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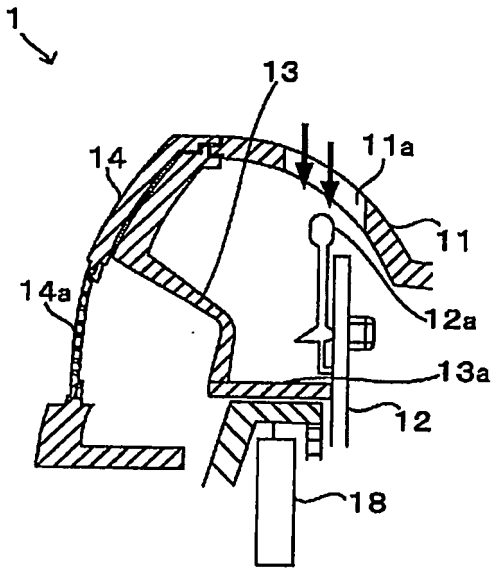
(54) **FIRE ALARM**

(57) A fire alarm device 1 includes a housing having an airflow introducing hole, and a sensor element arranged near the airflow introducing hole within the housing. The airflow introducing hole is formed on an upper surface of the housing facing upward when the fire alarm device is installed on a wall surface. A partition wall is provided within the housing to isolate a space in which the sensor element 12a is arranged and a space in which a sound element 18 for outputting a warning sound is arranged. Thus, at the initial stage of fire sensing, it is possible to prevent a phenomenon that the output of a warning sound becomes unstable due to the air vibration caused by a speaker.

FIG. 1



EP 2 447 922 A1

Description

Field of the Invention

[0001] The present invention relates to the improvement of a fire alarm device having a structure in which an airflow introducing hole is provided in a device housing and a sensor element is arranged near the airflow introducing hole within the housing.

Background of the Invention

[0002] Conventionally, fire alarm devices of the type having a sensor unit protruding from the central portion of a device body are commercially available as fire alarm devices attached to a ceiling surface or a wall surface.

[0003] One example of fire alarm devices of this type is disclosed in Japanese Patent Application Publication No. 2009-031833 (JP2009-031833A). More specifically, a smoke sensing chamber having a light emitting unit, a light receiving unit, a labyrinth wall and so forth protrudes from a disc-shaped body. The smoke sensing chamber is covered with a cylindrical insect screening cover with a closed bottom. A speaker for outputting a warning sound is arranged just above the insect screening cover. The insect screening cover and the speaker are covered with a guard cover.

[0004] In the structure noted above, the top surface of the insect screening cover acts as a partition wall for isolating the speaker reception space and the smoke sensing chamber from each other. A vent hole communicating with the smoke sensing chamber is formed in the partition wall so that the speaker can vibrate sufficiently to obtain a high enough sound pressure. A plurality of sound holes is formed on the top surface of the guard cover blocking the sound output surface of the speaker.

[0005] In the fire alarm device disclosed in JP2009-031833A, the vent hole is formed in the partition wall for isolating the speaker reception space and the smoke sensing chamber. Therefore, at the initial stage of fire sensing, there appears a phenomenon that the smoke-particle-containing airflow introduced into the smoke sensing chamber flows out from the smoke sensing chamber due to the air vibration caused by the speaker. This poses a problem in that the output of a warning sound is repeatedly stopped and resumed and therefore becomes unstable.

[0006] The same problem appears in a fire alarm device having a structure in which an airflow introducing hole is provided in a device housing and a sensor element is arranged near the airflow introducing hole within the housing. No solution to this problem has been proposed up to now.

Summary of the Invention

[0007] In view of the above, the present invention provides a fire alarm device having a structure in which an airflow introducing hole is provided in a device housing and a sensor element is arranged near the airflow introducing hole within the housing. This fire alarm device is capable of preventing a phenomenon that, at the initial stage of fire sensing, the output of a warning sound becomes unstable due to the air vibration caused by a speaker.

