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(54) **PUMP FOR PAIRING WITH A MOBILE DEVICE**

(57) A pump (**100, 200**) includes a motor (**130**) configured to actuate a pumping action of the pump (**100, 200**) on receiving a power supply (**110**). The pump (**100, 200**) includes a controller (**120**) communicably coupled to the motor (**130**). The controller (**120**) is configured to control the power supply (**110**) to the motor (**130**), and scan an environment (**140, 240**) of the pump (**100, 200**) for detecting a pairing signal (**S**). The pump (**100, 200**) is characterized in that the controller (**120**) is further configured to suspend the power supply (**110**) to the motor (**130**) upon detecting the pairing signal (**S**).

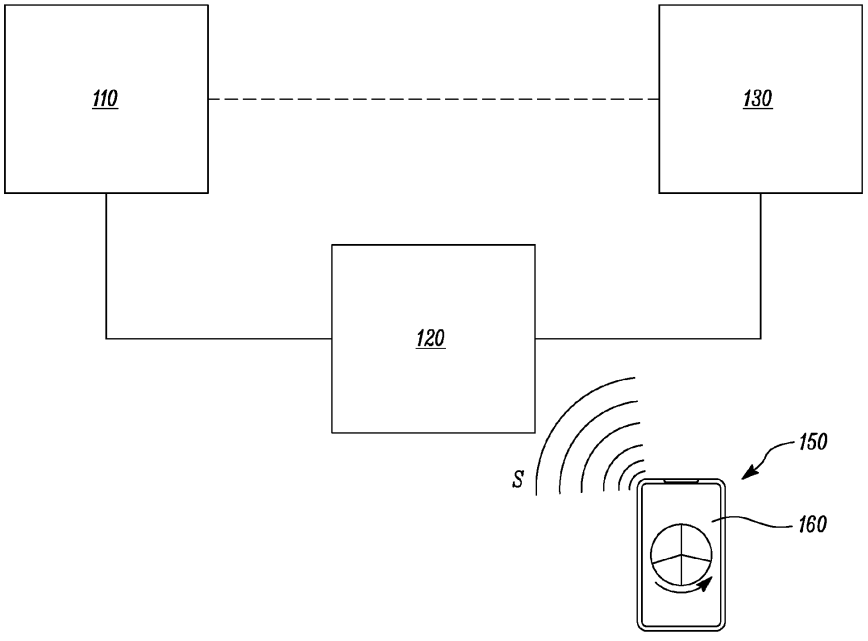

FIG. 3

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to pumps. More specifically, the present disclosure relates to a pump which allows an efficient and convenient operation based on pairing with a mobile device.

BACKGROUND

[0002] Pumps are known that include a control interface to operate a motor. These control interface often includes one or more buttons, switches, and indicators to allow interaction of a user with different modes and more importantly to start the motor and other features of the pumps. However, there are aesthetical, ergonomic and implementation constraints associated with application of displays i.e. a human-machine interface (HMI) of the control interface of the pumps.

[0003] Further, both non-submersible and submersible pumps face concerns regarding maintenance and overhaul costs of the displays (HMIs) of the control interface. In particular for submersible pumps, there may be extra consideration for separate sealing and connection of the displays with electronics of the pump. Moreover, there are limits to the on-board memory provided by the control interface to study and analyze any data. For similar reasons, there have been efforts in the art to provide alternatives to the displays of the control interface of the pumps.

[0004] Submersible pumps are known for automatically starting their pumping action after an initial startup sequence when being connected to a power supply.

[0005] An example of a different submersible pump is provided by US 2017 0 122 325 A1 (hereinafter referred to as '325 reference). The '325 reference provides a fluid pump which includes a housing with a fluid input and a fluid output, and a removable power tool battery pack disposed within the housing. Further, the fluid pump includes a motor disposed within the housing and electrically connected to the power tool battery pack, and an impeller driven by the motor for drawing fluid through an input opening and into an output opening. Further, a motor controller turns off the motor if the motor current is below a predetermined threshold. The motor controller controls the motor according to data received from a wireless control unit paired with the motor controller. With this embodiment of a submersible pump the motor controller does not power the motor if no start signal is received from the wireless control unit. Thus an intentional switch on signal is needed first for the pump to operate.

[0006] Thus, there is a need for an improved pump which provides convenient and user-friendly operation.

SUMMARY

[0007] In view of the above, it is an objective of the present invention to solve or at least reduce the drawbacks discussed above. The objective is at least partially achieved by a pump. The pump includes a motor to actuate a pumping action of the pump on receiving a power supply. The pump includes a controller communicably coupled to the motor. The controller controls the power supply to the motor and scans an environment of the pump for detecting a pairing signal. The pump is characterized in that the controller suspends the power supply to the motor upon detecting the pairing signal. Thus, the present disclosure provides a simple, efficient, and user-friendly pump which allows suspension of the power supply such that a paired mobile device takes the role of human-machine interface (HMI) of the pump. Moreover, the present disclosure allows direct pairing and communication between the pump and the mobile device, without a need of any third device for connection therebetween.

