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(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

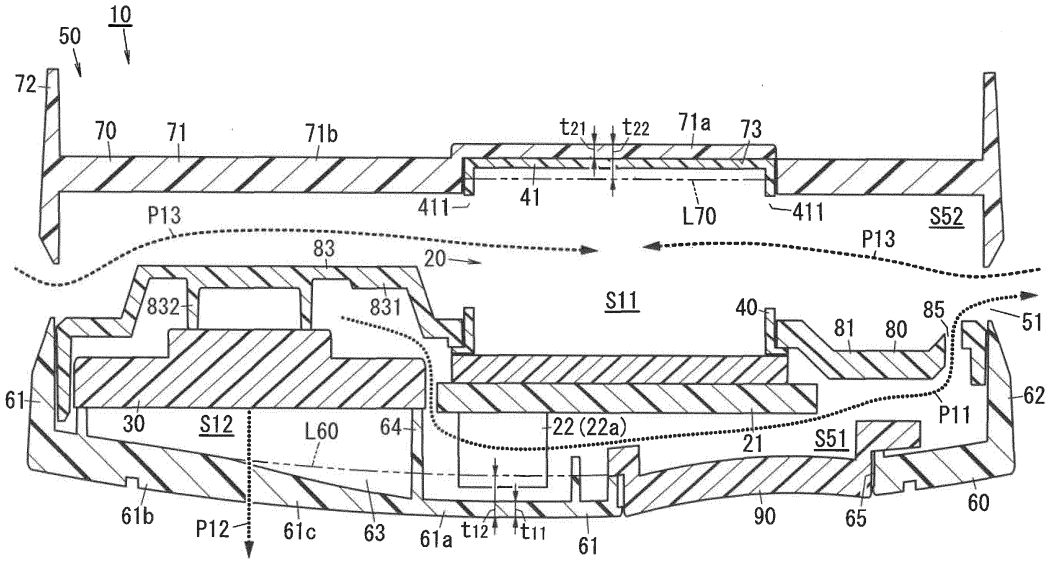
(72) Inventor: **SHIMADA, Yoshitake**
Osaka-shi, Osaka 540-6207 (JP)

(74) Representative: **Müller-Boré & Partner Patentanwälte PartG mbB**
Friedenheimer Brücke 21
80639 München (DE)

(54) **ALARM**

(57) An object is to provide an alarm configured to secure a sound volume while a sound outputter is protected. An alarm (10) includes a sound outputter (30) configured to generate a sound and a housing (50) in which the sound outputter (30) is accommodated. The housing (50) includes a shielding part (61c) and one or more air passages (P11). The shielding part (61c) has an airtight structure and covers the sound outputter (30). The one or more air passages (P11) are configured to transmit the sound from the sound outputter (30) through an opening (51) disposed at a location different from a location of the shielding part (61c) to an outside of the housing (50).

FIG. 3



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Description

Technical Field

[0001] The present disclosure generally relates to alarms. The present disclosure specifically relates to an alarm configured to take an alarm action by generating a sound.

Background Art

[0002] Patent Literature 1 discloses a fire detector (an alarm). The fire detector includes a loudspeaker configured to report a trouble. The fire detector includes a housing having a body, a front cover, and a rear cover. The front cover has a sound hole through which a sound output from the loudspeaker disposed on a back surface of a front cover body is to be emitted. The sound hole penetrates the front cover in a thickness direction of the front cover.

[0003] In Patent Literature 1, the sound hole is located in the front of the loudspeaker (a sound outputter). The sound hole may allow smoke, moisture, and the like to pass therethrough.

Citation List

Patent Literature

[0004] Patent Literature 1: JP 2016-128989 A

Summary of Invention

[0005] An object is to provide an alarm configured to secure a sound volume while a sound generation source is protected.

[0006] An alarm of one aspect of the present disclosure includes a sound outputter configured to generate a sound and a housing in which the sound outputter is accommodated. The housing includes: a shielding part having an airtight structure and covering the sound outputter; and one or more air passages configured to transmit the sound from the sound outputter via an opening at a location different from a location of the shielding part to an outside of the housing.

Brief Description of Drawings

[0007]

FIG. 1 is a perspective view illustrating an alarm (a disaster prevention device) of an embodiment;
FIG. 2 is a front view illustrating the alarm;
FIG. 3 is a sectional view schematically illustrating the alarm;
FIG. 4 is an exploded perspective view illustrating the alarm;
FIG. 5 is another exploded perspective view illustrating the alarm;
FIG. 6 is a perspective view illustrating a partition of the alarm;
FIG. 7 is another perspective view of the partition;
FIG. 8 is a cross sectional perspective view along line X-X of FIG. 2;
FIG. 9 is a cross sectional perspective view along line Y-Y of FIG. 2;
FIG. 10 is a view illustrating an introduction path of the alarm;
FIG. 11 is a sectional view schematically illustrating an alarm of a first variation;
FIG. 12 is a perspective view illustrating an alarm of a second variation;
FIG. 13 is an exploded perspective view illustrating the alarm of the second variation; and
FIG. 14 is another exploded perspective view illustrating the alarm of the second variation.

Description of Embodiments

1. Embodiment

1.1 Schema

[0008] FIGS. 1 and 2 shows an alarm 10 of an embodiment. The alarm 10 is one of disaster prevention devices. In particular, the alarm 10 according to the present embodiment is a disaster prevention device that takes an alarm action when detecting smoke generated by a fire or the like. When smoke is generated in the event of a disaster such as a fire, such a disaster prevention device detects this smoke and takes the alarm action by, for example, outputting a warning sound or cooperating with another apparatus by a communication function. As used herein, the "disaster prevention device" is an apparatus installed in a facility for the purpose of, for example, preventing disasters such as a fire, preventing the spread of damage caused by disasters, or restoring from disasters. In particular, when the disaster prevention device has a warning function of taking an alarm action, the disaster prevention device is also referred to as an alarm. Moreover, when the disaster prevention device has a detection function of detecting a target substance, the disaster prevention device is also referred to as a detector. Of course, the disaster prevention device may have both the warning function and the detection function, and in this case, the disaster prevention device may be referred to as a detector or an alarm. Examples of a facility in which such a disaster prevention device is installed include dwelling facilities such as multiple residential dwelling complexes and detached dwelling houses, and non-dwelling facilities such as hotels, office buildings, schools, welfare facilities, commercial facilities, theme parks, hospitals, and factories. The alarm 10 is installed by being attached to, for example, a ceiling or a wall in a room, a corridor, a staircase, or the like in a facility.

[0009] As illustrated in FIG. 3, the alarm 10 includes a

sound outputter 30 configured to generate a sound and a housing 50 in which the sound outputter 30 is accommodated. The housing 50 includes: a shielding part 61c having an airtight structure and covering the sound outputter 30; and one or more air passages P11 through which a sound from the sound outputter 30 is transmitted via an opening 51 at a location different from a location of the shielding part 61c to an outside of the housing 50.

[0010] The shielding part 61c is a part covering the sound outputter 30 in the housing 50 and has an airtight structure. Thus, protection of the sound outputter 30 which is a sound generation source can be expected. For example, the shielding part 61c can protect the sound outputter 30 from smoke, moisture, and the like. Since the shielding part 61c has the airtight structure, the sound from the sound outputter 30 does not pass directly through the shielding part 61c. However, the housing 50 has the air passages P11, and therefore, the housing 50 can transmit the sound from the sound outputter 30 to the outside of the housing 50 via the opening 51 provided at a location different from that of the shielding part 61c. Thus, the sound volume can be secured. As described above, according to the alarm 10, the sound volume can be secured while the sound generation source (the sound outputter 30) is protected.

1.2 Configuration

[0011] With reference to FIGS. 1 to 10, the alarm 10 will be described in detail below. Note that FIG. 3 is a sectional view merely schematically illustrating the alarm 10, and only to make the description easier to understand, the dimensions of components of the alarm 10 are illustrated differently from those in other drawings such as FIG. 1.

[0012] As illustrated in FIGS. 4 and 5, the alarm 10 includes a circuit block 20 and the housing 50. The alarm 10 further includes an operation button 90 and a battery 100. Note that it is not essential that the battery 100 is included in the components of the alarm 10. That is, the alarm 10 does not necessarily have to include the battery 100.

[0013] The circuit block 20 includes the sound outputter 30 and a sensor 40.

[0014] The sound outputter 30 is a device configured to generate a sound. More specifically, the sound outputter 30 is an electro-acoustic transducer configured to receive an electric signal and output a sound (a sonic wave). Examples of the electro-acoustic transducer include loudspeakers and buzzers. In the present embodiment, the sound outputter 30 includes a diaphragm 31. The sound outputter 30 has a disk shape as a whole. Moreover, the diaphragm 31 has a disk shape.

[0015] The sensor 40 is a device configured to detect the target substance. In the present embodiment, the target substance is smoke. However, the target substance is not limited to the smoke but may be carbon monoxide, carbon dioxide, or other gases. That is, the target substance may be a substance which is desired to be detected for disaster prevention. Such a target substance can be accordingly selected also depending on the kind of the disaster prevention device. As illustrated in FIG. 3, the sensor 40 has a detection space S11 and is configured to detect the target substance in the detection space S11. More specifically, the sensor 40 includes a case 41, a light-emitting element 42, and a light-receiving element 43 as illustrated in FIG. 10.

[0016] The case 41 has a hollow disk shape. The case 41 is made of a synthetic resin. The case 41 is a molded product made of, for example, a synthetic resin. Moreover, the case 41 has an internal space which is the detection space S11. Moreover, the case 41 has a plurality of paths 411 connecting a space lateral to the case 41 to the detection space S11. The plurality of paths 411 each have a bent shape. Thus, the target substance is taken from an outer side of the case 41 into the detection space S11 while light is suppressed from entering the detection space S11 from the outer side of the case 41. As illustrated in FIG. 10, the light-emitting element 42 and the light-receiving element 43 are accommodated in the case 41.

[0017] The sensor 40 detects smoke based on a change in the quantity of light reflected by the smoke in the detection space S11 or light transmitted through the detection space S11. In the present embodiment, light-emitting element 42 outputs light toward the detection space S11. The light-receiving element 43 is disposed at a location where direct light from the light-emitting element 42 is not incident on the light-receiving element 43 and scattered light by smoke in the detection space S11 is incident on the light-receiving element 43. Thus, in a state where no smoke is present in the detection space S11, the light-receiving element 43 does not receive the light output from the light-emitting element 42. In a state where smoke is present in the detection space S11, the light-receiving element 43 receives light (scattered light) which is the light output from the light-emitting element 42 and then scattered by the smoke. Thus, the sensor 40 is configured to detect smoke present in the detection space S11 based on a light receiving state of the light-receiving element 43. Note that the light-emitting element 42 is, for example, a Light Emitting Diode (LED). Moreover, the light-receiving element 43 is, for example, a Photodiode (PD).

[0018] As illustrated in FIGS. 4 and 5, the circuit block 20 further includes a printed wiring board 21 and one or more electronic components 22 including a switch. The electronic component 22 is mounted on the printed wiring board 21. The sensor 40 is also mounted on the printed wiring board 21. Moreover, the sound outputter 30 and the battery 100 are electrically connected to the printed wiring board 21 via, for example, electric wires. In the circuit block 20, the printed wiring board 21 and the one or more electronic components 22 form a control circuit. For example, the control circuit controls the sound outputter 30 based on an output from the sensor 40. More

specifically, when the sensor 40 detects smoke, the control circuit gives an electric signal to the sound outputter 30 to generate a sound.

[0019] The housing 50 accommodates the circuit block 20 (including the sound outputter 30 and the sensor 40). The housing 50 also accommodates the operation button 90 and the battery 100. As illustrated in FIGS. 1 and 2, the housing 50 has a disk shape which is a circular shape in plan view. The housing 50 is fixed to a mounting surface (e.g., a ceiling surface). However, in the present embodiment, the housing 50 is not directly fixed to the mounting surface but is indirectly fixed to the mounting surface by being fixed to an attachment base fixed to the mounting surface. Of course, the housing 50 may directly be fixed to the mounting surface.

