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(54) **MOBILE CONCRETE PUMP**

(57) The invention relates to a trailer assembly comprising: a concrete pump arranged for pumping liquid concrete and having a pumping speed; an electric motor arranged for driving the concrete pump; a battery; an adaptive electrical controller for converting a battery current from the battery to a motor current powering the electric motor; and an input configured for receiving a setting for adapting the motor current for controlling the pumping speed.

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MOBILE CONCRETE PUMP

FIELD OF THE INVENTION

The invention relates to a trailer assembly comprising a concrete pump. The invention more specifically relates to a trailer assembly comprising an electrically powered concrete pump. The invention also relates to a method for a mobile concrete pump. The invention also relates to use of a trailer assembly comprising a concrete pump.

BACKGROUND OF THE INVENTION

Concrete pumps are machines for transporting liquid concrete by pumping. There are mainly two types of concrete pumps. The first type of concrete pump is built on top of a truck or semi-trailer. Typically, these types of concrete pumps have a boom extending from the truck or semi-trailer. The second type of concrete pump is built on top of a truck or mounted on a trailer. This second type is commonly referred to as a line pump. The concrete pump requires attaching a steel or flexible hose to the outlet of the machine. Typically, multiple coupled hoses are used to transport the liquid over the distance to the pouring location.

CN208329635 discloses a trailer concrete pump car, wherein the sensors and control box are powered by a car battery. A disadvantage of CN208329635 is that the car battery is not powerful enough to power the concrete pump.

CN211950768 discloses a hybrid system applying a diesel engine power supply and a battery power supply for powering the concrete pump. In CN211950768 the flow of concrete is adapted by changing the transmission in the gear box driving the concrete pump.

SUMMARY OF THE INVENTION

An object of the invention is to overcome one or more of the disadvantages mentioned above.

According to a first aspect of the invention, a trailer assembly comprising:

- a concrete pump arranged for pumping liquid concrete and having a pumping speed;
- an electric motor arranged for driving the concrete pump;
- a battery;
- an adaptive electrical controller for converting a battery current from the

battery to a motor current powering the electric motor; and

- an input configured for receiving a setting for adapting the motor current for controlling the pumping speed.

A trailer assembly may be a trailer with additional items placed on top of or integrated in the trailer. The items placed on top of the trailer are typically coupled or jointed to the trailer. These couplings or joints may have a more permanent character or may be releasable. A trailer may be any mobile object that can be placed behind a pulling vehicle, such as a car, a lorry, a van, or the like. A trailer may have a towing hook coupling with the pulling vehicle. In more specific cases the trailer may move under its own power, such as small distances under own power. In more generalised context, the invention may be generalised such that the features of the invention may also be placed on a vehicle, such as a lorry. In this generalised case, the invention is typically placed on a vehicle wherein the driving power of the vehicle is obtained from an electrical battery, such as the same battery used as part of the invention.

The concrete pump is typically used to transport liquid concrete from an accessible location accessible to devices providing the liquid concrete to a less accessible location or a moving location where the liquid concrete is used as building material. The accessible location is typically accessible by a larger truck transporting the liquid concrete to the build location. The accessible location may also be a location where the liquid concrete is mixed or produced on site. The less accessible or moving location is the location where the liquid concrete is poured. This location typically moves around as the liquid concrete is in general not poured or needed at one location all the time. The liquid concrete is typically transported between the concrete pump and the less accessible or moving location with a pipe or tube. This pipe or tube has typically at least some flexible sections for easily adapting the location of the outflow of liquid concrete from the pipe or tube. The concrete pump pumps the liquid concrete with a pumping speed pushing the liquid concrete through the pipe or tube with this speed. The concrete pump may provide a pulsed pumping or periodical pumping of the liquid concrete, typically in this case the pumping speed is an average speed of the liquid concrete. The trailer assembly, more specifically the concrete pump, may be typed as a line pump.

The electric motor may be directly coupled to the concrete pump. The electric motor may have an axis providing a mechanical rotating force based on the electrical power provided to the electrical motor. The axis may be coupled to the concrete pump for pumping based on the rotation of the axis. Alternatively, the electric motor may be indirectly coupled

to the concrete pump. As an example, the electric motor may have an axis providing a mechanical rotating force based on the electrical power provided to the electrical motor. The rotational force may be provided to a hydraulic system which may comprise a hydraulic pump and hydraulic valves converting the rotational force to a hydraulic force. The hydraulic system may in turn drive the concrete pump. Other indirect couplings between the electric motor and the concrete pump are envisioned.

The battery is an electric battery for storing and providing electrical power to an application. A battery storing electrical power is charging. A battery providing electrical power is discharging. A battery may comprise multiple electrical cells. The electrical cells may be regulated independent from each other. A battery management system may be present to manage or control the charging and discharging of the battery.

An adaptive electrical controller is arranged for converting a battery current from the battery to a motor current powering the electric motor. The battery current typically is a DC current at a particular voltage. This voltage may differ over time. Also, the electrical motor may not be suitable for receiving a DC current at that particular voltage or may not operate efficiently at that particular voltage. The adaptive electrical controller converts the battery current to a motor current having the properties to let the electrical motor run, such as rotate, at a particular speed and/or with a particular torque. When the adaptive electrical controller provides an AC current, the motor current may have one or more of the characteristics of a particular frequency, peak current, effective current and/or even a particular shape, such as sinusoidal, stepped, square, triangular or sawtooth shape. When the adaptive electrical controller provides a DC current, the motor current may have one or more of the characteristics of a particular voltage, and/or current level. The preceding characteristics are merely examples of the characteristics of the motor current that may be adapted by the electrical controller.

The input of the trailer assembly is configured for receiving a setting. This setting may be inputted through one or more of a touch display input, keyboard, lever, push-button, switch. This input is provided to the adaptive electrical controller. This input allows to adapt, change or manipulate one or more of the characteristics of the motor current outputted by the adaptive electrical controller. The adapted motor current characteristic adapts the electric motor, such that the running of the electric motor is adapted. This adaptation of the running of the electric motor may result in that the electric motor rotates faster or slower. The electric motor in turn drives the concrete pump. The adaptation of the running of the electric motor adapts the pumping speed of the concrete pump. Therefore, the

input provides control over the volume of the concrete pumped over time. An advantage of the invention is that the electrification of the drive of the concrete pump, more specific the combination of features as presented, provides enhanced control over the pumped concrete volume over time. A further advantage is that the emission, such as exhaust fumes, of the trailer assembly is reduced or more or less void or null.

According to another aspect of the invention a method for a mobile concrete pump comprising the steps of:

- converting a battery current from a battery to a motor current powering an electric motor;
- driving the mobile concrete pump with the electric motor;
- pumping liquid concrete with the mobile concrete pump having a pumping speed;
- receiving a setting; and
- adapting the motor current for controlling the pumping speed based on the setting. The method provides the advantages as mentioned for the trailer assembly.

