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(54) **BUILDING SITE MACHINE**

(57) A building site machine (1), comprising a tracked power chassis (2) moved by means of a combustion engine (12).

The combustion engine (12) is connected, by means of a clutch assembly (13), to a removable enclosure (14) for containing an electric motor (112).

The enclosure (14) further supports a hydraulic pump assembly (24).

The power chassis (2) is provided with a container (25) for at least one removable battery pack (18).

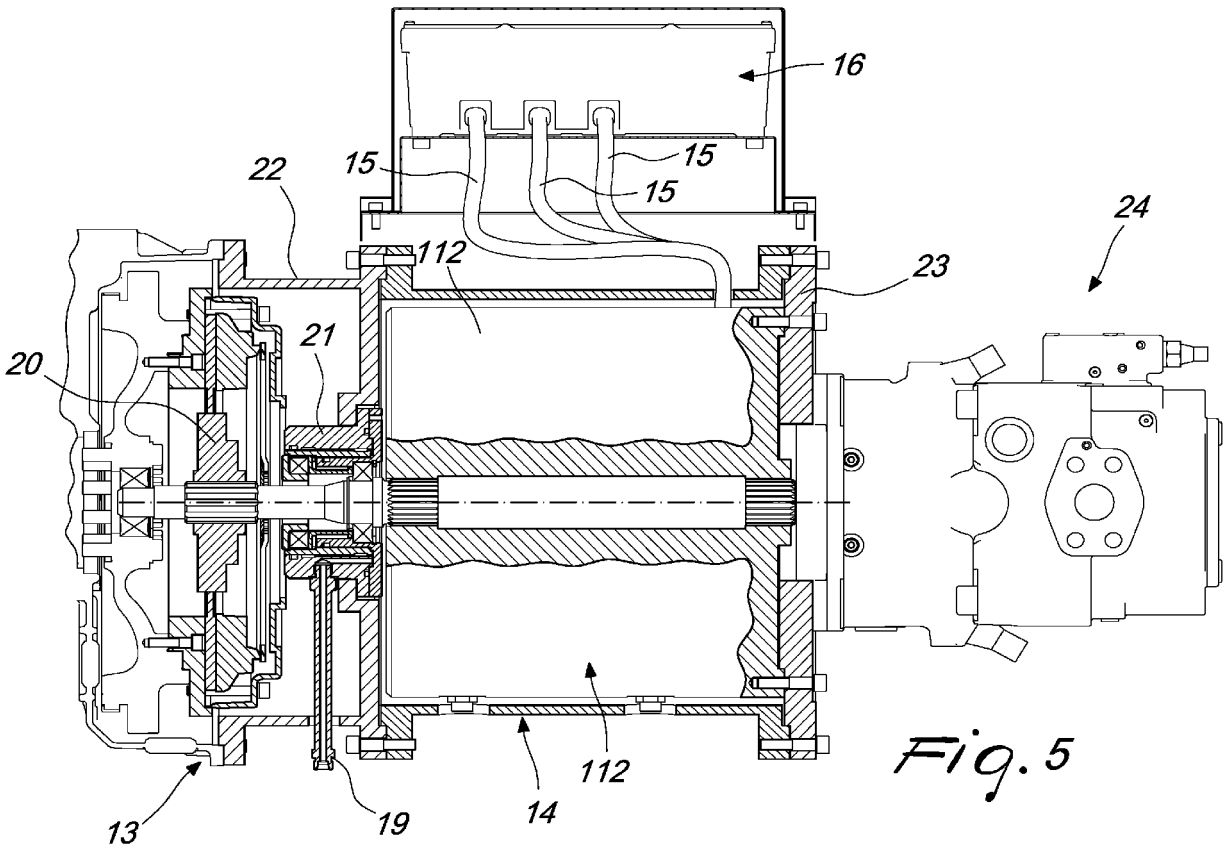

Fig. 5

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Description

[0001] The present application relates to a building site machine.

[0002] Nowadays building site machines are known which are substantially constituted by a tracked power chassis which is moved by means of a combustion engine located at its rear.

[0003] One example of a building site machine is a boring machine, to which at least one drill rod or boom is articulated in front of the power chassis and has at one end a tool, such as for example an auger, which is adapted to perforate the terrain.

[0004] Such machines comprise a hydraulic system that can absorb at least double the available power supplied by the combustion engine, thus necessitating an electronic system to continuously manage the absorption of power so as to not exceed the available power.

[0005] In such conventional machines, the use of a combustion engine entails the consumption of a considerable quantity of fuel and, as a consequence, the emission of a considerable quantity of CO_2 into the atmosphere.

[0006] Furthermore, the use of such machines can be restricted in particular residential zones, where operations have to be suspended in order not to disturb people who live near the building site where the machine operates.

[0007] The aim of the present invention is therefore to solve the above mentioned technical problems, eliminating the drawbacks in the cited known art and hence devising a building site machine that makes it possible to contain fuel consumption and reduce harmful emissions into the atmosphere.

[0008] Within this aim, an object of the invention is to provide a building site machine that can be used at any time of the day or night without disturbing people.

[0009] Another object of the invention is to obtain a building site machine that is structurally simple, that can be provided rapidly and simply, that can be made at low cost and that can be provided using the usual conventional machines and plants.

[0010] This aim and these and other objects which will become better apparent hereinafter are achieved by a building site machine, comprising a tracked power chassis moved by means of a combustion engine, characterized in that said combustion engine is connected, by means of a clutch assembly, to a removable enclosure for containing an electric motor and for supporting a hydraulic pump assembly, said power chassis being provided with a container for at least one removable battery pack.

