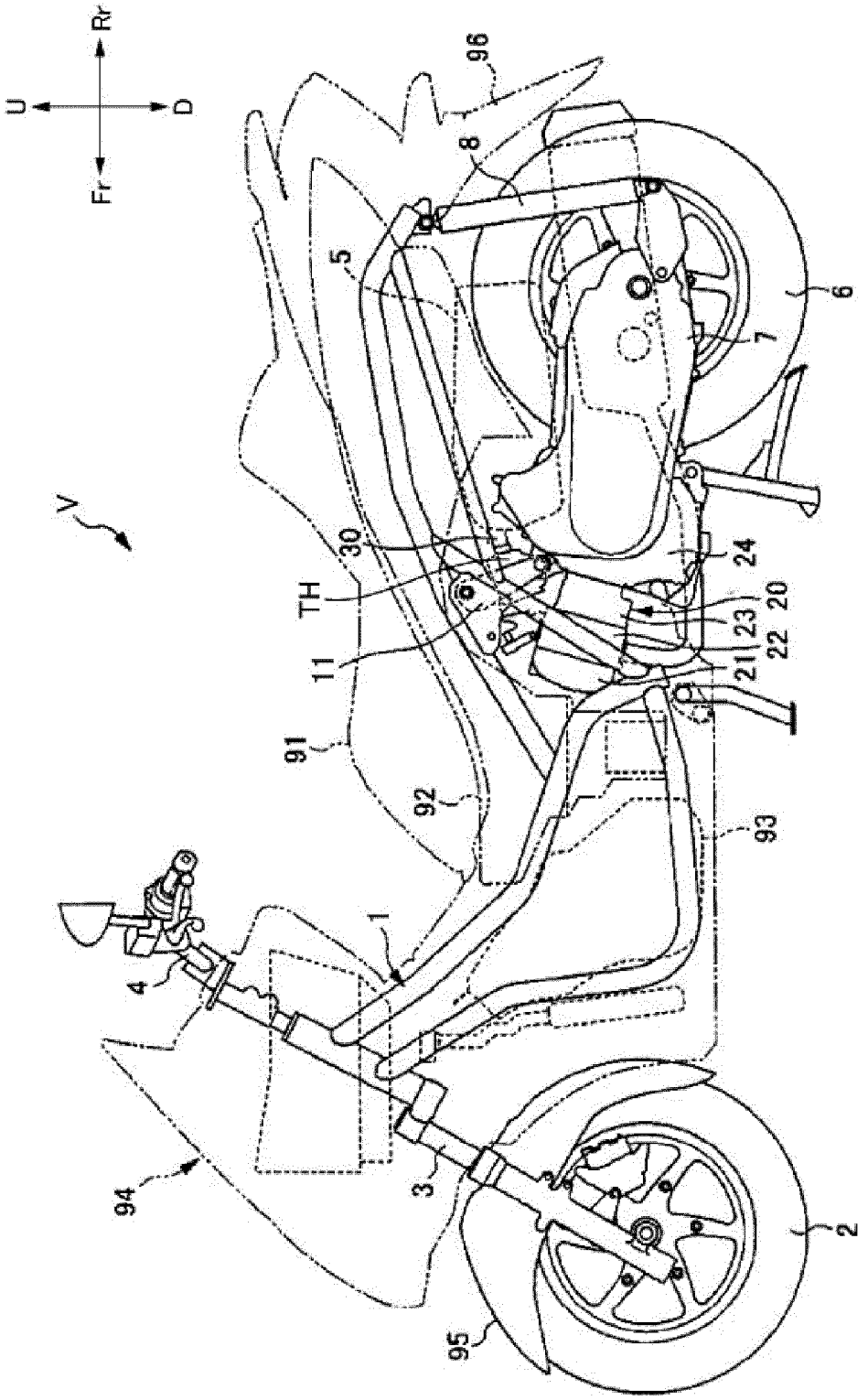


FIG.1

