

(19)



(11)

EP 2 058 171 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

13.05.2009 Bulletin 2009/20

(51) Int Cl.:

B60P 1/16 (2006.01)

B60P 1/28 (2006.01)

B60P 1/34 (2006.01)

(21) Application number: **08168695.8**

(22) Date of filing: **07.11.2008**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT
RO SE SI SK TR**

Designated Extension States:

AL BA MK RS

(30) Priority: **08.11.2007 IT BO20070745**

(71) Applicant: **Hinowa S.p.A.**

37054 Nogara (IT)

(72) Inventor: **Fracca Dante**

37054 Nogara (IT)

(74) Representative: **Jorio, Paolo et al**

STUDIO TORTA

Via Viotti 9

10121 Torino (IT)

(54) **Minidumper with electric drive**

(57) Minidumper (10) comprising:

- a drive unit;

- a dump body (13), possibly provided with a bucket for loading a body, and possibly provided with a raised un-

loading system (112). The minidumper is characterized in that the drive unit comprises at least one electric motor powered by at least one battery (101,102).

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Description

[0001] The present invention relates to an earth moving machine of the type commonly known as a "minidumper" or "minitransporter" for loading and transporting materials, in particular building materials such as sand, gravel, etc.

[0002] As is known, a generic minidumper normally comprises:

- a drive unit, track or tire-mounted, provided with an internal combustion engine normally situated in the rear part of said minidumper and rear drive control means that can be worked by an operator; the operator can stand on the minidumper on a platform situated in the rear part of said drive unit, or sit on a seat situated in the centre or at the side of the rear part of the drive unit; in another version the operator can follow the minidumper on foot, walking behind it and driving it using control means installed on said minidumper, or using hand-held control means (remote control or drive-by-wire control).
- a dump body arranged on the front part of the drive unit and substantially contained within the side and front clearance of the minidumper, and provided with hydraulic means suitable to tip the body with respect to the track-mounted drive unit to dump the material contained in said body.

[0003] Moreover, in another embodiment known in the prior art the dump body is provided with two lateral arms that are, in turn, hinged to said body or to the drive unit; the arms are suitable to operate a bucket for loading said body. More specifically, each bucket operating arm is operated by a respective hydraulic actuator controlled by the operator using said rear control means.

[0004] In another particular embodiment known in the prior art the dump body can be mounted on a lifting mechanism suitable to raise said body for unloading from a position that is raised with respect to the plane of translation of the drive unit. The lifting system is operated by hydraulic cylinders controlled by the operator using said rear control means.

[0005] One possible embodiment of a lifting mechanism for raising the body, filed by this same applicant, is described in the Italian Utility Model No. 0000256106 granted on 10/10/2005 (priority 24/04/2004), the contents of which are to be considered an integral part of this description. Therefore, hereinafter specific reference is made to Italian Utility Model No. 0000256106 as the document illustrating the prior art closest to the present invention. There are however other means for lifting the body to enable unloading at a different height with respect to the plane of translation. Non-limiting and non-exhaustive examples include the "scissors mechanism", or "vertical scissors", and the "articulated parallelogram system". All these systems are known in the prior art.

[0006] The prior art also describes examples of the

combined use of the self-loading system and the raised unloading system.

[0007] While advantageous in many respects the minidumpers of the type outlined above have the following drawbacks:

- they are fairly noisy in that they are provided with a petrol or diesel internal combustion engine; this makes them unsuitable for use at work-sites located close to houses or offices, places of worship, libraries, places of study, in historical town centres or residential areas; moreover the noise of the internal combustion engine can also be annoying for the operators of the minidumper or for other operators engaged in other activities at the work-site, especially when the minidumper is used in restricted or closed places; and
- the exhaust fumes generated by the internal combustion engine can cause significant problems in terms of pollution especially if the vehicle is used in closed places (dwelling houses, public concerns, industrial warehouses, basements, stables, greenhouses, etc.).

[0008] The purpose of the present invention is thus to overcome the drawbacks described above by providing a minidumper according to the characteristics claimed in Claim 1.

[0009] The present invention will now be described with reference to the accompanying drawings, illustrating three non-limiting embodiments thereof, in which:

- Figure 1 illustrates a first arrangement of a first embodiment of a minidumper according to the present invention;
- Figure 2 shows a second arrangement of the first embodiment of Figure 1;
- Figure 3 illustrates a first arrangement of a second embodiment of a minidumper according to the present invention;
- Figure 4 shows a second arrangement of the second embodiment of Figure 3;
- Figure 5 illustrates a first arrangement of a third embodiment of a minidumper according to the present invention; and
- Figure 6 shows a second arrangement of the third embodiment of Figure 5.

[0010] In Figures 1 and 2 a first embodiment of the minidumper according to the present invention is shown.

