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VerDught et al.

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(54) **APPARATUS AND METHOD OF REMOVING A TRANSMISSION FROM AN ARTICULATED WORK VEHICLE**

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B60K 17/04	(2006.01)
B60K 17/24	(2006.01)
B62D 55/065	(2006.01)

(Continued)

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CPC ***B62D 55/0655*** (2013.01); ***B60K 17/04*** (2013.01); ***B60K 17/24*** (2013.01); ***B62D 55/084*** (2013.01); ***B62D 65/00*** (2013.01)

(58) **Field of Classification Search**

CPC .. B62D 55/0655; B62D 55/084; B62D 65/00; B60K 17/04; B60K 17/24

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,939,250	B2	1/2015	Turner et al.	
2005/0082070	A1 *	4/2005	Juncker	B62D 55/305 172/684.5
2017/0291652	A1 *	10/2017	Marchildon	B62D 55/108

(Continued)

FOREIGN PATENT DOCUMENTS

DE	102007007518 A1	8/2008	
DE	102019215806 A1	4/2020	
WO	WO-2014210581 A1 *	12/2014	B62D 33/03

OTHER PUBLICATIONS

Deere & Company, Technical Manual for 7600, 7700, and 7800 Tractors, dated Nov. 4, 1996, pp. 124-133.

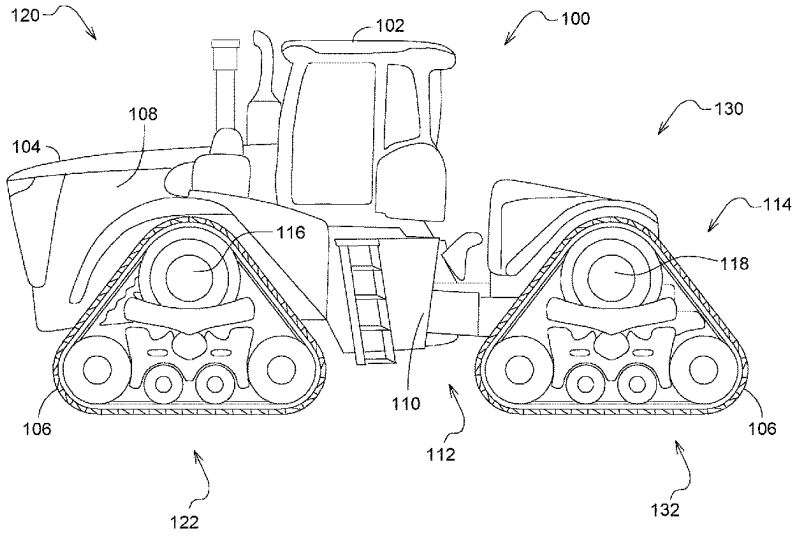
(Continued)

Primary Examiner — Zakaria Elahmadi

(57) **ABSTRACT**

An articulated work vehicle includes a front portion including a front set track assemblies, a rear portion including a rear set track assemblies, a power source installed in the front portion, a transmission installed in the front portion, a use mode, and a service mode. In the used mode, the rear portion is pivotally connected to the front portion and the transmission is operably connected to the power source, the front set of track assemblies, and the rear set of track assemblies. In the service mode, the rear portion is disconnected from the front portion, the transmission is disconnected from the front set of track assemblies, the transmission is removed from the front portion, and the transmission remains pivotally connected to the rear portion.

15 Claims, 10 Drawing Sheets



(51) **Int. Cl.**
B62D 55/084 (2006.01)
B62D 65/00 (2006.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2019/0308677	A1*	10/2019	Murfey	B62D 55/084
2021/0094617	A1*	4/2021	Hertsgaard	B60K 5/00

OTHER PUBLICATIONS

Deere & Company, Repair Technical Manual for 6230-7230 Tractors, dated Feb. 1, 2013, pp. 596-606.
German Search Report issued in application No. 102023127559.3 dated Jun. 13, 2024, 10 pages.

