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(54) Method for load detection in a dishwasher basket

(57) A method for load detection in a dishwasher, the method comprising:
(a) preliminarily detecting the level of vibrations generated during operation of the dishwasher for a plurality of different load distributions, and preparing a transfer function which assigns individual ranges of vibration levels to each load distribution;
(b) detecting the level of vibrations generated during a predetermined period of time of operation; and
(c) estimating the amount and the distribution of the load within the dishwasher by applying the transfer function to the level detected in step (b).

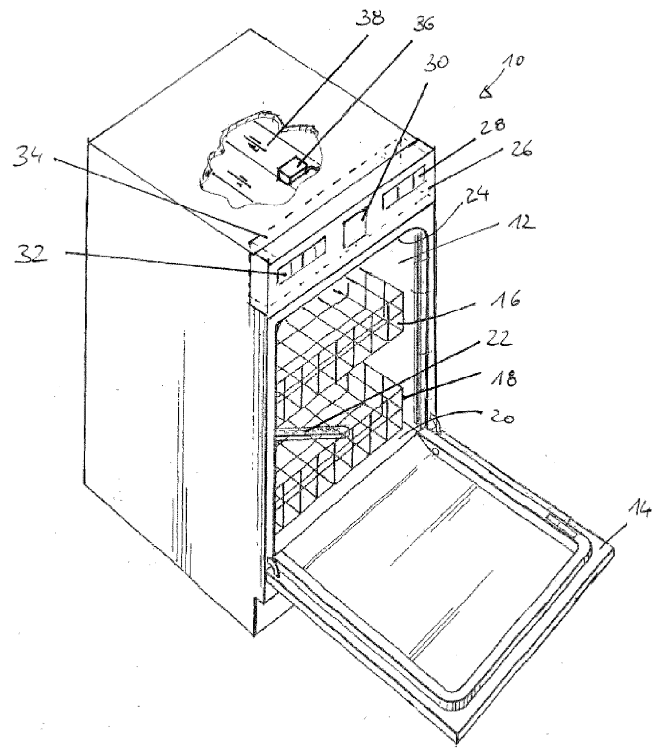


FIG. 1

EP 2 662 014 A1

Description

[0001] The present invention relates to a method for detecting the amount and distribution of the load within a dishwasher and to a dishwasher which is adapted to perform such method.

[0002] In the prior art several attempts were made to provide in a dishwasher means to detect the amount and distribution of the load in a dishwasher.

[0003] Thus, in EP-A-0943 287 it was suggested to provide in a dishwasher for a transmitter/receiver pair, such as for transmitting and receiving ultrasonic waves, wherein based on the time required for an ultrasonic signal to be transmitted from the transmitter to the receiver an evaluation shall be made as regards the amount of articles that are provided within the washing tub.

[0004] A further method for load monitoring of a dishwasher basket is described in DE-A-102 04 455 wherein it is suggested to record typical sound patterns that are created during operation of a dishwasher and to compare such sound patterns with a plurality of previously stored typical sound patterns which are recorded in advance for various parts of a washing cycle carried out in the dishwasher as well as for different load distributions within the dishwasher. By determining whether an instantaneous sound pattern can be regarded as similar to any of the pre-stored sound patterns, it thus shall be possible to make conclusions as regards the load distributions.

[0005] In EP-A-0 793 939 there is described a dish washer that comprises an acoustic detector, such as a capacitor or electret-type microphone transmitter, which is adapted to generate an information signal in response to the noise generated in the washing vessel of the machine during operation thereof. A processor performs a multiresolution analysis of the detector signals, i.e. it decomposes the signals so as to enable a thorough analysis to be performed, so as to evaluate the type and amount of items loaded in the machine.

[0006] A further document that suggests providing for a frequency analysis for load detection purposes is DE-A-100 48 085, which describes a method for load detection in a dishwasher in which method the impingement onto the wall of the jets ejected from the spray arms is detected in terms of amplitude and frequency. By providing for a plurality of sensors which are located at the walls of the tub at the level of the baskets it shall be possible to determine the load distribution, wherein it is assumed that if more articles are loaded, the signal amplitude decreases or even no longer can be detected.

[0007] The major drawback with the above methods that rely on detecting sound patterns is that the recording and comparison of sound patterns involves quite complicated signal processing algorithms which cannot be easily implemented and handled by common microprocessors. Therefore, it is an object of the present invention to provide for a method for load detection which is less complicated than the prior art systems and which thus can be implemented at lower costs.

[0008] In accordance with the present invention this object is solved by the method for load detection in a dishwasher which comprises:

(a) preliminarily detecting the level of vibrations generated during operation of the dishwasher for a plurality of different load distributions, and preparing a look-up table which assigns individual ranges of vibration levels to each load distribution;

(b) detecting the level of vibrations generated during a predetermined period of time of operation;

(c) comparing the level detected in step (b) with the entries in the look-up table prepared in step (a); and

(d) determining the amount and the distribution of the load within the dishwasher based upon the comparison of step (c).