[0011] Further characteristics and advantages of the invention will become better apparent from the detailed description of a particular but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a side view of the machine in a version adapted for boring, according to the present invention;

Figure 2 is a side view of the tracked power chassis showing the positioning of the combustion engine, of the clutch assembly, of the enclosure for the electric motor and the hydraulic pump assembly;

Figure 3 is a first perspective view of the electric motor assembly with the inverter;

Figure 4 is a second perspective view of the electric motor assembly with the inverter;

Figure 5 is a cross-sectional view of the clutch assembly associated with the enclosure containing the electric motor and the hydraulic pump assembly;

Figure 6 is a similar view to the previous one in which the electric motor has been substituted by a shaft that connects the clutch assembly to the hydraulic pump assembly;

Figure 7 is a side view of the container for a removable battery pack;

Figure 8 is a view from above of the removable battery pack.

[0012] In the exemplary embodiments that follow, individual characteristics, given in relation to specific examples, may actually be interchanged with other, different characteristics that exist in other exemplary embodiments.

[0013] With reference to the figures, the reference numeral 1 generally designates a building site machine, for example a boring machine, a crane, a concrete pumping machine.

[0014] Solely by way of example a boring machine is illustrated, of the type comprising a tracked power chassis 2, in front of which is articulated, by means of adapted and conventional devices that use struts 4, at least one boom 3 provided with adapted transmission pulleys 5 for cables 6 which are connected to a rotating head 7 associated with a drill rod 8 with one end of which a tool can in turn be associated, such as for example an auger 9, adapted to perforate the terrain 10.

[0015] At the rear of the tracked power chassis 2 there is a body 11 which accommodates a combustion engine 12, for example a diesel engine.

[0016] The combustion engine 12 is connected at the rear, by means of a clutch assembly 13, to an enclosure 14, shaped substantially like a parallelepiped and internally hollow and removable, for containing an electric motor 112 which is connected, by means of first cables 15, to an adapted inverter 16 and, by means of adapted second cables which are accommodated in protected conduits 17, to at least one removable battery pack 18.

[0017] The clutch assembly 13 comprises the usual mechanisms, such as the hydraulic actuation system 19, the clutch disc 20, the thrust bearing cylinder 21 for actuating the clutch by means of the hydraulic actuation system 19, the flywheel housing 22.

[0018] The enclosure 14 is advantageously connect-

ed, at the front end, to the flywheel housing 22 and, at the rear, to a coupling flange 23 for a hydraulic pump assembly 24 or for a device for coupling to hydraulic pumps.

[0019] This solution makes it possible to use an electric motor 112 that does not have load-bearing capacity (since it would be very difficult to obtain and would be expensive).

[0020] The power chassis 2 furthermore has, above the body 11, a container 25 provided with a cover 26 and adapted to accommodate inside it at least one removable battery pack 18.

[0021] Adapted dividers 29 are mounted on the cover 26 or on the container 25 and generate a path 30 for the conditioning air which is obtained by means of a conditioning unit 31 and a fan 32, which are arranged in the container 25.

[0022] The machine comprises conventional electronic systems that are adapted to take account of the availability of power both from the combustion engine 12 (for example a diesel engine), and from the electric motor 112 and from the state of charging of the battery.

[0023] For this reason there is a software program in the machine which will need to communicate (over a CANBUS) both with the controller/inverter and with the BMS (Battery Management System) of the battery.

[0024] The machine therefore comprises in general a control system that has to manage the control unit present in the combustion engine 12, the clutch between the combustion engine 12 and the electric motor 112, the electric motor 112 with inverter, and the battery assembly.

[0025] This solution furthermore makes it possible to remove the electric motor 112 (in the event of breakage and/or for maintenance) without stopping the machine: in place of the electric motor 112, a simple connecting shaft 27 is installed between the pinion 28a of the clutch assembly 13 and the pinion 28b of the hydraulic pump assembly 24, which are arranged in mutual axial alignment as shown in Figure 6.

[0026] Thus it has been found that the invention has fully achieved the intended aim and objects, a machine having been obtained that, although comprising a combustion engine, can be used:

- only with the combustion engine and with the electric motor being entrained idle;
- with the combustion engine and the electric motor: the electric motor provides torque (current to the stator) only when it is needed;
- the combustion engine charges the battery by means of the electric motor/generator; during the periods of use in which the only power comes from the combustion engine, the battery is charged using the electric motor as a generator;
- operation only with the electric motor; the clutch assembly is opened and the electric motor will be controlled independently, and the combustion engine can be switched off;
- operation only in electric mode with supplementary batteries that can be recharged by an external source; when the battery of the hybrid unit (which has for example two meters) is disengaged, a similar supplementary battery unit is engaged; the clutch remains constantly disengaged and the combustion engine remains constantly switched off.

[0027] The machine thus makes it possible to contain consumption and reduce harmful emissions into the atmosphere, including CO_2, given that the combination of the combustion engine with the electric motor makes it possible to use, in the absence of an electric motor, a combustion engine with reduced power. Furthermore, the building site machine can be used at any time of the day and of the night by means of using only the electric motor, thus without disturbing people living nearby, and therefore without requiring any prior authorization from the respective authorities.

