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(54) **Title**: MOBILE APPARATUS WITH OPERATING SYSTEM

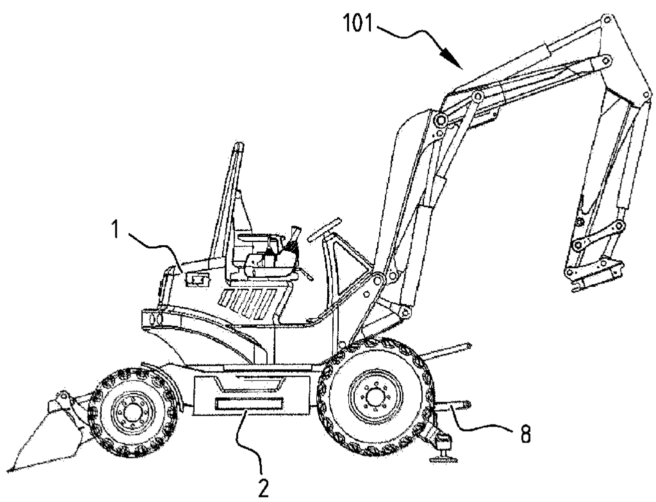

FIG. 1A

(57) **Abstract**: Mobile apparatus comprising a main frame (2), a sub-frame (1) connected rotatably to the main frame and an operating arm connected to the sub-frame, wherein the sub-frame is provided with a seating or standing location for a driver, operating instruments (4) controllable by a driver, and a bus system (5) connected to the operating instruments; wherein the main frame is provided with a lifting device (8) to which an implement (18) is connectable; wherein the mobile apparatus further comprises a drive (7, 17) for driving the lifting device and/or the implement, and a control unit (6, 16) connected to the bus system for controlling the drive on the basis of signals from the bus system; this such that the lifting device and/or the implement are controllable via the bus system using the operating instruments in the sub-frame.

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Mobile apparatus with operating system

Field of the invention

The present invention relates to the field of mobile apparatuses, for instance tractors, excavators, wheel loaders, arm mowers and rotating telescopic cranes, or combinations thereof.

Background

Excavators with a main frame and a rotatable sub-frame and telescopic cranes on a rotatable sub-frame are known. In such apparatuses the motor for the drive can be provided in the main frame or in the rotatable sub-frame, wherein an electronic signal is coupled, optionally via an electronic bus system, between the main frame and the rotatable sub-frame. Further known are platforms, such as a tractor with a crane constructed thereon, wherein an operating arm can rotate relative to the fixed main frame without the cab co-rotating. Such platforms can be provided with a lifting device on one or more sides of the main frame in order to couple implements. The lifting devices are often of the three-point lift type, generally with a power takeoff shaft. These machines have neither a rotatable sub-frame nor an operating arm which co-rotates on the sub-frame.

Electronic bus systems through which digital information is transported are generally known. In vehicles these are often CAN bus systems. There are different types of bus system, such as the CANopen and the J1939 standard. ISOBUS is for instance a standardized system for communication and data exchange between tractor and implement.

Another apparatus is a combination of a main frame with lifting device and a rotatable sub-frame with operating arm as described in NL 1035694 in the name of applicant. Yet another mobile apparatus with an adjustable control pattern of an articulated arm and a single operating arm is described in NL 1027370 in the name of applicant.

Summary of the invention

Advantageous embodiments of the invention are described in the appended claims.

Embodiments of the present invention have the object of providing an improved mobile apparatus with a main frame with tyres or caterpillar tracks on which are provided one or more lifting devices for coupling implements or a stabilizing device; and with a rotatable sub-frame with one or more operating arms thereon. The invention relates more particularly to an improved electronic control system with which information can be transferred between components in the main frame and components in the rotatable sub-frame.

This object is achieved with the embodiment of claim 1.

Embodiments of the invention are based on the transfer of electronic information or digital signals between components in the main frame and in the rotatable sub-frame, so that the technical installations such as mechanisms, hydraulics, pneumatics and main electric current can take a simpler form in that these components are provided with control signals electronically or via a bus system. Sensor modules can further be coupled to the bus system, wherein the values measured by the sensor modules can be fed back via the bus system to the control units which can take account of these fed back values in operating the drive of the lifting device, operating arm and the like. In the present prior art these technical components are still usually driven hydraulically or mechanically, while the lights are typically driven electrically. These are separate hydraulic or electric flows which are centrally controlled via the bus system and one or more control units. According to a typical embodiment, the bus system is configured to communicate by means of a Controller Area Network (CAN) protocol, and for instance a CANopen system or a J1939 system, or an ISOBUS system.

Embodiments of the invention make it possible to operate a large number of functions (lifting device, operating arm and so on) of the main frame from the rotatable sub-frame, wherein a feedback of the functions operated by the driver to the driver is possible using sensors in the main frame, and particularly sensors associated with the lifting device and an implement on the lifting device.

Embodiments of the invention have the great advantage that a bus system can control a large number of functions of the whole mobile vehicle, i.e. a central control of the operating arm on the rotating sub-frame as well as the one or more lifting devices on the main frame, and can here also distribute the motor power and/or the energy flows between the operating arm, the implements on the lifting arm and the one or more implements on the lifting devices on the main frame. A further innovative aspect is that the bus system controls the energy supply from the rotatable sub-frame to the implements coupled to the main frame.

According to yet another aspect of the invention, the mobile apparatus is configured to operate the movement of the lifting devices and the control of the one or more implements on the lifting devices on the main frame via a driver-operated remote control outside the mobile apparatus. The mobile apparatus comprises for this purpose a receiving device for receiving control signals from the remote control and for transmitting the control signals via the bus system to the control unit of the drive of the lifting device and/or the implement coupled thereto.

According to yet another aspect of the invention, additional operating instruments are provided on the main frame which communicate via the bus system with main control components in the rotatable sub-frame and, via the computing unit or computer in the sub-frame, operate the one or more lifting devices and implements therein.

According to an embodiment, a mobile apparatus has a main frame with tyres or caterpillar tracks having thereon one or more lifting devices to which can be coupled implements such as a wood chipper, a ground cutter, a salt-spreader, a grass mower, a pallet fork, a stabilizer shield. Many other implements for forestry or agriculture, construction or for landscape management can be coupled via a lifting device to the front or rear side of the main frame. The type of lifting device for coupling an implement can be random, for instance a known three-point lifting device. A rotatable sub-frame with a workplace or cab for the driver and one or more operating arms is arranged on top of the main frame, usually via a vertical or substantially vertical shaft. Via operating instruments on the rotatable sub-frame and via the bus system the driver can control the energy for operating the implement on a lifting device or moving a lifting device itself on the main frame.
This energy can be mechanical, hydraulic, pneumatic, electrical or a combination.

The skilled person will appreciate that an operating instrument on the sub-frame can be a computer or a panel with a number of buttons, or can be one or more joysticks or a combination thereof which transmits the commands entered by the driver, optionally via a computing unit/computer, to the bus system in the form of suitable signals.

Control units which transmit the different bus signals/commands from the bus system to the drive of for instance a lifting device or an implement on the lifting device are for instance so-called controllers or I/O units or interfaces or ECUs, which control the mechanical, hydraulic, electrical, pneumatic energy flows or combinations thereof on the basis of the bus signals. One of the examples is that such a controller operates an electric relay or a hydraulic valve. An electrical energy flow comes from for instance a battery or a generator. A hydraulic energy flow comes from for instance a hydraulic pump. A pneumatic energy flow comes from for instance a compressor. A mechanical energy flow comes from for instance a rotating shaft. These possible media, and thus energy flows, provide for movement of a lifting device or an implement, or a part of an implement on a lifting device.

According to an embodiment, the control unit (for instance a controller or I/O unit) of the lifting device can be placed in the rotatable sub-frame, although it is also possible for this control unit to be placed in the main frame.

According to different embodiments, the control unit (for instance a controller or I/O unit) of the drive of an implement on a lifting device can be placed in the rotatable sub-frame, although it is also possible for this control unit to be placed in the main frame.

According to different embodiments, the sub-frame can rotate partially or through 360 degrees.

According to different embodiments, the bus signals can be transmitted between the rotatable sub-frame and the main frame and vice versa by a so-called slip ring, or even via a wireless communication means.

According to a possible embodiment, the lifting device is provided with a quick change system for coupling an implement to the lifting device. The quick change system can have a geometry similar to that of a quick change system of an excavator or loading shovel, for instance of the Lehnhoff type (patent DE 102006023420), the OilQuick type, the Verachtert type or the Gangl or Gangl Docking Systems type. The quick change system is preferably adjustable using positioning means. A quick change control unit connected to the bus system can be provided here which is configured to control the positioning means on the basis of signals from the bus system.

According to a possible embodiment, wherein the control units are placed in the main frame, they receive and transmit bus signals from and to the corresponding bus system in the rotatable sub-frame.

A further embodiment provides for transfer of the bus signals between main frame and sub-frame via a so-called slip ring.

A further embodiment provides for transfer of the bus signals between main frame and sub-frame via a contactless wireless connection, such as for instance radiographically or via Bluetooth. A slip ring is an electromechanical device able to transmit power or electrical signals from a stationary structure to a structure freely rotatable through 360 degrees.

A further embodiment provides additional operating instruments which are placed at a location on the main frame and can be operated by the driver. The operating instruments transmit a bus signal, for instance for operation of a lifting device or the rotation of a power takeoff shaft in the vicinity of the lifting device, or operation or control of the implement in the lifting device itself. The location where the operating instruments are placed can be in the vicinity of the lifting device, such as for instance on a wing of a wheel or caterpillar track.

According to yet another embodiment, a control unit connected to the bus system is provided for controlling the energy source for the purpose of moving the mobile apparatus, such as for instance a diesel engine, a petrol engine, a gas motor, an electric motor, a battery pack or other type of motor or energy source in the rotatable sub-frame or in the main frame.

An embodiment is possible wherein the driver enters commands via a remote control system, wherein these are transferred via an antenna and data transmitter to the bus system for the purpose of controlling the mobile apparatus, and particularly the lifting device or the implement in a lifting device. The antenna or data transmitter can be placed here in the sub-frame or in the main frame.

A further embodiment provides for control of a plurality of energy flows to an implement in the lifting device. A first energy flow can for instance thus control the drive of the implement and another energy flow can control the adjustment of the implement or a part of the operation of the implement. The energy flows can be hydraulic, mechanical, electrical, pneumatic or of other type.

A further embodiment provides for control of a plurality of energy flows to an implement in the lifting device. A first energy flow can thus provide for driving of the implement and another flow for the adjustment of the implement or a part of the operation of the implement. The energy flows can be hydraulic, mechanical, electrical, pneumatic or of other type. An energy flow is for instance a rotating shaft, known as a power takeoff shaft, in the vicinity of the lifting device. The adjustment of the implement can also be realized via a hydraulic coupling.