According to another aspect of the invention the use of a concrete pump according to any of the embodiments described throughout the description. The use provides the advantages as mentioned for the trailer assembly.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

In an embodiment of the trailer assembly, the adaptive electrical controller is a frequency generator; the electric motor is an AC motor; the motor current is an AC current having a frequency; and the input is arranged for receiving a frequency setting for setting the frequency of the AC current. AC motors are readily available. Regulating the frequency of the motor current provides improved control over the pumping speed.

In an embodiment of the trailer assembly, the AC motor is a synchronous AC motor. A synchronous AC motor improves the coupling between the set frequency of the motor current and the rotational speed of the axis of the AC motor. The pumping speed is based on the rotational speed of the AC motor. Thus, the improved control over the rotational speed provides improved control over the pumping speed.

In an embodiment of the trailer assembly, the trailer assembly is arranged for being towed by a car, a van, or a lorry. The arrangement for towing may comprise a towing hook. This advantageously provides improved flexibility of use of the trailer assembly.

In an embodiment of the trailer assembly, the trailer assembly comprises wheels, preferably joined by an axle, and a towing hook; the battery has a centre point of gravity; and the centre point of gravity of the battery is arranged between the towing hook and the wheels, preferably between the axle and the towing hook. The battery is typically one of the major components of the trailer assembly contributing to the weight of the trailer assembly. The centre point of gravity of the battery is typically arranged such that the battery advantageously contributes positively to the noise weight of the trailer assembly.

In an embodiment of the trailer assembly, the battery has a U-shape having a base arranged proximal to the towing hook and legs extending towards or beyond the wheels, preferably in a substantially horizontal direction and/or preferably beyond the axle. The U-shape allows for other components of the trailer assembly to be arranged inside the U-shape. Furthermore, the U-shape allows the battery to be arranged along the circumference of the trailer assembly. Arranging the battery along the circumference of the trailer assembly provides the advantage of decreased thermal resistance with the environment providing for enhanced preventing overheating of the battery, typically in use.

In an embodiment of the trailer assembly, the concrete pump comprises a hopper arranged for receiving concrete to be pumped; and at least the hopper, preferably the concrete pump, is arranged on a side of the wheels, preferably the axle, distal from the towing hook. More preferably, the at least one hopper is arranged at a distal end of the trailer assembly distal from the towing hook. The hopper according to this embodiment is arranged advantageously arranged such that the liquid cement is easily poured in the hopper. Furthermore, this arrangement allows a liquid concrete providing device, such as a dump truck, to be placed inline with the trailer for advantageously allowing the complete set of trailer assembly and liquid concrete providing device to be arranged on the side of a road allowing other traffic to pass. Also, by arranging the hopper distal from the towing hook, the liquid concrete providing device can advantageously be arranged close or even over the hopper, as the towing hook is not in the way. Further, this embodiment balances the battery near the towing hook with the concrete pump at the other end of the wheels, preferably axis or axle.

In a further embodiment of the trailer assembly, the towing hook has a nose weight; the hopper is arranged for holding an amount of concrete residue; and the centre point of gravity of the battery is arranged such that despite of the amount of concrete residue the nose weight is at least 0 kg, preferably 10 kg, more preferably 20 kg, most preferably 25 kg, and/or at most 150 kg, preferably 125 kg, more preferably 100 kg, even more preferably

75 kg, most preferably 50 kg. The nose weight is advantageously within the legal limits for roadworthy trailers in all countries, such as most countries. A nose weight in the range specified allows to easily handle the trailer assembly with a single person. A nose weight in the range specified allows the application of a nose wheel which may be simple and lightweight and therefore easily adjustable.

In an embodiment of the trailer assembly, the trailer assembly has a weight of less than 5,000 kg, preferably 4,500 kg, more preferably 4,000kg, most preferably 3,500 kg. The electric motor is typically sized and/or dimensioned depending on the concrete pump. The battery is typically sized and/or dimensioned depending on the electric motor and/or the total time the concrete pump needs to operate without recharging. The battery of the trailer assembly is typically sufficient for providing power to the trailer assembly for one working day. The battery is typically recharged during out-of-office hours, such as during the evening and night. The total weight of the trailer assembly is typically substantially determined by the summation of the weight of the battery, electric motor and the concrete pump. Therefore, the sizing and capacity of the battery is such that the trailer assembly can operate a full working day and/or a substantial part of a working day.

In an embodiment of the trailer assembly, the concrete pump comprises: a pair of concrete cylinders arranged for receiving liquid concrete in the pair of concrete cylinders; a pair of concrete pistons each concrete piston arranged for travelling inside a respective one of the pair of concrete cylinders and arranged for sucking liquid concrete into the concrete cylinder and pressing liquid concrete out of the concrete cylinder based on the motor current; and a pipe valve arranged for receiving the liquid concrete pressed out of the respective one of the pair of concrete pistons. This embodiment advantageously provides a rugged and/or dependable concrete pump. Typically, the pair of concrete pistons is configured to alternate. This embodiment advantageously allows to continuously or substantially continuously pump liquid concrete out of the concrete pump. The flow of liquid concrete is only briefly interrupted when the pipe valve switches from one concrete cylinder to the other concrete cylinder.

In an embodiment of the trailer assembly, the pipe valve has a first position receiving the liquid concrete pressed out of one of the pair of concrete cylinders and a second position receiving the liquid concrete pressed out of the other of the respective pair of concrete cylinders; and the concrete pump comprises a controller configured for controlling the position of the pipe valve. Typically, the pair of concrete pistons is configured to alternate inside the concrete cylinders with concrete pistons moving in opposite directions.

This embodiment advantageously allows to continuously or substantially continuously pump liquid concrete out of the concrete pump. The flow of liquid concrete typically is only briefly interrupted when the pipe valve switches from one concrete cylinder to the other concrete cylinder.

In an embodiment of the trailer assembly, the pipe valve comprises an S-shaped tube having a first end swingable from a first position to a second position, and a second end at a stable position for coupling to a transport tube for transporting concrete to a site for pouring the liquid concrete. The S-shaped tube provides the advantage that only one end of the pipe valve swings, while the other end is stationary allowing a stable output of the trailer assembly. As the output of the trailer assembly is stable, a stiff and/or rugged pipe may be coupled to the output for transporting the liquid concrete to a site, such as a remote site, where the liquid concrete is poured and sets.

In an embodiment of the trailer assembly, the trailer assembly comprises: a pair of conveying cylinders; a pair of conveying pistons wherein each conveying piston arranged for travelling inside a respective one of the pair of conveying cylinders based on the motor current; a pair of conveying rods functionally coupling each of the conveying pistons to a respective one of the pair of concrete pistons; and a hydraulic system arranged for converting the rotational mechanical power from the AC motor to hydraulic power driving the pair of conveying pistons for driving the concrete pump. Hydraulic power advantageously provides the ease of coupling the electric power with the concrete pump. Hydraulic power advantageously allows to convert the rotational power of the electric motor to translational power for the cylinders, such as the conveying cylinders. The hydraulic system, preferably comprising hydraulic valves, advantageously allows to configure the hydraulic system to alternate the conveying pistons for alternating the concrete pistons. The respective conveying cylinder is typically aligned with a respective concrete cylinder for allowing a respective conveying piston to be functionally coupled with a respective concrete piston by a respective conveying rod, which may be a straight rod or bar.