[0011] The general structure of the minidumper 10 according to the present invention is substantially the same as that of the minidumper described in Italian Utility Model No. 0000256106, by this same applicant, the description of which is to be considered as an integral part of this description.

[0012] The essential difference between the minidumper 10 according to the present invention and that

described and claimed in Italian Utility Model No. 0000256106 consists of the fact that instead of an internal combustion engine the present minidumper 10 envisages the use of at least one electric motor (not illustrated) which can be a direct current or alternating current motor. In the case of an alternating current motor the minidumper must be provided with an inverter to control the voltage of said motor. The minidumper must also be provided with a potentiometer to control the revolutions of the motor, a battery charge level indicator and a stop pushbutton that acts directly on the power supply to the motor to stop the latter in case of an emergency.

[0013] The motor is powered by means of batteries. The position of the batteries is generally chosen with the aim of increasing the stability of the minidumper especially in the version with the raised unloading function (Figures 3, 4). Thus the centre of gravity of the set of batteries generally lies as close to the ground as possible within the supporting base of the tracks 16, 17 (or of the wheels which are not shown) to prevent it from moving outside said area during operation on sloping terrain. In the example illustrated in Figures 1, 2 a first pair of batteries 101 are arranged beneath the dump body 13, and a second pair of batteries 102 are arranged beneath the motor assembly 19, which, in turn, contains said electric motor (not illustrated).

[0014] Given the closeness of the batteries 101, 102 to the ground, there may be a risk of damage to these during use at the work-site if they come into contact with stones or debris thrown up by the tracks or that accidentally come into contact with the lower part of the minidumper 10. To protect them against such damage, the batteries 101, 102 are arranged inside a steel case (not illustrated) that is easily accessible during recharging and to perform routine maintenance on said batteries 101, 102.

[0015] Batteries of a different voltage and/or amperage can be used and connected "in series" and/or "in parallel" to obtain a total voltage or amperage suitable for the installed power and the required duration of electric motor operation.

[0016] The batteries 101, 102 that can be used are of the following types:

- lead (Pb);
- hermetically sealed batteries;
- nickel-cadmium (Ni-Cd);
- nickel-metal hydride (Ni-MH);
- lithium-ion or lithium-polymer;
- fuel cell.

[0017] The choice of battery 101, 102 depends on several factors, including:

- recharging times;
- method of recharging;
- duration of recharging;
- weight;

- availability of the recharging system (for example, fuel cells need hydrogen);
- overall cost of the batteries.

[0018] A battery charging device (not illustrated) can be fitted to any part of the minidumper 10 provided it is easily accessible by the operator. In another arrangement that is not illustrated the device can be part of the equipment supplied with the minidumper and left in a specific place where the minidumper is taken for recharging.

[0019] When required, the recharging device is connected to the electric power main.

[0020] Different uses of the principle of the present invention can be envisaged.

[0021] A first solution envisages a single electric motor that turns the impeller of a pump (not illustrated) belonging to a hydraulic circuit (not illustrated) to power the hydraulic motors (not illustrated) suitable to operate the tracks 16, 17.

[0022] In this case the same pump is also used to operate the lifting mechanism 112 of the body 113 (second embodiment illustrated in Figures 3, 4), to activate the actuator 26 (Figures 1, 2) for tipping said body 13, and to operate the arms 130, respectively, 230, for tipping the bucket 129, respectively, 229 (see, respectively, the second embodiment illustrated in Figures 3, 4 and the third embodiment illustrated in Figures 5, 6).

[0023] According to another solution (not illustrated), three electric motors are used, two electric motors to operate the two tracks 16, 17 separately and a third electric motor to turn the impeller of a pump belonging to the hydraulic circuit to power the other lifting and actuating devices.

[0024] The motors for translation may or may not be provided with a reducer as a function of the requested speed of rotation and torque that is required. The reducer can be of the axial or angular type. An angular reducer is normally used in order to transfer the electric motors (which are usually large) to a position other than the wheel axle and thus increase the clearance below the minidumper.

[0025] In other words, the minidumper 10, 100, 200 can be driven by means of geared motors or electric motors, or by means of geared motors or hydraulic motors powered by a pump operated by an electric motor.

[0026] Moreover, as illustrated in Figures 3, 4, the self-loading system and raised unloading system can be operated directly by means of electric actuators, or by means of hydraulic actuators powered, in any case, by a hydraulic circuit in which the pump is driven by an electric motor.

[0027] According to the third embodiment of the minidumper 200 according to the present invention the use of the lifting mechanism of the body 213 is not envisaged.

[0028] As illustrated in Figures 5, 6 the minidumper 200 also comprises, in the usual manner, the following components:

- the batteries 101, 102 arranged according to the principles described above;
- the control device 221;
- the tracks 216, 217;
- the motor assembly 219;
- the bucket 229; and
- the arms 230 for operating the bucket 219.