A further embodiment provides for control of a plurality of energy flows to a lifting device. A first energy flow can thus provide for moving the lifting device up and downward and another flow of energy can provide for the adjustment of the angle of the lifting device, such as for instance adjustment of the angle of a three-point lifting device or the angle of a quick change system on the lifting device of the types as described above.

A further embodiment has sensors coupled to the bus system which provide information about a lifting device or about an implement in the lifting device, or about a trailer being drawn beside a lifting device. In this latter case one or more sensors coupled to the bus system provide information about the state of the drawn trailer to the driver in that a bus signal reaches the operating instruments in the rotating sub-frame. Warnings in respect of implements or drawn trailers are then transferred via the bus signal. Examples of signals are for instance the state of the lights of a trailer or the state of the braking device of a trailer.

A further embodiment makes it possible to use sensors in the sub-frame as input in combination with sensors in the main frame. The signals can be transmitted via the bus system to a computing unit connected to warning means so that warnings or modifications in the control of the mobile apparatus can be communicated to a driver. An example is an input for the rotation angle of the sub-frame, an input for the position of the operating arm on the sub-frame and an input for the position of the lifting device.

A further embodiment makes it possible, via the bus system, to control lighting units such as rear lights and brake lights of a drawn trailer or implement coupled to the main frame, while the energy supply for the lighting comes from another electric source.

A further embodiment has an operating arm on the sub-frame in the form of an articulated arm which can be folded from an articulated position to a position in which the arm functions as a single lifting arm. This short lifting arm can move at a very short distance from a lifting device on the main frame.

A further embodiment makes it possible for a driver to enter a power priority via the operating instruments. Priority can for instance be given to the travel speed or the travel power of the whole mobile apparatus, or to the implement in a lifting device on the main frame, or to an implement on the operating arm. The computing unit is then preferably configured to transmit priority signals to the different components via the bus system.

A further embodiment provides for the transfer of information via the bus system from the fixed computing unit or computer or from an additional computing unit such as for instance a mobile computer, notebook, tablet computer such as an Apple iPad or Samsung Tab, to a control unit of an implement in a lifting device. A salt-spreader on the main frame can thus be controlled for instance via the bus system on the basis of GPS information available in a computer in the sub-frame.

A further embodiment provides for operation of a lifting device via the operating instruments in the sub-frame and via the bus system. The lifting device can thus be pushed downward or moved upward, or even have a floating function. Floating means that an implement in the lifting device can follow the ground during travel of the mobile apparatus. The control unit of the drive of the lifting device is then placed on the main frame or can be placed on the lifting device itself.

The above stated and other advantageous features and objects of the invention will become more apparent, and the invention better understood, on the basis of the following detailed description when read in combination with the accompanying drawings, in which:

Figure 1A illustrates a schematic side view of a first embodiment of a mobile apparatus;
Figure 1B illustrates a schematic side view of a second embodiment of a mobile apparatus;
Figure 1C illustrates a schematic side view of a third embodiment of a mobile apparatus;
Figure 1D illustrates a schematic top view of a fourth embodiment of a mobile apparatus;
Figures 2-14 illustrate block diagrams of respective embodiments of a mobile apparatus according to the invention.

Figure 1A shows a first embodiment of a mobile apparatus with a main frame 2 and a rotatable sub-frame 1 arranged thereon. An operating arm 101 is arranged on sub-frame 1. Provided on the main frame is a lifting device 8, for instance a three-point lifting device. Figure 1B shows a second embodiment of a mobile apparatus with a main frame 2 and a rotatable sub-frame 1 arranged thereon, wherein a slip ring 10 is arranged between sub-frame 1 and main frame 2 for the purpose of throughfeed of a bus system from sub-frame 1 to main frame 2, see also figure 7. Figure 1C shows a third embodiment of a mobile apparatus with a main frame 2 and a rotatable sub-frame 1 arranged thereon, wherein a lifting device 8 with quick change system 30 is provided on main frame 2. Quick change system 30 is connected via rotation points 31, 32 to respectively lifting device 8 and a cylinder (positioning means) 33 for the purpose of positioning quick change system 30. Such a positioning means will allow the quick change system to be placed in a suitable position for coupling to an implement. Operating instruments 12 are further provided on main frame 2. Figure 1D shows a fourth embodiment of a mobile apparatus with a main frame 2 and a rotatable sub-frame 1 arranged thereon, wherein the main frame is provided with a power takeoff shaft 40 which can function as mechanical drive for an implement.

Figure 2 is a schematic representation of rotatable sub-frame 1, main frame 2, the location of the driver on sub-frame 3, the operating instruments on sub-frame 4, a bus system 5 coupled to operating instruments 4, a lifting device on main frame 8, a drive 7, for instance a pump or valve block, of lifting device 8, and a control unit 6 for controlling the drive 7. A part 7' of the drive can optionally be provided in main frame 2. If the drive is a pump or valve block, hydraulic lines will run from sub-frame 1 to main frame 2.

Figure 3 shows a further embodiment in which a drive 17 for an implement 18 on lifting device 8 and a control unit 16 are also provided in the main frame in addition to the components of figure 2. This control unit 16 is likewise coupled to bus system 5 and configured to operate drive 17 in accordance with signals transmitted by operating instruments 4 via bus system 5.

Figure 4 illustrates that components 6, 7 and 16, 17 can also be placed on the main frame. Bus system 5 in this case extends into the main frame.

Figure 5 illustrates that components 6, 7 can be placed on sub-frame 1, while components 16, 17 are arranged on main frame 2.

Figure 6 illustrates that components 16, 17 can be placed on sub-frame 1, while components 6, 7 are arranged on main frame 2.

Figure 7 illustrates an embodiment with a device 10 for transmitting bus signals from the sub-frame to the main frame and from the main frame to the sub-frame. As stated above, this can be a so-called slip ring or a receiving and transmitting unit for wireless signals. This variant is otherwise the same as the variant of figure 5, although the skilled person will appreciate that the mobile apparatus of figure 7 could also be embodied as according to the variant of figure 6 or 7.

Figure 8 illustrates an embodiment in which a driver 11 can enter signals via bus system 5 via additional operating instruments 12 on the main frame.

Figure 9 illustrates an embodiment in which an energy source or motor 14 with a control unit 13 is placed on the sub-frame. Control unit 13 is coupled to bus system 5 and configured to receive signals from operating instruments 4, 12 via the bus system.

Figure 10 illustrates an embodiment in which an energy source or motor 14 with a control unit 13 is placed on the main frame. Control unit 13 is coupled to bus system 5 and configured to receive signals from operating instruments 4, 12 via the bus system.

Figure 11 illustrates an embodiment in which a data transmitter 26 is coupled on the one hand to bus system 5 and on the other to an antenna 27 for the purpose of receiving wireless commands from a remote control 28. These wireless commands are converted by data transmitter 26 into bus signals suitable for controlling control unit 6, 16.

Figure 12 illustrates an embodiment which is similar to that of figure 11 but wherein data transmitter 26 and antenna 27 are arranged on the main frame.

Figure 13 illustrates an embodiment in which the energy supply (the drive) 7, 17 of the implement and/or the lifting device can distribute energy via a plurality of energy flows, such as a first flow (I), a second flow (II) and a third flow (III).

Figure 14 illustrates an embodiment in which sensor modules 23, 24, 25 are placed on the sub-frame and on the main frame. The sensor modules are connected to the bus systems and configured to transmit signals with measurement information via the bus system to control unit 6, 16 and/or to operating instruments 4, and/or to warning means (not shown) on the sub- and/or main frame.

The invention is not limited to the above described embodiments, and the skilled person will appreciate that many modifications can be envisaged within the scope of the invention.

Claims

1. Mobile apparatus comprising a main frame (2), a sub-frame (1) connected rotatably to the main frame and an operating arm connected to the sub-frame, wherein the sub-frame is provided with a seating or standing location for a driver, operating instruments (4) controllable by a driver, and a bus system (5) connected to the operating instruments;
wherein the main frame is provided with a lifting device (8) to which an implement (18) is connectable;
wherein the mobile apparatus further comprises a drive (7, 17) for driving the lifting device and/or the implement, and a control unit (6, 16) connected to the bus system for controlling the drive on the basis of signals from the bus system;
this such that the lifting device and/or the implement are controllable via the bus system using the operating instruments in the sub-frame.

2. Mobile apparatus as claimed in claim 1, **characterized in that** the bus system is a vehicle bus system configured to communicate by means of a Controller Area Network (CAN) protocol.

3. Mobile apparatus as claimed in claim 1 or 2, **characterized in that** the control unit (6, 16) is provided in the sub-frame.

4. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the drive (7, 17) is provided at least partially in the sub-frame.

5. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the drive (7, 17) comprises a pump and/or a valve block and/or an electric motor and/or and electric actuator.

6. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the bus system (5) runs from the sub-frame to the main frame.

7. Mobile apparatus as claimed in claim 6, **characterized in that** a slip ring (10) configured to transfer signals from the bus system (5) between the sub-frame (1) and the main frame (2) is provided between the main frame and the sub-frame.

8. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the control unit (6, 16) is provided in the main frame and/or that the drive (7, 17) is provided in the main frame.

9. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the sub-frame is provided with a transmitting/receiving device for wireless transfer between the sub-frame (1) and the main frame (2) of signals from the bus system (5).

10. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** additional operating instruments (12) for the lifting device and/or for the implement are provided on the main frame (2).

11. Mobile apparatus as claimed in claim 10, **characterized in that** the additional operating instruments (12) for the lifting device and/or the implement are placed on a wing of a wheel or a caterpillar track or the main frame (2).

12. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** an energy source or motor (14) for displacing the mobile apparatus and a control unit (13) therefor is arranged in the sub-frame (1) or in the main frame (2) and that said control unit is connected to the bus system (5).

13. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the drive comprises at least one line for generating at least one hydraulic or electrical flow to the implement and/or to the lifting device.

14. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the drive of the implement comprises a rotating power takeoff shaft.

15. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the sub-frame is mounted on the main frame such that the rotation angle of the sub-frame (1) relative to the main frame (2) is 360 degrees or more, or that the rotation angle lies between 30 and 360 degrees.

16. Mobile apparatus as claimed in any of the foregoing claims with a front side and a rear side related to a travel direction of the mobile apparatus, **characterized in that** the lifting device is provided on the front side or on the rear side of the main frame (2).

17. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the lifting device is of the three-point lifting device type.

18. Mobile apparatus as claimed in any of the foregoing claims, further comprising a trailer with lighting means connected to the main frame, **characterized in that** a control unit (25) for controlling the lighting means is provided, the control unit being connected to the bus system (5).

19. Mobile apparatus as claimed in any of the foregoing claims, further comprising a receiving module connected to the bus system and having an antenna configured to receive wireless signals and to convert said signals to bus signals, this such that the lifting device and/or the implement can be operated wirelessly, for instance using a remote control.

20. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the lifting device is provided with a quick change system to which the implement is connectable.

21. Mobile apparatus as claimed in claim 20, **characterized in that** the quick change system is adjustable using positioning means, and that a quick change control unit connected to the bus system is provided which is configured to control the positioning means on the basis of signals from the bus system.

22. Mobile apparatus as claimed in claim 5 and 20 or 21, **characterized in that** the quick change control unit is provided on the main frame and connected there to the bus system.

23. Mobile apparatus as claimed in any of the foregoing claims, further comprising at least one sensor module (24) configured to measure the movements and/or the functioning of the lifting device and/or implement, which at least one sensor module is coupled to the bus system and configured to transmit signals with measurement values over the bus system.

24. Mobile apparatus as claimed in any of the foregoing claims, further comprising at least one sensor module (24) configured to measure the functioning of the lighting and/or brakes of the

mobile apparatus or of a trailer, which at least one sensor module is coupled to the bus system and configured to transmit signals with measurement values over the bus system.

25. Mobile apparatus as claimed in claim 23 or 24, **characterized in that** the at least one sensor module is provided on the main frame and connected there to the bus system.

26. Mobile apparatus as claimed in claim 23 or 24 or 25, further comprising warning means coupled to the bus system, the warning means being configured to warn a driver on the basis of the signals with measurement values from the at least one sensor module.

27. Mobile apparatus as claimed in any of the claims 23-26, **characterized in that** the control unit is configured to receive the signals with measurement values from the at least one sensor module and to control the drive of the lifting device and/or the implement partially on the basis thereof.

28. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the drive comprises drive means for the implement, for an additional implement on the operating arm and for the travel of the mobile apparatus, wherein the operating instruments are configured to transmit priority data relating to the power supplied to the implement, the additional implement on the operating arm and the travel of the mobile apparatus via the bus system to the control unit, wherein the control unit is configured to control the energy flows to the drive means for the implement, for an additional implement on the operating arm and for the travel of the mobile apparatus on the basis of the priority data.

29. Mobile apparatus as claimed in any of the foregoing claims, further comprising computer means with programming code connected to the bus system for controlling the control unit over the bus system and/or for controlling an additional control unit of a trailer coupled to the main frame (2).