In an embodiment of the trailer assembly, the trailer assembly comprises a battery management system comprising: an output port arranged for providing electrical power to the electrical motor; a battery port arranged for charging and discharging the battery; and an external port arranged for receiving electrical power from an external source; wherein the battery management system is configured for depending on the received electrical power and while providing electrical power charging, discharging, holding stable the battery. The trailer assembly equipped with the external port advantageously allows to

charge the battery and/or power the electric motor. Furthermore, the external port may advantageously also support the battery powering the electric motor when pumping concrete. The battery may therefore be advantageously selected smaller while still powering the electric motor for a predefined time, such as a complete working day. The trailer assembly may as a result be lighter due to the presence of the external port.

In an embodiment of the method for a trailer assembly, the method comprises the steps of: providing a trailer; arranging the mobile concrete pump, the electric motor, the battery, and the adaptive electrical controller on the trailer. This method is effectively constructing the trailer assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be apparent from and elucidated further with reference to the embodiments described by way of example in the following description and with reference to the accompanying drawings, in which:

Figure 1 schematically shows a top view of an embodiment of a trailer assembly;

Figure 2 schematically shows a side view of an embodiment of a trailer assembly;

Figure 3 schematically shows a front view of an embodiment of a trailer assembly; and

Figure 4 schematically shows a perspective view of an embodiment of a trailer assembly.

The figures are purely diagrammatic and not drawn to scale. In the figures, elements which correspond to elements already described may have the same reference numerals.

LIST OF REFERENCE NUMERALS

100	trailer assembly
101	frontside
102	backside
103	tow hook

104	nose wheel
105, 105’	front wheel
106	front axle
107, 107’	rear wheel
108	rear axle
109	base
110	concrete pump
111	hopper
112	outflow pipe
120, 120’	concrete cylinder
121, 121’	concrete piston
124, 124’	conveying cylinder
125, 125’	conveying piston
126, 126’	rod
127	concrete valve
128	S-shaped part
129	S-shaped part in first position
129’	S-shaped part in second position
130	battery
135	electric motor
137	hydraulic system
140	adaptive electrical controller
145	input

A, A'	direction of travel of the concrete pistons
B, B'	direction of travel of the conveying pistons

DETAILED DESCRIPTION OF THE FIGURES

The following figures may detail different embodiments. Embodiments can be combined to reach an enhanced or improved technical effect. These combined embodiments may be mentioned explicitly throughout the text, may be hint upon in the text or may be implicit.

Figure 1 schematically shows a top view of an embodiment of a trailer assembly 100. The trailer assembly comprises a concrete pump 110, an electric motor 135, a battery 130, an adaptive electrical controller 140, and an input 145.

The concrete pump is arranged for pumping liquid concrete. The concrete pump has a pumping speed. The electric motor is arranged for driving the concrete pump. This driving may be direct or indirect via another system. The adaptive electrical controller is arranged for converting a battery current from the battery to a motor current powering the electric motor. The input is configured for receiving a setting for adapting the motor current for controlling the pumping speed. The trailer assembly provides the advantage of an improved control over the pumping speed. Furthermore, the trailer assembly does not produce any exhaust fumes and is therefore advantageously suitable for use in urban environments having environmental restrictions, such as limitations or even prohibiting expelling exhaust fumes.

The trailer assembly typically has a front side 101 and a back side 102. At the front side a tow hook 103 and a nose wheel 104 may be arranged. When the tow hook is not hooked to a towing vehicle, the nose wheel may be arranged to carry the nose weight. The concrete pump may advantageously be arranged at the back side. This arrangement provides the advantage that liquid concrete may be provided to the concrete pump by a vehicle, such as a liquid concrete truck, parked directly behind the trailer assembly, such that the vehicle and the trailer assembly occupy a slender and/or small area.

The concrete pump may comprise a hopper 111, an outflow pipe 112, a first concrete cylinder 120, a second concrete cylinder 120', a first concrete piston 121, a second concrete piston 121', and a concrete valve 127. The first concrete piston is arranged in the first concrete cylinder for travelling up and down the cylinder in a direction A for sucking

concrete into the cylinder and pushing concrete out of the first concrete cylinder. The second concrete piston is arranged in the second concrete cylinder for travelling up and down the cylinder in a direction A' for sucking concrete into the cylinder and pushing concrete out of the second concrete cylinder. The concrete pistons are typically arranged to move in opposite directions. The concrete valve typically is synchronised with the motion of the concrete pistons to allow an outflow out of one of the concrete cylinders to flow into the outflow pipe and typically at the same time allows an inflow into the other of the concrete cylinders to flow form the hopper. The concrete valve 127 may comprise an S-shaped part 128. The S-shaped part may have a first end rotationally coupled to the outflow pipe. The S-shaped part may have a second end having a first position 129 indicated with a solid line and a second position 129' indicated with a dashed line. In the first position, the S-shaped part is coupled with the output of the first concrete cylinder for receiving an outflow of liquid concrete and directing this outflow to the outflow pipe. In the first position, the output of the second concrete cylinder is not coupled to the S-shaped part. In this position any liquid concrete sucked in into the second cylinder comes from the hopper. In the second position, the S-shaped part is coupled with the output of the second concrete cylinder for receiving an outflow of liquid concrete and directing this outflow to the outflow pipe. In the second position, the output of the first concrete cylinder is not coupled to the S-shaped part. In this position any liquid concrete sucked in into the first cylinder comes from the hopper. This arrangement of the concrete pump provides the advantage of a more continuous flow of liquid concrete with minimized interruption of the flow. Together with the input, this concrete valve provides an optimization of liquid concrete flow and/or liquid concrete pumping speed particularly at lower flows and/or pumping speeds.

The concrete pump may further comprise a first conveying cylinder 124, a second conveying cylinder 124', a first conveying piston 125, a second conveying cylinder 125', a first rod 126, and a second rod 126'. The first conveying piston is arranged in the first conveying cylinder for travelling up and down the cylinder in a direction B. The second conveying piston is arranged in the second conveying cylinder for travelling up and down the cylinder in a direction B'. The conveying pistons are typically arranged to move in opposite directions. The first conveying piston is via the first rod mechanically coupled to the first concrete piston for synchronously moving up and down. The second conveying piston is via the first rod mechanically coupled to the second concrete piston for synchronously moving up and down. The trailer assembly may comprise a hydraulic system

137. The conveying cylinders may be powered by the electric motor via the hydraulic system, hence indirectly.

The input is typically user operable. The input may be a lever, one or more buttons, a slider, or the like for receiving from the user and providing a setting to the adaptive electrical controller for adapting the motor current for controlling the pumping speed of the concrete pump. This input provides the enhanced control over the pumping speed as mentioned throughout the text.

