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(54) STRADDLED VEHICLE

(57) A first shaft includes a first threaded portion and is at least in part disposed inside a first accommodation portion. A second shaft is at least in part disposed inside a second accommodation portion, and is moved in an axis direction of a tensioner in accordance with rotation of the first shaft. The second shaft includes a second threaded portion and a distal end. The second threaded portion is screwed with the first threaded portion. The distal end protrudes from the second accommodation portion into an engine. A spring urges the first shaft to rotate the first shaft. As seen in a vehicle plan view, the tensioner at least in part overlaps with an intake pathway portion. The spring is disposed inside the first accommodation portion and the second accommodation portion.

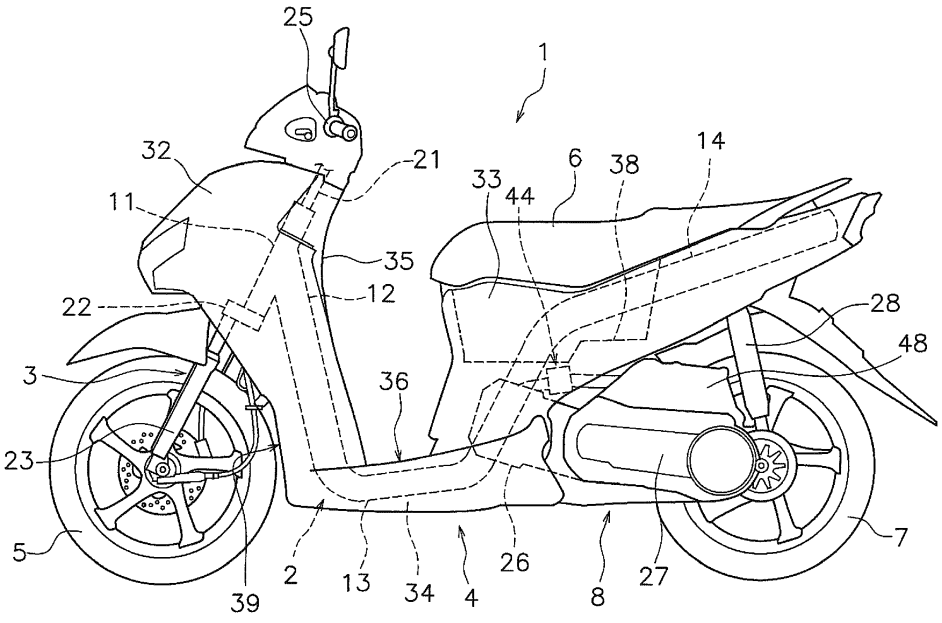

FIG. 1

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Description

[0001] The present invention relates to a straddled vehicle.

[0002] There is a type of engine to which a tensioner is attached for pressing either a timing chain or a timing belt. For example, PCT International Application No. WO20031048605 describes a tensioner that includes a rotary shaft, a thrust shaft, a casing, a spring and a bearing. The rotary shaft and the thrust shaft are screwed with each other through threads. The rotary shaft and the spring are disposed inside the casing. The spring urges the rotary shaft to rotate the rotary shaft. The bearing is attached to the casing, and restricts rotation of the thrust shaft. The rotary shaft is rotated by an urging force of the spring, whereby the thrust shaft is moved in an axial direction thereof. Accordingly, the thrust shaft presses either a timing chain or a timing belt.

[0003] There is a type of straddled vehicle in which a tensioner is disposed between an intake system and an engine. To compactly dispose the intake system and the engine in such a type of vehicle, it has been demanded to reduce the amount of the tensioner protruding from the engine.

[0004] To reduce the amount of the tensioner protruding from the engine, it can be assumed to shorten the casing disposed outside the engine. In this case, however, the spring disposed inside the casing is required to be shortened. This results in reduction in number of windings of the spring. Moreover, such a shortened spring is required to be increased in outer diameter, when intended to exert a load equivalent to that of an original spring not shortened. In this case, a rate of change in outer diameter of the spring to displacement of the thrust shaft is increased. In consideration of the rate of change in outer diameter of the spring, the casing is required to be increased in radial size. As a result, increase in size of the engine is brought about.

[0005] In the straddled vehicle, a storage box and a seat are disposed above the engine. Therefore, increase in size of the engine results in reduction in capacity of the storage box. Alternatively, increase in size of the engine results in increase in height of the seat, whereby degradation in a foot grounding property of a rider is inevitable.

[0006] It is an object of the present invention to provide a straddled vehicle that can inhibit increase in size of an engine, and simultaneously, make smaller the amount of a tensioner protruding from the engine. According to the present invention said object is solved by a straddled vehicle having the features of independent claim 1. Preferred embodiments are laid down in the dependent claims.

[0007] A straddled vehicle according to an aspect includes a vehicle body frame, an engine, a storage box, a seat, an intake pathway portion and a tensioner. The engine is pivotably supported by the vehicle body frame. The storage box is disposed above the engine. The seat is disposed above the storage box. The intake pathway portion is disposed below the storage box, and is connected to the engine. The tensioner is disposed between the intake pathway portion and the engine in a vehicle up-and-down direction, and is attached to the engine.

[0008] The tensioner includes a first accommodation portion, a second accommodation portion, a first shaft, a second shaft and a spring. The first accommodation portion is disposed outside the engine, and is attached to the engine. The second accommodation portion is disposed inside the engine, and is connected to the first accommodation portion. The first shaft is at least in part disposed inside the first accommodation portion, and includes a first threaded portion. The second shaft is at least in part disposed inside the second accommodation portion, and is moved in an axis direction of the tensioner in accordance with rotation of the first shaft. The second shaft includes a second threaded portion and a distal end. The second threaded portion is screwed with the first threaded portion. The distal end protrudes from the second accommodation portion into the engine. The spring urges the first shaft to rotate the first shaft. The tensioner at least in part overlaps with the intake pathway portion as seen in a vehicle plan view. The spring is disposed inside the first accommodation portion and the second accommodation portion.

[0009] In the straddled vehicle according to the present aspect, the spring is disposed inside both the first accommodation portion disposed outside the engine and the second accommodation portion disposed inside the engine. Because of this, in comparison with a configuration that the spring is entirely disposed inside the first accommodation portion, the amount of the tensioner protruding from the engine can be made smaller, while the spring can be reliably produced with sufficient length. Accordingly, the amount of the tensioner protruding from the engine can be made smaller, while increase in size of the engine can be inhibited. Moreover, the engine and the intake pathway portion can be compactly disposed because the amount of the tensioner protruding from the engine can be made smaller. Accordingly, reduction in capacity of the storage box can be inhibited. Furthermore, increase in height of the seat can be inhibited, whereby degradation in a foot grounding property of a rider can be inhibited.

[0010] The second accommodation portion may include a groove extending in the axis direction of the tensioner. The spring may include a lock portion locked to the groove. The lock portion may extend within the groove in the axis direction of the tensioner. In this case, the spring can be more stably restricted from rotating than when the lock portion of the spring extends in the circumferential direction of the spring. Because of this, the spring can be enhanced in durability.

[0011] The lock portion may protrude from the second accommodation portion. The engine may include an attachment hole into which the second accommodation portion is inserted. The attachment hole may include a

first relief portion and a second relief portion. The lock portion may be disposed at the first relief portion. The second relief portion may be disposed in a position displaced from the first relief portion by a predetermined angle of rotation about a center of the attachment hole. The second relief portion enables the lock po rtion to be disposed therein. In this case, interference between the lock portion and the attachment hole can be avoided by the first relief portion. Additionally, interference between the lock portion and the attachment hole can be avoided not only by the first relief portion but also by the second relief portion. Because of this, attaching the tensioner to the engine is made easy.

[0012] The lock portion may protrude from the second accommodation portion. The engine may include an attachment hole and first and second bolt holes for attaching the tensioner to the engine. The attachment hole may be a hole into which the second accommodation portion is inserted. The attachment hole may include a relief portion in which the lock portion is disposed. The relief portion may be disposed in a position not overlapping with a virtual straight line connecting centers of the first and second bolt holes as seen in an axis direction of the attachment hole. In this case, the relief portion can be provided, while increase in distance between the first and second bolt holes can be inhibited. Because of this, increase in size of the engine can be inhibited.

[0013] The first accommodation portion may include a flange portion attached to the engine. The second accommodation portion may be integrated with the flange portion. In this case, forming the first and second accommodation portions is made easy.

[0014] The first accommodation portion may be longer than the second accommodation portion in the axis direction of the tensioner. In this case, the spring can be reliably produced with large length.

[0015] The engine may include a crankcase, a cylinder and a head cover. The cylinder may include a first end and a second end. The first end may be attached to the head cover. The second end may be attached to the crankcase. The cylinder may include a tensioner attachment portion and an intake attachment portion. The tensioner may be attached to the tensioner attachment portion. The intake pathway portion may be attached to the intake attachment portion. The intake pathway portion may extend from the intake attachment portion toward the second end side. The intake attachment portion may be disposed between the first end and the tensioner attachment portion in an axis direction of the cylinder. A distance between the first end and the tensioner attachment portion is greater than a distance between the tensioner attachment portion and the second end in the axis direction of the cylinder. In this case, the tensioner is located closer to the second end than to the first end side. Therefore, the tensioner is disposed to be separated far from the intake attachment portion toward the second end. Because of this, the tensioner can be disposed far away from the intake attachment portion. Consequently, access to the tensioner is made easy, whereby the tensioner can be enhanced in maintenance performance.

[0016] The straddled vehicle may further include an exhaust system connected to the engine. The exhaust system may include a catalyst disposed below the engine. In this case, the amount of the tensioner protruding from the engine can be made smaller, whereby the engine and the intake pathway portion can be compactly disposed. Because of this, even when the catalyst is disposed below the engine, increase in height of the vehicle or reduction in lowest height of the vehicle from the ground can be inhibited.

[0017] The intake pathway portion may include an intake duct and a throttle body. The intake duct may be connected to the engine. The throttle body may be connected to the intake duct. The tensioner may at least in part overlap with the throttle body as seen in the vehicle plan view. In this case, the amount of the tensioner protruding from the engine can be made smaller, whereby the engine and the throttle body can be compactly disposed.

[0018] The engine may include a crankcase, a crankshaft and a cylinder. The crankshaft may be accommodated in the crankcase. The cylinder may be connected to the crankcase. The intake pathway portion may include an intake duct. The intake duct may be connected to the cylinder, and may curve backward from the cylinder. An axis of the cylinder may be set off downward from a rotational center of the crankshaft as seen in a vehicle side view. In this case, the cylinder can be lowered in position. Because of this, the intake pathway portion can be disposed in a low position, while a space can be reliably produced above the cylinder so as to dispose therein the intake duct having a curve shape. Consequently, increase in size of the engine can be inhibited.

[0019] The straddled vehicle may further include a radiator and a cooling water pathway. The axis of the cylinder may form an angle of greater than 45 degrees with respect to a horizontal direction. The cooling water pathway may be connected to the radiator and the engine. The tensioner may overlaps with the cooling water pathway as seen in a direction perpendicular to the axis of the cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a side view of a straddled vehicle according to a preferred embodiment.

FIG. 2 is an enlarged left side view of an engine and the surroundings thereof.

FIG. 3 is an enlarged top view of the engine and the surroundings thereof.

FIG. 4 is an enlarged right side view of a power unit and the surroundings thereof.

FIG. 5 is an enlarged bottom view of the power unit and the surroundings thereof.

FIG. 6 is a perspective view of a tensioner.
FIG. 7 is an exploded perspective view of the tensioner.
FIG. 8 is a cross-sectional view of the tensioner.
FIG. 9 is a cross-sectional view of part of the engine.
FIG. 10 is an enlarged view of part of an upper surface of a cylinder of the engine.
FIG. 11 is an enlarged left side view of an engine and the surroundings thereof according to a modification.
FIG. 12 is an enlarged top view of the engine and the surroundings thereof according to the modification.

DETAILED DESCRIPTION OF EMBODIMENTS

[0021] A straddled vehicle 1 according to a preferred embodiment will be hereinafter explained with reference to drawings. FIG. 1 is a side view of the straddled vehicle 1. The straddled vehicle 1 according to the present preferred embodiment is a scooter-type vehicle. As shown in FIG. 1, the straddled vehicle 1 includes a vehicle body frame 2, a steering device 3, a vehicle body cover 4, a front wheel 5, a seat 6, a rear wheel 7 and a power unit 8.