[0029] In summary, the advantages of the present invention consist of the fact that with the minidumper according to the present invention the noisiness of the vehicle is significantly reduced and the level of pollution generated by the vehicle is practically eliminated especially when used in closed places (dwelling houses, public concerns, industrial warehouses, basements, stables, greenhouses, etc.). The minidumper can therefore be used at work-sites located close to houses or offices, places of worship, libraries, places of study, historical town centres or residential areas, in restricted or closed places.

Claims

1. Minidumper comprising:

- a drive unit, track or tire-mounted, provided with a motor that is normally located in the rear part of said minidumper and rear control means that can be worked by an operator; the operator can stand on the minidumper on a platform situated in the rear part of said drive unit, or sit on a seat situated in the centre or at the side of the rear part of the drive unit; or the operator can follow the minidumper on foot, walking behind it and driving it using control means installed on said minidumper, or using hand-held control means (remote control or drive-by-wire control); and
- a dump body arranged on the front part of the drive unit and substantially contained within the side and front clearance of the minidumper, and provided with hydraulic means suitable to tip the body with respect to the track-mounted drive unit to dump the material contained in said body.

minidumper **characterized in that** said drive unit comprises at least one electric motor powered by at least one battery.

2. Minidumper, according to that claimed in Claim 1, **characterized in that** it is provided with a bucket for loading said body operated by lifting arms hinged in turn to said body or to said drive unit, each of said lifting arms of said bucket being operated by respective actuating means operated by the operator using said rear drive and control means.

3. Minidumper, according to that claimed in Claim 1, **characterized in that** it is provided with a lifting mechanism suitable to raise the body to enable unloading in a raised position with respect to the plane of translation of the drive unit; the lifting mechanism being operated by actuators controlled by the operator using said rear control means.

4. Minidumper, according to that claimed in Claim 1, **characterized in that** it is provided with:

- a lifting mechanism suitable to raise the body to enable unloading in a raised position with respect to the plane of translation of the drive unit; the lifting mechanism being operated by actuators controlled by the operator using said rear control means; and
- a bucket for loading said body operated by arms hinged in turn to said body or to said drive unit, each of said lifting arms of said bucket being operated by respective actuating means controlled by the operator using said rear drive and control means.

5. Minidumper, according to that claimed in any one of the previous Claims, **characterized in that** it envisages a single electric motor that turns an impeller of a single pump belonging to a hydraulic circuit that powers the hydraulic motors suitable to operate the tracks; said single pump also being suitable to operate the mechanisms for lifting the body and/or the bucket, by means of a hydraulic circuit.

6. Minidumper, as claimed in any one of the Claims from 1 to 4, **characterized in that** it envisages the use of at least three electric motors, two of which to operate the two tracks separately and a third electric motor to turn the impeller of a pump belonging to a hydraulic circuit to power the mechanisms to lift the body and/or the bucket.

7. Minidumper, as claimed in any one of the previous Claims, **characterized in that** said at least one battery is a lead battery (Pb).

8. Minidumper, as claimed in any one the Claims from 1 to 6, **characterized in that** said at least one battery is a hermetically sealed battery.

9. Minidumper, as claimed in any one the Claims from 1 to 6, **characterized in that** said at least one battery is a nickel-cadmium battery (Ni-Cd).

10. Minidumper, as claimed in any one the Claims from 1 to 6, **characterized in that** said at least one battery is a nickel-metal hydride battery (Ni-MH).

11. Minidumper, as claimed in any one the Claims from

1 to 6, **characterized in that** said at least one battery is a lithium-ion or lithium-polymer battery.

12. Minidumper, as claimed in any one the Claims from 1 to 6, **characterized in that** said at least one battery is a fuel cell battery. 5

13. Minidumper, as claimed in any one of the previous Claims, **characterized in that** the position of the batteries is chosen so as to increase the stability of the minidumper in particular in the version with the raised unloading function, so that the centre of gravity of the set of batteries lies as close to the ground as possible within the supporting base of the tracks (or of the wheels) to prevent it from moving outside said area of stability during operation on sloping terrain. 10
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14. Minidumper as claimed in Claim 13, **characterized in that** a first pair of batteries are arranged beneath the dump body, and a second pair of batteries are arranged beneath a motor assembly that, in turn, contains said electric motor. 20

15. Minidumper, as claimed in Claim 13 or in Claim 14, **characterized in that** the batteries are connected to one another in series to supply power to the electric motor. 25

16. Minidumper, as claimed in any one of the previous Claims, **characterized in that** it comprises a battery charging device. 30

