US012391110B2

(12) **United States Patent**
Tottori et al.

(10) **Patent No.: US 12,391,110 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **AIRFLOW ARRANGEMENT FOR COOLING AN ELECTRIC WORK VEHICLE**

(71) Applicant: **Kubota Corporation**, Osaka (JP)

(72) Inventors: **Norita Tottori**, Sakai (JP); **Hironobu Nogami**, Sakai (JP); **Daisuke Miyazaki**, Sakai (JP); **Renta Kasai**, Sakai (JP); **Daisuke Nakayama**, Sakai (JP)

(73) Assignee: **KUBOTA CORPORATION**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/768,286**

(22) Filed: **Jul. 10, 2024**

(65) **Prior Publication Data**

US 2024/0359549 A1 Oct. 31, 2024

Related U.S. Application Data

(63) Continuation of application No. 17/619,524, filed as application No. PCT/JP2020/020873 on May 27, 2020, now Pat. No. 12,070,995.

(30) **Foreign Application Priority Data**

Jun. 24, 2019 (JP) 2019-116723

(51) **Int. Cl.**
B60K 1/04 (2019.01)
B60K 11/04 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B60K 1/04*** (2013.01); ***B60K 11/04*** (2013.01); ***B60L 1/00*** (2013.01); ***B60L 50/60*** (2019.02);
(Continued)

(58) **Field of Classification Search**
CPC B60K 1/04; B60K 11/04; B60K 2001/003; B60K 2001/0411; B60L 1/00;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2005/0111167 A1 5/2005 Yamaguchi et al.
2018/0118014 A1* 5/2018 Wantschik B60K 1/00
2019/0075724 A1* 3/2019 Becke A01D 34/006

FOREIGN PATENT DOCUMENTS

JP 2005178732 A 7/2005

OTHER PUBLICATIONS

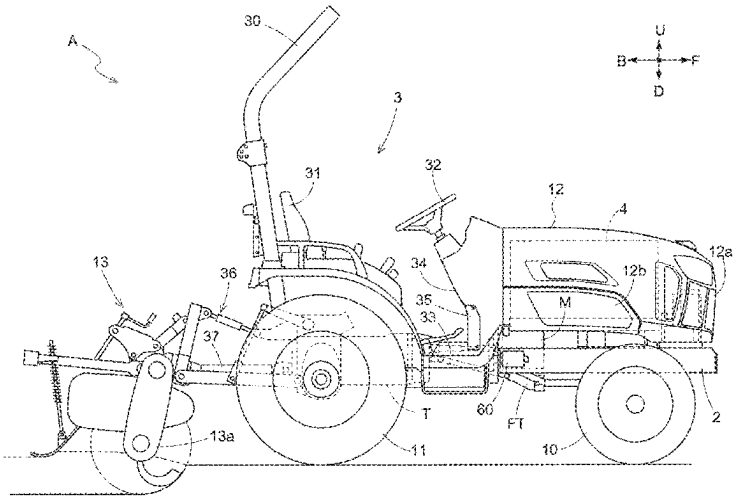
Tottori et al., "Cooling Arrangement for Electric Work Vehicle", U.S. Appl. No. 17/619,524, filed Dec. 15, 2021.
(Continued)

Primary Examiner — Jason D Shanske
Assistant Examiner — James J Triggs
(74) *Attorney, Agent, or Firm* — Keating & Bennett, LLP

(57) **ABSTRACT**

An electric work vehicle includes a travel battery, an auxiliary battery, a motor drivable on electric power supplied by the travel battery, a travel device drivable by the motor, a voltage converter positioned forward of the travel battery to step down a voltage of electric power from the travel battery and supply the electric power to the auxiliary battery, and a radiator positioned forward of the travel battery, wherein the voltage converter and the radiator are laterally next to each other in a plan view.

9 Claims, 8 Drawing Sheets



(51) **Int. Cl.**

B60L 1/00	(2006.01)
B60L 50/60	(2019.01)
B62D 25/08	(2006.01)
B62D 25/10	(2006.01)
B60K 1/00	(2006.01)
B62D 49/06	(2006.01)

(52) **U.S. Cl.**
CPC ***B62D 25/084*** (2013.01); ***B62D 25/10*** (2013.01); *B60K 2001/003* (2013.01); *B60K 2001/0411* (2013.01); *B60L 2200/40* (2013.01); *B62D 49/06* (2013.01)

(58) **Field of Classification Search**
CPC B60L 50/60; B60L 2200/40; B62D 25/084; B62D 25/10; B62D 49/06
See application file for complete search history.

(56) **References Cited**

OTHER PUBLICATIONS

Official Communication issued in corresponding Chinese Patent Application No. 202080036387.X, mailed on Oct. 11, 2024, 7 pages.

* cited by examiner

Fig.1

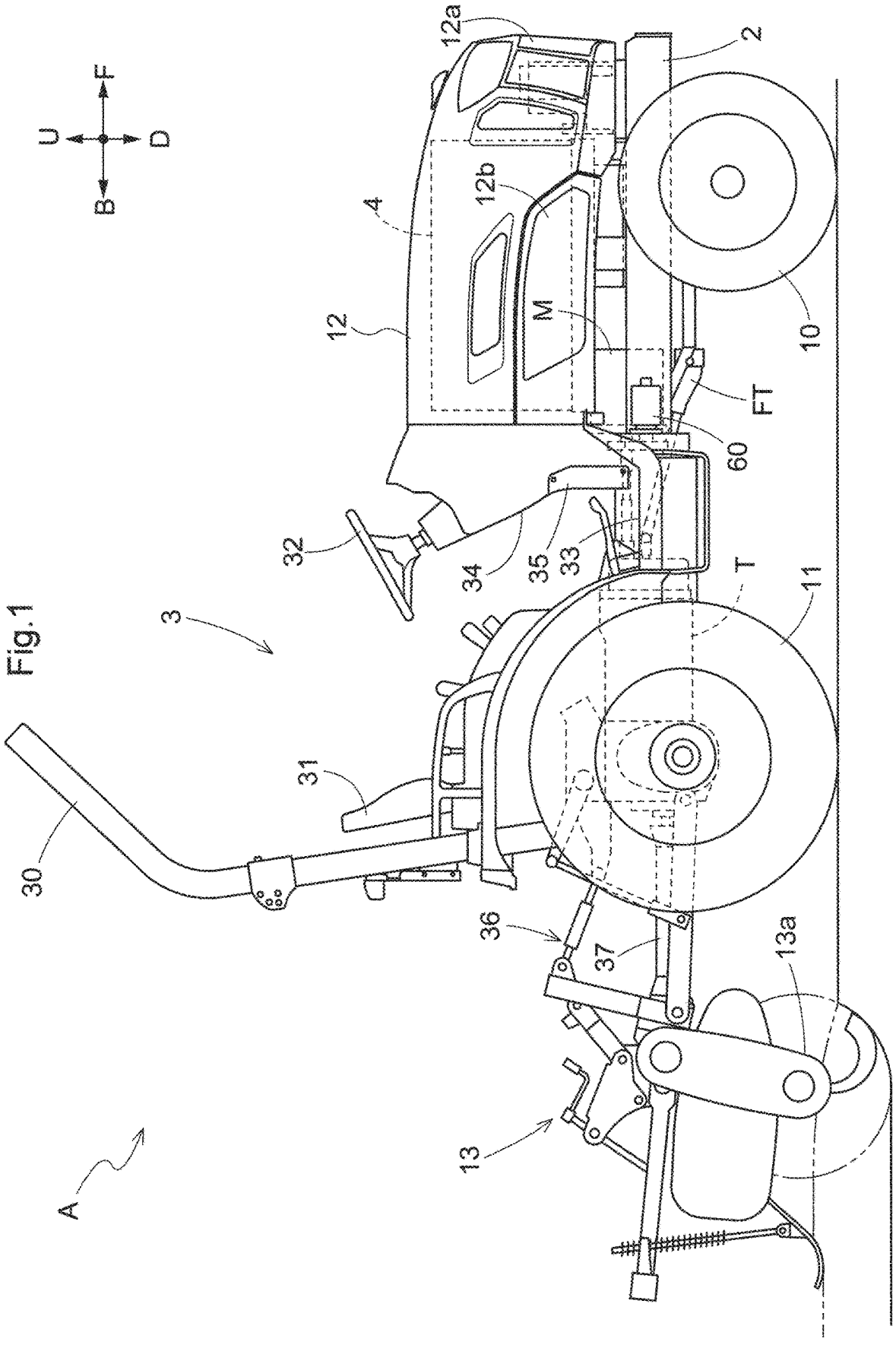
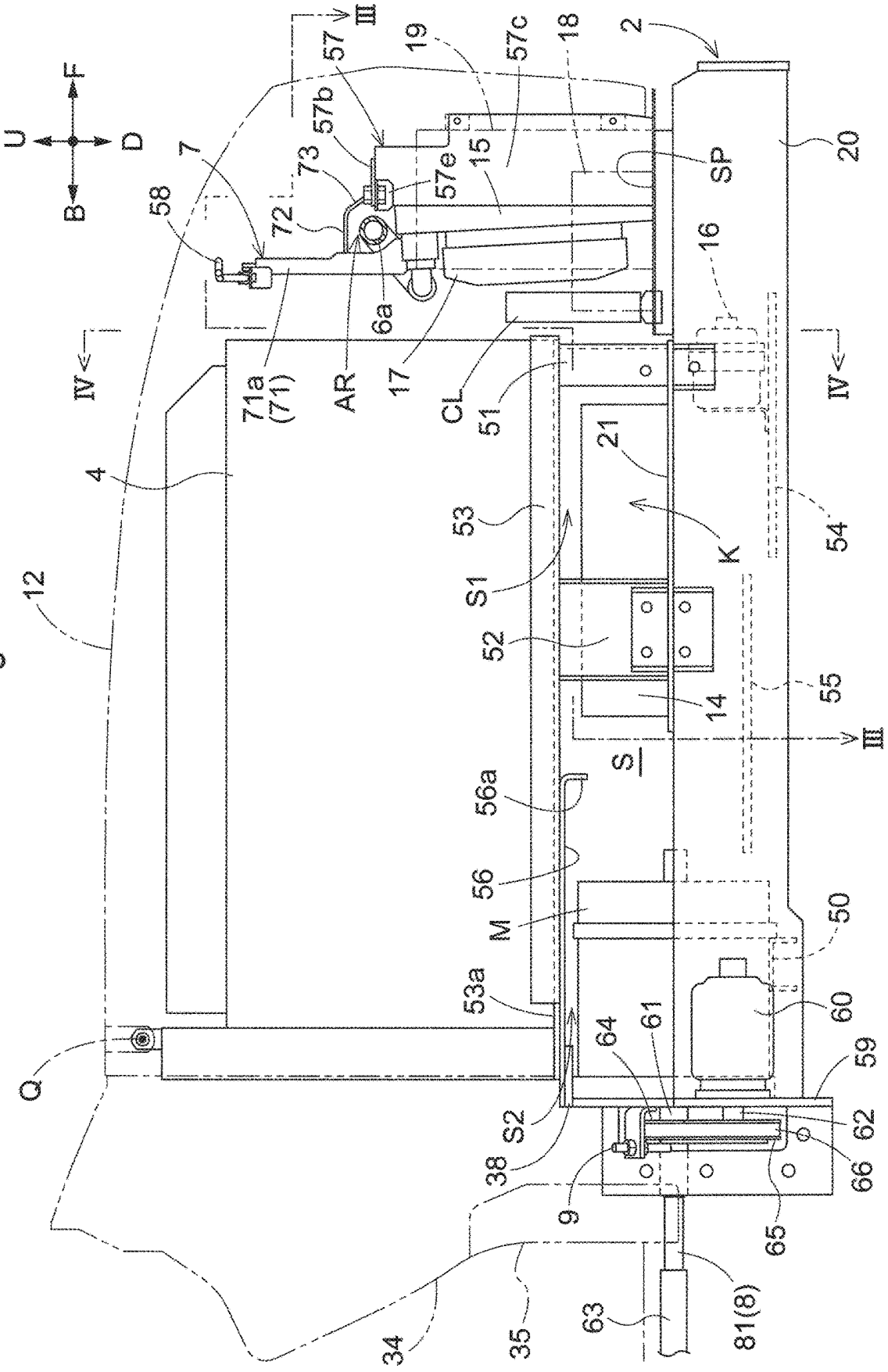


