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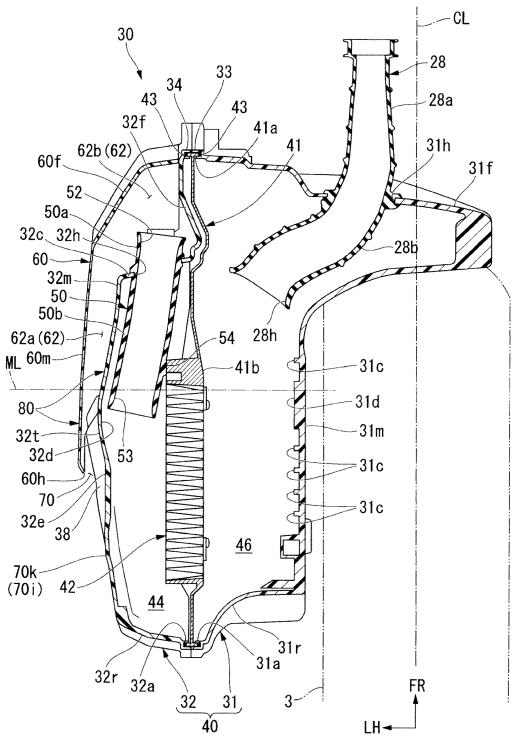
(54) AIR CLEANER APPARATUS OF STRADDLE TYPE VEHICLE

(57) [Problem] The present invention aims to suppress the water, foreign materials and the like entering the unpurified chamber, simultaneously to improve the outer appearance performance in the air cleaner apparatus for straddle type vehicle.

[Means for Solving Problem] In an air cleaner apparatus 30 comprising: an air cleaner case 40 whose inside is divided into an unpurified chamber 44 and a purified chamber 46 by an air cleaner element 42; an intake duct 50 attached to the air cleaner case 40 so as to communicate with the unpurified chamber 44, simultaneously provided with an air inlet opening 52 directing the front direction; a cover member 60 forming an intake passage 62 between the air cleaner case 40 and the cover member and covering an air inlet opening 52, the cover member 60 extends in the longitudinal direction of the vehicle such that the longitudinal length becomes longer than the vertical length, the air inlet opening 52 is positioned further frontward than the longitudinal center of the air cleaner case 40, an air inlet 70 to the intake passage 62 is formed further rearward than the longitudinal center of the air cleaner case 40 as well as on the rear portion of the cover member 60.

Fig.2



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Description

[Technical field]

[0001] The present invention relates to an air cleaner apparatus of straddle type vehicle.

[Background of the Invention]

[0002] As a conventional air cleaner apparatus for straddle type vehicle including motorcycle, there is an example of the air cleaner disclosed in PATENT DOCUMENT 1. An air cleaner case is provided above a transmission case which is a unit swing type power unit such that the inside of the air cleaner case is divided into an upper stream side air chamber and a lower stream side air chamber by an air cleaner element. The air cleaner case has a communication pipe communicating the upper streamside air chamber with a recessed portion opened on the front portion of the air cleaner case to the outside in the width direction of the vehicle. A cover is attached to the front portion of the air cleaner case outside in the width direction of the vehicle so as to form an air chamber for introducing the air between the recessed portion and the air cleaner case, simultaneously so as to cover a communication pipe. An air inlet opened downward is formed at the lowest portion of the recessed portion.

[0003] According to the structure, the air passed through the air inlet flows inside the air chamber for introducing the air to the front direction, and is inhaled into the communication pipe. Thus, an air passage with a labyrinth structure is formed inside the air chamber for introducing the air, which suppresses the water, foreign materials and the like inhaled into the air chamber for introducing the air entering the upper stream side air chamber.

[Description of the Related Art]

[PATENT DOCUMENT]

[0004] [PATENT DOCUMENT 1] Japanese Patent No. 4249345

[SUMMARY OF THE INVENTION]

[Problem to Be Solved by the Invention]

[0005] There is a problem that the integrated appearance of the cover and the air cleaner case is faded and the outer appearance performance is reduced because the cover protrudes downward to the front direction from the outer shell of the air cleaner case in the side view in PATENT DOCUMENT 1. Accordingly, a structure has been required so as to suppress the water, foreign materials and the like entering the upper stream side air chamber, simultaneously to improve the outer appearance performance.

[0006] The present invention aims to suppress the water, foreign materials and the like entering the unpurified chamber, simultaneously to improve the outer appearance performance in the air cleaner apparatus for straddle type vehicle.

[Means for Solving Problem]

[0007] As a means for solving problem of the abovementioned problem, the invention according to claim 1 is characterized in that in an air cleaner apparatus (30) comprising: an air cleaner case (40) whose inside is divided into an unpurified chamber (44) and a purified chamber (46) by an air cleaner element (42); an intake duct (50) attached to the air cleaner case (40) so as to communicate with the unpurified chamber (44), simultaneously provided with an air inlet opening (52) directing the front direction; a cover member (60) attached to the outside surface of the air cleaner case (40) in the width direction of the vehicle, simultaneously forming an intake passage (62) between the air cleaner case (40) and the cover member, and covering the air inlet opening (52), the cover member (60) extends in the longitudinal direction of the vehicle such that the longitudinal length becomes longer than the vertical length, the air inlet opening (52) is positioned further frontward than the longitudinal center of the air cleaner case (40), an air inlet (70) to the intake passage (62) is formed further rearward than the longitudinal center of the air cleaner case (40) as well as on the rear portion of the cover member (60).

[0008] The invention according to claim 2 is characterized in that the straddle type vehicle (1) has a power unit (20) swingably supported on a body frame (10), the power unit (20) has a transmission case (26) continuously provided to a crank case (24) of an engine E (22) and extended from the crank case (24) to the rear direction, the air cleaner case (40) is disposed above the transmission case (26).

[0009] The invention according to claim 3 is characterized in that the cover member (60) is disposed further inside an outer shell (34a) of the air cleaner case (40) in the side view.

[0010] The invention according to claim 4 is characterized in that the air cleaner case (40) has a case main body (31) having a first flange portion (33) forming an opening edge portion (31a) opened to the outside in the width direction of the vehicle, and a second flange portion (34) forming the inside opening edge portion (32a) opened to the inside in the width direction of the vehicle so as to be overlapped with the outside opening edge portion (31a), and also has a case cover (32) disposed on the outside of the case main body (31) in the width direction of the vehicle, and the outline of the second flange portion (34) is set as the outer shell (34a).

[0011] The invention according to claim 5 is characterized in that an upper end (52a) of the air inlet opening (52) is positioned below an upper end (70a) of the air

inlet (70), simultaneously a lower end (52b) of the air inlet opening (52) is positioned above a lower end (70b) of the air inlet (70).

[0012] The invention according to claim 6 is characterized in that the air inlet (70) is opened to the rear direction of the vehicle.

[0013] The invention according to claim 7 is characterized in that a projecting portion (36) projecting from the air cleaner case (40) to the outside in the width direction of the vehicle is disposed in the rear and upper direction of the air inlet (70).

[0014] The invention according to claim 8 is characterized in that a passage forming portion (80) is formed with the air cleaner case (40) and the cover member (60) so as to surround the intake passage (62), and a lower portion (82) of the passage forming portion (80) is inclined so as to be positioned further downward as it approaches to the rear side.

[0015] The invention according to claim 9 is characterized in that a drain hole (84) is formed at least at the position facing to the upper stream side end portion of the intake passage (62) on the lower portion (82) of passage forming portion (80).

[0016] The invention according to claim 10 is characterized in that the intake passage (62) has a first intake passage (62a) connected to the air inlet (70), a second intake passage (62b) connected to the first intake passage (62a) as well as connected to the air inlet opening (52), and the drain hole (84) is formed at least at the position facing to one of the upper stream side end portions of the first intake passage (62a) and the second intake passage (82b).

[0017] The invention according to claim 11 is characterized in that a rib (38) longitudinally extended is formed on at least one of the portions of the air cleaner case (40) and the cover member (60), which face to the air inlet (70).

[0018] The invention according to claim 12 is characterized in that the rib (38) is formed so as to be extended further rearward than the cover member (60) in the side view.

[0019] The invention according to claim 13 is characterized in that the air cleaner case (40) has the case main body (31) having the outside opening edge portion (31a) opened to the outside in the width direction of the vehicle, the case cover (32) having an inside opening edge portion (32a) opened to the inside in the width direction of the vehicle so as to be overlapped with the outside opening edge portion (31a) in the side view and disposed on the outside of the case main body (31) in the width direction of the vehicle, and the cover member (60) is attached to the case cover (32) with the fastening member (90) fastening from the inside of the case cover (32) in the width direction of the vehicle.

[0020] The invention according to claim 14 is characterized in that the fastening member (90) is covered with the cover member (60) so as not to be exposed from the cover member (60) in the side view.

[0021] The invention according to claim 15 is characterized in that the cover member (60) is fastened to the air cleaner case (40) at least at the front portion or the rear portion of the cover member (60), a joint portion (64) for fitting the cover member (60) and the air cleaner case (40) is formed between front side fastening portions (65c, 65d) provided on the front portion of the cover member (60) and rear side fastening portions (65a, 65b) provided on the rear portion of the cover member (60).

[0022] The invention according to claim 16 is characterized in that the joint portion (64) is covered with at least one of the cover member (60) and the air cleaner case (40) so as not to be exposed from the cover member (60) to the outside in the side view.

[0023] The invention according to claim 17 is characterized in that the air cleaner case (40) has the case main body (31) having the outside opening edge portion (31a) opened to the outside in the width direction of the vehicle, the case cover (32) having the inside opening edge portion (32a) opened to the inside in the width direction of the vehicle so as to be overlapped with the outside opening edge portion (31a) in the side view and disposed on the outside of the case main body (31) in the width direction of the vehicle, and the cover member (60) is attached to the case cover (32) with the fastening member (90) fastening from the inside of the case cover (32) in the width direction of the vehicle,

And the joint portion (64) has the axial direction regulating portion (66) regulating the movement of the cover member (60) along the fastening axis direction of the fastening member (90).

[0024] The invention according to claim 18 is characterized in that the intake duct (50) is inclined so as to be positioned further outward in the width direction of the vehicle as it approaches to the rear side, and the concave portion (32d) avoiding the rear portion of the intake duct (50) is formed on the portion facing to the rear portion of the intake duct (50) of the inside surface of the air cleaner case (40) in the width direction of the vehicle.

[0025] The cleaner apparatus for straddle type vehicle according to claim 19 is characterized in that the convex portion (32t) projecting to the outside in the width direction of the vehicle at the position corresponding to the concave portion (32d) on the outside surface of the air cleaner case (40) in the width direction of the vehicle, and the convex portion (32t) is covered with the cover member (60).

[Effect of the Invention]

[0026] According to the invention mentioned in claim 1, the air inlet opening is positioned further frontward than the longitudinal center of the air cleaner case, and the air inlet to the intake passage is formed further rearward than the longitudinal center of the air cleaner case as well as on the rear portion of the cover member. Accordingly, the intake air from the inlet is guided to the front direction inside the intake passage. Then the intake air turns back to the air inlet opening. Thus, the labyrinth

structure of the air cleaner case can be formed by using the longitudinally long intake passage, which suppress the water, foreign materials and the like entering the unpurified chamber. Moreover, the cover member extends in the longitudinal direction of the vehicle such that the longitudinal length becomes longer than the vertical length. It is possible to reduce the vertically projecting amount of the cover member to the air cleaner case, and the outer appearance performance can be improved. Therefore, it is possible to suppress the water, foreign materials and the like entering the unpurified chamber, simultaneously the outer appearance performance can be improved.

[0027] When the air cleaner case is disposed above the transmission case, the air inlet is exposed to the outside. Accordingly, the the water, foreign materials and the like are more likely to enter the unpurified chamber compared with the case when the air cleaner case is disposed inside the vehicle. Therefore, according to the invention mentioned in claim 2, the air cleaner case is disposed above the transmission case, the labyrinth structure can effectively achieve to suppress the water, foreign materials and the like entering unpurified chamber. Moreover, even if the cover member is disposed above the transmission case, the cover member has a longitudinally long shape. Accordingly, the clearance between the transmission case and the cover member can be easily secured, and the swinging amount of the power unit can be fully secured.

[0028] According to the invention mentioned in claim 3, the cover member can be compactly provided on the air cleaner case such that the cover member does not protrude from the outer shell of the air cleaner case to the outside in the side view. Thus, compared with the case when the cover member is disposed so as to protrude from the outer shell of the air cleaner case in the side view, the integrated appearance of the cover member and the air cleaner case is enhanced, and the outer appearance is further improved.

[0029] According to the invention mentioned in claim 4, the outline of the second flange portion is set as the outer shell, it is possible to downsize the cover member and to further improve the integrated appearance of the cover member and the air cleaner case. Moreover, even if the cover member is disposed outside the case cover, it is possible to simplify the outer shell shape of the case cover.

[0030] According to the invention mentioned in claim 5, the vertical height of the air inlet opening and the vertical height of the air inlet are arranged so as to be overlapped in the longitudinal direction of the vehicle. The vertical size of the cover member can be further shortened. Moreover, even if the air inlet is opened to the rear direction of the vehicle, the air can be inhaled smoothly.

[0031] According to the invention mentioned in claim 6, the direct inhalation of the traveling wind from the air inlet can be suppressed, which enable the stable inhalation. Moreover, compared with the case when the air inlet is opened to the vertical direction or opened to the side direction of the vehicle, the water, foreign materials and the like hardly enters the unpurified chamber. Moreover, even if the air cleaner case is disposed so as to be adjacent to the upper portion of the transmission case, the air can be inhaled smoothly without being obstructed by the transmission case. Accordingly, the air cleaner case can be disposed so as to be adjacent to the transmission case, which further suppresses the air cleaner apparatus projecting to the upper direction of the vehicle.

[0032] According to the invention mentioned in claim 7, the projecting portion can be functioned as a roof of the air inlet, which can suppress the water, foreign materials and the like entering the air inlet from above the vehicle. Moreover, the lower portion of the projecting portion can be functioned as a guide for the intake air, and the air can be inhaled smoothly.

[0033] According to the invention mentioned in claim 8, the lower portion of the passage forming portion is inclined so as to be positioned further downward, as it approaches to the rear side. Accordingly, compared with the case when the lower portion of the passage forming portion is inclined so as to be positioned further downward, as it approaches to the front side or the case when the lower portion of the passage forming portion is longitudinally and horizontally disposed, the water, foreign materials and the like hardly enter from the air inlet.

[0034] According to the invention mentioned in claim 9, the drain hole is formed at the position facing to the upper stream side end portion of the intake passage on the lowest portion of the passage forming portion, namely, in the vicinity of the lowest end of the intake passage. Accordingly, if the water and the like enter from the air inlet, it is possible to suppress the water and the like accumulating in the intake passage.

[0035] According to the invention mentioned in claim 10, the drain hole is formed at the position facing to at least one of the upper stream side end portions of the first intake passage and the second intake passage on the lower portion of the passage forming portion. Accordingly, even if the water and the like enter from the air inlet, it can suppress the water and the like accumulating the intake passage. Moreover, even if the passage forming portion is longitudinally long, it is possible to suppress the water and the like accumulating in the middle of the intake passage due to that the drain hole is formed at the position facing to at least one of the upper stream side end portions of the first intake passage and the second intake passage on the lower portion of the passage forming portion.

[0036] According to the invention mentioned in claim 11, the rib can straighten the intake air guided into the air inlet. Moreover, the rib partitions the air inlet, which suppress large foreign materials entering the air inlet. Moreover, the rib is formed at the portion facing to the air inlet. Accordingly, when the air inlet is seen from above the vehicle, the rib can shield the intake passage such that the inside thereof is hardly seen, which can improve

the outer appearance performance.

[0037] According to the invention mentioned in claim 12, the rib can be provided so as not to be exposed from the cover member in the side view. Accordingly, the rib can further effectively shield the intake passage such that the inside thereof is hardly seen from the outer appearance.

[0038] According to the invention mentioned in claim 13, the cover member can be easily fastened.

[0039] According to the invention mentioned in claim 14, the fastening member is not exposed to the outer appearance of the vehicle, which can improve the outer appearance performance.

[0040] According to the invention mentioned in claim 15, it is possible to suppress the clearance and the floating without increasing the number of fastening portion. When the cover member is formed so as to be longitudinally long, the intervals between the front and rear end portions of the cover member become larger. Accordingly, the clearance between the cover member and the air cleaner, and the floating of the cover member may be generated. However, according to the structure, the joint portion is formed between the front and rear fastening portions of the cover member. Accordingly, it is possible to suppress the clearance and the floating without increasing the fastening portion.

[0041] According to the invention mentioned in claim 16, the joint portion is not exposed to the outer appearance of the vehicle, which can improve the outer appearance performance.

[0042] According to the invention mentioned in claim 17, when the cover member is fastened to air cleaner case, the cover member can be temporarily fastened to the air cleaner case and the workability can be improved.