[0009] In contrast to prior art methods which rely on frequency analysis of the detected sound pattern and which therefore require a rather sophisticated means for processing the detected signals, the method suggested herein makes use of the recognition that different load distributions in a dishwasher not only results in different spectral sound patterns but rather that different load distributions can be differentiated also by the overall level of the detected vibrations. Thus, by preliminarily detecting, for a plurality of different load distributions, the level of vibrations that are generated during operation of the dishwasher, and using the measured values preparing a look-up table which assigns individual ranges of vibration levels to each load distribution, the amount and distribution of the load within the dishwasher can be determined simply by detecting the level of vibrations that are generated during operation of the dishwasher and comparing the thus detected level with the entries in the look-up table.

[0010] Preferred embodiments of the present invention are defined in the dependent claims.

[0011] While the step of preliminarily detecting the level of vibrations generated during operation of the dishwasher for a plurality of different load distributions, and preparing a look-up table which assigns individual ranges of vibration levels to each load distribution generally can be carried out by the manufacturer of the dishwasher, the look-up table also could be prepared and/or modified by self-learning techniques that are carried out during operation of the dishwasher.

[0012] To this end the minimum and maximum level of vibrations generated during operation of the dishwasher can be repeatedly measured and a predefined load function is fitted to the thus measured minimum and maximum values. In a simplified embodiment, the thus detected minimum vibration level can be assigned to the fully loaded state of the dishwasher, and the thus detected maximum vibration level can be assigned to the empty state of the dishwasher. Then a pre-shaped load function, in the most simple case, a linear curve, can be fitted to the thus detected minimum and maximum values so as to provide for an estimated load value for any vibration level in between the minimum and maximum values, which intermediate values thus can be easily calculated to prepare the look-up table.

[0013] Also in cases in which the relationship between detected vibration level and amount of load is non-linear and/or in which there shall be provided for a more accurate approximation of the amount and the distribution of the load, the look-up table can be prepared and/or modified by self-learning techniques that do not rely on any user input by determining the minimum and the maximum of the detected vibration level, and then fitting a pre-shaped non-linear load curve through such minimum and maximum values. To this end an assignment scheme, such as an assignment function or an assignment table, can be stored in the controller of the dishwasher, which assignment scheme assigns a certain load to a predefined percentage of the maximum vibration level or the range of vibrations to be expected. Thus, in a first step the range of the vibration levels to be expected during operation of the dishwasher can be detected by calculating the difference between the detected maximum vibration level and the detected minimum vibration level. In a subsequent step, based on the assignment scheme, load values are assigned to given percentages of the thus determined range so as to prepare the look-up table. During use of the dishwasher the amount and the distribution of the load then can be an estimated simply by comparing the instantaneously detected vibration level with the entries in the thus prepared look-up table.

[0014] Instead of, or in addition to, using predetermined load curves for providing for an assignment between load and vibration level, the dishwasher can be provided with input means by which the user when starting a washing cycle can input the instantaneous load distribution, such as by inputting a number that is representative for one of a plurality of predefined load distributions, such as "full - 1", "upper basket full, lower basket half full - 2", "upper basket half full, lower basket partially loaded - 3", "upper basket half full, lower basket empty - 4" etc. During operation of the dishwasher the level of vibrations then is detected and the transfer function adapted accordingly, such as by making a respective entry in the look-up table. In this manner the method is able to repeatedly adapt the transfer function so as to further improve the accuracy of the assignment of the ranges of vibration levels to the respective load distributions.

[0015] The method can be designed such that in the step of preliminarily detecting the level of vibrations generated during operation of the dishwasher for a plurality of different load distributions, and preparing a transfer function or look-up table which assigns individual ranges of vibration levels to each load distribution, the vibration levels are determined by calculating an average of the level of the vibrations detected over a predetermined period of time.

[0016] In such latter embodiments, the average of the level of the vibrations can be calculated as:

$$Av = \frac{1}{M}\sum_{i=0}^{M-1} |P_i|$$

wherein P_i is representative for the level of the vibrations detected during a predetermined sampling period.

[0017] Preferably, the level of the vibrations is detected using a vibration sensor which outputs a voltage signal that is proportional to the level of vibrations. Such a vibration sensor thus could be a piezoelectric shock sensor which produces a voltage output signal that is substantially proportional to the acceleration of the sensor caused by a mechanical vibration of the sensor, i.e. an output signal that is substantially proportional to impacts or vibrations to which the sensor is exposed.

[0018] The different load distributions for which preliminarily an individual range of vibration levels is assigned may include load distributions which differ in the amount, such as fully or partially loaded, placement, such as upper or lower basket or placement within certain regions of the baskets, such as left/right, front/back, basket floor or cup shelf etc., type, such as dishes, glasses, pots, etc., size and/or material, such as glass, ceramics or plastic, of the items provided within the dishwasher.

[0019] Once the amount and the distribution of the load within the dishwasher has been detected, the dishwasher can automatically adapt the washing cycle. Thus, if for example it is detected that the dishwasher is only partially loaded, the dishwasher may be operated with a shorter or less intensive washing cycle, in which manner savings in time, energy and water can be achieved.