[0022] It should be noted that in the present specification, a back-and-forth direction, an up-and-down direction and a right-and-left direction of the straddled vehicle 1 refer to the back-and-forth direction, the up-and-down direction and the right-and-left direction seen from a rider riding on the straddled vehicle 1. Additionally, the back-and-forth direction is defined as not only indicating directions arranged in parallel to the back-and-forth direction of the straddled vehicle 1, but also encompassing directions tilting within an angular range of $\pm$45 degrees with respect to the back-and-forth direction of the straddled vehicle 1. In other words, a given direction closer to the back-and-forth direction than to the right-and-left direction and the up-and-down direction is classified as the back-and-forth direction.

[0023] Likewise, the up-and-down direction is defined as encompassing directions tilting within an angular range of $\pm$45 degrees with respect to the up-and-down direction of the straddled vehicle 1. In other words, a given direction closer to the up-and-down direction than to the back-and-forth direction and the right-and-left direction is classified as the up-and-down direction. Moreover, the right-and-left direction is defined as encompassing directions tilting within an angular range of $\pm$45 degrees with respect to the right-and-left direction of the straddled vehicle 1. In other words, a given direction closer to the right-and-left direction than to the back-and-forth direction and the up-and-down direction is classified as the right-and-left direction.

[0024] In the present specification, the term "connection" is not limited to direct connection, and encompasses indirect connection. Additionally, the term "connection" is not limited to a condition that separate members are fixed to each other, and encompasses a condition that a plurality of portions in an integrated member continue to each other.

[0025] The vehicle body frame 2 includes a head pipe 11, a down frame 12, a lower frame 13 and a rear frame 14. The down frame 12 extends downward from the head pipe 11. The lower frame 13 is connected to a lower part of the down frame 12. The lower frame 13 extends backward from the down frame 12. The rear frame 14 extends backward and upward from the lower frame 13.

[0026] The steering device 3 is turnably supported by the head pipe 11. The steering device 3 includes a steering shaft 21, an under bracket 22 and a front fork 23. The steering shaft 21 is inserted into the head pipe 11. The steering shaft 21 is connected at an upper part thereof to a handle 25. The steering shaft 21 is supported by the head pipe 11 and is thereby turnable right and left. The under bracket 22 is connected to a lower part of the steering shaft 21. The front fork 23 is connected at the upper end thereof to the under bracket 22. The front wheel 5 is rotatably supported by the front fork 23.

[0027] The vehicle body cover 4 includes a front cover 32, a rear cover 33, a lower cover 34, a leg shield 35 and a mud cover 39. The front cover 32 is disposed in front of the head pipe 11. The leg shield 35 is disposed behind the front cover 32. The leg shield 35 is disposed behind the head pipe 11 and the down frame 12. The mud cover 39 is disposed behind the front wheel 5 and in front of the leg shield 35. The rear cover 33 covers the surroundings of the rear frame 14. The rear cover 33 is disposed below the seat 6. The lower cover 34 is disposed between the front cover 32 and the rear cover 33. The lower cover 34 covers the surroundings of the lower frame 13.

[0028] The upper surface of the lower cover 34 includes a footboard 36. The footboard 36 is disposed below and forward of the seat 6. The footboard 36 is disposed behind the leg shield 35. The footboard 36 is disposed above the lower frame 13. The footboard 36 is provided for allowing the rider to put his/her feet thereon. The footboard 36 has an entirely flat shape in a vehicle width direction. However, the footboard 36 may not have a flat shape. For example, a center tunnel portion may be provided in the middle of the footboard 36. The center tunnel portion has an upwardly protruding shape and extends in the back-and-forth direction.

[0029] The power unit 8 is disposed below the seat 6. The power unit 8 includes an engine 26 and a transmission 27. The power unit 8 is pivotably supported by the vehicle body frame 2. The power unit 8 rotatably supports the rear wheel 7. In other words, the power unit 8, including the engine 26, pivots together with the rear wheel 7. Thus, the straddled vehicle 1 includes the power unit 8 of a so-called unit swing type.

[0030] The rear wheel 7 is supported by the vehicle body frame 2 through a rear suspension 28. A storage box 38 is disposed above the engine 26. The seat 6 is disposed above the storage box 38. The seat 6 is disposed above the rear frame 14.

[0031] FIG. 2 is an enlarged left side view of the engine

26 and the surroundings thereof. FIG. 3 is an enlarged top view of the engine 26 and the surroundings thereof. It should be noted that in FIG. 3, the position of the storage box 38 is depicted with dashed two-dotted line. As shown in FIGS. 2 and 3, the engine 26 includes a crankcase 41, a cylinder 42 and a head cover 43. The crankcase 41 is disposed sideward of the transmission 27. The crankcase 41 accommodates a crankshaft 40.

[0032] The cylinder 42 is disposed in front of the crankcase 41. The cylinder 42 includes a cylinder body 42a and a cylinder head 42b. The cylinder body 42a is connected to the crankcase 41. The cylinder head 42b is connected to the cylinder body 42a. The head cover 43 is disposed in front of the cylinder 42. The head cover 43 is connected to the cylinder head 42b. As seen in the vehicle side view, an axis Ax1 of the cylinder 42 (hereinafter referred to as "cylinder axis Ax1") tilts forward and upward. As seen in the vehicle side view, the cylinder axis Ax1 is set off (displaced) downward from a rotational center C1 of the crankshaft 40. The cylinder axis Ax1 forms an angle of less than 45 degrees with respect to a horizontal direction.

[0033] The straddled vehicle 1 includes an intake pathway portion 44. The intake pathway portion 44 is connected to the engine 26. The intake pathway portion 44 is disposed above the engine 26. As seen in the vehicle plan view, the intake pathway portion 44 at least in part overlaps with the engine 26. The intake pathway portion 44 is disposed below the storage box 38. As seen in the vehicle plan view, the intake pathway portion 44 overlaps with the storage box 38.

[0034] The intake pathway portion 44 includes an intake duct 45, a throttle body 46, an intake duct 47 and an air cleaner 48. The intake duct 45 is connected to the engine 26. Detailedly, the intake duct 45 is connected to the cylinder head 42b. The intake duct 45 is disposed above the cylinder 42. As seen in the vehicle plan view, the intake duct 45 at least in part overlaps with the cylinder 42. The intake duct 45 is disposed below the storage box 38. As seen in the vehicle plan view, the intake duct 45 overlaps with the storage box 38.

[0035] The intake duct 45 is connected to an upper surface 420 of the cylinder head 42b. The intake duct 45 is shaped to curve backward from the upper surface 420 of the cylinder head 42b. The throttle body 46 is connected to the intake duct 45. The throttle body 46 is disposed behind the intake duct 45. The throttle body 46 is disposed above the cylinder 42. As seen in the vehicle plan view, the throttle body 46 overlaps with the cylinder 42. The throttle body 46 is disposed below the storage box 38. As seen in the vehicle plan view, the throttle body 46 overlaps with the storage box 38.

[0036] The intake duct 47 is connected to the throttle body 46. The intake duct 47 is disposed behind the throttle body 46. The intake duct 47 is disposed above the crankcase 41. As seen in the vehicle plan view, the intake duct 47 overlaps with the crankcase 41. As seen in the vehicle plan view, the intake duct 47 may overlap with the cylinder 42. The intake duct 47 is disposed below the storage box 38. As seen in the vehicle plan view, the intake duct 47 overlaps with the storage box 38. The intake duct 47 extends backward from the throttle body 46.

[0037] The air cleaner 48 is connected to the intake duct 47. The air cleaner 48 is disposed behind the intake duct 47. The air cleaner 48 is disposed above the power unit 8. Detailedly, the air cleaner 48 is disposed above the transmission 27. The air cleaner 48 is disposed above the engine 26.

[0038] FIG. 4 is an enlarged right side view of the power unit 8 and the surroundings thereof. FIG. 5 is an enlarged bottom view of the power unit 8 and the surroundings thereof. It should be noted that FIGS. 4 and 5 omit illustration of the intake pathway portion 44. As shown in FIGS. 4 and 5, the straddled vehicle 1 includes an exhaust system 51. The exhaust system 51 is connected to the engine 26. The exhaust system 51 includes a first exhaust pipe 52, a catalyst 53, a second exhaust pipe 54 and a silencer 55.

[0039] The first exhaust pipe 52 is connected to the cylinder head 42b. The first exhaust pipe 52 is at least in part disposed below the cylinder 42. As seen in the vehicle plan view, the first exhaust pipe 52 at least in part overlaps with the cylinder 42. The first exhaust pipe 52 is at least in part disposed below the crankcase 41. As seen in the vehicle plan view, the first exhaust pipe 52 at least in part overlaps with the crankcase 41. The first exhaust pipe 52 extends backward from the cylinder head 42b.

[0040] The catalyst 53 is connected to the first exhaust pipe 52. The catalyst 53 is thicker in diameter than the first exhaust pipe 52. The catalyst 53 is thicker in diameter than the second exhaust pipe 54. The catalyst 53 purifies exhaust gas transferred thereto from the engine 26. The catalyst 53 is at least in part disposed below the engine 26. Detailedly, the catalyst 53 is at least in part disposed below the crankcase 41. As seen in the vehicle plan view, the catalyst 53 at least in part overlaps with the crankcase 41. The second exhaust pipe 54 is connected to the catalyst 53. The silencer 55 is connected to the second exhaust pipe 54.

[0041] As shown in FIGS. 2 and 3, the straddled vehicle 1 includes a tensioner 60. The tensioner 60 is attached to the engine 26. Detailedly, the tensioner 60 is attached to the cylinder body 42a. The tensioner 60 is disposed between the intake pathway portion 44 and the engine 26 in the vehicle up-and-down direction. The tensioner 60 is attached to the upper surface 420 of the cylinder 42. The tensioner 60 is disposed below the intake pathway portion 44. As seen in the vehicle plan view, the tensioner 60 at least in part overlaps with the intake pathway portion 44. Detailedly, as seen in the vehicle plan view, the tensioner 60 at least in part overlaps with the throttle body 46. However, as seen in the vehicle plan view, the tensioner 60 may at least in part overlap with the intake duct 45. As seen in the vehicle plan view, the tensioner 60 may at least in part overlap with the intake

duct 47.

[0042] FIG. 6 is a perspective view of the tensioner 60. FIG. 7 is an exploded perspective view of the tensioner 60. FIG. 8 is a cross-sectional view of the tensioner 60. FIG. 9 is a cross-sectional view of part of the engine 26. As shown in FIGS. 6 to 9, the tensioner 60 includes a first accommodation portion 61, a second accommodation portion 62, a first shaft 63, a second shaft 64 and a spring 65.

[0043] As shown in FIG. 9, the first accommodation portion 61 is disposed outside the engine 26. The first accommodation portion 61 is attached to the upper surface 420 of the cylinder 42. As shown in FIG. 8, the first accommodation portion 61 is larger in length than the second accommodation portion 62 in a direction of an axis Ax2 of the tensioner 60. In other words, the first accommodation portion 61 is longer than the second accommodation portion 62 in the axis direction (Ax2) of the tensioner 60. The first accommodation portion 61 includes an accommodation body 66 and a flange portion 67. The accommodation body 66 has a cylindrical shape. The accommodation body 66 includes an uppermost portion 68. The uppermost portion 68 is provided with an opening 680. The opening 680 is opposed to the first shaft 63 in the axis direction (Ax2) of the tensioner 60. A cap 77 is attached to the opening 680.

[0044] The flange portion 67 protrudes radially outward from the accommodation body 66. The flange portion 67 is attached to the upper surface 420 of the cylinder 42. As shown in FIG. 7, the flange portion 67 includes a plurality of attachment holes 671 and 672. Detailedly, the plural attachment holes 671 and 672 include a first attachment hole 671 and a second attachment hole 672. The first and second attachment holes 671 and 672 are disposed to be symmetric to each other with respect to the axis Ax2 of the tensioner 60. It should be noted that the number of attachment holes is not limited to two, and alternatively, may be greater than two. The first and second attachment holes 671 and 672 may not be disposed to be symmetric to each other with respect to the axis Ax2 of the tensioner 60.

[0045] The second accommodation portion 62 is disposed inside the engine 26. The second accommodation portion 62 has a cylindrical shape. The second accommodation portion 62 is connected to the flange portion 67. The second accommodation portion 62 extends from the flange portion 67 in the axis direction (Ax2) of the tensioner 60. The second accommodation portion 62 is integrated with the first accommodation portion 61. The second accommodation portion 62 is integrated with the flange portion 67. However, the second accommodation portion 62 may be separated from the first accommodation portion 61. The second accommodation portion 62 is opened at the distal end thereof.

