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(71) Applicant: **HUSQVARNA AB**
561 82 Huskvarna (SE)

(72) Inventors:
• **Gungl, Johannes**
89079 Ulm (DE)
• **Jian, Wang**
Wenling, Zhejiang 317500 (CN)
• **Xingan, Chen**
Wenling, Zhejiang 317500 (CN)

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(74) Representative: **Finkele, Rolf**
Gardena Manufacturing GmbH
Hans-Lorensen-Straße 40
89079 Ulm (DE)

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(54) **RAIN PROTECTION FOR BATTERY OF A SUBMERSIBLE PUMP**

(57) A rain protection system (RPS) (100) includes a pump (110) having a pump housing (112). The (RPS) (100) includes a power source (202) housed within a control housing (120). The (RPS) (100) includes a control unit (122) housed inside the control housing (120). The control unit (122) at least partially controls the pump (110). The (RPS) (100) includes a cover (124) hingedly coupled to the control housing (120) such that the cover (124) moves between an open state and a closed state. Further, the cover (124) allows access to the power source (202) in the open state of the cover (124). The (RPS) (100) is characterized in the cover (124) is made of a transparent material, allowing visual access to the power source (202) on account of the transparent material. Further the cover (124) includes a ribbed portion (404) near to part of the cover (124) which contacts the control housing (122), with the ribbed portion (404) overlapping corresponding ribbed portion of the control housing (122) providing a snug fit of the cover (124) with the control housing (122).

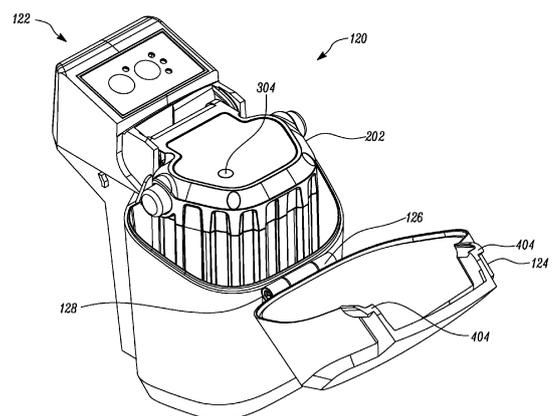


FIG. 4

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DescriptionTECHNICAL FIELD

[0001] The present disclosure relates to submersible pumps. More specifically, the present disclosure relates to rain protection for a battery of the submersible pumps.

BACKGROUND

[0002] Submersible pumps generally make use of a power source (generally referred to as batteries) for supplying power to the submersible pumps. The batteries are generally housed inside a control housing for protection from outside agents such as rains, impurities and the like. However, conventional arrangements of the control housing have constraints which make it difficult to access the batteries. Access to batteries is important since they can find applications with other devices too such as hedge trimmers, grass trimmers or any other appliance compatible with the batteries. Moreover, there is a need to make access to the batteries user-friendly with a simple and convenient opening of covering means of the control housing.

[0003] However, in case of inability to access the batteries there may not be full utilization of universal nature of the batteries, particularly with different compatible devices/appliances. Further, there may be constraints to properly maintain the batteries in case of restricted access to the batteries. But protection from water and other agents is also desirable for desired working of the batteries along with the submersible pumps. For similar reasons, there have been efforts in the art to provide waterproof arrangements, or covers for the batteries but such efforts have led to undesirable hindrances for a common user to access and use the batteries for various other purposes.

[0004] An example of a submersible pump is provided by EP1455092 (hereinafter referred to as '092 reference). The '092 reference provides a battery-driven pump with a motor and a battery, an adjustable control device for adjusting the power output of the battery to the motor. The power output of the battery to the motor can be preset by a user. Further, the control device can be waterproof in nature. However, the '092 reference does not disclose means for allowing convenient access to the battery while providing protection from water such as during rain.

[0005] Thus, improved rain protection for batteries of submersible pump is required.

SUMMARY

[0006] 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 rain protection system (RPS). The RPS includes a pump having a pump housing. The RPS in-

cludes a power source housed within a control housing. The RPS further includes a control unit housed inside the control housing. The control unit at least partially controls the pump. The RPS includes a cover hingedly coupled to the control housing such that the cover moves between an open state and a closed state. Moreover, the cover allows access to the power source in the open state of the cover. The RPS is characterized in that the cover is biased by a biasing means to remain in the closed state of the cover. Thus, the present disclosure prevents any inadvertent opening of the cover, and also allows the cover to remain in the natural state (i.e. the closed state) of the cover, by biasing action of the biasing means.

[0007] According to an embodiment of the present invention, the biasing means (alternatively, spring) is actuated by means (such as any buttons, electronics) of the control unit to change between the open state and the closed state of the cover. This may be convenient for a common user while reducing any unreasonable manual load on the spring which might take place during any manual engaging event with the cover.

[0008] According to an embodiment of the present invention, the cover is made of a transparent material leading to a transparent state. This will provide safety and security of operation by ease of monitoring of the control housing or any components present therein. Moreover, application of the cover in the transparent state allows heat radiation from the sun being efficiently and more directly passing through the cover to bring the power source to working temperature earlier than normal operation. In some embodiments, the transparent state of the cover may be set in accordance with the desired working temperature of the power source or any other operation factor associated with the control housing or the pump. Additionally, or alternatively, the cover may be such that the transparent state (say like tint of glasses) of the cover may change dynamically with environmental or external conditions such as change in sunlight, temperature, wind, humidity to further synchronize the working of the power source of the control housing as per the operating conditions. This makes operation of the battery more effective, smart, and user-friendly among other benefits.

