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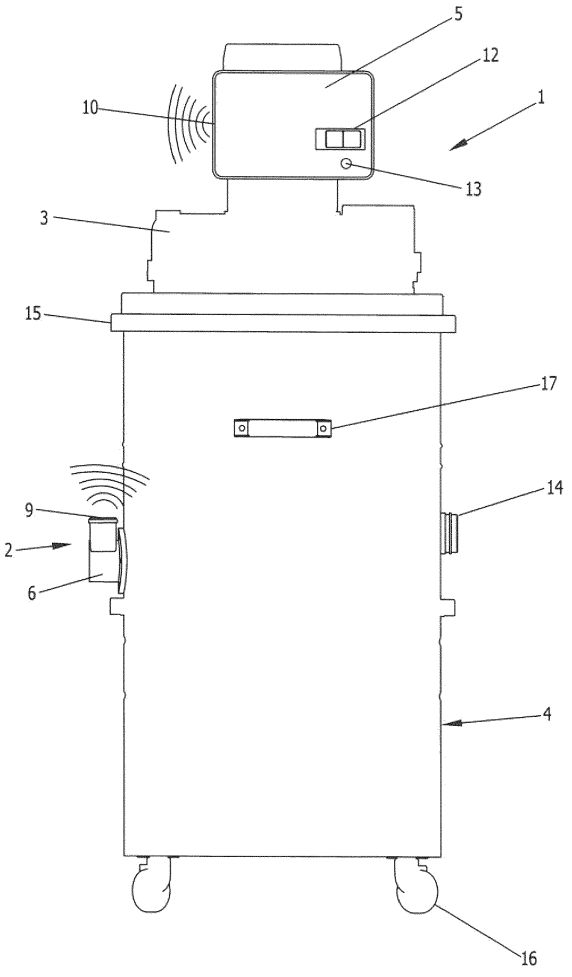
(54) **INDUSTRIAL VACUUM CLEANER FOR LIQUID SUBSTANCES WITH DETECTION DEVICE OF THE LEVEL OF FILLING OF ITS TANK**

(57) Industrial vacuum cleaner (1) for liquid substances with detection device (2) of the level of filling of its collection tank.

Said vacuum cleaner provided with a vacuum turbine (3) comprises:
- a collection tank (4) of the vacuumed liquid products (L);
- an electrical control unit (5) for controlling the various functions;
- a detection device (2) of the level of liquid reached in said tank (4), comprising a housing (6) obtained in said tank (4), a float (7) and a micro switch (8), wherein said float (7), rising as a result of the increase in the level of liquid (L), cooperates with said micro switch (8) to change its status and generate a control signal, manageable by said electrical control unit (5), to stop said vacuum turbine (3) upon reaching a predefined maximum level of filling;
- transmission means of said control signal from said detection device (2) to said electrical control unit (5).

Said detection device (2) comprises a circuit board comprising an emitter (9) of an electromagnetic wave control signal, said control signal being generated as a result of the change in status of said micro switch (8). Said electrical control unit (5) comprises a receiver (10) adapted to receive said electromagnetic wave control signal, and said transmission means of said control signal are of wireless type.

Fig. 1



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Description

[0001] The invention relates to the industrial vacuum cleaner sector. In particular, the invention concerns an industrial vacuum cleaner, for liquid substances, with detection device of the level of filling of its collection tank.

[0002] Industrial vacuum cleaners, in mobile or fixed version, are machines able to vacuum material, either powders or liquids, in large quantities. They are machines designed to operate for long periods of time in extreme conditions and with the possibility of rapidly discharging the vacuumed material.

[0003] Conventional vacuum cleaners for liquids essentially comprise at least one vacuum turbine, containment means of the liquid substances vacuumed (generally a cylindrical tank to which a vacuum brush is connected with a flexible hose) and an electrical control unit of the various functions generally positioned on the lid of the tank, which also acts as supporting base for the vacuum turbine.

[0004] The turbine draws in air, creating a vacuum pressure in the collection tank: the vacuumed air draws with it the liquids, which fill said tank.

[0005] It is important to be able to know how full the liquid collection tank is, both for the purpose of checking normal operation of the vacuum cleaner, and for safety purposes, to prevent the vacuumed liquids in excess from escaping from the collection tank and reaching the turbine and the electrical components, causing inevitable damages.

