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(54) Intake system for internal combustion engine

Ansaugsystem für Verbrennungsmotoren

Système d'entrée pour moteur à combustion interne

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Description

BACKGROUND OF THE INVENTION

[Field of the Invention]

[0001] The present invention relates to an intake system for an internal combustion engine. In more detail, the present invention relates to an intake system for taking in air for combustion for an internal combustion engine from an outside, cleaning the air, and supplying the air to the internal combustion engine.

[Description of the Related Art]

[0002] A motorcycle is provided with an intake system for supplying air for combustion to an internal combustion engine. Some of the conventional intake systems have the configurations in which in insides thereof, filter elements for cleaning air are provided and flow channels for guiding the air taken therein to the filters are formed. In such an intake system, as the configuration for aiming at reduction of intake noise, the configuration described in, for example, Patent Document 1 is proposed. The intake system (air cleaner) described in Patent Document 1 has the configuration in which a partition portion is formed in the lid body, and a flow path is formed between the side wall portion of the lid body and the partition portion. The intake system of Patent Document 1 intends to reduce the intake noise by rectifying the air, which is taken in, in the flow path.

[0003] However, the configuration described in Patent Document 1 has the following problem. In the configuration in which the flow path of air is formed by the side wall portion of the lid body and the partition wall, the length of the flow path is determined by the size and the shape of the intake system (in particular, the lid body). Therefore, the flow path cannot be made long, rectification of intake air becomes insufficient, and therefore, there is the fear of being incapable of reducing the intake noise. Further, if the flow path is made long, pipe resonance sound that occurs in the flow path becomes large, and therefore, there arises the fear of increasing noise. Further, if the flow path is made long, pressure loss becomes large, and therefore, there arises the fear of causing decline in the output power of the engine.

Patent Document 1

[0004] Japanese Laid-open Utility Model Publication No. 59-212466

[0005] DE 36 06 360 A1 and DE 34 29 633 A1 disclose further intake systems aiming toreduction of intake noise.

SUMMARY OF THE INVENTION

[0006] In the light of the above described circumstances, a problem to be solved by the present invention is to reduce noise in an intake system (air cleaner) of an internal combustion engine.

[0007] In order to solve the above described problem, the present invention is an intake system (air cleaner) for an internal combustion engine that supplies air for combustion to the internal combustion engine, the intake system has: a casing in which a space is formed in an inside thereof; and in the inside of the casing, a dirty side in which a dirty side chamber and an introduction channel that introduces air into the dirty side chamber are formed; a clean side in which a clean side chamber is formed; a partition member being partition between the dirty side and the clean side; and an intake portion that takes air into the dirty side from an outside of the casing, wherein in the dirty side, a bulkhead portion, which extends along a part of a side wall of the casing from the intake portion to form the introduction channel between the bulkhead portion and the part of the side wall, is formed, and a communication hole, which allows the introduction channel and the dirty side chamber to communicate with each other to allow air to flow therebetween, is formed midway in an extending direction of the bulkhead portion.

[0008] The communication hole is formed at a downstream side in a flowing direction of air from the intake portion.

[0009] The communication hole is formed in a range of 1/3 to 2/3 from an initial end to a terminal end in the extending direction of the bulkhead portion.

[0010] In the bulkhead portion, a curved portion that is curved in a vicinity of the intake portion, and a linear portion that is formed in a substantially straight line in a terminal end side of the curved portion are formed, and the communication hole is formed in the linear portion.

[0011] The communication hole is provided in a substantially central portion in a height direction of the bulkhead portion.

[0012] The casing has a main body, and a lid member that is attachably and detachably mounted to the main body, and the bulkhead portion is integrally formed in the lid member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a left side view schematically showing a configuration of a motorcycle to which an intake system according to an embodiment of the present invention is applied;

Fig. 2 is a right side view schematically showing the configuration of the motorcycle to which the intake system according to the embodiment of the present invention is applied;

Fig. 3 is a right side view schematically showing a mounting configuration of an engine unit and the intake system;

Fig. 4 is an exploded perspective view schematically showing the configuration of the intake system, and

is a view seen from a diagonally front side;

Fig. 5 is an exploded perspective view schematically showing the configuration of the intake system, and is a view seen from a diagonally rear side;

Fig. 6 is a sectional view schematically showing the configuration of the intake system;

Fig. 7 is a view schematically showing configurations of an introduction channel and a dirty side chamber;

Fig. 8 is a sectional view of an intake portion and the introduction channel seen from above;

Fig. 9 is a sectional view schematically showing the configurations of the introduction channel and the dirty side chamber, and is a view seen from a side; and

Fig. 10 is a graph showing an effect of an example.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Hereinafter, an embodiment of the present invention will be described in detail with reference to the drawings. In the following description, a configuration in which an intake system 5 (air cleaner) for an internal combustion engine according to the embodiment of the present invention is applied to a motorcycle 1 will be shown as an example. For convenience of description, the intake system 5 for an internal combustion engine according to the embodiment of the present invention is sometimes simply called "intake system". Further, in the following description, respective orientations of the intake system 5 and the motorcycle 1 to which the intake system 5 is applied are based on an orientation of a driver who rides on the motorcycle 1. In the respective drawings, a front side of the intake system 5 and the motorcycle 1 is shown by an arrow Fr, a rear side is shown by an arrow Rr, an upper side is shown by an arrow Tp, a lower side is shown by an arrow Bt, a right side is shown by an arrow R, and a left side is shown by an arrow L, in accordance with necessity.

[0015] First, a configuration of the motorcycle 1 to which the intake system 5 is applied, and a mounting configuration of the intake system 5 will be described with reference to Figs. 1 to 3. Fig. 1 is a left side view schematically showing the configuration of the motorcycle 1 to which the intake system 5 is applied. Fig. 2 is a right side view schematically showing the configuration of the motorcycle 1 to which the intake system 5 is applied. Fig. 3 is a right side view schematically showing the mounting configuration of the intake system 5.

[0016] As shown in Figs. 1 and 2, the motorcycle 1 includes a vehicle body frame 11, a steering system 12, an engine unit 13 and a rear wheel suspension system 14. Further, the motorcycle 1 is loaded with the intake system 5. In the present embodiment, as the motorcycle 1 to which the intake system 5 is applied, the motorcycle 1 having the vehicle body frame 11 of a so-called underbone type is shown as an example.

[0017] The vehicle body frame 11 is configured by including a steering head pipe 111, a main frame 112 and a pair of left and right rear frames 113. The steering head pipe 111 is formed into a shape of a pipe that is inclined rearward. The main frame 112 is formed into a shape of a rod that extends diagonally downward to a rear side from a rear portion of the steering head pipe 111. The pair of left and right rear frames 113 are each formed into a shape of a rod that extends diagonally upward to the rear side from a rear portion of the main frame 112, and separate from each other with a predetermined distance in a lateral direction therebetween. The steering head pipe 111, the main frame 112 and the rear frames 113 are respectively formed from an iron material, an aluminum alloy or the like, and are integrally joined to one another by welding or the like.

[0018] The steering system 12 includes a front wheel 121, a steering shaft 122, a pair of left and right front forks 123 and a handle unit 124. The steering shaft 122 is rotatably supported at the steering head pipe 111 of the vehicle body frame 11. Upper end portions of the pair of left and right front forks 123 are coupled to the steering shaft 122. Lower end portions of the pair of left and right front forks 123 rotatably support the front wheel 121. Further, a front fender 151 with which an upper portion of the front wheel 121 is covered, and a brake rim 125 of the front wheel 121 are mounted to the pair of left and right front forks 123. The handle unit 124 is provided at an upper end portion of the steering shaft 122, and is rotatably supported by the steering head pipe 111. The handle unit 124 has a handle cover 127, and left and right handle grips 126. The handle grips 126 are provided to protrude to the left and the right from the handle cover 127. A meter unit (not illustrated) is provided at an upper portion of the handle cover 127. The meter unit is provided with measuring instruments such as a speed meter. Furthermore, a headlight 174 is provided at a front portion of the handle cover 127. Besides, the handle cover 127 is provided with switches and the like for manipulating lights.

[0019] The engine unit 13 (internal combustion engine) is fixed to a lower side of the main frame 112. The engine unit 13 includes a cylinder assembly 131, a crankcase assembly 132 and a clutch 133.

[0020] The cylinder assembly 131 includes a cylinder block, a cylinder head, and a cylinder head cover. In an inside of the cylinder block, a combustion chamber is formed, and a piston is placed to be able to reciprocate. The cylinder head is provided at a front side of the cylinder block. In the cylinder head, an intake port 134 and an exhaust port 135 which allow the combustion chamber and an outside of the cylinder block to communicate with each other are formed. The cylinder head cover is a member to be a lid of the cylinder head, and is placed at a front side of the cylinder head.

[0021] In an inside of the crankcase assembly 132, a crank chamber is formed at a front side, and a mission chamber is formed at a rear side. In an inside of the crank chamber, a crankshaft is rotatably placed. In an inside

of the mission chamber, a countershaft and a driven shaft are rotatably placed, and a transmission is provided. At an outside of a left side of the crankcase assembly 132, an end portion of the driven shaft is protruded. At an end portion of the driven shaft, a drive chain sprocket is provided. The drive chain sprocket is covered with a sprocket cover. At a right side of the crankcase assembly 132, the clutch 133 is placed. Further, a magneto that is a generator, and a starter that starts the engine unit 13 are provided at a left side of the crankcase assembly 132, at a front side of the drive chain sprocket.

[0022] The rear wheel suspension system 14 is configured by including a rear wheel 141, and a pair of left and right swing shafts 142.

[0023] The rear wheel 141 is integrally provided with a driven chain sprocket (hidden and invisible in the drawings). Front end portions of the pair of left and right swing shafts 142 are connected to a rear end portion of the main frame 112 or in a vicinity thereof to be swingable in a vertical direction. At rear end portions of the swing shafts 142, the rear wheel 141 is rotatably supported. A drive chain is wound around the drive chain sprocket of the engine unit 13 and the driven chain sprocket of the rear wheel 141, so that power from the engine unit 13 is transmitted to the rear wheel 14 by the drive chain. A chain case 143 is mounted to one of the pair of swing shafts 142, and the driven chain sprocket of the rear wheel 141 and the drive chain are housed in the chain case 143.

[0024] A shock absorber 144 is provided between each of the pair of left and right swing shafts 142 and each of the pair of left and right rear frames 113. Above the rear wheel 14, a rear fender 152 is provided.

