(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 093 730 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
26.08.2009 Bulletin 2009/35

(21) Application number: **07830271.8**

(22) Date of filing: **22.10.2007**

(51) Int Cl.:
G08B 17/00 *(2006.01)*

(86) International application number:
PCT/JP2007/070537

(87) International publication number:
WO 2008/065831 (05.06.2008 Gazette 2008/23)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

(30) Priority: **29.11.2006 JP 2006321307**

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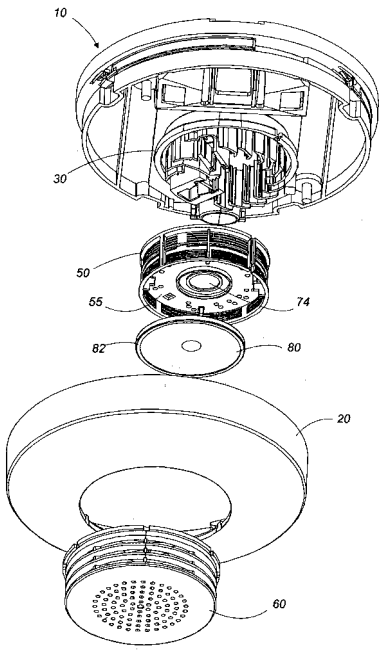
(54) FIRE DETECTOR

(57) A fire alarm incorporates a speaker issuing a fire alarm in the form of a voice. The speaker is held within an insect-proof net barrel surrounding a detection head that detects a fire condition. The speaker is attached to the detection head together with the insect-proof net barrel so as to be disposed below the detection head for spreading a fire alarm voice message into a room.

FIG. 3



EP 2 093 730 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a fire alarm that is installed in a room in a building and issues a fire alarm when detecting smoke or heat or the like.

BACKGROUND ART

[0002] In a conventional fire alarm that is installed in a room, as shown in Japanese Patent Publication No. 11-16064, a detection head is fixed to a base that is fixed to the ceiling, and smoke that is generated within the room enters the detection head, and fire determination is carried out depending on the smoke density. The detection head is enclosed by an insect-proof net barrel, to prevent the ingress of insects and other foreign matters into the detection head, to maintain accurate fire determination. This type of fire alarm is constituted to transmit a fire alarm signal to an external device when it is determined that a fire has occurred.

[0003] Recently there has been demand for residents to be accurately warned of the occurrence of a fire by voice, not by an ambiguous sound such as a buzzer or the like, when a fire occurs, so it is desirable that a speaker that issues the fire alarm in the form of voice be added, in particular it is desirable that the speaker be incorporated in the fire alarm itself.

DISCLOSURE OF THE INVENTION

[0004] In view of the above, the present invention has been achieved to provide a fire alarm which incorporates a speaker issuing a fire alarm voice. The fire alarm in accordance with the present invention includes a base adapted to be installed in a room of a premises, a detector head mounted on the base for detection of a fire condition; and an insect-proof net barrel covering the detection head. The detection head has a sensor which is disposed in an air of the room for sensing smoke or heat. The insect-proof net barrel surrounding the detection head is coupled at its upper end to the detection head or the base, and carries at its lower end the speaker. The base is provided with a circuit board which mounts electronic parts forming an alarm sound generation circuit that processes an output from the sensor to generate a fire alarm sound and issue the fire alarm sound from the speaker when the output satisfies a predetermined fire determination criteria. Thus, the speaker makes the use of the insect-proof net barrel and is be mounted to the detection head together with the insect-proof barrel such that the speaker is disposed below the detection head for spreading the fire alarm voice message into the room.

[0005] Preferably, the insect-proof net barrel has its upper and lower end opened, and is divided by a partition wall into an upper barrel and a lower barrel. In this instance, the speaker is accommodated within the lower barrel, while the upper barrel surrounds the detection head in an overlapping relation therewith. The upper barrel is formed in its peripheral wall with net holes for introducing the room air into the detection head.

[0006] The detection head is shaped to have a barrel having a number of slits for introduction of smoke generated in the room. Mounted within the detection head are a light source and the sensor configured to receive a light from the light source for detecting a smoke density based upon a variation of the intensity of the received light. The detection head has its lower opening closed by the partition wall. Accordingly, the insect-proof net barrel is given functions of preventing the entry of the light from below the detection head and holding the speaker, in addition to its insect-proof function, thereby reducing the number of components constituting the fire alarm.

[0007] In order to provide the speaker of open-type for improving efficiency, the partition wall of the insect-proof net barrel is preferably formed with a plurality of tiny holes which communicate with the interior of the detection head for making the speaker open back through the detection head. In this instance, the speaker conceals therebehind the tiny holes for preventing the light from passing into the detection head through the tine holes.

[0008] It is also preferred that the lower barrel of the insect-proof net barrel is formed in its peripheral wall with air vents. In this instance, the air vents can release the pressure developed behind the vibrator of the speaker.

[0009] It is possible to use the insect-proof net barrel without the partition wall. In such instance, the speaker held at the lower end of the insect-proof net barrel is used to close the lower end of the detection head.

[0010] The upper barrel of the insect-proof net barrel may be tapered to have its diameter smaller towards its lower end. In this instance, the insect-proof net barrel is preferably provided with a plurality of circumferential ribs extending circumferentially of the upper barrel, and a plurality of vertical ribs crossing with the circumferential ribs to form a lattice which defines therein net holes opened radially outwardly as well as axially downwardly of the insect-proof net barrel. With this arrangement, foreign matters such as insects entrapped to the lattice can be dropped downward by their weight or by the vibration of the speaker for preventing the entry into the detection head.

[0011] The fire alarm of the present invention is preferred to include a head cover (60) configured to surround the insect-proof net barrel and cover the speaker. The head cover is a top-opened barrel and is detachably at its top to the base. The head cover is formed in its periphery with windows through which the sensor is exposed to the room air, and is formed in its bottom with sound holes for passing therethrough the sound of the speaker. Thus, the insect-proof net barrel and the speaker can be concealed within the head cover to give an improved aesthetic appearance to the fire alarm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a perspective diagram of a fire alarm according to an embodiment of the present invention;
Fig. 2 is a front section diagram of the above fire alarm;
Fig. 3 is an exploded perspective diagram of the above fire alarm;
Fig. 4 is a bottom diagram showing the detection head of the above fire alarm;
Fig. 5 is a perspective diagram showing the insect-proof net barrel used in the above fire alarm;
Fig. 6 is a cross-section diagram showing the above insect-proof net barrel;
Fig. 7 is an exploded perspective diagram of the main parts of the above fire alarm;
Fig. 8 is an exploded front diagram of the main parts of the above fire alarm;
Fig. 9 is an exploded section diagram of the main parts of the above fire alarm;
Fig. 10 is an exploded perspective diagram showing a modified form of the insect-proof net barrel used in the above fire alarm; and
Fig. 11 is an enlarged perspective diagram showing a part of the above insect-proof net barrel.

