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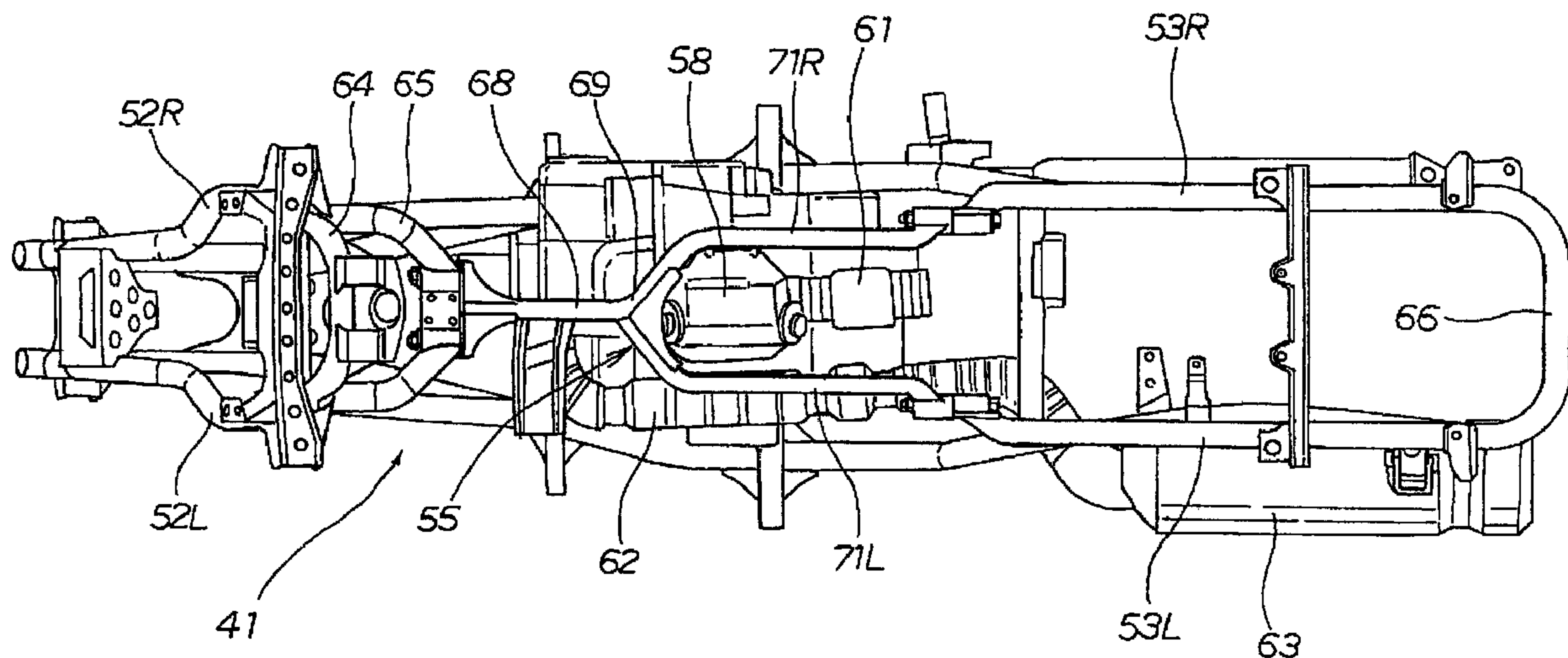
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(57) Abrégé/Abstract:

It is an object of the present invention to provide a technology that can downsizing a body frame in a vehicle where an upper pipe is disposed immediately above an internal combustion engine. An upper pipe includes a single front pipe portion, a branch portion bifurcated from the rear end of the front pipe portion, and two left and right rear pipe portions extending vehicle-rearward from the branch portion. A cylinder head cover is located between the two left and right rear pipe portions as viewed from above. Therefore, the cylinder head cover can be accessed from above and removed from a cylinder head, whereby a valve train chamber can be inspected and maintained. The upper pipe can be lowered close to the cylinder head cover. Consequently, the downsizing of the body frame can be achieved.

ABSTRACT OF THE DISCLOSURE

It is an object of the present invention to provide a technology that can downsizing a body frame in a vehicle where an upper pipe is disposed immediately above an internal combustion engine. An upper pipe includes a single front pipe portion, a branch portion bifurcated from the rear end of the front pipe portion, and two left and right rear pipe portions extending vehicle-rearward from the branch portion. A cylinder head cover is located between the two left and right rear pipe portions as viewed from above. Therefore, the cylinder head cover can be accessed from above and removed from a cylinder head, whereby a valve train chamber can be inspected and maintained. The upper pipe can be lowered close to the cylinder head cover. Consequently, the downsizing of the body frame can be achieved.

VEHICLE

FIELD OF THE INVENTION

The present invention relates to an improvement in the vehicle frame structure of a vehicle,
5 specifically, of an all terrain vehicle.

BACKGROUND OF THE INVENTION

All terrain vehicles often employ a body frame formed by assembling pipes or plates in a
tower-like form (see e.g. Japanese Patent Laid-Open No. Sho 60-255593 (Figs. 1 and 2)).

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As illustrated in Fig. 1 of Japanese Patent Laid-Open No. Sho 60-255593, a main pipe (2) (the
parenthetic numeral denotes a symbol described in Japanese Patent Laid-Open No. Sho 60-
255593, which applies to the following) extends from a head pipe (3) in a longitudinal
direction of a vehicle. Seat pillar tubes (5) extend from a longitudinally intermediate portion
15 of the main pipe (2). Down tubes (4) extend downward from the head pipe (3) and then
toward the rear of the vehicle. An engine (13) is supported by the down tubes (4) and the seat
pillar tubes (5).

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As illustrated in Fig. 2 of Japanese Patent Laid-Open No. Sho 60-255593, the down tubes (4)
are composed of two left and right tubes (4, 4). Also the seat pillar tubes (5) are composed of
two left and right tubes (5, 5). A body frame is assembled in a tower-like form. The main
pipe (2) extends from the head pipe (3) in such a form as to cross immediately above the
engine (13).

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In Fig. 1 of Japanese Patent Laid-Open No. Sho 60-255593, the engine (13) is mounted on the
body frame by being shifted in the left-right direction of the vehicle body in an assembly
plant.

After the vehicle has been delivered to a user, the engine (13) undergoes inspection and maintenance, and repair while remaining mounted on the body frame.

- 5 The engine (13) is composed of a crankcase, a cylinder extending upward from the crankcase, a cylinder head allowed to overlap the cylinder, and a cylinder head cover put on the cylinder head.

10 As illustrated in Fig. 1 of Japanese Patent Laid-Open No. Sho 60-255593, the uppermost cylinder head cover is close to the main pipe (2).

A valve train mechanism (a rocker arm, a camshaft, a valve stem, etc.) is disposed inside the cylinder head cover. Because of having a complicated structure, the valve train mechanism needs to undergo inspection and maintenance.

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To remove the cylinder head cover from the cylinder head, it is necessary to ensure a sufficiently large clearance between the cylinder head cover and the main pipe (2).

20 Further, considering the replacement of a piston ring, it is desirable that the cylinder head and the cylinder (the cylinder block) be removed from the crankcase. To fulfill the desire, it is necessary to further increase the sufficiently large clearance between the cylinder head cover and the main pipe (2).

25 However, if the clearance is enlarged as mentioned above, it is necessary to further raise the main pipe (2), with the result that the body frame is enlarged.

Amid the demand for the downsizing and weight reduction of vehicles, the enlargement of the body frame is not preferable. Therefore, a technology is required that can downsize a body frame in a vehicle whose main pipe is disposed immediately above an engine.

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It is an object of the present invention to provide a technology that can downsize a body frame in a vehicle whose main pipe (upper pipe) is disposed immediately above an engine.

SUMMARY OF THE INVENTION

The present invention is characterized in that in a vehicle allowed by transmitting power from an internal combustion engine to at least one of a front wheel and a rear wheel to travel, the internal combustion engine being mounted on a vehicle frame provided with the front wheel
5 and the rear wheel, a cylinder of the internal combustion engine extends upward and a cylinder head cover is put on an upper end of the cylinder, the body frame includes an upper pipe extending in the longitudinal direction of the vehicle at a position above the internal combustion engine, and the upper pipe includes a single front pipe portion, a branch portion bifurcated from an rear end of the front pipe portion, and two left and right rear pipe portions
10 extending vehicle-rearward from the branch portion, and the branch portion is located vehicle-forward of the cylinder head cover so that the cylinder head cover is located between the two left and right rear pipe portions as viewed from above.

In the present invention, the upper pipe (corresponding to the main pipe of the conventional
15 art) includes the single front pipe portion, the branch portion bifurcated from the rear end of the front pipe portion, and the two left and right rear pipe portions extending vehicle-rearward from the branch portion. The branch portion is disposed vehicle-forward of the cylinder head cover so that the cylinder head cover is disposed between the two left and right rear pipe portions as viewed from above.

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Since the cylinder head cover is disposed between the two left and right rear pipe portions as viewed from above, the cylinder head cover can be accessed from above and removed from the cylinder head and the valve train chamber can be inspected and maintained. Further, the cylinder head can be removed.

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Since the portion rearward of the branch portion is composed of the two rear pipe portions, its rigidity can be increased easily to ensure the rigidity of the upper pipe.

The upper pipe can be lowered close to the cylinder head cover. Consequently, the
30 downsizing of the body frame can be achieved.

An aspect of the invention is characterized in that an air cleaner and electric device storage box having a left chamber and a right chamber juxtaposed in a vehicle-widthwise direction is mounted to the front pipe portion, an air cleaner is housed in one of the left chamber and the right chamber and an electric device is housed in the other.

5

In the above aspect of the invention, the air cleaner and electric device storage box having the left chamber and the right chamber juxtaposed in the vehicle-widthwise direction is mounted to the front pipe portion. Specifically, the air cleaner and electric device storage box is installed to straddle the single front pipe portion. Laterally of and below the left chamber and
10 the right chamber are vacant; therefore, the bottom of the left chamber and of the right chamber can be more lowered than the front pipe portion. Consequently, the capacity of the left chamber and of the right chamber can be enlarged easily.

Another aspect of the vehicle is characterized in that a throttle body adapted to control intake
15 air supplied to the internal combustion engine is disposed between the two left and right rear pipe portions in a plan view, and a connecting tube connecting the air cleaner with the throttle body extends from the air cleaner, then passing through between the two left and right rear pipe portions, and terminates at the throttle body.

20 In the above aspect of the invention, the throttle body is disposed between the two left and right rear pipe portions as viewed from above. The throttle body can be accessed from above so that it can be inspected and maintained easily.

The connecting tube extends from the air cleaner, then passing through between the two left
25 and right rear pipes, and terminates at the throttle body. The lateral surfaces of the connecting tube can be protected by the left and right rear pipe portions.

Yet another aspect of the invention is characterized in that a seat on which an occupant sits is disposed vehicle-rearward of the air cleaner and electric device storage box, the seat is a part
30 that is arcuate in vehicle-widthwise section, has a groove-like recessed portion recessed upward at the center of a bottom and extending in the longitudinal direction of the vehicle,

- 5 -

and is supported by the two left and right rear pipe portions, and a portion of the connecting tube is housed in the recessed portion.

5 In the above aspect of the invention, the seat on which the occupant sits is a part that is arcuate in vehicle-widthwise section, has the groove-like recessed portion recessed upward at the center of the bottom and extending in the longitudinal direction of the vehicle, and is supported by the two left and right rear pipe portions. The seat is supported by the two left and right rear pipe portions; therefore, the support rigidity of the seat can be increased easily. A portion of the connecting tube is housed in the recessed portion of the seat. The upper
10 surface of the connecting tube can be protected by the seat.

A further aspect of the invention is characterized in that the internal combustion engine is mounted on the body frame via a plurality of engine mounts, and of the plurality of engine mounts, at least one engine mount is installed on the upper pipe at a position close to the
15 branch portion.

In the above aspect of the invention, of the plurality of engine mounts, at least one engine mount is installed on the upper pipe at a position close to the branch portion.

20 The branch portion has higher rigidity than that of the front pipe portion and of the rear pipe portion in terms of structure. The engine mounts are installed close to the branch portion having high rigidity, so that the weight of the internal combustion engine can effectively be supported by the upper pipe.

25 Another aspect of the invention is characterized in that the body frame includes a pair of left and right main frames extending in the longitudinal direction of the vehicle at a position below the internal combustion engine and then extending upward and a left and right seat rails extending vehicle-rearward from corresponding rear ends of the main frames and supporting a rear portion of the seat, and rail side collars extending in the longitudinal
30 direction of the vehicle are provided at corresponding leading ends of the left and right seat rails, pipe side collars extending in the longitudinal direction of the vehicle are provided at a

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rear end of the upper pipe, and the rail side collars and the pipe side collars are fastened to each other by means of bolts extending in the longitudinal direction of the vehicle.

5 In the above aspect of the invention, the rail side collars extending in the longitudinal direction of the vehicle are provided at the corresponding leading ends of the left and right seat rails. The pipe side collars extending in the longitudinal direction of the vehicle are provided at the rear end of the upper pipe. The rail side collars and the pipe side collars are fastened to each other by means of bolts extending in the longitudinal direction of the vehicle. If the upper pipe is to be mounted to the seat rails after having been removed from the seat
10 rails, a gap may occur between the upper pipe and each of the seat rails in some cases. This gap is increased or decreased in the longitudinal direction of the vehicle. The gap can be eliminated by tightening up the bolts extending in the longitudinal direction of the vehicle.

