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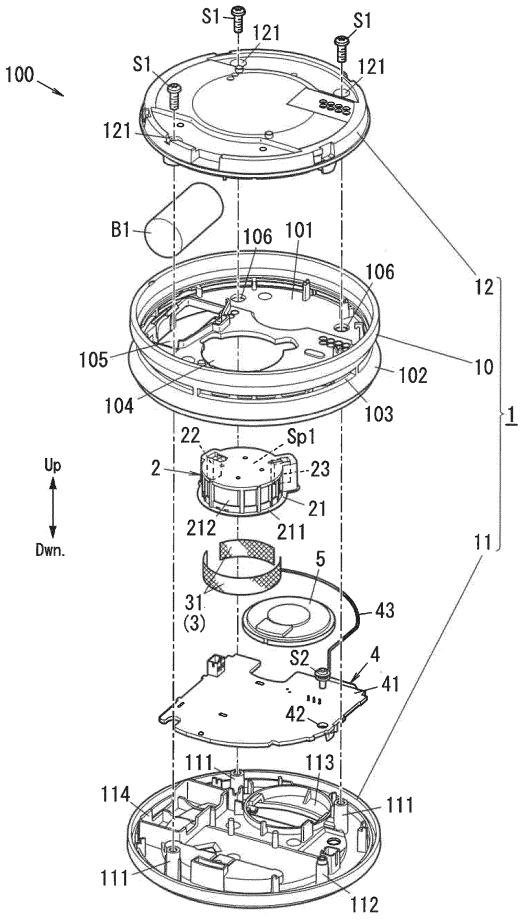
(54) SMOKE DETECTOR

(57) The present disclosure provides a smoke detector that reduces the chances of making erroneous detection. A smoke detector (100) includes a housing (1), a sensor block (2) of a photoelectric type, and a repellent structure (3). The housing (1) has an opening (103) that allows smoke to flow into the housing (1) from outside of the housing (1). The sensor block (2) has a detection space (Spl) inside the housing (1) and detects any smoke in the detection space (Spl). The repellent structure (3) repels invasion of a particular insect (Al) into at least the detection space (Spl). The particular insect (Al) to be repelled by the repellent structure (3) lacks the ability to fly by itself, and therefore, has no choice but to move either by creeping or by being carried on the wind.

FIG. 1



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Description

Technical Field

[0001] The present disclosure generally relates to a smoke detector and more particularly relates to a photoelectric smoke detector.

Background Art

[0002] JP 2010-257258 A discloses a smoke detector. The smoke detector includes a smoke detecting unit for detecting smoke optically by using a light-emitting unit and a photodetector unit. The smoke detecting unit includes an optical base that houses the light-emitting unit and the photodetector unit. The optical base is covered with an insect net.

[0003] The smoke detector of JP 2010-257258 A may allow a particular insect to invade the smoke detecting unit through the insect net. The invasion of the particular insect could cause the smoke detector to make erroneous detection.

Summary of Invention

[0004] It is therefore an object of the present disclosure to provide a smoke detector that reduces the chances of making erroneous detection.

[0005] A smoke detector according to an aspect of the present disclosure includes a housing, a sensor block of a photoelectric type, and a repellent structure. The housing has an opening that allows smoke to flow into the housing from outside of the housing. The sensor block has a detection space inside the housing and detects any smoke in the detection space. The repellent structure repels invasion of a particular insect into at least the detection space. The particular insect to be repelled by the repellent structure lacks the ability to fly by itself, and therefore, has no choice but to move either by creeping or by being carried on the wind.

Brief Description of Drawings

[0006]

FIG. 1 is an exploded perspective view of a smoke detector according to an exemplary embodiment of the present disclosure as viewed from above the smoke detector;

FIG. 2 is a perspective view illustrating the appearance of the smoke detector as viewed above the smoke detector;

FIG. 3 is a schematic representation of an insect net for use in the smoke detector;

FIG. 4 is a perspective view illustrating the appearance of a smoke detector according to a first variation of the exemplary embodiment of the present disclosure as viewed from above the smoke detector with a second cover thereof removed;

FIG. 5 is a cross-sectional view illustrating principal parts of the smoke detector;

FIG. 6 is a perspective view illustrating the appearance of a smoke detector with an alternative configuration as viewed from above the smoke detector with a second cover thereof removed;

FIG. 7 is a cross-sectional view of a principal part of a smoke detector according to a second variation of the exemplary embodiment of the present disclosure;

FIG. 8 is a cross-sectional view illustrating an alternative configuration for the smoke detector;

FIG 9 is a cross-sectional view of a principal part of a smoke detector according to a third variation of the exemplary embodiment of the present disclosure;

FIG. 10 is a perspective view illustrating the appearance of a smoke detector according to a fourth variation of the exemplary embodiment of the present disclosure as viewed from above the smoke detector with a second cover thereof removed;

FIG. 11 is a cross-sectional view of a principal part of a smoke detector according to a fifth variation of the exemplary embodiment of the present disclosure;

FIG. 12 is a cross-sectional view of a principal part of a smoke detector according to a sixth variation of the exemplary embodiment of the present disclosure; and

FIG. 13 is a cross-sectional view of a principal part of a smoke detector according to a seventh variation of the exemplary embodiment of the present disclosure.

Description of Embodiments

(Overview)

[0007] A smoke detector 100 (see FIG. 1) according to an exemplary embodiment is a type of disaster prevention equipment for alerting, when detecting any smoke involved with a fire, for example, people to the outbreak of the fire. That is to say, when smoke is present due to the outbreak of a disaster such as a fire, the smoke detector 100 detects the smoke and alerts people to the outbreak of the disaster by either sounding an alarm or activating other devices via instant communication with those devices. As used herein, the "disaster prevention equipment" refers to a type of equipment installed in various types of facilities for the purpose of preventing a disaster such as a fire, preventing the spread of damage caused by the disaster, or recovering from the damage caused by the disaster.

[0008] The smoke detector 100 is installed and used in any of various types of facilities. Examples of those facilities in which the smoke detector 100 according to this embodiment may be installed include non-dwelling houses such as hotels, office buildings, schools, welfare

facilities, commercial facilities, theme parks, hospitals, and factories. However, this is only an example of the present disclosure and should not be construed as limiting. The smoke detector 100 may naturally be used in dwelling houses including multi-family dwelling houses and single-family dwelling houses. In any case, the smoke detector 100 may be installed in any of these various facilities to be mounted on the ceiling, a wall, or any other building component in, for example, a room, a hallway, or stairs of the facility.

[0009] As shown in FIGS. 1 and 2, the smoke detector 100 includes a housing 1, a sensor block 2 of a photoelectric type, and a repellent structure 3. In the housing 1, various parts including the sensor block 2 are housed.

[0010] The housing 1 has at least one opening 103 that allows smoke to flow into the housing 1 from outside of the housing 1. That is to say, when smoke is present due to the outbreak of a fire, for example, the smoke flows into the housing 1 through the opening 103.

[0011] The sensor block 2 has a detection space Sp1 inside the housing 1 and detects any smoke in the detection space Sp1. That is to say, the smoke that has flowed into the housing 1 is taken in the detection space Sp1 inside the sensor block 2 provided in the housing 1. This allows the sensor block 2 of the photoelectric type to detect the smoke in the detection space Sp1.

[0012] As used herein, the adjective "photoelectric" refers to a method for detecting, using a light-emitting unit 22 and a photodetector unit 23 provided for the sensor block 2, smoke based on a variation in the intensity of either light reflected from the smoke in the detection space Sp1 or light transmitted through the detection space Sp1. In this embodiment, the light-emitting unit 22 emits light toward the detection space Sp1. The photodetector unit 23 is arranged at a position where the light emitted from the light-emitting unit 22 is not incident directly but the light scattered by the smoke in the detection space Sp1 is incident. Thus, when no smoke is present in the detection space Sp1, the photodetector unit 23 does not receive the light emitted from the light-emitting unit 22. On the other hand, when any smoke is present in the detection space Sp1, the photodetector unit 23 receives the light emitted from the light-emitting unit 22 and scattered by the smoke (i.e., receives the scattered light). This allows the smoke detector 100 to detect the presence of smoke in the detection space Sp1 depending on whether or not the photodetector unit 23 receives any light.

[0013] The repellent structure 3 repels the invasion of a particular insect A1 (see FIG. 3) into at least the detection space Sp1. The repellent structure 3 may be a structure for repelling the invasion of a particular insect A1 into the detection space Sp1 by preventing the particular insect A1 from entering the housing 1 or may also be a structure for repelling the invasion, into the detection space Sp1, of the particular insect A1 that has managed to enter the housing 1.

[0014] As used herein, the "particular insect" refer to a species of insects that lack the ability to fly by themselves, and therefore, have no choice but to move either by creeping or being carried on the wind. Specifically, the particular insect A1 has an elongate body and, in most cases, has a body length of around 2 mm. Such particular insects A1 include winged ones and wingless ones. A winged particular insect A1 may have, for example, two pairs of elongate wings, each of which has long ciliation. The particular insects A1 go through hemimetabolous metamorphosis. Also, most of those particular insects A1 suck plant juices. However, some detritivore species and predacious species are also known. In the example illustrated in FIG. 3, the particular insect A1 is a winged one. However, wingless ones are also known. Note that the particular insect A1 shown in FIG. 3 only represents a general winged insect and does not directly represent an actual particular insect A1.

[0015] The particular insect A1 may move by creeping or be carried on the wind to either put itself on the ceiling or wall on which the smoke detector 100 is mounted or invade the housing 1 through the opening 103. Were it not for the repellent structure 3 for the smoke detector 100, the particular insect A1 could move by creeping on the ceiling, wall, or an inner wall of the housing 1 and eventually invade the detection space Sp1. If the particular insect A1 invaded the detection space Sp1, the light emitted from the light-emitting unit 22 might be reflected and scattered by the particular insect A1 to have the scattered light received by the photodetector unit 23. In that case, the smoke detector 100 could make erroneous detection even though no smoke is actually present in the detection space Sp1.

[0016] Meanwhile, according to this embodiment, the smoke detector 100 includes the repellent structure 3 for repelling the invasion of the particular insect A1 into the detection space Sp1. Thus, the repellent structure 3 may reduce the chances of the particular insects A1 invading the detection space Sp1. Consequently, this embodiment achieves the advantage of reducing the chances of making erroneous detection due to the invasion of a particular insect A1.