[0046] The first shaft 63 extends in the axis direction (Ax2) of the tensioner 60. As shown in FIG. 8, the first shaft 63 is disposed inside both the first accommodation portion 61 and the second accommodation portion 62. The first shaft 63 includes a first base end 631 and a first distal end 632. The first base end 631 includes a groove 633 extending in a radial direction of the first shaft 63. The groove 633 is opposed to the opening 680 of the uppermost portion 68 of the first accommodation portion 61 in the axis direction (Ax2) of the tensioner 60. The first distal end 632 is provided on the opposite side of the first base end 631.

[0047] The tensioner 60 includes a first support member 69. The first support member 69 is disposed inside the first accommodation portion 61. The first support member 69 rotatably supports the first shaft 63. The first support member 69 is disposed between the first base end 631 of the first shaft 63 and the uppermost portion 68 of the first accommodation portion 61. The first support member 69 supports the first shaft 63 at the first base end 631. The first support member 69 includes an opening 690. The opening 690 of the first support member 69 is opposed to the opening 680 of the uppermost portion 68 of the first accommodation portion 61 in the axis direction (Ax2) of the tensioner 60.

[0048] The first shaft 63 includes a first threaded portion 634. The first threaded portion 634 is provided on the outer peripheral surface of the first shaft 63. The first threaded portion 634 is provided on the first shaft 63 in a predetermined range that ranges from the first distal end 632 in the axis direction (Ax2). The first shaft 63 includes a head portion 71 and a shaft body 72. The head portion 71 includes the first base end 631 and groove 633 described above. An outer diameter of the head portion 71 is larger than an outer diameter the shaft body 72. The shaft body 72 includes the first distal end 632 and first threaded portion 634 described above.

[0049] The second shaft 64 extends in the axis direction (Ax2) of the tensioner 60. The second shaft 64 is in part disposed inside the second accommodation portion 62. The second shaft 64 is in part disposed outside both the first accommodation portion 61 and the second accommodation portion 62. The second shaft 64 includes a second base end 641 and a second distal end 642. The second base end 641 is disposed inside the second accommodation portion 62. However, the second base end 641 may be disposed inside the first accommodation portion 61. The second shaft 64 has a hollow tubular shape. The second shaft 64 is opened at the second base end 641.

[0050] The second shaft 64 includes a second threaded portion 643. The second threaded portion 643 is provided on the inner peripheral surface of the second shaft 64. The second threaded portion 643 is provided on the second shaft 64 in a predetermined range that ranges from the second base end 641 in the axis direction (Ax2). The second threaded portion 643 is screwed with the first threaded portion 634. The second distal end 642 is provided on the opposite side of the second base end 641. The second distal end 642 protrudes from the second accommodation portion 62 into the engine 26. A cap 73 is attached to the second distal end 642.

[0051] The tensioner 60 includes a second support member 74. The second support member 74 is attached to the second accommodation portion 62. The second support member 74 non-rotatably supports the second shaft 64. The second support member 74 movably supports the second shaft 64 in the axis direction (Ax2). Detailedly as shown in FIG. 7, the second support member 74 includes a support body 740 and attachment portions 741 to 743. The support body 740 has a contour fitting to the inner peripheral surface of the second accommodation portion 62, and is disposed inside the second accommodation portion 62. The attachment portions 741 to 743 are attached to the second accommodation portion 62. The attachment portions 741 to 743 are made in the shapes of a plurality of protrusions protruding radially outward from the support body 740.

[0052] The second accommodation portion 62 includes a plurality of cutouts 621 to 623. The cutouts 621 to 623 are provided in correspondence to the attachment portions 741 to 743, respectively. The cutouts 621 to 623 are shaped to be recessed from the distal end of the second accommodation portion 62 in the axis direction (Ax2). The attachment portions 741 to 743 are locked to the cutouts 621 to 623, whereby the second support member 74 is restricted from rotating about the axis Ax2. Additionally, the second accommodation portion 62 is provided with an attachment groove 624. The attachment groove 624 circumferentially extends on the outer peripheral surface of the second accommodation portion 62. A clip 75 is attached to the attachment groove 624, whereby the second support member 74 is prevented from being detached from the second accommodation portion 62 in the axis direction (Ax2). It should be noted that in the present preferred embodiment, the second support member 74 is provided with the three attachment portions 741 to 743. However, the number of attachment portions is not limited to three, and alternatively, may be less than or greater than three.

[0053] The support body 740 includes an opening 744. The opening 744 is penetrated by the second shaft 64. The opening 744 has a non-circular shape. Detailedly, the edge of the opening 744 includes lock portions 745 and 746. The second shaft 64 includes locked portions 644 and 645 on the outer peripheral surface thereof. The lock portions 745 and 746 of the support body 740 are locked to the locked portions 644 and 645 of the second shaft 64, whereby the second shaft 64 is restricted from rotating about the axis Ax2. Detailedly, the lock portions 745 and 746 each have a straight shape. The locked portions 644 and 645 each have a flat shape. However, the shapes of the lock portions 745 and 746 and the locked portions 644 and 645 may be different from those described above. Additionally in the present preferred embodiment, two pairs of the lock portion 745, 746 and the locked portion 644, 645 are provided. However, the number of pairs of the lock portion and the locked portion is not limited to two, and alternatively, may be one or may be three or greater.

[0054] As shown in FIG. 8, the tensioner 60 includes a spacer 76. The spacer 76 is disposed between the head portion 71 of the first shaft 63 and the second support member 74 in the axis direction (Ax2). The spacer 76 has a hollow tubular shape. The shaft body 72 of the first shaft 63 is disposed inside the spacer 76. The spacer 76 includes a first support portion 761 and a second support portion 762. The first support portion 761 is provided on one end of the spacer 76. The second support portion 762 is provided on the other end of the spacer 76.

[0055] The first support portion 761 includes a hole 763. The hole 763 is penetrated by the shaft body 72. The inner diameter of the hole 763 is smaller than the outer diameter of the head portion 71. Because of this, the first support portion 761 makes contact with the head portion 71, whereby the first shaft 63 is restricted from moving toward the second support member 74 in the axis direction (Ax2). The second support portion 762 extends outward in circumferential direction. The second support portion 762 is opposed to the second support member 74 in the axis direction (Ax2). When the second support portion 762 makes contact with the second support member 74, the spacer 76 is restricted from moving toward the second support member 74 in the axis direction (Ax2).

[0056] The spring 65 is disposed inside both the first accommodation portion 61 and the second accommodation portion 62. The spring 65 urges the first shaft 63 to rotate the first shaft 63. In the present preferred embodiment, the spring 65 is a coil spring. The shaft body 72 of the first shaft 63 is at least in part disposed inside the spring 65. The spacer 76 is at least in part disposed inside the spring 65. As shown in FIG. 8, the spring 65 includes a coil portion 651, a first lock portion 652 and a second lock portion 653. The first lock portion 652 is provided on one end of the spring 65. The second lock portion 653 is provided on the other end of the spring 65. The first lock portion 652 protrudes radially inward from the coil portion 651. The first lock portion 652 is disposed in the groove 633 of the first shaft 63. The first lock portion 652 is locked to the first shaft 63 at the groove 633. An urging force of the spring 65 is transmitted to the first shaft 63 through the first lock portion 652.

[0057] The second lock portion 653 protrudes radially outward from the coil portion 651. The second accommodation portion 62 includes a lock groove 625. The lock groove 625 is extends in the axis direction (Ax2) in the second accommodation portion 62. The second lock portion 653 is disposed in the lock groove 625. The second lock portion 653 extends within the lock groove 625 in the axis direction (Ax2). As shown in FIG. 6, the second lock portion 653 protrudes from the second accommodation portion 62 to the outside of the second accommodation portion 62. The second lock portion 653 is locked to the second accommodation portion 62 at the lock groove 625. Accordingly, the spring 65 is restricted from rotating about the axis Ax2.

[0058] It should be noted that the lock groove 625 extends from the distal end of the second accommodation

portion 62 to the first accommodation portion 61 in the axis direction (Ax2). Detailedly, the lock groove 625 in part extends to the accommodation body 66 through the flange portion 67. The distal end of the second lock portion 653 is locked to the lock groove 625 in the flange portion 67. It should be noted that the range provided with the lock groove 625 may be changed.

[0059] In the tensioner 60 according to the present preferred embodiment, an urgi ng force of rotation about the axis Ax2 is applied to the first shaft 63 by the spring 65. The first threaded portion 634 of the first shaft 63 is screwed with the second threaded portion 643 of the second shaft 64. Additionally, the second shaft 64 is supported by the second support member 74, while being movable in the axis direction (Ax2) and non-rotatable about the axis Ax2. Therefore, when the first shaft 63 is rotated, the second shaft 64 is moved in the axis direction (Ax2). As shown in FIG. 9, the second shaft 64 presses a transmission member 57 such as a timing chain or a timing belt through a pressing member 56 disposed inside the engine 26. Accordingly, the tensioner 60 is enabled to apply a predetermined magnitude of tension to the transmission member 57.

[0060] Moreover, it is possible to lock a jig to the groove 633 of the first shaft 63 by inserting the jig into the opening 680 of the first accommodation portion 61. Therefore, when the first shaft 63 is rotated by the jig, it is possible to regulate a magnitude of pressing force to be applied to the transmission member 57 by the tensioner 60.

[0061] Next, a structure for attaching the tensioner 60 to the engine 26 will be explained. As shown in FIG. 2, the cylinder 42 includes a first end 421 and a second end 422. The first end 421 is attached to the head cover 43. The second end 422 is attached to the crankcase 41. The cylinder 42 includes a tensioner attachment portion 49 and an intake attachment portion 50. The tensioner attachment portion 49 and the intake attachment portion 50 are provided on the upper surface 420 of the cylinder 42. The tensioner attachment portion 49 is disposed behind the intake attachment portion 50. Tensioner 60 is attached to the tensioner attachment portion 49. The intake pathway portion 44 is attached to the intake attachment portion 50. Detailedly, the intake duct 45 is attached to the intake attachment portion 50.

[0062] The intake pathway portion 44 extends toward the second end 422 side from the intake attachment portion 50. In other words, the intake pathway portion 44 extends backward from the intake attachment portion 50. The intake attachment portion 50 is disposed between the first end 421 and the tensioner attachment portion 49 in the cylinder axis direction (Ax1). Distance L1 between the first end 421 and the tensioner attachment portion 49 is greater than distance L2 between the tensioner attachment portion 49 and the second end 422 in the cylinder axis direction (Ax1). It should be noted that the position of the tensioner attachment portion 49 is herein defined as meaning the position of the center of an attachment hole 80 (to be described) of the tensioner attachment portion 49.

[0063] FIG. 10 is an enlarged view showing part of the upper surface 420 of the cylinder 42 of the engine 26. In FIG. 10, the position of the tensioner 60 is depicted with dashed two-dotted line. As shown in FIG. 10, the tensioner attachment portion 49 includes the attachment hole 80, a first bolt hole 81 and a second bolt hole 82. The second accommodation portion 62 is inserted into the attachment hole 80. The first and second bolt holes 81 and 82 are provided in correspondence to the first and second attachment holes 671 and 672 of the flange portion 67, respectively. The first bolt hole 81 and the first attachment hole 671 are penetrated by one of bolts 83 and 84 shown in FIG. 3, while the second bolt hole 82 and the second attachment hole 672 are penetrated by the other of the bolts 83 and 84. Accordingly, the flange portion 67 of the tensioner 60 is fixed to the cylinder 42.

[0064] The attachment hole 80 has a non-circular shape. Detailedly, the attachment hole 80 is shaped to be longer in a direction perpendicular to a virtual straight line V1 than in a direction of the virtual straight line V1 as seen in a direction of an axis Ax3 of the attachment hole 80. The virtual straight line V1 is a straight line connecting a center C1 of the first bolt hole 81 and a center C2 of the second bolt hole 82 as seen in the axis direction (Ax3) of the attachment hole 80. It should be noted that the position of the axis Ax3 of the attachment hole 80 means the position of the axis Ax2 of the tensioner 60. The attachment hole 80 includes a first relief portion 801 and a second relief portion 802.

[0065] The second relief portion 802 is disposed in a position displaced from the first relief portion 801 by a predetermined angle of rotation about the axis Ax3 of the attachment hole 80. In the present preferred embodiment, the predetermined angle is 180 degrees. However, the predetermined angle may be different from 180 degrees. The second relief portion 802 is disposed to be symmetric to the first relief portion 801 with respect to the axis Ax3 of the attachment hole 80. The first and second relief portions 801 and 802 are disposed in positions not overlapping with the virtual straight line V1 as seen in the axis direction (Ax3) of the attachment hole 80.