Figure 2 schematically shows a side view of an embodiment of a trailer assembly 100. This may be the same trailer assembly as shown in Figure 1 except for that the towing hook is left out of Figure 2. The trailer assembly has a frontside 102. The trailer assembly may comprise a base 109, a first wheel 105, a second wheel 105', and an axle 106. The axle joins the first wheel and the second wheel. The axle may further be coupled to the base. The base may provide a support and installation surface for most of or even all the other features of the trailer assembly. The double axle configuration provides the advantage of more stability or control over the nose weight for a wider range of weight or momentum of the concrete residue that may be left in the hopper between uses and especially during transport of the trailer assembly.

Figure 3 schematically shows a front view of an embodiment of a trailer assembly. This may be the same trailer assembly as shown in Figure 1 and/or 2 except for that the towing hook is left out of Figure 3. The trailer assembly has a frontside 102. The trailer assembly may comprise a base 109, a front first wheel 105, and a first rear wheel 107. Not shown are the second front wheel 105' and the front axle 106 joining them. Not shown are the second rear wheel 107' and the rear axle 108 joining them. The axles may further be coupled to the base. The base may provide a support and installation surface for most of or even all the other features of the trailer assembly.

Figure 4 schematically shows a perspective view of an embodiment of a trailer assembly. This may be the same trailer assembly as shown in Figure 1, 2, and/or 3 except for that the towing hook is left out of Figure 4. The trailer assembly has a frontside 102. The trailer assembly may comprise a base 109, a front second wheel 105', and a second rear wheel 107'. Not shown are the first front wheel 105 and the front axle 106 joining them. Not shown are the first rear wheel 107 and the rear axle 108 joining them. The axles may further be coupled to the base. The base may provide a support and installation surface for most of or even all the other features of the trailer assembly.

Examples, embodiments or optional features, whether indicated as non-limiting or not, are not to be understood as limiting the invention as claimed. It should be noted that the figures are purely diagrammatic and not drawn to scale. In the figures, elements which correspond to elements already described may have the same reference numerals.

The term “substantially” herein, such as in “substantially all emission” or in “substantially consists”, will be understood by the person skilled in the art. The term “substantially” may also include embodiments with “entirely”, “completely”, “all”, etc. Hence, in embodiments the adjective substantially may also be removed. Where applicable, the term “substantially” may also relate to 90% or higher, such as 95% or higher, especially 99% or higher, even more especially 99.5% or higher, including 100%. The term “comprise” includes also embodiments wherein the term “comprises” means “consists of”.

The term "functionally" will be understood by, and be clear to, a person skilled in the art. The term “substantially” as well as “functionally” may also include embodiments with “entirely”, “completely”, “all”, etc. Hence, in embodiments the adjective functionally may also be removed. When used, for instance in “functionally parallel”, a skilled person will understand that the adjective “functionally” includes the term substantially as explained above. Functionally in particular is to be understood to include a configuration of features that allows these features to function as if the adjective “functionally” was not present. The term “functionally” is intended to cover variations in the feature to which it refers, and which variations are such that in the functional use of the feature, possibly in combination with other features it relates to in the invention, that combination of features is able to operate or function. For instance, if an antenna is functionally coupled or functionally connected to a communication device, received electromagnetic signals that are receives by the antenna can be used by the communication device. The word “functionally” as for instance used in “functionally parallel” is used to cover exactly parallel, but also the embodiments that are covered by the word “substantially” explained above. For instance, “functionally parallel” relates to embodiments that in operation function as if the parts are for instance parallel. This covers embodiments for which it is clear to a skilled person that it operates within its intended field of use as if it were parallel.

Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the

invention described herein are capable of operation in other sequences than described or illustrated herein.

The devices or apparatus herein are amongst others described during operation. As will be clear to the person skilled in the art, the invention is not limited to methods of operation or devices in operation.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "to comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention may be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device or apparatus claims enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

The invention further applies to an apparatus or device comprising one or more of the characterising features described in the description and/or shown in the attached drawings. The invention further pertains to a method or process comprising one or more of the characterising features described in the description and/or shown in the attached drawings.

The various aspects discussed in this patent can be combined in order to provide additional advantages. Furthermore, some of the features can form the basis for one or more divisional applications.

EMBODIMENTS

1. Trailer assembly (100) comprising:

- a concrete pump (110) arranged for pumping liquid concrete and having a pumping speed;

- an electric motor (135) arranged for driving the concrete pump;

- a battery (130);

- an adaptive electrical controller (140) for converting a battery current from the battery to a motor current powering the electric motor; and

- an input (145) configured for receiving a setting for adapting the motor current for controlling the pumping speed.

2. Trailer assembly according to the preceding embodiment,

wherein the adaptive electrical controller is a frequency generator;

wherein the electric motor is an AC motor;

wherein the motor current is an AC current having a frequency; and

wherein the input is arranged for receiving a frequency setting for setting the frequency of the AC current.

3. Trailer assembly according to any of the preceding embodiments, wherein the AC motor is a synchronous AC motor.

4. Trailer assembly according to any of the preceding embodiments, wherein the trailer assembly is arranged for being towed by a car, a van, or a lorry.

5. Trailer assembly according to the preceding embodiment,

wherein the trailer assembly comprises wheels, preferably joined by an axle (106, 108), and a towing hook (103);

wherein the battery has a centre point of gravity; and

wherein the centre point of gravity of the battery is arranged between the towing hook and the wheels, preferably between the axle and the towing hook.

6. Trailer assembly according to the preceding embodiment, wherein the battery has a U-shape having a base arranged proximal to the towing hook and legs extending towards or

beyond the wheels, preferably in a substantially horizontal direction and/or preferably beyond the axle.

7. Trailer assembly according to any of the preceding embodiments 5-6,

wherein the concrete pump comprises a hopper arranged for receiving concrete to be pumped; and

wherein at least the hopper, preferably the concrete pump, is arranged on a side of the wheels, preferably the axle, distal from the towing hook.

8. Trailer assembly according to the preceding embodiment,

wherein the towing hook has a nose weight;

wherein the hopper is arranged for holding an amount of concrete residue; and

wherein the centre point of gravity of the battery is arranged such that despite of the amount of concrete residue the nose weight is at least 0 kg, preferably 10 kg, more preferably 20 kg, most preferably 25 kg, and/or at most 150 kg, preferably 125 kg, more preferably 100 kg, even more preferably 75 kg, most preferably 50 kg.

9. Trailer assembly according to any of the preceding embodiments, wherein the trailer assembly has a weight of less than 5,000 kg, preferably 4,500 kg, more preferably 4,000kg, most preferably 3,500 kg.

10. Trailer assembly according to any of the preceding embodiments, wherein the concrete pump comprises:

- a pair of concrete cylinders arranged for receiving liquid concrete in the pair of concrete cylinders;

- a pair of concrete pistons, wherein each concrete piston arranged for travelling inside a respective one of the pair of concrete cylinders and arranged for sucking liquid concrete into the concrete cylinder and pressing liquid concrete out of the concrete cylinder based on the motor current; and

- a pipe valve arranged for receiving the liquid concrete pressed out of the respective one of the pair of concrete pistons.