(2) Details

[0017] The smoke detector 100 according to this embodiment will be described in further detail. In the embodiment to be described below, the smoke detector 100 is supposed to be mounted on the ceiling of a facility, for example. In the following description, a direction perpendicular to the horizontal plane with the smoke detector 100 mounted on the ceiling will be hereinafter referred to as "upward/downward direction" with the direction pointing from the smoke detector 100 toward the ceiling defined as an "upward direction" and the opposite direction defined as a "downward direction." Note that the arrows indicating the "upward/downward directions" on the drawings are just shown there for convenience sake and are actually insubstantial ones. Also, these directions

should not be construed as defining the direction in which the smoke detector 100 is used (or mounted).

[0018] Furthermore, the drawings to be referred to in the following description of embodiments all illustrate the configuration of the smoke detector 100 schematically. That is to say, the ratio of the dimensions (including thicknesses) of respective constituent elements illustrated on the drawings does not always reflect their actual dimensional ratio.

[0019] As shown in FIGS. 1 and 2, the smoke detector 100 includes the housing 1, the sensor block 2, and a sound emission unit 5. In this embodiment, the smoke detector 100 further includes a circuit block 4 and a battery B1. Note that the battery B1 does not have to be one of constituent elements of the smoke detector 100.

[0020] The housing 1 has the shape of a circular disk in a plan view. The housing 1 is a molded product made of a synthetic resin. The housing 1 has a body 10, a first cover 11, and a second cover 12. The housing 1 is formed by joining the first cover 11 and the second cover 12 with the body 10. The second cover 12 is fixed onto an installation surface (e.g., a ceiling surface 200 (see FIG. 5)). Strictly speaking, the second cover 12 is fixed onto the installation surface not directly but indirectly by being secured onto a mounting base fixed on the installation surface.

[0021] The body 10 is made up of a bottom wall 101 and a peripheral wall 102. The bottom wall 101 has a circular shape in a plan view and has a first through hole 104, a second through hole 105, and a plurality of (e.g., three in this example) insert holes 106. The first through hole 104 runs through the bottom wall 101 along the thickness thereof (i.e., in the upward/downward direction) and has the same circular shape as the profile of a sensor case 21 of the sensor block 2 in a plan view. The sensor case 21 of the sensor block 2 is inserted into the first through hole 104 from under the body 10. The second through hole 105 also runs through the bottom wall 101 along the thickness thereof (i.e., in the upward/downward direction) and has the same rectangular shape as the profile of a battery case 114 in a plan view. The battery case 114 is inserted into the second through hole 105 from under the body 10. Each of the insert holes 106 runs through the bottom wall 101 along the thickness thereof and has a circular shape in a plan view. When the first cover 11 and the second cover 12 are joined with the body 10, the respective insert holes 106 face their corresponding first bosses 111 (to be described later) of the first cover 11 and their corresponding screw holes 121 (to be described later) of the second cover 12.

[0022] The peripheral wall 102 is made up of a wall protruding upward from an outer peripheral portion of the upper surface of the bottom wall 101 such that its diameter increases upward and another wall protruding downward from an outer peripheral portion of the lower surface of the bottom wall 101 such that its diameter increases downward. The peripheral wall 102 is provided with a plurality of (e.g., twelve in this example) openings 103 arranged circumferentially. In a front view, each of the plurality of openings 103 has the shape of a rectangle, which is elongated along the circumference of the peripheral wall 102. Each opening 103 runs through the peripheral wall 102 along the thickness thereof (i.e., along the radius of the circular housing 1). These openings 103 allow the internal space of the housing 1 to communicate with the outside of the housing 1. This allows smoke to flow into the internal space of the housing 1 from the outside of the housing 1 through the openings 103. In this embodiment, the internal space of the housing 1 is a space surrounded with the bottom wall 101 and peripheral wall 102 of the body 10 and the second cover 12.

[0023] The first cover 11 has the shape of a circular disk in a plan view and has the same outer peripheral shape as the body 10 in a plan view. The first cover 11 includes the plurality of (e.g., three in this example) first bosses 111, a second boss 112, an acoustic case 113, and the battery case 114. Also, in the first cover 11, the circuit block 4 is arranged in a region surrounded with the plurality of first bosses 111 and the second boss 112.

[0024] Each of the first bosses 111 has the shape of a cylinder, which is circular in a plan view, and is formed integrally with the first cover 11 so as to protrude upward from the upper surface of the first cover 11. Each of the first bosses 111 has a screw hole, into which a first screw S1 is screwed. The second boss 112 has the shape of a cylinder, which is circular in a plan view, and is formed integrally with the first cover 11 so as to protrude upward from the upper surface of the first cover 11. The second boss 112 has a screw hole, into which a second screw S2 is screwed.

[0025] The acoustic case 113 has the shape of a cylinder, which is circular in a plan view, and is formed integrally with the first cover 11 so as to protrude upward from the upper surface of the first cover 11. The sound emission unit 5 is housed in the acoustic case 113. The bottom of the acoustic case 113 has a sound hole that runs through the first cover 11 along the thickness thereof (i.e., in the upward/downward direction). Through this sound hole, a sound is emitted from the sound emission unit 5. Note that the sound hole is covered with a decorative plate provided on the lower surface of the first cover 11.

[0026] The battery case 114 has the shape of a box, which is rectangular in a plan view, and is formed integrally with the first cover 11 so as to protrude upward from the upper surface of the first cover 11. The battery case 114 houses the battery B1 serving as a power supply for powering the smoke detector 100. The battery B1 may be a primary battery or a secondary battery, whichever is appropriate.

[0027] The second cover 12 has the shape of a circular disk in a plan view and has the same outer peripheral shape as the body 10 in a plan view. The second cover 12 has the plurality of (e.g., three in this example) screw holes 121. Each of these screw holes 121 has the shape

of a circle in a plan view and runs through the second cover 12 along the thickness thereof (i.e., in the upward/downward direction). To each of these screw holes 121, the first screw S1 is inserted from over the second cover 12.

[0028] The housing 1 may be assembled in the following manner. First, the first cover 11 is fitted into the body 10 to close the upper opening of the body 10. Next, the second cover 12 is fitted into the body 10 to close the lower opening of the body 10. Then, the plurality of insert holes 106 of the body 10, their corresponding first bosses 111 of the first cover 11, and their corresponding screw holes 121 of the second cover 12 are aligned with each other. In this state, the plurality of first screws S1 are inserted into their corresponding screw holes 121 from over the second cover 12 and tightened, thereby joining the body 10, the first cover 11, and the second cover 12 together.

[0029] The circuit block 4 includes a printed wiring board 41 and a plurality of electronic components including switches. The plurality of electronic components is assembled together on the printed wiring board 41. To an electrical conductor portion of the printed wiring board 41, electrically connected are the light-emitting unit 22 and photodetector unit 23 of the sensor block 2. To the electrical conductor portion of the printed wiring board 41, further electrically connected are the sound emission unit 5 and the battery B1.

[0030] The printed wiring board 41 is arranged under the sensor block 2, i.e., between the sensor block 2 and the bottom wall 101 of the body 10. The sensor block 2 is mounted on one surface (i.e., upper surface) of the printed wiring board 41 along the thickness thereof. The printed wiring board 41 has a through hole 42 which has a circular shape in a plan view and runs through the printed wiring board 41 along the thickness thereof (i.e., in the upward/downward direction). With an upper end portion of the second boss 112 of the first cover 11 inserted into the through hole 42, the second screw S2, of which the shaft allows one end of an antenna 43 to pass therethrough, is inserted and tightened into the through hole 42 from over the through hole 42. This allows the antenna 43 to be fixed to be electrically connected to the printed wiring board 41. The antenna 43 is a part of a communications module mounted on the printed wiring board 41 for communicating wirelessly with other devices (e.g., other smoke detectors).

[0031] In this embodiment, the circuit block 4 includes a control circuit made up of a plurality of electronic components. The control circuit is a circuit for controlling the light-emitting unit 22, the photodetector unit 23, the sound emission unit 5, and other units, drives at least the light-emitting unit 22, and performs signal processing on the output signal of the photodetector unit 23. When performing the signal processing, the circuit block 4 compares the quantity of light received by the photodetector unit 23 (i.e., the magnitude of its output signal) with a threshold value, thereby determining whether or not any smoke is present in the detection space Sp1. The quantity of light received by the photodetector unit 23 varies according to the concentration of the smoke in the detection space Sp1 and the type of the smoke (which may be white smoke or black smoke, for example). Thus, when finding, based on a result of the comparison with the threshold value, that smoke, of which the concentration is equal to or greater than a predetermined value, should be present in the detection space Sp1, the circuit block 4 determines that smoke should be present. On finding that the quantity of the light received is equal to or greater than a predetermined value, the circuit block 4 outputs an electrical signal for driving the sound emission unit 5 to the sound emission unit 5.

[0032] On receiving the electrical signal from the circuit block 4, the sound emission unit 5 emits a sound (as a sound wave). The sound emission unit 5 may be implemented as, for example, a loudspeaker or buzzer for converting the electrical signal into the sound. The sound emission unit 5 has the shape of a circular disk in a plan view. The sound emission unit 5 is driven according to the state of the smoke detector 100. Specifically, when detecting that the quantity of light received is at least qual to a predetermined value, the smoke detector 100 emits a sound from the sound emission unit 5.

[0033] The sensor block 2 includes the sensor case 21, the light-emitting unit 22, and the photodetector unit 23. The sensor case 21 has the shape of a circular disk in a plan view. The sensor case 21 is a molded product made of a synthetic resin and has at least the ability to cut off the incoming light. The peripheral wall 211 of the sensor case 21 is provided with a plurality of window holes 212, each of which has a rectangular shape in a front view and runs through the peripheral wall 211 along the thickness thereof (i.e., along the radius of the sensor block 2) and which are arranged along the circumference of the sensor case 21. This allows smoke to flow into the internal space of the sensor case 21 (i.e., into the detection space Sp1) from outside of the sensor case 21 through the plurality of window holes 212. In addition, the sensor case 21 also houses the light-emitting unit 22 and the photodetector unit 23.

[0034] In this embodiment, a labyrinth structure is provided inside the sensor case 21. The labyrinth structure is a set of small pieces which are arranged inside the sensor case 21 in an annular pattern along the circumference of the sensor case 21 so as to surround the detection space Sp1. The labyrinth structure allows smoke to be taken in the detection space Sp1 from outside of the sensor case 21 through the gaps between the plurality of small pieces.

