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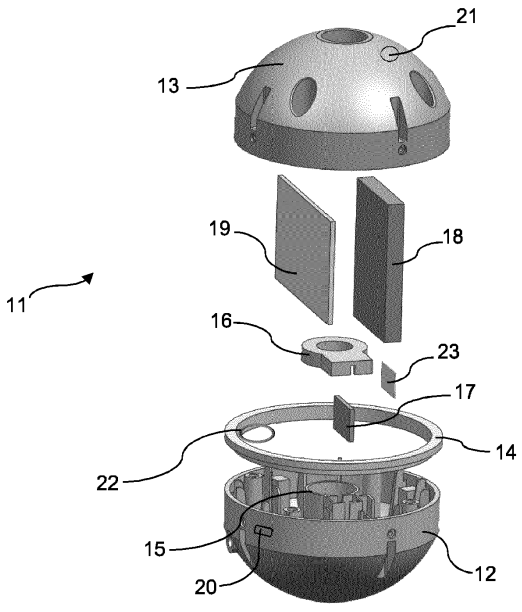
(54) MEASURING UNIT OF HOUSEHOLD APPLIANCE

(57) A measuring unit (11) of a household appliance (10) for collecting process parameters of the household appliance (10) comprises: a housing(12,13) an energy storage (18), a PCB electronics (19), and a measuring sensor (17). The measuring unit (11) is wirelessly connected with the household appliance (10) and the measuring sensor (17) is placed in a tunnel (15) which tunnel (15) extends into the housing (12, 13).

The measuring unit is intended for use in a household appliance, especially washing machine or tumble dryer which is able to measure and collect the washing or drying parameters and are able to communicate wirelessly with the household appliance. Supervising the processes parameters helps to control the process and adjust the process parameters in order to achieve the best effectiveness of the household appliance.

Fig. 3



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Description

[0001] The present invention relates to a measuring unit of a household appliance, especially a washing machine or a tumble dryer. The measuring unit collects the household appliance parameters and comprises: a housing,an energy storage, a PCB electronics and a measuring sensor. The measuring unit is wirelessly connected with the household appliance.

[0002] Measuring units are known from the state of the art. There are many solutions available on the market for measuring different type of values e.g. temperature, humidity, pressure etc. with the capability of wireless data transmission to a receiving device. Measuring units are widely used in today's high-end household appliances e. g. in washing machines or tumble dryers. Sensors provided in such appliances provide a real-time monitoring and feedback to improve certain functions. The washing parameters such as temperature, water amount, rotating speed, spinning time are likely to influence the washing or drying process therefore measuring and adjusting of those parameters are significant for obtaining the satisfactory washing or drying effect. Accurate humidity measurement can bring significant savings in both energy and costs. By knowing the humidity level it is possible to avoid over-drying and overheating the air. Exact humidity data helps to optimize processes. Depending on the product, it can mean for example longer shelf life or improved stability. Controlling process humidity is also crucial for safety reasons.

[0003] Wireless measuring units are also known from the state of the art. The wireless measuring unit is designed in such a way to be able to work in a drum of the washing machine or tumble dryer machine and transfer data such as temperature, pressure, air humidity and moisture of the load to an external hub.

[0004] The patent document WO 2020/ 089 198 A1 discloses a method involving the following: detecting one or more pieces of air humidity information indicative of relative air humidity within a treatment space of an air-guiding domestic appliance, wherein the one or more pieces of air humidity information are detected by means of at least one air humidity sensor; and determining a piece of drying information indicative of a finishing time of a drying process carried out by the air-guiding domestic appliance, wherein the drying information is determined on the basis of the one or more pieces of air humidity information. The document also discloses a device for carrying out and/or controlling this method, a system having one or more devices for carrying out and/or controlling this method and a computer program for carrying out and/or controlling this method by means of a processor. The results of collecting and analyzing washing parameters provide valuable information for the optimization of washing programs for satisfactory washing result.

[0005] The patent document WO 03/ 100 153 A1 discloses a sensor device adapted to detect, identify and/or measure a chemical and/or physical characteristic upon placement of the device into an environment, especially a liquid medium for which monitoring is sought.

[0006] The patent document DE 40 31 981 A1 discloses an unit for measuring temperature and moisture degree of the washing and chemical composition of the washing solution in the washing drum of a washing machine. The temperature measuring sensor, moisture measuring sensor and the sensor for measuring the chemical composition are incorporated into a container located in the washing drum together with the washing. A receiver is located outside the drum for receiving the measuring results, which are led on to the control unit of the washing machine for evaluation.

