Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2902968 C 2017/06/20

(11)(21) **2 902 968**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(22) **Date de dépôt/Filing Date:** 2015/09/02

(41) **Mise à la disp. pub./Open to Public Insp.:** 2016/03/26

(45) **Date de délivrance/Issue Date:** 2017/06/20

(30) **Priorité/Priority:** 2014/09/26 (JP2014-197455)

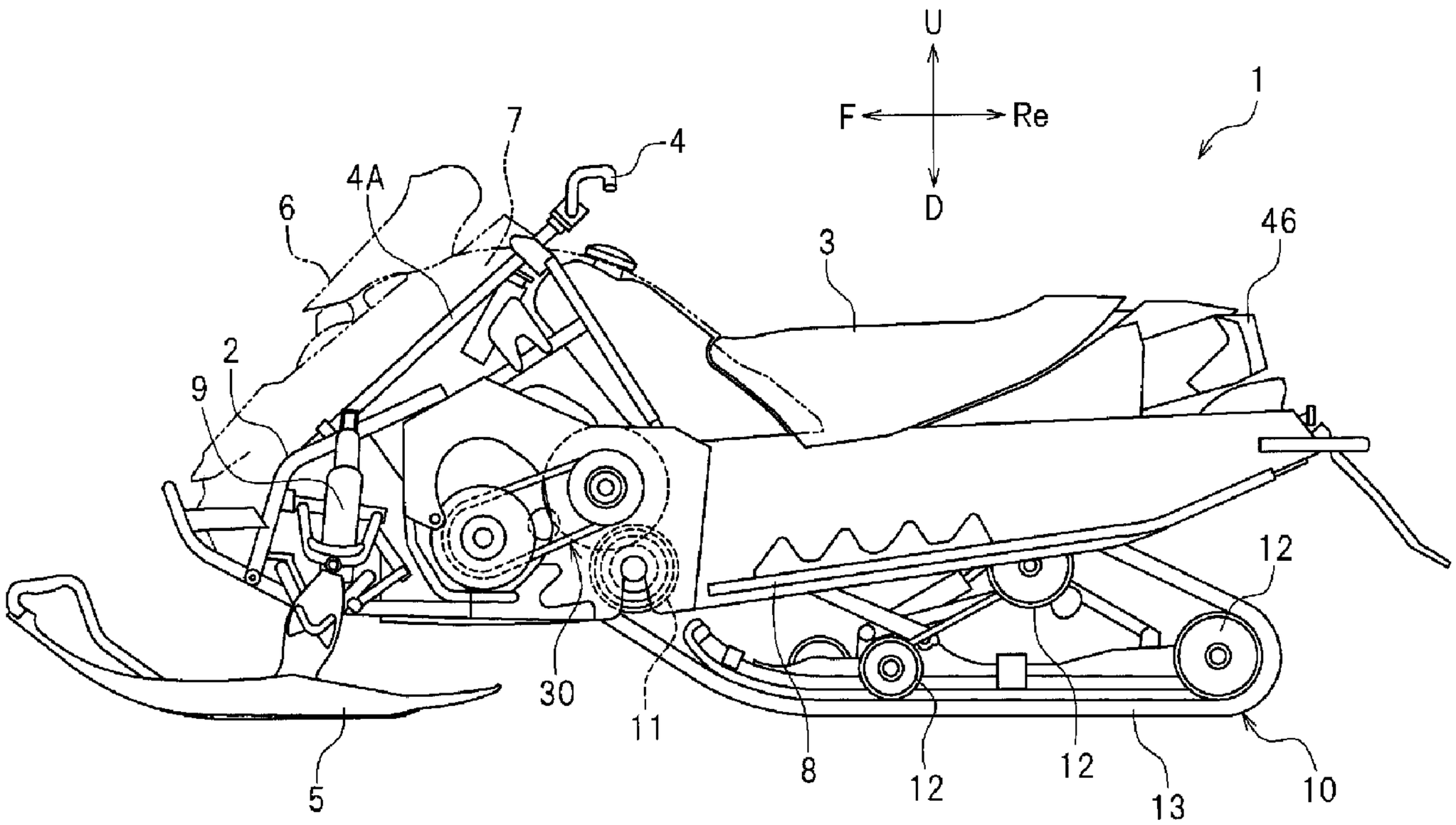
(51) **Cl.Int./Int.Cl.** ***B60K 25/02*** (2006.01),
B60K 13/02 (2006.01), ***B62D 55/07*** (2006.01)

(72) **Inventeurs/Inventors:**
KAI, MANABU, JP;
NAKAMURA, AKIHIKO, JP

(73) **Propriétaire/Owner:**
YAMAHA HATSUDOKI KABUSHIKI KAISHA, JP

(74) **Agent:** PERRY + CURRIER

(54) **Titre : VEHICULE**
(54) **Title: VEHICLE**



(57) **Abrégé/Abstract:**
A vehicle includes a transmission including an input shaft linked to a crankshaft of an engine so that power is transmitted therebetween, and an output shaft which is able to rotate at a rotational speed lower than a rotational speed of the input shaft . The snowmobile includes a driving device linked to the output shaft so that power is transmitted therebetween to generate a driving power, a supercharger including a rotation shaft linked to the output shaft so that power is transmitted therebetween, and a centrifugal clutch located between the crankshaft and the input shaft or between the output shaft and the rotation shaft .

ABSTRACT OF THE DISCLOSURE

A vehicle includes a transmission including an input shaft linked to a crankshaft of an engine so that power is transmitted therebetween, and an output shaft which is able to rotate at a rotational speed lower than a rotational speed of the input shaft. The snowmobile includes a driving device linked to the output shaft so that power is transmitted therebetween to generate a driving power, a supercharger including a rotation shaft linked to the output shaft so that power is transmitted therebetween, and a centrifugal clutch located between the crankshaft and the input shaft or between the output shaft and the rotation shaft.

VEHICLE

[0001] The present application claims priority to Japanese Patent Application No. 2014-197455, filed on September 26, 2014.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a vehicle including a supercharger.

2. Description of the Related Art

[0003] A supercharger has been used in order to improve the engine power in vehicles such as snowmobiles and four-wheel buggies. United States Patent No. 7,198,127 discloses a snowmobile including a turbo-type supercharger that utilizes the energy of the exhaust gas from the internal combustion engine. U.S. Patent Application Publication No. 2007/0102215 discloses a snowmobile including a mechanical supercharger that is driven by the crankshaft of the internal combustion engine.

[0004] A turbo-type supercharger utilizes the energy of the exhaust gas, and when it is used in an off-road vehicle such as a snowmobile or a four-wheel buggy, the responsiveness is poor in the low- to mid-speed range where the energy of the exhaust gas is small. That is, in the low- to mid-speed range, the effect of the turbo-type

supercharger for enhancing the engine power does not respond well to the throttle control. Moreover, the use of hot exhaust gas necessitates an advanced thermal management in the turbo-type supercharger and the engine room.

[0005] With a supercharger that is driven by the crankshaft, a vehicle that is normally used at a high engine speed, such as a snowmobile, will have an unnecessarily high supercharging pressure at a low speed. The need to control the supercharging pressure so that the supercharging pressure will not be too high leads to a complicated structure. An off-road vehicle such as a snowmobile or a four-wheel buggy is sometimes used under harsh environments such as subfreezing temperatures. When using a supercharger that is driven by the crankshaft, the load on the crankshaft is increased by the power used to drive the supercharger. Therefore, when starting the engine with a starter motor, it is necessary to provide a large power to the crankshaft, and it is thus necessary to provide a larger starter motor.

SUMMARY OF THE INVENTION

[0006] Preferred embodiments of the present invention have been made in view of the problems set forth above, and provide a vehicle that improves the engine power, keeps the load on the crankshaft at start-up low, and achieves desirable supercharging pressure characteristics.

[0007] A vehicle according to a preferred embodiment of the present

invention includes an internal combustion engine including a crankshaft, a transmission, a driving device, a supercharger, and a centrifugal clutch. The transmission includes an input shaft linked to the crankshaft so that power is transmitted therebetween, and an output shaft which is linked to the input shaft and is able to rotate at a rotational speed lower than a rotational speed of the input shaft. The driving device is linked to the output shaft so that power is transmitted therebetween and is configured to generate a driving power. The supercharger includes a rotation shaft linked to the output shaft so that power is transmitted therebetween and is configured to compress air and supply compressed air to the internal combustion engine. The centrifugal clutch is located between the crankshaft and the input shaft or between the output shaft and the rotation shaft.

[0008] The vehicle according to the preferred embodiment described above preferably includes a supercharger, and it is therefore possible to improve the engine power. The supercharger includes the rotation shaft linked to the output shaft so that power is transmitted therebetween, and is driven by the power from the output shaft. Therefore, unlike a turbo-type supercharger that utilizes the exhaust gas, the responsiveness is not lowered in the low- to mid-speed range, and there is no need for advanced thermal management. Moreover, in the vehicle described above, the centrifugal clutch is located between the crankshaft and the input shaft or between the output shaft and the rotation shaft. That is, the centrifugal clutch is located upstream

of the rotation shaft of the supercharger along the power transmission path. Therefore, when the rotational speed of the crankshaft is zero or low, the power transmission between the crankshaft and the rotation shaft of the supercharger is disconnected, thus reducing the load on the crankshaft. Therefore, the engine is desirably started by the starter motor without having to provide a large starter motor. Moreover, the supercharging pressure does not become unnecessarily high at a low speed thus achieving desirable supercharging pressure characteristics. As described above, with the vehicle described above, it is possible to improve the engine power, to keep the load on the crankshaft at start-up low, and to achieve desirable supercharging pressure characteristics.

[0009] According to a preferred embodiment of the present invention, the transmission is preferably a belt-type continuously variable transmission including a driving pulley attached to the input shaft, a driven pulley attached to the output shaft, and a belt wound around the driving pulley and the driven pulley.

[0010] According to this preferred embodiment, the transmission is able to continuously vary the transmission ratio. While the supercharger is driven by the output shaft, the rotational speed of the output shaft changes smoothly during a speed change. This prevents the operation of the supercharger from becoming unstable, thus achieving more desirable supercharging pressure characteristics.

[0011] According to another preferred embodiment of the present

invention, the transmission is located on a side of the internal combustion engine. The supercharger is located on an opposite side of the internal combustion engine from the transmission.

[0012] According to this preferred embodiment, the vehicle has a desirable weight balance.

[0013] According to another preferred embodiment of the present invention, the crankshaft extends in a vehicle width direction. The transmission is located on a first side of the internal combustion engine in the vehicle width direction. The supercharger is located on a second side, opposite to the first side, of the internal combustion engine in the vehicle width direction.

[0014] According to this preferred embodiment, the vehicle has a desirable weight balance in the vehicle width direction.

[0015] According to another preferred embodiment of the present invention, the output shaft extends from the first side toward the second side of the internal combustion engine in the vehicle width direction.

[0016] According to this preferred embodiment, on the second side of the internal combustion engine in the vehicle width direction, the output shaft and the rotation shaft of the supercharger are linked together so that power is transmitted therebetween. Thus, it is possible to simplify the configuration of the power transmission member that links together the output shaft and the rotation shaft of the supercharger.

[0017] According to another preferred embodiment of the present invention, the supercharger includes a suction port that takes in air and includes an opening facing the first side in the vehicle width direction.

[0018] According to this preferred embodiment, since the suction port of the supercharger includes an opening facing toward the first side in the vehicle width direction, it is possible to provide extra space on the second side of the supercharger in the vehicle width direction. This extra space is effectively utilized as a space to install other components. For example, the extra space is effectively utilized as a space to install the power transmission member that links together the output shaft and the rotation shaft of the supercharger.

[0019] According to another preferred embodiment of the present invention, the vehicle includes a duct including an inlet located on the first side of the internal combustion engine in the vehicle width direction, and an outlet connected to the suction port of the supercharger, wherein the duct extends from the first side toward the second side in the vehicle width direction.

[0020] According to this preferred embodiment, air is taken in from the first side in the vehicle width direction.

[0021] According to another preferred embodiment of the present invention, the rotation shaft of the supercharger is linked to the output shaft via at least one of a belt, a chain, and a gear.

[0022] According to this preferred embodiment, the power from the

output shaft is desirably transmitted to the rotation shaft of the supercharger.

[0023] According to another preferred embodiment of the present invention, the output shaft includes a driving device link portion linked to the driving device, and a supercharger link portion linked to the rotation shaft of the supercharger.

[0024] According to this preferred embodiment, since the supercharger is not located downstream of the driving device, along the power transmission path, the supercharger operates without being substantially influenced by the operation of the driving device. Thus, it is possible to desirably operate the supercharger.

[0025] According to another preferred embodiment of the present invention, the driving device link portion is located between the supercharger link portion along the output shaft and the transmission.

[0026] According to this preferred embodiment, the supercharger link portion is located on the outer side of the driving device link portion along the output shaft. Thus, a common internal combustion engine is able to be used both for vehicles including a supercharger and for vehicles including no supercharger.

[0027] According to another preferred embodiment of the present invention, the driving device includes a switching device to switch between a forward moving mode in which a forward driving power is generated and a backward moving mode in which a backward driving power is generated.