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] A fire alarm according to an embodiment of the present invention is explained based on Figs. 1 through 9. The fire alarm is designed to determine whether a fire has occurred based on the density of smoke that occurs within a room, and is provided with a detection head 30, that measures the smoke density, on a base 10 that is fixed to the surface of the ceiling within a room. The fire alarm includes an insect-proof net barrel 50 that covers the periphery of the detection head 30, a head cover 60 that covers the periphery of the insect-proof net barrel 50, and a base cover 20 that covers the base 10 on the outside of the head cover 60, and a speaker 80 that sounds a fire alarm voice signal is retained on the bottom end of the insect-proof net barrel 50.

[0014] The base 10 includes a first base 11 that is fixed to the constructed surface of the building, and a second base 12 to which the detection head 30 is fixed, and the two are joined by screws to become integral. A circuit board 14 on which electronic parts are mounted to constitute a circuit for fire determination is fixed to the second base 12.

[0015] The detection head 30 is a cylindrical body provided with a plurality of slits 32 in the circumferential wall, and the top end is fixed to the circuit board 14. As shown in Fig. 4, the circumferential wall of the detection head 30 has a plurality of curved fins 31 arranged in the circumferential direction, with the slits formed between the fins. The fins 31 are constituted to guide air from outside to the inside through the slits 32, but to prevent the ingress of light. An LED 34 that is mounted on the circuit board 14 and a photodiode (PD) 35 that receives the light from the LED project into the interior space of the detection head 30, and light scattered by smoke that is guided into the detection head 30 is detected by the photodiode 35, and the density of the smoke is obtained from the strength of the light. The smoke density is detected by a detection circuit that is realized by an IC chip 15 mounted on the circuit board 14. This detection circuit is configured to output the fire alarm signal when the detection circuit detects the smoke density which exceeds a predetermined threshold value. A voice generation circuit is likewise realized by the IC chip. The voice generation circuit generates a fire alarm message on the basis of the fire alarm signal, and outputs the voice from the speaker.

[0016] The LED 34, the photodiode 36, and a battery 18 that supplies electrical power to the IC chip 15 are retained on the second base 12. A circuit is also formed in the IC chip 15 that monitors the capacity of the battery 18, and when the capacity of the battery is less than a predetermined value, the circuit generates a battery alarm signal by voice, and the battery alarm signal is output from the speaker 80.

[0017] As shown in Fig. 5 and Fig. 6, the insect-proof net barrel 50 is formed in a cylindrical shape from resin with both the top and bottom ends open, and is divided into an upper barrel 51 and a lower barrel 52 by a partition wall 55 formed in the interior. A projection 53 is formed in the top end of the upper barrel 51. This projection 53 is engaged with a catch 33 which is provided in the outer periphery of the detection head 30, so that the insect-proof net barrel 50 is removably attached to the detection head 30, and the upper barrel 51 covers the area around the lower end of the detection head 30. A plurality of net holes 54 that communicate with the slits 32 of the detection head 30 is formed in the circumferential wall of the upper barrel 51, so that air within the room proceeds into the interior space of the detection head 30 via the net holes 54.

[0018] The lower barrel 52 is provided with a structure to house the speaker 80. A voice coil case that projects from the rear surface of the speaker 80 is fixed and engaged to an installation recess 74 formed in the center of the partition wall 55, and a circular frame 82 that surrounds the outer periphery of the speaker 80 is fixed to the internal wall of the lower barrel 52. A plurality of tiny holes 58 that communicates with the space within the detection head 30 is formed in the partition wall 55, so that by opening the back of the speaker 80 to the outside via the detection head 30 the speaker becomes an open-type and the efficiency is increased. Also, projections 56, 57 that project into the detection head 30 are formed on the partition wall 55, and the projections are combined with an LED base 36 and a PD base 37 of the detection head 30, to constitute a guide for the light emitted from the LED and a mask for the light received by the PD respectively. In other words, the projection 56, 57 coop-

erate with members inside the detection head 30 to construct the optical structure for detection of smoke by the detection head 30.The lower barrel 52 is provided at its circumferential wall with air bents 59 which open to the rear side of the speaker 80. Sound pressure is developed behind the speaker 80. The air vents 59 cooperate with tiny holes 58 to release the sound pressure to the outside. A lead wire (not shown on the drawings) that extends from the speaker 80 passes through a part of the tiny holes 58 and is connected electrically to the circuit board 14, for outputting the fire alarm messages and low battery alarms generated by the voice generation circuit.

[0019] The head cover 60 is a cylindrical body which covers the insect-proof net barrel 50. The head cover 60 has a top end and the bottom end. The top end of the head cover is removably fitted to the peripheral edge of a central aperture 22 of the base cover 20 which covers the bottom surface of the base 10. The bottom end of the head cover 60 is formed with the bottom wall which conceals the speaker 80. A plurality of sound holes 62 is formed in the bottom wall of the head cover 60, and the voice output of the speaker is emitted into the room via the sound holes 62. The circumferential wall of the head cover 60 is formed with windows 64. These windows 64 are communicated with the slits 32 of the detection head 30 via the net holes 54 of the upper barrel 51 through the net holes 54, and also are communicated with the air vents 59 of the lower barrel 52 through the net holes 54.

[0020] In the embodiment shown in the drawings, an example is shown in which a gap is provided between the outer periphery of the speaker 80 and the inside wall of the insect-proof net barrel 50, and the speaker 80 is fixed to the insect-proof net barrel 50, but the circular frame that surrounds the outer periphery of the speaker 80 may be in close contact with the inside wall of the lower barrel 52 of the insect-proof net barrel 50.