[0035] The sensor block 2 detects any smoke present in the detection space Sp1 inside the sensor case 21. That is to say, the sensor block 2 is housed in the internal space of the housing 1, i.e., in the space surrounded with the bottom wall 101 and peripheral wall 102 of the body 10 and the second cover 12. Since the internal space of the housing 1 communicates with the outside of the hous-

ing 1 through the openings 103 as described above, smoke may flow into the internal space of the housing 1 through the openings 103. Then, the sensor block 2 takes, into the detection space Sp1, the smoke that has flowed into the internal space of the housing 1 from outside of the sensor case 21 through the plurality of window holes 212 and the labyrinth structure. This allows the sensor block 2 to detect the presence of any smoke.

[0036] The smoke detector 100 with the configuration described above may be one of constituent elements of an automatic fire alarm system, for example. The automatic fire alarm system includes not only the smoke detector 100 but also a receiver for receiving an alert signal (fire signal) from the smoke detector 100 and a transmitter allowing a person who has detected the outbreak of a fire to operate a press button. In the automatic fire alarm system, when the smoke detector 100 detects the presence of (smoke involved with) a fire, for example, an alert signal (fire signal) is transmitted from the smoke detector 100 to the receiver so as to notify the receiver of the outbreak of a fire.

[0037] In this embodiment, the smoke detector 100 further includes the repellent structure 3. As described above, the repellent structure 3 has the ability to repel the invasion of a particular insect A1 into at least the detection space Sp1. In this embodiment, the repellent structure 3 is a structure for repelling the invasion, into the detection space Sp1, of the particular insect A1 that has managed to enter the internal space of the housing 1. Specifically, the repellent structure 3 may be implemented as an insect net 31 having a mesh, of which each mesh element 311 has a size of 0.25 mm or less.

[0038] The insect net 31 has a rectangular shape in a front view. The insect net 31 is attached to the peripheral wall 211 to cover the plurality of window holes 212 inside the sensor case 21. In this embodiment, all of the window holes 212 are covered with a plurality of (e.g., two in this example) insect nets 31. The insect net 31 has multiple rectangular mesh elements 311 as shown in FIG. 3. In this embodiment, a first width W1 and a second width W2 of each mesh element 311 are both equal to or less than 0.25 mm. Although the respective widths of two sides (i.e., the first width W1 and the second width W2) of each mesh element 311 are both equal to or less than 0.25 mm in this embodiment, the width of at least one of the two sides (i.e., at least one of the first width W1 or the second width W2) of each mesh element 311 may be equal to or less than 0.25 mm. Alternatively, if each mesh element 311 has a circular shape, its width (diameter) may be equal to or less than 0.25 mm. Optionally, not all of those mesh elements 311 of the insect net 31 have to have the mesh element size but some mesh elements 311 may have a mesh element size larger than the above-specified size.

[0039] Next, an advantage of the insect net 31 according to this embodiment over an insect net as a comparative example will be described. The insect net as a comparative example has a mesh, of which each mesh element has first and second widths that are both larger than 0.25 mm, which is a major difference from the insect net 31 according to this embodiment. For example, the insect net according to the comparative example has a mesh element, of which the first and second widths are both 0.3 mm. The insect net according to the comparative example repels the invasion of an insect, of which the maximum body width is greater than 0.3 mm (hereinafter referred to as a "general insect"), into the detection space by preventing such a general insect from passing through the insect net. In this case, the particular insect A1 has such a property as to be able to have its entire body passed through the mesh as long as at least its head may pass through the mesh. That is why even if the maximum width of the particular insect A1 is greater than the first and second widths of the mesh according to the comparative example, but its head may pass through the mesh, then the particular insect A1 could invade the detection space Sp1 by passing through the mesh according to the comparative example. That is to say, the insect net according to the comparative example may be able to repel the invasion of a general insect into the detection space Sp1 but cannot always repel the invasion of a particular insect A1 into the detection space Sp1.

[0040] In contrast, the insect net 31 according to this embodiment has a mesh, of which each mesh element 311 has a size (first and second widths W1, W2) of 0.25 mm or less. That is to say, the insect net 31 according to this embodiment has a mesh, of which each mesh element 311 has too small a size for the particular insect A1 to have its head passed through. Thus, according to this embodiment, the particular insect A1 is unable to have its head passed through the mesh element 311 easily, and therefore, cannot have its entire body passed through the mesh element 311 of the insect net 31 easily. Consequently, the insect net 31 according to this embodiment achieves the advantage of repelling the invasion of the particular insect A1 into the detection space Sp1 more perfectly than the insect net according to the comparative example.

(3) Brief summary

[0041] As described above, the smoke detector 100 according to this embodiment includes the repellent structure 3 for repelling the invasion of a particular insect A1 into the detection space Sp1. This allows the repellent structure 3 to reduce the chances of the particular insect A1 invading the detection space Sp1. Suppose a particular insect A1 has managed to enter the internal space of the housing 1 through the openings 103 of the housing 1 either by being carried on the wind or by creeping on the ceiling surface 200, for example. In that case, the particular insect A1 may move toward the sensor block 2 (i.e., toward the detection space Sp1) by creeping on the bottom wall 101 of the housing 1. Even when such a situation arises, the repellent structure 3 (insect net 31) may still reduce the chances of the particular insect A1

invading the detection space Sp1.

[0042] Thus, this embodiment may reduce the chances of the particular insect A1 being present in the detection space Sp1, and therefore, may also reduce the chances of the light emitted from the light-emitting unit 22 being reflected and scattered by the particular insect A1. That is to say, this embodiment may reduce the chances of the scattered light impinging on the photodetector unit 23 due to the presence of the particular insect A1, thus achieving the advantage of reducing the chances of making erroneous detection due to the presence of such a particular insect A1.

(4) Variations

[0043] Note that the embodiment described above is only an exemplary one of various embodiments of the present disclosure and should not be construed as limiting. Rather, the exemplary embodiment described above may be readily modified in various manners depending on a design choice or any other factor without departing from the scope of the present disclosure. Variations of the exemplary embodiment described above will be enumerated one after another. Note that the variations to be described below may be adopted in combination as appropriate. Also, in the variations to be described below, the smoke detector 100 may use the insect net according to the comparative example in place of the insect net 31. Optionally, in the variations to be described below, the smoke detector 100 may have neither the insect net 31 nor the insect net according to the comparative example.

(4.1) First variation

[0044] The first variation of the smoke detector 100 includes, as the repellent structure 3, a wall body 32 as shown in FIGS. 4 and 5, which is a major difference from the smoke detector 100 according to the exemplary embodiment described above. The wall body 32 has the shape of a bar in a plan view and protrudes upward from the upper surface of the bottom wall 101 of the body 10. In this variation, in a plan view, the wall body 32 is curved along the circumference of the housing 1. The height of the wall body 32 (i.e., its dimension as measured in the upward/downward direction) may be greater than the body height of a particular insect A1 creeping on the bottom wall 101. In addition, the wall body 32 is arranged in a region provided on the upper surface of the bottom wall 101 which is located between the sensor block 2 and the openings 103. That is to say, the repellent structure 3 includes the wall body 32. The wall body 32 is provided, inside the housing 1, in a region between the openings 103 and the detection space Sp1 and protrudes from the bottom wall 101 of the housing 1.

[0045] Suppose a particular insect A1 has managed to enter the internal space of the housing 1 and is now creeping on the bottom wall 101 of the housing 1 toward the sensor block 2 (i.e., toward the detection space Spl). Even when such a situation arises, since the wall body 32 is provided according to this variation in the region between the openings 103 and the detection space Sp1, the particular insect A1 cannot reach the detection space Sp1 without going over the wall body 32. Thus, according to this variation, providing the wall body 32 would achieve the advantage of reducing the chances of the particular insect A1 reaching the detection space Sp1.

[0046] In this case, the wall body 32 may include a plurality of (e.g., four in this variation) wall bodies 32 as shown in FIG. 6. The plurality of wall bodies 32 is arranged from the openings 103 toward the detection space Sp1 (i.e., along the radius of the housing 1). According to this variation, even when the situation described above arises, the particular insect A1 cannot reach the detection space Sp1 without going over all of those wall bodies 32. Thus, this variation would achieve the advantage of further reducing the chances of the particular insect A1 reaching the detection space Sp1 compared to the situation where only one wall body 32 is provided.

(4.2) Second variation

[0047] In the second variation of the smoke detector 100, the wall body 32 has a folded portion 321 as shown in FIG. 7, which is a major difference from the first variation of the smoke detector 100. Note that each of FIG. 7 and FIGS. 8 and 9 to be referred to later is a cross-sectional view illustrating a portion (i.e., a portion including the wall body 32) of the bottom wall 101 of the body 10 on a larger scale. The folded portion 321 is formed by folding the tip portion (i.e., an upper end portion) of the wall body 32 so that the folded portion 321 protrudes toward the openings 103. The height of the protruding portion may be greater than the body height of a particular insect A1 creeping on the surface of the wall body 32 (i.e., a dimension as measured in the rightward/leftward direction in FIG. 7).

[0048] According to this variation, even when a particular insect A1 is creeping on the surface of the wall body 32 in an attempt to go over the wall body 32, the particular insect A1 cannot reach the detection space Sp1 without going over the folded portion 321 against gravity. In addition, in a situation where the particular insect A1 is creeping on the surface of the folded portion 321, the particular insect A1 would likely fall down from the folded portion 321. Thus, this variation would achieve the advantage of further reducing the chances of the particular insect A1 reaching the detection space Sp1 compared to the situation where the wall body 32 has no folded portions 321.

[0049] Optionally, the folded portion 321 may be formed such that its cross-sectional area. increases from the bottom wall 101 toward the upper end thereof (i.e., the folded portion 321 expands upward) as shown in FIG. 8. This variation would also achieve the advantage of

further reducing the chances of the particular insect A1 reaching the detection space Sp1 compared to the situation where the wall body 32 has no folded portions 321.

[0050] In the example illustrated in FIG. 8, the folded portions 321 are provided on both sides (i.e., on the right and left in FIG. 8) of the wall body 32 in a front view. However, this variation is only an example and should not be construed as limiting. Alternatively, only the folded portion 321 facing the openings 103 may be provided (i.e., on the left of the wall body 32 in FIG. 8).