[0009] According to an embodiment of the present invention, the cover allows visual access to the power source on account of the transparent material. This will allow uninterrupted check on internal indicators or any part/component of the power source even from outside of the cover (in the closed state).

[0010] According to an embodiment of the present invention, the biasing means is a spring. The present disclosure has a preference for the biasing means to be a spring, however any other mechanical energy storing means such as bellows, spring mechanical seals can be used for the biasing means, and all such variations are well within the scope of the present disclosure.

[0011] According to an embodiment of the present invention, the cover does not allow access to the power source in the closed state of the cover. This provides

protection from unwarranted access to the power source, particularly during working of the pump.

[0012] According to an embodiment of the present invention, the cover in the closed state protects the power source and the control unit from spray of water. Protection from water during rain and the like is essential in order to protect the power source from corrosion, therefore incurring a low maintenance cost, and enhanced life of the power source.

[0013] According to an embodiment of the present invention, the power source is a battery. The battery is used for powering the pump and alternatively any other compatible device for which the cover provides convenient access to the battery. The cover allows ease of replacement of the battery with access to the battery in the open state of the cover.

[0014] According to an embodiment of the present invention, the control housing is made of a water proof material. The control housing ensures protection of the power source from outside agents such as water, dust etc.

[0015] According to an embodiment of the present invention, the biasing means is a torsion spring. This choice of the spring will generally depend on multiple factors namely size/weight/dimensions of the cover and the control housing among other operational factors having a bearing on the service life of the spring.

[0016] According to an embodiment of the present invention, the control housing can be made of any or a combination of a metal, and/or a polymer. Materials such as metals, plastics, provide benefits such as light-weight, ease of manufacture, user-friendliness among others.

[0017] According to an embodiment of the present invention, the control unit stops operation of the pump in the open state of the cover. This provides safety against any inadvertent use of the pump. A user may remove the power source in the open state of the cover, and if the pump is in operation it may lead to injury to the user due to sparks in contact elements of the power source, or may also incur damages to the pump. Automatic switching off of the pump prevents occurrence of any such events.

[0018] Other features and aspects of this invention will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The invention will be described in more detail with reference to the enclosed drawings, wherein:

FIG. 1 shows a front view of a rain protection system (RPS) with a cover of a control housing in a closed state, in accordance with an embodiment of the present invention;

FIG. 2 shows a front view of the RPS with the cover of the control housing in an open state, in accordance

with an embodiment of the present invention;

FIG. 3 shows a perspective view of the control housing with the cover in the closed state, in accordance with an embodiment of the present invention;

FIG. 4 shows a perspective view of the control housing with the cover in the open state, in accordance with an embodiment of the present invention; and

FIG. 5 shows a perspective view of the control housing without the cover, in accordance with an embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0020] 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.

[0021] 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.

[0022] 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.

[0023] **FIG. 1** illustrates a rain protection system (RPS) **100**. The RPS **100** of the present disclosure generally refers to a submersible pump. However, The RPS **100** may also be implemented with any other pump such as, but not limited to, impulse pumps, velocity pumps, gravity pumps since the present disclosure is not to be limited by the type/size/mechanism of the pump in any manner.

[0024] The RPS **100** includes a pump **110** having a

pump housing **112**. The RPS **100** includes a control housing **120** which houses a control unit **122**. The control unit **122** is configured to at least partially control the pump **110**. The control unit **122** can be configured to perform various levels of control of the pump **110** such as, for example but need not necessarily, total control of the pump **110** where the control unit **122** can be used to control any function of the pump **110** without any restriction. Further, there may be situations where the control unit **122** may be able to control the pump **110** with some restrictions, for whatsoever reason, such as only power control of the pump **110**. In such cases, where there are restricted controls with the control unit **122** of the pump **110**, there may be independent controls provided on the pump **110** itself dedicated to rest of the functions of the pump **110**. Moreover, the control unit **122** can have means such as levers, buttons etc. to perform changes to the various levels of the control of the pump **110**. This allows ease of operation of the pump **110** for an operator while providing multiple options (i.e. the pump **110** itself or the control unit **122**) for the operator to control the pump **110**.

[0025] The control housing **120** has a cover **124** which is hingedly coupled to the control housing **120** using a hinge **126**. Herein, the cover **124** is illustrated in a closed state **124** which restricts access inside the control housing **120**. Further, the pump **110**, the control unit **122** and the power source **202** can be configured with a flexible connection **130**.

[0026] The flexible connection **130** can be an electrical cable, power cord, hydraulic hose, mechanical connection, any combination thereof or any other connection as used or known in the art. Various other modifications of type/dimension/size of the flexible connection **130** have been contemplated, and are well within the scope of the present disclosure.