[0007] It is the object of the present invention to provide a measuring unit of a household appliance which is able to measure parameters in improved way.

[0008] Another object of the present invention is to provide a measuring unit of improved, reliable functioning.

[0009] This object is solved by a measuring unit of household appliance, especially a washing machine or a tumble dryer whereby the measuring sensor is placed in a tunnel, which tunnel extends into the housing of the measuring unit. The measuring unit of the household appliance is provided for collecting the household appliance parameters. The measuring unit is able to work in a drum of a washing machine or in a drum of a tumble dryer and is able to collect process parameters like temperature, pressure, air humidity, moisture of the load etc. The measuring unit is wirelessly connected with the household appliance to transfer the collected data. All collected parameters can be stored also in an external hub. The measuring unit is wirelessly connected with the appliance by standard wireless communication connection like Wi-Fi, Bluetooth, WLAN etc. The purpose of collecting respective data is to supervise and adjust the parameters of processes of household appliances in order to improve the processes effectiveness.

[0010] The housing is preferably round, for example of spherical or elipsoid shape without sharp edges which allows the measuring unit to be installed almost everywhere inside the household appliance e.g. in a drum of a washing machine or tumble dryer. The measuring unit shape facilitates the movement of the unit inside the drum and does not affect the movement of clothes inside the drum.

[0011] The measuring unit comprises also an energy storage, a PCB electronics and a measuring sensor. An energy storage of the measuring unit is preferably a Li-Ion battery as this type of battery is much more resistant to the working conditions than other known batteries. The Li-Ion battery cells are much more resistant to the temperature and vibrations and they does not lose their capacity over time of its use in conditions of high temperature and humidity.

[0012] The measuring unit preferably has a 4-layer PCB electronics to reduce the noise impact on the electronics.

[0013] The measuring unit comprises a measuring

sensor or a group of sensors which measure different types of parameters like temperature, pressure, humidity, speed etc. The measuring sensor is placed in a tunnel. The tunnel can e.g. be a simple protrusion of a shape adapted to the measuring sensor dimensions. The positive effect is that the measuring sensor is isolated from the inner heat coming from the energy storage and electronics. Isolated measuring sensor measures the temperature only outside the measuring unit so the parameter is measured more precisely. The second purpose of the tunnel is to protect the measuring sensor from fluff from clothes which disturbs the reading of the ambient conditions by the measuring sensor.

[0014] The tunnel plays an additional role in that it protects the measuring sensor against vibrations and impacts. The tunnel is extending into the housing of the measuring unit. The positive effect is that in such position of the tunnel with the measuring sensor that the sensor is protected against fluffy from clothes in the most effective way. Additionally, at the center area of the measuring unit is an area with the lowest vibration level which is significant for providing an accurate measurements of the ambient.

[0015] In another embodiment of the invention the measuring unit has a magnet. The magnet is provided on the surface of the measuring unit or inside the casing in order to attach the measuring unit to the metal surface of the drum during cycle. The measuring unit can be attached to the drum when the load of the drum is low. The positive effect is that the measuring unit is protected against hitting the metal drum which could cause an additional noise.

[0016] In a preferred embodiment of the invention the measuring unit has a USB port for wire charging. The energy storage allows the measuring unit to work for limited period of time. The measuring unit is provided with a USB port thanks to which the energy storage of the measuring unit can be recharged in a simple manner by the user. The USB port is designed to be waterproof.

[0017] In another embodiment of the invention the measuring unit has an induction coil for inductive charging. The other way to recharge the measuring unit is the inductive charging which is possible thanks to the induction coil placed inside the measuring unit casing. This feature assure possibility of inductive charging of the measuring unit with no extra wires and sockets. Inductive charging capability make daily use of the measuring unit very easy and convenient.

[0018] In a preferred embodiment of the invention the measuring unit has an energy harvesting module. Energy harvesting is the process by which energy is derived from ambient energy and convert it into energy which is supplied to the energy storage of the wireless measuring unit. The energy harvesting module is responsible for gathering of the kinetic energy during the movement or vibration of the measuring unit inside the rotating drum of the home appliance. The gathered energy is collecting inside the super capacitor. In the next step energy collected in the capacitor is used in the next step to charge the energy storage. Thanks to the energy harvesting module the time of use of the measuring unit is significantly extended and there is no involvement of the user needed.

[0019] In another embodiment of the invention the housing is made of material resistant to mechanical impact. During the washing or drying process the measuring unit housing is exposed to damages which can be done by zippers or other metal elements of clothes. For this reason casing of the measuring unit has to be made of material resistant to small mechanical impact e.g. different types of plastic.

