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United States Patent	12391104
Kind Code	B2
Date of Patent	August 19, 2025
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Work vehicle

Abstract

A work vehicle includes: a front wheel; a rear travel device; a travel body supported by the front wheel and the rear travel device; a driving section provided in the travel body and having an occupant floor section; a travel power transmission device configured to transmit power to the rear travel device; at least one electric motor coupled to the travel power transmission device; a first inverter connected to the at least one electric motor; and a second inverter connected to the at least one electric motor.

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Appl. No.: **18/129582**

Filed: **March 31, 2023**

Prior Publication Data

Document Identifier	Publication Date
US 20230391176 A1	Dec. 07, 2023

Foreign Application Priority Data

JP	2022-090762	Jun. 03, 2022

Publication Classification

Int. Cl.: **B60K1/02** (20060101)

U.S. Cl.:

CPC **B60K1/02** (20130101); B60Y2200/221 (20130101)

Field of Classification Search

CPC: B62D (33/0617); B62D (33/0604); B62D (49/06); B60L (50/66); B60H (1/00278); B60H (1/00564); B60K (1/02); B60K (11/02); B60K (11/04); B60K (6/40); H02K (9/19); H05K (7/20927); F01P (3/12); F01P (3/20)

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Background/Summary

BACKGROUND OF THE INVENTION

1. Field of the Invention

(1) The present invention relates to work vehicles provided with a travel body that is supported by front wheels and a rear travel device, and includes a driving section having an occupant floor

section.
2. Description of the Related Art
(2) Such work vehicles include those provided with a travel power transmission device (continuously variable transmission, forward-reverse switching device, gear transmission) that transmits power to the rear travel device (rear wheels), and an electric motor (motor generator) coupled to the travel power transmission device, as shown in the JP 2014-65349A.
SUMMARY OF THE INVENTION
(3) Such work vehicles are generally equipped with an inverter that is connected to the electric motor, and require easy maintenance of the inverter.
(4) The present invention provides a work vehicle in which an inverter can be provided in such a manner as to facilitate maintenance while increasing the minimum ground height of the inverter without increasing the ground height of the floor section.
(5) A work vehicle according to the present invention comprising: a front wheel; a rear travel device; a travel body supported by the front wheel and the rear travel device; a driving section provided in the travel body and having an occupant floor section; a travel power transmission device configured to transmit power to the rear travel device; at least one electric motor coupled to the travel power transmission device; a first inverter connected to the at least one electric motor; and a second inverter connected to the at least one electric motor;
wherein: the first inverter is provided between the front wheel and the rear travel device, on a first side in a width direction of a vehicle body of the work vehicle relative to the travel power transmission device within a space downward of the floor section, and the second inverter is provided between the front wheel and the rear travel device, on a second side in the width direction of the vehicle body relative to the travel power transmission device within the space downward of the floor section.
(6) According to this configuration, maintenance on the inverter can be performed via the region between the front wheel and the rear travel device from laterally outward of the vehicle body. Two inverters are employed, thus enabling the up-down length of each inverter to be shortened while obtaining the necessary power exchange function, compared with the case where one inverter is employed. The inverters having short up-down lengths are provided one on either side of the travel power transmission device downward of the floor section, thus enabling the minimum ground height of the inverters to be increased without increasing the ground height of the floor section, compared with the case where one invertor having a long up-down length is provided downward of the floor section.
(7) In other words, the inverters can be provided in such a manner as to facilitate maintenance, while increasing the minimum ground height of the inverters without increasing the ground height of the floor section.
(8) Also, inverters that are used in work vehicles tend to be large in size in order to support high power, but dividing the inverter in two opens up the possibility of reducing the overall size. Also, the degree of freedom in terms of layout can be enhanced.
(9) In the present invention, it is preferable that the travel power transmission device includes a transmission case and a transmission provided inside the transmission case.
(10) According to this configuration, the drive speed of the rear travel device can be changed by the transmission, thus enabling the work vehicle to travel at a speed corresponding to the work being performed even in the case of performing various different work.
(11) In the present invention, it is preferable that the at least one electric motor includes a first electric motor and a second electric motor, the first electric motor is connected to the first inverter, and the second electric motor is connected to the second inverter.
(12) According to this configuration, it is easy to ensure that the connection structure connecting one electric motor and one inverter does not intersect the connection structure connecting the other electric motor and the other inverter.

