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(54) **COMPACT POWER WASHER BATTERY, MOTOR AND PUMP DESIGN**

KOMPAKTER DESIGN FÜR BATTERIE, MOTOR- UND PUMPE EINES ELEKTRISCHEN
WASCHGERÄTS

CONCEPTION COMPACTE D'UNE BATTERIE, D'UN MOTEUR ET D'UNE POMPE DESTINÉS À
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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a power washer, and more specifically, to the design of the battery, motor, and pump within a power washer.

BACKGROUND

[0002] Power washers are known in the art and can be powered by DC batteries, AC power or internal combustion engines. Power washers are typically used to provide a high pressure water stream to clean surfaces such as walls, sidewalks, cars, etc. A motor is operatively-connected to and turns a pump, typically a high pressure water pump. The water from a reservoir or a hose is passed through a pump which creates a high pressure stream which flows through a hose to a wand for spraying. The stream exits and is directed with the wand. Typically the wand has a handle which allows the user to easily and securely hold the wand, because as the water exits the wand with great velocity, it exerts a strong force pushing back on the wand.

[0003] Power washers are increasingly popular to clean materials such as concrete, wood, plastics, and metals. Typically power washers are sold with various attachments such as different wands for different spray patterns, hose extensions, etc. Electric power washers are increasingly popular and typically require quite large batteries. Such large batteries are required to provide the voltage, wattage, and endurance required to run a motor and the pump for an extended period of time.

[0004] The CN 104 520 024 A discloses a cleaning machine in accordance with the preamble of claim 1, provided with a main body, an electric motor connected to an inclined battery pack and a control circuit, a pump driven by the electric motor to increase the pressure of the cleaning liquid. The CN 103 316 859 A refers to a cleaning device for greenhouse tops with a movable working platform, a steel wire rope and a spray pipe with a nozzle, wherein a high-pressure water supply system mounted on the movable working platform having vertically arranged generator unit, motor unit and pump unit. The JP 2013 169486 A describes a high pressure washing device having a base unit, a motor, a laterally inserted battery pack, a pump driven by the motor and a cleaning liquid reservoir provided in the base unit, wherein the cleaning fluid reservoir is positioned in the top of the base unit, while the battery, motor and pump are positioned below. The EP 2 268 421 B1 relating to a high-pressure cleaning device comprising a motor-pump unit for pressurizing and delivering a cleaning liquid, and an electrical unit for controlling the motor pump unit, wherein the electric unit is connectable to an external power supply device via a power cable. The WO 2015/194426 A1 depicts a high-pressure cleaner having a pump, a brushless motor to drive the pump, and a control unit to supply the brush-

less motor with electric energy from a battery pack, wherein the battery pack, control unit, brushless motor and pump unit are provided in a lower portion of the casing while a reservoir for cleaning liquid is placed in the upper portion.

[0005] However, it has been found that users desire ever more compact power washers, that nonetheless provide sufficient power for cleaning applications. Thus, while it is easy to increase power while also increasing size and the footprint of the power washer, it is quite difficult to increase power while maintain or even shrinking the footprint. Also, as many users do not have very much storage space for a large footprint power washer, many users are unable to purchase such a device. In addition, a reduced footprint power washer requires reduced materials to form the housing, packaging, etc. Accordingly, a reduced footprint also leads to multiple benefits such as reduced manufacturing costs, shipping costs, increased improved stocking at the point of sale, a lower shelf-space requirement, reduced storage requirements both for the vendor and the user, etc.

[0006] Accordingly, the need remains for a power washer which provides a reduced footprint, and/or an improved internal design.

SUMMARY OF THE INVENTION

[0007] The present invention relates to an electric power washer according to claim 1. The washer comprising a housing and an internal component design having a battery having a battery axis, a motor electrically-connected to the battery, a pump operatively-connected to the motor and an output valve fluidly-connected to the pump. The motor has a motor axis and the pump has a pump axis. The battery is immediately adjacent to the motor, and the motor axis is parallel to the battery axis. Furthermore, the pump axis is parallel to the motor axis and the output valve is below the pump. An electric power washer having such an internal component design is also provided herein.

[0008] Without intending to be limited by theory, it is believed that such an internal component design is very space-efficient and provides improved use of space so as to allow the construction of a power washer having a smaller footprint and better stability.

[0009] An electric power washer has a housing, an electric battery being a smart battery, a motor, a pump, an input valve, and an output valve. The motor is a brushless motor that is operatively-connected to the battery and located in the housing. The pump is operatively-connected to the motor and is located in the housing. The input valve is operatively-connected to the pump as is the output valve. Water enters the input valve and the water pressure is increased by the pump to form high pressure water. The high pressure water exits the output valve.

[0010] Without intending to be limited by theory, it is believed that the combination of a brushless motor and

a smart battery provides specific power-management benefits which allow the power washer herein to be more efficient, to provide a longer battery life, to provide improved boost power, and/or other benefits.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 shows an embodiment of an internal component design of the present invention

Fig. 2 shows a partially-cut-away perspective view of an embodiment of a power washer; and

Fig. 3 shows a partially-cut-away embodiment of a power washer.

[0012] The figures herein are for illustrative purposes only and are not necessarily drawn to scale.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Unless otherwise specifically provided, all tests herein are conducted at standard conditions which include a room and testing temperature of 25 °C, sea level (1.01235 bar(1 atm.)) pressure, pH 7, and all measurements are made in metric units. Furthermore, all percentages, ratios, etc. herein are by weight, unless specifically indicated otherwise.

Internal Component Design

[0014] Turning to Fig. 1 which shows an internal component design, 10, of an embodiment of the present invention having a battery, 12, in this case two batteries, 12 and 12', a motor, 14, a pump, 16, and a frame, 18. A battery support, 20, holds the batteries in place, and also contains the electrical connections necessary to receive and transmit the electrical power to the motor, 14.

[0015] In the present invention, the battery is electrically-connected to the motor, either directly or indirectly. Furthermore, in the present invention, the pump is operatively-connected to the motor, typically via a gear, or directly.

[0016] In an embodiment herein, the motor is a brushless motor, such as known in the art. See for example, WO 2015/165012 to Foster Assets Corporation, published on 5 November 2015. In the typical embodiment herein, the brushless motor contains a switching element to selectively enable and disable the driving mechanism for the motor. The brushless motor may further contain a printed circuit board or other type of controller therein, as seen in WO 2014/031539 A1 to Milwaukee Electric Tool Corp., published on February 27, 2014. In an embodiment herein, the power washer herein contains a motor controller, which may be part of the controller, 26, the motor, 14, or may be located elsewhere. In an embodiment herein the motor controller either directly or indirectly regulates the output of the smart battery.

[0017] Without intending to be limited by theory, it is believed that the combination of a brushless motor communicating with a smart battery is especially effective as it may provide one or more benefits such as improved efficiency, provide improved power management, increase the spray power while reducing wasted energy, provide a more efficient boost function, etc., especially if the motor controller directly communicates with the smart battery.

