A CLEANING DEVICE FOR A SENSOR AND A VACUUM CLEANER COMPRISING SUCH A CLEANING DEVICE
A CLEANING DEVICE FOR A SENSOR AND A VACUUM CLEANER
COMPRISING SUCH A CLEANING DEVICE

This invention relates to a cleaning device used to clean a sensor particularly a dust sensor and also to a vacuum cleaner comprising such a cleaning device.

In the prior art, optical dust sensors provided in an air passageway between a suction opening and a dust collecting device are used to detect the dust in the drawn air. Dust sensors are formed of two main parts; namely a light emitting device and a light receiving device. Light emitting device is emitting an infrared light beam or like and light receiving device is receiving light emitted by the light emitting device. These devices are arranged in a predetermined position on the air passageway. These light emitting and light receiving devices are placed opposite each other at fixed positions so that the change in light intensity indicates the amount of dust passing through the suction path. When these devices are covered with dust, the light received by the phototransistor is decreased so the performance of the dust sensing means is degraded.

To overcome this degradation, two solutions were proposed in previous art;

One was the electronic calibration of the system, which can be explained as “sensitivity correction means”. In EP 0904723 such a “sensitivity correction means” is described. The aim of the method described in this patent is to increase the amount of light emitted by the emitter proportional to the reduction of light emitted and received caused by the adhering of particles on the sensors. The problem with this method is that, if the amount of light emitted is increased when the window members on the sensors are soiled, after certain period it reaches a threshold value where the light intensity can no longer be increased. In this case, window members on the sensors have to be cleaned manually. The user is informed such that soiling of the window members has reached its maximum value and the sensors have to be cleaned.
The other solution was cleaning the surface of the sensors with the help of a mechanical device. A similar approach is described in US 5152028. In this patent an upright vacuum cleaner including a dust sensor is introduced. The problem explained above, is solved by a cleaning member that cleans the surface of the window members by the help of the sliding movement of the vacuum cleaner. Since this is an upright vacuum cleaner, the sliding movement is achieved by the movement of the handle. As the handle reaches 90° angle, the sliding member covers the surface of the sensors. A disadvantage of this method is that when the sliding degree is less than 90° but not big enough to completely move out, the sliding member may partially cover the surface of the sensor thus light intensity may be decreased thus the sensitivity will be decreased as a result.

In US 4937912, a mounting device for sensors is described. In this patent, it is proposed to form at least one axial channel, leading from inside to the outside, immediately adjacent to the sensor, through which an air flow is passed due to underpressures and overpressures prevailing in the area of the sensor, which air flow acts to continuously clean the sensitive area of the sensor.

In US 5319827, a device providing the cleaning of light emitting and receiving elements are described. This device comprises of cover means for the light emitting and receiving elements. One end of each of these cover means is flush with an inside surface of suction member. There are ring-shaped projection means formed on inside surface of the suction member adjacent to and upstream of the light emitting element and the light receiving element to increase the inflow speed of the air including particulate material through a space between the light emitting element and the light receiving element. The projection means includes cuts which form diverging channels, each channel having side walls formed by the cuts, which diverge towards and aligned with one of the light emitting element and the light receiving element to further increase the speed of the air including particulate material passing over the cover means.
Therefore, the object of the present invention is to provide a cleaning device for sensors of any type particularly for optical dust sensors used in vacuum cleaners.

The cleaning device according to the present invention is illustrated in the drawings, wherein:

Figure 1 - is the three dimensional front view of the cleaning device where the cleaning members are over the sensor components while the cleaning device is moving.

Figure 2 - is the three dimensional front view of the cleaning device when the holes are over the sensor components while the cleaning device is at fixed position.

Figure 3 – is the side view showing an overall arrangement of a vacuum cleaner according to one embodiment of the invention.