[0020] As illustrated in FIGS. 4 and 5, the housing 50 includes a first cover 60, a second cover 70, and a partition 80. In the housing 50, the first cover 60 is a front side portion, and the second cover 70 is a back side portion. That is, in the alarm 10, it is assumed that the second cover 70 is used by being directly or indirectly fixed to the mounting surface. Note that the first cover 60, the second cover 70, and the partition 80 are made of a synthetic resin. The first cover 60, the second cover 70, and the partition 80 are, for example, molded products made of a synthetic resin.

[0021] As illustrated in FIGS. 4 and 5, the first cover 60 includes a front wall (a first wall) 61 and a peripheral wall (a first peripheral wall) 62.

[0022] The front wall 61 has a plate-like shape. In particular, the front wall 61 has a circular plate shape. The peripheral wall 62 protrudes from a peripheral edge of the front wall 61 toward the second cover 70. The peripheral wall 62 is cylindrical.

[0023] As illustrated in FIG. 3, the front surface 61 has the recess (a first recess) 63 in the surface (a rear surface) (an upper surface in FIG. 3) of the front wall 61 such that the front wall 61 has a partially reduced thickness, the surface facing the inner side of the housing 50. As illustrated in FIGS. 3 and 5, the front wall 61 has a prescribed part (a first prescribed part) 61a forming the recess 63 and a peripheral part (a first peripheral part) 61b surrounding the prescribed part 61a. The prescribed part 61a is a part having a circular shape, and the peripheral part 61b is a part having an annular shape. In the present embodiment, the prescribed part 61a is a central part of the front wall 61. Thus, the recess 63 is located at the center in the rear surface of the front wall 61. The prescribed part 61a has a thickness that gradually changes. More specifically, the thickness of the prescribed part 61a gradually decreases from an edge to the center of the prescribed part 61a. In particular, the surface (the rear surface), which faces the inner side of the housing 50, of the front wall 61 has, at least at the prescribed part 61a, a greater curvature than a surface (a front surface), which faces an outer side of the housing 50, of the front wall 61. That is, the prescribed part 61a and the peripheral part 61b have the same curvature on a front surface side of the front wall 61, but the prescribed part 61a has a greater curvature than the peripheral part 61b on a back surface side of the front wall 61. Thus, the recess 63 is formed.

[0024] For example, in FIG. 3, a long dashed double-short dashed line L60 shows a contour of the rear surface of the prescribed part 61a when the prescribed part 61a has, also at the back surface side, the same curvature as the peripheral part 61b (i.e., when the thickness of the front wall 61 is not partially reduced). The long dashed double-short dashed line L60 shows a state where the thickness of the prescribed part 61a is not reduced to t11 but remains t12 equal to the thickness of the peripheral part 61b. Providing the recess 63 increases the space available for accommodation of the circuit block 20 in the housing 50. In the present embodiment, the part (the electronic component 22a) of the circuit block 20 is in the recess 63 as illustrated in FIGS. 3 and 8. Thus, the size of the housing 50 (in particular, the thickness of the housing 50) can be suppressed from increasing. That is, according to the alarm 10, the alarm 10 is downsized.

[0025] As illustrated in FIGS. 1 and 3, the front wall 61 has a shielding part 61c covering the sound outputter 30. The shielding part 61c is part of the front wall 61 and faces the sound outputter 30. In the present embodiment, the shielding part 61c extends to the prescribed part 61a and the peripheral part 61b. The front wall 61 has no opening in the shielding part 61c. That is, the shielding part 61c has an airtight structure. Moreover, the shielding part 61c has a shape which difficultly functions as a cone or a diaphragm to the sound from the sound outputter 30. That is, the shielding part 61c does not have a structure that amplifies a vibration. Thus, the shielding part 61c may have a structure that reduces the sound pressure of a sound (see arrow P12 in FIG. 3) that propagates from the sound outputter 30 through the shielding part 61c and then reaches the outside of the housing 50 to be lower than the sound pressure of a sound that propagates from the sound outputter 30 through air passages P11 (see FIG. 3) and then reaches the outside of the housing 50. Note that the air passages P11 will be described later in detail.

[0026] Moreover, as illustrated in FIG. 5, the first cover 60 includes a tubular part 64. The tubular part 64 protrudes from the shielding part 61c toward the sound outputter 30. In the present embodiment, the tubular part 64 is in contact with the entire circumference of the sound outputter 30 protruding from the shielding part 61c (see FIGS. 3 and 9). The tubular part 64 is cylindrical. The sound outputter 30 is disposed with the diaphragm 31 facing the front wall 61, and the tubular part 64 abuts the sound outputter 30 to surround the diaphragm 31. The tubular part 64 has an airtight structure. The tubular part 64 and the shielding part 61c form a hermetically closed box. In other words, a hermetically sealed space S12 is formed in front of the sound outputter 30. Thus, an improvement in acoustic characteristics of the alarm 10 can be expected.

[0027] Moreover, the front wall 61 of the first cover 60 has an opening 65. The opening 65 is formed to expose the operation button 90. In the present embodiment, the opening 65 has a circular shape. The operation button 90 is a member for operating the switch of the circuit block 20. The operation button 90 is movable along the thickness of the front wall 61 to the first cover 60. Note that the operation button 90 is made of a synthetic resin. For example, the operation button 90 is a molded product made of a synthetic resin.

[0028] As illustrated in FIGS. 4 and 5, the second cover 70 includes a rear wall (a second wall) 71 and a peripheral wall (a second peripheral wall) 72.

[0029] The rear wall 71 has a plate shape. In particular, the rear wall 71 has a circular plate shape. The peripheral wall 72 protrudes, from a peripheral edge of the rear wall 71, both toward the first cover 60 and away from the first cover 60. The peripheral wall 72 is cylindrical.

[0030] As illustrated in FIG. 3, the rear wall 71 has the recess (a second recess) 73 in the surface (a front surface) (a lower surface in FIG. 3) of the rear wall 71 such that the rear wall 71 has a partially reduced thickness, the surface facing the inner side of the housing 50. As illustrated in FIGS. 3 and 5, the rear wall 71 has a prescribed part (a second prescribed part) 71a forming the recess 73 and a peripheral part (a second peripheral part) 71b surrounding the prescribed part 71a. The prescribed part 71a is a part having a circular shape, and the peripheral part 71b is a part having an annular shape. In the present embodiment, the prescribed part 71a is located to be shifted from a central part of the rear wall 71. The thickness of the prescribed part 71a does not change and is uniform unlike the thickness of the prescribed part 61a. The prescribed part 71a is thinner than the peripheral part 71b but protrudes to the outside of the housing 50 more than the peripheral part 71b. In the rear wall 71, the prescribed part 71a is thinner than the peripheral part 71b, thereby forming the recess 73.

[0031] For example, in FIG. 3, a long dashed double-short dashed line L70 shows a contour of the front surface of the prescribed part 71a when the prescribed part 71a has the same thickness as the peripheral part 71b (i.e., when the thickness of the rear wall 71 is not partially reduced). The long dashed double-short dashed line L70 shows a state where the thickness of the prescribed part 71a is not t21 but remains t22 which is equal to the thickness of the peripheral part 71b. Providing the recess 73 increases the space available for accommodation of the circuit block 20 in the housing 50. In the present embodiment, the part (the sensor 40) of the circuit block 20 is in the recess 73 as illustrated in FIGS. 3 and 8. Thus, the size of the housing 50 (in particular, the thickness of the housing 50) can be suppressed from increasing. That is, according to the alarm 10, the alarm 10 is downsized.

[0032] Moreover, the second cover 70 has a wall part (a second wall part) 74. The wall part 74 is formed on the surface, which faces the inner side of the housing 50, of the rear wall 71. The wall part 74 forms part of a specific guide wall 87a which will be described later.

[0033] Moreover, the rear wall 71 of the second cover 70 has an opening 75. The opening 75 is formed for removal of the battery 100. In the present embodiment, the opening 75 has a rectangular shape.

[0034] Moreover, the second cover 70 includes a plurality of attachment pawls 76 provided on the rear wall 71. The plurality of attachment pawls 76 protrude from the surface, which faces the outer side of the housing 50, of the rear wall 71. The plurality of attachment pawls 76 are used to attach the alarm 10 to the above-described attachment base.

[0035] As illustrated in FIG. 3, the partition 80 is disposed between the first cover 60 and the second cover 70. The partition 80 partitions the space between the first cover 60 and the second cover 70 into a first space S51 between the first cover 60 and the partition 80 and a second space S52 between the second cover 70 and the partition 80.

[0036] As illustrated in FIGS. 6 and 7, the partition 80 includes a partition plate 81. In the present embodiment, the partition plate 81 has a circular plate shape. The partition plate 81 is sized to be on an inner side of the peripheral wall 62 of the first cover 60. In particular, the partition plate 81 entirely covers the opening of the peripheral wall 62 as illustrated in FIGS. 8 to 10. Moreover, the partition plate 81 has a surface facing the second cover 70 and located on a substantially the same plane as a surface which is a tip end of the peripheral wall 62.

[0037] Moreover, the partition 80 has an opening 82, a holder 83, a battery accommodation part 84, a plurality of through holes 85, and a plurality of supporting parts 86. The opening 82, the holder 83, the battery accommodation part 84, the plurality of through holes 85, and the plurality of supporting parts 86 are provided to the partition plate 81.

[0038] The opening 82 is a pore through which the sensor 40 protrudes toward the second space S52. The opening 82 has a size that allows the case 41 of the sensor 40 to pass therethrough. In the present embodiment, the opening 82 has a circular shape. Here, in the circuit block 20, the printed wiring board 21 and the sound outputter 30 are accommodated in the first space S51, and the sensor 40 protrudes through the opening 82 toward the second space S52. Thus, the sensor 40 is accommodated in the second space S52. Thus, the sound outputter 30 and the sensor 40 are accommodated respective spaces (the first space S51 and the second space S52) separated from each other by the partition 80. This reduces the possibility that the sensor 40 is influenced by the sound generated by the sound outputter 30.

[0039] The holder 83 is a part for accommodation of the sound outputter 30. The holder 83 has a bottom 831 which is formed at the partition plate 81 and which has a shape recessed toward the second cover 70. The bottom 831 is a counter part which is part of the partition 80 and which faces the sound outputter 30. The bottom 831

is elastic. That is, the thickness and the shape of the bottom 831 are determined such that the bottom 831 is elastic. In addition, the holder 83 has a support projection 832 and a plurality of positioning projections 833. The support projection 832 abuts the central part of the sound outputter 30. The support projection 832 protrudes from the bottom 831 toward the first cover 60. The support projection 832 is cylindrical. Each of the plurality of positioning projections 833 abuts a side surface and a rear surface of the sound outputter 30 at the edge of the sound outputter 30. The plurality of projections 833 are disposed to surround the sound outputter 30. The plurality of projections 833 abut the side surface and the rear surface of the sound outputter 30 to guide the sound outputter 30 to a specified location with respect to the partition plate 81. In the specified location, a space for propagation of the sound from the sound outputter 30 is formed between the sound outputter 30 and the bottom 831 of the holder 83. Of the holder 83, the bottom 831 is elastic. Therefore, the sound outputter 30 can be pressed by the bottom 831 against the front wall 61 (the tubular part 64) of the first cover 60. Thus, the sound outputter 30 can be stably disposed in the first space S51.

[0040] The battery accommodation part 84 is a part for accommodation of the battery 100. The battery accommodation part 84 has a recess 841 which is formed at the partition plate 81 and which is a part recessed toward the first cover 60. The recess 841 accommodates part of the battery 100. The battery accommodation part 84 further has a peripheral wall 842 which surrounds the battery 100 part of which is accommodated in the recess 841. The peripheral wall 842 separates the interior of the battery accommodation part 84 from the second space S52. Thus, the battery 100 can be protected from smoke flowing into the second space S52.