[0043] According to the invention mentioned in claim 18, even if the intake duct is inclined so as to be positioned further outward in the width direction of the vehicle as it approaches to the rear side, the projecting amount of the intake duct to the outward in the width direction of the vehicle is absorbed in the concave portion. Accordingly, it is possible to reduce the projecting amount of the air cleaner apparatus to the outside in the width direction of the vehicle.

[0044] According to the invention mentioned in claim 19, the convex portion is not exposed to the outer appearance of the vehicle, which can improve the outer appearance performance.

[Brief Description of the drawings]

[0045]

FIG.1 is a left side view of the motorcycle in one embodiment of the present invention.

FIG.2 is a sectional view taken along a II-II line in FIG.1.

FIG.3 is a back view of the air cleaner apparatus of the above-mentioned motorcycle.

FIG.4 is a left side view of the above-mentioned air cleaner apparatus.

FIG.5 is a left side view of the air cleaner case of the above-mentioned air cleaner apparatus.

FIG.6 is a right side view of the above-mentioned air cleaner apparatus in the state that the case cover is detached from the case main body.

FIG.7 is a perspective view of the above-mentioned air clearner apparatus in the state that the cover member is seen from the upper right and rear direction.

FIG.8 is a sectional view taken along a VIII-VIII line in FIG.4.

FIG.9 is a sectional view taken along a IX-IX line in FIG.4.

FIG.10 is a sectional view taken along a X-X line in FIG.4.

FIG.11 is a sectional view taken along a XI-XI line in FIG.4.

FIG.12 is a sectional view taken along a XII-XII line in FIG.4.

FIG.13 is a sectional view taken along a XIII-XIII line in FIG.4.

[Best Mode for Carrying Out the Invention]

[0046] Hereinafter, the embodiment of the present invention will be explained with reference to the drawings. Moreover, the directions in the following explanation such as "front" and "rear", "right" and "left" will be the same as the directions relative to the vehicle unless otherwise specified. An arrow "FR" showing the front direction of the vehicle, an arrow " LH" showing the left direction of the vehicle, and an arrow " UP" showing the upper direction of the vehicle are respectively shown on the proper places in the drawings.

[0047] FIG.1 is a left side view of a motorcycle 1 (straddle type vehicle) in one embodiment of the present invention. Hereinafter, the motorcycle 1 may be called as a "vehicle".

[0048] FIG.1 shows the motorcycle 1 in a scooter type, to which the one embodiment of the present invention is applied. The motorcycle 1 has a power unit 20 swingably supported on a body frame 10. The power unit 20 is continuously provided to a crank case 24 of an engine 22, and has a transmission case 26 extended from the crank case 24 to the rear direction in the left side of a rear wheel 3. The rear wheel 3 is rotatably supported on the rear end portion of the transmission case 26.

[0049] Moreover, in FIG.1, the engine 22 and the like which are included in the power unit 20 are shown in solid lines with partly breaking a left rear side body cover 9f and a left under side cover 9g, for convenience.

[0050] The front wheel 2 is disposed in the front direction of the power unit 20. The front wheel 2 is rotatably supported on the lower portion of right and left pair of front forks 4. A bridge 5 is disposed between upper portion of the right and left pair of front forks 4. A steering

shaft 6 as a steering shaft is vertically provided to stand on the center of the bridge 5 in the width direction of the vehicle.

[0051] A bar handle 7 is provided above the steering shaft 6. The bar handle 7 is configured with a single pipe member extended in the width direction of the vehicle. The steering system of the motorcycle 1 is mainly configured with the front wheel 2, the front fork 4, the steering shaft 6, and the bar handle 7 and the like.

[0052] The steering shaft 6 is rotatably supported on a head pipe 8 provided on the front end of the body frame 10. The body frame 10 is formed with a plurality of frame members integrally combined by welding and the like. The body frame 10 has a main frame 11 combined with the head pipe 8 at the front end, right and left pair of center frames 12 combined with the main frame 11 at the front and rear ends, and right and left pair of seat frames 13 combined with the right and left center frame 12 at the front end.

[0053] The main frame 11 has a down frame portion 11a, and right and left pair of lower frame portions 11b. The down frame portion 11a is slightly inclined relative to the vertical direction, and is extended downward from the head pipe 8 to the rear direction. The right and left lower frame portions 11b is extended from the rear end of the down frame portion 11a, respectively bifurcated to right and left, is substantially and horizontally extended to the rear direction, and then is extended upward to the rear direction.

[0054] Moreover, the configuration of the main frame 11 is not limited to the configuration such that the right and left lower frame portions 11b are extended from the rear end of the down frame portion 11a, are respectively bifurcated to right and left, and are extended to the rear direction. For example, the main frame 11 may have the configuration such that the right and left lower frame portions 11b is respectively extended from the rear end of the right and left pair of down frame portions 11a to the rear direction. Moreover, the main frame 11 may have the configuration such that the main frame is combined with a cross pipe is orthogonal to the rear end of the down frame portion 11a and is extended in the width direction of the vehicle, and the front ends of the right and left lower frame portions 11b are respectively combined with the right and left end portions of the cross pipe.

[0055] The right and left center frames 12 has a front frame portion 12a and a rear frame portion 12b. The right and left front frame portions 12a are extended downward from the vertical center portion of the down frame portion 11a of the main frame 11 to the rear direction. The right and left rear frame portions 12b are extended downward from the rear ends of the right and left front frame portions 12a to the rear direction in further steeply inclined manner than the right and left front frame portions 12a, and are reached to the longitudinal center portion of the right and left lower frame portions 11b of the main frame 11.

[0056] Right and left seat frames 13 are extended upward from the upper portion of the right and left rear frame portions 12b of the right and left center frame 12 to the rear direction. The rear end portion of the right and left lower frame portions 11b of the main frame 11 is combined with the longitudinal center portion of the right and left seat frames 13.

[0057] The front lower portion of the crank case 24 is supported on the longitudinal center portion of the right and left lower frame portions 11b of the main frame 11 through a link member 14. Accordingly, the unit swing type power unit 20 is vertically swingable through the link member 14. A cushion unit 15 is interposed between the rear end portion of the transmission case 26 in the power unit 20 and the rear portion of the right and left seat frames 13 of the body frame 10.

[0058] The air cleaner apparatus 30 including an air cleaner case 40 is provided on the upper portion of the transmission case 26. Supporting members 46a, 46b are respectively disposed on the front and rear lower portions of the air cleaner case 40. The air cleaner case 40 is fastened and fixed on the upper portion of the transmission case 26 with bolts 93 through the supporting members 46a, 46b.

[0059] In the side view, the air cleaner case 40 is disposed in the area surrounded by an upper edge of the transmission case 26, a lower edge of the rear portion of the left seat frame 13, and an axis of the cushion unit 15. The air cleaner case 40 is smaller than the transmission case 26. Specifically, the longitudinal maximum length of the air cleaner case 40 is shorter than the longitudinal maximum length of the transmission case 26. The vertical maximum length of the air cleaner case 40 is shorter than the vertical maximum length of the transmission case 26.

[0060] The air cleaner case 40 is disposed so as to be spaced apart at a predetermined distance from the lower edge of the rear portion of the left seat frame 13, and is disposed closer to the upper edge of the transmission case 26, in the side view (same as "in the side view of the vehicle"). Accordingly, the integrated appearance of the air cleaner case 40 and the transmission case 26 is enhanced, compared with the case when the air cleaner case 40 is disposed so as to be spaced apart at a predetermined distance from the upper edge of the transmission case 26, and is disposed closer to the lower edge of the rear portion of the left seat frame 13 in the side view.

[0061] The rear portion of the air cleaner case 40 is overlapped with the front lower portion of the cushion unit 15 in the side view. Accordingly, the integrated appearance of the air cleaner case 40 and the cushion unit 15 is enhanced, compared with the case when the rear portion of the air cleaner case 40 is disposed so as to be spaced apart at a predetermined distance from the cushion unit 15 in the side view.

[0062] A seat 17 on which a passenger sits is disposed above the power unit 20. The seat 17 is longitudinally extended. The seat 17 is integrally formed with a front seat 17a on which a rider sits and a reat seat 17b on which a pillion passenger sits.

[0063] The motorcycle 1 is covered with a body cover

9 configured with a plurality of exterior covers made of resin material.

A front cover 9a is disposed above the front wheel 2 and in front of the head pipe 8. A visor 9b is provided on the upper portion of the front cover 9a. The visor 9b stands upward from the upper portion of the front cover 9a to the rear direction in the side view. The visor 9b helps the traveling wind flowing upward from the front direction to the rear direction. The front cover 9a integrally has a front light 9c and right and left blinkers (not shown).

[0064] An inner cover 9d covering the periphery of the head pipe 8 and the steering shaft 6 from the rear direction, and a center cover 9e covering the periphery of the down frame portion 11a and right and left front frame portions 12a on the rear portion of the front cover 9a from above are provided on the rear portion of the front cover 9a. The center cover 9e is connected to the lower end of the inner cover 9d and is extend to the rear direction, and the rear end of the center cover 9e is reached to the lower direction of the front end of the seat 17.

[0065] Right and left pair of rear side body covers 9f covering the right and left seat frames 13 from the side directions are provided on the rear portion of the center cover 9e. The right and left rear side body covers 9f are connected to the rear end of the center cover 9e and are extended to the rear direction. The right and left rear side body covers 9f are disposed below the seat 17 and are extended so as to be long along the longitudinal direction of the vehicle, and are reached from the rear end of the center cover 9e to the upper direction of the rear wheel 3.

[0066] A right and left pair of underside covers 9g covering the periphery of the right and left lower frame portions 11b from the side directions are provided on the lower portion of the center cover 9e. The right and left under side covers 9g are extended along the longitudinal direction of the vehicle.

[0067] Right and left of step floors 16 covering the periphery of right and left lower frame portions 11b from above are provided between the upper edge portions of the right and left under side covers 9g. The right and left step floors 16 are disposed in the center in the width direction of the vehicle so as to be spaced apart from right to left. The right and left step floors 16 has a fixed width in the width direction of the vehicle, and the passengers can put their feet on the upper surface of the right and left step floors 16.

[0068] A straddling space 18 through which the passengers put the legs for riding is formed above the center cover 9e, and between the bar handle 7 and the seat 17. The driver (passengers) can ride on the motorcycle 1 by straddling the straddle space 18, sitting on the seat 17 (the front seat 17a) and putting the feet on the right and left step floors 16 provided on the center lower portion in the longitudinal direction of the vehicle.

[0069] The engine 22 of the power unit 20 has the crank case 24 containing a crankshaft (not shown) and a cylinder portion 21 provided on a combustion chamber (not shown). The cylinder portion 21 has a cylinder block, a cylinder head, a head cover, and the like. An intake pipe 23 is connected to the upper surface side of the front end portion of the cylinder portion 21. An exhaust pipe 25 is connected to the lower surface side of the front end portion of the cylinder portion 21.

[0070] The cylinder portion 21 projects upward from the front end portion of the crank case 24 to the front direction. Specifically, the cylinder portion 21 projects from the space between the rear inclined portions of the right and left lower frame portions 11b to the front direction in the state that the power unit 20 is attached to the body frame 10.

[0071] The crank shaft inside the crank case 24 extends in parallel to the shaft of the rear wheel 3 in the width direction of vehicle. An input side mechanism portion of a belt type stepless transmission (not shown) is connected to the left end portion of the crank shaft. An electric generator and a cooling fan (both of which are not shown) are connected to the right end portion of the crank shaft.

[0072] The transmission case 26 extends from the left side portion of the main body of the crank case 24 containing the crank shaft. The belt type stepless transmission is contained in the transmission case 26. The shaft of the rear wheel 3 is supported on the rear portion of the belt type stepless transmission through a reduction gear mechanism (not shown). The power of the engine 22 is output to the crank shaft and transmitted to the shaft of the rear wheel 3 through the belt type stepless transmission and the reduction gear mechanism.

[0073] The intake pipe 23 of the engine 22 is connected to the air cleaner apparatus 30 through a throttle body 27 and a connecting tube 28. The fresh air filtered by the air cleaner apparatus 30 is introduced to the intake portion of the engine 22 through the connecting tube 28, the throttle body 27, and the intake pipe 23.

[0074] An exhaust pipe 25 of the engine 22 is pulled out to the right side of the vehicle from below the engine 22, and is connected to a silencer (not shown) disposed on the right side direction of the rear wheel 3.

[0075] FIG.2 is the sectional view taken along the II-II line in FIG.1. Moreover, for convenience, the rear wheel 3 is shown in a two-dot chain line. Moreover, a body center axis CL extended to the longitudinal direction of the vehicle is shown in a dashed line in FIG.2.

[0076] As show in in FIG.2, the air cleaner apparatus 30 has the air cleaner case 40, the intake duct 50, and the cover member 60.

[0077] For example, the air cleaner case 40 is formed with resin and the like, has a depth in the width direction of the vehicle. The inside of the air cleaner case 40 is partitioned with the air cleaner element 42 into an unpurified chamber 44 conducted to the fresh air, and a purified chamber 46 conducted to the intake portion of the engine 22.

[0078] The air cleaner case 40 has a case main body 31 disposed in the side of the rear wheel 3, a case cover 32 disposed outside of the case main body 31 in the width

direction of the vehicle.

[0079] The case main body 31 has an outside opening edge portion 31a opened to the outside in the width direction of the vehicle.

[0080] The case cover 32 has an inside opening edge portion 32a, opened to the inside in the width direction of the vehicle so as to be overlapped with the outside opening edge portion 31a in the side view.

[0081] For example, the case main body 31 and the case cover 32 is formed by molding. A first flange portion 33 projecting to the outer peripheral side in the side view is formed on the outside opening edge portion 31a which is a peripheral edge portion of the opening of the case main body 31. A second flange portion 34 projecting to the outer peripheral side in the side view is formed on the inside opening edge portion 32a which is a peripheral edge portion of the opening of the case cover 32. The case main body 31 and the case cover 32 are combined by fastened from the outside with a plurality of fastening members 91 such as bolts and the like (see FIG.1. for example, seven fastening members in the present embodiment) in the state that the first flange portion 33 and the second flange portion 34 are abutted.

[0082] The air cleaner element 42 is formed with a filter paper folded in a bellow shape, is formed in a thick plate-like shape which is orthogonal to the right and left, as a whole. The outside edge portion of the air cleaner element 42 is held by an element holding plate 41. For example, the element holding plate 41 is formed with resin and the like. A sandwiching frame 41a projecting to the both sides in the width direction of the vehicle (the both sides in the depth direction) is integrally formed on an outer peripheral edge portion of the element holding plate 41. The sandwiching frame 41a is sandwiched and fixed with the first flange portion 33 and the second flange portion 34 through a seal member 43.

[0083] The element holding plate 41 integrally has a holding frame 41b holding and fixing the air cleaner element 42. The holding frame 41b is formed from the longitudinal center of the element holding plate 41 to the rear portion. The thickness of the holding frame 41b in the width direction of the vehicle is larger than the thickness of the sandwiching frame 41a in the width direction of the vehicle.

[0084] The case main body 31 is formed in an L-shape so as to be along the outer shape of the wheel 3 in the sectional view in FIG.2. Specifically, a front wall portion 31f of the case main body 31 is bulged from the first flange portion 33 on the front side of the case main body 31 to the inside in the width direction of the vehicle so as to be overlapped with the front end portion of the rear wheel3, in the cross sectional view in FIG.2. A longitudinal center wall portion 31m of the case main body 31 linearly extends from the rear end of a wall portion 31f to the rear direction in the cross sectional view in FIG.2. A rear wall portion 31r of the case main body 31 extends from the rear end of the longitudinal center wall portion 31m as a starting point to the outside in the width direction of the vehicle in the cross sectional view in FIG.2, then bends in a circular arc shape, extended to the rear direction and reached to the first flange portion 33 in the rear side of the case main body 31.

[0085] A tube connecting portion 31h connecting the longitudinal center portion of the connecting tube 28 is formed on the center of the front wall portion 31f of the case main body 31 in the width direction of the vehicle. A front portion 28a of the connecting tube 28 is disposed outside the case main body 31, and is linearly extended from the tube connecting portion 31h to the front direction. A rear portion 28b of the connecting tube 28 is disposed inside the case main body 31, and is inclined, bent, and extended so as to be positioned outward in the width direction of the vehicle, as it approaches to the rear side. An opening 28h on the rear end of the connecting tube 28 faces to the portion closer to the front portion of the longitudinal center of the purified chamber 46.

[0086] A convex portion 31d and a plurality of ribs 31c (for example, five convex portions in the present embodiment) are formed so as to be project to the outside in the width direction of the vehicle on the outside surface in the width direction of the vehicle (the case inner surface) of the longitudinal center wall portion 31m of the case main body 31. The convex portion 31d, the rib 31c and the like extend along the inner surface of the longitudinal center wall portion 31m of the case main body 31. Accordingly, the rigidity of the case main body 31 is secured.