FIG.2

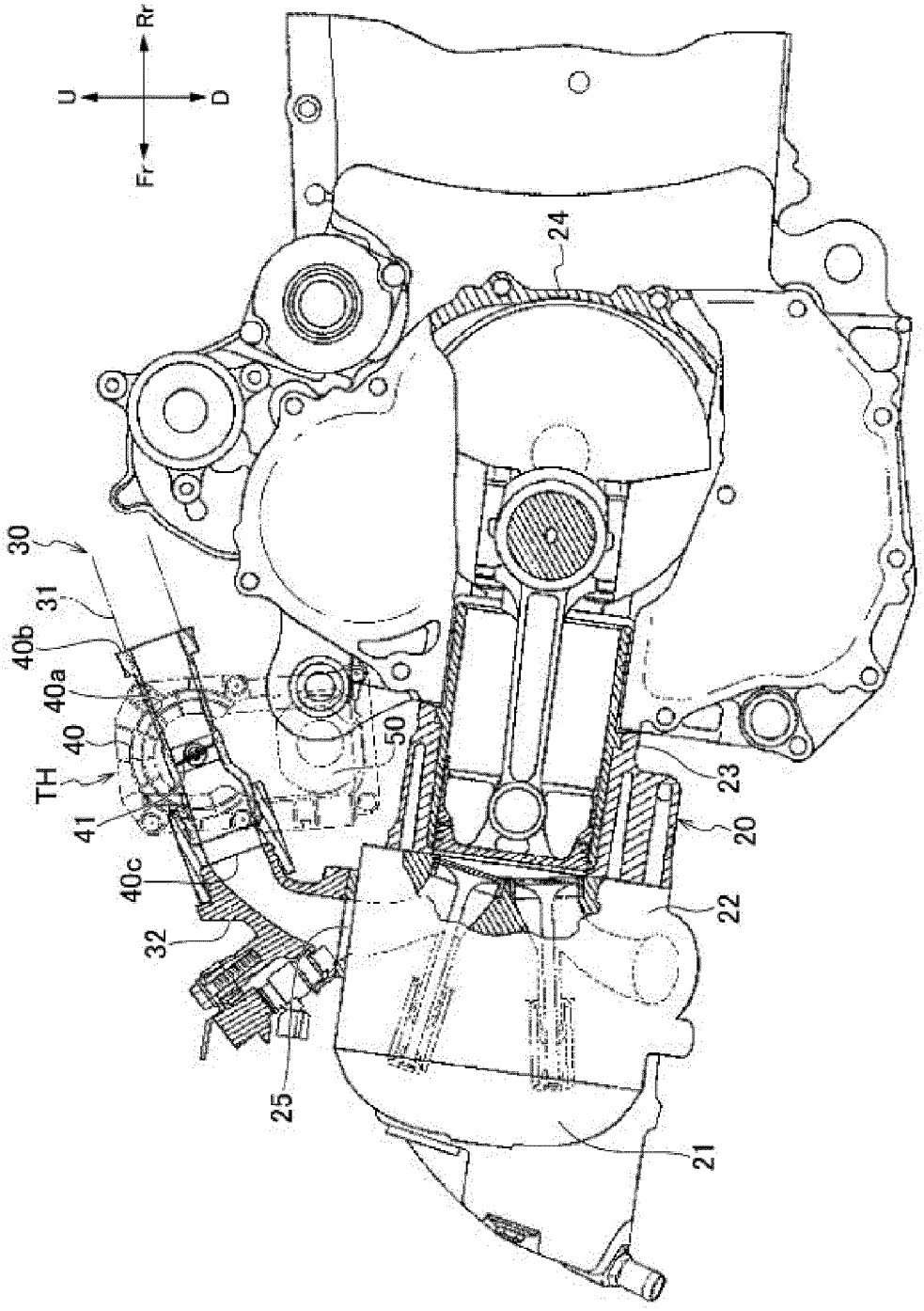