[0008] In accordance with the present invention, there is provided a fire alarm device including a housing having an airflow introducing hole, and a sensor element arranged near the airflow introducing hole within the housing, **characterized in that**: the airflow introducing hole is formed on an upper surface of the housing facing upward when the fire alarm device is installed on a wall surface; and a partition wall is provided within the housing to isolate a space in which the sensor element is arranged and a space in which a sound element for outputting a warning sound is arranged. The sensor element may be either a heat sensing element or a smoke sensing element.

[0009] In the fire alarm device, the upper surface of the housing may be formed of a slant surface making an acute angle smaller than 90 degrees with respect to the wall surface when the fire alarm device is installed on the wall surface.

[0010] In the fire alarm device, the housing may have a sound passing portion for passing therethrough a sound generated from the sound element, the sound passing portion provided on a front surface of the housing facing forward when the fire alarm device is installed on the wall surface. The fire alarm device may further include: an attachment base member arranged at a rear side of the housing, the attachment base member being smaller in size than the housing so that the attachment base member can be hidden by the housing when the fire alarm device attached to the wall surface is seen at a front side thereof.

[0011] With such configuration, even if the air existing within the housing is vibrated by the operation of the sound element, the partition wall prevents the air vibration from being propagated to the space in which the sensor element is arranged. This eliminates the possibility that, at the initial stage of fire sensing, the airflow existing near the sensor element is dispersed due to the air vibration caused by the sound element and that the output of a warning sound becomes unstable. Moreover, the sensitivity of the sensor element is not reduced even when the sensor element is stored within the housing. This makes it possible to form the fire alarm device into a small size with a reduced thickness. Accordingly, there is provided an advantage that the degree of freedom in designing the fire alarm device can be enhanced.

[0012] In the configuration in which the upper surface of the housing is formed of a slant surface making an acute angle smaller than 90 degrees with respect to the wall surface when the fire alarm device is installed on the wall surface, the airflow introducing hole is arranged in a position where the air pressure is increased by the air-

flow moving from the upper side toward the lower side. This makes it possible to introduce the airflow in an efficient manner. Moreover, if the airflow introducing hole is formed on the slant surface, it becomes possible to increase the air intake area of the airflow introducing hole as compared with a case where the airflow introducing hole is formed a surface perpendicular to the wall surface.

[0013] In the configuration in which the housing has a sound passing portion provided on a front surface of the housing facing forward when the fire alarm device is installed on the wall surface and in which the fire alarm device further includes an attachment base member arranged at a rear side of the housing and having a size smaller than that of the housing, the attachment base member can be hidden by the housing when the fire alarm device attached to the wall surface is seen at a front side thereof. At a first glance, the fire alarm device looks like a wall-fixed speaker and serves as a good interior decoration.

Brief Description of the Drawings

[0014]

Fig. 1 is a partially enlarged section view of a fire alarm device according to one embodiment of the present invention, which is taken along line I-I in Fig. 2B.

Figs. 2A through 2C are top, front and side views of the fire alarm device.

Fig. 3 is an exploded perspective view of the fire alarm device.

Fig. 4 is an exploded perspective view for explaining a partition wall of the fire alarm device.

Detailed Description of the Preferred Embodiments

[0015] The present invention will now be described by taking, as an example, a wall-fixed heat-type fire alarm device. However, the present invention is not limited to the heat-type fire alarm device but may be applied to a smoke-type fire alarm device.

[0016] Referring to Figs. 1, 2A through 2C and 3, the fire alarm device 1 is of a wall-fixed type fixed to a wall surface through a bracket 15 as an attachment base member. The fire alarm device 1 includes a housing composed of a base panel 11, a body panel 13 and a cover panel 14. The housing is configured to accommodate a main board 12, a push button 16 serving as an operation unit and a speaker 18 serving as a sound element. The bracket 15 is smaller in size than the housing so that the bracket 15 can be hidden by the housing when the fire alarm device 1 attached to a wall surface is seen at the front side thereof. The bracket 15, the base panel 11 and the body panel 13 are resin-molded products. The cover panel 14 includes a sound passing portion 14a to which a metal net is attached.