[0087] A case cover 32 is formed along the outer shape of the case main body 31. Specifically, a front wall portion 32f of the case cover 32 inclinedes and extends from the second flange portion 34 on the front side of the case cover 32 to the rear direction, extends to the inside in the width direction of the vehicle, then bends and extends to the outside in the width direction of the vehicle, and forms an inclined portion 32c in the side view in FIG.2. The longitudinal center wall portion 32m of the case cover 32 inclines and extends from the rear end of the front wall portion 32f (the rear end of the inclined portion 32c) as a starting point so as to position further outward in the width direction of the vehicle as it approaches to the rear side, forms a convex portion 32t in a curved shape projecting to the outside in the width direction of the vehicle, then bends, curves, extends to the rear direction, forms a concave portion 32e, reaches to a rear edge 70k, and inclines and extends so as to position inward in the width direction of the vehicle as it approaches to the rear side, in the cross sectional view in FIG.2. The rear wall portion 32r of the case cover 32 bends from the rear end of the longitudinal center wall portion 32m to the inside in the width direction of the vehicle, and reaches to the second flange portion 34 on the rear side of the case cover 32, in the cross sectional view in FIG.2.

[0088] A duct connecting portion 32h is formed so as to connect the front portion of the intake duct 50 introducing the fresh air into the unpurified chamber 44 on the center in the width direction of the vehicle on the rear

portion (the inclined portion 32c) of the front wall portion 32f of the case cover 32. A duct connecting portion 32h fits into a groove formed on the outer wall surface of the front portion of the intake duct 50, and holds the front portion of the intake duct 50. The intake duct 50 is attached to the air cleaner case 40 so as to be communicated with the unpurified chamber 44. Simultaneously an inlet opening 52 directing to the front direction is formed. The air inlet opening 52 is positioned further frontward than the longitudinal center of the air cleaner case 40.

[0089] The intake duct 50 has a longitudinally long and cylindrical shape, and inclines and linearly extends so as to position further outward in the width direction of the vehicle so as to position as it approaches to the rear side. A front portion 50a of the intake duct 50 is disposed outside the case cover 32. A longitudinal center rear portion 50b of the intake duct 50 is disposed inside the case cover 32. An opening 53 on the rear end of the intake duct 50 faces to the unpurified chamber 44 outside the front portion of the air cleaner element 42 in the width direction of the vehicle.

[0090] The portion facing to the rear portion (the opening 53 on the rear end) of the intake duct 50 on the inside surface of the case cover 32 in the width direction of the vehicle is equivalent to the inside portion of the convex portion 32t. The inside portion forms concave portion 32d. Namely, the concave portion 32d avoiding the rear portion of the intake duct 50 is bent to the outside in the width direction of the vehicle, and is formed on the portion facing to the rear portion (the opening 53 on the rear end) of the intake duct 50 on the inside surface of the case cover 32 in the width direction of the vehicle. A convex portion 32t projecting to the outside in the width direction of the vehicle is formed at the position corresponding to the concave portion 32d on the outside surface of the case cover 32in the width direction of the vehicle. A cover member 60 covers the convex portion 32t from outward in the width direction of the vehicle. Accordingly, the convex portion 32t is hidden behind the cover member 60 in the side view.

[0091] An abutting surface 54 abutting on the outside portion of the holding frame 41b of the element holding plate 41 in the width direction of the vehicle is formed on the inside portion of the longitudinal center rear portion 50b of the intake duct 50 in the width direction of the vehicle. The inside portion of the longitudinal center rear portion 50b of the intake duct 50 in the width direction of the vehicle is supported on the case cover 32 through the below-mentioned supporting convex portion 51 (see FIG.6).

[0092] The cover member 60 is attached on the outside surface of the case cover 32 in the width direction of the vehicle. For example, the cover member 60 is made of resin and the like. The cover member 60 forms a gate-shaped opened to the inside in the width direction of the vehicle, and extends in the longitudinal direction of the vehicle such that the longitudinal length becomes longer than the vertical length. The cover member 60 forms an intake passage 62 longitudinally extending between the case cover 32 and the cover member. The cover member 60 covers the air inlet opening 52 of the intake duct 50 from outward in the width direction of the vehicle. The gate-shaped edge portion 60h forming an air inlet 70 and an edge portion 70i of the case cover 32 are formed on the rear end of the cover member 60.

[0093] A front wall portion 60f of the cover member 60 inclines and extends from the front end of the case cover 32 as a starting point to the outside in the width direction and inclines and extends so as to position further outward in the width direction of theew in FIG.2. A longitudinal center rear wall portion 60m of the cover member 60 more gently inclines than the front wall portion 60f, and extends from the rear end of the front wall portion 60f as a starting point so as to positionfurther outward in the width direction of the vehicle, as it approaches to the rear side, in the cross sectional view in FIG.2, bends to the inside in the width direction of the vehicle, and reaches to the gate-shaped edge portion 60h.

[0094] The air inlet 70 introducing the fresh air (the air) to the intake passage 62 is formed on the further rear direction than a longitudinal center of the air cleaner case 40 (a longitudinal center shaft ML of the air cleaner case 40, which extends to the width direction of the vehicle), and on the rear portion of the cover member 60. The air inlet 70 is opened to the rear direction of the vehicle. The air inlet 70 introduces the fresh air from the rear direction.

[0095] Moreover, the air inlet 70 may be positioned further rearward than the air inlet opening 52 of the intake duct 50, and may be configured so as to introduce the fresh air from the side direction, the upper direction, and the lower direction and the like of the vehicle.

[0096] A plurality of ribs 38 (see FIG.1. for example, three ribs in the present embodiment) extending to the longitudinal direction of the vehicle is formed on the portion facing to the air inlet 70 on the outside surface of the case cover 32 in the width direction of the vehicle. Specifically, the ribs 38 are formed between the middle of the convex portion 32t formed on the outside surface of the case cover 32 in the width direction of the vehicle and the rear end of the concave portion 32e in the rear direction of the convex portion. The outside edge of the rib 38 in the width direction of the vehicle extends rearward from the middle of the convex portion 32t to the left direction, and inclined and extended so as to be positioned further inside in the width direction of the vehicle as it approaches to the rear side, and smoothly connected to the outside surface of the case cover 32 in the width direction of the vehicle, in the cross sectional view in FIG.2. The rib 38 is bulged inside the upper stream end of the intake passage 62 in the cross sectional view in FIG.2. The rib 38 approximately and horizontally extends and hides the inside of the intake passage 62 when the air inlet 70 is seen from the rear and upper direction.

[0097] A passage forming portion 80 is formed such that the case cover 32 and the cover member 60 surround the intake passage 62 longitudinally extending. The pas-

sage forming portion 80 as an inner wall surface facing to the intake passage 62 has the outside surface of the case cover 32 in the width direction of the vehicle and the inside surface of the cover member 60 in the width direction of the vehicle.

[0098] The intake passage 62 has a first intake passage 62a positioned at the upper stream side (the rear side) of the intake passage 62 and a second intake passage 62b positioned at the lower stream side (the front side) of the intake passage 62.

[0099] The first intake passage 62a is formed between the longitudinal center wall portion 32m of the case cover 32 and the longitudinal center rear wall portion 60m of the cover member 60, and is connected to the air inlet 70. The fresh air is introduced from the air inlet 70 to the first intake passage 62a.

[0100] The second intake passage 62b is formed between the front wall portion 32f of the case cover 32 and the front wall portion 60f of the cover member 60, and is connected to the first intake passage 62a as well as to the air inlet opening 52. The fresh air is introduced through the first intake passage 62a to the second intake passage 62b. The fresh air is introduced through the second intake passage 62b to the air inlet opening 52.

[0101] The intake passage 62 and the air inlet 70 are surrounded with the rear portion (the upper stream end portion) of the passage forming portion 80. Specifically, a part of the intake passage 62 (the upper stream portion of the first intake passage 62a) and the air inlet 70 are surrounded with the concave portion 32e formed on the outside surface of the case cover 32 in the width direction of the vehicle and the inside surface of the cover member 60 in the width direction of the vehicle in the passage forming portion 80.

[0102] According to the above-mentioned configuration, when the engine 22 (see FIG.1) of the motorcycle 1 is started, the fresh air is introduced from the air inlet 70, and is guided through the intake passage 62 to the front direction, then is turned back heading for the inlet opening 52. After that, the fresh air flows into the unpurified chamber 44 through the intake duct 50. The fresh air flowed into the unpurified chamber 44 flows from the unpurified chamber 44 through the air cleaner element 42 into the purified chamber 46. The fresh air which flowed into the purified chamber 46 is passed through the connecting tube 28, the throttle body 27 and the intake pipe 23 which are shown in FIG.1 and is introduced to the intake portion of the engine 22.

[0103] FIG.3 is the back view of the air cleaner apparatus 30 of the above-mentioned motorcycle 1, which is same as the state that the air cleaner apparatus 30 is seen from the rear direction of the vehicle.

[0104] As shown in FIG.3, the projecting portion 36 projecting from the case cover 32 to the outside in the width direction of the vehicle is integrally formed in the rear and upper direction of the air inlet 70.

[0105] Moreover, even if the projecting portion 36 projects from the case cover 32 to the outside in the width direction of the vehicle, the projecting portion with a separate member may be disposed as a different body from the case cover 32.

[0106] The projecting portion 36 has a shape in the rear view such that the projecting portion extends downward from the upper end of the case cover 32 to the left direction and bends downward and bends to the inside in the width direction of the vehicle, and reaches to the air inlet 70. A maximum projecting width Wa of the projecting portion 36 in the width direction of the vehicle is larger than a maximum width Wb of the rib 38 in the width direction of the vehicle (Wa>Wb), simultaneously is smaller than a maximum width W1 of the cover member 60 in the width direction of the vehicle (Wa<W1). A maximum width Wc of the convex portion 32t in the width direction of the vehicle is smaller than the maximum width Wb of the rib 38 in the width direction of the vehicle (Wc<Wb).

[0107] Moreover, the projecting portion 36 is longitudinally extended and formed so as to cover the upper direction of the air inlet 70 in the side view in FIG.4.

[0108] The three ribs 38 are exposed from the air inlet 70. The three ribs 38 are vertically disposed at approximately same intervals. The air inlet 70 is partitioned by the three ribs 38 at approximately and vertically same intervals. Moreover, the three ribs are provided in the present embodiment. However, the invention is not limited to this embodiment, one or more than three ribs may be appropriately provided.

[0109] The outside edge of the cover member 60 in the width direction of the vehicle in the rear view linearly extends from the projecting portion 36 to the lower direction, inclines so as to position further inward in the width direction of the vehicle as it approaches to the lower side, and reaches to the lower portion of the case cover 32.

[0110] The outside edge of the cover member 60 in the width direction of the vehicle in the rear view is disposed further outside in the width direction of the vehicle than the transmission case 26. Namely, the maximum width W1 of the cover member 60 in the width direction of the vehicle is larger than the maximum width W2 of the transmission case 26 in the width direction of the vehicle (W1>W2) due to that the width of the air cleaner case 40 is extended as much as possible with less influence on the bank angle.

[0111] Moreover, the outside edge of the cover member 60 in the width direction of the vehicle in the rear view may be disposed further inside in the width direction of the vehicle than the transmission case 26. Namely, the maximum width W1 of the cover member 60 in the width direction of the vehicle may be smaller than the maximum width W2 of the transmission case 26 in the width direction of the vehicle (W1<W2). Accordingly, the air cleaner apparatus 30 can reduce the projection amount to the outside in the width direction of the vehicle, which enable to secure the clearance between the body cover 9 (see FIG.1) and the air cleaner apparatus.

[0112] The transmission case 26 has a transmission

case main body 26a and a transmission case cover 26b.

[0113] The belt type stepless transmission is contained in the transmission case main body 26a. The transmission case cover 26b is disposed outside the transmission case main body 26a in the width direction of the vehicle, and covers the left side direction of the belt type stepless transmission. Fastening member 92 including bolts fastens and fixs the outer peripheral edge portion of the transmission case cover 26b to the outer peripheral edge portion of the transmission case main body 26a. The outside surface of the transmission case cover 26b in the width direction of the vehicle has an arc-shape projecting to the left side direction.

[0114] FIG.4 is a left side view of the above-mentioned air cleaner apparatus 30. Moreover, for convenience, the air inlet 70 is shown in a dot hatch in FIG.4. Moreover, FIG.4 and the following FIGs.5, 6 are same as the state that air cleaner apparatus 30 installed on the vehicle is seen from the side surface of the vehicle.

[0115] As shown in FIG.4, the cover member 60 is disposed further inside than an outer shell 34a (an outer shape) of the air cleaner case 40 in the side view. The cover member 60 is disposed from the front end portion of the case cover 32 to the further rear part than the longitudinal center portion.

[0116] The outer shell 34a of the air cleaner case 40 includes an outline of the second flange portion 34 of the case cover 32. The outline of the second flange portion 34 is set as the outer shell 34a in the present embodiment. A first outer shell 34a1 of the outer shell 34a, which is longitudinally extended from the front end portion of the air cleaner case 40 to the vicinity of the rear end of the cover member 60, has a projecting and tapered shape such that the vertical intervals become smaller as it approaches to the front side in the side view. Meanwhile, a second outer shell 34a2 on the rear portion of the air cleaner case 40 behind the first outer shell 34a1 has a curved shape gently projecting than the front portion of the air cleaner case 40 such that the vertical intervals become smaller as it approaches to the rear side in the side view.

[0117] The passage forming portion 80 (a concave portion 81 of the case cover 32 shown in FIG.5) is formed from the front end of the cover member 60 to the further rear part than the rear end of the cover member 60. A lower portion 82 (the lower portion of the air cleaner case 40) of the passage forming portion 80 longitudinally extends and gently inclines so as to position further downward as it approaches to the rear side. A plurality of drain holes 84 opened to the lower direction are formed on the lower portion 82 of the passage forming portion 80. Specifically, The first drain hole 84a is formed on the portion facing to the upper stream side end portion of the first intake passage 62a (see FIG.2), and the second drain hole 84b is formed on the portion facing to the upper steam side end portion of the second intake passage 62b (see FIG.2) in the lower portion 82 of the passage forming portion 80.

[0118] The rib 38 is formed so as to be extended further rearward than the cover member 60 in the side view. Namely, the rear portion of the rib 38 is exposed from the cover member 60 (the air inlet 70) in the side view. The air inlet 70 has a rear edge 70k inclined so as to be positioned further rearward as it approaches to the upper side, approximately horizontal upper and lower edges 70j, 70m. The air inlet 70 forms an approximate parallelogram in the side view. The air inlet 70 is formed so as to be along a plane inclined downward and outward in the width direction of the vehicle relative to a plane (virtual surface) facing to the rear direction. Namely, the air inlet 70 is opened to the rear direction, simultaneously is opened to the lower direction and to the outside direction in the width direction of the vehicle. The longitudinally exposed lengths of the rear portion of the respective ribs 38 are approximately same, and are arranged in approximately parallel to the upper and lower edges 70j, 70m of the air inlet 70.

[0119] Moreover, a plurality of inserting holes 91h (for example, seven fastening members in the present embodiment) into which the fastening member 91 (see FIG. 1) including bolts are inserted is formed on the second flange portion 34 so as to be opened in the width direction of the vehicle.

[0120] A drain tube 39 is integrally formed on the rear lower end portion of the case cover 32 of the air cleaner case 40 so as to be projected downward to the rear direction.

[0121] FIG.5 is a left side view of the air cleaner case 40 of the above-mentioned air cleaner apparatus 30. Namely, FIG.5 is a left side view showing the state that cover member 60 is detached from the air cleaner apparatus 30. Moreover, for convenience, the outer shell (the outer shape) of the air inlet 70 is shown in a two-dot chain line in FIG.5. Moreover, the air inlet 70 as well as the concave portion 81 of the case cover 32 as a part of the passage forming portion 80 are shown in a dot hatch.

[0122] As shown in FIG.5, an upper end 52a of the air inlet opening 52 of the intake duct 50 is positioned further below than the upper end 70a of the air inlet 70 in the side view. Meanwhile, the lower end 52b of the air inlet opening 52 is positioned further above than the lower end 70b of the air inlet 70 in the side view.

[0123] Namely, the air inlet opening 52 is disposed between the virtual parallel axes passing through the upper and lower ends 70a, 70b of the air inlet 70 in the side view. A vertical height H2 of the air inlet opening 52, which is a distance between the upper and lower ends 52a, 52b of the air inlet opening 52, is smaller than a vertical height H1 of the air inlet 70, which is a distance between the upper and lower ends 70a, 70b of the air inlet 70 (H2<H1).

[0124] Moreover, the vertical positions of the upper and lower ends 70a, 70b of the air inlet 70 are approximately same as the vertical position of the upper and lower ends of the gate-shaped edge portion 60h of the cover member 60 (see FIG.4).

[0125] A rib 37 is formed on the front portion of the

case cover 32 of the air cleaner case 40 in the inner periphery side of the first outer shell 34a1 so as to be along the inner periphery of the first outser shell.
Accordingly, the rigidity of the front portion of the case cover 32 is secured, simultaneously the fresh air is hardly reached from the clearance between the case cover 32 and the cover member 60 to the air inlet opening 52 directly (see FIG.11).