Yet another aspect of the invention is characterized in that front wheel suspension support
15 portions each formed of a pipe or plate and suspending the front wheel extend upward from corresponding front portions of the main frames, an upper pipe front support portion formed of a pipe and supporting a front portion of the upper pipe extends vehicle-rearward from the front wheel suspension support portions, support portion side collars extending in the longitudinal direction of the vehicle are provided at the upper pipe front support portion, and
20 a front portion of the upper pipe is fastened to the support portion side collars by means of bolts extending in the longitudinal direction of the vehicle.

In the above aspect of the invention, the support portion side collars extending in the longitudinal direction of the vehicle are provided at the upper pipe front support portion, and
25 the front portion of the upper pipe is fastened to the support portion side collars by means of bolts extending in the longitudinal direction of the vehicle.

If the upper pipe is to be mounted to the upper pipe front support portion after having been removed from the upper pipe front support portion, a gap may occur between the upper pipe
30 and the upper pipe front support portion in some cases. The gap is increased or decreased in the longitudinal direction of the vehicle. The gap can be eliminated by tightening up the bolts in the longitudinal direction of the vehicle.

A further aspect of the invention is characterized in that the upper pipe includes a first member connecting one rear pipe portion of two left and right rear pipe portions with the single front pipe portion and a second member composed of the other rear pipe portion of the two left and right rear pipe portions, and a leading end of the second member is welded to the first member at the branch portion.

In the above aspect of the invention, the upper pipe includes the first member connecting one rear pipe portion with the single front pipe portion and the second member composed of the other rear pipe portion of the two left and right rear pipe portions, and the leading end of the second member is welded to the first member at the branch portion.

The upper pipe is Y-shaped as viewed from above. For example the Y-shape can be manufactured by welding the leading ends of three pipes. However, the number of parts is three and also the welding length is increased.

In this regard, in the present invention, the leading end of the second member is brought into contact with the intermediate portion of the long first member and is welded to the first member. The number of parts is two and the welding length can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are shown in the drawings, wherein:

Fig. 1 is a left lateral view of a vehicle according to the present invention.

Fig. 2 is a plan view of the vehicle.

Fig. 3 is a lateral view for assistance in explaining a suspension for a front wheel.

Fig. 4 is a front view for assistance in explaining the suspension for the front wheel.

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Fig. 5 is a left lateral view of a body frame.

Fig. 6 is a plan view of the body frame.

5 Fig. 7 is an exploded view of an essential portion of the body frame.

Fig. 8 is a plan view of a cleaner and electric device storage box.

Fig. 9 is a perspective view of the body frame.

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Fig. 10 is a cross-sectional view taken along line 10-10 in Fig. 9.

Fig. 11 is a mount view of an engine mount.

15 Fig. 12 illustrates another embodiment with respect to Fig. 6.

Fig. 13 is a view for assistance in explaining a procedure for removing a cylinder head cover.

Fig. 14 is a view for assistance in explaining a procedure for removing a cylinder head.

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Fig. 15 is a view for assistance in explaining a procedure for removing a cylinder.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will hereinafter be described with reference to the
25 accompanying drawings. It is to be noted that the drawings shall be viewed in the direction of
reference numerals.

An embodiment of the present invention is described with reference to the drawings.

30 Referring to Fig. 1, a vehicle 10 is a small-sized vehicle including a front wheel 11 at a front
lower portion of a vehicle body; a front fender 12 above the front wheel 11; a rear wheel 13 at
a rear lower portion of the vehicle body; a rear fender 14 above the rear wheel 13; a steering

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handlebar 15 above the front wheel 11; a front luggage carrier 16 in front of the steering handlebar 15; and a seat 17 and a rear luggage carrier 18 in the rear of the steering handlebar 15.

- 5 The front wheel 11 and the rear wheel 13 are special tires called the balloon tires each having wide width and lower pressure. In such a case, the low pressure tire is deformed to absorb the irregularity of a road surface. In addition, even if the road surface is soft, the tire having the wide width can suppress its sinking. Thus, such a vehicle 10 is called an all terrain vehicle.
- 10 Referring to Fig. 2, the vehicle 10 is a straddle-ride type all terrain vehicle in which left and right step floors 19, 19 are located between the steering handlebar 15 and the seat 17 and the feet of an occupant sitting on the seat 17 can be put on the step floors 19, 19. The vehicle 10 is provided with a front cover 22 disposed between a steering shaft 21 and the seat 17 to cover an air cleaner and electric device storage box (reference numeral 90 in Fig. 8) as
- 15 described later.

A description is next given of a structure around the front wheel.

- Referring to Fig. 3, an internal combustion engine 23 is disposed at the center in the longitudinal direction of the vehicle. The power generated by the internal combustion engine
- 20 23 is transmitted to a final reducer 25 via a power transmission device 24 such as a propeller shaft extending vehicle-forward and the like and is provided to drive the front wheels. This applies to the rear wheels. The internal combustion engine 23 is desirably a gasoline engine or diesel engine.

25

In the state where the front wheel is removed, a front cushion 27, a power steering unit 28 and a tie rod 29 driven by the power steering unit 28 can be seen below the front fender 12. Incidentally, the power steering unit 28 is secured by means of bolts 31 to front tension brackets 32L, 32R denoted with imaginary lines.

30

Referring to Fig. 4, a front-wheel suspension 40 includes the front cushion 27 connected at its upper end to the body frame 41 and extending downward; a knuckle support member 42

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extending downward from the lower portion of the front cushion 27; a lower arm 43 extending in a vehicle-width direction to connect the lower portion of the knuckle support member 42 with the body frame 41; a knuckle 45 mounted to the knuckle support member 42 turnably around a king pin axis 44 and supporting the front wheel 11; and the tie rod 29
5 extending in the vehicle-width direction and turning the knuckle 45 around the king pin axis 44.

Incidentally, the front wheels 11 are driven by the drive shaft 46 extending from the final reducer 25 in the vehicle-width direction. The drive shaft 46 is preferably a flexible shaft
10 called a constant-velocity ball joint.

A structure of the body frame 41 is next described in detail.

Referring to Fig. 5, the body frame 41 includes as main constituents a pair of left and right
15 main frames 51L, 51R ("L" and "R" are suffixes denoting the left and right, respectively, as viewed from the occupant, which applies to the following); a left and right front-wheel suspension support portions 52L, 52R; a pair of left and right seat rails 53L, 53R; rear sub-pipes 54L, 54R; and an upper pipe 55. The main frames 51L, 51R passes below the internal combustion engine 23 in the longitudinal direction of the vehicle and bends upward at its rear
20 end. The front-wheel suspension support portions 52L, 52R are composed of pipes or frames extending upward from the corresponding front portions of the main frames 51L, 51R and supporting the front wheel suspension (reference numeral 40 in Fig. 4). The seat rails 53L, 53R are joined to the corresponding rear upper ends of the main frames 51L, 51R and extend in the longitudinal direction of the vehicle. The rear sub-pipes 54L, 54R are obliquely
25 spanned from the main frames 51L, 51R to the seat rails 53L, 53R so as to suppress the deflection of the seat rails 53L, 53R. The upper pipe 55 is spanned between the front ends of the seat rails 53L, 53R and the front-wheel suspension support portions 52L, 52R so as to pass above the internal combustion engine 23.

30 A cylinder 57 of the internal combustion engine 23 extends upward. A head cover 58 is put on the upper end of the cylinder 57. A gap 59 between the cylinder head cover 58 and the

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upper pipe 55 passing above the cylinder head cover 58 is small. Incidentally, in this description, a cylinder head is omitted. The cylinder head is detailed with Fig. 13.

A throttle body 61 adapted to supply intake air to the cylinder 57 is disposed vehicle-rearward of the cylinder 57. An exhaust pipe 62 adapted to discharge exhaust gas extends vehicle-forward from the cylinder 57, then turns around, passes below a left rear pipe portion 71L and below a left seat rail 53L as illustrated in Fig. 6, then extends vehicle-rearward, and is coupled to a muffler 63.

As illustrated in Fig. 6, a first U-shaped pipe portion 64 extends vehicle-rearward from the rear ends of the left and right front wheel suspension support portions 52L, 52R. Additionally, a second U-shaped pipe portion 65 as an upper pipe front support portion extends from the rear ends of the front wheel suspension support portions 52L, 52R so as to surround the first U-shaped pipe portion 64. The upper pipe 55 is coupled to the second U-shaped pipe portion 65.

The left and right seat rails 53L, 53R are connected at their rear ends to each other via a third U-shaped pipe portion 66, so that they are composed of a single U-shaped pipe member as a whole. The upper pipe 55 connected to the front ends of such seat rails 53L, 53R is characterized by a shape, whereby the cylinder head cover 58 can be viewed from above.

The details of the upper pipes 55 are next described.

Referring to Fig. 7, the upper pipe 55 includes a single front pipe portion 68 having triangular brackets 67L, 67R at its front end; a branch portion 69 bifurcated leftward and rightward from the rear end of the front pipe portion 68; two left and right rear pipe portions 71L, 71R extending vehicle-rearward from the branch portion 69; and pipe side collars 72L, 72R coupled to corresponding rear ends of the rear pipe portions 71L, 71R and extending in the longitudinal direction of the vehicle. Incidentally, the pipe side collar 72L is a thick cylindrical member (the same holds true for the other collars).

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Rail side collars 73L, 73R extending in the longitudinal direction of the vehicle are secured to the corresponding front ends of the seat rails 53L, 53R. A bolt 74 is inserted into the left rail side collar 73L from the rearward of the vehicle, the pipe side collar 72L is fitted to the bolt 74 and a nut 75 is screwed to the end of the bolt 74. Even if a gap 76 having a length L1 exists between the collars 72L, 73L before the tightening, it can be eliminated by tightening the nut 75.

In other words, the length L1 of the gap 76 is increased or decreased in the longitudinal direction of the vehicle; therefore, the gap 76 can be eliminated by the bolt 74.

Incidentally, it is not a problem that the bolt 74 is inserted from the front of the vehicle. The same holds true for the right pipe side collar 72R and the rail side collar 73R.

A bearing cap 77 is brought into contact with the first U-shaped pipe portion 64 from the vehicle-rearward and fastened to the first U-shape pipe portion 64 by means of bolts 78 and nuts 79. In this way, the steering shaft (reference numeral 21 in Fig. 2) can be supported.

Support portion side collars 81L, 81R extending in the longitudinal direction of the vehicle are secured to the second U-shaped pipe portion 65. Bolts 82, 82 are passed through the triangle brackets 67L, 67R and further through the support portion side collars 81L, 81R. Nuts 83, 83 are screwed to the corresponding ends of the bolts 82, 82. Even if a gap 84 having a length L2 exists between the collar 81R and the triangular bracket 67R before tightening, it can be eliminated by tightening the nut 83. This is because also the length L2 of the gap 84 is increased or decreased in the longitudinal direction of the vehicle. Incidentally, it is not a problem that the bolts 82 are inserted from the forward of the vehicle.

As illustrated in Fig. 6, the cylinder head cover 58 is located between the two left and right rear pipe portions 71L, 71R as viewed from above. Therefore, the valve train chamber can be subjected to inspection and maintenance by accessing the cylinder head cover 58 from above and removing the cylinder head.

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Since the cylinder head cover 58 can be accessed from above, the gap 59 illustrated in Fig. 5 can be made small as much as possible. In other words, the upper pipe 55 can be lowered close to the cylinder head cover 58. Consequently, the height of the body frame can be reduced to achieve the downsizing of the body frame.

5

A description is given of a procedure for manufacturing the upper pipe 55 formed in a Y-shape as illustrated in Fig. 7.

A first member 85 is manufactured by bending work so as to have such a shape that one, e.g., the rear pipe portion 71R, of the two left and right rear pipe portions 71L, 71R is continuous with the single front pipe portion 68.

In addition to this, a second member 86 is manufactured by bending work so as to have the shape of the other rear pipe portion 71L of the two left and right rear pipe portions 71L, 71R.

15

A second member 86 is welded at its distal end with an intermediate portion of the first member 85.

The branch portion 69 is such that the two members 85, 86 are joined together, so that it has a larger sectional area than the other portions. For this reason, the branch portion 69 has high rigidity. An engine mount (reference numeral 102 in Fig. 11) can be installed close to such a branch portion 69, as described later.

Further, it is preferable that a triangular reinforcing plate 87 be brought into contact with the branch portion 69 from the rearward of the vehicle and welded to the first member 85 and the second member 86.

Further, the air cleaner and electric device storage box 90 denoted with an imaginary line can be mounted to the single front pipe portion 68.

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Referring to Fig. 8, the air cleaner and electric device storage box 90 has a left chamber 91 and a right chamber 92 juxtaposed in the vehicle-width direction. An air cleaner 93 is housed

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in one (the right chamber 92 in this embodiment) of the left chamber 91 and the right chamber 92; electric devices 94 such as a battery, a regulator, a fuse box, a relay, a CPU, etc. are housed in the other.

5 The left chamber 91 and the right chamber 92 protrude vehicle-widthwise to straddle the front pipe portion (reference numeral 68 in Fig. 7). Below the left chamber 91 and the right chamber 92 is vacant. Therefore, the bottom of the left chamber 91 and of the right chamber 92 can be extended toward the back in the drawing if needed. Consequently, the volume of the left chamber 91 and of the right chamber 92 can be increased easily.