[0041] The plurality of through holes 85 are pores penetrating the partition plate 81. The plurality of through holes 85 connect the first space S51 to the second space S52. In other words, the plurality of through holes 85 are pathways of a sound from the first space S51 to the second space S52. The plurality of through holes 85 are located at an edge portion of the partition plate 81. The plurality of through holes 85 each have an arc-like shape. The plurality of through holes 85 are arranged to surround the opening 82. Moreover, the plurality of through holes 85 include specific through holes 85a located on an opposite side of the opening 82 from the holder 83.

[0042] The plurality of supporting parts 86 support the rear wall 71 of the second cover 70 with respect to the partition plate 81. The plurality of supporting parts 86 each have a prism shape. The plurality of supporting parts 86 determines the distance between the partition plate 81 and the rear wall 71. The distance between the partition plate 81 and the rear wall 71 and the dimensions of the peripheral wall 62 and the peripheral wall 72 are determined such that the peripheral wall 62 and the peripheral wall 72 do not come into contact with each other and an opening 51 is formed between the peripheral wall 62 and the peripheral wall 72 (FIGS. 1, 3, 8, and 9).

[0043] The opening 51 is used to transmit the sound from the sound outputter 30 to the outside of the housing 50. That is, as illustrated in FIG. 3, the housing 50 has the air passages P11 through which the sound from the sound outputter 30 is transmitted to the outside of the housing 50 via the opening 51 provided at a location (i.e., a lateral part of the housing 50) different from that of the shielding part 61c. Thus, the air passages P11 transmit the sound from the sound outputter 30 to a space lateral to the housing 50. In particular, the air passages P11 transmit the sound from the sound outputter 30 via the first space S51, the through holes 85, and the second space S52 to the outside of the housing 50. In the present embodiment, the air passages P11 correspond to the through holes 85 on a one-to-one basis. That is, the same number of air passages P11 as the through holes 85 are provided.

[0044] In the present embodiment, the sound outputter 30 outputs the sound toward both the front wall 61 and the rear wall 71. The sound output from the sound outputter 30 toward the front wall 61 passes through the hermetically sealed space S12, propagates through the shielding part 61c, and reaches the outside of the housing 50. On the other hand, the sound output from the sound outputter 30 toward the rear wall 71 passes through the first space S51 (in particular, the space between the sound outputter 30 and the bottom 831 and the space between the printed wiring board 21 and the front wall 61), the through holes 85, and the second space S52 and reaches the outside of the housing 50.

[0045] Thus, the sound from the alarm 10 includes the sound (a first sound) which advances from the sound outputter 30 toward the front wall 61, propagates through the shielding part 61c, and reaches the outside of the housing 50 and the sound (a second sound) which advances from the sound outputter 30 toward the rear wall 71, passes through the through holes 85, and reaches the outside of the housing 50. When the first sound and the second sound cancel each other, the sound volume of overall sound output from the alarm 10 decreases. In the housing 50, the plurality of through holes 85 form part of the air passages P11. Thus, in the housing 50, the locations of the through holes 85 are adjusted. In particular, the specific through holes 85a of the plurality of through holes 85 are disposed at a location which is on an opposite side of the opening 82 from the holder 83 and which is apart from the sound outputter 30. Providing the specific through holes 85a suppresses the first sound and the second sound from canceling each other. More specifically, the through holes 85 are formed in the partition 80 (the partition plate 81) such that the waveform of the first sound and the waveform of the second sound are not in antiphase at a reference point in front of the housing 50. This suppresses the sound volume of the sound from the alarm 10 from decreasing.

[0046] Moreover, the opening 51 is also used to introduce smoke into the detection space S11. In addition,

the housing 50 has, in the second space S52, a plurality of introduction paths P13 connecting the detection space S11 of the sensor 40 to the opening 51 of the housing 50 (FIGS. 3 and 10). As illustrated in FIG. 10, the plurality of introduction paths P13 are defined by the plurality of guide walls 87. Note that in the present embodiment, the peripheral wall 842 of the battery accommodation part 84 also defines, together with the plurality of guide walls 87, the introduction paths P13. Note that in FIG. 10, part of the partition 80 which forms the introduction paths P13 is denoted by shading of dots.

[0047] As illustrated in FIG. 10, the guide walls 87 extend from the peripheral edge of the partition plate 81 toward the sensor 40 such that smoke entering the second space S52 from the opening 51 is guided to the detection space S11. In the housing 50, the plurality of through holes 85 are located at the peripheral edge of the partition plate 81. Thus, the plurality of through holes 85 include a through hole communicated with the introduction path P13. Thus, the air passages P11 and the introduction paths P13 share the space between the opening 51 and the through holes 85. This enables the air passages P11 and the introduction path P13 to be efficiency arranged.

[0048] As described above, the housing 50 includes the plurality of guide walls 87 defining the introduction paths P13. Here, as illustrated in FIG. 10, the plurality of guide walls 87, except for the specific guide wall 87a, are formed on the partition plate 81 of the partition 80. Some of the guide walls 87 are formed integrally with the supporting parts 86. The guide wall 87a is a guide wall extending across the bottom 831 (the counter part facing the sound outputter 30) of the partition 80. As illustrated in FIG. 10, the specific guide wall 87a has: a pair of first wall parts 871, 871 protruding from the partition 80 toward the second cover 70; and the second wall part 74 protruding from the second cover 70 toward the partition 80. The second wall part 74 is located between the pair of first wall parts 871, 871. Providing the second wall part 74 can reduce the possibility that the guide wall 87a suppresses the bottom 831 from being deformed. This can reduce the possibility that pressing of the sound outputter 30 at the bottom 831 against the front wall 61 is inhibited. In particular, part of the guide wall 87a that overlaps the support projection 832 is the second wall part 74. This can further reduce the possibility that the guide wall 87a suppresses the bottom 831 from being deformed. Moreover, the second wall part 74 is not in contact with the bottom 831 as illustrated in FIG. 9. This can further reduce the possibility that the guide wall 87a suppresses the bottom 831 from being deformed.

1.3 Summary

[0049] In the alarm 10 described above, the shielding part 61c is a part covering the sound outputter 30 in the housing 50 and has an airtight structure. Thus, protection of the sound outputter 30 which is a sound generation source can be expected. For example, the shielding part 61c can protect the sound outputter 30 from smoke, moisture, and the like. Since the shielding part 61c has the airtight structure, the sound from the sound outputter 30 does not pass directly through the shielding part 61c. However, the housing 50 has the air passages P11, and therefore, the housing 50 can transmit the sound from the sound outputter 30 to the outside of the housing 50 via the opening 51 provided at a location different from that of the shielding part 61c. Thus, the sound volume can be secured. As described above, according to the alarm 10, the sound volume can be secured while the sound generation source (the sound outputter 30) is protected.

[0050] In addition, providing the recess 63 increases the space available for accommodation of the circuit block 20 in the housing 50. In the present embodiment, the part (the electronic component 22a) of the circuit block 20 is in the recess 63 as illustrated in FIGS. 3 and 8. Thus, the size of the housing 50 (in particular, the thickness of the housing 50) can be suppressed from increasing. In addition, providing the recess 73 enables the space available for accommodation of the circuit block 20 in the housing 50 to be increased. In the present embodiment, the part (the sensor 40) of the circuit block 20 is in the recess 73 as illustrated in FIGS. 3 and 8. Thus, the size of the housing 50 (in particular, the thickness of the housing 50) can be suppressed from increasing. That is, according to the alarm 10, the alarm 10 is downsized.

2. Variations

[0051] The embodiment according to the present disclosure is not limited to the above-described embodiment. Various modifications may be made to the above-described embodiment depending on design and the like as long as the object of the present disclosure is achieved. Variations of the above-described embodiment will be described below.

2.1 First Variation

[0052] FIG. 11 shows an alarm 10A of a first variation. The alarm 10A includes a housing 50A different from the housing 50 of the alarm 10. The housing 50A includes a second cover 70A different from the second cover 70 of the housing 50. FIG. 11 is, in a similar manner to FIG. 3, a sectional view merely schematically illustrating the alarm 10, and only to make the description easier to understand, the thicknesses of components of the alarm 10A are emphasized.

[0053] As illustrated in FIG. 11, the second cover 70A has openings 77. The openings 77 are, in a similar manner to the opening 51, used to transmit a sound from a sound outputter 30 to the outside of the housing 50A. The openings 77 are provided, for example, at a location of a rear wall 71, the location overlapping through holes 85.

[0054] The openings 77 are used to transmit the sound from the sound outputter 30 to the outside of the housing 50A. That is, as illustrated in FIG. 11, the housing 50A has air passages P11A through which the sound from the sound outputter 30 to the outside of the housing 50A via the openings 77 provided at locations (i.e., rear parts of the housing 50A) different from that of the shielding part 61c. Thus, the air passages P11A transmit the sound from the sound outputter 30 to a space behind the housing 50A. In particular, the air passages P11A transmit the sound from the sound outputter 30 via a first space S51, the through holes 85, and a second space S52 to the outside of the housing 50A. The openings 77 are provided at the locations, which overlap the through holes 85, of the rear wall 71. Thus, the air passages P11A correspond to the through holes 85 on a one-to-one basis. That is, the same number of air passages P11A as the through holes 85 are provided.

[0055] Thus, the housing 50A includes not only air passages P11 but also the air passages P11A. Thus, the housing 50A transmits the sound from the sound outputter 30 to both the space behind the housing 50A and a space lateral to the housing 50A. More specifically, the housing 50A transmits the sound from the sound outputter 30 to the outside of the housing 50A through the openings 51 and 77 provided at locations different from the location of the shielding part 61c.

[0056] Moreover, the openings 77 are also used to introduce smoke into a detection space S11 in a similar manner to the opening 51. Thus, the housing 50A has, in the second space S52, a plurality of introduction paths P13A connecting the detection space S11 of a sensor 40 to the outside of the housing 50A (FIG. 11). That is, the housing 50A includes not only introduction paths P13 but also the introduction paths P13A. Thus, the housing 50A easily introduces smoke into the detection space S11.

2.2 Second Variation

[0057] FIGS. 12 to 14 show an alarm 10B of a second variation. As illustrated in FIGS. 13 and 14, the alarm 10B includes a circuit block 20 and a housing 50B. The alarm 10B further includes an operation button 90 and a battery 100. The circuit block 20, the operation button 90, and the battery 100 are similar to those of the alarm 10, and thus, the description thereof is omitted.

[0058] The housing 50B accommodates the circuit block 20 (including a sound outputter 30 and a sensor 40). The housing 50B also accommodates the operation button 90 and the battery 100. As illustrated in FIG. 12, the housing 50B has a disk shape which is a circular shape in plan view.

[0059] As illustrated in FIGS. 13 and 14, the housing 50B includes a first cover 60B and a second cover 70B. In the housing 50B, the first cover 60B is a front side portion, and the second cover 70B is a back side portion. The first cover 60B and the second cover 70B are made of a synthetic resin. The first cover 60B and the second cover 70B are molded products made of, for example, a synthetic resin.

[0060] As illustrated in FIGS. 13 and 14, the first cover 60B includes a front wall (a first wall) 610 and a peripheral wall (a first peripheral wall) 620.

[0061] The front wall 610 has a plate-like shape. In particular, the front wall 610 has a circular plate shape. The peripheral wall 620 protrudes from a peripheral edge of the front wall 610 toward the second cover 70B. The peripheral wall 620 is cylindrical. In a similar manner to the front wall 61, the front wall 61 has a recess 630 in a surface of the front wall 610 such that the front wall 610 has a partially reduced thickness, the surface of the front wall 610 facing an inner side of the housing 50B. The front wall 610 includes a prescribed part 610a forming the recess 630 and a peripheral part 610b surrounding the prescribed part 610a. Also in the housing 50B, providing the recess 630 increases a space for accommodation of the circuit block 20 in the housing 50B. Thus, the size of the housing 50B (in particular, the thickness of the housing 50B) can be suppressed from increasing.