[0126] The rib 37 extends downward from above the inlet opening 52 to the front direction, bends downward to the rear direction, then extends to the rear direction, and bends and reaches to the lower direction of the air inlet opening 52 in the side view.

[0127] A plurality of inserting holes (for example, four fastening members in the present embodiment: a first inserting hole 90h1; a second inserting hole 90h2; a third inserting hole 90h3; and a fourth inserting hole 90h4) into which the fastening member 90 (see FIG.6) including bolts and the like for attaching the cover member 60 are inserted is formed on the case cover 32 so as to be opened in the width direction of the vehicle.

[0128] The first inserting hole 90h1 is formed on the first boss receive portion 90a positioned above the upper rib 38. The second inserting hole 90h2 is formed on the second boss receive portion 90b positioned below the lower rib 38. The third inserting hole 90h3 is formed on the third boss receive portion 90c positioned above the air inlet opening 52. The fourth inserting hole 90h4 is formed on the fourth boss receive portion 90d positioned below the air inlet opening 52. The diameter of the second inserting hole 90h2 is larger than the diameters of the first inserting hole 90h1 and the like in a manner that a tip 65t (the inside end in the width direction of the vehicle, as shown in FIG.9) of a second fastening boss 65b can be inserted. Accordingly, when the cover member 60 is fastened to the case cover 32, the cover member is positioned with the second fastening boss 65 and the second inserting hole 90h2. Then, the fastening member 90 including bolts and the like is inserted into the first inserting hole 90h1 and the like.

[0129] A plurality of (for example, two fitting concaved portions in the present embodiment) fitting concaved portions 32k, 32k2 into which below-described joint portions 64 (see FIG.7) are fitted are formed on the case cover 32.

[0130] The first fitting concaved portion 32k1 is positioned at the longitudinal center between the first boss receive portion 90a and the third boss receive portion 90c.

[0131] The second fitting concaved portion 32k2 is positioned at the longitudinal center between the second boss receive portion 90b and the fourth boss receive portion 90d.

[0132] The first fitting concaved portion 32k1 and the second fitting concaved portion 32k2 are respectively formed so as to be recessed from the outside surface (the case outer surface) of the case cover 32 in the width direction of the vehicle to the inside in the width direction of the vehicle (see FIG.8).

[0133] FIG.6 is a right side view of the above-mentioned air cleaner apparatus 30 in the state that the case cover 32 is detached from the case main body 31.

[0134] As shown in FIG.6, the fastening members 90 including bolts are inserted into the inserting holes 90h1 to 90h4 respectively, and are screwed and fastened into fastening portions 90j (see FIG.7) of the below-mentioned fastening bosses 65 formed on the cover member 60 from the inside of the case cover 32 in the width direction of the vehicle. The cover member 60 is fastened to the case cover 32 with the fastening members 90 including bolts fastening from the inside of the case cover 32 in the width direction of the vehicle. The cover member 60 covers the fastening member 90 so as not to be exposed from the cover member 60 in the side view. Namely, all of fastening members 90 are fastened from the inside in the width direction of the vehicle.

[0135] A supporting convex portion 51 is projected downward and integrally formed on the lower side of a longitudinal center rear portion 50b of the intake duct 50. An inserting hole 51h opened in the width direction of the vehicle is formed on the supporting convex portion 51. The intake duct 50 is fastened and supported on the case cover 32 by inserting the fastening members including bolts, for example, into the inserting holes 51h of the supporting convex portion 51, and by screwing and fastening into the fastening portion of the case cover 32.

[0136] A latticed rib 55 is integrally formed on the longitudinal center rear portion 50b of the intake duct 50 in the side view. Accordingly, the rigidity of the longitudinal center rear portion 50b of the intake duct 50 is secured.

[0137] Moreover, the portion positioned just above the supporting convex portion 51 of the ribs 55 crosses with the abutting surface 54.

[0138] FIG.7 is a perspective view of the above-mentioned air clearner apparatus 30 in the state that the cover member 60 is seen from the upper right and rear direction.

[0139] As shown in FIG.7, a plurality of fastening bosses 65 (for example, four fastening bosses 65a to 65d in the present embodiment) are integrally formed on the front portion and the rear portion of the cover member 60. The cover member 60 is fastened to the case cover 32 with the respective fastening bosses 65a to 65d.

[0140] The first fastening boss 65a is positioned at the rear and upper portion of the cover member 60 and in the front and upper direction of the upper end of the gate-shaped edge portion 60h. The second fastening boss 65b is positioned at the rear and lower portion of the cover member 60 and in the front direction of the lower end of the gate-shaped edge portion 60h. The third fastening boss 65c is positioned at the front and upper portion of the cover member 60. The fourth fastening boss 65d is positioned at the front and lower portion of the cover member 60. The second drain hole 84b is formed so as to be recessed outward in a notched shape in the width direction of the vehicle on the front and lower portion of the cover member 60 and in the front direction of the

fourth fastening boss 65d.

[0141] The first joint portion 64a is formed between the front and rear fastening portions on the upper portion of the cover member 60 (between the first fastening boss 65a and the third fastening boss 65c).

[0142] The first joint portion 64 has an engaging hook 66 and a fitting convex portion 67.

[0143] The tip portion (the inside end portion in the width direction of the vehicle) of the engaging hook 66 is projected above from the upper end edge of the cover member 60. The engaging hook 66 is engaged with an engaging concave portion 32j (see FIG.8) recessed to the upper direction so as to be formed further inside in the width direction of the vehicle than an upper end edge portion 32p just above the first fitting concaved portion 32k1 of the case cover 32. The engaging hook 66 functions as an axial direction regulating portion regulating the movement of the cover member 60 to the fastening axis direction (the outside in the width direction of the vehicle) of the fastening member 90 in the state before fastening the cover member 60 with the fastening members 90, namely, in the temporarily holding state of the cover member 60 (see FIG.8).

[0144] In the temporary holding state of the cover member 60, a root portion 60p of the engaging hook 66 is abutted on the lower surface of the upper end edge portion 32p in the upper side of the first fitting concaved portion 32k1 and controls the upward movement of the cover member 60 in the orthogonal direction to the fastening axis of the fastening member 90 (see FIG.8).

[0145] The fitting convex portion 67 is disposed just below the engaging hook 66. The fitting convex portion 67 is projected from the inside surface of the cover member 60 in the width direction of the vehicle (the inner surface) to the inward in the width direction of the vehicle.

[0146] The fitting convex portion 67 has a tip shape corresponding to the recessed shape of the first fitting concaved portion 32k1. The fitting convex portion 67 decides the longitudinal position of the cover member 60 (see FIG.8).

[0147] The second joint portion 64b is formed between the front and rear fastening portions (between the second fastening boss 65b and the fourth fastening boss 65d) on the lower portion of the cover member 60.

[0148] The second joint portion 64b has an upward extended portion 64c extended upward from the inside surface (the inner surface) in the width direction of the vehicle of the cover member 60, and a projecting portion 64d projected from the upward extended portion 64c to the inward in the width direction of the vehicle (the right direction). In the temporary holding state of the cover member 60, the projecting portion 64d of the second joint portion 64b is abutted on the upper surface of the lower end edge portion 32q in the lower side of the second fitting concaved portion 32k2 and functions as the cross direction regulating portion which controls the downward movement of the cover member 60 in the orthogonal direction to the fastening axis of the fastening member 90 (see FIG.8).

[0149] A plurality of ribs 68 (for example, a pair of upper and lower ribs in the present embodiment) extended to the width direction of the vehicle are approximately and horizontally formed on the front end portion of the cover member 60. A notch 68a engaged with the rib 37 from the inner periphery side of the case cover 32 at the inside end of the rib 68 in the width direction of the vehicle is formed. Accordingly, the positioning of front end portion of the cover member 60 becomes easier. Moreover, the rib 68 is approximately and horizontally formed, which enable to secure the rigidity of the front end portion of the cover member 60. Moreover, the rib 68 can straighten the fresh air introduced into the second intake passage 62b (see FIG.2).

[0150] FIG.8 is a sectional view taken along a VIII-VIII line in FIG.4. FIG.9 is a sectional view taken along a IX-IX line in FIG.4. FIG.10 is a sectional view taken along a X-X line in FIG.4.

[0151] As shown in FIG.8, the first joint portion 64a, the first fitting concaved portion 32k1, the second joint portion 64b, and the second fitting concaved portion 32k2 are positioned outside the intake passage 62, respectively.

[0152] Specifically, the first joint portion 64a and the first fitting concaved portion 32k1 are respectively disposed at the positions offset above the upper end 62j of the intake passage 62, namely, the upper end (the upper end 81a of the concave portion 81) of the passage forming portion 80 forming the intake passage 62.

[0153] Meanwhile, the second joint portion 64b and the second fitting concaved portion 32k2 are respectively disposed at the positions offset inward in the width direction the vehicle than the inside end of the lower portion of the passage forming portion 80 (the inside end 81s of the concave portion 81 in the width direction of the vehicle) in the width direction of the vehicle.

[0154] The upper end edge portion 32p of the case cover 32 covers the engaging hook 66 of the first joint portion 64a from above so as not to be exposed from the cover member 60 and the air cleaner case 40 to the outside.

[0155] The cover member 60 covers the fitting convex portion 67 of the first joint portion 64a from outward in the width direction of the vehicle so as not to be exposed from the cover member 60 and the air cleaner case 40 to the outside.

[0156] The cover member 60 covers the second joint portion 64b from below so as not to be exposed from the cover member 60 and the air cleaner case 40 to the outside.

[0157] The outside edge of the upper portion of the cover member 60 in the width direction of the vehicle is extended upward from the upper end 62j of the intake passage 62 to the right direction and is smoothly connected to the outside edge of the upper portion of the case cover 32 in the width direction of the vehicle in the cross sectional view in FIG.8.

[0158] The outside edge of the lower portion of the cover member 60 in the width direction of the vehicle is extended downward from the lower end 62k of the intake passage 62 and is smoothly connected to the lower end edge of the lower portion of the case cover 32 in the cross sectional view in FIG.8.

[0159] Moreover, in the cross sectional view in FIG.9 and in the sectional view in FIG.10 as well as in the cross sectional view in FIG.8, the outside edges of the upper and lower end portions of the cover member 60 in the width direction of the vehicle are respectively and smoothly connected to the outside edge of the upper portion of the case cover 32 in the width direction of the vehicle and to the lower end edge of the lower portion of the case cover.

[0160] As shown in FIG.9, the first fastening boss 65a and the first boss receive portion 90a, as well as the second fastening boss 65b and the second boss receive portion 90b are respectively positioned at the outside of the intake passage 62.

[0161] Specifically, the first fastening boss 65a and the first boss receive portion 90a are respectively disposed at the positions offset above the upper end 62j of the intake passage 62, namely, the upper end (the upper end 81a of the concave portion 81) of the passage forming portion 80 forming the intake passage 62

[0162] Meanwhile, the second fastening boss 65b and the second boss receive portion 90b are respectively disposed at the positions offset further inward in the width direction of the vehicle than the inside end lower portion of the passage forming portion 80 in the width direction of the vehicle (the inside end 81s of the concave portion 81 in the width direction of the vehicle).

[0163] Moreover, without showing in the drawings, the third fastening boss 65c and the third boss receive portion 90c are disposed at the positions offset above the upper end 62j of the intake passage 62, namely, the upper end of the passage forming portion 80 (the upper end 81a of the concave portion 81) forming the intake passage 62.

[0164] Meanwhile, the fourth fastening boss 65d and the fourth boss receive portion 90d are respectively disposed at the positions offset inward in the width direction of the vehicle than the inside end of the lower portion of the passage forming portion 80 in the width direction of the vehicle (the inside end in the width direction of the vehicle 81s of the concave portion 81).

[0165] FIG.11 is the sectional view taken along the XI-XI line in FIG.4.

[0166] As shown in FIG.11, the rib 37 is the portion facing to the second intake passage 62b of the case cover 32 and projects from the position corresponding to the inside opening edge portion 32a to the outward in the width direction of the vehicle. The rib 37 of the case cover 32 controls the movement of the outer peripheral edge portion 60p of the cover member 60 to the direction crossing with the width direction of the vehicle.

[0167] The outer peripheral edge of the front portion of the cover member 60 is smoothly connected to the front end edge of the case cover 32 in the cross sectional view in FIG.11.

[0168] FIG.12 is the sectional view taken along the XII-XII line in FIG.4.

[0169] As shown in FIG.12, the second drain hole 84b is formed so as to be recessed outward in a notched shape in the side view in the width direction of the vehicle on the portion facing to the upper stream side end portion of the second intake passage 62b on the lower portion of the cover member 60. The portion facing to the upper stream side end portion of the second intake passage 62b on the lower portion of the cover member 60 inclines and extends so as to be positioned further below as it approaches to the inside in the width direction of the vehicle in the cross sectional view in FIG.12 and reaches to the second drain hole 84b.

[0170] The rib 37 is the portion facing to the upper stream side end portion of the second intake passage 62b on the lower portion of the case cover 32 longitudinally extends above the second drain hole 84. Accordingly, it is possible to suppress foreign materials entering from the second drain hole 84b into the second intake passage 62b.

[0171] FIG.13 is the sectional view taken along the XIII-XIII line in FIG.4.

[0172] As shown in FIG.13, the first drain hole 84a is formed so so as to be recessed inward in a notched shape in the width direction of the vehicle in the cross sectional view on the portion facing to the upper stream side end portion of the first intake passage 62a on the lower portion of the case cover 32. The inside edge in the width direction of the vehicle on the portion facing to upper stream side end portion of the first intake passage 62a on the lower portion of the cover member 60 inclines and extends so as to position further below as it approaches to the inside in the width direction of the vehicle in the cross sectional view and reaches to the first drain hole 84a.

[0173] As mentioned above, the present embodiment is characterized in that in the air cleaner apparatus 30 comprising: an air cleaner case 40 whose inside is divided into the unpurified chamber 44 and the purified chamber 46 by the air cleaner element 42; the intake duct 50 attached to the air cleaner case 40 so as to communicate with the unpurified chamber 44, simultaneously provided with the air inlet opening 52 directing the front direction; the cover member 60 attached to the outside surface of the air cleaner case 40 in the width direction of the vehicle, simultaneously forming the intake passage 62 between the air cleaner case 40 and the cover member and covering the air inlet opening 52, the cover member 60 extends in the longitudinal direction of the vehicle such that the longitudinal length becomes longer than the vertical length, the air inlet opening 52 is positioned further frontward than the longitudinal center of the air cleaner case 40, the air inlet 70 to the intake passage 62 is formed further rearward than the longitudinal center of the air cleaner case 40 as well as on the rear portion of the cover member 60.

[0174] According to the structure, the air inlet opening 52 is positioned further frontward than the longitudinal center of the air cleaner case 40, the air inlet 70 is formed further rearward than the longitudinal center of the air cleaner case 40 as well as on the rear portion of the cover member 60, the intake air from the air inlet 70 is guided to the front direction inside the intake passage 62. Then the intake air turns back to the air inlet opening 52. Thus, the labyrinth structure can be formed by using the longitudinally long intake passage 62 of the air cleaner case 40, which suppress the water, foreign materials and the like entering the unpurified chamber 44.

[0175] Moreover, the cover member 60 extends in the longitudinal direction of the vehicle such that the longitudinal length becomes longer than the vertical length. Accordingly, it is possible to reduce the vertically projecting amount of the cover member 60 to the air cleaner case 40, and the outer appearance performance can be improved.

[0176] Therefore, it is possible to suppress the water, foreign materials and the like entering the unpurified chamber 44, simultaneously the outer appearance performance can be improved.

[0177] Moreover, the above-mentioned embodiment, the straddle type vehicle 1 has the power unit 20 swingably supported on the body frame 10. The power unit 20 has the transmission case 26 continuously provided to the crank case 24 of the engine 22 and extended from the crank case 24 to the rear direction. The air cleaner case 40 is disposed above the transmission case 26. When the air cleaner case 40 is disposed above the transmission case 26, the air inlet 70 is exposed to the outside. Accordingly, the water, foreign materials and the like are more likely to enter the unpurified chamber 44, compared with the case when the air cleaner case 40 is disposed inside the vehicle. Therefore, according to the configuration, the air cleaner case 40 is disposed above the transmission case 26. Accordingly, the labyrinth structure can effectively achieve to suppress the water, foreign materials and the like entering the unpurified chamber 44. Moreover, even if the cover member 60 is disposed above the transmission case 26, the cover member 60 has the longitudinally long shape. Accordingly, the clearance between the transmission case 26 and the cover member 60 can be easily secured, and the swinging amount of the power unit 20 can be fully secured.