10

Specifically, as illustrated in Fig. 9, the bottom 95 of the air cleaner and electric device storage box 90 extends downward. A connecting tube 96 extends vehicle-rearward from the cleaner and electric device storage box 90; specifically, it is bent from the upside to downside of the upper pipe 55 at a position rearward of the branch portion 69.

15

The connecting tube 96 is joined to the throttle body 61 illustrated in Fig. 6. As clear from Fig. 6, the throttle body 61 is disposed between the left and right rear pipe portions 71L, 71R as viewed from above so that it is accessible from above similarly to the cylinder head cover 58.

20

Fig. 10 is a cross-sectional view taken along line 10-10 in Fig. 9. The seat 17 is arcuate in vehicle-widthwise section and has a groove-like recessed portion 97 recessed upward at the center of its bottom and extending in the longitudinal direction of the vehicle. In addition, the seat 17 is supported by the two left and right rear pipe portions 71L, 71R. Since the seat 17 is supported by the two left and right rear pipe portions 71L, 71R, the support rigidity of the seat 17 can easily be increased.

25

30

Lateral surfaces 98, 98 of the connecting tube 96 are protected by the respective left and right rear portions 71L, 71R. In addition, a portion of the connecting tube 96 is housed in the recessed portion 97 of the seat 17. An upper surface 99 of the connecting tube 96 is protected by the seat 17. A lower surface 101 of the connecting tube 96 is protected by the internal combustion engine (reference numeral 23 in Fig. 5).

- 15 -

All terrain vehicles have a possibility that a pebble or the like thrown up by the front wheel may move toward the connecting tube 96. However, all of the upper surface 99, the lateral surfaces 98, 98 and the lower surface 101 is covered; therefore, there is no concern that a
5 pebble or the like hits the connecting tube 96.

A description is next given of the engine mount.

The internal combustion engine 23 illustrated in Fig. 9 is connected to the left and right main
10 frames 51L, 51R via the engine mount.

Additionally, the front upper portion of the internal combustion engine 23 is connected to the upper pipe 55 via the engine mount 102 illustrated in Fig. 11. The engine mount 102 is installed close to the branch portion 69 of the upper pipe 55 (in the vicinity of between the
15 branch portion 69 and the front pipe portion 68).

The branch portion 69 has higher rigidity than the other portions in terms of structure. The engine mount 102 is installed close to the branch portion 69 having high rigidity. Therefore, the weight of the internal combustion engine 23 can effectively be supported by the upper
20 pipe 55.

The Y-shaped upper pipe 55 is described with Fig. 6. However, the upper pipe 55 can be modified into another shape. Its specific example is next described.

25 Referring to Fig. 12, an upper pipe 55B has an O-shape and includes a single front pipe portion 68 having triangular brackets 67L, 67R at its front end; a branch portion 69 bifurcated from a rear end of the front pipe portion 68; two left and right pipe portions 71L, 71R extending vehicle-rearward from the branch portion 69; a junction portion 103 joining together the rear ends of the rear pipe portions 71L, 71R; and triangular brackets 104L, 104R
30 provided at the junction portion 103. The cylinder head cover 58 can be viewed from above.

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A description is next given of a procedure for removing the cylinder head and the cylinder (the cylinder block) while targeting the internal combustion engine 23 described with Fig. 5.

As illustrated in Fig. 13(a), the internal combustion engine 23 includes a crankcase 106; a
5 cylinder 57 put on the crankcase 106; a cylinder head 107 put on the cylinder 57; and a cylinder head cover 58 put on the cylinder head 107. Bolts fastening the cylinder head cover 58 are first loosened and removed.

As illustrated in Fig. 13(b), the cylinder head cover 58 is raised upward and removed upward
10 by being passed through between the left rear pipe portion 71L and the right rear pipe portion 71R. Incidentally, the cylinder head cover 58 may be removed also vehicle-laterally by being passed below the left rear pipe 71L or the right rear pipe 71R.

As illustrated in Fig. 14(a), the cylinder head 107 is raised while being pulled out from the
15 stack pins 108. Then, the cylinder head 107 is removed upward by being passed through between the left rear pipe portion 71L and the right rear pipe portion 71R.

Incidentally, as illustrated in Fig. 14(b) which is a view as viewed from arrow "b" in Fig.
14(a), if the length of a left stack pin 108L is shorter than a right stack pin 108R, the cylinder
20 head 107 can be removed leftward in the vehicle-width direction.

As illustrated in Fig. 15(a), the cylinder 57 is raised while being pulled out from the stack
pins 108. However, the cylinder 57 cannot be removed toward the front of the drawing
(laterally of the vehicle) because a sleeve 109 gets stuck with the stack pins 108, 108.

25

Fig. 15(b) is a plan view of Fig. 15(a). The upper surface of the cylinder 57 has a vehicle-
widthwise length greater than a vehicle-longitudinal length. Therefore, the cylinder 57 gets
stuck with the left and right rear portions 71L, 71R. Thus, the cylinder 57 cannot be removed
upward.

30

With that, the cylinder 57 is turned around its vertical axis by 90°. If so, as illustrated in Fig. 15(c), the cylinder 57 can be removed upward from between the left and right rear pipe portions 71L, 71R.

5 As described above, according to the present invention, not only the cylinder head cover (reference numeral 58 in Fig. 13) can be removed but also the cylinder 57 can be removed because of employing the Y-shaped upper pipe 55. In this case, it is not necessary to increase the height-size of the body frame 41. Consequently, the downsizing and weight reduction of the body frame can be
10 maintained so that the downsizing and weight reduction of the vehicle can be maintained.

Incidentally, the present invention is suitable for all terrain vehicles; however, it is acceptable to apply the invention to general vehicles.

15

The present invention is suitable for all terrain vehicles.

Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that
20 variations may be made thereto without departing from the invention as defined in the appended claims.

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. A vehicle comprising an internal combustion engine for transmitting
5 power to at least one of a front wheel and a rear wheel to travel, the internal
combustion engine being mounted on a body frame supporting the front wheel and
the rear wheel, wherein a cylinder of the internal combustion engine extends
upward and a cylinder head cover is secured on an upper end of the cylinder, the
10 body frame includes an upper pipe extending in the longitudinal direction of the
vehicle at a position above the internal combustion engine, and the upper pipe
includes a single front pipe portion, a branch portion bifurcated from a rear end of
the front pipe portion, and two left and right rear pipe portions extending vehicle-
rearward from the branch portion, and the branch portion is located vehicle-
15 forward of the cylinder head cover so that the cylinder head cover is located
between the two left and right rear pipe portions as viewed from above.

2. The vehicle according to claim 1, wherein an air cleaner and electric
device storage box having a left chamber and a right chamber juxtaposed in a
vehicle-widthwise direction is mounted to the front pipe portion, an air cleaner is
20 housed in one of the left chamber and the right chamber and an electric device is
housed in the other.

3. The vehicle according to claim 2, wherein a throttle body adapted to
control intake air supplied to the internal combustion engine is disposed between
25 the two left and right rear pipe portions in a plan view, and a connecting tube
connecting the air cleaner with the throttle body extends from the air cleaner, then
passing through between the two left and right rear pipe portions, and terminates
at the throttle body.

30 4. The vehicle according to claim 3, wherein a seat on which an occupant
sits is disposed vehicle-rearward of the air cleaner and electric device storage box,
the seat is a part that is arcuate in vehicle-widthwise section, has a groove-like
recessed portion recessed upward at the center of a bottom and extending in the
longitudinal direction of the vehicle, and is supported by the two left and right rear
35 pipe portions, and a portion of the connecting tube is housed in the recessed
portion.

5. The vehicle according to any one of claims 1 to 4, wherein the internal combustion engine is mounted on the body frame via a plurality of engine mounts, and of the plurality of engine mounts, at least one engine mount is installed on the upper pipe at a position close to the branch portion.

5

6. The vehicle according to any one of claims 1 to 5, wherein the body frame includes a pair of left and right main frames extending in the longitudinal direction of the vehicle at a position below the internal combustion engine and then extending upward and a left and right seat rails extending vehicle-rearward from corresponding rear ends of the main frames and supporting a rear portion of the seat, and rail side collars extending in the longitudinal direction of the vehicle are provided at corresponding leading ends of the left and right seat rails, pipe side collars extending in the longitudinal direction of the vehicle are provided at a rear end of the upper pipe, and the rail side collars and the pipe side collars are fastened to each other by means of bolts extending in the longitudinal direction of the vehicle.

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7. The vehicle according to claim 6, wherein front wheel suspension support portions each formed of a pipe or plate and suspending the front wheel extend upward from corresponding front portions of the main frames, an upper pipe front support portion formed of a pipe and supporting a front portion of the upper pipe extends vehicle-rearward from the front wheel suspension support portions, support portion side collars extending in the longitudinal direction of the vehicle is provided at the upper pipe front support portion, and a front portion of the upper pipe is fastened to the support portion side collars by means of bolts extending in the longitudinal direction of the vehicle.

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8. The vehicle according to any one of claims 1 to 7, wherein the upper pipe includes a first member connecting one rear pipe portion of two left and right rear pipe portions with the single front pipe portion and a second member composed of the other rear pipe portion of the two left and right rear pipe portions, and a leading end of the second member is welded to the first member at the branch portion.