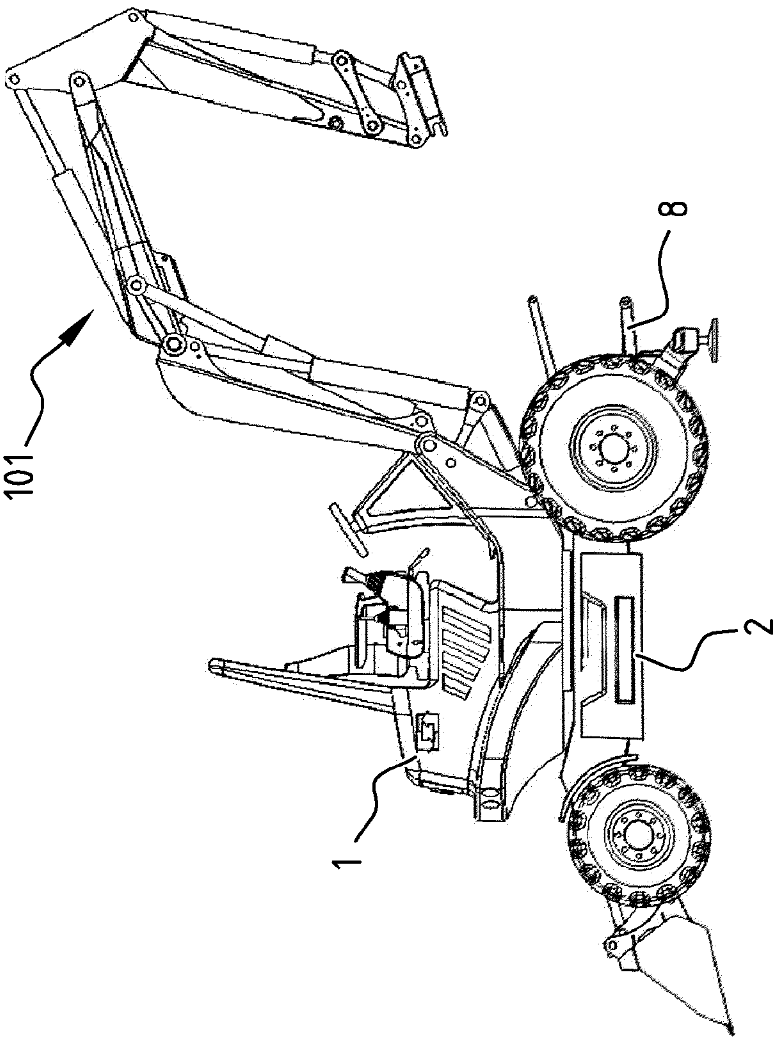

FIG. 1A

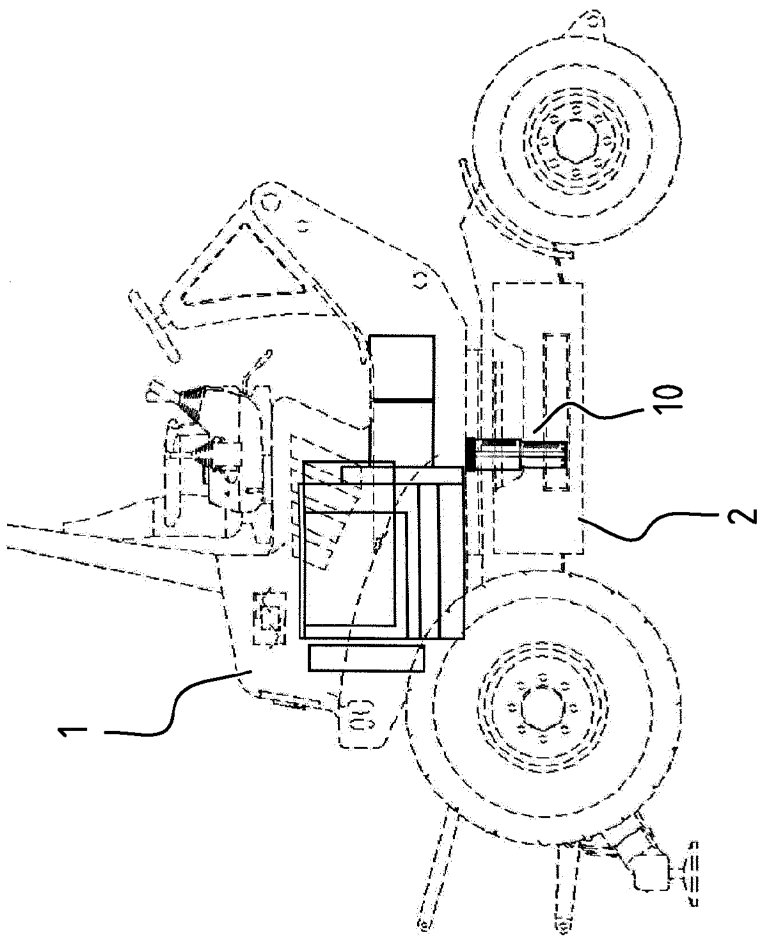

FIG. 1B

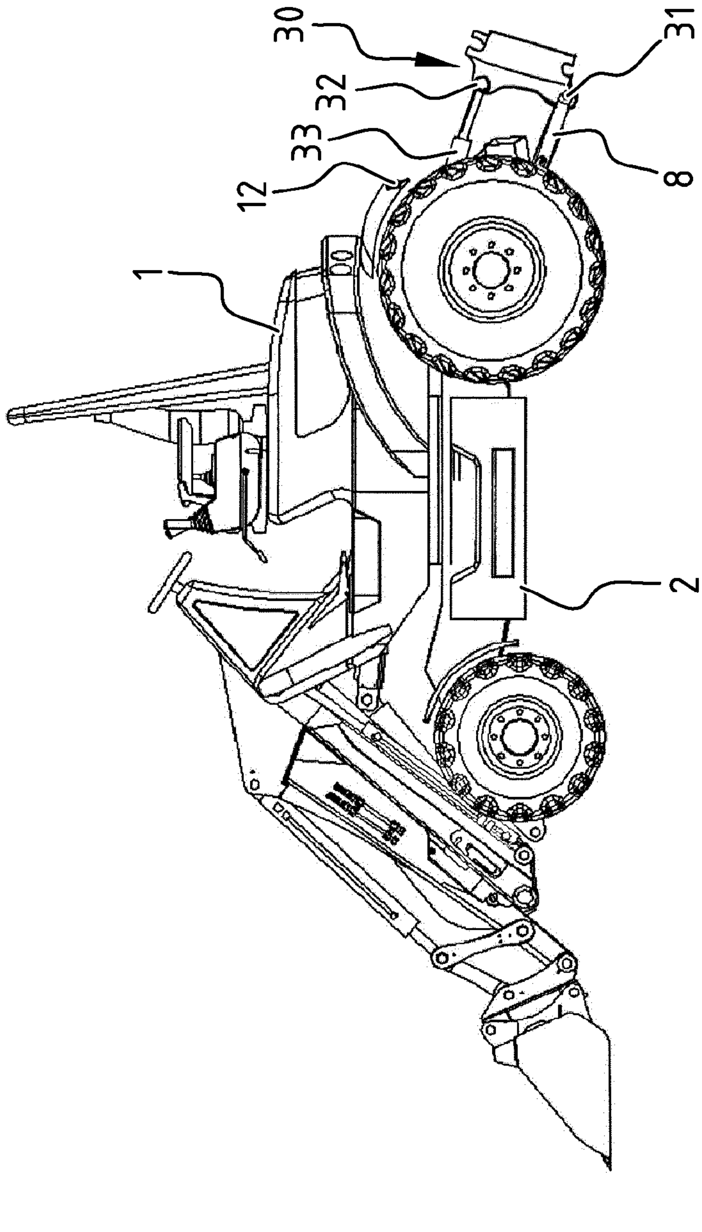

FIG. 1C

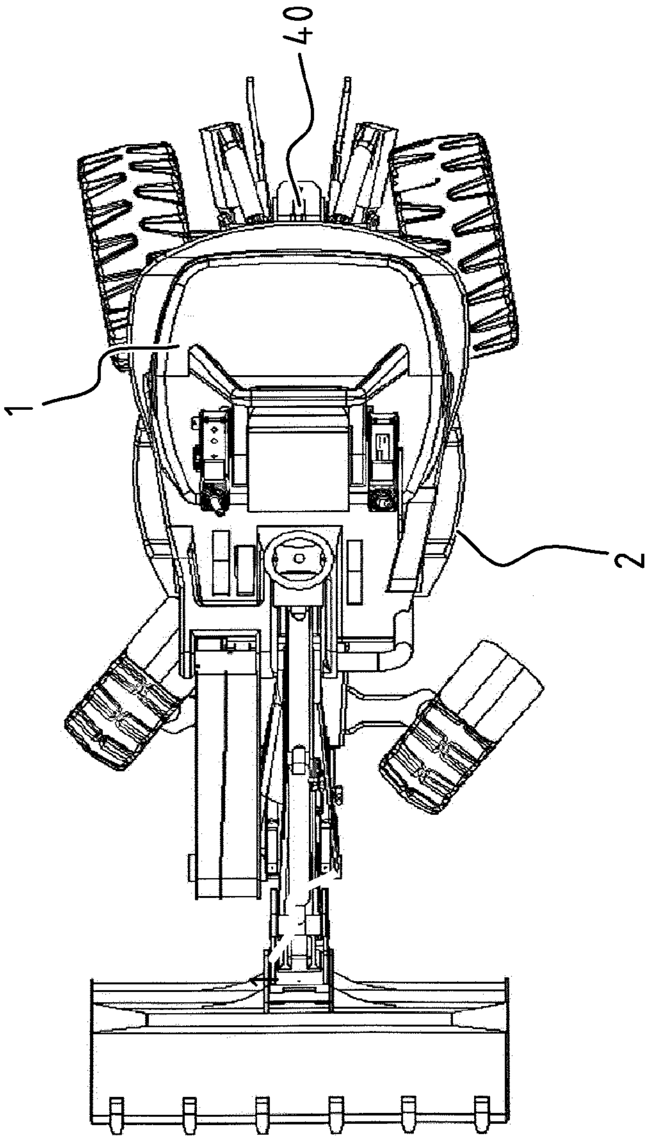

FIG. 1D

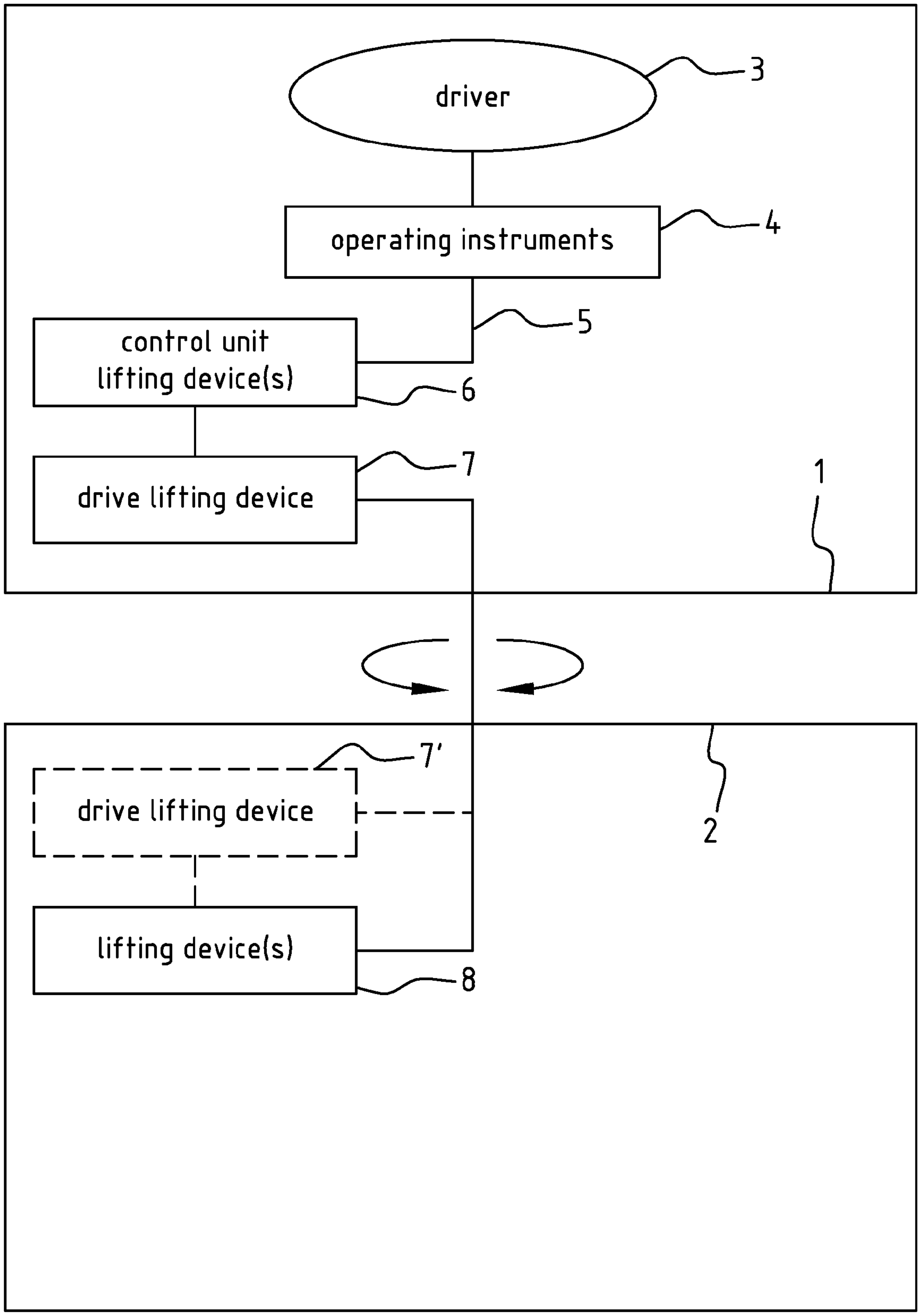
driver
3
operating instruments
4
5
control unit
lifting device(s)
6
drive lifting device
7
1
7'
drive lifting device
2
lifting device(s)
8

FIG. 2

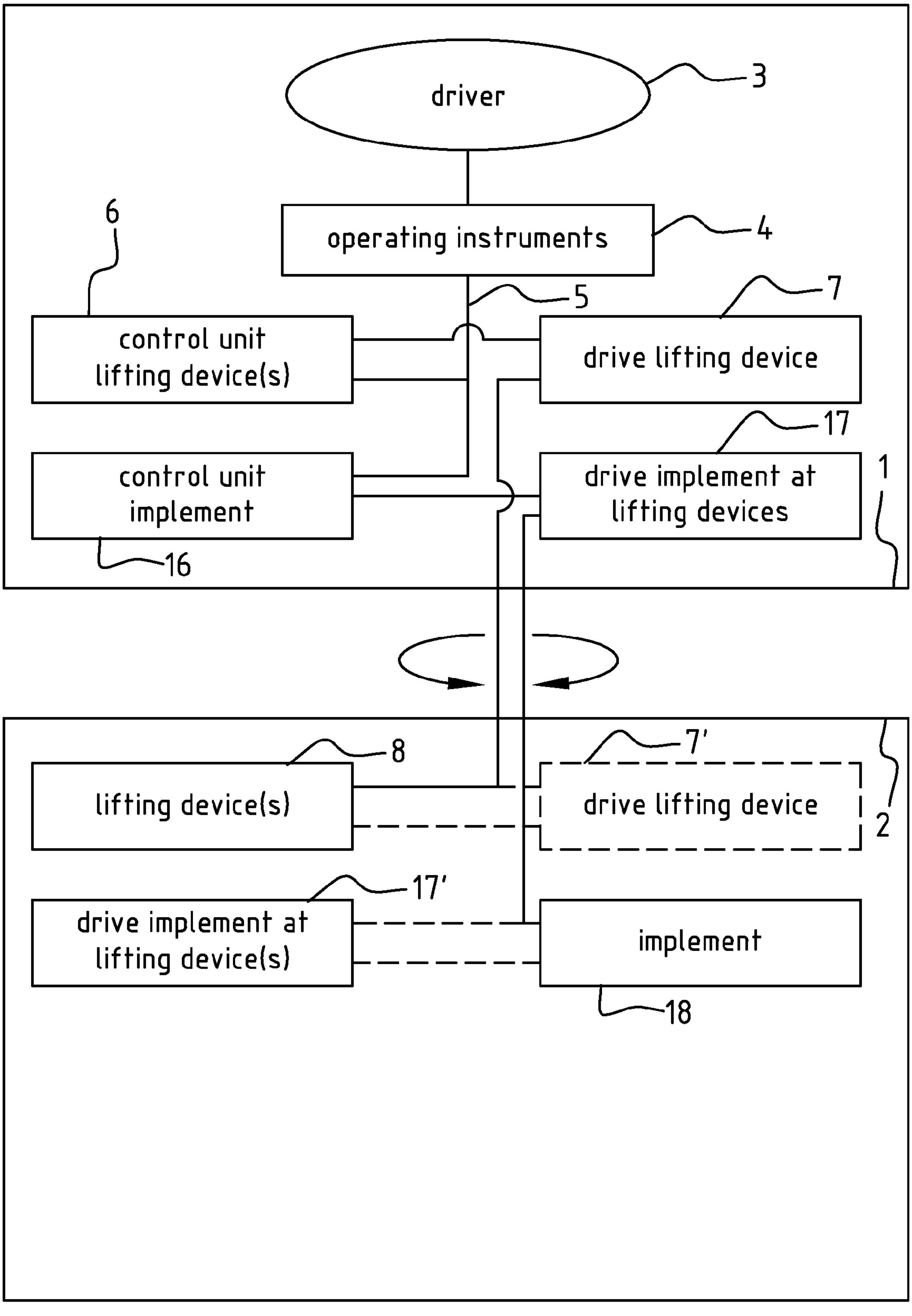
driver
3
operating instruments
4
6
5
7
control unit
lifting device(s)
drive lifting device
17
control unit
implement
drive implement at
lifting devices
1
16
8
7'
lifting device(s)
drive lifting device
2
17'
drive implement at
lifting device(s)
implement
18

