



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.02.2012 Bulletin 2012/08

(51) Int Cl.:
F24C 15/20 (2006.01)

(21) Application number: **11177270.3**

(22) Date of filing: **11.08.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventors:
• **Qing, Liyong**
210000 Nanjing Jiangsu (CN)
• **Wang, Hui**
210037 Nanjing Jiangsu (CN)
• **Xi, Yunfei**
210046 Nanjing Jiangsu (CN)
• **Xu, Yingxue**
210000 Nanjing Jiangsu (CN)

(30) Priority: **17.08.2010 CN 201010258967**

(71) Applicant: **BSH Bosch und Siemens Hausgeräte GmbH**
81739 München (DE)

(54) **Range hood having ultrasonic fume detection device and control method thereof**

(57) A control method for a range hood (1) having an automatic fume detection device is provided. The range hood (1) includes a main control module (2), a fan capable of adjusting a rotating speed as instructed by the main control module (2), and an ultrasonic module (3) for controlling the automatic fume detection device. The control method includes: a) setting a plurality of threshold mean

values corresponding to different fan speeds in the main control module (39; b) collecting statistical data of a mean value of sampled ultrasonic signals over a predetermined period by the ultrasonic module (3), and feeding back the mean value to the main control module (2); and c) comparing the mean value of the sampled ultrasonic signals with the threshold mean values, and adjusting the rotating speed of the fan according to a comparison result.

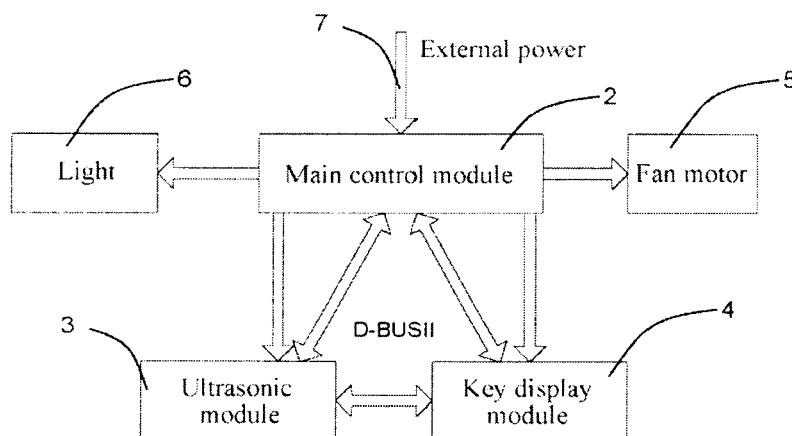


FIG. 2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a range hood, and more particularly to a range hood implementing an automatic fume detection through an ultrasonic technology, and a control method for the range hood.

Related Art

[0002] A range hood is a widely used every-day household kitchen appliance widely used in people's daily life. Through the development of science and technology intelligent devices have become an inevitable development trend in the field of household appliances. Conventionally, when a range hood is operated, a user selects a corresponding operational state according to a using habit, for example, he selects a tap configuration or position of a control element for a fan speed such as 1, 2 or 3. For such a range hood, the user needs to manually operate the range hood according to a fume state. Another disadvantage of such a range hood is that the fan is often in a state corresponding to a fixed tap position, and the tap position may be either too low for realizing a good fume extraction effect, or too high such that energy may be wasted. Therefore, it is desirable to design a range hood capable of intelligently changing a tap position of the range hood according to a fume situation.

[0003] Chinese Utility Model Patent Application 200920000606.X discloses a range hood that automatically regulates a ventilation speed according to a fume density. A device for detecting the fume density is a photoelectric detection unit installed at the range hood. The photoelectric detection unit includes a light emitter and a photoelectric detector, and a space exists between the light emitter and the photoelectric detector. The fume from the surrounding environment may enter the space and can be detected by the photoelectric detection unit. A disadvantage of such a design is that an emission source of the light emitter and a receiving source of the photoelectric detector must be kept clean enough; otherwise, the sensitivity and feedback accuracy of the detection may be severely affected. It is inevitable that a large amount of fume is generated in an environment where the range hood is used. After long periods of use, it is hard to keep the range hood sufficiently clean.

[0004] Another technology used for detecting a fume density employs ultrasonic waves. Ultrasonic technology has advanced rapidly in recent years. An acoustic signal of the ultrasonic wave responds well to fume. Therefore, the application of ultrasonic technology to fume detection may improve the efficiency of range hoods and improve user friendliness substantially. In U.S. Patent Applications US 5,074,281 and US 6,324,889 B1, technical solutions for detecting a fume density by using ultrasonic

waves are disclosed. However, during operation of the range hood, due to influences of a variety of factors such as environmental temperature and environmental humidity at a circuit board, an ultrasonic sensor and an ultrasonic signal, a signal received by the ultrasonic sensor may become too great or too small. It is then hard to determine an influence of the fume on the ultrasonic signal, which can affect the accuracy of the ultrasonic fume detection.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to an automatic fume detection device improved through an ultrasonic technology, so as to improve accuracy of ultrasonic fume detection.