[0025] Beside the above, a seat 153 on which the driver is seated is provided above the rear frame 113. A side cover 154 is fitted to a lower side of the seat 153. Further, a fuel tank and a housing box are provided under the seat 153 (both of them are not illustrated). A front cover 155 is fitted to front sides of the steering head pipe 111 and an upper portion of the front fork 123, and a leg shield 156 is fitted to rear sides thereof. The front cover 155 and the leg shield 156 have predetermined widths in the lateral direction to protect a lower half body of the driver who is seated on the seat 153. The side cover 154, the front cover 155 and the leg shield 156 are members which are formed from, for example, a synthetic resin material, and configure the design of an external appearance of the motorcycle 1. Further, a front end of an exhaust pipe 172 is connected to the exhaust port 135 of the cylinder assembly 131 of the engine unit 13, and a silencer 173 is mounted to a rear end of the exhaust pipe 172.

[0026] As shown in Fig. 3, the intake system 5 is provided at a diagonally upper side in front of the cylinder assembly 131 of the engine unit 13. The intake system 5 is fixed to a lower side of the main frame 112. The intake system 5 takes in air for combustion for the engine unit 13 (internal combustion engine) from an outside, and filters out impurities (dust and the like) to clean the air. Subsequently, the intake system 5 supplies the cleaned air to the engine unit 13. The intake system 5 has a casing 50, an intake port 532 from which air is taken into the casing 50 from the outside, and a funnel 55 from which the cleaned air is supplied to the engine unit 13 (internal combustion engine) from the casing 50. The intake port 532 is located at an upper side of the intake system 5, and is opened toward a rear side. The funnel 55 is connected to the intake port 134 of the cylinder assembly 131 of the engine unit 13 to be able to supply air thereto. Further, as shown in Fig. 3, a throttle body 171 that mixes a fuel into the air for combustion is provided between the funnel 55 of the intake system 5 and the intake port 134.

[0027] Next, an entire configuration of the intake system 5 will be described with reference to Figs. 4 to 6. Fig. 4 is an exploded perspective view schematically showing the configuration of the intake system 5, and is a view seen from a diagonally front side. Fig. 5 is an exploded perspective view schematically showing the configuration of the intake system 5, and is a view seen from a diagonally rear side. Fig. 6 is a sectional view schematically showing an internal structure of the intake system 5, and is a view of the intake system 5 cut at a substantially horizontal plane and seen from above. As shown in Figs. 4 to 6, the intake system 5 has the casing 50 constituted of a main body 51 and a lid member 52, a partition member 53, a filter element 54, and the funnel 55. The partition member 53 and the lid member 52 are attachably and detachably mounted to the main body 51 of the casing 50. The filter element 54 is fitted to the partition member 53.

[0028] The casing 50 is constituted of the main body 51 and the lid member 52, and a space is formed in an inside.

[0029] The main body 51 of the casing 50 is opened at a side (front side in the present embodiment) opposed to the partition member 53 and the lid member 52, and has a box-shaped configuration in which a cavity is formed in an inside thereof, as a whole. The space in the inside of the main body 51 forms a clean side chamber 571. The main body 51 is provided with the funnel 55 which allows the clean side chamber 571 and the outside to communicate with each other so that air can flow therebetween. At a front end (end portion at a side of the partition member 53) of a side wall portion 511 of the main body 51, an engaging groove 512 is formed. The engaging groove 512 is a groove in which a third engaging portion 536 (which will be described later) of the partition member 53 can be engaged. On a top surface of the side wall portion 511 of the main body 51, a concave portion which is recessed toward a lower side is sometimes formed to avoid interference with the main frame 112 of the vehicle body frame 11. Note that the concrete shape of the main body 51 is not especially limited.

[0030] The lid member 52 of the casing 50 has a configuration of a shallow box shape (in other words, a tray shape) that opens toward a side of the partition member 53 and the main body 51 (rear side in the present em-

bodiment) as a whole. A space in an inside of the lid member 52 forms a dirty side chamber 561, and an introduction channel 562 that introduces air into the dirty side chamber 561 (which will be described later).

[0031] As shown in Figs. 4 and 5, the lid member 52 has a front wall portion 521, a side wall portion 522, an intake portion 523, and a bulkhead portion 58. The front wall portion 521 is formed into a plate shape, and separates from the partition wall 531 of the partition member 53 with a predetermined distance therebetween.

[0032] The side wall portion 522 is formed into a shape of a band plate (in other words, a shape of a screen) raised toward the side of the partition member 53 from an outer peripheral edge of the front wall portion 521. The intake portion 523 is a portion that guides air, which is taken in through the intake port 532 from the outside, to the introduction channel 562.

[0033] The intake portion 523 further bulges toward the outer side from the outer peripheral edge of the front wall portion 521. In the present embodiment, the intake portion 523 bulges toward the upper side from the top surface of the front wall portion 521 as shown in Figs. 3 and 4. The side wall portion 522 is formed along an outer peripheral edge of the intake portion 523. In this manner, the intake portion 523 opens toward the side (rear side) of the partition member 53 and the side (lower side) of the front wall portion 521, and the other portions (both left and right sides and an upper side) are surrounded by the side wall portion 522.

[0034] The bulkhead portion 58 provides partition between the dirty side chamber 561 and the introduction channel 562. The bulkhead portion 58 is formed into a wall shape (in other words, a screen shape) that is raised toward the side of the partition member 53 from the front wall portion 521. One end (initial end) in the extending direction of the bulkhead portion 58 is integrally connected to the side wall portion 522 in the vicinity of a root of the intake portion 523 (boundary of the intake portion 523 and the front wall portion 521). The bulkhead portion 58 extends along a predetermined part of the side wall portion 522 with a predetermined space therebetween from a vicinity of the root of the intake portion 523. The other end (terminal end) in the extending direction of the bulkhead portion 58 is not connected to the side wall portion 522, and is separated from the side wall portion 522 with a predetermined distance from the side wall portion 522. A notch 581 is formed in an intermediate portion in the extending direction of the bulkhead portion 58. The notch 581 opens toward the side of the partition member 53. Note that the details of a configuration of the bulkhead portion 58 will be described later.

[0035] On an end portion (end portion at the side of the partition member 53) in the protruding direction of the side wall portion 522, an engaging groove 529 that opens toward the side of the partition member 53 is formed. The engaging groove 529 is a groove in which a second engaging portion 535 (which will be described later) of the partition member 53 can be engaged.

[0036] The front wall portion 521 and the bulkhead portion 58 of the lid member 52 are integrally formed. For example, the whole of the lid member 52 is integrally formed from a resin material, a metal material or the like. If the lid member 52 has a configuration formed from a resin material, a configuration formed integrally by injection molding or the like can be applied. Further, if the lid member 52 has a configuration formed from a metal material, a configuration formed integrally by casting, a die cast method, or the like can be applied.

[0037] The partition member 53 is a member that partitions the space in the inside of the casing 50 into a dirty side 56 (upstream side) and a clean side 57 (downstream side). The partition member 53 has the partition wall 531 that is formed into a plate shape. The partition wall 531 is formed into such a size and a shape that an opening (front end portion) of the main body 51 and an opening (rear end portion) of the lid member 52 can be covered with the partition wall 531 without a gap. In the partition wall 531 of the partition member 53, the intake port 532, an element fitting portion 533, a first engaging portion 534, a second engaging portion 535 and a third engaging portion 536 are formed.

[0038] The intake port 532 has a cylindrical configuration that penetrates through the partition wall 531 in a thickness direction (forward and backward direction) of the partition wall 531 and allows air to pass through. The intake port 532 is formed at a position which is at an outer side of an outer peripheral edge of the partition wall 531 and corresponds to the intake portion 523 of the lid member 52. In the present embodiment, the intake port 532 is provided at a top side of an upper side of the partition wall 531.

[0039] The element fitting portion 533 is a through-hole that penetrates through the partition wall 531 in the thickness direction, and has a configuration in which air can flow. As shown in Figs. 4 to 6, the element fitting portion 533 is formed in a portion to be an inner peripheral surface of the dirty side chamber 561, in a state in which the lid member 52 is mounted to the partition member 53 (in particular, see Fig. 6). The filter element 54 is fitted to the element fitting portion 533. The filter element 54 is a member that removes impurities (dust and the like) in air by filtering the air which passes through it. Note that as the filter element 54, various known filter elements are applied. Accordingly, the description of the filter element 54 will be omitted. Further, a size and a shape of the element fitting portion 533 are properly set, and are not especially limited.

[0040] The first engaging portion 534 is a portion which engages with a rear end (end portion in the protruding direction from the front wall portion 521) of the bulkhead portion 58 of the lid member 52, and is formed in a position and a range corresponding to the rear end of the bulkhead portion 58 of the lid member 52. For example, the first engaging portion 534 is configured by two rib shapes that protrude toward the side of the lid member 52. The rear end of the bulkhead portion 58 of the lid member 52

can be fitted in between the two ribs as the first engaging portion 534.

[0041] The second engaging portion 535 has a configuration in a rib shape (in other words, a screen shape) raised toward the side (front side) of the lid member 52. The third engaging portion 536 has a configuration in a rib shape that is raised toward the side (rear side) of the main body 51. The second engaging portion 535 and the third engaging portion 536 are both formed along an outer peripheral edge of the partition wall 531 to surround the partition wall 531. Note that the second engaging portion 535 is formed to surround the intake port 532 along the outer peripheral edge of the intake port 532. In contrast with this, the third engaging portion 536 is formed to pass an inner side (vicinity of a boundary of the intake port 532 and the partition wall 531) of the intake port 532. The second engaging portion 535 can be fitted into the engaging groove 529 which is formed in the side wall portion 522 of the lid member 52. The third engaging portion 536 can be fitted into the engaging groove 512 which is formed in the side wall portion 511 of the main body 51.

[0042] The mounting configuration of the intake system 5 is as follows. The filter element 54 is fitted to the element fitting portion 533 of the partition member 53. The partition member 53 to which the filter element 54 is fitted is mounted to the opening (front side) of the main body 51 portion, and the lid member 52 is further mounted. Note that the partition member 53 and the lid member 52 are attachably and detachably mounted to the main body 51 with screws or the like.

[0043] When the partition member 53 and the lid member 52 is mounted to the main body 51, the second engaging portion 535 of the partition member 53 is fitted into the engaging groove 529 of the side wall portion 522 of the lid member 52. Likewise, the third engaging portion 536 of the partition member 53 is fitted into the engaging groove 512 of the side wall portion 511 of the main body 51. Further, the rear end of the bulkhead portion 58 of the lid member 52 is fitted in between the two ribs as the first engaging portion 534 of the partition member 53.

[0044] The front end of the intake port 532 of the partition member 53 and the rear end of the intake portion 523 of the lid member 52 are coupled to each other. Therefore, the front end side of the intake port 532 of the partition member 53 is covered with the intake portion 523 of the lid member 52. Meanwhile, the intake port 532 of the partition member 53 protrudes to an outer side from the outer peripheral surface of the side wall portion 511 of the main body 51, and the rear end side is exposed without being covered with the main body 51. In this manner, the intake port 532 which opens toward the side (rear side) of the main body 51 is formed in the intake system 5.