[0020] In a further aspect, the present invention is a dishwasher adapted to carry out the above process, and in particular a dishwasher comprising a washing tub for accommodating articles to be cleaned, at least one spray arm arranged within the washing tub for directing a cleaning fluid to the articles to be cleaned, and a vibration sensor for detecting vibrations generated during operation of the dishwasher, wherein the dishwasher further comprises means for load detection, which means is adapted to carry out the method described above.

[0021] In preferred embodiments the vibration sensor comprises a piezoelectric shock sensor. A piezoelectric shock sensor produces a voltage output signal that is substantially proportional to the acceleration of the sensor caused by a mechanical vibration of the sensor, i.e. an output signal that is substantially proportional to impacts or vibrations to which the sensor is exposed.

[0022] Preferably the vibration sensor is attached to the exterior side of the tub so that the sensor is located outside the wet zone of the dishwasher. In this manner it is not necessary to take any specific precautions to avoid contact of electrically driven sensor components with the cleaning liquid that is circulated through the dishwasher tub.

[0023] Preferred locations for the vibration sensor are at a side wall of the tub or even further preferred at a top wall of the tub.

[0024] In order to provide for a substantially attenuation-free transmission of the vibratory signal from the sidewall of the tub where the signal is generated by impingement of a water jet onto the sidewall to the vibration sensor, the vibration sensor preferably is attached to the exterior side of the tub by a substantially rigid connection, such as by gluing the vibration sensor directly to the exterior side of the tub.

[0025] A preferred embodiment of the method of the present invention is explained below by reference to the drawings in which:

FIG. 1 is a perspective view of a dishwasher made in accordance with the present invention;

FIGS. 2 to 6 illustrate voltage signals provided by a vibration sensor provided in the dishwasher of FIG. 1 during operation of the dishwasher with different load distributions; and

FIGS. 7 and 8 illustrate load curves used in preparing a look-up table by self-learning techniques.

[0026] FIG. 1 shows a perspective view of a dishwasher made in accordance with the present invention: Dishwasher 10 comprises a washing compartment 12 which is accessible via a front door 14. Within washing compartment 12 there are arranged an upper basket 16 and a lower basket 18 which, for loading and unloading purposes, can be moved into and out of the washing compartment 12 in a drawer-like manner. In the sump 20 of dishwasher 10 there is provided a rotatable spray arm 22 which comprises a plurality of spraying nozzles which eject water jets towards the baskets 16 and 18. While not shown in FIG. 1, dishwasher 10 further can be equipped with additional spray arms, such as a spray arm which is rotatably supported below upper basket 16 as well as an optional additional spray arm that is rotatably supported at the roof 24 of washing compartment 12. Above washing compartment 12 there is located a control panel 26 which comprises a plurality of control elements 28, such as buttons and the like, as well as a display element 30. The individual components of control panel 26 are connected to a central control unit 34 which controls all the various components of the dishwasher such as the water feed system including a circulation pump which feeds water to the spray arms, a drain pump for draining sump 20, a heating system for heating the cleaning fluid, a detergent dispensing system, and the like.

[0027] In order to detect vibrations which are generated within the washing compartment 12 during operation of the dishwasher 10, a vibration sensor 36 is attached to the exterior of the top wall 36 of the washing compartment 12. Vibration sensor 36 likewise is connected to the central control unit 34. In the embodiment shown in FIG. 1, dishwasher 10 further comprises a plurality of input elements 32 by means of which a user can provide input data, such as data as regards the load distribution within the upper and the lower baskets 16 and 18, to the central control unit 34.

[0028] FIGS. 2 to 6 illustrate voltage signals which are provided by vibration sensor 36 during operation of the dishwasher with different load distributions. In particular, the voltage signals shown in FIGS. 2 to 6 were obtained with a dishwasher 10 in which a piezoelectric shock sensor was used as vibration sensor 36. Such piezoelectric shock sensors which usually comprise an unimorph diaphragm which consists of a piezoelectric ceramic disk that is laminated to a metal disk, which diaphragm is supported along its circumference within a housing, are readily available in the art. Piezoelectric shock sensor 36, when exposed to vibrations, produces a voltage signal that is proportional to the acceleration of the sensor that is caused by the vibrations.

[0029] FIG. 2 shows the voltage signal obtained from vibration sensor 36 when both be upper basket 16 and the lower basket 18 were fully loaded.

[0030] FIG. 3 illustrates the voltage signal that was obtained when both the upper basket 16 and the lower basket 18 were loaded, wherein however less articles were loaded than during full load.

[0031] FIGS. 4 and 5 show the voltage signals obtained from vibration sensor 36 when an increasing number of articles were removed from the baskets 16 and 18 which thus were only partially loaded.

[0032] Finally, FIG. 6 shows the voltage signal obtained from vibration sensor 36 when the baskets were empty.