11. Trailer assembly according to the preceding embodiment,

wherein the pipe valve has a first position receiving the liquid concrete pressed out of

one of the pair of concrete cylinders and a second position receiving the liquid concrete pressed out of the other of the respective pair of concrete cylinders; and

wherein the concrete pump comprises a controller configured for controlling the position of the pipe valve.

12. Trailer assembly according to the preceding embodiment, wherein the pipe valve comprises an S-shaped tube having a first end swingable from a first position to a second position, and a second end at a stable position for coupling to a transport tube for transporting concrete to a site for pouring the liquid concrete.

13. Trailer assembly according to any of the preceding embodiments 10-12, comprising:

- a pair of conveying cylinders;

- a pair of conveying pistons wherein each conveying piston arranged for travelling inside a respective one of the pair of conveying cylinders based on the motor current;

- a pair of conveying rods functionally coupling each of the conveying pistons to a respective one of the pair of concrete pistons; and

- a hydraulic system arranged for converting the rotational mechanical power from the AC motor to hydraulic power driving the pair of conveying pistons for driving the concrete pump.

14. Trailer assembly according to any of the preceding embodiments, comprising a battery management system comprising:

- an output port arranged for providing electrical power to the electrical motor;

- a battery port arranged for charging and discharging the battery; and

- an external port arranged for receiving electrical power from an external source;

wherein the battery management system is configured for depending on the received electrical power and while providing electrical power charging, discharging, holding stable the battery.

15. Method for a mobile concrete pump comprising the steps of:

- converting a battery current from a battery to a motor current powering an electric motor;

- driving the mobile concrete pump with the electric motor;

- pumping liquid concrete with the mobile concrete pump having a pumping speed;

- receiving a setting; and

- adapting the motor current for controlling the pumping speed based on the setting.

16. Method according to the preceding embodiment, comprising the steps of:

- providing a trailer;

- arranging the mobile concrete pump, the electric motor, the battery, and the adaptive electrical controller on the trailer.

17. Use of a concrete pump according to any of the preceding claims 1- 14.

CONCLUSIES

1. Aanhangwagensamenstel omvattende:

- een betonpomp, ingericht voor het pompen van vloeibaar beton en met een pompsnelheid;
- een elektromotor ingericht voor het aandrijven van de betonpomp;
- een batterij;
- een adaptieve elektrische regelaar voor het omzetten van een accustroom van de accu in een motorstroom die de elektromotor aandrijft; en
- een ingang geconfigureerd voor het ontvangen van een instelling voor het aanpassen van de motorstroom voor het regelen van de pompsnelheid.

2. Aanhangwagensamenstel volgens de voorafgaande conclusie,

waarbij de adaptieve elektrische regelaar een frequentiegenerator is;

waarbij de elektromotor een wisselstroommotor is;

waarbij de motorstroom een wisselstroom is met een frequentie; en

waarbij de input is ingericht voor het ontvangen van een frequentie-instelling voor het instellen van de frequentie van de wisselstroom.

3. Aanhangwagensamenstel volgens een van de voorafgaande conclusies, waarbij de wisselstroommotor een synchrone wisselstroommotor is.

4. Aanhangwagensamenstel volgens een van de voorafgaande conclusies, waarbij het aanhangwagensamenstel is ingericht voor het trekken door een auto, een bestelwagen, of een vrachtwagen.

5. Aanhangwagensamenstel volgens de voorafgaande conclusie,

waarbij het aanhangwagensamenstel wielen, bij voorkeur verbonden door een as, en een trekhaak omvat;

waarbij de batterij een zwaartepunt heeft; en

waarbij het zwaartepunt van de batterij tussen de trekhaak en de wielen is gerangschikt, bij voorkeur tussen de as en de trekhaak.

6. Aanhangwagensamenstel volgens de voorgaande conclusie, waarbij de batterij een U-vorm heeft met een basis die proximaal aan de trekhaak is gerangschikt en benen die zich

naar of voorbij de wielen uitstrekken, bij voorkeur in een wezenlijk horizontale richting en/of bij voorkeur voorbij de as.

7. Aanhangwagensamenstel volgens een van de voorafgaande conclusies 5-6,

waarbij de betonpomp een laadtrechter omvat ingericht voor het ontvangen van beton dat verpompt gaat worden; en

waarbij tenminste de laadtrechter, bij voorkeur de betonpomp, is geplaatst aan een kant van de wielen, bij voorkeur de as, distaal van de trekhaak.

8. Aanhangwagensamenstel volgens de voorafgaande conclusie,

waarbij de trekhaak een kogeldruk heeft;

waarbij de laadtrechter is ingericht voor het houden van een hoeveelheid betonresidu; en

waarbij het zwaartepunt van de batterij zodanig is geplaatst dat ondanks de hoeveelheid betonresidu de kogeldruk tenminste 0 kg, bij voorkeur 10 kg, bij verdere voorkeur 20 kg, bij meeste voorkeur 25 kg, en/of ten hoogste 150 kg, bij voorkeur 125 kg, bij verdere voorkeur 100 kg, bij nog verdere voorkeur 75 kg, bij meeste voorkeur 50 kg bedraagt.

9. Aanhangwagensamenstel volgens een van de voorgaande conclusies, waarbij het aanhangwagensamenstel een gewicht heeft van minder dan 5.000 kg, bij voorkeur 4.500 kg, bij verdere voorkeur 4.000 kg, bij meeste voorkeur 3.500 kg.

10. Aanhangwagensamenstel volgens een van de voorgaande conclusies, waarbij de betonpomp omvat:

- een paar betoncilinders ingericht voor het ontvangen van vloeibaar beton in het paar betoncilinders;

- een paar betonzuigers, waarbij elke betonzuiger gerangschikt is voor het bewegen binnen een respectieve van het paar betoncilinders en geschikt is voor het aanzuigen van vloeibaar beton in de betoncilinder en het eruit persen van het vloeibare beton uit de betoncilinder op basis van de motorstroom; en

- een pijpklep gerangschikt voor het ontvangen van het vloeibare beton dat uit respectief één van het paar betonzuigers wordt gedrukt.

11. Aanhangwagensamenstel volgens de voorafgaande conclusie,

waarbij de pijpklep een eerste positie voor het ontvangen van het vloeibare beton dat uit een van het paar betonzuigers wordt geperst en een tweede positie voor het ontvangen van het vloeibare beton dat uit de andere van het respectieve paar betonzuigers wordt geperst heeft; en

waarbij de betonpomp een regelaar omvat die is ingericht voor het regelen van de positie van de pijpklep.

12. Aanhangwagensamenstel volgens de voorgaande conclusie, waarbij de pijpklep een S-vormige buis omvat met een eerste uiteinde dat van een eerste positie naar een tweede positie zwenkbaar is, en een tweede uiteinde in een stabiele positie voor het koppelen aan een transportbuis voor het transporteren van beton naar een locatie voor het storten van het vloeibare beton.