(13) In the present invention, it is preferable that the at least one electric motor includes a first electric motor and a second electric motor, and the first electric motor and the second electric motor are provided inside the transmission case, with the first electric motor, the second electric motor, the first inverter and the second inverter located at positions corresponding to each other in a front-rear direction of the vehicle body.
(14) According to this configuration, the inverters are located near the respective electric motors, thus facilitating the connection of the inverters to the respective electric motors.
(15) In the present invention, it is preferable that the first electric motor and the second electric motor are arranged laterally to each other in the width direction of the vehicle body.
(16) According to this configuration, the inverters on both sides of the transmission case are near the respective electric motors, thus facilitating connection of the inverters to the respective electric motors.
(17) In the present invention, it is preferable that the work vehicle further includes a first support member spanning from the first inverter to the transmission case and supporting the first inverter, and a second support member spanning from the second inverter to the transmission case and supporting the second inverter.
(18) According to this configuration, the first inverter and the second inverter are supported by the highly rigid transmission case respectively via the first support member and the second support member, thus enabling the first and second inverters to be firmly supported so as to minimize any looseness.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a side view showing the left side of a tractor.
(2) FIG. **2** is a side view showing the right side of the tractor.
(3) FIG. **3** is a schematic diagram of a travel power transmission device.
(4) FIG. **4** is a front view showing installation of inverters.
(5) FIG. **5** is a side view showing installation of an inverter on the left side of the vehicle body.
(6) FIG. **6** is a side view showing installation of an inverter on the right side of the vehicle body.
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS
(7) Hereinafter, an example embodiment of the present invention will be described with reference to the drawings.
(8) Note that, in the following description, in relation to the travel body of a tractor (example of "work vehicle"), the direction of the F arrow in FIGS. **1**, **2** and the like indicates "vehicle body front", the direction of the B arrow in FIGS. **1**, **2** and the like indicates "vehicle body back", the direction of the U arrow in FIGS. **1**, **2** and the like indicates "vehicle body up", and the direction of the D arrow in FIGS. **1**, **2** and the like indicates "vehicle body down". The near side in FIG. **1**, the far side in FIG. **2**, and the direction of the L arrow in FIG. **4** indicate "vehicle body left", and the far side in FIG. **1**, the near side in FIG. **2**, and the direction of the R arrow in FIG. **4** indicate "vehicle body right". The left-right direction of the vehicle body is the width direction of the vehicle body.
(9) Overall Configuration of Tractor
(10) As shown in FIGS. **1** and **2**, the tractor includes a travel body **3** supported by a pair of left and right drivable front wheels **1** and a pair of left and right drivable rear wheels **2** serving as a rear travel device. The travel body **3** includes a vehicle body frame **4** that is constituted by an engine **5** provided in a front portion of the travel body **3**, a transmission case **13** coupled at the front to a rear portion of the engine **5**, and a front frame **14** coupled to a lower portion of the engine **5**. In a front portion of the travel body **3** is provided a motive section **6** having the engine **5**. In a rear portion of

the vehicle body **3** is provided a driving section **9**. In a rear portion of the transmission case **13** are provided a link mechanism (not shown) for coupling work machinery such as a rotary tiller (not shown) in such a manner as to be liftable and lowerable, and a power takeoff shaft **12** that takes power from the engine **5** and transmits power to the coupled work machinery. In the present embodiment, the rear wheels **2** serving as a rear travel device are provided, but a mini crawler type travel device can be employed as the rear travel device.

(11) Driving Section

(12) As shown in FIGS. **1** and **2**, the driving section **9** includes a driver's seat **7**, an occupant floor section **11** (see FIG. **4**) provided on the lower front side of the driver's seat **7**, a steering wheel **8** for steering the front wheels **1**, and a driver's cabin **10** covering the occupant space. The floor section **11** is supported by the driver's cabin **10**. As shown in FIG. **4**, in a middle portion of the floor section **11** in the width direction of the vehicle body (region located upward of the transmission case **13**) is provided an upward protruding section **11***a*.