[0006] Detection devices of the level reached by liquids in the collection tank of vacuum cleaners are known.

[0007] A prior art detection device of the level reached by liquids in the tank comprises:

- a housing obtained in said tank, for example projecting from the cylindrical wall;
- a float, provided inside said housing, and movable vertically as a result of the hydrostatic thrust exerted on it by the liquid increasing in the tank;
- a micro switch, also provided in said housing, generally of reed type, on the cylindrical body of which said float is movable, adapted to cooperate with said float, which comprises a magnet adapted to cause the change of status of said micro switch;
- a wired connection that joins said micro switch to the electrical control unit of the various functions of the vacuum cleaner.

[0008] When the liquid in the tank has reached a predefined maximum safety level, the float is raised by the same liquid, so as to operate said micro switch, causing closing of the electrical circuit connected to said electrical control unit.

[0009] When the status of the micro switch changes, the electrical control unit stops the turbine of the vacuum cleaner to prevent further liquids from being introduced into the tank.

[0010] The change of state signal is transmitted from the micro switch to the electrical control unit by means of said wired connection that joins the housing positioned in the tank to the control unit associated with the lid.

[0011] Unfortunately, a wired connection can be subject to undesirable malfunctions. A wired connection, without protection, can in fact be accidentally tampered with, for example with detachment, even partial, of the cable, without faults and problems being indicated. Therefore, there is the risk of the device failing to correctly detect that the maximum filling level has been reached, and of excess liquids being vacuumed, with the drawbacks described above.

[0012] The operator, in vacuum cleaners of small size, after having disconnected the cable from the control unit to remove the lid and empty the tank, may reconnect the cable incorrectly, or even forget to connect it, making the maximum level indicator device useless.

[0013] Even more disadvantageously, the vacuumed liquid inside the collection tank often reaches conditions of turbulent motion, thereby creating vortices, The waves created by the liquid in its swirling movement can accidentally raise and lower the float several times, causing a succession of changes of status of the micro switch, even before the maximum filling level is reached in the tank. Continuous contacts and releases of the micro switch cause continuous pulses to generate a control signal to stop the turbine. In this way, the device is activated and deactivated continuously, without carrying out its correct function, causing the operator to disconnect the signal cable to deactivate the device.

[0014] The object of the invention is to eliminate these problems, producing an industrial vacuum cleaner with detection device of the level of filling with improved technical and functional performances with respect to prior art devices, with particular attention to management of consumptions.

[0015] The aim is achieved with an industrial vacuum cleaner for liquid substances with detection device of the level of filling of its collection tank, wherein said vacuum cleaner comprises:

- at least one vacuum turbine;
- a collection tank of the vacuumed liquid products;
- an electrical control unit for controlling the various functions;
- a detection device of the level of liquid reached in said tank, comprising a housing obtained in said tank, a float, provided inside said housing, and a micro switch, wherein said float, rising as a result of the increase in the level of liquid, cooperates with said micro switch to change its status and generate a control signal, manageable by said electrical control unit, to stop said at least one vacuum turbine upon reaching a predefined maximum level of filling;
- transmission means of said control signal from said detection device to said electrical control unit,

characterized in that:

- said detection device comprises a circuit board comprising an emitter of an electromagnetic wave control signal, said control signal being generated as a result of the change in status of said micro switch;
- said electrical control unit comprises a receiver adapted to receive said electromagnetic wave control signal,

wherein said transmission means of said control signal are of wireless type.

[0016] In a preferred variant of the invention, said wireless technology is of radio wave type.

[0017] According to a first aspect of the invention, said emitter comprises battery power supply means, and said receiver comprises connection means to an electrical power supply network with interposition of a transformer.

[0018] Advantageously, said emitter comprises means for setting the duration of said control signal generated.

[0019] In a particularly preferred variant of the invention, said electrical control unit comprises resettable blocking means of said at least one turbine, activated by the first pulse generated by said control signal.

[0020] Moreover, said resettable blocking means comprise a selector switch of manually controlled type.

[0021] In particular, said resettable blocking means comprise a lever adapted to operate said selector switch from the outside of the lid of the vacuum cleaner where said electrical control unit is housed.