[0006] The present invention is further directed to a range hood having an automatic fume detection device and a control method for operating the range hood.

[0007] Accordingly, in a control method for a range hood having an automatic fume detection device according to an embodiment of the present invention, the range hood includes a main control module, a fan capable of adjusting a rotating speed in response to an instruction of the main control module, and an ultrasonic module for controlling the automatic fume detection device. The control method includes the following steps.

a) Setting a plurality of threshold mean values corresponding to different fan speeds in the main control module.

b) By use of the ultrasonic module, collecting statistical data on a mean value of sampled ultrasonic signals over a predetermined period, and feeding back the mean value to the main control module.

c) Comparing the mean value of the sampled ultrasonic signals with the threshold mean values, and adjusting the rotating speed of the fan according to a comparison result.

[0008] As a further improvement of the present invention, the threshold mean value is a predetermined specific value V_{Speed} ; at a specific fan speed, and if the mean value of the sampled ultrasonic signals is smaller than the predetermined specific value V_{Speed} , the fan speed is increased; and/or at a specific fan speed, if the mean value of the sampled ultrasonic signals is larger than the predetermined specific value V_{Speed} , the fan speed is decreased.

[0009] As a further improvement of the present invention, the threshold mean value is a predetermined mean value range (V_{speedmin} , V_{speedmax}); at a specific fan speed, if the mean value of the sampled ultrasonic signals exceeds (V_{speedmin} , V_{speedmax}) by a count value larger than a set maximum criterion C_{max} , the fan speed is increased; and/or at a specific fan speed, if the mean value

of the sampled ultrasonic signals exceeds (V_{speedmin} , V_{speedmax}) by a count value smaller than a set minimum criterion C_{min} , the fan speed is decreased.

[0010] The main control module and/or the ultrasonic module are/is, for example, implemented to execute a control method describes above.

[0011] A beneficial effect of embodiments of the present invention is that valid information of the influence of the fume on the ultrasonic signal is fully extracted through a smart algorithm. The aspects of the method may be adopted individually or may be combined according to the specific embodiments of the range hood, therefore achieving an effect of automatically changing the fan speed of the range hood according to the fume state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a schematic structural view of an embodiment of aa range hood;

FIG. 2 is a schematic view of an embodiment of a control system for a range hood;

FIG. 3 is a detailed schematic structural view of an ultrasonic module shown in FIG. 2;

FIG. 4 is a schematic view of a flow chart for a self-examination process in a control system for a range hood;

FIG. 5 is a schematic view of a flow chart for a control process for an ultrasonic module shown in FIG. 2;

FIG. 6a is a schematic view of a distribution of sample values of an ultrasonic signal when a range hood is started and no fume exists;

FIG. 6b is a schematic view of a distribution of sample values of an ultrasonic signal when a range hood is started and fume exists;

FIG. 7a is a schematic view of a distribution of mean values of sampled signals corresponding to FIG. 6a; and

FIG. 7b is a schematic view of a distribution of mean values of sampled signals corresponding to FIG. 6b.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0013] Referring to FIG. 1, a range hood 1 according to an embodiment of the present invention includes a hood body 10 and a volute 11 installed in the hood body 10. A fan driven by an electric motor is installed in the volute 11. When the fan rotates, the fan carries the fume away. The structure and working principle of the range

hood 1 are the same as range hoods commonly used in the market, the detailed description of which is omitted here. A first filter device 12 is disposed at an opening of the hood body 10 towards a fume source. In this embodiment, the first filter device 12 is a grid-shaped metal filter mesh. Through a gap arrangement of the metal filter mesh, a part of the grease in the outside fume is filtered when the fume passes through the filter mesh. However, the metal filter mesh is incapable of completely filtering all the grease and other odorous impurities in the fume. An ultrasonic sensor arrangement is installed in an internal space of the hood body 10, and is located behind the first filter device 12. Here, "behind" means that a spatial location relationship between the first filter device and the ultrasonic sensor arrangement, which refers to that the outside fume has to pass through the first filter device 12 before reaching the ultrasonic sensor. The ultrasonic sensor includes a signal generator 14 and a signal feedback device 15. In this embodiment, the signal generator 14 and the signal feedback device 15 are installed at two opposite side walls in the inner space of the hood body 10. In this manner, a space passage for the fume is formed for passing between the signal generator 14 and the signal feedback device 15. An ultrasonic signal is emitted by the signal generator 14 and fed back by the signal feedback device 15 through the space passage, thereby one obtains an interference state of the ultrasonic signal passing through the space passage, and one may determine the density of the fume passing through the space passage. An embodiment of a method for determining the fume density is described in detail in the following. A second filter device 13 is disposed between the volute 11 and the ultrasonic sensor arrangement. In this embodiment, the second filter device 13 is a fine filter mesh comprising a carbon (such as active carbon) material. Since the grid-shaped gap of the first filter device 12 is larger and does not completely filter the impurities in the fume, the arrangement of the second filter device 13 may further filter the fume to make the fume sufficiently clean to be discharged to an external environment. It should be noted that, in other embodiments of the present invention, the second filter device 13 can be mandatory. Preferably, the ultrasonic sensor arrangement of the present embodiment should not be installed behind the second filter device 13, so as to avoid that the density of the fume passing through the ultrasonic sensor arrangement is too low to be detected.