[0008] According to an embodiment of the present invention, the pairing signal is generated by a mobile device. This may allow users benefits of operation and control of the pump by taking advantage of different features (such as display resolution, display size and the like) of the mobile device.

[0009] According to an embodiment of the present invention, suspending the power supply includes stopping the pump during initial starting of the motor, upon detecting the pairing signal. This may allow suspending the power supply during initial starting of the pump itself and transfer the control to the mobile device.

[0010] According to an embodiment of the present invention, suspending the power supply includes stopping the pump sometime after the starting of the motor, upon detecting the pairing signal. This feature may allow that the pump keeps scanning for the pairing signal and suspends the power supply of the running pump upon detecting the pairing signal.

[0011] According to an embodiment of the present invention, the mobile device controls the pumping action and one or more operational parameters of the pump. The mobile device such as a smart phone may be used to actuate or operate any feature of the pump.

[0012] According to an embodiment of the present invention, the mobile device allows display and analysis of the one or more operational parameters of the pump. This may allow efficient use of the mobile device to display and analysis to limit need of any dedicated display on the pump.

[0013] According to an embodiment of the present invention, the pairing signal is one or more of a Bluetooth, Wi-Fi, Near-field Communication (NFC), Zigbee, cellular, and infrared. The pairing signal allows to establish a wireless connection to control the pump by taking advantage of advanced features (say substantial storage, online/cloud data backup) of the mobile device.

[0014] According to an embodiment of the present invention, the environment of the pump is defined by a range up to which the pairing signal from the mobile de-

vice is detected. This allows the pump to detect presence of any mobile device for pairing within the environment.

[0015] Other features and aspects of this invention will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The invention will be described in more detail with reference to the enclosed drawings, wherein:

FIG. 1 shows a schematic view of a pump during pairing with a mobile device, in accordance with an embodiment of the present invention;

FIG. 2 shows a block diagram of a motor, a controller, and a power supply of the pump, in accordance with an embodiment of the present invention;

FIG. 3 shows a block diagram of a motor, a controller, and a power supply of the pump with pairing of a mobile device, in accordance with an embodiment of the present invention;

FIG. 4 shows a schematic view of a pump during pairing with a mobile device, in accordance with another embodiment of the present invention; and

FIG. 5 shows a schematic view of a mobile device, in accordance with another embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0017] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which example embodiments of the invention incorporating one or more aspects of the present invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. For example, one or more aspects of the present invention can be utilized in other embodiments and even other types of structures and/or methods. In the drawings, like numbers refer to like elements.

[0018] Certain terminology is used herein for convenience only and is not to be taken as a limitation on the invention. For example, "upper", "lower", "front", "rear", "side", "longitudinal", "lateral", "transverse", "upwards", "downwards", "forward", "backward", "sideward", "left," "right," "horizontal," "vertical," "upward", "inner", "outer", "inward", "outward", "top", "bottom", "higher", "above", "below", "central", "middle", "intermediate", "between", "end", "adjacent", "proximate", "near", "distal", "remote", "radial", "circumferential", or the like, merely describe the configuration shown in the Figures. Indeed, the components may be oriented in any direction and the terminology, therefore, should be understood as encompassing such variations unless specified otherwise.

[0019] **FIG. 1** illustrates a pump **100** and a wireless control unit **150**. The present figure illustrates a submersible pump, however, the present disclosure may be implemented with any other pump such as, but not limited to, impulse pumps, electric pressure pumps, battery pump, velocity pumps, gravity pumps since the present disclosure is not to be limited by the type/size/mechanism of the pump in any manner. Further, the mobile device **150** may be any smart phone, personal digital assistant (PDA), and the like which allows wireless pairing, such as with the pump **100** of the present disclosure. The mobile device may be any smart device which supports and allows ease of operation, pairing, and control of the pump **100**.

[0020] **FIG. 1** illustrates the pump **100** during pairing with the mobile device **150**. The pump includes a controller **120** (shown in **FIGS. 2, 3**) which receives power as soon the pump is connected to a power supply. The controller (**120**) then scans an environment **140** of the pump **100** for detecting a pairing signal **S**. As illustrated in the present figure, the pairing signal **S** is generated by the mobile device **150**. However, actual implementation of the present disclosure may have the pairing signal generated by one or more of the pump **100** and the mobile device **150**. This scanning of the environment **140** by the pump **100** may preferably be associated with starting of the motor **130** (shown in **FIG. 2**) such as at a t = 0 time period. The pump **100** of the present disclosure may scan the environment **140** for a pre-fixed time period during starting for any mobile device. The pump **100** may start the pumping action in case no mobile device is detected. Further, the pump **100** may continuously scan the environment **140** for any pairing signal **S** even after the pump **100** starts the pumping action based on absence of detection of any mobile device during an initial scanning protocol by the pump **100**.

[0021] As used herein, "the environment **140"** is defined by a range up to which the pairing signal **S** from the mobile device **150** can be detected by the pump **100**. The environment **140** may generally be a sphere-like area (or any other shape area, profile, type of area) around the pump **100** where the presence of any pairing signal from any mobile device is detectable. In a non-limiting example, the range of the environment **140** of pairing with the pump **100** may be set in accordance with different factors such as application area, strength of the pairing signal **S**, or based on any other operational consideration. This allows the pump **100** to detect presence of any mobile device for pairing within the environment **140**.