[0018] In this embodiment, the frame, 18, is affixed to the motor, 14, the pump, 16, and the battery support, 20, and keeps them aligned. In this embodiment, the frame, 18, has open cells, 22, formed by reinforcing ribs, 24, so as to reduce the weight while retaining strength and a certain amount of flexibility. The frame seeks to provide a lightweight, yet sturdy component that prevents shifting and/or movement of the motor, 14, the pump, 16, and the battery support, 20, relative to each other. Without intending to be limited by theory, it is believed that such a frame reduces maintenance issues, breakage, etc. while balancing the opposing needs for rigidity and flexibility. The frame may be made from a metal, a plastic, and/or a resin; or from steel, a high impact plastic, and or a resin.

[0019] The battery useful herein is typically an electric battery; or a rechargeable electric battery; having a voltage of more than 1v; or from about 1v to about 56v; or from about 1.5v to about 48v; or from about 3v to about 45v; or from about 6v to about 40v. The power washer herein includes at least one battery; or from about 1 to about 12 batteries, or from about 2 to about 8 batteries. In Fig. 1, it can be seen that the power washer, 10, contains 2 batteries, 12 and 12', each rated at about 18v.

[0020] In an embodiment herein, the power washer contains a plurality of smart batteries; or having two smart batteries. In an embodiment herein, two smart 18 v batteries are provided in a single battery casing and provide a total maximum voltage of 36 v. Additional voltage configurations are also possible, such as 3 x 18 v to provide a total maximum voltage of 54 v, etc. However, when present, the smart batteries and the electrical system of the power washer are able to interact and communicate such that the smart batteries discharge at the optimum voltage and/or current.

[0021] The battery useful herein typically possesses a mAh rating of greater than 750 mAh; or from about 750 mAh to about 10000 mAh; or from about 1000 mAh to about 6000 mAh; or from about 1100 mAh to about 5000 mAh. The chemistry in the battery is largely irrelevant, but may be, for example nickel-cadmium, lithium ion, or a combination thereof; or lithium ion. Generally, higher energy-density batteries are preferred. In an embodiment herein the battery is a removable battery.

[0022] The electric battery herein may be a smart battery, which indicates that the electric battery (or the battery cell(s), or the casing, etc.) contain a physical, electrical, or other method/structure to control the discharge and/or charging of the battery. The person skilled in the

art understands that this may be accomplished by, for example, including battery controller, a variety of different electrical terminals to connect to the electrical system, a software to control the battery, etc. Such a smart battery may control one or more features of the battery, for example, voltage, current, temperature, charging, discharging, etc.

[0023] In an embodiment herein, the smart battery contains a plurality of terminals for electrically-connecting to the power washer's electrical system. The terminals may include, for example, a high-current discharge terminal, a low-current discharge terminal, a battery pack identification terminal, a battery pack temperature terminal, and/or a positive voltage terminal. In some embodiments, the battery pack housing does not include circuitry for controlling the switching between the low-current discharge terminal and the high-current discharge terminal, and in other embodiments, the battery pack does contain such circuitry. See, for example, the smart battery described in Chinese Patent Publication CN 102301246 A to Techtronic Industries, published on December 28, 2001. Such a smart battery may be especially useful when the power washer contains a boost function.

[0024] In an embodiment herein, the power washer contains a single battery. In an embodiment herein the power washer contains two batteries.

[0025] The battery, 12, has a battery axis, BA, which is defined as the axis running parallel to the longest dimension of the battery. As batteries are typically roughly cylindrical or rectangular prisms, or variations thereof, the battery axis is typically readily apparent. In the case where the battery does not contain a longest dimension, then the battery axis will be an axis perpendicular to the plane formed by the electrical connections if the electrical connections are flat. If the electrical connections are not flat and the battery does not contain a longest dimension, then the battery axis is parallel to the plane formed by the electrical connections. In the embodiment of Fig. 1, one skilled in the art will understand that the battery connections are at the bottom of the battery, 12, and are therefore not visible as they are covered by the battery support, 20. In an embodiment herein, the battery support fits together with the battery at one end of the battery axis. In an embodiment herein, the battery support surrounds the battery on at least about 1 side; or on from about 1 side to about 6 sides; or from about 1 side to about 5 sides; or from about 2 sides to about 6 sides; or from about 2 sides to about 5 sides; or from about 4 sides to about 6 sides; or from about 4 sides to about 5 sides; or 4 sides; or 5 sides; or 6 sides.

[0026] In the embodiment shown, the motor, 14 has a motor axis, MA. The motor axis is defined as the axis around which the motor spindle rotates. Such a motor axis, MA, is also typically the axis parallel to the longest dimension of the motor. The motor is electrically-connected to the battery, 12, either directly or through a controller, 26, which typically contains a printed circuit board (PCB), 28, software, additional hardware, etc. The con-

troller, 26, may act as an electronic control center for all aspects of the power washer (see Fig. 2 at 36), and may detect and/or regulate one or more parameters and/or conditions such as, but not limited to, power output, battery drain, water pressure, motor speed, pump speed, emergency shut off, water temperature, battery temperature, motor temperature, etc.

Electric Power Washer

[0027] In an embodiment herein, the electric power washer contains a main body, a hose, a handle, and a controller. The main body contains a pump and an electric power source operatively-connected to the pump. The hose contains a first end that is fluidly-connected to the pump and second end fluidly-connected to the handle. The handle has a button operatively-connected to the controller. The controller is operatively-connected to both the pump and the electric power source. The controller controls the output of the pump. The controller may contain a timer as well.

[0028] In an embodiment herein, the electric power washer contains the internal component design described herein.

[0029] Under normal conditions, the controller permits the pump to operate at up to 100% normal power. However, when the button is activated, the controller permits the pump to exceed the 100% normal power, and to operate in a boost power mode. The controller may control the pump to operate either directly or indirectly as desired. In an embodiment herein, the controller controls the pump speed directly. In an embodiment herein, the controller controls the pump speed indirectly via, for example, by controlling the battery output and/or motor speed.

[0030] However, when the button is activated, the controller permits the pump to operate at a boost power mode of from about 103% normal power to about 300% normal power. In the boost power mode, the controller permits the pump to operate at from about 103% normal power to about 300% normal power; or from about 105% normal power to about 250% normal power; or from about 110%, normal power to about 200% normal power.

[0031] The level of 100% normal power is defined as the highest sustainable power draw which will not permanently damage the batteries, motor or the pump; in contrast, the "boost power mode" is defined as being more powerful than the (sustainable) 100% normal power mode, and which does not cause overt, and/or unrecoverable damage to the power washer and the components therein.