[0021] Fig. 10 shows a modified example of the insect-proof net barrel that can be applied to the above embodiment. Similar to the above embodiment, this insect-proof net barrel 50A is a cylinder partitioned internally into an upper barrel 51 A and a lower barrel 52A by a partition wall 55A, and the upper barrel 51 A is tapered to have its diameter smaller towards its lower end. The upper barrel 51A is provided with a plurality of circumferential ribs 71 extending circumferentially, and a plurality of vertical ribs 72 crossing with the circumferential ribs to form a lattice, and net holes 54A are formed in the lattice. By giving the upper barrel 51 A a tapered shape, each net hole 54A is opened in the radial direction and in the axial downward direction of the insect-proof net barrel 50A as shown in Fig. 11. Therefore insects and dust that adhere to the lattice can be made to fall down by applying vibrations to the insect-proof net barrel 50A so it is possible to prevent the net holes 54A from becoming blocked. These insects and dust can also be expected to fall down due to gravity, but they can be effectively removed from the insect-proof net barrel 50A by external vibrations. In particular, by using the speaker 80, preferably the insect-proof net barrel 50A is vibrated by the sound generated by the speaker. In this case, in order to make the sound pressure developed behind the speaker 80 act on the partition wall 55A, as shown in Fig. 10, preferably holes that communicate with the detection head are not provided in the partition wall 55A. In order to periodically clean the insect-proof net barrel 50A, an electrical circuit for periodically outputting an appropriate sound from the speaker may be provided separately from the voice generation circuit, and in this case the sound may be outside the audible range, instead of a voice. As shown in the drawings, air vents 59A that open into the rear surface of the speaker 80 may be provided in the circumferential wall of the lower barrel 52A, to make the speaker an open-type, but in order to effectively apply vibrations to the insect-proof net barrel 50A, the air vents 59A may be eliminated to give an enclosed speaker structure.

[0022] In this modified form, the speaker 80 is retained by the circular frame 82, and by closely engaging the circular frame 82 within the lower barrel, the speaker 80 is retained within the insect-proof net barrel 50A. The circular frame 82 has a cover 84 that covers the vibrator of the speaker 80, and sound holes 86 are formed in the cover 84.

Claims

1. A fire alarm comprising:

a base adapted to be installed in a room of a premises;
a detector head mounted on said base for detection of a fire condition; and
an insect-proof net barrel covering said detection head,

wherein said detection head has a sensor which is disposed in an air of the room for sensing smoke or heat,
said insect-proof net barrel surrounds said detection head, and is coupled at its upper end to said detection head or said base, while carrying at its lower end a speaker,
said base is provided with a circuit board which mounts electronic parts forming an alarm sound generation circuit that processes an output from said sensor to generate a fire alarm sound and issue said fire alarm sound from said speaker when said output satisfies a predetermined fire determination criteria.

2. A fire alarm as set forth in claim 1, wherein
said insect-proof net barrel has its upper and lower end opened, and is divided by a partition wall into an upper barrel and a lower barrel,
said upper barrel surrounding said detection head,
said lower barrel accommodating therein said speaker, and

said upper barrel being formed in its peripheral wall with net holes for introducing the room air into said detection head.

3. A fire alarm as set forth in claim 2, wherein
said detection head is shaped to have a barrel having a number of slits for introduction of smoke generated in the room,
said sensor being configured to receive a light from a light source disposed in said detection head so as to detect a smoke density based upon a variation of the intensity of the received light, and
said detection head having its lower opening closed by said partition wall.

4. A fire alarm as set forth in claim 3, wherein
said partition wall is formed with a plurality of tiny holes communicating with the interior of said detection head, said tiny holes being hidden behind said speaker in order to prevent the light from entering into the detection head through said tine holes.

5. A fire alarm as set forth in claim 2, wherein
said lower barrel is formed in its peripheral wall with air vents.

6. A fire alarm as set forth in claim 1, wherein
said insect-proof net barrel is shaped to have its upper and lower end opened,
said speaker being accommodated within a lower end of said insect-proof net barrel so as be held herein.

7. A fire alarm as set forth in claim 2, wherein
said upper barrel is tapered to have its diameter smaller towards its lower end,
said insect-proof net barrel being provided with a plurality of circumferential ribs extending circumferentially of said upper barrel, and a plurality of vertical ribs crossing with said circumferential ribs to form a lattice which defines therein net holes opened radially outwardly as well as axially downwardly of said insect-proof net barrel.

8. A fire alarm as set forth in claim 1, further including:

a head cover configured to surround said insect-proof net barrel and cover said speaker, said head cover being in the form of a top-opened and bottom-closed barrel, and being detachably coupled at its top with said base so as to expose said sensor to the room air through windows formed in the periphery of said head cover,
said head cover being formed in its bottom with sound holes for passing therethrough the sound from said speaker.