[0178] Moreover, in the above-mentioned embodiment, the cover member 60 is disposed further inside than the outer shell 34a of the air cleaner case 40 in the side view. Accordingly, the cover member 60 can be compactly provided on the air cleaner case 40 such that the cover member 60 does not protrude from the outer shell 34a of the air cleaner case 40 in the side view. Thus, compared with the case when the cover member 60 is disposed so as to protrude from the outer shell 34a of the air cleaner case 40 in the side view, the integrated appearance of the cover member 60 and the air cleaner case 40 is enhanced, and the outer appearance performance is further improved.

[0179] Moreover, in the above-mentioned embodiment, the air cleaner case 40 has the case main body 31 having the first flange portion 33 forming the outside opening edge portion 31a opened to the outside in the width direction of the vehicle, and the second flange portion 34 forming the inside opening edge portion 32a opened to the inside in the width direction of the vehicle so as to be overlapped with the outside opening edge portion 31a in the side view, and also has the case cover 32 disposed on the outside of the case main body 31 in the width direction of the vehicle, and the the outline of the second flange portion 34 is set as outer shell 34a. Accordingly, it is possible to downsize the cover member 60 and to further improve the integrated appearance of the cover member 60 and the air cleaner case 40. Moreover, even if the cover member 60 is disposed outside the case cover 32, it is possible to simplify the outer shell shape of the case cover 32.

[0180] Moreover, the above-mentioned embodiment, the upper end 52a of the air inlet opening 52 is positioned below the upper end 70a of the air inlet 70, simultaneously the lower end 52b of the air inlet opening 52 is positioned above the lower end 70b of the air inlet 70. Accordingly, the vertical height of the air inlet opening 52 and the vertical height of the air inlet 70 are arranged so as to be overlapped in the longitudinal direction of the vehicle. The vertical size of the cover member 60 can be further shortened. Moreover, even if the air inlet 70 is opened to the rear direction of the vehicle, the air can be inhaled smoothly.

[0181] Moreover, in the above-mentioned embodiment, the air inlet 70 is opend to the rear direction of the vehicle. Accordingly, the direct inhalation of the traveling wind from the air inlet 70 can be suppressed, which makes the stable inhalation possible. Moreover, compared with the case when the air inlet 70 is opened to the vertical direction or opened to the side direction of the vehicle, the water, foreign materials and the like hardly enters the unpurified chamber 44.

[0182] Moreover, even if the air cleaner case 40 is disposed so as to be adjacent to the upper portion of the transmission case 26, the air can be inhaled smoothly without being obstructed by the transmission case 26. Accordingly, the air cleaner case 40 can be disposed so as to be adjacent to the transmission case 26, which further suppresses the air cleaner apparatus 30 to project to the upper direction of the vehicle.

[0183] Moreover, the above-mentioned embodiment, the projecting portion 36 projecting from the air cleaner case 40 to the outside in the width direction of the vehicle is disposed in the rear and upper direction of the air inlet 70. Accordingly, the projecting portion 36 can be functioned as the roof of the air inlet 70, which can suppress the water, foreign materials and the like entering the air inlet 70 from above the vehicle. Moreover, the lower portion of the projecting portion 36 can be functioned as the guide for the intake air, and the air can be inhaled smooth-

ly.

[0184] Moreover, in the above-mentioned embodiment, the passage forming portion 80 is formed with the air cleaner case 40 and the cover member 60 so as to surround the intake passage 62 and the lower portion 82 of the passage forming portion 80 is inclined so as to be positioned further downward as it approaches to the rear side. Accordingly, compared with the case when the lower portion of the passage forming portion 80 is inclined so as to be positioned further downward, as it approaches to the front side or the case when the lower portion of the passage forming portion 80 is longitudinally and horizontally disposed, the water, foreign materials and the like hardly enter from the air inlet 70.

[0185] Moreover, in the above-mentioned embodiment, the drain hole 84 is formed at the position facing to the upper stream side end portion of the intake passage 62 on the lower portion 82 of the passage forming portion 80. Accordingly, the drain hole 84 is formed in the vicinity of the lowest end of the intake passage 62. If the water and the like enter from the air inlet 70, it is possible to suppress the water and the like accumulating in the intake passage 62.

[0186] Moreover, in the above-mentioned embodiment, the intake passage 62 has the first intake passage 62a connected to the air inlet 70, the second intake passage 62b connected to the first intake passage 62a as well as connected to the air inlet opening 52, and the drain holes 84a, 84b are formed at the respective positions facing to the upper stream side end portions of the first intake passage 62a and the second intake passage 62b on the lower portion 82 of the passage forming portion 80. Accordingly, if the water and the like enter from the air inlet 70, it is possible to suppress the water and the like accumulating in the intake passage 62. Even if the passage forming portion 80 is longitudinally long, the drain holes 84a, 84b are formed at the respective positions facing to the upper stream side end portions of the first intake passage 62a and the second intake passage 62b on the lower portion 82 of the passage forming portion 80. Accordingly, it is possible to suppress the water and the like accumulating in the middle of the intake passage 62.

[0187] Moreover, in the above-mentioned embodiment, the rib 38 extended in the longitudinal direction of the vehicle is formed on the portions facing to the air inlet 70 of the air cleaner case 40. Accordingly, the rib 38 can straighten the intake air guided into the air inlet 70. Moreover, the rib 38 partitions the air inlet 70, which suppress large foreign materials entering the air inlet 70. Moreover, the rib 38 is formed at the portion facing to the air inlet 70. Accordingly, when the air inlet 70 is seen from above the vehicle, the rib 38 can shield the intake passage 62 such that the inside thereof is hardly seen, which can improve the outer appearance performance.

[0188] Moreover, in the above-mentioned embodiment, the rib 38 is formed so as to be extended further rearward than the cover member 60 in the side view. Accordingly, the rib 38 can be provided so as to be exposed from the cover member 60 in the side view. Accordingly, the rib can further effectively shield the intake passage 62 such that the inside thereof is hardly seen.

[0189] Moreover, in the above-mentioned embodiment, the air cleaner case 40 has the case main body 31 having the outside opening edge portion 31a opened to the outside in the width direction of the vehicle, the case cover 32 having the inside opening edge portion 32a opened to the inside in the width direction of the vehicle so as to be overlapped with the outside opening edge portion 31a in the side view and disposed on the outside of the case main body 31 in the width direction of the vehicle, and the cover member 60 is attached to the case cover 32 with the fastening member 90 fastening from the inside of the case cover 32 in the width direction of the vehicle. Accordingly, the cover member 60 can be easily fastened.

[0190] Moreover, in the above-mentioned embodiment, the fastening member 90 is covered with the cover member 60 so as not to be exposed from the cover member 60 in the side view. Accordingly, the fastening member 90 is not exposed to the outer appearance of the vehicle, which can improve the outer appearance performance.

[0191] Moreover, in the above-mentioned embodiment, the cover member 60 is fastened to the air cleaner case 40 at the front portion and the rear portion of the cover member 60, the joint portion 64 for fitting the cover member 60 and the air cleaner case 40 is formed between the front side fastening portions 65c, 65d provided on the front portion of the cover member 60 and the rear side fastening portions 65a, 65b provided on the rear portion of the cover member 60. When the cover member 60 is formed so as to be longitudinally long, the intervals between the front and rear end portions of the cover member 60 become larger. Accordingly, the clearance between the cover member 60 and the air cleaner case 40, and the floating of the cover member 60 may be generated between the front and rear end portions of the cover member 60. However, according to the structure, the joint portion 64 is formed between the front and rear fastening portions of the cover member 60. Accordingly, it is possible to suppress the clearance and the floating without increasing the number of fastening portion.

[0192] Moreover, in the above-mentioned embodiment, the joint portion 64 is covered with at least one of the cover member 60 and the air cleaner case 40 so as not to be exposed from the cover member 60 and the air cleaner case 40 to the outside in the side view. Accordingly, the joint portion 64 is not exposed to the outer appearance of the vehicle, which can improve the outer appearance performance.

[0193] Moreover, in the above-mentioned embodiment, the air cleaner case 40 has the case main body 31 having the outside opening edge portion 31a opened to the outside in the width direction of the vehicle, and the case cover 32 having the inside opening edge portion

32a opened to the inside in the width direction of the vehicle so as to be overlapped with the outside opening edge portion 31a in the side view and disposed on the outside of the case main body 31 in the width direction of the vehicle, and the cover member 60 is attached to the case cover 32 with the fastening member 90 fastening from the inside of the case cover 32 in the width direction of the vehicle, and the joint portion 64 has the engaging hook 66 regulating the movement of the cover member 60 along the fastening axis direction of the fastening member 90. Accordingly, when the cover member 60 is fastened to air cleaner case 40, the cover member 60 can be temporarily fastened to the cleaner case 40 and the workability can be improved.

[0194] Moreover, in the above-mentioned embodiment, the intake duct 50 is inclined so as to be positioned further outward in the width direction of the vehicle as it approaches to the rear side, and the concave portion 32d avoiding the rear portion of the intake duct 50 is formed on the portion facing to the rear portion of the intake duct 50 of the inside surface of the air cleaner case 40 in the width direction of the vehicle. Accordingly, even if the intake duct 50 is inclined so as to be positioned further outward in the width direction of the vehicle as it approaches to the rear side, the projecting amount of the intake duct 50 to the outward in the width direction of the vehicle is absorbed in the concave portion 32d. Accordingly, it is possible to reduce the projecting amount of the air cleaner apparatus 30 to the outside in the width direction of the vehicle.

[0195] Moreover, in the above-mentioned embodiment, the convex portion 32t projecting to the outside in the width direction of the vehicle at the position corresponding to the concave portion 32d on the outside surface of the air cleaner case 40 in the width direction of the vehicle, and the convex portion 32t is covered with the cover member 60. Accordingly, the convex portion 32t is not exposed to the outer appearance of the vehicle, which can improve the outer appearance performance.

[0196] Moreover, in the above-mentioned embodiment, the intake passage 62 and the air inlet 70 are surrounded with the passage forming portion 80 formed with the concave portion 32e formed on the outside surface of the air cleaner case 40 in the width direction of the vehicle and the inside surface of the cover member 60 in the width direction of the vehicle. Accordingly, when the intake passage 62 and the air inlet 70 are formed, the outside surface of the air cleaner case 40 in the width direction of the vehicle can be used. There is no need to provide separate components for forming the intake passage 62 and the air inlet 70. Therefore, the number of components can be reduced. Simultaneously, it is possible to reduce the projecting amount of the air cleaner apparatus 30 to the outside in the width direction of the vehicle.

[0197] Moreover, in the above-mentioned embodiment, due to the fact that the fastening bosses 65 are positioned outside the intake passage 62, the fastening bosses 65 are not disposed on the intake passage 62. Accordingly, the intake resistance can be reduced.

[0198] Moreover, due to the fact that the upper and lower joint portions 64 are positioned outside the intake passage 62, the joint portions 64 are not disposed on the intake passage 62. Accordingly, the intake resistance can be reduced.

[0199] Moreover, in the above-mentioned embodiment, the upper joint portion 64a has the engaging hook 66 as the axial direction regulating portion regulating the movement of the cover member 60 to the fastening axis direction of the fastening member 90. Simultaneously, the lower joint portion 64b functions as the cross direction regulating portion which regulates the movement of the cover member 60 in the orthogonal direction (the vertical direction of the vehicle) to the fastening axis. Accordingly, the floating of the cover member 60 to the opened direction can be suppressed.

[0200] Moreover, in the above-mentioned embodiment, the outside edge of the cover member 60 in the width direction of the vehicle is smoothly connected to the outside edge of the case cover 32 in the width direction of the vehicle. Accordingly, the integrated appearance of the cover member 60 and the air cleaner case 40 including the case cover 32 is enhanced, and the outer appearance is further improved.

[0201] Moreover, the present invention is not limited to the above-mentioned embodiment. For example, the straddle type vehicle includes general vehicles such that the rider straddles the vehicle body. Not only motorcycles (including motorized bicycle and scooter-type vehicle) but also tricycle (including front single-wheel and rear double-wheels vehicle, and front double-wheels and rear single-wheel vehicle) or four-wheeled vehicle are included.

[0202] Moreover, the straddle type vehicle are not limited to swing unit type vehicle and may be the vehicle such that the engine and the air cleaner apparatus are fixedly supported on the body frame.

Then, the configuration in the above-mentioned embodiment is the example of the present invention, the components of the embodiment can be replaced with the components widely known. Various modification can be possible within the scopes of the present invention.

[Description of Reference Numerals]

[0203]

1 motorcycle (straddle type vehicle)
10 body frame
20 power unit
22 engine
24 crank case
26 transmission case
30 air cleaner apparatus
31 case main body
31a outside opening edge portion

32 case cover
32a inside opening edge portion
32d concave portion
32t convex portion
34a outer shell
36 projecting portion
38 rib
40 air cleaner case
42 air cleaner element
44 unpurified chamber
46 purified chamber
50 intake duct
52 air inlet opening
52a upper end of the air inlet opening
52b lower end of the air inlet opening
60 cover member
62 intake passage
62a first intake passage
62b second intake passage
64 joint portion
65a first fastening boss (rear side fastening portion)
65b second fastening boss (rear side fastening portion)
65c third fastening boss (front side fastening portion)
65d fourth fastening boss (front side fastening portion)
66 engaging hook (axial direction regulating portion)
70 air inlet
70a upper end of the air inlet
70b lower end of the air inlet
80 passage forming portion
82 lower portion of the passage forming portion
84 drain hole
90 fastening member

Claims

1. An air cleaner apparatus (30) comprising:

an air cleaner case (40) whose inside is divided into an unpurified chamber (44) and a purified chamber (46) by an air cleaner element (42);
an intake duct (50) attached to said air cleaner case (40) so as to communicate with said unpurified chamber (44), simultaneously provided with an air inlet opening (52) directing the front direction;
a cover member (60) attached to the outside surface of said air cleaner case (40) in the width direction of the vehicle, simultaneously forming an intake passage (62) between said air cleaner case (40) and the cover member, and covering the air inlet opening (52), and
a cleaner apparatus for straddle type vehicle (1), **characterized in that** said cover member (60) extends in the longitudinal direction of the vehicle such that the longitudinal length becomes longer than the vertical length, said air inlet opening (52) is positioned further frontward than the longitudinal center of said air cleaner case (40), an air inlet (70) to said intake passage (62) is formed further rearward than the longitudinal center of said air cleaner case (40) as well as on the rear portion of said cover member (60).

2. The cleaner apparatus for straddle type vehicle according to Claim 1 **characterized in that** said straddle type vehicle (1) has a power unit (20) swingably supported on a body frame (10), said power unit (20) has a transmission case (26) continuously provided to a crank case (24) of an engine E (22) and extended from said crank case (24) to the rear direction, said air cleaner case (40) is disposed above said transmission case (26).

3. The cleaner apparatus for straddle type vehicle according to Claims 1 or 2 **characterized in that** said cover member (60) is disposed further inside than an outer shell (34a) of said air cleaner case (40) in the side view.

4. The cleaner apparatus for straddle type vehicle according to Claim 3 **characterized in that** said air cleaner case (40) has a case main body (31) having a first flange portion (33) forming an opening edge portion (31a) opened to the outside in the width direction of the vehicle, and a second flange portion (34) forming said inside opening edge portion (32a) opened to the inside in the width direction of the vehicle so as to be overlapped with said outside opening edge portion (31a), and also has a case cover (32) disposed on the outside of said case main body (31) in the width direction of the vehicle, and the outline of said second flange portion (34) is set as said outer shell (34a).

5. The cleaner apparatus for straddle type vehicle according to any one of Claims 1 to 4 **characterized in that** an upper end (52a) of said air inlet opening (52) is positioned below an upper end (70a) of said air inlet (70), simultaneously a lower end (52b) of said air inlet opening (52) is positioned above a lower end (70b) of said air inlet (70).

6. The cleaner apparatus for straddle type vehicle according to any one of Claims 1 to 5 **characterized in that** said air inlet (70) is opened to the rear direction of the vehicle.

7. The cleaner apparatus for straddle type vehicle according to Claim 6 **characterized in that** a projecting portion (36) projecting from said air cleaner case (40) to the outside in the width direction of the vehicle is disposed in the rear and upper direction of said air inlet (70).

8. The cleaner apparatus for straddle type vehicle according to any one of Claims 1 to 7 **characterized in that** a passage forming portion (80) is formed with said air cleaner case (40) and said cover member (60) so as to surround said intake passage (62), and a lower portion (82) of said passage forming portion (80) is inclined so as to be positioned further downward as it approaches to the rear side.

9. The cleaner apparatus for straddle type vehicle according to Claim 8 **characterized in that** a drain hole (84) is formed on said lower portion (82) of passage forming portion (80) at least at the position facing to the upper stream side end portion of said intake passage (62).

10. The cleaner apparatus for straddle type vehicle according to Claims 8 or 9 **characterized in that** said intake passage (62) has a first intake passage (62a) connected to said air inlet (70), a second intake passage (62b) connected to said first intake passage (62a) as well as connected to said air inlet opening (52), and the drain hole (84) is formed on said lower portion (82) of passage forming portion (80) at the position facing to at least one of the upper stream side end portions of said first intake passage (62a) and said second intake passage (62b).