17. Minidumper, as claimed in any one of the previous Claims, **characterized in that** it is driven by means of hydraulic geared motors or electric geared motors, or electric or hydraulic motors. 35
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18. Minidumper, as claimed in any one of the previous Claims, **characterized in that** the mechanisms for lifting the dump body and/or the bucket are operated by means of electric actuators, or by means of hydraulic actuators powered, in any case, by a hydraulic circuit in which the pump is started by an electric motor. 45
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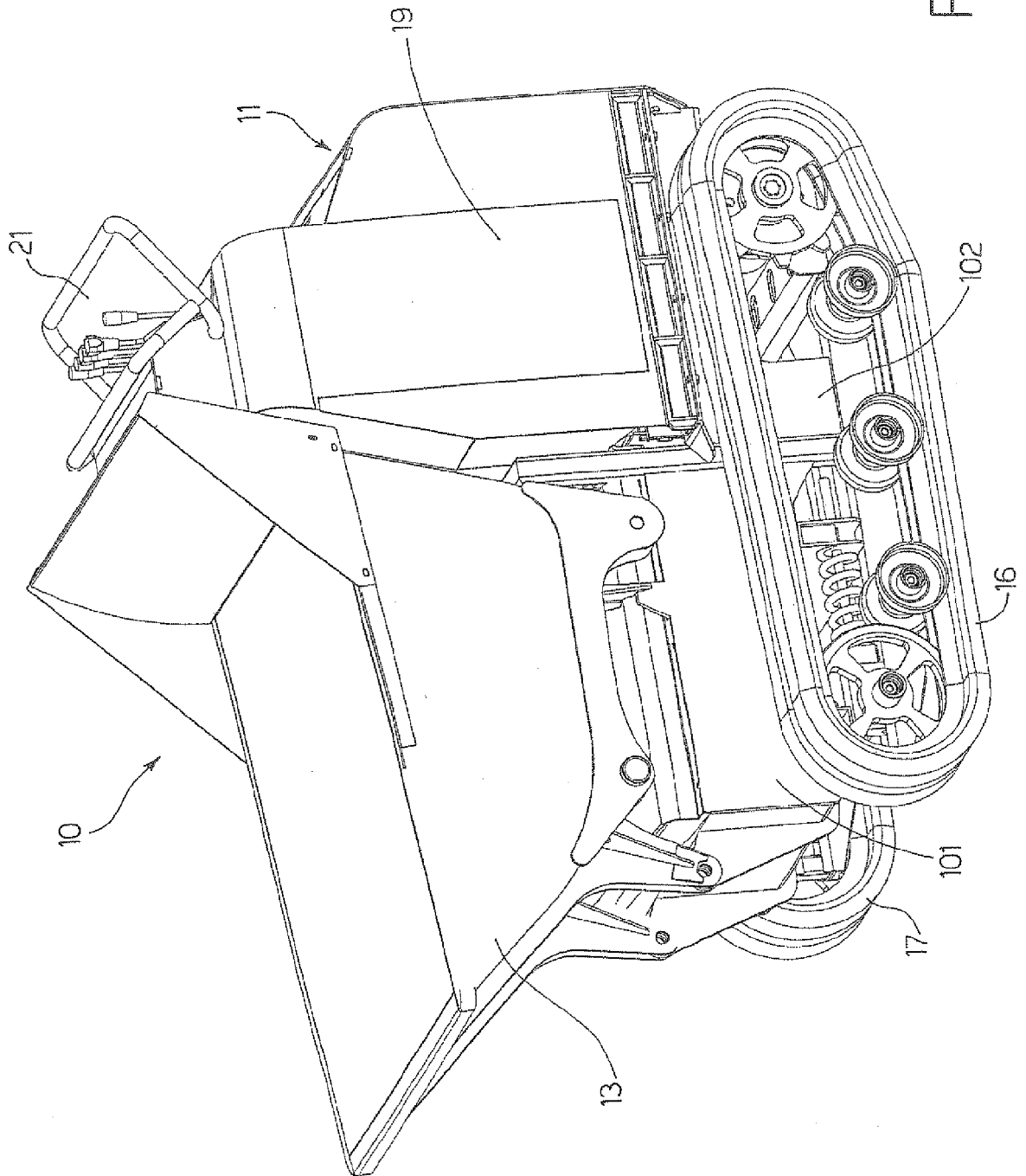