Fig.2


U
F
B
D
III
IV
IV
III
57
19
57c
18
2
57b
7
73
15
SP
20
58
72
57e
16
6a
71a
(71)
AR
17
CL
51
4
21
53
K
54
S1
12
52
55
14
S
56a
56
M
50
53a
60
64
61
59
Q
S2
62
38
66
9
65
34
35
63
81(8)

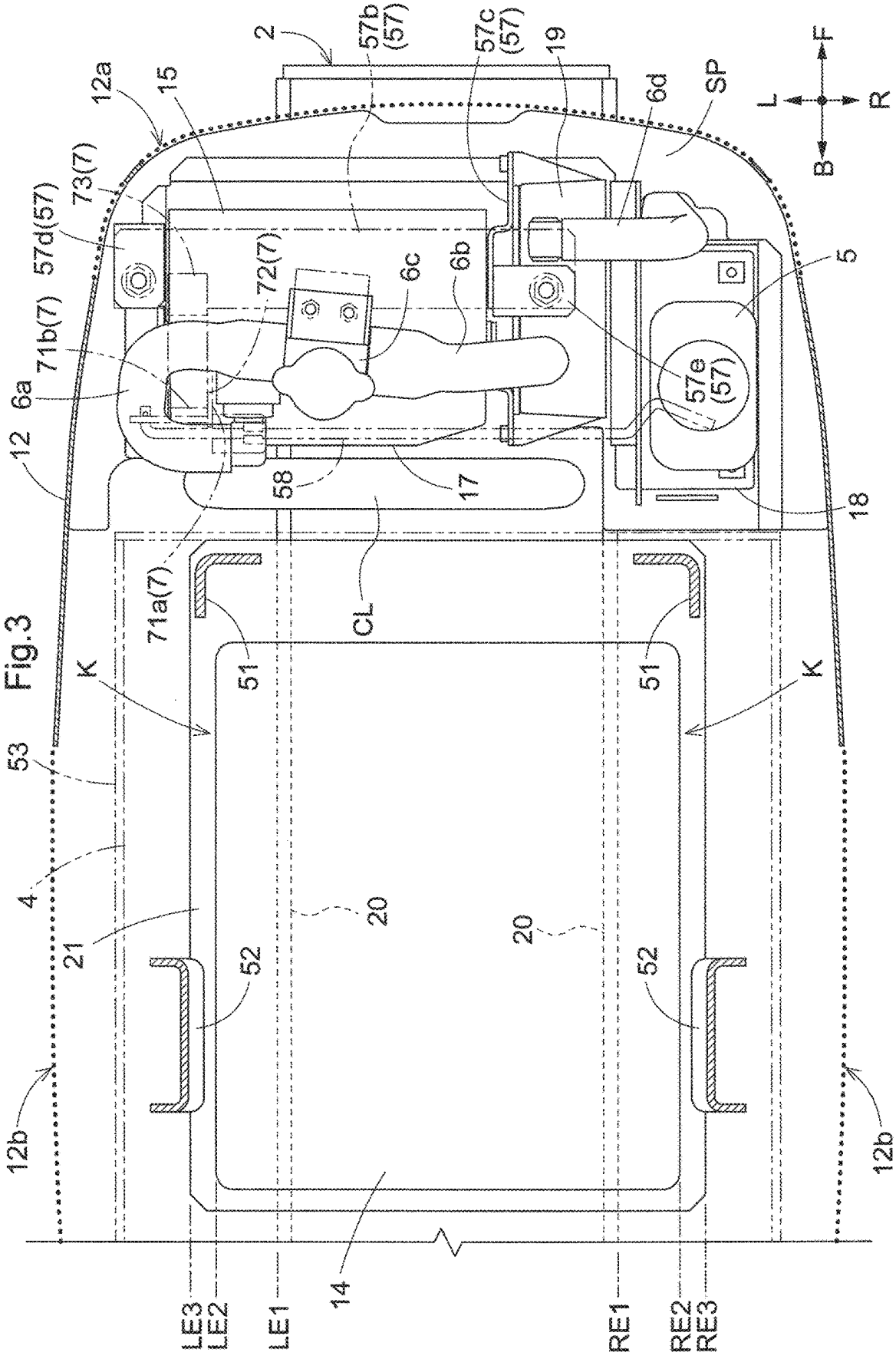

2
57b (57)
57c (57)
19
12a
15
6d
SP
F
L
R
B
73(7)
57d(57)
72(7)
6c
6b
5
71b(7)
6a
57e (57)
12
58
17
18
71a(7)
CL
51
51
K
K
53
4
21
20
20
52
52
12b
12b
14
LE3
LE2
LE1
RE1
RE2
RE3

Fig.3

Fig.4

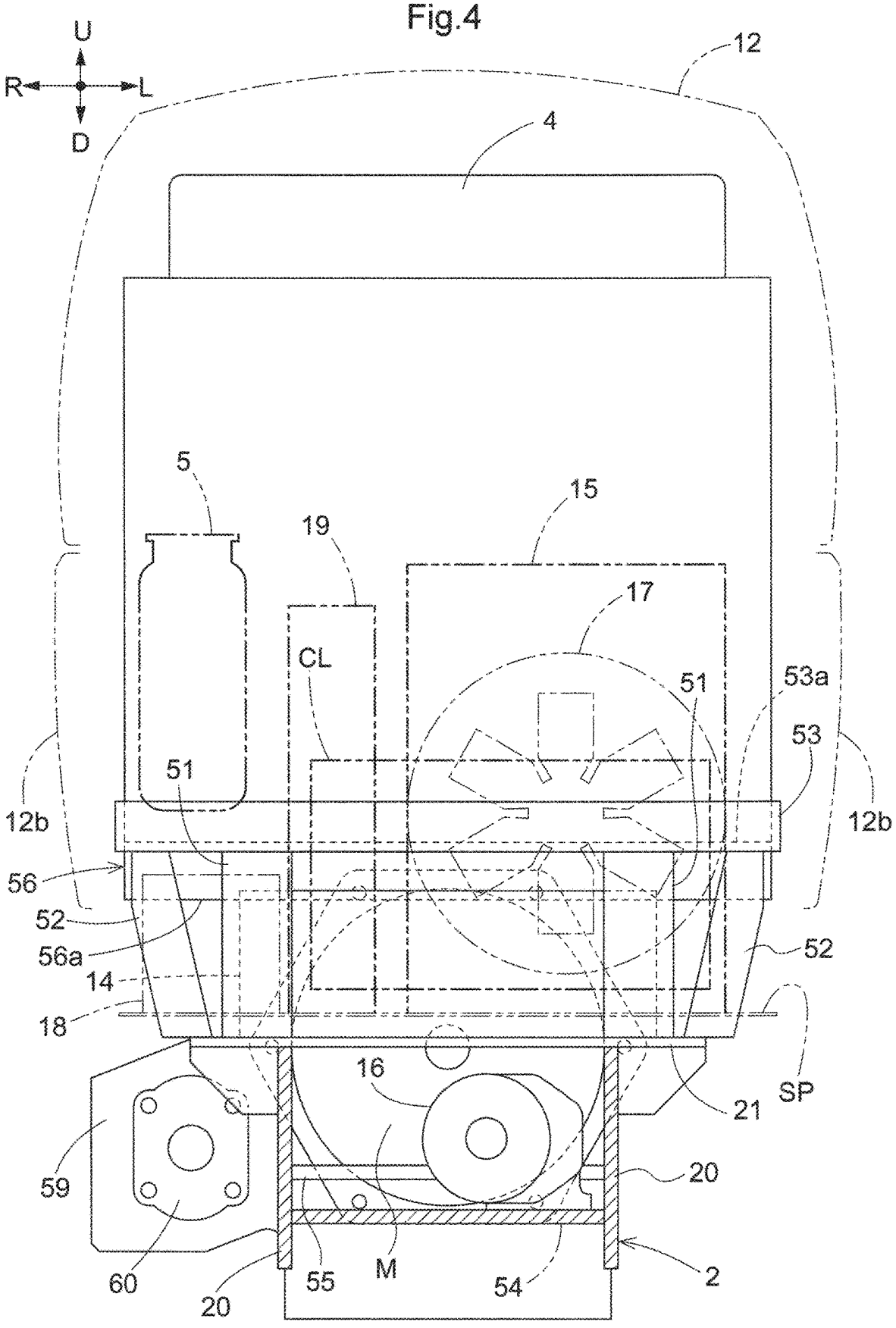

U
R
L
D
12
4
5
19
15
17
CL
51
53a
53
51
12b
12b
56
52
56a
14
18
52
16
21
SP
59
20
60
20
55
M
54
2