FIG. 1

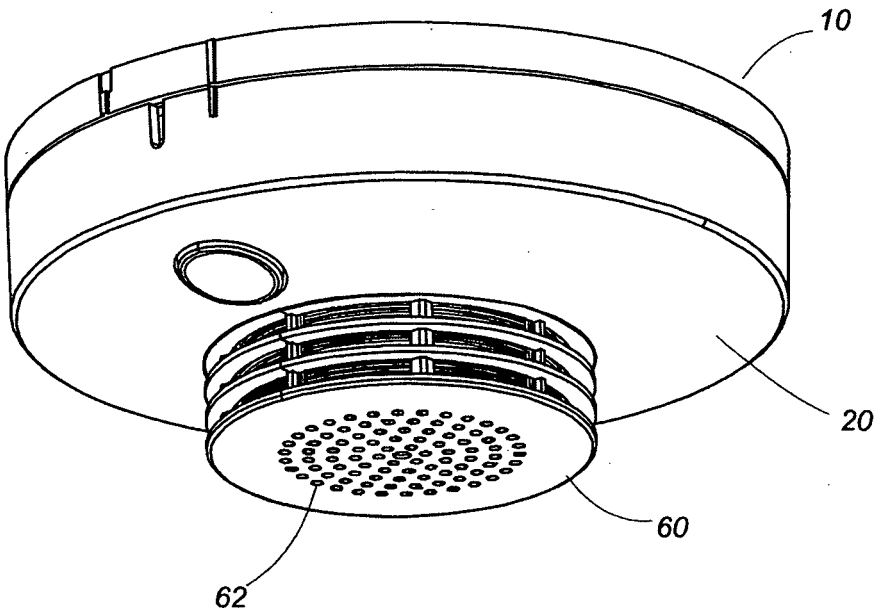


FIG. 2

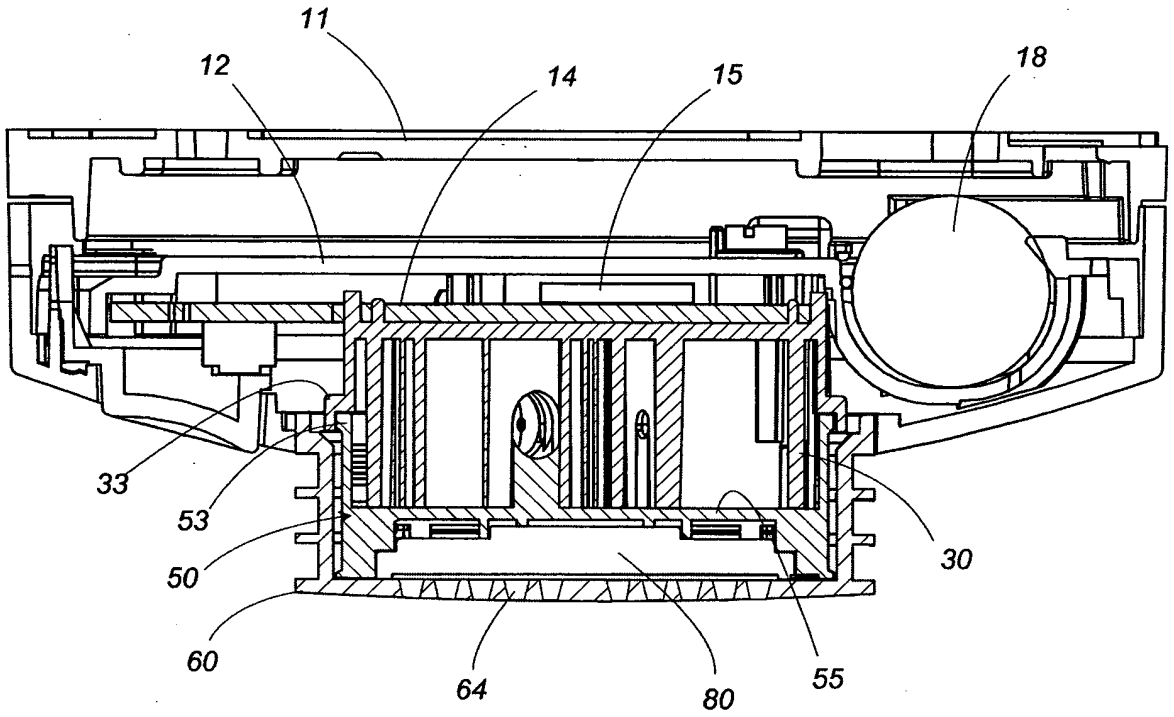


FIG. 3

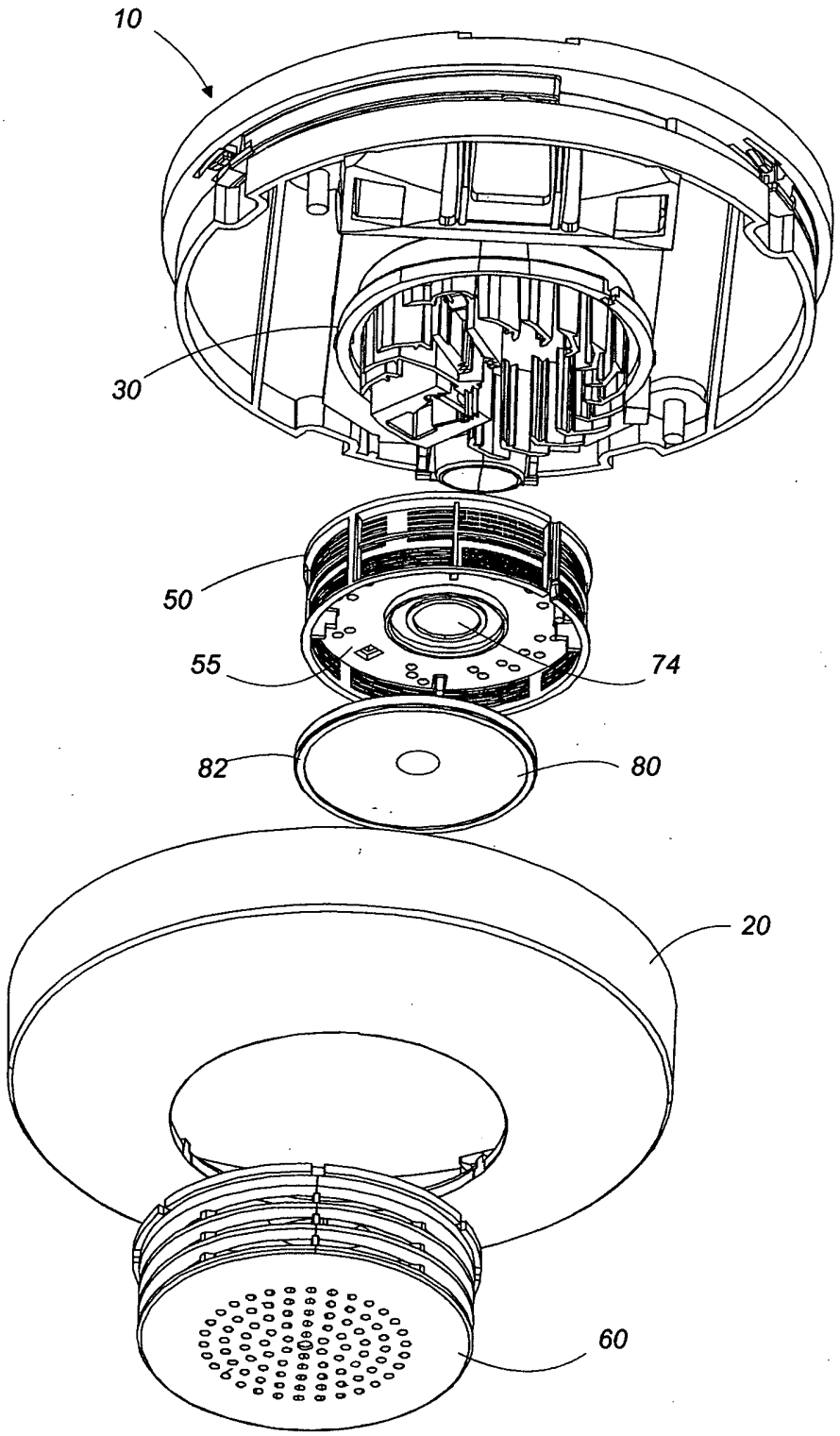


FIG. 4

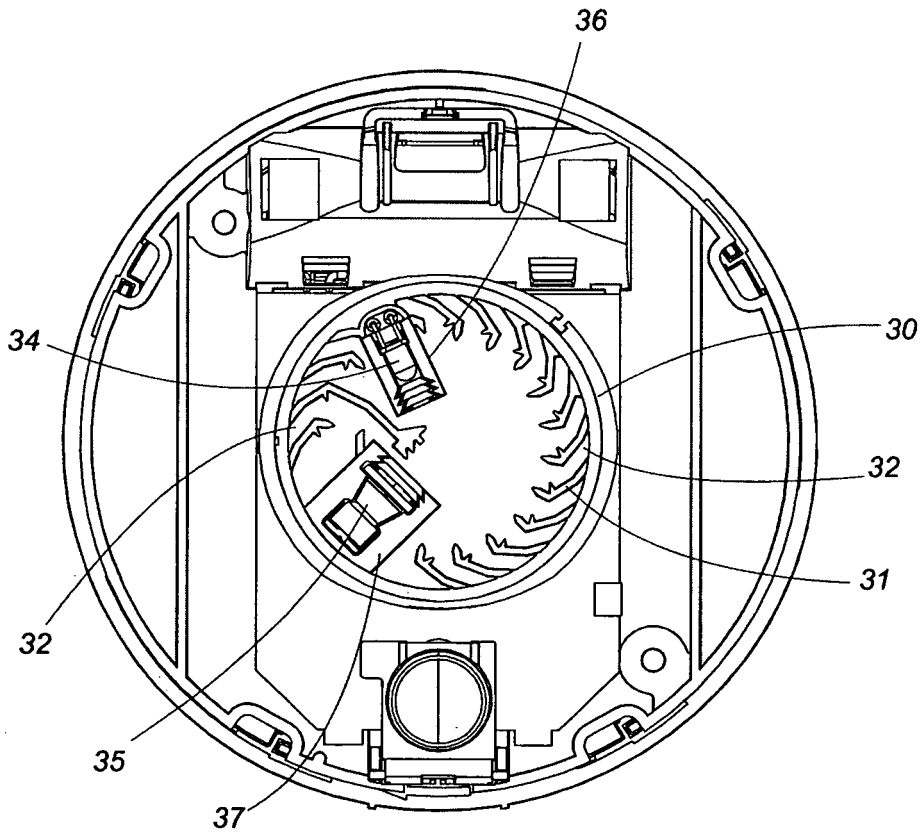


FIG. 5

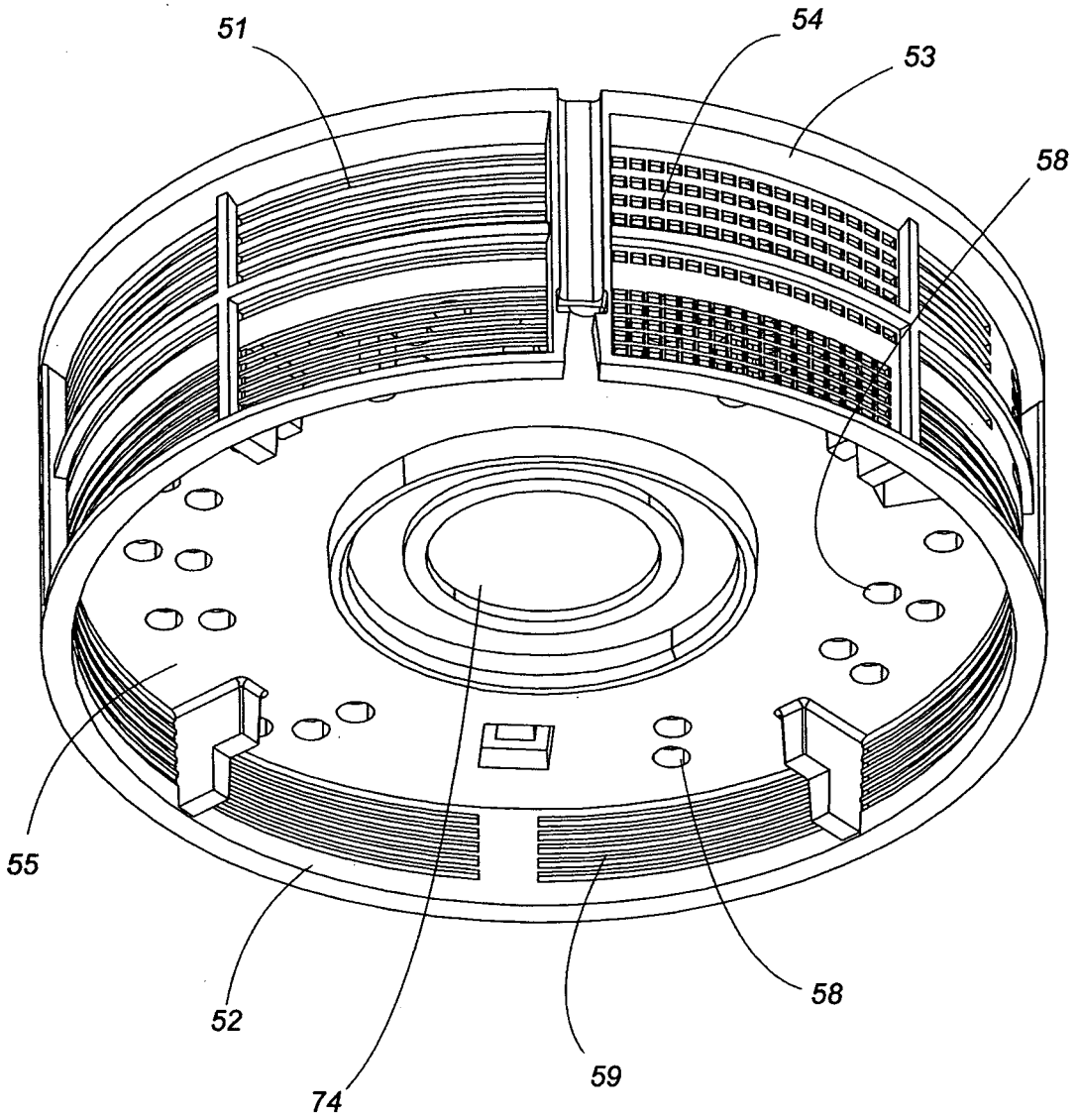


FIG. 6

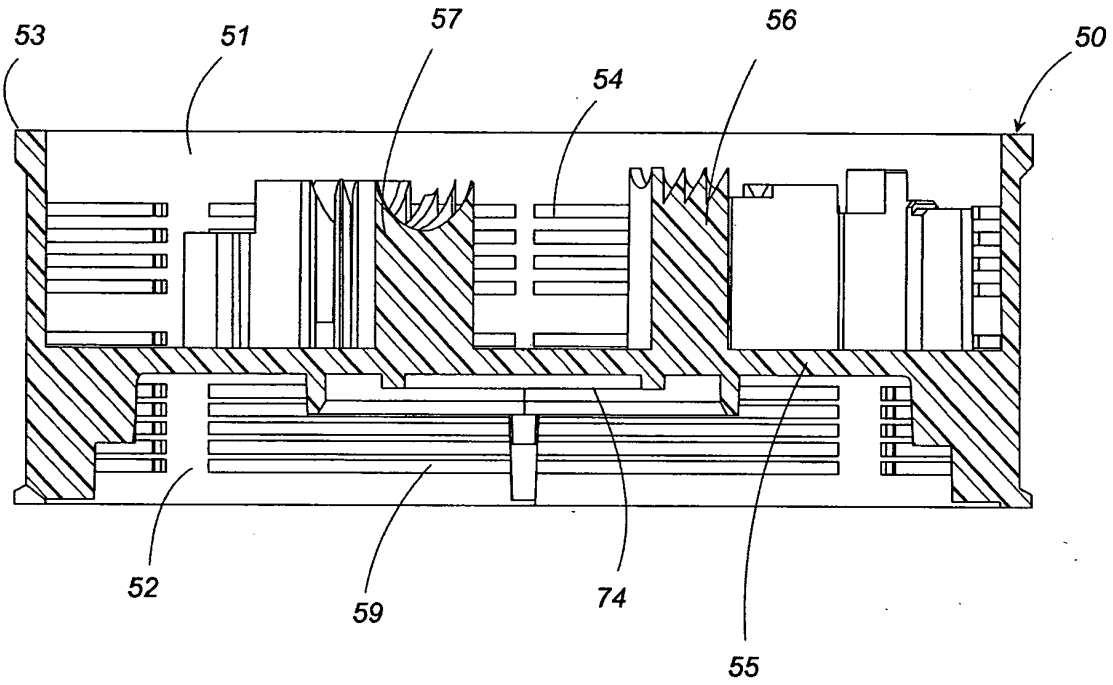


FIG. 7

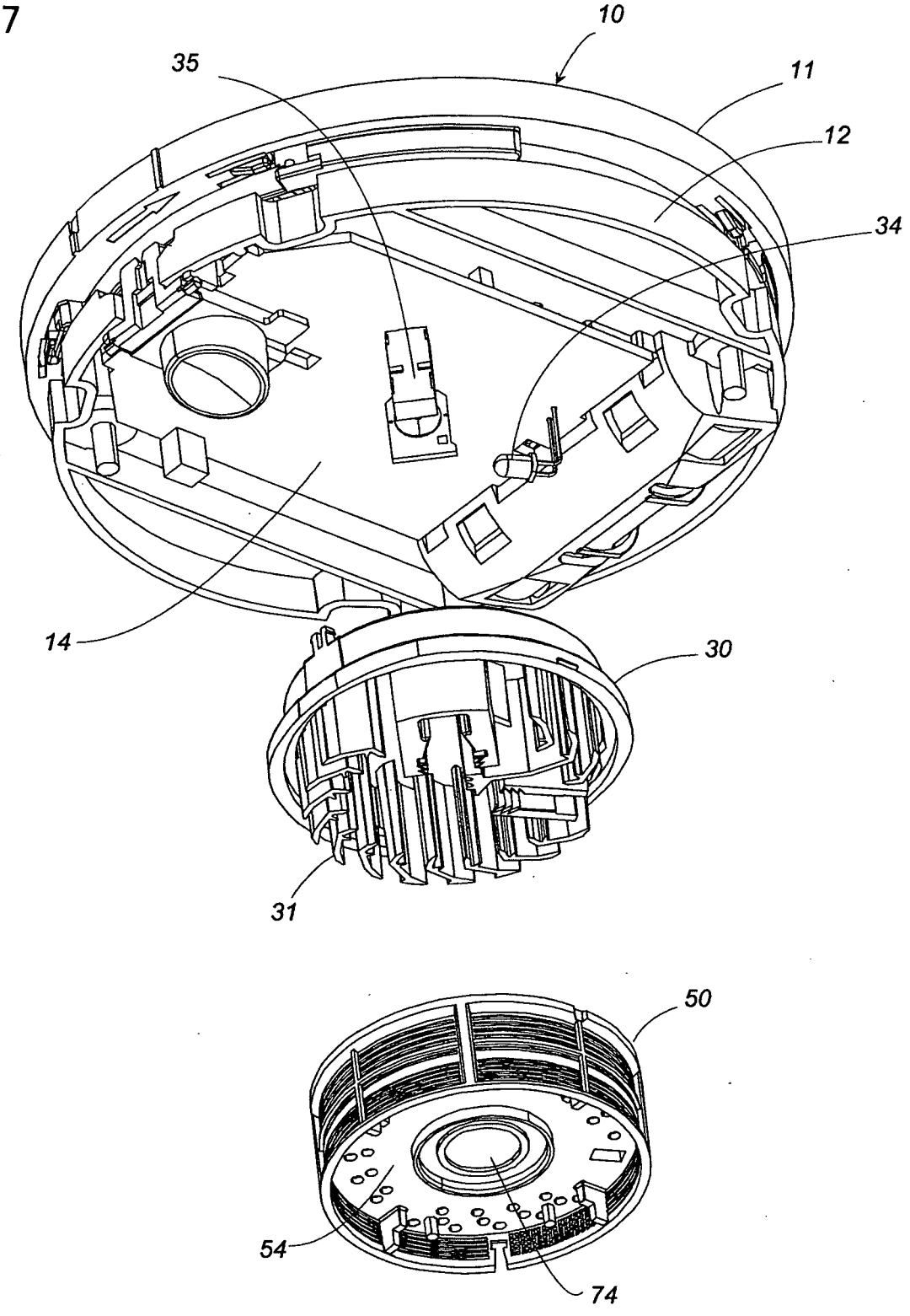