[0020] In another embodiment of the invention the measuring unit has an outer soft layer. The measuring unit is placed in a drum of a household appliance and moves in different directions together with the washing or drying load. The measuring unit hits the metal drum which is unavoidable when the measuring unit is freely inserted into the drum. The impact of the measuring unit with the metal drum causes noise which is very uncomfortable for the user. To eliminate the noise the casing of the measuring unit is provided with an outer soft layer thanks to which the measuring unit can hit the metal drum without negative consequences to the consumer.

[0021] In an embodiment of the invention, the housing of the measuring unit comprises a first casing and a second casing connected to the first casing. The first casing and the second casing are preferably round, spherical shape without sharp edges which allows the measuring unit to be installed almost everywhere inside the household appliance e.g. in a drum of a washing machine or tumble dryer. The measuring unit shape facilitates the movement of the unit inside the drum and does not affect the movement of clothes inside the drum.

[0022] According to a preferred embodiment, the first casing and the second casing are detachably connected to each other, e.g by screws. This provides easy access to the components of the measuring unit, specifically in case servicing action is needed, and guarantees sustainability of the measuring unit.

[0023] Preferrably, the first casing and the second casing are sealed by a seal which preferrably is placed on the circumference of the sphere to make the measuring unit water proof which is necessary to protect the inner components of the measuring unit and provide reliable functioning.

[0024] In an embodiment where the housing comprises a first casing and the second casing, the tunnel may preferrably be located in the first center of the first casing and/or the second casing which means that the tunnel is made in the axis of the first casing and/or the second casing.

[0025] In a preferred embodiment of the invention where the tunnel extends into the first and the second casing, the tunnel may comprise a first part, which is shaped in the first casing and a second part which is shaped in the second casing. In such an embodiment a

tunnel sealing may be provided between the first part of the tunnel and the second part of the tunnel. The tunnel sealing may be a simple rubber sealing which helps to provide a proper tunnel insulation and measuring sensor protection, which is significant for proper functioning of the measuring unit.

[0026] In a specific embodiment of the invention the first casing and the second casing are made of rubber. Thanks to use a rubber for the casing, the measuring unit is not only convenient to use but also is waterproof and fluff proof.

[0027] The present invention enables a measuring unit for use in a household appliance, especially washing machine or tumble dryer, which is able to measure and collect the washing or drying parameters and are able to communicate wirelessly with the household appliance. Supervising the processes parameters helps to control the process and adjust the process parameters in order to achieve the best effectiveness of the household appliance.

[0028] The construction of the invention, however, together with additional objects and corresponding advantages will be best understood from the following description of specific embodiments and in connection with the accompanying drawing.

[0029] In the drawing:

Fig. 1. shows a household appliance in isometric view,

Fig. 2. shows a measuring unit in isometric view, and

Fig. 3. shows an exploded view of the measuring unit.

[0030] In cooperation with attached drawing, the technical contents and detailed description of the present invention are described thereinafter according to a preferable embodiment being not used to limit its executing scope. Any equivalent variation and modification made according to appended claims is all covered by the claims claimed by the present invention.

[0031] In the following description of the preferred embodiments of the present invention, similar identical reference numbers designate identical of comparable components.

[0032] Fig. 1 shows a household appliance 10, here a washing machine with a measuring unit 11 which is placed inside the drum of the household appliance 10. The measuring unit 11 is provided inside the drum to collect data about the process. The measuring unit 11 is wirelessly connected with the household appliance 10 to transmit collected data.

[0033] Fig. 2 shows a measuring unit 11 in isometric view. The measuring unit 11 comprises a housing which comprises a first casing 12 and a second casing 13 connected to each other by screws. Between the first casing 12 and the second casing 13 a seal 14 is provided. As the measuring unit 11 works in a wet environment its internal components have to be protected.

[0034] Fig. 3 shows an exploded view of a measuring unit 11. The measuring unit 11 housing comprises a first casing 12 and a second casing 13 which are sealed by a seal 14. The first casing 12 and the second casing 13 have spherical shape. Between the first casing 12 and the second casing 13 all internal components of the measuring unit 11 has been shown. The first casing 12 is connected to the second casing 13 by screws. The measuring unit 11 has a tunnel 15 extending into the housing for placing a measuring sensor 17. The tunnel 15 in this embodiment is a part of the first casing 12 and it is placed in the axis of the first casing 12. The tunnel 15 and the first casing 12 constitutes one part and it was created in one moulding process. The tunnel 15 is sealed by a tunnel sealing 16. The tunnel sealing 16 is a standard rubber sealing. The measuring sensor 17 is a standard sensor which is able to sense different parameters of the ambient. The measuring unit 11 comprises a PCB electronics which is a standard printed circuit board. The measuring unit 11 has an energy storage 18 which is charged by wires by using a USB port 20 placed on the external surface of the first casing 12. The energy storage 18 can be charged also by energy harvesting module 23 which gather the kinetic energy and transfer it to charge the energy storage 18. The energy storage 18 can be charged also by inductive charging. For this reason an induction coil 22 was provided inside the measuring unit 11.

