

DRIVE ASSEMBLY FOR TRACKED VEHICLES

The present invention relates to a drive assembly for tracked vehicles.

As is known, in some strategic sectors such as civil defense, there are large vehicle fleets in which numerous tracked vehicles are left parked
5 unused because their transmission components are obsolete even though other parts of the vehicles are potentially still usable.

As is known, in fact, the logistics line for spare parts no longer supports such vehicles, as such parts are often made of materials that are no longer produced, particularly in the case of transmission components.
10 Therefore, in the absence of the necessary spare parts, the vehicle owners are forced to dispose of such vehicles and buy new ones.

Also, the regeneration of existing vehicles with alternative components is often difficult or impossible, in that the spaces available are not suitable for new and more modern power generation and transmission
15 lines.

Therefore, the aim of the present invention is to provide a drive assembly for tracked vehicles that can be easily installed on existing, unused vehicles in substitution of the currently-installed mechanical traction assemblies, which ensures high reliability and high performance levels, and
20 which makes use of components with reduced weight and dimensions but which at the same time are capable of developing high levels of power, also taking into consideration the considerable weight of the vehicles in question.

The above-mentioned aim, as well as other objects which will become
25 clearer from the description that follows, are achieved by a drive assembly that has the characteristics recited in claim 1, while the dependent claims define further characteristics of the invention.

Now the invention will be described in greater detail, with reference to a preferred but not exclusive embodiment thereof, which is illustrated for
30 the purposes of non-limiting example in the accompanying drawings,

wherein:

- Figure 1 is a schematic side view of a generic tracked vehicle on which a drive assembly according to the invention can be installed;

- Figure 2 is a block diagram of the drive assembly according to the
5 invention.

With initial reference to Figure 1, a drive assembly, indicated by the reference numeral 10, is adapted to be installed on a generic tracked vehicle V in substitution of the existing drive assembly.

The tracked vehicle V is supported on a pair of crawler tracks C1, C2
10 which are moved independently of each other by respective sprockets P1, P2.

With reference now to Figure 2, the drive assembly 10 comprises an electric actuation system powered by an internal combustion engine 12, advantageously a four-stroke Diesel cycle engine fueled by a conventional
15 fuel or by a synthetic fuel.

The electric actuation system according to the invention comprises a first current generator 14 and a second current generator 16 which are functionally connected to the drive shaft (not shown) of the internal combustion engine 12 and are adapted to transfer the electric power
20 generated by them, by means of a control system C, to a first electric motor 18 and to a second electric motor 20. Each one of the electric motors 18, 20 is connected to a respective one of the two sprockets P1, P2, preferably by means of a respective gearbox 22, 24.

The control system C comprises a battery pack 26 (which can be
25 substituted by, or paired with, a conventional kinetic energy recovery system, not shown) which is adapted to store the energy recovered during phases of braking or downhill driving for subsequent use as a buffer and/or as auxiliary power. This contrivance increases the efficiency of the entire system and ensures determined periods of silent locomotion. The battery
30 pack 26 is advantageously provided with a management system (not shown)

for exchanging data over a CAN-bus, as will be seen below.

The control system C comprises a first controller 28 connected to the first current generator 14 by means of a first three-phase alternating current line AC1, and a second controller 30 connected to the second current
5 generator 16 by means of a second three-phase alternating current line AC2.

The first controller 28 and the second controller 30 are adapted to rectify and level the voltage generated by the current generators 14, 16.

The first controller 28 is connected to a third controller 32 by means of a high voltage direct current line DCH. The third controller 32 is
10 connected to the first electric motor 18 by means of a third three-phase alternating current line AC3.

The second controller 30 is connected to a fourth controller 34 by means of the high voltage direct current line DCH. The fourth controller 34 is connected to the second electric motor 20 by means of a fourth three-
15 phase alternating current line AC4.

The third controller 32 and the fourth controller 34 are adapted to manage the traction of the first electric motor 18 and of the second electric motor 20 respectively.

A series of voltage converters, advantageously four voltage
20 converters DCC1, DCC2, DCC3 and DCC4, convert the voltage taken from the high voltage direct current line DCH, e.g., a voltage of 700V DC, to a lower voltage, e.g., a voltage of 24V DC, which powers, by means of a low voltage direct current line DCL, a cooling unit 36 and a sensor assembly for services 38.

25 The cooling unit 36 manages the cooling of the internal combustion engine 12 and of the various electronic power elements, and is provided with a dedicated electronic card (not shown) which makes it possible to switch on/switch off, by means of MOSFETs and relay switches, fans and pumps for circulating the coolant liquid (per se known and not shown) as
30 well as regulate their speed.

The sensor assembly for services 38 manages the various services of the vehicle such as lights, sensors, and the like.