[0014] Referring to FIG. 2, a control system for a range hood according to an embodiment of the present invention includes a main control module 2, an ultrasonic module 3, a key display module 4, a fan motor 5, a light 6, and an external power line 7. The main control module 2 acts as a control center of the range hood, and includes a circuit board having a control chip. An installation position of the main control module 2 may be any proper position in or at the hood body 10 such as the position behind the key display module 4. Driven by the external power 7, the main control module 2 receives instruction

signals from the ultrasonic module 3 and the key display module 4, and correspondingly sends instruction signals to the ultrasonic module 3, the key display module 4, the fan motor 5 and the light 6. The ultrasonic module 3 is an independent module, and a specific architecture thereof is shown in FIG. 3, which will be described in detail in the following. The ultrasonic module 3 and the main control module 2 may be connected through a power line and a data line, and exchange information through a D-BUSII communication protocol. Such a design enables the ultrasonic module 3 to be independent of the main control module 2 and capable of being freely installed at any proper position of the range hood. For example, the ultrasonic module 3 may be installed close to the ultrasonic sensor arrangement, which allows for an use of the space, and also facilitates the design of the entire system (if the ultrasonic module 3 is integrated in the main control module 2, the size of an entire control unit may be too large to be placed at a proper position for installation). The key display module 4 may be connected to the main control module 2 through a power line and a data line, and can be connected to the ultrasonic module 3 through a data line, and exchange information through the D-BUSII communication protocol. The key display module 4 receives a key instruction input from an operator and sends information to the main control module 2 according to the key instruction, so as to control the operation of the range hood. The key display module 4 may also send information to the ultrasonic module 3 to control the operation of the ultrasonic module. Similarly, the key display module 4 may also display control instructions sent by the main control module 2 and the ultrasonic module 3 or display working state information of the range hood, so that the operator obtains information on a working state of the range hood. The fan motor 5 and the light 6, respectively, receive the instructions from the main control module 2 in a unidirectional fashion for implementing a start/stop/speed-shift of the motor 5, or on/off of the light 6.

[0015] Referring to FIG. 2, the control system for or the method for controlling the range hood of the present invention may include seven steps comprising Step S 1 to Step S7 in total. After the seven steps, the ultrasonic module of the range hood stays in a normal working state.

[0016] Referring to FIG. 3, the ultrasonic module 3 includes an MCU 30, an oscillator 31, a first amplifier 32, a shaping circuit 33, an ultrasonic sensor arrangement 34, a first switch 35, a second amplifier 36, a band-pass filter 37, a peak detection circuit 38, and a second switch 39. A working principle of the ultrasonic module 3 is that the MCU 30 controls and enables an oscillation frequency of the oscillator 31, a state of the first switch 35 and the second switch 39, and an amplification factor of the second amplifier 36. The oscillator 31 is capable of generating a signal of a certain frequency. The first amplifier 32 amplifies an output signal of the oscillator 31 to a certain amplitude. The shaping circuit 33 shapes the output signal of the first amplifier 32 and outputs the shaped

signal to the ultrasonic sensor arrangement 34. The ultrasonic sensor arrangement 34 receives an excitation signal output by the shaping circuit 33, sends an acoustic signal and receives a feedback signal. The second amplifier 39 amplifies the feedback signal. The band-pass filter 37 filters the amplified feedback signal. The peak detection circuit 38 extracts a peak voltage from an alternating current (AC) feedback signal and outputs the voltage peak to the MCU 30 for AD sampling.

[0017] A device implementing and/or a method for operating the ultrasonic module 3 of the present invention may have the following features. In structure, two switches are disposed, namely the first switch 35 and the second switch 39. In the respective process or method, referring to FIG. 5, the two switches are turned ON/OFF in sequence, therefore effectively reducing an OFF noise input during an amplification process of a small signal. The detailed operation is described as follows.

[0018] In Step S30, the oscillator 31 is enabled; the first switch 35 and the second switch 39 are both maintained in an OFF state.

[0019] In Step S31, an excitation signal is sent by the oscillator 31; the first amplifier 32 amplifies and sends the excitation signal; and the first switch 35 and the second switch 39 are both maintained in their OFF state.

[0020] In Step S32, it is waited for an ultrasonic feedback signal, and the first switch 35 and the second switch 39 are both maintained in the OFF state.

[0021] In Step S33, the first switch 35 is turned on; a feedback signal is received; the second amplifier 36 amplifies the feedback signal; and the second switch 39 is maintained in the OFF state.

[0022] In Step S34, the second switch 39 is turned on to start AD sampling, and the first switch 35 and the second switch 39 are both maintained in an ON state.

[0023] In Step S35, during an idle time, a fan speed is calculated as a function of the sampled data, and the first switch 35 and the second switch 39 are both maintained in the OFF state.