[0045] When the partition member 53 and the lid member 52 are mounted to the main body 51, a space is formed in the inside of the casing 50 constituted of the main body 51 and the lid member 52. The space which is formed in the inside of the casing 50 is partitioned into the dirty side 56 (upstream side) which is the side of the lid member 52, and the clean side 57 (downstream side) which is the side of the main body 51 by the partition wall 531 of the partition member 53.

[0046] In the dirty side 56 (inside of the lid member 52), the dirty side chamber 561 and the introduction channel 562 which introduces air to the dirty side chamber 561 from the intake portion 523 are formed. More specifically, the introduction channel 562 is formed by a predetermined part (portion of the left side surface in the present embodiment) of the side wall portion 522 of the lid member 52, and the bulkhead portion 58 which is formed to be along the predetermined part of the side wall portion 522 with a predetermined distance therefrom. Furthermore, the dirty side chamber 561 is formed by the portions other than the aforementioned predetermined part of the side wall portion 522 and the bulkhead portion 58. In this manner, the bulkhead portion 58 partitions the dirty side 56 of the casing 50 into the dirty side chamber 561 and the introduction channel 562. The element fitting portion 533 which is formed in the partition wall 531 of the partition member 53 and the filter element 54 are located at a rear surface of the dirty side chamber 561.

[0047] In the intermediate portion in the extending direction of the bulkhead portion 58, a communication hole 525 is formed. The communication hole 525 is a through-hole that is formed by the notch 581 formed in the bulkhead portion 58, and the first engaging portion 534 formed in the partition wall 531. The communication hole 525 allows the introduction channel 562 and the dirty side chamber 561 to communicate with each other so that air can flow therebetween.

[0048] In the clean side 57 (inside of the main body 51) of the casing 50, the clean side chamber 571 is formed.

[0049] With the configuration as above, the outside of the intake system 5 and the dirty side chamber 561 communicate with each other so that air can flow therebetween, via the intake port 532 of the partition member 53, the intake portion 523 of the lid member 52 and the introduction channel 562. Further, the introduction channel 562 and the dirty side chamber 561 also communicate with each other via the communication hole 525 so that air can flow. The dirty side chamber 561 and the clean side chamber 571 communicate with each other through the filter element 54 fitted to the element fitting portion 533 of the partition member 53 so that air can flow therebetween. The clean side chamber 571 and the intake port 134 of the engine unit 13 communicate with each other through the funnel 55 so that air can flow therebetween. Accordingly, the intake system 5 takes in air for combustion of the engine unit 13 (internal combustion engine) from the intake port 532 of the partition member 53, and introduces the air into the dirty side chamber 561 via the intake portion 523 of the lid member 52 and the introduction channel 562. Subsequently, the intake system 5 filters and cleans the air introduced into the dirty side chamber 561 by the filter element 54, and supplies the air to the intake port 134 of the engine unit 13 via the clean side chamber 571 and the funnel 55.

[0050] Next, configurations of the introduction channel 562 and the dirty side chamber 561 will be described with reference to Figs. 7 to 9. Fig. 7 is a sectional view schematically showing the configurations of the introduction channel 562 and the dirty side chamber 561, and is a view seen from the front side. Further, the arrow in Fig. 7 schematically shows a flow of air. Fig. 8 is a sectional view of the intake portion 523 and the introduction channel 562 seen from above, and is a view showing a state of the intake portion 523 and the intake port 532 cut at a substantially horizontal plane. Fig. 9 is a sectional view schematically showing configurations of the introduction channel 562 and the dirty side chamber 561, and is a view cut in the extending direction of the introduction channel 562.

[0051] As shown in Fig. 7, the intake port 532 of the partition member 53 and the intake portion 523 of the lid member 52 protrude to the upper side from the top surface of the side wall portion 522 of the lid member 52. The intake port 532 and the intake portion 523 are formed at a position inward to the center instead of the end portion in the lateral direction, seen from the side of the main body 51. As shown in Fig. 7, when the configuration is such that the top surface of the side wall portion 522 of the lid member 52 is formed to be a substantially flat surface, and the top surface and the left side surface of the side wall portion 522 are smoothly connected by a circular arc, the intake port 532 and the intake portion 523 are formed at the left end of the portion which is the top surface of the side wall portion 522 and is formed into a substantially flat surface. Namely, the intake port 532 and the intake portion 523 are formed near to the center in the lateral direction from the portion where the side wall portion 522 is formed into a circular arc. Note that the configuration in which the intake port 532 and the intake portion 523 are formed at the portion of the circular arc of the side wall portion 522 may be adopted. Namely, the intake port 532 and the intake portion 523 can be configured to be formed at the position displaced to the center from one end in the lateral direction of the side wall portion 522.

[0052] An initial end (upper end) of the bulkhead portion 58 is integrally connected to the side wall portion 522 near the center in the lateral direction in the vicinity of the root of the intake portion 523 (vicinity of the boundary of the intake portion 523 and the front wall portion 521). The side wall portion 522 extends from the initial end to a portion (portion formed into a circular arc) at an upper left corner of the front wall portion 521, and a portion (predetermined portion of the side wall portion 522) formed at a left side, of the side wall portion 522, to be along with a predetermined distance being left. A terminal end (lower end) of the bulkhead portion 58 is located in the vicinity of a lower side of the front wall portion 521. The terminal end of the bulkhead portion 58 separates from the side wall portion 522 with a predetermined distance therefrom. A region between the predetermined part of the side wall portion 522 and the bulkhead portion 58 forms the introduction channel 562, and a region surrounded by the portions other than the predetermined part of the side wall portion 522 and the bulkhead portion 58 forms the dirty side chamber 561. Like this, the introduction channel 562 has the intake portion 523 as the initial point, extends along the predetermined part of the side wall portion 522, and has the vicinity of the lower left of the inside of the lid member 52 as the terminal point. The introduction channel 562 allows the intake portion 523 and the dirty side chamber 561 to communicate with each other so that air can flow therebetween.

[0053] Note that as shown in Fig. 6, the left end portion of the lower side of the lid member 52 bulges downward as compared with the other portions. With the configuration like this, the introduction channel 562 can be made long as compared with the configuration in which the lower side of the lid member 52 is formed to be substantially horizontal.

[0054] Here, the communication hole 525 which is formed in the bulkhead portion 58 will be described. As shown in Fig. 7, in the bulkhead portion 58, a first curved portion 582, a linear portion 583 that is located at a terminal end side from the first curved portion 582, and a second curved portion 584 that is located at a terminal end side from the linear portion 583 are formed.

[0055] The first curved portion 582 is a portion that is curved diagonally downward to an outer side (left side) in the lateral direction, seen from the initial end side. The linear portion 583 is a portion with a center line thereof formed to be a straight line. The second curved portion 584 is a portion that is curved toward a lower side, seen from the initial end side. As described above, the intake portion 523 is formed at the position inward to the center from the left end. Therefore, the bulkhead portion 58 first extends substantially downward from the initial end, and is immediately curved toward the outer side (diagonally downward to the left) in the lateral direction to be along the side wall portion 522 which is formed at the upper left corner portion. The portion is the first curved portion 582. The first curved portion 582 is formed in the direction (lower side) in which the intake portion 523 opens. The air that passes through the intake portion 523 is to flow toward the direction in which the intake portion 523 opens, and therefore, the first curved portion 582 is located at the downstream side in the flowing direction in the case of air flowing in a straight line, seen from the intake portion 523.

[0056] The bulkhead portion 58 linearly extends diagonally downward to the left from a terminal end side of the first curved portion 582. The portion is the linear portion 583. The communication hole 525 is formed in the linear portion 583. The linear portion 583 is also located at the downstream side in the flowing direction in the case of air flowing in a straight line, seen from the intake portion 523, similarly to the first curved portion 582.

[0057] That is to say, when the intake system 5 is seen through from the upper side, as shown in Fig. 8, the first curved portion 582 and the communication hole 525 are

located in an inside of the opening of the intake portion 523.

[0058] Further, the bulkhead portion 58 is curved toward the lower side from the terminal end side of the linear portion 583. The portion is the second curved portion 584. Thereafter, the bulkhead portion 58 extends toward a substantially lower side to reach the terminal end.

[0059] As above, in the dirty side 56 of the casing 50 of the intake system 5, a channel that passes through the communication hole 525 from the intake portion 523 to reach the dirty side chamber 561, and a channel that passes through the introduction channel 562 from the intake portion 523 (without passing through the communication hole 525), and reaches the dirty side chamber 561 from the terminal end of the introduction channel 562 are formed in parallel. A distance to the dirty side chamber 561 from the intake portion 523 is shorter in the channel that passes through the communication hole 525 to reach the dirty side chamber 561 than in the channel which reaches the dirty side chamber 561 from the terminal end of the introduction channel 562.

[0060] Note that the communication hole 525 is formed in a position in a range of 1/3 to 2/3 from one end (the initial end or the terminal end) in the extending direction of the bulkhead portion 58.

[0061] Further, as shown in Fig. 9, the communication hole 525 is formed in a substantially center portion in a height direction of the bulkhead portion 58 of the lid member 52 (direction perpendicular to at least one of the inner peripheral surface of the front wall portion 521 and the surface of the partition wall 531). As described above, in the bulkhead portion 58 of the lid member 52, the notch 581 which opens toward the rear side is formed. When the bulkhead portion 58 of the lid member 52 engages with the first engaging portion 534 of the partition member 53, the communication hole 525 is formed by the notch 581 of the bulkhead portion 58 and the two ribs as the first engaging portion 534. Namely, the inner peripheral surface of the notch 581 of the bulkhead portion 58 and the end surfaces in the height direction of the two ribs as the first engaging portion 534 become the inner peripheral surface of the communication hole 525. The notch 581 does not reach the inner peripheral surface of the front wall portion 521, and a bottom surface of the notch 581 is located at a position separated from the front wall portion 521 in the height direction. Meanwhile, the two ribs as the first engaging portion 534 protrudes from the surface of the partition wall 531, the end surfaces in the height direction of the two ribs are separated from the surface of the partition wall 531. Therefore, the communication hole 525 is formed midway in the height direction of the bulkhead portion 58 of the lid member 52. The distance from the surface of the front wall portion 521 to the bottom surface of the notch 581, and the protruding heights of the two ribs as the first engaging portion 534 from the surface of the partition wall 531 are substantially the same. Therefore, the communication hole 525 is formed in the substantially center portion in the height direction of the bulkhead portion 58 of the lid member 52.

[0062] Here, an operation and an effect of the intake system 5 will be described.