[0066] As seen in the axis direction (Ax3) of the attachment hole 80, distance L3 from the axis Ax3 of the attachment hole 80 to the first relief portion 801 is greater than distance L4, L5 from the axis Ax3 of the attachment hole 80 to the edge of the attachment hole 80 on the virtual straight line V1. As seen in the axis direction (Ax3) of the attachment hole 80, distance L6 from the axis Ax3 of the attachment hole 80 to the second relief portion 802 is greater than the distance L4, L5 from the axis Ax3 of the attachment hole 80 to the edge of the attachment hole 80 on the virtual straight line V1. As seen in the axis direction (Ax3) of the attachment hole 80, the distance L4, L5 from the axis Ax3 of the attachment hole 80 to the edge of the attachment hole 80 on the virtual straight line V1 is less than distance L7 from the axis Ax3 of the attachment hole 80 to the distal end of the second lock

portion 653 of the spring 65.

[0067] As seen in the axis direction (Ax3) of the attachment hole 80, the distance L3 from the axis Ax3 of the attachment hole 80 to the first relief portion 801 is greater than the distance L7 from the axis Ax3 of the attachment hole 80 to the distal end of the second lock portion 653 of the spring 65. As seen in the axis direction (Ax3) of the attachment hole 80, the distance L6 from the axis Ax3 of the attachment hole 80 to the second relief portion 802 is greater than the distance L7 from the axis Ax3 of the attachment hole 80 to the di stal end of the second lock portion 653 of the spring 65. Therefore, each of the first and second relief portions 801 and 802 enables the second lock portion 653 of the spring 65 to be disposed therein. Because of this, when the tensioner 60 is attached to the engine 26, the second lock portion 653 of the spring 65 is enabled to be disposed in either of the first and second relief portions 801 and 802.

[0068] In the straddled vehicle 1 according to the present preferred embodiment described above, the spring 65 of the tensioner 60 is disposed inside both the first accommodation portion 61 disposed outside the engine 26 and the second accommodation portion 62 disposed inside the engine 26. Because of this, in comparison with a configuration that the spring 65 is entirely disposed inside the first accommodation portion 61, the amount of the tensioner 60 protruding from the engine 26 can be made smaller, while the spring 65 can be reliably produced with sufficient length. Accordingly, the amount of the tensioner 60 protruding from the engine 26 can be made smaller, while increase in size of the engine 26 can be inhibited. Moreover, the engine 26 and the intake pathway portion 44 can be compactly disposed because the amount of the tensioner 60 protruding from the engine 26 can be made smaller. Accordingly, reduction in capacity of the storage box 38 can be inhibited. Furthermore, increase in height of the seat 6 can be inhibited, whereby degradation in a foot grounding property of the rider can be inhibited.

[0069] In the tensioner 60, the second lock portion 653 of the spring 65 extends in the axis direction (Ax2) of the tensioner 60 within the lock groove 625 of the second accommodation portion 62. Therefore, the spring 65 can be herein more stably restricted from rotating than when the second lock portion 653 of the spring 65 extends in the circumferential direction of the spring 65. Because of this, the spring 65 can be enhanced in durability.

[0070] The attachment hole 80 of the tensioner attachment portion 49 includes the first and second relief portions 801 and 802. Therefore, interference between the second lock portion 653 and the attachment hole 80 can be avoided by the first relief portion 801. Additionally, interference between the second lock portion 653 and the attachment hole 80 can be avoided not only by the first relief portion 801 but also by the second relief portion 802. Because of this, attaching the tensioner 60 to the engine 26 is made easy.

[0071] The first and second relief portions 801 and 802 are disposed in the positions not overlapping with the virtual straight line V1 as seen in the axis direction (Ax3) of the attachment hole 80. Therefore, the first and second relief portions 801 and 802 can be provided, while increase in distance between the first and second bolt holes 81 and 82 can be inhibited. Because of this, increase in size of the engine 26 can be inhibited.

[0072] The second accommodation portion 62 is integrated with the flange portion 67 of the first accommodation portion 61. Because of this, forming the first and second accommodation portions 61 and 62 is made easy.

[0073] The first accommodation portion 61 is longer than the second accommodation portion 62 in the axis direction (Ax2) of the tensioner 60. Because of this, the spring 65 can be reliably produced with large length.

[0074] The distance L1 between the first end 421 and the tensioner attachment portion 49 is greater than the distance L2 between the tensioner attachment portion 49 and the second end 422 in the axis direction (Ax1) of the cylinder 42. Therefore, the tensioner 60 is disposed to be separated far from the intake attachment portion 50 toward the second end 422 side. Because of this, the tensioner 60 can be disposed far away from the intake attachment portion 50. Consequently, access to the tensioner 60 is made easy, whereby the tensioner 60 can be enhanced in maintenance performance.

[0075] As described above, the amount of the tensioner 60 protruding from the engine 26 can be made smaller, whereby the engine 26 and the intake pathway portion 44 can be compactly disposed. Accordingly, even when the catalyst 53 is disposed below the engine 26, increase in height of the straddled vehicle 1 or reduction in lowest height of the straddled vehicle 1 from the ground can be inhibited.

[0076] The cylinder axis Ax1 of the engine 26 is set off (displaced) downward from the rotational center C1 of the crankshaft 40. Because of this, the cylinder 42 can be lowered in position. Therefore, the intake pathway portion 44 can be disposed in a low position, while a space can be reliably produced above the cylinder 42 so as to dispose therein the intake duct 45 having a curve shape. Consequently, increase in size of the engine 26 can be inhibited.

[0077] One preferred embodiment according to the present teaching has been explained above. However, the present teaching is not limited to the aforementioned preferred embodiment, and a variety of changes can be made without departing from the present teaching.

[0078] The straddled vehicle 1 is not limited to a scooter-type vehicle, and alternatively, may be another type of vehicle. The number of front wheels is not limited to one, and alternatively, may be two or greater. Instead of this, the number of rear wheels is not limited to one, and alternatively, may be two or greater.

[0079] The structure of the vehicle body frame 2 is not limited to that of the aforementioned preferred embodiment, and may be changed. For example, the shape or

layout of the head pipe 11, the down frame 12, the lower frame 13 or the rear frame 14 may be changed.

[0080] The structures and/or layouts of the engine 26, the intake pathway portion 44 and the exhaust system 51 may be changed without being limited to those of the aforementioned preferred embodiment. For example, the structure and/or layout of the intake attachment portion 50 may be changed. The structure and/or layout of the tensioner attachment portion 49 may be changed. The shape of the attachment hole 80 may be changed. Either or both of the first and second relief portions 801 and 802 may be omitted. The shape of the catalyst 53 may be changed. Alternatively, the catalyst 53 may be omitted.

[0081] The cylinder axis Ax1 may form an angle of 45 degrees or greater with respect to a horizontal direction. For example, FIG. 11 is an enlarged left side view of the eng ine 26 and the surroundings thereof according to a modification. FIG. 12 is an enlarged top view of the engine 26 and the surroundings thereof according to the modification. As shown in FIG. 11, the cylinder axis Ax1 may form an angle of greater than 45 degrees with respect to the horizontal direction. As shown in FIGS. 11 and 12, the straddled vehicle 1 according to the modification includes a radiator 91, a cooling water pathway 92 and a water pump 93.

[0082] As shown in FIG. 12, the radiator 91 is disposed in front of the engine 26 as seen in the vehicle plan view. The water pump 93 is connected to the cylinder head 42b. The cooling water pathway 92 is connected to the engine 26 and the radiator 91. The cooling water pathway 92 is disposed to pass behind the cylinder head 42b. The tensioner 60 overlaps with the cooling water pathway 92 as seen in a direction perpendicular to the cylinder axis Ax1. As shown in FIG. 11, an extension of the axis Ax2 of the tensioner 60 overlaps with the cooling water pathway 92 as seen in the vehicle side view. As shown in FIG. 12, the extension of the axis Ax2 of the tensioner 60 overlaps with the cooling water pathway 92 as seen in the vehicle top view.

[0083] The structure and/or layout of the tensioner 60 may be changed without being limited to those/that of the aforementioned preferred embodiment. For example, the tensioner 60 may entirely overlap with the intake pathway portion 44 as seen in the vehicle plan view. The structure and/or layout of the first accommodation portion 61, the second accommodation portion 62, the first shaft 63, the second shaft 64 and/or the spring 65 may be changed.

Claims

1. A straddled vehicle comprising:

a vehicle body frame (2);
an engine (26) pivotably supported by the vehicle body frame (2);
a storage box (38) disposed above the engine (26) in a vehicle up-and-down direction;
a seat (6) disposed above the storage box (38) in the vehicle up-and-down direction;
an intake pathway portion (44) disposed below the storage box (38) in the vehicle up-and-down direction, the intake pathway portion (44) being connected to the engine (26); and
a tensioner (60) disposed between the intake pathway portion (44) and the engine (26) in the vehicle up-and-down direction, the tensioner (60) being attached to the engine (26), wherein the tensioner (60) includes
a first accommodation portion (61) disposed outside the engine (26), the first accommodation portion (61) being attached to the engine (26),
a second accommodation portion (62) disposed inside the engine (26), the second accommodation portion (62) being connected to the first accommodation portion (61), a first shaft (63) at least in part disposed inside the first accommodation portion (61), the first shaft (63) including a first threaded portion (634),
a second shaft (64) at least in part disposed inside the second accommodation portion (62), the second shaft (64) being moved in an axis direction (Ax2) of the tensioner (60) in accordance with rotation of the first shaft (63), the second shaft (64) including a second threaded portion (643) and a distal end (642), the second threaded portion (643) being screwed with the first threaded portion (634), the distal end (642) protruding from the second accommodation portion (62) into the engine (26), and
a spring (65) urging the first shaft (63) to rotate the first shaft (63),
the tensioner (60) at least in part overlaps with the intake pathway portion (44) as seen in a vehicle plan view, and
the spring (65) is disposed inside the first accommodation portion (61) and the second accommodation portion (62).

2. The straddled vehicle according to claim 1, wherein the second accommodation portion (62) includes a groove (625) extending in the axis direction (Ax2) of the tensioner (60),
the spring (65) includes a lock portion (653) locked to the groove (625), and
the lock portion (653) extends within the groove (625) in the axis direction (Ax2) of the tensioner (60).

3. The straddled vehicle according to claim 2, wherein the lock portion (653) protrudes from the second accommodation portion (62),
the engine (26) includes an attachment hole (80) into which the second accommodation portion (62) is inserted, and
the attachment hole (80) includes

a first relief portion (801) in which the lock portion (653) is disposed, and
a second relief portion (802) enabling the lock portion (653) to be disposed therein, the second relief portion (802) being disposed in a position displaced from the first relief portion (801) by a predetermined angle of rotation about a center of the attachment hole (80).

4. The straddled vehicle according to claim 2, wherein the lock portion (653) protrudes from the second accommodation portion (62),
the engine (26) includes
an attachment hole (80) into which the second accommodation portion (62) is inserted, and
first and second bolt holes (81, 82) for attaching the tensioner (60) to the engine (26), the attachment hole (80) includes a relief portion (801) in which the lock portion (653) is disposed, and
the relief portion (801) is disposed in a position not overlapping with a virtual straight line (V1) connecting centers (C1, C2) of the first and second bolt holes (81, 82) as seen in an axis direction (Ax3) of the attachment hole (80).

5. The straddled vehicle according to any of claims 1 to 4, wherein the first accommodation portion (61) includes a flange portion (67) attached to the engine (26), and
the second accommodation portion (62) is integrated with the flange portion (67).

6. The straddled vehicle according to any of claims 1 to 5, wherein the first accommodation portion (61) is longer than the second accommodation portion (62) in the axis direction (Ax2) of the tensioner (60).

7. The straddled vehicle according to any of claims 1 to 6, further comprising:

an exhaust system (51) connected to the engine (26), wherein
the exhaust system (51) includes a catalyst (53) disposed below the engine (26).

8. The straddled vehicle according to any of claims 1 to 7, wherein the intake pathway portion (44) includes
an intake duct (45) connected to the engine (26), and
a throttle body (46) connected to the intake duct (45), and
the tensioner (60) at least in part overlaps with the throttle body (46) as seen in the vehicle plan view.

9. The straddled vehicle according to any of claims 1 to 8, wherein the engine (26) includes a crankcase (41) and a cylinder (42) connected to the crankcase (41).