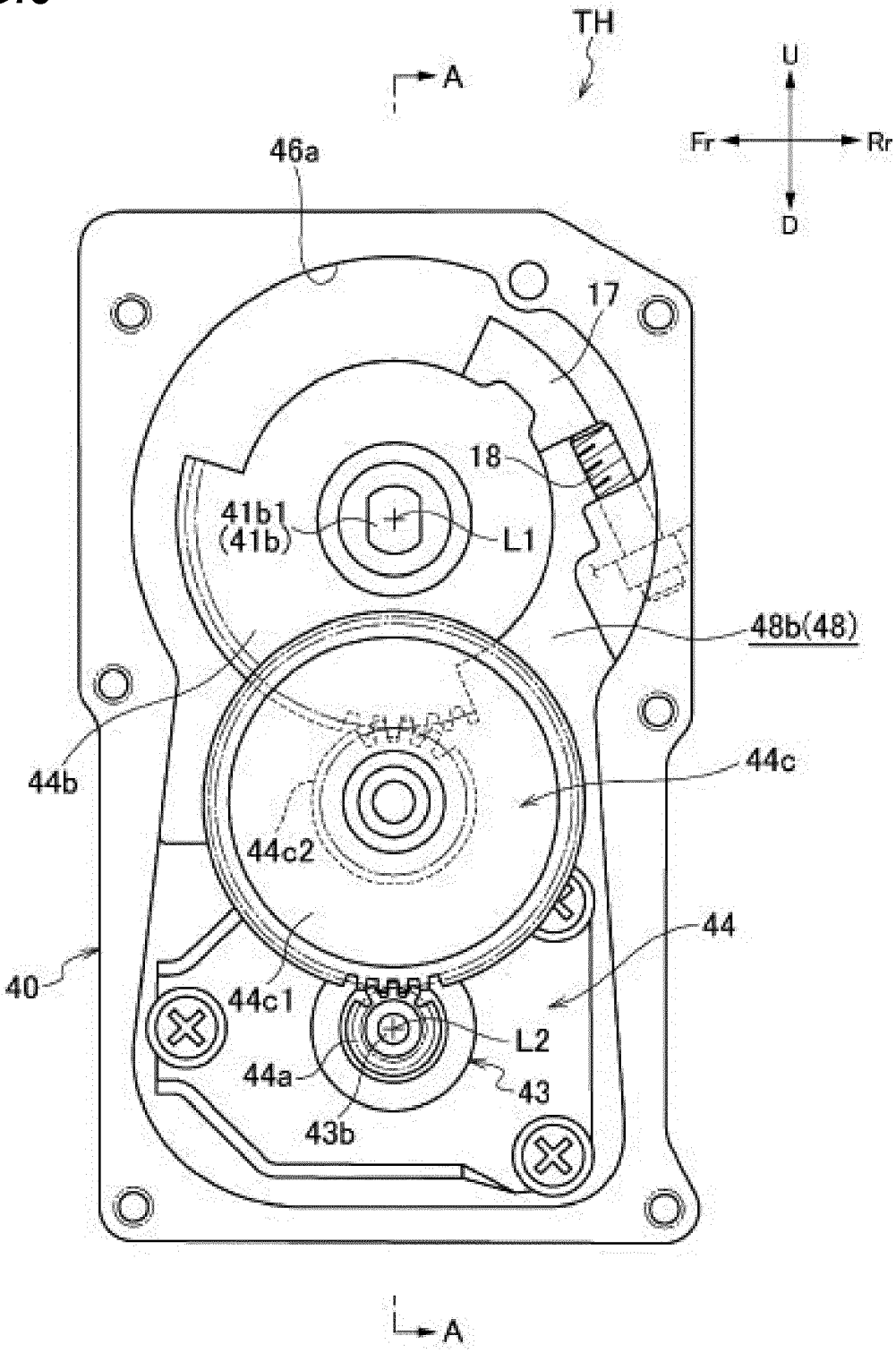