[0017] As shown in Figs. 2A through 2C, the outward appearance of the fire alarm device 1 differs largely from the outward appearance of the conventional ceiling-fixed fire alarm device. At a first glance, the fire alarm device 1 looks like a wall-fixed speaker and serves as a good interior decoration.

[0018] An airflow introducing hole 11a for introducing a heat-carrying airflow therethrough, a power supply battery storing portion 11b and a main board storing portion 11c are formed in the base panel 11. In the illustrated example, the base panel 11 has a slant surface where the airflow introducing hole 11a is formed. The slant surface makes an acute angle smaller than 90 degrees with respect to the wall surface on which the fire alarm device 1 is installed.

[0019] Thus, the airflow introducing hole 11a is arranged in a position where the air pressure is increased by the airflow moving from the upper side toward the lower side (as indicated by arrows in Fig. 1). This makes it possible to introduce the airflow in an efficient manner. Moreover, the formation of the slant surface makes it possible to increase the air intake area of the airflow introducing hole 11a.

[0020] On the rear surface of the base panel 11, there are formed engagement portions engaging with engagement claws 15a formed in the bracket 15. In addition to the engagement claws 15a, screw holes 15b, through which screws are inserted to fix the base panel 11 to the wall surface, are formed in the bracket 15. The fire alarm device 1 is installed on the wall surface by fixing the bracket 15 to the wall surface and then bringing the engagement portions of the base panel 11 into engagement with the engagement claws 15a of the bracket 15.

[0021] The main board 12 is, e.g., a printed circuit board made of glass fibers, epoxy resin, paper or other suitable materials. A heat sensing element 12a such as a thermistor or the like, a microcomputer, a sound output circuit, a switch 12b and various kinds of electronic parts such as a light emitting diode and the like are mounted on the main board 12. A metal component 12c for holding one or more (e.g., four) power supply batteries is fixedly secured to the main board 12. The heat sensing element 12a is mounted to protrude from the main board 12 so that the heat sensing element 12a can be positioned just below the airflow introducing hole 11a when the fire alarm device 1 is fixed to the wall surface.

[0022] As shown in Figs. 1 and 4, the main board 12 and the speaker 18 are attached to the body panel 13. The body panel 13 is provided with a partition wall 13a for isolating the space in which the heat sensing element 12a is arranged and the space in which the speaker 18 is arranged. In the present embodiment, no hole is formed in the partition wall 13a. The sound passing portion 14a is formed on the front surface of the housing when the fire alarm device 1 installed on the wall surface is seen at the front side. Thus, the output of the speaker 18 is effectively propagated through the sound passing portion 14a, thereby preventing the heated airflow from being dispersed due to the air vibration caused by the speaker

18. In the illustrated example, the partition wall 13a is formed into a plate-like shape only between the heat sensing element 12a and the speaker 18. Alternatively, the partition wall 13a may be formed as a continuous wall surrounding the rear surface of the speaker 18. In the further alternative, the partition wall 13a may be formed as a wall surrounding the heat sensing element 12a.

[0023] In the illustrated example, even if the air existing within the housing is vibrated by the operation of the speaker 18, the partition wall 13a prevents the air vibration from being propagated to the space in which the heat sensing element 12a is arranged. This eliminates the possibility that, at the initial stage of fire sensing, the heated airflow is dispersed due to the air vibration caused by the speaker 18 and that the alarm output becomes unstable. Moreover, the sensitivity of the heat sensing element 12a is not reduced even when the heat sensing element 12a is stored within the housing. This makes it possible to form the fire alarm device 1 into a small size with a reduced thickness. Accordingly, there is provided an advantage that the degree of freedom in designing the fire alarm device 1 can be enhanced.

[0024] The push button 16 serves as an operation unit for receiving an alarm stopping operation or other operations. The push button 16 is a molded product made of, e.g., a fiber-reinforced plastic. The push button 16 includes a push-operated operating piece 16a, a pressing piece and a pair of elastic support pieces 16c, the latter two of which protrude from one lateral end of the the operating piece 16a. The respective portions of the push button 16 may be one-piece molded or may be independently formed and then assembled together. The pressing piece is arranged in alignment with the switch 12b mounted on the main board 12. If the operating piece 16a is pushed, the pressing piece presses the switch 12b.