[0028] According to this preferred embodiment, the vehicle is moved forward and backward through the switching of the switching device. Since the supercharger is not located downstream of the driving device, as described above, the direction of rotation of the rotation shaft is not reversed upon switching of the switching device. Thus, the supercharger is desirably operated whether the vehicle is moving forward or backward.

[0029] According to another preferred embodiment of the present invention, the vehicle is a snowmobile.

[0030] According to this preferred embodiment, it is possible to provide a snowmobile with the advantageous effects set forth above.

[0031] According to another preferred embodiment of the present invention, the vehicle is an off-road vehicle.

[0032] According to this preferred embodiment, it is possible to provide an off-road vehicle with the advantageous effects set forth above.

[0033] According to the preferred embodiments of the present invention, it is possible to provide a vehicle, with which it is possible to improve the engine power, to keep the load on the crankshaft at start-up low, and to achieve desirable supercharging pressure characteristics.

[0034] The above and other elements, features, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of the preferred

embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] FIG. **1** is a left side view showing a snowmobile according to a preferred embodiment of the present invention.

[0036] FIG. **2** is a plan view showing a primary section of the snowmobile.

[0037] FIG. **3** is a plan view showing the primary section of the snowmobile.

[0038] FIG. **4** is a left side view showing the primary section of the snowmobile.

[0039] FIG. **5** is a right side view showing the primary section of the snowmobile.

[0040] FIG. **6** is a right side view showing the primary section of the snowmobile.

[0041] FIG. **7** is a perspective view showing a driving force transmission path, a supercharger, and a duct of the snowmobile.

[0042] FIG. **8** is a cross-sectional view taken along line VIII of FIG. **6**.

[0043] FIG. **9** is a conceptual diagram showing a positional relationship between an output shaft gear, a brake disc, and a driving pulley.

[0044] FIG. **10** is a left side view of an ATV according to another preferred embodiment of the present invention.

[0045] FIG. **11** is a left side view of an ROV according to another preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0046] Preferred embodiments of the present invention will now be described. As shown in FIG. **1**, a vehicle of the present embodiment is a snowmobile **1**. The terms front, rear, left, right, up, and down, as used in the description below, refer to these directions as seen from a passenger seated in a seat **3** of the snowmobile **1**, unless specified otherwise. The designations F, Re, L, R, U, and D, as used in the figures, refer to front, rear, left, right, up, and down, respectively.

[0047] The snowmobile **1** includes a frame **2**, the seat **3** supported on the frame **2** in which a passenger is seated, a handle **4** operated by the passenger, and a pair of left and right skis **5**. A steering shaft **4A** is connected to the handle **4**. Although not shown in the figures, the steering shaft **4A** is linked to the left and right skis **5**. A front cover **6** is provided forward of the seat **3**. A left side cover **7** is located leftward of the front cover **6**, and a right side cover (not shown) is located rightward of the front cover **6**. A left footrest **8** is provided on the lower left side of the seat **3**, and a right footrest (not shown) is provided on the lower right side of the seat **3**. The left and right skis **5** are supported on the frame **2** via left and right suspension units **9**. The snowmobile **1** is an example of a straddle-type vehicle, and is configured to be ridden by a passenger straddling the

seat **3**. Note, however, that the vehicle of the present invention may be a straddle-type vehicle other than the snowmobile **1**, and may be a vehicle other than a straddle-type vehicle.

[0048] As shown in FIGS. **2** and **3**, the snowmobile **1** includes an internal combustion engine (hereinafter referred to as an engine) **40**, a centrifugal clutch **15**, a belt-type continuously variable transmission (hereinafter referred to as a CVT) **30**, which is an example of a transmission, and a supercharger **50** that compresses air and supplies the compressed air to the engine **40**. As shown in FIG. **1**, the snowmobile **1** includes a driving device **10** driven by the power from the engine **40**. The driving device **10** is a device that generates the driving power of the snowmobile **1**. In the present preferred embodiment, the driving device **10** includes a driving wheel **11**, a driven wheel **12**, and a track belt **13** wound around the driving wheel **11** and the driven wheel **12**. The snowmobile **1** further includes a starter motor **19** (see FIGS. **3** and **6**) that starts the engine **40**.

[0049] FIG. **4** is a left side view showing a primary section of the snowmobile **1**, and FIG. **5** is a right side view showing the primary section. Note, however, that a belt **58** to be described below is not shown in FIG. **5**. FIG. **6** is a view similar to FIG. **5**, with a brake device **65** and an oil tank **39** to be described below removed. As shown in FIG. **4**, the frame **2** includes a steering frame **4B** that rotatably supports the steering shaft **4A**. The steering shaft **4A** extends diagonally toward the lower front side. The steering frame **4B** extends diagonally toward

the lower rear side as the vehicle is seen from the side. As shown in FIG. **3**, the steering frame **4B** extends in the vehicle width direction as the vehicle is seen from above. Note that the vehicle width direction refers to the left-right direction.

[0050] As shown in FIG. **4**, the frame **2** includes an upper left frame **21L**, a lower left frame **22L**, and a left side frame **23L**. As shown in FIG. **5**, the frame **2** includes an upper right frame **21R**, a lower right frame **22R**, and a right side frame **23R**.

[0051] The upper left frame **21L**, the lower left frame **22L**, the upper right frame **21R**, and the lower right frame **22R** are preferably pipe-shaped members. As shown in FIG. **3**, the upper left frame **21L** and the upper right frame **21R** are spaced apart from each other in the vehicle width direction. As shown in FIGS. **4** and **5**, the upper left frame **21L** and the upper right frame **21R** preferably have a bent shape as the vehicle is seen from the side. As shown in FIG. **3**, the upper left frame **21L** and the upper right frame **21R** preferably have a bent shape as the vehicle is seen from above. As the vehicle is seen from above, a front portion of the upper left frame **21L** and a front portion of the upper right frame **21R** are inclined with respect to the vehicle center line **CL** so that the interval or space therebetween decreases in the forward direction. A rear portion of the upper left frame **21L** and a rear portion of the upper right frame **21R** extend in the vehicle front-rear direction.

[0052] The lower left frame **22L** is located under the upper left frame **21L**, and the lower right frame **22R** is located under the upper

right frame **21R**. As the vehicle is seen from above, the lower left frame **22L** and the lower right frame **22R** preferably have a bent shape similar to that of the upper left frame **21L** and the upper right frame **21R**. As shown in FIG. **4**, the upper left frame **21L** extends diagonally in an upper rear direction from the front end portion of the lower left frame **22L** as the vehicle is seen from the side. An intermediate portion of the upper left frame **21L** preferably has a bent shape. As shown in FIG. **5**, the upper right frame **21R** extends diagonally in an upper rear direction from the front end portion of the lower right frame **22R** as the vehicle is seen from the side. An intermediate portion of the upper right frame **21R** preferably has a bent shape.

[0053] As shown in FIG. **3**, a plurality of transverse frames **24** extending in the vehicle width direction bridge the upper left frame **21L** and the upper right frame **21R**. The upper left frame **21L** and the upper right frame **21R** are connected together by the transverse frames **24**. Although not shown in the figures, the lower left frame **22L** and the lower right frame **22R** are connected together by a plurality of transverse frames extending in the vehicle width direction.

[0054] As shown in FIGS. **4** and **5**, the left side frame **23L** and the right side frame **23R** are preferably plate-shaped members. The left side frame **23L** and the right side frame **23R** extend in the vehicle front-rear direction and in the vertical direction. Note that the vertical direction refers to the vehicle up-down direction. As shown in FIG. **3**, the left side frame **23L** and the right side frame **23R** are

spaced apart from each other in the vehicle width direction. The left side frame **23L** and the right side frame **23R** are connected together by a plurality of transverse frames extending in the vehicle width direction. As shown in FIGS. **4** and **5**, a recessed portion **25** recessed toward the rear side is provided in the front portion of the left side frame **23L** and in the front portion of the right side frame **23R**. As shown in FIG. **3**, the left side frame **23L** is located between a portion of the engine **40**, excluding an outer crankshaft **45B** to be described below, and the CVT **30**, as the vehicle is seen from above. The right side frame **23R** is located between the engine **40** and the supercharger **50** as the vehicle is seen from above.

[0055] As shown in FIG. **4**, the upper left frame **21L** and the lower left frame **22L** are connected to the left side frame **23L**. While a rear portion **21La** of the upper left frame **21L** is connected to the left side frame **23L** and a rear portion **22La** of the lower left frame **22L** is connected to the left side frame **23L** in the present preferred embodiment, there is no particular limitation on how they are connected together. The upper end portion of a left vertical frame **27L** is connected to the rear portion **21La** of the upper left frame **21L**. The vertical frame **27L** preferably has a bent shape. A lower end portion **27La** of the vertical frame **27L** is connected to the left side frame **23L**. The lower end portion **27La** of the vertical frame **27L** is located above the rear portion **22La** of the lower left frame **22L**. A front portion **21Lb** of the upper left frame **21L** and the vertical frame **27L** are connected together via a middle

frame **28L** extending in the vehicle front-rear direction as the vehicle is seen from the side. The front end portion of the middle frame **28L** is connected to the front portion **21Lb** of the upper left frame **21L**, and the rear end portion of the middle frame **28L** is connected to the vertical frame **27L**.

[0056] As shown in FIG. **5**, the upper right frame **21R** and the lower right frame **22R** are connected to the right side frame **23R**. While a rear portion **21Ra** of the upper right frame **21R** is connected to the right side frame **23R** and a rear portion **22Ra** of the lower right frame **22R** is connected to the right side frame **23R** in the present preferred embodiment, there is no particular limitation on how they are connected together. The upper end portion of a right vertical frame **27R** is connected to the rear portion **21Ra** of the upper right frame **21R**. The vertical frame **27R** preferably has a bent shape. A lower end portion **27Ra** of the vertical frame **27R** is connected to the right side frame **23R**. The lower end portion **27Ra** of the vertical frame **27R** is located above the rear portion **22Ra** of the lower right frame **22R**. A front portion **21Rb** of the upper right frame **21R** and the vertical frame **27R** are connected together via a middle frame **28R** extending in the vehicle front-rear direction as the vehicle is seen from the side. The front end portion of the middle frame **28R** is connected to the front portion **21Rb** of the upper right frame **21R**, and the rear end portion of the middle frame **28R** is connected to the vertical frame **27R**.

[0057] Next, the engine **40** will be described. While there is no

particular limitation on the type of the engine **40**, the engine **40** of the present preferred embodiment is preferably a three-cylinder internal combustion engine, for example, including three cylinders arranged next to one another in the vehicle width direction. As shown in FIG. **3**, the engine **40**, excluding the outer crankshaft **45B** to be described below, is located between the left side frame **23L** and the right side frame **23R**. The engine **40** includes a crankcase **41** (see FIG. **6**), a cylinder block (not shown) connected to the crankcase **41**, and a cylinder head **43** (see FIG. **3**) connected to the cylinder block. In the present preferred embodiment, as shown in FIG. **6**, a cylinder axis **44** of the engine **40** is inclined with respect to the horizontal line and the vertical line as the vehicle is seen from the side. Specifically, the cylinder axis **44** is inclined diagonally in an upper rear direction as the vehicle is seen from the side. Although not shown in the figures, the cylinder block extends diagonally in an upper rear direction from the crankcase **41**, and the cylinder axis **44** is inclined upward toward the rear side. As shown in FIGS. **3** and **7**, the engine **40** includes a crankshaft **45** extending in the vehicle width direction. A combustion chamber (not shown) is provided inside the cylinder head **43** and the cylinder block, and a fuel is combusted in the combustion chamber to rotate the crankshaft **45**. Although not shown in the figures, the crankshaft **45** is linked to the starter motor **19** via a gear (not shown). The crankshaft **45** includes an inner crankshaft **45A** located inside the crankcase **41**, and the outer crankshaft **45B** located outside the crankcase

41. The outer crankshaft **45B** extends leftward from the crankcase **41**. Hereinbelow, "inside" in the vehicle width direction refers to a direction of moving toward the vehicle center line **CL**, whereas "outside" in the vehicle width direction refers to a direction of moving away from the vehicle center line **CL**. The outer crankshaft **45B** extends outward in the vehicle width direction from the crankcase **41**. In the present preferred embodiment, the inner crankshaft **45A** and the outer crankshaft **45B** preferably are integral and made of a single member. Note, however, that the inner crankshaft **45A** and the outer crankshaft **45B** may be separate members.

[0058] The engine **40** is supported on the frame **2**. Specifically, the engine **40** is supported on the left side frame **23L** and the right side frame **23R**. Next, the structure supporting the engine **40** will be described.

[0059] As shown in FIG. **6**, a hole **81R** is provided in the front portion of the right side frame **23R**. A hole **82R** is provided in the central portion of the right side frame **23R**. The hole **82R** is located rearward of the hole **81R**. The hole **81R** and the hole **82R** are configured to receive fasteners, such as bolts to fix the engine **40** on the right side frame **23R**, therein. As shown in FIG. **4**, a bracket **83** with a hole **81L** therein is provided in the front portion of the left side frame **23L**. A hole **82L** is provided in the central portion of the left side frame **23L**. The hole **82L** is located rearward of the hole **81L**. The hole **81L** and the hole **82L** are configured to receive fasteners, such as bolts to

fix the engine **40** on the left side frame **23L**, therein.