(4.3) Third variation

[0051] In the third variation of the smoke detector 100, the wall body 32 has an upwardly pointed tip portion (upper end portion) as shown in FIG. 9, which is a major difference from the smoke detector 100 according to the first variation. The tip portion of the wall body 32 has a shape in which an acute angle θ is formed between two sides of the wall body 32 in a front view. In addition, the upper surface of the tip portion of the wall body 32 has too small an area for the particular insect A1 to creep on.

[0052] According to this variation, even when the particular insect A1 is creeping on the surface of the wall body 32 in an attempt to go over the wall body 32, the particular insect A1 would lose its balance at, and fall down from, the tip portion of the wall body 32. This variation would also achieve the advantage of further reducing the chances of the particular insect A1 reaching the detection space Sp1 compared to the situation where the tip portion of the wall body 32 is not pointed.

(4.4) Fourth variation

[0053] The fourth variation of the smoke detector 100 includes a region 33 serving as the repellent structure 3 (i.e., the region shaded in FIG. 10) as shown in FIG. 10, which is a major difference from the smoke detector 100 according to the exemplary embodiment. In other words, the repellent structure 3 includes the region 33. The region 33 is a region provided on the upper surface of the bottom wall 101 which is located between the sensor block 2 and the openings 103,i.e., a region between the openings 103 and the detection space Sp1 inside the housing 1. An insect repellent for repelling the particular insect A1 is either applied onto the region 33 or kneaded into the material for the housing 1. As used herein, the "insect repellent" includes not only a chemical agent including a component that repels the particular insect A1 but also a chemical agent including a component that poisons the particular insect A1 to death.

[0054] Suppose the particular insect A1 has managed to enter the internal space of the housing 1 and is now creeping on the bottom wall 101 of the housing 1 toward the sensor block 2 (i.e., toward the detection space Spl). Even when such a situation arises, providing the region 33 to which the insect repellent is applied according to this variation would either repel the invasion of the particular insect A1 into the region 33 or would poison the particular insect A1 to death with more reliability even if the particular insect A1 has somehow invaded the region 33. Thus, providing such a region 33 according to this variation would reduce the chances of the particular insect A1 reaching the detection space Sp1. Additionally or alternatively, the insect repellent may also be applied onto the insect net 31 or kneaded into the material for the insect net 31.

[0055] Alternatively, as the repellent structure 3, the region 33 may be replaced with a region 34 as shown in FIG. 10. The region 34 is provided in the same area as the region 33. That is to say, the region 34 is a region located between the openings 103 and the detection space Sp1 inside the housing 1. A sticky trap for trapping the particular insect A1 is provided in the region 34. This variation would increase, even if the particular insect A1 has entered the region 34 in the above-described situation, the chances of immobilizing the particular insect A1 in the sticky trap. Thus, providing such a region 34 according to this variation would reduce the chances of the particular insect A1 reaching the detection space Sp1.

(4.5) Fifth variation

[0056] The smoke detector 100 according to the fifth variation includes two protruding walls 35 as the repellent structure 3 as shown in FIG. 11, which is a major difference from the smoke detector 100 according to the exemplary embodiment. The protruding walls 35 respectively protrude outward (i.e., toward the outside of the housing 1) along the radius of the housing 1 from an upper end edge and lower end edge of the openings 103 with respect to the peripheral wall 102 of the body 10. That is to say, the protruding walls 35 protrude toward the outside of the housing 1 from peripheral edges of the openings 103 on the external wall (peripheral wall 102) of the housing 1. In addition, each protruding wall 35 is provided along the circumference of the housing 1. That is to say, each protruding wall 35 has an annular shape in a plan view. The height of each protruding wall 35 may be greater than the body height of the particular insect A1 creeping on the peripheral wall 102 (as measured along the radius of the housing 1), for example.

[0057] Suppose a particular insect A1 has reached, and is now creeping on, the peripheral wall 102 of the housing 1 toward the openings 103 either by being carried on the wind or by creeping on the ceiling surface 200, for example. Even in such a situation, providing the protruding walls 35 for the peripheral edges of the openings 103 according to this variation prevents the particular insect A1 from passing through the openings 103 to enter the internal space of the housing 1 unless the particular insect A1 goes over the protruding walls 35. That is to say, the repellent structure 3 according to this variation is a structure for repelling the invasion of the particular insect A1 into the detection space Sp1 by preventing the particular insect A1 from entering the internal

space of the housing 1. Thus, providing the protruding walls 35 according to this variation would achieve the advantage of reducing the chances of the particular insect A1 reaching the detection space Sp1.

(4.6) Sixth variation

[0058] The smoke detector 100 according to a sixth variation includes a protruding wall 35 at a different position as shown in FIG. 12, which is a major difference from the smoke detector 100 according to the fifth variation described above. Specifically, in this variation, the protruding wall 35 is arranged on the peripheral wall 102 (outer wall) of the body 10 so as to be located above the openings 103. More specifically, the peripheral wall 102 is made up of a wall protruding upward from an outer peripheral portion of the upper surface of the bottom wall 101 (hereinafter referred to as an "upper peripheral wall portion 102a") such that its diameter increases upward and another wall protruding downward from an outer peripheral portion of the lower surface of the bottom wall 101 such that its diameter increases downward (hereinafter referred to as a "lower peripheral wall portion 102b") as already described for the exemplary embodiment. The upper peripheral wall portion 102a includes a tapered cylindrical portion 102c and a cylindrical portion 102d. The tapered cylindrical portion 102c protrudes upward from the outer peripheral portion of the upper surface of the bottom wall 101 such that its diameter increases upward (i.e., so as to taper downward). The cylindrical portion 102d protrudes upward from an upper end of the tapered cylindrical portion 102c and has the shape of a cylinder (e.g., a circular cylinder). The openings 103 are provided below the upper peripheral wall portion 102a (i.e., below the tapered cylindrical portion 102c). The protruding wall 35 according to this variation protrudes outward from the housing 1 along the radius of the housing 1 from the boundary between the tapered cylindrical portion 102c and the cylindrical portion 102d.

[0059] As in the fifth variation, the protruding wall 35 according to this variation is also provided along the circumference of the housing 1. In addition, as in the fifth variation, the height of the protruding wall 35 according to this variation may also be greater than the body height of the particular insect A1 creeping on the peripheral wall 102 (as measured along the radius of the housing 1), for example.

[0060] According to this variation, providing the protruding wall 35 increases, particularly when the particular insect A1 has reached, and is now creeping on, the upper peripheral wall portion 102a by creeping on the ceiling surface 200, the chances of repelling the invasion of the particular insect A1 into the detection space Sp1. In addition, providing the protruding wall 35 on the upper peripheral wall portion 102a above the openings 103 (i.e., spacing the protruding wall 35 upwardly from the openings 103) also reduces the chances of the particular insect A1 accessing the openings 103. Furthermore, providing the protruding wall 35 on the boundary between the tapered cylindrical portion 102c and the cylindrical portion 102d would allow, even if the particular insect A1 has somehow managed to go over the protruding wall 35 after having crept on the ceiling surface 200, the tapered cylindrical portion 102c to slip the particular insect A1 off the peripheral wall 102, thus preventing the particular insect A1 from reaching the openings 103.

(4.7) Seventh variation

[0061] The smoke detector 100 according to a seventh variation includes a protruding wall 35 with a different shape as shown in FIG. 13, which is a major difference from the smoke detector 100 according to the sixth variation. Specifically, the protruding wall 35 according to this seventh variation protrudes outward from the housing 1 so as to be sloped diagonally upward from a point, set above the openings 103, on the peripheral wall 102 (more specifically, from the boundary between the tapered cylindrical portion 102c and the cylindrical portion 102d). This further reduces, even if the particular insect A1 has reached, and is now creeping on, the upper peripheral wall portion 102a by creeping on the ceiling surface 200, the chances of the particular insect A1 going over the protruding wall 35, compared to the sixth variation.

(4.8) Other variations

[0062] According to another variation of the exemplary embodiment, the housing 1 may be made of a chargeable material. In other words, the repellent structure 3 may include the housing 1 made of a chargeable material. Suppose a particular insect A1 is now creeping on the peripheral wall 102 of the housing 1 toward the openings 103. Even in such a situation, since the housing 1 is made of a chargeable material according to this variation, Coulomb force (electrostatic force) is produced between the housing 1 and the particular insect A1, thus increasing the chances of catching the particular insect A1 on the housing 1. This reduces the chances of the particular insect A1 entering the internal space of the housing 1 through the openings 103, thus achieving the advantage of reducing the chances of the particular insect A1 reaching the detection space Sp1.

[0063] Optionally, in the first to third variations described above, the repellent structure 3 may also be a labyrinth structure formed as a combination of a plurality of wall bodies 32. This variation would reduce the chances of a particular insect A1 that has entered the labyrinth structure reaching the detection space Sp1. In addition, according to this variation, providing the exit of the labyrinth structure at a place other than the sensor block 2, for example, would lead the particular insect A1 to a place other than the detection space Sp1.

[0064] In the first to third variations described above, the wall body 32 is suitably made of a material with a

coefficient of friction that is small enough for the particular insect A1 to slip down. Likewise, in the fifth variation described above, the protruding walls 35 are suitably made of a material with a coefficient of friction that is small enough for the particular insect A1 to slip down. According to these variations, the particular insect A1 attempting to go over the wall body 32 (or the protruding walls 35) would tend to slip down, thus achieving the advantage of preventing the particular insect A1 from going over the wall body 32 (or the protruding walls 35).

[0065] In the exemplary embodiment described above, the smaller the size of the mesh element 311 of the insect net 31 is, the more likely the advantage of repelling the invasion of the particular insect A1 into the detection space Sp1 would be achieved. Nevertheless, the smaller the size of the mesh element 311 of the insect net 31 is, the less smoothly smoke passes through the mesh element 311, thus possibly causing a decline in the capability of taking smoke into the detection space Sp1. In view of these considerations, the mesh element 311 of the insect net 31 suitably has a size of about 0.2 mm. This variation would achieve the advantage of repelling the invasion of the particular insect A1 into the detection space Sp1 with more reliability without causing a decline in the capability of taking the smoke into the detection space Sp1.

[0066] In the exemplary embodiment described above, the light-emitting unit 22 does not have to be a light-emitting diode but may also be an organic electroluminescent (EL) element, a laser diode (LD), or any other suitable light-emitting element. In addition, the photodetector unit 23 does not have to be a photodiode but may also be a phototransistor, for example.