[0062] Moreover, the front wall 610 has a shielding part 610c covering the sound outputter 30. The shielding part 610c is part of the front wall 610 and faces the sound outputter 30. The front wall 610 has no opening in the shielding part 610c. That is, the shielding part 610c has an airtight structure.

[0063] The first cover 60B further has a tubular part 640. The tubular part 640 protrudes from the shielding part 610c toward the sound outputter 30. The tubular part 640 is in contact with the entire circumference of the sound outputter 30 protruding from the shielding part 610c. The tubular part 640 is cylindrical. The tubular part 640 has an airtight structure. The tubular part 640 and the shielding part 610c form a hermetically closed box.

[0064] Moreover, the front wall 610 of the first cover 60B has an opening 650. The opening 650 is formed to expose the operation button 90. The opening 650 has a circular shape.

[0065] As illustrated in FIGS. 13 and 14, the second cover 70B has a rear wall (a second wall) 710 and a peripheral wall (a second peripheral wall) 720.

[0066] The rear wall 710 has a plate shape. In particular, the rear wall 710 has a circular plate shape. The peripheral wall 720 protrudes from a peripheral edge of the rear wall 710 away from the first cover 60B. The peripheral wall 720 is cylindrical.

[0067] As illustrated in FIGS. 13 and 14, the second cover 70B includes a circuit accommodation part 730. The circuit accommodation part 730 is a part for accommodation of the sensor 40. The circuit accommodation part 730 has a shape recessed in the rear wall 710 toward an opposite side from the first cover 60B. Thus, the circuit block 20 is accommodated in the housing 50B in a state where the sensor 40 is located in the circuit accommodation part 730.

[0068] As illustrated in FIGS. 13 and 14, the second

cover 70B further includes a battery accommodation part 740. The battery accommodation part 740 is a part for accommodation of a battery 100. The battery accommodation part 740 has a part in the rear wall 710, the part recessed toward the first cover 60B.

[0069] The second cover 70B further includes a plurality of supporting parts 750. The plurality of supporting parts 750 support the front wall 610 of the first cover 60B with respect to the second cover 70B. The plurality of supporting parts 750 each have a prism shape. The plurality of supporting parts 750 determines the distance between the front wall 610 and the rear wall 710. The distance between the front wall 610 and the rear wall 710 and the dimensions of the peripheral wall 620 and the peripheral wall 720 are determined such that the peripheral wall 620 and the peripheral wall 720 do not come into contact with each other and an opening 510 is formed between the peripheral wall 620 and the peripheral wall 720 (see FIG. 12).

[0070] Moreover, the second cover 70B includes a plurality of attachment pawls 760 provided on the rear wall 710. The plurality of attachment pawls 760 protrude from a surface of the rear wall 710, the surface facing an outer side of the housing 50B. The plurality of attachment pawls 760 are used to attach the alarm 10B to the above-described attachment base.

[0071] The opening 510 described above is used to transmit a sound from the sound outputter 30 to the outside of the housing 50B. That is, as illustrated in FIG. 12, the housing 50B has air passages P11B through which the sound from the sound outputter 30 is transmitted to the outside of the housing 50B via the opening 510 provided at a location (i.e., a lateral part of the housing 50B) different from that of the shielding part 610c. Thus, the air passages P11B transmit the sound from the sound outputter 30 to a space lateral to the housing 50B.

[0072] Moreover, the opening 510 is also used to introduce smoke into a detection space S11. In addition, the housing 50B has, in the housing 50B, a plurality of introduction paths P13B connecting the detection space S11 of the sensor 40 to the opening 510 of the housing 50B (see FIG. 12). The plurality of introduction paths P13B are defined by a plurality of guide walls 770.

[0073] The guide walls 770 extend from the peripheral edge of the rear wall 710 toward the sensor 40 such that smoke entering the housing 50B from the opening 51 is guided to the detection space S11. As illustrated in FIG. 13, the plurality of guide walls 770 are formed on the rear wall 710 of the second cover 70B. The plurality of guide walls 770 are formed integrally with some of the supporting parts 750.

[0074] In the above-described alarm 10B, the housing 50B includes the first cover 60B and the second cover 70B. That is, the housing 50B includes no partition 80 unlike the housing 50. That is, the partition 80 is not essential.

2.3 Other Variations

[0075] Further variations of the alarms 10, 10A, and 10B will be described below. Deformation of the alarm 10 will be mainly described below, but, similar deformation is of course applicable to the alarms 10A and 10B.

[0076] For example, each component of the alarm 10 is not limited to that in the embodiment and may be accordingly modified.

[0077] For example, in the circuit block 20 of the alarm 10, the sound outputter 30 and the sensor 40 are not limited to those in the example described above but may be replaced with conventionally known devices. The circuit block 20 does not necessarily have to include both the sound outputter 30 and the sensor 40. For example, the circuit block 20 of the alarm 10 does not have to include the sensor 40. In this case, no introduction path P13 is required. The circuit block 20 does not have to include a switch, and in this case, neither the operation button 90 nor the opening 65 are required.

[0078] The shape of the housing 50 of the alarm 10 is not limited to that of the embodiment but may accordingly be modified. For example, the housing 50 does not have to have a circular shape but may be rectangular or polygonal in plan view. That is, the first cover 60 and the second cover 70 also does not have to have a circular shape but may be rectangular or polygonal in plan view.

[0079] In the housing 50, the plurality of through holes 85 and 85a are arranged to surround the sensor 40. However, only one through hole 85 may be provided. In this case, the one through hole 85 is preferably formed to surround the sensor 40. Thus, the housing 50 has at least one or more through holes 85 and does not necessarily have to have a plurality of through holes 85. The through hole(s) 85 does not have to have an arc-like shape but may have a circular shape, a polygonal shape, or any other desired shape. The location of the through hole(s) 85 is not limited to that described in the above-described embodiment, and the through hole 85 may be disposed at an appropriate location.

[0080] The housing 50 includes at least one or more air passages P11 and does not necessarily have to have a plurality of air passages P11. In the alarm 10, the air passages P11 do not have to correspond to the through holes 85 on a one-to-one basis. For example, the air passage P11 may have two or more through holes 85, and the two or more through holes 85 may be present in series or in parallel in the air passage P11.

[0081] The housing 50 does not necessarily have to have a plurality of introduction paths P13 and may, for example, include only one introduction path P13. In the alarm 10, the introduction path P13 does not have to share the opening 51 with the air passage P11. Note that when the circuit block 20 of the alarm 10 includes no sensor 40, the introduction path P13 is naturally not required.

[0082] In the housing 50, the shielding part 61c is part of the front wall 61, but this is a mere example. When the

sound outputter 30 is disposed to face the rear wall 71, part of the rear wall 71 may be a shielding part. That is, in the housing 50, a part facing the sound outputter 30 (in particular, a part located in front of the diaphragm 31 of the sound outputter 30) may be the shielding part.

[0083] In the first cover 60, the thickness of the prescribed part 61a gradually decreases from the edge of the prescribed part 61a toward the center but may stepwise decrease. However, a sink mark at the time of shaping is more easily suppressed when the thickness of the prescribed part 61a gradually decreases. This facilitates the formation of the housing 50 by a shaping technique. The prescribed part 61a is at least thinner than the peripheral part 61b and may have uniform thickness. The surface, which faces the inner side of the housing 50, of the front wall 61 may have, not only at the prescribed part 61a but at the entirety of the surface, a greater curvature than a surface of the front wall 61, the surface facing the outer side of the housing 50. The first cover 60 may have a plurality of prescribed parts 61a (i.e., recesses 63).

[0084] In the second cover 70, the prescribed part 71a has a uniform thickness, but the thickness of the prescribed part 71a may gradually or stepwise decrease from the edge of the prescribed part 71a toward the center. The surface, which faces the inner side of the housing 50, of the rear wall 71 may have, at least at the prescribed part 71a, a greater curvature than a surface of the rear wall 71, the surface facing the outer side of the housing 50. The second cover 70 may have a plurality of prescribed parts 71a (i.e., recesses 73).

[0085] It is not necessary that the thicknesses of both the front wall 61 and the rear wall 71 partially decrease. That is, at least one of the front wall 61 or the rear wall 71 has a recess 63 or 73 in the surface of the at least one of the front wall 61 or the rear wall 71 such that the at least one of the front wall 61 or the rear wall 71 has a reduced thickness, the surface facing the inner side of the housing 50.

[0086] Moreover, in the housing 50, the thickness of the first cover 60 does not have to be partially reduced. That is, the first cover 60 does not have to have the recess 63. Similarly, the thickness of the second cover 70 does not have to be partially reduced. That is, the second cover 70 does not have to have the recess 73.

[0087] The alarm 10A includes both the air passage P11 and the air passage P11A, but in this case, the air passage P11 is not essential. That is, in the alarm 10A, the housing 50A does not have to have the opening 51.

3. Aspects

[0088] As can be seen from the above-described embodiment and variations, the present disclosure includes the following aspects. In the following description, reference signs are provided to clarify the correspondence relationship to the embodiment.

[0089] An alarm (10; 10A; 10B) of a first aspect includes a sound outputter (30) configured to generate a sound and a housing (50; 50A; 50B) in which the sound outputter (30) is accommodated. The housing (50; 50A; 50B) includes a shielding part (61c; 610c) and one or more air passages (P11; P11A; P11B). The shielding part (61c; 610c) has an airtight structure and covers the sound outputter (30). The one or more air passages (P11; P11A; P11B) are configured to transmit the sound from the sound outputter (30) from an opening (51; 77; 510) at a location different from a location of the shielding part (61c; 610c) to an outside of the housing (50; 50A; 50B). According to the first aspect, the sound volume is secured while a sound generation source (the sound outputter (30) is protected.

[0090] An alarm (10; 10A; 10B) of a second aspect would be realized in combination with the first aspect. In the second aspect, the housing (50; 50A; 50B) includes a tubular part (64; 640) protruding from the shielding part (61c; 610c) and being in contact with an entire circumference of the sound outputter (30). According to the second aspect, improvement in acoustic characteristics is expected.

[0091] An alarm (10; 10A; 10B) of a third aspect would be realized in combination with the first or second aspect. In the third aspect, the shielding part (61c; 610c) is configured to reduce a sound pressure of the sound from the sound outputter (30) to lower when the sound propagates through the shielding part (61c; 610c), and reaches the outside of the housing (50; 50A; 50B) than when the sound propagates through the one or more air passages (P11; P11A; P11B). According to third aspect, improvement in acoustic characteristics is expected.

[0092] An alarm (10; 10A; 10B) of a fourth aspect would be realized in combination with any one of the first to third aspects. In the fourth aspect, the housing (50; 50A; 50B) includes: a first cover (60; 60B) having the front wall (61; 610); and a second cover (70; 70A; 70B) having the rear wall (71; 71A; 710). The shielding part (61c; 610c) is part of the front wall (61; 610). According to the fourth aspect, the sound volume is secured while the sound generation source is protected.

[0093] An alarm (10; 10A; 10B) of a fifth aspect would be realized in combination with the fourth aspect. In the fifth aspect, the one or more air passages (P11; P11A; P11B) configured to transmit the sound from the sound outputter (30) to a space lateral to or behind the housing (50; 50A; 50B). According to the fifth aspect, the sound volume is secured while the sound generation source is protected.

[0094] An alarm (10; 10A) of a sixth aspect would be realized in combination with the fourth or fifth aspect. In the sixth aspect, the housing (50; 50A) further includes a partition (80) between the first cover (60) and the second cover (70; 70A). The partition (80) has one or more through holes (85, 85a) via which a first space (S51) between the front wall (61) and the partition (80) and a second space (S52) between the rear wall (71; 71A) and the partition (80) are communicated with each other. The

sound outputter (30) is in the first space (S51). According to the sixth aspect, the sound volume is secured while the sound generation source is protected.