[0060] FIG. **8** is a view schematically representing the cross section along line VIII of FIG. **6**. As shown in FIG. **8**, the engine **40** includes a mount boss **87** with a through hole **89** extending therethrough. The mount boss **87** is positioned with respect to the right side frame **23R** so that the hole **81R** of the right side frame **23R** and the through hole **89** are aligned together. A tubular bush **88** is inserted inside the through hole **89** of the mount boss **87**, and a bolt **85** is inserted through the hole **81R** of the right side frame **23R** and the bush **88**. The bolt **85** extends in the vehicle width direction. The bolt **85** extends through the right side frame **23R**, the mount boss **87**, and the bush **88**, with a nut **86** tightened on the distal portion of the bolt **85**. With the bolt **85** and the nut **86**, the mount boss **87** is supported on the right side frame **23R**. The bush **88** is preferably made of an elastic material, and the bush **88** is preferably made by a rubber in the present preferred embodiment. With the rubber bush **88** interposed between the mount boss **87** and the bolt **85**, the mount boss **87** is allowed to rotate relative to the bolt **85**. Thus, the mount boss **87** rotates relative to the right side frame **23R**. The engine **40** is supported on the right side frame **23R** so as to be movable relative to the right side frame **23R**.

[0061] Although not shown in the figures, the bolts **85** are similarly inserted through the hole **82R** of the right side frame **23R** and the hole **81L** and the hole **82L** of the left side frame **23L** so that the engine **40** is supported on the right side frame **23R** and the left side frame

23L by the bolts **85** so as to be movable relative to the right side frame **23R** and the left side frame **23L**. The support structures that support the engine **40** of the hole **82R**, the hole **81L**, and the hole **82L** are similar to that of the hole **81R** (see FIG. **8**), and will not therefore be described below. Note that the support structures for supporting the engine **40** of the hole **82R**, the hole **81L**, and the hole **82L** may be different from that of the hole **81R**. The support structure described above is merely illustrative. Any other suitable structure may be used to support the engine **40** on the right side frame **23R** and the left side frame **23L** so that the engine **40** is movable relative to the right side frame **23R** and the left side frame **23L**. In the present preferred embodiment, the engine **40** includes a first left side portion located beside the hole **81L**, a second left side portion located beside the hole **82L**, a first right side portion located beside the hole **81R**, and a second right side portion located beside the hole **82R**, and is supported on the frame **2** via the first left side portion, the second left side portion, the first right side portion, and the second right side portion. However, the engine **40** may be supported on the frame **2** via other portions. The number of portions via which the engine **40** is supported is not limited to four.

[0062] As shown in FIG. **3**, the CVT **30** is located leftward of the engine **40**. As shown in FIGS. **3** and **7**, the CVT **30** includes a first driving pulley **31**, a first driven pulley **32**, and a belt **33** wound around the first driving pulley **31** and the first driven pulley **32**. The first

driven pulley **32** is located rearward of the first driving pulley **31**. The first driving pulley **31** includes a pair of right and left drive sheaves **31a** and **31b** that move toward and away from each other, and the first driven pulley **32** includes a pair of right and left driven sheaves **32a** and **32b** that move toward and away from each other. A portion of the belt **33** is sandwiched between the right drive sheave **31a** and the left drive sheave **31b**, and another portion of the belt **33** is sandwiched between the right driven sheave **32a** and the left driven sheave **32b**. The transmission ratio is changed through continuous changes of the interval or gap between the right drive sheave **31a** and the left drive sheave **31b** and the interval or gap between the right driven sheave **32a** and the left driven sheave **32b**.

[0063] An input shaft **35** is attached to the center of the first driving pulley **31**. The first driving pulley **31** is configured to rotate with the input shaft **35**. An output shaft **36** is attached to the center of the first driven pulley **32**. The first driven pulley **32** is configured to rotate with the output shaft **36**. The input shaft **35** and the output shaft **36** both extend in the vehicle width direction.

[0064] The centrifugal clutch **15** is located between the crankshaft **45** and the input shaft **35**. Note that the position of the centrifugal clutch **15** as used herein refers not to its spatial position but to its position along the transmission path to receive power from the crankshaft **45**. Where "upstream" and "downstream" refer to the driving side and the driven side, respectively, along the power transmission

path, the centrifugal clutch **15** is located downstream of the crankshaft **45** and upstream of the input shaft **35**. Although not shown in the figures, the centrifugal clutch **15** includes a drive portion connected to the outer crankshaft **45B**, and a driven portion connected to the input shaft **35**. The drive portion of the centrifugal clutch **15** rotates with the crankshaft **45**. If the rotational speed of the drive portion is less than a predetermined speed, the drive portion and the driven portion are disconnected from each other. Therefore, if the rotational speed of the drive portion is less than the predetermined speed, the crankshaft **45** and the input shaft **35** are disconnected from each other. On the other hand, if the rotational speed of the drive portion is greater than or equal to the predetermined speed, the drive portion and the driven portion are linked together. Therefore, if the rotational speed of the drive portion is greater than or equal to the predetermined speed, the crankshaft **45** and the input shaft **35** are linked together. Note that the centrifugal clutch **15** is spatially located leftward of the first driving pulley **31**. The centrifugal clutch **15** is located on the outer side of the first driving pulley **31** in the vehicle width direction.

[0065] The output shaft **36** extends from the left side of the engine **40** toward the right side of the engine **40**. Where "first side" and "second side" refer to the left side and the right side, respectively, in the vehicle width direction, the output shaft **36** extends from the first side toward the second side of the engine **40** in the vehicle width

direction. The left end portion of the output shaft **36** is connected to the first driven pulley **32**. The power from the crankshaft **45** is transmitted to the output shaft **36** via the CVT **30**. The power from the crankshaft **45** is transmitted to the output shaft **36** after undergoing a speed conversion through the CVT **30**. The power from the crankshaft **45** is transmitted to the output shaft **36** after being decelerated through the CVT **30**. Since the rotational speed of the first driven pulley **32** is smaller than the rotational speed of the first driving pulley **31**, the rotational speed of the output shaft **36** is smaller than the rotational speed of the input shaft **35**. The rotational speed of the output shaft **36** is smaller than the rotational speed of the crankshaft **45**.

[0066] As shown in FIG. **6**, a gearbox **60** is provided rightward of the engine **40**. The gearbox **60** is located rightward of the right side frame **23R**. An output shaft gear **61** fixed on the output shaft **36** and a drive shaft gear **63** fixed on a drive shaft **62** of the driving device **10** are accommodated inside the gearbox **60**. The driving wheel **11** (see FIG. **1**) is fixed on the drive shaft **62**. A switching device **64** is also provided in the gearbox **60**, which links together the output shaft gear **61** and the drive shaft gear **63** so that the drive shaft gear **63** rotates by receiving the power from the output shaft gear **61**, and which switches the direction of rotation of the drive shaft gear **63**. As the output shaft **36** rotates, the power from the output shaft **36** is transmitted to the drive shaft **62** via the output shaft gear **61** and the drive shaft

gear **63**, thus rotating the drive shaft **62**. This in turn rotates the driving wheel **11**, and moves the track belt **13**. In FIG. **1**, the counterclockwise rotation of the driving wheel **11** moves the track belt **13** counterclockwise, thus generating a forward driving power for the snowmobile **1**. If the switching device **64** switches the direction of rotation of the drive shaft **62** so that the driving wheel **11** rotates clockwise in FIG. **1**, the track belt **13** moves clockwise, thus generating a backward driving power for the snowmobile **1**. Thus, the switching device **64** switches between the forward moving mode in which a forward driving power is generated and the backward moving mode in which a backward driving power is generated. Note that the gearbox **60** and the switching device **64** may each include any known mechanism. Therefore, the gearbox **60** and the switching device **64** will not be further described in detail.

[0067] As shown in FIG. **5**, the brake device **65** is located on the outer side of the gearbox **60** in the vehicle width direction. The brake device **65** includes a brake disc **37** linked to the output shaft **36**, and a brake caliper **38**. The output shaft **36** is fixed to the central portion of the brake disc **37**. The brake caliper **38** is configured so that the brake disc **37** is sandwiched therein when braking. The brake disc **37** and the brake caliper **38** are located rightward of the right side frame **23R**. The brake disc **37** and the brake caliper **38** are located rightward of the gearbox **60**.

[0068] Next, the supercharger **50** will be described. As shown in

FIG. **3**, the supercharger **50** is located rightward of the engine **40**. The supercharger **50** is preferably located rightward of the right side frame **23R**. The supercharger **50** is located on the opposite side from the CVT **30** with respect to the engine **40**. That is, in the vehicle width direction, the engine **40** is located between the CVT **30** and the supercharger **50**. Where "first side" and "second side" refer to the left side and the right side, respectively, in the vehicle width direction, the CVT **30** is located on the first side of the engine **40** in the vehicle width direction, and the supercharger **50** is located on the second side of the engine **40** in the vehicle width direction.

[0069] As shown in FIG. **6**, the supercharger **50** is located above the engine **40** as the vehicle is seen from the side. The supercharger **50** is located above the crankcase **41** of the engine **40** as the vehicle is seen from the side. The supercharger **50** is located above the output shaft **36**. The supercharger **50** is preferably located above the brake disc **37**. As shown in FIG. **5**, the supercharger **50** is located above the right side frame **23R** as the vehicle is seen from the side. At least a portion of the supercharger **50** is located in an area surrounded by the steering shaft **4A**, the steering frame **4B**, and the right side frame **23R** as the vehicle is seen from the side. A rotation shaft **51** of the supercharger **50** is located in an area surrounded by the steering shaft **4A**, the steering frame **4B**, and the right side frame **23R** as the vehicle is seen from the side. In the present preferred embodiment, the entire supercharger **50** is located in an area surrounded by the

steering shaft **4A**, the steering frame **4B**, and the right side frame **23R** as the vehicle is seen from the side.

[0070] The supercharger **50** is a mechanical supercharger using the power from the engine **40** as its power source. The supercharger **50** operates by receiving the power from the crankshaft **45** of the engine **40**. The supercharger **50** is connected indirectly to the crankshaft **45**, details of which will be described below. While the supercharger **50** is of a centrifugal type in the present preferred embodiment, there is no particular limitation on the type of the supercharger **50**. The supercharger **50** includes the rotation shaft **51**, an impeller **52** (see FIG. **3**) fixed on the rotation shaft **51**, and a casing **53** accommodating the impeller **52** therein. The casing **53** is provided with a suction port **54** to take in air, and a discharge port **55** to discharge air. The suction port **54** includes an opening facing leftward. Where "first side" refers to the left side in the vehicle width direction, the suction port **54** includes an opening facing toward the first side in the vehicle width direction. The discharge port **55** including an opening facing forward.

[0071] As shown in FIG. **7**, a duct **67** is connected to the suction port **54**. The duct **67** is a tubular member that allows passage of air therethrough. The duct **67** extends in the left-right direction. An inlet **68** through which air flows in is provided at the left end of the duct **67**, and an outlet **69** through which air flows out is provided at the right end of the duct **67**. The right end portion of the duct

67 is inserted in the suction port **54** of the casing **53** of the supercharger **50**, with the outlet **69** of the duct **67** connected to the suction port **54** of the casing **53**. A flange portion **67a** is provided at the left end portion of the duct **67**. A filter **66** is attached to the flange portion **67a**. The inlet **68** of the duct **67** is covered by the filter **66**. When the supercharger **50** is operative, outside air is taken into the duct **67** through the filter **66**, and taken into the casing **53** of the supercharger **50** through the duct **67**. Air, which has been taken into the casing **53** of the supercharger **50**, is compressed and discharged through the discharge port **55**.

[0072] As shown in FIG. **6**, a second driven pulley **56** is fixed on the rotation shaft **51** of the supercharger **50**. The second driven pulley **56** is located on the outer side of the casing **53** in the vehicle width direction. The second driven pulley **56** is located rightward of the casing **53**. A second driving pulley **57** is fixed on the output shaft **36**. The second driving pulley **57** is located rightward of the right side frame **23R**. The second driving pulley **57** is located on the outer side of the gearbox **60** in the vehicle width direction. The second driving pulley **57** is located on the outer side of the brake device **65** in the vehicle width direction. The second driving pulley **57** is located rightward of the gearbox **60** and is located rightward of the brake device **65**. The belt **58**, which is an example of the power transmission member, is wound around the second driving pulley **57** fixed on the output shaft **36** and the second driven pulley **56** fixed on the

rotation shaft **51**. Note that reference numeral **59** refers to a tensioner that tensions the belt **58**. The output shaft **36** and the rotation shaft **51** are linked together so that power is transmitted therebetween via the second driving pulley **57**, the belt **58**, and the second driven pulley **56**. Thus, the power from the output shaft **36** is transmitted to the rotation shaft **51**. The supercharger **50** is driven by the power from the output shaft **36**. The rotation shaft **51** of the supercharger **50** is linked to the crankshaft **45** of the engine **40** via the input shaft **35**, the CVT **30**, the output shaft **36**, the second driving pulley **57**, the belt **58**, and the second driven pulley **56**.

[0073] As shown in FIG. **3**, the rotation shaft **51** is located rearward of the crankshaft **45**. The rotation shaft **51** is located forward of the output shaft **36**. The rotation shaft **51** is preferably located between the crankshaft **45** and the output shaft **36** as the vehicle is seen from above. As shown in FIG. **6**, the rotation shaft **51** is located above the output shaft **36**. The rotation shaft **51** is located above the crankshaft **45**.