[0028] The easy access to the battery pack makes it possible to replace it rapidly, as needed, with another, charged battery pack. If maintenance needs to be carried out on the electric motor, the motor can be removed while at the same time making it possible, by virtue of the possibility of using the connecting shaft 27 between the combustion engine and the pump assembly, to continue to use the building site machine powered only by the combustion engine. The electric motor can also be used in combination with the combustion engine, so that, for the same power dispensed, a combustion engine with reduced power, and therefore of lower cost, can be installed.

[0029] Naturally the materials used as well as the dimensions of the individual components of the device according to the invention may be more relevant according to specific requirements. The various means of achieving certain different functions certainly need not coexist only in the embodiment shown, but may be present in many embodiments, even if they are not shown. The characteristics indicated above as advantageous, convenient or the like, may also be missing or be substituted by equivalent characteristics.

[0030] The disclosures in Italian Patent Application No. 102021000014825 from which this application claims priority are incorporated herein by reference.

[0031] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs

Claims

1. A building site machine (1), comprising a tracked

power chassis (2) moved by means of a combustion engine (12), **characterized in that** said combustion engine (12) is connected, by means of a clutch assembly (13), to a removable enclosure (14) for containing an electric motor (112) and for supporting a hydraulic pump assembly (24), said power chassis (2) being provided with a container (25) for at least one removable battery pack (18).

2. The building site machine (1) according to claim 1, **characterized in that** in the momentary absence of said electric motor (112), a connecting shaft (27) between a pinion (28a) of said clutch assembly (13) and a pinion (28b) of said hydraulic pump assembly (24) is installed in its place.

3. The building site machine (1) according to one or more of the preceding claims, **characterized in that** a body (11) is located at the rear of said tracked power chassis (2) and accommodates said combustion engine (12), to the rear of which said enclosure (14), shaped substantially like a parallelepiped and internally hollow and removable, for containing said electric motor (112) is connected by means of said clutch assembly (13).

4. The building site machine (1) according to one or more of the preceding claims, **characterized in that** said electric motor (112) is connected, by means of first cables (15), to an inverter (16) and, by means of second cables which are accommodated in protected conduits (17), to said at least one removable battery pack (18).

5. The building site machine (1) according to one or more of the preceding claims, **characterized in that** said clutch assembly (13) comprises mechanisms such as a hydraulic actuation system (19), a clutch disc (20), a thrust bearing cylinder (21) for the actuation of said clutch assembly (13) by means of said hydraulic actuation system (19), and a flywheel housing (22).

6. The building site machine (1) according to one or more of the preceding claims, **characterized in that** said enclosure (14) is connected, at a front end, to said flywheel housing (22) and, at the rear, to a coupling flange (23) for said hydraulic pump assembly (24) or for a device for coupling to hydraulic pumps.

7. The building site machine (1) according to one or more of the preceding claims, **characterized in that** said power chassis (2) has, above said body (11), a container (25) provided with a cover (26) and adapted to accommodate inside it said at least one removable battery pack (18).

8. The building site machine (1) according to claim 7, **characterized in that** dividers (29) are mounted on said cover (26) or on said container (25) and generate a path (30) for the conditioning air which is obtained by means of a conditioning unit (31) and a fan (32), which are arranged in said container (25).