Fig.1

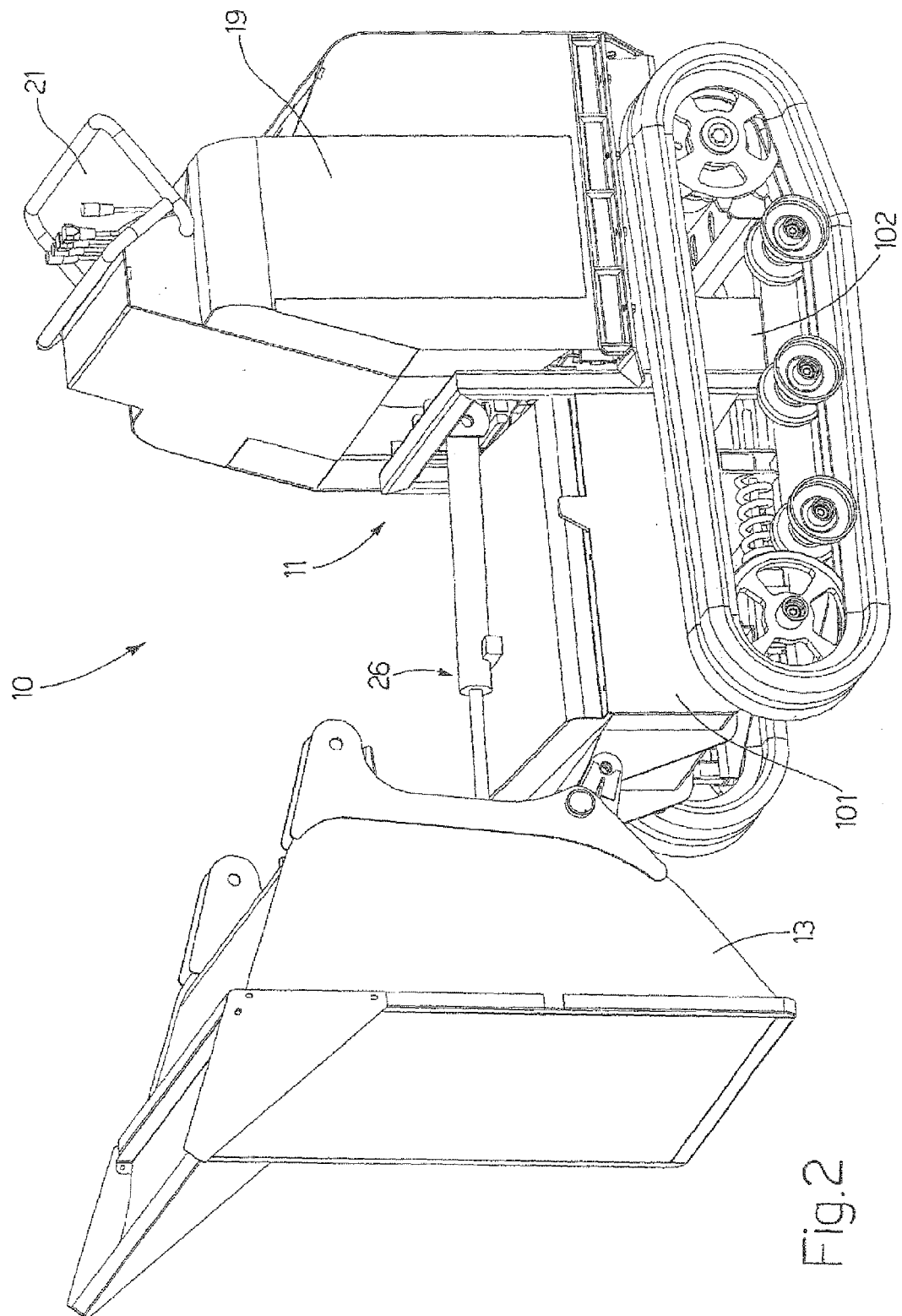


Fig.2

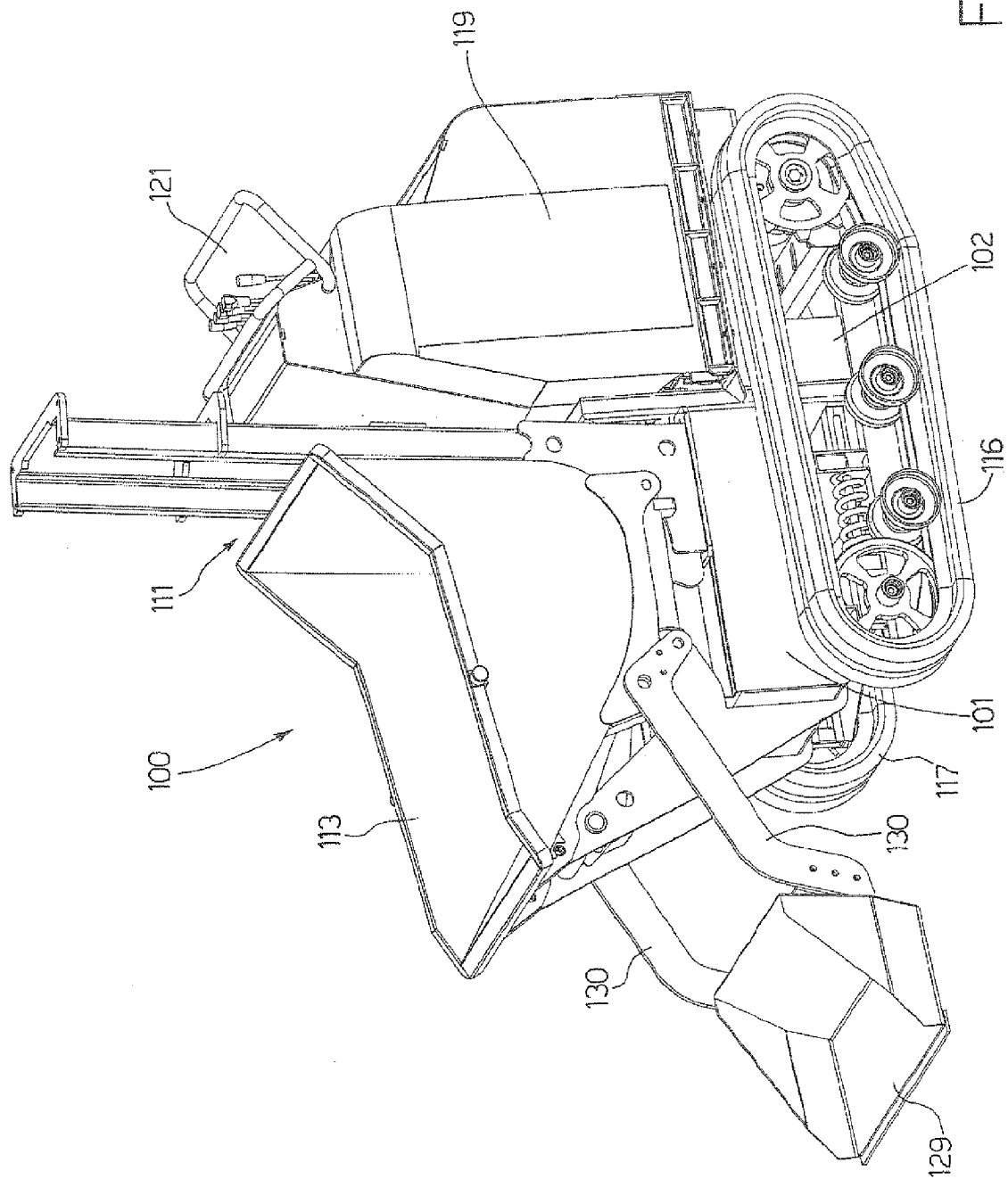