10. The straddled vehicle according to claim 9, wherein the cylinder (42) includes
a first end (421) attached to the head cover (43), and
a second end (422) attached to the crankcase (41),
the cylinder (42) includes
a tensioner attachment portion (49) to which the tensioner (60) is attached, and
an intake attachment portion (50) to which the intake pathway portion (44) is attached,
the intake pathway portion (44) extends from the intake attachment portion (50) toward the second end (422) side,
the intake attachment portion (50) is disposed between the first end (421) and the tensioner attachment portion (49) in an axis direction (Ax1) of the cylinder (42), and
a distance (L1) between the first end (421) and the tensioner attachment portion (49) is greater than a distance (L2) between the tensioner attachment portion (49) and the second end (422) in the axis direction (Ax1) of the cylinder (42).

11. The straddled vehicle according to claims 9 or 10, wherein the engine (26) includes a crankshaft (40) accommodated in the crankcase (41), and
the intake pathway portion (44) includes an intake duct (45), the intake duct (45) being connected to the cylinder (42), the intake duct (45) curving backward from the cylinder (42) in a vehicle back-and-forth direction, and
an axis of the cylinder (42) is set off downward from a rotational center (C1) of the crankshaft (40) as seen in a vehicle side view.

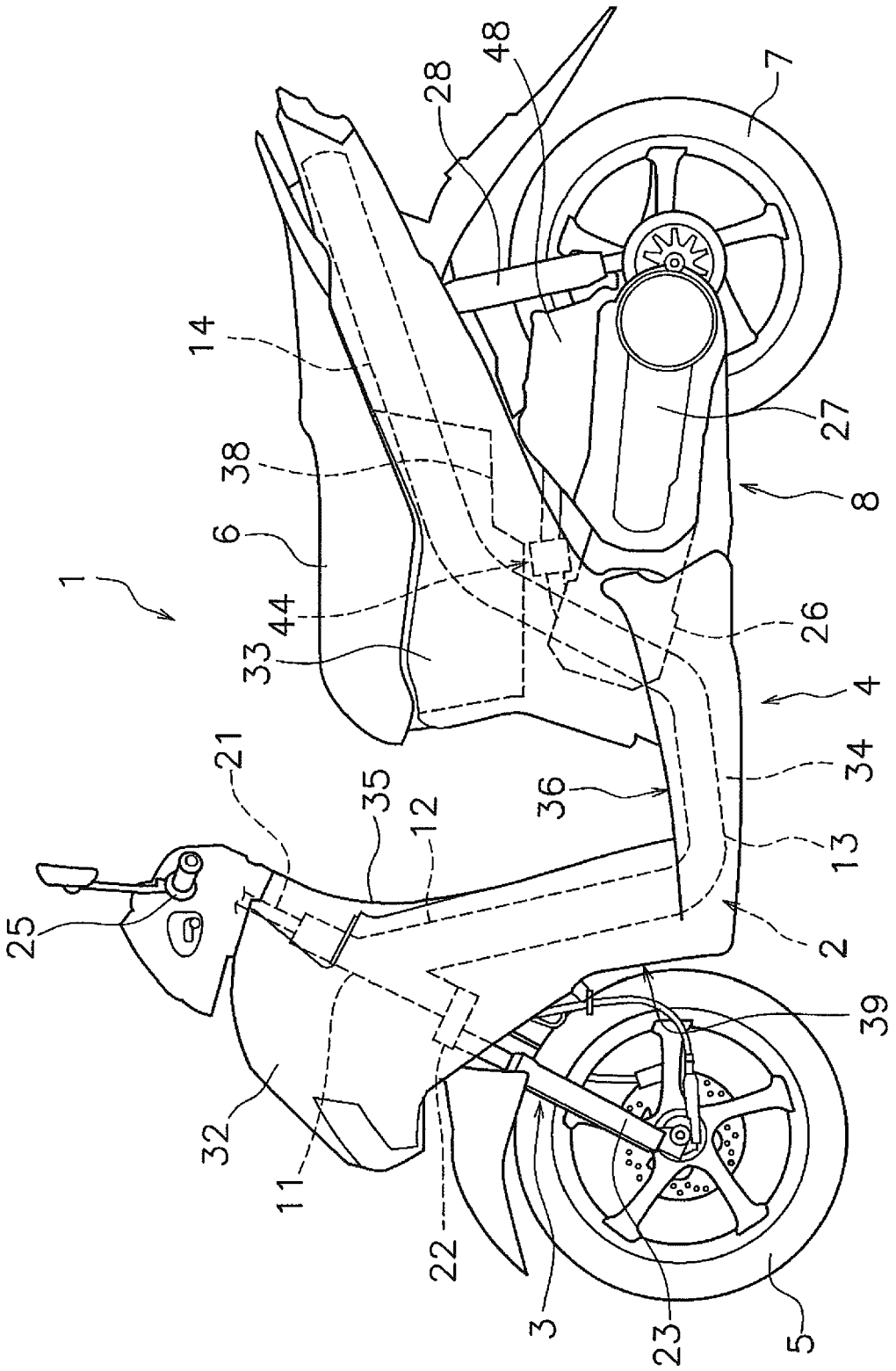


FIG. 1

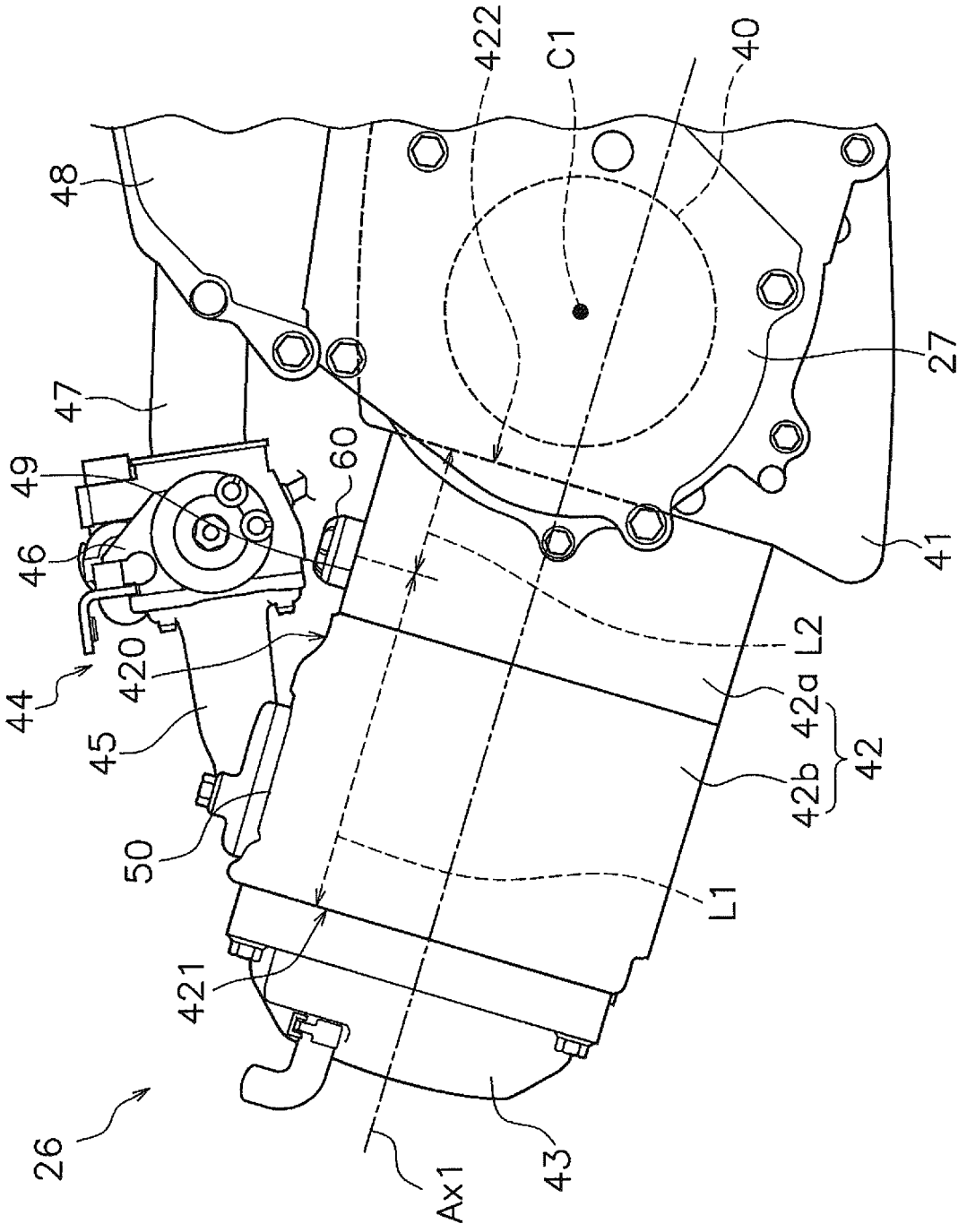

422
C1
40
48
27
47
49
60
46
41
L2
44
420
42a
45
42b
42
50
L1
421
26
Ax1
43

FIG. 2

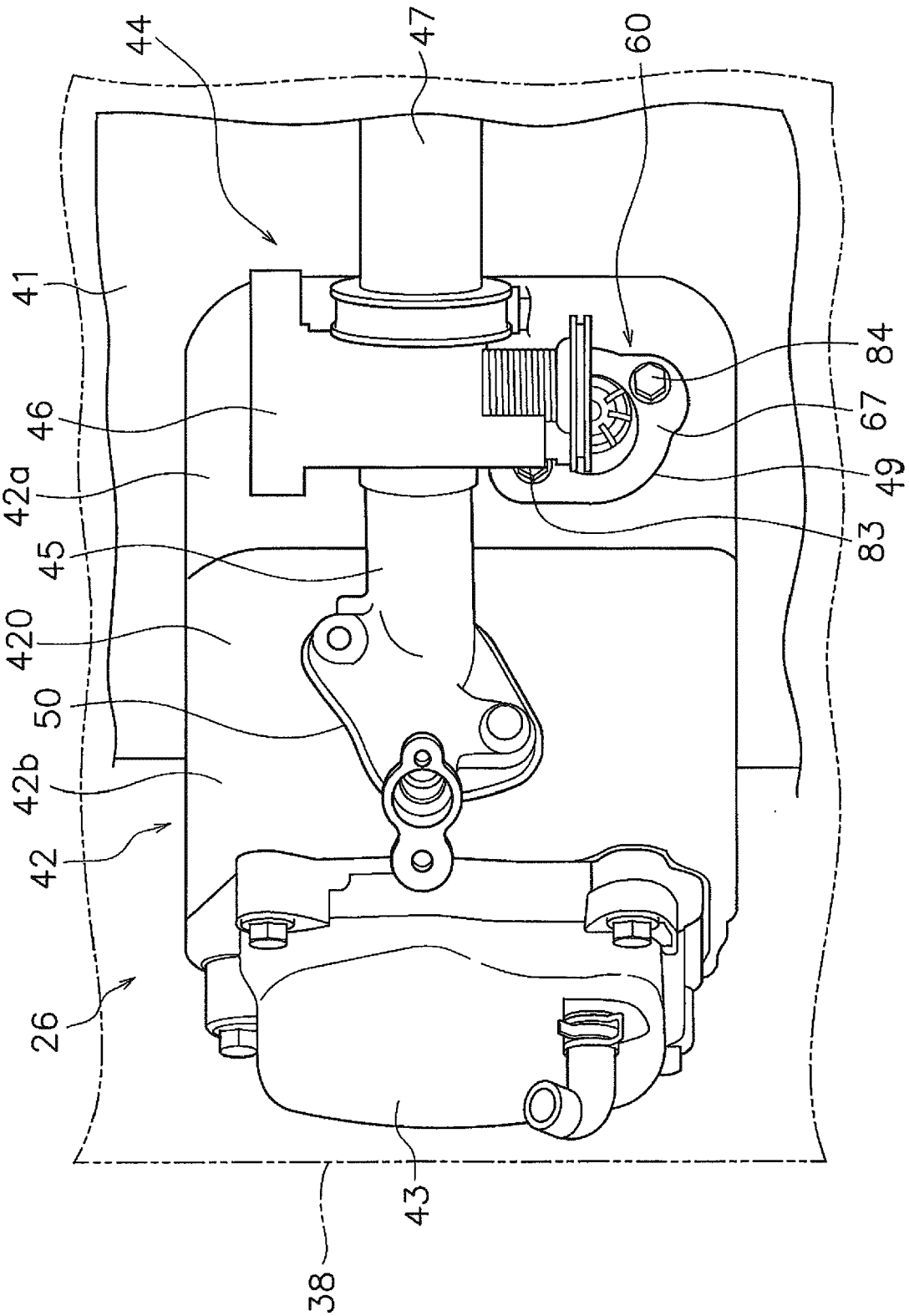


FIG. 3

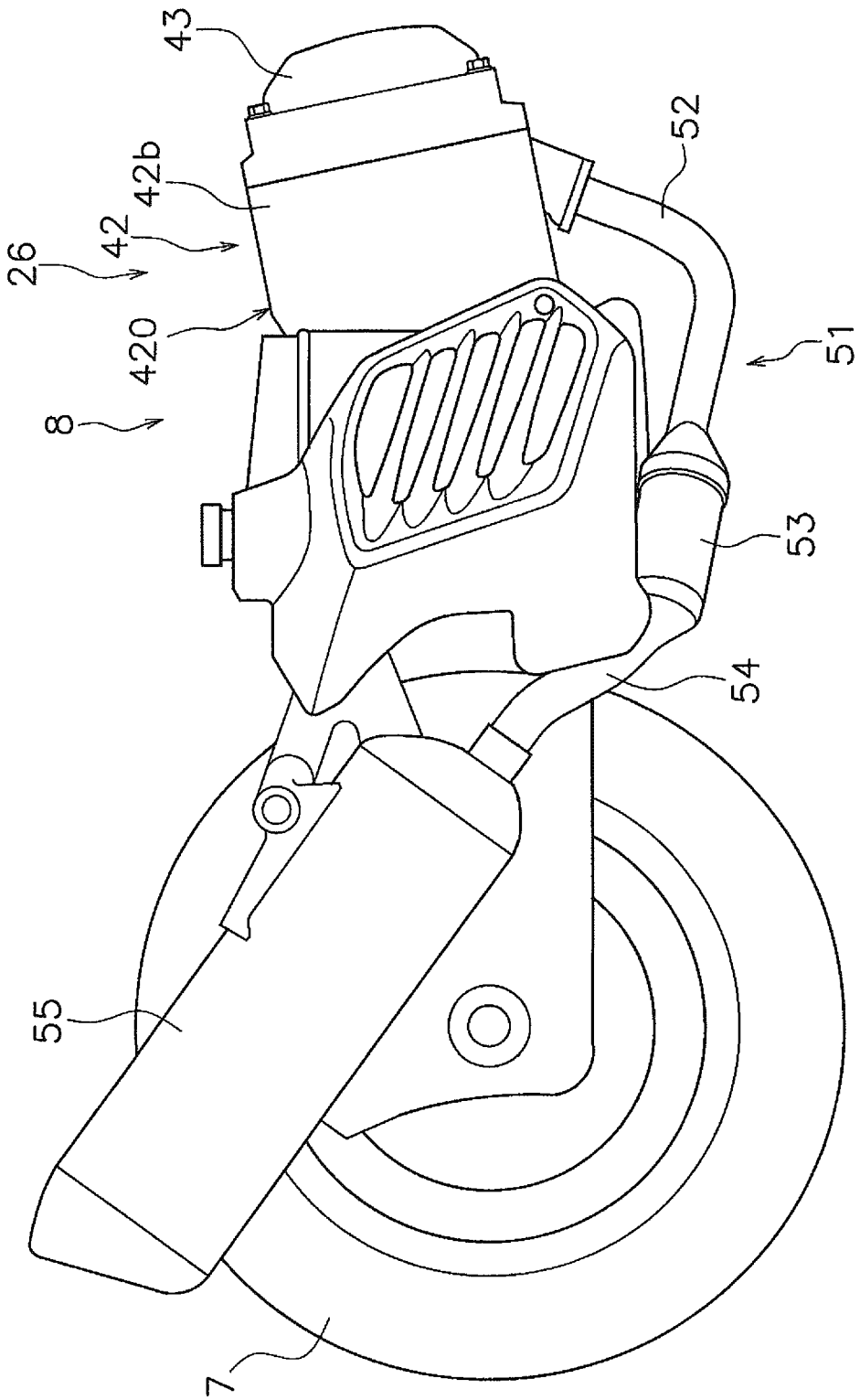


FIG. 4

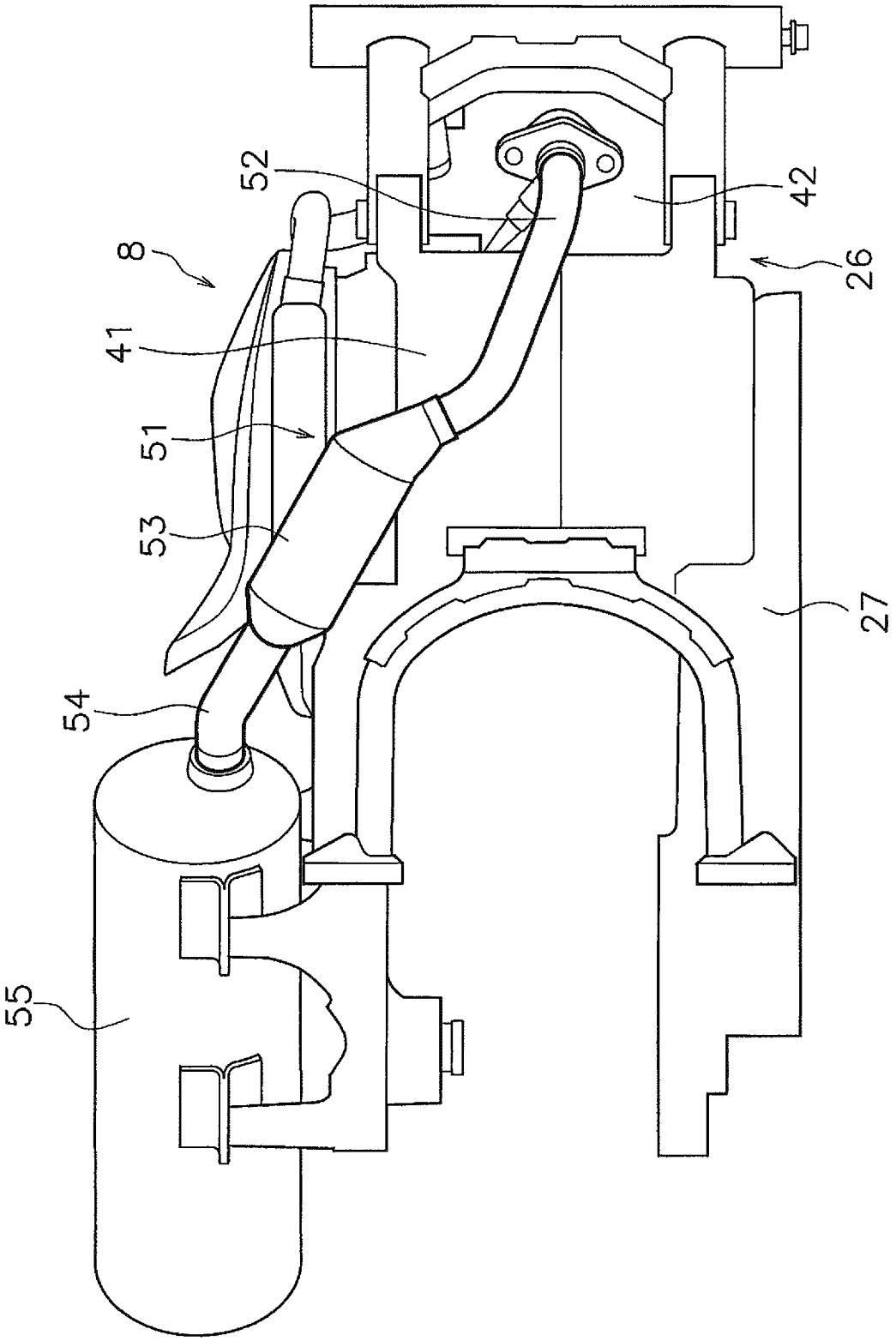


FIG. 5

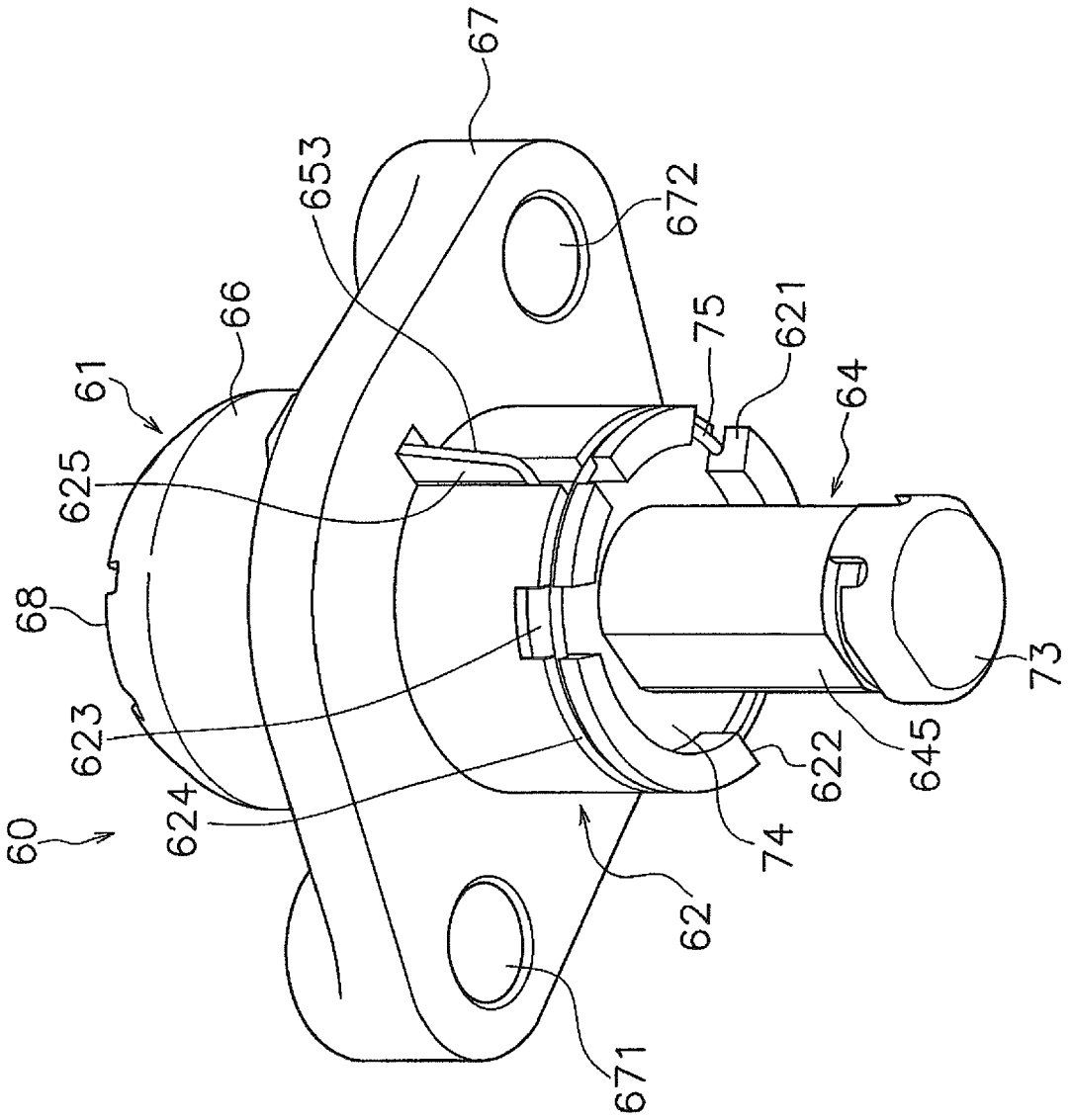
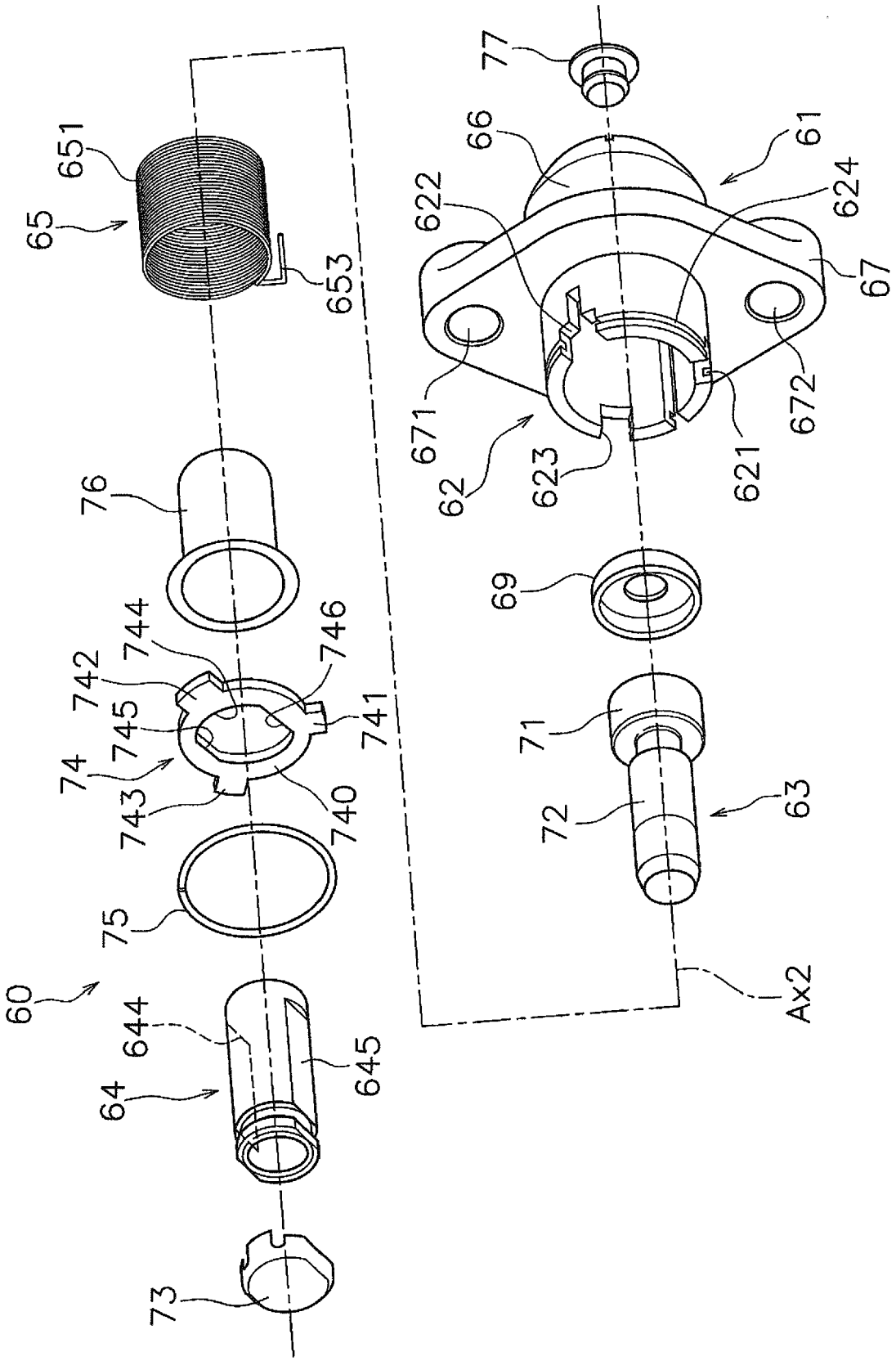