FIG.3


TH
A
U
Fr
Rr
D
46a
17
18
41b1
(41b)
L1
48b(48)
44b
44c
44c2
44
40
44c1
L2
44a
43
43b
A

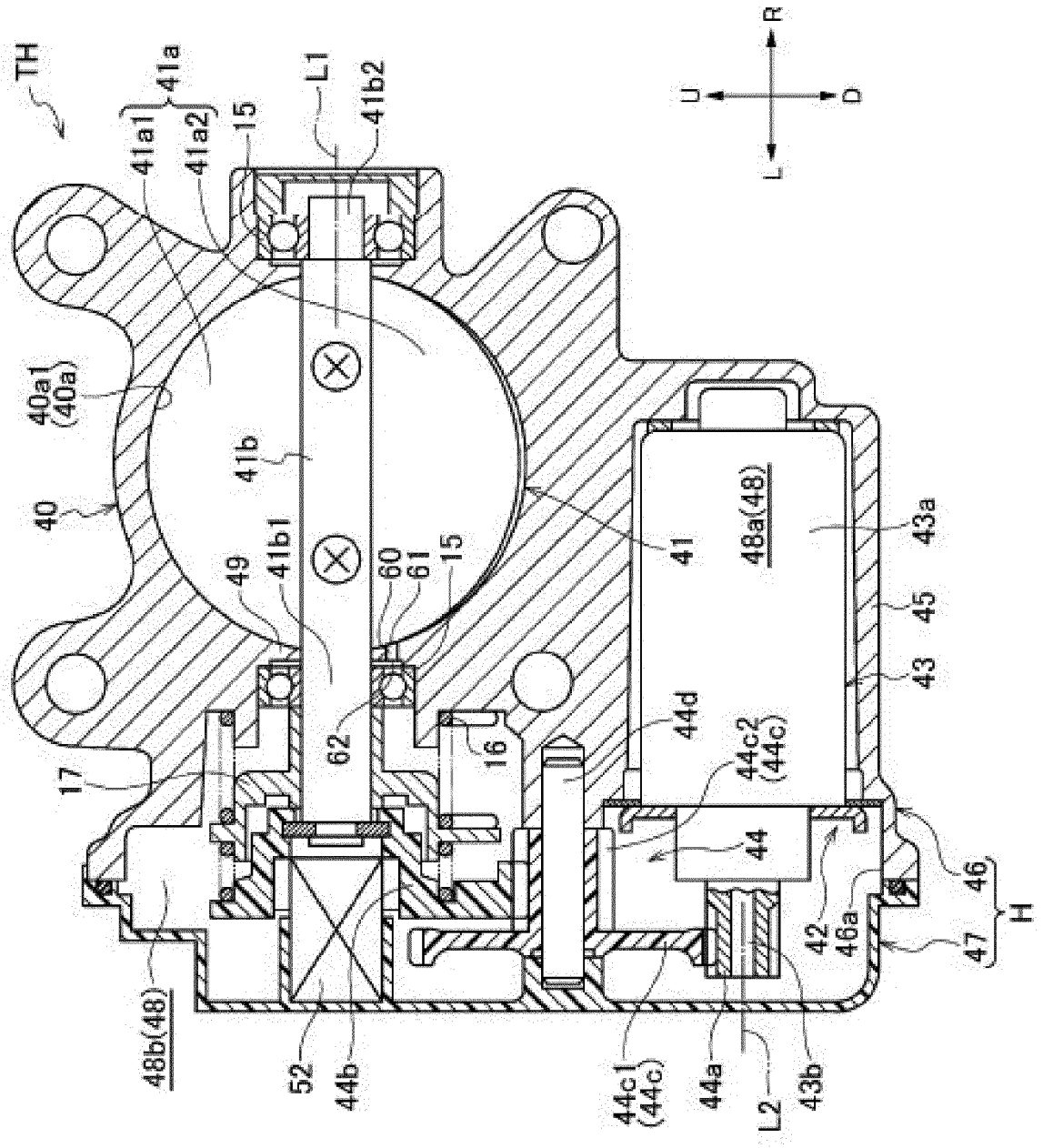

TH
41a
41a1
41a2
15
L1
41b2
R
U
D
L
40a1
(40a)
40
41b
41b1
49
60
61
15
41
48a(48)
43a
45
43
44d
44c2
(44c)
44
46
H
42
46a
47
17
62
16
48b(48)
52
44b
44c1
(44c)
44a
L2
43b