30

FIG. 1

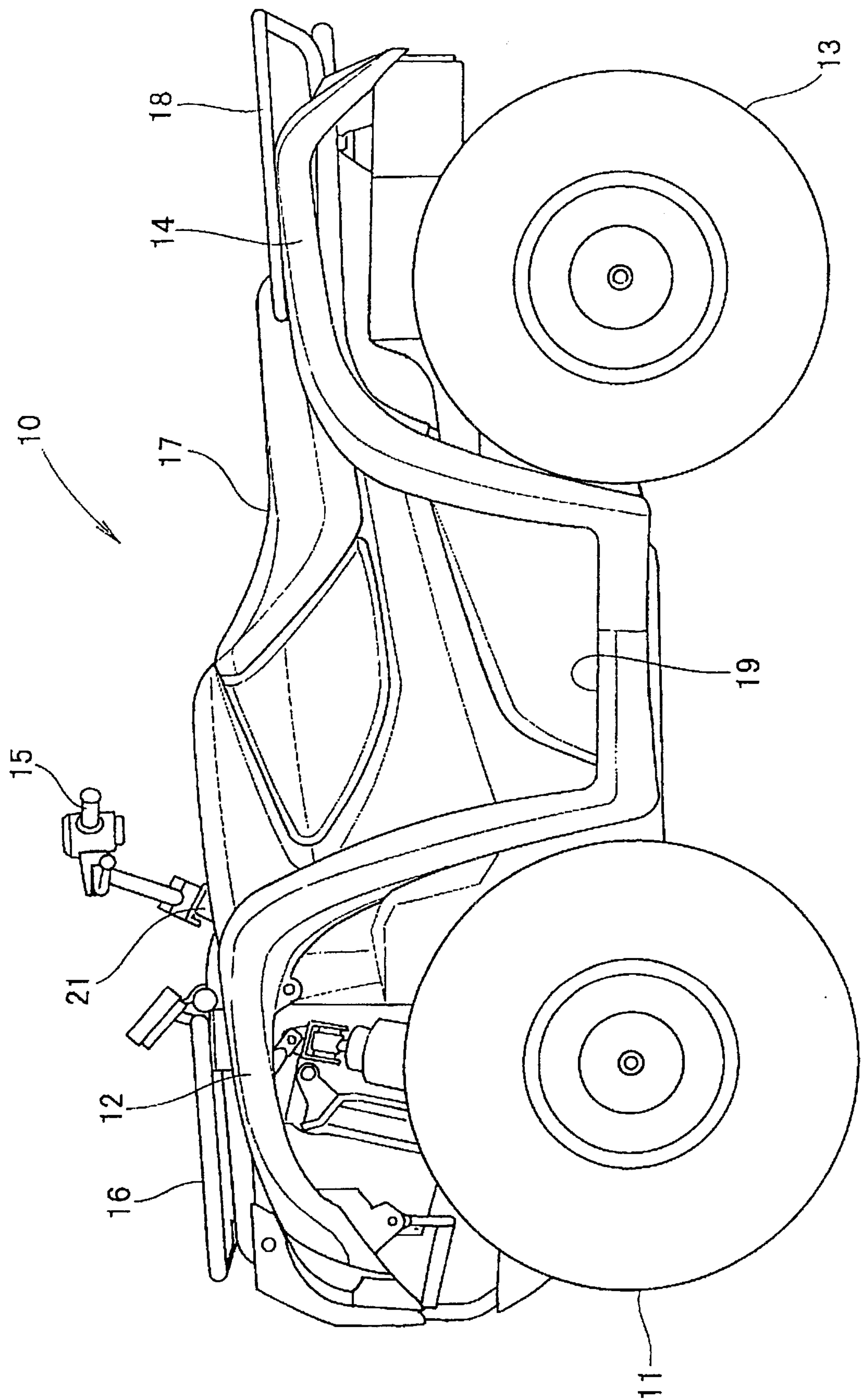


FIG. 2

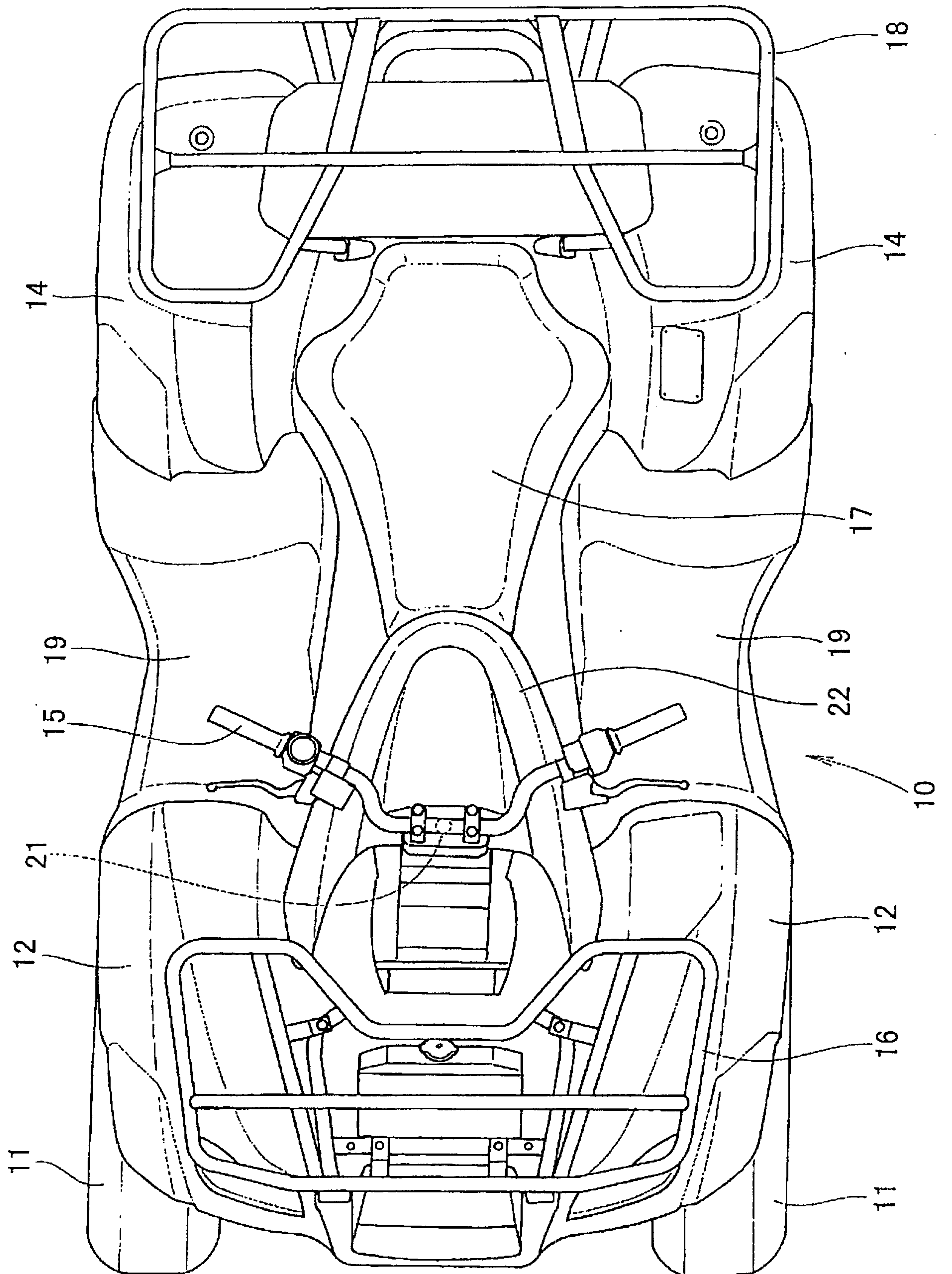


FIG. 3

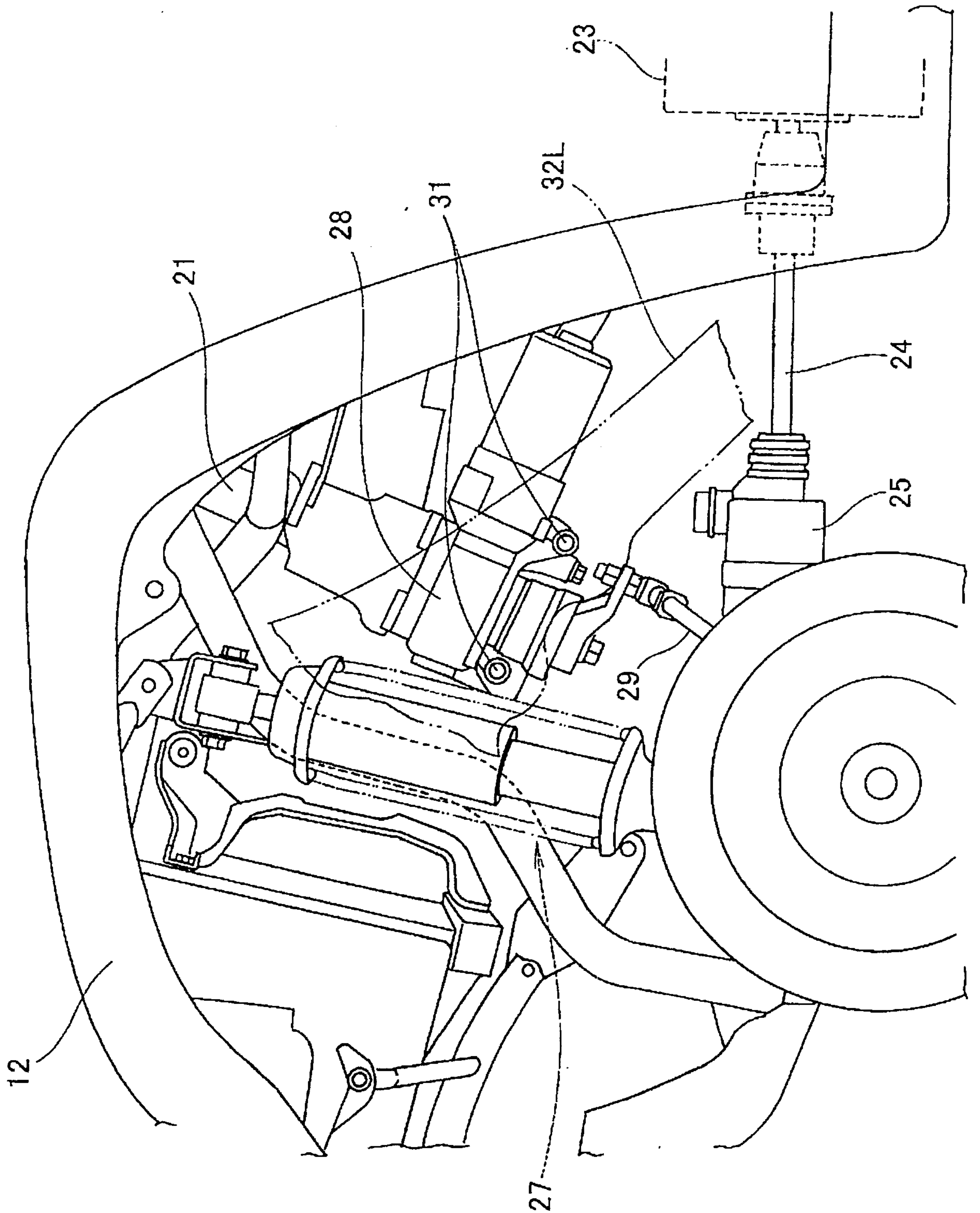


FIG. 4