* cited by examiner

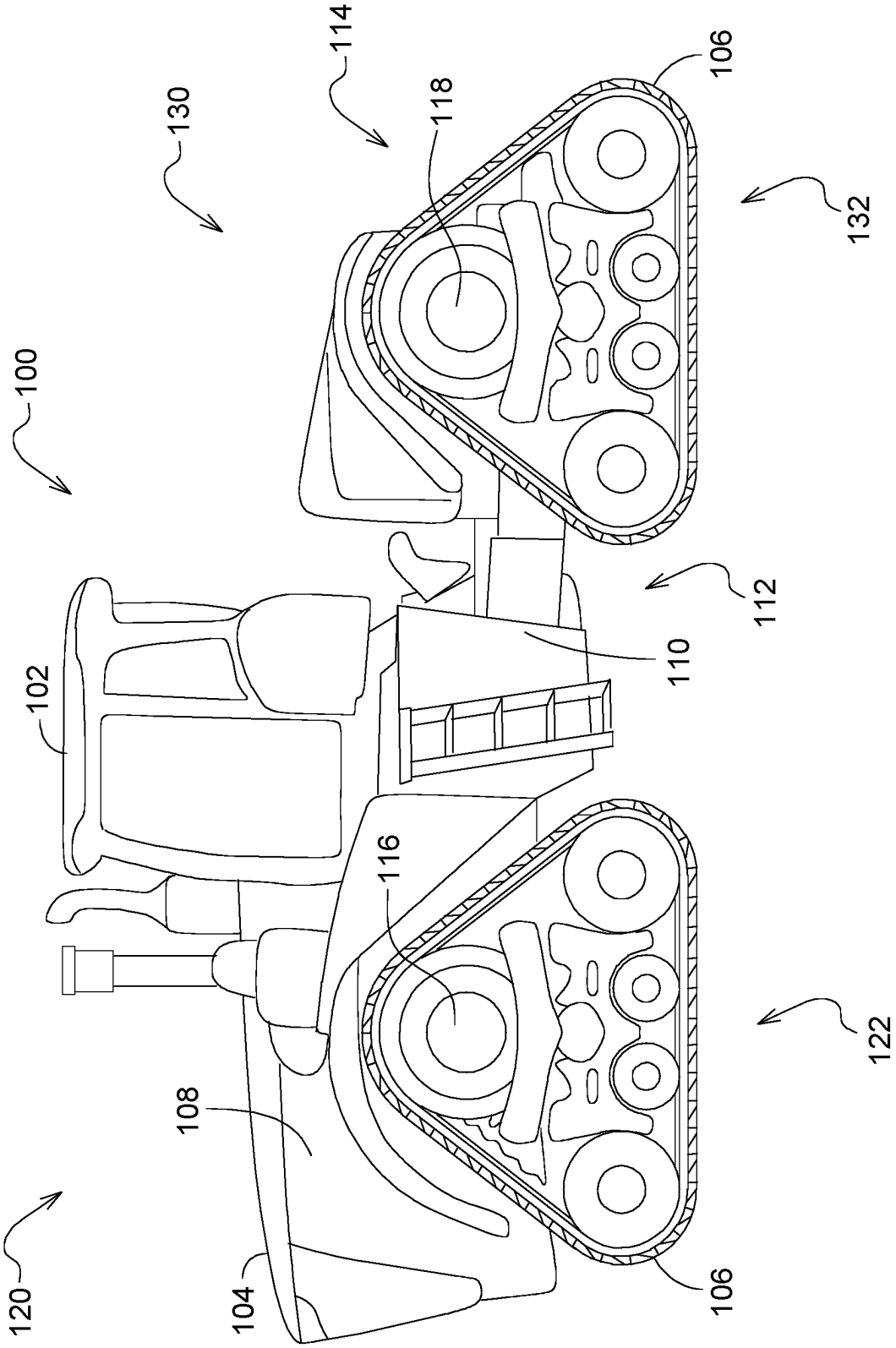


FIG. 1

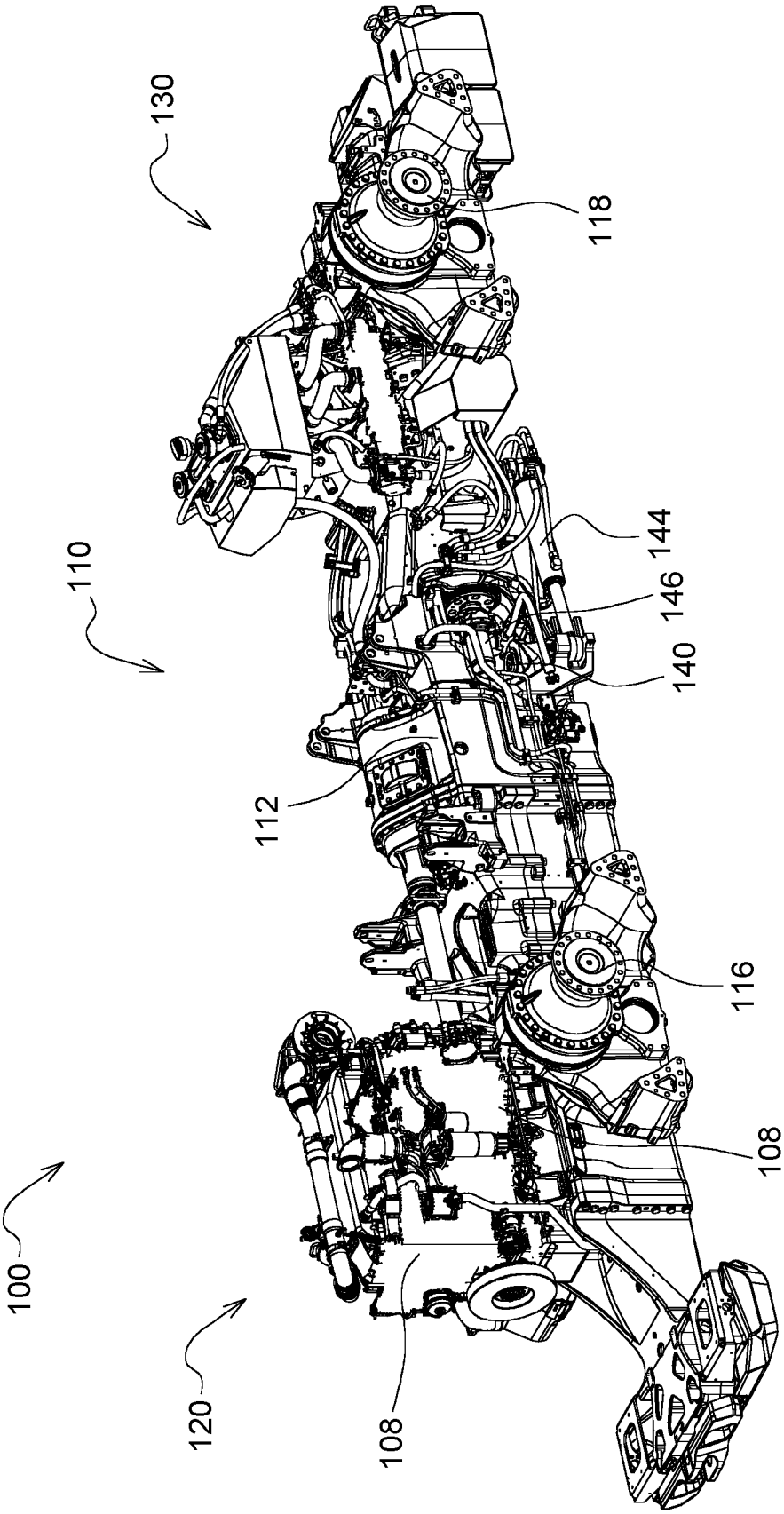


FIG. 2

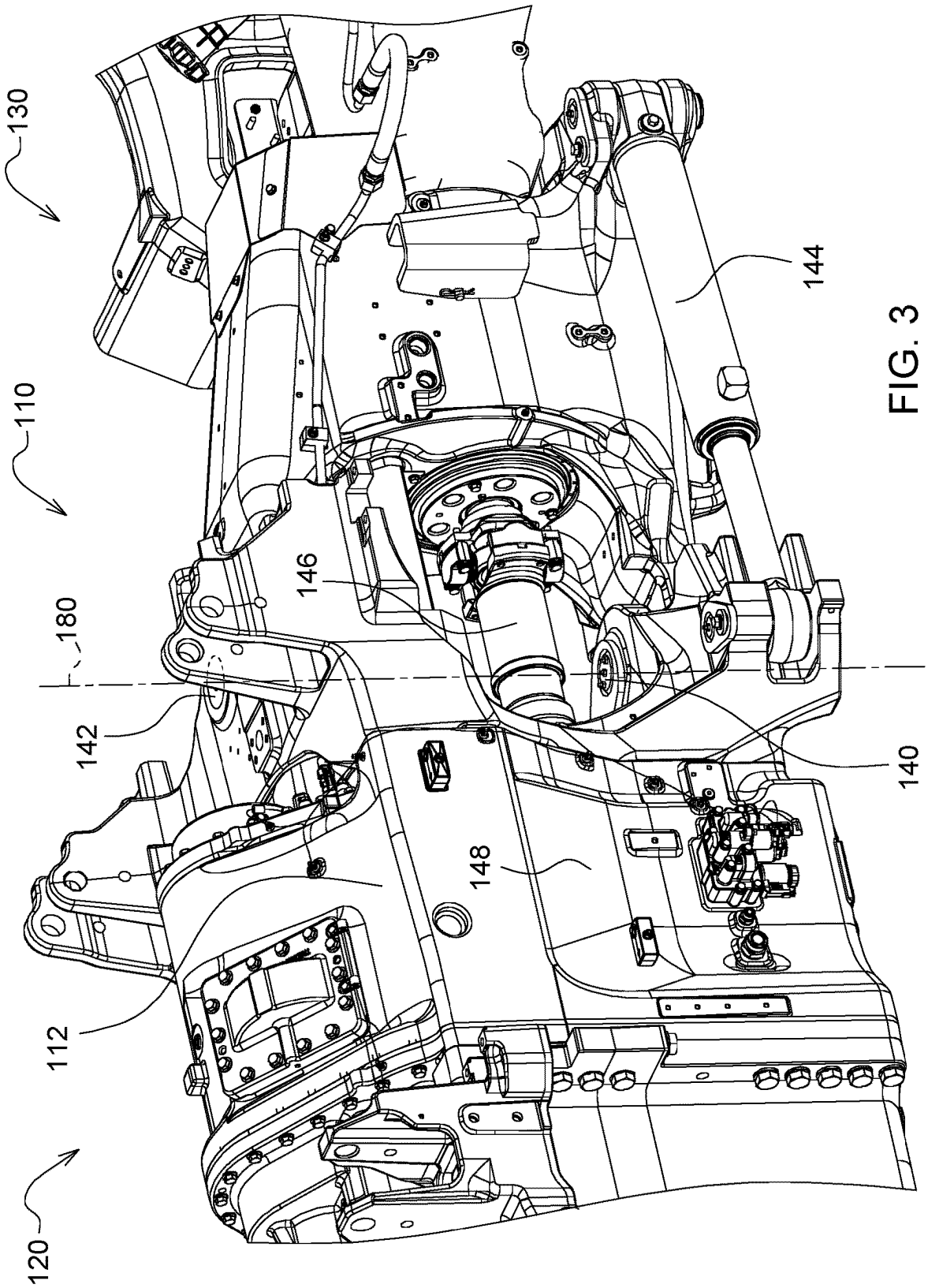


FIG. 3

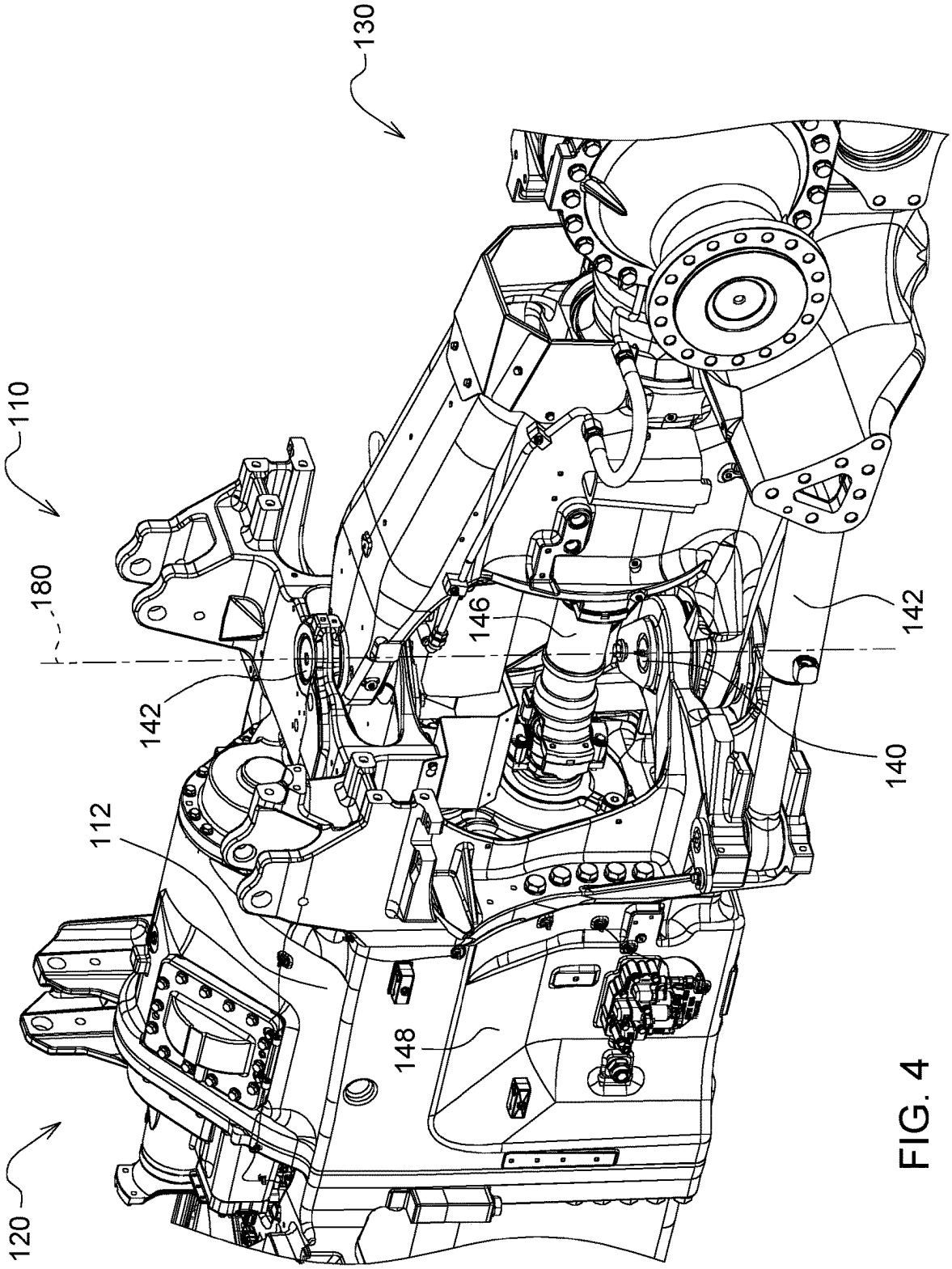


FIG. 4

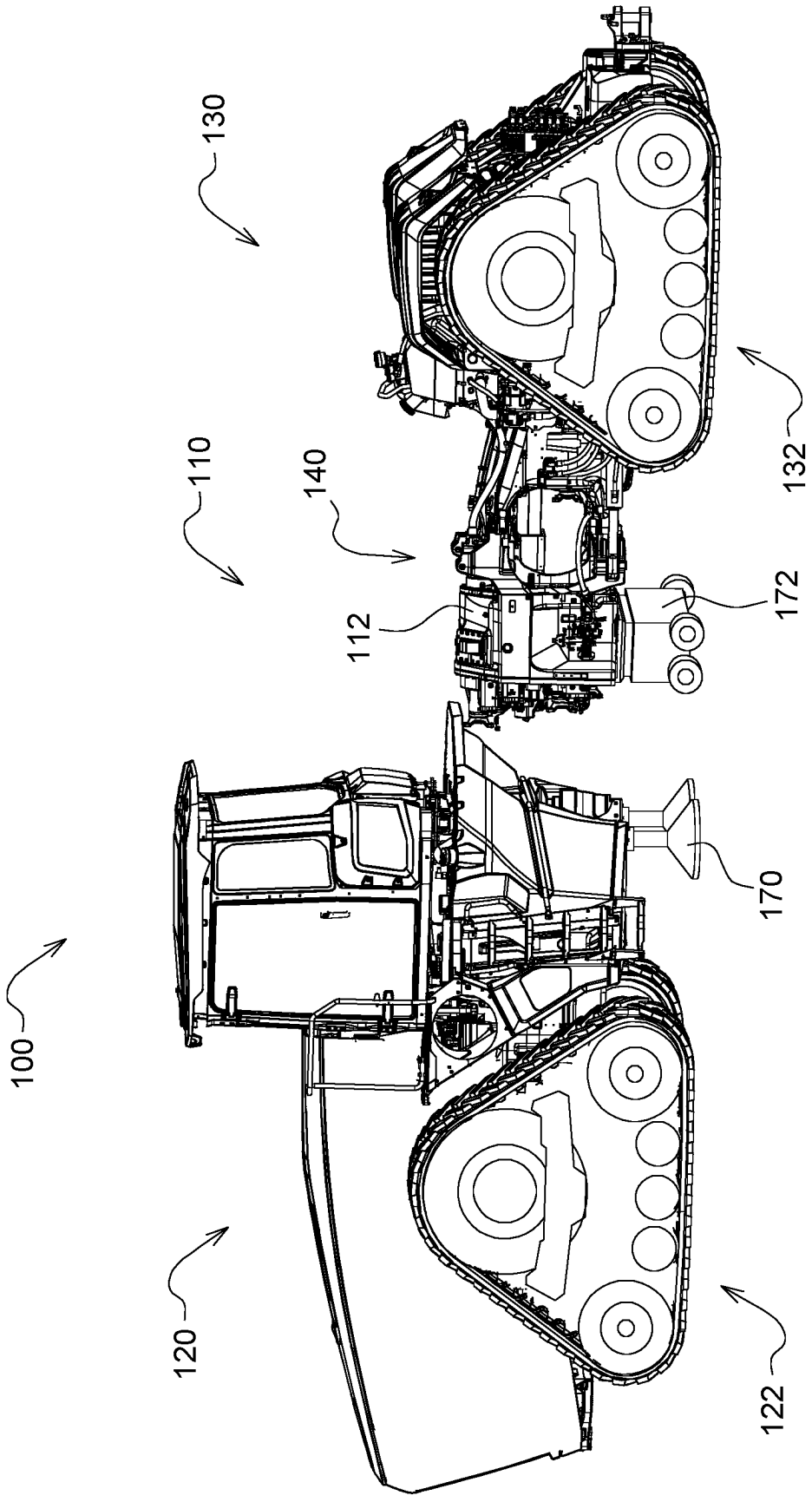


FIG. 5

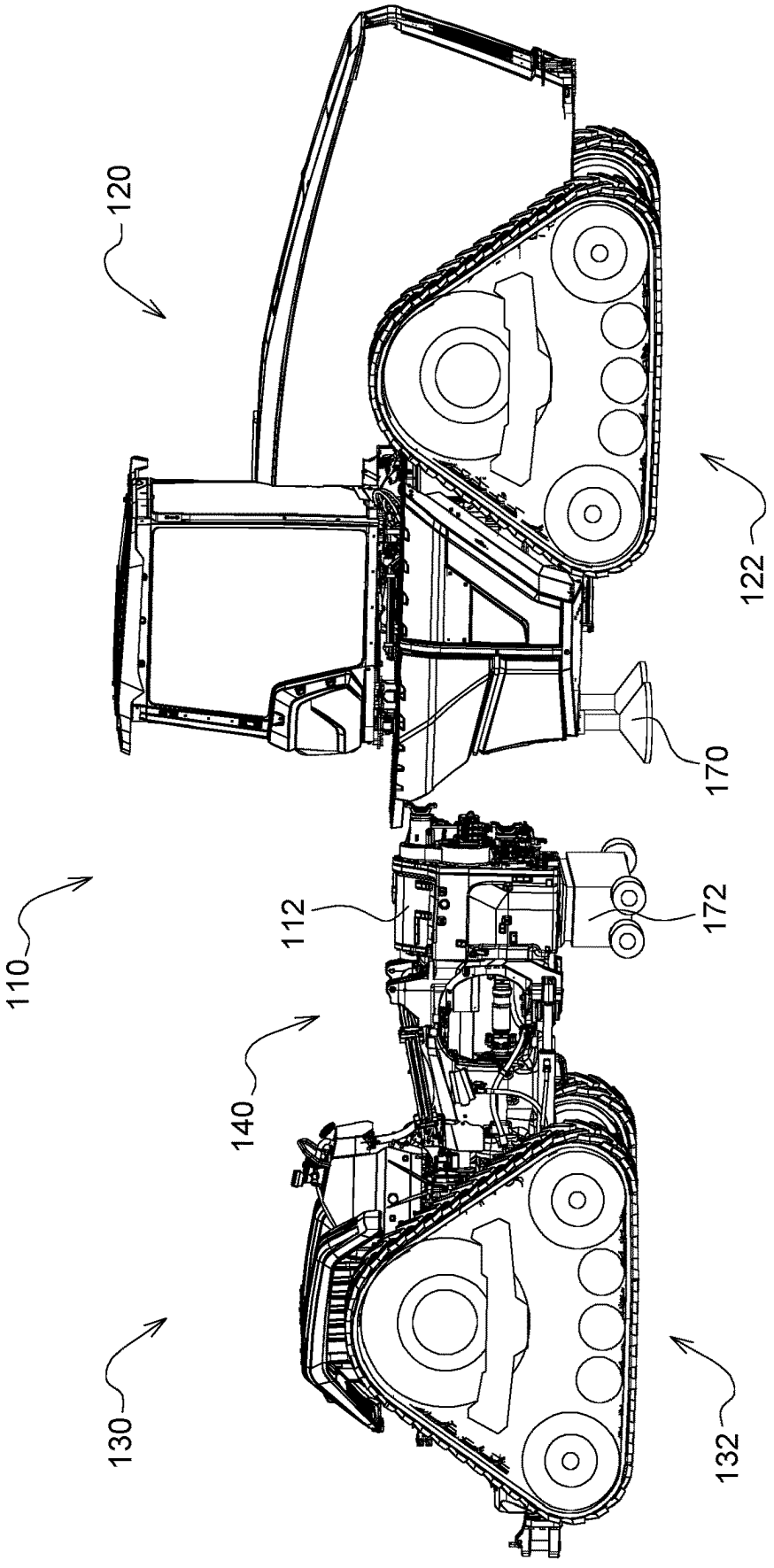


FIG. 6

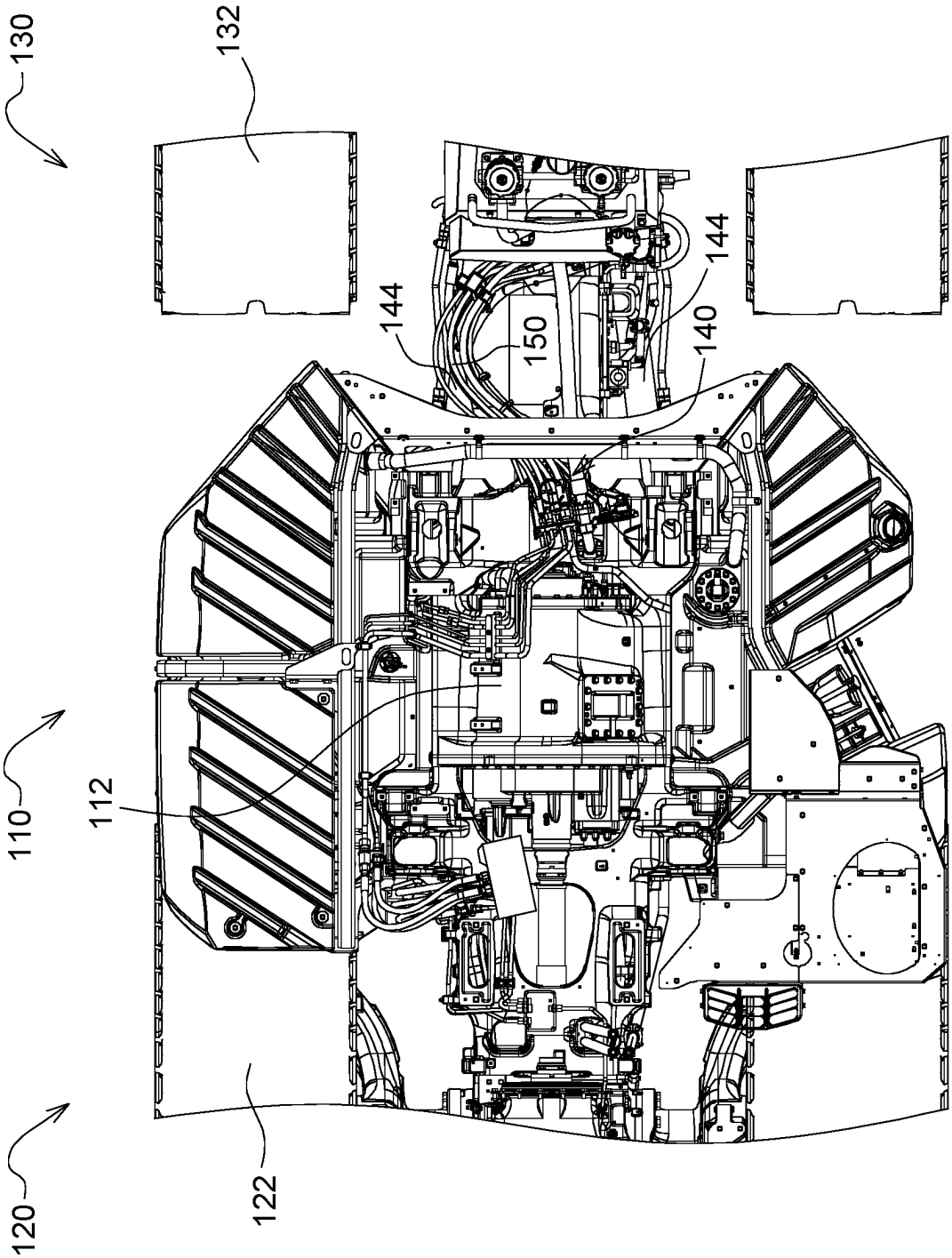


FIG. 7

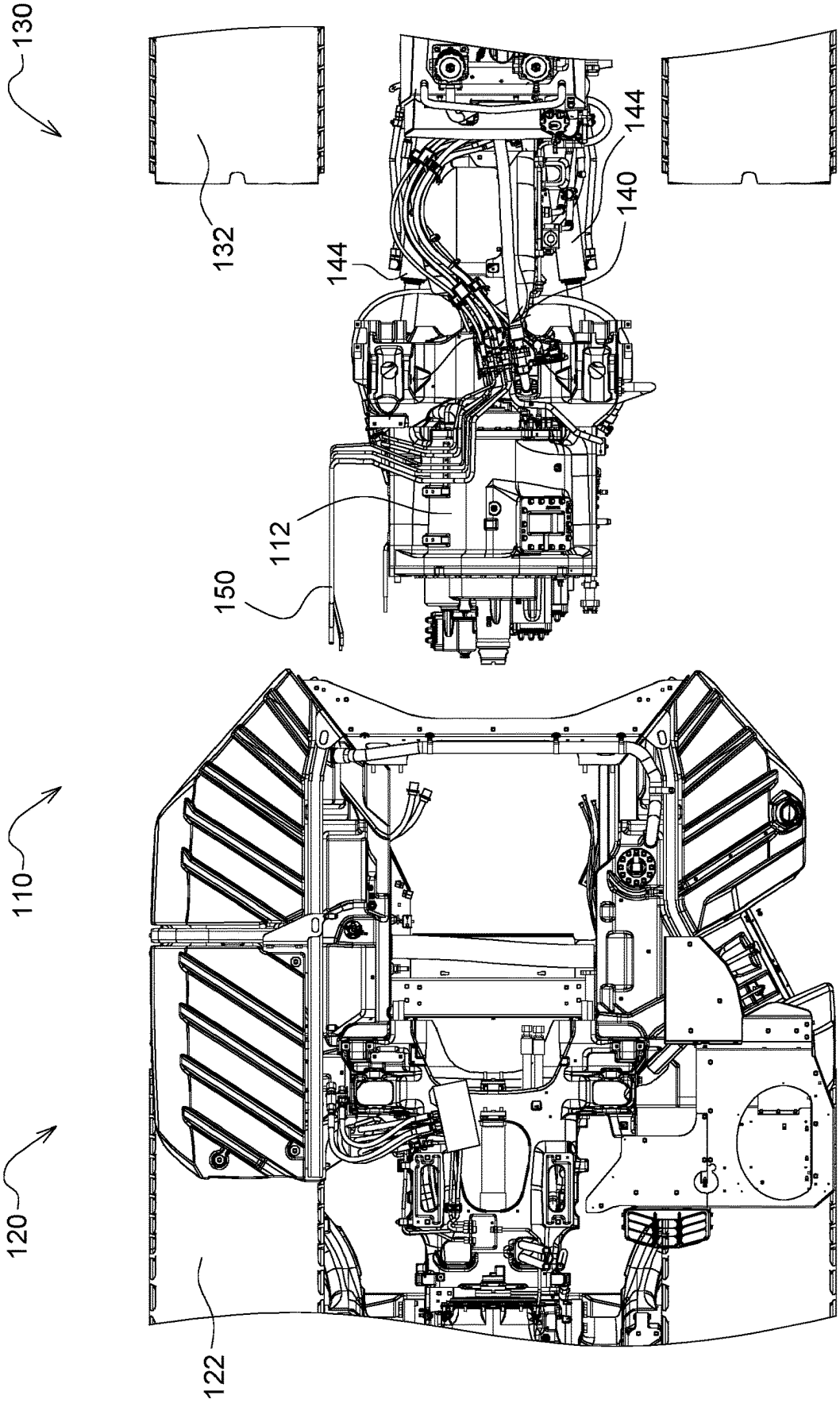


FIG. 8

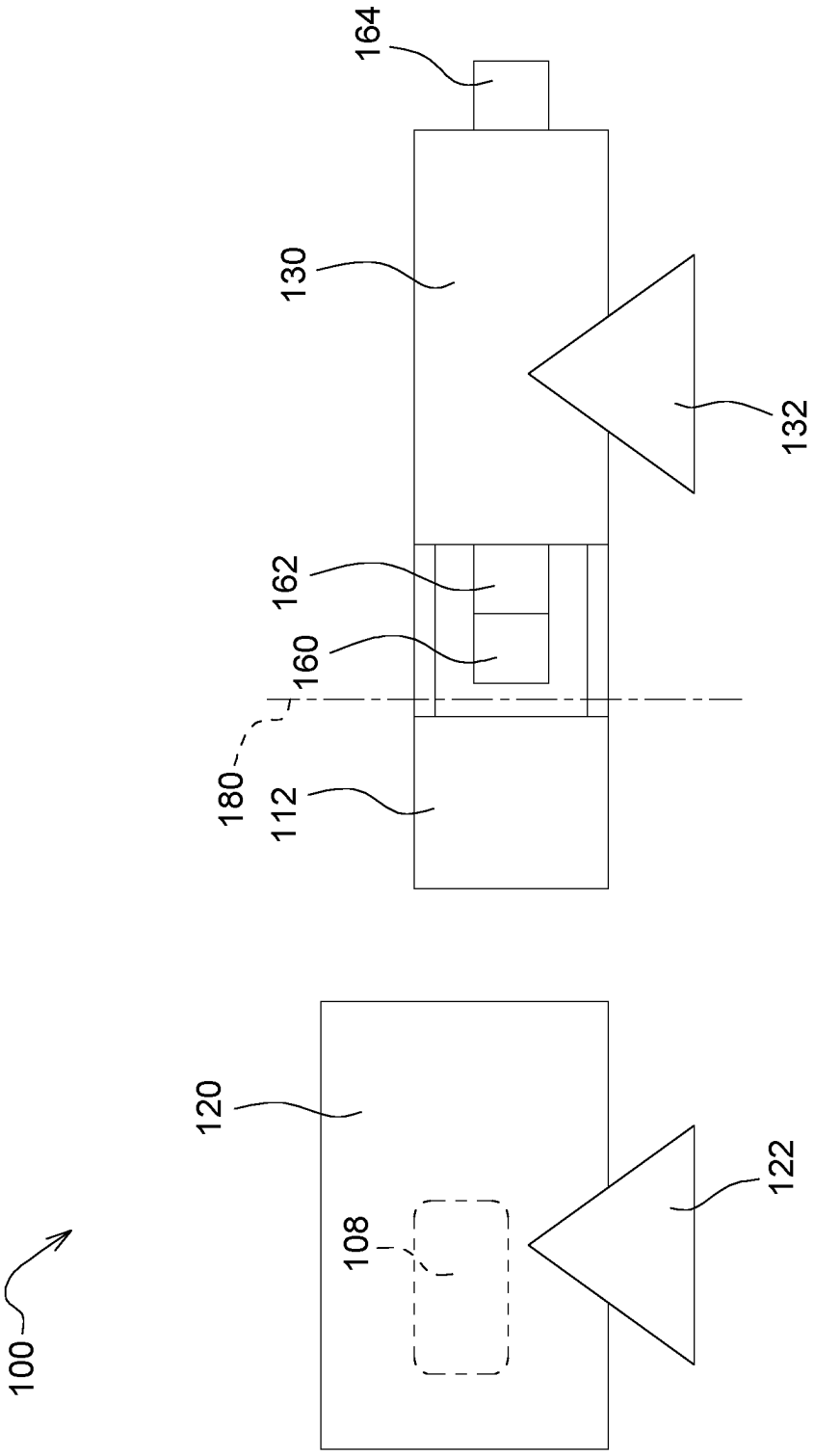


FIG. 9

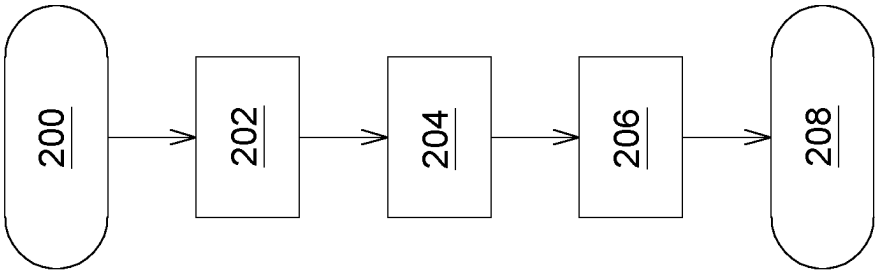


FIG. 10

APPARATUS AND METHOD OF REMOVING A TRANSMISSION FROM AN ARTICULATED WORK VEHICLE

FIELD OF THE DISCLOSURE

The present disclosure relates to an apparatus and method of removing a transmission from a work vehicle.

