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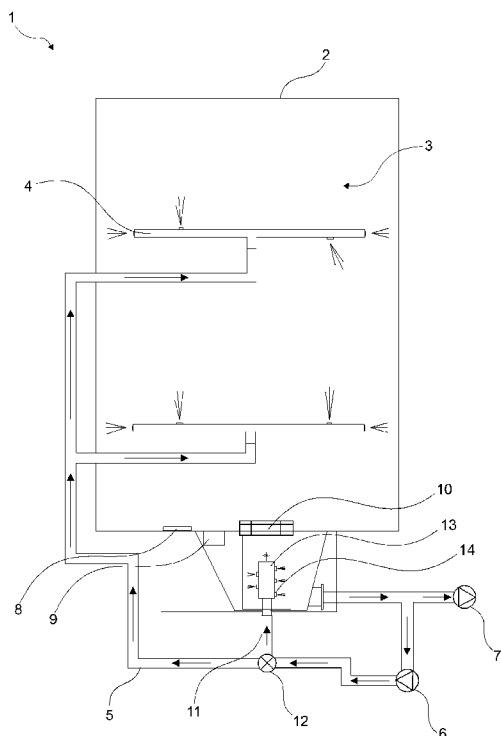
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[Continued on next page]

(54) **Title:** A DISHWASHER WITH IMPROVED WASHING PERFORMANCE

Figure 1



(57) **Abstract:** The present invention relates to a dishwasher, comprising a body (2); a washing tub (3) wherein the objects to be washed are placed and that is positioned in the body (2); at least one spraying arm (4) that enables the water with the suitable temperature and pressure to be sprayed on the dishes in accordance with the washing program; a circulation line (5) that is disposed on the body (2) and that enables the wash water to be carried to the spraying arm (4); a circulation pump (6) that is disposed on the circulation line (5) and that enables the wash water to be circulated inside the washing tub (3); a discharge pump (7) that is disposed in the washing tub (3) and that enables the wash water in the washing tub (3) to be discharged; a sensor (8) that is disposed in the washing tub (3) and that enables the dirt amount in the wash water to be measured, and a control unit (9) that performs the washing programs that are composed of washing, rinsing and drying steps.

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Description**A DISHWASHER WITH IMPROVED WASHING PERFORMANCE**

- [0001] The present invention relates to a dishwasher the washing performance of which is improved.
- [0002] In dishwashers, a washing program is performed that is composed of various washing steps such as pre-washing, main washing and rinsing. During the washing process, wash water is delivered on the objects to be washed, and the dirt on the objects are removed together with the wash water. Especially in the embodiments wherein the washing program to be used is automatically determined by the dishwasher, turbidity sensors are used in order to determine the information such as the dirt amount on the dishes that are placed in the dishwasher, the amount of the detergent that is mixed into the wash water and whether the dishes are fully cleaned after the washing. However, during the washing process, the efficient cleaning of the objects cannot be provided as a result of the dirt that are wiped out of the objects being circulated in the washing tub.
- [0003] In the state of the art United States Patent Document No. US20090071508, a dishwasher is disclosed, wherein the amount of the dishes are detected by the turbidity sensor, the optical sensor or the electromagnetic sensor.
- [0004] The aim of the present invention is the realization of a dishwasher the washing performance of which is improved.
- [0005] The dishwasher realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a body; a washing tub wherein the objects to be washed are placed and that is positioned in the body; at least one spraying arm that enables the water with the suitable temperature and pressure to be sprayed on the dishes in accordance with the washing program; a circulation line that is disposed on the body and that enables the wash water to be carried to the spraying arm; a circulation pump that is disposed on the circulation line and that enables the wash water to be circulated inside the washing tub; a discharge pump that is disposed in the washing tub and that enables the wash water in the washing tub to be discharged; a sensor that is disposed

in the washing tub and that enables the dirt amount in the wash water to be measured, and a control unit that performs the washing programs that are composed of washing, rinsing and drying steps.