[0032] Without intending to be limited by theory, it is surprisingly-believed that such a boost power mode and a method for using such a boost power mode provides a limited burst of increased power and therefore increased water pressure/water output, without causing any significant, lasting damage to the battery, the internal mechanisms, the pump, seals, etc. It is further believed

that such a limited boost power mode specifically does not cause significant and/or lasting damage to an electric battery such as a lithium ion battery. Without intending to be limited by theory, it is also believed that an intermittently pulsing boost power mode more easily dislodges dirt and grime, while balancing wear and tear on the power washer components such as, for example, the battery, the pump, the seals, the motor, etc.

[0033] The controller may intermittently pulse the boost power mode.

[0034] The controller typically automatically shuts down the boost power mode when a preset criteria is reached. The preset criteria may be, for example, one or more of a certain (typically a predetermined) period of time, a specific battery temperature, a specific motor temperature, a specific pump temperature, a specific motor speed, a specific pump speed, a specific battery discharge voltage, a specific battery discharge current, when the button is no longer activated, etc.; or when the button is no longer activated and/or a predetermined period of time.

[0035] In an embodiment herein, the boost power mode is terminated after a predetermined period of time, or when the button is no longer activated, whichever period is shorter. The predetermined period of time may be from about 2 seconds to about 10 minutes; or from about 5 seconds to about 2 minutes; or from about 7 seconds to about 1.5 minutes; or from about 10 seconds to about 1 minute; or from about 15 seconds to 45 seconds. Without intending to be limited by theory, it is believed that the present invention allows the user greater control, and also reduces the change of damage to the battery, the pump, and/or the internal mechanisms of the power washer. In addition, some consumers prefer such a pulsing boost function as the consumer perception is that it more effectively cleans and dislodges dirt and grime. Without intending to be limited by theory, it is believed that such a feature provides improved performance while maintaining the safety and reliability of the power washer.

[0036] Further, it can be seen that the pump, 16, contains a pump axis, PA, which is defined as the axis around which the motor turns the pump. Such a pump axis, PA, is also typically the axis parallel to the longest dimension of the pump. The pump useful herein is typically a high pressure pump; or a high pressure electric pump, having an output of more than about 500 psi (3.4 MPa); or of from about 500 psi (3.4 MPa) to about 5000 psi (34 MPa); or from about 1000 psi (6.8 MPa) to about 4000 psi (27.6 MPa); or from about 1250 psi (8.6 MPa) to about 3500 psi (24.1 MPa). Such pumps are commonly available from many makers worldwide.

[0037] In Fig. 1, it can be seen that the battery axis, BA, the motor axis, MA, and the pump axis PA are parallel to each other, in the Y-dimension. In an embodiment herein the battery axis is parallel to the motor axis in one dimension, while the battery and the motor are offset in another dimension. In an embodiment herein the pump axis is parallel to the motor axis in one dimension, while

the pump and the motor are offset in another dimension. Without intending to be limited by theory, it is believed that such an alignment of the battery axis, motor axis and/or pump axis allows the internal components of the power washer to be extremely space-efficient, as the long dimensions are all parallel. Such efficiency may be further enhanced when the motor axis, the battery axis, and the pump axis are parallel to each other in the Y-dimension, but the actual battery, motor and/or pump are offset from each other in one or more other dimensions, for example the X-dimension and/or the Z-dimension.

[0038] In Fig. 1 an input valve, 30, is fluidly-connected to the pump, 16, and is also fluidly-connected to an output valve, 32. In an embodiment herein the output valve is positioned in a plane below the pump; or directly below the pump. Externally, the input valve is typically connected to a hose (see Fig. 2 at 40) which then leads to the water supply such as a water tank, a water faucet, etc. Externally, the output valve is typically connected to a different hose which leads to a wand (see Fig. 2 at 52), typically at a wand grip (see Fig. 2 at 54). Accordingly, in this embodiment, the output valve, 32, has a hose connector, 34 thereupon. Any hose connected to the output valve is typically a high pressure hose made specifically to withstand and safely contain the high pressure water running therethrough during use of the power washer (see Fig. 2 at 38). In an embodiment herein, the high pressure hose is capable of withstanding a pressure of greater than about 50 psi (0.34 MPa); or of from about 50 psi (0.34 MPa) to about 5000 psi (34 MPa); or from about 100 psi (0.68 MPa) to about 4000 psi (27.6 MPa); or from about 125 psi (0.86 MPa) to about 3500 psi (24.1 MPa).

[0039] Fig. 2 shows a partially-cut-away perspective view of an embodiment of a power washer, 36, herein, specifically an electric power washer, having a housing, 38. The housing will typically be made of a relatively tough material selected from a plastic, a resin, rubber, metal, and a combination thereof; or a plastic, rubber, a metal and a combination thereof. The plastic herein may be a high impact plastic; or polyethylene, polypropylene, polystyrene, and a combination thereof; or linear low density polyethylene, low density polyethylene, high density polyethylene, and a combination thereof either with or without other co-monomers. The metal useful herein may be, for example, brass, steel (including stainless steel), iron, aluminium, other metals known in the art of power washers and power tools, and a combination thereof.

[0040] The housing contains an internal component design, 10, therein. The internal component design, 10, contains two batteries, 12 and 12', a motor, 14, and a pump, 16, operatively-connected to the motor, 14. The frame, 18, is affixed to and securely holds together the battery support, 20, the motor, 14, and the pump, 16. In an embodiment herein the frame is also affixed to the housing; or the interior of the housing. In an embodiment herein the frame is integral to the housing.

[0041] The batteries, 12 and 12', are held in place by

the battery support, 20. The input valve, 30, is fluidly-connected to the pump, 16, and is also fluidly-connected to the output valve, 32. The hose connector, 34, is external to the housing, 38, so that it may connect the output valve, 32, to a hose (see Fig. 3 at 60), especially a high pressure hose. The input valve, 30, leads outside of the housing, 38, and connects to a hose, 40, which leads to the water supply.

[0042] In addition, in the embodiment of Fig. 2, the housing, 38, has a top portion, 42. The top portion, 42, contains a battery door, 44, which the user may open to reveal the batteries, 12 and 12', thereunder. The battery door, 44, allows access to the battery for removal during storage, recharging, replacement, etc. In the preferred embodiment in Fig. 2, the battery door, 44, forms a battery seal, 46, with the housing, 38. The battery seal, 46, is an optional water-tight seal which prevents water from entering the housing and contacting the batteries, 12 and 12', when the battery door, 44, is closed. Such a battery seal may be formed by the housing and the battery door by various methods known in the art, such as using coordinated upper and lower closures, a snap-fit closure, a flange, a clamp, a gasket made from rubber or another material, etc. Without intending to be limited by theory, it is believed that such a battery seal is an especially useful safety feature which serves to prevent water from reaching the battery during use, thereby preventing, and/or reducing the chances of short, circuits, damage, etc.