[0024] An ultrasonic system is affected by many factors such as environmental temperature, environmental humidity and fume. These factors may affect the circuit board, the ultrasonic sensors and the ultrasonic signal, so that the received ultrasonic feedback signal changes. For example, when the environmental temperature and the environmental humidity change rapidly, the ultrasonic signal may become too great or too small. As an example, the rapid changes of the environmental temperature and the environmental humidity can result in a great value of the ultrasonic signal in a fumeless situation, which may cause a problem, i.e. the amplitude of the ultrasonic signal is too great, and when the fume exists, many sampled ultrasonic signals are saturation values. A mean value of the ultrasonic signals is great and a fluctuation interval of the mean value is small, and therefore, it is difficult for the system to determine whether fume exists. In another example, the rapid changes of the environmental temperature and the environmental humidity can result in a

small value of the ultrasonic signal in a fumeless situation, which may cause another problem, i.e. the amplitude of the ultrasonic signal is too small, and the ultrasonic signal fluctuates in a small range no matter fume exists or not. Therefore, it is also difficult for the system to determine whether fume exists.

[0025] In view of the above problems, according to another feature of the ultrasonic module 3, the second amplifier 36 is an amplifier having an adjustable amplification factor. The amplification factor can be controlled through the MCU 30. Such structure in combination with an appropriate system software is capable of solving the problem that the rapid or violent changes of the environmental temperature and the environmental humidity affect the ultrasonic signal. Ultrasonic signal threshold values V_{MAX} and V_{MIN} are preset in the MCU, and the amplification factor is adjusted as a function of the sampled actual ultrasonic signals.

[0026] When the mean sampled value $V_{MeanValue} > V_{MAX}$, the amplification factor of the second amplifier 36 is decreased until $V_{MeanValue} < V_{MAX}$.

[0027] When the mean sampled value $V_{MeanValue} < V_{MIN}$, the amplification factor of the second amplifier 36 is increased until $V_{MeanValue} > V_{MIN}$.

[0028] In this manner, the mean sampled value $V_{MeanValue}$ falls in a reasonable interval, thereby ensuring that the ultrasonic signal is capable of accurately reflecting an influence of the fume.

[0029] Referring to FIG. 6a to FIG. 7b, the working principle of embodiments of the range hood having the automatic fume detection device and the control method thereof are described in the following.

[0030] An ultrasonic signal is affected by many factors such as environmental temperature, environmental humidity and fume. However, if the ultrasonic sensor is disposed inside the hood body of the range hood, as shown in FIG. 1, the influence of the factors such as environmental temperature and environmental humidity on the ultrasonic signal is relatively uniform. FIG. 6a shows a distribution state of sampled values of an ultrasonic signal at a certain fan speed. It can be seen from FIG. 6a that the distribution of the sampled values of the ultrasonic signal is relatively uniform. Definitely, the fan speed also influences the sampled values. Generally speaking, the greater the fan speed is, the greater is the discreteness of the sampled values.

[0031] FIG. 6b shows the influence of the fume on the sampled signals at the same fan speed. Before the fume appears, the sampled values of the ultrasonic signal are relatively concentrated, and the values are relatively great. After the fume appears, the sampled values of the ultrasonic signal fluctuate in a relatively great range, and the sampled values tend to be low. After the fume disappears, the sampled values of the ultrasonic signal return to the relatively great values and fluctuate in a small range.

[0032] Mean values of the sampled signals are calculated in a certain period, and graphs of the mean values

shown in FIG. 7a and FIG. 7b are obtained according to the signals of FIG. 6a and FIG. 6b, respectively. Comparing FIG. 7a and FIG. 7b, it can be seen that the influence of the fume on the mean values of the sampled ultrasonic signal leads to a change in the distribution, that is, when no fume exists, the signal curve is relatively smooth and stable; after the fume is generated, since the fume weakens the ultrasonic signal, the amplitude of the curve decreases. Moreover, due to an inhomogeneity of the fume, the signal jumps rapidly, which is reflected by an up-and-down oscillation in the signal curve. Therefore, embodiments of the present invention comprise two approaches for determining the density of the fume as a function of a change of amplitude of the mean value.

[0033] According to a first aspect, different threshold mean values are preset for different fan speeds. When the mean value of the sampled ultrasonic signal is lower than a set threshold value, it is determined that the fan speed needs to be increased. When the mean value of the sampled ultrasonic signal is higher than a pre-set threshold value, it is determined that the fan speed needs to be decreased. For example, threshold values V_{speed1} and V_{speed2} are respectively set for fan speeds Speed1 and Speed2. $V_{MeanValue}$ is a mean value of sampled signals in a period between T1 and T2. When the sampled value $V_{MeanValue} < V_{speed1}$, the fan speed is increased from tap position 1 to tap position 2. When the sampled value $V_{MeanValue} > V_{speed2}$, the fan speed is decreased from tap position 2 to tap position 1.