[0027] The RPS **100** further includes a biasing means (preferably and used alternatively hereinafter, as a spring **128** (best shown in **FIG. 5**) housed inside the hinge **126** of the control housing **120**. The spring **128** biases the cover **124** to keep it in the closed state, in absence of any command for opening of the cover **124**. The cover **124** can move from the closed state to the open state by actuation of the spring **128** by means of a button (or like means) of the control housing **120**. This may check any inadvertent opening of the cover **124**. In other embodiments, there may be a provision to even allow change-over between the closed state and the open state of the cover **124** by manual engagement (and without a need of the control housing **120** for the same) with the cover **124** while the cover **124** moves under the action of the spring **128**.

[0028] As used herein, the "biasing means" or "spring" of the present disclosure is used to bias the cover **124** in the closed state. So, as will be evident to a person having knowledge in the art, the biasing means **126** can be any elastic object that stores mechanical energy and uses it to bias an object like the cover **124** of the present disclo-

sure. Moreover, the present disclosure can be implemented with bellows, spring mechanical seals or any other biasing/elastic object as used or known in the art and all such variations are well within the scope of the present disclosure.

[0029] The cover **124** is preferably made of a transparent material, however any other type of material which may be opaque, translucent and the like have been contemplated and are well within the scope of the present disclosure. Use of the transparent material will provide safety and security of operation by ease of monitoring of the control housing **120** or any components present therein. Further, this will allow ease of monitoring of the power source **202** or anywhere inside the control housing **120** without a need to move the cover **124** to the open state. Such a feature will find more prominence in case of a wet environment where unreasonable opening of the cover **124** may lead to intrusion of water or any other potentially harmful liquid inside the control housing **120** which can even lead to any damage.

[0030] As explained above, the cover **124** thus allows visual access to the power source **202** on account of the transparent material. The cover **124** being transparent allows any indicators, or display, or sensors which may be provided with the power source **202** to be seen through the cover **124**, without opening the cover **124**. Further, this will allow uninterrupted check on internal indicators **304** (shown in **FIGS. 3-5**) or any part/component of the power source **202** even from outside of the control housing **120** and the cover **124** (in the closed state). Additionally, this visual access may provide hint or indication of any foreign intrusion such as water, dust or any other material inside the control housing **120** even in the closed state of the cover **124**.

[0031] **FIG. 2** illustrates the RPS **100** with the cover **124** in an open state. The open state is achieved when the cover **124** is being moved against the force exerted by the biasing means **128**. The RPS **100** includes a power source **202** housed with a control housing **120**. The cover **124** is hingedly coupled (by the hinge **126**) to the control housing **120** such that the cover **124** allows access to the power source **202** in the open state of the cover **124**.

[0032] There can be events when an operator may want to access the power source **202** in the open state of the cover **124**. Such events can be related to maintenance and replacement of the power source **202** thereby enhancing the usability and application of the power source **202** with other appliances (say hedge trimmers) of the operator. Further, ease of replacement of the power source **202** without the need of any special tools to open the cover **124** makes the pump **110** more usable for the operator.

[0033] **FIG. 3** illustrates the control housing **120** with the cover **124** in the closed state. The cover **124** does not allow access to the power source **202** in the closed state of the cover **124**. The cover **124** in the closed state, protects the power source **202** from water, dust, moisture or any other such environmental agents. The cover **124**

may also protect the control unit **122** from sprays of water. In some embodiments, the power source **202** can be a battery. More particularly, the cover **124** protects electrical contacts of the battery **202** and the battery **202** itself from water.

[0034] In an embodiment, the control housing **120** is made of a water proof material. From aesthetics and implementation benefits, the control housing **120** can be made of a transparent material. Further, the control housing **120** can be made of any or a combination of a metal, and a polymer or any other material as used or known in the relevant art.

[0035] As illustrated, the control housing **120** has a hook **302** while the pump housing **112** has a mounting port (not visible), while the present disclosure is not to be limited by the choice of the hook **302** and the mounting port. The hook **302** and the mounting port are designed such that the hook **302** mates with the mounting port during assembly of the control housing **120** and the pump housing **120** respectively. Further the control housing **120** has the internal indicators **304** which serve multiple purposes such as indicate temperature, working state, life, maintenance status of the battery **202**. The internal indicators **304** have varied applications and a plurality of such internal indicators **304** are possible with each one of them serving a different purpose, mainly to convey a message/notification/alert to a user. Moreover, the internal indicators **304** may be adapted to interact with a user portable device (such as smartphone, tab and the like) to convey the message/notification/alert to the user portable device in real-time, or as per feature preference set by the user. Such arrangement is merely for illustration purposes, and the present disclosure can be readily used with any mounting arrangement or mechanism and or the convey a message/notification/alert, as known or used in the art.

[0036] The control unit **122** may be configured with functionality to control opening of the cover **124**. The control unit **122** may be configured to allow opening of the cover **124** only after entering, a password, or a code, or any other such input through a user interface. The control unit **122** may further switch off a motor when the cover **124** is in the open state. Appropriate sensors may be provided to detect opening of the cover **124**, and the control unit **122** may perform control actions such as switching off the motor, cutting off power supply etc. based on sensor output.

[0037] **FIG. 4** illustrates the control housing **120** with the cover **124** in the open state. The cover **124** is hinged substantially midway in vertical dimension of the control housing **120** in various embodiments of the present disclosure. However, the cover **124** may be hinged at any other angular orientation as well such as around top of the control housing **120**. Moreover, a person having ordinary knowledge in the art will appreciate that the cover **124** may be attached using any arrangement such as snap-fit, sliding-fit and the like as used or implemented in the pertinent art.