[0043] A handle, 48, is attached to the housing, 38, to allow the power washer, 36 to be easily transported and carried around. The handle, 48, is covered with an optional rubber grip, 50, which provides a firm place to hold, and also increases friction so as to reduce slippage. Without intending to be limited by theory, it is believed that a rubber grip is especially useful herein, as the handle will often become wet and slippery during use. Furthermore, the power washing system may weigh more than 10 or even more than 15 kg. Accordingly, having a rubber grip or other type of non-slip grip which remains securely graspable even when wet is especially desired by users and improves the safety of the power washer.

[0044] Fig. 2 also shows a wand, 52, and a wand grip, 54, removably-attached to the housing, 38. Such a wand and a wand grip are required for typical use of the pressure washer. A hose (see Fig. 3 at 60), typically a high-pressure hose, is connected from the hose connector, 34, to the wand input, 56, which also typically has a hose connector, 34, as well. The wand, 52, and the wand grip, 54, may be removed from the housing, 38, and connected together to direct and control the high pressure water to be sprayed therefrom.

[0045] In the embodiment of Fig. 2, an AC power cord, 58, is shown. The AC power cord is electrically-connected to the motor, 14, typically through the controller, 26. Thus, in some cases the power washer, 38, may be considered a hybrid power sprayer which contains both AC and DC power options. Such a power sprayer may be

especially desirable as the user can select to use AC power when it is available, and yet has the option to unplug the AC power cord, 58, from the power washer, 38, and switch to DC battery power, either automatically or manually, when AC power is not available. In addition, such a feature allows the power washer, 38, itself to act as a battery charger to charge the battery, 12, or batteries. In an embodiment herein, the AC power cord terminates at both ends in a plug. Typically the plug at one end will be a standard plug for accessing an AC power grid in whatever locality the power washer is intended to be used. Standard plugs include, a Type A plug, a Type B plug, a Type C plug, a Type D plug, a Type F plug, a Type I plug, a Type J plug, a Type K plug, a Type X plug, and other plugs known in the art. See, for example, <http://www.interpower.com/ic/guide.html> which lists and describes different types of standard plugs around the world. The other end of the power cord may provide the same or a different type of plug for connection to the power washer itself. In such a case, typical plugs useful herein include an IEC 60230 C5 plug, an IEC 60230 C-13 plug, and an IEC 60230 C-14 plug and other plugs known in the art (see, for example, [http://international-configurations.com/configuration.php?category=international&intl_type=IEC %2060320](http://international-configurations.com/configuration.php?category=international&intl_type=IEC%2060320)). Of course, in such a case, the power washer would also contain a reciprocal plug to connect therewith, preferably a waterproof reciprocal plug and/or a further waterproofing device, such as a cover, to keep water from entering the plug, to prevent short circuits and/or to prevent damage therefrom.

[0046] In Fig. 2, there can also be seen a battery midpoint plane, BMP, which is defined by the plane formed in the Z-axis at the middle of the battery's height (as measured in the Y-direction). It has been found that when the center of gravity, CG, is at or below the battery midpoint plane, BMP, that the power washer is more stable and less likely to either fall or tip over, even during use. As a power washer may employ a significant amount of torque due to the starting and stopping of the high pressure spray and/or high pressure water, it is believed that having the center of gravity at or below the battery midpoint plane is preferred. As used herein, the term "below" is a relative term that indicates farther away from the handle (if present) or closer to where the housing sits on the ground at rest. In an embodiment herein, the center of gravity is on the Y axis between the battery midpoint plane and the pump; or between the battery midpoint plane and the bottom of the motor. In an embodiment herein, the center of gravity is also centered in the housing (as viewed on the X-axis).

[0047] Fig. 3 shows a partially-cut-away embodiment of the present invention where a power washer, 10, is formed of a housing, 38, containing a pump, 16. Two electric batteries, 12 and 12', which are smart batteries, are operatively-connected to the motor (not shown in Fig. 3), either directly or indirectly via the controller, 26.

[0048] Fig. 3 also shows a hose, 60, having a first end, 62, and a second end, 64. The first end, 62, is in fluid

connection with the output valve, 32, while the second end, 64, is in fluid connection with the wand, 52. The wand, 52, contains a button, 66, that is operatively-connected to a transmitter, 68. The wand, 52, also contains a wand battery, 70, to power the transmitter, 68. The wand battery useful herein is typically a standard battery such as a disposable battery; or a 1.5v AAA battery, a 1.5v AA battery, a 1.5v C battery, a 1.5v D battery, a 9-volt battery, a watch battery, etc.

[0049] In the embodiment of Fig. 3, the controller, 26, contains a PCB (printed circuit board), 28, which contains a timer, 72, operatively-connected to the controller, 26. In this case the timer, 72, is a timing circuit embedded on the PCB, 28, but other types of timers known in the art are also useful herein. A receiver, 74, is also operatively connected to the controller, 26.

[0050] The transmitter and receiver useful herein are mutually compatible such that a signal transmitted from the transmitter is receivable by the receiver. Thus, the transmitter is operatively-connected to the controller, via the receiver. The transmitter may be a wireless transmitter and the receiver may be a wireless receiver.

[0051] In an embodiment herein the transmitter is a transceiver.

[0052] In an embodiment herein the receiver is a transceiver.

[0053] The signal may be a radio signal, a light signal, a sonic signal, an electric signal, a magnetic signal, and a combination thereof; or a radio signal, a light signal and a combination thereof; or a radio signal; or a light signal. A radio signal useful herein may be a Bluetooth™ signal, a Wi-Fi signal, a Z-Wave™ signal, a ZigBee™ signal, and a combination thereof; or a Bluetooth™ signal; or a Wi-Fi signal.

[0054] In an embodiment herein, the transmitter and/or the receiver is a transceiver microchip and may be encrypted or non-encrypted.

[0055] The wand, 52, further contains a water output, 76, from where the high pressure water exits. The water output, 76, may further attach to and/or contain one or more spray heads (not shown) which produce a variety of water spray patterns such as a stream, a fan, and a combination thereof. The wand, 52, further contains a trigger, 78, which activates the power sprayer, a grip, 80, for the user to securely hold the wand, and an optional guard, 82, which protects the user's hand during use.

[0056] In an embodiment herein, the controller intermittently pulses the boost power mode. The controller may intermittently pulse the boost power mode by, for example, controlling the pump speed, the motor speed, the battery output, and a combination thereof; or by controlling the pump speed.

[0057] In an embodiment herein, the controller measures a characteristic of the power washer and adjusts the intermittent pulsing of the boost power mode based on the characteristic. For example, the characteristic may be the current usage, battery temperature, motor temperature, pump temperature, motor speed, pump speed,

and a combination thereof; or current usage, battery temperature, and a combination thereof. If, for example, the current usage is too high, the battery temperature is too high, the motor temperature is too high, the pump temperature is too high, the motor speed is too high, the pump speed is too high, or a combination thereof, then the controller may adjust the intermittent pulsing of the boost power mode so as to reduce the battery usage, the battery output, the motor speed, the pump speed, etc. The adjustment may be, for example, to increase the time between pulses, to reduce the total number of pulses, to reduce the power of a pulse (for example, by reducing the boost power mode), to reduce the length of a pulse, and a combination thereof; or by increasing the time between pulses, reducing the power of a pulse, and a combination thereof. Such an adjustment may be made either directly, indirectly, or both by the controller.