Fig.5

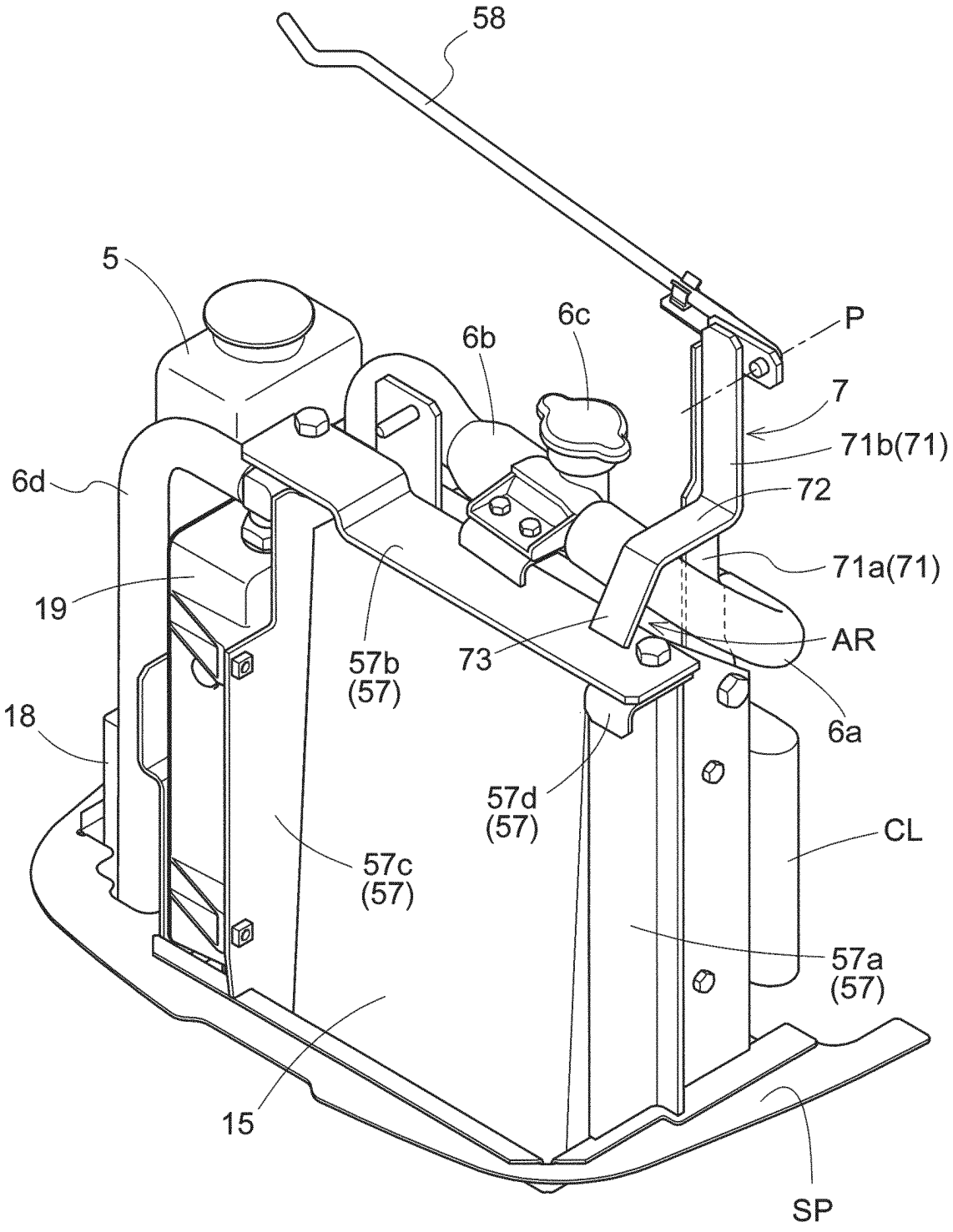

58
5
6c
6b
P
7
71b(71)
72
6d
71a(71)
19
AR
57b
(57)
73
18
6a
57d
(57)
CL
57c
(57)
57a
(57)
15
SP

Fig.6

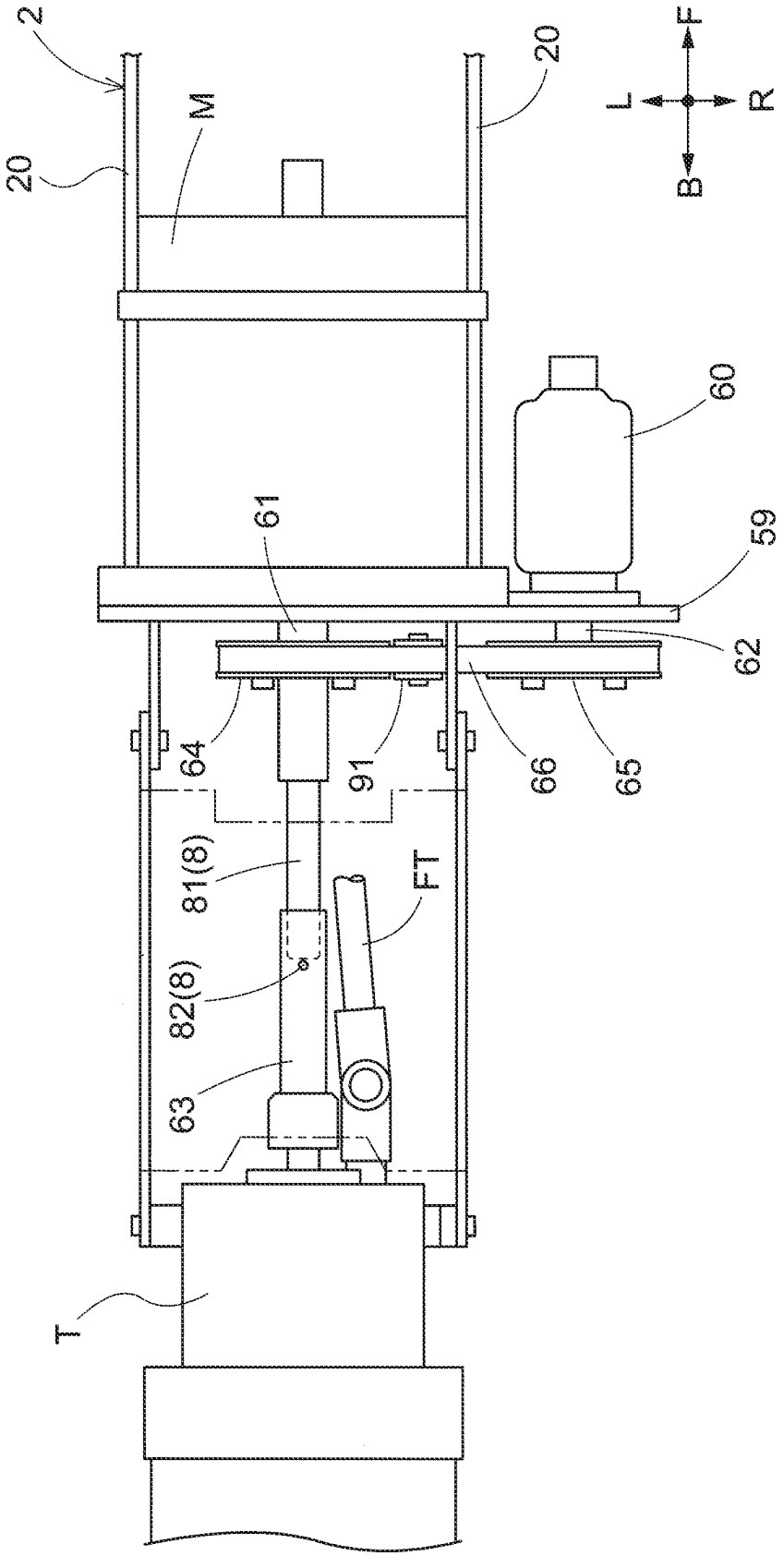


Fig.7

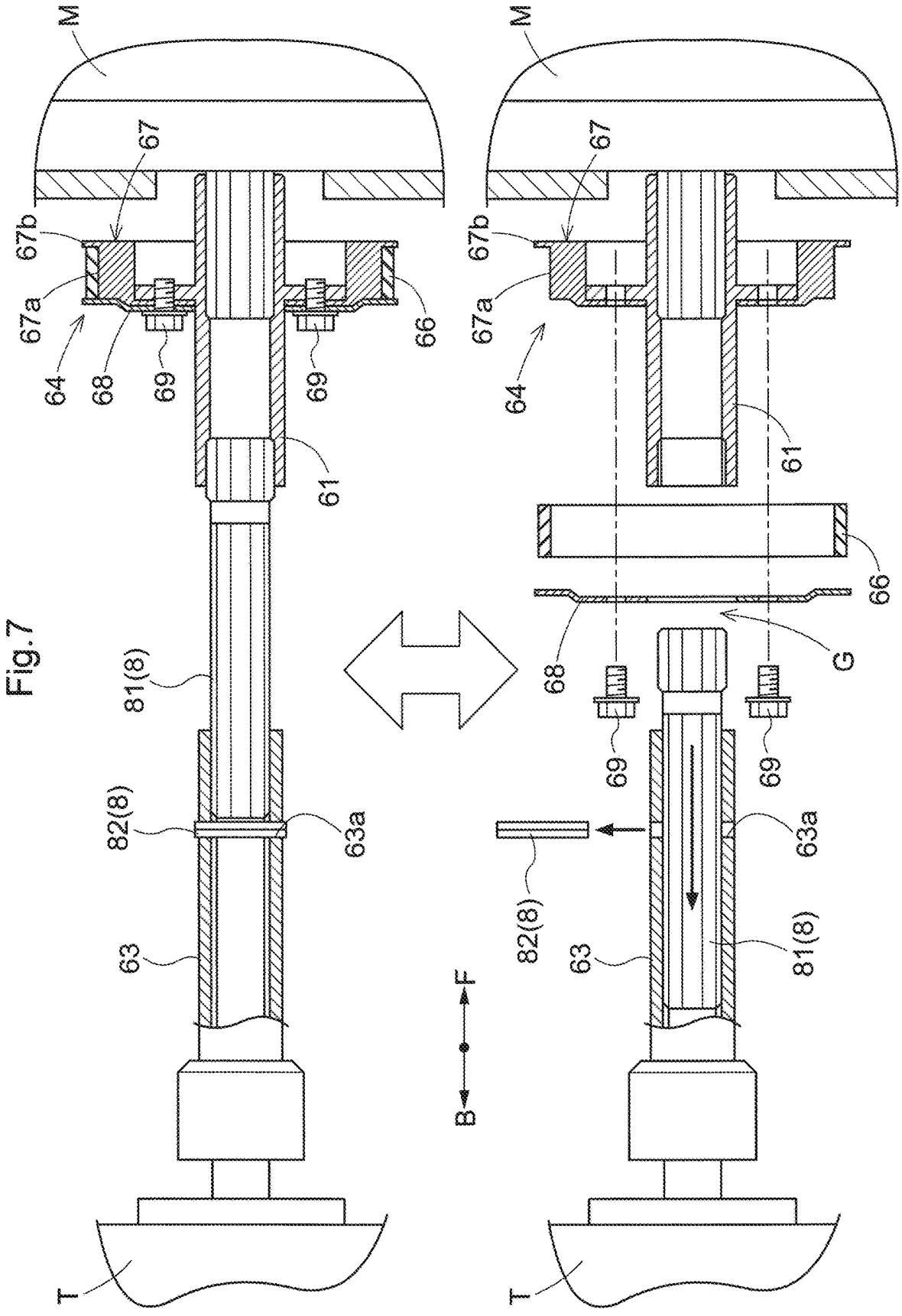
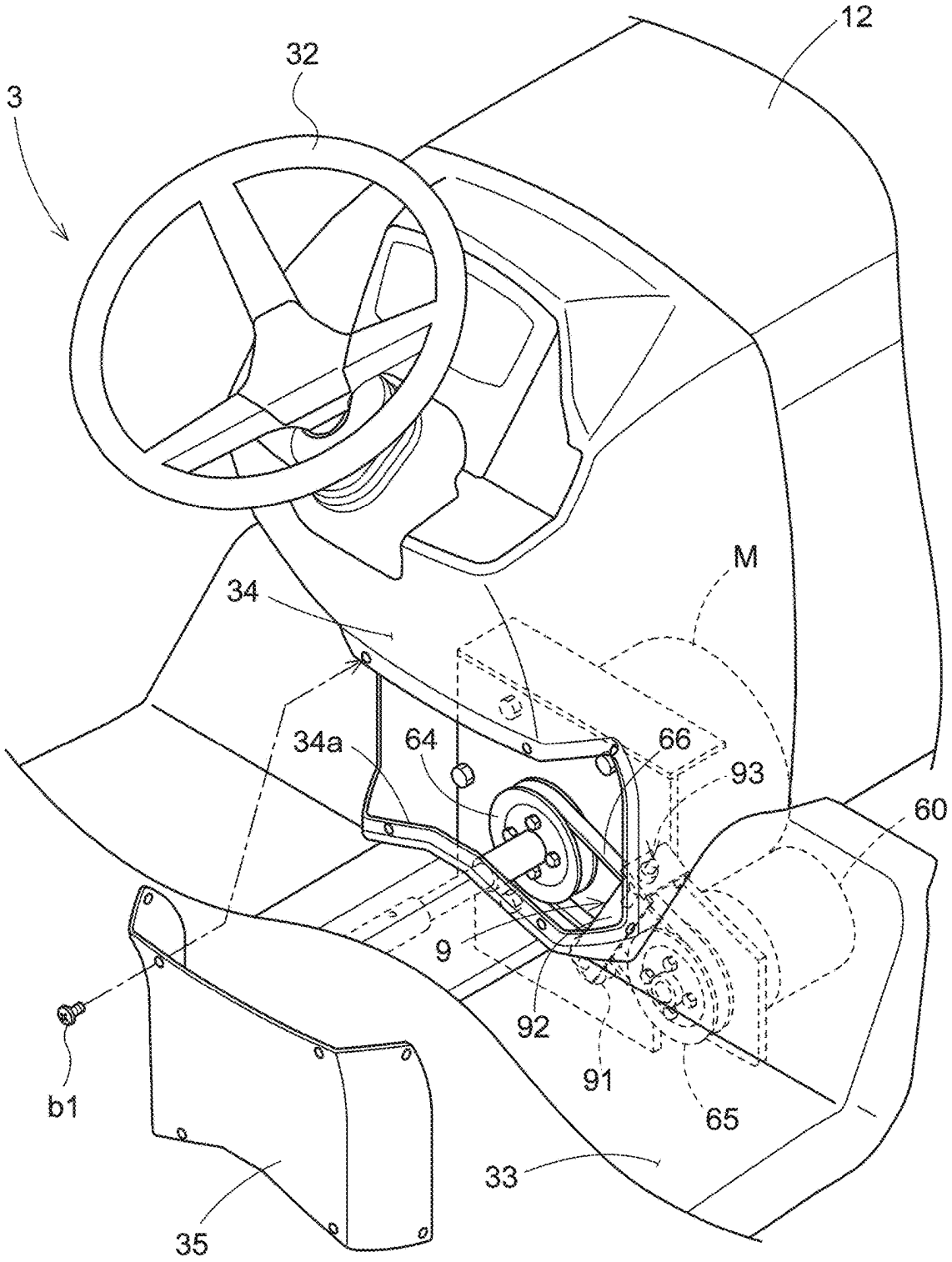