(13) The driver's cabin **10** is supported by the vehicle body frame **4** via a front shock absorber **10***a* (see FIGS. **1**, **2**) and a rear shock absorber **10***b* (see FIGS. **1**, **2**) that mitigate the transmission of travel vibration and the like to the driver's cabin **10**. Specifically, the driver's cabin **10** includes a lower frame **10***c*, and the lower frame **10***c* is coupled at two (left and right) places of a front portion thereof to a front portion of the transmission case **13** via the front shock absorber **10***a*, and at two (left and right) places of a rear portion thereof to a rear portion of the transmission case **13** via the rear shock absorber **10***b*.

(14) As shown in FIGS. **1** and **2**, on both the outer right side and outer left side of the driving section **9** is provided a two-step running board **50** having an upper step and a lower step used for getting in and out of the driving section **9**. The two-step lower running board includes an upper running board **50***a* that, in side view of the vehicle body, is located downward of an entrance **9***a* of the driving section **9**, and a lower running board **50***b* that is positionally shifted to the front side of the vehicle body relative to the upper running board

(15) Motive Section

(16) As shown in FIGS. **1** and **2**, the motive section **6** includes an engine compartment **52** formed by an engine bonnet **51**. The engine **5** is provided in a rear portion of the engine compartment **52**. Upward of a rear portion of the engine **5** is provided an exhaust gas treatment device **53** for purifying the exhaust of the engine **5**. The exhaust gas treatment device **53** performs purification of the exhaust gas by injecting a urea solution serving as a reducing agent supplied from a reducing agent tank (not show) into exhaust gas introduced from the engine **5** to promote hydrolysis, and obtaining exhaust gas containing a reduced amount of nitrogen oxide as a result. The purified exhaust gas is discharged from an exhaust pipe **53***a* connected to the exhaust gas treatment device **53**.

(17) Travel Power Transmission Device

(18) The tractor is provided with a travel power transmission device **15** that transmits power from the engine **5** to the front wheels **1** and the rear wheels **2** and includes the transmission case **13** which is coupled at the front to a rear portion of the engine **5**, as shown in FIGS. **1** and **2**. The transmission case **13** is aligned with the engine **5** in the front-rear direction of the vehicle body, and extends in the front-rear direction of the vehicle body through a middle portion in the width direction of the vehicle body. The engine **5** and the transmission case **13** are coupled together by coupling a flywheel housing (not shown) provided in a rear portion of the engine **5** and housing a flywheel **5***a* (see FIG. **3**) to a clutch housing (not shown) provided in a front portion of the transmission case **13**.

(19) As shown in FIG. **3**, the transmission case **13** houses a hybrid transmission **16** serving as a transmission that shifts power from the engine **5** and outputs the resultant power to the front wheels **1** and the rear wheels **2**.