[0033] As can be seen from a comparison of FIGS. 2 through 6, the voltage signal obtained for different load distributions, here for different amounts of load placed within baskets 16 and 18, distinctively differs in amplitude. By detecting the vibrations for a plurality of predetermined sampling periods, an average of the level of vibrations over the sampling periods can be calculated and subsequently can be used as a reference value which is indicative for a certain load distribution. The average of the level of vibrations can be calculated as

$$Av = \frac{1}{M} \sum_{i=0}^{M-1} |P_i|$$

wherein P_i is representative for the level of the vibrations detected during a predetermined sampling period and wherein *M* is the number of samples evaluated within a given measuring time. Based on the average values thus obtained, each different load distribution is assigned an individual range for the average value, which ranges are stored in a look-up table.

[0034] Once a look-up table has been prepared and stored within the central control unit 34, the instantaneous load distribution within dishwasher 10 can be determined by detecting the level of vibrations by means of vibration sensor 36 and comparing the thus detected level with the entrees in the look-up table.

[0035] In the embodiment shown in FIG. 1 the central control unit 34 is provided with a self learning capacity for the look-up table stored therein, wherein the user, before starting a washing cycle, can provide the central control unit 34 via the input elements 32 with input data as regards the actual load distribution, wherein during the then following washing cycle the vibration sensor 36 provides for a vibration signal which is assigned to the input data that have been provided by the user. Such input data can be indications as regards amount, placement, type, size and/or material of the items that have been loaded into the baskets, wherein the choice of individual parameters to be inputted via the input elements 32 can be laid down in the instruction manual of the dishwasher 10, or can be indicated at the display element 30. The individual parameters such as amount, placement, type, size and material of the items provided within the dishwasher can be inputted one after another. In this manner, the machine can automatically adapt the washing cycles carried out in the dishwasher to the personal needs of the user.

[0036] FIG. 7 illustrates an example of a load curve that can be used in preparing a transfer function or look-up table without user input. To this end the controller is set to repeatedly measure the minimum and the maximum level of vibrations generated during operation of the dishwasher. That is, in a very basic implementation, the controller stores the lowest and the highest level of vibrations measured during operation of the dishwasher. Cycle by cycle, the controller measures the level of vibrations of the washing cycle carried out in the dishwasher and checks if it is lower or higher than the maximum and minimum stored values. In case it is lower or higher the memory is updated accordingly. Having determined the maximum and minimum vibration levels, a predefined load function is fitted to the thus measured minimum and maximum vibration levels. Assuming that the lowest level of vibrations detected and stored corresponds to the dishwasher being fully loaded, and that the highest level of vibrations detected corresponds to an empty dishwasher, the controller adopts a linear interpolation between the maximum to and the minimum to assign any determined level of vibrations V_{meas} to an estimated amount of load L_{est}.

[0037] FIG. 8 illustrates an example of a non-linear load curve used for preparing a transfer function or look-up table without manual user input. While in general, there is no linear relationship between the level of vibrations generated during operation of the dishwasher and the amount and distribution of the load, by using a non-linear load curve there can be provided for a more accurate approximation of the amount and the distribution of the load. In order to establish the load curve shown in Fig. 8, the minimum and maximum vibration levels are determined, and, by calculating the difference between the detected maximum vibration level MAX and the detected minimum vibration level MIN, the range of the vibration levels to be expected during operation of the dishwasher is determined. Using an assignment scheme that is stored in the controller of the dishwasher, a number of intermediate load values are assigned to certain percentaged values of the vibration range. In the example shown in Fig. 8, in which 6 assignment points are pre-stored, a load level L_0 is assigned to a value of 88% of the vibration range (MAX - MIN), a load level L_1 is assigned to a value of 70% of the vibration range, a load level L_2 is assigned to a value of 54% of the vibration range, a load level L_3 is assigned to a value of 34% of the vibration range, a load level L_4 is assigned to a value of 20% of the vibration range, and a load level L_5 is assigned to a value of 10% of the vibration range.

[0038] As shown in Fig. 8, the assignment scheme used in this example provides for a curved concave interpolation curve. By defining percentaged values of the vibration range, any shape of curve can be pre-defined and fitted to the minimum and vibration levels which are repeatedly detected during operation of the dishwasher.

Claims

1. A method for load detection in a dishwasher, the method comprising:

   (a) preliminarily detecting the level of vibrations generated during operation of the dishwasher for a plurality of different load distributions, and preparing a transfer function which assigns individual ranges of vibration levels to each load distribution;
   (b) detecting the level of vibrations generated during a predetermined period of time of operation; and
   (c) estimating the amount and the distribution of the load within the dishwasher by applying the transfer function to the level detected in step (b).

2. The method of claim 1, wherein in step (a) the transfer function is prepared and/or modified by self-learning techniques that are carried out during operation of the dishwasher

3. The method of claim 2, wherein in step (a) a minimum and a maximum level of vibrations are detected, and

the transfer function is prepared and/or modified by fitting a predefined load function to the thus detected minimum and maximum values.

4. The method of any one of the preceding claims, wherein the transfer function comprises a look-up table which assigns individual ranges of vibration levels to each load distribution, wherein step (c) comprises comparing the level detected in step (b) with the entries in the look-up table.