13. Aanhangwagensamenstel volgens een van de voorgaande conclusies 10-12, omvattende:

- een paar transportcilinders;
- een paar transportzuigers, waarbij elke transportzuiger geschikt is voor het bewegen in een van de twee transportcilinders op basis van de motorstroom;
- een paar transportstangen voor het functioneel koppelen van elke van de transportzuigers aan een respectieve van de twee betonzuigers; en
- een hydraulisch systeem ingericht voor voor het omzetten van de roterende mechanische kracht van de wisselstroommotor in hydraulische kracht die het paar transportzuigers aandrijft voor het aandrijven van de betonpomp.

14. Aanhangwagensamenstel volgens een van de voorafgaande conclusies, omvattende een batterijbeheersysteem omvattende:

- een uitvoerpoort geschikt voor het verschaffen van elektrisch vermogen aan de elektromotor;
- een batterijpoort geschikt voor het laden en het lossen van de batterij; en
- een externe poort geschikt voor het ontvangen van elektrisch vermogen van een externe bron;

waarbij het batterijbeheersysteem geschikt is voor afhankelijk van het ontvangen

elektrisch vermogen en gedurende het verstrekken van elektrisch vermogen laden, ontladen en stabiel houden van de batterij.

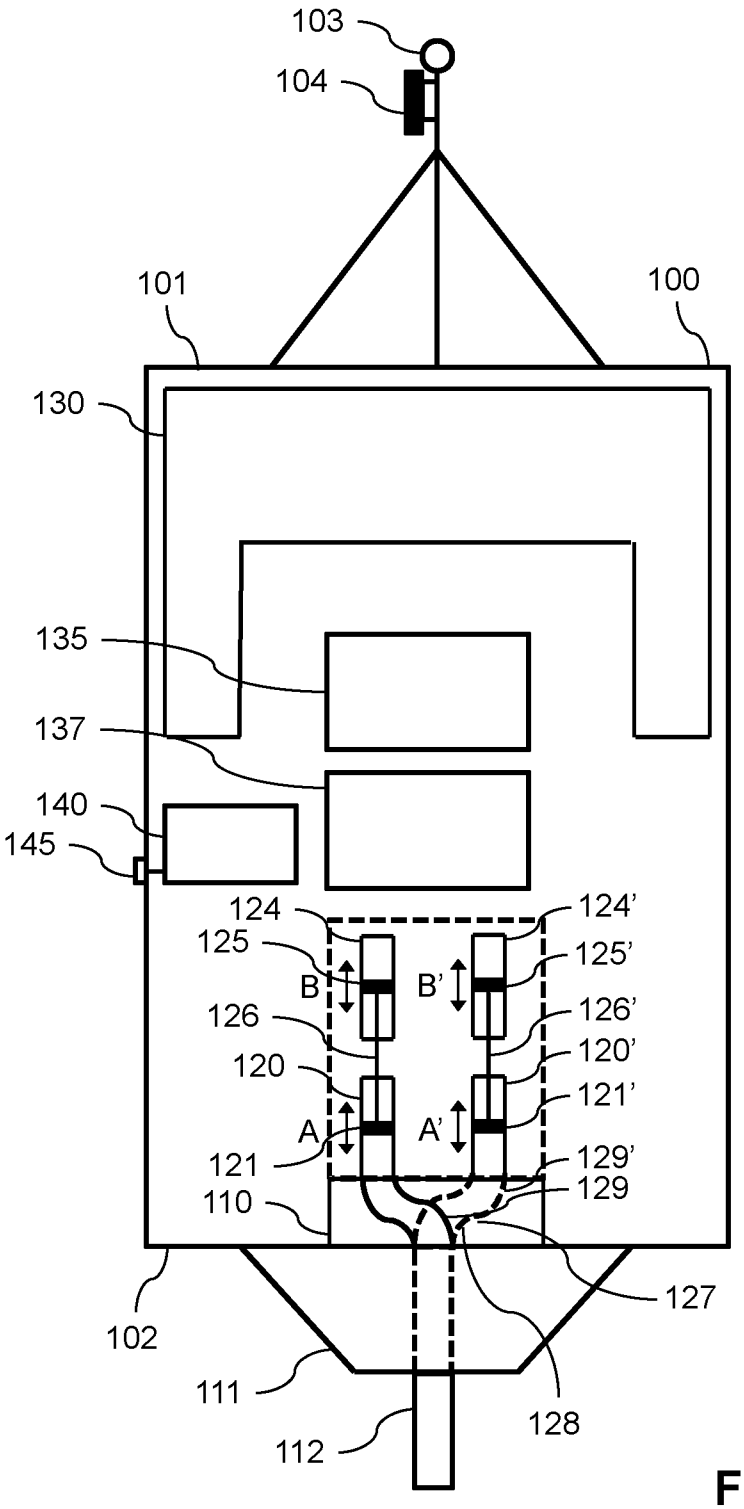
15. Werkwijze voor een mobiele betonpomp omvattende de stappen van:

- het omzetten van een batterijstroom in een motorstroom voor het voeden van een elektrische motor;
- het aandrijven van de mobiele betonpomp met de elektromotor
- het pompen van vloeibaar beton met de mobiele betonpomp met een pompsnelheid;
- het ontvangen van een instelling; en
- het aanpassen van de motorstroom voor het regelen van de pompsnelheid op basis van de instelling.

16. Werkwijze volgens de voorgaande conclusie, omvattende de stappen van:

- het verstrekken van een aanhangwagen;
- het plaatsen van de mobiele betonpomp, de elektromotor, de accu, en de adaptieve elektrische regelaar op de aanhanger.

17. Gebruik van een betonpomp volgens een van de voorgaande conclusies 1-14.


103
104
101
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124'
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128
112