(20) Hybrid Transmission

(21) The hybrid transmission **16**, as shown in FIG. **3**, includes an input shaft **23** provided in a front portion of the transmission case **13** and to which the power of the output shaft **5***b* of the engine **5** is input, an electric transmission section **16**A rearwardly adjacent to the engine **5**, and a gear transmission section **16**B rearward of the electric transmission section **16**A. The axis of the input shaft **23** and the axis of the output shaft **5***b* are located on a common axis.
(22) As shown in FIG. **3**, the electric transmission section **16**A is housed in an electric transmission compartment **28** formed in a front portion of the transmission case **13**. The gear transmission section **16**B is housed in a gear transmission compartment **29** formed in a rear portion of the transmission case **13**. The electric transmission compartment **28** is formed by a peripheral wall of the transmission case **13**, a front wall **13***a* provided internally in a front end section of the transmission case **13**, and an isolating wall **13***b* provided internally in an intermediate portion of the transmission case **13**. The gear transmission compartment **29** is formed by the peripheral wall of the transmission case **13**, a rear wall **13***c* located in a rear end section of the transmission case **13**, and the isolating wall **13***b*. The electric transmission compartment **28** and the gear transmission compartment **29** are adjacent to each other across the isolating wall **13***b*. The electric transmission compartment **28** and the gear transmission compartment **29** are isolated from each other by the isolating wall **13***b* so as not to communicate.
(23) Electric Transmission Section
(24) As shown in FIG. **3**, the electric transmission section **16**A is provided between the engine **5** and the gear transmission section **16**B. The electric transmission section **16**A includes two motor generators **17** and **18** serving as electric motors. In the present embodiment, as shown in FIG. **4**, the two motor generators **17** and **18** are arranged laterally to each other in the width direction of the vehicle body, with the rotation axis of each of the motor generators **17** and **18** lying in the front-rear direction of the vehicle body, and the rotation axes of the two motor generators **17** and **18** being arranged laterally to each other in the width direction of the vehicle body. A motor generator that is long in the front-rear direction of the vehicle body can be employed as each of the motor generators **17** and **18**, compared with the case where two motor generators are aligned in the front-rear direction of the vehicle body. In the present embodiment, the two motor generators **17** and **18** are set to corresponding outer diameters. In the present embodiment, the two motor generators **17** and **18** are arranged laterally to each other in the width direction of the vehicle body, but may be aligned in the up-down direction of the vehicle body, or may be arranged diagonally with the motor generator **18** higher than the motor generator **17** or with the motor generator **17** higher than the motor generator **18** as viewed in the front-rear direction of the vehicle body.
(25) Gear Transmission Section
(26) As shown in FIG. **3**, the gear transmission section **16**B is provided on the opposite side of the electric transmission section **16**A to the engine **5**. The gear transmission section **16**B is rearwardly adjacent to the electric transmission section **16**A.
(27) As shown in FIG. **3**, the gear transmission section **16**B has a gear transmission mechanism **30**. The gear transmission mechanism **30** includes a transmission mechanism input shaft **99**, a gear transmission mechanism **98**, a low speed planetary transmission section **100**, a low speed clutch **100**C, a high speed planetary transmission section **110**, a high speed clutch **110**C, a forward-reverse switching device **25**, a sub-transmission **26**, a rear wheel differential mechanism **19**, a front wheel transmission **20**, and a gear linkage mechanism **27**.
(28) In the following description, the one motor generator **17** out of the two motor generators **17** and **18** will be referred to as a first motor generator **17** (corresponds to first electric motor), and the other motor generator **18** out of the two motor generators **17** and **18** will be referred to a second motor generator **18** (corresponds to second electric motor).
(29) The transmission mechanism input shaft **99** is located rearward of the input shaft **23** of the transmission case **13**, and the axis thereof and the axis of the input shaft **23** are located on a common axis. The transmission mechanism input shaft **99** and the input shaft **23** are coupled

together, and the power of the input shaft **23** is transmitted to the transmission mechanism input shaft **99**. The gear transmission mechanism **9** spans the transmission mechanism input shaft **99** and a rotor support shaft **17***b* of the first motor generator **17**, and is configured to transmit the power of the input shaft **23** to the first motor generator **17**.

(30) As shown in FIG. **3**, the low speed planetary transmission section **100** includes a sun gear **101**, a planetary gear **102**, an internal gear **103**, and a carrier **104**. The low speed planetary transmission section **100** is provided rearward of the second motor generator **18**, with the rotation axis of the sun gear **101** and the axis of a rotor support shaft **18***b* of the second motor generator **18** being located on a common axis. The internal gear **103** and the transmission mechanism input shaft **99** are coupled together via a gear linkage mechanism **105**. The sun gear **101** includes a first input shaft **136**, and the first input shaft **136** is coupled to the rotor support shaft **18***b* of the second motor generator **18**.

(31) In the low speed planetary transmission section **100**, the power of the input shaft **23** is transmitted to the internal gear **103** to drive the internal gear **103**, the drive power of the second motor generator **18** is transmitted to the sun gear **101** to drive the sun gear **101**, the power from the engine **5** and the drive power of the second motor generator **18** are combined to produce low speed combined power, and the low speed combined power is output from the carrier **104**.

(32) The low speed clutch **100**C is provided between an output section of the low speed planetary transmission section **100** and an input shaft **25***a* of the forward-reverse switching device **25**, and is configured to transmit the low speed combined power output by the low speed planetary transmission section **100** to the forward-reverse switching device **25** when engaged (on state), and to cut power transmission from the low speed planetary transmission section **100** to the forward-reverse switching device **25** when disengaged (off state).

(33) As shown in FIG. **3**, the high speed planetary transmission section **110** includes a sun gear **111**, a planetary gear **112**, an internal gear **113**, and a carrier **114**. The high speed planetary transmission section **110** is provided rearward of the first motor generator **17**, with the rotation axis of the sun gear **111** and the axis of the rotor support shaft **17***b* of the first motor generator **17** being located on a common axis. The carrier **114** and the transmission mechanism input shaft **99** are coupled together via a gear linkage mechanism **115**. The sun gear **111** includes a second input shaft **137**, and the second input shaft **137** and the rotor support shaft **18***b* of the second motor generator **18** are coupled together via a gear linkage mechanism **116** and the first input shaft **136**.