[0063] The air for combustion for the internal combustion engine is firstly introduced into the introduction channel 562 through the intake port 532 which is formed in the partition member 53 and the intake portion 523 which is formed in the lid member 52. The intake portion 523 of the lid member 52 opens toward the lower side. Therefore, the air which flows into the introduction channel 562 through the intake portion 523 of the lid member 52 flows toward the lower side first. In the bulkhead portion 58 which forms the introduction channel 562, the communication hole 525 is formed in a position which is at a downstream side of the intake portion 523, and is directly visible from the intake portion 523. Furthermore, the first curved portion 582 is formed at the upstream side of the communication hole 525 (linear portion 583), downstream of the intake portion 523. Therefore, part of the air which flows toward the lower side directly flows into the communication hole 525, or flows into the communication hole 525 by being guided by the first curved portion 582. Subsequently, the air that passes through the communication hole 525 flows into the dirty side chamber 561. Meanwhile, the remainder of the air which flows toward the lower side does not flow into the communication hole 525, but flows further downward along the introduction channel 562, and flows into the dirty side chamber 561 from the terminal end of the introduction channel 562.

[0064] As above, in the intermediate portion in the extending direction of the introduction channel 562, the communication hole 525 which allows the introduction channel 562 and the dirty side chamber 561 to communicate with each other is formed. Therefore, pressure of the air which is introduced into the inside of the intake system 5 can be released through the communication hole 525. Accordingly, occurrence of resonance sound can be prevented or suppressed in the introduction channel 562, and the noise of the intake system 5 can be reduced.

[0065] The communication hole 525 is formed at a downstream side (position directly visible from the intake portion 523) in the flowing direction of the air introduced into the introduction channel 562 from the intake portion 523. With the configuration like this, if the velocity of the air which is introduced into the introduction channel 562 becomes higher, the amount of the air which flows into the communication hole 525 becomes larger. Therefore, in the case of requiring high power output (in the case of requiring a large amount of air), response of the engine can be enhanced (or reduction can be prevented or suppressed). Meanwhile, when the velocity of the air which flows into the introduction channel 562 is low, the amount of the air passing through the communication hole 525 becomes small, and the amount of the air which reaches the dirty side chamber 561 from the terminal end of the introduction channel 562 without passing through the

communication hole 525 becomes large. Therefore, the effect of reduction of the noise by the introduction channel 562 can be enhanced.

[0066] Note that if the position of the communication hole 525 is within the range of 1/3 to 2/3 of the bulkhead portion 58 in the extending direction, the effect of reducing noise becomes large. The details will be described later.

[0067] The first curved portion 582 is formed at a downstream side of the intake portion 523, the linear portion 583 is formed at a downstream side of the first curved portion 582, and the second curved portion 584 is formed downstream of the linear portion 583. According to the configuration like this, the air which flows in the introduction channel 562 can be smoothly guided to the dirty side chamber 561 by the first curved portion 582 and the second curved portion 584. Accordingly, noise can be reduced, and the flow resistance of air can be reduced. Further, the communication hole 525 is formed in the linear portion 583 which is located downstream of the first curved portion 582. With the configuration like this, the function and the effect of guiding air by the first curved portion 582 are not reduced. More specifically, the configuration is such that the direction of the flow of the air is changed by the first curved portion 582, and therefore, if the configuration is such that the communication hole 525 is formed in the first curved portion 582, an area of the region which is used for guidance of air in the first curved portion 582 is decreased. Accordingly, the effect of guiding the air by the first curved portion 582 is reduced. In contrast with this, if the configuration is such that the linear portion 583 is formed at the downstream side of the first curved portion 582, and the communication hole 525 is formed in the linear portion 583, the area of the region which is used for guidance of the air in the first curved portion 582 is not decreased. Accordingly, with the configuration like this, the effect of guiding air can be kept.

[0068] The communication hole 525 is formed substantially in the center in the height direction of the bulkhead portion 58. The amount of the air which flows in the introduction channel 562 becomes maximum substantially in the center in the height direction of the bulkhead portion 58. Therefore, if the configuration is such that the communication hole 525 is formed in this position, the amount of the air passing through the communication hole 525 can be made large. Consequently, according to the configuration like this, the effect of prevention or suppression of occurrence of the resonance sound in the introduction channel 562, and the effect of enhancing the response of the engine when high output power is required can be enhanced.

[0069] The bulkhead portion 58 has a configuration in the wall shape which protrudes toward the side of the partition member 53 from the front lid portion of the lid member 52. According to the configuration like this, the front wall portion 521 and the bulkhead portion 58 can be integrally formed by injection molding or the like. Accordingly, formation of the bulkhead portion 58 is facilitated. Further, since the lid member 52 is easily formed integrally as a whole, the number of components can be reduced, and the number of assembly process steps can be reduced (or increase can be prevented or suppressed). If the configuration is such that the notch 581 is formed in the bulkhead portion 58, and the communication hole 525 is formed by the notch 581, formation of the communication hole 525 becomes easier as compared with the configuration in which a through-hole is formed in the bulkhead portion 58. For example, by a vertically split die, the front wall portion 521 and the bulkhead portion 58 are integrally formed, and the notch 581 can be formed in the bulkhead portion 58. Accordingly, reduction of manufacture cost and the like can be realized.

[Example]

[0070] Next, an example of the present invention will be described. The present inventor verified the effect of reduction of the noise of the intake system 5. Fig. 10 is a graph showing the effect of reduction of the noise of the intake system 5 according to the example. An axis of abscissa represents the position (position in the extending direction of the bulkhead portion 58) where the communication hole 525 is formed. An axis of ordinates represents the degree of reduction of the noise of the intake system 5 according to the example in a logarithmic scale, in comparison with the intake system (comparative example) having the partition wall portion in which the communication hole is not formed.

[0071] As shown in Fig. 10, the degree of reduction of the noise of the intake system 5 according to the example becomes abruptly large in the position in the range of 1/3 to 2/3 from one end (the initial end or the terminal end) in the extending direction of the bulkhead portion 58. The degree of reduction of noise becomes the largest in the center in the extending direction of the bulkhead portion 58. Accordingly, the communication hole 525 is preferably in the position in the range of 1/3 to 2/3 from one end (the initial end or the terminal end) in the extending direction of the bulkhead portion 58. Further, the communication hole 525 is preferably in the position at the center in the extending direction of the bulkhead portion 58 or in the vicinity thereof.

[0072] The embodiment and the example of the present invention are described in detail above with reference to the drawings, but the aforementioned embodiment and example only show specific examples in carrying out the present invention. The technical scope of the present invention is not limited to the aforementioned embodiment and example. The present invention can be variously modified without departing from the technical scope or main features thereof, and the various modifications are also included in the technical scope of the present invention.

[0073] For example, in the aforementioned embodi-

ment, the configuration of the intake system being applied to an underbone type motorcycle is shown, but the kind of the motorcycle to which the intake system is applied is not limited. The intake system 5 of the present invention can be applied to various motorcycles (including a motor-assisted bicycle) such as a street motorcycle, an off-road motorcycle, and a scooter type motorcycle. Further, the intake system can be also applied to tricycles, four-wheel cars and the like for traveling rough terrains, besides motorcycles.

[0074] The present invention is an effective art for the intake system for an internal combustion engine. According to the present invention, the intake pressure is released, and the resonance sound can be reduced. Accordingly, noise can be reduced.

[0075] According to the present invention, the intake pressure can be released by the communication hole which allows the introduction channel and the dirty side chamber to communicate with each other halfway in the introduction channel. Accordingly, the resonance sound can be reduced, and the noise that is generated by the intake system can be reduced.

Claims

1. An intake system (5) for an internal combustion engine, comprising:

   a casing (50) in which a space is formed in an inside thereof; and
   in the inside of the casing (50),
   a dirty side (56) in which a dirty side chamber (561) and an introduction channel (562) that introduces air into the dirty side chamber (561) are formed;
   a clean side (57) in which a clean side chamber (571) is formed;
   a partition member (53) being partition between the dirty side (56) and the clean side (57); and
   an intake portion (523) that takes air into the dirty side (56) from an outside of the casing (50),
   characterized in that the casing has a main body (51), and a lid member (52) that is attachably and detachably mounted to the main body (51),
   in the lid member (52), a side wall portion (522) and a bulkhead portion (58), which has a configuration in the wall shape which protrudes toward the side of the partition member (53) and extends along a part of the side wall portion (522) from the intake portion (523) to form the introduction channel (562) between the bulkhead portion (58) and the part of the side wall portion (522) formed integrally, and a communication hole (525), which allows the introduction channel (562) and the dirty side chamber (561) to communicate with each other to allow air to flow therebetween, is formed midway in an extending direction of the bulkhead portion (58).

2. The intake system (5) for an internal combustion engine according to claim 1,
   wherein the communication hole (525) is formed at a downstream side in a flowing direction of air from the intake portion (523).

3. The intake system (5) for an internal combustion engine according to claim 1 or 2,
   wherein the communication hole (525) is formed in a range of 1/3 to 2/3 from an initial end to a terminal end in the extending direction of the bulkhead portion (58).

4. The intake system (5) for an internal combustion engine according to any one of claims 1 to 3,
   wherein in the bulkhead portion (58), a curved portion (581) that is curved in a vicinity of the intake portion (523), and a linear portion (583) that is formed in a substantially straight line in a terminal end side of the curved portion (581) are formed, and the communication hole (525) is formed in the linear portion (583).

5. The intake system (5) for an internal combustion engine according to any one of claims 1 to 4,
   wherein the communication hole (525) is provided in a substantially central portion in a height direction of the bulkhead portion (58).

Patentansprüche

1. Ein Einlasssystem (5) für einen Verbrennungsmotor, umfassend:

   ein Gehäuse (50), in dem ein Raum in einem Inneren davon ausgebildet ist;
   und
   in dem Inneren des Gehäuses (50);
   eine Schmutzseite (56), in welcher eine Schmutzseitenkammer (561) und ein Einführungskanal (562), der Luft in die Schmutzseitenkammer (561) einführt,
   ausgebildet sind;
   eine Reinseite (57), in der eine Reinseitenkammer (571) ausgebildet ist;
   ein Abtrennungselement (53), das eine Abtrennung zwischen der Schmutzseite (56) und der Reinseite (57) darstellt; und
   ein Einlassbereich (523), der Luft in die Schmutzseite (56) von einer Außenseite des Gehäuses (50) aufnimmt,
   dadurch gekennzeichnet, dass das Gehäuse einen Hauptkörper (51) und ein Deckelelement (52), das an dem Hauptkörper (51) anbringbar

und ablösbar montiert ist, aufweist,
in dem Deckelelement (52): ein Seitenwandbereich (522) und ein Trennwandbereich (58), der eine Konfiguration bei der Wandform aufweist, die in Richtung der Seite des Abtrennungselements (53) vorsteht und sich entlang eines Teils von dem Seitenwandbereich (522) von dem Einlassbereich (523) erstreckt, um den Einführungskanal (562) zwischen dem Trennwandbereich (58) und dem Teil des Seitenwandbereichs (522), der ganzheitlich ausgebildet ist, auszubilden, und ein Verbindungsloch (525), das dem Einführungskanal (562) und der Schmutzseitenkammer (561) ermöglicht, miteinander in Verbindung zu stehen, um Luft zu ermöglichen, dazwischen zu strömen, ist in der Mitte in einer Erstreckungsrichtung von dem Trennwandbereich (58) ausgebildet.