11. The cleaner apparatus for straddle type vehicle according to any one of Claims 8 or 9 **characterized in that** a rib (38) extended in the longitudinal direction is formed on at least one of the portions of said air cleaner case (40) and said cover member (60), which face to said air inlet (70).

12. The cleaner apparatus for straddle type vehicle according to Claim 11 **characterized in that** said rib (38) is formed so as to be extended further rearward than said cover member (60) in the side view.

13. The cleaner apparatus for straddle type vehicle according to any one of Claims 8 or 9 **characterized in that** said air cleaner case (40) has the case main body (31) having an outside opening edge portion (31a) opened to the outside in the width direction of the vehicle, the case cover (32) having an inside opening edge portion (32a) opened to the inside in the width direction of the vehicle so as to be overlapped with said outside opening edge portion (31a) in the side view and disposed on the outside of said case main body (31) in the width direction of the vehicle, and said cover member (60) is attached to said case cover (32) with the fastening member (90) fastening from the inside of said case cover (32) in the width direction of said case cover (32).

14. The cleaner apparatus for straddle type vehicle according to Claim 13 **characterized in that** said fastening member (90) is covered with said cover member (60) so as not to be exposed from said cover member (60) in the side view.

15. The cleaner apparatus for straddle type vehicle according to any one of Claims to 14 **characterized in that** said cover member (60) is fastened to said air cleaner case (40) at least at the front portion or the rear portion of said cover member (60), a joint portion (64) for fitting said cover member (60) and said air cleaner case (40) is formed between front side fastening portions (65c, 65d) provided on the front portion of said cover member (60) and rear side fastening portions (65a, 65b) provided on the rear portion of the said cover member (60).

16. The cleaner apparatus for straddle type vehicle according to Claim 15 **characterized in that** said joint portion (64) is covered with at least one of said cover member (60) and said air cleaner case (40) so as not to be exposed from said cover member (60) and said air cleaner case (40) to the outside in the side view.

17. The cleaner apparatus for straddle type vehicle according to Claims 15 or 16 **characterized in that** said air cleaner case (40) has said case main body (31) having the outside opening edge portion (31a) opened to the outside in the width direction of the vehicle, said case cover (32) having said inside opening edge portion (32a) opened to the inside in the width direction of the vehicle so as to be overlapped with said outside opening edge portion (31a) in the side view and disposed on the outside of said case main body (31) in the width direction of the vehicle, and said cover member (60) is attached to said case cover (32) with the fastening member (90) fastening from the inside of said case cover (32) in the width direction of the vehicle, and said joint portion (64) has the axial direction regulating portion (66) regulating the movement of said cover member (60) along the fastening axis direction of said fastening member (90).

18. The cleaner apparatus for straddle type vehicle according to any one of Claims 1 or 17 **characterized in that** said intake duct (50) is inclined so as to be positioned further outward in the width direction of the vehicle as it approaches to the rear side, and the concave portion (32d) avoiding the rear portion of said intake duct (50) is formed on the portion facing to the rear portion of said intake duct (50) of the inside surface of said air cleaner case (40) in the width direction of the vehicle.

19. The cleaner apparatus for straddle type vehicle according to Claim 18 **characterized in that** the convex portion (32t) projecting to the outside in the width

direction of the vehicle at the position corresponding to said concave portion (32d) on the outside surface of said air cleaner case (40) in the width direction of the vehicle, and said convex portion (32t) is covered with said cover member (60).

Fig.1

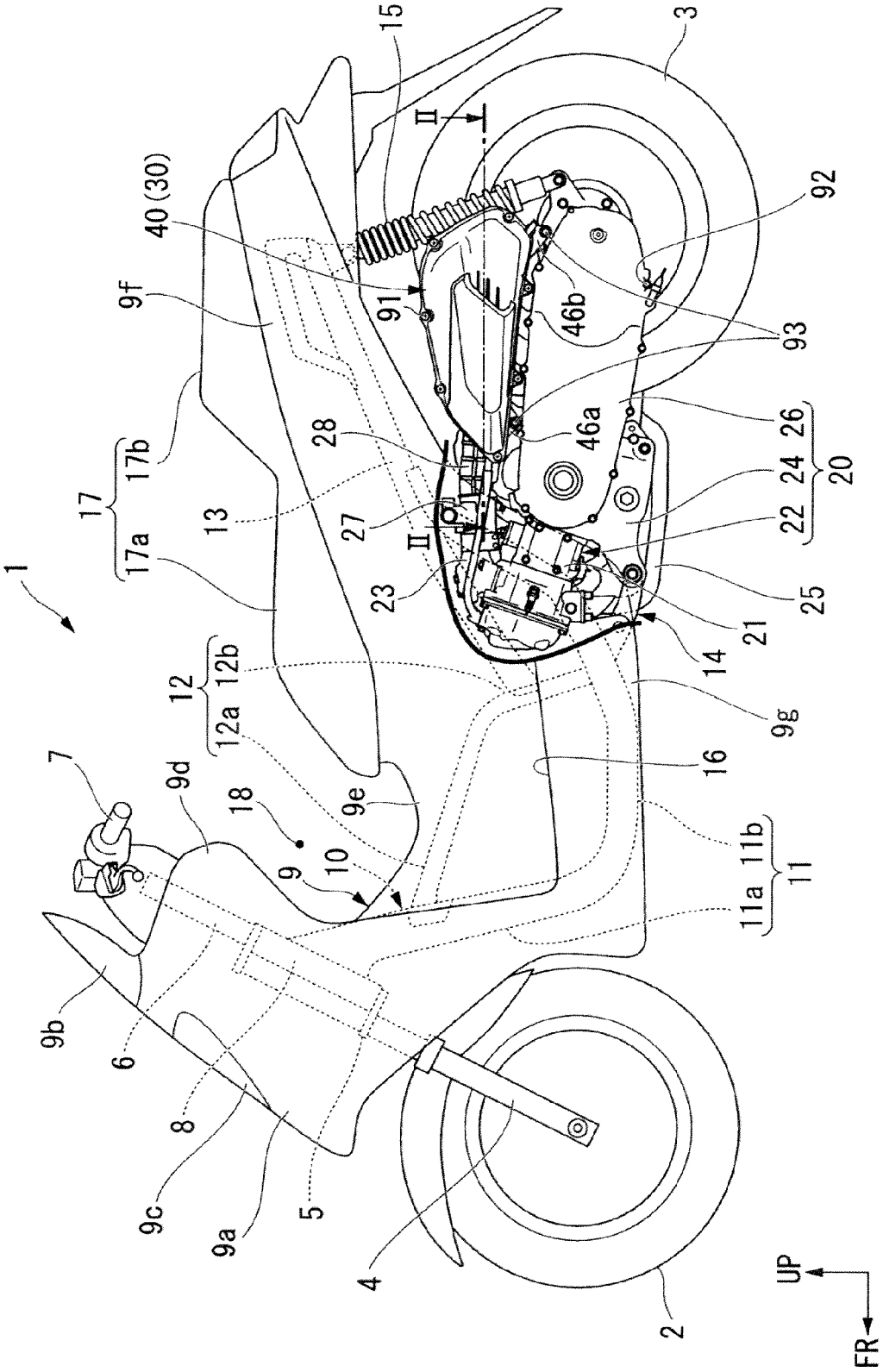

1
2
3
4
5
6
7
8
9
9a
9b
9c
9d
9e
9f
9g
10
11
11a
11b
12
12a
12b
13
14
15
16
17
17a
17b
18
20
21
22
23
24
25
26
27
28
40 (30)
46a
46b
91
92
93
II
II
UP
FR

Fig.2

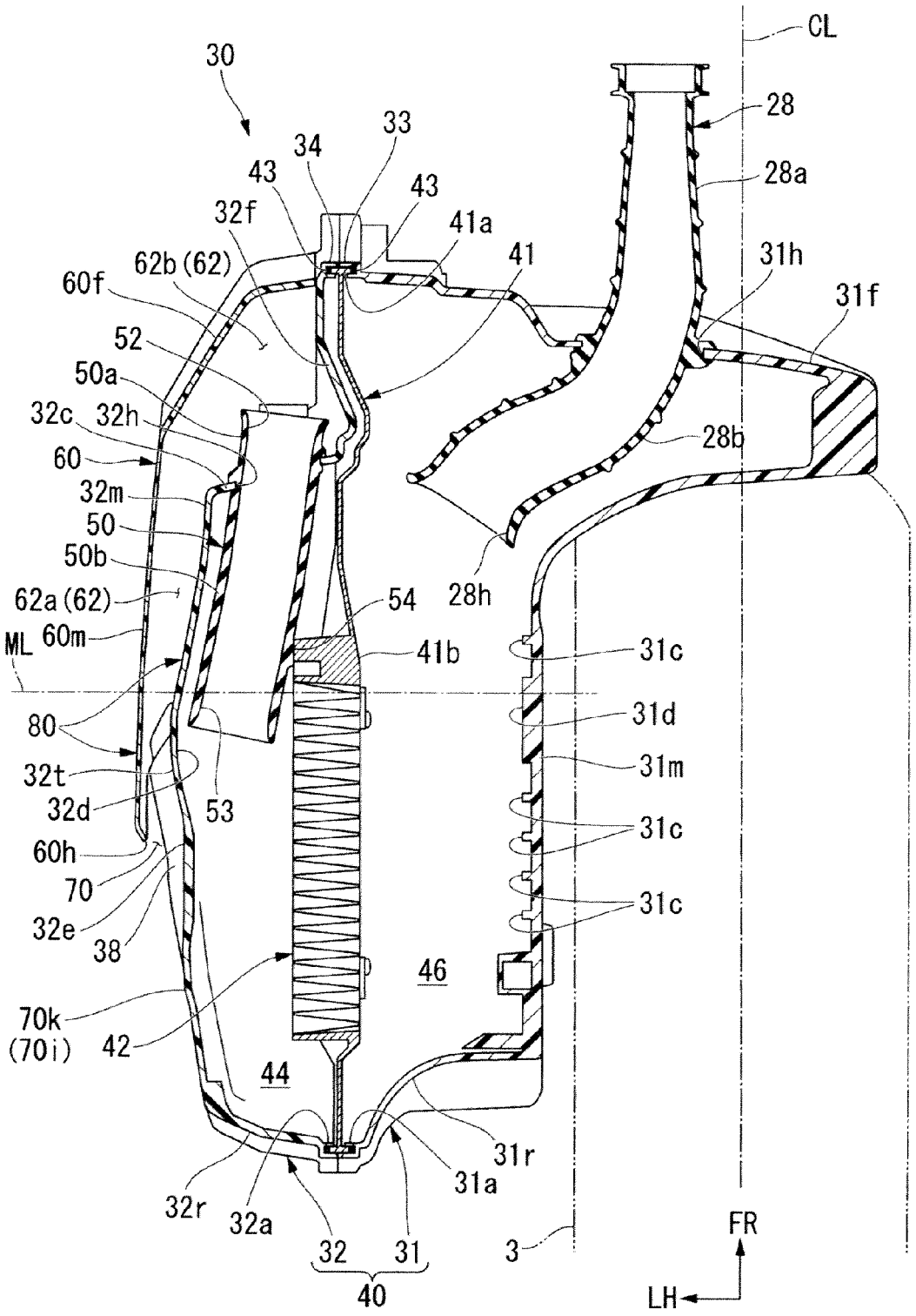

CL
30
33
34
43
43
32f
41a
41
62b (62)
60f
52
50a
32c
32h
60
32m
50
50b
62a (62)
ML
60m
80
32t
32d
60h
70
32e
38
70k
(70i)
42
44
53
54
41b
46
28
28a
31h
31f
28b
28h
31c
31d
31m
31c
31c
31r
31a
32r
32a
32
31
40
3
FR
LH

Fig.3

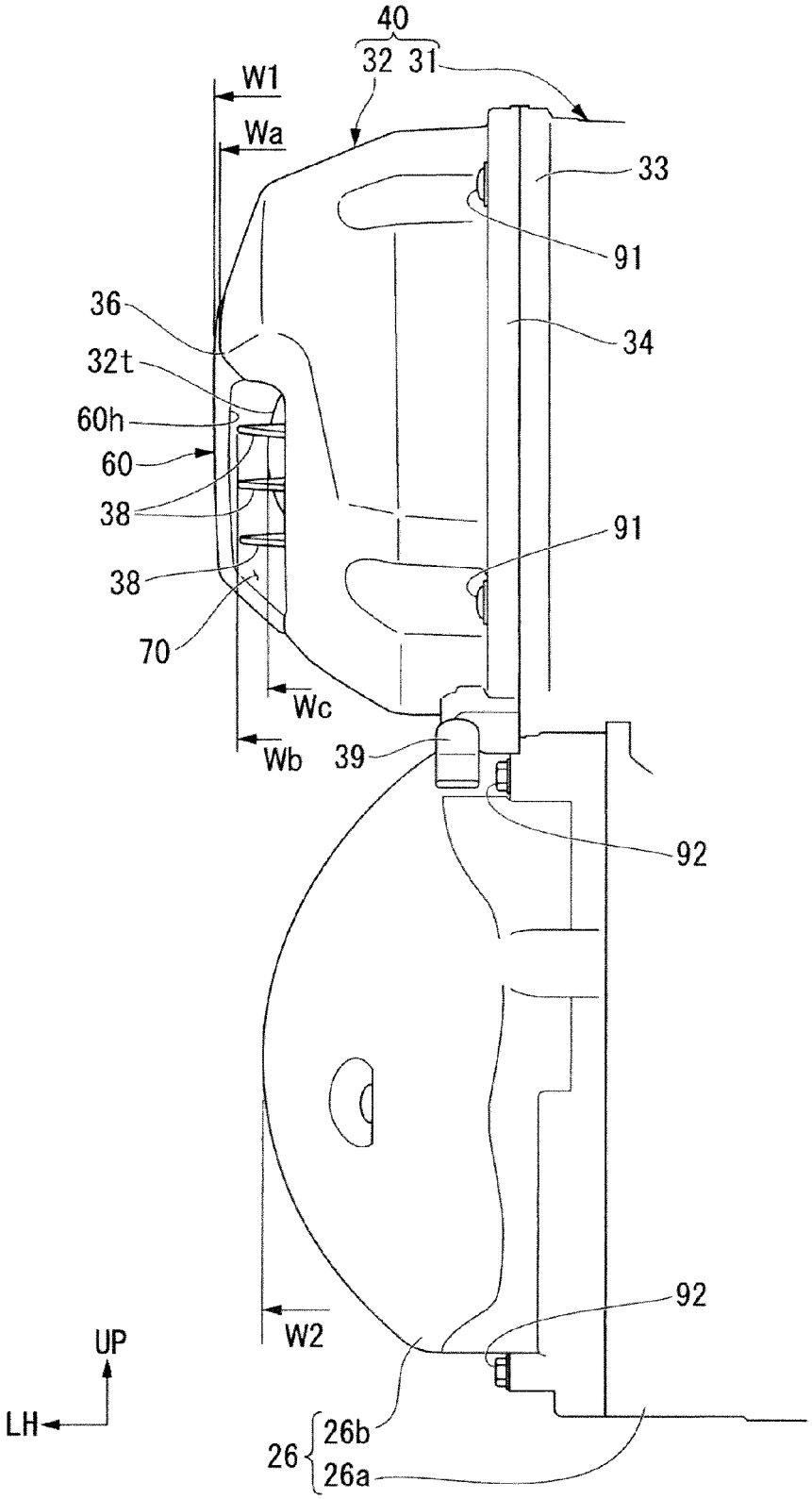

40
32 31
W1
Wa
33
91
36
34
32t
60h
60
38
91
38
70
Wc
Wb
39
92
92
W2
UP
LH
26
26b
26a