[0058] Without intending to be limited by theory, it is also believed that an intermittently pulsing boost power mode more easily dislodges dirt and grime, while balancing wear and tear on the power washer components such as, for example, the battery, the pump, the seals, the motor, etc.

[0059] In an embodiment herein the input valve is; or the input valve and the output valve are; located at the front of the housing. Without intending to be limited by theory, it is believed that some users may want to be able to easily access both the input and output valves on the same side of the power washer. In another embodiment herein, the input valve is on opposite sides of the housing from the output valve. Without intending to be limited by theory, it is believed that such an arrangement may make the power washer more stable during use.

Claims

1. An electric power washer comprising an internal component design (10) and a housing (38),

wherein the internal component design (10) comprises a battery (12) comprising a battery axis (BA), a motor (14) electrically-connected to the battery (12), wherein the motor (14) has a motor axis (MA), a pump (16) operatively-connected to the motor (14), wherein the pump (16) has a pump axis (PA), and an output valve (32) fluidly-connected to the pump (16), and wherein the battery (12) is immediately adjacent to the motor (14);

wherein the housing (38) surrounds the battery (12), the motor (14) and the pump (16), the housing (38) further comprises a top portion (42) and a bottom portion, and wherein a direction between the bottom portion and the top portion (42) of the housing (38) defining a Y-dimension;

characterized in that the battery (12) is located within the top portion (42) of the housing (38);

- wherein the motor axis (MA) is parallel to the battery axis (BA), wherein the pump axis (PA) is parallel to the motor axis (MA), and wherein the battery axis (BA), the motor axis (MA) and the pump axis (PA) are parallel to each other in the Y-dimension; and
 wherein the output valve (32) is positioned in a plane below the pump (16).
2. The electric power washer according to claim 1, wherein the housing (38) further comprises a battery seal (46), and wherein the battery seal (46) prevents water from reaching the battery (12).
 3. The electric power washer according to claim 1, wherein the electric battery (12) is a smart battery, an input valve (30) is operatively-connected to the pump (16) and the output valve (32) is operatively-connected to the pump (16), and wherein water enters the input valve (30), the pump (16) increases the water pressure to form high pressure water, and the high pressure water exits the output valve (32).
 4. The electric power washer according to claim 3, wherein the motor (14) is a brushless motor.
 5. The electric power washer according to claim 4, wherein the smart battery comprises a battery pack comprising a high current discharge terminal and a low current discharge terminal.
 6. The electric power washer according to claim 4, wherein the smart battery comprises a battery midpoint plane, wherein the electric power washer further comprises a center of gravity, and wherein the center of gravity is below the battery midpoint plane.
 7. The electric power washer according to claim 4, wherein the smart battery comprises a voltage controller therein.
 8. The electric power washer according to claim 4, wherein the electric battery comprises a plurality of smart batteries.
 9. The electric power washer according to claim 4, further comprising a motor controller, wherein the motor controller regulates the output of the smart battery.
 10. The electric power washer according to claim 3, further comprising a wand (52) fluidly-connected to the output valve (32), wherein the wand (52) comprises a button (66); and further comprising a controller (26) operatively-connected to the pump (16), wherein the controller (26) is operatively-connected to the electric power source, wherein the controller (26) controls the output of the pump (16), wherein the button (66) is operatively-connected to the controller (26), and wherein the controller (26) permits the pump (16) to normally operate at up to 100% normal power, wherein when the button (66) is activated, the controller (26) permits the pump (16) to operate at a boost power mode of
 from 103% normal power to 300% normal power; or
 from 105% normal power to 250% normal power; or
 from 110% normal power to 200% normal power.
 11. The electric power washer according to claim 10, wherein the controller (26) intermittently pulses the boost power mode.
 12. The electric power washer according to claim 10, further comprising a transmitter (68) operatively-connected to the button (66) and a receiver (74) operatively-connected to the controller (26) and wherein the transmitter (68) transmits a signal to the receiver (74).
 13. The electric power washer according to claim 10, wherein the controller (26) comprises a timer (72) operatively-connected to the controller (26).
 14. The electric power washer according to claim 1, wherein the output valve (32) is located on the exterior of the housing (38).
 15. The electric power washer according to claim 1, wherein the battery (12) is a removable battery (12).

Patentansprüche

1. Elektrischer Hochdruckreiniger, umfassend eine innere Komponentenbauweise (10) und ein Gehäuse (38),
 wobei die innere Komponentenbauweise (10) eine Batterie (12), umfassend eine Batterieachse (BA), einen Motor (14), der elektrisch mit der Batterie (12) verbunden ist, wobei der Motor (14) eine Motorachse (MA) aufweist, eine Pumpe (16), die mit dem Motor (14) wirkverbunden ist, wobei die Pumpe (16) eine Pumpenachse (PA) aufweist, und ein Ausgabeventil (32) umfasst, das mit der Pumpe (16) fluidverbunden ist, und wobei die Batterie (12) unmittelbar an den Motor (14) angrenzt;
 wobei das Gehäuse (38) die Batterie (12), den Motor (14) und die Pumpe (16) umgibt, wobei das Gehäuse (38) ferner einen oberen Abschnitt (42) und einen unteren Abschnitt umfasst, und

wobei eine Richtung zwischen dem unteren Abschnitt und dem oberen Abschnitt (42) des Gehäuses (38) eine Y-Dimension definiert;

dadurch gekennzeichnet, dass die Batterie (12) innerhalb des oberen Abschnitts (42) des Gehäuses (38) gelegen ist; wobei die Motorachse (MA) parallel zu der Batterieachse (BA) ist, wobei die Pumpenachse (PA) parallel zu der Motorachse (MA) ist und wobei die Batterieachse (BA), die Motorachse (MA) und die Pumpenachse (PA) in der Y-Dimension parallel zueinander sind; und

wobei das Ausgabeventil (32) in einer Ebene unter der Pumpe (16) positioniert ist.