2. Das Einlasssystem (5) für einen Verbrennungsmotor nach Anspruch 1, wobei das Verbindungsloch (525) an einer stromabwärtigen Seite in einer Strömungsrichtung der Luft von dem Einlassbereich (523) ausgebildet ist.

3. Das Einlasssystem (5) für einen Verbrennungsmotor nach Anspruch 1 oder 2, wobei das Verbindungsloch (525) in einem Größenbereich von 1/3 bis 2/3 von einem anfänglichen Ende zu einem endständigen Ende in der Erstreckungsrichtung des Abtrennbereichs (58) ausgebildet ist.

4. Das Einlasssystem (5) für einen Verbrennungsmotor nach einem der Ansprüche 1-3,
wobei in dem Trennwandbereich (58) ein gekrümmter Bereich (581), der in einer Umgebung des Einlassbereichs (523) gekrümmt ist, und ein linearer Bereich (583), der in einer im Wesentlichen geraden Linie an einer endständigen Endseite des gekrümmten Bereiches (561) ausgebildet ist, ausgebildet sind, und das Verbindungsloch (525) in dem linearen Bereich (583) ausgebildet ist.

5. Das Einlasssystem (5) für einen Verbrennungsmotor nach einem der Ansprüche 1-4,
wobei das Verbindungsloch (525) in einem im Wesentlichen zentralen Bereich in einer Höhenrichtung des Trennwandbereichs (58) vorgesehen ist.

Revendications

1. Système d'admission (5) pour un moteur à combustion interne, comprenant:

un carter (50) dans lequel un espace est formé dans son intérieur ; et
à l'intérieur du carter (50),
un côté sale (56) dans lequel sont formés une chambre du côté sale (561) et un canal d'introduction (562) qui introduit l'air dans la chambre du côté sale (561) ;
un côté propre (57) dans lequel est formée une chambre du côté propre (571);
un élément de séparation (53) faisant la séparation entre le côté sale (56) et le côté propre (57) ; et
une partie d'admission (523) qui prend l'air dans le côté sale (56) depuis un extérieur du carter (50), **caractérisé en ce que** le carter a un corps principal (51) et un élément de couvercle (52) qui est monté de manière attachable et détachable sur le corps principal (51), dans l'élément de couvercle (52), une partie de paroi latérale (522) et une partie de cloison (58), qui a une configuration dans la forme de paroi qui fait saillie vers le côté de l'élément de séparation (53) et s'étend le long d'une partie de la partie de paroi latérale (522) à partir de la partie d'admission (523) afin de former le canal d'introduction (562) entre la partie de cloison (58) et la partie de la partie de paroi latérale (522) formée de manière solidaire, et un trou de communication (525) qui permet au canal d'introduction (562) et à la chambre du côté sale (561) de communiquer entre eux pour permettre à l'air de s'écouler entre eux, est formé à mi-chemin dans une direction d'extension de la partie de cloison (58).

2. Système d'admission (5) pour un moteur à combustion interne selon la revendication 1,
dans lequel le trou de communication (525) est formé au niveau d'un côté en aval dans une direction d'écoulement de l'air à partir de la partie d'admission (523).

3. Système d'admission (5) pour un moteur à combustion interne selon la revendication 1 ou 2,
dans lequel le trou de communication (525) est formé dans une plage de 1/3 à 2/3 à partir d'une extrémité initiale jusqu'à une extrémité terminale dans la direction d'extension de la partie de cloison (58).

4. Système d'admission (5) pour un moteur à combustion interne selon l'une quelconque des revendications 1 à 3,
dans lequel dans la partie de cloison (58), une partie incurvée (581) qui est incurvée dans un voisinage de la partie d'admission (523) et une partie linéaire (583) qui est formée selon une ligne sensiblement droite dans un côté d'extrémité terminale de la partie incurvée (581) sont formées et le trou de communication (525) est formé dans la partie linéaire (583).

5. Système d'admission (5) pour un moteur à combustion interne selon l'une quelconque des revendica-

tions 1 à 4,
dans lequel le trou de communication (525) est prévu dans une partie sensiblement centrale dans une direction de hauteur de la partie de cloison (58).

FIG. 1

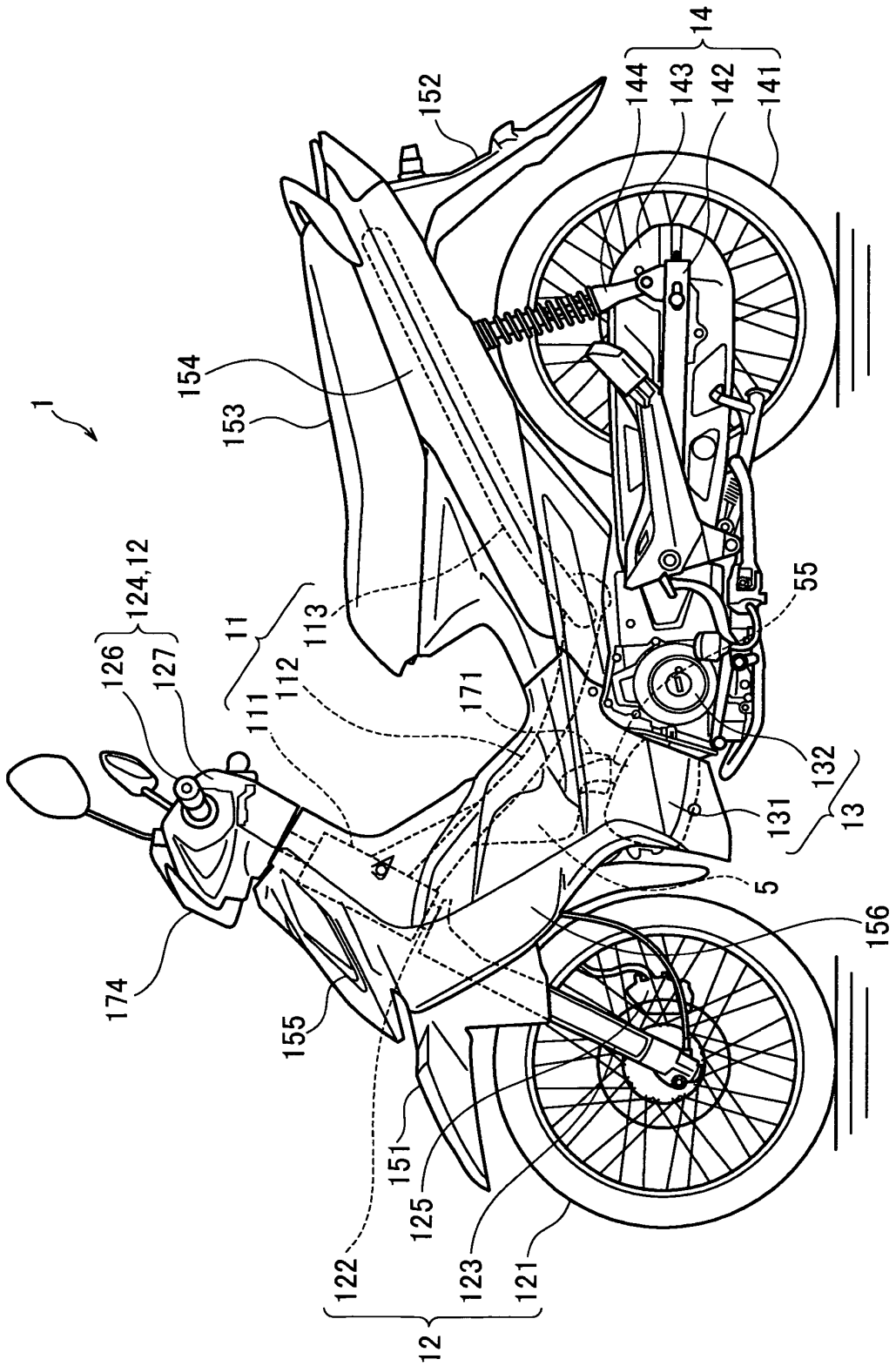
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FIG. 2

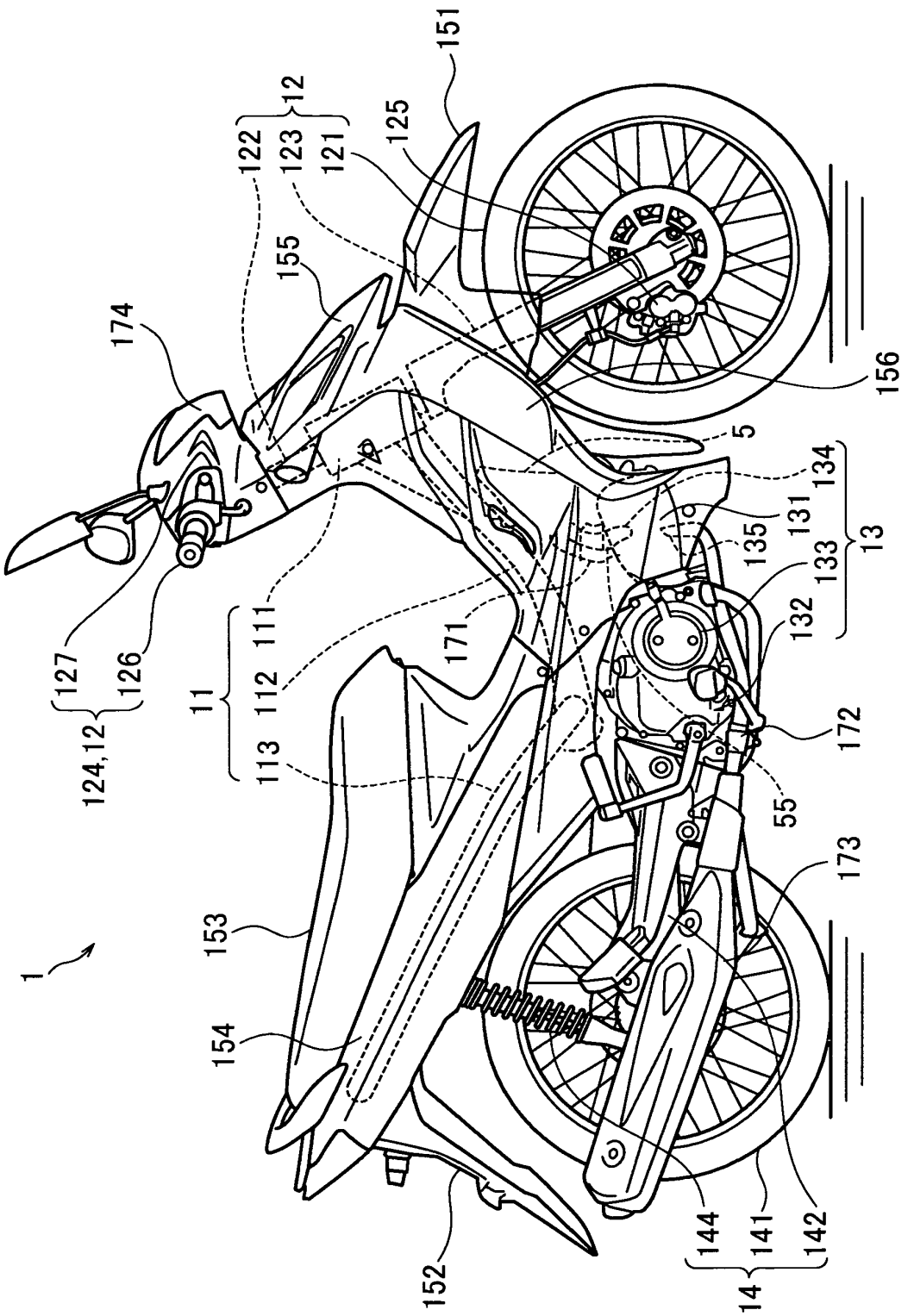
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FIG. 3