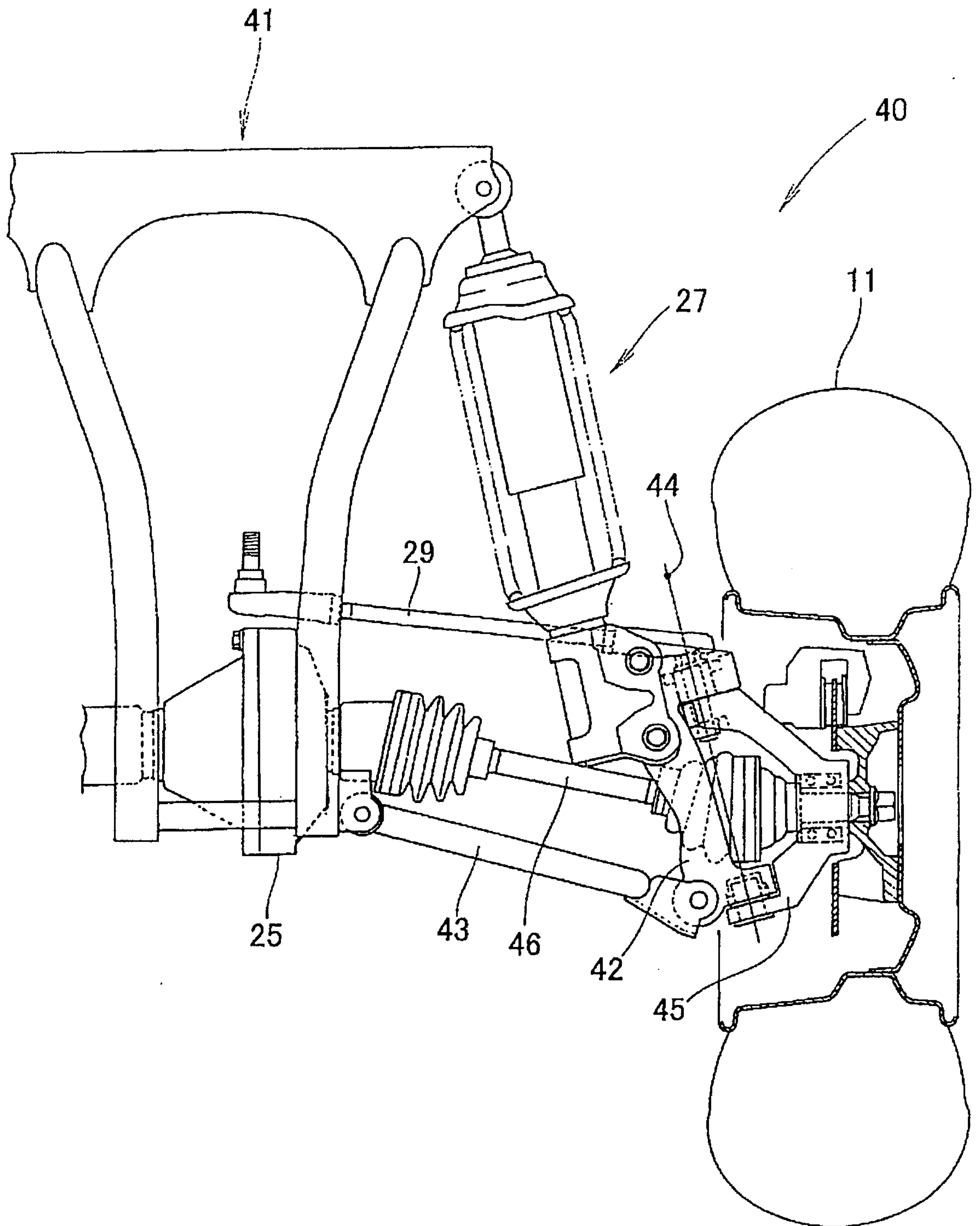


FIG. 5

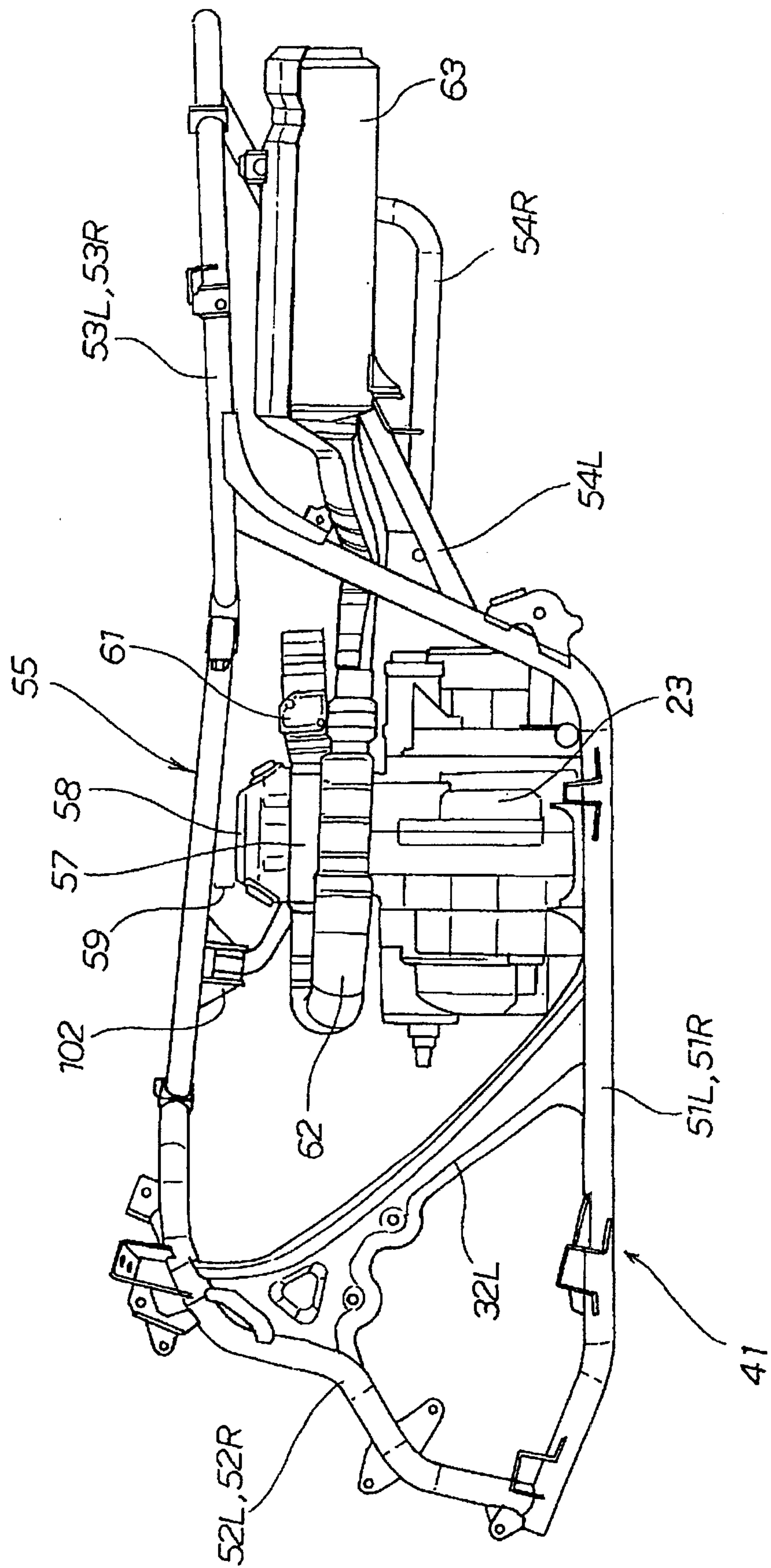


FIG. 6

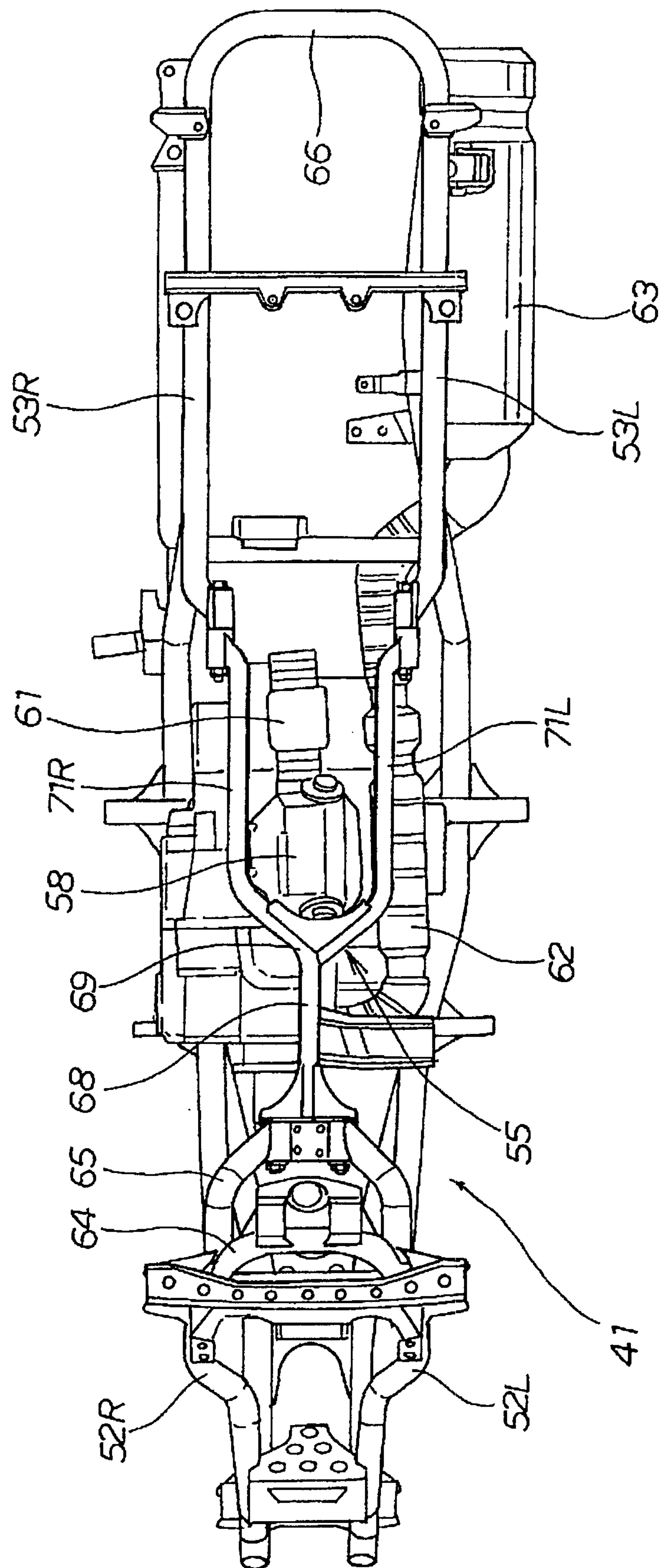


FIG. 7

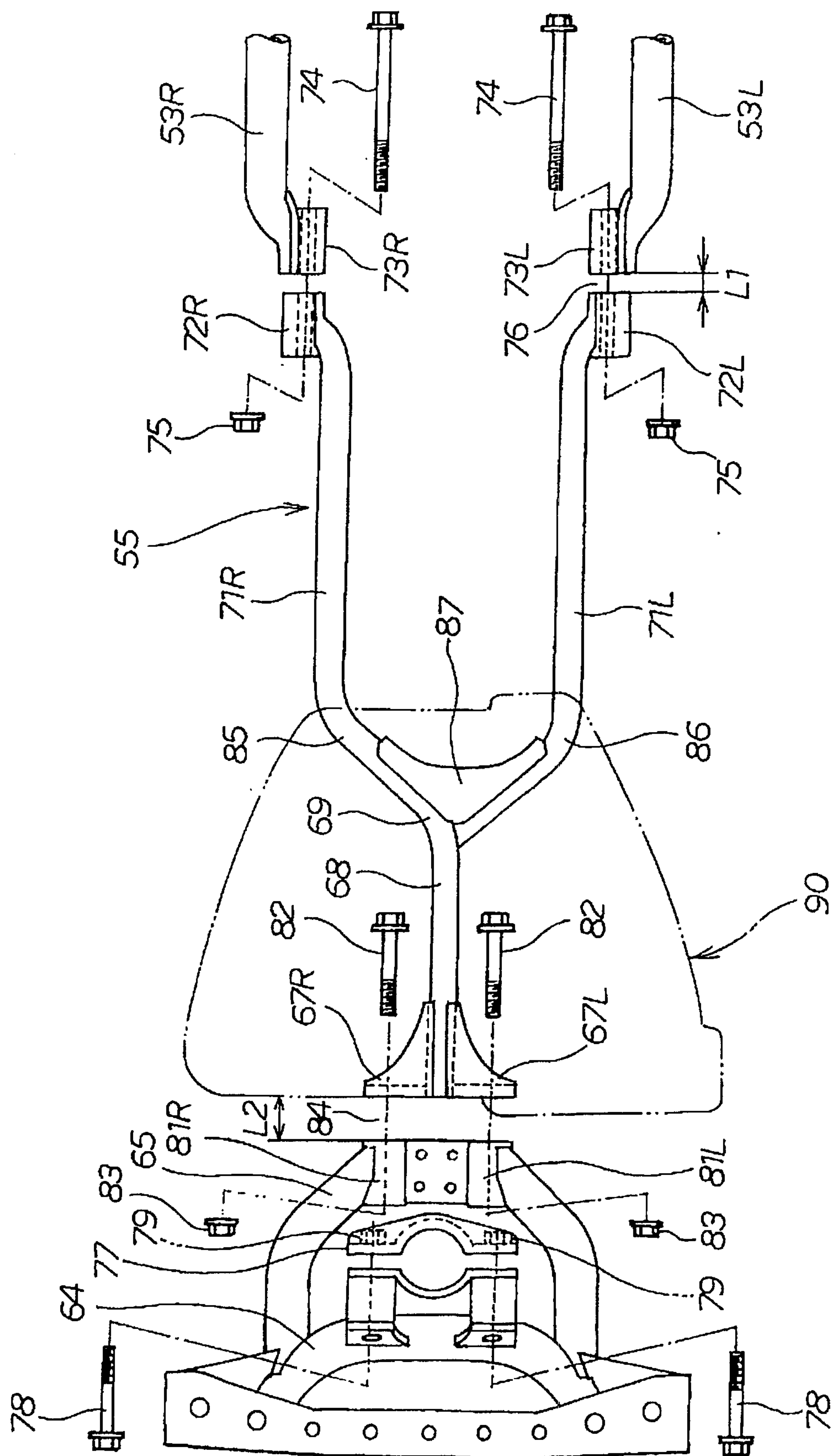