M
67
67b
67a
64
68
69
69
66
61
81(8)
82(8)
63a
63
T
F
B
M
67
67b
67a
64
61
66
68
G
69
69
63a
82(8)
63
81(8)
T

Fig.8



AIRFLOW ARRANGEMENT FOR COOLING AN ELECTRIC WORK VEHICLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electric work vehicle including a travel battery, a motor drivable on electric power supplied by the travel battery, and a travel device drivable by the motor.

2. Description of the Related Art

JP2018-69926A discloses a work vehicle ("tractor" in JP2018-69926A) including an engine and a travel device drivable by the engine ("front wheels" and "rear wheels" in JP2018-69926A).

SUMMARY OF THE INVENTION

The work vehicle disclosed in JP2018-69926A may be modified by replacing the engine with a battery and a motor. This will allow the work vehicle to travel without discharging exhaust gas.

The work vehicle disclosed in JP2018-69926A may also be modified by including a cooling water path through various devices and a radiator to cool cooling water. This will allow various devices to be cooled.

The work vehicle disclosed in JP2018-69926A may also be modified by including an auxiliary battery and a voltage converter for stepping down the voltage of electric power from the travel battery and supplying the resulting electric power to the auxiliary battery. This will allow electric power to be supplied to the auxiliary battery.

The arrangement of the voltage converter and the radiator can make it impossible to suitably cool both the voltage converter and the radiator, or can make it troublesome to maintain the voltage converter and the radiator.

If, for instance, the voltage converter is positioned forward of the radiator, the voltage converter will block cooling air supplied from an area positioned forward of the radiator toward the radiator as the work vehicle travels. As a result, while the voltage converter will be cooled effectively, the radiator will not. In other words, this arrangement will make it impossible to effectively cool both the voltage converter and the radiator.

If, for instance, the voltage converter is positioned backward of the travel battery, and the radiator is positioned forward of the travel battery, the voltage converter and the radiator will be far apart from each other with the travel battery therebetween. This will likely make it difficult to maintain the voltage converter and the radiator at the same time, making the maintenance work troublesome.

Preferred embodiments of the present invention provide electric work vehicles each including a voltage converter and a radiator both of which can be cooled effectively and maintained easily.

A preferred embodiment of the present invention includes a travel battery, an auxiliary battery, a motor drivable on electric power supplied by the travel battery, a travel device drivable by the motor, a voltage converter positioned forward of the travel battery to step down a voltage of electric power from the travel battery and supply the electric power to the auxiliary battery, and a radiator positioned forward of the travel battery, wherein the voltage converter and the radiator are laterally next to each other in a plan view.

A preferred embodiment of the present invention includes a voltage converter and a radiator that are laterally next to each other in a plan view. This allows cooling air to be supplied to the voltage converter and the radiator similarly as the work vehicle travels. The above configuration, in other words, prevents cooling air flowing toward one of the voltage converter and the radiator from being blocked by the other.

As a result, the above configuration makes it possible to effectively cool both the voltage converter and the radiator.

In addition, with a preferred embodiment of the present invention, the voltage converter and the radiator are both positioned forward of the travel battery. This allows the voltage converter and the radiator to be maintained at the same time, making the maintenance work easy.

A preferred embodiment of the present invention therefore allows production of an electric work vehicle including a voltage converter and a radiator, both of which can be cooled effectively and maintained easily.

A preferred embodiment of the present invention may preferably be further structured such that the radiator, the voltage converter, and the auxiliary battery are laterally next to one another in a plan view.

The above configuration allows cooling air to be supplied to the radiator, the voltage converter, and the auxiliary battery similarly as the work vehicle travels, making it easy to cool all of the radiator, the voltage converter, and the auxiliary battery effectively.

In addition, with the above configuration, the radiator, the voltage converter, and the auxiliary battery are all positioned forward of the travel battery. This allows the radiator, the voltage converter, and the auxiliary battery to be maintained at the same time, making the maintenance work easy.

A preferred embodiment of the present invention may preferably further include a reserve tank for the radiator, wherein the radiator, the voltage converter, and the reserve tank are laterally next to one another in a plan view.

The above configuration allows cooling air to be supplied to the radiator, the voltage converter, and the reserve tank similarly as the work vehicle travels, making it easy to cool all of the radiator, the voltage converter, and the reserve tank effectively.

In addition, with the above configuration, the radiator, the voltage converter, and the reserve tank are all positioned forward of the travel battery. This allows the radiator, the voltage converter, and the reserve tank to be maintained at the same time, making the maintenance work easy.

A preferred embodiment of the present invention may preferably be further structured such that the reserve tank and the auxiliary battery are arranged in an up-down direction of a machine body.

The above configuration allows cooling air to be supplied to the radiator, the voltage converter, the reserve tank, and the auxiliary battery similarly as the work vehicle travels, making it easy to cool all of the radiator, the voltage converter, the reserve tank, and the auxiliary battery effectively.

In addition, with the above configuration, the radiator, the voltage converter, the reserve tank, and the auxiliary battery are all positioned forward of the travel battery. This allows the radiator, the voltage converter, the reserve tank, and the auxiliary battery to be maintained at the same time, making the maintenance work easy.

In addition, the above configuration uses only a small space in terms of the left-right direction of the machine body for the reserve tank and the auxiliary battery as compared to a case of a reserve tank and an auxiliary battery being

laterally next to each other in a plan view. The machine body, as a result, likely has an advantageously small width.

A preferred embodiment of the present invention may preferably further include a radiator frame with an angular arch shape surrounding the radiator and holding the radiator in place, wherein the voltage converter is attached to the radiator frame and oriented to have a longitudinal direction extending in an up-down direction of a machine body.

The above configuration uses only a small space in terms of the left-right direction of the machine body for the voltage converter as compared to a case of a voltage converter being oriented to have a longitudinal direction extending in the left-right direction of the machine body. The machine body, as a result, likely has an advantageously small width.

In addition, the above configuration allows the voltage converter to be held in place by the radiator frame. The above configuration thus eliminates the need to include a dedicated member for holding the voltage converter in place, and thus reduces the production cost as compared to a case of including a dedicated member for holding the voltage converter in place.

A preferred embodiment of the present invention may preferably further include a cooling water hose connected to the radiator, a cover capable of being opened and closed and of accommodating the voltage converter, the radiator, the cooling water hose, and the radiator frame, a support extending upward from an upper portion of the radiator frame, and a cover support coupled to an upper end portion of the support and capable of supporting the cover in an open state, wherein the support includes a first portion extending upward from the upper portion of the radiator frame, a second portion extending forward from a middle portion of the first portion in the up-down direction of the machine body, and a third portion extending downward from a front end portion of the second portion and connected to the upper portion of the radiator frame, and the cooling water hose extends through an area defined by the first portion, the second portion, and the third portion.

With the above configuration, the support is connected to an upper portion of the radiator frame at the first portion and the third portion. This allows the support to be supported stably by the radiator frame as compared to a case of only either of a first portion and a third portion of the support being connected to an upper portion of a radiator frame.

In addition, the above configuration allows the area defined by the first portion, the second portion, and the third portion to be utilized as a space for the cooling water hose. This allows the electric work vehicle to be compact.

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

FIG. **1** is a right side view of a tractor.

FIG. **2** is a right side view of a travel battery and elements therearound.

FIG. **3** is a cross-sectional view of the tractor taken along line III-III in FIG. **2**.

FIG. **4** is a cross-sectional view of the tractor taken along line IV-IV in FIG. **2**.

FIG. **5** is a perspective view of a radiator and elements therearound.

FIG. **6** is a plan view of a motor and other elements.

FIG. **7** provides views of a coupling section and other elements.