[0025] The fire alarm device 1 further includes a light guide 17 made of a transparent resin. The light guide 17 serves to guide the light of a light emitting diode mounted on the main board 12 to an illuminating hole 16d formed in the push button 16. The light emitting diode is turned on or repeatedly turned on and off depending on the operating condition of the fire alarm device 1. The light emitted from the light emitting diode can be visually perceived and confirmed through the illuminating hole 16d.

[0026] The fire alarm device 1 further includes an emblem 20, a decorating part, on which a type number and a manufacturer logo are printed.

[0027] Description will now be made on the basic operation of the fire alarm device 1. The fire alarm device 1 has a function of repeatedly performing, at a specified time interval, a standby mode in which the operation of the heat sensing element 12a is stopped to reduce power consumption and a monitoring mode in which the heat sensing element 12a is operated to monitor occurrence of fire. For example, the standby mode may be performed for thirty seconds and the monitoring mode for one second, which time period can be arbitrarily changed if needed. In the monitoring mode, the heat sensing element 12a is operated a specified number of times to measure an ambient temperature. The heat sensing element 12a determines occurrence of fire depending on how many times the measured temperature has exceeded a predetermined value. If it is determined that fire has occurred, the fire alarm device 1 begins to output a fire alarming sound and turns on the light emitting diode. The fire alarming sound continues to be outputted until an alarm stopping operation is made by the push button 16. In addition, the output voltage of the power supply batteries is monitored at a specified time interval. If the output voltage is lower than a predetermined value, the light emitting diode is repeatedly turned on and off to urge a user to replace the batteries.

[0028] The present invention is not limited to the embodiment described above and may be modified in many different forms without departing from the scope of the invention.

Claims

1. A fire alarm device including a housing having an airflow introducing hole, and a sensor element arranged near the airflow introducing hole within the housing, **characterized in that**:

   the airflow introducing hole is formed on an upper surface of the housing facing upward when the fire alarm device is installed on a wall surface; and
   a partition wall is provided within the housing to isolate a space in which the sensor element is arranged and a space in which a sound element for outputting a warning sound is arranged.

2. The fire alarm device of claim 1, wherein the upper surface of the housing is formed of a slant surface making an acute angle with respect to the wall surface when the fire alarm device is installed on the wall surface.

3. The fire alarm device of claim 1 or 2, wherein the housing has a sound passing portion for passing therethrough a sound generated from the sound element, the sound passing portion provided on a front surface of the housing facing forward when the fire alarm device is installed on the wall surface, the fire alarm device further comprising: an attachment base member arranged at a rear side of the housing, the attachment base member being smaller in size than the housing.