[0074] The supercharger **50** is fixed on the frame **2**. The supercharger **50** is not attached to the engine **40** and is preferably not supported on the engine **40**. As shown in FIG. **6**, the casing **53** of the supercharger **50** is provided with a first arm **91** extending forward, a second arm **92** extending downward, and a third arm **93** extending rearward. The distal portion of the first arm **91**, the distal portion of the second arm **92**, and the distal portion of the third arm **93** each include a hole

therein. A bolt **94** is inserted through the hole of the first arm **91**. The first arm **91** is fixed on the right side frame **23R** by the bolt **94**. A bolt **95** is inserted through the hole of the second arm **92**. The second arm **92** is fixed on the right side frame **23R** by the bolt **95**. A bolt **96** is inserted through the hole of the third arm **93**. The third arm **93** is fixed on the right side frame **23R** by the bolt **96**. Since the engine **40** is supported on the frame **2** via an elastic material therebetween as described above, the engine **40** is movable relative to the frame **2**. On the other hand, the supercharger **50** is fixed on the frame **2** so as to be immovable relative to the frame **2**. Thus, the supercharger **50** is movable relative to the engine **40**.

[0075] As described above, the output shaft gear **61**, the brake disc **37**, and the second driving pulley **57** are fixed on the output shaft **36**. FIG. **9** is a conceptual diagram showing a positional relationship between the output shaft gear **61**, the brake disc **37**, and the second driving pulley **57**. The output shaft gear **61**, the brake disc **37**, and the second driving pulley **57** are located, outside the right side frame **23R** in the vehicle width direction, in this order, from the inner side toward the outer side in the vehicle width direction. That is, the output shaft gear **61** is located on the outer side of the right side frame **23R** in the vehicle width direction, the brake disc **37** is located on the outer side of the output shaft gear **61** in the vehicle width direction, and the second driving pulley **57** is located on the outer side of the brake disc **37** in the vehicle width direction. The output

shaft gear **61** is located rightward of the right side frame **23R**, the brake disc **37** is located rightward of the output shaft gear **61**, and the second driving pulley **57** is located rightward of the brake disc **37**.

[0076] The output shaft **36** is linked to the driving device **10** via the output shaft gear **61**. A portion of the output shaft **36** where the output shaft gear **61** is fixed is a driving device link portion **36a** linked to the driving device **10**. The power from the output shaft **36** is output toward the driving device **10** from the driving device link portion **36a**. The output shaft **36** is also linked to the rotation shaft **51** of the supercharger **50** via the second driving pulley **57**, the belt **58**, and the second driven pulley **56**. A portion of the output shaft **36** where the second driving pulley **57** is fixed is a supercharger link portion **36b** linked to the rotation shaft **51** of the supercharger **50**. The power from the output shaft **36** is output toward the supercharger **50** from the supercharger link portion **36b**. The supercharger link portion **36b** is provided in the distal portion of the output shaft **36**. The supercharger link portion **36b** is provided at the right end portion of the output shaft **36**. The driving device link portion **36a** is located on the inner side of the supercharger link portion **36b** in the vehicle width direction. The driving device link portion **36a** is located leftward of the supercharger link portion **36b**. The driving device link portion **36a** is located between the supercharger link portion **36b** along the output shaft **36** and the CVT **30**.

[0077] As shown in FIG. **3**, the snowmobile **1** includes an intercooler **70** that cools compressed air from the supercharger **50**. The intercooler **70** is located between the left side frame **23L** and the right side frame **23R** as the vehicle is seen from above. The intercooler **70** is preferably located rightward of the CVT **30** and leftward of the supercharger **50**. The intercooler **70** is preferably located forward of the output shaft **36** as the vehicle is seen from above. The intercooler **70** is preferably located forward of the supercharger **50**. As shown in FIG. **6**, the intercooler **70** is preferably located above the crankcase **41** of the engine **40** as the vehicle is seen from the side. The intercooler **70** is preferably located forward of the cylinder block and the cylinder head **43**. Note, however, that the location of the intercooler **70** is merely illustrative, and there is no particular limitation on the location of the intercooler **70**.

[0078] The intercooler **70** includes a box-shaped casing **71**, an air filter (not shown) inside the casing **71**, a cooler (not shown) inside the casing **71**, a suction port **72** that takes air into the casing **71**, and a discharge tube **73** that discharges air out of the casing **71**. The suction port **72** is located rightward of the vehicle center line **CL**. That is, the suction port **72** is located on the same side as the supercharger **50** with respect to the vehicle center line **CL**. The discharge port **55** of the supercharger **50** and the suction port **72** are connected together via a rubber tube (hereinafter referred to as a rubber tube) **74** therebetween. The rubber tube **74** is an example of

a flexible tube. One end of the rubber tube **74** is connected to the discharge port **55**, and the other end of the rubber tube **74** is connected to the suction port **72**. At least a portion of the discharge port **55** of the supercharger **50** is located rightward of the right side frame **23R**, and the suction port **72** is located leftward of the right side frame **23R**. The rubber tube **74** extends from the right side to the left side of the right side frame **23R** as the vehicle is seen from above.

[0079] The engine **40** includes an intake pipe **47** that guides air into the combustion chamber. The discharge tube **73** of the intercooler **70** is connected to the intake pipe **47** of the engine **40**. The engine **40** is preferably a three-cylinder engine, for example, and includes three discharge tubes **73** and three intake pipes **47**. As shown in FIG. **3**, the discharge tubes **73** are arranged next to one another in the vehicle width direction, and the intake pipes **47** are arranged next to one another in the vehicle width direction. The discharge tubes **73** and the intake pipes **47** extend in the vehicle front-rear direction as the vehicle is seen from above.

[0080] Air having been compressed through the supercharger **50** is guided into the casing **71** of the intercooler **70** through the rubber tube **74**. Air having been guided into the casing **71** is filtered through the air filter and cooled through the cooler. The cooled, filtered air is discharged from the discharge tubes **73** to be supplied into the intake pipes **47** of the engine **40**.

[0081] As shown in FIG. **2**, an exhaust pipe **48** extends rearward.

The three exhaust pipes **48** of the engine **40** are connected to a merge collector pipe **49**. A silencer **46** is connected to the merge collector pipe **49**. The exhaust pipes **48**, the merge collector pipe **49**, and a portion of the silencer **46** are located under the seat **3** (see FIG. **1**). The exhaust gas from the combustion chamber of the engine **40** is discharged to the outside through the exhaust pipes **48**, the merge collector pipe **49**, and the silencer **46**. With the snowmobile **1** of the present preferred embodiment, the supercharger **50** does not use the exhaust gas from the engine **40**. The supercharger **50** is separate from the passageway of the exhaust gas, i.e., from the exhaust pipes **48**, the merge collector pipe **49**, and the silencer **46**.

[0082] The oil tank **39** is located rightward of the engine **40**. The oil tank **39** is located rightward of the right side frame **23R**. As shown in FIG. **3**, the supercharger **50** is located rearward of the oil tank **39** as the vehicle is seen from above. As shown in FIG. **5**, the oil tank **39** is located forward of the gearbox **60** and the brake device **65** as the vehicle is seen from the side. The supercharger **50** is located above the oil tank **39** as the vehicle is seen from the side.

[0083] As described above, the snowmobile **1** of the present preferred embodiment is provided with the supercharger **50**, and it is therefore possible to increase the engine power. The supercharger **50** includes the rotation shaft **51** linked to the output shaft **36** so that power is transmitted therebetween, and is driven by the power from the output shaft **36**. Therefore, unlike a turbo-type supercharger that utilizes

the energy of the exhaust gas from the engine **40**, the responsiveness is not lowered in the low- to mid-speed range, and there is no need for an advanced thermal management. Moreover, in the snowmobile **1**, the centrifugal clutch **15** is located between the crankshaft **45** and the input shaft **35** of the CVT **30**. That is, along the power transmission path, the centrifugal clutch **15** is located upstream of the rotation shaft **51** of the supercharger **50**. Therefore, when the rotational speed of the crankshaft **45** is zero or low, the power transmission between the crankshaft **45** and the rotation shaft **51** of the supercharger **50** is disconnected, thus reducing the load on the crankshaft **45**. Therefore, the engine **40** is desirably started by the starter motor **19** without having to provide a large starter motor **19**. Moreover, the supercharging pressure does not become unnecessarily high at a low speed, thus achieving desirable supercharging pressure characteristics. As described above, with the snowmobile **1** of the present preferred embodiment, it is possible to increase the engine power, to keep the load on the crankshaft **45** at start-up low, and to achieve desirable supercharging pressure characteristics.

[0084] In the snowmobile **1**, the CVT **30** is provided as a transmission. Therefore, it is possible to continuously vary the transmission ratio. While the supercharger **50** is driven by the output shaft **36**, the rotational speed of the output shaft **36** changes smoothly during a speed change. This prevents the operation of the supercharger **50** from becoming unstable, thus achieving more desirable supercharging pressure

characteristics.

[0085] In the snowmobile **1**, the supercharger **50** is located on the opposite side from the CVT **30** with respect to the engine **40** as shown in FIG. **3**. Thus, the snowmobile **1** has a desirable weight balance.

[0086] With the snowmobile **1**, the crankshaft **45** extends in the vehicle width direction. Where "first side" and "second side" refer to the left side and the right side, respectively, in the vehicle width direction, the CVT **30** is located on the first side of the engine **40** in the vehicle width direction, and the supercharger **50** is located on the second side, opposite to the first side, of the engine **40** in the vehicle width direction. Thus, the snowmobile **1** has a desirable weight balance in the vehicle width direction.

[0087] The output shaft **36** extends from the first side toward the second side of the engine **40** in the vehicle width direction. With the snowmobile **1**, on the second side of the engine **40** in the vehicle width direction, the output shaft **36** and the rotation shaft **51** of the supercharger **50** are linked together so that power is transmitted therebetween. Thus, it is possible to simplify the configuration of the power transmission member that links together the output shaft **36** and the rotation shaft **51** of the supercharger **50**.

[0088] The supercharger **50** includes the suction port **54** including an opening facing toward the first side in the vehicle width direction to take in air. With the snowmobile **1**, since the suction port **54** includes an opening facing toward the first side in the vehicle width direction,

it is possible to provide extra space on the second side of the supercharger **50** in the vehicle width direction. This extra space is effectively utilized as a space to install other components. In the present preferred embodiment, the extra space is effectively utilized as a space to install the power transmission member (the belt **58**) that links together the output shaft **36** and the rotation shaft **51** of the supercharger **50**.

[0089] As shown in FIG. **7**, the snowmobile **1** includes the duct **67** that guides air to the supercharger **50**. The duct **67** includes the inlet **68** located on the first side of the engine **40** in the vehicle width direction, and the outlet **69** connected to the suction port **54** of the supercharger **50**, and the duct **67** extends from the first side toward the second side in the vehicle width direction. In the snowmobile **1**, with the provision of the duct **67**, air is taken in from the first side of the engine **40** in the vehicle width direction toward the supercharger **50**. The position at which air is taken in is determined by appropriately choosing the shape or the length of the duct **67**.

[0090] As shown in FIG. **6**, the rotation shaft **51** of the supercharger **50** is linked to the output shaft **36** via the belt **58**. With the snowmobile **1**, the power from the output shaft **36** is desirably transmitted to the rotation shaft **51** of the supercharger **50**. Note that the power transmission member that transmits the power from the output shaft **36** to the rotation shaft **51** is not limited to the belt **58**, but may be a chain, a gear, or any other suitable member. The power transmission

member may include two or more of a belt, a chain, and a gear.

[0091] As shown in FIG. **9**, the output shaft **36** includes the driving device link portion **36a** linked to the driving device **10**, and the supercharger link portion **36b** linked to the rotation shaft **51** of the supercharger **50**. In the snowmobile **1**, the supercharger **50** is not located downstream of the driving device **10**, along the power transmission path that transmits the power from the crankshaft **45** of the engine **40**. With the snowmobile **1**, the supercharger **50** operates without being substantially influenced by the operation of the driving device **10**. Thus, it is possible to desirably operate the supercharger **50**.

[0092] The driving device link portion **36a** is located between the supercharger link portion **36b** along the output shaft **36** and the CVT **30**. The supercharger link portion **36b** is located closer to the distal end of the output shaft **36** than the driving device link portion **36a**. Therefore, the power transmission member that links together the output shaft **36** and the rotation shaft **51** of the supercharger **50** so that power is transmitted therebetween is located closer to the distal end of the output shaft **36**.

[0093] The driving device **10** includes the switching device **64** (see FIG. **6**) that switches between the forward moving mode in which a forward driving power is generated and the backward moving mode in which a backward driving power is generated. The snowmobile **1** not only moves forward but also moves backward through the switching of the switching

device **64**. As described above, since the supercharger **50** is not located downstream of the driving device **10** along the power transmission path, the direction of rotation of the rotation shaft **51** is not reversed upon switching of the switching device **64**. Thus, the supercharger **50** desirably operates whether the snowmobile **1** is moving forward or backward.