[0022] According to a further aspect of the invention, said resettable blocking means comprise visual signalling means of the blocked condition of said at least one turbine.

[0023] The advantages deriving from the constructional aspects indicated above consist in the reliability and safety of the detection device of the level reached by the liquids inside a collection tank of an industrial vacuum cleaner.

[0024] The use of wireless technology ensures optimal performance without the risk of malfunction: in fact, no cable is exposed outside the vacuum cleaner. Wireless technology, in particular electromagnetic waves, always ensures transmission of the control signal from the emitter to the receiver.

[0025] The circuit board comprises setting means that allow setting of the maximum emission time of the control signal, with significant savings in terms of energy absorption and consequent increased duration of the power supply battery of the emitter.

[0026] In addition to the economic saving, machine downtimes for maintenance and to replace used parts are avoided.

[0027] The resettable blocking means of said turbine inhibit the operation of the turbine at the first pulse generated by the micro switch: the control unit manages the control signal only once, preventing the device from continuing to activate and deactivate due to repeated oscillations of the float, at the mercy of the waves generated by swirling of the flow of vacuumed liquid.

[0028] Moreover, even if the tank were to remain full, due to failure to empty it, the duration of the control signal limited by the timer would prevent the battery from becoming rapidly depleted.

[0029] The visual signalling means of the blocked condition of the turbine facilitate the work of the operator, immediately referred to the operations to reset the device.

[0030] These and other advantages of the invention will be more apparent below from the description of a preferred embodiment, provided by way of non-limiting example, and with the aid of the figures, wherein:

Fig. 1 represents, in a front plan view, an industrial vacuum cleaner for liquid substances with detection device of the level of filling according to the invention;
Figs. 2 and 3 represent, in a vertical section along two planes orthogonal to each other, the device according to the invention, in a first operating configuration of the vacuum cleaner with which it is associated;
Fig. 4 represents, in a vertical section, the device of Fig. 2 in a second operating configuration of the vacuum cleaner with which it is associated;
Fig. 5 represents, in an exploded axonometric view, a particular component of the invention.

[0031] With reference to Fig. 1, there is illustrated an industrial vacuum cleaner 1 for liquids comprising:

- a vacuum turbine 3;
- a cylindrical collection tank 4 of the vacuumed liquids L, provided with a coupling 14 for a vacuum tube (not illustrated), with a lid 15 also acting as supporting base for said vacuum turbine 3, with wheels 16 and with a handle 17;
- an electrical control unit 5 of the various functions positioned on said the lid 15 of said tank 4.

[0032] Said vacuum cleaner 1 comprises a detection device 2 of the level of liquid L reached in said tank 4.

[0033] With particular reference to Figs. 2-5, said device 2 comprises:

- a housing 6 obtained in said tank 4 and projecting from its lateral wall;
- a float 7 adapted to generate a magnetic field, free to move vertically inside said housing 6;
- a micro switch 8, of reed technology type, on which said float 7 slides;
- transmission means of a control signal from said detection device 2 to said electrical control unit 5.

[0034] Said transmission means comprise an emitter 9 and a receiver 10 in communication with each other.

[0035] Said emitter 9 is associated with a circuit board,

in turn associated with said micro switch 8, and is provided with battery power supply means 11.

[0036] Said receiver 10 is associated with said electrical control unit 5 and comprises connection means to an electrical power supply network. A transformer (for example 230v-12v is interposed between said receiver 10 and said electrical power supply network.

[0037] Said emitter 9 and said receiver 10 communicate with systems based on wireless technology, without cables and physical connections.

[0038] In the variant of embodiment illustrated said wireless technology is of electromagnetic wave type, in particular radio wave type.

[0039] With reference to operation of the invention, said float 7, as a result of the vacuumed liquid L reaching the maximum level MAX of filling of the tank 4, is thrust upward in said housing 6, until its magnetic field interacts with said micro switch 8 (Fig. 4).

[0040] Cooperation of the magnetic field generated by the float 7 and the micro switch 8 generates a change of state of said micro switch 8.

[0041] Said change of state is managed by said circuit board to generate a control signal that said emitter 9 will send via radio waves to said receiver 10 so that it is then managed by the electrical control unit 5 on which the same receiver is provided.