(Resume)

[0067] As can be seen from the foregoing description, a smoke detector (100) according to a first aspect includes a housing (1), a sensor block (2) of a photoelectric type, and a repellent structure (3). The housing (1) has an opening (103) that allows smoke to flow into the housing (1) from outside of the housing (1). The sensor block (2) has a detection space (Sp1) inside the housing (1) and detects any smoke in the detection space (Spl). The repellent structure (3) repels invasion of a particular insect (A1) into at least the detection space (Spl). The particular insect to be repelled by the repellent structure (3) lacks the ability to fly by itself, and therefore, has no choice but to move either by creeping or by being carried on the wind.

[0068] This aspect achieves the advantage of reducing the chances of making erroneous detection.

[0069] In a smoke detector (100) according to a second aspect, which may be implemented in conjunction with the first aspect, the repellent structure (3) includes an insect net (31) having a mesh, of which each mesh element (311) has a size of 0.25 mm or less.

[0070] This aspect regulates the movement of a particular insect (A1) toward the detection space (Sp1) by using the insect net (31), thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Sp1).

[0071] In a smoke detector (100) according to a third aspect, which may be implemented in conjunction with the first or second aspect, the repellent structure (3) includes at least one wall body (32) arranged in a region provided inside the housing (1) which is located between the opening (103) and the detection space (Spl). The at least one wall body (32) protrudes from a bottom wall (101) of the housing (1).

[0072] This aspect regulates the movement of a particular insect (A1) toward the detection space (Sp1) by using the wall body (32), thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Spl).

[0073] In a smoke detector (100) according to a fourth aspect, which may be implemented in conjunction with the third aspect, the at least one wall body (32) includes a plurality of wall bodies (32). The plurality of wall bodies (32) is arranged from the opening (103) toward the detection space (Sp1).

[0074] This aspect prevents the particular insect (A1) from reaching the detection space (Sp1) unless the insect (A1) goes over the plurality of wall bodies (32), thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Spl).

[0075] In a smoke detector (100) according to a fifth aspect, which may be implemented in conjunction with the third or fourth aspect, the wall body (32) includes a folded portion (321), of which a tip portion protrudes toward the opening (103).

[0076] This aspect prevents the particular insect (A1) from reaching the detection space (Spl) unless the insect (A1) goes over the folded portion (321) against gravity, thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Spl).

[0077] In a smoke detector (100) according to a sixth aspect, which may be implemented in conjunction with any one of the first to fifth aspects, the repellent structure (3) includes a region (33) provided inside the housing (1) which is located between the opening (103) and the detection space (Spl). An insect repellent for repelling the particular insect (A1) is either applied onto the region (33) or kneaded into a material itself for the region (33) of the housing (1).

[0078] This aspect either repels the particular insect (A1) from the region (33) or poisons the particular insects (A1) that has entered the region (33) to death, thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Spl).

[0079] In a smoke detector (100) according to a seventh aspect, which may be implemented in conjunction with any one of the first to sixth aspects, the repellent structure (3) includes a region (34) provided inside the housing (1) which is located between the opening (103) and the detection space (Spl). A sticky trap to trap the

particular insect (A1) is provided in the region (34).

[0080] This aspect immobilizes the particular insect (A1) that has entered the region (34), thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Spl).

[0081] In a smoke detector (100) according to an eighth aspect, which may be implemented in conjunction with any one of the first to seventh aspects, the repellent structure (3) includes the housing (1) made of a chargeable material.

[0082] This aspect attracts and catches the particular insect (A1) onto the housing (1) with Coulomb force (electrostatic force), thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Sp1).

[0083] In a smoke detector (100) according to a ninth aspect, which may be implemented in conjunction with any one of the first to eighth aspects, the repellent structure (3) includes a protruding wall (35) protruding from a peripheral edge of the opening (103) on an external wall (peripheral wall (102)) of the housing (1) toward outside of the housing (1).

[0084] This aspect prevents the particular insect (A1) from entering the housing (1) unless the insect (A1) goes over the protruding wall (35), thus achieving the advantage of reducing the chances of the particular insect (A1) invading the detection space (Spl).

[0085] Note that constituent elements according to the second to ninth aspects are not essential constituent elements for the smoke detector (100) but may be omitted as appropriate.

Reference Signs List

[0086]

100	Smoke Detector
1	Housing
101	Bottom Wall
102	Peripheral Wall (External Wall)
102c	Tapered Cylindrical Portion
102d	Cylindrical Portion
103	Opening
2	Sensor Block
3	Repellent Structure
31	Insect Net
311	Mesh Element
32	Wall Body
321	Folded Portion
33, 34	Region
35	Protruding Wall
A1	Particular Insect
Sp1	Detection Space

Claims

1. A smoke detector (100) comprising:

a housing (1) having an opening (103) that allows smoke to flow into the housing (1) from outside of the housing (1);

a sensor block (2) of a photoelectric type, the sensor block (2) having a detection space (Sp1) inside the housing (1) and configured to detect any smoke in the detection space (Sp1); and

a repellent structure (3) configured to repel invasion of a particular insect (A1) into at least the detection space (Sp1), the particular insect (A1) to be repelled by the repellent structure (3) lacking the ability to fly by itself and therefore having no choice but to move either by creeping or by being carried on the wind.

2. The smoke detector (100) of claim 1, wherein the repellent structure (3) includes an insect net (31) having a mesh, of which each mesh element (311) has a rectangular shape and has at least one side with a size of 0.25 mm or less.

3. The smoke detector (100) of claim 1, wherein the repellent structure (3) includes an insect net (31) having a mesh, of which each mesh element (311) has a circular shape and has a diameter of 0.25 mm or less.

4. The smoke detector (100) any one of claims 1 to 3, wherein the repellent structure (3) includes at least one wall body (32) in a region provided inside the housing (1) which is located between the opening (103) and the detection space (Sp1), the at least one wall body (32) protruding from a bottom wall (101) of the housing (1).

5. The smoke detector (100) of claim 4, wherein the at least one wall body (32) includes a plurality of wall bodies (32),

the plurality of wall bodies (32) being arranged from the opening (103) toward the detection space (Spl).

6. The smoke detector (100) of claim 4 or 5, wherein the wall body (32) includes a folded portion (321), of which a tip portion protrudes toward the opening (103).

7. The smoke detector (100) of any one of claims 1 to 6, wherein the repellent structure (3) includes a region (33) provided inside the housing (1) which is located between the opening (103) and the detection space (Sp1), and

an insect repellent for repelling the particular insect (A1) is either applied onto the region (33) or kneaded into a material itself for the region (33) of the housing (1).

8. The smoke detector (100) of any one of claims 1 to 7, wherein
the repellent structure (3) includes a region (34) provided inside the housing (1) which is located between the opening (103) and the detection space (Sp1), and
a sticky trap configured to trap the particular insect (A1) thereon is provided in the region (34).

9. The smoke detector (100) of any one of claims 1 to 8, wherein
the repellent structure (3) includes the housing (1) made of a chargeable material.

10. The smoke detector (100) of any one of claims 1 to 9, wherein
the repellent structure (3) includes a protruding wall (35) protruding from a peripheral edge of the opening (103) on an external wall (102) of the housing (1) toward outside of the housing (1).

11. The smoke detector (100) of any one of claims 1 to 9, wherein
the repellent structure (3) includes a protruding wall (35) protruding from a point, set above the opening (103), on the external wall (102) of the housing (1) toward outside of the housing (1).

12. The smoke detector (100) of claim 11, wherein
the external wall (102) includes: a bottom wall (101); a tapered cylindrical portion (102c) protruding upward from an outer peripheral portion of an upper surface of the bottom wall (101) such that a diameter of the tapered cylindrical portion (102c) increases upward; and a cylindrical portion (102d) protruding upward from an upper end of the tapered cylindrical portion (102c),
the opening (103) is provided below the tapered cylindrical portion (102c), and
the protruding wall (35) protrudes outward from a boundary between the tapered cylindrical portion (102c) and the cylindrical portion (102d).

13. The smoke detector (100) of claim 11 or 12, wherein
the protruding wall (35) protrudes toward the outside of the housing (1) so as to be sloped diagonally upward from the external wall (102).