[0035] The present invention enables a measuring unit for use in a household appliance, especially washing machine or tumble dryer which is able to measure and collect the washing or drying parameters and are able to communicate wirelessly with the household appliance. Supervising the processes parameters helps to control the process and adjust the process parameters in order to achieve the best effectiveness of the household appliance.

REFERENCE SIGNS

[0036]

10	household appliance
11	measuring unit
12	first casing
13	second casing
14	seal
15	tunnel
16	tunnel sealing
17	measuring sensor
18	energy storage
19	PCB electronics
20	USB port
21	magnet
22	induction coil
23	energy harvesting module

Claims

1. A measuring unit (11) of a household appliance (10) for collecting process parameters of the household appliance (10) and comprising: a housing(12,13) an energy storage (18), a PCB electronics (19), and a measuring sensor (17) where the measuring unit (11) is wirelessly connected with the household appliance (10) **characterized in that**

2. the measuring sensor (17) is placed in a tunnel (15) which tunnel (15) extends into the housing (12, 13). The measuring unit (11) according to any of the preceding claims, **characterized in that** the measuring unit (11) has a magnet (21).

3. The measuring unit (11) according any of the preceding claims, **characterized in that** the measuring unit (11) has a USB port (20) for wire charging.

4. The measuring unit (11) according to any of the preceding claims, **characterized in that** the measuring unit (11) has an induction coil (22) for inductive charging.

5. The measuring unit (11) according to any of the preceding claims, **characterized in that** the measuring unit (11) has an energy harvesting module (23).

6. The measuring unit (11) according to any of the preceding claims, **characterized in that** the housing is made of material resistant to mechanical impact.

7. The measuring unit (11) according to any of the preceding claims **characterized in that** the measuring unit (11) has an outer soft layer.

8. The measuring unit (11) according to any of the preceding claims **characterized in that** the housing comprises a first casing (12) and a second casing (13) connected to the first casing.

9. The measuring unit (11) according to claim 8, **characterized in that** the first casing (12) and the second casing (13) are made of rubber.

10. The measuring unit (11) according to any of the preceding claims 8 to 9 **characterized in that** the first casing (12) and the second casing (13) are sealed by a seal (14).