[0042] Said control signal is thus adapted to cause said vacuum turbine 3 to stop upon reaching a predefined maximum level MAX of filling of the tank 4 of the liquids.

[0043] Said emitter 9 comprises setting means (not illustrated) of the duration of said control signal generated.

[0044] An optimal, but purely indicative, duration time of the control signal is of a few seconds, for example 5 seconds.

[0045] Said electrical control unit 5 comprises reversible resettable blocking means (not illustrated) of said at least one vacuum turbine 3, activated by the first pulse generated by said control signal received by said receiver 10.

[0046] Said blocking means comprise visual signalling means 13 of the blocked condition of said at least one turbine 3.

[0047] Said electrical control unit 5 comprises resetting means of said blocking means that can be operated from the outside of said control unit, adapted to reactivate said at least one turbine 3, once the vacuumed liquids L have been emptied from the tank 4.

[0048] Said resetting means comprise a selector switch 12 of manually controlled type. In the variant illustrated (Fig. 1), to reset the blocking means of the turbine it is necessary to position the selector switch 12 to OFF, corresponding to the vacuum cleaner 1 being switched off, and then to move it to ON and/or modulate it to the various vacuum speeds of the turbine 3.

[0049] In possible variants of the invention, not illustrated, said resetting means comprise a lever adapted to operate said selector switch. In this case, the movement of said lever is also associated with reversal of the vacuum flow of the turbine, which no longer flows into the liquid containment means, but in the opposite direction, with the aim of discharging the liquid and emptying of the tank.

Claims

1. Industrial vacuum cleaner (1) for liquid substances with detection device (2) of the level of filling of its collection tank, wherein said vacuum cleaner (1) comprises:

- at least one vacuum turbine (3);
- a collection tank (4) of the vacuumed liquid products (L);
- an electrical control unit (5) for controlling the various functions;
- a detection device (2) of the level of liquid reached in said tank (4), comprising a housing (6) obtained in said tank (4), a float (7), provided inside said housing (6), and a micro switch (8), wherein said float (7), rising as a result of the increase in the level of liquid (L), cooperates with said micro switch (8) to change its status and generate a control signal, manageable by said electrical control unit (5), to stop said at least one vacuum turbine (3) upon reaching a predefined maximum level of filling;
- transmission means of said control signal from said detection device (2) to said electrical control unit (5),

characterized in that:

- said detection device (2) comprises a circuit board comprising an emitter (9) of an electromagnetic wave control signal, said control signal being generated as a result of the change in status of said micro switch (8);
- said electrical control unit (5) comprises a receiver (10) adapted to receive said electromagnetic wave control signal,

wherein said transmission means of said control signal are of wireless type.

2. Industrial vacuum cleaner (1) with detection device (2) of the level of filling according to claim 1, **characterized in that** said wireless technology is of radio wave type.

3. Industrial vacuum cleaner (1) with detection device (2) of the level of filling according to claim 1, **characterized in that** said emitter (9) comprises battery power supply means (11), and said receiver (10) comprises connection means to an electrical power supply network with interposition of a transformer.

4. Industrial vacuum cleaner (1) with detection device (2) of the level of filling according to claim 1, **characterized in that** said emitter (9) comprises means for setting the duration of said control signal generated.

5. Industrial vacuum cleaner (1) with detection device (2) of the level of filling according to claim 1, **characterized in that** said electrical control unit (5) comprises resettable blocking means of said at least one turbine (3), activated by the first pulse generated by said control signal.

6. Industrial vacuum cleaner (1) with detection device (2) of the level of filling according to claim 5, **characterized in that** said resettable blocking means comprise a selector switch (12) of manually controlled type.

7. Industrial vacuum cleaner (1) with detection device (2) of the level of filling according to claim 5, **characterized in that** said resettable blocking means comprise a lever adapted to operate said selector switch (12) from the outside of the lid (15) of the vacuum cleaner (1) where said electrical control unit (5) is housed.

8. Industrial vacuum cleaner (1) with detection device (2) of the level of filling according to claim 5, **characterized in that** said resettable blocking means comprise visual signalling means (13) of the blocked condition of said at least one turbine (3).