FIG. 8

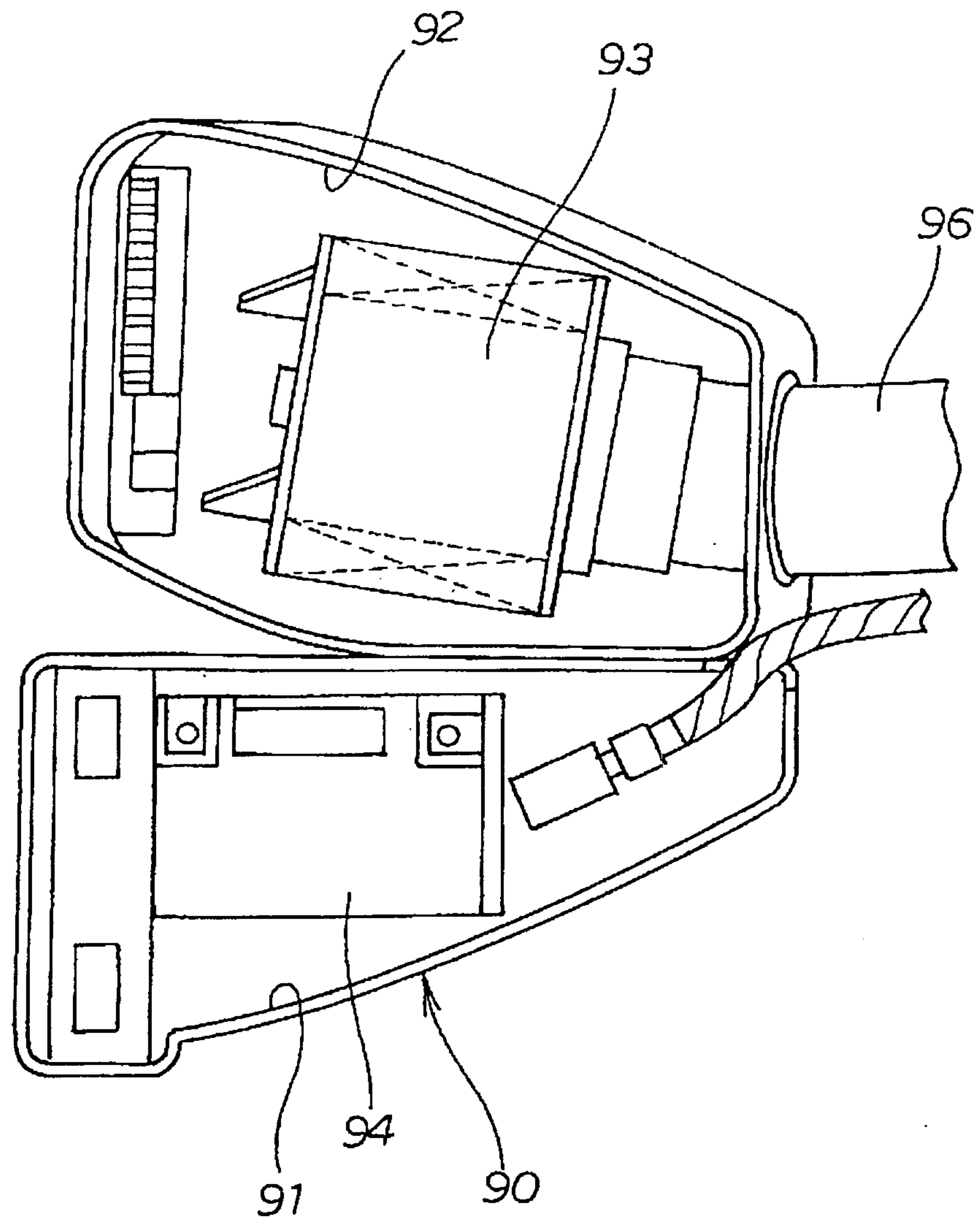


FIG. 9

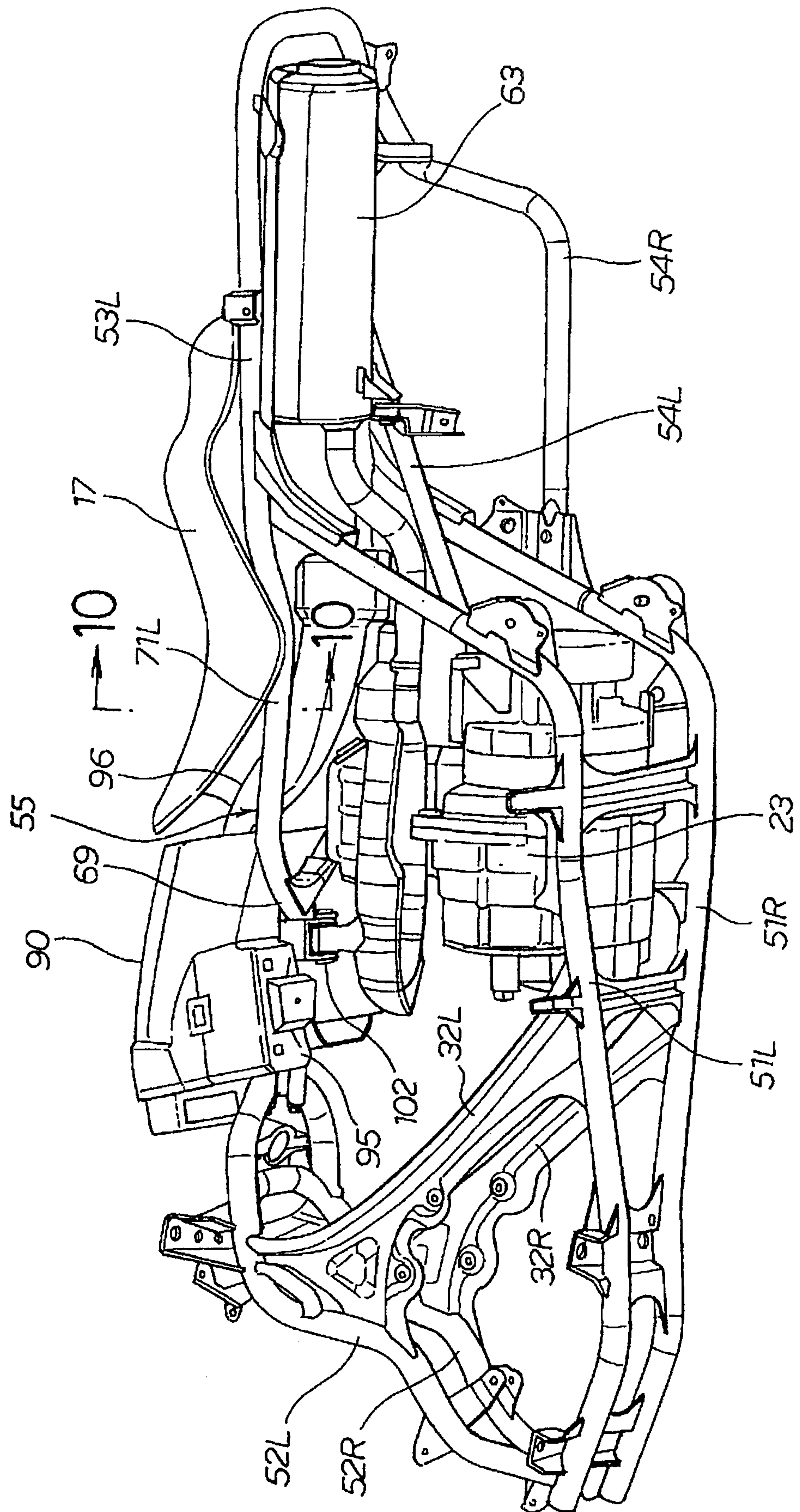


FIG. 10

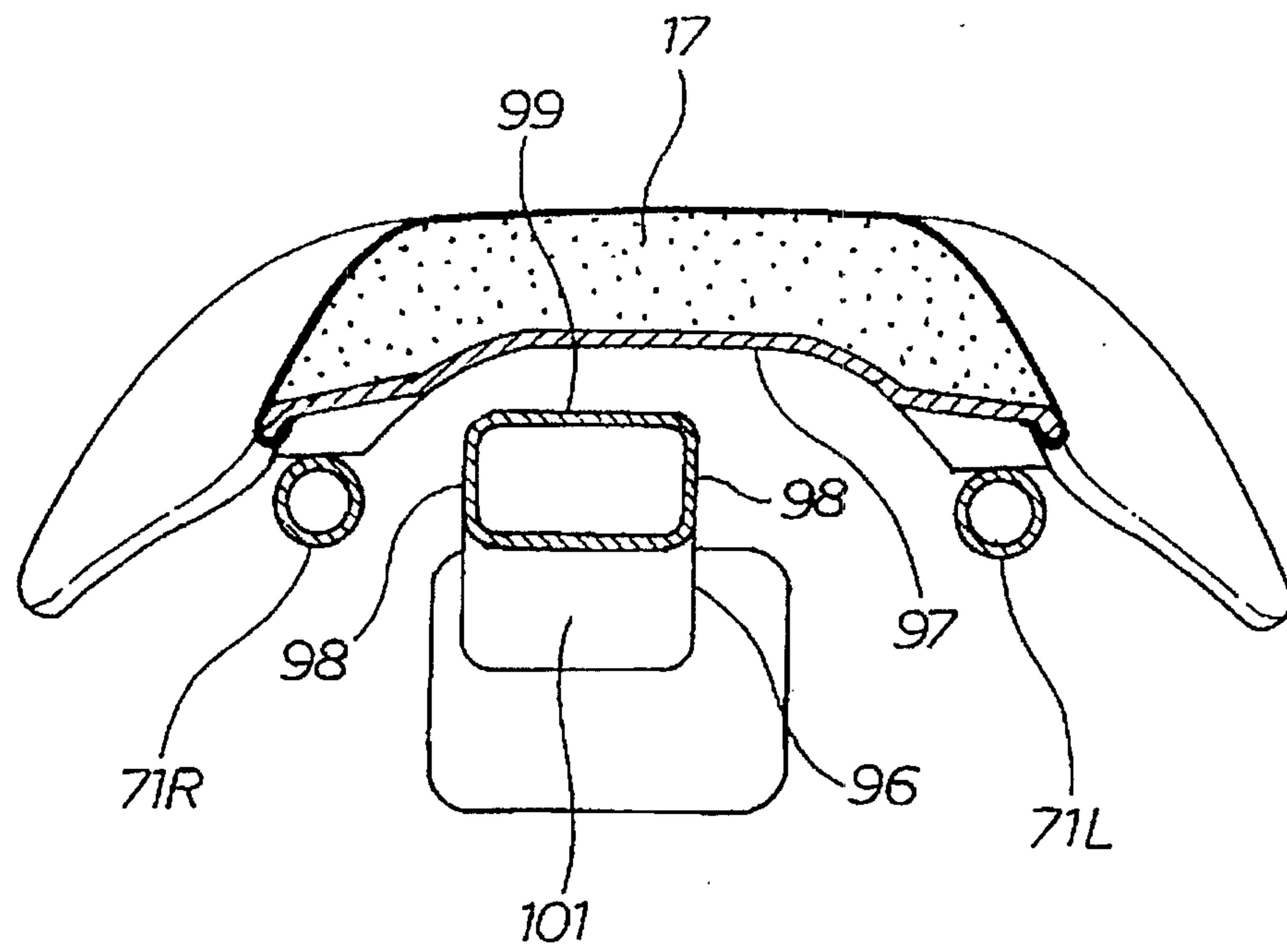


FIG. 11