FIG. 3

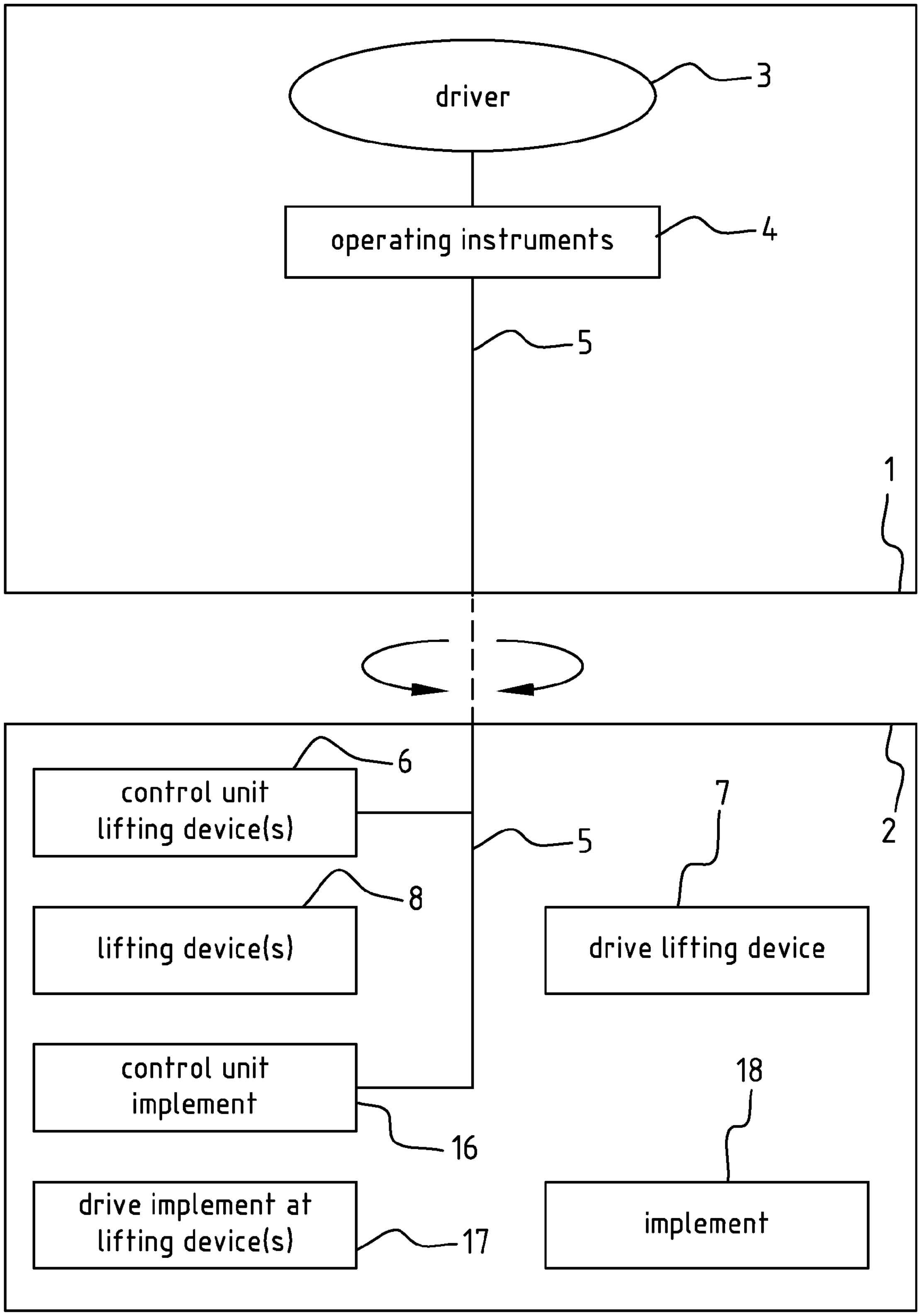
driver
3
operating instruments
4
5
1
control unit
lifting device(s)
6
5
2
7
lifting device(s)
8
drive lifting device
control unit
implement
18
16
drive implement at
lifting device(s)
17
implement

FIG. 4

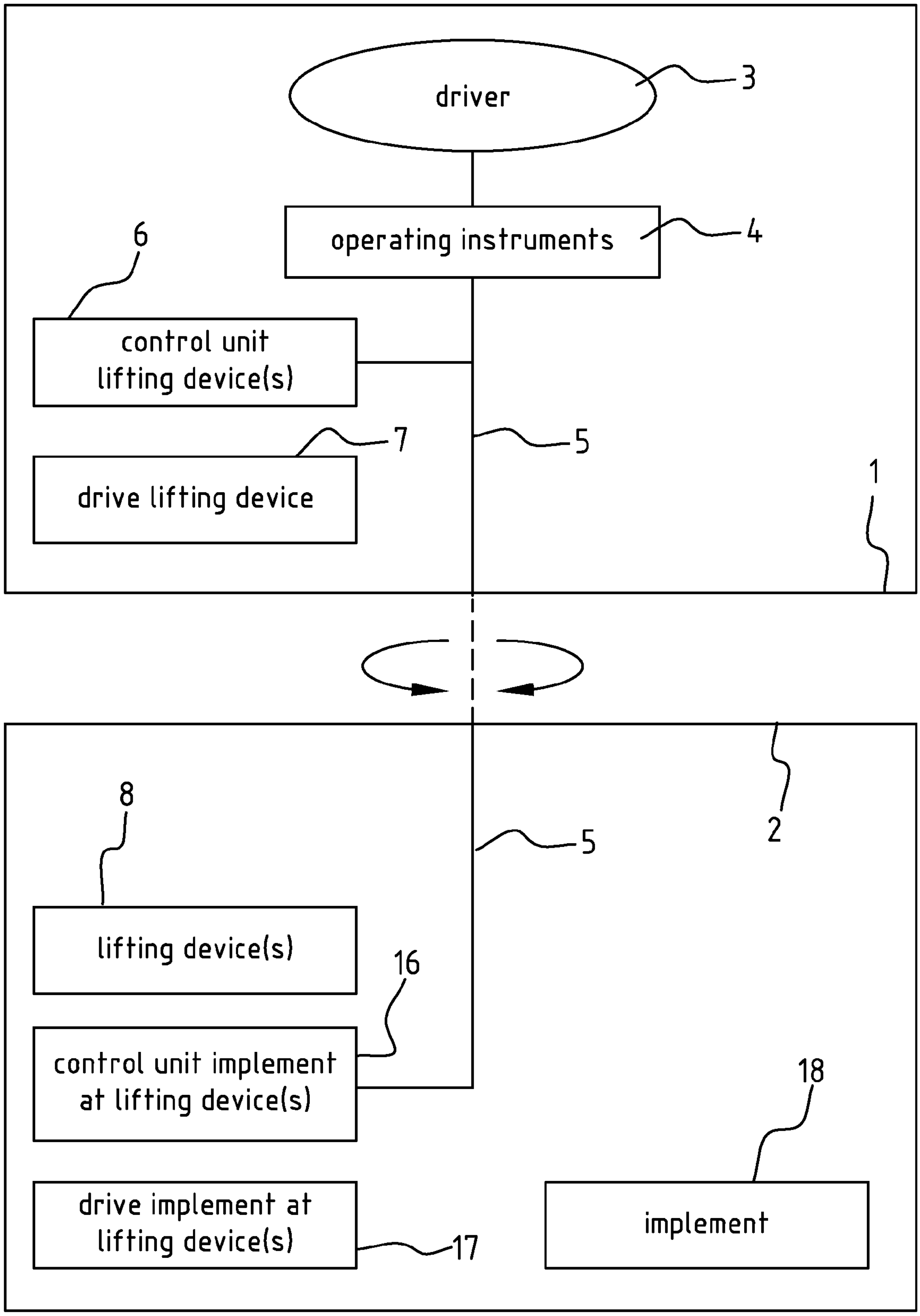
driver
3
operating instruments
4
6
control unit
lifting device(s)
7
5
drive lifting device
1
2
8
5
lifting device(s)
16
control unit implement
at lifting device(s)
18
drive implement at
lifting device(s)
17
implement

FIG. 5

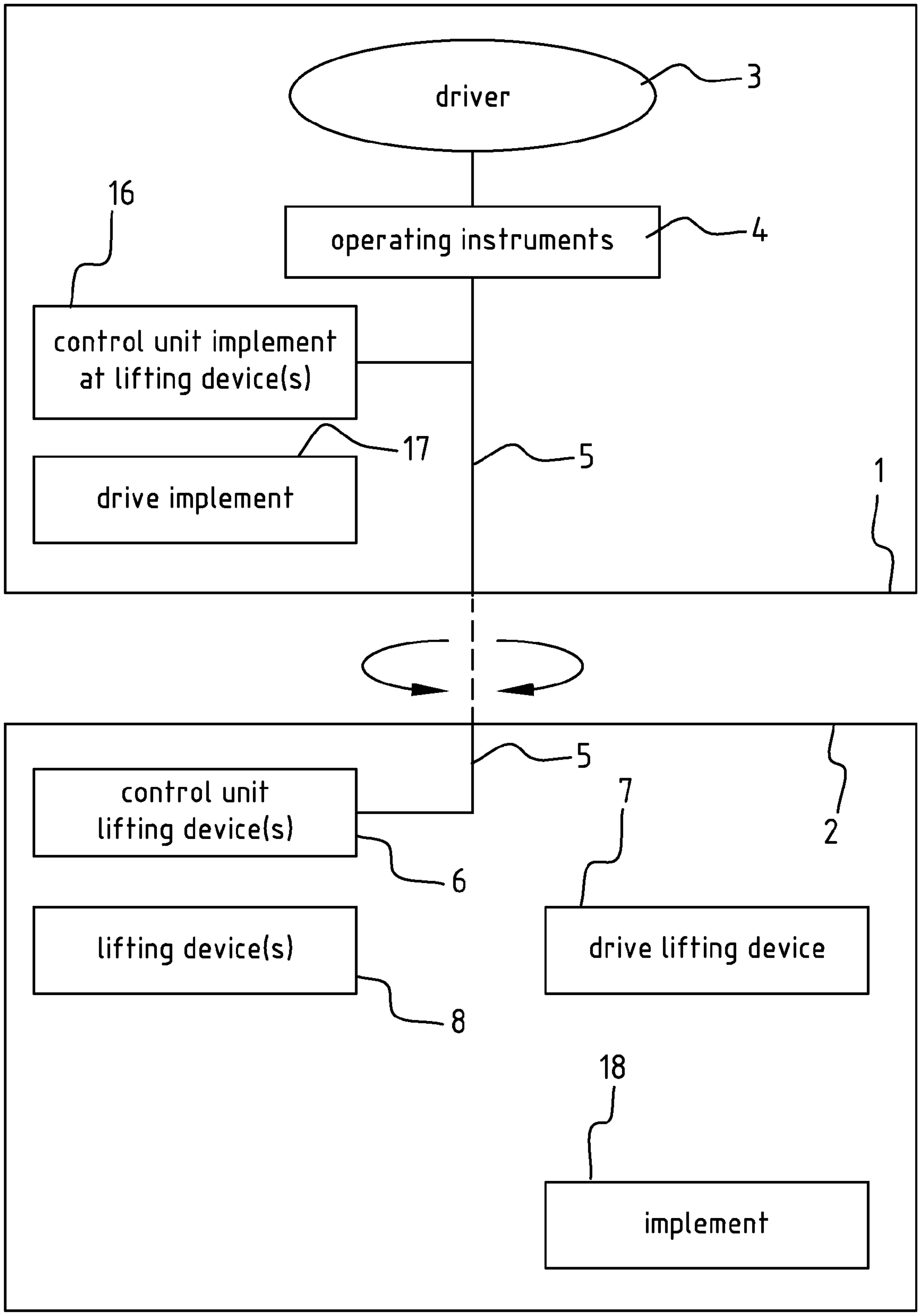
driver
3
16
operating instruments
4
control unit implement
at lifting device(s)
17
5
drive implement
1
5
control unit
lifting device(s)
7
2
6
lifting device(s)
drive lifting device
8
18
implement