Fig.3

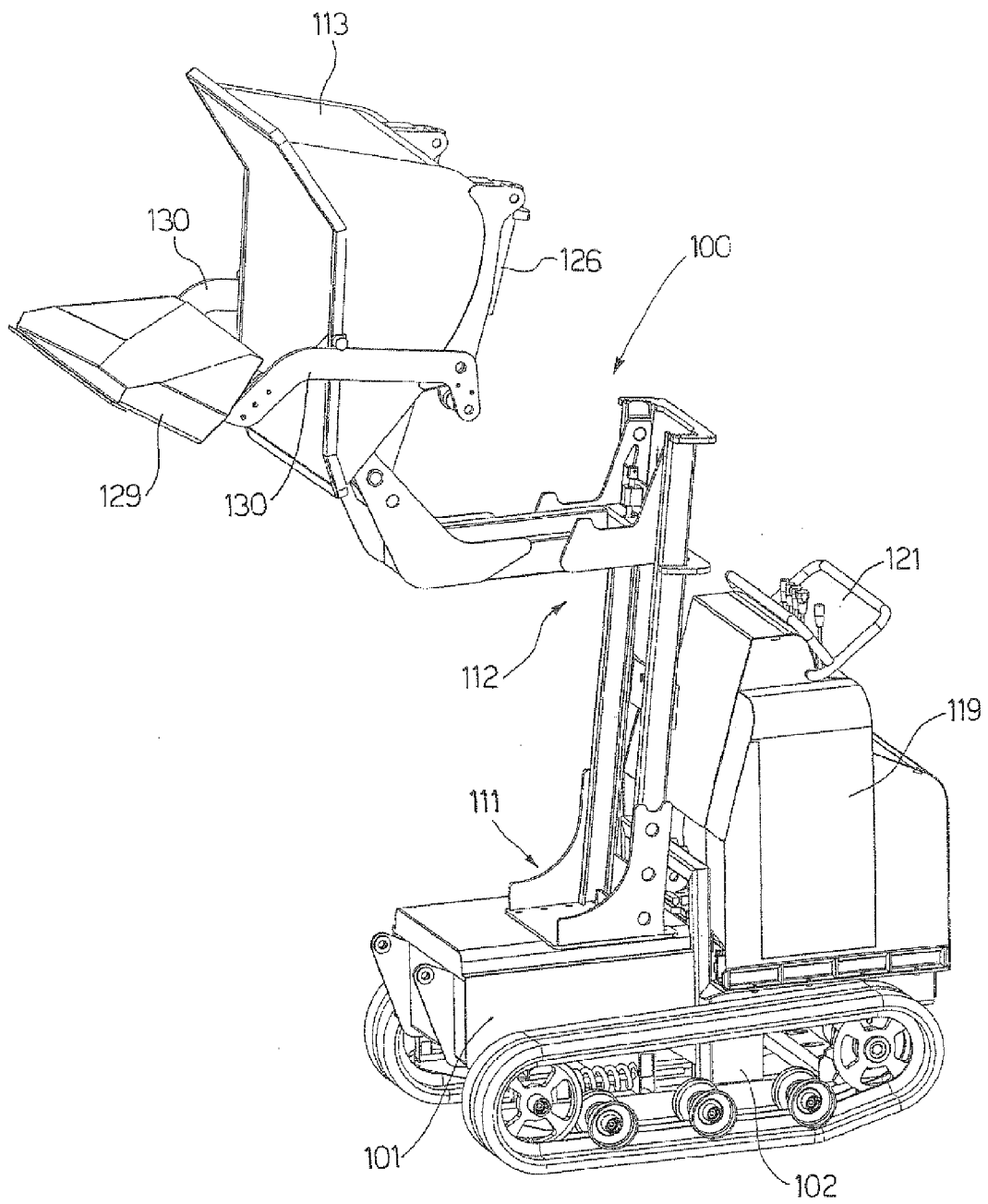


Fig.4