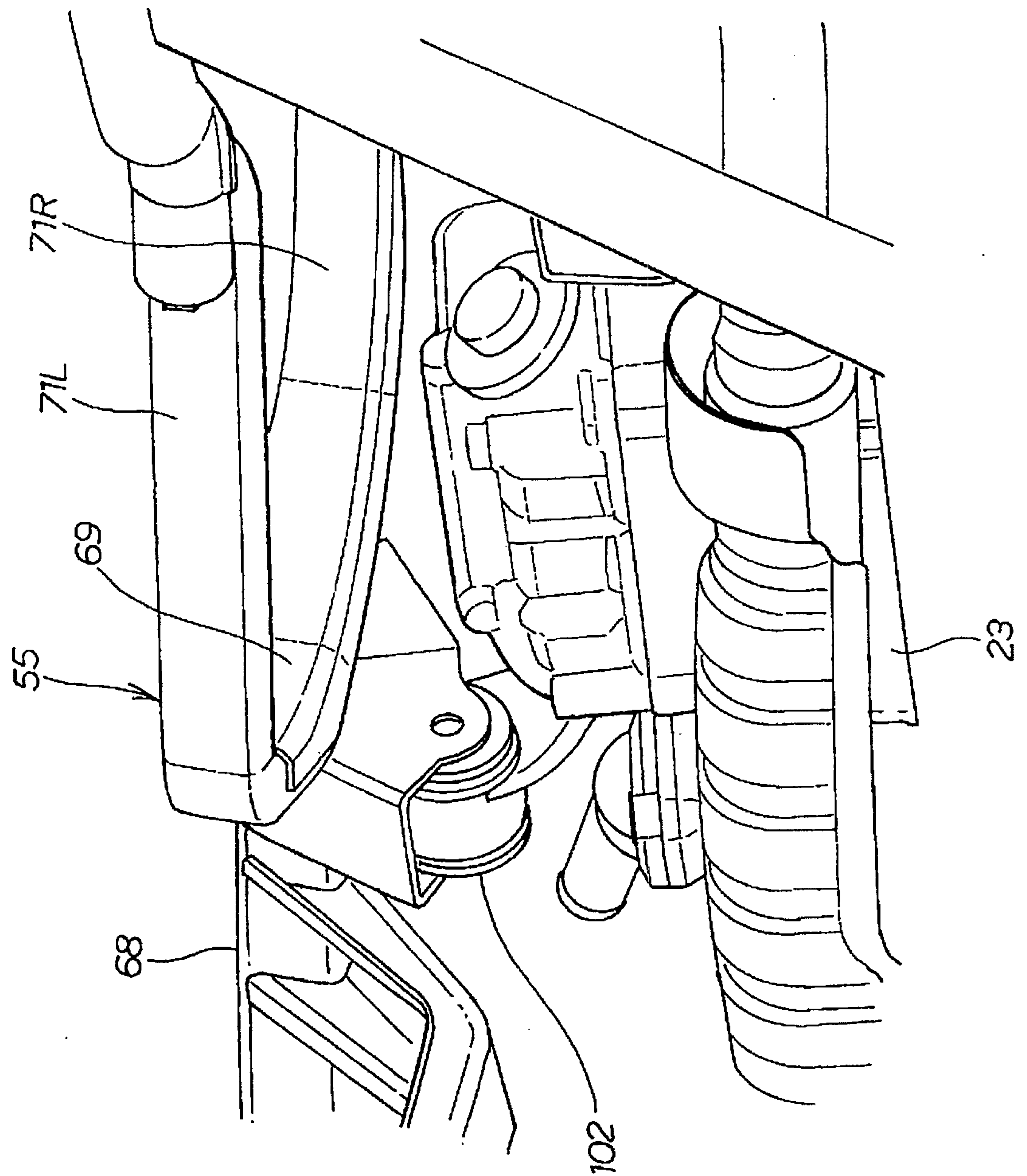


FIG. 12

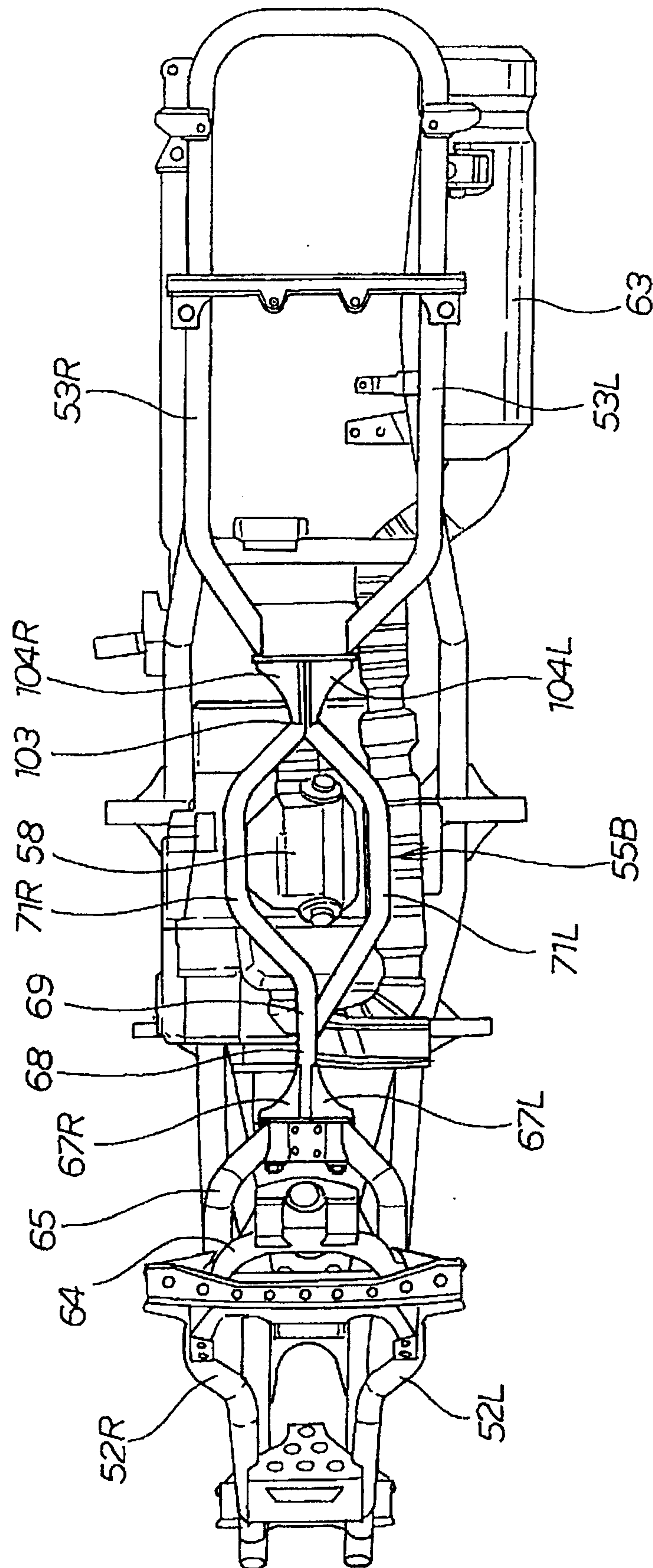


FIG. 13

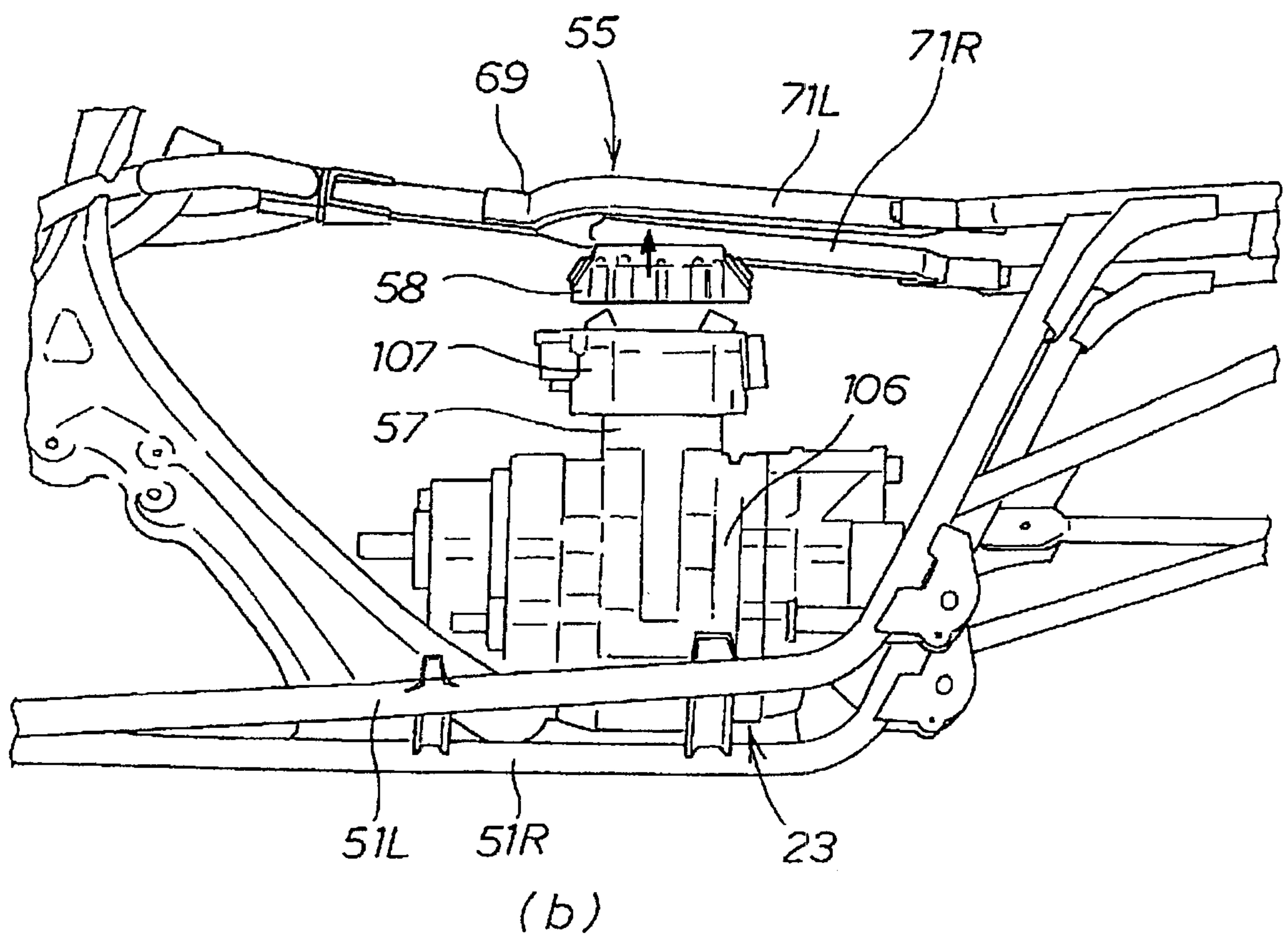
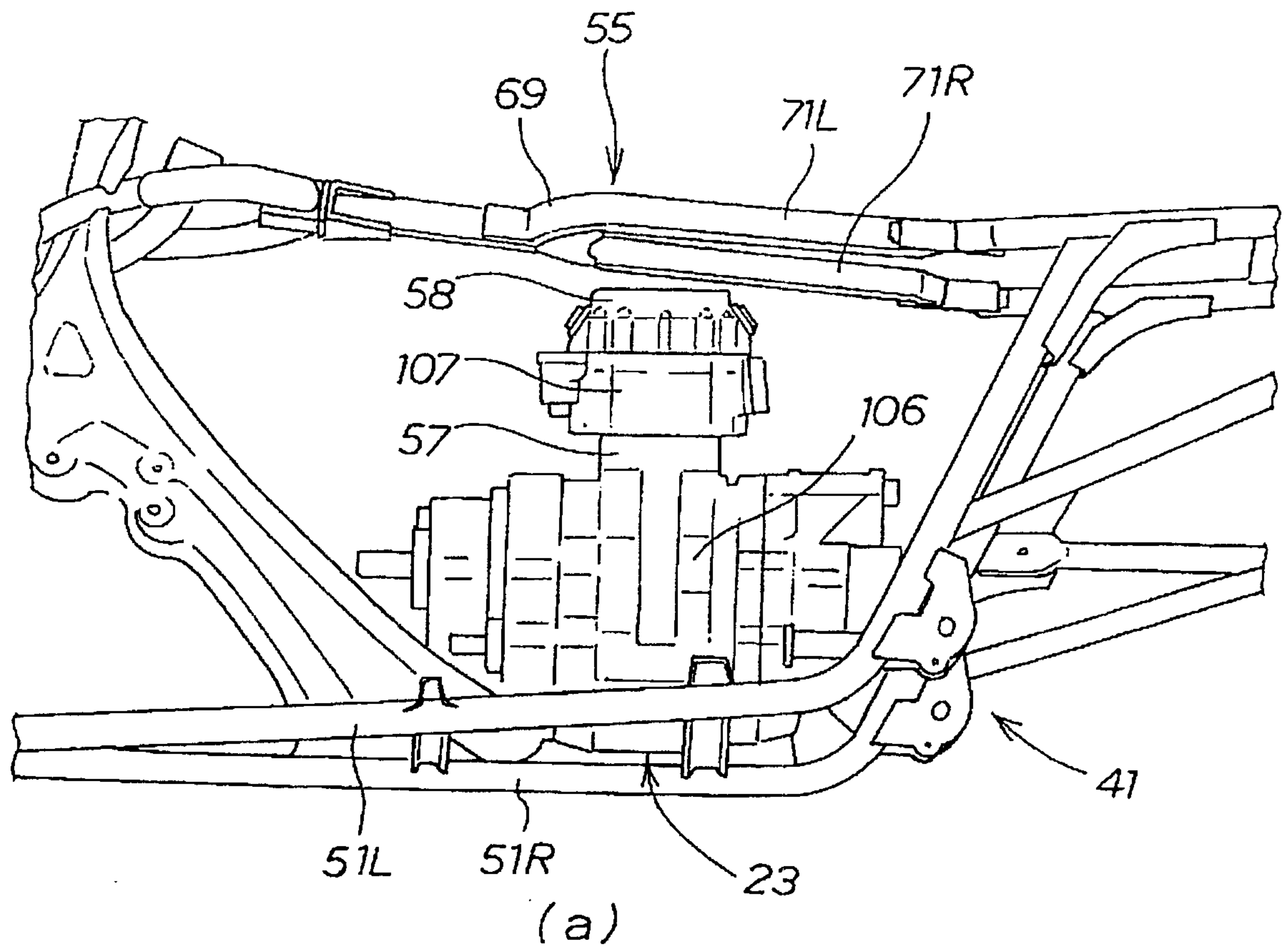