2. Elektrischer Hochdruckreiniger nach Anspruch 1, wobei das Gehäuse (38) ferner eine Batteriedichtung (46) umfasst und wobei die Batteriedichtung (46) verhindert, dass Wasser die Batterie (12) erreicht.
3. Elektrischer Hochdruckreiniger nach Anspruch 1, wobei die elektrische Batterie (12) eine Smart-Batterie ist, ein Eingangsventil (30) mit der Pumpe (16) wirkverbunden ist und das Ausgabeventil (32) mit der Pumpe (16) wirkverbunden ist, und wobei Wasser in das Eingangsventil (30) eintritt, wobei die Pumpe (16) den Wasserdruck erhöht, um Hochdruckwasser auszubilden, und das Hochdruckwasser das Ausgabeventil (32) verlässt.
4. Elektrischer Hochdruckreiniger nach Anspruch 3, wobei der Motor (14) ein bürstenloser Motor ist.
5. Elektrischer Hochdruckreiniger nach Anspruch 4, wobei die Smart-Batterie einen Batteriepack umfasst, umfassend eine Hochstromentladungsanschlussstelle und eine Niedrigstromentladungsanschlussstelle.
6. Elektrischer Hochdruckreiniger nach Anspruch 4, wobei die Smart-Batterie eine Batteriemittelpunktebene umfasst, wobei der elektrische Hochdruckreiniger ferner einen Schwerpunkt umfasst, und wobei der Schwerpunkt unter der Batteriemittelpunktebene liegt.
7. Elektrischer Hochdruckreiniger nach Anspruch 4, wobei die Smart-Batterie eine Spannungssteuerung darin umfasst.
8. Elektrischer Hochdruckreiniger nach Anspruch 4, wobei die elektrische Batterie eine Vielzahl von Smart-Batterien umfasst.
9. Elektrischer Hochdruckreiniger nach Anspruch 4, ferner umfassend eine Motorsteuerung, wobei die Motorsteuerung die Ausgabe der Smart-Batterie re-

gelt.

10. Elektrischer Hochdruckreiniger nach Anspruch 3, ferner umfassend einen Stab (52), der mit dem Ausgabeventil (32) fluidverbunden ist, wobei der Stab (52) eine Taste (66) umfasst; und ferner umfassend eine Steuerung (26), die mit der Pumpe (16) wirkverbunden ist, wobei die Steuerung (26) mit der elektrischen Leistungsquelle wirkverbunden ist, wobei die Steuerung (26) die Ausgabe der Pumpe (16) steuert, wobei die Taste (66) mit der Steuerung (26) wirkverbunden ist, und wobei die Steuerung (26) es der Pumpe (16) ermöglicht, mit bis zu 100 % normaler Leistung normal betrieben zu werden, wobei, wenn die Taste (66) aktiviert ist, die Steuerung (26) es der Pumpe (16) ermöglicht, auf einem Verstärkungsleistungsmodus betrieben zu werden

von 103 % Normalleistung bis 300 % Normalleistung; oder
von 105 % Normalleistung bis 250 % Normalleistung; oder
von 110 % Normalleistung bis 200 % Normalleistung.

11. Elektrischer Hochdruckreiniger nach Anspruch 10, wobei die Steuerung (26) den Verstärkungsleistungsmodus intermittierend pulsiert.
12. Elektrischer Hochdruckreiniger nach Anspruch 10, ferner umfassend einen Transmitter (68), der mit der Taste (66) wirkverbunden ist, und einen Empfänger (74), der mit der Steuerung (26) wirkverbunden ist, und wobei der Transmitter (68) ein Signal an den Empfänger (74) überträgt.
13. Elektrischer Hochdruckreiniger nach Anspruch 10, wobei die Steuerung (26) einen Zeitgeber (72) umfasst, der mit der Steuerung (26) wirkverbunden ist.
14. Elektrischer Hochdruckreiniger nach Anspruch 1, wobei das Ausgabeventil (32) auf der Außenseite des Gehäuses (38) gelegen ist.
15. Elektrischer Hochdruckreiniger nach Anspruch 1, wobei die Batterie (12) eine entfernbare Batterie (12) ist.

Revendications

1. Nettoyeur sous pression électrique comprenant une conception de composants internes (10) et un boîtier (38),

dans lequel la conception de composants internes (10) comprend une batterie (12) comprenant un axe de batterie (BA), un moteur (14)

- relié électriquement à la batterie (12), dans lequel le moteur (14) a un axe de moteur (MA), une pompe (16) reliée de manière fonctionnelle au moteur (14), dans lequel la pompe (16) a un axe de pompe (PA), et une soupape de sortie (32) reliée de manière fluidique à la pompe (16), et dans lequel la batterie (12) est immédiatement adjacente au moteur (14) ; dans lequel le boîtier (38) entoure la batterie (12), le moteur (14) et la pompe (16), le boîtier (38) comprend en outre une partie supérieure (42) et une partie inférieure, et dans lequel une direction entre la partie inférieure et la partie supérieure (42) du boîtier (38) définissant une dimension Y ;
- caractérisé en ce que** la batterie (12) est située dans la partie supérieure (42) du boîtier (38) ; dans lequel l'axe de moteur (MA) est parallèle à l'axe de batterie (BA), dans lequel l'axe de pompe (PA) est parallèle à l'axe de moteur (MA), et dans lequel l'axe de batterie (BA), l'axe de moteur (MA) et l'axe de pompe (PA) sont parallèles entre eux dans la dimension Y ; et dans lequel la soupape de sortie (32) est positionnée dans un plan en dessous de la pompe (16).
2. Nettoyeur sous pression électrique selon la revendication 1, dans lequel le boîtier (38) comprend en outre un joint d'étanchéité de batterie (46), et dans lequel le joint d'étanchéité de batterie (46) empêche l'eau d'atteindre la batterie (12).
 3. Nettoyeur sous pression électrique selon la revendication 1, dans lequel la batterie électrique (12) est une batterie intelligente, une soupape d'entrée (30) est reliée de manière fonctionnelle à la pompe (16) et la soupape de sortie (32) est reliée de manière fonctionnelle à la pompe (16), et dans lequel l'eau entre dans la soupape d'entrée (30), la pompe (16) augmente la pression d'eau pour former de l'eau haute pression, et l'eau haute pression sort de la soupape de sortie (32).
 4. Nettoyeur sous pression électrique selon la revendication 3, dans lequel le moteur (14) est un moteur sans balai.
 5. Nettoyeur sous pression électrique selon la revendication 4, dans lequel la batterie intelligente comprend un bloc-batterie comprenant une borne de décharge à courant élevé et une borne de décharge à faible courant.
 6. Nettoyeur sous pression électrique selon la revendication 4, dans lequel la batterie intelligente comprend un plan médian de batterie, dans lequel le nettoyeur sous pression électrique comprend en outre un centre de gravité, et dans lequel le centre de gravité est en dessous du plan médian de batterie.
 7. Nettoyeur sous pression électrique selon la revendication 4, dans lequel la batterie intelligente comprend un dispositif de commande de tension dedans.
 8. Nettoyeur sous pression électrique selon la revendication 4, dans lequel la batterie électrique comprend une pluralité de batteries intelligentes.
 9. Nettoyeur sous pression électrique selon la revendication 4, comprenant en outre un dispositif de commande de moteur, dans lequel le dispositif de commande de moteur régule la sortie de la batterie intelligente.
 10. Nettoyeur sous pression électrique selon la revendication 3, comprenant en outre une tige (52) reliée de manière fluidique à la soupape de sortie (32), dans lequel la tige (52) comprend un bouton (66) ; et comprenant en outre un dispositif de commande (26) relié de manière fonctionnelle à la pompe (16), dans lequel le dispositif de commande (26) est relié de manière fonctionnelle à la source d'alimentation électrique, dans lequel le dispositif de commande (26) commande la sortie de la pompe (16), dans lequel le bouton (66) est relié de manière fonctionnelle au dispositif de commande (26), et dans lequel le dispositif de commande (26) permet à la pompe (16) de fonctionner normalement jusqu'à 100 % de puissance normale, dans lequel lorsque le bouton (66) est activé, le dispositif de commande (26) permet à la pompe (16) de fonctionner en mode de puissance d'amplification de
 - de 103 % de puissance normale à 300 % de puissance normale ; ou
 - de 105 % de puissance normale à 250 % de puissance normale ; ou
 - de 110 % de puissance normale à 200 % de puissance normale.
 11. Nettoyeur sous pression électrique selon la revendication 10, dans lequel le dispositif de commande (26) pulse par intermittence le mode de puissance d'amplification.
 12. Nettoyeur sous pression électrique selon la revendication 10, comprenant en outre un émetteur (68) relié de manière fonctionnelle au bouton (66) et un récepteur (74) relié de manière fonctionnelle au dispositif de commande (26) et dans lequel l'émetteur (68) émet un signal au récepteur (74).
 13. Nettoyeur sous pression électrique selon la revendication 10, dans lequel le dispositif de commande (26) comprend un temporisateur (72) relié de ma-