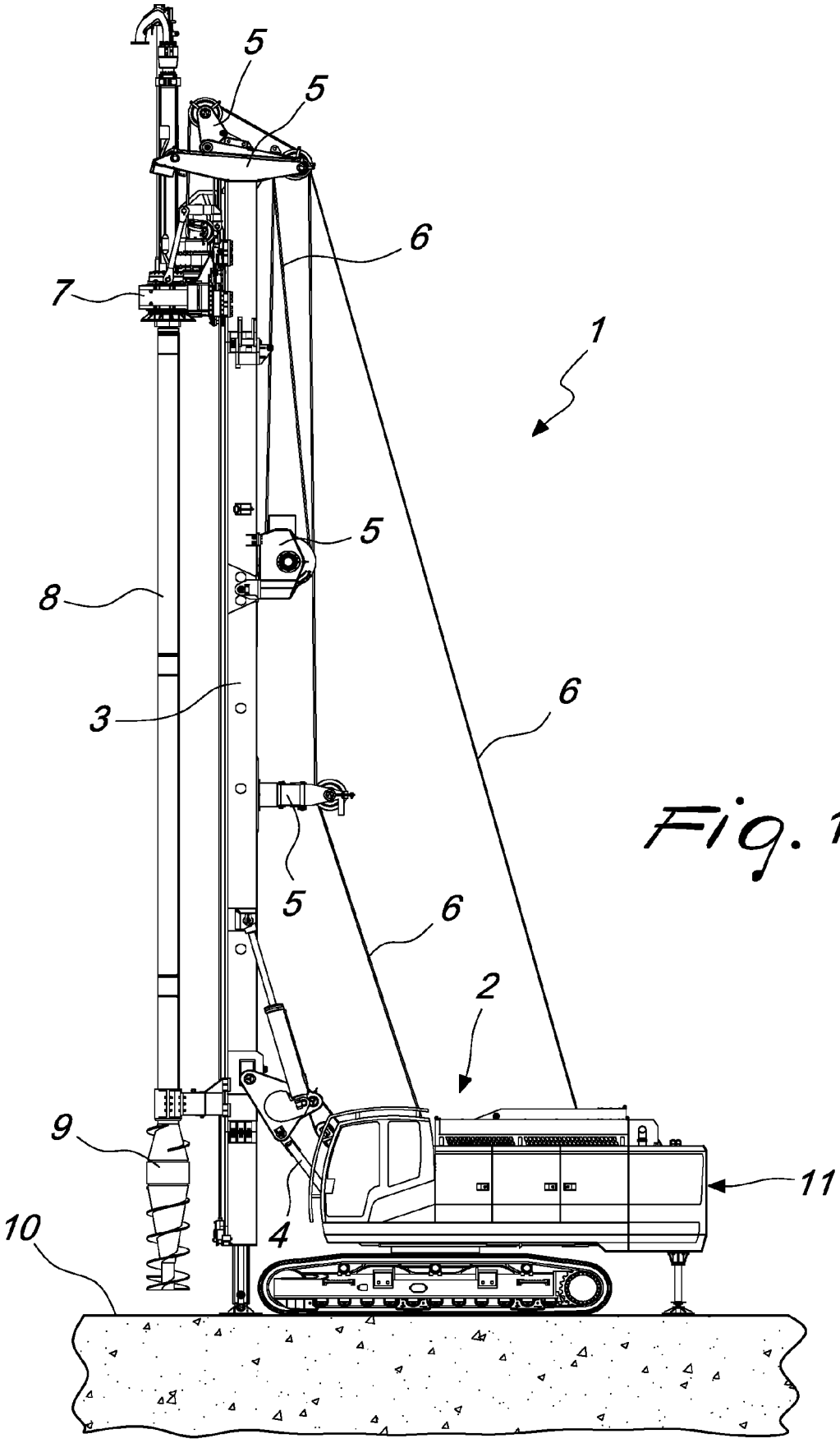

Fig. 1

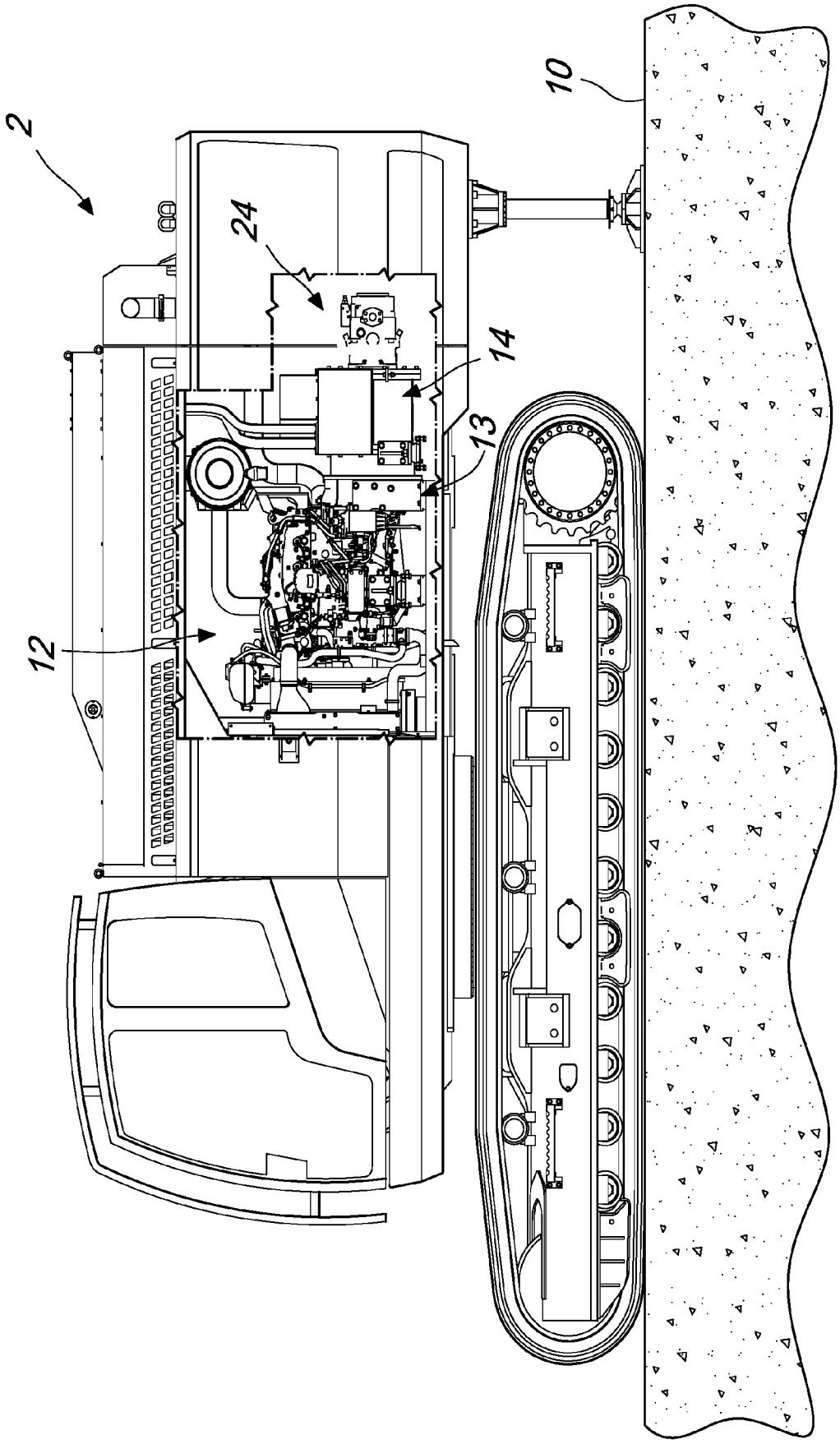

Fig. 2

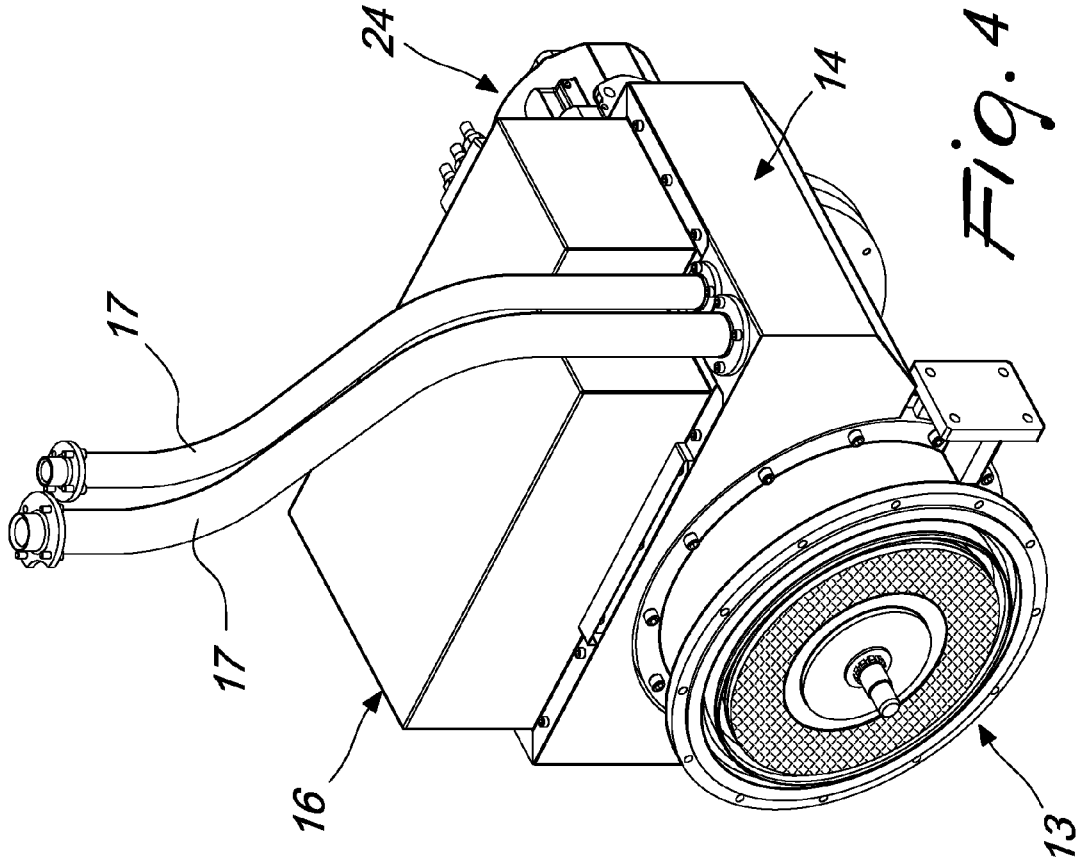