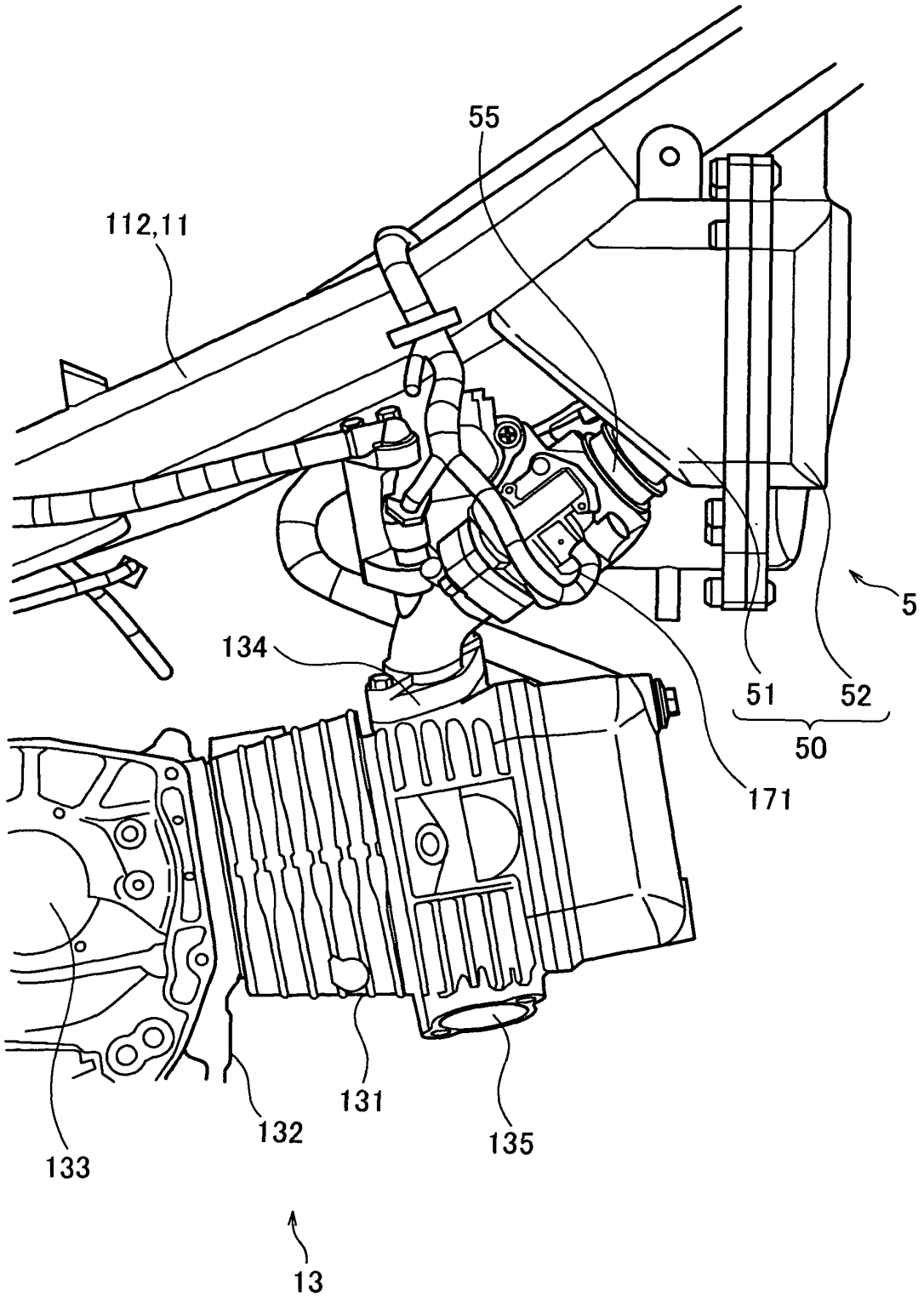
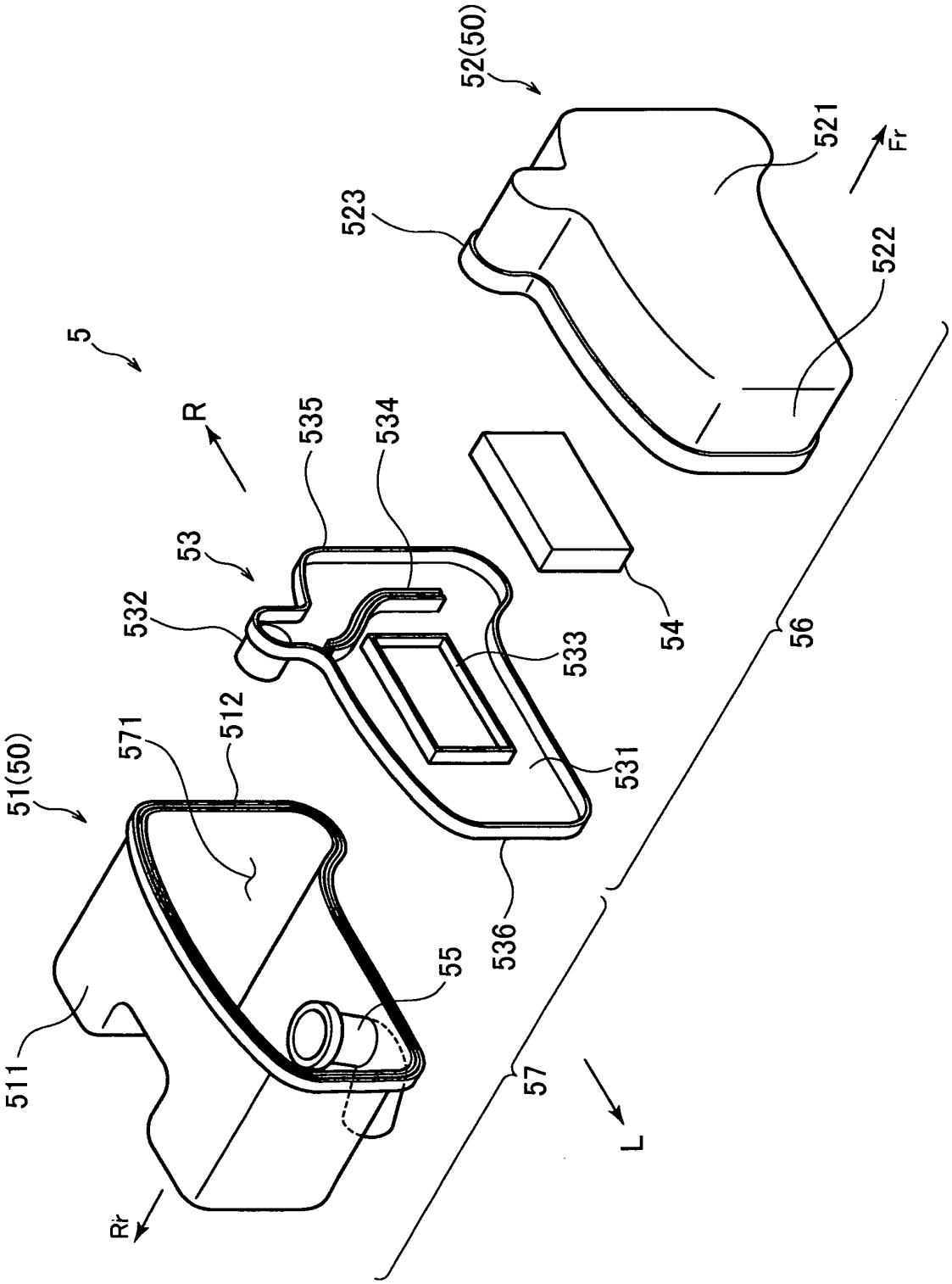