[0006] The dishwasher of the present invention comprises the control unit

- that compares the dirt amount that is measured by the sensor with the limit dirt amount that is predetermined by the producer,
- that realizes the steps of stopping the circulation pump and operating the discharge pump for the time predetermined by the producer after the waiting time predetermined by the producer elapses, and if the measured dirt amount is bigger than the limit dirt amount, and
- that continues the current washing step if the measured dirt amount is less than the limit dirt amount.

[0007] By controlling the measurements realized at certain intervals by the sensor, the control unit enables the dirt to be discharged out of the washing tub by means of the discharge pump by stopping the washing process if the dirt amount that is measured by the sensor is bigger than the limit dirt amount predetermined by the producer. Thus, the control unit prevents the wash water dirt amount from getting bigger than the limit dirt amount.

[0008] In an embodiment of the present invention, the control unit enables the waiting time to be determined according to the dirt amount that is measured by the sensor. In cases where the dishes with intensive dirt are washed, the dirt amount that is carried to the wash water also increases. In this case, the control unit enables the dirt amount that deposits to the base of the washing tub from the wash water to be increased by increasing the waiting time. Thus, a hygienic washing environment is provided by enabling more the dirt to be removed from the wash water.

[0009] In another embodiment of the present invention, the control unit enables the discharge pump to be stopped again after being operated during the time predetermined by the producer and enables the circulation pump to be operated again after the discharge pump is stopped. In case the dirt amount in the wash water is high, the dirt amount that deposits to the base of the washing tub also increases. In this case, the control unit enables the

discharge pump to be operated for a longer time so that the dirt accumulated at the base of the washing tub is enabled to be discharged. After the discharge pump is stopped, the control unit enables the ongoing washing process to be realized with the more hygienic wash water by operating the circulation pump again.

[0010] In another embodiment of the present invention, the washing machine comprises a microfilter that is disposed at the base of the washing tub and that holds the dirt that is carried with the discharged wash water; an additional line one end of which extends to the circulation line and the other end to the microfilter; a valve that is disposed at the entrance of the of the additional line, and the control unit that enables the water to be delivered to the microfilter by keeping the valve open during the time predetermined by the producer when the circulation pump is operated again. A part of the water in the circulation line is taken to the additional line by passing from the valve. By means of the water that is delivered to the microfilter through the additional line, the dirt that is accumulated on the microfilter is enabled to be removed. Thus, especially during the washing of the intensively dirty dishes, the microfilter is prevented from being clogged.

[0011] In another embodiment of the present invention, the control unit enables the time the valve is kept open to be determined according to the dirt amount that is measured by the sensor. More amounts of the dirt are carried to the wash water during the washing of the intensively dirty dishes, therefore more dirt is accumulated at the surfaces of the microfilter after the wash water is passed from the microfilter. In order to prevent the microfilter from being clogged by being efficiently cleaned, the control unit enables the valve to be kept open for a longer time, thus more water is delivered to the surfaces of the microfilter.

[0012] In another embodiment of the present invention, the dishwasher comprises a spraying means whereon more than one hole is arranged and that is disposed at the end of the additional line that extends to the microfilter. The water that fills in the spraying means that is positioned so as to remain in the microfilter is sprayed by means of the holes that are disposed on the

spraying means to the inner surface of the microfilter. Since the water sprayed through the holes exits by sweeping the surface of the spraying means in a pressured manner, the water creates a moment force so as to rotate the spraying means around its own axis. Thus, the spraying means rotates and sprays water to the inner surface of the microfilter and enables the dirt adhered to the surface of the microfilter to be efficiently removed. Thus, the microfilter is enabled to be cleaned without the need of user intervention. The cleaning of the microfilter increases the filtration quality, thus the washing performance of the dishwasher is improved.

[0013] In another embodiment of the present invention, the control unit enables the microfilter to be cleaned by delivering the wash water only to the additional line before the water in the washing tub is discharged at the end of the rinsing step. The water that passes from the spraying means by means of the additional line is sprayed to the surface of the microfilter from the holes. Thus, the microfilter is enabled to be cleaned after the rinsing step. Since there is no possibility of the dirt and filth adhering to the surface of the microfilter after the rinsing step, the microfilter is in a clean state for next washing processes.