FIG. 1

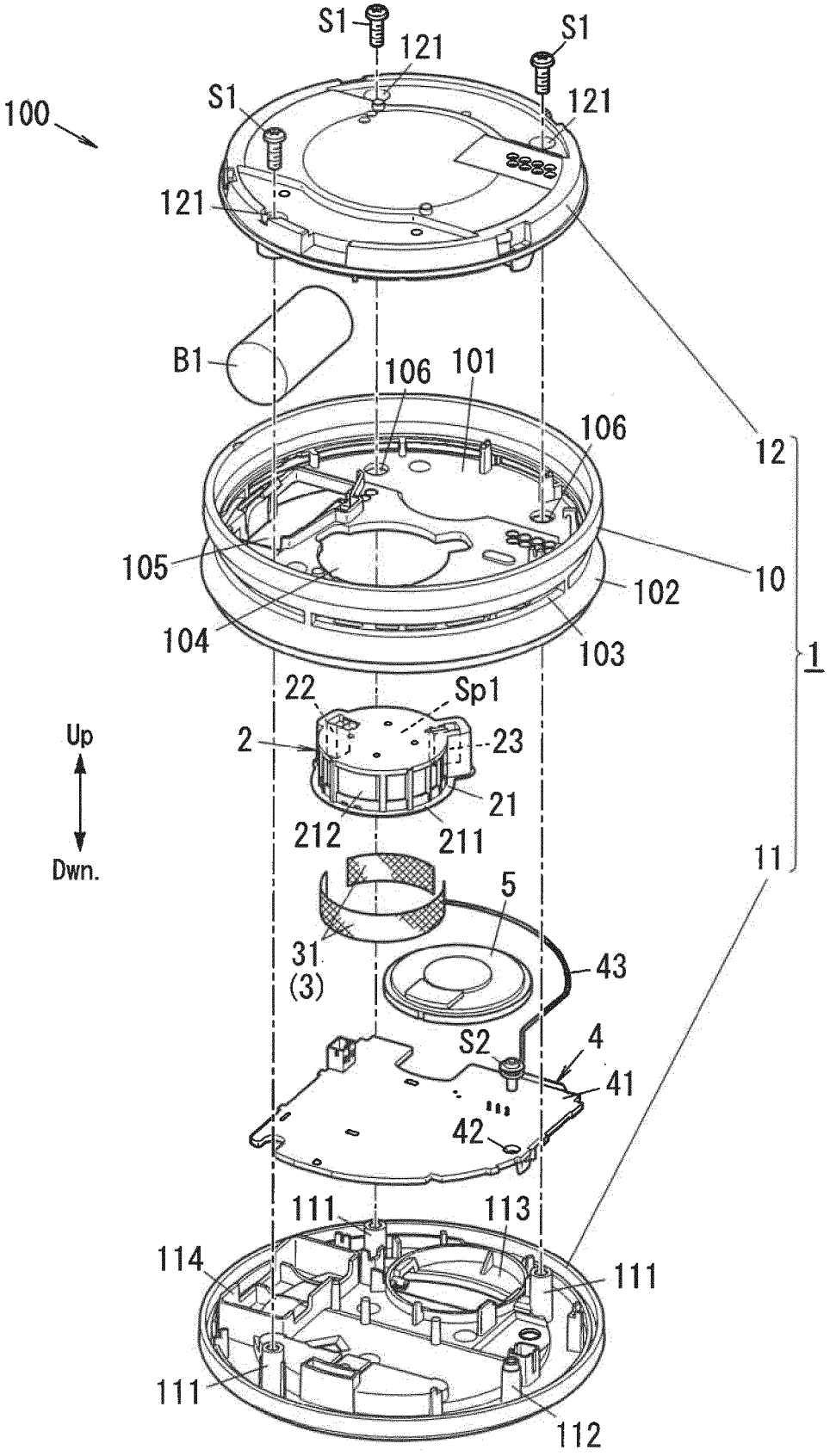

100
S1
121
S1
121
S1
121
B1
106
101
106
12
105
10
102
104
103
1
22
Sp1
2
23
21
212
211
11
Up
Dwn.
5
31
(3)
43
S2
4
41
42
111
113
114
111
111
112