FIG. 6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66
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622
624
67
671
672
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623
621
651
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653
76
744
746
742
745
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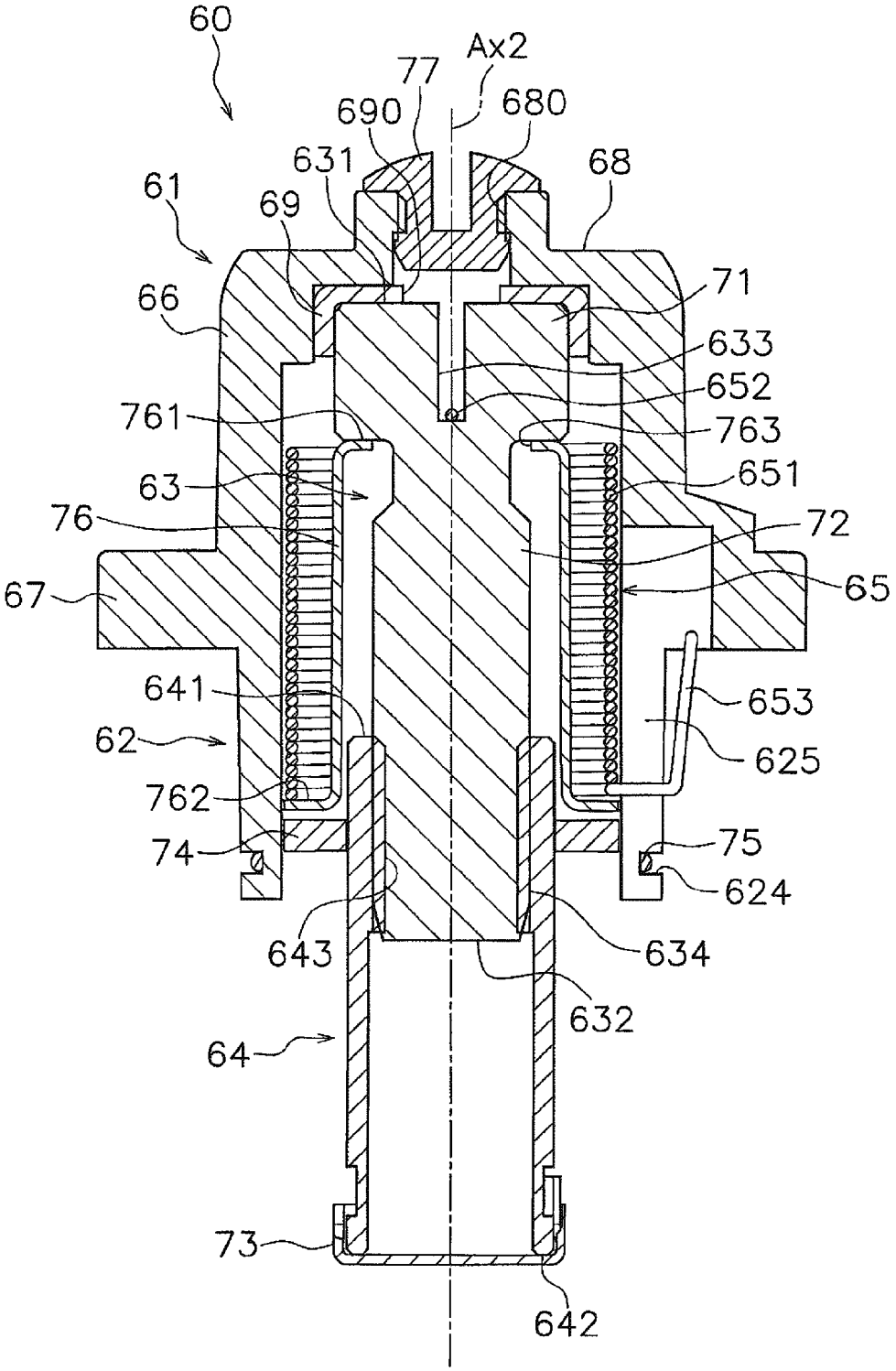
74
743
740
75
60
644
645
64
73
69
71
72
63
Ax2

FIG. 7


60
Ax2
77
690
680
631
68
61
69
66
71
633
652
761
763
651
63
76
72
67
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641
653
62
625
762
74
75
624
643
634
632
64
73
642