5. The method of any one of the preceding claims, wherein in step (a) the vibration levels are determined by calculating an average of the level of the vibrations detected over a predetermined period of time.

6. The method of claim 5, wherein the average of the level of the vibrations is calculated as:

$$Av = \frac{1}{M}\sum_{i=0}^{M-1}|P_i|$$

wherein P_i is representative for the level of the vibrations detected during a predetermined sampling period.

7. The method of any one of the preceding claims, wherein in step (a) the level of the vibrations is detected using a vibration sensor which outputs a voltage signal that is proportional to the level of vibrations.

8. The method of any one of the preceding claims, wherein the different load distributions to which in step (a) an individual range of vibration levels is assigned include load distributions which differ in the amount, placement, type, size and/or material of items provided within the dishwasher.

9. The method of any one of the preceding claims, wherein based on the estimation made in step (c) the washing cycle carried out in the dishwasher is adapted.

10. A dishwasher (10) comprising a washing tub (12) for accommodating articles to be cleaned, at least one spray arm (22) arranged within the washing tub for directing a cleaning fluid to the articles to be cleaned, and a vibration sensor (36) for detecting vibrations generated during operation of the dishwasher, **characterized in that** the dishwasher (10) further comprises means (34) for load detection adapted to carry out the method of any one of the preceding claims.

11. The dishwasher of claim 10, wherein the vibration sensor (36) comprises a piezoelectric shock sensor.

12. The dishwasher of claim 10 or 11, wherein the vibration sensor (36) is adapted to produce a voltage output signal that is substantially proportional to the acceleration of the sensor caused by a mechanical vibration of the sensor.

13. The dishwasher of any of claims 10 to 12, wherein the vibration sensor (36) is attached to the exterior side of the tub (12), and preferably is attached to a side wall or a top wall of the tub (12).

14. The dishwasher of any of claims 13, wherein the vibration sensor (36) is attached to the exterior side of the tub (12) by a substantially rigid connection.

15. The dishwasher of any of claim 14, wherein the vibration sensor (36) is glued directly to the exterior side of the tub (12).

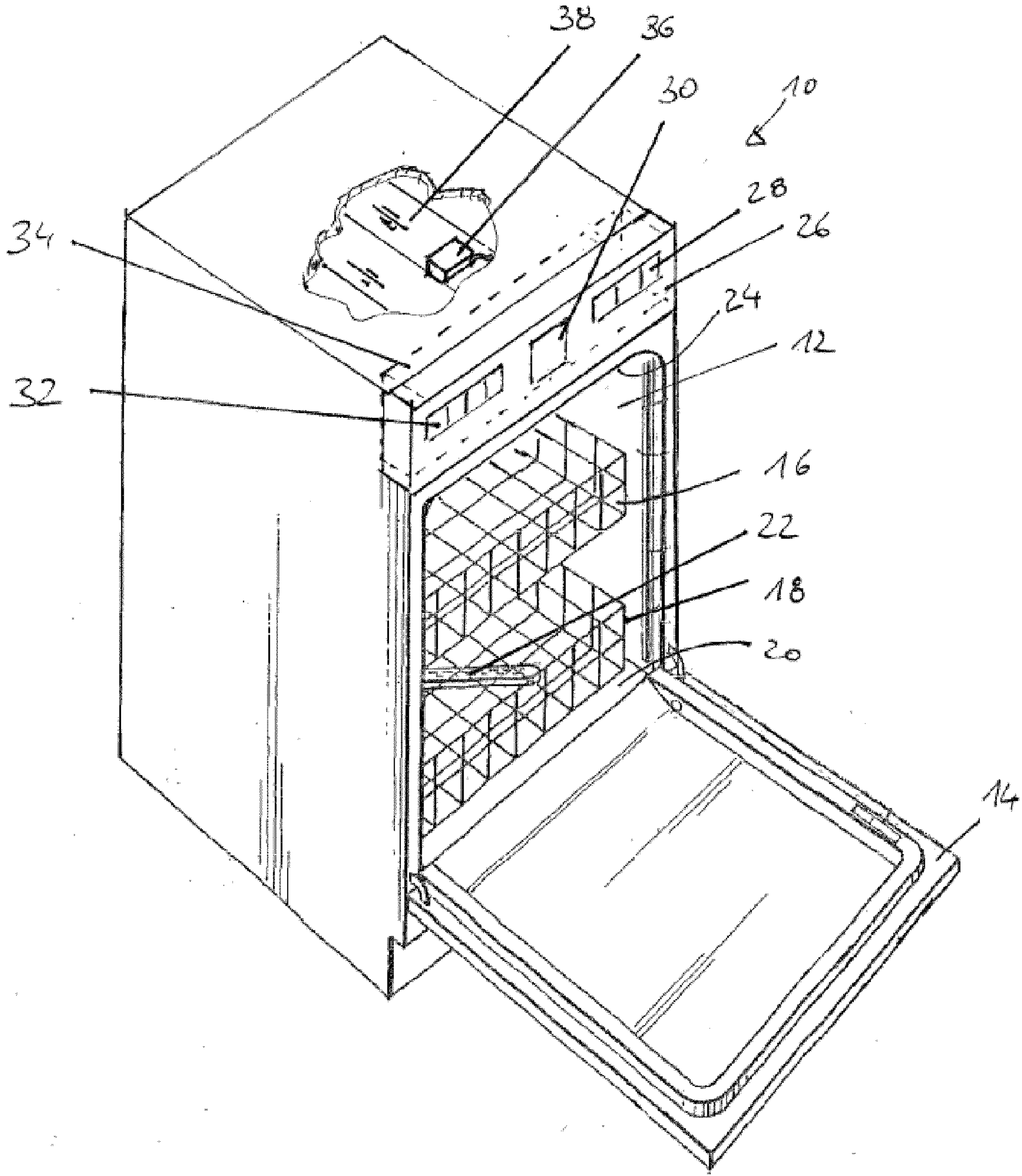
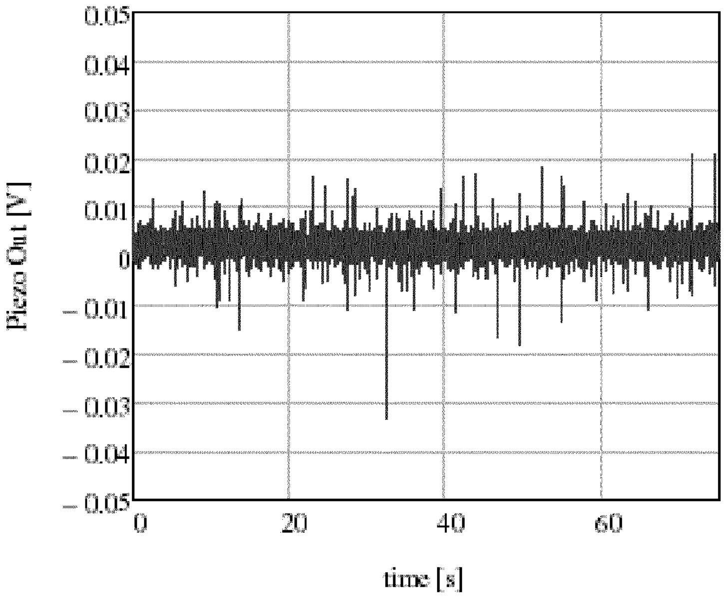