[0094] While preferred embodiments of the present invention have been described above, the present invention is not limited to the these preferred embodiments, and can be carried out in various other preferred embodiments. Other preferred embodiments will now be described.

[0095] In the preferred embodiments described above, the centrifugal clutch **15** is preferably located between the crankshaft **45** and the input shaft **35**. However, the centrifugal clutch **15** may be located at any position that is downstream of the crankshaft **45** and upstream of the supercharger **50** along the power transmission path. The centrifugal clutch **15** may be located between the output shaft **36** and the rotation shaft **51** of the supercharger **50**.

[0096] In the preferred embodiments described above, the discharge port **55** of the supercharger **50** and the suction port **72** of the intercooler **70** are preferably connected together via the rubber tube **74** extending therebetween. However, any other suitable flexible tube may be used instead of the rubber tube **74**. For example, the rubber tube **74** may be replaced by an easily-deformable corrugated tube (in other words, a bellows-shaped tube). The rubber tube **74** may be replaced by a

non-flexible tube (e.g., a resin tube or a metal tube), with a rubber fitting provided between the tube and the discharge port **55** or between the tube and the suction port **72**.

[0097] While the transmission preferably is the CVT **30** in the preferred embodiments described above, there is no particular limitation on the type of the transmission. The transmission may be a stepped transmission, or may be a dog clutch transmission, for example.

[0098] In the preferred embodiments described above, the CVT **30** is preferably located on the left side of the engine **40** and the supercharger **50** on the right side of the engine **40**. However, the CVT **30** may be located on the right side of the engine **40** and the supercharger **50** may be located the left side of the engine **40**. In such a case, where "first side" and "second side" refer to the right side and the left side, respectively, in the vehicle width direction, the transmission is located on the first side of the engine **40** in the vehicle width direction, and the supercharger **50** is located on the second side of the engine **40** in the vehicle width direction. Then, the suction port **54** of the supercharger **50** includes an opening facing toward the right side, which is the first side in the vehicle width direction.

[0099] While the supercharger **50** is preferably located on the opposite side from the CVT **30** with respect to the engine **40** in the preferred embodiments described above, the supercharger **50** and the CVT **30** may be located on the same side of the engine **40**. The supercharger **50** and the CVT **30** may both be located on the left side of the engine

40 or on the right side of the engine **40**.

[0100] In the preferred embodiments described above, the duct **67**, extending from the first side toward the second side in the vehicle width direction, is preferably connected to the suction port **54** of the supercharger **50**. The duct **67** extends from the right side toward the left side in the vehicle width direction. However, there is no particular limitation on the length of the duct **67**. The inlet **68** of the duct **67** may be located rightward of the right end of the engine **40**, but it may be located leftward of the right end of the engine **40**. The duct **67** is not limited to a straight shape, but may be bent. Moreover, the duct **67** may be optional, and may be omitted. The filter **66** may be attached to the suction port **54** of the supercharger **50**.

[0101] While the vehicle of the preferred embodiments described above is preferably the snowmobile **1**, the vehicle of the present invention is not limited to the snowmobile **1**. The vehicle may be any other suitable off-road vehicle. For example, the vehicle may be an ATV (All Terrain Vehicle) **101** as shown in FIG. **10**. The ATV **101** is an example straddle-type off-road vehicle. The ATV **101** includes an internal combustion engine **102**, a transmission **103**, a supercharger **104** and a centrifugal clutch (not shown), and further includes a left front wheel **105**, a right front wheel (not shown), a left rear wheel **106** and a right rear wheel (not shown), as part of the driving device.

[0102] As shown in FIG. **11**, the vehicle may also be an ROV (Recreational Off-highway Vehicle) **110**. The ROV **110** is an example

off-road vehicle including a plurality of seats **111** arranged next to one another in the vehicle width direction. The ROV **110** includes an internal combustion engine **112**, a transmission (not shown), a supercharger **113** and a centrifugal clutch (not shown), and further includes a left front wheel **114**, a right front wheel (not shown), a left rear wheel **115** and a right rear wheel (not shown), as part of the driving device.

[0103] The terms and expressions used herein are used for explanation purposes and should not be construed as being restrictive. It should be appreciated that the terms and expressions used herein do not eliminate any equivalents of features illustrated and mentioned herein, but include various modifications falling within the claimed scope of the present invention. The present invention may be embodied in many different forms. The present disclosure is to be considered as providing examples of the principles of the present invention. These examples are described herein with the understanding that such examples are not intended to limit the present invention to preferred embodiments described herein and/or illustrated herein. Hence, the present invention is not limited to the preferred embodiments described herein. The present invention includes any and all preferred embodiments including equivalent elements, modifications, omissions, combinations, adaptations and/or alterations as would be appreciated by those skilled in the art on the basis of the present disclosure. The limitations in the claims are to be interpreted broadly based on

the language included in the claims and not limited to examples described in the present specification or during the prosecution of the application.

[0104] While preferred embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art. The scope of the claims should not be limited by the preferred embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.

WHAT IS CLAIMED IS:

1. A vehicle comprising:

an internal combustion engine including a crankshaft;

a transmission including an input shaft linked to the crankshaft to transmit power therebetween, and an output shaft linked to the input shaft and that rotates at a rotational speed lower than a rotational speed of the input shaft;

a driving device linked to the output shaft to transmit power therebetween and to generate a driving power;

a supercharger including a rotation shaft linked to the output shaft to transmit power therebetween and to compress air and supply the compressed air to the internal combustion engine; and

a centrifugal clutch located between the crankshaft and the input shaft or between the output shaft and the rotation shaft, wherein

the centrifugal clutch includes a drive portion and a driven portion, and

the centrifugal clutch is configured to disconnect the drive portion and the driven portion from each other when a rotational speed of the drive portion is less than a predetermined speed and to link the drive portion and the driven portion together when the rotational speed of the drive portion is greater than or equal to the predetermined speed.

2. The vehicle according to claim 1, wherein the transmission is a belt-type continuously variable transmission including a driving pulley attached to the input shaft, a driven pulley attached to the output shaft, and a belt wound around the driving pulley and the driven pulley.

3. The vehicle according to claim 1, wherein:

the transmission is located to a side of the internal combustion engine; and

the supercharger is located on an opposite side of the internal combustion engine from the transmission.

4. The vehicle according to claim 3, wherein:

the crankshaft extends in a vehicle width direction;

the transmission is located on a first side of the internal combustion engine in the vehicle width direction; and

the supercharger is located on a second side, opposite to the first side, of the internal combustion engine in the vehicle width direction.

5. The vehicle according to claim 4, wherein the output shaft extends from the first side toward the second side of the internal combustion engine in the vehicle width direction.

6. The vehicle according to claim 5, wherein the supercharger includes a suction port including an opening that takes in air and faces the first side in the vehicle width direction.

7. The vehicle according to claim 6, further comprising a duct including an inlet located on the first side of the internal combustion engine in the vehicle width direction, and an outlet connected to the suction port of the supercharger, wherein the duct extends from the first side toward the second side in the vehicle width direction.

8. The vehicle according to claim 1, wherein the rotation shaft of the supercharger is linked to the output shaft via at least one of a belt, a chain, and a gear.

9. The vehicle according to claim 1, wherein the output shaft includes a driving device link portion linked to the driving device, and a supercharger link portion linked to the rotation shaft of the supercharger.

10. The vehicle according to claim 9, wherein the driving device link portion is located between the supercharger link portion along the output shaft and the transmission.

11. The vehicle according to claim 9, wherein the driving device

includes a switch that switches between a forward moving mode in which a forward driving power is generated and a backward moving mode in which a backward driving power is generated.