The components shown in the drawings have the following numbers:

1- Housing
2a- Light emitter
2b- Light receiver
3- Cleaning device
4- Canal
5- Pin
6- Cleaning member
7- Holes
8- Hose
9- Vacuum cleaner body
10- Vacuum cleaner

Vacuum cleaner (10) comprises a vacuum cleaner body (9), a hose (8), a dust sensor including a light emitter (2a) and a light receiver (2b) located on the air
passageway, a housing (1) for the dust sensor and a cleaning device (3) located in the housing (1) in order to clean light emitter (2a) and light receiver (2b) components. In the preferred embodiment, the light emitter (2a) and the light receiver (2b) components are placed in a housing (1) on the inlet of the vacuum cleaner body (9) and the cleaning device (3) is placed in the outlet of the hose (8). There is one or more canals (4) preferably in “L” form, placed in the housing (1) next to the light emitter (2a) and the light receiver (2b) components. The canals (4) are placed preferably in reverse sides leading to opposite directions.

The cleaning device (3) has one or more preferably cylindrical pins (5), that move within the canal (4) according to the movement of the cleaning device (3). One or more preferably felt cleaning members (6), to clean the light emitter (2a) and the light receiver (2b) components and one or more holes (7) to let the light pass between the light emitter (2a) and the light receiver (2b) components, are arranged consecutively on the cleaning device (3). Other embodiments may be realized with only one canal (4), one cleaning member (6) and one hole (7).

Since the light emitter (2a) and the light receiver (2b) components are placed in the inlet of the vacuum cleaner body (9) and the cleaning device (3) is placed in the outlet of the hose (8) as shown in Figure 3, when the hose (8) is engaged into the vacuum cleaner body (9), the cleaning device (3) meets the dust sensor and the two cleaning members (6) come across the light emitter (2a) and the light receiver (2b). The user has to rotate the hose (8) so the cleaning device (3) with an angle (here 90°, in clockwise direction) in order to fix the hose (8) into the vacuum cleaner body (9). When the cleaning device (3) is rotated, the cleaning members (6) pass over the light emitter (2a) and the light receiver (2b) and rub them, as in Figure 1 and the adhered dust on the light emitter (2a) and the light receiver (2b) components are removed. For the light emitter (2a) and the light receiver (2b) to be operated correctly there should not be any portion of the cleaning member left (6) over them. Therefore, when the cleaning device (3) is fixed as in Figure 2, the light emitter (2a) and the light receiver (2b) face each other since the holes (7) come over the light emitter (2a) and the light receiver (2b)
components. The dust sensor operates without any problem since the passageway of the light is open and the light emitter (2a) and the light receiver (2b) are cleaned.

When the cleaning device (3) is taken out by a movement in counterclockwise direction, the pin (5) also moves in the counterclockwise direction in the canal (4) and the cleaning members (6) pass over the light emitter (2a) and the light receiver (2b) components, cleaning the soil adhered on them.

In another embodiment of this invention, only one canal (4) which comprises one pin (5) is located in the housing (1) and one cleaning member (6) is arranged on the cleaning device (3) leaving the rest of the cleaning device (3) empty. When the cleaning device (3) is rotated such that the cleaning member (6) passes over both of the light emitter (2a) and the light receiver (2b) components, the cleaning member (6) rubs the light emitter (2a) and the light receiver (2b) components and the cleaning device (3) becomes fixed, the hole (7) comes over the light emitter (2a) and the light receiver (2b) components and the passage of the light from light emitter (2a) to light receiver (2b) is provided.

In an alternative embodiment of this invention the canals (4) are arranged on the cleaning device (3) and the pins (5) are located on the housing (1) in order to provide the movement of the cleaning device (3) within the housing (1).

By using the above explained solutions, dust collected on the light emitter (2a) and the light receiver (2b) components does not reach to a threshold value and the performance loss during the waiting period for the manual cleaning of the light emitter (2a) and the light receiver (2b) is avoided.
CLAIMS

1. A cleaning device (3) for a sensor having a light emitter (2a) and a light receiver (2b) placed in a housing (1) characterized in that the cleaning device (3) is movable within the housing (1) and it comprises a cleaning member (6) that cleans the light emitter (2a) and the light receiver (2b) components by rubbing them when it passes over while the cleaning device (3) is moving within the housing (1), and one or more holes (7) that let the light pass between the light emitter (2a) and the light receiver (2b) components when the cleaning device (3) comes to its fixed position within the housing (1).