Fig. 4

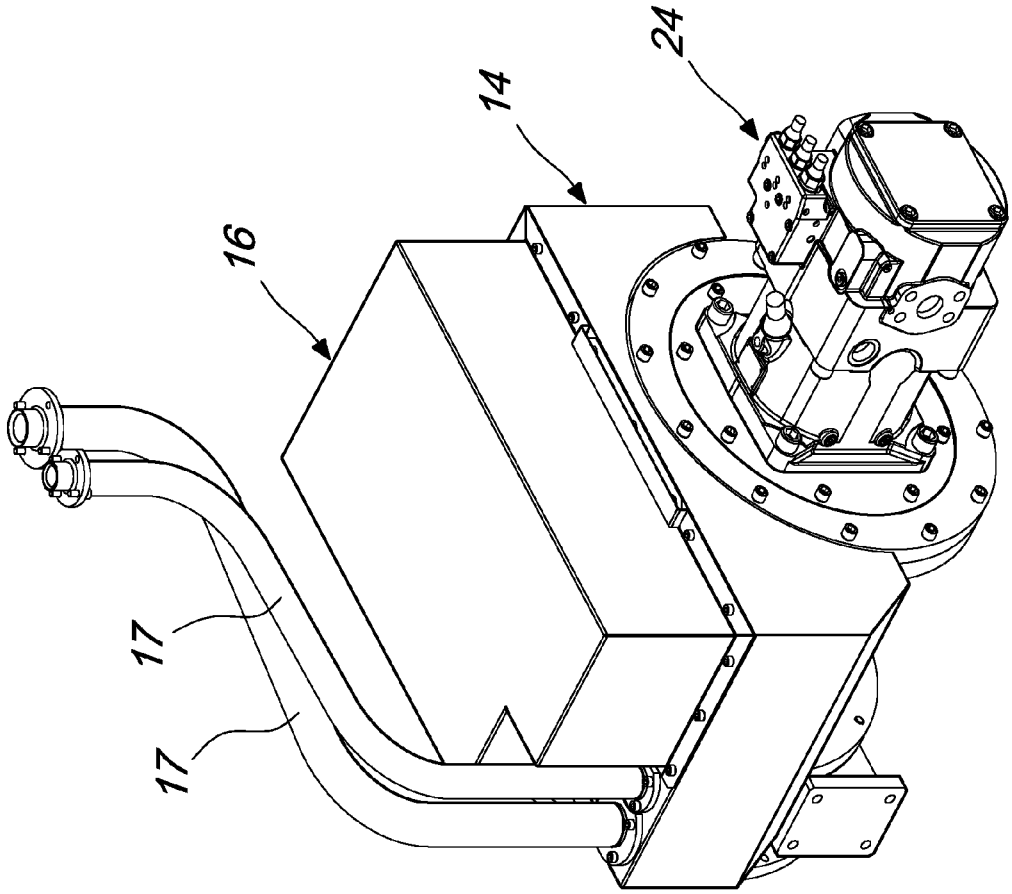

Fig. 3

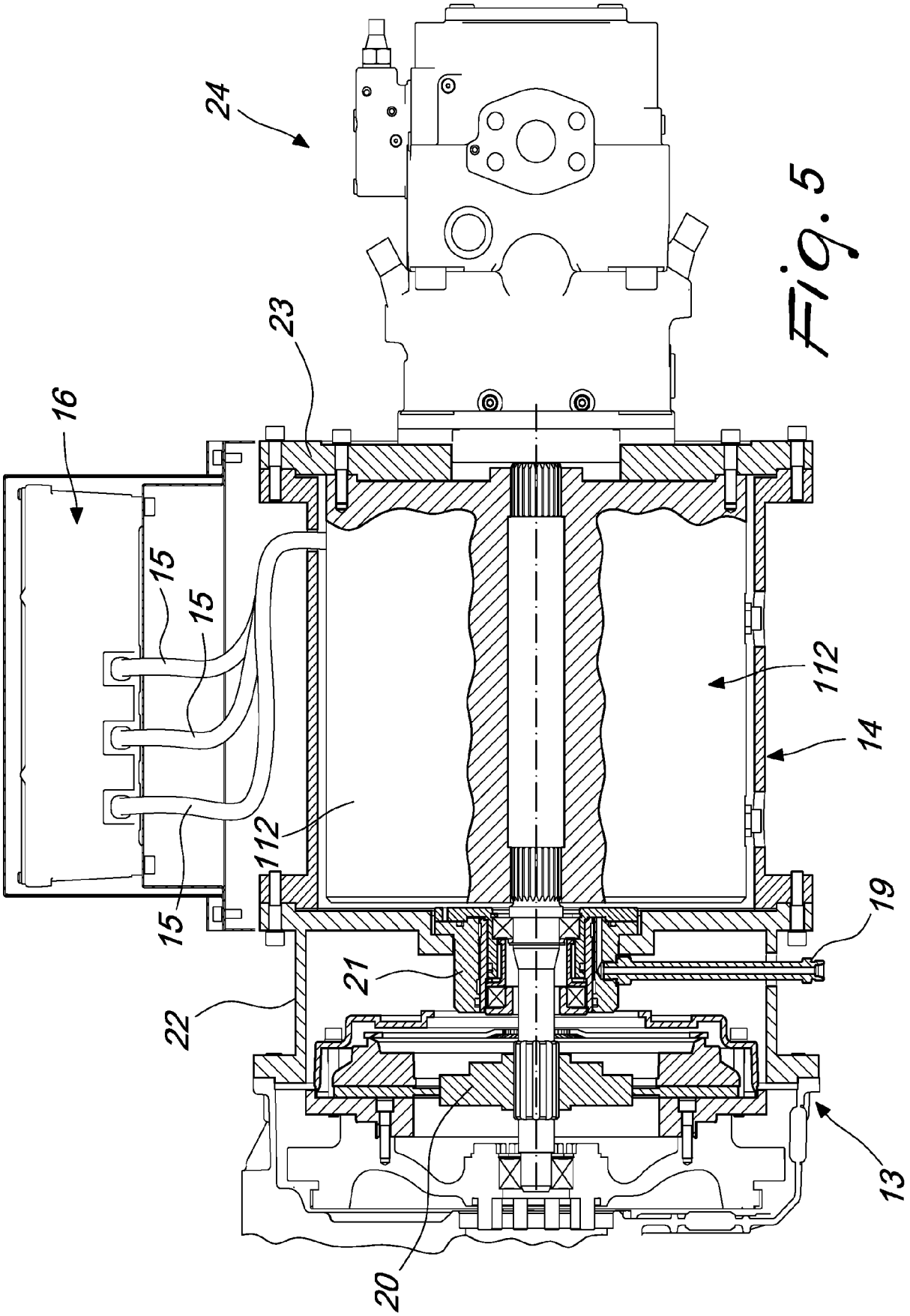

Fig. 5