[0095] An alarm (10; 10A) of a seventh aspect would be realized in combination with the sixth aspect. In the seventh aspect, the one or more through holes (85, 85a) are formed in the partition (80) to avoid that the waveform of a first sound and the waveform of a second sound are in antiphase at a reference point in front of the housing (50; 50A). The first sound is a sound that advances from the sound outputter (30) toward the front wall (61), propagates through the shielding part (61c), and reaches the outside of the housing (50; 50A). The second sound is a sound that advances from the sound outputter (30) toward the rear wall (71; 71A), passes through the one or more through holes (85, 85a), and reaches the outside of the housing (50; 50A). According to seventh aspect, improvement in acoustic characteristics is expected.

[0096] An alarm (10; 10A) of an eighth aspect would be realized in combination with the sixth or seventh aspect. In the eighth aspect, the one or more air passages (P11; P11A; P11B) are configured to transmit the sound from the sound outputter (30) through the first space (S51), the one or more through holes (85, 85a), and the second space (S52) to the outside of the housing (50; 50A). According to the eighth aspect, the sound volume is secured while the sound generation source is protected.

[0097] An alarm (10; 10A) of a ninth aspect would be realized in combination with any one of the sixth to eighth aspects. In the ninth aspect, the opening (51) includes a gap between the second cover (70; 70A) and each of the first cover (60) and the partition (80). The ninth aspect simplifies the structure of the housing (50; 50A).

[0098] An alarm (10; 10A; 10B) of a tenth aspect would be realized in combination with any one of the sixth to ninth aspects. In the tenth aspect, the alarm (10; 10A) further includes a sensor (40) having a detection space (S11) and configured to detect a target substance in the detection space (S11). The sensor (40) is in the second space (S52). The tenth aspect reduces the possibility that the sensor (40) is influenced by the sound generated by the sound outputter (30).

[0099] An alarm (10; 10A; 10B) of an eleventh aspect would be realized in combination with the tenth aspect. In the eleventh aspect, the one or more through holes (85, 85a) surround the sensor (40). According to the eleventh aspect, the sound volume is secured while the sound generation source is protected.

[0100] An alarm (10; 10A; 10B) of a twelfth aspect would be realized in combination with the tenth or eleventh aspect. In the twelfth aspect, the housing (50; 50A) has an introduction path (P13; P13A) connecting the detection space (S11) of the sensor (40) to the opening (51; 77). The one or more through holes (85, 85a) have a through hole (85, 85a) communicated with the introduction path (P13; P13A). The twelfth aspect enables the air passage (P11; P11A) and the introduction path (P13; P13A) to be efficiency disposed.

[0101] An alarm (10; 10A) of a thirteenth aspect would be realized in combination with the twelfth aspect. In the thirteenth aspect, the partition (80) has a counter part (831) facing the sound outputter (30) and being elastic. The thirteenth aspect enables the sound outputter (30) to be stably disposed in the first space (S51).

[0102] An alarm (10; 10A) of a fourteenth aspect would be realized in combination with the thirteenth aspect. In a fourteenth aspect, the housing (50; 50A; 50B) includes one or more guide walls (87) that define the introduction path (P13; P13A; P13B). The one or more guide walls (87) include a specific guide wall (87a) extending across the counter part (831) of the partition (80). The specific guide wall (87a) includes a first wall section (871) protruding from the partition (80) toward the second cover (70; 70A; 70B) and a second wall section (74) protruding from the second cover (70; 70A; 70B) to the partition (80). The fourteenth aspect reduces the possibility that deformation of the counter part (the bottom 831) is suppressed by the guide wall (87a).

[0103] An alarm (10; 10A) of a fifteenth aspect would be realized in combination with the fourteenth aspect. In the fifteenth aspect, the second wall section (74) is out of contact with the counter part (831). The fifteenth aspect further reduces the possibility that the deformation of the counter part (the bottom 831) is suppressed by the guide wall (87a).

Reference Signs List

[0104]

10, 10A, 10B	ALARM
30	SOUND OUTPUTTER
40	SENSOR
S11	DETECTION SPACE
50, 50A, 50B	HOUSING
S51	FIRST SPACE
S52	SECOND SPACE
P11, P11A, P11B	AIR PASSAGE
P13, P13A	INTRODUCTION PATH
51, 77, 510	OPENING
60, 60B	FIRST COVER
61,610	FRONT WALL
61c, 610c	SHIELDING PART
64, 640	TUBULAR PART
70, 70A, 70B	SECOND COVER
71, 71A, 710	REAR WALL
74	SECOND WALL SECTION
80	PARTITION
85, 85a	THROUGH HOLE
831	BOTTOM (COUNTER PART)
87	GUIDE WALL
87a	GUIDE WALL (SPECIFIC GUIDE WALL)
871	FIRST WALL SECTION

Claims

1. An alarm, comprising:

   a sound outputter configured to generate a sound and
   a housing in which the sound outputter is accommodated,
   the housing including

   a shielding part having an airtight structure and covering the sound outputter and
   one or more air passages configured to transmit the sound from the sound outputter via an opening at a location different from a location of the shielding part to an outside of the housing.

2. The alarm of claim 1, wherein
   the housing includes a tubular part protruding from the shielding part and being in contact with an entire circumference of the sound outputter.

3. The alarm of claim 1 or 2, wherein
   the shielding part is configured to reduce a sound pressure of the sound from the sound outputter to be lower when the sound propagates through the shielding part and reaches the outside of the housing than when the sound propagates through the one or more air passages.

4. The alarm of any one of claims 1 to 3, wherein
   the housing includes

   a first cover having a front wall, and
   a second cover having a rear wall, wherein

   the shielding part is part of the front wall.

5. The alarm of claim 4, wherein
   the one or more air passages are configured to transmit the sound from the sound outputter to a space lateral to or behind the housing.

6. The alarm of claim 4 or 5, wherein
   the housing further includes a partition between the first cover and the second cover, the partition has one or more through holes via which a first space between the front wall and the partition and a second space between the rear wall and the partition are communicated with each other, and
   the sound outputter is in the first space.

7. The alarm of claim 6, wherein
   the one or more through holes are formed in the partition to avoid that the waveform of a first sound and the waveform of a second sound are in antiphase at a reference point in front of the housing,
   the first sound is a sound that advances from the sound outputter toward the front wall, propagates through the shielding part, and reaches the outside of the housing, and
   the second sound is a sound that advances from the sound outputter toward the rear wall, passes through the one or more through holes, and reaches the outside of the housing.

8. The alarm of claim 6 or 7, wherein
   the one or more air passages are configured to transmit the sound from the sound outputter through the first space, the one or more through holes, and the second space to the outside of the housing.

9. The one alarm of any one of claims 6 to 8, wherein
   the opening includes a gap between the second cover and each of the first cover and the partition.

10. The one alarm of any one of claims 6 to 9, wherein
    the alarm further includes a sensor having a detection space and configured to detect a target substance in the detection space, and
    the sensor is in the second space.

11. The alarm of claim 10, wherein
    the one or more through holes surround the sensor.

12. The alarm of claim 10 or 11, wherein
    the housing has an introduction path connecting the detection space of the sensor to the opening, and
    the one or more through holes have through holes communicated with the introduction path.

13. The alarm of claim 12, wherein
    the partition has a counter part facing the sound outputter and being elastic.

14. The alarm of claim 13, wherein
    the housing includes one or more guide walls that define the introduction path, the one or more guide walls include a specific guide wall extending across the counter part of the partition, and
    the specific guide wall includes

    a first wall section protruding from the partition toward the second cover and
    a second wall section protruding from the second cover to the partition.