BACKGROUND

Work vehicles include transmissions positioned between a power source and the wheels or track assemblies. Transmissions can be removed from the work vehicles for service or replacement.

SUMMARY

According to an aspect of the present disclosure, an articulated work vehicle includes a front portion having a front set track assemblies, a rear portion having a rear set track assemblies, a power source installed in the front portion, a transmission installed in the front portion, a use mode, and a service mode. In the use mode, the rear portion is pivotally connected to the front portion and the transmission is operably connected to the power source, the front set of track assemblies, and the rear set of track assemblies. In the service mode, the rear portion is disconnected from the front portion, the transmission is disconnected from the front set of track assemblies, the transmission is removed from the front portion, and the transmission remains pivotally connected to the rear portion.

According to an aspect of the present disclosure, the articulated work vehicle includes an operator station connected to the front portion.

According to an aspect of the present disclosure, the articulated work vehicle includes an alternate power source operably connected to the rear set of track assemblies in the service mode.

According to an aspect of the present disclosure, the articulated work vehicle includes an alternate power source operably connected via an alternate gearbox to the rear set of track assemblies in the service mode.

According to an aspect of the present disclosure, the articulated work vehicle includes one or more actuators pivotally connected to the transmission and the rear portion in the use mode and the service mode.

According to an aspect of the present disclosure, the articulated work vehicle includes a front support supporting the front portion in the service mode, and a rear support supporting the rear portion in the service mode. The rear support includes one or more wheels or rollers.

According to an aspect of the present disclosure, the articulated work vehicle includes a drive shaft operably connecting the transmission to the rear set of track assemblies in the use mode, and an alternate power source operably positioned in place of the drive shaft in the service mode.

According to an aspect of the present disclosure, a method of removing a transmission from an articulated work vehicle includes disconnecting a rear portion of the articulated work vehicle including a rear set of track assemblies from a front portion of the articulated work vehicle including a front set of track assemblies, disconnecting the transmission from the front portion while the transmission remains pivotally connected via one or more actuators to the rear portion, and powering via an alternate power source the rear set of track assemblies to remove the transmission from the front portion in a rearward direction.