FIG. 1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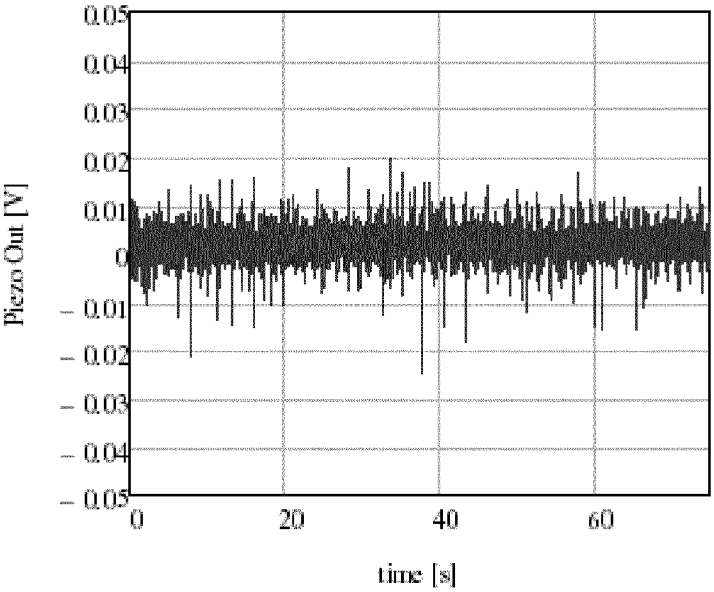
0.02
0.01
0
− 0.01
− 0.02
− 0.03
− 0.04
− 0.05
Piezo Out [V]
0
20
40
60
time [s]

FIG. 2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0
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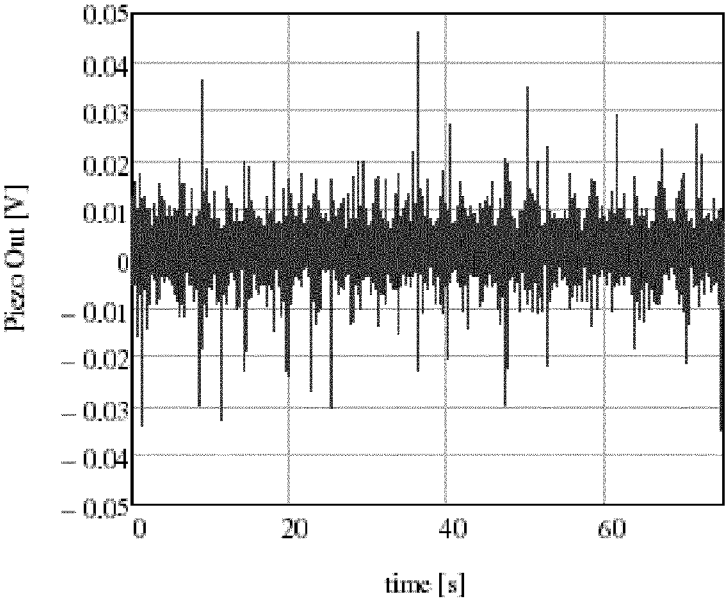
Piezo Out [V]
0
20
40
60
time [s]