FIG. **8** is a view of an opening and elements therearound.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The description below describes preferred embodiments of the present invention with reference to drawings. The description below uses terms such as "front" and "forward" to refer to the direction indicated with arrow F in FIGS. **1** to **3**, **6**, and **7**, terms such as "back" and "backward" to refer to the direction indicated with arrow B in the same drawings, terms such as "left" and "leftward" to refer to the direction indicated with arrow L in FIGS. **3**, **4**, and **6**, terms such as "right" and "rightward" to refer to the direction indicated with arrow R in the same drawings, terms such as "above" and "upward" to refer to the direction indicated with arrow U in FIGS. **1**, **2**, and **4**, and terms such as "below" and "downward" to refer to the direction indicated with arrow D in the same drawings.

FIG. **1** illustrates a tractor A (as an example of the "electric work vehicle" of the present invention) including left and right front wheels **10** (as an example of the "travel device" for the present invention), left and right rear wheels **11** (as an example of the "travel device" for the present invention), a cover member **12**, and a tiller device **13**.

The tractor A further includes a body frame **2** and a driver section **3**.

The body frame **2** is supported by the left and right front wheels **10** and the left and right rear wheels **11**. The tiller device **13** is supported by a back portion of the body frame **2**.

The cover member **12** is at a front portion of the machine body. The driver section **3** is behind the cover member **12**.

The driver section **3** includes a protection frame **30**, a driver's seat **31**, a steering wheel **32**, and a floor **33**. An operator can sit on the driver's seat **31** and perform various drive operations in the driver section **3**.

Operating the steering wheel **32** changes the direction of the left and right front wheels **10**. The operator can place their feet on the floor **33** when sitting on the driver's seat **31**.

The tractor A, in other words, includes a driver section **3** including a driver's seat **31** on which an operator is able to sit.

The tractor A further includes a travel battery **4**, a motor M, a transmission device T, and a front transmission mechanism FT.

The cover member **12** is swingable about an open/close axis Q (see FIG. **2**) extending in the left-right direction of the machine body. This allows the cover member **12** to be opened and closed. The cover member **12**, when in the closed state, accommodates the travel battery **4**. The travel battery **4** supplies electric power to the motor M.

The motor M is under the travel battery **4**. The motor M is driven on electric power supplied by the travel battery **4**, and transmits its driving force to the transmission device T.

The transmission device T is positioned backward of the travel battery **4** and behind the motor M. The front transmission mechanism FT extends forward from the transmission device T. The transmission device T varies the driving force received from the motor M, and transmits the resulting driving force to the left and right rear wheels **11** as well as to the left and right front wheels **10** via the front transmission mechanism FT. This drives the left and right front wheels **10** and the left and right rear wheels **11**.

The tractor A, in other words, includes a motor M positioned under the travel battery **4** and drivable on electric power supplied by the travel battery **4**. The tractor A also includes left and right front wheels **10** and left and right rear wheels **11** drivable by the motor M.

The transmission device T transmits a portion of the driving force received from the motor M to the tiller device **13**. This drives the tiller device **13**.

The above configuration allows the tractor A to travel with use of the left and right front wheels **10** and the left and right rear wheels **11** and simultaneously perform tillage work with use of the tiller device **13**.

As illustrated in FIGS. **2** to **4**, the travel battery **4** is above the body frame **2**. The body frame **2** and the travel battery **4** define a ventilation space S therebetween.

The tractor A, in other words, includes a travel battery **4** above the body frame **2**.

The ventilation space S is capable of letting air through.

The tractor A further includes an inverter **14** under the travel battery **4** and forward of the motor M.

The inverter **14** converts direct-current electric power from the travel battery **4** into alternating-current electric power, and supplies the alternating-current electric power to the motor M.

The tractor A, in other words, includes an inverter **14** positioned under the travel battery **4** and forward of the motor M and configured to convert direct-current electric power from the travel battery **4** into alternating-current electric power and supply the alternating-current electric power to the motor M.

The motor M and the inverter **14** are arranged in the front-back direction of the machine body.

The inverter **14** and the travel battery **4** define a first space S**1** therebetween. The first space S**1** is part of the ventilation space S, and is thus capable of letting air through.

The motor M and the travel battery **4** define a second space S**2** therebetween. The second space S**2** is part of the ventilation space S, and is thus capable of letting air through.

The motor M is positioned in contact with the ventilation space S.

The motor M is, in other words, in contact with the ventilation space S.

The body frame **2** includes left and right main frames **20** and an inverter support **21**. The left and right main frames **20** extend in the front-back direction of the machine body.

The tractor A, in other words, includes a left main frame **20** and a right main frame **20** both extending in the front-back direction of the machine body.

The motor M is between the left and right main frames **20**.

The inverter support **21** extends over the left and right main frames **20**, and is supported thereby. The inverter support **21** supports the inverter **14**.

The inverter **14** is, in other words, supported by the left main frame **20** and the right main frame **20** with the inverter support **21** therebetween.

FIG. **3** shows a first left-end position LE**1**, a second left-end position LE**2**, and a third left-end position LE**3**. The first left-end position LE**1** coincides with the left end of the left main frame **20**. The second left-end position LE**2** coincides with the left end of the inverter **14**. The third left-end position LE**3** coincides with the left end of the inverter support **21**.

As illustrated in FIG. **3**, the second left-end position LE**2** is leftward of the first left-end position LE**1**. In other words, the inverter **14** extends farther leftward than the left end of the left main frame **20**.

The third left-end position LE**3** is leftward of the first left-end position LE**1** and the second left-end position LE**2**. In other words, the inverter support **21** extends farther leftward than the left end of the left main frame **20**.

FIG. **3** also shows a first right-end position RE**1**, a second right-end position RE**2**, and a third right-end position RE**3**. The first right-end position RE**1** coincides with the right end of the right main frame **20**. The second right-end position RE**2** coincides with the right end of the inverter **14**. The third right-end position RE**3** coincides with the right end of the inverter support **21**.

As illustrated in FIG. **3**, the second right-end position RE**2** is rightward of the first right-end position RE**1**. In other words, the inverter **14** extends farther rightward than the right end of the right main frame **20**.

The third right-end position RE**3** is rightward of the first right-end position RE**1** and the second right-end position RE**2**. In other words, the inverter support **21** extends farther rightward than the right end of the right main frame **20**.

The inverter **14**, in other words, extends farther leftward than the left end of the left main frame **20** and farther rightward than the right end of the right main frame **20**.

The inverter support **21** also extends farther leftward than the left end of the left main frame **20** and farther rightward than the right end of the right main frame **20**.

As illustrated in FIGS. **2** to **4**, the tractor A includes left and right first support frames **51**, left and right second support frames **52**, and a battery support **53**.

The left and right first support frames **51** are forward of the left and right second support frames **52**. The left and right first support frames **51** and the left and right second support frames **52** all stand on the inverter support **21**.

The left and right first support frames **51** and the left and right second support frames **52**, in other words, all stand on the body frame **2**.

The tractor A further includes a plate-shaped support **38** and a plate-shaped partition member **56** (described later) between the motor M and the travel battery **4**. The plate-shaped support **38** and the plate-shaped partition member **56** are each oriented horizontally. The plate-shaped partition member **56** is over the plate-shaped support **38**.

The tractor A further includes a back portion support frame **59** supported by the body frame **2**. The back portion support frame **59** supports a back end portion of the battery support **53** with the plate-shaped support **38** and the plate-shaped partition member **56** therebetween.

The battery support **53** is above the body frame **2**, and is supported by the left and right first support frames **51**, the left and right second support frames **52**, and the back portion support frame **59**. The battery support **53** supports the travel battery **4**.

The tractor A, in other words, includes a battery support **53** positioned above the body frame **2** and supporting the travel battery **4**.

With the above configuration, the travel battery **4** is supported by the inverter support **21** with the battery support **53**, the left and right first support frames **51**, and the left and right second support frames **52** therebetween.

The travel battery **4** is, in other words, supported by the inverter support **21** with the left and right first support frames **51** therebetween, which stand on the inverter support **21**. In addition, the travel battery **4** is supported by the inverter support **21** with the left and right second support frames **52** therebetween, which stand on the inverter support **21**.

The tractor A has a left ventilation opening K defined by the body frame **2**, the battery support **53**, the left first support frame **51**, and the left second support frame **52**.

The tractor A also has a right ventilation opening K defined by the body frame **2**, the battery support **53**, the right first support frame **51**, and the right second support frame **52**.

The left and right ventilation openings K each communicate with the ventilation space S.

In other words, the ventilation space S communicates with the left and right ventilation openings K.

As illustrated in FIG. **2**, the battery support **53** includes a bottom plate **53***a*. The bottom plate **53***a* is oriented horizontally, and defines and functions as a partition between the travel battery **4** and the inverter **14**.

The tractor A, in other words, includes a bottom plate **53***a* as a partition between the travel battery **4** and the inverter **14**.

As illustrated in FIGS. **2** and **4**, the tractor A includes a first plate-shaped member **54** and a second plate-shaped member **55**.

The first plate-shaped member **54** and the second plate-shaped member **55** each extend from one of the left and right main frames **20** to the other. The first plate-shaped member **54** is forward of the second plate-shaped member **55**. The first plate-shaped member **54** and the second plate-shaped member **55** are each held in position by the left and right main frames **20**.

In other words, the body frame **2** holds the first plate-shaped member **54** and the second plate-shaped member **55** in position.

The first plate-shaped member **54** and the second plate-shaped member **55** are below the ventilation space S, and are oriented horizontally.

As illustrated in FIGS. **1** and **3**, the cover member **12** includes an inlet section **12***a*. The inlet section **12***a* is capable of letting outside air into the cover member **12**. The inlet section **12***a* is at a front end portion of the cover member **12**.

The inlet section **12***a* for the present preferred embodiment is in the form of a plurality of small holes. The present invention is, however, not limited to such an arrangement. The inlet section **12***a* may alternatively be in any other form. The inlet section **12***a* may, for instance, be in the form of a single hole, or include a blower to let outside air in.

The cover member **12** includes left and right outlet sections **12***b*. The left and right outlet sections **12***b* are each capable of letting air out of the cover member **12**.

The cover member **12**, in other words, includes left and right outlet sections **12***b* each capable of letting air out of the cover member **12**.

The left outlet section **12***b* is at a left side portion of the cover member **12**, whereas the right outlet section **12***b* is at a right side portion of the cover member **12**.

The left outlet section **12***b* is leftward of the travel battery **4**. The right outlet section **12***b* is rightward of the travel battery **4**. The left and right outlet sections **12***b* are, in other words, each lateral to the travel battery **4**.

The left and right outlet sections **12***b* for the present preferred embodiment are each in the form of a plurality of small holes. The present invention is, however, not limited to such an arrangement. The left and right outlet sections **12***b* may each alternatively be in any other form. The left and right outlet sections **12***b* may each, for instance, be in the form of a single hole, or include a blower to let air out.

As illustrated in FIGS. **2** to **4**, the tractor A includes a radiator **15** and a water pump **16**. The radiator **15** is forward of the travel battery **4**.

The tractor A, in other words, includes a radiator **15** forward of the travel battery **4**.