FIG. 2

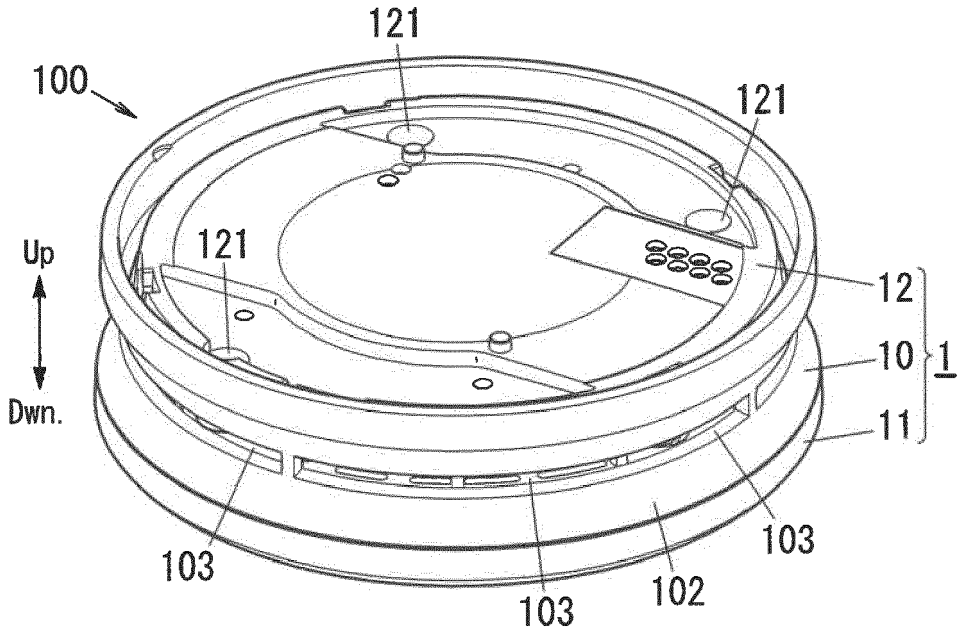


FIG. 3

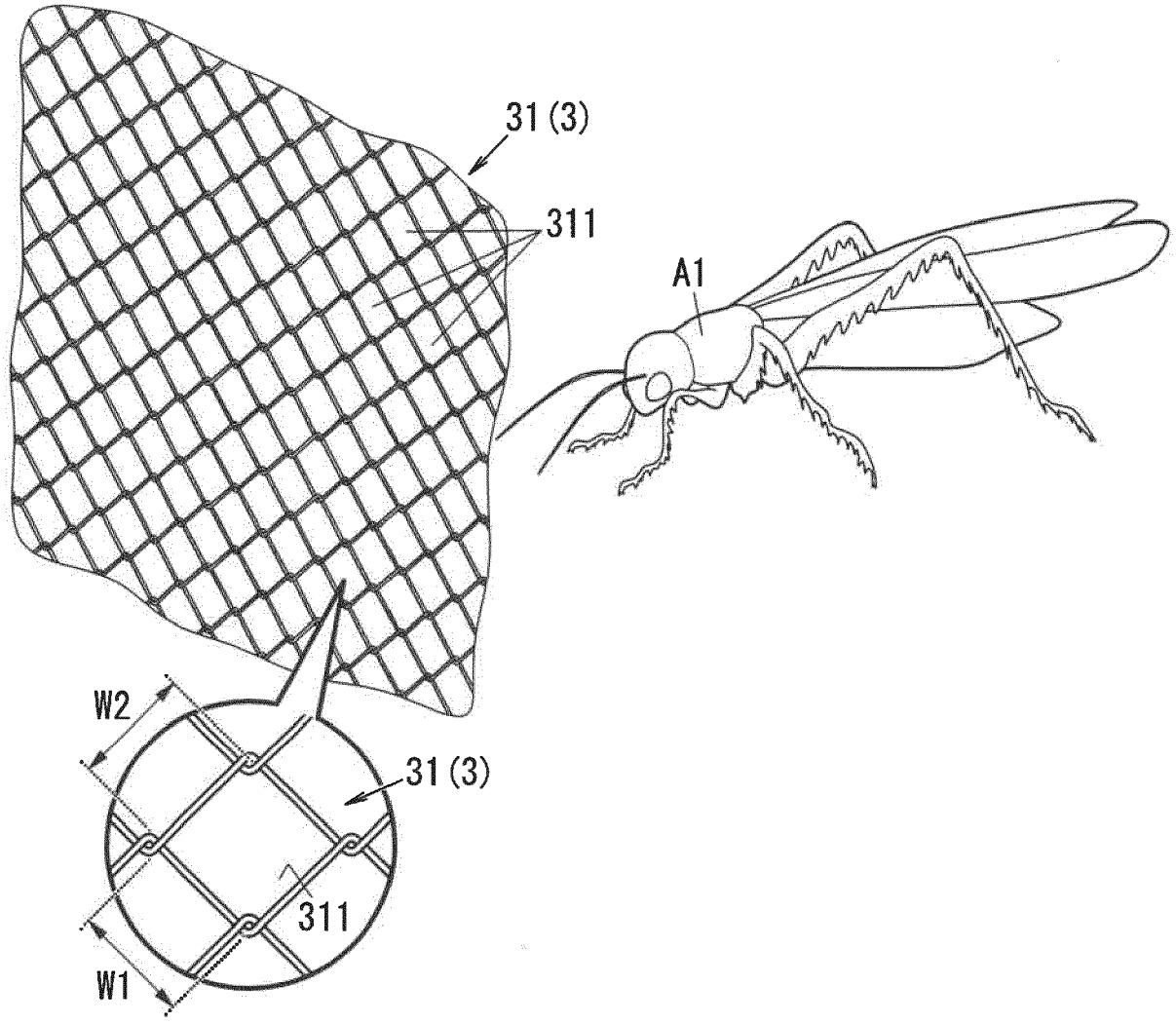


FIG. 4

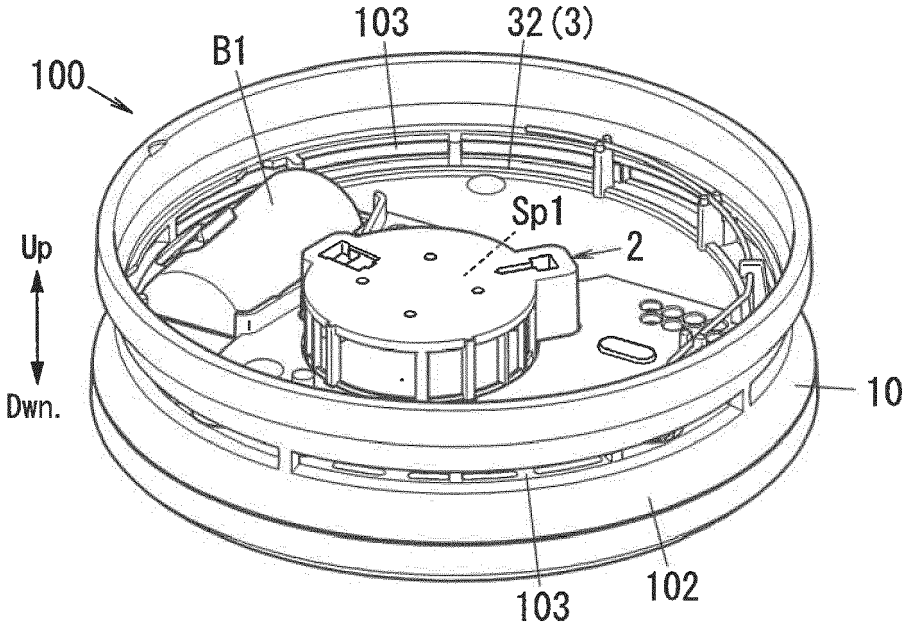


FIG. 5

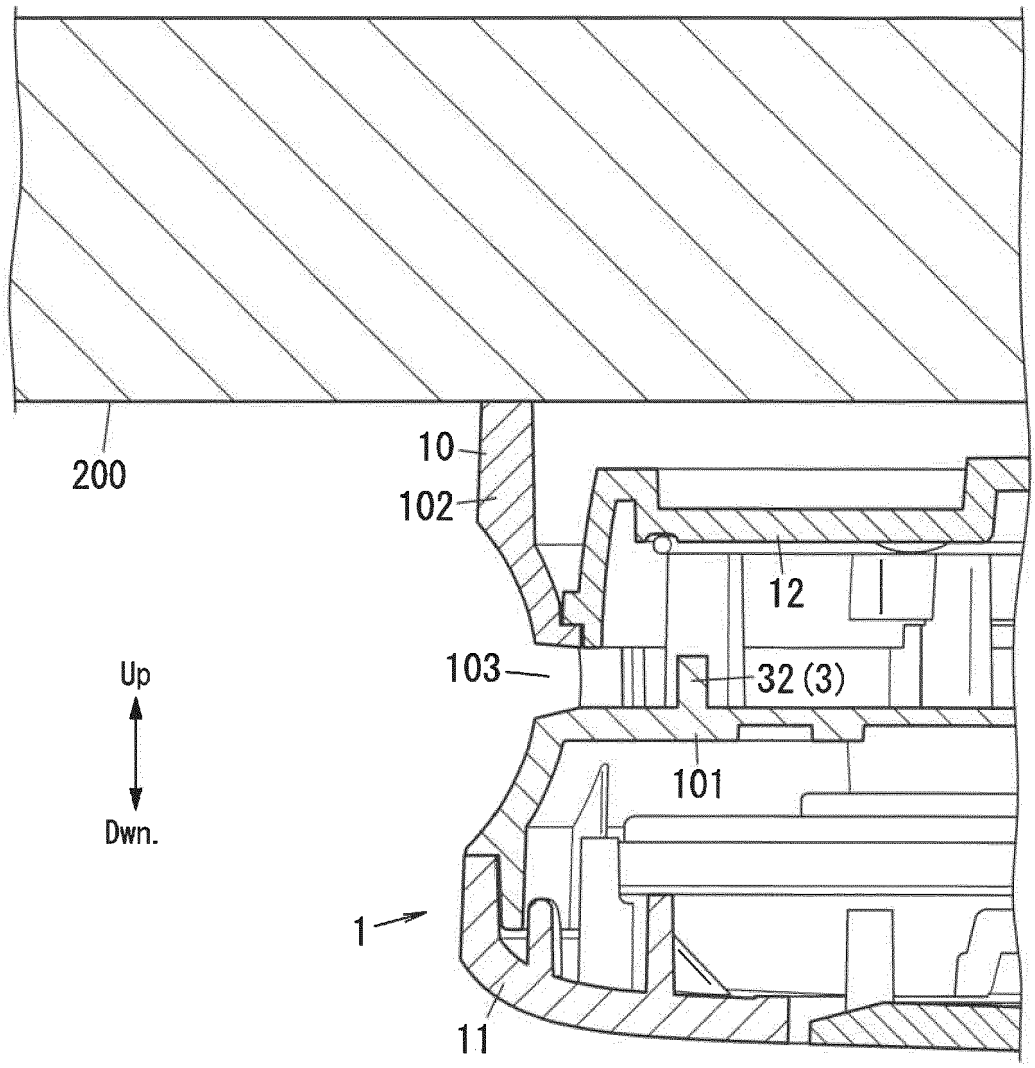


FIG. 6

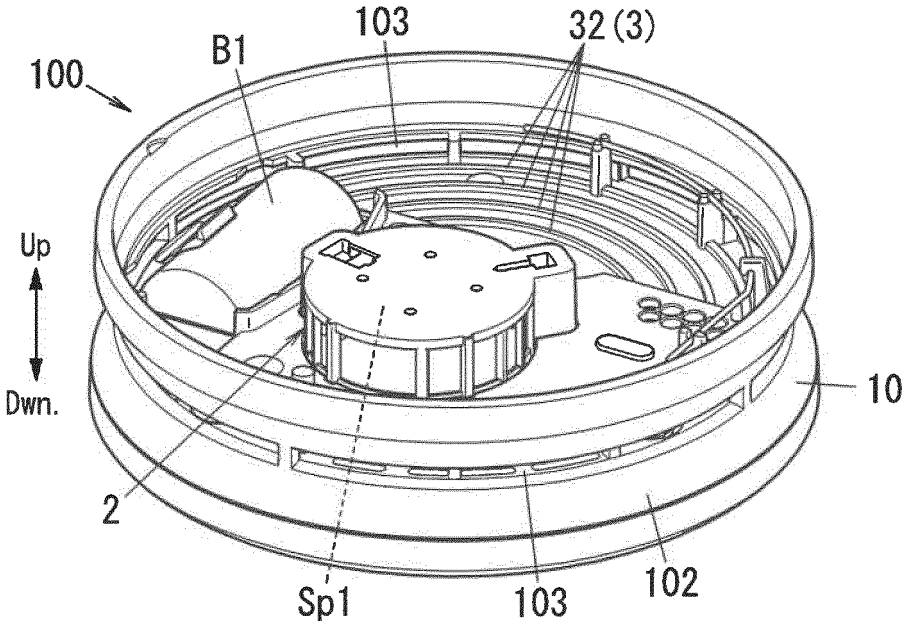


FIG. 7

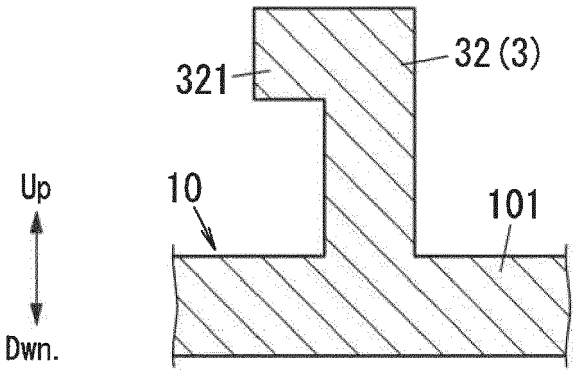


FIG. 8

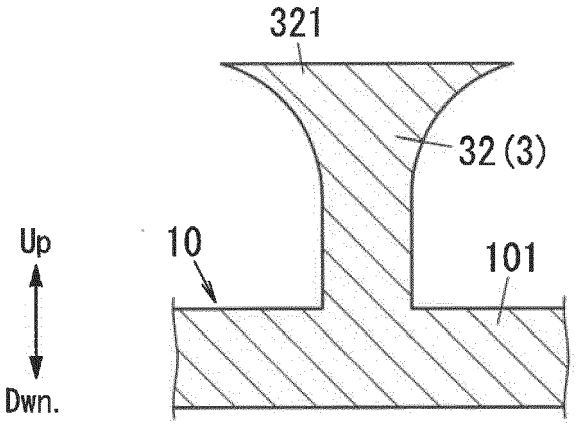


FIG. 9

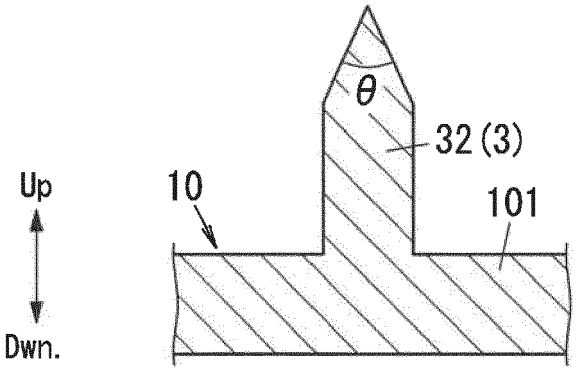


FIG. 10

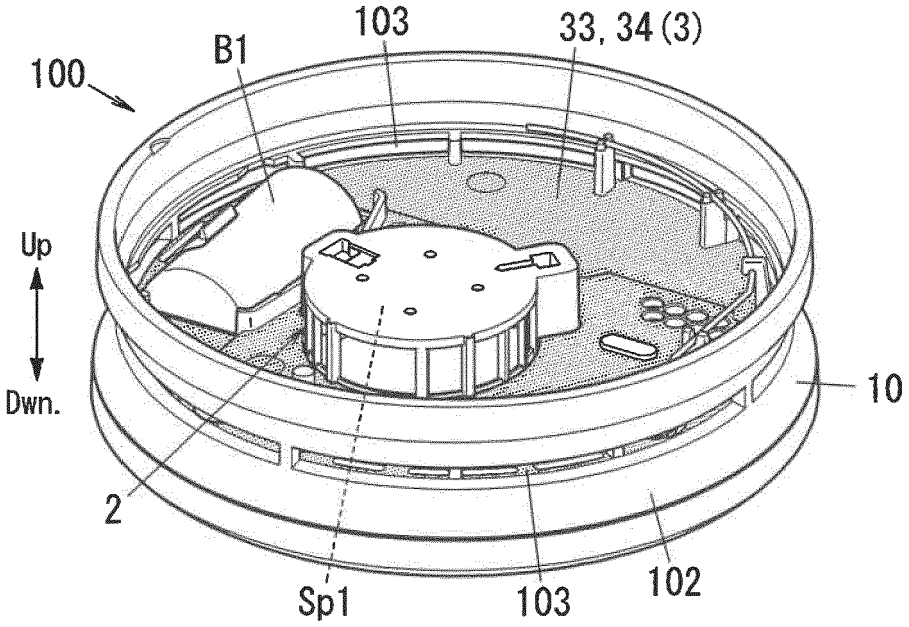


FIG. 11

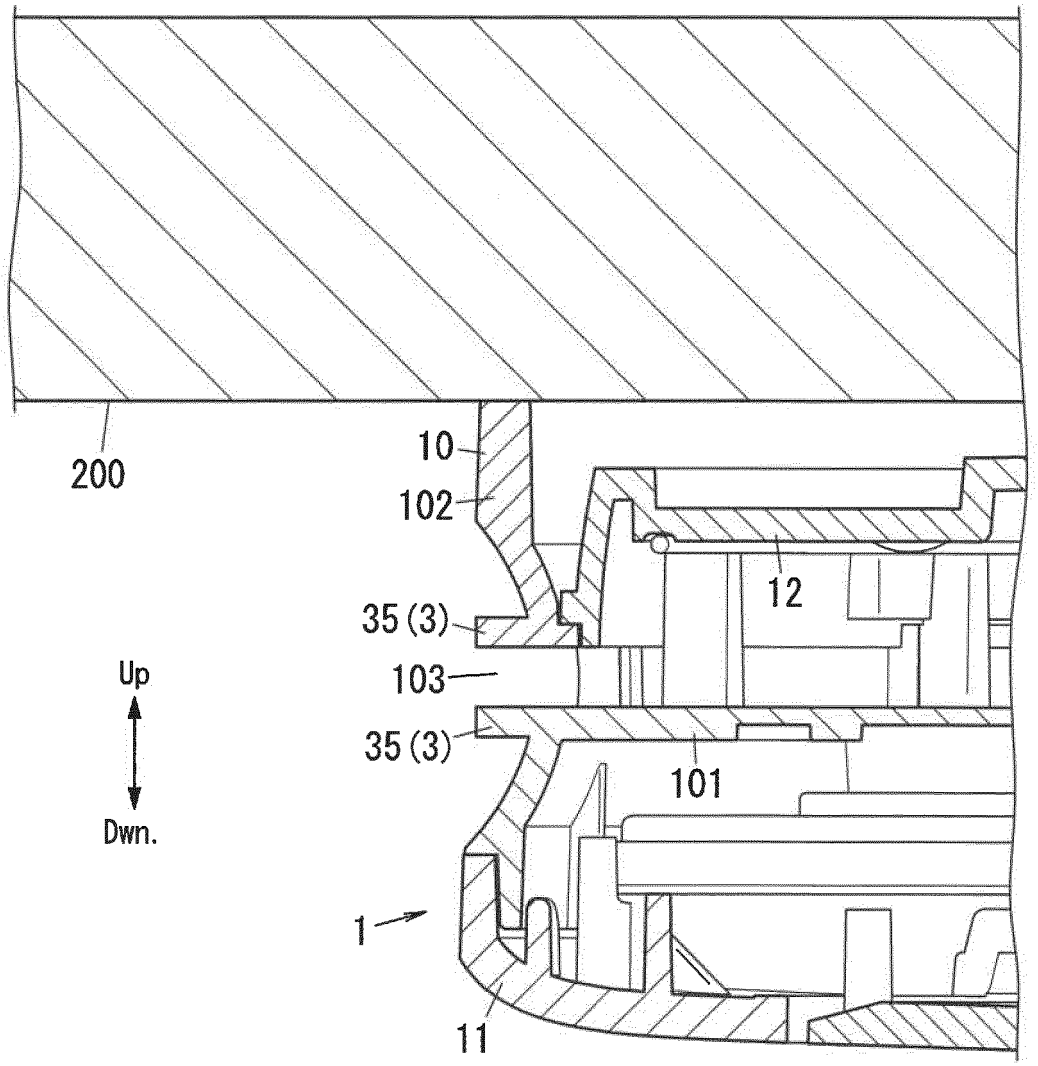


FIG. 12

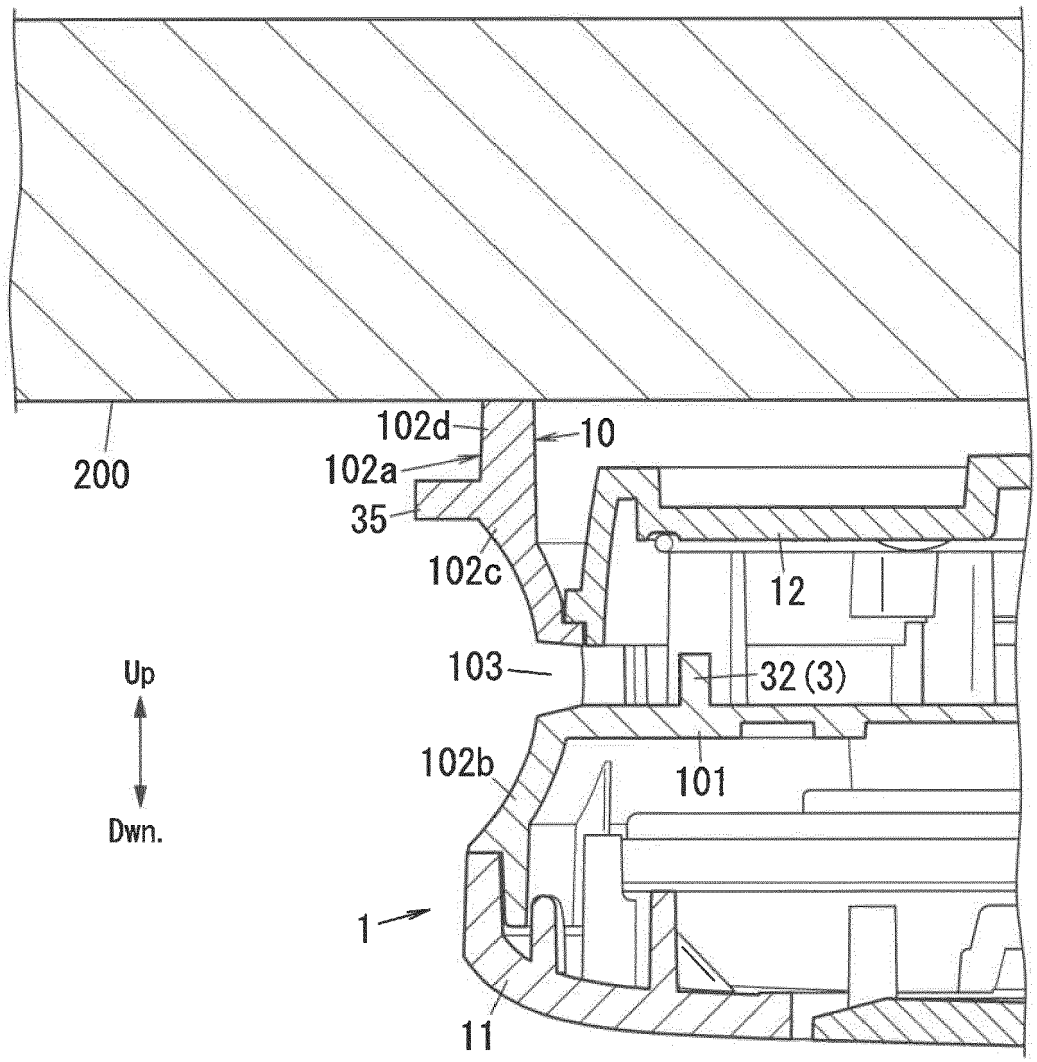
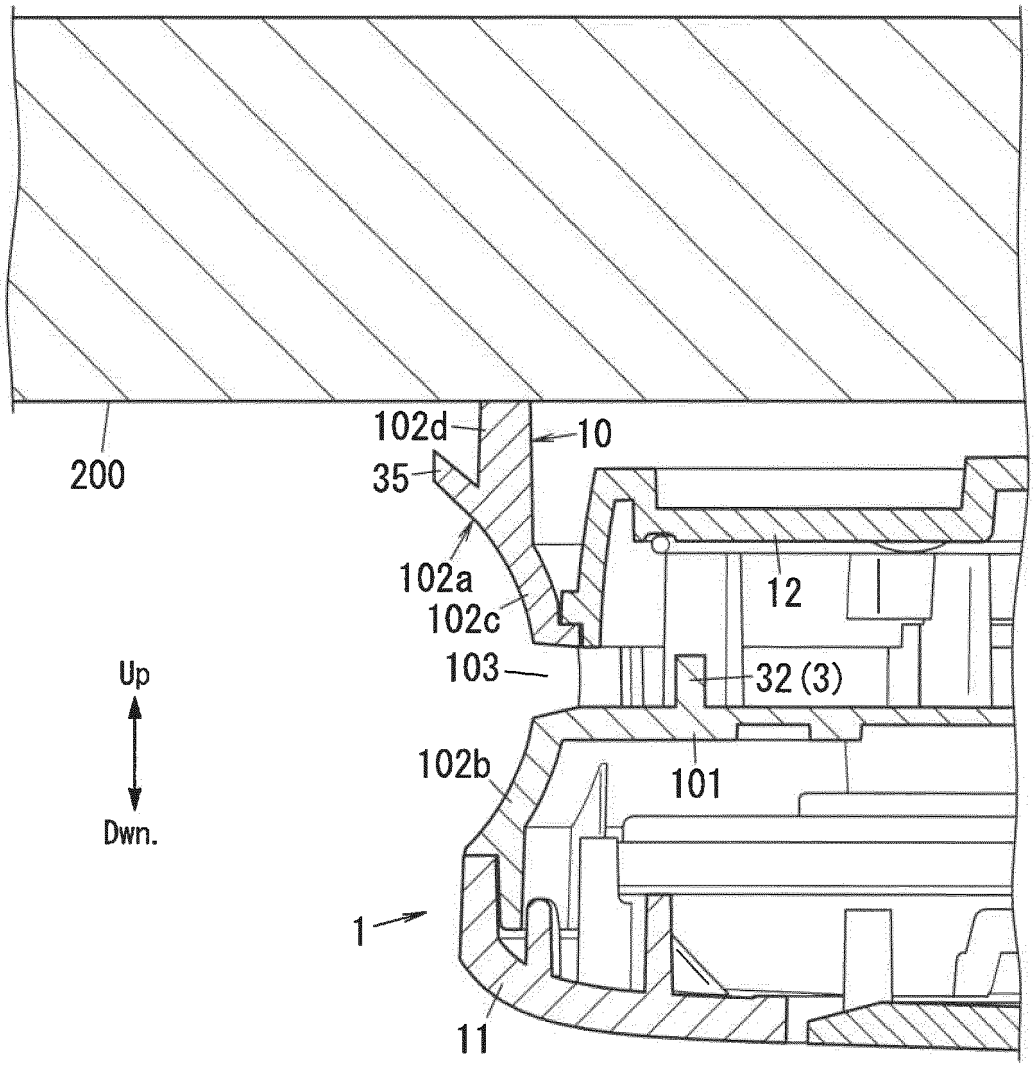


FIG. 13



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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 6731

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	DE 100 54 111 A1 (HOCHIKI CO [JP]) 12 July 2001 (2001-07-12) * paragraph [0004] - paragraph [0016]; figures 1-3,19 * * paragraph [0066] - paragraph [0077] *	1-7,9-13 8	INV. G08B17/113
X	EP 2 166 520 A1 (PANASONIC ELEC WORKS CO LTD [JP]) 24 March 2010 (2010-03-24) * paragraph [0029] - paragraph [0039]; figures 1,2,5 *	1,4-6, 10-13	
X	WO 2020/003712 A1 (HOCHIKI CO [JP]) 2 January 2020 (2020-01-02) * the whole document *	1-6, 10-13	
			TECHNICAL FIELDS SEARCHED (IPC) G08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 June 2021	Kurzbauer, Werner

CATEGORY OF CITED DOCUMENTS

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