Fig. 1

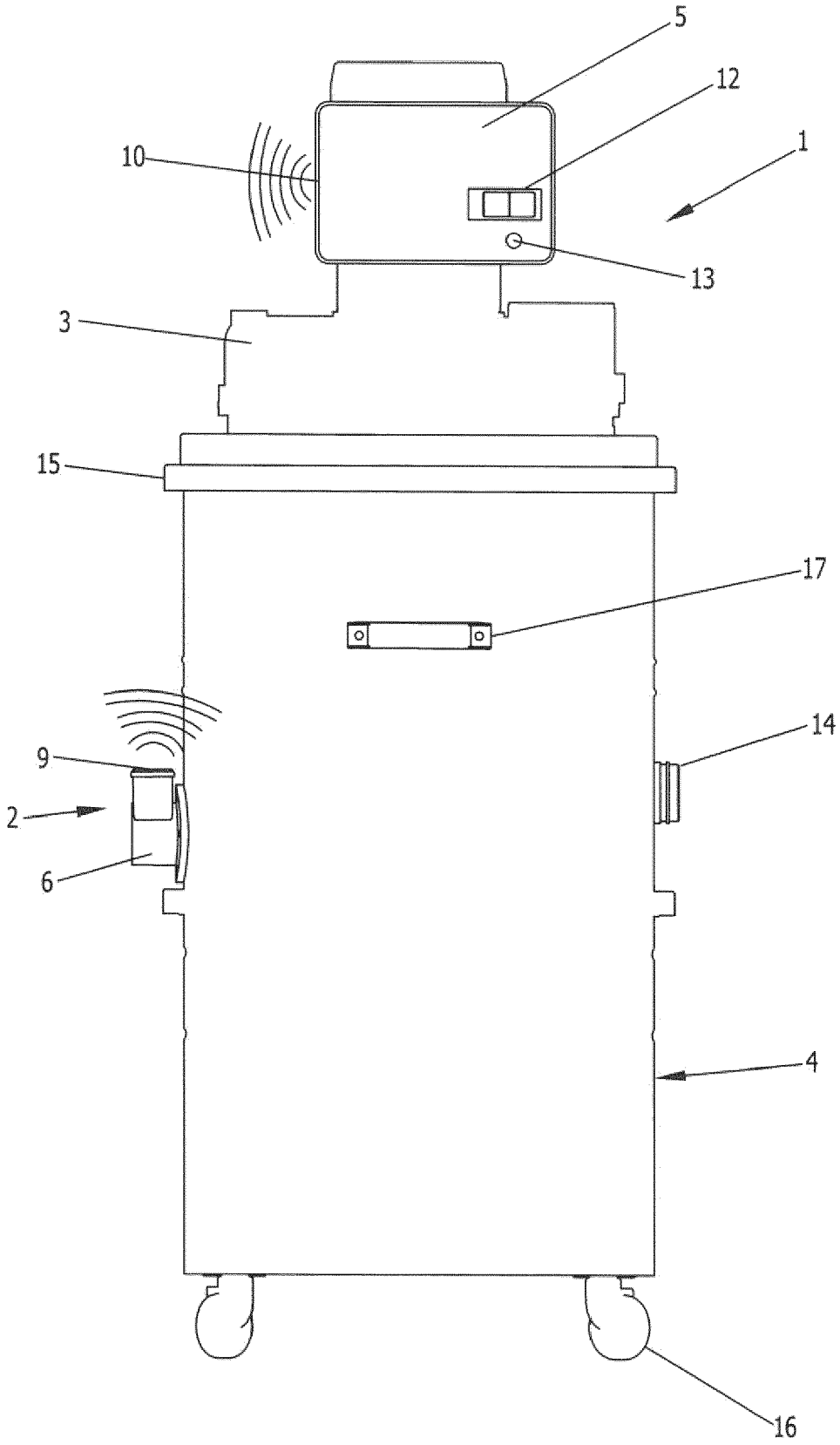


Fig. 2

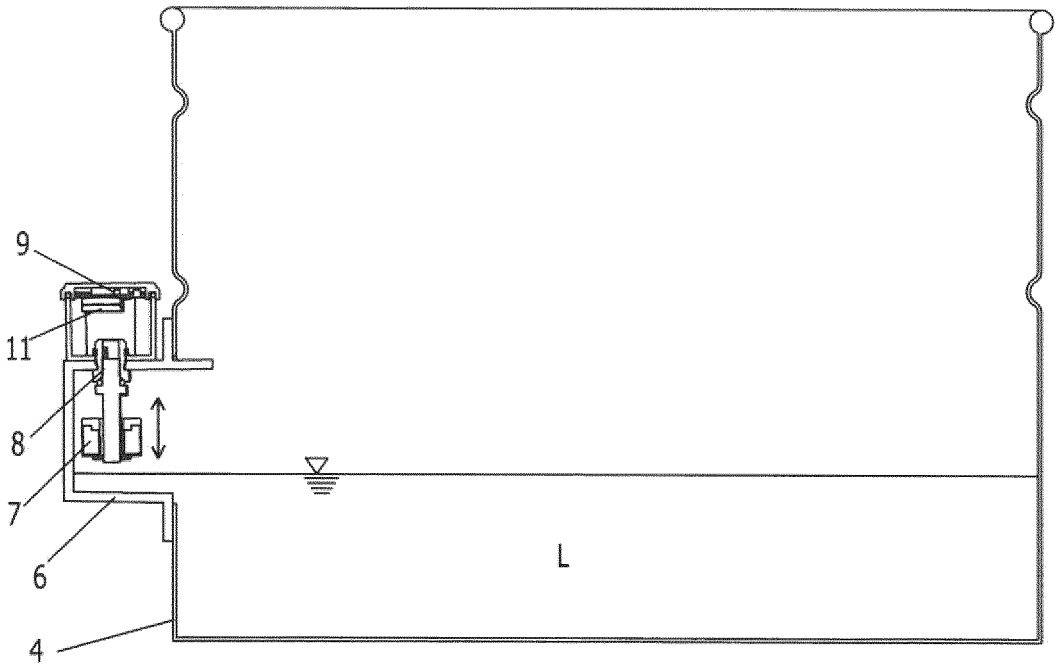


Fig. 3

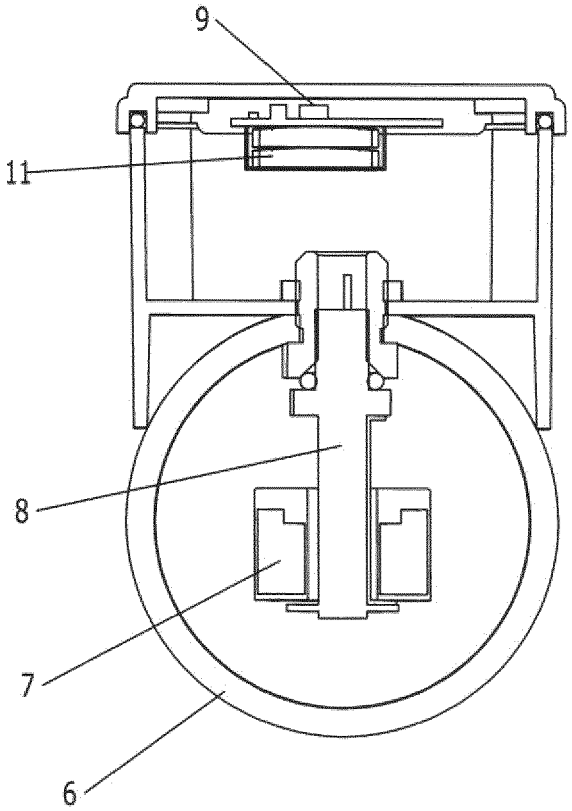


Fig. 4

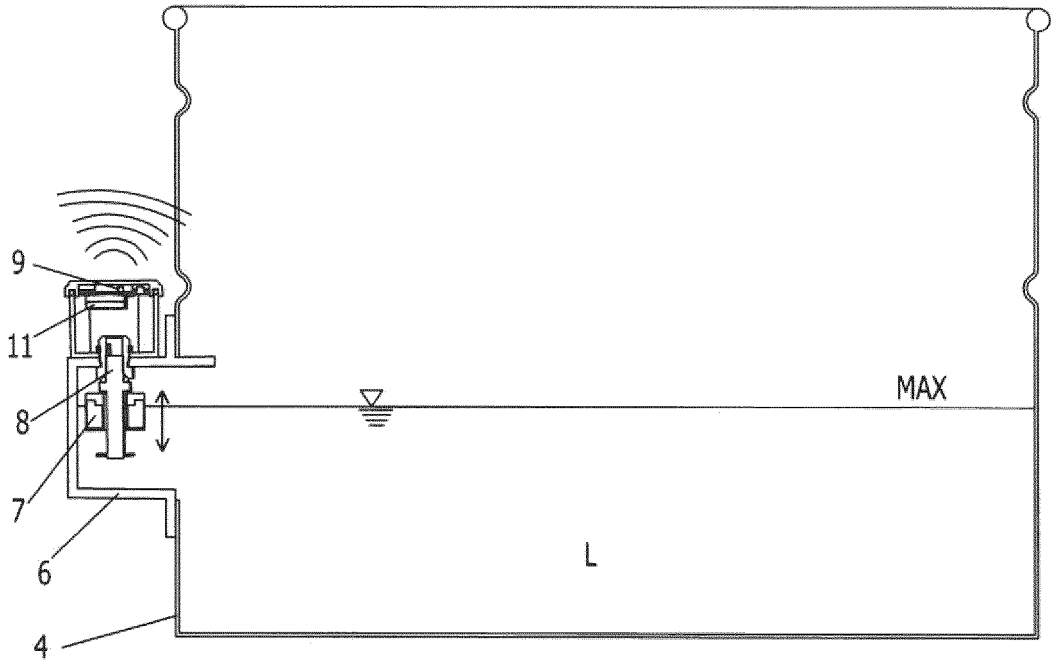
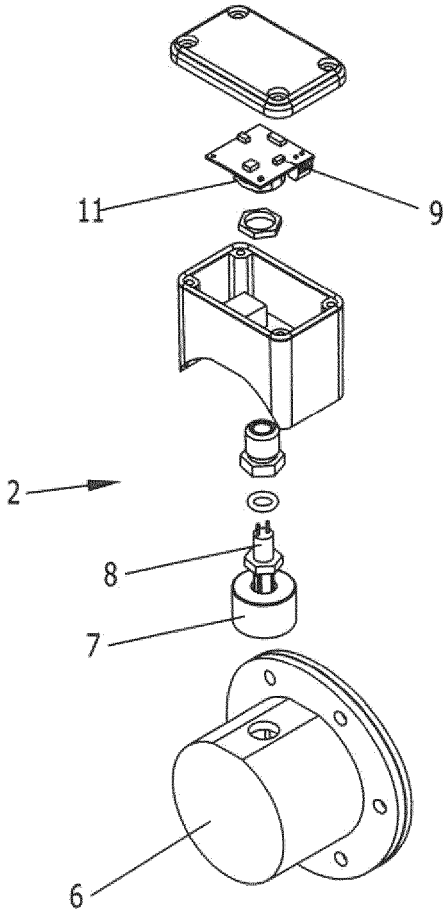


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 17 15 8235

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	WO 00/42893 A2 (SHOP VAC CORP [US]) 27 July 2000 (2000-07-27) * page 9, lines 13-28 * * page 21, line 27 - page 22, line 13 *	1-8	INV. A47L7/00
A	US 2006/260088 A1 (NAM HYEUN S [KR] ET AL) 23 November 2006 (2006-11-23) * paragraph [0041] *	1-8	
A	US 5 465 455 A (ALLEN HAROLD [US]) 14 November 1995 (1995-11-14) * column 4, lines 14-49 *	1-8	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 June 2017	Eckenschwiller, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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22-06-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0042893 A2	27-07-2000	AU 4957899 A	07-08-2000
		CA 2347889 A1	27-07-2000
		DE 69919582 D1	23-09-2004
		DE 69919582 T2	14-07-2005
		EP 1143842 A2	17-10-2001
		US 6112366 A	05-09-2000
		WO 0042893 A2	27-07-2000
US 2006260088 A1	23-11-2006	CN 1864621 A	22-11-2006
		GB 2426186 A	22-11-2006
		US 2006260088 A1	23-11-2006
US 5465455 A	14-11-1995	NONE	

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