[0022] The pairing signal **S** of the present disclosure may be any wireless signal or radio frequency signal which allows to control the pump **100** from the mobile device **150**. The pairing signal may be one or more of a Bluetooth, Wi-Fi, Near-field Communication (NFC), Zig-

bee, cellular, and infrared, or any other signal as used or known in the art. The pairing signal allows to establish a wireless connection to control the pump **100** from the mobile device **150**. Additionally, or alternatively, the mobile device **150** may be connected to the pump **100** via a cable, USB, and the like.

[0023] The pump **100** further includes a human-machine interface (HMI) **170** which allows user to interact and control the pump **100**. The HMI **170** may be a series of buttons, switches, LEDs, and the like as per the application. Based on the pairing of the pump **100** and the mobile device **150**, the mobile device **150** takes the role of the HMI **170**. This may be particularly advantageous for submersible pumps where users may prefer to interact safety and conveniently with the mobile device **150**, as compared to the HMI **170** of the pump **100**. In some embodiments, one or more of the pump **100** and the mobile device **150** may include at least one of a visual, audio, haptic alerts to indicate pairing of the pump **100** and the mobile device **150**. In a non-limiting example, the pump **100** may include a light (such as an LED and the like) while the mobile device **150** may have any text, vibrational, lighting alert to indicate successful pairing therebetween.

[0024] **FIG. 2** illustrates a power supply **110**, the controller **120**, and a motor **130** of the pump **100** during initial starting of the motor **130**. The pump **100** includes the motor **130** to actuate the pumping action of the pump **100** on receiving the power supply **110**. The pump **100** includes the controller **120**. The controller **120** is communicably coupled to the motor **130**. The controller **120** controls the power supply **110** to the motor **130** and scans the environment **140** of the pump **100** for detecting the pairing signal. As illustrated in the present figure, the controller **120** may initially run the initial scanning protocol to check for any mobile device and then allow the pumping action since no pairing signal **S** is detected by the controller **120**.

[0025] In some embodiments, multiple pairing signals may be detected by the controller **120** of the pump **100**. Such cases may have any predefined preference for any saved or known devices i.e. the mobile device **150**. Additionally, or alternatively, the pump **100** may be setup with any preferred mobile device based on any feature such as passkey, one-time password (OTP), biometric feature or any other authentication feature as known or used in the art. It should be contemplated that the present disclosure is not limited by use of any such authentication feature in any manner.

[0026] **FIG. 3** illustrates the controller **100** detecting the pairing signal **S** from the mobile device **150**. The controller **120** suspends the power supply **110** to the motor **130** upon detecting the pairing signal, as illustrated in **FIG. 3.** The suspension of the power supply **110** may take place at initial starting (say t = 0 seconds) of the motor **130** as illustrated in **FIG. 2**, or later during further scans for the pairing signal **S** by the controller **120**, say at a time t = 3 seconds after starting of the motor **130**. It should be contemplated that the example of t=3 seconds is exemplary, and the present disclosure is not limited by any such values. The suspension of the power **110** is illustrated by a dashed or phantom line between the power supply **110** to the motor **130**. During implementation, the power supply **110** may be suspended momentarily such as to exchange data and allow desired pairing between the mobile device **150** and the pump **100**. Additionally, or alternatively, the power supply **110** may be suspended for a pre-fixed time period. The pre-fixed time period may be such that user(s) of the mobile device **150** may have sufficient time to configure the pump **100** using the mobile device **150**. The pump **100** of the present disclosure provides a simple, efficient, and user-friendly suspension of the power supply **110** based upon pairing with the mobile device **150**. Further, the mobile device **150** allows to limit the role of the HMI **170** and different constraints associated therewith.

[0027] As used herein, "suspend" the power supply **110** to the motor **130** may include stopping the initial starting of the motor **130**, and thereby the pump **100** whenever the pump **100** detects any pairing signal within the environment **140** of the pump **100**. Further, in cases where the pump **100** is unable to detect any pairing signal, such as due to absence of any mobile device, the pump **100** may allow starting of the pumping action. Then, during operation of the pump **100** whenever the pump **100** detects any pairing signal, the controller **120** may "suspend" the power supply **110** and thereby the pumping action by the motor **130**. Moreover, "suspending" the pumping action ensures that the motor **130** does not run when the pump **100** pairs and/or communicates data with the mobile device **150**. This may avoid any safety hazard, inadvertent sound/action due to running of the pump **100** during pairing with the mobile device **150**.

[0028] In an embodiment, suspending the power supply **110** may include stopping the pump **100** during initial starting (such as t = 0 time period) of the motor **130**, upon detecting the pairing signal **S**, as illustrated in **FIG. 3**. This may allow suspending of the power supply during initial starting of the pump **100** itself. Alternatively, suspending the power supply **110** may include stopping the pump **100** sometime (anytime such as t = 1, 2 or so on) after the starting of the motor **130**, upon detecting the pairing signal **S**. This may allow suspending the power supply **110** of the running pump **100** upon detecting the pairing signal **S**.