(34) In the high speed planetary transmission section **110**, the power of the input shaft **23** is transmitted to the carrier **114** to drive the planetary gear **112**, the drive power of the second motor generator **18** is transmitted to the sun gear **111** to drive the sun gear **111**, the engine power from the input shaft **23** and the drive power of the second motor generator **18** are combined to produce high speed combined power, and the high speed combined power is output from the internal gear **113**. The high speed combined power is higher than the low speed combined power that is produced by the low speed planetary transmission section **100**.

(35) The high speed clutch **110**C is provided between an output section of the high speed planetary transmission section **110** and the input shaft **25***a* of the forward-reverse switching device **25**, and is configured to transmit the high speed combined power output by the high speed planetary transmission section **110** to the forward-reverse switching device **25** when engaged (on state), and to cut power transmission from the high speed planetary transmission section **110** to the forward-reverse switching device **25** when disengaged (off state).

(36) The forward-reverse switching device **25**, as shown in FIG. **3**, includes the input shaft **25***a* rearward of the transmission mechanism input shaft **99**, and an output shaft **25***b* parallel to the input shaft **25***a*. The axis of the input shaft **25***a* and the axis of the transmission mechanism input shaft **99** are located on a common axis. Provided on the input shaft **25***a* are a forward clutch **25***c* and a reverse clutch **25***d*. Spanning the forward clutch **25***c* and the output shaft **25***b* is a forward gear mechanism **25***e*. Spanning the reverse clutch **25***d* and the output shaft **25***b* is a reverse gear

mechanism **25***f*.
(37) In the forward-reverse switching device **25**, the outputs of the low speed clutch **100**C and the high speed clutch **110**C are input to the input shaft **25***a*. In response to the forward clutch **25***c* being engaged, the power of the input shaft **25***a* is switched to forward power by the forward gear mechanism **25***e* and the forward clutch **25***c*, transmitted to the output shaft **25***b*, and output from the output shaft **25***b*. In response to the reverse clutch being engaged, the power of the input shaft **25***a* is switched to reverse power by the reverse gear mechanism **25***f* and the reverse clutch **25***d*, transmitted to the output shaft **25***b*, and output from the output shaft **25***b*.
(38) The sub-transmission **26**, as shown in FIG. **3**, includes an input shaft **26***a* coupled to the output shaft **25***b* of the forward-reverse switching device **25** and the output shaft **26***b* rearward of the input shaft **26***a*. The axis of the input shaft **26***a* and the axis of the output shaft **26***b* are located on a common axis. Provided between a rear portion of the input shaft **26***a* and a front portion of the output shaft **26***b* is a high speed clutch **26***c*. Spanning the input shaft **26***a* and a rear portion of the output shaft **26***b* are a low speed gear mechanism **26***f* and a low speed clutch **26***d*.
(39) In the sub-transmission **26**, the output of the forward-reverse switching device **25** is input to the input shaft **26***a*. In response to the high speed clutch **26***c* being engaged, the power of the input shaft **26***a* is transmitted to the output shaft **26***b* without being shifted via the high speed clutch **26***c*, and the high speed power is output from the output shaft **26***b*. In response to the low speed clutch **26***d* being engaged, the power of the input shaft **26***a* is shifted to low speed power by the low speed gear mechanism **26***f* and the low speed clutch **26***d*, transmitted to the output shaft **26***b*, and output from the output shaft **26***b*. The low speed power is lower than the high speed power output in response to the high speed clutch **26***c* being engaged.
(40) As shown in FIG. **3**, the rear wheel differential mechanism **19** includes an input shaft **19***a* to which the output of the sub-transmission **26** is input. The input shaft **19***a* is coupled to a rear portion of the output shaft **26***b* of the sub-transmission **26**. The gear linkage mechanism **27** spans the output shaft **26***b* of the sub-transmission **26** and the input shaft **20***a* of the front wheel transmission **20**, and is configured to transmit the power of the output shaft **26***b* of the sub-transmission **26** to the input shaft **20***a* of the front wheel transmission **20**.
(41) The front wheel transmission **20**, as shown in FIG. **3**, includes an input shaft **20***a* coupled to the gear linkage mechanism **27** and an output shaft **20***e* parallel to the input shaft Provided on the input shaft **20***a* are a constant speed clutch **20***b* and an acceleration clutch **20***c*. Spanning the constant speed clutch **20***b* and the output shaft **20***e* is a constant speed gear mechanism **20***d*. Spanning the acceleration clutch **20***c* and the output shaft **20***e* is an acceleration gear mechanism **20***f*.
(42) In the front wheel transmission **20**, the output of the sub-transmission **26** is transmitted to the input shaft **20***a* by the gear linkage mechanism **27**. In response to the constant speed clutch **20***b* being engaged, the power of the input shaft **20***a* is shifted to constant speed power by the constant speed clutch **20***b* and the constant speed gear mechanism **20***d*, transmitted to the output shaft **20***e*, and output from the output shaft **20***e*. The constant speed power drives the front wheels **1** at a speed corresponding to the speed of the rear wheels **2**. In response to the acceleration clutch **20***c* being engaged, the power of the input shaft **20***a* is shifted to acceleration power by the acceleration clutch **20***c* and the acceleration gear mechanism **20***f*, transmitted to the output shaft **20***e*, and output from the output shaft **20***e*. The acceleration power drives the front wheels **1** at a higher speed than the rear wheels **2**. The power of the output shaft **20***e* of the front wheel transmission **20** is transmitted to the front wheel differential mechanism **39** via a rotation shaft **38**.
(43) In the travel power transmission device **15**, when driving the front wheels **1** and the rear wheels **2**, the power of the engine **5** and the drive power of the second motor generator **18** are transmitted to the front wheels **1** and the rear wheels **2**.
(44) That is, the power (engine power) from the engine **5** transmitted to the input shaft **23** and the drive power (motor power) of the second motor generator **18** are combined to produce low speed