Fig. 1

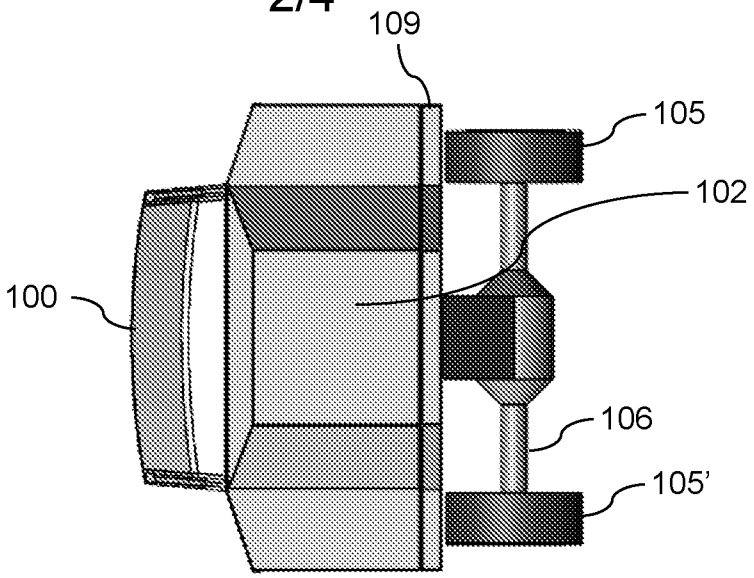

Fig. 2

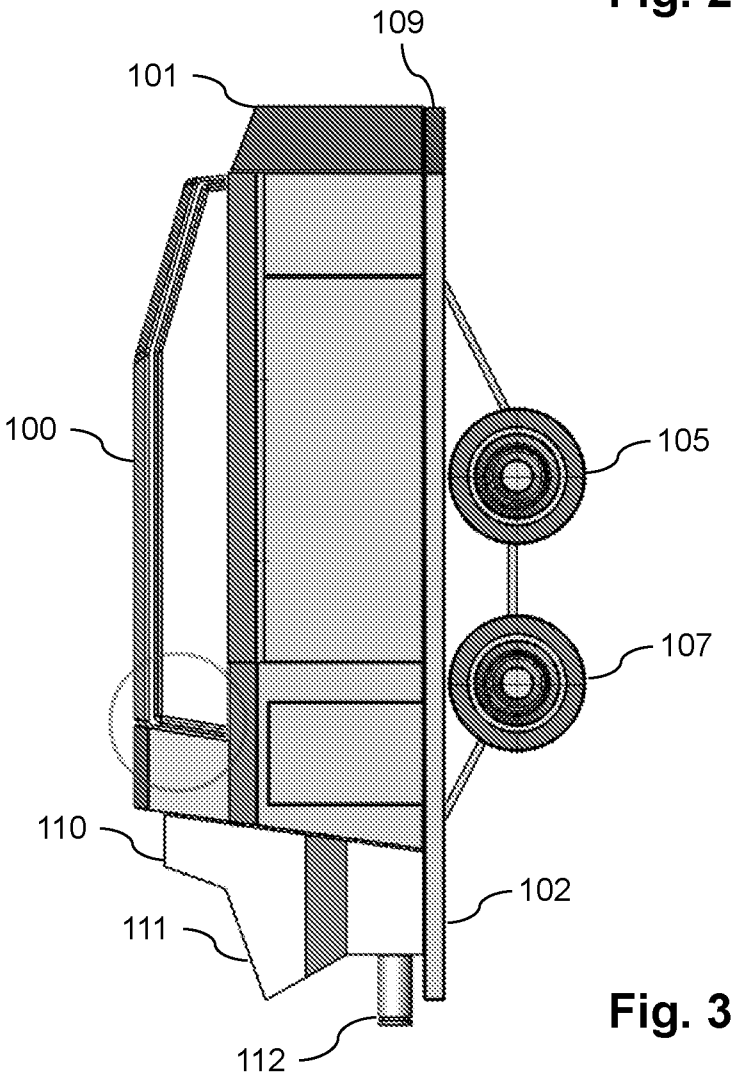

Fig. 3

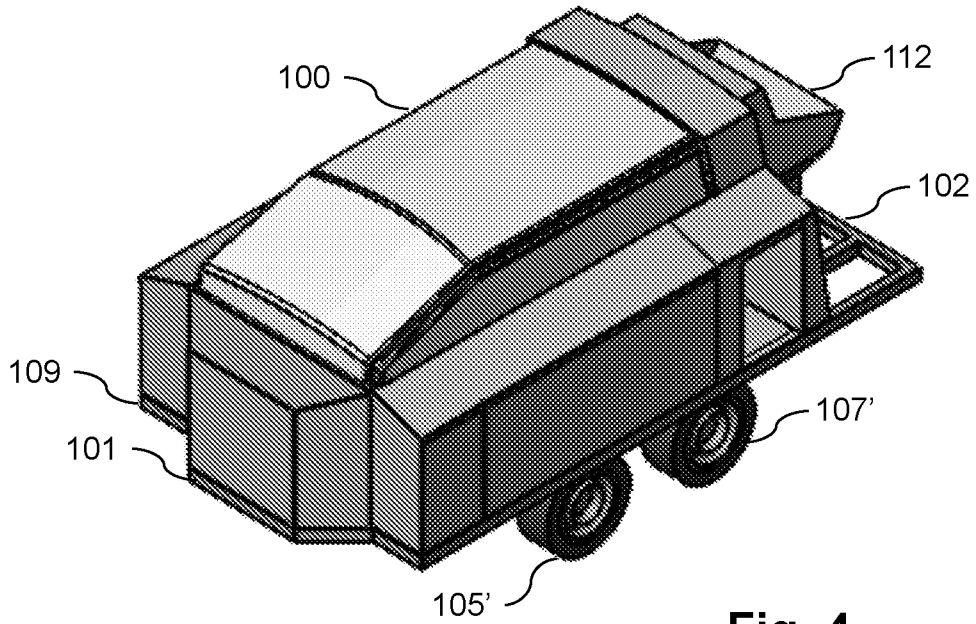

Fig. 4

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
Nederlands aanvraag nr. **2028622**	Indieningsdatum **02-07-2021**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **RvR Betonpomp Verhuur B.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **31-07-2021**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN79228**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

Zie onderzoeksrapport

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**Zie onderzoeksrapport**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐	**GEBREK AAN EENHEID VAN UITVINDING**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2028622

A. CLASSIFICATIE VAN HET ONDERWERP

INV. F04B15/02 E04G21/04 F04B17/03 F04B17/06 F04B49/06 F04B49/20

ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)

F04B E04G

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)

EPO-Internal

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
Y	US 4 298 288 A (WEISBROD ALVIN J) 3 november 1981 (1981-11-03)	1-5, 7-10,13, 14,16,17
A	* kolom 4, regel 62 - kolom 5, regel 47 * * figuren 1,2 *	6,11,12, 15

X	WO 2020/078040 A1 (SANY AUTOMOBILE MFG CO LTD [CN]) 23 april 2020 (2020-04-23)	15
Y	* het gehele document *	1-5, 7-10,13, 14,16,17
A		6,11,12

X	CN 110 219 466 A (XUZHOU COLLEGE IND TECHNOLOGY) 10 september 2019 (2019-09-10)	1,15
A	* het gehele document *	2-14,16, 17

	-/--	

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid	Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type
3 maart 2022	

Naam en adres van de instantie	De bevoegde ambtenaar
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	**Lange, Christian**

1

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2028622

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	US 2021/010465 A1 (HANCOCK JR DOUGLAS L [US] ET AL) 14 januari 2021 (2021-01-14) * alineas [0038], [0039] * * figuren 1,2,3 *	1-17
A	DE 10 2017 222949 A1 (PUTZMEISTER ENGINEERING GMBH [DE]) 19 juni 2019 (2019-06-19) * alineas [0021], [0060] * * figuren 1,3 *	1-17
A	US 3 279 382 A (BENNETT MARVIN D) 18 oktober 1966 (1966-10-18) * kolom 12, regel 15 - kolom 13, regel 39 * *	1-17
A	US 10 829 946 B2 (CIFA SPA [IT]) 10 november 2020 (2020-11-10) * het gehele document *	1-17
A	JP H09 250448 A (ISHIKAWAJIMA CONSTR MACH) 22 september 1997 (1997-09-22) * alinea [0003] * * figuren 2,6 *	1-17