12. The vehicle according to claim 1, wherein the vehicle is a snowmobile.

13. The vehicle according to claim 1, wherein the vehicle is an off-road vehicle.

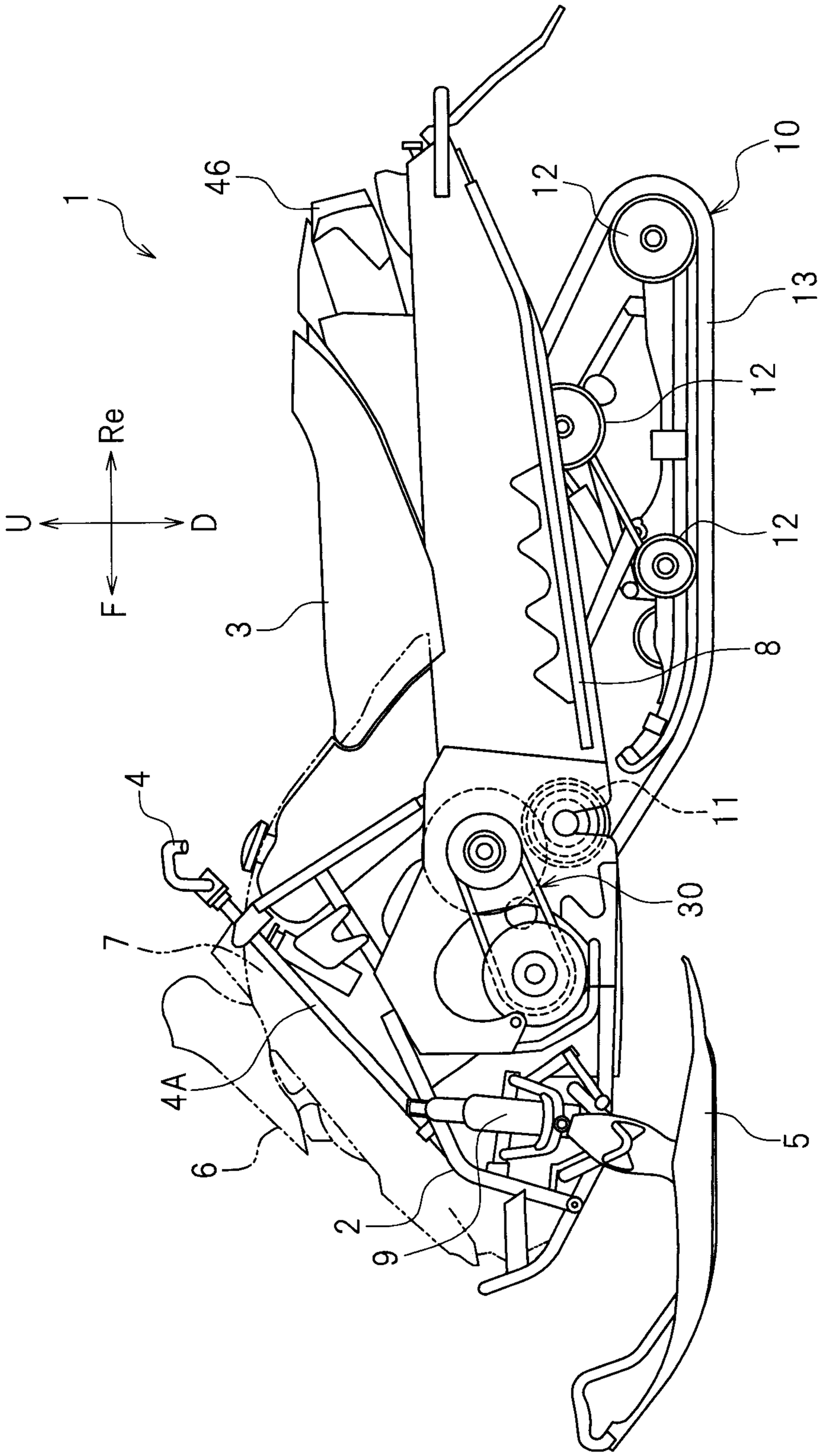


FIG.1

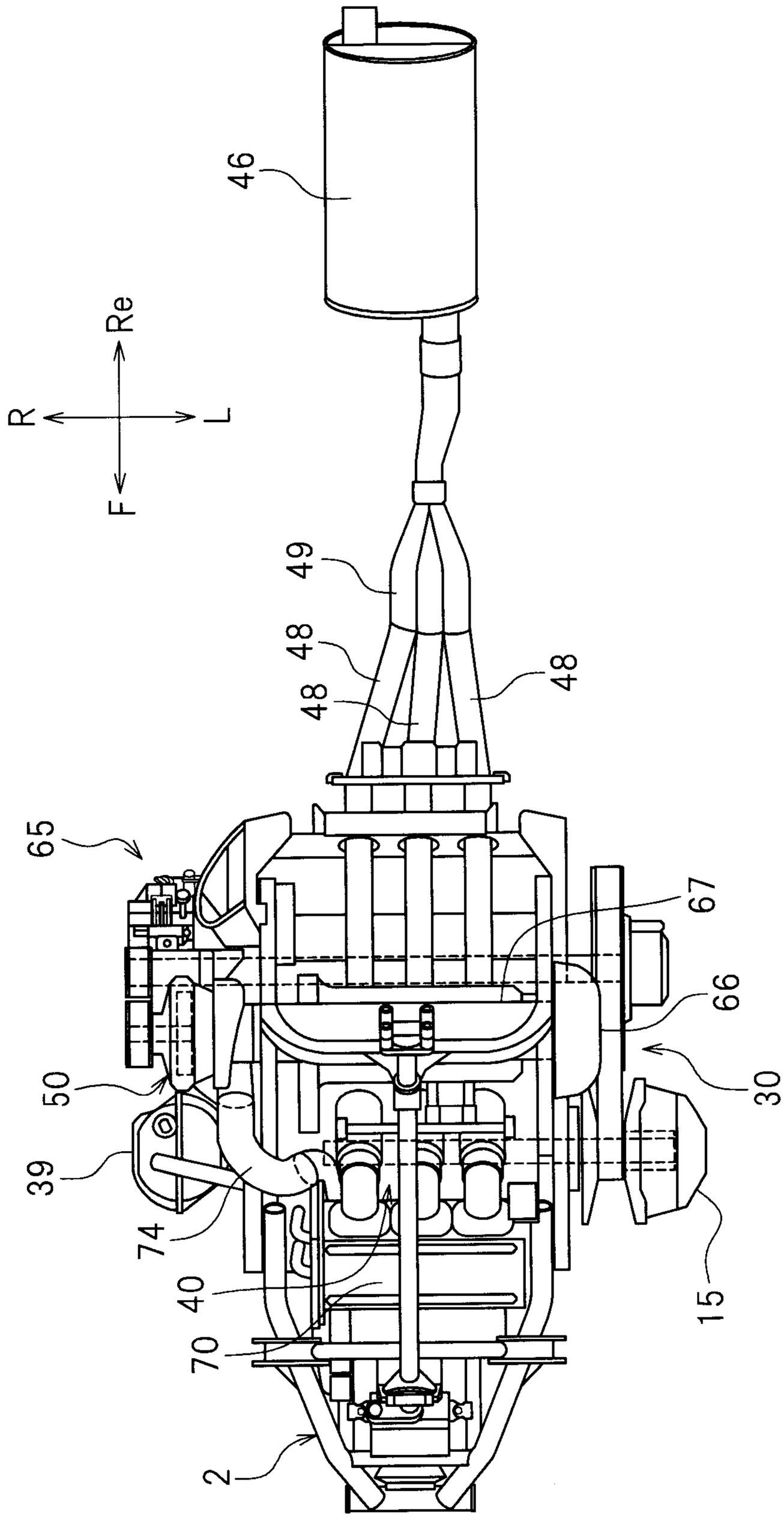


FIG.2

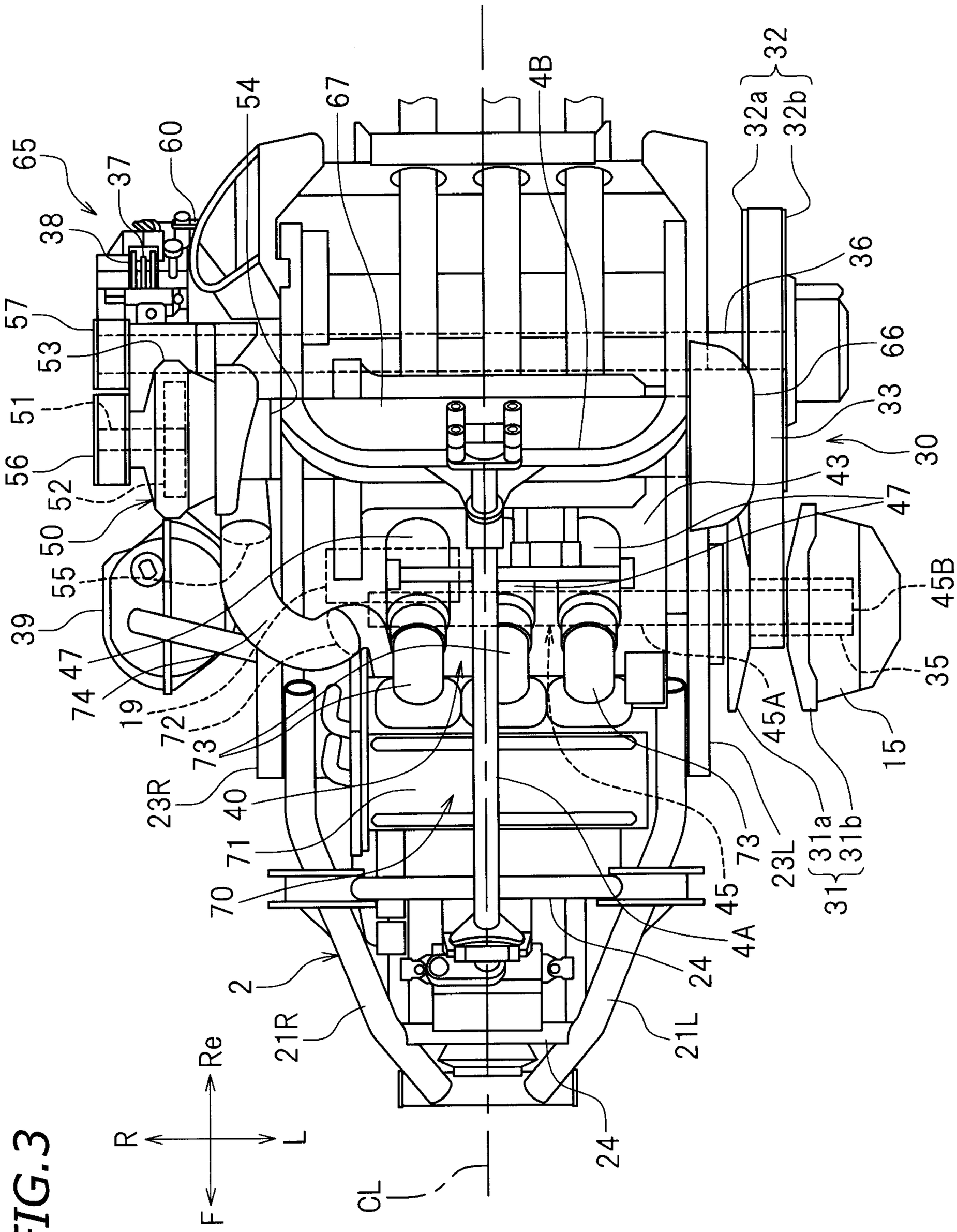

65
37
60
38
57
53
51
56
52
50
55
39
74
47
19
72
73
23R
40
71
70
2
21R
Re
R
L
F
CL
54
67
4B
32a
32b
32
36
66
33
30
43
47
45B
35
45A
15
23L
31a
31b
31
45
4A
24
21L

FIG.3

FIG.4

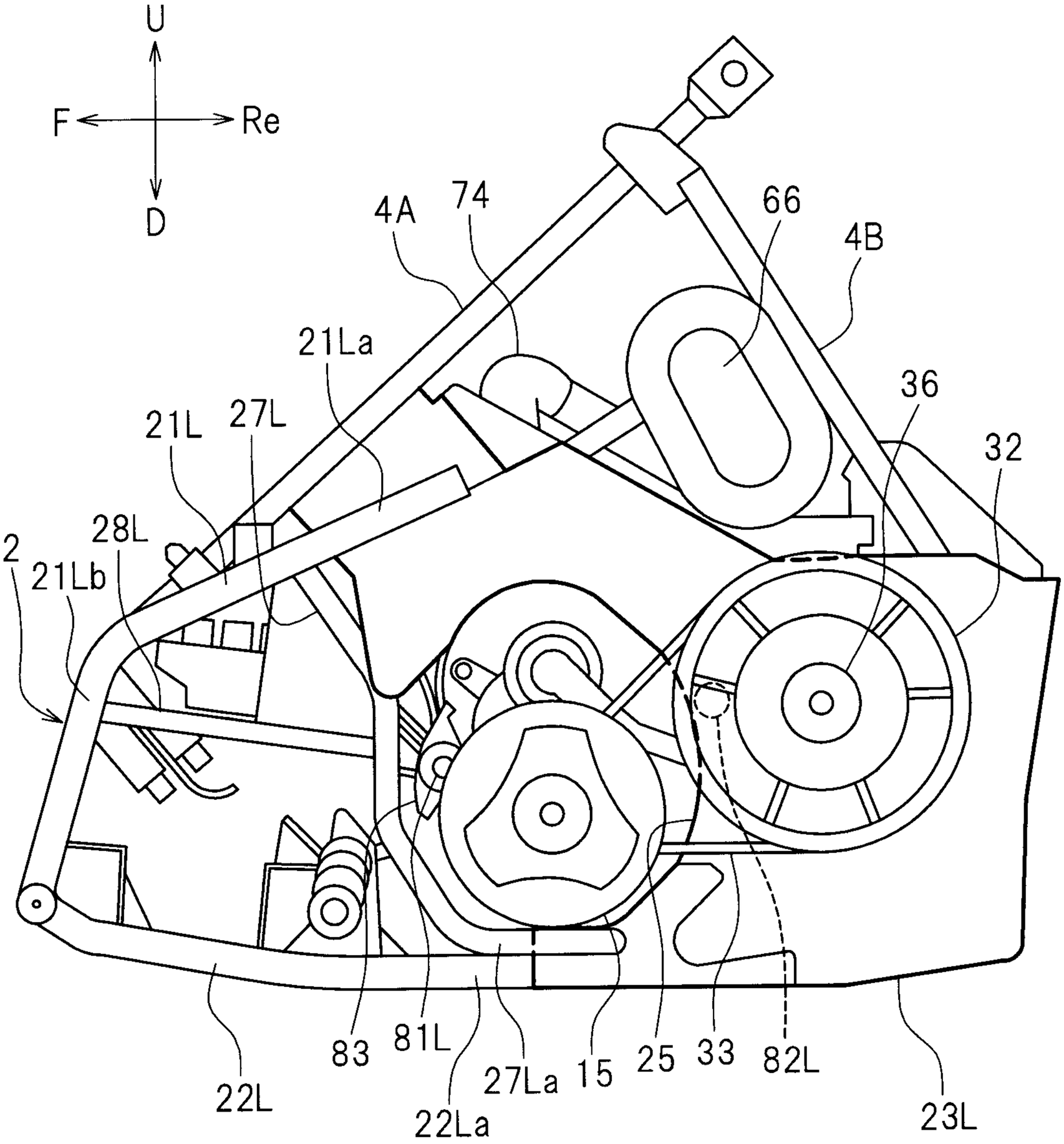

U
F
Re
D
4A
74
66
4B
21La
36
32
21L
27L
28L
2
21Lb
83
81L
22L
22La
27La
15
25
33
82L
23L

FIG.5

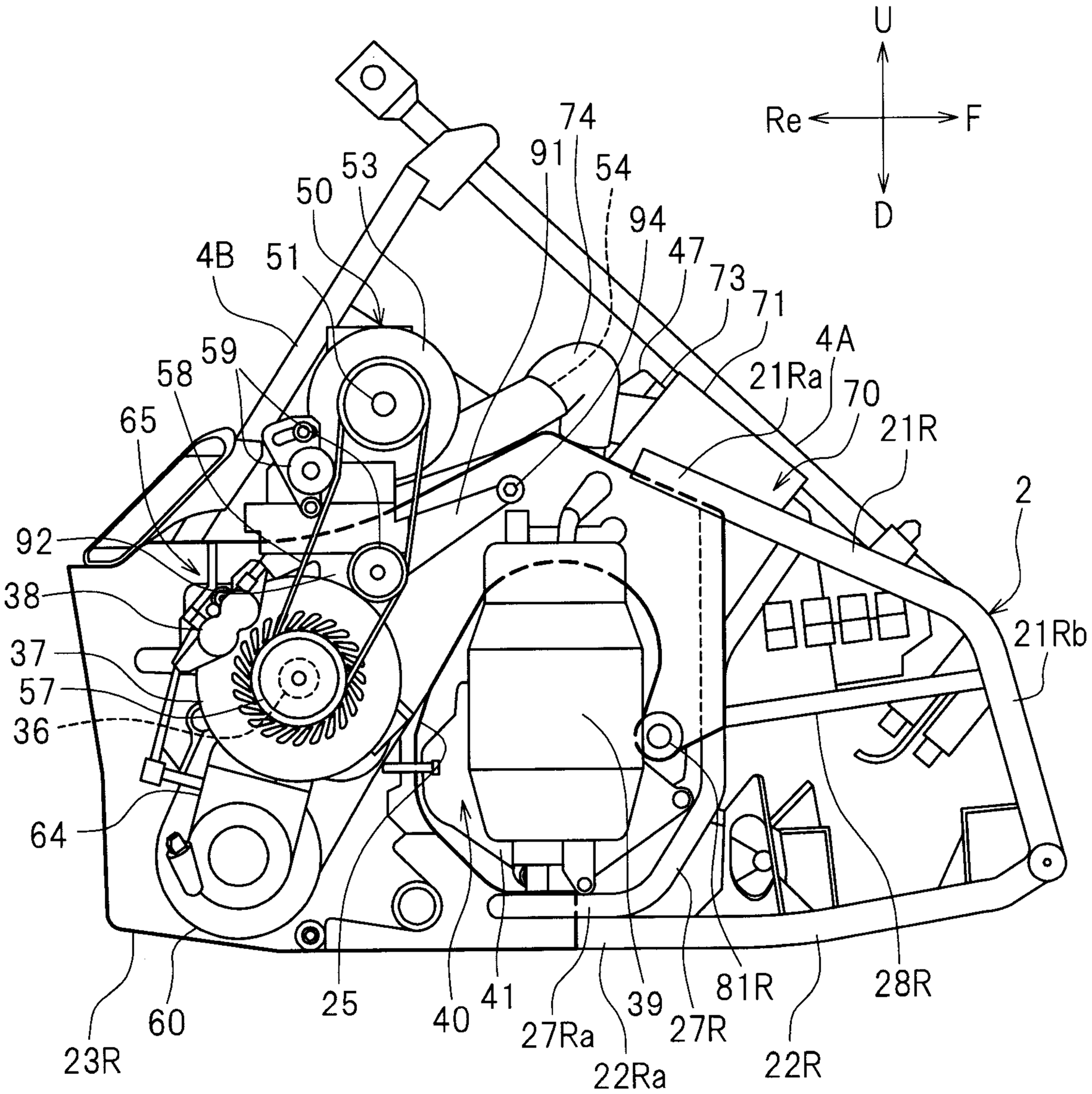

U
Re
F
D
74
91
54
53
50
94
47
4B
51
73
71
4A
59
58
21Ra
70
65
21R
2
92
38
21Rb
37
57
36
64
23R
60
25
40
41
27Ra
22Ra
39
27R
81R
22R
28R