FIG. 6

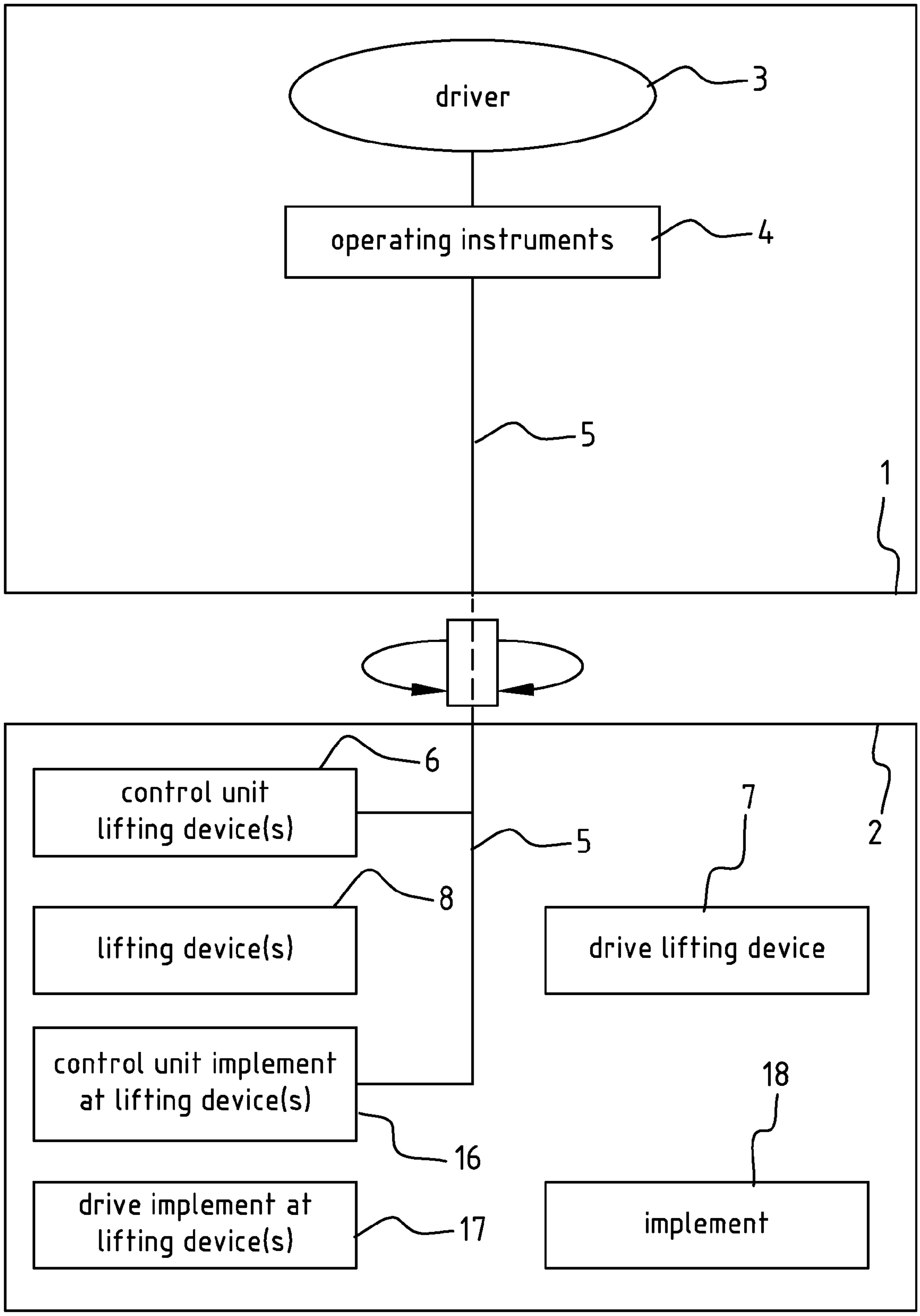
driver
3
operating instruments
4
5
1
6
control unit
lifting device(s)
5
7
2
8
lifting device(s)
drive lifting device
control unit implement
at lifting device(s)
18
16
drive implement at
lifting device(s)
17
implement

FIG. 7

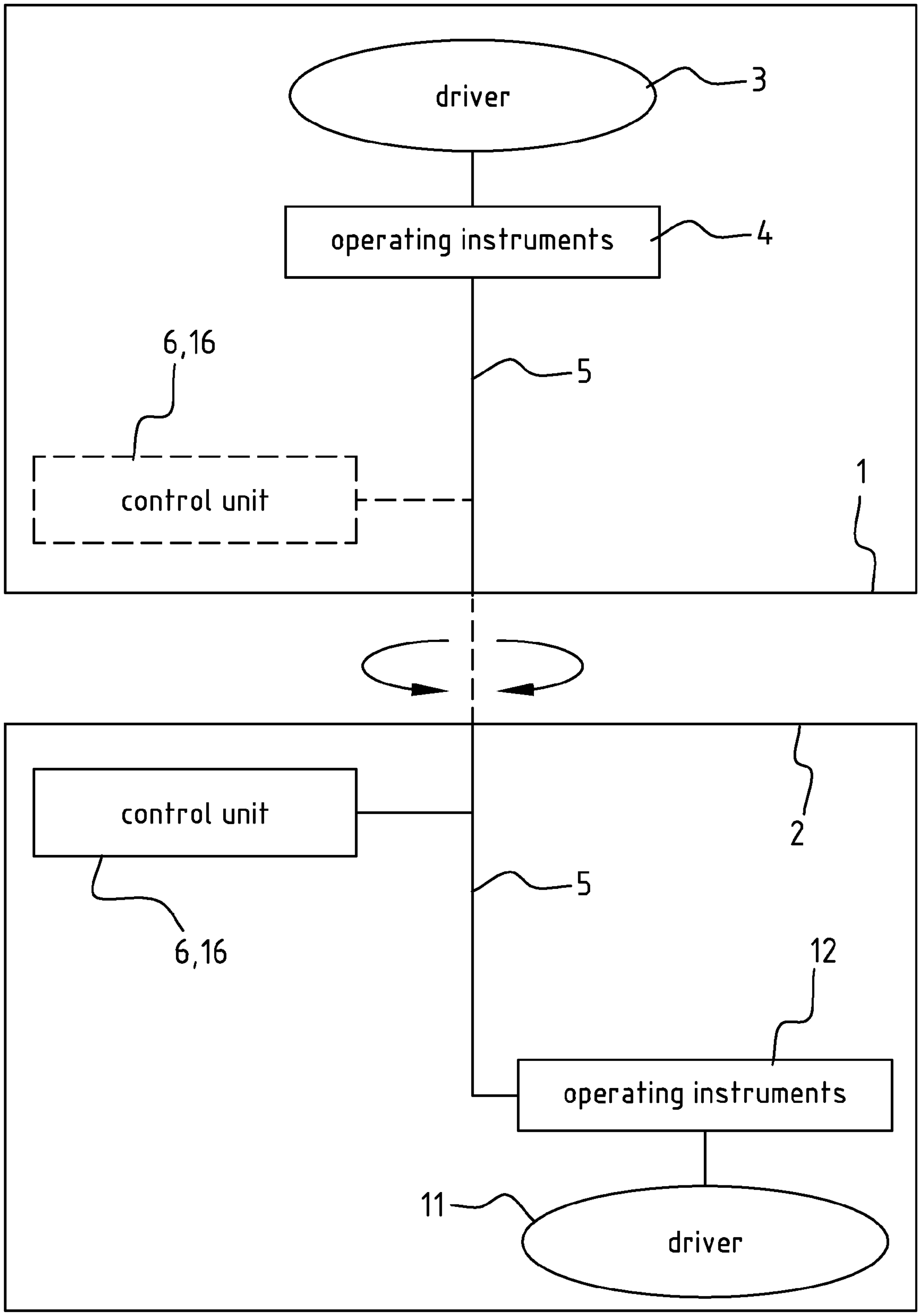
driver
3
operating instruments
4
6,16
5
control unit
1
control unit
2
5
6,16
12
operating instruments
11
driver

FIG. 8

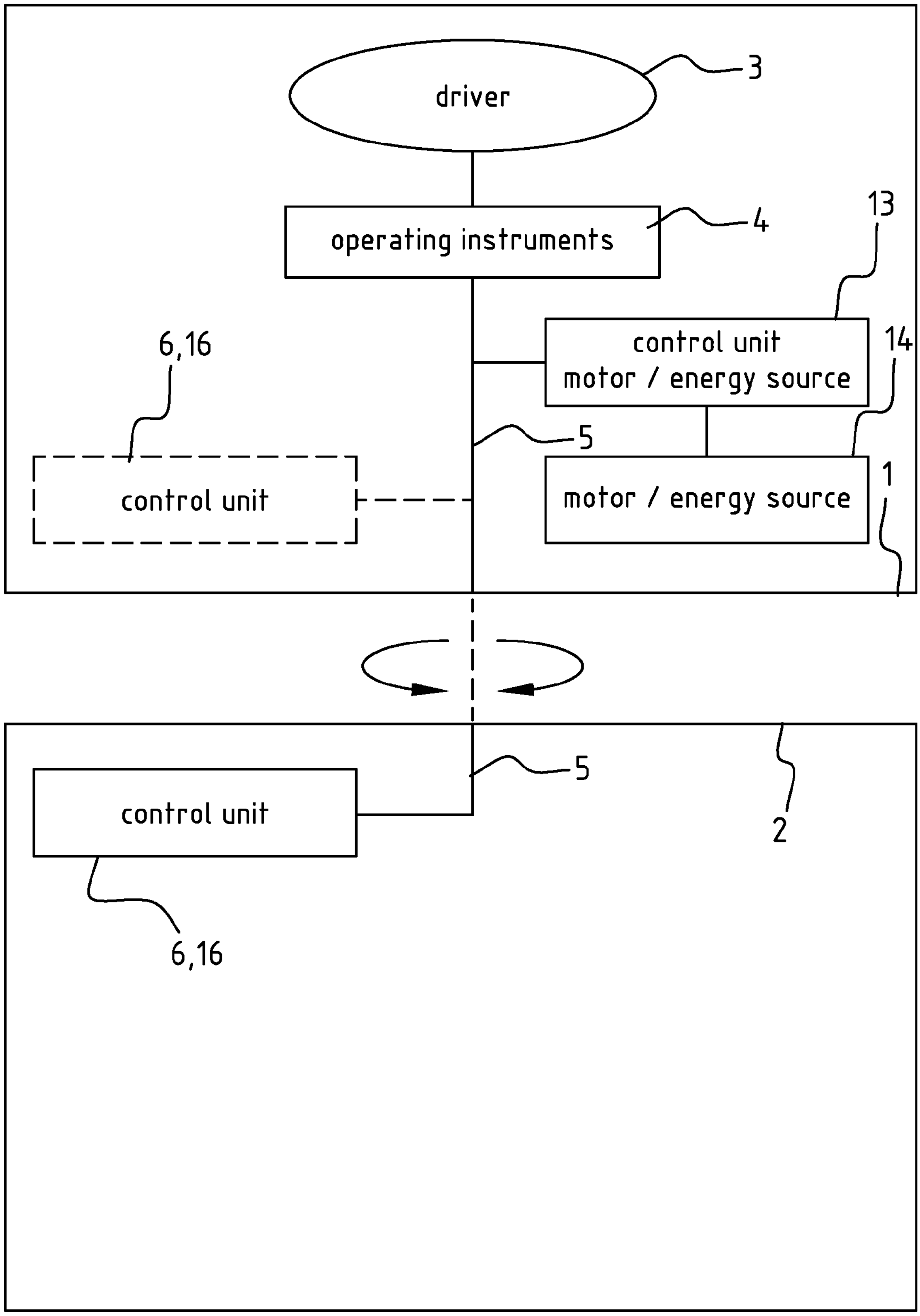
driver
3
operating instruments
4
13
control unit
motor / energy source
14
6,16
5
control unit
motor / energy source
1
5
control unit
2
6,16