[0029] **FIG. 4** illustrates a pump **200** during pairing with the mobile device **150**, in accordance with an embodiment of the present invention. The pump **200** may be a non-submersible pump which may include a user interface such as a human-machine interface (HMI) **210** to control and operate the pump **200**. The pump **200** of the present disclosure may advantageously be implemented without any HMI **210** since the mobile device **150** takes the role of the HMI **210** after pairing. The pump **200** detects the pairing signal **S** from mobile device **150** within an environment **240** of the pump **200**. In some embodi-

ments, the mobile device **150** may control one or more operational parameters, and the pumping action of the pump **200**. The mobile device **150** such as a smart phone may be used to actuate or operate any feature of the pump **200**. Further, the mobile device **150** may include saved modes, logistics, diagnostic features which run whenever the mobile device **150** pairs with the pump **200**.

[0030] The pumps **100, 200** of the present disclosure are illustrated with HMIs **170, 210** as user interface or electronic display. The mobile device **150** pairs with the corresponding pumps **100, 200** to allow control of the pumping action, and the one or more operational features. This may obviate or at least limit need of any user interface or electronic display on the pump **100**, as such a role is taken by the mobile devices **150, 250**. Further, this allows saving on maintenance, costs and other operational constraints associated with application of the user interface or electronic display of conventional pumps.

[0031] In an embodiment, the pumps **100, 200** may be made of any material such as a water proof material. From aesthetics and implementation benefits, some part, or components of the pumps **100, 200** can be made of a transparent material, or a combination of a metal, and a polymer or any other material as used or known in the relevant art.

[0032] In some embodiments, the mobile device **150** may allow connection with multiple devices such as pumps **100, 200,** watering devices among other gardening devices. This connection between different devices and the mobile **150** may be based on internet of things (IOT), wireless communication or a combination of any connection technology as used or known in the art. Further, the mobile device **150** may thus allow efficient and user-preferred synchronization between the multiple devices to optimize different applications, watering patters, and supplement, or take the role of an irrigation control unit. Moreover, the mobile device **150** may track working of the multiple devices to alert users regarding maintenance events, leakages, part replacement and other related events.

[0033] Further, the mobile device **150** may automatically present users with solutions for any problems encountered with the multiple devices such as the pumps **100, 200**. Then, the mobile device **150** may automatically or on-user demand provide diagnostics (say videos, manuals) to self-service the problem. Additionally, or alternatively, the mobile device **150** may have a feature to even submit query with customer support regarding any irregularity with the multiple devices. In some cases, the mobile device **150** may be setup to regularly communicate data, analysis, feedbacks to service, R&D teams of the multiple devices. This may further allow to customize the multiple devices and provide latest software and other updates for the multiple devices using the mobile device **150**.

[0034] **FIG. 5** illustrates a user interface **160** of the mobile device **150**, in accordance with an embodiment of the present invention. As illustrated, the mobile device **150** may allow display and analysis of the one or more operational parameters of the pump **150,** using the user interface **160** of the mobile device **150.** This may allow use of enhanced display, high memory storage, analysis, and other advanced features of the mobile device **150** to and limit need of any dedicated display (such as the HMIs **170, 210**) on the pumps **100, 200**. As illustrated in the present figure, the user interface **160** of the mobile device **150** may further enable users to control one or more of operational features of the pumps **100, 200**, such as on/off control, motor speed, rotational motor direction, back flush operation, fluid volume to be pumped out, etc. The mobile device **150** may allow to show different operational parameters, such as remaining battery charge, motor speed, rotational motor direction, etc.

[0035] The mobile device **150** allows different levels or modes of control of the pumps **100, 200**. The mobile device **150** can allow to perform various levels of control of the pumps **100, 200** such as, for example but need not necessarily, total control of the pump **100, 200** where the mobile device **150** can be used to control any function of the pump **100, 200** without any restriction. Further, there may be situations where the mobile device **150** may be able to control the pumps **100, 200** with some restrictions, for whatsoever reason, such as only power control of the pumps **100, 200**. The present disclosure further aims to avoid or at least limit the need of any user interface such as the HMIs **170, 210** and in some cases role of multiple levers, buttons etc. to perform changes to the various modes, parameters which are now operable by the mobile device **150**. This may allow ease of operation and setup of the pumps (such as the submersible pump **100**) for running in the submerged state by a common user.

[0036] In some embodiments, the pumps **100, 200** instead of having a dedicated control unit such as the HMIs **170, 210,** such functionality may be implemented in an application (app) on a computer, a tablet, or a smart phone i.e. the mobile device **150**. Further, a single mobile device **150** may allow to control more than one pumps **100, 200**. As will be appreciated with a person skilled in the art, in order to provide information to be displayed, the mobile device **150** is preferably a transceiver that can both transmit and receive information to and from the pumps **100, 200**.

[0037] In some embodiments, the pumps **100, 200** may be adapted to interact with the mobile device **150** such as smartphone, tab and the like, to convey any message/notification/alert regarding mode change, operating features, time periods in real-time, or as per feature preference set by the user. The mobile device **150** may also allow activation, switching of different modes, operational features with application thereof. Such arrangement is merely for exemplary purposes, and the present disclosure can be readily used with any wireless device to the convey a message/notification/alert, as known or used in the art.