The battery pack 26 is connected, by means of the high voltage direct current line DCH, to the first controller 28 and to the third controller 32 with the interposition of a first isolator switch SW1, as well as to the second controller 30 and to the fourth controller 34 with the interposition of a second isolator switch SW2. The isolator switches SW1 and SW2 are advantageously power relay switches that make it possible to include/exclude the battery pack 26.

The low voltage direct current line DCL is connected to a battery 40 controlled by the internal combustion engine 12. The battery 40 powers a control box 42 for managing the internal combustion engine 12 and a vehicle control unit 44.

The control box 42 manages, over a CAN-bus (as will be seen below) or by means of MOSFETs on the pins of the control box, the ignition of the internal combustion engine 12 and the acceleration/deceleration phases. The control box 42 also has the function of enabling/disabling the high voltage direct current line DCH and charging and discharging the condensers of the controllers 28, 30, 32 and 34 and of the voltage converters DCC1, DCC2, DCC3 and DCC4 (as will be seen in more detail below). Furthermore, the control box 42 gives the physical addresses to the four voltage converters DCC1, DCC2, DCC3 and DCC4 and manages the wakeups of these latter converters based on the power required on the low voltage direct current line DCL.

The vehicle control unit 44 acts as the onboard computer, managing all the information relating to driving, services, alarms and the like, as well as displaying information for the crew.

As anticipated previously, the drive assembly further comprises a control system for charging/discharging the condensers associated with the controllers 28, 30, 32 and 34 and with the voltage converters DCC1, DCC2,

DCC3 and DCC4. The control system for charging/discharging the condensers comprises a first charge/discharge controller CDC1 and a second charge/discharge controller CDC2 which are connected on the first high voltage direct current line DCH between the first controller 28 and the third controller 32, as well as a third charge/discharge controller CDC3 and a fourth charge/discharge controller CDC4 which are connected on the high voltage direct current line DCH between the second controller 30 and the fourth controller 34. The voltage converters DCC1, DCC2, DCC3 and DCC4 are connected to the high voltage direct current line DCH between the first charge/discharge controller CDC1 and the second charge/discharge controller CDC2. The control system for charging/discharging the condensers is managed by relay switches which are driven by MOSFETs (not shown). The control box 42, using dedicated firmware, manages the opening/closing of the relay switches based on preset internal priorities.

The vehicle control unit 44 is connected to exchange data and commands: with the third controller 32 and the fourth controller 34 over a first CAN-bus CAN1 dedicated to traction; with the charging/discharging controllers CDC1, CDC2, CDC3, CDC4, the battery pack 26, the series of voltage converters DCC1, DCC2, DCC3, DCC4, the cooling unit 36 and the sensor assembly for services 38, over a second CAN-bus CAN2 dedicated to services; and with the first controller 28, the second controller 30 and the control box 42 over a third CAN-bus CAN3 dedicated to the internal combustion engine 12. The sensor assembly for services 38 is connected to the vehicle control unit 44 by a digital input/output line IOL. A fourth CAN-bus CAN4 connects the control box 42 to the four voltage converters DCC1, DCC2, DCC3, DCC4 and to the four controllers 28, 30, 32, 34.

Advantageously, the two current generators 14, 16 are identical to each other, as are the two electric motors 18, 20, the controllers 28, 30, 32, 34, the voltage converters DCC1, DCC2, DCC3, DCC4 and the isolator switches SW1 and SW2. This factor ensures high interchangeability

between the components and, as a consequence, a considerable reduction in production and maintenance costs and times.

Advantageously, in the electrical parts, the stators and rotors are made of high-strength steel and aluminum, in order to develop high power levels
5 with reduced weights.

The operation of the vehicle fitted with the drive assembly according to the invention is handled completely electronically, which makes it possible to optimize the running regime of the internal combustion engine and fuel consumption as a function of different conditions of use.
10 Furthermore, the fully electronic management of the vehicle enables it to be driven remotely, e.g., over GPS. This aspect can be particularly useful for rescue operations under hazardous conditions.

The current generators 14, 16, driven by the internal combustion engine 12, generate the currents that power the electric motors 18, 20 by
15 means of the control system C.

Driving and steering are handled by increasing and reducing the speed of the two electric motors 18, 20 and the torque dispensed by them.

A preferred embodiment of the invention has been described, but obviously the person skilled in the art may make various modifications and
20 variations within the scope of protection of the claims.

For example, in an alternative embodiment the internal combustion engine could comprise a gas turbine fueled by kerosene and/or methane.

The disclosures in Italian Utility Model Application No. 202023000004317 from which this application claims priority are
25 incorporated herein by reference.

Where the technical features mentioned in any claim are followed by reference numerals and/or signs, those reference numerals and/or signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference numerals and/or signs do not have
30 any limiting effect on the interpretation of each element identified by way of

example by such reference numerals and/or signs.