FIG. 9

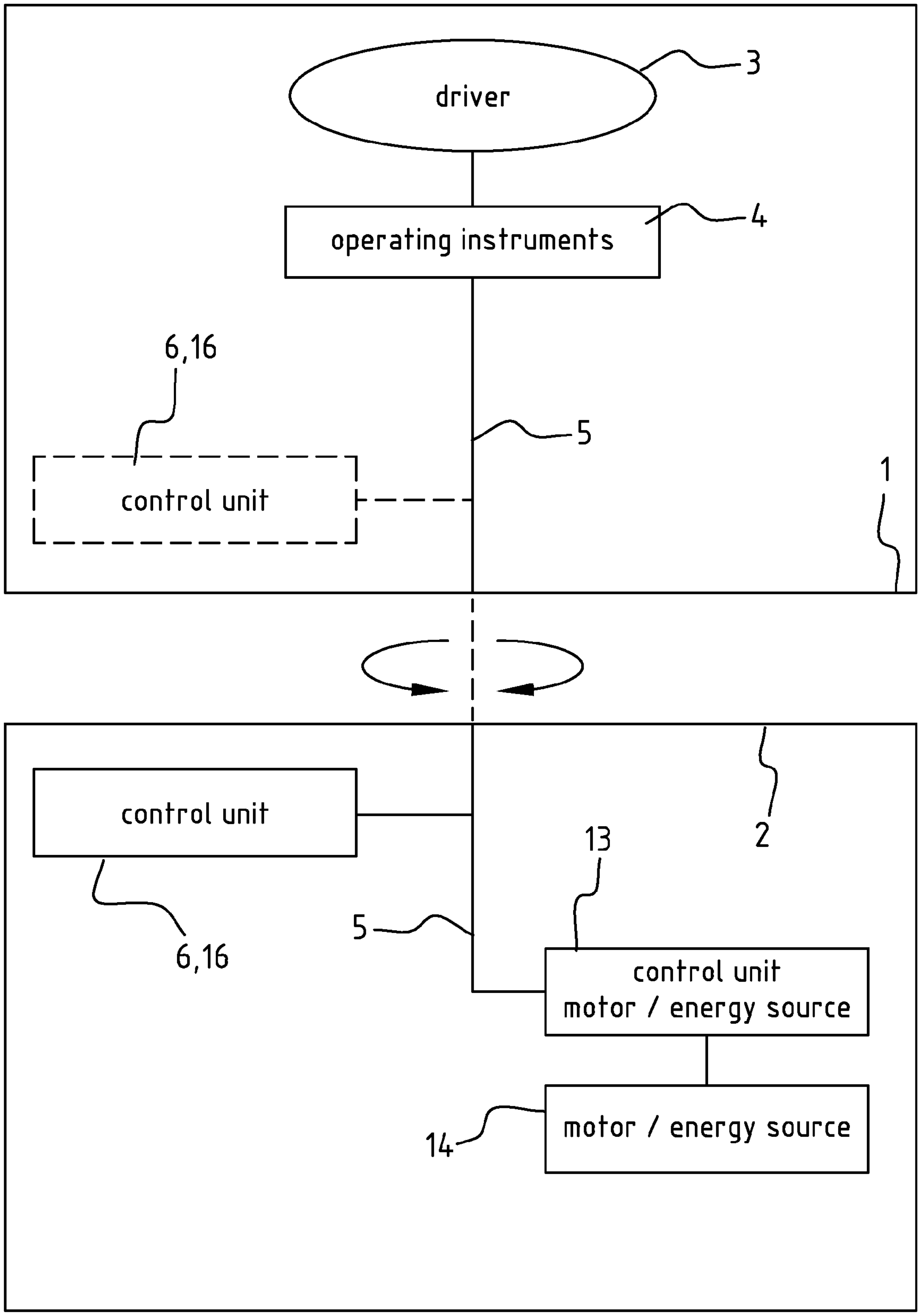
driver
3
operating instruments
4
6,16
5
control unit
1
control unit
2
13
5
6,16
control unit
motor / energy source
14
motor / energy source

FIG. 10

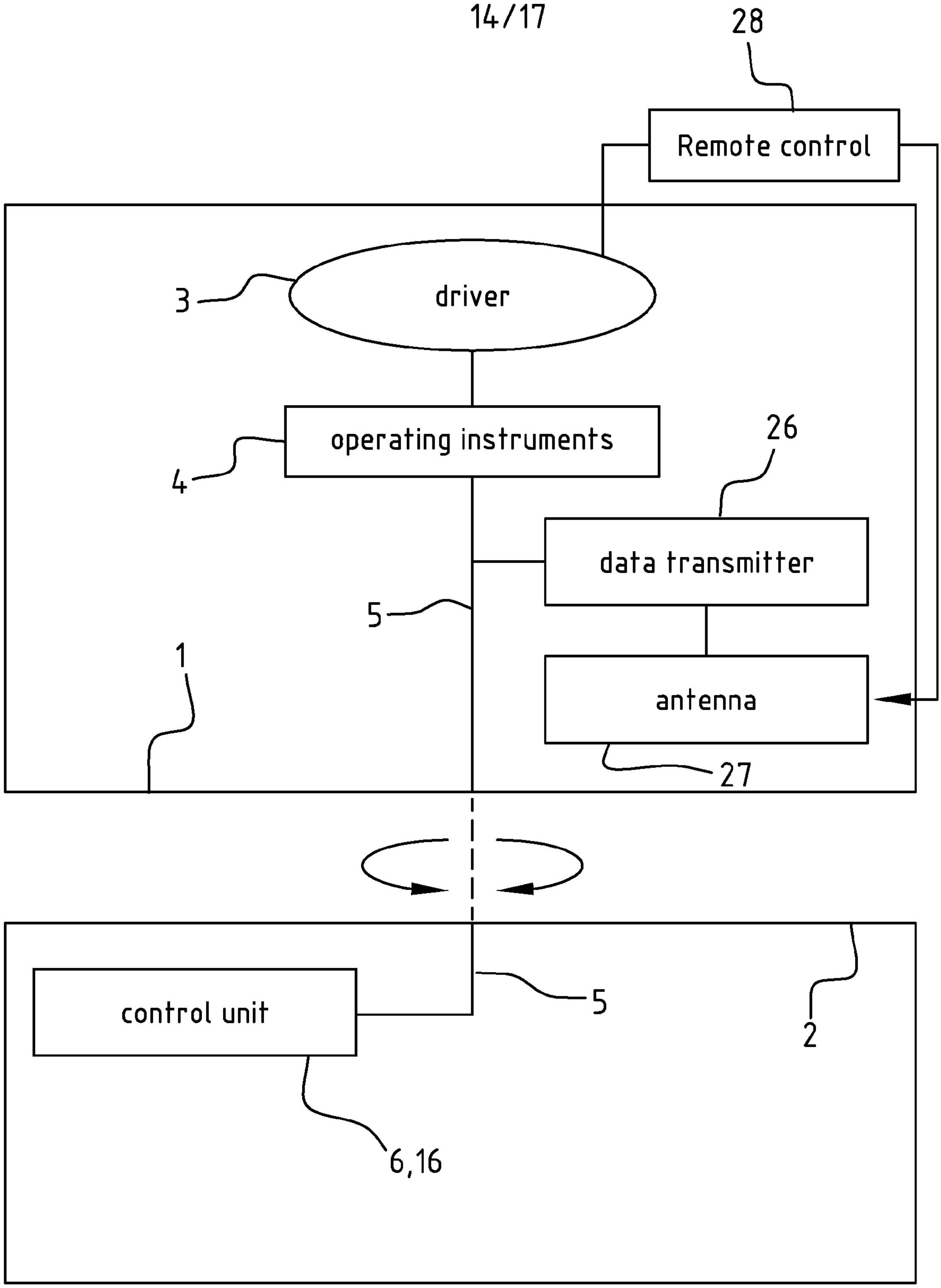
28
Remote control
3
driver
4
operating instruments
26
data transmitter
5
1
antenna
27
control unit
5
2
6,16