The radiator **15** and the water pump **16** are included in a cooling water path of the tractor A. The water pump **16** forces cooling water to circulate through the cooling water path. The cooling water is cooled by the radiator **15** as it passes therethrough.

The tractor A, in other words, includes a water pump **16** to force cooling water to pass through a radiator **15**.

The water pump **16** is forward of the motor M and below the inverter **14**. The water pump **16** is supported by the first plate-shaped member **54**.

The tractor A further includes a cooling fan **17**. The cooling fan **17** is in front of the travel battery **4**. The cooling fan **17** is, in other words, forward of the travel battery **4**.

When the cover member **12** is in the closed state, the radiator **15** and the cooling fan **17** are accommodated in the cover member **12**.

The tractor A, in other words, includes a cover member **12** capable of accommodating the cooling fan **17** and the travel battery **4**.

The cooling fan **17** extends in the up-down direction of the machine body to face both the travel battery **4** and the ventilation space S. The cooling fan **17** also extends in the up-down direction of the machine body to face both the travel battery **4** and the inverter **14**.

The cooling fan **17** blows cooling air backward. This causes outside air to enter the cover member **12** through the inlet section **12***a* and pass through the radiator **15**, thus cooling the radiator **15**.

The cooling fan **17** is, in other words, forward of the travel battery **4**, and cools the radiator **15**.

The cooling fan **17** sends cooling air to a front portion of the travel battery **4** and to the ventilation space S.

The tractor A, in other words, includes a cooling fan **17** positioned forward of the travel battery **4** and configured to send cooling air to the travel battery **4**.

The cooling fan **17** sends cooling air to a front portion of the travel battery **4**, at least a portion of which cooling air flows to a space leftward of the travel battery **4** and to a space rightward of the travel battery **4** to be let out through the left and right outlet sections **12***b*. This cools the front portion and lateral side portions of the travel battery **4**.

The cooling fan **17** sends cooling air to the ventilation space S, a portion of which cooling air reaches the first space **S1** and then passes through the left and right ventilation openings K and the left and right outlet sections **12***b* to be let out of the cover member **12**.

This cools a lower portion of the travel battery **4** and the inverter **14**.

Another portion of the cooling air, which the cooling fan **17** sends to the ventilation space S, reaches the first space **S1** and then continues to flow through the ventilation space S to pass through the second space **S2**.

This cools a lower portion of the travel battery **4**, the inverter **14**, and the motor M.

As illustrated in FIG. **2**, the tractor A includes a horizontally oriented plate-shaped partition member **56** between the battery support **53** and the motor M.

The plate-shaped partition member **56** includes a wind guide plate **56***a*. The wind guide plate **56***a* is a front end portion of the plate-shaped partition member **56** which is bent downward. The wind guide plate **56***a* is thus oriented vertically, and faces toward the cooling fan **17**.

The tractor A, in other words, includes a wind guide plate **56***a* facing toward the cooling fan **17**.

The wind guide plate **56***a* is under the travel battery **4** and forward of the second space S**2**.

This allows that portion of the cooling air through the ventilation space S which flows toward the second space S**2** to be guided by the wind guide plate **56***a* to downward thereof. This in turn allows more cooling air to flow toward the motor M, thus cooling the motor M with cooling air effectively.

As illustrated in FIGS. **3** to **5**, the tractor A includes a reserve tank **5** for the radiator **15**. The reserve tank **5** stores cooling water. The reserve tank **5** is forward of the travel battery **4** and rightward of the radiator **15**.

As illustrated in FIGS. **2** to **5**, the tractor A includes an auxiliary battery **18** and a voltage converter **19**. The auxiliary battery **18** supplies electric power to various auxiliaries such as the cooling fan **17**.

The travel battery **4** transmits electric power to the voltage converter **19**, which then steps down the voltage of the electric power and supplies the resulting electric power to the auxiliary battery **18**.

The tractor A, in other words, includes a voltage converter **19** positioned forward of the travel battery **4** and configured to step down the voltage of electric power from the travel battery **4** and supply the resulting electric power to the auxiliary battery **18**.

The auxiliary battery **18** and the voltage converter **19** are forward of the travel battery **4** and rightward of the radiator **15**. The voltage converter **19** is oriented to have a longitudinal direction extending in the up-down direction of the machine body.

As illustrated in FIG. **3**, the voltage converter **19** and the radiator **15** are laterally next to each other in a plan view. The radiator **15**, the voltage converter **19**, and the auxiliary battery **18** are laterally next to one another in a plan view.

The voltage converter **19** is between the radiator **15** and the auxiliary battery **18** in a plan view.

The radiator **15**, the voltage converter **19**, and the reserve tank **5** are laterally next to one another in a plan view.

The voltage converter **19** is between the radiator **15** and the reserve tank **5** in a plan view.

As illustrated in FIGS. **3** and **4**, the reserve tank **5** extends over the auxiliary battery **18**. The reserve tank **5** and the auxiliary battery **18** are arranged in the up-down direction of the machine body.

As illustrated in FIGS. **2** and **3**, the tractor A includes a cooler CL. The cooler CL cools an operating fluid of the tractor A as it passes through the cooler CL.

As illustrated in FIGS. **2**, **3**, and **5**, the radiator **15** is held in place by a radiator frame **57** in the shape of an angular arch. The radiator frame **57** surrounds the radiator **15**.

The tractor A, in other words, includes a radiator frame **57** with an angular arch shape surrounding the radiator **15** and holding the radiator **15** in place.

The radiator frame **57** includes a left side plate **57***a*, a top plate **57***b*, a right side plate **57***c*, a first top plate support **57***d*, and a second top plate support **57***e*.

The left side plate **57***a* is a left portion of the radiator frame **57**. The top plate **57***b* is a top portion of the radiator frame **57**. The right side plate **57***c* is a right portion of the radiator frame **57**.

The left side plate **57***a* and the right side plate **57***c* are each oriented vertically, and are arranged in the left-right direction. The left side plate **57***a* and the right side plate **57***c* face each other.

The first top plate support **57***d* extends leftward from an upper end portion of the left side plate **57***a*. The second top plate support **57***e* extends rightward from an upper end portion of the right side plate **57***c*. The top plate **57***b* is placed on and supported by the upper surface of the first top plate support **57***d* and the upper surface of the second top plate support **57***e*.

The voltage converter **19** is attached to the radiator frame **57**. Specifically, the voltage converter **19** is attached to the right surface of the right side plate **57***c*.

The tractor A includes a first hose **6***a* (as an example of the "cooling water hose" for the present invention), a second hose **6***b*, a water supply section **6***c*, and a third hose **6***d*, which are included in the cooling water path of the tractor A.

The first hose **6***a* has a first end connected to the radiator **15** and a second end connected to the water supply section **6***c*.

The tractor A, in other words, includes a first hose **6***a* connected to the radiator **15**.

The second hose **6***b* has a first end connected to the water supply section **6***c* and a second end connected to the voltage converter **19**.

The third hose **6***d* is connected to the voltage converter **19**.

An operator can supply cooling water into the water supply section **6***c*. The cooling water flows sequentially through the third hose **6***d*, the voltage converter **19**, the second hose **6***b*, the water supply section **6***c*, the first hose **6***a*, and the radiator **15**.

As illustrated in FIGS. **2**, **3**, and **5**, the tractor A includes a support **7** and a cover support **58**. The support **7** is supported by the radiator frame **57**, and extends upward from an upper portion of the radiator frame **57**.

The tractor A, in other words, includes a support **7** extending upward from an upper portion of the radiator frame **57**.

The cover support **58** is in the shape of a bar. The cover support **58** includes a first end portion coupled to an upper end portion of the support **7** in such a manner as to be swingable in the up-down direction about a swing axis P extending in the front-back direction of the machine body.

When the cover member **12** is in the open state, swinging the cover support **58** upward to a standing position allows its second end portion to come into contact with an inner wall surface of the cover member **12**. With the second end portion of the cover support **58** in contact with the inner wall surface of the cover member **12**, the cover member **12** is supported by the cover support **58**.

The above configuration allows the cover support **58** to support the cover member **12** in the open state.

The tractor A, in other words, includes a cover support **58** coupled to an upper end portion of the support **7** and capable of supporting the cover member **12** in the open state.

The cover member **12**, in the closed state, accommodates the voltage converter **19**, the first hose **6***a*, the radiator frame **57**, the reserve tank **5**, and the auxiliary battery **18**.

The tractor A, in other words, includes a cover member **12** capable of being opened and closed and of accommodating the voltage converter **19**, the radiator **15**, the first hose **6***a*, and the radiator frame **57**.

The support **7** includes a first portion **71**, a second portion **72**, and a third portion **73**.

The first portion **71** extends upward from an upper portion of the radiator frame **57**. The first portion **71** includes a lower end portion connected to the upper portion of the radiator frame **57**.

The second portion **72** extends forward from a middle portion of the first portion **71** in the up-down direction of the machine body. The second portion **72** is oriented horizontally.

The third portion **73** extends substantially downward from a front end portion of the second portion **72**, and is connected to an upper portion of the radiator frame **57**. The third portion **73** is oriented obliquely in a lower front direction. The third portion **73** includes a back end portion connected to the front end portion of the second portion **72**, and includes a front end portion connected to the upper portion of the radiator frame **57**.

The support **7**, in other words, includes (i) a first portion **71** extending upward from an upper portion of the radiator frame **57**, (ii) a second portion **72** extending forward from a middle portion of the first portion **71** in the up-down direction of the machine body, and (iii) a third portion **73** extending substantially downward from a front end portion of the second portion **72** and connected to an upper portion of the radiator frame **57**.

The first hose **6***a* extends through an area AR defined by the first portion **71**, the second portion **72**, and the third portion **73**.

The description below deals with the first portion **71** in detail. The first portion **71** includes a support stay **71***a* and a vertical fixed portion **71***b*. The support stay **71***a* is in the shape of an elongated plate, and extends in the up-down direction of the machine body along the left side plate **57***a*. The support stay **71***a* includes a lower end portion bolted to a back end portion of an upper end portion of the left side plate **57***a*.

The vertical fixed portion **71***b* is in the shape of an elongated plate, and extends in the up-down direction of the machine body. The vertical fixed portion **71***b* has a dimension smaller than the support stay **71***a* in the up-down direction of the machine body.

The vertical fixed portion **71***b* is perpendicular to the support stay **71***a*, and is fixed to its left surface. The vertical fixed portion **71***b*, the second portion **72**, and the third portion **73** are integral with one another.

The above-mentioned area AR is defined by the support stay **71***a*, the second portion **72**, and the third portion **73**.

As illustrated in FIGS. **2** to **5**, the tractor A includes a horizontally oriented support plate SP at a front portion thereof. The support plate SP supports the radiator **15**, the cooling fan **17**, the auxiliary battery **18**, the voltage converter **19**, the radiator frame **57**, and the cooler CL.

As illustrated in FIGS. **1** and **2**, the tractor A includes a hydraulic pump **60**. The hydraulic pump **60** supplies operating fluid to an operating mechanism for operating the tiller device **13**. The hydraulic pump **60** controls the supply of operating fluid to operate the tiller device **13**.