CLAIMS

1. A drive assembly for tracked vehicles, which comprises an electric actuation system powered by an internal combustion engine (12) and adapted to turn a pair of crawler tracks (C1, C2) which are moved
5 independently of each other by respective sprockets (P1, P2), characterized in that said electric actuation system comprises a first current generator (14) and a second current generator (16) which are functionally connected to the drive shaft of the internal combustion engine (12) and are adapted to transfer the electrical energy generated by them, by means of a control
10 system (C), respectively to a first electric motor (18) associated with a first one of said sprockets (P1) and to a second electric motor (20) associated with a second one of said sprockets (P2).

2. The drive assembly for tracked vehicles according to claim 1, characterized in that said control system (C) comprises a first controller (28)
15 connected to said first current generator (14) by means of a first three-phase alternating current line (AC1), and a second controller (30) connected to said second current generator (16) by means of a second three-phase alternating current line (AC2), said first controller (28) and said second controller (30) being adapted to rectify and level the voltage generated by
20 said current generators (14, 16).

3. The drive assembly for tracked vehicles according to claim 2, characterized in that said first controller (28) and said second controller (30) are connected, by means of a high voltage direct current line (DCH), respectively to a third controller (32) which is connected to said first electric
25 motor (18) by means of a third three-phase alternating current line (AC3), and to a fourth controller (34) which is connected to said second electric motor (20) by means of a fourth three-phase alternating current line (AC4), said third controller (32) and said fourth controller (34) being adapted to handle the traction of the first electric motor (18) and of the second electric
30 motor (20) respectively.

4. The drive assembly for tracked vehicles according to claim 3, characterized in that it comprises a series of voltage converters (DCC1, DCC2, DCC3 and DCC4) which are adapted to convert the voltage picked up by said high voltage direct current line (DCH) to a lower voltage that powers, by means of a low voltage direct current line (DCL), a cooling unit (36) which is adapted to manage the cooling of said internal combustion engine (12) and of the various electronic power elements, and a sensor assembly for services (38) which is adapted to manage the various services of the vehicle such as lights, sensors, and the like.

10 5. The drive assembly for tracked vehicles according to claim 4, characterized in that said control system (C) comprises a battery pack (26) which is adapted to store the energy recovered during phases of braking or downhill driving for subsequent use as a buffer and/or as auxiliary power.

6. The drive assembly for tracked vehicles according to claim 5, 15 characterized in that said battery pack (26) is connected, by means of said high voltage direct current line (DCH), to said first controller (28) and to said third controller (32) with the interposition of a first isolator switch (SW1), as well as to said second controller (30) and to said fourth controller (34) with the interposition of a second isolator switch (SW2), said isolator 20 switches (SW1 and SW2) making it possible to include/exclude said battery pack (26).

7. The drive assembly for tracked vehicles according to one or more of claims 4-6, characterized in that said low voltage direct current line (DCL) is connected to a battery (40) controlled by the internal combustion 25 engine (12) and powering a control box (42) adapted to manage said internal combustion engine (12) and a vehicle control unit (44) the function of which is to act as an onboard computer.

8. The drive assembly for tracked vehicles according to claim 7, characterized in that said control box (42) is programmed to manage the 30 ignition of said internal combustion engine (12) and the

acceleration/deceleration phases, enable/disable said high voltage direct current line DCH and, by means of a set of charging/discharging controllers (CDC1, CDC2, CDC3, CDC4), enable/disable the charging and discharging of the condensers of said first controller (28), of said second controller (30),
5 of said third controller (32), of said fourth controller (34), as well as of said series of voltage converters (DCC1, DCC2, DCC3 and DCC4), give the physical addresses to said series of voltage converters (DCC1, DCC2, DCC3, DCC4), as well as manage the wakeups of these latter converters based on the power required on said low voltage direct current line (DCL).

10 9. The drive assembly for tracked vehicles according to claim 8, characterized in that said vehicle control unit (44) is connected in order to exchange data and commands: with said third controller (32) and said fourth controller (34) over a first CAN-bus (CAN1) dedicated to traction; with said set of charging/discharging controllers (CDC1, CDC2, CDC3, CDC4), said
15 battery pack (26), said series of voltage converters (DCC1, DCC2, DCC3, DCC4), said cooling unit (36) and said sensor assembly for services (38), over a second CAN-bus (CAN2) dedicated to services; and with said first controller (28), said second controller (30) and said control box (42) over a third CAN-bus (CAN3) dedicated to said internal combustion engine (12).

20 10. The drive assembly for tracked vehicles according to claim 9, characterized in that it comprises a fourth CAN-bus (CAN4) connecting said control box (42) to said series of voltage converters (DCC1, DCC2, DCC3, DCC4) and to said first controller (28), said second controller (30), said third controller (32) and said fourth controller (34).