FIG. 1

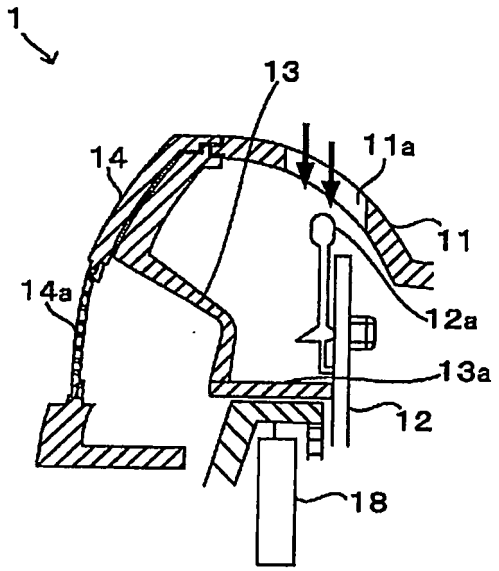


FIG. 2A

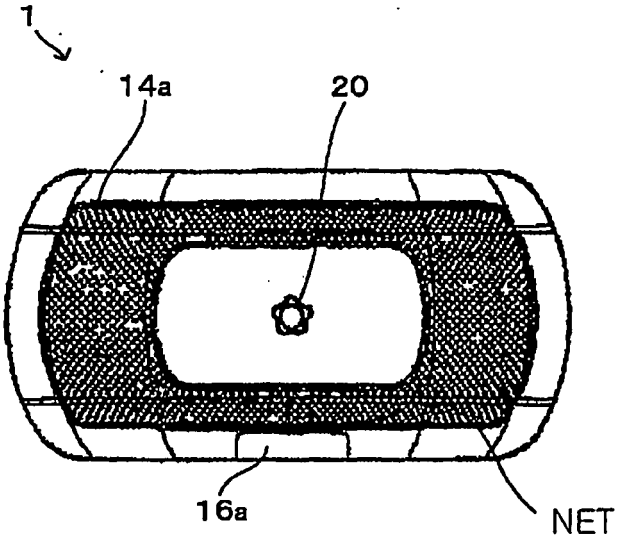


FIG. 2C

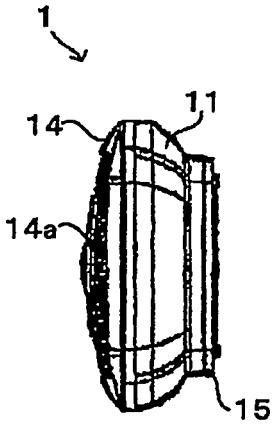


FIG. 2B

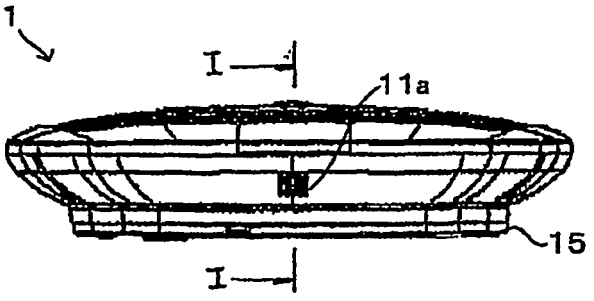


FIG. 3

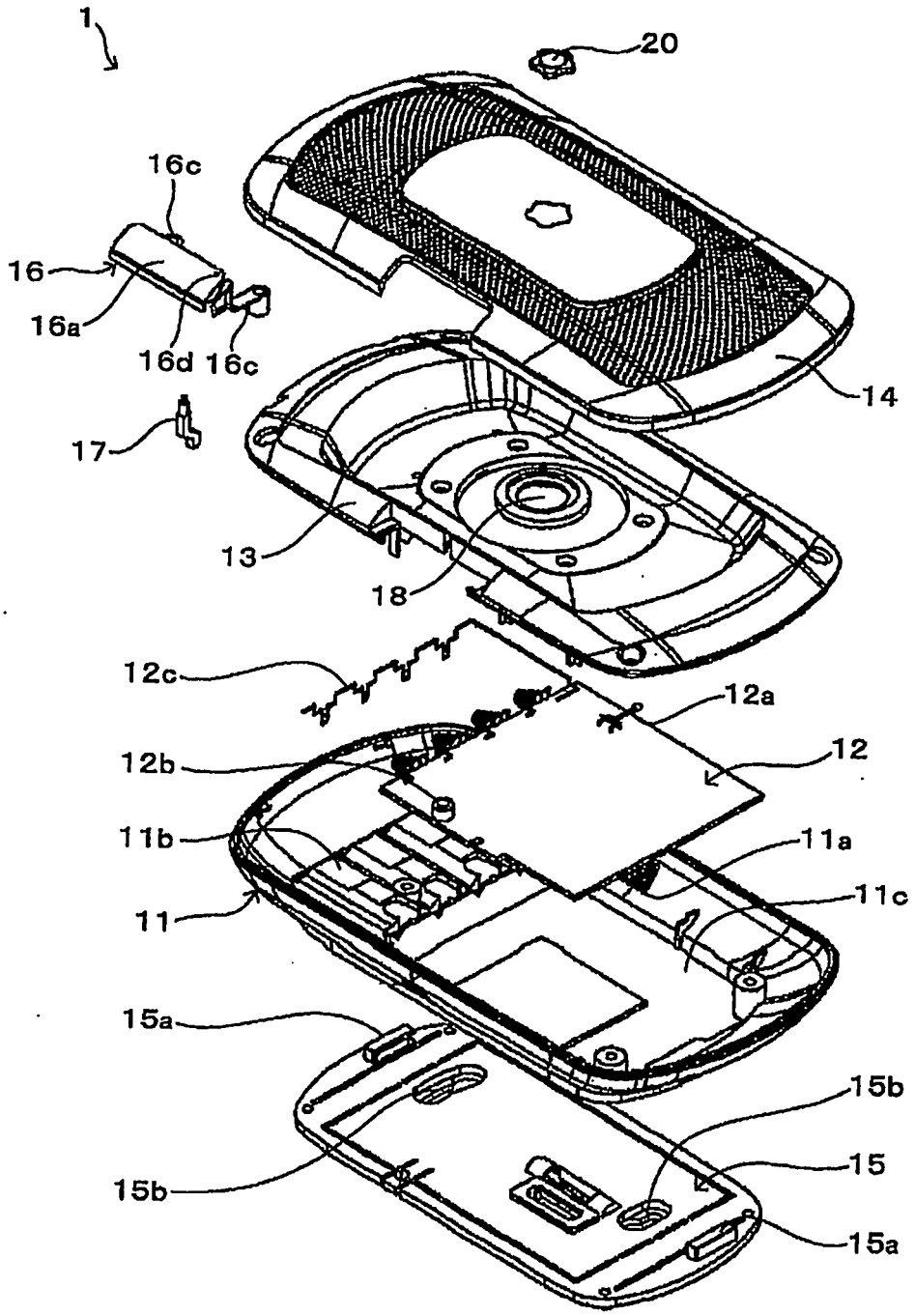
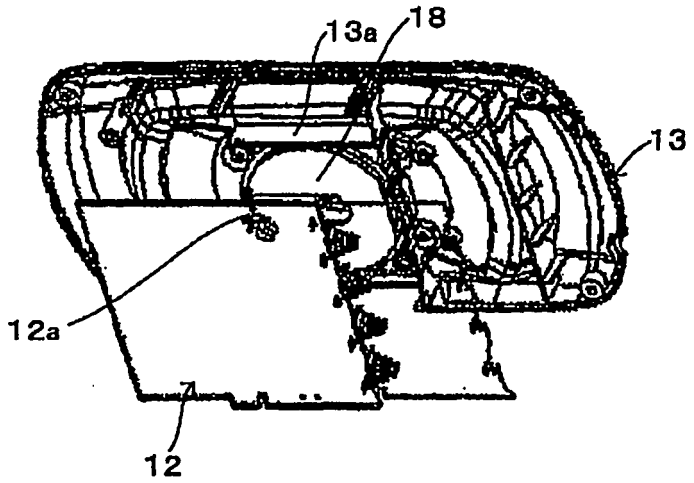

1
20
16c
16
16a
16d
16c
17
14
13
18
12c
12a
12b
12
11b
11a
11c
11
15a
15b
15
15b
15a

FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2010/001434

A. CLASSIFICATION OF SUBJECT MATTER
G08B17/00(2006.01)i, *G08B17/107*(2006.01)i

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)
G08B17/00, G08B17/107

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007-11829 A (Hochiki Corp.), 18 January 2007 (18.01.2007), fig. 1 to 3 (Family: none)	1-3
Y	JP 2008-310757 A (Panasonic Electric Works Co., Ltd.), 25 December 2008 (25.12.2008), fig. 2 (Family: none)	1-3
A	JP 2007-257107 A (Nohmi Bosai Ltd.), 04 October 2007 (04.10.2007), fig. 1c (Family: none)	1-3

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

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Date of the actual completion of the international search 02 September, 2010 (02.09.10)	Date of mailing of the international search report 14 September, 2010 (14.09.10)
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009031833 A **[0003] [0005]**