Fig.4

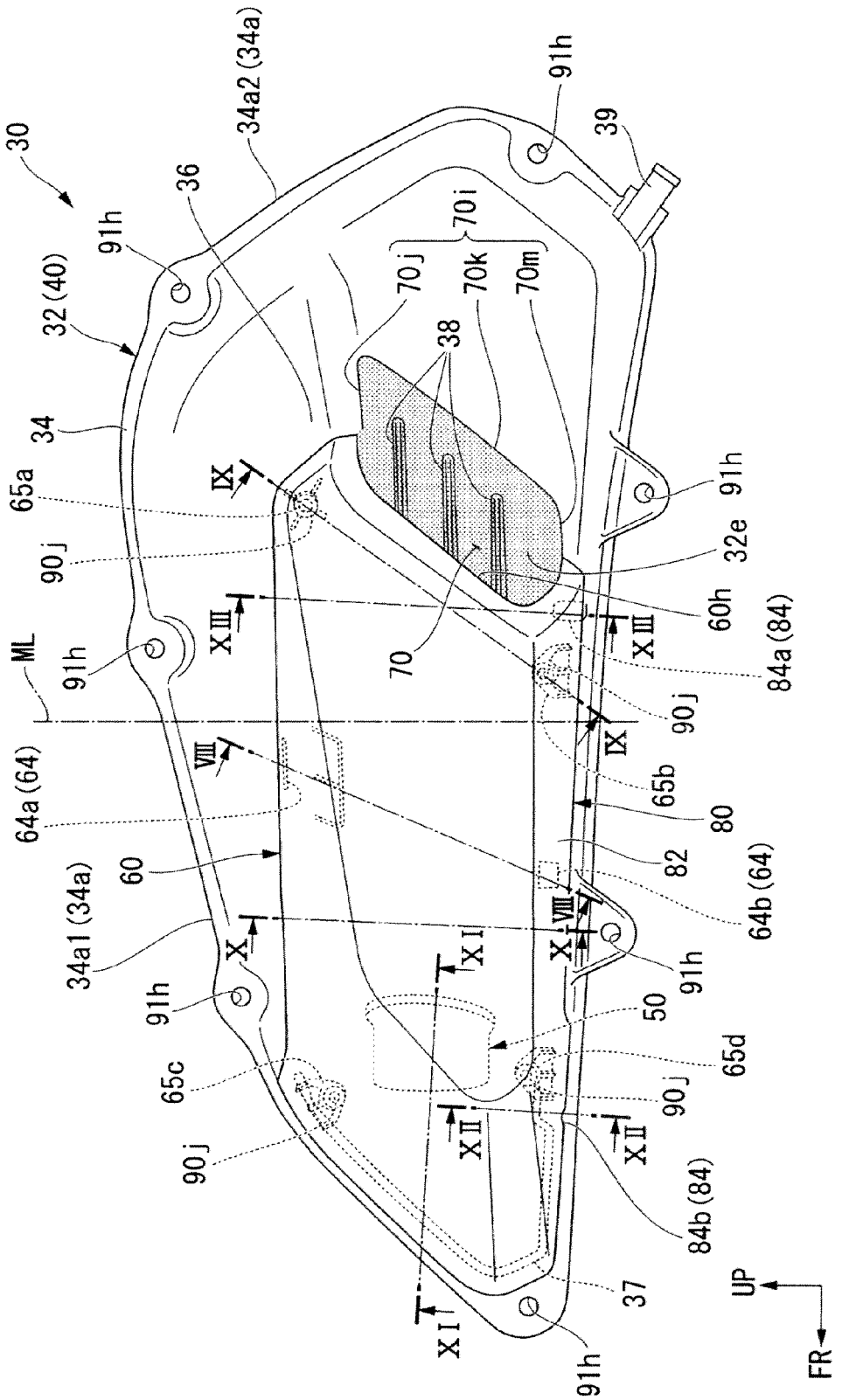

30
34a2 (34a)
91h
39
36
91h
32 (40)
70i
70j
70k
70m
38
34
65a
IX
91h
90j
32e
XIII
60h
ML
91h
70
84a (84)
90j
IX
64a (64)
VIII
65b
80
60
82
64b (64)
34a1 (34a)
X
XI
VIII
91h
91h
50
65c
65d
90j
XII
XII
90j
84b (84)
37
XI
91h
UP
FR

Fig.5

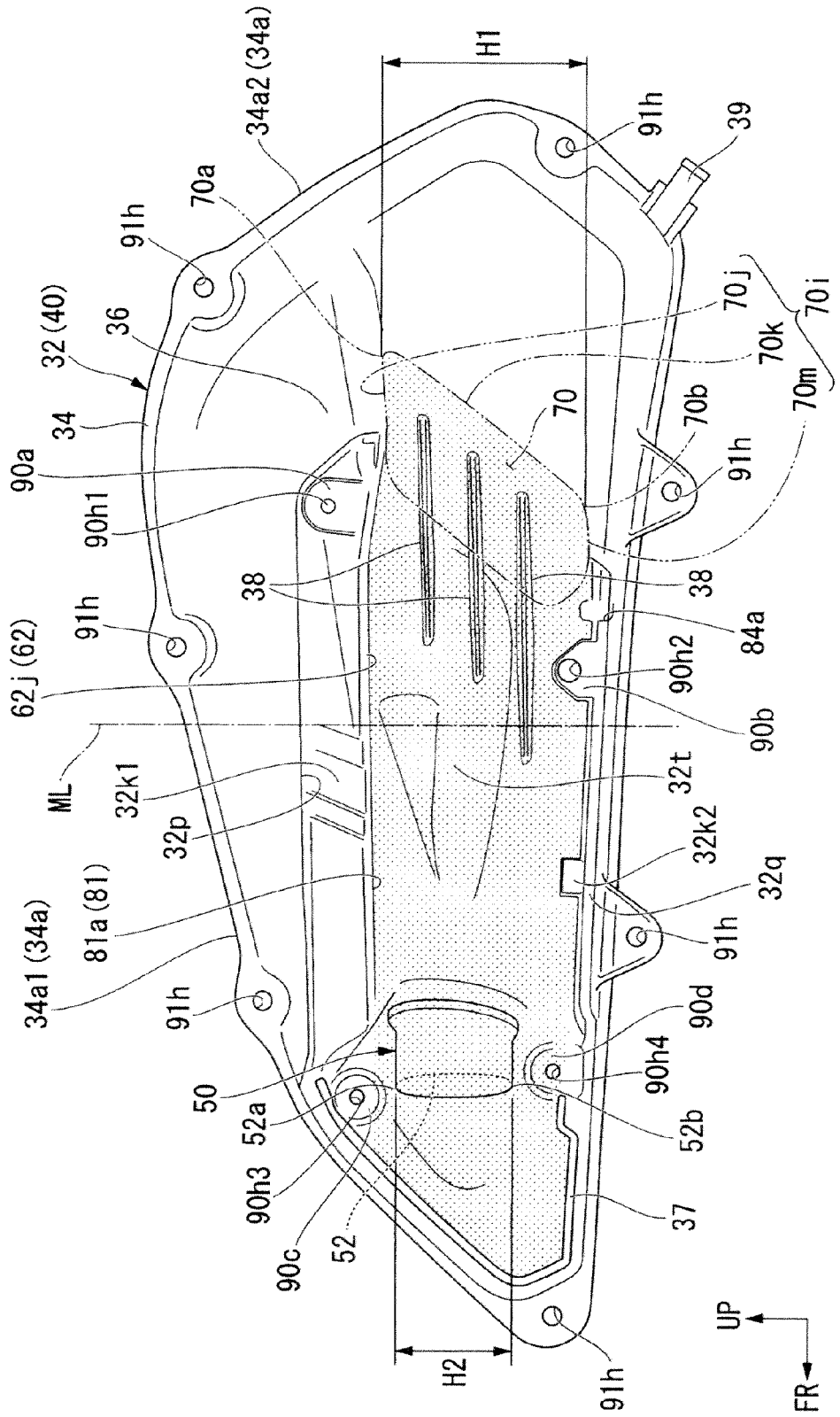

H1
34a2 (34a)
91h
39
70a
91h
70j
70i
32 (40)
36
70k
70m
34
70
70b
90a
91h
90h1
38
38
84a
91h
62j (62)
90h2
90b
ML
32t
32k1
32p
32k2
32q
81a (81)
34a1 (34a)
91h
91h
90d
90h4
50
52a
52b
90h3
37
90c
52
91h
H2
UP
FR

Fig.6

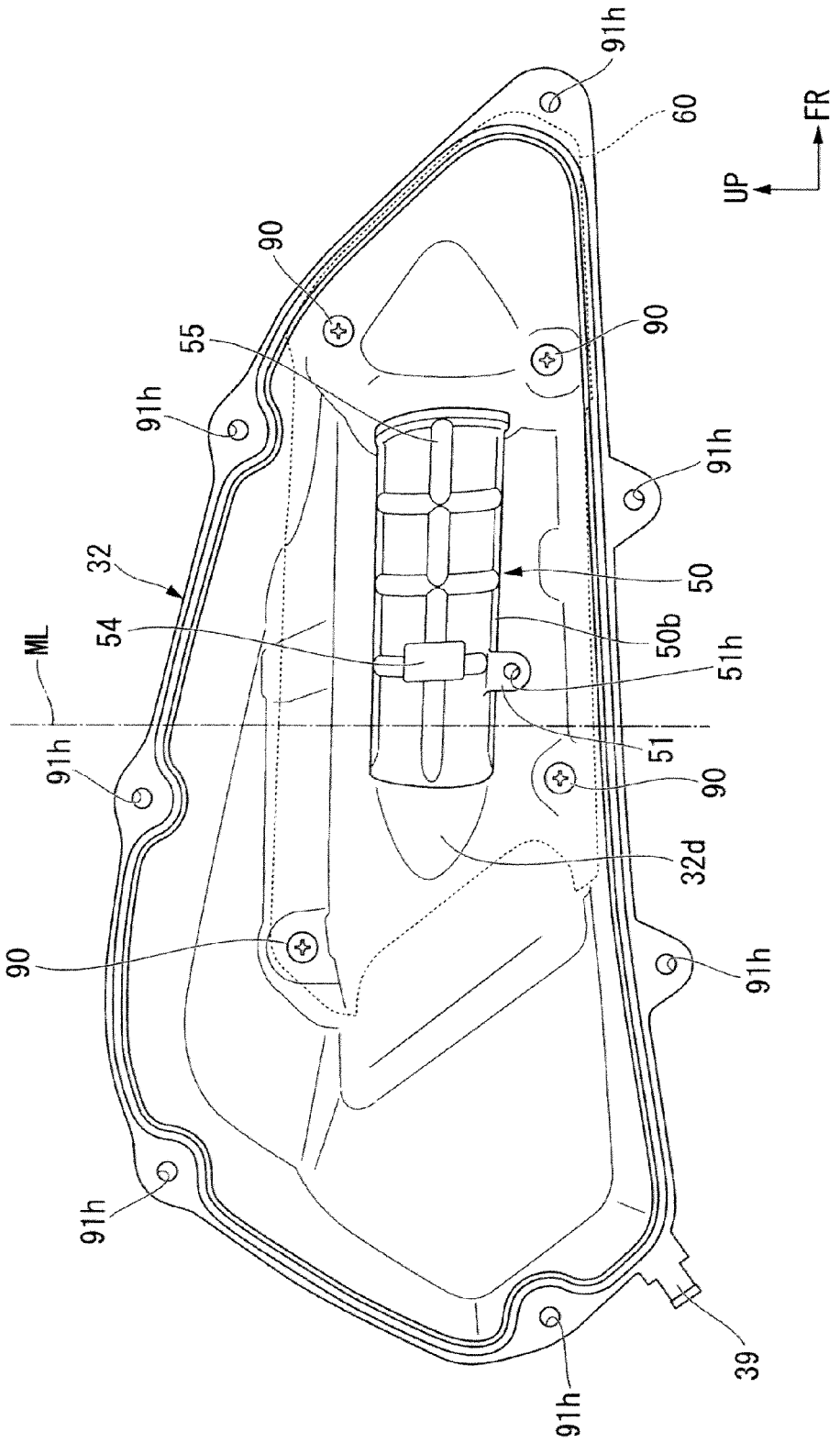

91h
60
FR
UP
90
55
90
91h
91h
32
50
54
50b
ML
51h
91h
51
90
32d
90
91h
91h
91h
39

Fig.7

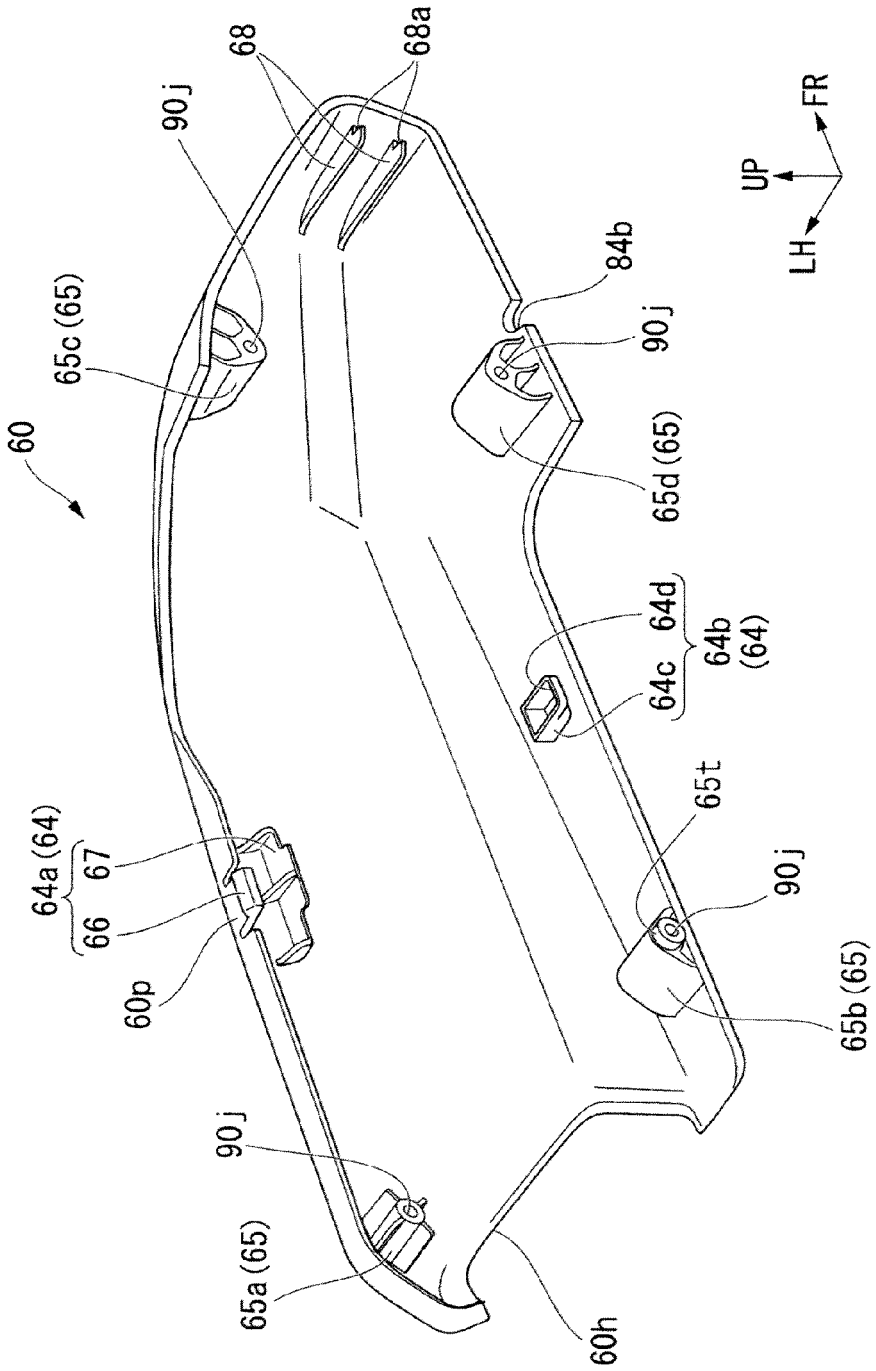

68
68a
90j
65c (65)
60
84b
90j
65d (65)
64d
64b (64)
64c
65t
90j
64a (64)
67
66
60p
65b (65)
90j
65a (65)
60h
UP
FR
LH