FIG.6

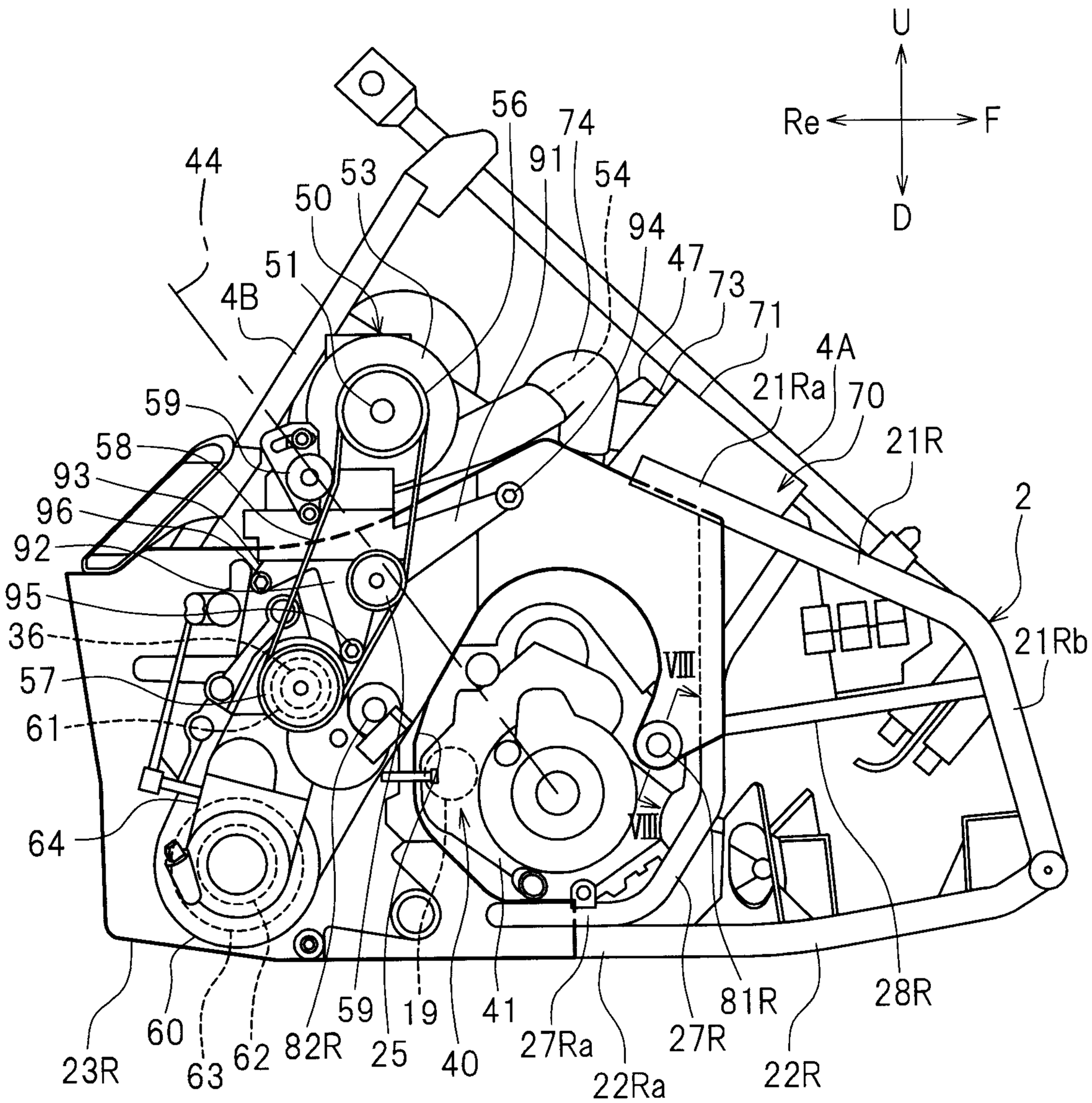

U
Re
F
D
56
74
91
54
44
53
50
94
47
73
71
51
4B
4A
21Ra
70
59
21R
58
2
93
96
92
95
21Rb
36
VIII
57
61
64
23R
60
63
62
82R
59
25
19
40
41
27Ra
22Ra
27R
81R
22R
28R

FIG.7

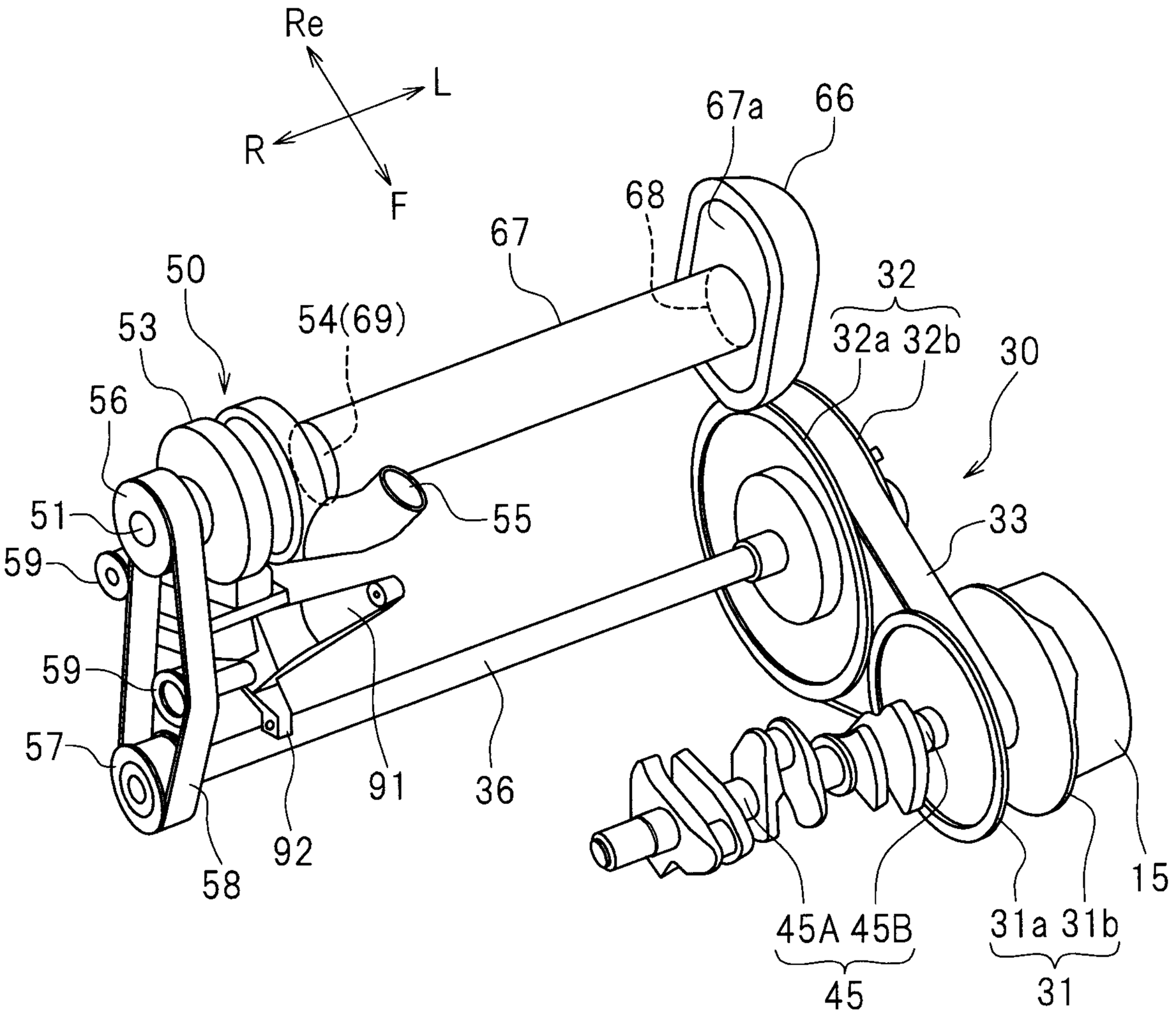

Re
L
R
F
67a
66
68
67
32
32a 32b
30
50
53
54(69)
56
51
55
33
59
59
57
91
36
92
58
15
45A 45B
45
31a 31b
31

FIG.8

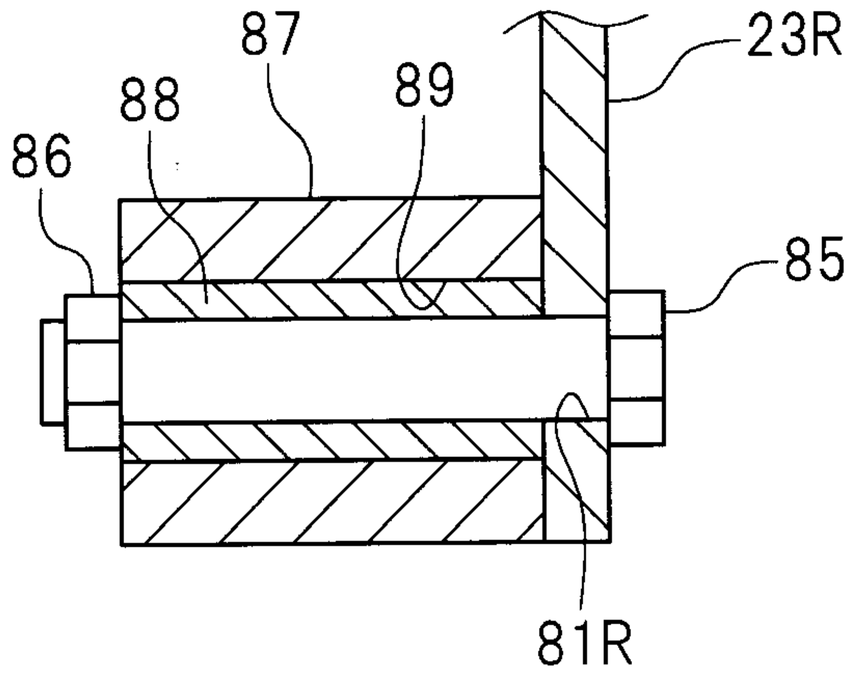
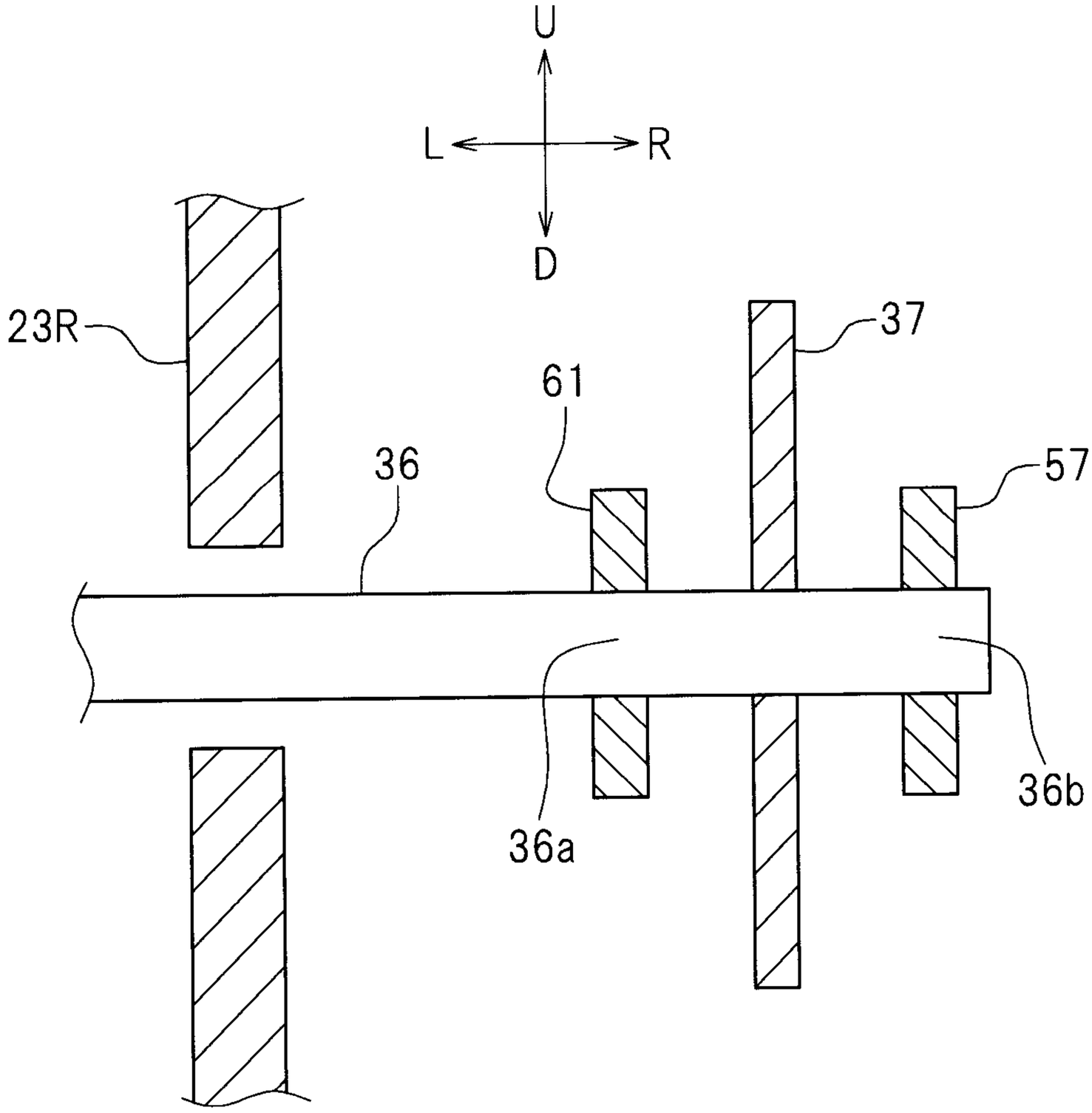