15. The alarm of claim 14, wherein
    the second wall section is out of contact with the counter part.

FIG. 1

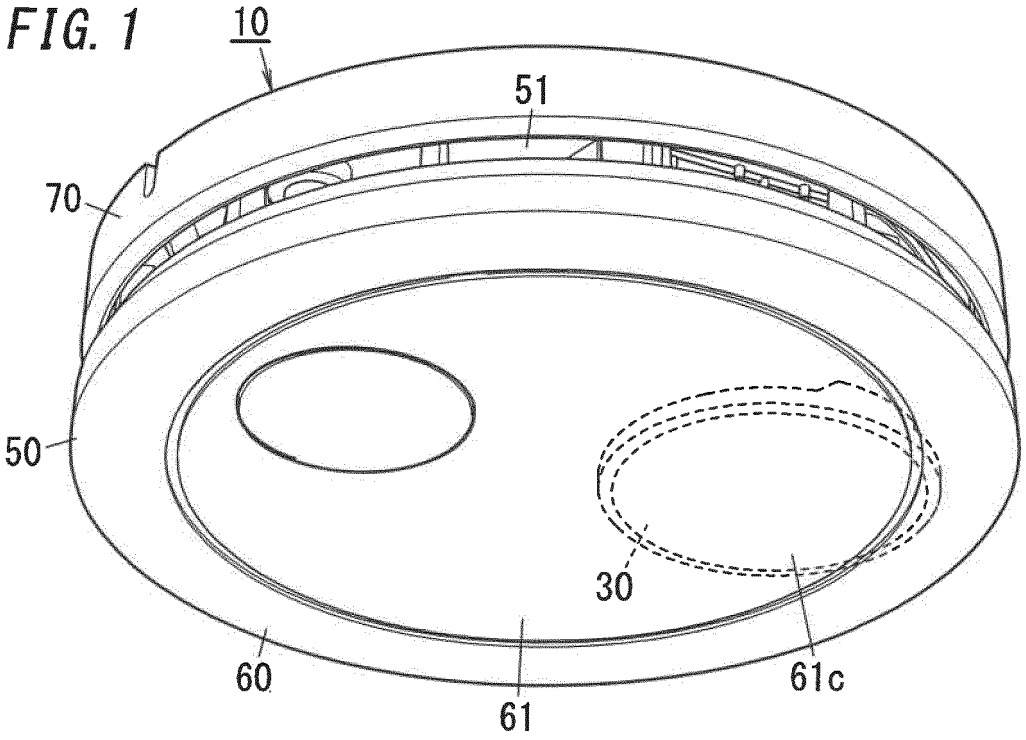


FIG. 2

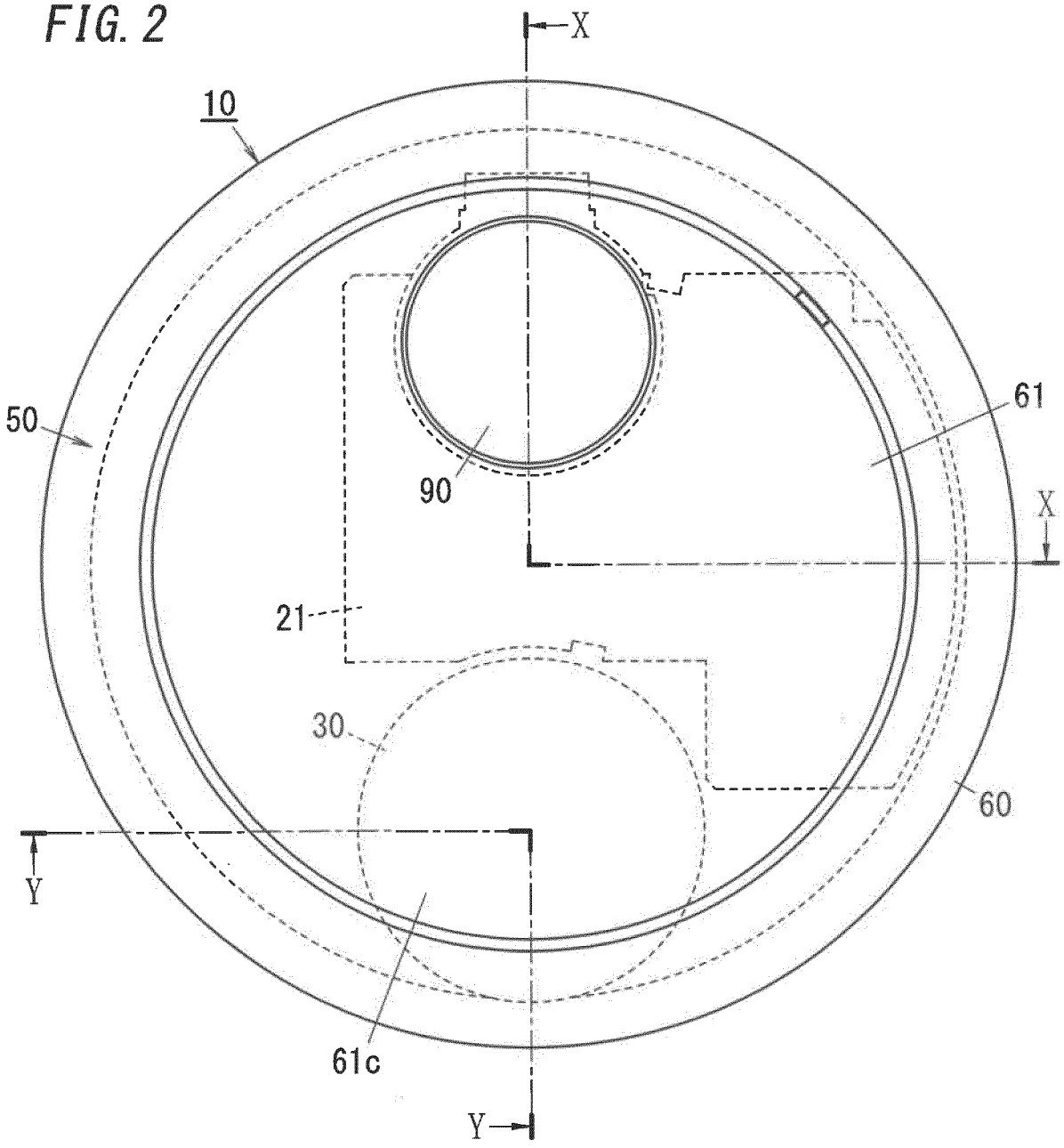
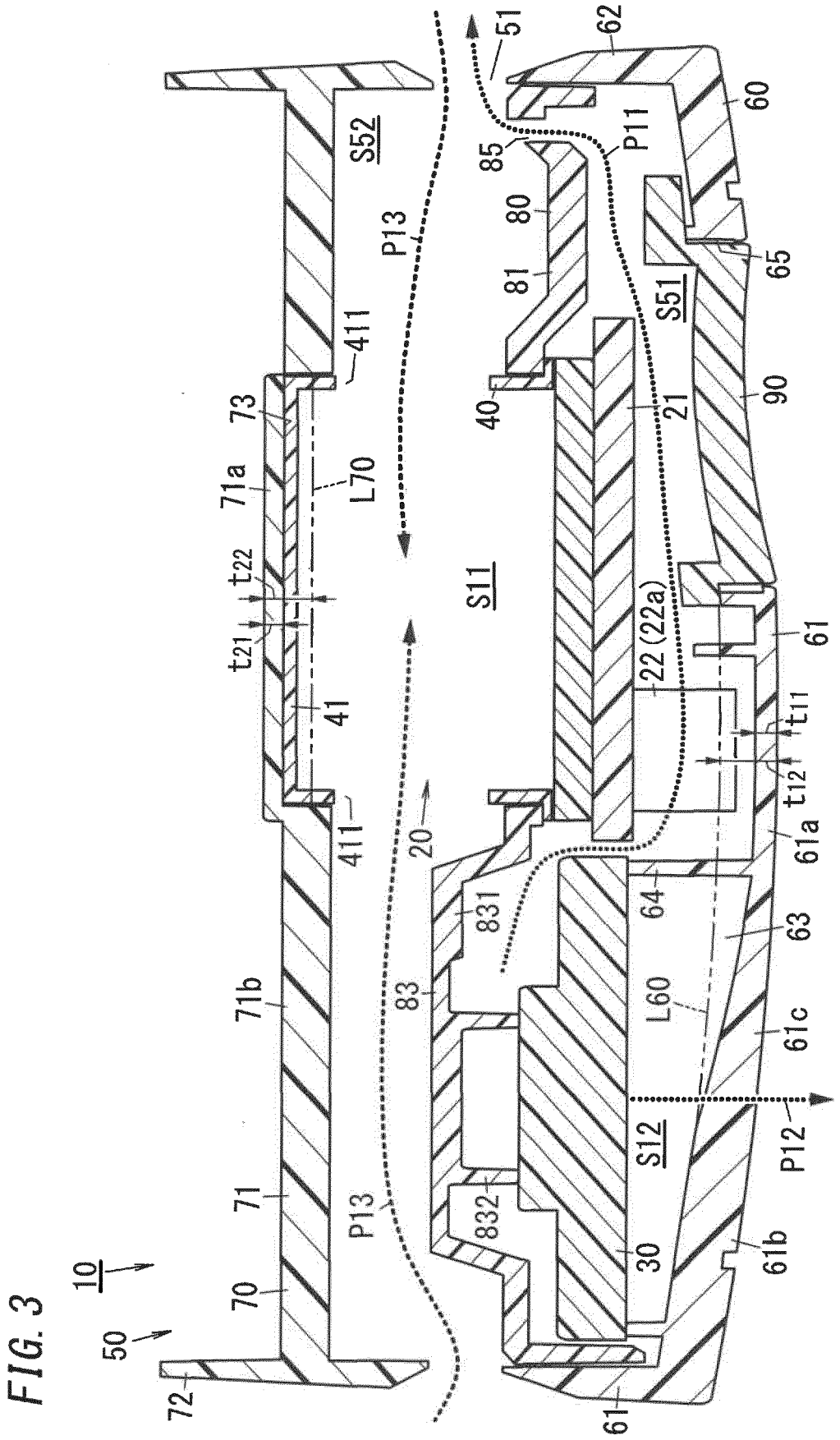


FIG. 3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50
72
70
71
71b
71a
73
411
S52
P13
51
62
60
85
P11
80
81
65
S51
90
40
21
L70
t22
t21
41
S11
22 (22a)
61
t11
t12
61a
20
831
64
63
83
L60
61c
S12
P12
832
30
61b
61

FIG. 4

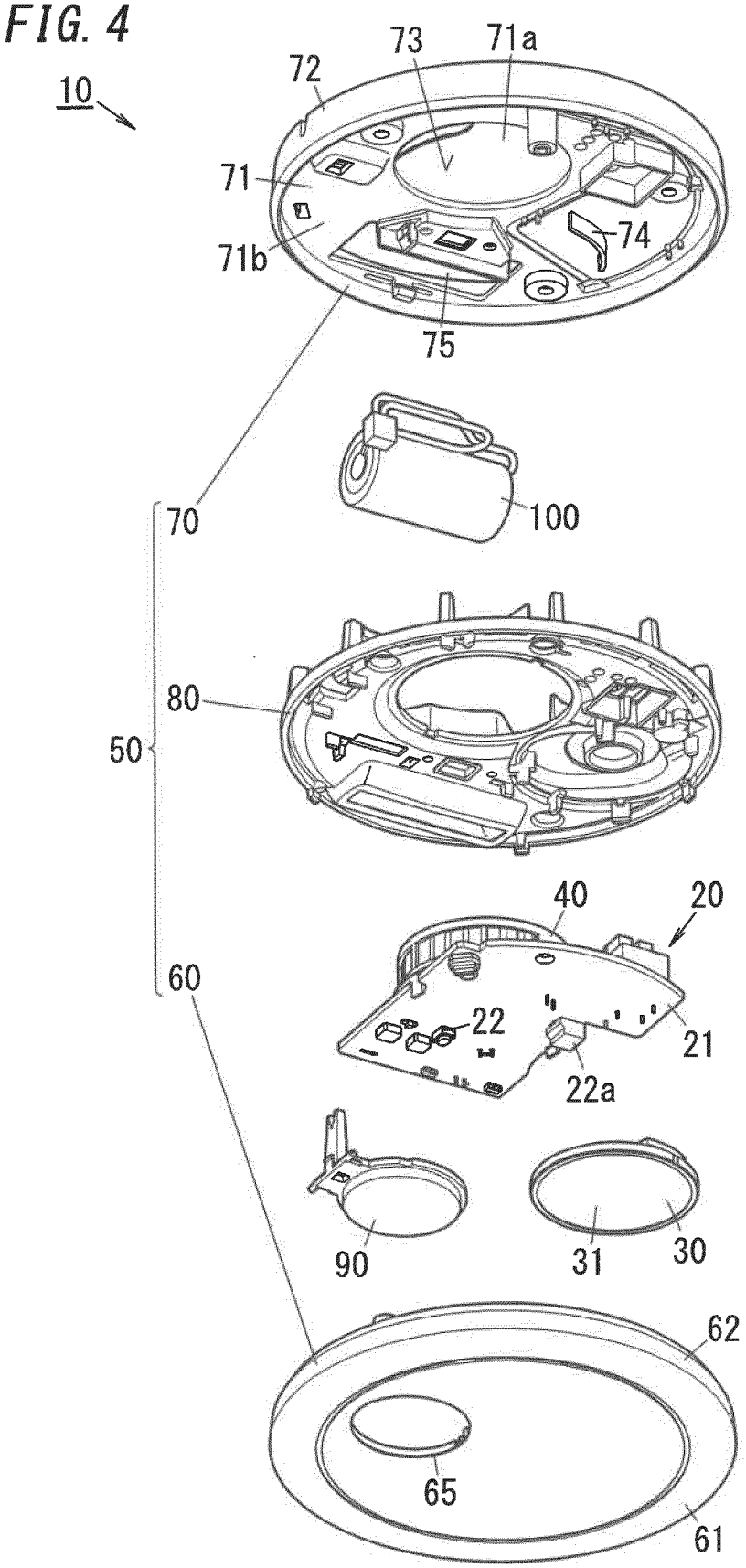
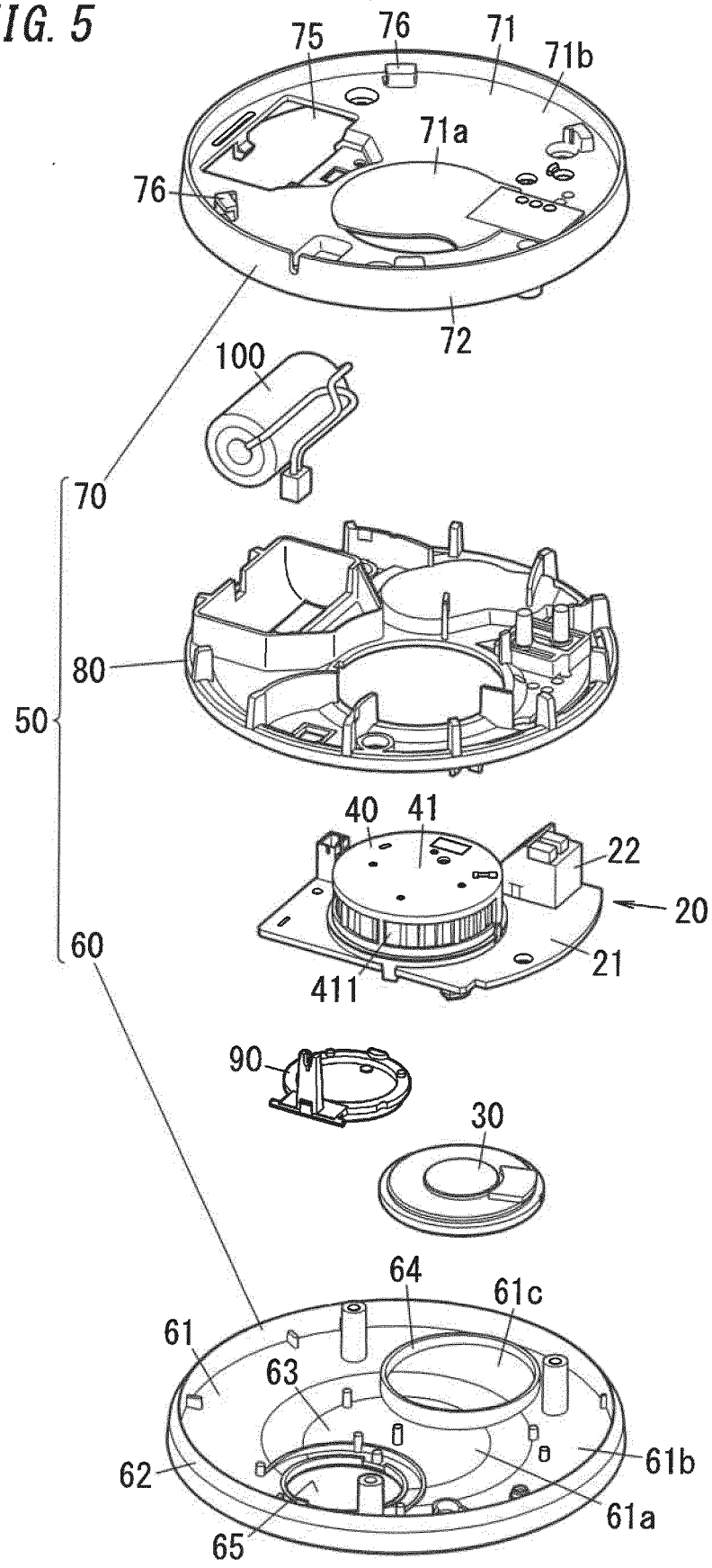