FIG.4

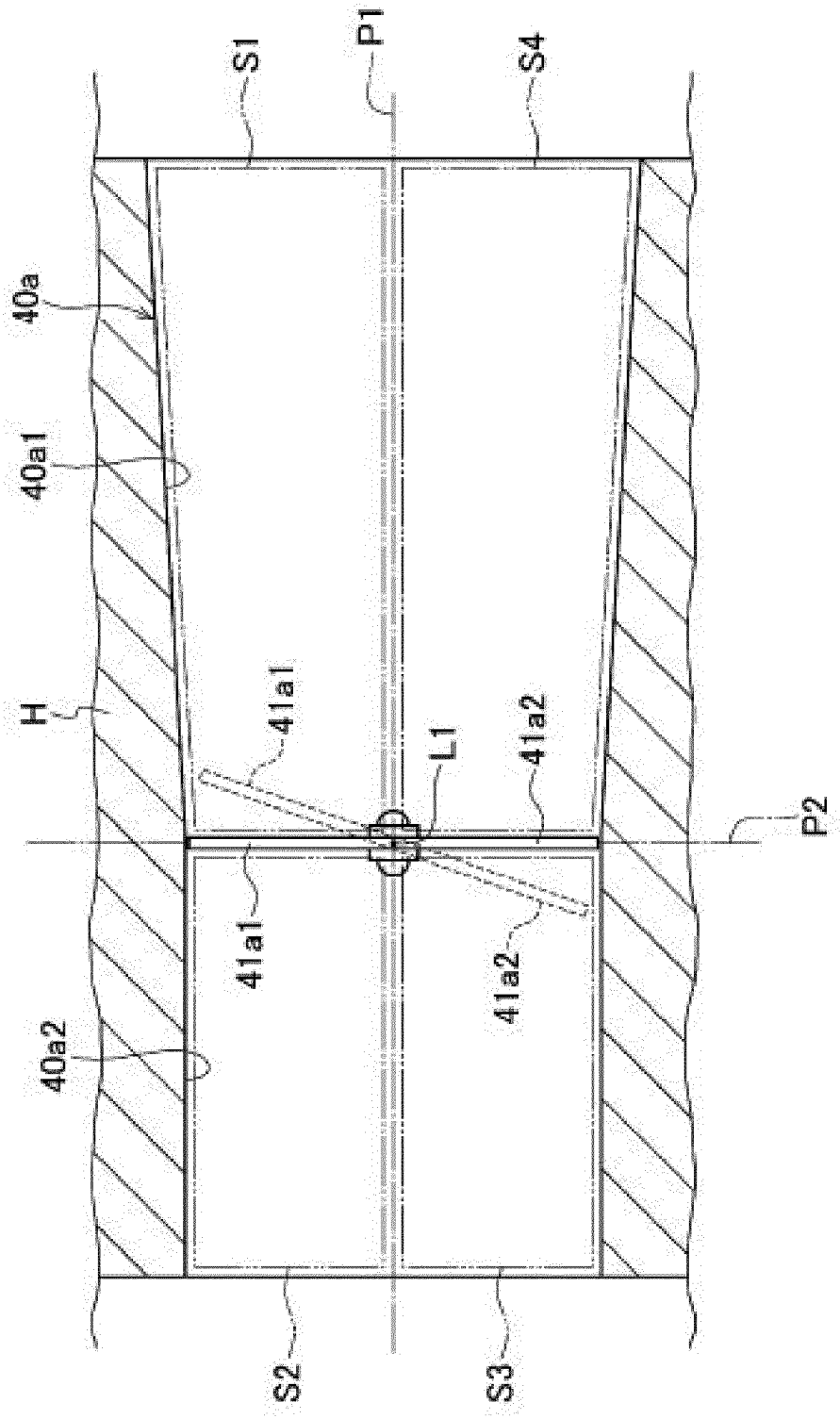


FIG.5

FIG.6

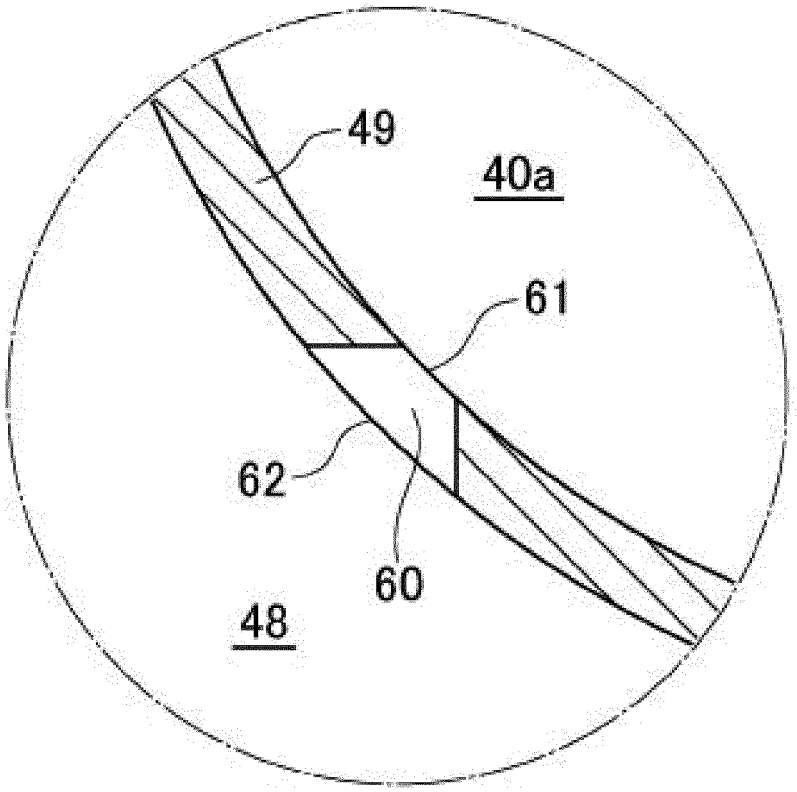
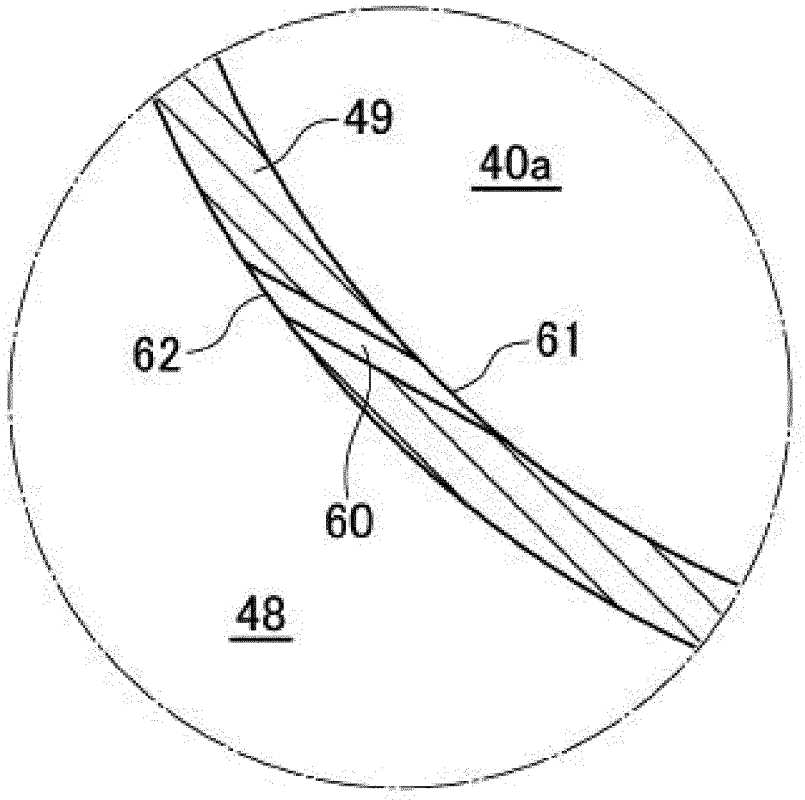


FIG.7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/004629

A. CLASSIFICATION OF SUBJECT MATTER
F02D9/10(2006.01)i, *F02D9/02*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F02D9/10, F02D9/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 6-129267 A (Aisan Industry Co., Ltd.), 10 May 1994 (10.05.1994), abstract; claim 1; paragraphs [0005] to [0017]; fig. 1 to 2 (Family: none)	1-4,6-8 5
X A	JP 2008-95559 A (Aisan Industry Co., Ltd.), 24 April 2008 (24.04.2008), abstract; claim 1; paragraphs [0026] to [0042], [0046] to [0047], [0052]; fig. 1, 5 to 7, 11 (Family: none)	1-2,7-8 5
X A	JP 2007-255240 A (Denso Corp.), 04 October 2007 (04.10.2007), paragraph [0061]; fig. 2 to 5 & CN 101042074 A	1-3 5

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 April 2017 (21.04.17)	09 May 2017 (09.05.17)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/004629

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2007-132269 A (Toyota Motor Corp.), 31 May 2007 (31.05.2007), paragraph [0007]; fig. 1 to 4 (Family: none)	1 2-8

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010196599 A **[0004]**
- JP 2016053284 A **[0059]**