According to an aspect of the present disclosure, the alternate power source includes an alternate gearbox having a reduction gear set.

According to an aspect of the present disclosure, the method includes removing a drive shaft operably connecting the transmission to the rear set of track assemblies, and positioning the alternate power source in place of the drive shaft.

The above and other features will become apparent from the following detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description refers to the accompanying figures in which:

FIG. **1** is a perspective view of a work vehicle, according to an implementation;

FIG. **2** is a perspective view of a chassis for a work vehicle, according to an implementation;

FIG. **3** is a front perspective view of a chassis for a work vehicle, according to an implementation;

FIG. **4** is a rear perspective view of a chassis for a work vehicle, according to an implementation;

FIG. **5** is a left perspective view of a work vehicle, according to an implementation;

FIG. **6** is a right perspective view of a work vehicle, according to an implementation;

FIG. **7** is a top perspective view of a chassis for a work vehicle, according to an implementation;

FIG. **8** is a top perspective view of a chassis for a work vehicle, according to an implementation;

FIG. **9** is a schematic diagram of a work vehicle, according to an implementation; and

FIG. **10** is a flow diagram of a method for a work vehicle, according to an implementation;

Like reference numerals are used to indicate like elements throughout the several figures.

DETAILED DESCRIPTION

The embodiments or implementations disclosed in the above drawings and the following detailed description are not intended to be exhaustive or to limit the present disclosure to these embodiments or implementations.

With reference to FIGS. **1-9**, a work vehicle **100** (e.g., an agricultural tractor) can include an operator station or cab **102**, a hood **104**, one or more ground engaging apparatus **106** (e.g., wheels, track assemblies, etc.), and an articulated frame or chassis **110**. The work vehicle **100** can include one or more power sources **108** (e.g., an internal combustion engine, a hybrid engine, a battery and electric machine, etc.). The work vehicle **100** can include a transmission **112** transferring power from the one or more power sources **108** to a drivetrain, which includes the ground engaging apparatus **106** and one or more power take off (PTO) shafts **114** or other auxiliary power outputs or inputs. The transmission **112** can include a transmission housing **148**. The transmission **112** can include one or more electric or hydraulic machines. The work vehicle **100** can include an operator interface having any number and combination of electronic devices, such as an interactive display. This disclosure also applies to other types of work vehicles in agriculture, construction, forestry, and road building.

The work vehicle **100** can include a front portion **120** with one or more track assemblies **106** and rear portion **130** with one or more track assemblies **106**. The front portion **120** can include a front set of track assemblies **122** (e.g., a left track assembly and a right track assembly) and the rear portion **130** can include a rear set of track assemblies **132** (e.g., a left track assembly and a right track assembly). The power source **108** and the transmission **112** can be installed in the front portion **120**. The operator station **102** can connect or attach to the front portion **120**. The operator station **102** can be omitted or excluded in some implementations (e.g., autonomous vehicles). The work vehicle **100** can include one or more front axles **116** and one or more rear axles **118**. The rear portion **130** can rotatably or pivotally connect to the front portion **120** at one or more connections **140** (e.g., a lower connection **140** and an upper connection **142**). The front and rear portions **120**, **130** can rotate or pivot relative to each other about an axis of rotation **180** located at the lower and upper connections **140**, **142**.

One or more actuators **144** (e.g., hydraulic, pneumatic, electric, etc.) can rotatably or pivotally connect to the front and rear portions **120**, **130**. The one or more actuators **144** can rotatably or pivotally connect to the transmission housing **148**. The one or more actuators **144** (e.g., a left actuator and a right actuator) can rotate or pivot the front and rear portions **120**, **130** relative to each other about the axis of rotation **180** at the lower connection **140** and the upper connection **142**. The one or more actuators **144** can rotate or pivot the rear portion **130** relative to the front portion **120**, or vice versa.

With reference to FIG. **7**, one or more lines, hoses, or cables **150** (e.g., hydraulic, pneumatic, electric, etc.) connect to one or more components in the front portion **120** and one or more components in the rear portion **130**. The one or more lines **150** include connectors for connecting and disconnecting the one or more lines **150**. FIG. **7** shows the one or more lines **150** connected, and FIG. **8** shows the one or more lines **150** disconnected.

The work vehicle **100** includes a use mode with the rear portion **130** pivotally connected to the front portion **120**, as shown for example in FIGS. **1-4** and **7**. The transmission **112** is operably connected to the power source **108**, the front set of track assemblies **122**, and the rear set of track assemblies **132**. A drive shaft **146** operably connects the transmission **112** to the rear set of track assemblies **132**. The one or more actuators **144** can connect to the rear set of track assemblies **132** and to the front track assemblies **122** at the transmission housing **148**. In the use mode, the work vehicle **100** is arranged in a normal operating mode.

The work vehicle **100** includes a service mode with the rear portion **130** disconnected from the front portion **120**, as shown for example in FIGS. **5-6** and **8-9**. The transmission **112** is disconnected from the front set of track assemblies **122**. The transmission **112** is removed from the front portion **120**. The transmission **112** remains pivotally connected to the rear portion **130** at the one or more connections **140**. The transmission **112** can rotate or pivot about the axis of rotation **180**. The actuators **144** remain connected to the transmission housing **148** and the rear set of track assemblies **132**. The transmission **112** can remain operably connected to or can be disconnected from the rear set of track assemblies **132**. The drive shaft **146** can remain operably connected or can be removed. When the drive shaft **146** is removed, an alternate power source **160** can be operably connected to the rear set of track assemblies **132** in place of the drive shaft **146**.

The alternate power source **160** generates rotational power for the rear set of track assemblies **132**. The alternate power source **160** can include an electric machine and an electrical energy source (e.g., an electric drill). Alternatively, the alternate power source **160** can include a hydraulic or pneumatic tool to provide rotational power to the rear set of track assemblies **132** (e.g., a pneumatic drill). The alternate power source **160** can be operably connected to the rear set of track assemblies **132** via an alternate gearbox **162**, which can include a reduction gear set. The alternate power source **160** and the alternate gearbox **162** can operably connect to the rear set of track assemblies **132** in place of the drive shaft **146** or via an alternate input shaft **164**. Either or both the alternate power source **160** and the alternate gearbox **162** can be removably connected or can be installed in the rear portion **130** of the work vehicle **100**.

In the service mode, a front stand or support **170** can support the front portion **120** to maintain the orientation of the front portion **120** with the ground surface. A rear stand or support **172** can support the rear portion **130** to maintain the orientation of the rear portion **130** with the ground surface. Either or both of the front and rear supports **170**, **172** can include wheels or rollers.

FIG. **10** illustrates a method of removing a transmission **112** from an articulated work vehicle **100**, which may be utilized in one or more of the implementations described herein and depicted in the various FIGURES. At **200**, the method starts.

At **202**, a rear portion **130** of the articulated work vehicle **100** is disconnected from a front portion **120** of the articulated work vehicle **100**. This can include disconnecting lines, hoses, and cables **150** which travel between the front and rear portions **120**, **130**.