2. A cleaning device (3) according to Claim 1 characterized in that the cleaning device (3) comprises a pin (5) that moves within a canal (4) placed in the housing (1) letting the cleaning device (3) move and come to its fixed position within the housing (1).

3. A cleaning device (3) according to Claim 1 characterized in that the cleaning device (3) comprises a canal (4) in which a pin (5) placed in the housing (1) moves, letting the cleaning device (3) move and come to its fixed position within the housing (1).

4. A cleaning device (3) according to Claim 1 to 3 characterized in that the cleaning device (3) comprises more than one cleaning member (6) and hole (7), that are arranged consecutively.

5. A cleaning device (3) according to Claim 1 to 4 characterized in that the cleaning members are made of felt.

6. A cleaning device (3) according to Claim 1 to 4 characterized in that the cleaning members are made of a transparent material.
7. A vacuum cleaner (10) comprising a cleaning device (3) as described in any of Claims 1 to 6.

8. A vacuum cleaner (10) according to Claim 7 including a hose (8) and a vacuum cleaner body (9) characterized in that the cleaning device (3) is placed in the outlet of the hose (8) where it meets with the vacuum cleaner body (9) in the inlet of which the housing (1) is placed, and the cleaning device (3) moves within the housing (1) when the hose (8) is engaged into the vacuum cleaner body (9) and the cleaning member (6) passes over the light emitter (2a) and the light receiver (2b) which are placed in the inlet of the vacuum cleaner body (9) and the holes (7) come over the light emitter (2a) and the light receiver (2b) components when the cleaning device (3) comes to its fixed position within the housing (1).
INTERNATIONAL SEARCH REPORT

CLASSIFICATION OF SUBJECT MATTER

IPC: A47L 9/28

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)

IPC: 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)

epodoc, wpi, fi cl txtg, fi cl txtc

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>EP 0347223 A2 (Matsushita) 20 December 1989 (20.12.89) abstract, fig. 2,3.</td>
<td>1,8</td>
</tr>
<tr>
<td>A</td>
<td>EP 0443845 A1 (Matsushita) 28 August 1991 (28.08.91) abstract, fig. 2,3.</td>
<td>1,8</td>
</tr>
<tr>
<td>A</td>
<td>US 4937912 A (Kurz) 3 July 1990 (03.07.90) abstract, fig. 2.</td>
<td>1</td>
</tr>
</tbody>
</table>

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
   "A" document defining the general state of the art which is not considered to be of particular relevance
   "P" earlier application or patent but published on or after the international filing date
   "D" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
   "O" document referring to an oral disclosure, use, exhibition or other means
   "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principles or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"A" document member of the same patent family

Date of the actual completion of the international search 4 April 2001 (04.04.2001)

Date of mailing of the international search report 4 May 2001 (04.05.2001)

Name and mailing address of the ISA/AT
Austrian Patent Office
Kohlmarkt 8-10; A-1014 Vienna
Facsimile No. 1/53424/535

Authorized officer
BABUREK
Telephone No. 1/53424/352

Form PCT/ISA/210 (second sheet) (July 1998)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP A2 347223</td>
<td>20-12-1989</td>
<td>DE C0 68908489</td>
<td>23-05-1993</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP A2 1314534</td>
<td>19-12-1989</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP A2 2007925</td>
<td>11-01-1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE T2 69102304</td>
<td>08-12-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ES T3 2055526</td>
<td>16-06-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP A2 3244420</td>
<td>31-10-1991</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US A 5144714</td>
<td>08-09-1992</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE A1 3803824</td>
<td>17-06-1989</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE C2 3803824</td>
<td>31-10-1991</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE C0 58905716</td>
<td>04-11-1993</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E2 A2 327936</td>
<td>16-08-1989</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP A3 327936</td>
<td>12-09-1990</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP B1 327936</td>
<td>25-09-1993</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP A2 1214326</td>
<td>20-08-1989</td>
</tr>
</tbody>
</table>