10
72
73
71a
71
71b
74
75
70
100
80
50
40
20
60
22
21
22a
90
31
30
62
65
61

FIG. 5


75
76
71
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71a
76
72
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70
80
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40
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20
60
411
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30
64
61c
61
63
62
61b
61a
65

FIG. 6

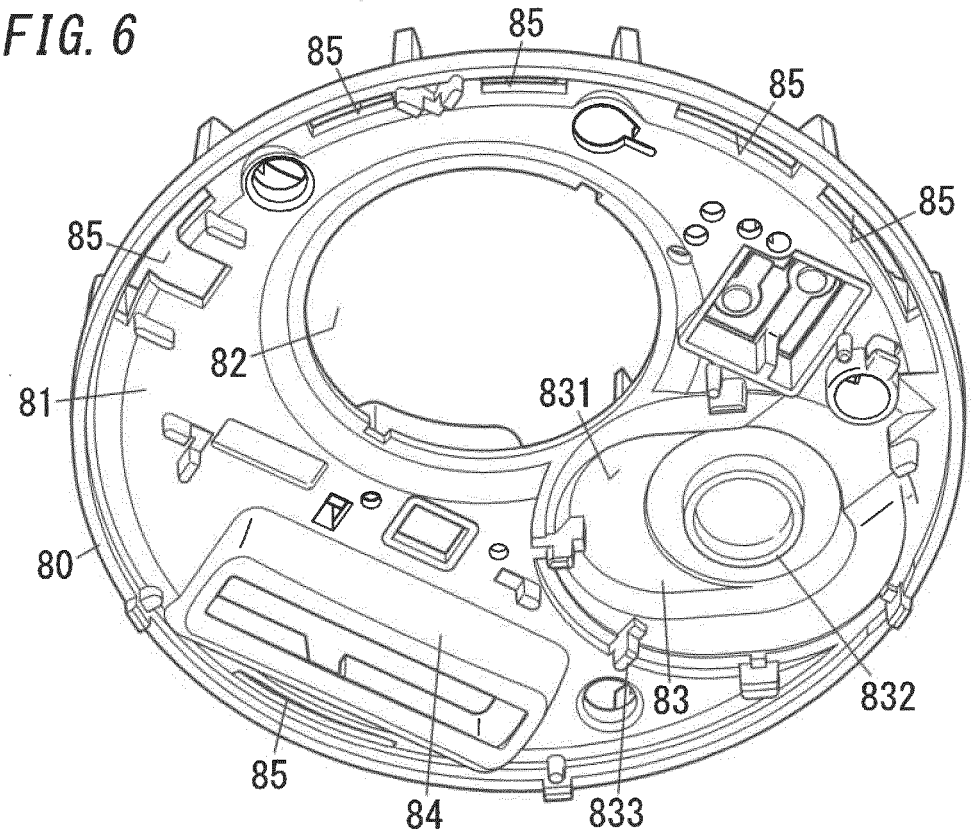
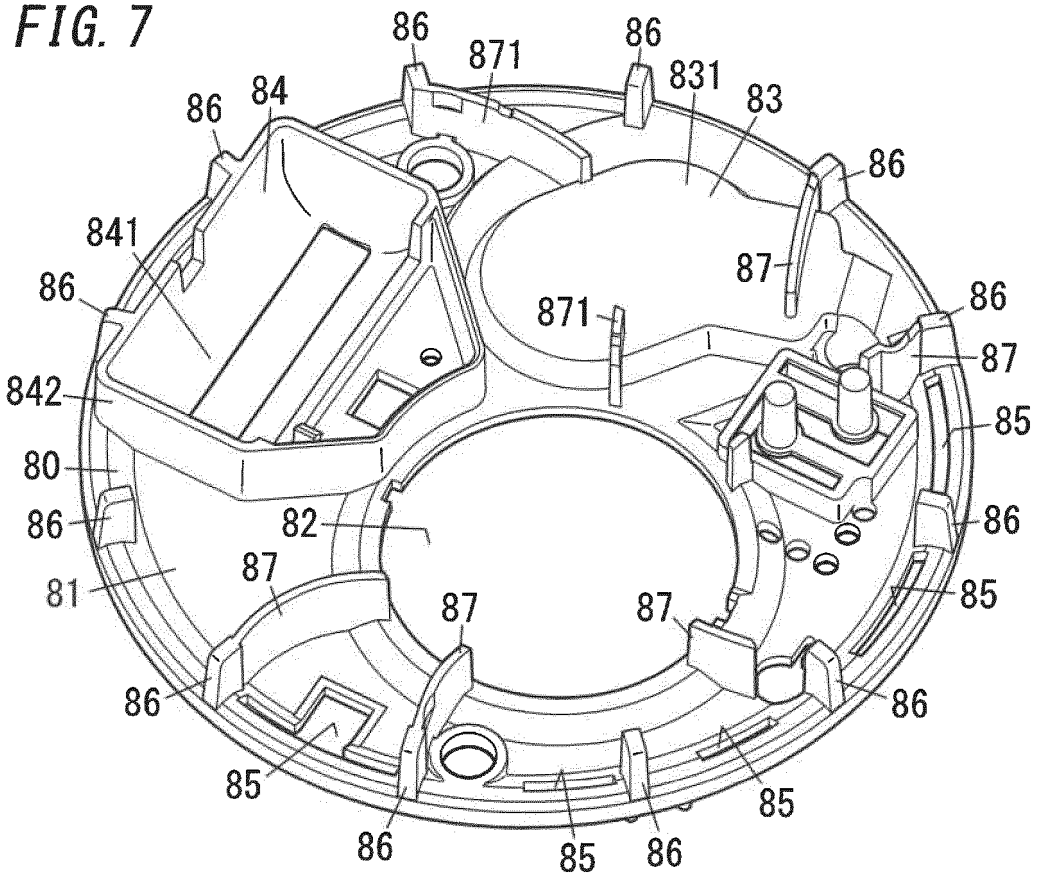


FIG. 7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831
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841
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871
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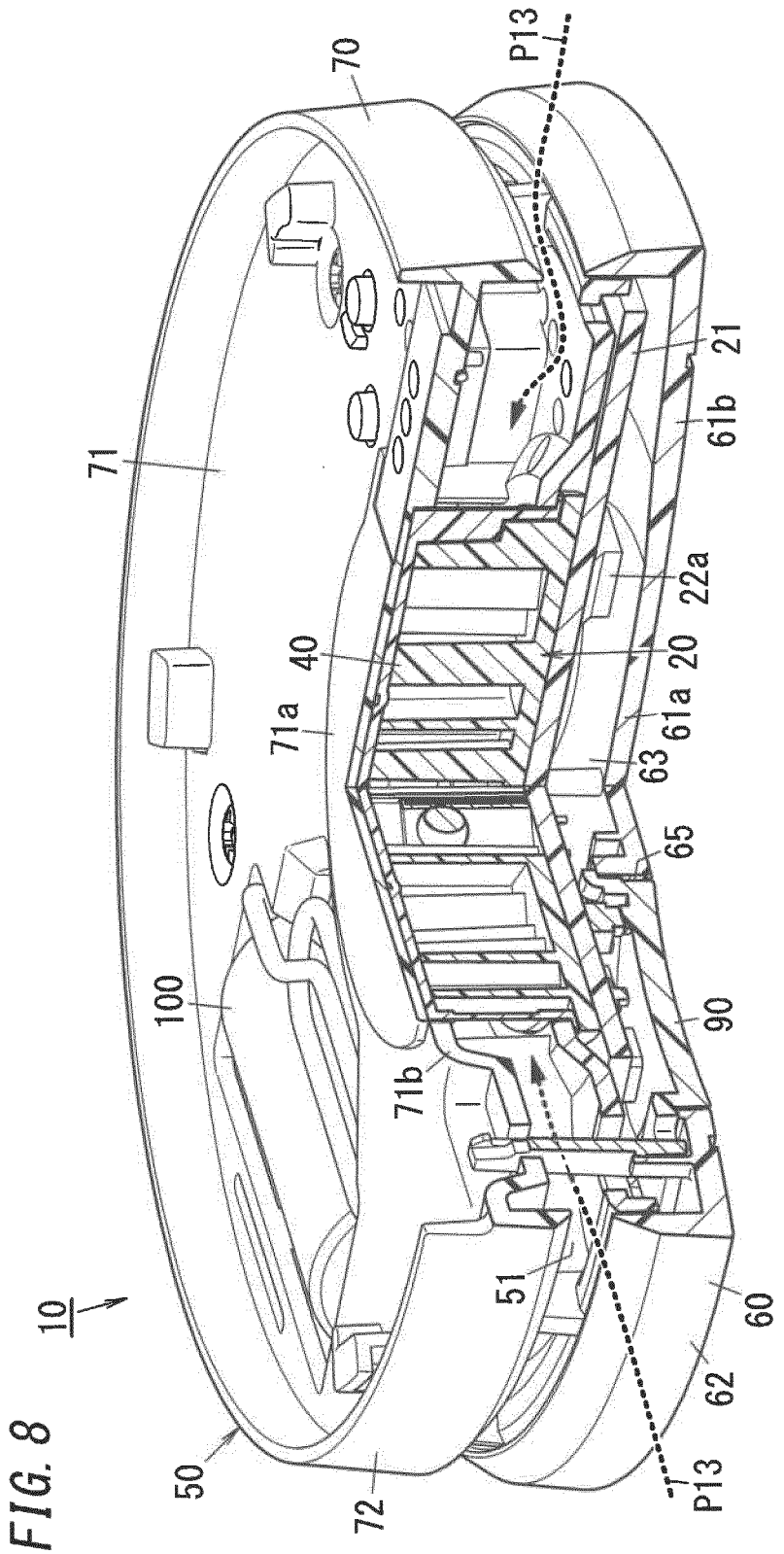
86
85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70
P13
71
21
61b
22a
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71a
61a
63
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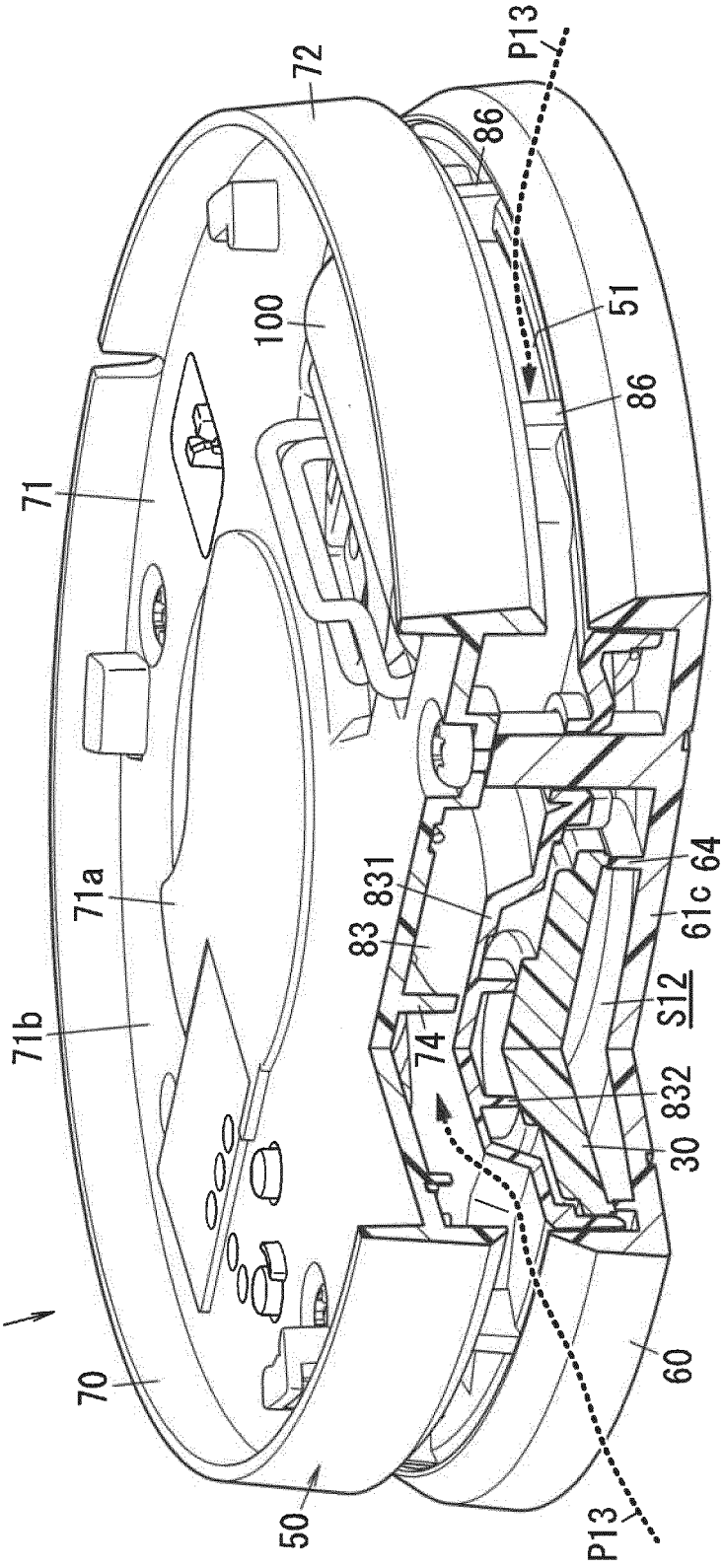
71b
51
60
62
50
72
P13