At **204**, the transmission **112** is disconnected from the front portion **120** while the transmission **112** remains pivotally connected to the rear portion **130**. The one or more actuators **144** remain pivotally connected to the transmission **112**. A front support **170** can be positioned at or near the rear of the front portion **120** to prevent the front portion **120** from rotating or tilting towards the ground surface. A rear support **172** can be positioned at or near the front of the rear portion **130** to prevent the rear portion **130** from rotating or tilting towards the ground surface.

At **206**, the rear set of track assemblies **130** are powered via an alternate power source **160** to drive the rear set of track assemblies **130** in a rearward direction and remove the transmission **112** from the front portion **120**, also in a rearward direction. The rear support **172** can travel with the rear set of track assemblies **130** on or more wheels or rollers. The drive shaft **146** can be removed and the alternate power source **160** can be positioned in place of the drive shaft **146**. Additionally, the alternate power source **160** can include an alternate gearbox **162**. Either or both the alternate power source **160** and the alternate gearbox can be utilized in place of the drive shaft **146** or can be connected to an alternate input shaft **164**, which operably connects to the rear set of track assemblies **132**.

At **208**, the method of removing a transmission **112** from an articulated work vehicle **100** is complete, according to one implementation. In other implementations, one or more of these steps, processes, or operations may be omitted, repeated, re-ordered, combined, or separated and are within the scope of the present disclosure.

The terminology used herein is for the purpose of describing example embodiments or implementations and is not intended to be limiting of the disclosure. As used herein, the singular forms "a," "an," and "the" are intended to include

the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the any use of the terms "has," "includes," "comprises," or the like, in this specification, identifies the presence of stated features, integers, steps, operations, elements, and/or components, but does not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Those having ordinary skill in the art will recognize that terms such as "above," "below," "upward," "downward," "top," "bottom," etc., are used descriptively for the figures, and do not represent limitations on the scope of the present disclosure, as defined by the appended claims. Furthermore, the teachings may be described herein in terms of functional and/or logical block components or various processing steps, which may include any number of hardware, software, and/or firmware components configured to perform the specified functions.

Terms of degree, such as "generally," "substantially," or "approximately" are understood by those having ordinary skill in the art to refer to reasonable ranges outside of a given value or orientation, for example, general tolerances or positional relationships associated with manufacturing, assembly, and use of the described embodiments or implementations.

As used herein, "e.g.," is utilized to non-exhaustively list examples and carries the same meaning as alternative illustrative phrases such as "including," "including, but not limited to," and "including without limitation." Unless otherwise limited or modified, lists with elements that are separated by conjunctive terms (e.g., "and") and that are also preceded by the phrase "one or more of" or "at least one of" indicate configurations or arrangements that potentially include individual elements of the list, or any combination thereof. For example, "at least one of A, B, and C" or "one or more of A, B, and C" indicates the possibilities of only A, only B, only C, or any combination of two or more of A, B, and C (e.g., A and B; B and C; A and C; or A, B, and C).

While the above describes example embodiments or implementations of the present disclosure, these descriptions should not be viewed in a restrictive or limiting sense. Rather, there are several variations and modifications which may be made without departing from the scope of the appended claims.

What is claimed is:

1. An articulated work vehicle, comprising:
- a front portion including a front set track assemblies;
- a rear portion including a rear set track assemblies;
- a power source installed in the front portion;
- a transmission installed in the front portion;
- a use mode with the rear portion pivotally connected to the front portion and the transmission operably connected to the power source, the front set of track assemblies, and the rear set of track assemblies;
- a service mode with the rear portion disconnected from the front portion, the transmission disconnected from the front set of track assemblies, the transmission removed from the front portion, and the transmission remaining pivotally connected to the rear portion; and
- an alternate power source operably connected to the rear set of track assemblies in the service mode.

2. The articulated work vehicle of claim **1**, further comprising:
- an operator station connected to the front portion.

3. The articulated work vehicle of claim **1**, wherein the alternate power source operably connects via an alternate gearbox to the rear set of track assemblies in the service mode.

4. The articulated work vehicle of claim **1**, further comprising:
- one or more actuators pivotally connected to the transmission and the rear portion in the use mode and the service mode.

5. The articulated work vehicle of claim **1**, further comprising:
- a front support supporting the front portion in the service mode; and
- a rear support including one or more rollers, the rear support supporting the rear portion in the service mode.

6. The articulated work vehicle of claim **1**, further comprising:
- a drive shaft operably connecting the transmission to the rear set of track assemblies in the use mode; and
- the alternate power source operably positioned in place of the drive shaft in the service mode.

7. An articulated work vehicle, comprising:
- a front portion including a front set track assemblies;
- a rear portion including a rear set track assemblies;
- a power source installed in the front portion;
- a transmission installed in the front portion;
- a use mode with the rear portion pivotally connected to the front portion and the transmission operably connected to the power source, the front set of track assemblies, and the rear set of track assemblies;
- a service mode with the rear portion disconnected from the front portion, the transmission disconnected from the front set of track assemblies, the transmission removed from the front portion, and the transmission remaining pivotally connected to the rear portion; and
- one or more actuators pivotally connected to the transmission and the rear portion in the use mode and the service mode.

8. The articulated work vehicle of claim **7**, further comprising:
- an operator station connected to the front portion.

9. The articulated work vehicle of claim **7**, further comprising:
- an alternate power source operably connected via an alternate gearbox to the rear set of track assemblies in the service mode.

10. The articulated work vehicle of claim **7**, further comprising:
- a front support supporting the front portion in the service mode; and
- a rear support including one or more rollers, the rear support supporting the rear portion in the service mode.

11. The articulated work vehicle of claim **7**, further comprising:
- a drive shaft operably connecting the transmission to the rear set of track assemblies in the use mode; and
- an alternate power source operably positioned in place of the drive shaft in the service mode.

12. An articulated work vehicle, comprising:
- a front portion including a front set track assemblies;
- a rear portion including a rear set track assemblies;
- a power source installed in the front portion;
- a transmission installed in the front portion;
- a use mode with the rear portion pivotally connected to the front portion and the transmission operably connected to the power source, the front set of track assemblies, and the rear set of track assemblies;

a service mode with the rear portion disconnected from the front portion, the transmission disconnected from the front set of track assemblies, the transmission removed from the front portion, and the transmission remaining pivotally connected to the rear portion;

a front support supporting the front portion in the service mode; and

a rear support including one or more rollers, the rear support supporting the rear portion in the service mode.

13. The articulated work vehicle of claim **12**, further comprising:

an operator station connected to the front portion.

14. The articulated work vehicle of claim **12**, further comprising:

an alternate power source operably connected via an alternate gearbox to the rear set of track assemblies in the service mode.

15. The articulated work vehicle of claim **12**, further comprising:

a drive shaft operably connecting the transmission to the rear set of track assemblies in the use mode; and

an alternate power source operably positioned in place of the drive shaft in the service mode.

* * * * *