Fig.8

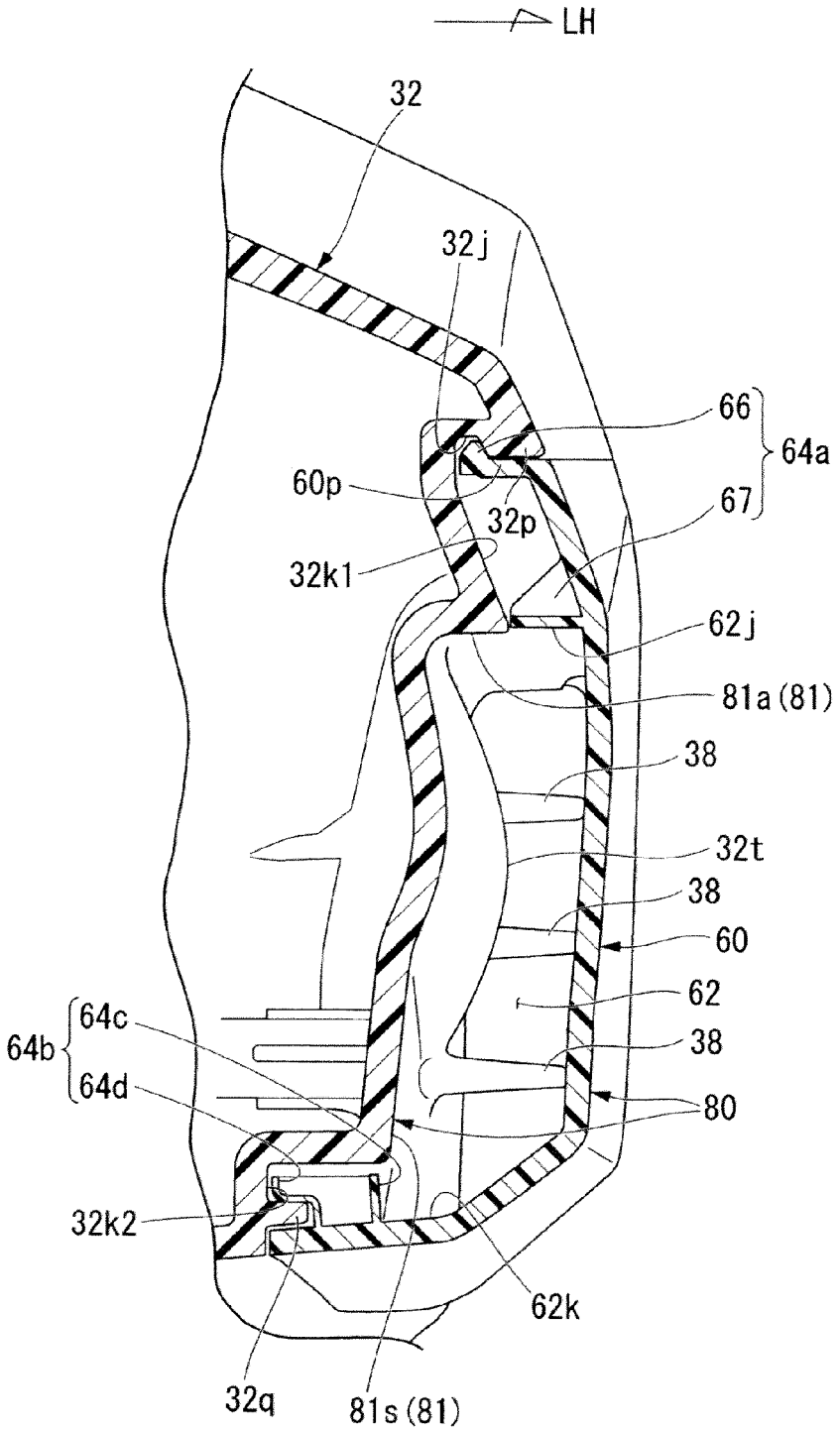

LH
32
32j
66
64a
67
60p
32p
32k1
62j
81a (81)
38
32t
38
60
62
64b
64c
64d
38
80
32k2
62k
32q
81s (81)

Fig.9

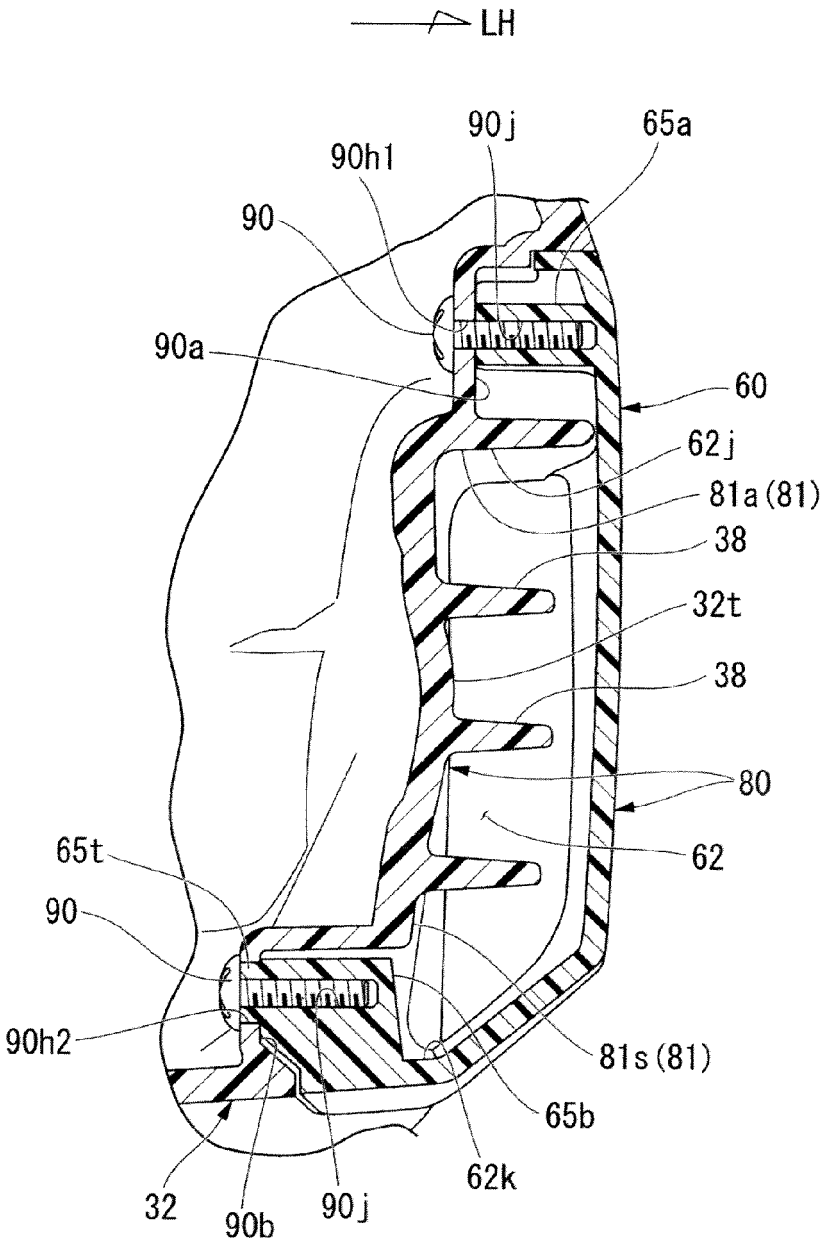

LH
90j
65a
90h1
90
90a
60
62j
81a(81)
38
32t
38
80
62
65t
90
90h2
81s(81)
65b
62k
32
90b
90j

Fig.10

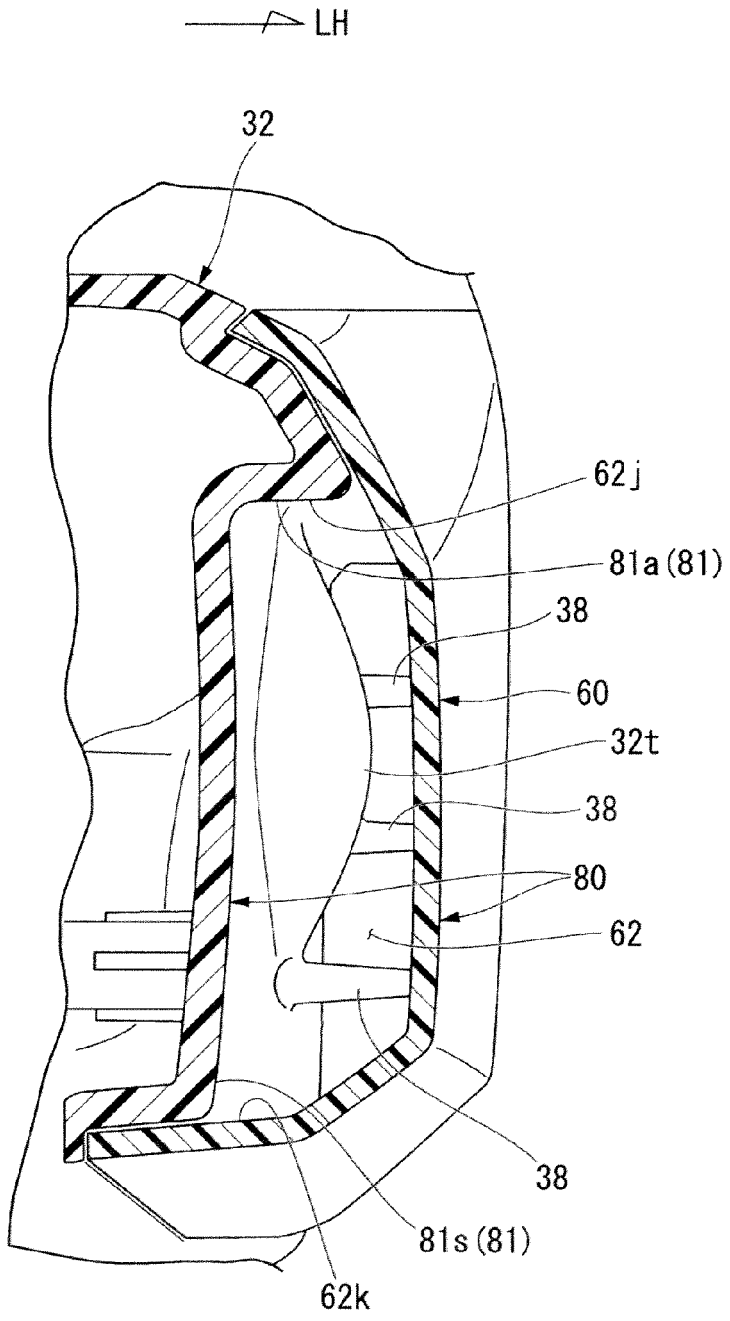


Fig.11

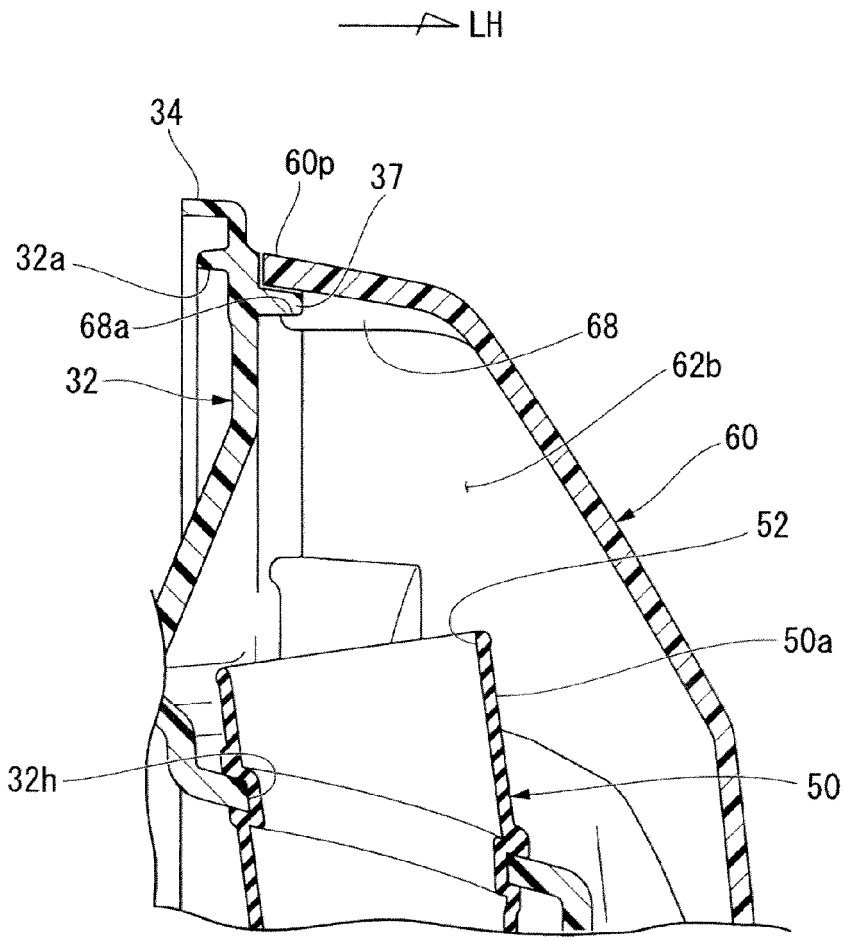


Fig.12

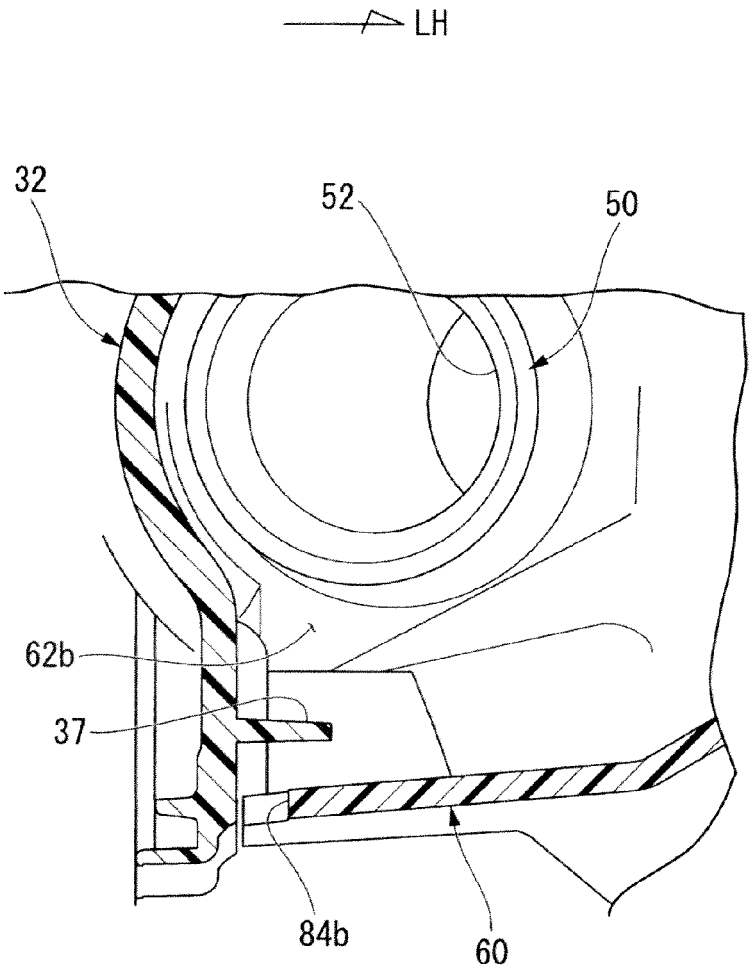
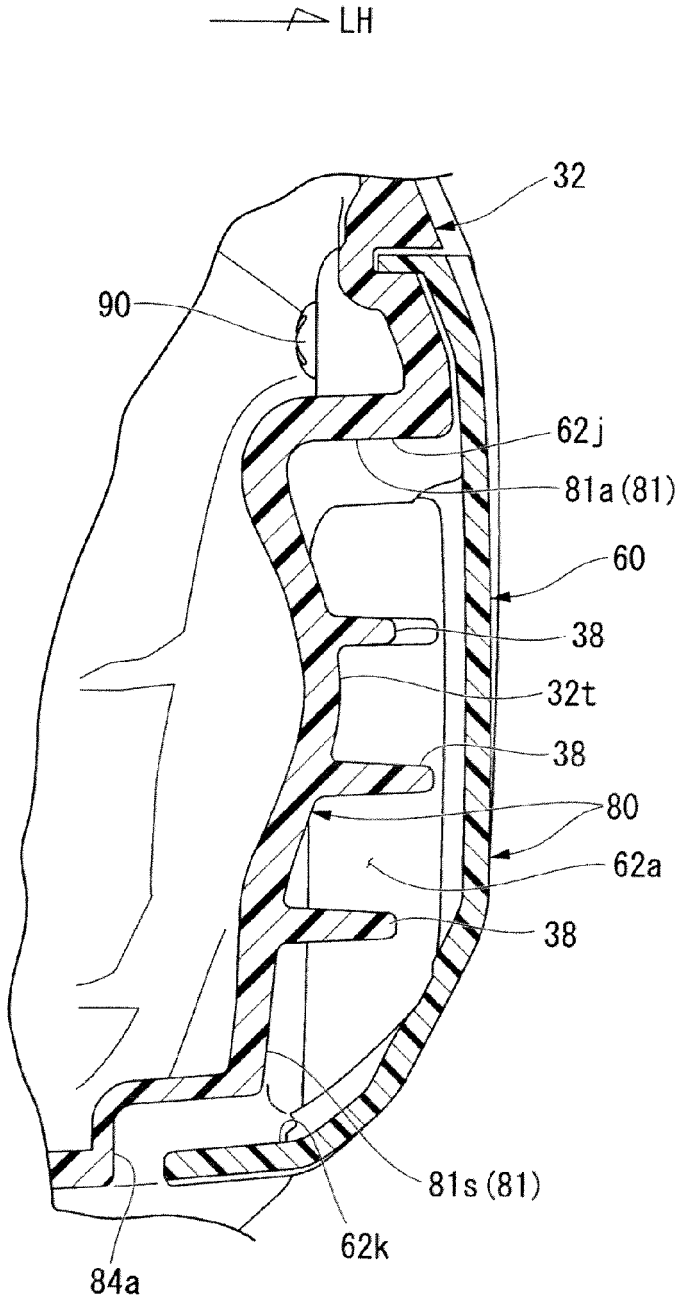


Fig.13



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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 8431

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X,D	JP 4 249345 B2 (YAMAHA MOTOR CO LTD) 2 April 2009 (2009-04-02) * abstract; figures 1-5 *	1-19	INV. F02B61/02 F02M35/16 F02M35/02 F02M35/04 F02M35/08 F02M35/10
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 September 2015	Payr, Matthias

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