[0034] According to a second aspect, different mean value fluctuation ranges are pre-set for different fan speeds, and the mean values that exceed the pre-set range are counted over a certain period. A pre-set count threshold value is changed for different fan speeds, so as to determine a change of the fan speed. For example, different fluctuation range criteria are set for different fan speeds: Speed1 corresponds to an interval ($V_{speed1min}$, $V_{speed1max}$), and Speed2 corresponds to an interval ($V_{speed2min}$, $V_{speed2max}$). $V_{MeanValue}$ is a mean value of the sampled signals in a period between T1 and T2. At Speed1, if $V_{MeanValue}$ of the sampled ultrasonic signals in the period between T1 and T2 exceeds ($V_{speedmin}$, $V_{speedmax}$) by a number of counted values larger than a pre-set criterion C_{max} , it is regarded that the fume is relatively thick, and the fan speed is increased from tap position 1 to tap position 2. At Speed2, if $V_{MeanValue}$ of the sampled ultrasonic signals in the period between T1 and T2 exceeds ($V_{speedmin}$, $V_{speedmax}$) by a number of counted values smaller than a pre-set criterion C_{min} , it is regarded that the fume is relatively thin, and the fan speed is decreased from tap position 2 to tap position 1.

[0035] An advantage of the first aspect and the second aspect is in that valid information of the influence of the fume on the ultrasonic signal is fully extracted using a smart algorithm. The two methods may be embodied independently or may be combined according to the specific design of the range hood, thereby allowing an automatic change of the fan speed of the range hood accord-

ing to the fume state.

[0036] Preferred embodiments of the present invention are described above. It should be noted that, based on the disclosure of the embodiments, adaptive modifications may be made by persons with ordinary skills in the art without any creative work. These reasonable modifications shall fall within the protection scope of the present invention.

1 - 4, **characterized in that** the threshold mean value is a predetermined mean value range (V_{speedmin} , V_{speedmax}) at a specific fan speed, and if the mean value of the sampled ultrasonic signals exceeds (V_{speedmin} , V_{speedmax}) by a counted number smaller than a set minimum criterion C_{min} the fan speed is decreased.

Claims

1. A control method for a range hood (1) having an automatic fume detection device, wherein the range hood (1) comprises a main control module (2), a fan capable of adjusting a rotating speed in response to an instruction of the main control module (2), and an ultrasonic module (3) for controlling the automatic fume detection device, the control method comprising:
 - a) setting a plurality of threshold mean values corresponding to different fan speeds in the main control module (2);
 - b) collecting statistical data of a mean value of sampled ultrasonic signals over a predetermined period through the ultrasonic module (3), and feeding back the mean value to the main control module (2); and
 - c) comparing the mean value of the sampled ultrasonic signals with the threshold mean values, and adjusting the rotating speed of the fan as a function of a comparison result.
2. The control method according to claim 1, **characterized in that** the threshold mean value is a predetermined specific value V_{Speed} for a specific fan speed, and, if the mean value of the sampled ultrasonic signals is smaller than the predetermined specific value V_{Speed} , the fan speed is increased.
3. The control method according to claim 1 or 2, **characterized in that** the threshold mean value is a predetermined specific value V_{Speed} for a specific fan speed, and, if the mean value of the sampled ultrasonic signals is larger than the predetermined specific value V_{Speed} , the fan speed is decreased.
4. The control method according to any one of claims 1 - 3, **characterized in that** the threshold mean value is a predetermined mean value range (V_{speedmin} , V_{speedmax}) at a specific fan speed, and if the mean value of the sampled ultrasonic signals exceeds (V_{speedmin} , V_{speedmax}) by a counted number larger than a pre-set maximum criterion C_{max} the fan speed is increased.
5. The control method according to any one of claims