FIG. 8

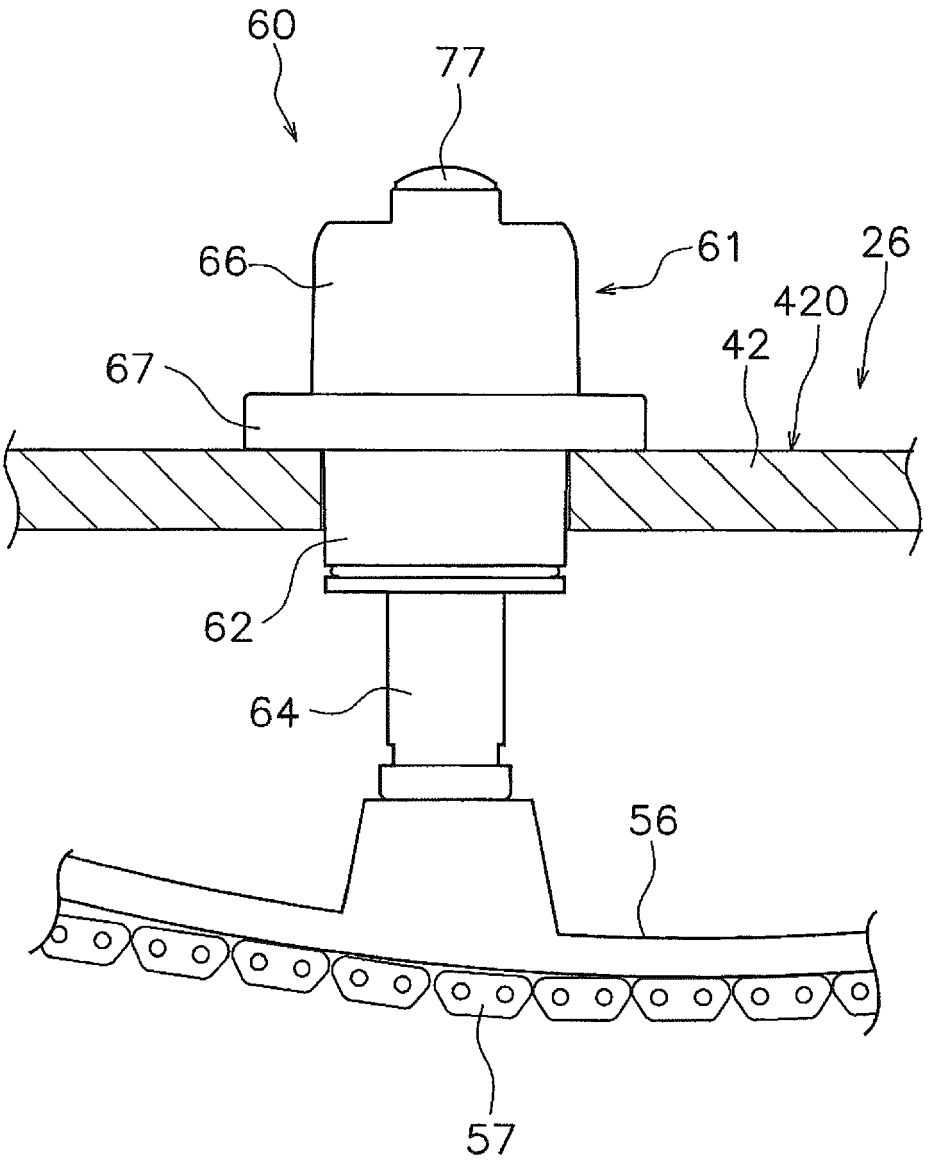

FIG. 9

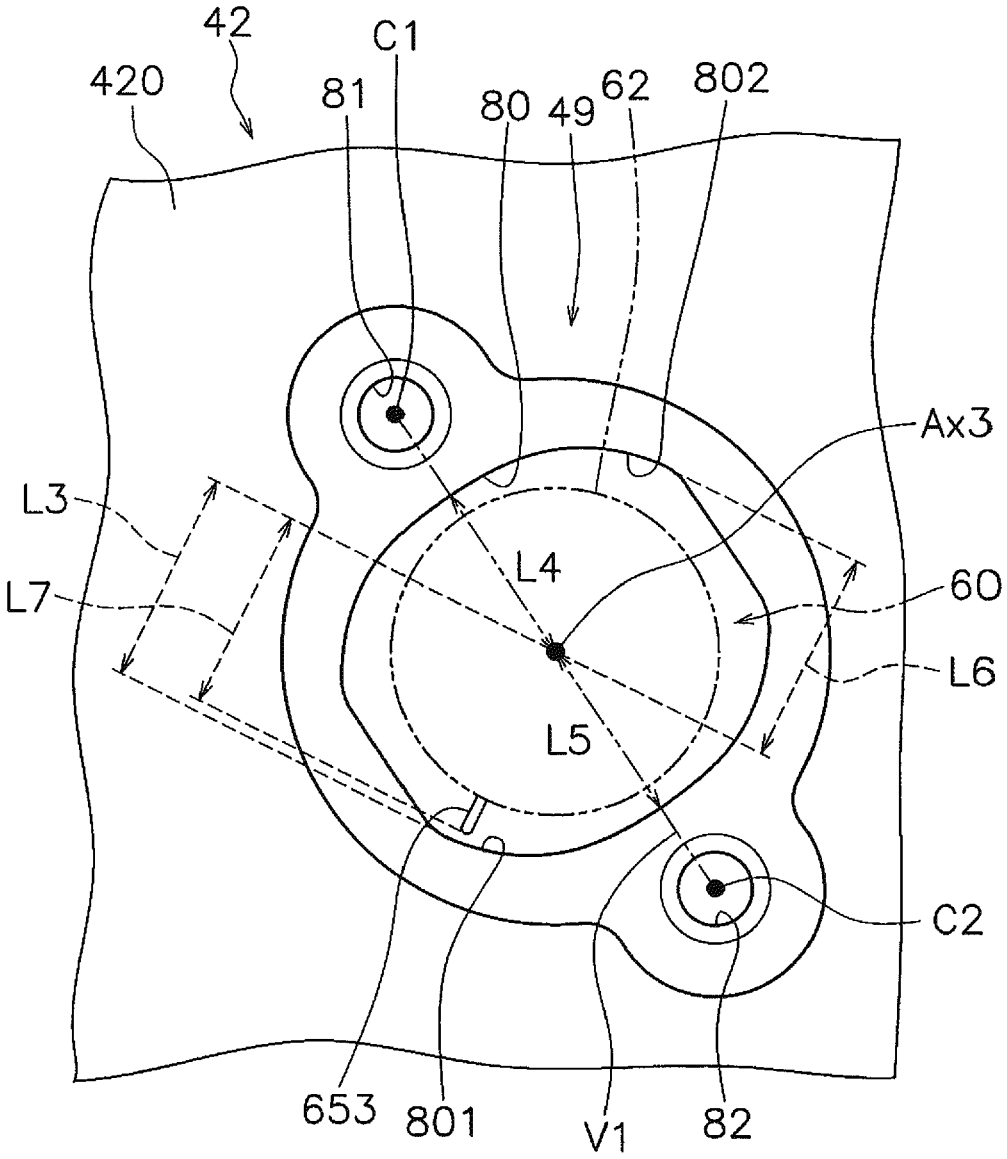

FIG. 10

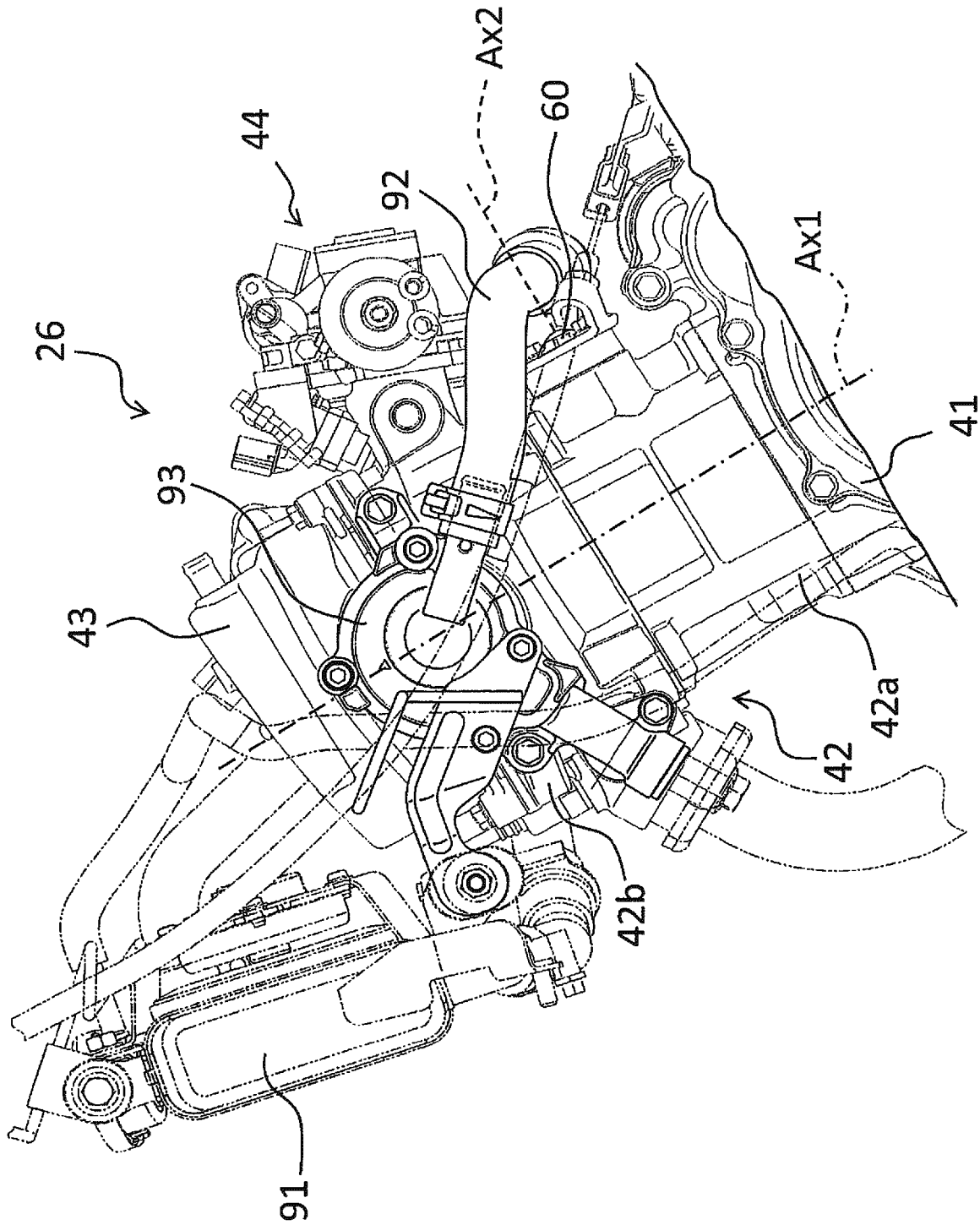

FIG. 11

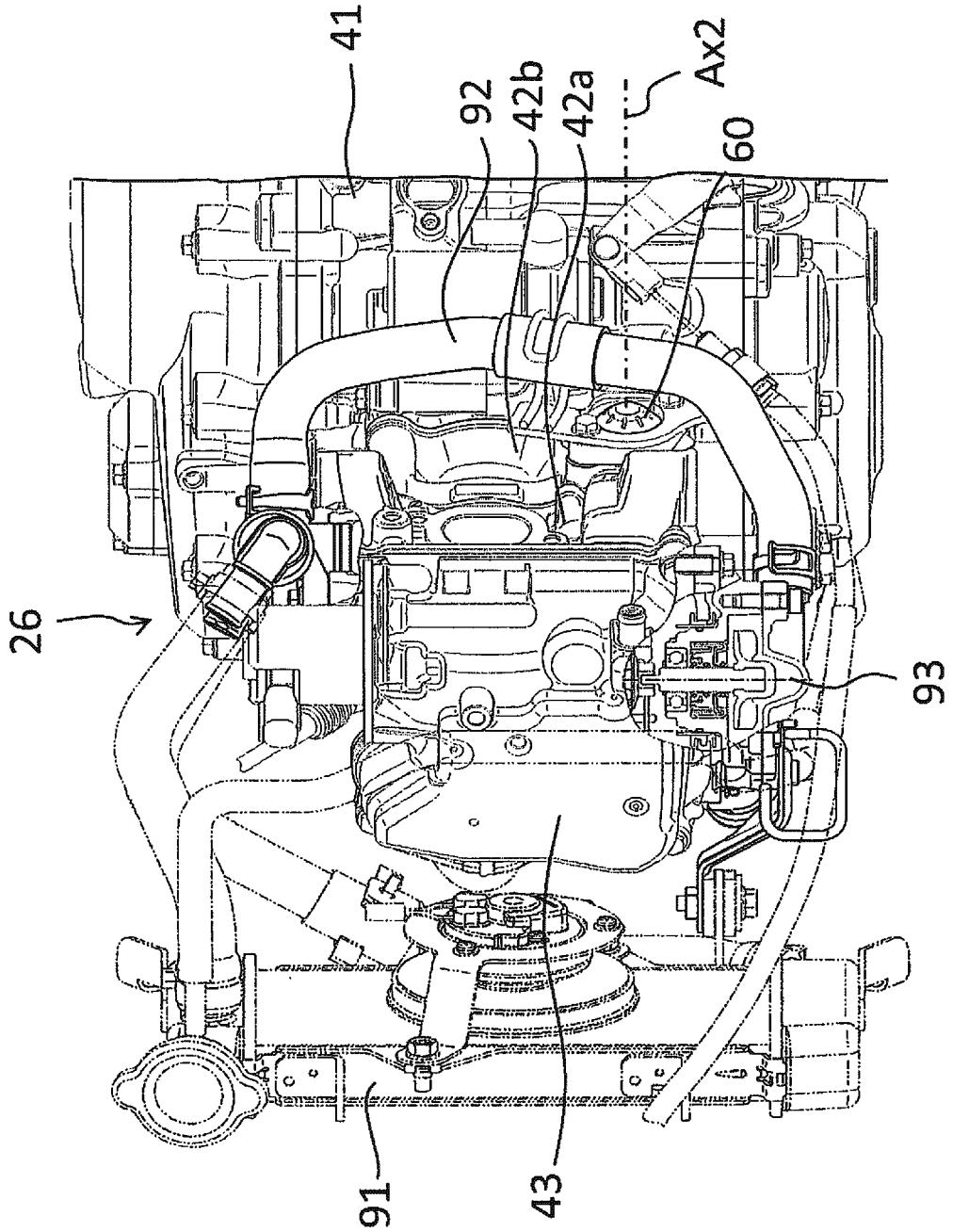

FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 19 20 8946

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y,D	WO 03/048605 A1 (NHK SPRING CO LTD [JP]; KOBAYASHI TAKAO [JP]; AMANO TANEHIRA [JP]) 12 June 2003 (2003-06-12) * abstract; figures *	1-11	INV. F02B61/02 F01L1/02 F01L1/20
Y	WO 2018/029822 A1 (HONDA MOTOR CO LTD [JP]) 15 February 2018 (2018-02-15) * abstract; figures *	1-11	
Y	EP 2 272 740 A1 (YAMAHA MOTOR CO LTD [JP]) 12 January 2011 (2011-01-12) * abstract; figures *	1-11	
Y	EP 3 121 421 A1 (HONDA MOTOR CO LTD [JP]; KEIHIN CORP [JP]) 25 January 2017 (2017-01-25) * abstract; figures *	1-11	
Y	US 2002/104504 A1 (SUZUKI MASATOSHI [JP] ET AL) 8 August 2002 (2002-08-08) * figures 2,4 *	11	

TECHNICAL FIELDS SEARCHED (IPC)

F16H
B62J
B62K
F01L
F02B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 January 2020	Paulson, Bo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 20 8946

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
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22-01-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03048605 A1	12-06-2003	AU 2002354344 A1	17-06-2003
		CN 1608180 A	20-04-2005
		CN 101149098 A	26-03-2008
		JP 3837595 B2	25-10-2006
		JP WO2003048605 A1	14-04-2005
		WO 03048605 A1	12-06-2003
WO 2018029822 A1	15-02-2018	CN 109563780 A	02-04-2019
		EP 3499006 A1	19-06-2019
		JP 6543851 B2	17-07-2019
		JP WO2018029822 A1	07-03-2019
		WO 2018029822 A1	15-02-2018
EP 2272740 A1	12-01-2011	EP 2272740 A1	12-01-2011
		ES 2544726 T3	03-09-2015
		JP 2011031873 A	17-02-2011
EP 3121421 A1	25-01-2017	CN 106103943 A	09-11-2016
		EP 3121421 A1	25-01-2017
		JP 6155213 B2	28-06-2017
		JP 2015183538 A	22-10-2015
		WO 2015141749 A1	24-09-2015
US 2002104504 A1	08-08-2002	BR 0200296 A	29-10-2002
		CN 1369628 A	18-09-2002
		DE 60223304 T2	21-02-2008
		EP 1228956 A2	07-08-2002
		ES 2295245 T3	16-04-2008
		JP 3986760 B2	03-10-2007
		JP 2002227601 A	14-08-2002
		KR 20020064673 A	09-08-2002
		TW I222944 B	01-11-2004
		US 2002104504 A1	08-08-2002

EPO FORM P0459

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 20031048605 A **[0002]**