[0014] In another embodiment of the present invention, the control unit enables the user to be informed by visual and/or audio warnings according to the data received from the sensor. The control unit enables the user to be informed by visual and/or audio warnings if the dirt amount that is measured by the sensor is bigger than the limit dirt amount. In case more dirt is present in the wash water than the limit dirt amount, the washing time of the dishwasher gets longer as a result of the realized waiting and discharge times. The control unit enables the user to be informed by visual and/or audio warnings about the prolonged washing time.

[0015] By means of the present invention, a dishwasher is realized, wherein the dirt amount in the wash water in the washing tub is kept less than the limit dirt amount predetermined by the producer during the washing process, and a hygienic washing is provided.

[0016] The dishwasher realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

[0017] Figure 1 – is the schematic view of a dishwasher.

[0018] The elements illustrated in the figures are numbered as follows:

1. Dishwasher
2. Body
3. Washing tub
4. Spraying arm
5. Circulation line
6. Circulation pump
7. Discharge pump
8. Sensor
9. Control unit
10. Microfilter
11. Additional line
12. Valve
13. Spraying means
14. Hole

[0019] The dishwasher (1) comprises

- a body (2),
- a washing tub (3) wherein the objects to be washed are placed and that is positioned in the body (2),
- at least one spraying arm (4) that enables the water with the suitable temperature and pressure to be sprayed on the dishes in accordance with the washing program,
- a circulation line (5) that is disposed on the body (2) and that enables the wash water to be carried to the spraying arm (4),
- a circulation pump (6) that is disposed on the circulation line (5) and that enables the wash water to be circulated inside the washing tub (3),
- a discharge pump (7) that is disposed on the body (2) and that enables the water in the washing tub (3) to be discharged,
- a sensor (8) that is disposed in the washing tub (3) and that enables the dirt amount in the wash water to be measured, and
- a control unit (9) that performs the washing programs that are composed of washing, rinsing and drying steps

[0020] (Figure 1).

[0021] The dishwasher (1) of the present invention comprises the control unit (9)

- that compares the dirt amount (K) that is measured by the sensor (8) with the limit dirt amount (K_{lim}) predetermined by the producer, and
- that realizes the steps of stopping the circulation pump (6) and operating the discharge pump (7) for the time (t_p) predetermined by the producer after the waiting time (t_b) predetermined by the producer elapses if the measured amount of the dirt is bigger than the limit dirt amount (K_{lim}), and
- that continues the current washing step if the measured dirt amount (K) is less than the limit dirt amount (K_{lim}).

[0022] During the washing process, the dirt and filth on the washed objects are removed from the objects by means of the wash water and are mixed to the water that is accumulated in the washing tub (3). In cases intensive dirt is present on the objects to be washed, the circulation of the removed wash water in the washing tub (3) causes the objects not to be washed in an efficient and hygienic manner. In the dishwasher (1) of the present invention, the dirt amount in the wash water is measured by means of the sensor (8) during the washing process. If the dirt amount (K) that is measured by the sensor (8) that is preferably a turbidity sensor is bigger than the limit dirt amount (K_{lim}), the circulation pump (6) is stopped and the dirt that is present in the wash water during a waiting time (t_b) predetermined by the producer is waited to deposit to the base of the washing tub (3). Then, the control unit (9) enables the dirt to be efficiently discharged by operating the discharge pump (7). Thus, the washing process is realized by the wash water the dirt amount of which is reduced.

[0023] In an embodiment of the present invention, the control unit (9) enables the waiting time (t_b) to be determined according to the dirt amount (K) that is measured by the sensor (8). In this embodiment, different waiting times (t_b) are defined by the producer for certain dirt amount (K) ranges. The control unit (9) determines the waiting time (t_b) to be applied by comparing the dirt amount (K) that is measured by the sensor (8) with the waiting time (t_b) ranges predetermined by the producer. Thus, the waiting time (t_b) is

increased in cases the dirt amount (K) is high, and all the dirt is enabled to deposit to the base of the washing tub (3).