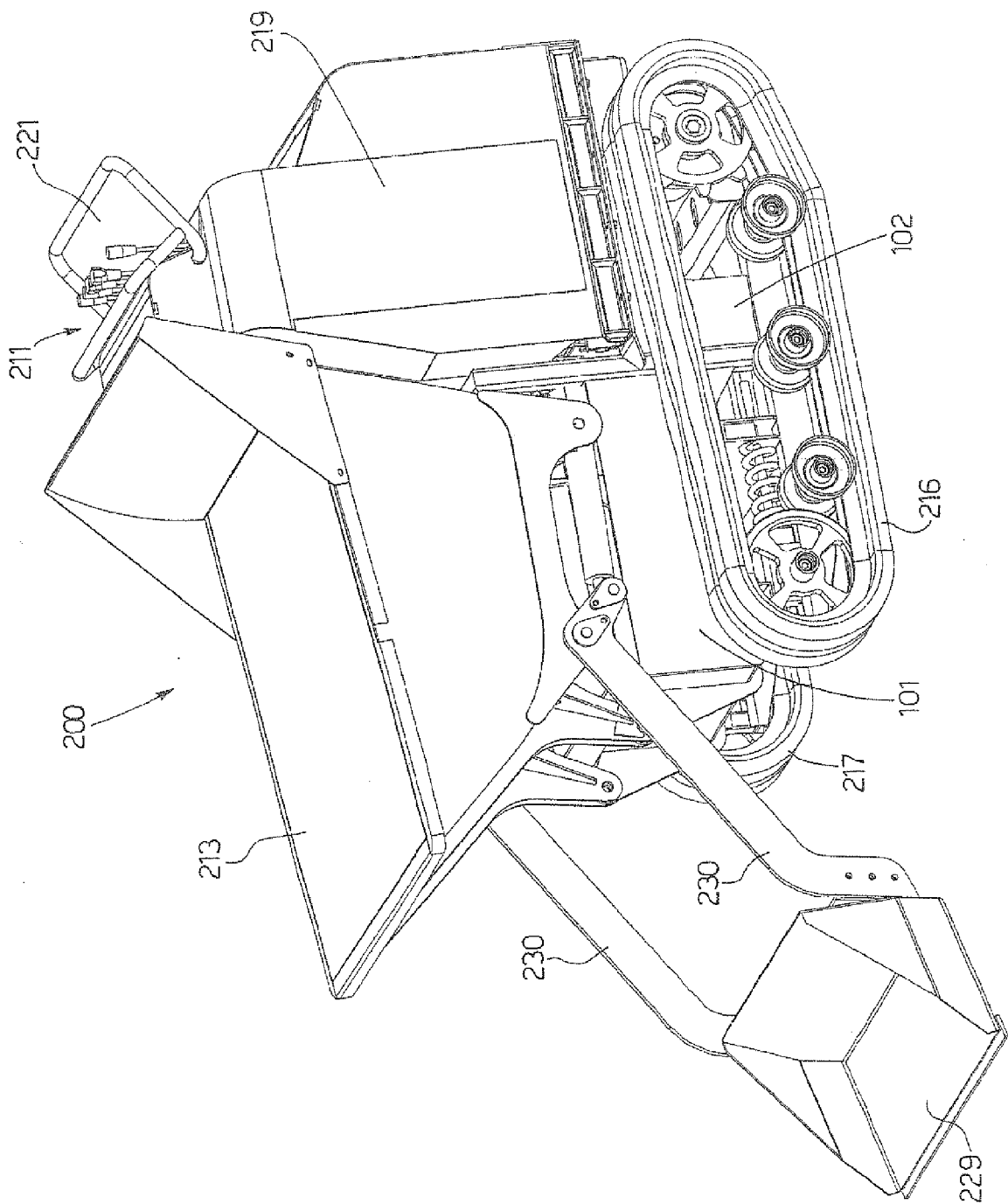


Fig. 5

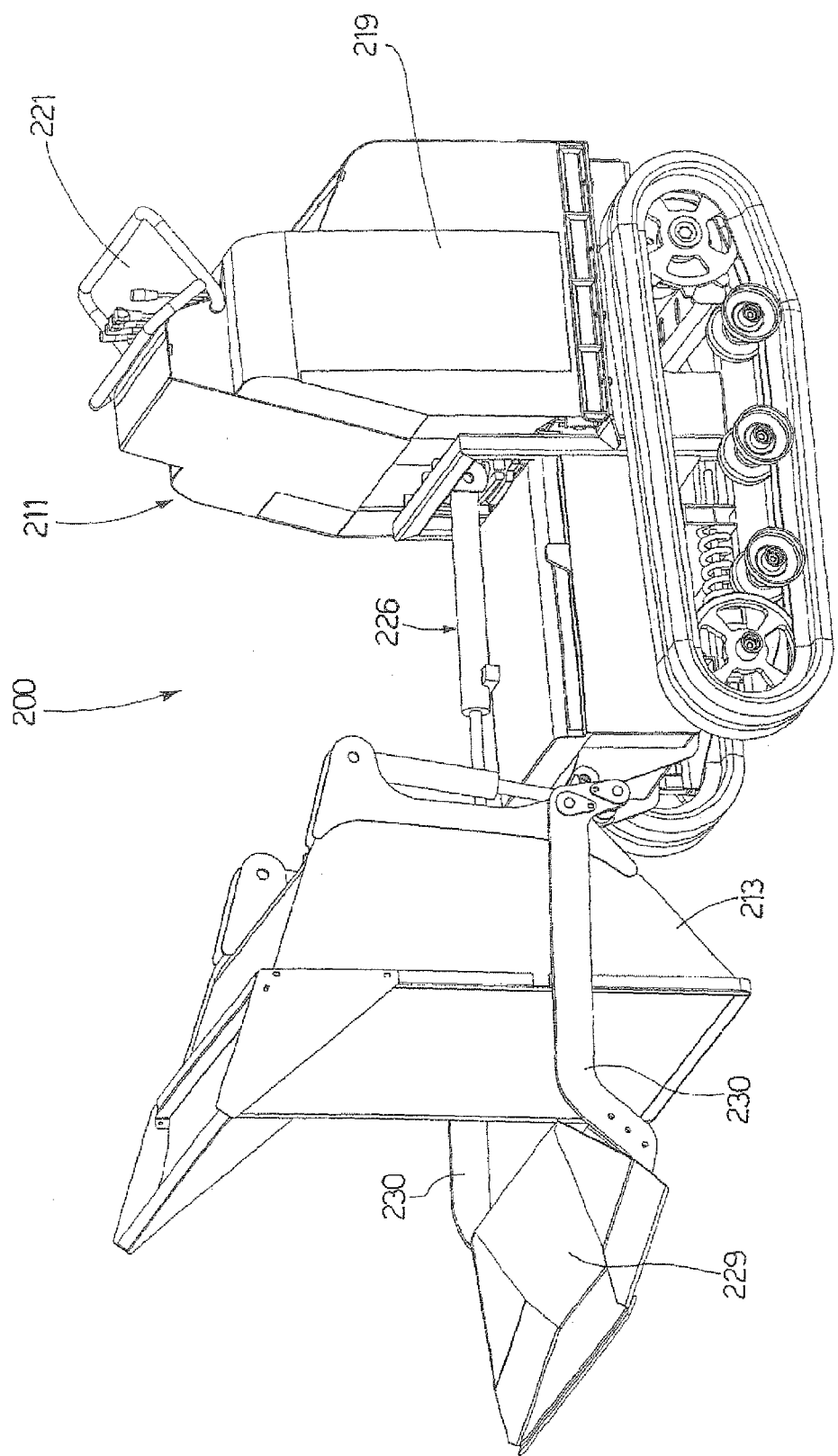


Fig.6

REFERENCES CITED IN THE DESCRIPTION

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