[0038] In the present disclosure, the open state of the cover **124** has been illustrated with the cover **124** opening around front of the control housing **120**. However, the cover **124** may be configured to open/move towards any other part of the control unit **122** in some embodiments. This can be desirable to avoid any interference between the cover **124** and any part of the pump **110**, particularly during opening of the cover **124**.

[0039] **FIG. 4** further illustrates that the cover **124** includes a ribbed portion **404** near to part of the cover **124** which contacts the control housing **122**. The ribbed portion **404** overlaps corresponding ribbed portion (not shown) of the control housing **122**, and provides a snug fit of the cover **124** with the control housing **122**. However, it should be contemplated that any other type of structural features may also be incorporated to provide effective coupling between the cover **124** and the control housing **122**.

[0040] **FIG. 5** illustrates the control housing **120** without the cover **124**. The cover **124** has been removed from aesthetical and clarity considerations only and the control housing **120** is preferred to be used with the cover **124**. During working life of the RPS **100**, the cover **124** may need to be removed for events such as maintenance, particularly during maintenance/inspection of the control housing **120**. In some cases, the cover **124** may be required to be replaced with another cover **124** of different dimensions i.e. different height to accommodate changed requirement of some other type of batteries to be housed in the control housing **120**.

[0041] As best illustrated in the present figure, the spring **128** can be a torsion spring or any other spring such as, but not limited to, compression spring, conical spring or any other spring as used or known in the art. The choice of the spring **128** will generally be dependent upon the amount or degree of actuation by means of which the control unit is required to change between the open state and the closed state of the cover **124**. Moreover, the amount of the biasing force required to keep the cover **124** in the closed state will also have a bearing on the choice of the spring **128**. Use of the spring **128** will also ensure that the cover **124** remains in the desired state (i.e. the open state or the closed state) as long as the cover **124** or, more particularly the spring **128** is not actuated by intervention of the control unit **122**. Additionally, or alternatively, actuation of the spring **128** may be solely or partially controlled by mere manual intervention (say user touch/push) to the cover **124**. However, from safety and procedural considerations the spring **128** and the cover **124** may be so configured that they respond only to interventions through the control unit **122**, and disregard any manual intervention or action with the cover **124**. This may be convenient for a common user while reducing any unreasonable manual load on the spring **128** which may be expected during manually moving the cover **124** between the closed state and the open state.

[0042] In an embodiment, the control housing **120** itself can be hingedly coupled to the pump housing **112** such

that the control housing **120** allows access to the power source **202** in an open configuration of the control housing **120**. This arrangement can be utilized with or without the cover **124** as disclosed in the present disclosure. Moreover, application of the cover **124** in the transparent state allows heat radiation from the sun being efficiently and more directly passing through the cover **124** to bring the battery **202** to working temperature earlier than normal operation. In some embodiments, the transparent state of the cover **124** may be set in accordance with the desired working temperature of the battery **202** or any other operation factor associated with the control housing **120** or the pump **110**. Additionally, or alternatively, the cover **124** may be such that the transparent state (say like tint of glasses) of the cover **124** may change dynamically with environmental or external conditions such as change in sunlight, temperature, wind, humidity to further synchronize the working of the battery **202** of the control housing **120** as per the operating conditions. This makes operation of the battery more effective, smart, and user-friendly among other benefits.

[0043] In some embodiments, the cover **124** may be configured to be actuated i.e. moved between the open state and the closed state only by using the control unit **122** of the control housing **120**. This can ensure that only legitimate access to the battery **202** is possible while providing desired rain/water protection to the battery **202**.

[0044] 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

[0045]

100	Rain Protection System
110	Pump
112	Pump Housing
120	Control Housing
122	Control Unit
124	Cover
126	Hinge
128	Biasing Means/Spring
130	Flexible Connection
202	Power Source
302	Hook
304	Internal Indicators
404	Ribbed Portion

Claims

1. A rain protection system (RPS) (**100**) comprising:
a pump (**110**) having a pump housing (**112**);

a power source (**202**) housed within a control housing (**120**);

a control unit (**122**) housed inside the control housing (**120**), wherein the control unit (**122**) is configured to at least partially control the pump (**110**);

a cover (**124**) hingedly coupled to the control housing (**120**) such that the cover (**124**) is adapted to move between an open state and a closed state, wherein the cover (**124**) allows access to the power source (**202**) in the open state of the cover (**124**);

the cover (**124**) is biased by a biasing means (**128**) to remain in the closed state of the cover (**124**).

characterized in that:

the cover (**124**) is made of a transparent material, allowing visual access to the power source (**202**) on account of the transparent material,

wherein the cover **124** includes a ribbed portion **404** near to part of the cover **124** which contacts the control housing **122**, with the ribbed portion **404** overlapping corresponding ribbed portion of the control housing **122** providing a snug fit of the cover **124** with the control housing **122**.