[0024] In another embodiment of the present invention, the control unit (9) enables the discharge pump (7) to be stopped again after being operated during the time (t_p) predetermined by the producer and enables the circulation pump (6) to be operated again after the discharge pump (7) is stopped. During the time the discharge pump (7) is operated, the dirt that is accumulated at the base of the washing tub (3) is discharged with a part of the wash water. After the discharge pump (7) is stopped, the control unit (9) operates the circulation pump (6) again, and enables the washing process to be continued by circulating the water that is cleansed of the dirt inside the washing tub (3).

[0025] In another embodiment of the present invention, the dishwasher (1) comprises

- a microfilter (10) that is disposed at the base of the washing tub (3) and that holds the dirt that is carried with the discharged wash water;
- an additional line (11) one end of which extends to the circulation line (5) and the other end to the microfilter (10);
- a valve (12) that is disposed at the entrance of the of the additional line (11), and
- the control unit (9) that enables the water to be delivered to the microfilter (10) by keeping the valve (12) open during the time (t_v) predetermined by the producer when the circulation pump (6) is operated again

[0026] The wash water that is accumulated in the washing tub (3) is sucked by means of the circulation pump (6) or the discharge pump (7), and the dirt and filth in the washing tub (3) is prevented from passing to the circulation pump (6) and the discharge pump (7) by passing the sucked wash water through the microfilter (10). In this embodiment, after the discharge pump (7) is stopped, the control unit (9) enables the water to be delivered to the microfilter (10) by opening the valve (12) that is disposed on the additional line (11) while operating the circulation pump (6), thus the dirt that is accumulated in the microfilter (10) is enabled to be cleaned during the time

that the discharge pump (7) operates.

- [0027] In another embodiment of the present invention, the control unit (9) enables the time (t_v) the valve (12) is kept open to be determined according to the dirt amount (K) that is measured by the sensor (8). In this embodiment, different times (t_v) the valve (12) is kept open are defined by the producer for certain dirt amount (K) ranges. The control unit (9) controls the time the valve (12) is kept open by comparing the dirt amount (K) that is measured by the sensor (8) with the intervals of time (t_v) the valve (12) is kept open that are predetermined by the producer, and thus the amount of the water to be delivered to the microfilter (10) is controlled. Thus, in cases the dirt amount (K) is high, the time (t_v) the valve (12) is kept open is increased and the microfilter (10) is enabled to be efficiently cleaned.
- [0028] In another embodiment of the present invention, the dishwasher (1) comprises a spraying means (13) whereon more than one hole (14) is arranged and that is disposed at the end of the additional line (11) that extends to the microfilter (10). The spraying means (13) rotates around its own axis with the moment effect created by the water that is sprayed from the holes (14). By the rotation of the spraying means (13), the water sprayed from the holes (14) hits the inner walls of the microfilter (10). By the impact of the water hitting to the inner walls of the microfilter (10), the dirt adhered to the surface of the microfilter (10) is enabled to be removed. Thus, the microfilter (10) is enabled to be automatically cleaned without the need of the user to dismount and clean the microfilter (10).
- [0029] In another embodiment of the present invention, the control unit (9) enables the microfilter (10) to be cleaned by delivering the wash water only to the additional line (11) before the water in the washing tub (3) is discharged at the end of the rinsing step. The control unit (9) directs the water that is accumulated in the washing tub (3) at the end of the rinsing step to the additional line (11) through the valve (12). The water that reaches the spraying means (13) from the additional line (11) is sprayed from the holes (14), and thus the microfilter (10) is enabled to be cleaned. Thus, after the rinsing step is completed, the dirt that is accumulated on

the inner surface of the microfilter (10) during the main washing step is enabled to be removed from the inner surface of the microfilter (10). Since no circulation process is performed inside the washing tub (3) after the rinsing step, the dirt is prevented from adhering to the surface of the microfilter (10) again.

- [0030] In another embodiment of the present invention, the control unit (9) enables the user to be informed by visual and/or audio warnings according to the data received from the sensor (8). The control unit (9) enables the user to be informed by visual and/or audio warnings if the dirt amount (K) that is measured by the sensor (8) is bigger than the limit dirt amount (K_{lim}).
- [0031] In the dishwasher (1) of the present invention, the dirt that is present in the wash water is discharged by the discharge pump (7) being operated during the washing process, thus the dirt is prevented from contacting the objects to be washed by being circulated in the washing tub (3) during the washing process. Thus, the objects to be washed in the dishwasher (1) are enabled to be efficiently cleaned, and the washing performance of the dishwasher (1) is improved.