FIG. 4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571
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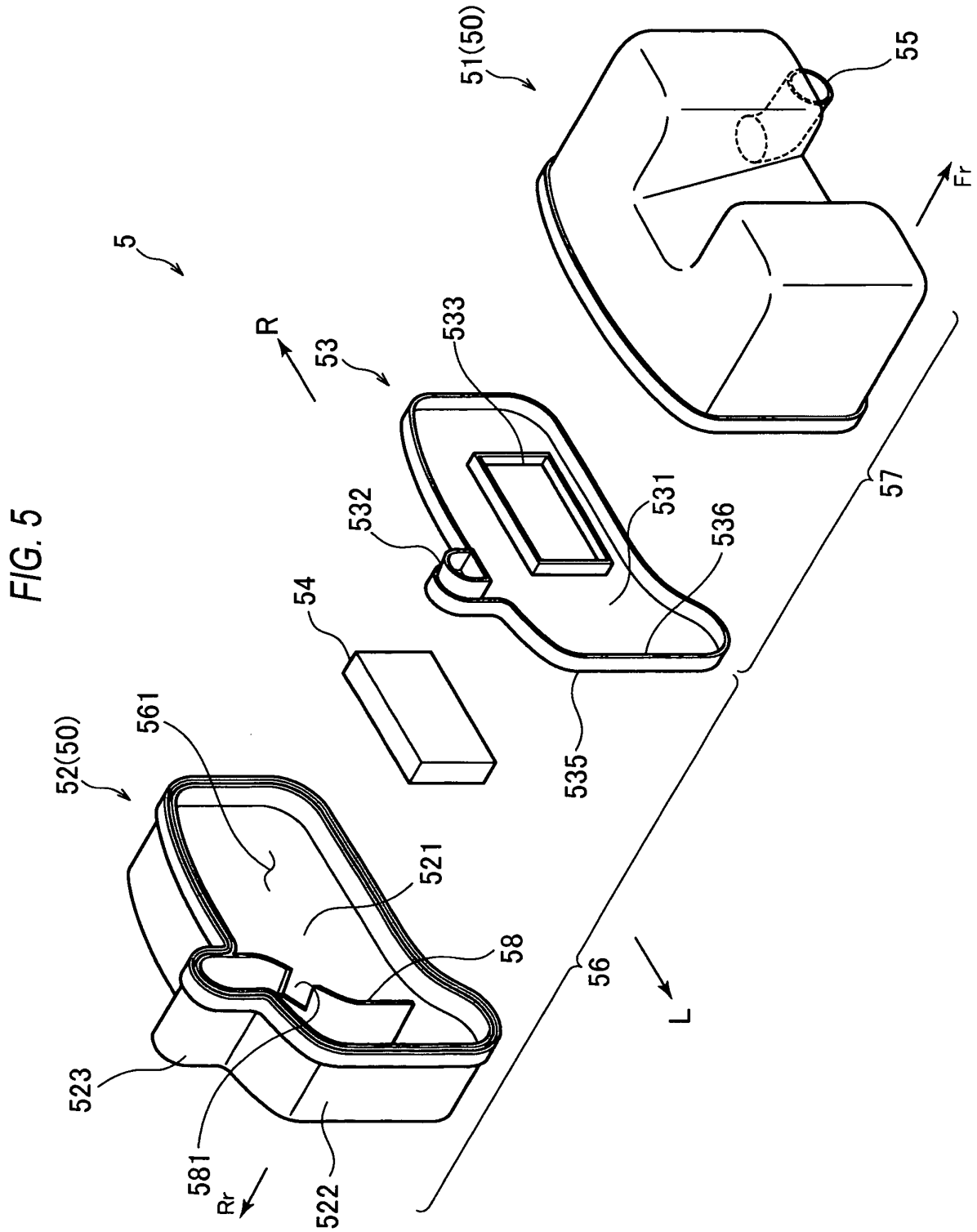
536
55
511
57
Rr
L

FIG. 5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R
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56
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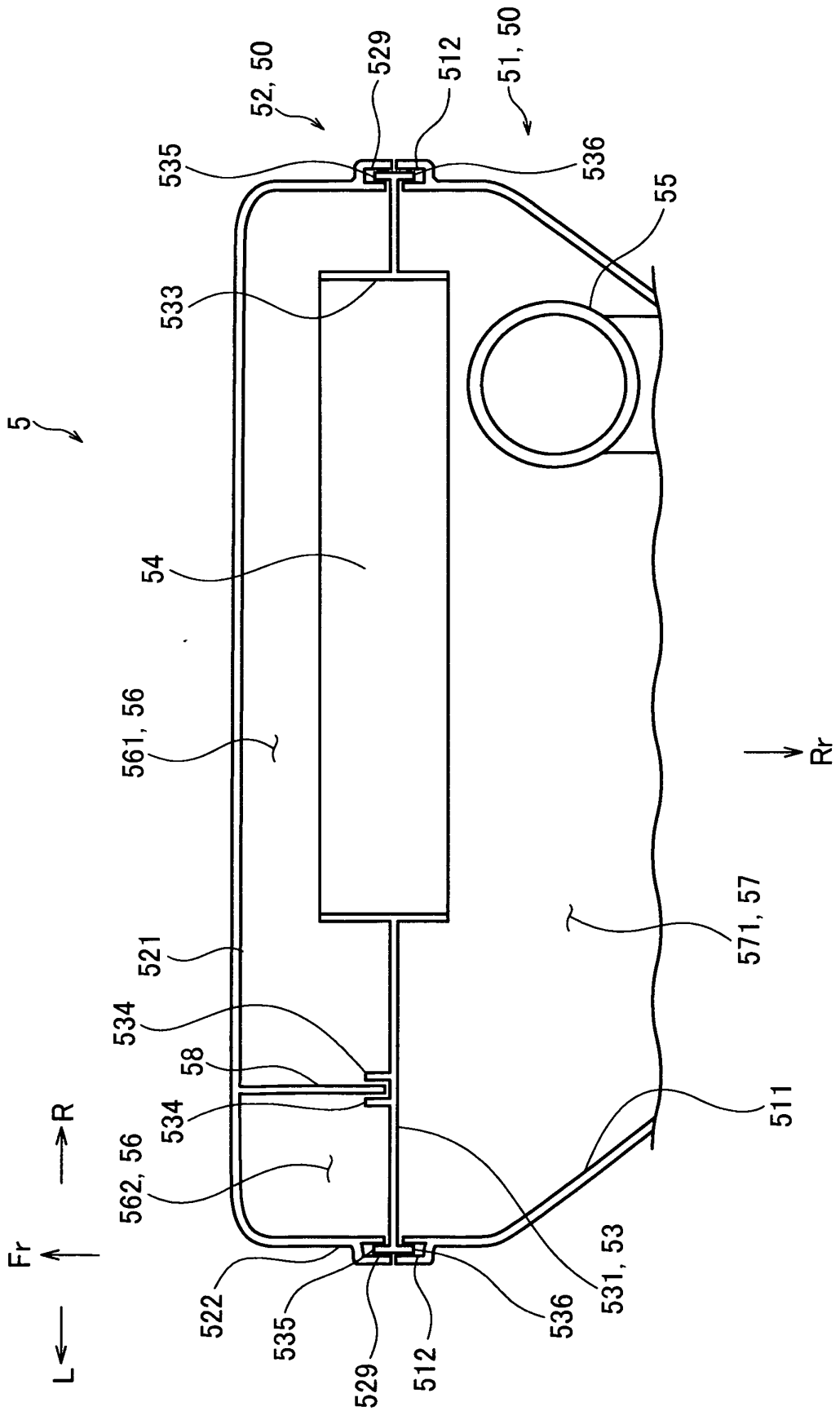
Rr
522

FIG. 6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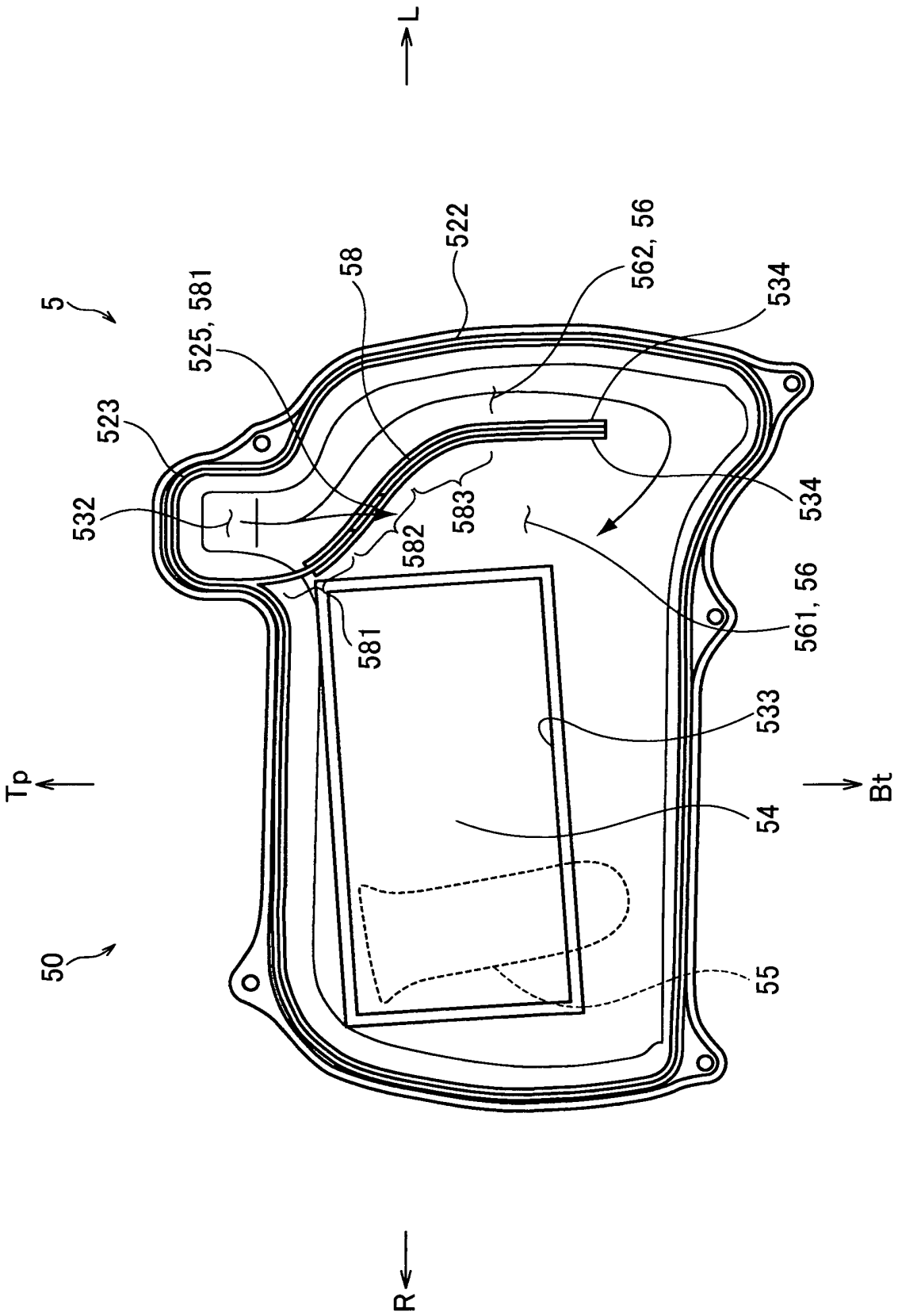
L