FIG. 3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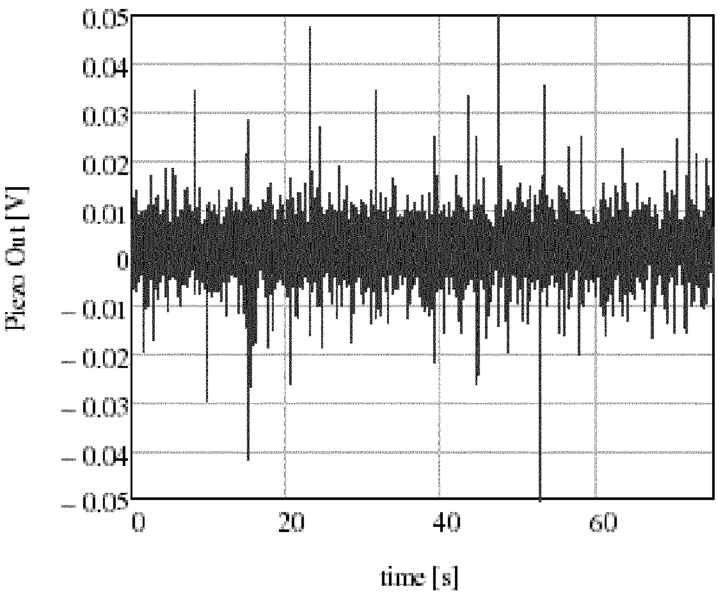
0.01
0
– 0.01
– 0.02
– 0.03
– 0.04
– 0.05
Piezo Out [V]
0
20
40
60
time [s]

FIG. 4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Piezo Out [V]
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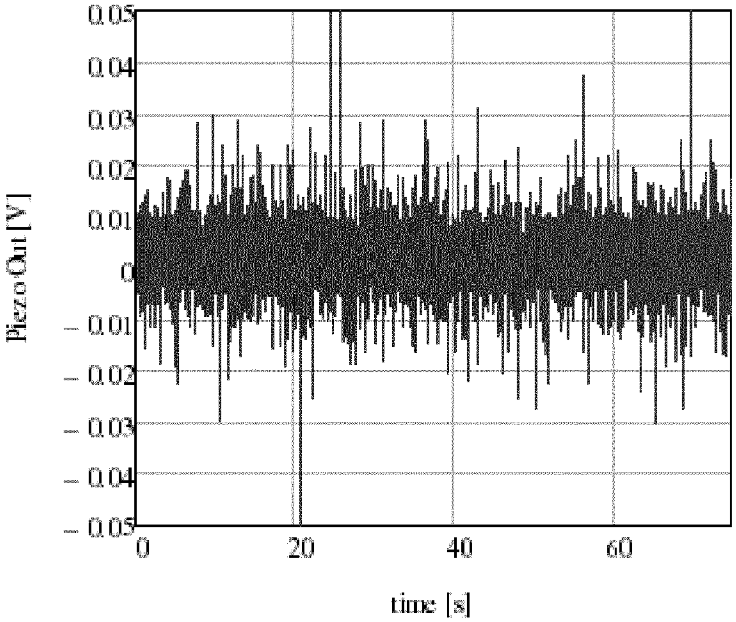
60
time [s]

FIG. 5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0.01
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– 0.01
– 0.02
– 0.03
– 0.04
– 0.05
Piezo Out [V]
0
20
40
60
time [s]

FIG. 6

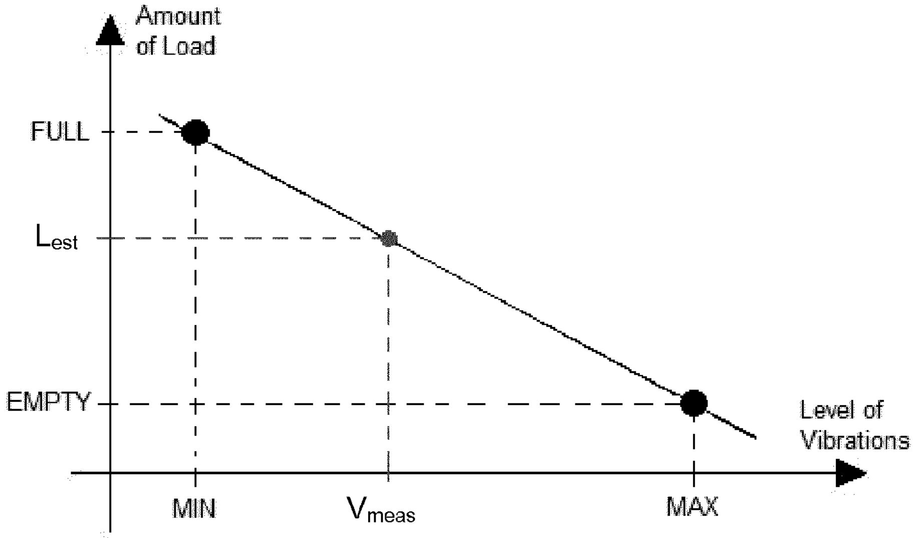
Amount of Load
FULL
L_{est}
EMPTY
Level of Vibrations
MIN
V_{meas}
MAX