2. The RPS (**100**) of claim 1, wherein the biasing means (**128**) is actuated by means of the control unit (**122**) to change between the open state and the
3. The RPS (**100**) of any one of the preceding claims, wherein the biasing means (**128**) is a spring.
4. The RPS (**100**) of claim 3, wherein the spring is a torsion spring.
5. The RPS (**100**) of any one of the preceding claims, wherein the cover (**124**) does not allow access to the power source (**202**) in the closed state of the cover (**124**).
6. The RPS (**100**) of any one of the preceding claims, wherein the biasing means (**128**) is housed within a hinge (**126**) of the control housing (**120**).
7. The RPS (**100**) of any one of the preceding claims, wherein the power source (**202**) is a battery.
8. The RPS (**100**) of any one of the preceding claims, wherein the control housing (**120**) is made of a water proof material.
9. The RPS (**100**) of any one of the preceding claims, wherein the control housing (**120**) is made of any or a combination of a plastic, and a polymer.

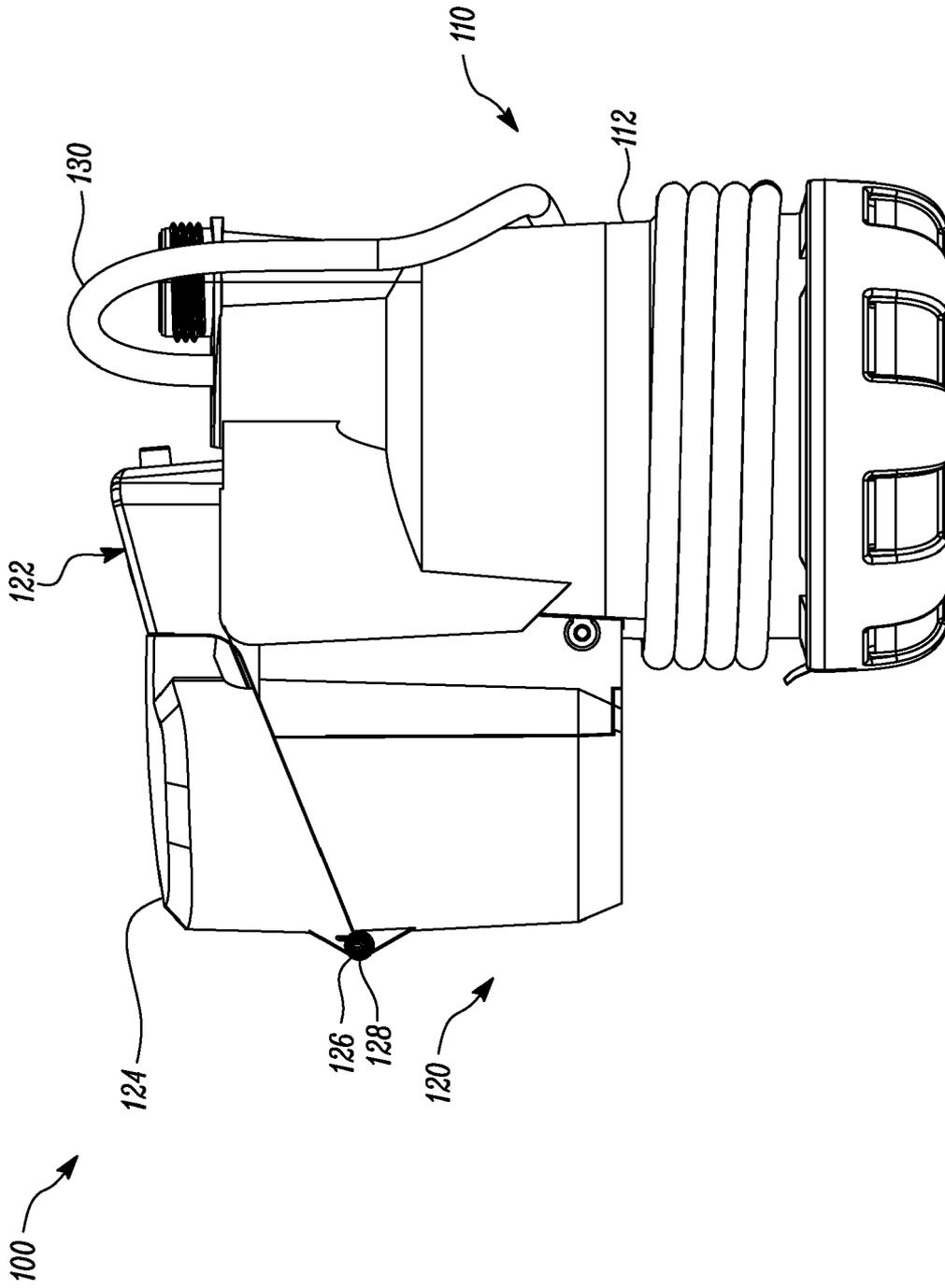


FIG. 1

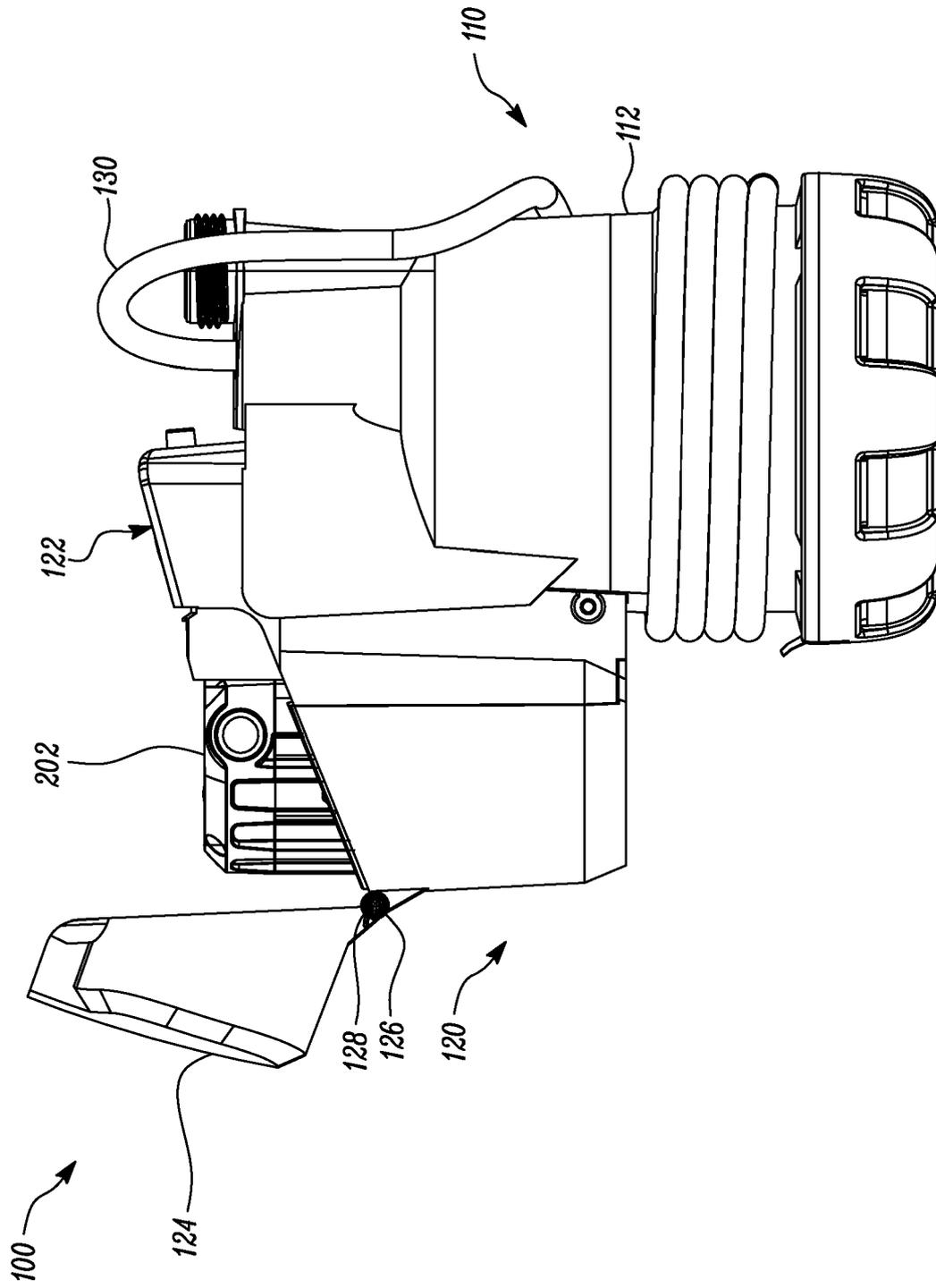


FIG. 2

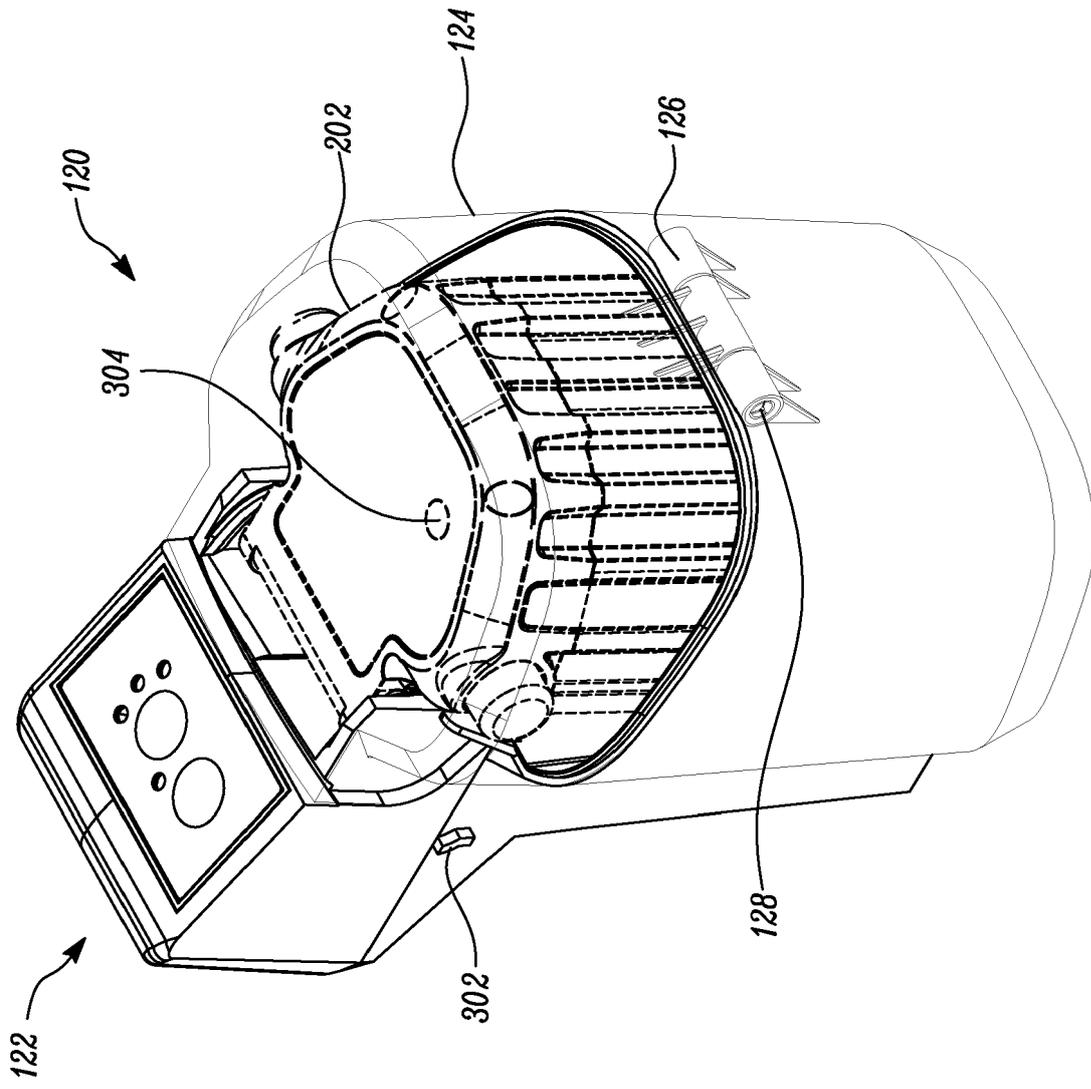