combined power by the low speed planetary transmission section **100**. The power (engine power) from the engine **5** transmitted to the input shaft **23** and the drive power (motor power) of the second motor generator **18** are combined to produce high speed combined power by the high speed planetary transmission section **110**. By engaging the low speed clutch **100**C and disengaging the high speed clutch **110**C, the low speed combined power from the low speed planetary transmission section **100** is transmitted to the input shaft **25***a* of the forward-reverse switching device **25** and from the output shaft of the forward-reverse switching device **25** to the sub-transmission **26**, and is then transmitted from the sub-transmission **26** to the rear wheel differential mechanism **19** and the front wheel transmission **20** via the gear linkage mechanism **27**. By engaging the high speed clutch **110**C and disengaging the low speed clutch **100**C, the high speed combined power from the high speed planetary transmission section **110** is transmitted to the input shaft **25***a* of the forward-reverse switching device **25** and from the output shaft **25***b* of the forward-reverse switching device **25** to the sub-transmission **26**, and is then transmitted from the sub-transmission **26** to the rear wheel differential mechanism **19** and the front wheel transmission **20**.

(45) In the travel power transmission device **15**, when driving the front wheels **1** and the rear wheels **2**, the power from the engine **5** transmitted to the input shaft **23** is input to the first motor generator **17** via the transmission mechanism input shaft **99** and the gear transmission mechanism **98**, the first motor generator **17** is driven and generates power, and the generated power can be supplied for use in driving to the second motor generator **18**. Power supply to the second motor generator **18** is performed by charging a battery **22** with the generated power and supplying power via the battery **22**, or is performed without charging the battery **22** with the generated power and supplying power via the battery **22**.

(46) Spanning the output shaft **5***b* and the input shaft **23** is a clutch **45**, as shown in FIG. **3**. The clutch **45** is configured to be switched between engaged (on state) and disengaged (off state) by a hydraulic solenoid valve or the like. Due to being engaged, the clutch **45** transmits the power from the engine **5** to the electric transmission section **16**A and the gear transmission section **16**B, drives the front wheels **1** and the rear wheels **2** with the power of the engine **5** and the drive power of the second motor generator **18**, and switches the hybrid transmission **16** to a hybrid mode in which power is generated by the first motor generator **17**. Due to being disengaged, the clutch **45** cuts power transmission from the engine **5** to the electric transmission section **16**A and the gear transmission section **16**B, and switches the hybrid transmission **16** to an electric mode in which the front wheels **1** and the rear wheels **2** are driven by only the drive power of the second motor generator **18**. A dry clutch can be employed as the clutch **45**.