nière fonctionnelle au dispositif de commande (26).

14. Nettoyeur sous pression électrique selon la revendication 1, dans lequel la soupape de sortie (32) est située à l'extérieur du boîtier (38).

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15. Nettoyeur sous pression électrique selon la revendication 1, dans lequel la batterie (12) est une batterie amovible (12).

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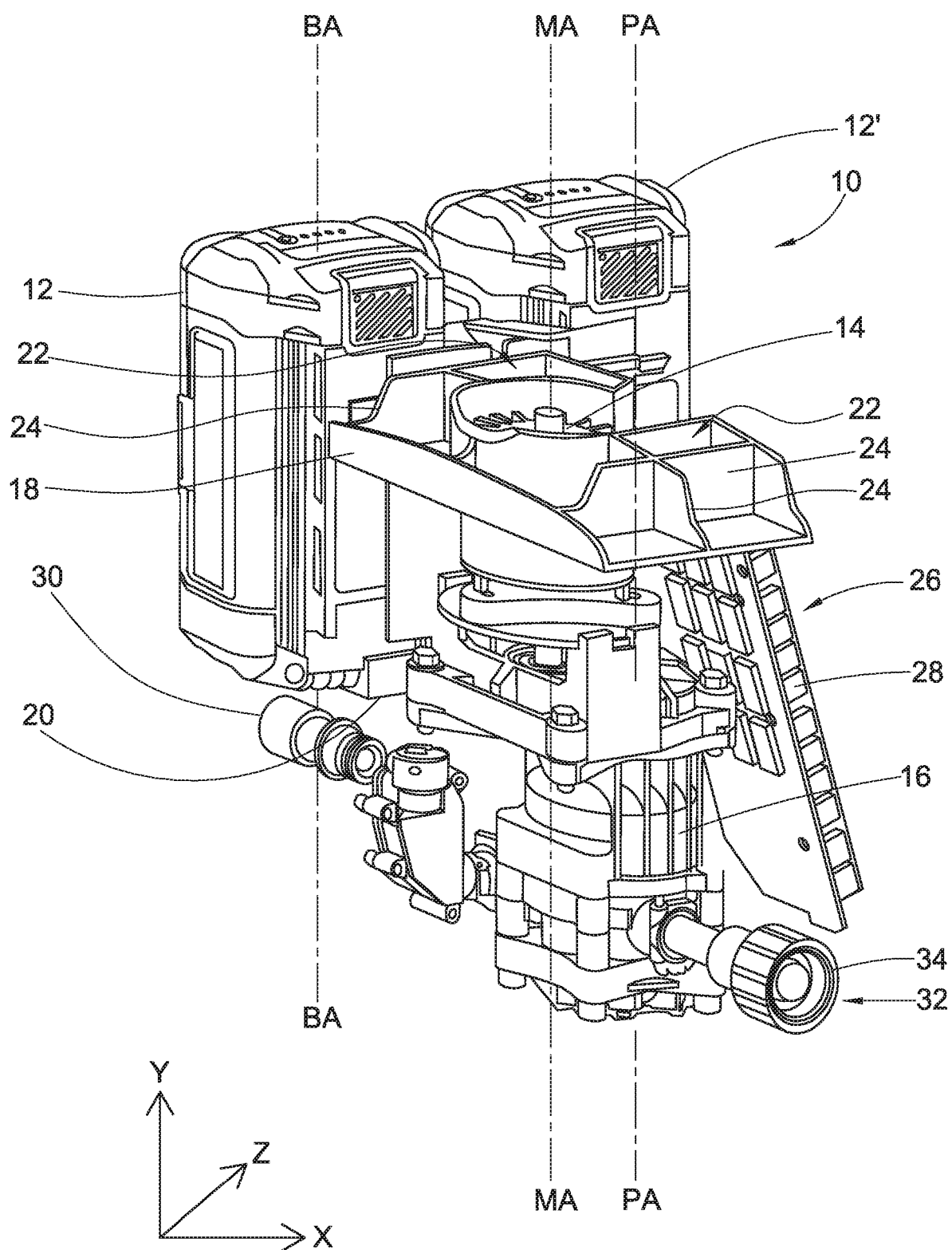