FIG. 7

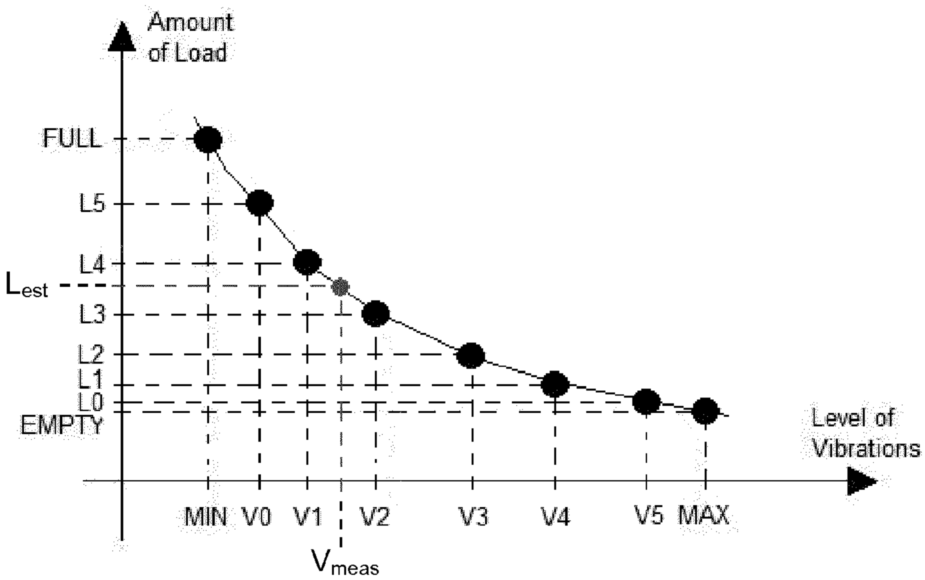
Amount
of Load
FULL
L5
L4
L_{est}
L3
L2
L1
L0
EMPTY
Level of
Vibrations
MIN
V0
V1
V2
V3
V4
V5
MAX
V_{meas}

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 12 16 7717

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,D Y	DE 100 48 085 A1 (MIELE & CIE [DE]) 18 April 2002 (2002-04-18) * column 1, paragraph 6 - column 4, paragraph 28; figures * -----	1,3-10, 12-15 2,11	INV. A47L15/42 A47L15/00 G01H11/08
X Y	US 2012/097199 A1 (TULLER BARRY E [US]) 26 April 2012 (2012-04-26) * page 1, paragraph 9-15 * * page 2, paragraph 24 - page 3, paragraph 31 * * page 4, paragraph 41-48; claims 16,17,20; figures 1,2,5 * -----	1,3-10 2,11-15	
Y	EP 1 779 762 A1 (ELECTROLUX HOME PROD CORP [BE]) 2 May 2007 (2007-05-02) * column 2, paragraphs 9,13,14 * * column 3, paragraph 22; claim 3; figure * -----	2	
X	DE 198 28 871 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 30 December 1999 (1999-12-30) * column 3, line 62 - column 4, line 12 * * column 4, lines 42-45; claims 6-9; figure * -----	11-15	TECHNICAL FIELDS SEARCHED (IPC) A47L G01H
Y	DE 299 19 445 U1 (AEG HAUSGERAETE GMBH [DE]) 29 March 2001 (2001-03-29) * claims 1,2; figure 1 * -----	11-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 October 2012	Lodato, Alessandra

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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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
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2

EPO FORM 1503 03.82 (P04C01)

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

EP 12 16 7717

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The members are as contained in the European Patent Office EDP file on
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23-10-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10048085 A1	18-04-2002	DE 10048085 A1	18-04-2002
		EP 1192892 A1	03-04-2002
US 2012097199 A1	26-04-2012	NONE	
EP 1779762 A1	02-05-2007	AT 478598 T	15-09-2010
		EP 1779762 A1	02-05-2007
		WO 2007048482 A1	03-05-2007
DE 19828871 A1	30-12-1999	DE 19828871 A1	30-12-1999
		IT MI991403 A1	27-12-2000
DE 29919445 U1	29-03-2001	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0943287 A **[0003]**
- DE 10204455 A **[0004]**
- EP 0793939 A **[0005]**
- DE 10048085 A **[0006]**