Specifically, the tractor A includes a lifting/lowering mechanism **36** as an operating mechanism for a work device. The hydraulic pump **60** supplies operating fluid to the lifting/lowering mechanism **36** to operate the lifting/lowering mechanism **36**, which then lifts and lowers the tiller device **13**. The tiller device **13** includes a tiller section **13***a* with a drive section connected to a PTO shaft **37** of the tractor A. The tiller device **13** performs tillage work with use of power from the PTO shaft **37**.

As illustrated in FIGS. **2**, **4**, and **6**, the hydraulic pump **60** is next to the motor M.

As illustrated in FIG. **2**, the motor M is held in place by a front portion support frame **50** and a back portion support frame **59**.

The front portion support frame **50** extends from one of the left and right main frames **20** to the other, and is fixed to respective lower portions of the left and right main frames **20**. The front portion support frame **50** is under a front portion of the motor M and supports it.

The back portion support frame **59** extends beyond the left and right main frames **20**. The back portion support frame **59** is in contact with a back end portion of the motor M and holds a back portion of the motor M in place.

As illustrated in FIGS. **2** and **6**, the hydraulic pump **60** is in front of and attached to the back portion support frame **59**. The hydraulic pump **60** is held in place by the back portion support frame **59**.

In other words, the motor M and the hydraulic pump **60** are both held in place by the same back portion support frame **59**.

As illustrated in FIG. **6**, the motor M includes a motor output shaft **61** as its output shaft. The motor output shaft **61** is provided with a first rotor **64** configured to rotate integrally with the motor output shaft **61**.

The tractor A, in other words, includes a first rotor **64** attached to the motor output shaft **61** and configured to rotate integrally with the motor output shaft **61**.

The hydraulic pump **60** includes a pump input shaft **62** as its input shaft. The pump input shaft **62** is provided with a second rotor **65** configured to rotate integrally with the pump input shaft **62**.

The tractor A, in other words, includes a second rotor **65** attached to the pump input shaft **62** as an input shaft of the hydraulic pump **60** and configured to rotate integrally with the pump input shaft **62**.

The tractor A also includes an endless rotary body **66** wound around the first rotor **64** and the second rotor **65**.

The tractor A, in other words, includes an endless rotary body **66** windable around the first rotor **64** and the second rotor **65**.

The endless rotary body **66** for the present preferred embodiment is a belt. Preferred embodiments of the present invention are, however, not limited to such an arrangement. The endless rotary body **66** is not necessarily a belt, and may be a chain, for example.

The above configuration allows the motor M to transmit its driving force to the hydraulic pump **60** via the motor output shaft **61**, the first rotor **64**, the endless rotary body **66**, the second rotor **65**, and the pump input shaft **62**. This drives the hydraulic pump **60**.

The tractor A, in other words, includes a hydraulic pump **60** drivable by the motor M to supply operating fluid to the tiller device **13**.

The transmission device T includes a transmission input shaft **63** as its input shaft. The transmission input shaft **63** is coupled to the motor output shaft **61** with a coupling section **8**. This allows the transmission input shaft **63** to rotate integrally with the motor output shaft **61**.

Specifically, as illustrated in FIG. **7**, the motor output shaft **61** and the transmission input shaft **63** each have a cylinder shape extending in the front-back direction of the machine body. The coupling section **8** includes a coupling shaft **81** and a pin **82**.

The coupling shaft **81** extends in the front-back direction of the machine body. The coupling shaft **81** includes a front end portion inserted in the motor output shaft **61** and in spline engagement therewith. The coupling shaft **81** includes a back end portion inserted in the transmission input shaft **63** and in spline engagement therewith.

The transmission input shaft **63** includes a pin hole **63***a*, in which the pin **82** is insertable. The pin **82** is, when inserted, behind the coupling shaft **81** to prevent it from sliding backward.

In the state illustrated on the left side of FIG. **7**, the transmission input shaft **63** and the motor output shaft **61** are incapable of rotation relative to each other.

The tractor A, in other words, includes a coupling section **8** configured to couple the transmission input shaft **63** and the motor output shaft **61** to each other in such a manner that the transmission input shaft **63** and the motor output shaft **61** are incapable of rotation relative to each other.

As illustrated in FIG. **7**, the coupling section **8** is switchable between a coupling state and a non-coupling state. In the coupling state, the coupling section **8** couples the transmission input shaft **63** and the motor output shaft **61** to each other. In the non-coupling state, the coupling section **8** does not couple the transmission input shaft **63** and the motor output shaft **61** to each other.

FIG. **7** illustrates on the left side the coupling section **8** in the coupling state. In this state, the transmission input shaft **63** and the motor output shaft **61** are incapable of rotation relative to each other as described above. The transmission input shaft **63** thus rotates integrally with the motor output shaft **61**.

In other words, while the coupling section **8** is in the coupling state, the transmission input shaft **63** rotates integrally with the motor output shaft **61**.

With the pin **82** has been pulled out of the pin hole **63***a*, and the coupling shaft **81** has been slid backward, the coupling section **8** is in the state illustrated on the right side of FIG. **7**, that is, in the non-coupling state.

In this state, the coupling shaft **81** is spaced apart from the motor output shaft **61**, with a gap G between the front end of the coupling shaft **81** and the back end of the motor output shaft **61**.

The gap G is between the front end of the transmission input shaft **63** and the back end of the motor output shaft **61**, and is larger than the width of the endless rotary body **66**. This allows the endless rotary body **66** to pass through the gap G in a case where the endless rotary body **66** has been removed from the first rotor **64** or the second rotor **65**.

In other words, while the coupling section **8** is in the non-coupling state, the front end of the transmission input shaft **63** and the back end of the motor output shaft **61** define a gap G that allows the endless rotary body **66** to pass therethrough in a case where the endless rotary body **66** has been removed.

As illustrated in FIG. **7**, the first rotor **64** includes a first segment **67** and a second segment **68**. The first segment **67** is forward of the second segment **68**. As illustrated on the left side of FIG. **7**, the second segment **68** includes a front surface in contact with the back surface of the first segment **67**.

The first segment **67** includes a wind-around section **67***a* and a flange section **67***b*. The wind-around section **67***a* allows the endless rotary body **66** to be wound therearound. The flange section **67***b* protrudes radially at a front end portion of the first segment **67**.

The second segment **68** is in the shape of a disk. The second segment **68** is fixed to the back end of the wind-around section **67***a* with use of a plurality of fixation bolts **69**. The second segment **68** has an outer diameter equal to that of the flange section **67***b*.

With this configuration, removing the plurality of fixation bolts **69** allows the second segment **68** to be removed as illustrated on the right side of FIG. **7**. With the second segment **68** removed, moving the endless rotary body **66** backward allows the endless rotary body **66** to be removed from the first rotor **64** easily.

With the coupling section **8** in the non-coupling state, an operator can remove the endless rotary body **66** from the first rotor **64** and pass the endless rotary body **66** through the gap G to remove the endless rotary body **66** from the tractor A easily.

To attach the endless rotary body **66** to the tractor A, an operator can pass the endless rotary body **66** through the gap G, wind the endless rotary body **66** around the wind-around section **67***a*, and then fix the second segment **68** as illustrated on the left side of FIG. **7**. The operator can easily attach the endless rotary body **66** to the tractor A as such.

As illustrated in FIG. **8**, the tractor A includes a tension adjusting mechanism **9**. The tension adjusting mechanism **9** includes a tension ring **91**, a long linkage member **92**, and an adjuster **93**.

The tension ring **91** is in contact with the endless rotary body **66**, and applies tension thereto. The tension ring **91** is supported by the body frame **2** with the linkage member **92** therebetween.

The adjuster **93** is manually operable. Manually operating the adjuster **93** moves the linkage member **92** in its longitudinal direction. The movement of the linkage member **92** causes the tension ring **91** to also move in the longitudinal direction of the linkage member **92**. This changes the tension of the endless rotary body **66**.

With this configuration, the tension adjusting mechanism **9** is manually operable to adjust the tension of the endless rotary body **66**.

The tractor A, in other words, includes a tension adjusting mechanism **9** manually operable to adjust the tension of the endless rotary body **66**.

As illustrated in FIGS. **1**, **2**, and **8**, the driver section **3** includes a wall **34** and an opening cover member **35**.

The wall **34** defines and functions as a partition that separates the driver's seat **31** from the endless rotary body **66** and the tension adjusting mechanism **9**. The wall **34** includes an opening **34***a* in the vicinity of the tension adjusting mechanism **9**. The opening **34***a* is also in the vicinity of the front end of the floor **33**.

The opening cover member **35** is detachably attached to the wall **34** to close the opening **34***a*. Detaching the opening cover member **35** exposes the opening **34***a*. Attaching the opening cover member **35** closes the opening **34***a*.

Specifically, the opening cover member **35** is attached to the wall **34** with use of a bolt(s) b**1**. Removing the bolt b**1** allows the opening cover member **35** to be detached. While FIG. **8** shows only one bolt b**1**, the number of bolts b**1** may be any number of one or more.

The driver section **3**, in other words, includes a wall **34** as a partition that separates the driver's seat **31** from the endless rotary body **66** and the tension adjusting mechanism **9**. The driver section **3** also includes an opening cover member **35** capable of exposing and closing the opening **34***a*.

Preferred embodiments of the present invention are, however, not limited to such an arrangement. The opening cover member **35** may be attachable to the wall **34** without use of a bolt b**1**. For instance, a preferred embodiment of the present invention may be arranged such that the opening cover member **35** has a protrusion, whereas the wall **34** has a depression and that fitting the protrusion into the depression causes the opening cover member **35** to be attached to the wall **34**.

An operator can remove the opening cover member **35** to easily reach the adjuster **93** through the opening **34***a*.

With the configuration described above, the voltage converter **19** and the radiator **15** are laterally next to each other in a plan view. This allows cooling air to be supplied to the voltage converter **19** and the radiator **15** similarly as the tractor A travels. The above configuration, in other words,

prevents cooling air toward one of the voltage converter **19** and the radiator **15** from being blocked by the other.

The above configuration makes it possible to effectively cool both the voltage converter **19** and the radiator **15**.

In addition, with the above configuration, the voltage converter **19** and the radiator **15** are both forward of the travel battery **4**. This allows the voltage converter **19** and the radiator **15** to be maintained at the same time, making the maintenance work easy.

The configuration described above therefore allows production of a tractor A including a voltage converter **19** and a radiator **15** both of which can be cooled effectively and maintained easily.

The preferred embodiments described above are mere examples. Preferred embodiments of the present invention are not limited thereto, and may be altered as appropriate.

Alternative Preferred Embodiments

The tractor A may include a single first support frame **51** or three or more first support frames **51**.

The tractor A may include a single second support frame **52** or three or more second support frames **52**.

The tractor A may have a single ventilation opening K or three or more ventilation openings K.

The cover member **12** may include a single outlet section **12***b* or three or more outlet sections **12***b*.

The cover member **12** may have a single vent hole that doubles as an inlet section **12***a* and an outlet section **12***b*.