Fig. 1

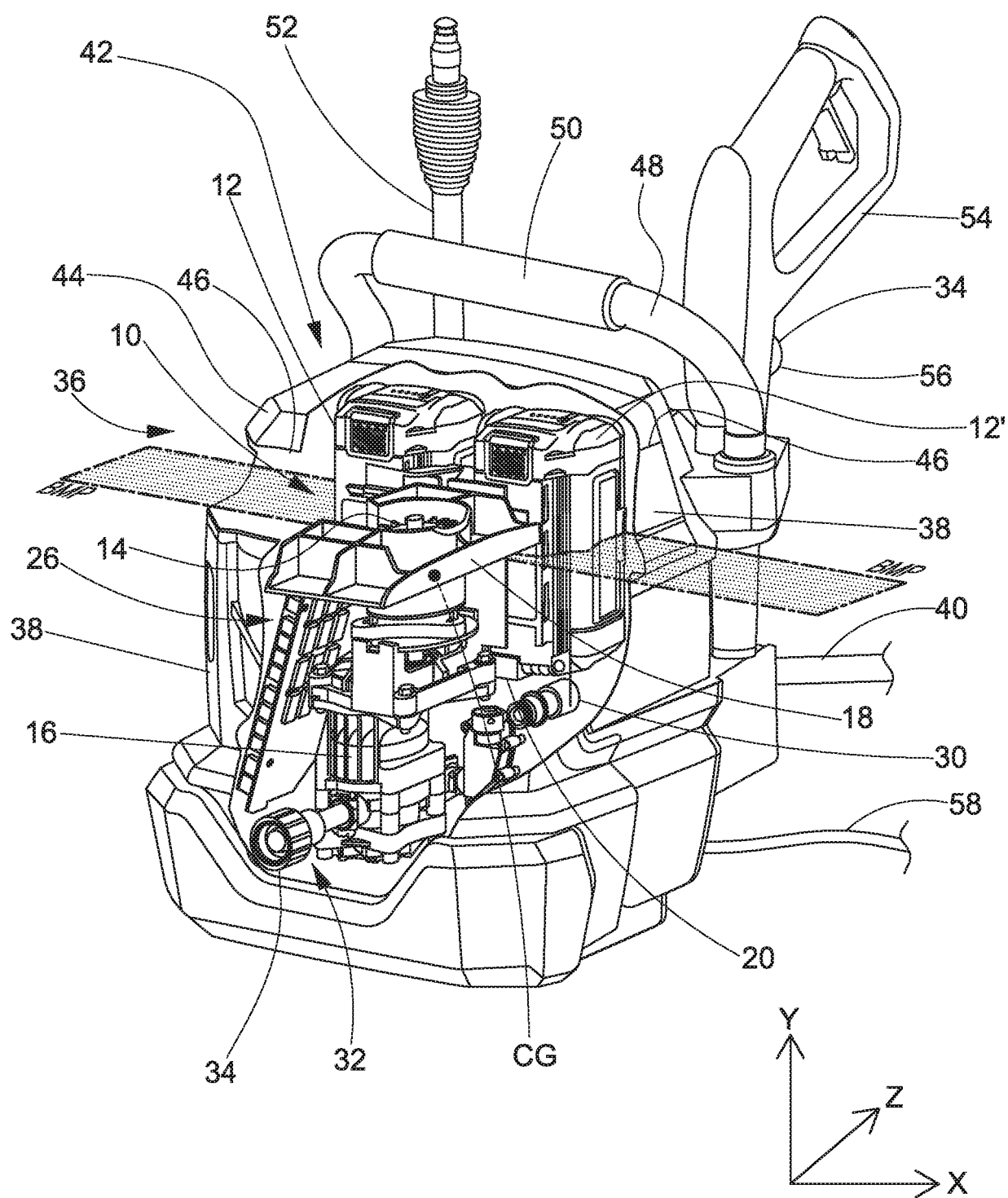


Fig. 2

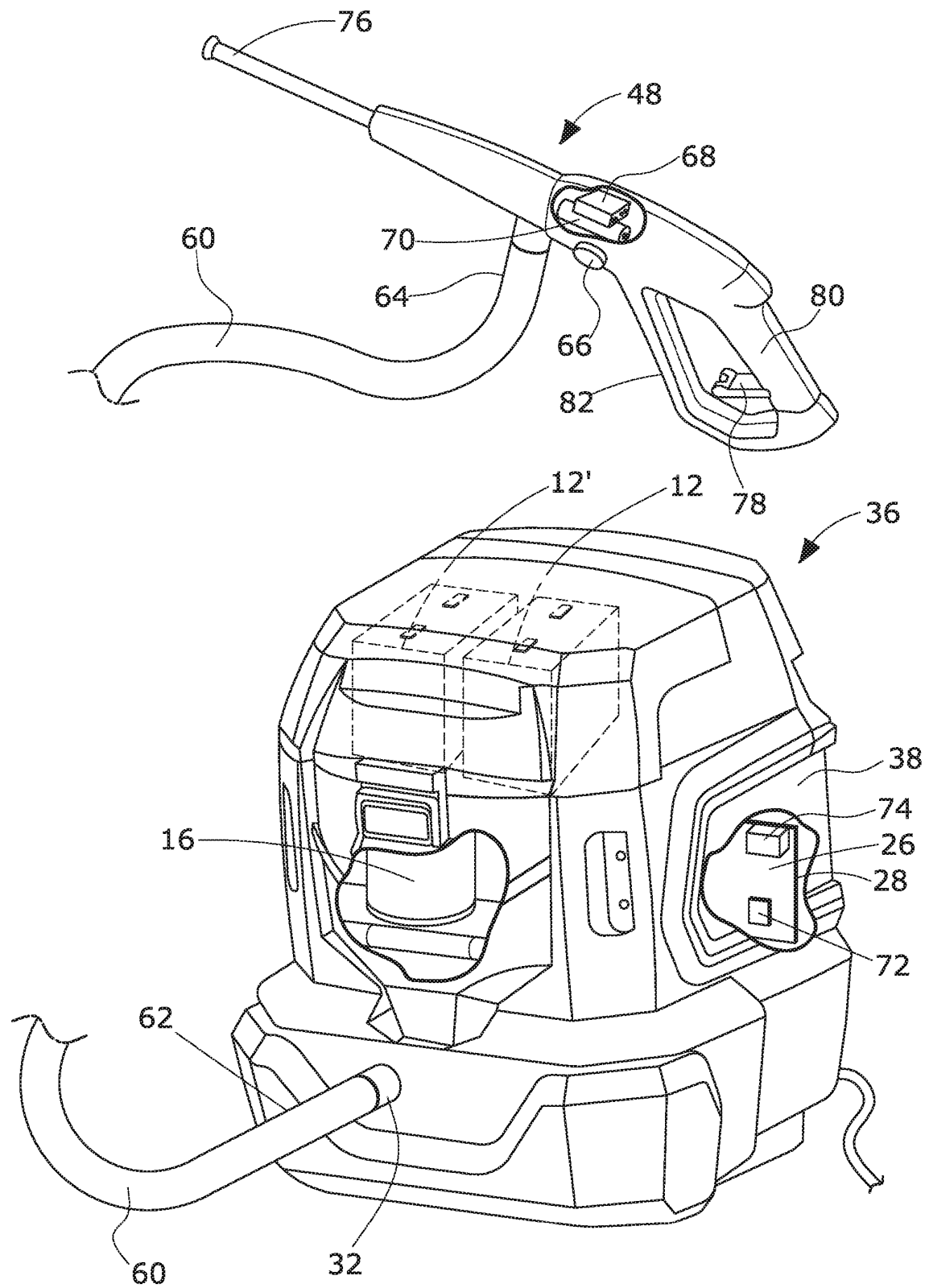


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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