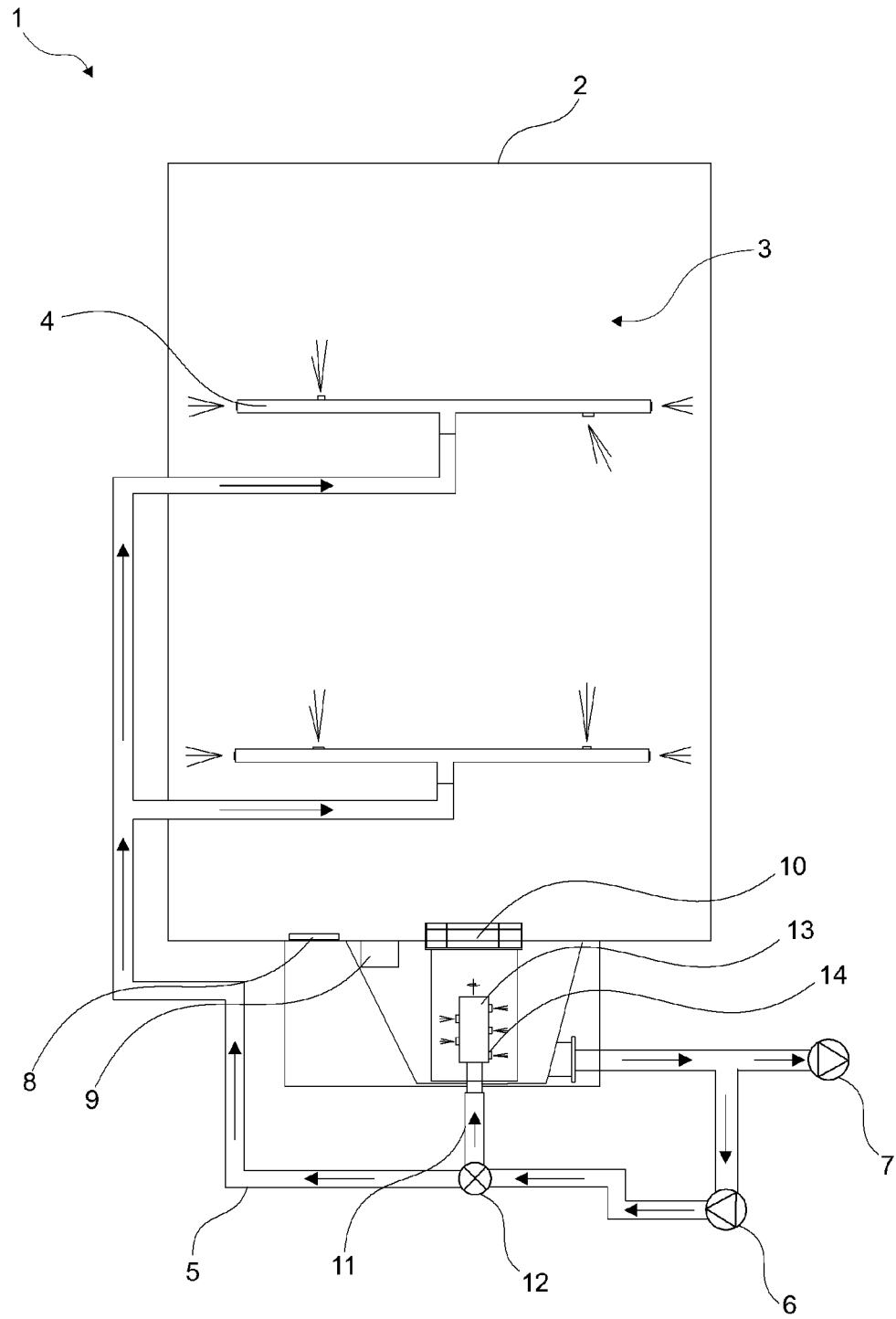
Claims

1. A dishwasher (1) **comprising** a body (2);
 - a washing tub (3) wherein the objects to be washed are placed and that is positioned in the body (2),
 - at least one spraying arm (4) that enables the water with the suitable temperature and pressure to be sprayed on the dishes in accordance with the washing program,
 - a circulation line (5) that is disposed on the body (2) and that enables the wash water to be carried to the spraying arm (4);
 - a circulation pump (6) that is disposed on the circulation line (5) and that enables the wash water to be circulated inside the washing tub (3),
 - a discharge pump (7) that is disposed on the body (2) and that enables the water in the washing tub (3) to be discharged,
 - a sensor (8) that is disposed in the washing tub (3) and that enables the dirt amount in the wash water to be measured, and
 - a control unit (9) that performs the washing programs that are composed of washing, rinsing and drying steps**characterized by** the control unit (9)
 - that compares the dirt amount (K) that is measured by the sensor (8) with the limit dirt amount (K_{lim}) predetermined by the producer, and
 - that realizes the steps of stopping the circulation pump (6) and operating the discharge pump (7) for the time (t_p) predetermined by the producer after the waiting time (t_b) predetermined by the producer elapses if the measured amount of the dirt is bigger than the limit dirt amount (K_{lim}), and
 - that continues the current washing step if the measured dirt amount (K) is less than the limit dirt amount (K_{lim}).
2. A dishwasher (1) as in Claim 1, **characterized by** the control unit (9) that enables the waiting time (t_b) to be determined according to the dirt amount (K) that is measured by the sensor (8).
3. A dishwasher (1) as in Claim 1, **characterized by** the control unit (9) that enables the discharge pump (7) to be stopped again after being operated during the time (t_p) predetermined by the producer and that enables the circulation pump (6) to be operated again after the discharge pump (7) is

stopped.

4. A dishwasher as in Claim 3, **characterized by** a microfilter (10) that is disposed at the base of the washing tub (3) and that holds the dirt that is carried with the discharged wash water;