FIG. 8

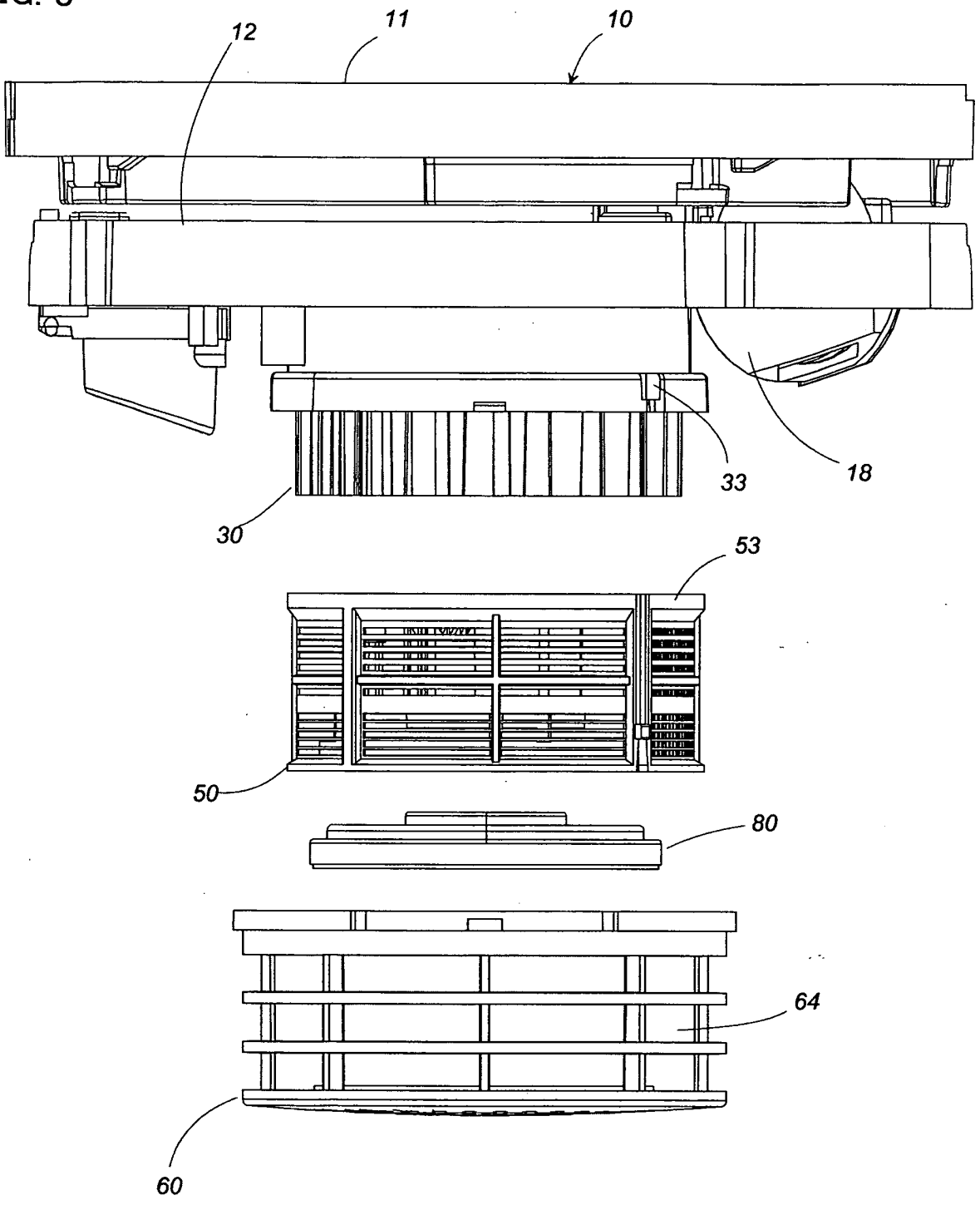


FIG. 9

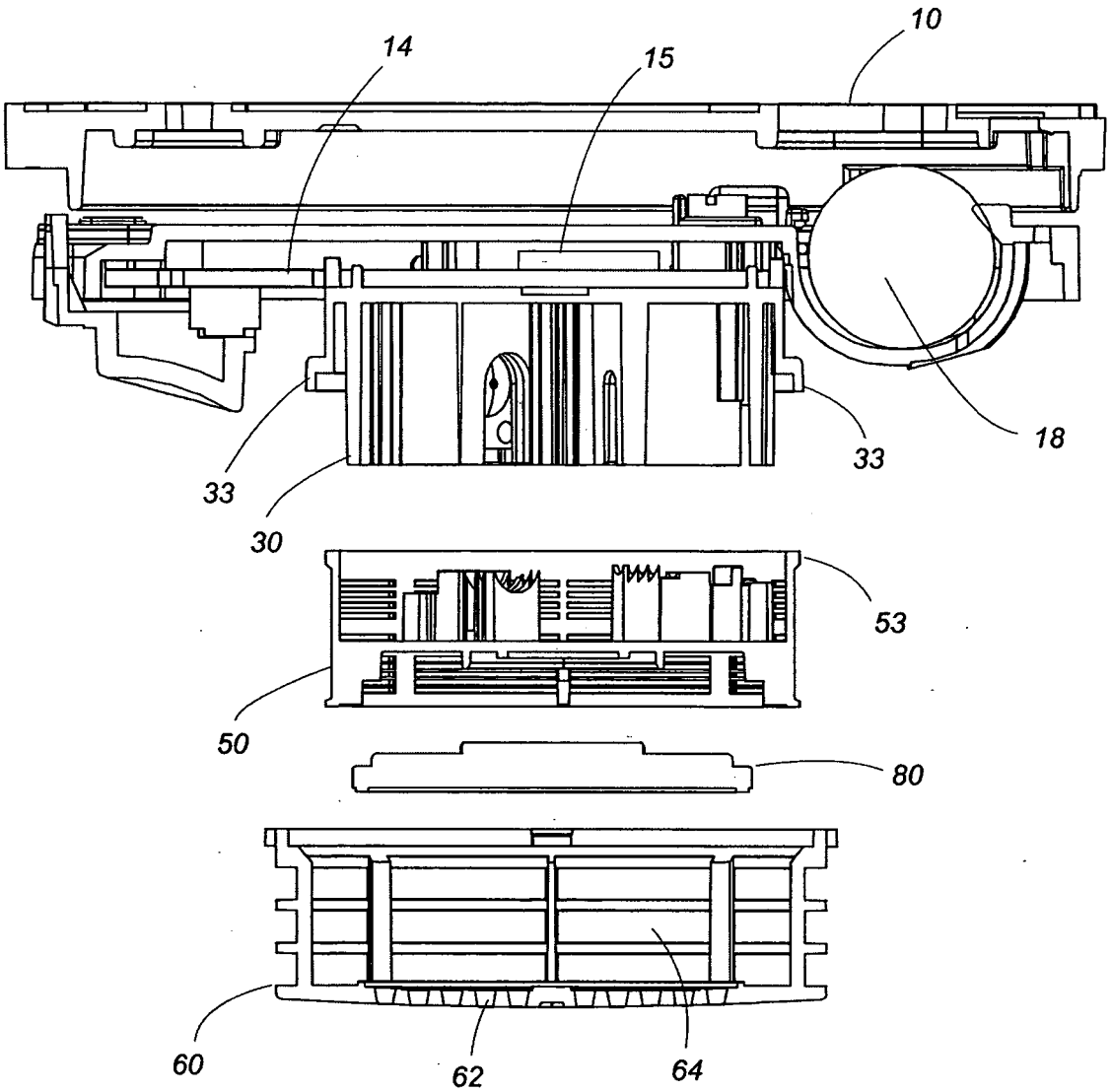


FIG. 10

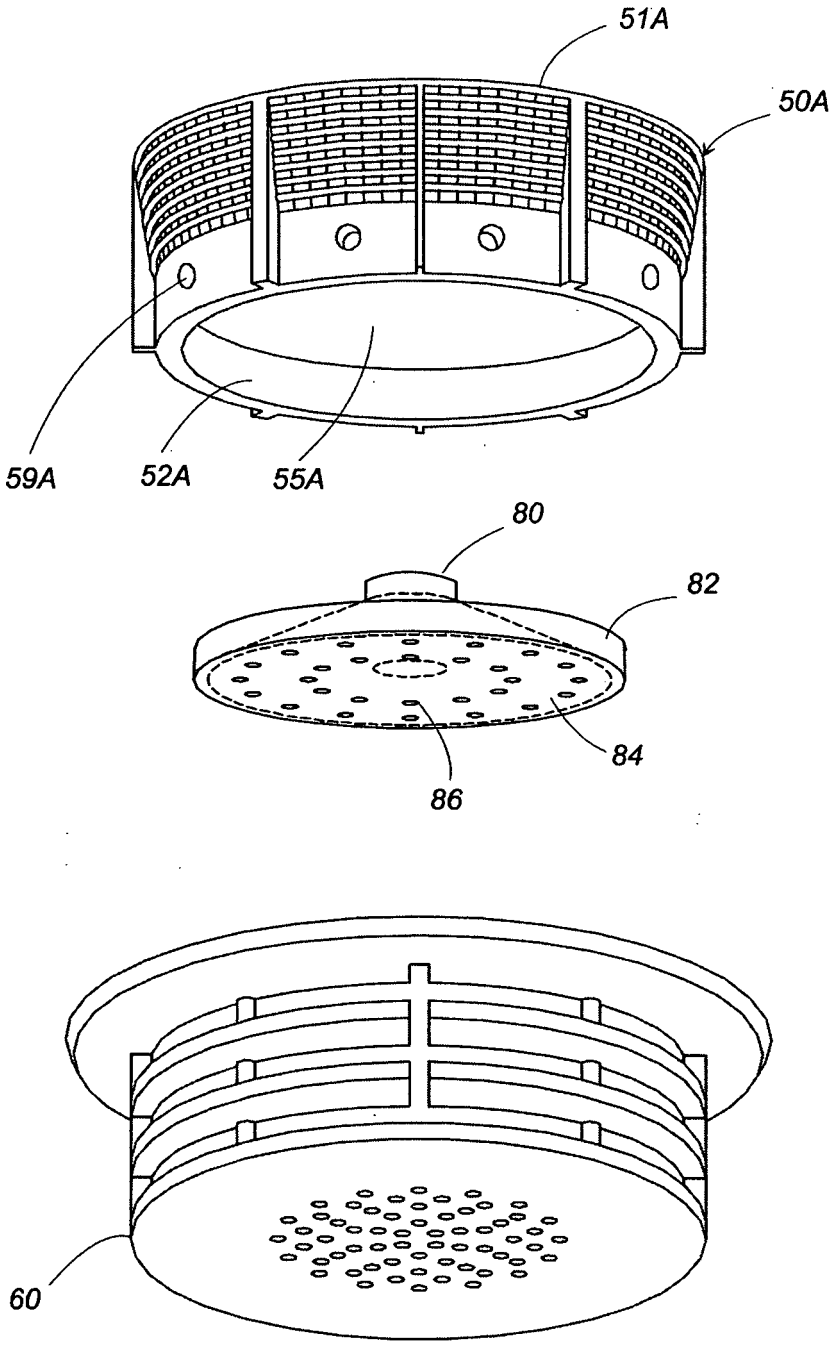
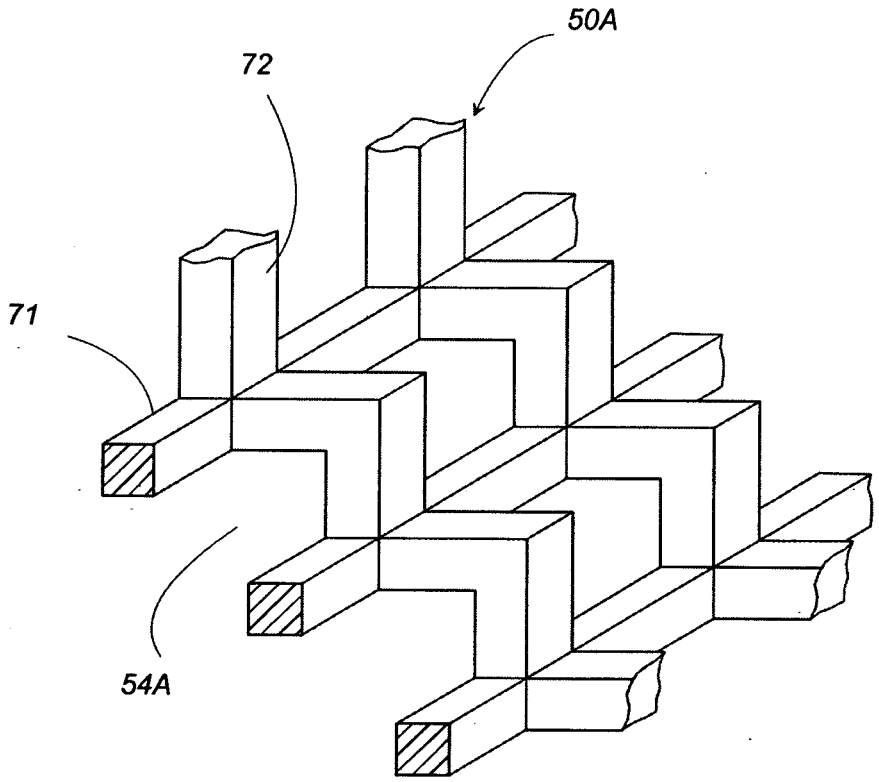


FIG. 11



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/070537

A. CLASSIFICATION OF SUBJECT MATTER
G08B17/00(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

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 1996-2007
Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

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 A	JP 2003-281641 A (Matsushita Electric Works, Ltd.), 03 October, 2003 (03.10.03), Par. Nos. [0031] to [0042]; Fig. 1 (Family: none)	1-3,5-8 4
Y	JP 2006-146305 A (Nohmi Bosai Ltd.), 08 June, 2006 (08.06.06), Par. No. [0015] (Family: none)	1-3,5-8
Y	JP 7-105461 A (Hochiki Corp.), 21 April, 1995 (21.04.95), Par. No. [0014]; Fig. 5 (Family: none)	7

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

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
31 October, 2007 (31.10.07)	13 November, 2007 (13.11.07)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/070537

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2005-309798 A (Hochiki Corp.), 04 November, 2005 (04.11.05), Fig. 4 (Family: none)	7

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 11016064 A **[0002]**