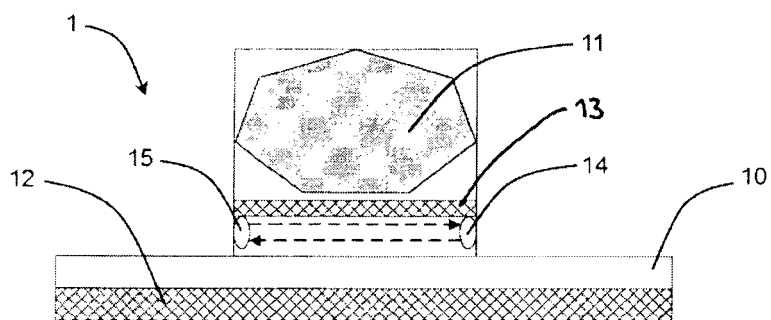


FIG. 1

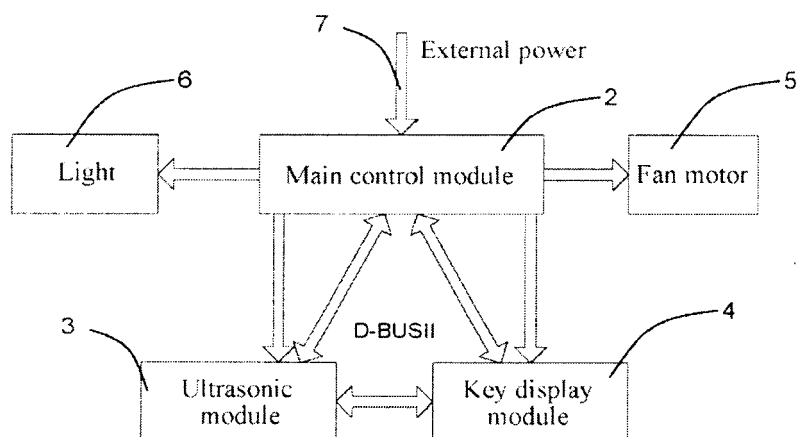


FIG. 2

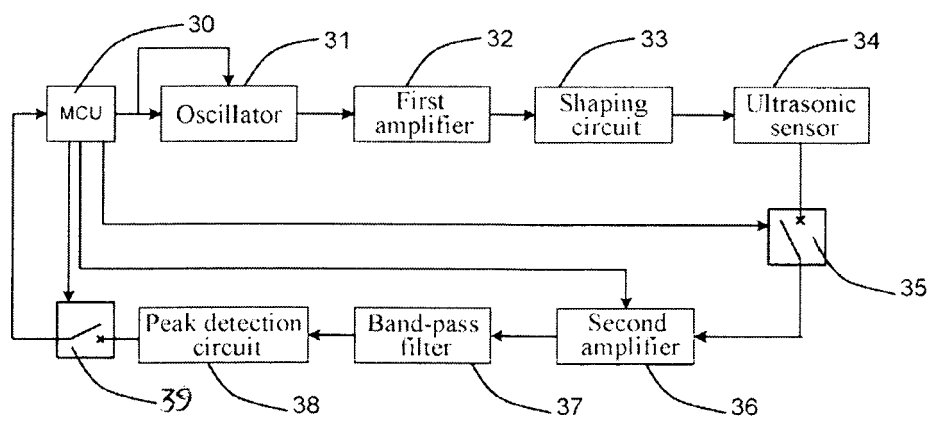


FIG. 3

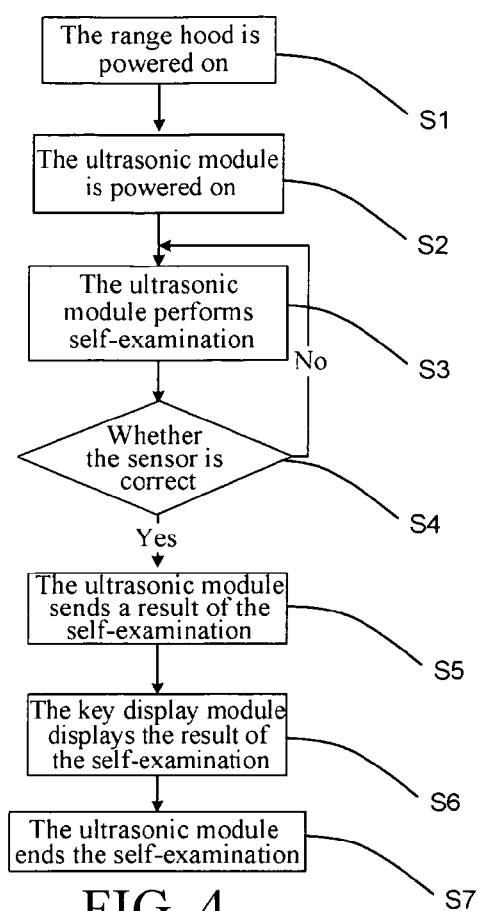


FIG. 4

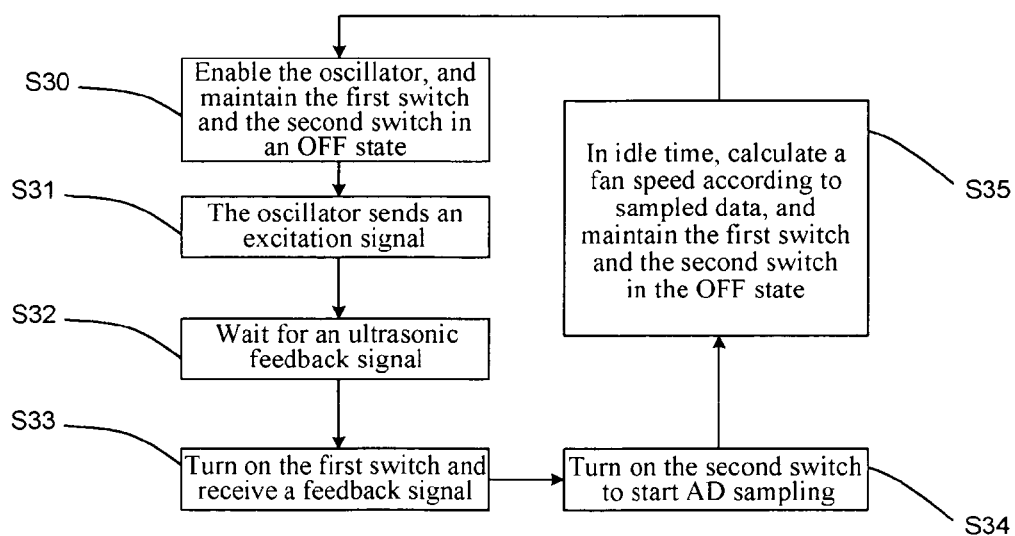


FIG. 5

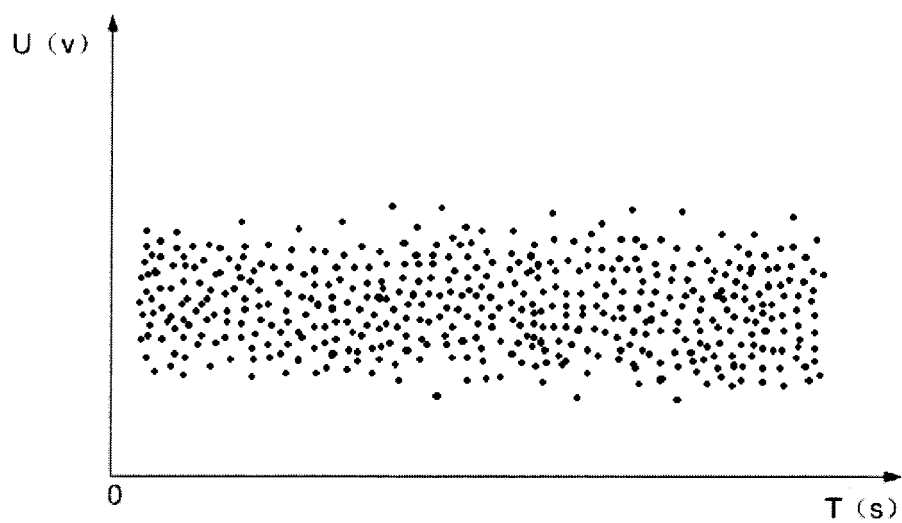


FIG. 6a

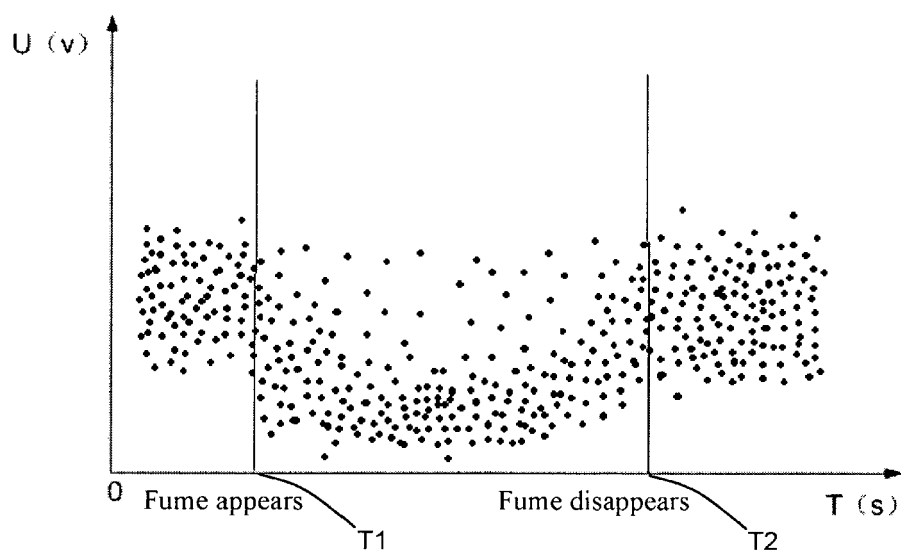


FIG. 6b

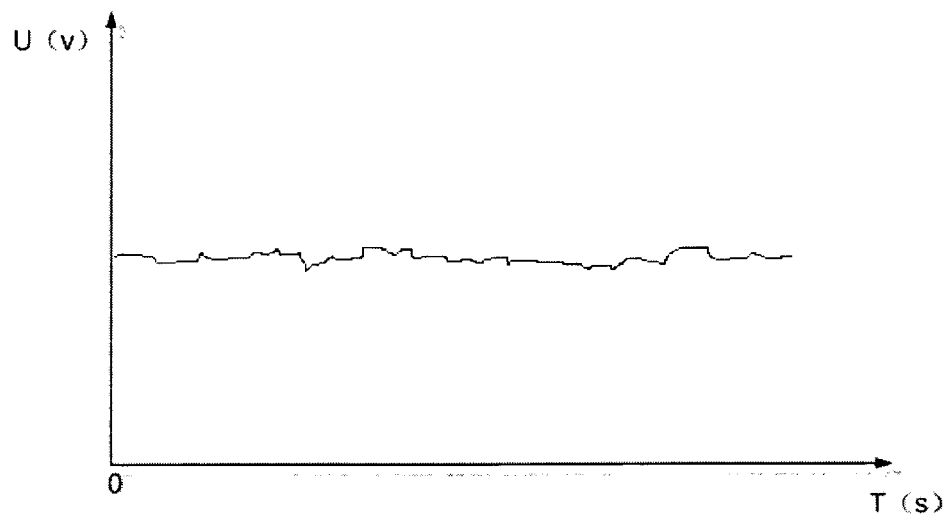


FIG. 7a

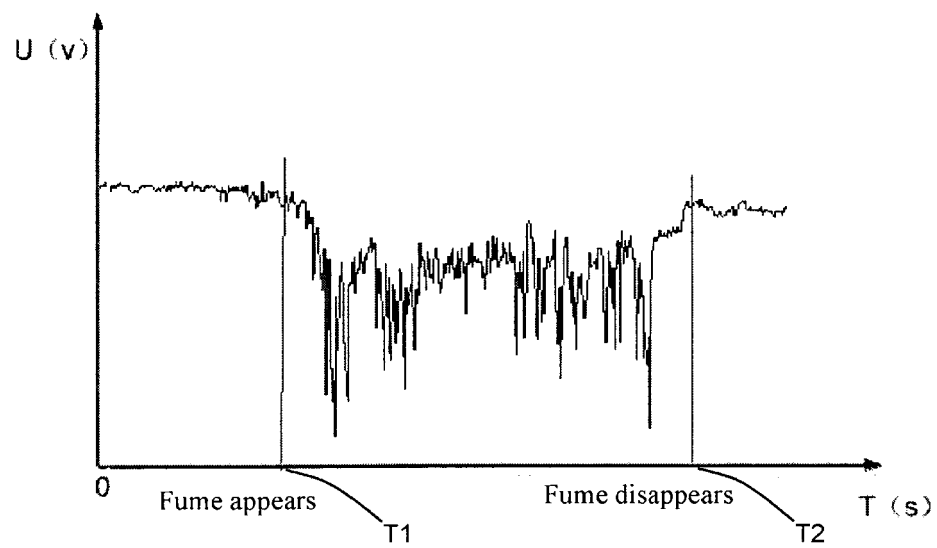


FIG. 7b



EUROPEAN SEARCH REPORT

Application Number
EP 11 17 7270

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	WO 00/66950 A1 (ELECTROLUX AB [SE]; ESKILDSEN CHRISTIAN [DK]; OVENDEN NEIL A [IT]; HAE) 9 November 2000 (2000-11-09) * the whole document *	1-5	INV. F24C15/20
Y,D	EP 0 443 141 A2 (DIEHL GMBH & CO [DE]) 28 August 1991 (1991-08-28) * the whole document *	1-5	
A	EP 1 333 231 A2 (DIEHL AKO STIFTUNG GMBH & CO [DE]) 6 August 2003 (2003-08-06) * the whole document *	1-5	