(47) Provided on the input shaft **23** is a trochoid pump **81** that supplies lubricating oil to the first motor generator **17**, the second motor generator **18**, and the gear transmission mechanism **30**, as shown in FIG. **3**.

(48) Work Power Transmission Device

(49) As shown in FIGS. **1** and **2**, the power takeoff shaft **12** is supported by a rear portion of the transmission case **13**. As shown in FIG. **3**, the transmission case **13** houses a work power transmission device **40** that transmits the power of the engine **5** to the power takeoff shaft **12**.

(50) The work power transmission device **40**, as shown in FIG. **3**, includes the transmission mechanism input shaft **99** coupled to the input shaft **23**, a rotation shaft **41** that extends in the front-rear direction of the vehicle body rearward of the transmission mechanism input shaft **99** and is coupled at the front to a rear portion of the transmission mechanism input shaft **99**, a work clutch **42** that is coupled to a rear portion of the rotation shaft **41**, and a power takeoff shaft transmission **43** that shifts the output of the work clutch **42** and transmits the resultant output to the power takeoff shaft **12**. The axis of the rotation shaft **41** and the axis of the input shaft **23** are located on a common axis. The input shaft **23** and the rotation shaft **41** are linked directly or via a joint.

(51) In the work power transmission device **40**, the power of the input shaft **23** is transmitted to the rotation shaft **41**, and is transmitted from the rotation shaft **41** to the power takeoff shaft **12** via the

work clutch **42** and the power takeoff shaft transmission **43**. The work clutch **42** is switched between an engaged state in which power from the engine **5** is transmitted to the power takeoff shaft **12** and a disengaged state in which power transmission from the engine **5** to the power takeoff shaft **12** is cut.

(52) Motor Generators, Inverters

(53) As shown in FIG. **4**, the first motor generator **17** and the second motor generator **18** are provided laterally to each other in the width direction of the vehicle body inside the transmission case **13**. The first motor generator **17** is disposed on the left of the second motor generator **18**. Note that the first motor generator **17** and the second motor generator **18** may also be disposed in the front-rear direction of the vehicle body.

(54) As shown in FIG. **3**, two inverters **21**A and **21**B are disposed. The first inverter **21**A is connected to the first motor generator **17**, and the second inverter **21**B is connected to the second motor generator **18**. The battery **22** is connected to both the first inverter **21**A and the second inverter **21**B. The first inverter **21**A converts AC power from the first motor generator **17** into DC power and supplies the DC power to the battery **22**. The second inverter **21**B converts DC power from the battery **22** into AC power and supplies the AC power to the second motor generator **18**. It is possible to provide batteries **22** that are separately connected to the first inverter **21**A and the second inverter **21**B.

(55) As shown in FIGS. **1**, **2**, **4**, **5** and **6**, the first inverter **21**A is located between the front wheels **1** and the rear wheels **2**, laterally on the left side relative to the travel power transmission device **15** within the space downward of the floor section **11** of the driving section **9**, and the second inverter **21**B is located between the front wheels **1** and the rear wheels **2**, laterally on the right side relative to the travel power transmission device **15** within the space downward of the floor section **11** of the driving section **9**. Maintenance of both the first inverter **21**A and the second inverter **21**B is possible via the region between the front wheels **1** and the rear wheels **2** from laterally outward of the vehicle body. In the present embodiment, the first inverter **21**A is provided laterally on the left side relative to the travel power transmission device **15**, and the second inverter **21**B is provided laterally on the right side relative to the travel power transmission device **15**, but alternatively it is possible for the first inverter **21**A to be provided laterally on the right side relative to the travel power transmission device **15**, and for the second inverter **21**B to be provided laterally on the left side relative to the travel power transmission device **15**. In the present embodiment, the inverter **21**A on the left side of the vehicle body out of the two inverters **21**A and **21**B is connected to the motor generator **17** on the left side of the vehicle body out of the two motor generators **17** and **18**, and the inverter **21**B on the right side of the vehicle body out of the two inverters **21**A and **21**B is connected to the motor generator **18** on the right side of the vehicle body out of the two motor generators **17** and **18**, but it is possible to adopt a connection structure that connects the inverter **21**A on the left side of the vehicle body out of the two inverters **21**A and **21**B to the motor generator **18** on the right side of the vehicle body out of the two motor generators **17** and **18**, and connects the inverter **21**B on the right side of the vehicle body out of the two inverters **21**A and **21**B to the motor generator **17** on the left side of the vehicle body out of the two motor generators **17** and **18**.