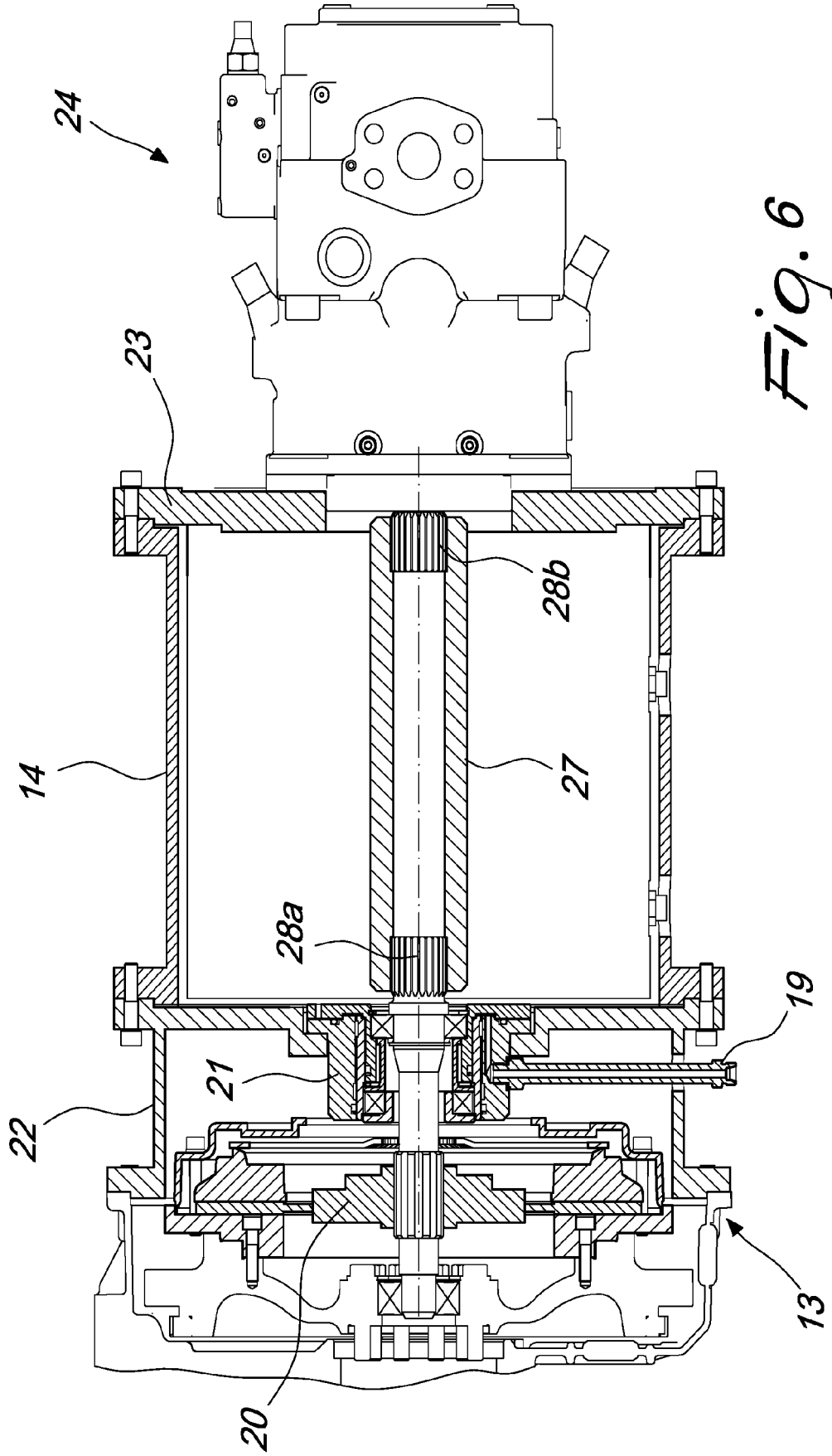

Fig. 6

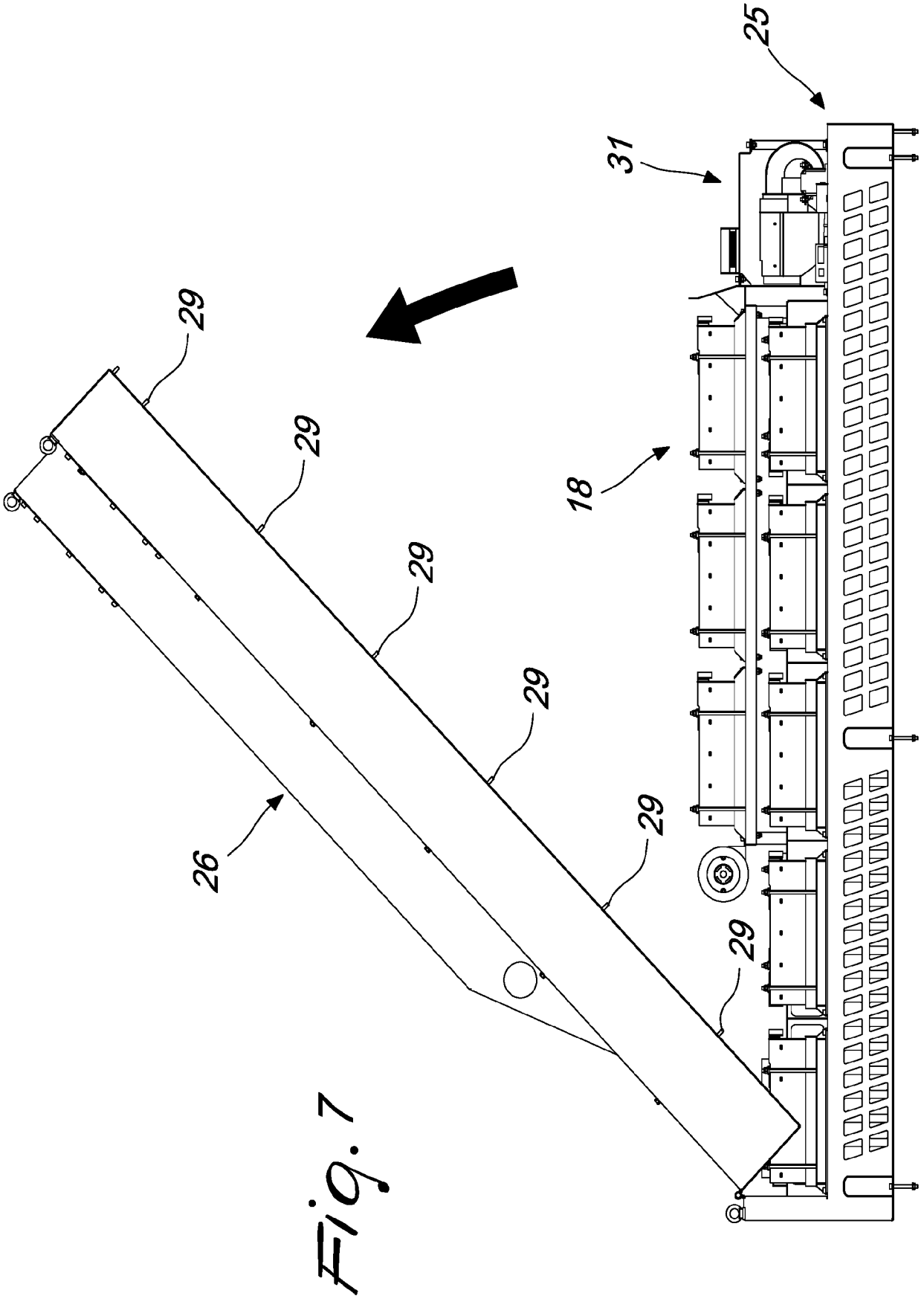

Fig. 7

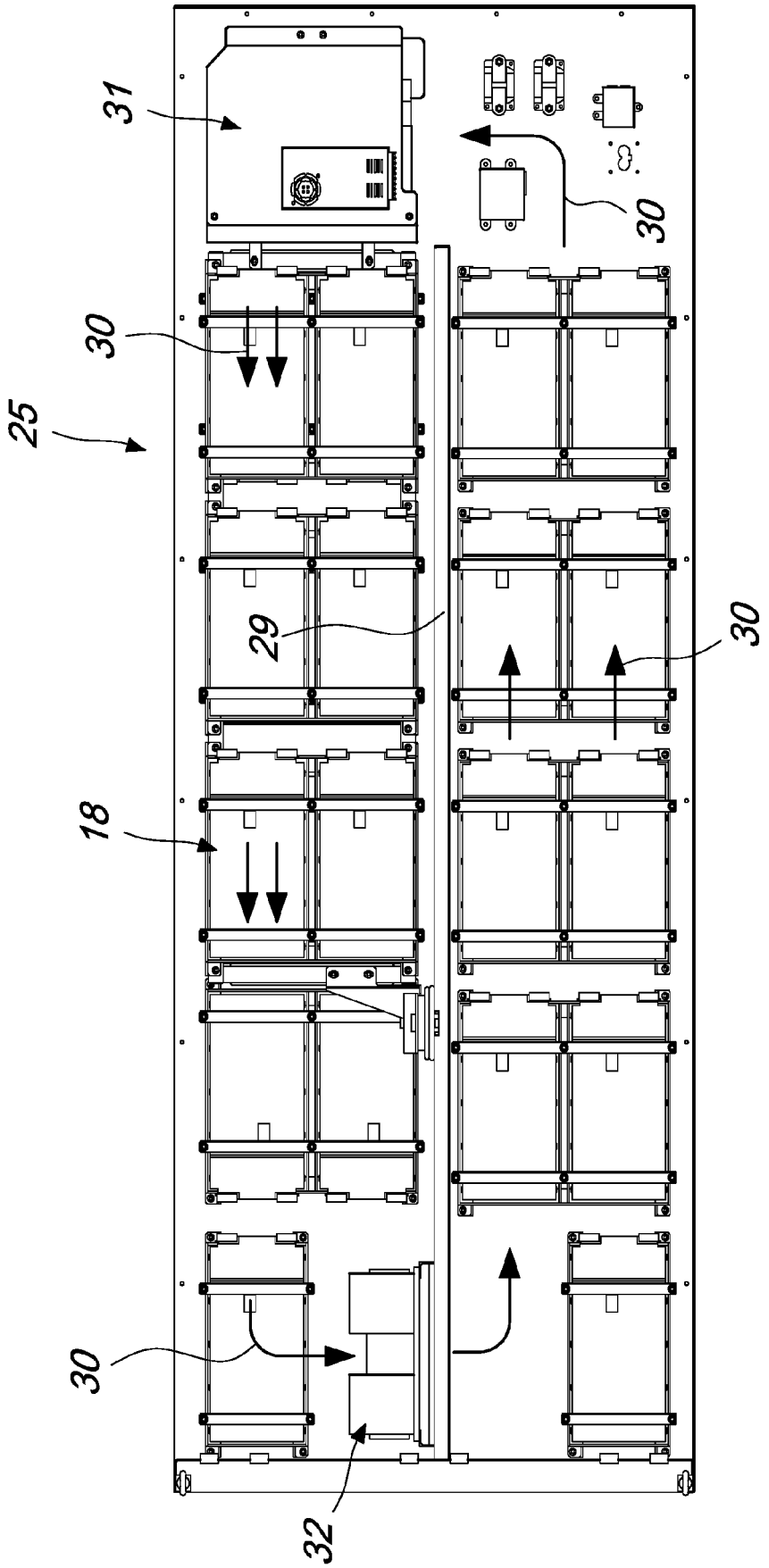

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 7353

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 October 2022	Clarke, Alister

CATEGORY OF CITED DOCUMENTS

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