FIG. 3

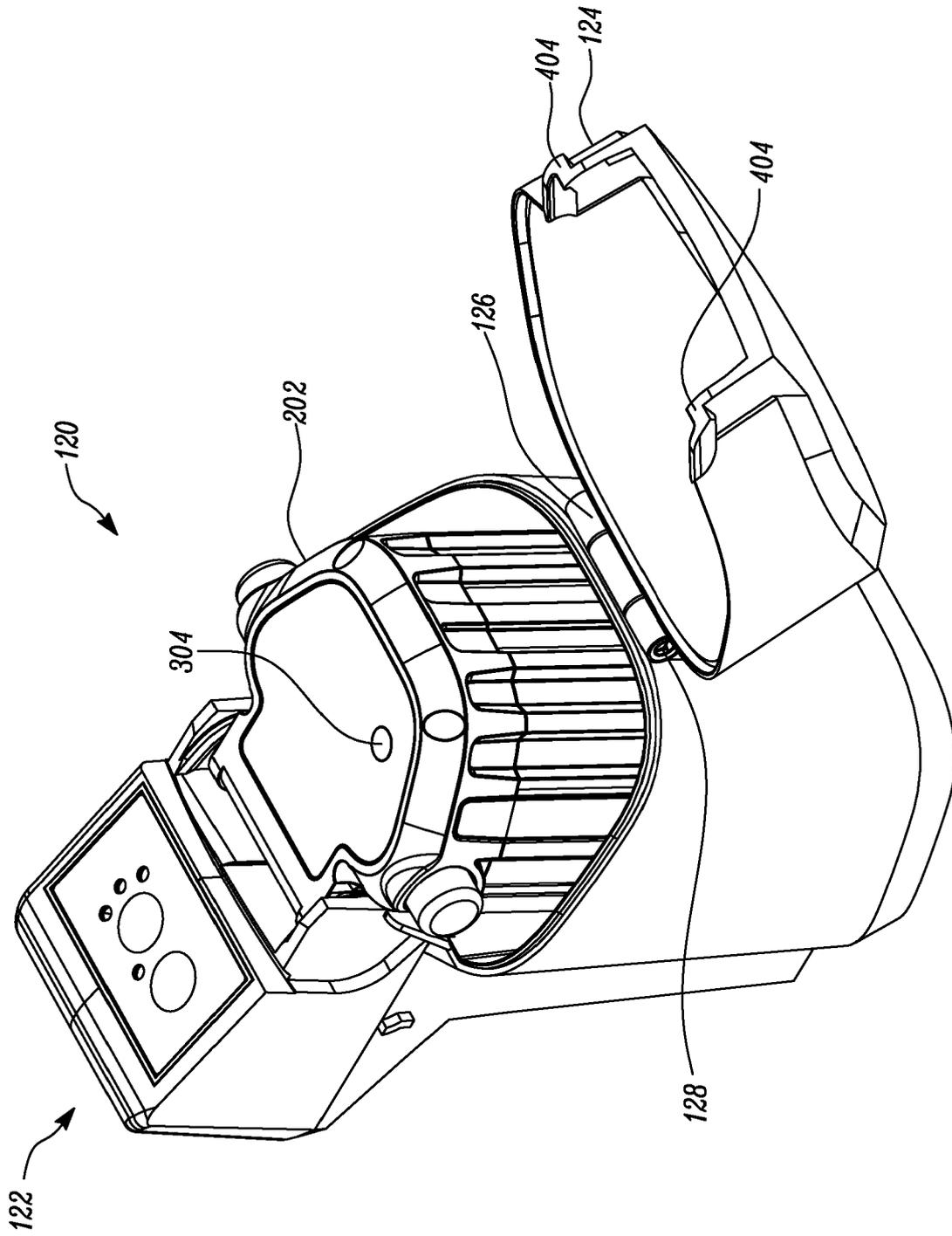


FIG. 4

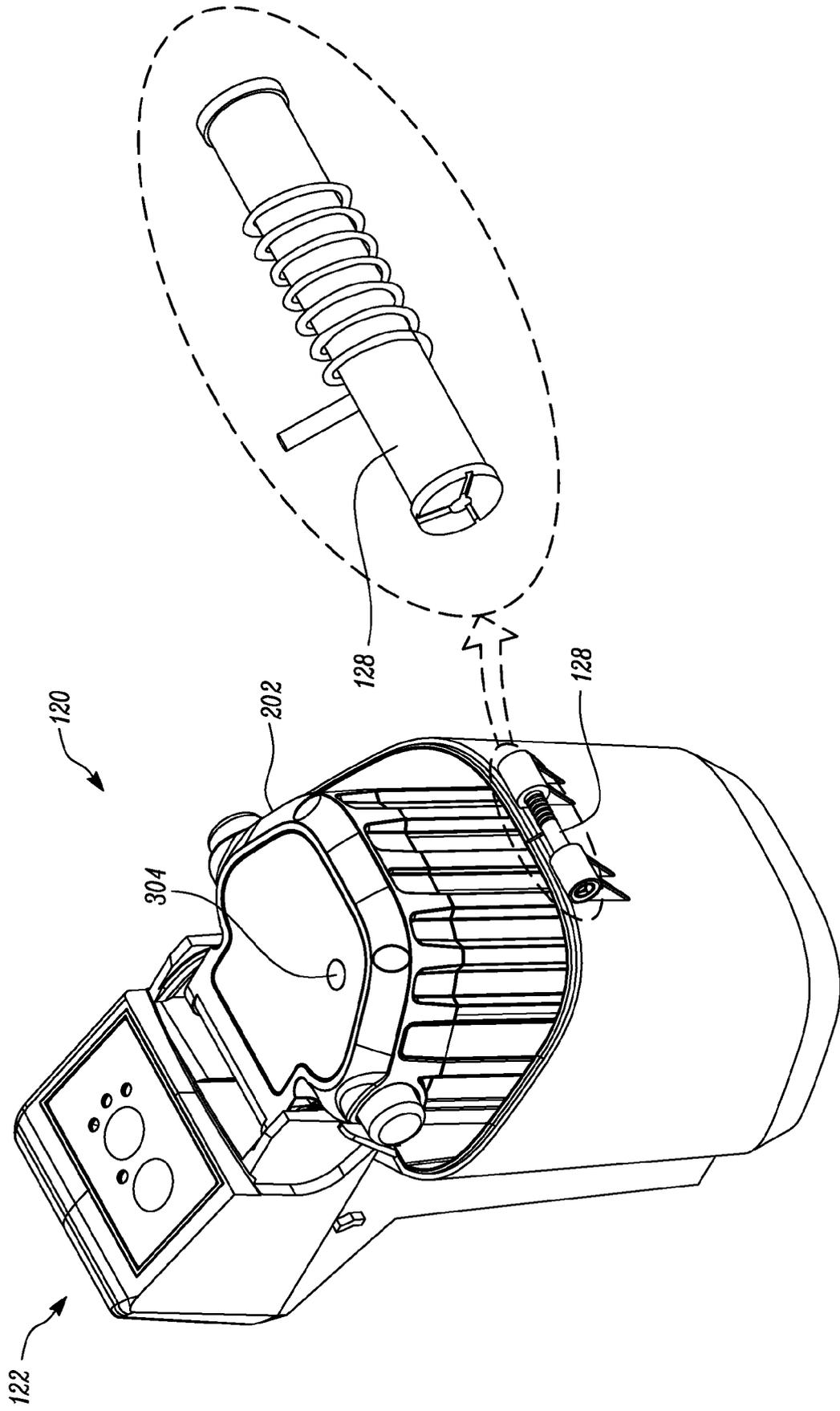


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 20 20 6153

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 6 146 108 A (MULLENDORE KEVIN H [US]) 14 November 2000 (2000-11-14) * abstract; figures 1,3,4 * -----	1-9	INV. F04D13/06 F04D13/08 F04D29/40
A	US 2017/122325 A1 (SEMAN JR ANDREW E [US] ET AL) 4 May 2017 (2017-05-04) * paragraph [0008]; figures 1,2 * -----	1-9	F04B17/03 F04B53/16
A	US 4 789 307 A (SLOAN DONALD L [US]) 6 December 1988 (1988-12-06) * column 1, line 65 - column 2, line 9; figure 1 * -----	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			F04D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 January 2021	Examiner de Martino, Marcello
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (F04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 20 6153

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
10	US 6146108	A	14-11-2000	NONE

15	US 2017122325	A1	04-05-2017	NONE

20	US 4789307	A	06-12-1988	NONE

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30				
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1455092 A [0004]