[0038] The pumps **100, 200** of the present disclosure

thus allow benefits of replacing HMIs **170, 210** with advanced, updated features of the mobile device **150**. Further, the present disclosure allows direct pairing and communication between the pumps **100, 200** and the mobile device **150**, without a need of any third device for connection therebetween. The mobile device **150** further enables users to control one or more of operational features of the pumps **100, 200,** and show different operational parameters, taking advantage of advanced features of the mobile device **150**.

[0039] In the drawings and specification, there have been disclosed preferred embodiments and examples of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation of the scope of the invention being set forth in the following claims.

LIST OF ELEMENTS

[0040]

100	Pump
110	Power Supply
120	Controller
130	Motor
140	Environment
150	Mobile Device
160	User Interface
170	Human-machine interface (HMI)
200	Pump
210	Human-machine interface (HMI)
240	Environment
S	Pairing Signal

Claims

1. A pump **(100, 200)** comprising:

a motor **(130)** configured to actuate a pumping action of the pump **(100, 200)** on receiving a power supply **(110)**;
a controller **(120)** communicably coupled to the motor **(130)**, the controller **(120)** configured to:

control the power supply **(110)** to the motor **(130)**; and
pair with a wireless control unit **(150)**;

characterized in that:

the controller **(120)** scans an environment **(140, 240)** of the pump **(100, 200)** for detecting a pairing signal **(S)**,
the controller **(120)** is further configured to suspend the power supply **(110)** to the motor **(130)** upon detecting the pairing signal **(S)**.

2. The pump **(100, 200)** of claim 1, wherein suspending the power supply **(110)** includes stopping the pump **(100, 200)** during initial starting of the motor **(130)**, upon detecting the pairing signal **(S)**.

3. The pump **(100, 200)** of any of claims 1 or 2, wherein suspending the power supply **(110)** includes stopping the pump **(100, 200)** sometime after the starting of the motor **(130)**, upon detecting the pairing signal **(S)**.

4. The pump **(100, 200)** of any of the preceding claims, wherein the pairing signal **(S)** is one or more of a Bluetooth, Wi-Fi, Near-field Communication (NFC), Zigbee, cellular, and infrared.

5. The pump **(100, 200)** of any of the preceding claims, wherein the environment **(140, 240)** of the pump **(100, 200)** is defined by a range up to which the motor controller (120) is able to detect the pairing signal **(S)** from the wireless control unit **(150)** is detected.

6. Wireless control unit **(150) characterized in that** the wireless controller (150) generates a pairing signal S and controls a pump of any of claims 1-5.

7. Wireless control unit **(150)** of claim 6, wherein the wireless control unit **(150)** is configured to control one or more operational parameters, and the pumping action of the pump **(100, 200)**.

8. Wireless control unit **(150)** of any one of claims 6 or 7, wherein the wireless control unit **(150)** allows display and analysis of the one or more operational parameters of the pump **(100, 200)**.

9. Wireless control unit **(150)** of any one of claims 6 to 8, wherein some of the functions of the wireless control unit **(150)** are controlled via a software application (APP) that runs on the wireless controller **(150)**.

10. Wireless control unit **(150)** of any one of claims 6 to 9, wherein the wireless control unit **(150)** is a mobile device.