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek

NL 2028622

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 4298288 A	03-11-1981	GEEN	
WO 2020078040 A1	23-04-2020	CN 109057346 A	21-12-2018
		WO 2020078040 A1	23-04-2020
CN 110219466 A	10-09-2019	GEEN	
US 2021010465 A1	14-01-2021	GEEN	
DE 102017222949 A1	19-06-2019	DE 102017222949 A1	19-06-2019
		EP 3498518 A1	19-06-2019
US 3279382 A	18-10-1966	DE 1296524 B	29-05-1969
		DE 1703886 A1	20-04-1972
		DE 1780018 A1	13-01-1972
		GB 1068863 A	17-05-1967
		GB 1068864 A	17-05-1967
		GB 1068865 A	17-05-1967
		JP S5211441 B1	31-03-1977
		JP S5211442 B1	31-03-1977
		JP S5211443 B1	31-03-1977
		US 3279382 A	18-10-1966
		US 3507347 A	21-04-1970
US 10829946 B2	10-11-2020	CN 110670881 A	10-01-2020
		EP 3591142 A1	08-01-2020
		US 2020002961 A1	02-01-2020
JP H09250448 A	22-09-1997	GEEN	

WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
SN79228	02.07.2021		NL2028622

International Patent Classification (IPC)
INV. F04B15/02 E04G21/04 F04B17/03 F04B17/06 F04B49/06 F04B49/20

Applicant
RvR Betonpomp Verhuur B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

	Examiner
	Lange, Christian

Application number

WRITTEN OPINION

NL2028622

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	2-14, 16, 17
	No:	Claims	1, 15
Inventive step	Yes:	Claims	6, 11, 12
	No:	Claims	1-5, 7-10, 13-17
Industrial applicability	Yes:	Claims	1-17
	No:	Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Box No. VII Certain defects in the application

see separate sheet

1 **Re Item V**

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 Reference is made to the following documents:

D1	US 4 298 288 A (WEISBROD ALVIN J) 3 november 1981 (1981-11-03)
D2	WO 2020/078040 A1 (SANY AUTOMOBILE MFG CO LTD [CN]) 23 april 2020 (2020-04-23)
D3	CN 110 219 466 A (XUZHOU COLLEGE IND TECHNOLOGY) 10 september 2019 (2019-09-10)

1.2 The present application does not meet the criteria of patentability, because the subject-matter of claim 1 does not involve an inventive step.

1.2.1 Document D1 is regarded as being the prior art closest to the subject-matter of claim 1, and discloses

een "aanhangwagensamenstel (see figure 1) omvattende:

- een betonpomp (see figure 2), ingericht voor het pompen van vloeibaar beton met een pompsnelheid - see paragraph column 5, line 62, until column 6, line 4.

1.2.2 The subject-matter of claim 1 therefore differs from this known "aanhangwagensamenstel" in that

"- een elektromotor ingericht voor het anndrijven van de betonpomp

- een batterij;

- een adaptive elektrische regelaar voor het omzetten van een accustroom van de accu in een motorstroom die de elektromotor aandrijft; en

- een ingang geconfigureerd voor het ontvangen van een instelling voor het aanpassen van de motorstroom voor het regelen van de pompsnelheid."

1.2.3 The problem to be solved by the present invention may therefore be regarded as

providing an alternative driving unit taking the benefit of less weight, less noise emission and less exhaust gas.

1.2.4 The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step.

The driving means for the pump as claimed is known in the art for a similar device. See document D2. D2 discloses a concrete pump to be installed on a truck, the pump is driven by an electric motor that is powered by a battery. The speed of the pump is electrically controlled by a rectifier module and an inverter module.

See the following parts of the description:

a) On the one hand, the boom pump is driven by a motor, and the motor is connected to the battery assembly or an external power source through a power supply interface, and the boom pump motor is driven by the power provided by the generator, so that the boom pump motor drives the boom pump to complete the corresponding work. In other words, the boom pump is driven by electricity, so as to ensure accurate control of the boom pump and improve its working efficiency.

b) On the one hand, the energy storage battery is charged through the external power supply, and on the other hand, the external power supply directly drives the motor module to run. In this embodiment, the hybrid drive is implemented by the engine 14 and the battery and external power supply. **The motor controller has a built-in rectifier module and inverter module to adjust the motor speed, monitor the working current, and adjust the current.**

Therefore, the differing feature is described in document D2 as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal option to include this feature in the concrete pump on the trailer described in document D1 in order to solve the problem posed.

For this reasons the subject-matter of claim 1 is not considered to involve an inventive step.

1.3 Dependent claims 2-5,7-10,13 and 14 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of inventive step, the reasons being as follows:

1.3.1 The characterising features of claims 2 and 3 have not been explicitly mentioned in D2, however, they are considered as being well known in the art and its application is obvious.

It is, thus, at present not apparent in which manner these features could justify an inventive step.

1.3.2 The additional feature of claim 4 is known from D1 and can, thus, not form the basis of an inventive step argumentation.

1.3.3 The additional features of claim 5 concern the arrangement of the battery on the trailer which is regarded as common design features. Note that the wheels of the trailer as shown in D1 are arranged on the rear side so as the positon of a battery would be positioned as claimed.

1.3.4 The characterising features of claim 7 are shown in D1 and can, thus, not justify inventiveness.

1.3.5 Claims 8 and 9 claim additional features that are purely a matter of constructional design that the skilled person would consider in order to achieve an appropriate weight balance.

At present there is no inventive step apparent.

1.3.6 The characterising features of claim 10 concerning the pump assembly are known from D1 and, thus, the subject-matter of claim 10 is not inventive.

1.3.7 The additional features of claim 13 are known from D1, as seen in figure 4 and from the description column 6, lines 5-22.

The subject-matter of claim 13 is, thus, not inventive.

1.3.8 The characterising features of claim 14 are known from D2 and regarded as being obvious.

The external energy plug for charging the battery is anticipated by D2 as described in the description, see the citation of the description under a) in above paragraph 1.2.4.

The further features considering the battery controlling system are known in general in the field of accumulators. It is not apparent in which manner these features could form the basis of an inventive step argumentation.

1.4 The method as claimed in claim 15 is entirely anticipated by D2. Claim 15 does not claim a trailer as in claim 1. The mobile concrete pump is disclosed by D2 since the concrete pump is installed on a truck.

1.5 The method as claimed in claim 16 does not contain any method step that go beyond the corresponding features of the previous product claims and is, thus, not inventive for the reasons as given above.

1.6 The use as claimed in claim 17 is not inventive for the reasons as given above.

1.7 Additionally, the applicant's attention is drawn to document D3 which discloses a hand moved trailer that is supposed to transport concrete in a container and that includes as pump for emptying the container. It, furthermore, discloses a battery for energising the electric motor of the pump.

This document is novelty destroying for the subject-matter of claim 1 and the method of claim 15 although it does not anticipate the pump on a trailer as meant in the present application.

1.8 The subject-matter of claims 1-14, the method of claims 15 and 16 and the use of claim 17 is industrially applicable in the field of concrete pumps.

2 **Re Item VII**

Certain defects in the application

2.1 Independent claim 1 is not in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterising part.

2.2 The features of the claims are not provided with reference signs placed in parentheses.

2.3 The relevant background art disclosed in documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.

C. Lange