FIG. 7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R

FIG. 8

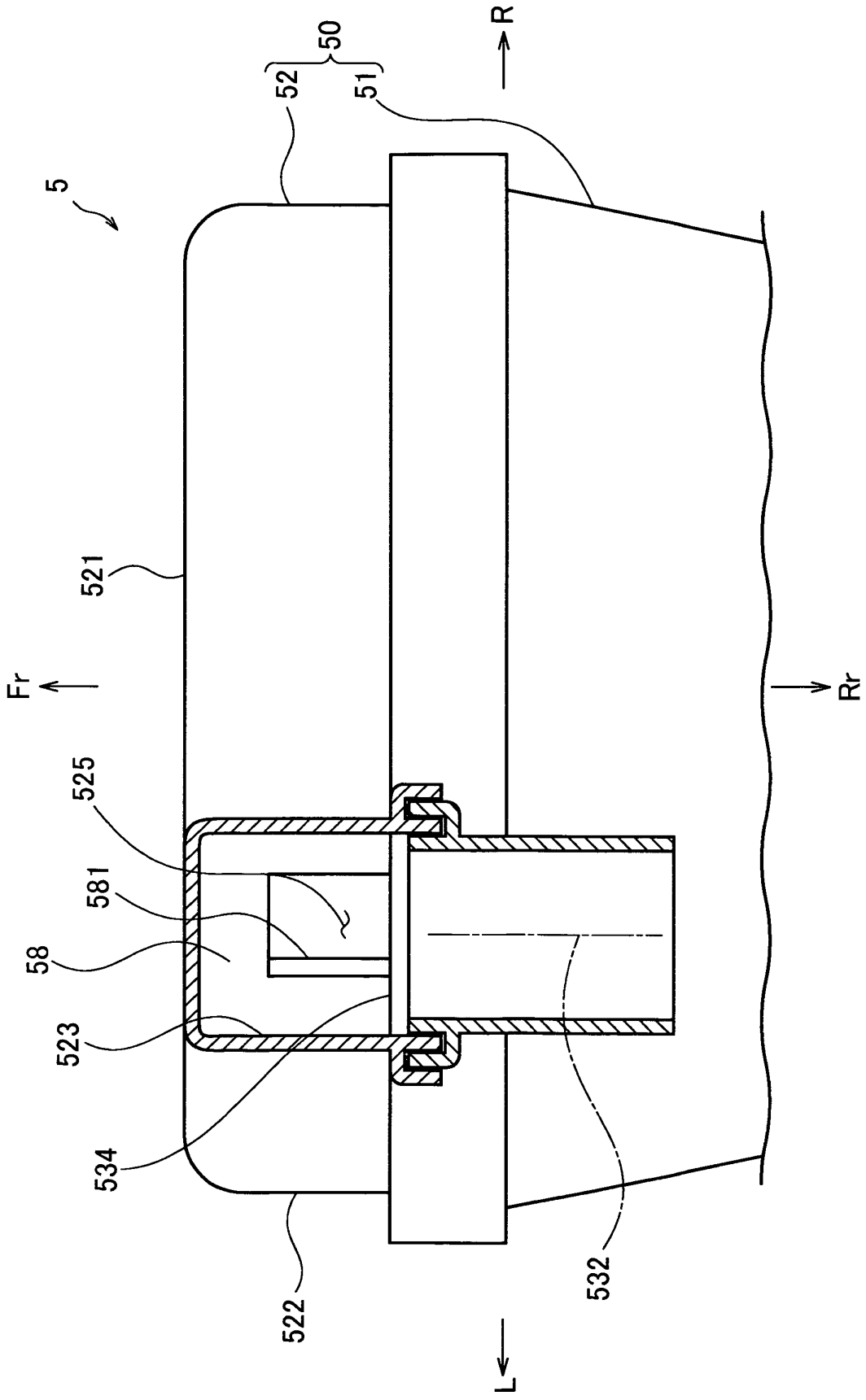
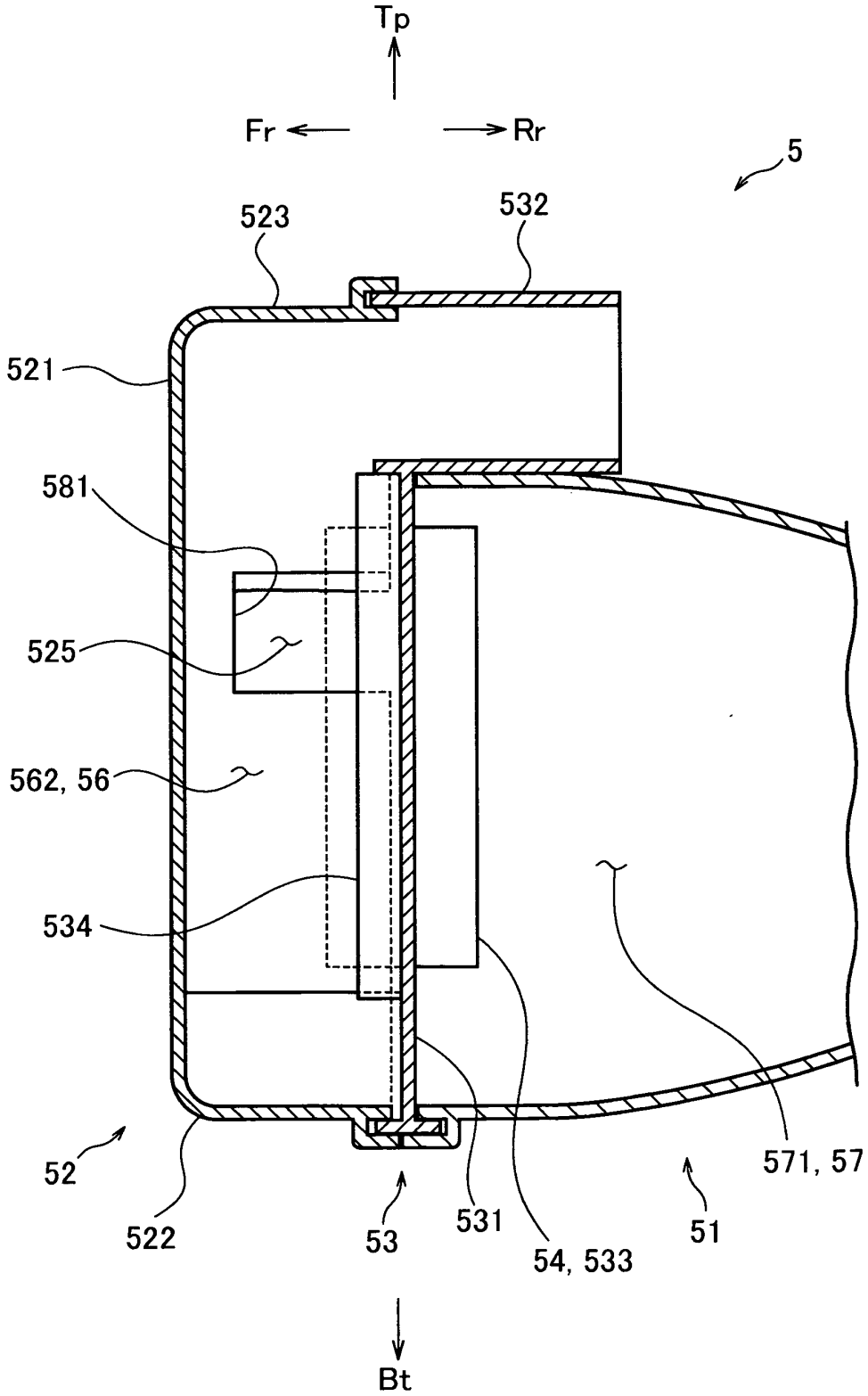


FIG. 9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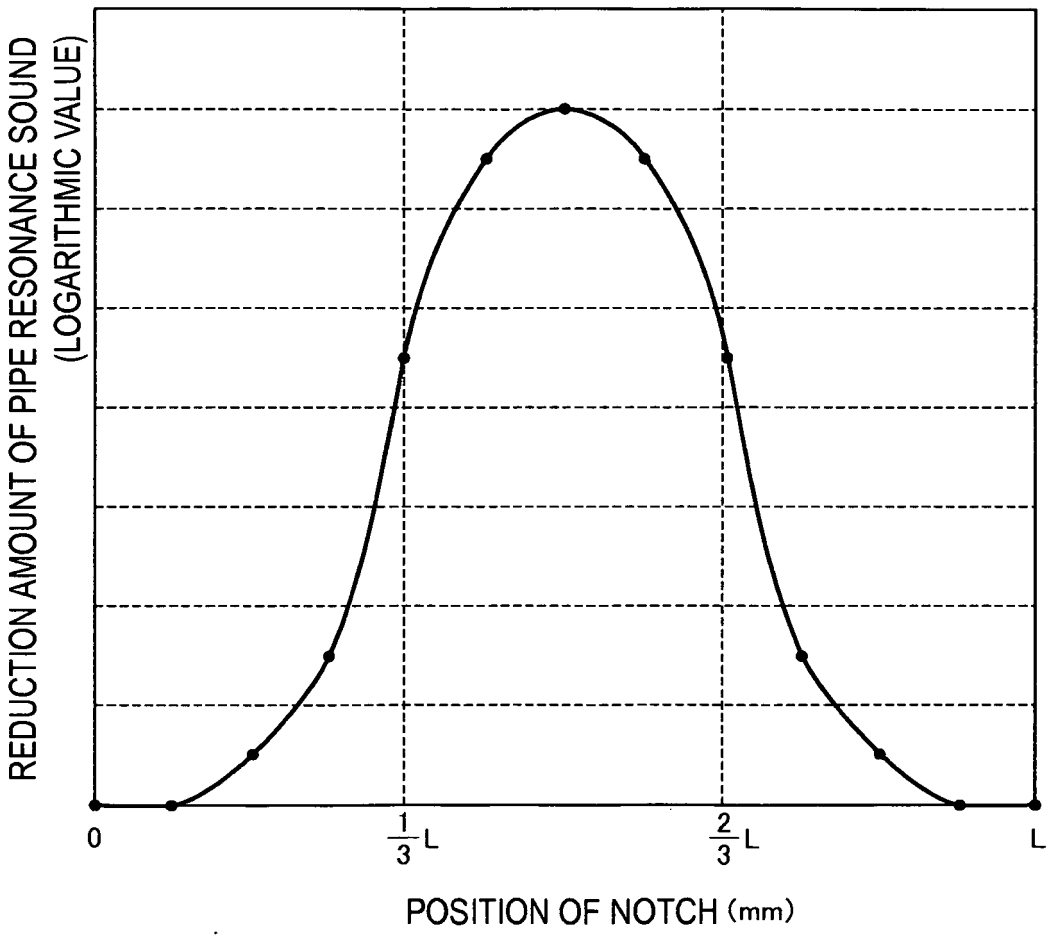
571, 57
Bt

FIG. 10


REDUCTION AMOUNT OF PIPE RESONANCE SOUND
(LOGARITHMIC VALUE)
0
1/3 L
2/3 L
L
POSITION OF NOTCH (mm)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP DE3606360 A **[0005]**
- DE 3429633 A1 **[0005]**