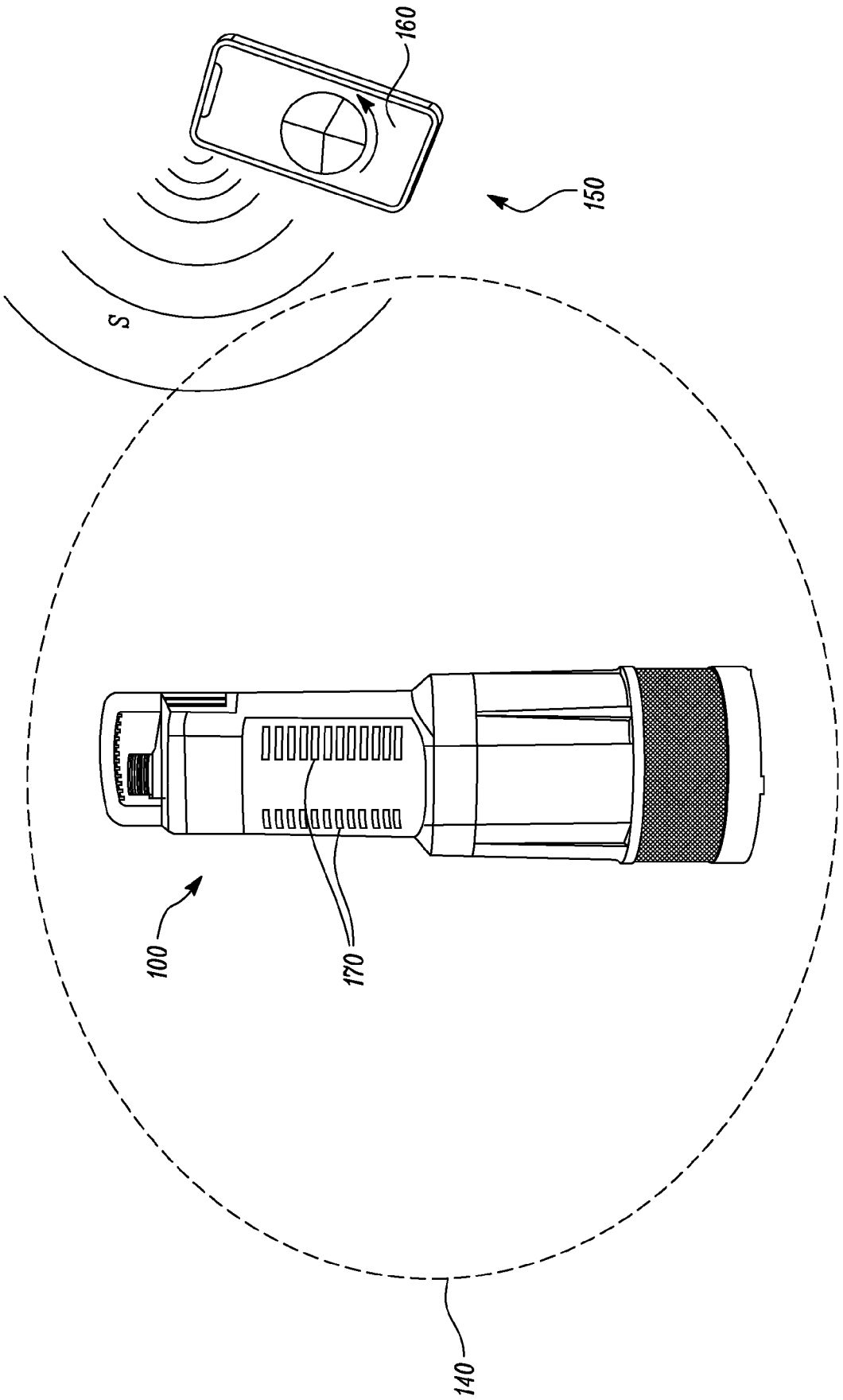

FIG. 1

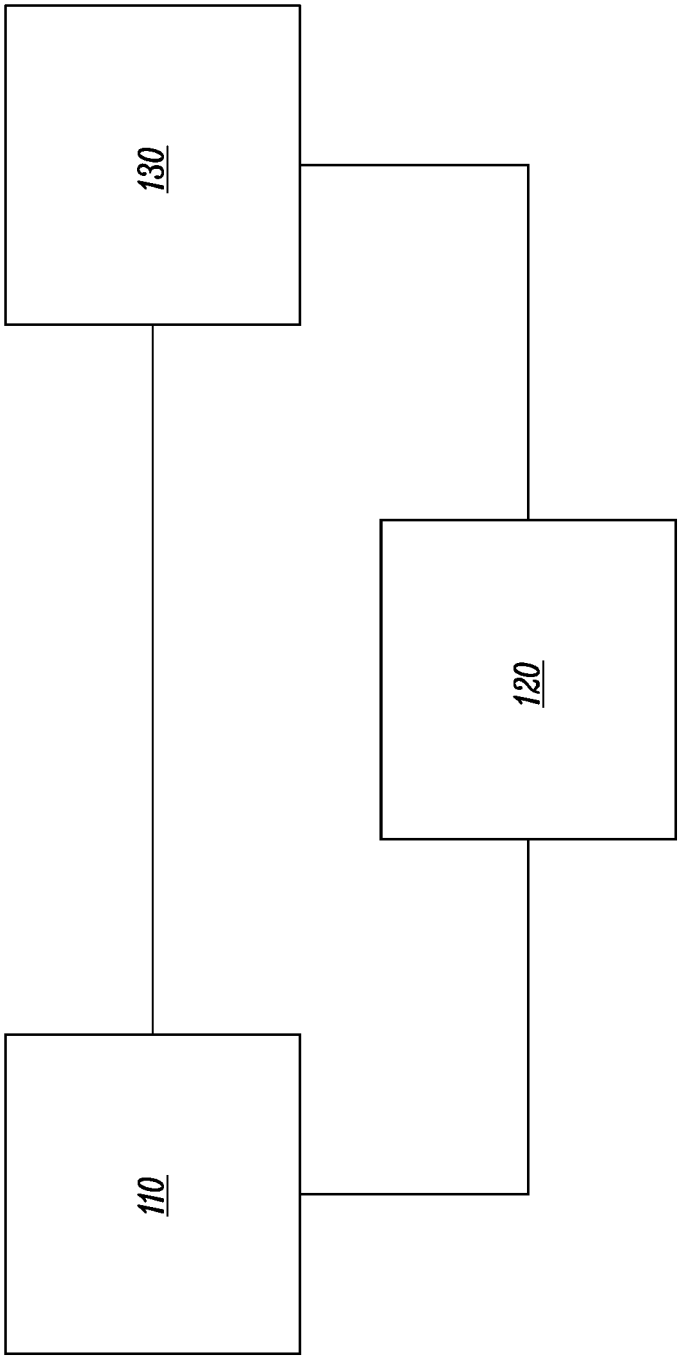

FIG. 2

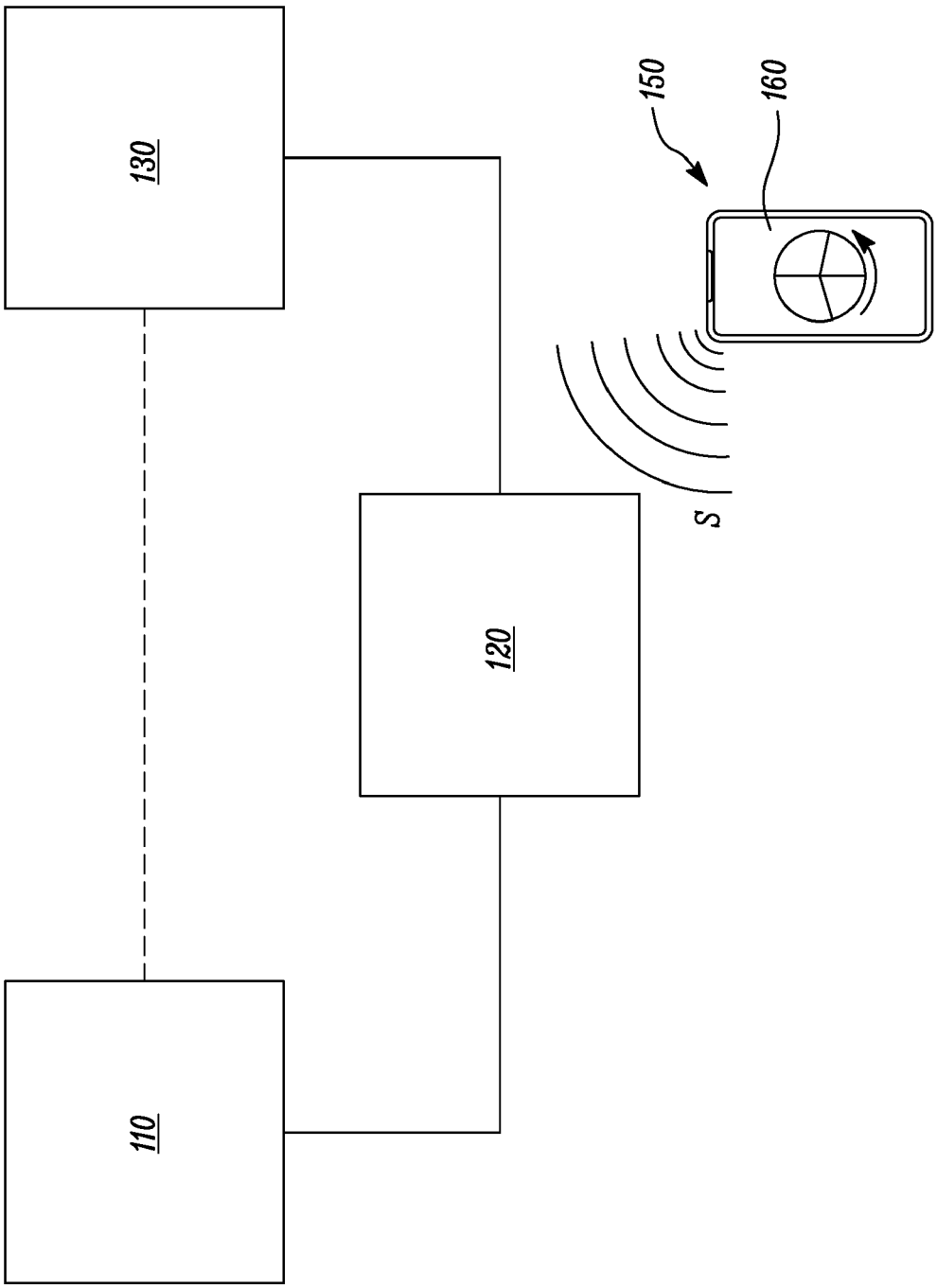

FIG. 3

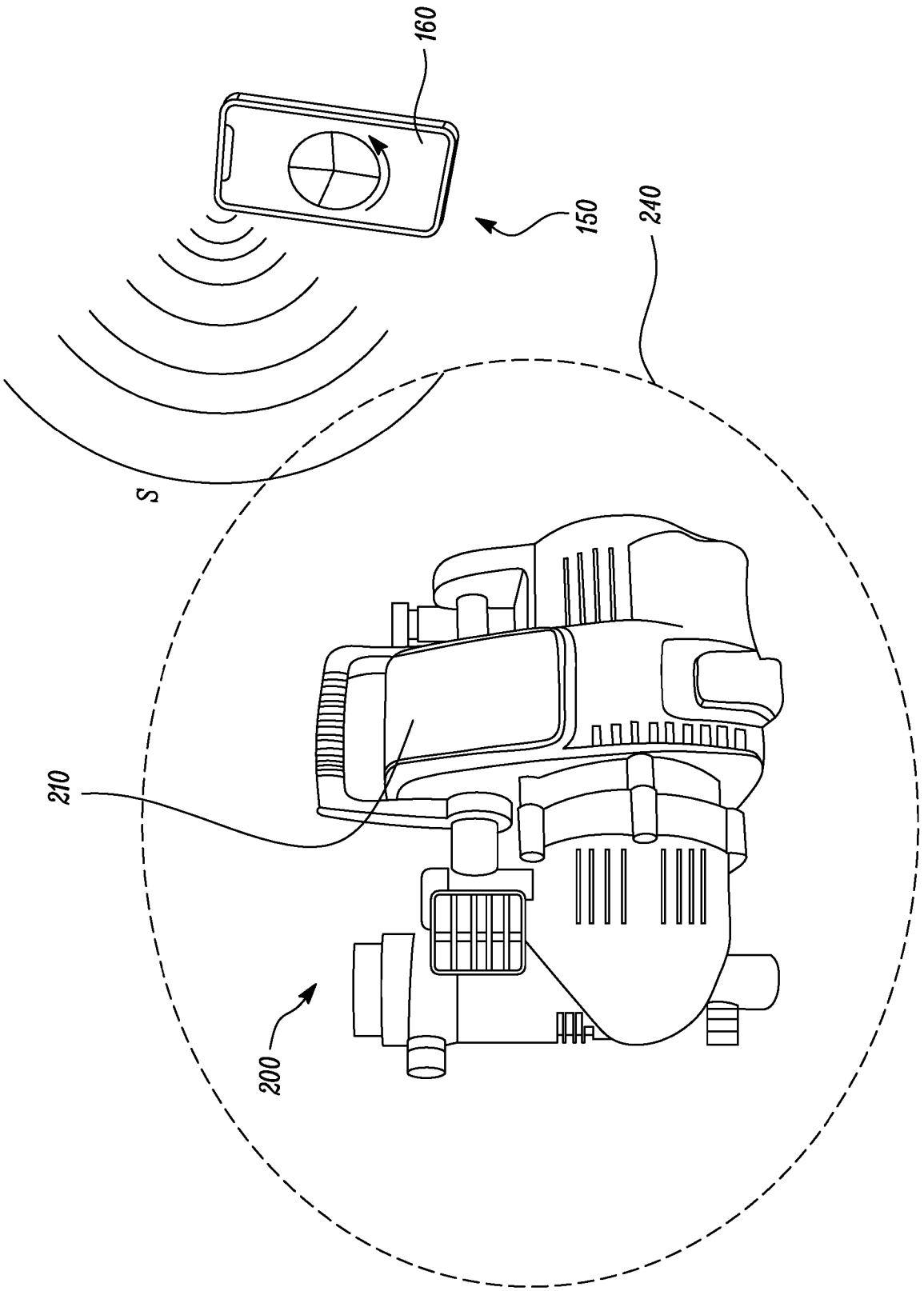

FIG. 4

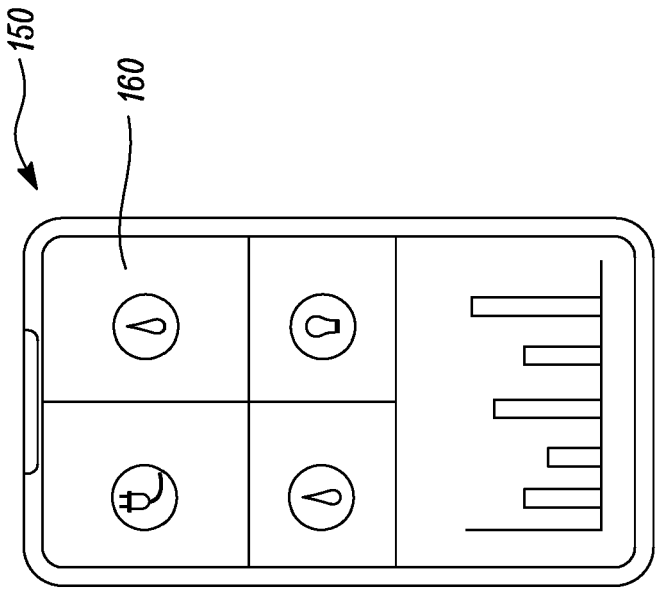

FIG. 5

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 20 20 4513

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 3 639 653 A1 (HUSQVARNA AB [SE]) 22 April 2020 (2020-04-22) * paragraphs [0039] - [0044], [0064], [0067] - [0071] *	1-10	INV. F04D13/08 F04D15/00 F04B23/02 F04B49/06 F04B51/00
Y	US 2020/003217 A1 (WILDS JOSHUA MICHAEL [US]) 2 January 2020 (2020-01-02) * paragraphs [0111] - [0161] *	1-10	
A	CN 207 049 027 U (ZHEJIANG CHENGXIN PHARM & CHEM EQUIPMENT CO LTD) 27 February 2018 (2018-02-27) * paragraphs [0029] - [0043] *	1	

TECHNICAL FIELDS SEARCHED (IPC)

F04D
F04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 March 2021	Nobre Correia, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 20 4513

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