A,D	EP 1 001 226 A2 (DIEHL CONTROLS NUERNBERG GMBH [DE] DIEHL AKO STIFTUNG GMBH & CO [DE]) 17 May 2000 (2000-05-17) * the whole document *	1-5	
A	DE 10 2004 039549 A1 (MIELE & CIE [DE]) 3 November 2005 (2005-11-03) * the whole document *	1-5	
A	GB 2 450 732 A (FOOD INDUSTRY TECHNICAL LTD [GB]) 7 January 2009 (2009-01-07) * the whole document *	1-5	TECHNICAL FIELDS SEARCHED (IPC) F24C
A	WO 2006/012628 A2 (HALTON COMPANY [US]; LIVCHAK ANDREY [US]; SCHROCK DEREK [US]; BAGWELL) 2 February 2006 (2006-02-02) * the whole document *	1-5	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 November 2011	Examiner Rodriguez, Alexander
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

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

EP 11 17 7270

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-11-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0066950 A1	09-11-2000	AT 260445 T	15-03-2004
		AU 4101200 A	17-11-2000
		DE 60008506 D1	01-04-2004
		DE 60008506 T2	23-12-2004
		EP 1159566 A1	05-12-2001
		ES 2215636 T3	16-10-2004
		PT 1159566 E	30-06-2004
		WO 0066950 A1	09-11-2000
EP 0443141 A2	28-08-1991	DE 4005363 A1	22-08-1991
		EP 0443141 A2	28-08-1991
		US 5074281 A	24-12-1991
EP 1333231 A2	06-08-2003	DE 10203679 A1	07-08-2003
		EP 1333231 A2	06-08-2003
		PL 358504 A1	11-08-2003
EP 1001226 A2	17-05-2000	DE 19851884 A1	18-05-2000
		EP 1001226 A2	17-05-2000
		US 6324889 B1	04-12-2001
DE 102004039549 A1	03-11-2005	NONE	
GB 2450732 A	07-01-2009	EP 2188574 A2	26-05-2010
		GB 2450732 A	07-01-2009
		GB 2450967 A	14-01-2009
		WO 2009004332 A2	08-01-2009
WO 2006012628 A2	02-02-2006	AT 473062 T	15-07-2010
		CA 2573955 A1	02-02-2006
		EP 1778418 A2	02-05-2007
		US 2009032011 A1	05-02-2009
		US 2010294259 A1	25-11-2010
		US 2011021128 A1	27-01-2011
		WO 2006012628 A2	02-02-2006

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 200920000606X [0003]
- US 5074281 A [0004]
- US 6324889 B1 [0004]