The second portion **72** is not necessarily oriented horizontally. The second portion **72** may be, for instance, oriented obliquely in an upper front direction or a lower front direction.

The third portion **73** is not necessarily oriented in a lower front direction. The third portion **73** may, for instance, be oriented vertically or extend from a front end portion of the second portion **72** in a lower back direction.

The coupling shaft **81** may be slidable forward. In this case, the back end of the coupling shaft **81** and the front end of the transmission input shaft **63** may define a gap G.

The coupling shaft **81** may be slidable backward such that its front end is moved backward of the front end of the transmission input shaft **63**. In this case, the back end of the motor output shaft **61** and the front end of the transmission input shaft **63** may define a gap G.

The second segment **68** may be fixed to the back end of the wind-around section **67***a* with use of a single fixation bolt **69**.

The second segment **68** may be fixed to the back end of the wind-around section **67***a* without use of fixation bolts **69**. A preferred embodiment of the present invention may be arranged, for instance, such that the first segment **67** has a protrusion, whereas the second segment **68** has a depression and that fitting the protrusion into the depression causes the second segment **68** to be fixed to the back end of the wind-around section **67***a*.

The second segment **68** may have an outer diameter different from that of the flange section **67***b*.

The motor M is not necessarily in contact with the ventilation space S.

The tractor A may be a hybrid tractor including an engine as well.

The wind guide plate **56***a* may be absent.

The plate-shaped partition member **56** may be absent.

The motor M and the travel battery **4** do not necessarily define a second space S**2** therebetween.

The second space S**2** may not be part of the ventilation space S. The second space S**2** may, in other words, be separated from the ventilation space S.

The inverter **14** and the travel battery **4** do not necessarily define a first space S**1** therebetween.

The first space S**1** may not be part of the ventilation space S. The first space S**1** may, in other words, be separated from the ventilation space S.

The cover member **12** may be absent.

The cover member **12** may be incapable of accommodating at least one or even all of the travel battery **4**, the reserve tank **5**, the first hose **6***a*, the radiator **15**, the cooling fan **17**, the auxiliary battery **18**, the voltage converter **19**, and the radiator frame **57**.

The outlet sections **12***b* may be absent.

The inlet section **12***a* may be absent.

The outlet sections **12***b* are not necessarily lateral to the travel battery **4**. The outlet sections **12***b* may be backward of the travel battery **4**, for instance.

The first plate-shaped member **54** may be absent.

The second plate-shaped member **55** may be absent.

The first plate-shaped member **54** is not necessarily oriented horizontally. The first plate-shaped member **54** may, for instance, be inclined in a lower front direction or a lower back direction.

The second plate-shaped member **55** is not necessarily oriented horizontally. The second plate-shaped member **55** may, for instance, be inclined in a lower front direction or a lower back direction.

The ventilation space S does not necessarily communicate with the ventilation openings K.

The ventilation openings K may be absent.

The first support frames **51** do not necessarily stand on the body frame **2**.

The second support frames **52** do not necessarily stand on the body frame **2**.

The first support frames **51** may be absent.

The second support frames **52** may be absent.

The first hose **6***a* does not necessarily extend through an area AR defined by the first portion **71**, the second portion **72**, and the third portion **73**. The first hose **6***a* may, for instance, extend through an area forward of the third portion **73**.

The support **7** does not necessarily include a second portion **72** or a third portion **73**.

The cover support **58** may be absent.

The support **7** may be absent.

The tractor A may not include at least one or even all of the first hose **6***a*, the second hose **6***b*, the water supply section **6***c*, and the third hose **6***d*.

The voltage converter **19** may be oriented to have a longitudinal direction extending in the front-back or left-right direction of the machine body.

The voltage converter **19** is not necessarily attached to the radiator frame **57**.

The radiator frame **57** may be absent.

The reserve tank **5** and the auxiliary battery **18** are not necessarily arranged in the up-down direction of the machine body, and may be arranged in, for example, the left-right direction of the machine body.

The radiator **15**, the voltage converter **19**, and the reserve tank **5** are not necessarily laterally next to one another in a plan view. For instance, the reserve tank **5** may be over the voltage converter **19**.

The radiator **15**, the voltage converter **19**, and the auxiliary battery **18** are not necessarily laterally next to one

another in a plan view. For instance, the auxiliary battery **18** may be over the voltage converter **19**.

The cooling fan **17** may blow cooling air in a direction other than backward. The cooling fan **17** may blow cooling air forward, for example.

The cooling fan **17** may be above or below the inverter **14**.

The bottom plate **53***a* may be absent.

The inverter support **21** may be rightward of the left end of the left main frame **20**.

The inverter support **21** may be leftward of the right end of the right main frame **20**.

The inverter support **21** may be absent. In this case, the inverter **14** is supported directly by the left main frame **20** and the right main frame **20**.

The inverter **14** may be rightward of the left end of the left main frame **20**.

The inverter **14** may be leftward of the right end of the right main frame **20**.

The body frame **2** does not necessarily include left and right main frames **20**. The body frame **2** may include, for example, a single frame member.

The water pump **16** is not necessarily positioned forward of the motor M, and may be backward of the motor M, for instance.

The water pump **16** may be above the inverter **14**.

The motor M is not necessarily between the left and right main frames **20**, and may be above the left and right main frames **20**, for instance.

The hydraulic pump **60** is not necessarily supported by the back portion support frame **59**. In other words, the motor M and the hydraulic pump **60** are not necessarily both held in place by the same back portion support frame **59**.

The opening cover member **35** may be incapable of exposing and closing the opening **34***a*. The opening cover member **35** may be unremovable, for instance.

The wall **34** does not necessarily have an opening **34***a*.

The wall **34** may be absent.

The opening cover member **35** may be absent.

The tension adjusting mechanism **9** may be absent.

The endless rotary body **66** may, after being removed, be incapable of passing through the gap G.

The coupling section **8** is not necessarily switchable from the coupling state to the non-coupling state.

The coupling section **8** may be absent.

The first rotor **64** and the second rotor **65** may both be gears that mesh with each other. In this case, the endless rotary body **66** may be absent.

The transmission input shaft **63** does not necessarily rotate integrally with the motor output shaft **61**. For instance, the transmission input shaft **63** and the motor output shaft **61** may be interlocked with each other with use of a plurality of gears.

The transmission device T is not necessarily backward of the motor M, and may be forward of the motor M, for instance.

The tiller device **13** may be replaced with any of (i) various devices such as a fertilizer distributing device, an agent sparging device, a disseminating device, and a harvesting device and (ii) work devices such as a loader and a shovel.

The wind guide plate **56***a* is not necessarily oriented vertically, and may be, for instance, inclined in a lower front direction or a lower back direction.

The motor M is not necessarily located below the travel battery **4**, and may be located above the travel battery **4**, for instance.

The inverter **14** is not necessarily located below the travel battery **4**, and may be above the travel battery **4**, for instance.

The cooling fan **17** may be above or below the travel battery **4** or the ventilation space S.

The ventilation space S may be absent.

The cooling fan **17** is not necessarily in front of the travel battery **4**, and may be backward of the travel battery **4**, for instance.

The cooling fan **17** may supply cooling air that does not cool the travel battery **4**.

The travel battery **4** may coincide with or be below the body frame **2** in a side view.

The motor M and the inverter **14** may be next to each other in the left-right direction of the machine body or be arranged in the up-down direction of the machine body.

The transmission device T may be positioned forward of the travel battery **4**.

The hydraulic pump **60** may be relatively far from the motor M.

The hydraulic pump **60** may be drivable by a power source other than the motor M.

Preferred embodiments of the present invention are applicable to not only tractors but also various electric work vehicles such as combines, rice transplanters, and construction machines.

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 without departing from the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by the following claims.

What is claimed is:

1. An electric work vehicle, comprising:

a travel battery;

an auxiliary battery;

a motor drivable on electric power supplied by the travel battery;

a travel device drivable by the motor;

a voltage converter configured to step down a voltage of electric power from the travel battery and supply the electric power to the auxiliary battery; and

a radiator,

a body frame extending in the front-back direction of a machine body,

wherein a cover member for accommodating the voltage converter, the radiator, and the travel battery is provided at a front end portion of the machine body,

an inlet section for letting outside air into the cover member is provided at a front end of the cover member,

the travel battery is supported by the body frame with a support frame or a battery support in-between, and

the auxiliary battery is arranged at a position between the travel battery and the inlet section in a plan view to face the inlet section.

2. The electric work vehicle according to claim **1**, wherein

an outlet section which is for letting air out of the cover member is provided on at least one of a left side portion and a right side portion of the cover member.

3. The electric work vehicle according to claim **1**, wherein

the voltage converter is positioned forward of the travel battery, and

the radiator is positioned forward of the travel battery.

4. The electric work vehicle according to claim **1**, wherein the voltage converter and the radiator are laterally next to each other in a plan view.

5. The electric work vehicle according to claim 1, wherein the radiator, the voltage converter, and the auxiliary battery are laterally next to one another in a plan view.

6. The electric work vehicle according to claim 1, comprising:

a reserve tank for the radiator,

wherein the radiator, the voltage converter, and the reserve tank are laterally next to one another in a plan view.

7. The electric work vehicle according to claim 6, wherein the reserve tank and the auxiliary battery are arranged in an up-down direction of the machine body.

8. The electric work vehicle according to claim 1, further comprising:

a radiator frame having a shape of an angular arch surrounding the radiator and holding the radiator in place,

wherein the voltage converter is attached to the radiator frame and oriented to have a longitudinal direction extending in an up-down direction of the machine body.

9. An electric work vehicle, comprising:

a travel battery;

an auxiliary battery;

a motor drivable on electric power supplied by the travel battery;

a travel device drivable by the motor;

a voltage converter configured to step down a voltage of electric power from the travel battery and supply the electric power to the auxiliary battery; and

a radiator,

a body frame extending in the front-back direction of a machine body,

wherein a cover member for accommodating the voltage converter, the radiator, and the travel battery is provided at a front end portion of the machine body,

an inlet section for letting outside air into the cover member is provided at a front end of the cover member,

the travel battery is supported by the body frame with a support frame or a battery support in-between,

the electric work vehicle further comprises a radiator frame having a shape of an angular arch surrounding the radiator and holding the radiator in place,

the voltage converter is attached to the radiator frame and oriented to have a longitudinal direction extending in an up-down direction of the machine body,

the electric work vehicle further comprises a cooling water hose connected to the radiator;

wherein the cover member is for being opened and closed and for accommodating the voltage converter, the radiator, the cooling water hose, and the radiator frame;

the electric work vehicle further comprises:

a support extending upward from an upper portion of the radiator frame; and

a cover support coupled to an upper end portion of the support and for supporting the cover member in an open state;

wherein the support includes:

a first portion extending upward from the upper portion of the radiator frame;

a second portion extending forward from a middle portion of the first portion in the up-down direction of the machine body; and

a third portion extending downward from a front end portion of the second portion and connected to the upper portion of the radiator frame, and

the cooling water hose extends through an area defined by the first portion, the second portion, and the third portion.

* * * * *