FIG.9



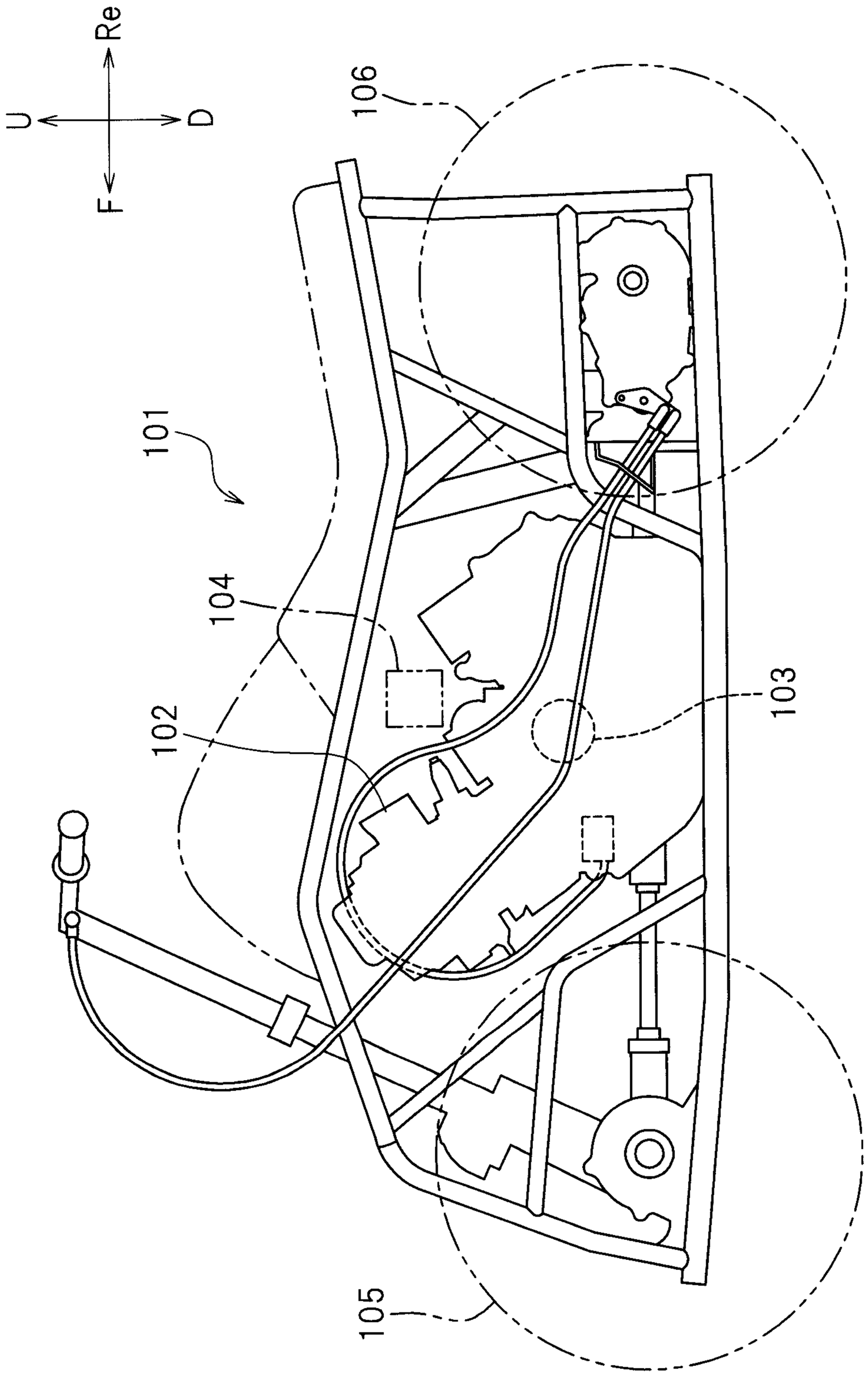


FIG. 1.10

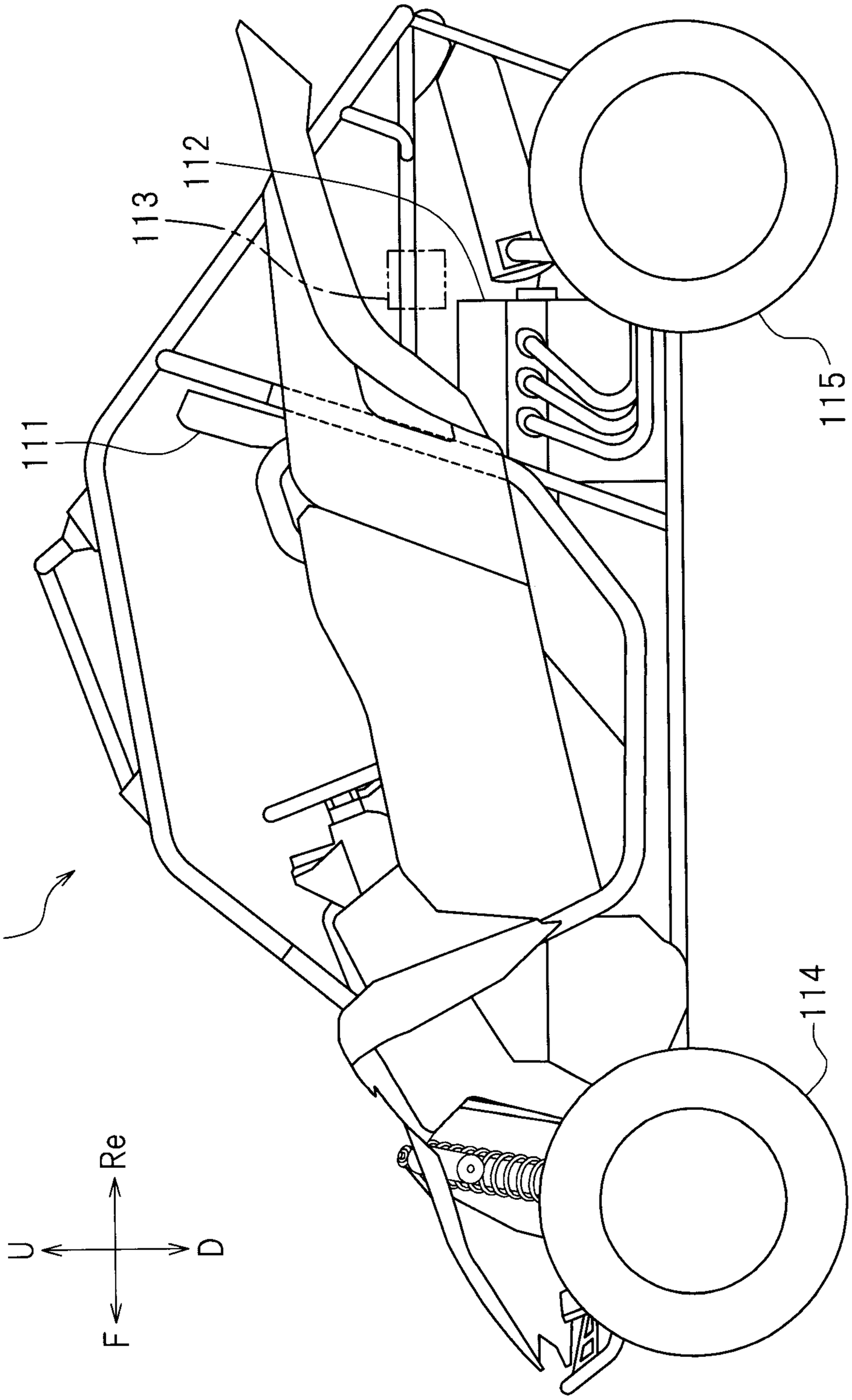
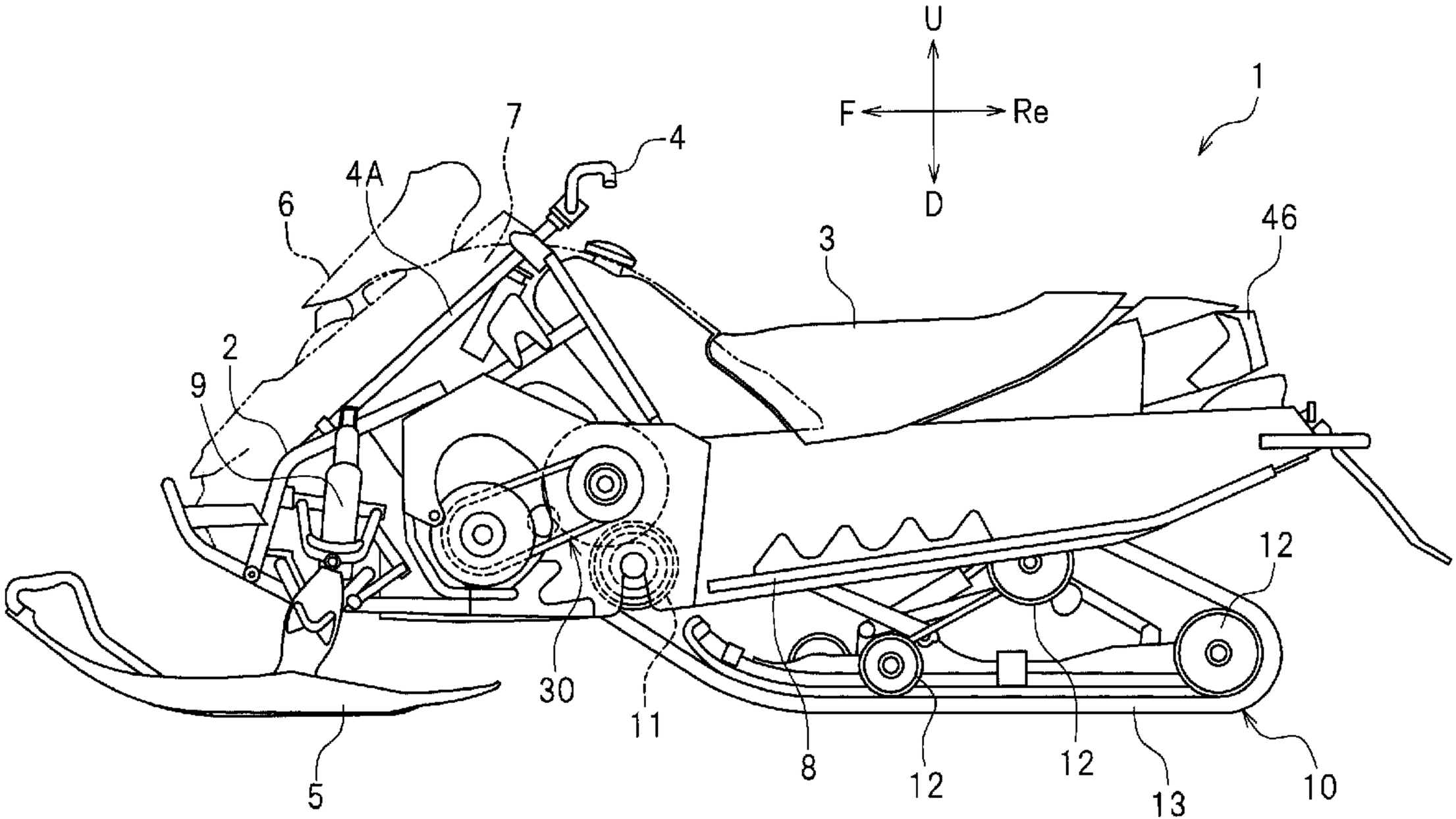


FIG.11


U
F
Re
D
1
7
4
4A
6
3
46
2
9
12
30
11
8
12
12
13
10
5