 - an additional line (11) one end of which extends to the circulation line (5) and the other end to the microfilter (10);
 - a valve (12) that is disposed at the entrance of the of the additional line (11), and
 - the control unit (9) that enables the water to be delivered to the microfilter (10) by keeping the valve (12) open during the time (t_v) predetermined by the producer when the circulation pump (6) is operated again.
5. A dishwasher (1) as in Claim 4, **characterized by** the control unit (9) that enables the time (t_v) the valve (12) is kept open to be determined according to the dirt amount (K) that is measured by the sensor (8).
6. A dishwasher (1) as in Claim 4 or 5, **characterized by** a spraying means (13) whereon more than one hole (14) is arranged and that is disposed at the end of the additional line (11) that extends to the microfilter (10).
7. A dishwasher (1) as in any one of the Claim 4 to Claim 6, **characterized by** the control unit (9) that enables the microfilter (10) to be cleaned by delivering the wash water only to the additional line (11) before the water in the washing tub (3) is discharged at the end of the rinsing step.
8. A dishwasher (1) as in any one of the above claims, **characterized by** the control unit (9) that enables the user to be informed by visual and/or audio warnings according to the data received from the sensor (8).

Figure 1



INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. A47L15/00 A47L15/42
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/205680 A1 (BRAGG JOHN C [US]) 20 August 2009 (2009-08-20)	1-4,6-8
A	paragraph [0008] - paragraph [0029] -----	5
A	US 2003/019510 A1 (HEGEMAN ARIAN JOHANNES [US] ET AL) 30 January 2003 (2003-01-30) paragraph [0023] - paragraph [0033] -----	4-7
A	KR 2005 0012523 A (LG ELECTRONICS INC) 2 February 2005 (2005-02-02) abstract -----	8



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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/079415

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009205680	A1	20-08-2009	NONE
US 2003019510	A1	30-01-2003	CA 2393144 A1 27-01-2003 US 2003019510 A1 30-01-2003
KR 20050012523	A	02-02-2005	NONE