FIG. 14

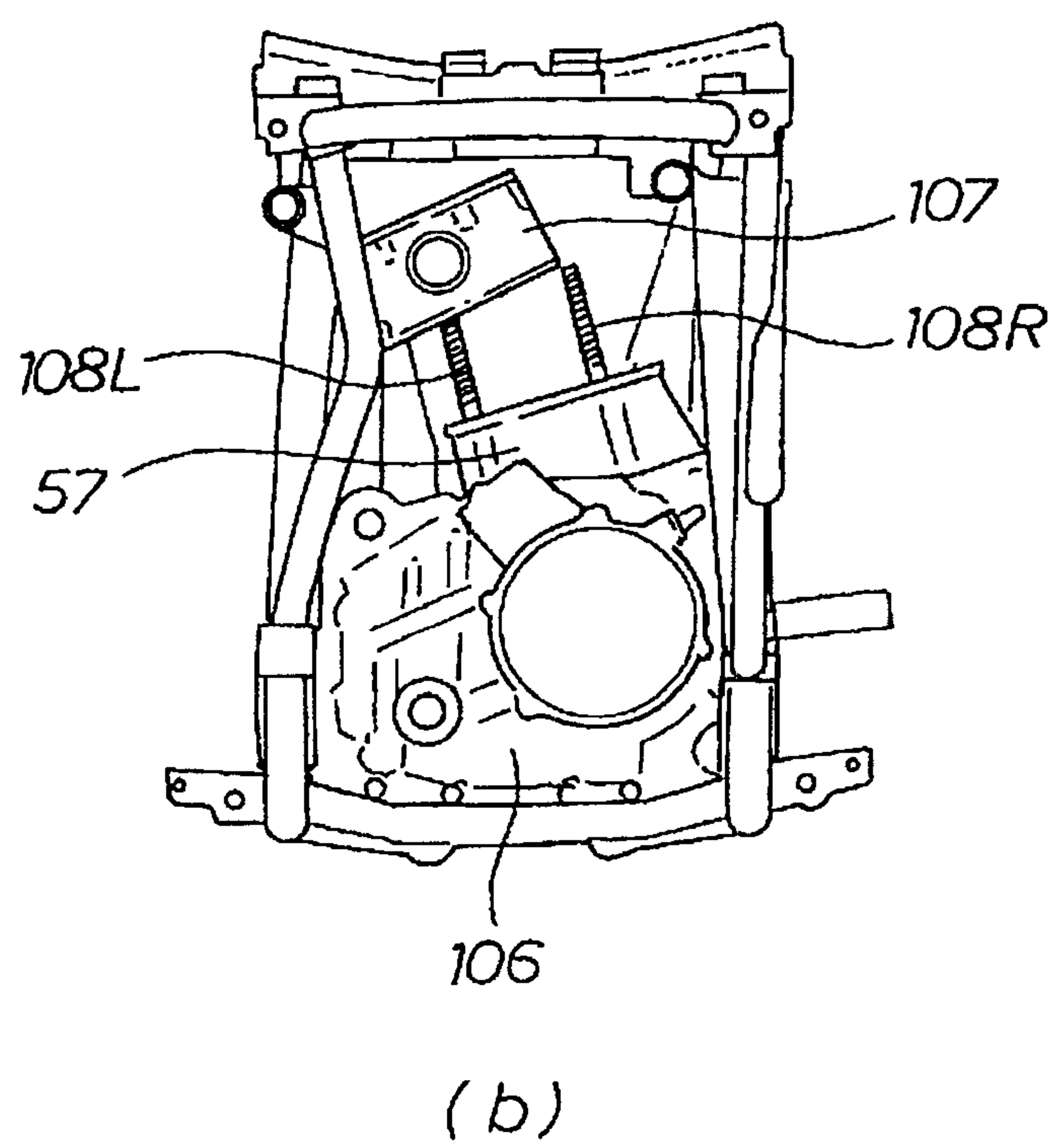
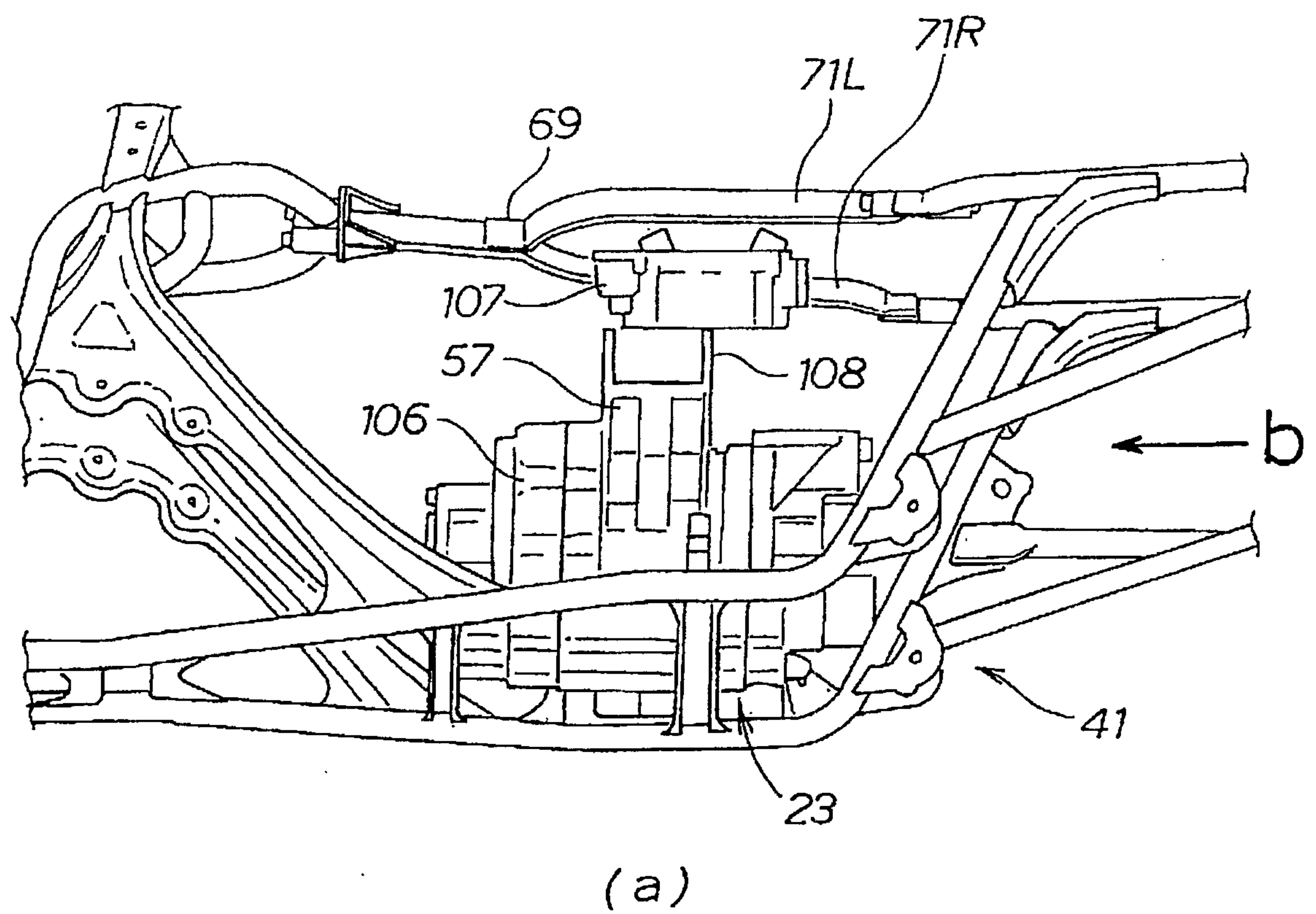
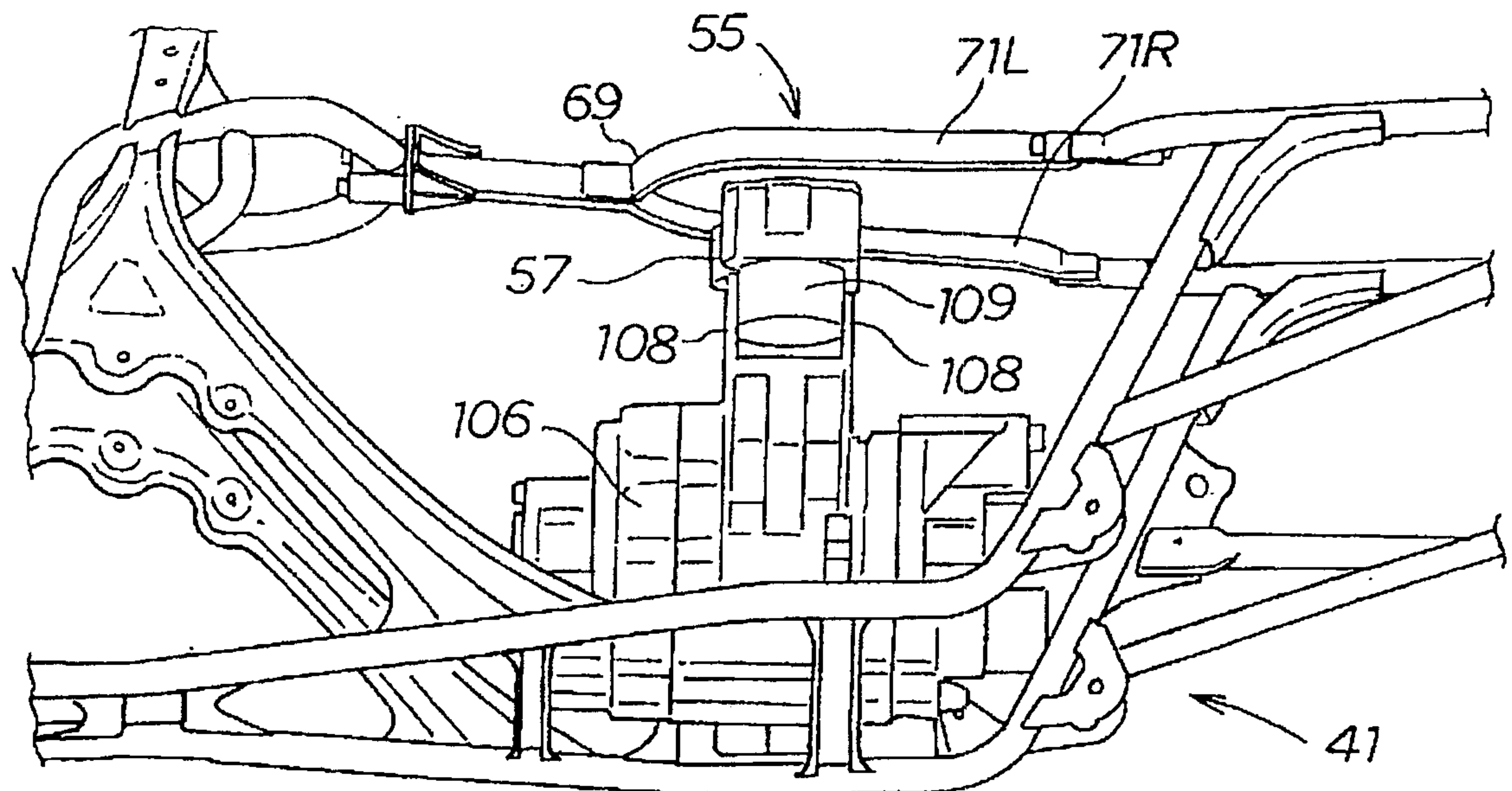
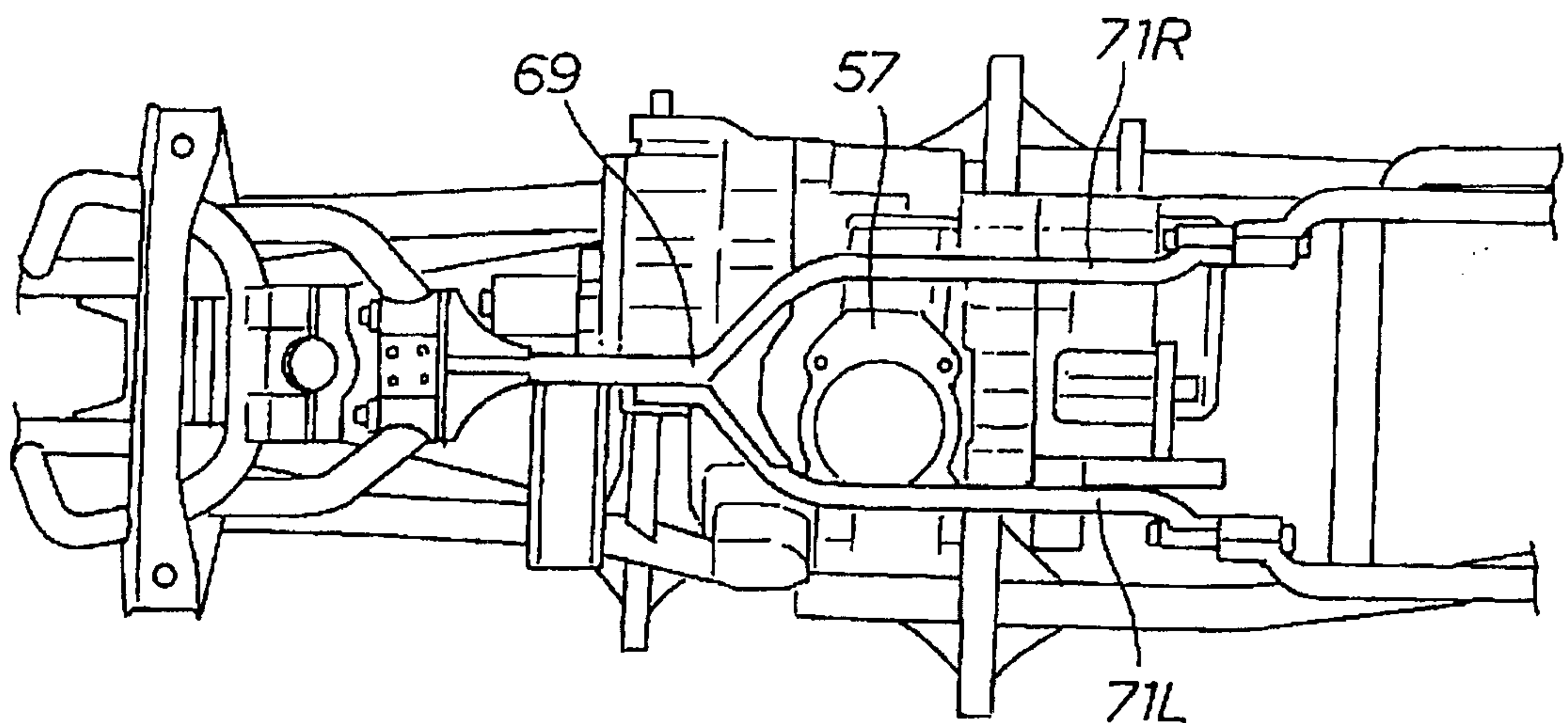


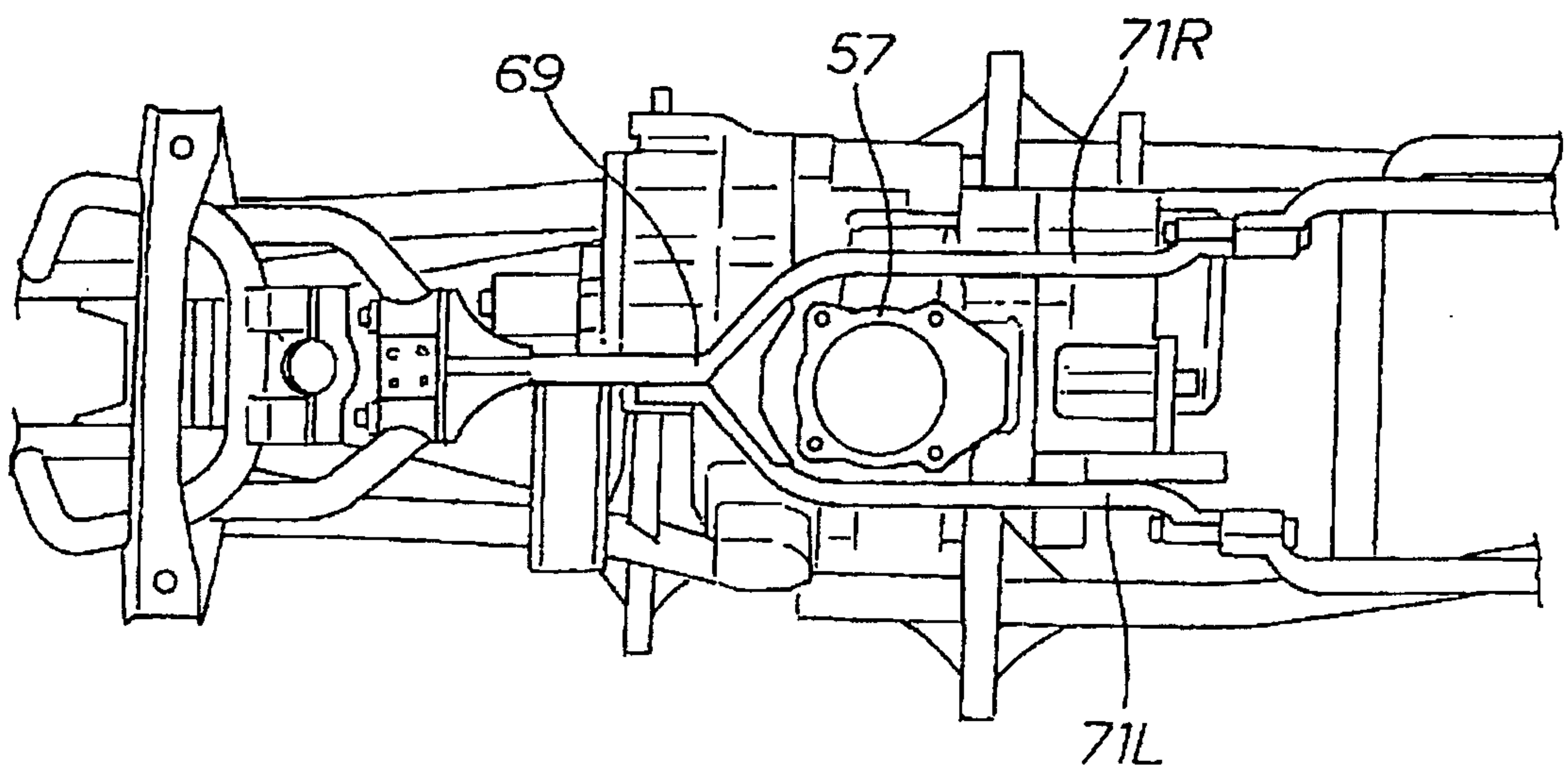
FIG. 15



(a)



(b)



(c)