FIG. 11

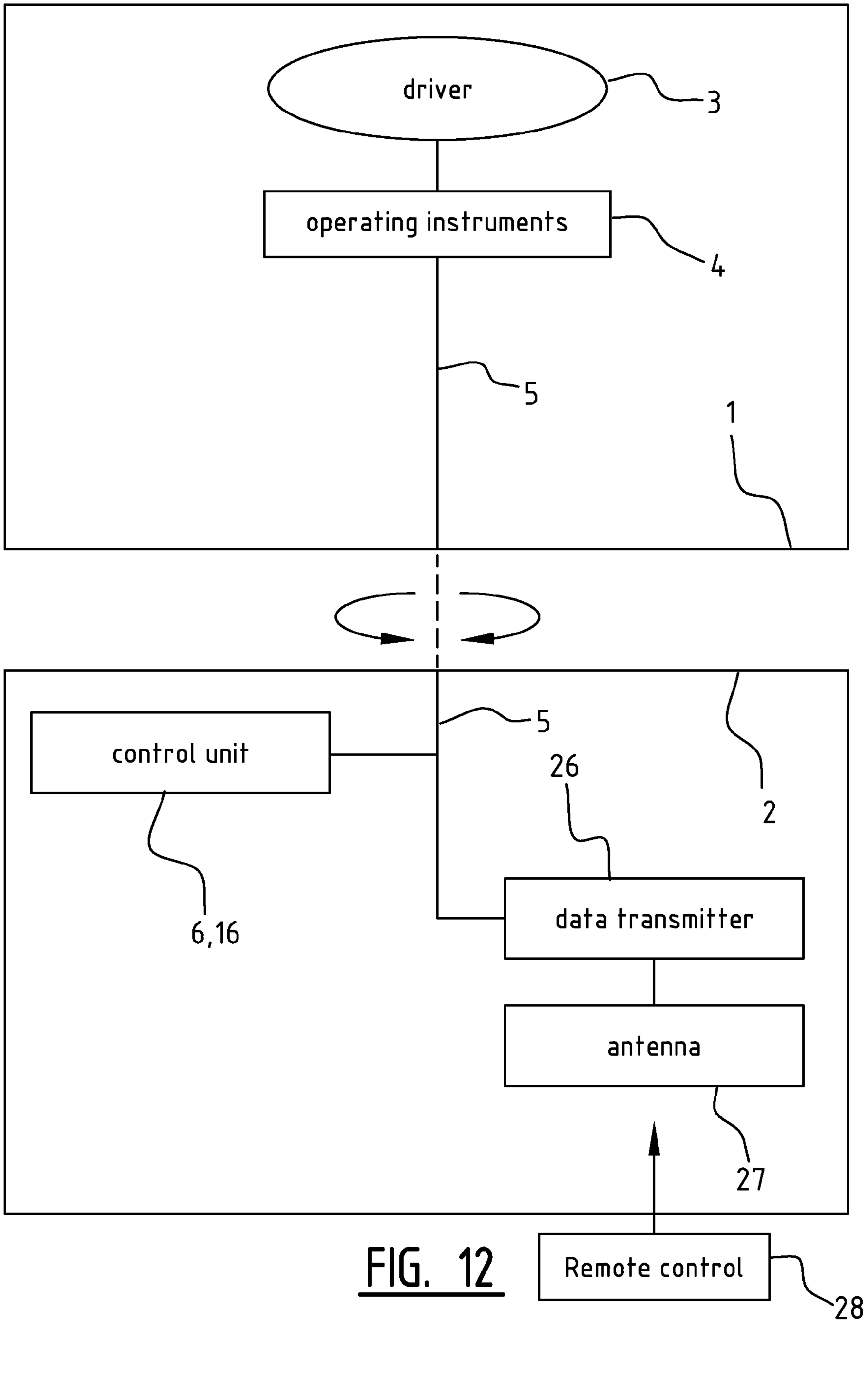
driver
3
operating instruments
4
5
1
5
control unit
26
2
6,16
data transmitter
antenna
27
Remote control
28

FIG. 12

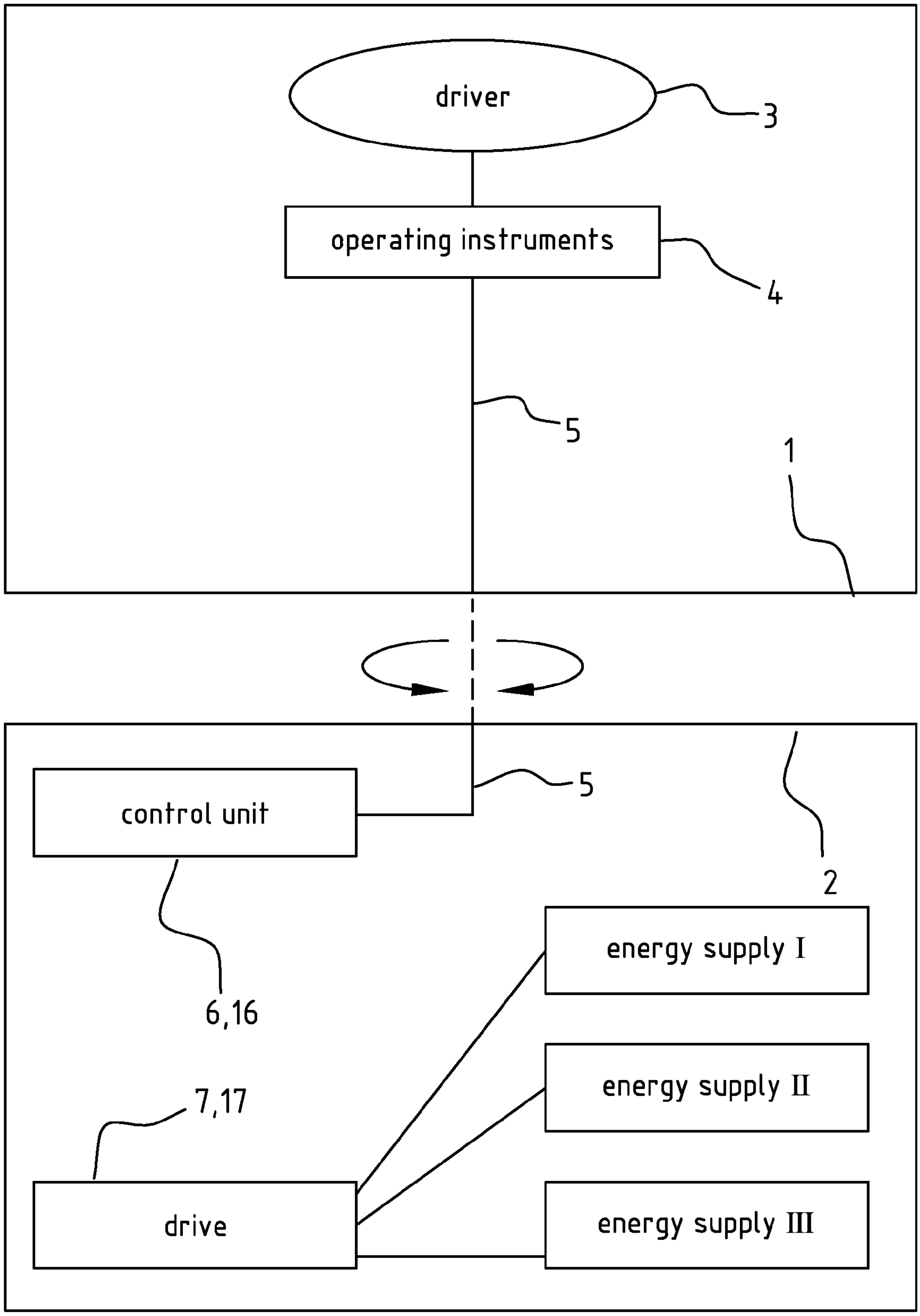
driver
3
operating instruments
4
5
1
5
control unit
2
6,16
energy supply I
7,17
energy supply II
drive
energy supply III

FIG. 13

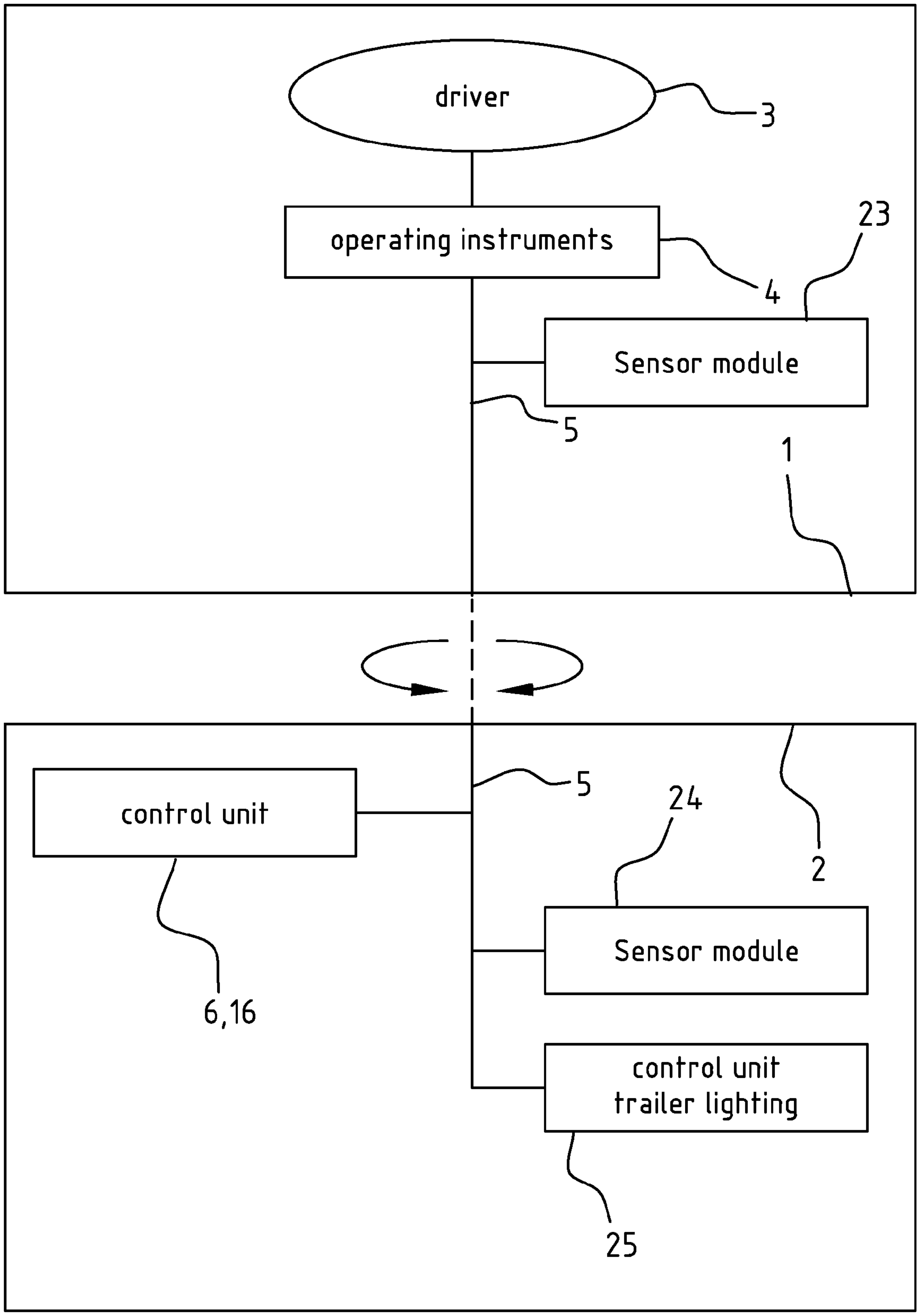
driver
3
operating instruments
4
23
Sensor module
5
1
control unit
5
24
2
Sensor module
6,16
control unit
trailer lighting
25

FIG. 14