Fig. 1

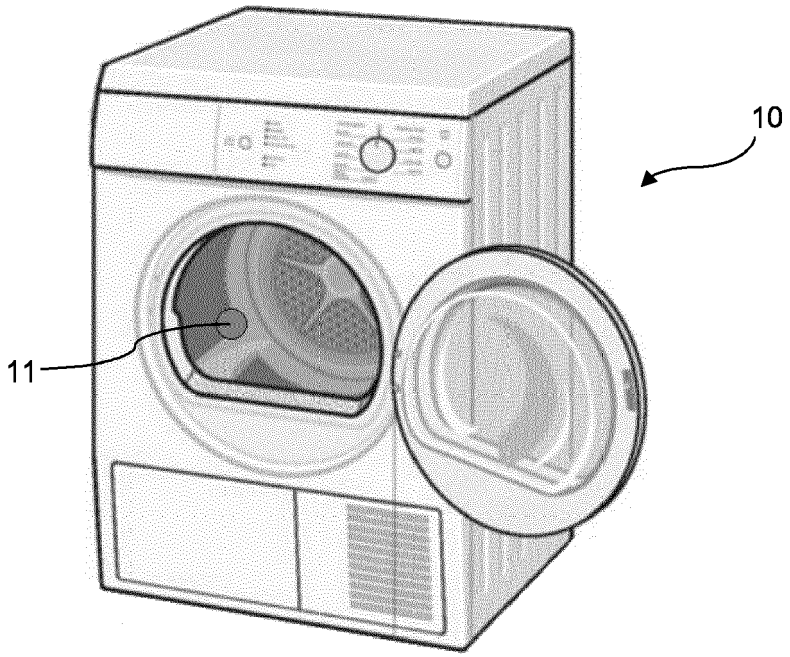


Fig. 2

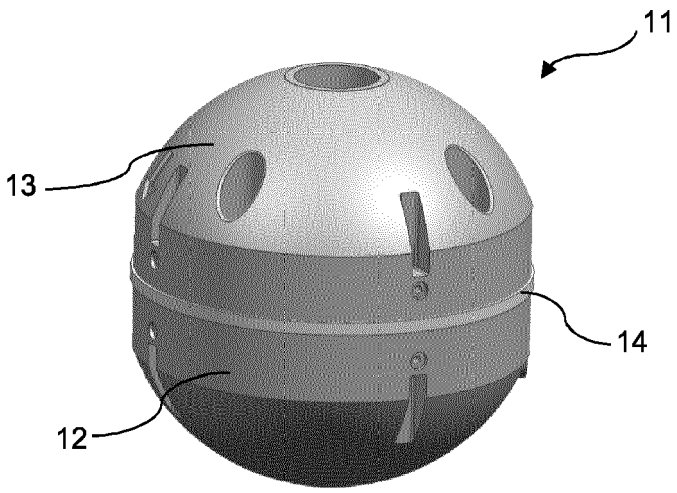
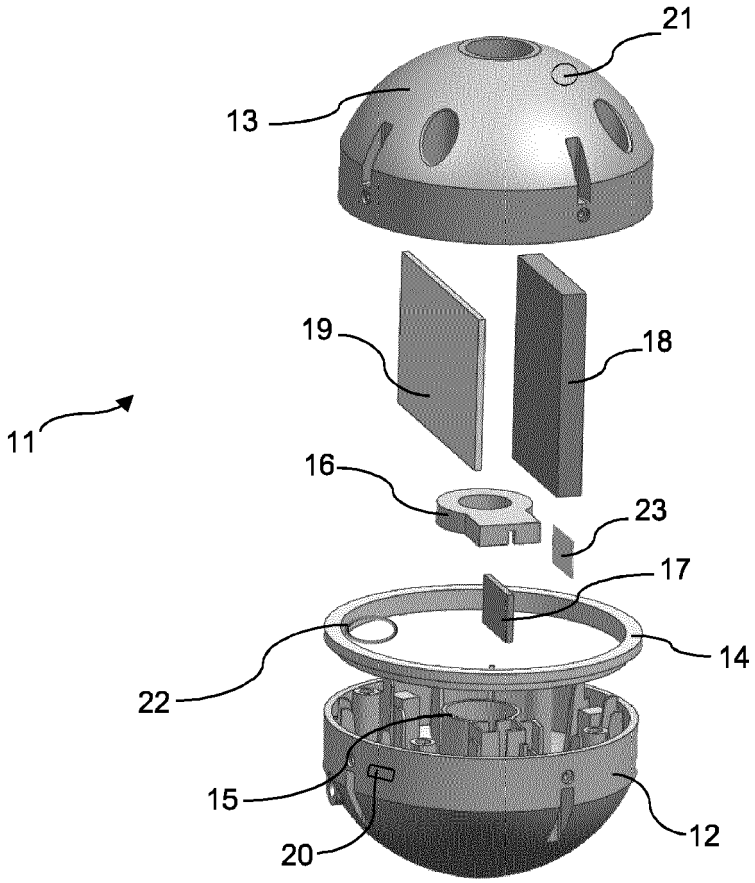


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 22 18 6052

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	EP 3 757 270 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 30 December 2020 (2020-12-30) * paragraphs [0081], [0088], [0098], [0099], [0101] * * paragraph [0115] - paragraph [0118]; claims; figures * -----	1,2,4,5, 8 3,10	INV. D06F34/18 D06F34/22 D06F34/26 D06F39/02 ADD. D06F34/05
X Y	KR 2022 0000580 A (SAMSUNG ELECTRONICS CO LTD [KR]) 4 January 2022 (2022-01-04) * paragraphs [0060], [0066] * * paragraph [0090] - paragraph [0095] * * paragraph [0111]; claims; figures * -----	1,2,4-9 3,10	
Y	US 2020/374604 A1 (PARK SUNGBUM [KR] ET AL) 26 November 2020 (2020-11-26) * paragraphs [0042], [0048]; claims; figures * -----	3	
Y	WO 2019/219363 A1 (ARCELIK AS [TR]) 21 November 2019 (2019-11-21) * paragraphs [0017], [0030], [0031]; claims; figures * -----	3,10	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 January 2023	Popara, Velimir

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 18 6052

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- WO 03100153 A1 **[0005]**
- DE 4031981 A1 **[0006]**