(56) As shown in FIGS. **1** and **2**, the first inverter **21**A, the second inverter **21**B, the first motor generator **17** and the second motor generator **18** are located at positions corresponding to each other in the front-rear direction of the vehicle body. The first inverter **21**A is near the first motor generator **17**, and the second inverter **21**B is near the second motor generator **18**.

(57) As shown in FIG. **4**, the first inverter **21**A is supported by a first support member **54** spanning from the first inverter **21**A to the transmission case **13**, and is supported by the transmission case **13** via the first support member **54**. The second inverter **21**B is supported by a second support member **55** spanning from the second inverter **21**B to the transmission case **13**, and is supported by the transmission case **13** via the second support member **55**.

Other Embodiments

(58) (1) In the above-described embodiment, the two motor generators (electric motors) **17** and **18** are provided, but only one motor generator (electric motor) or three or more motor generators (electric motors) may be provided.

(59) (2) In the above-described embodiment, the travel power transmission device **15** includes the transmission case **13** and the hybrid transmission **16** provided inside the transmission case **13**, but the present invention is not limited thereto, and the travel power transmission device may be constituted by only a rotation shaft that transmits power to the rear wheels **2**. Also, in the above-described embodiment, the hybrid transmission **16** is provided, but the present invention is not limited thereto, and an engine may be omitted, and a transmission that transmits only the drive power of an electric motor to the rear wheels **2** may be provided.

(60) (3) In the above-described embodiment, power is transmitted to the front wheels **1** and the rear wheels **2**, but power may be transmitted to only the rear wheels **2** and not to the front wheels **1**.

(61) (4) In the above-described embodiment, the rear wheels **2** are provided as the rear travel device, but a mini crawler travel device may be provided as the rear travel device.

(62) (5) In the above-described embodiment, the two motor generators **17** and **18** have corresponding outer diameters, but the two motor generators **17** and **18** may have different outer diameters.

(63) (6) In the above-described embodiment, both the first and second inverters **21**A and **21**B and both the first and second motor generators **17** and **18** are located at positions corresponding to each other in the front-rear direction of the vehicle body, but may be located in different positions in the front-rear direction of the vehicle body.

(64) (7) The present invention is applicable to a work vehicle equipped with an electric motor coupled to a transmission that outputs power to the rear wheels (rear travel device).

Claims

1. A work vehicle comprising: a front wheel; a rear travel device; a travel body supported by the front wheel and the rear travel device; a driving section provided in the travel body and having an occupant floor section; a travel power transmission device configured to transmit power to the rear travel device; at least one electric motor coupled to the travel power transmission device; a first inverter connected to the at least one electric motor; and a second inverter connected to the at least one electric motor, wherein: the first inverter is provided between the front wheel and the rear travel device, on a first side in a width direction of a vehicle body of the work vehicle relative to the travel power transmission device within a space downward of the floor section, and the second inverter is provided between the front wheel and the rear travel device, on a second side in the width direction of the vehicle body relative to the travel power transmission device within the space downward of the floor section.

2. The work vehicle according to claim 1, wherein: the travel power transmission device includes a transmission case and a transmission provided inside the transmission case.

3. The work vehicle according to claim 1, wherein: the at least one electric motor includes a first electric motor and a second electric motor, the first electric motor is connected to the first inverter, and the second electric motor is connected to the second inverter.

4. The work vehicle according to claim 2, wherein: the at least one electric motor includes a first electric motor and a second electric motor, and the first electric motor and the second electric motor are provided inside the transmission case, with the first electric motor, the second electric motor, the first inverter and the second inverter located at positions corresponding to each other in a front-rear direction of the vehicle body.

5. The work vehicle according to claim 4, wherein: the first electric motor and the second electric motor are arranged laterally to each other in the width direction of the vehicle body.

6. The work vehicle according to claim 4, further comprising: a first support member spanning from the first inverter to the transmission case and supporting the first inverter; and a second support member spanning from the second inverter to the transmission case and supporting the second inverter.