FIG. 8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71
71a
71b
72
P13
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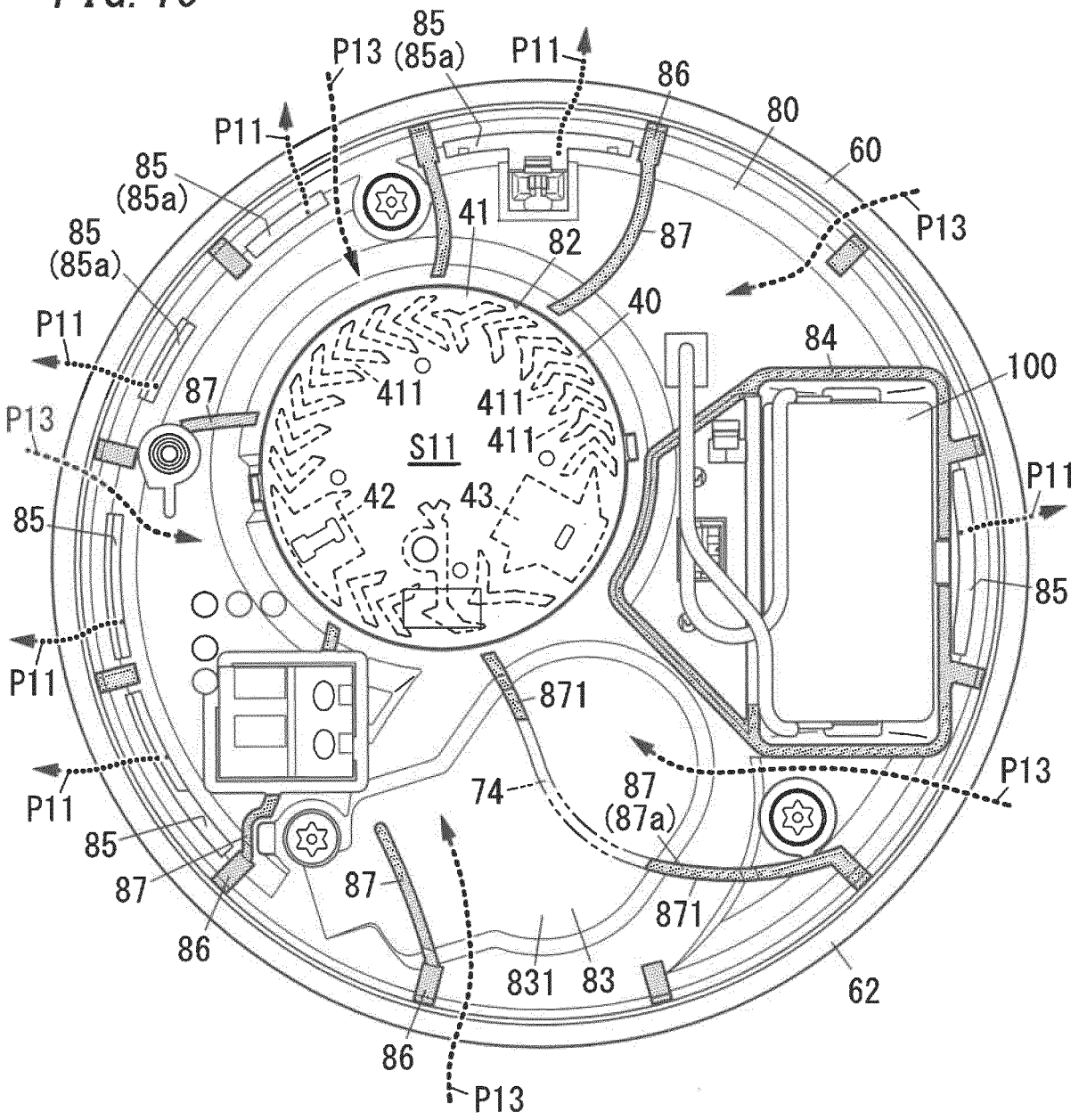
51
86
831
83
61c
64
S12
74
832
30
60
50
P13

FIG. 9

FIG. 10


85
(85a)
P13
P11
86
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P13
P11
85
(85a)
41
82
87
85
(85a)
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P11
84
100
87
411
411
411
P13
S11
P11
85
42
43
85
P11
871
P13
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87
(87a)
P11
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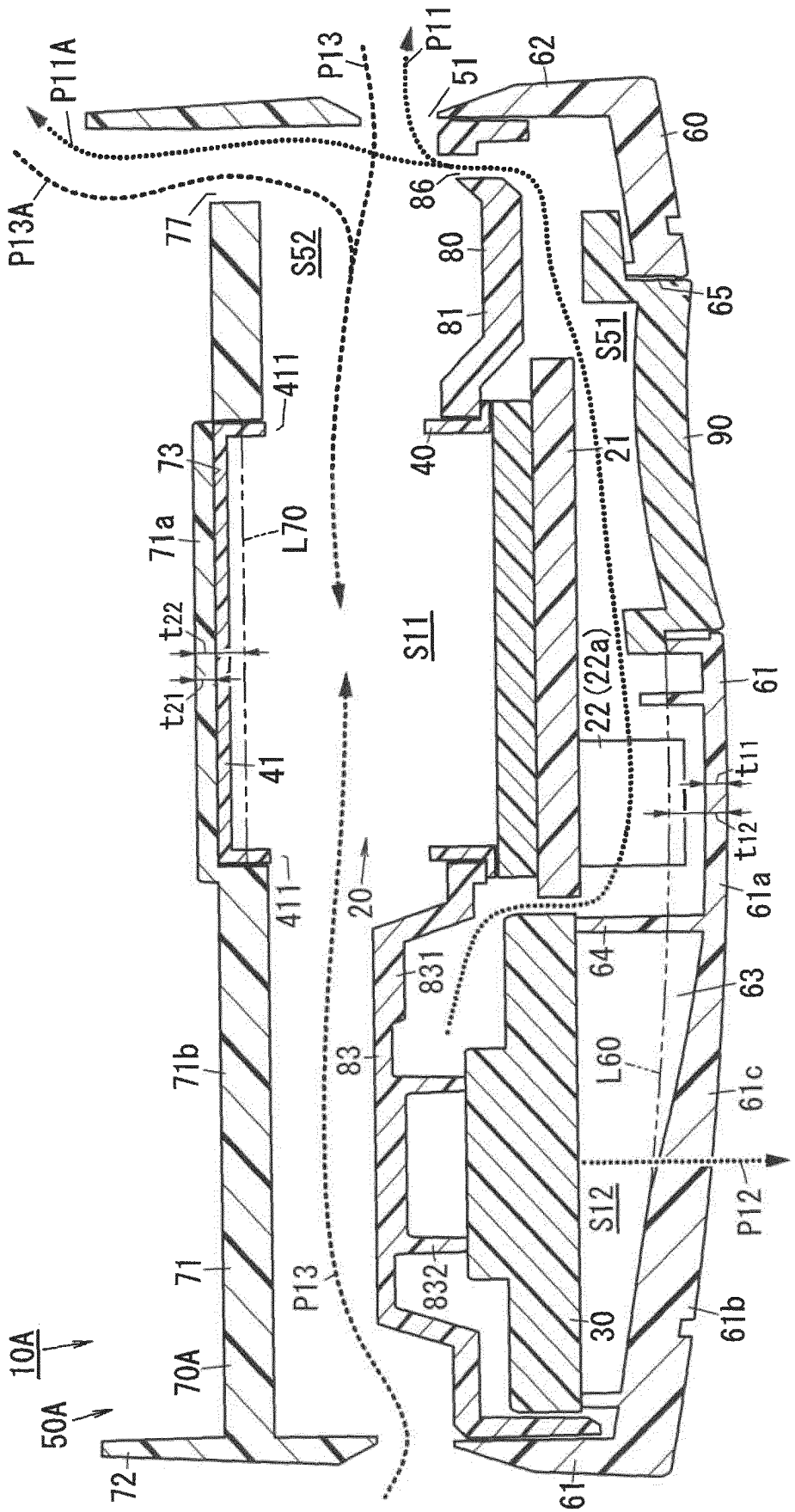
871
86
831
83
62
86
P13

FIG. 11


P11A
P13
P11
62
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60
P13A
77
S52
86
80
65
81
S51
411
73
40
21
90
71a
L70
t22
S11
t21
22 (22a)
61
41
t11
t12
411
20
61a
831
64
63
71b
83
L60
61c
S12
P12
71
P13
832
30
61b
10A
70A
50A
72
61

FIG. 12

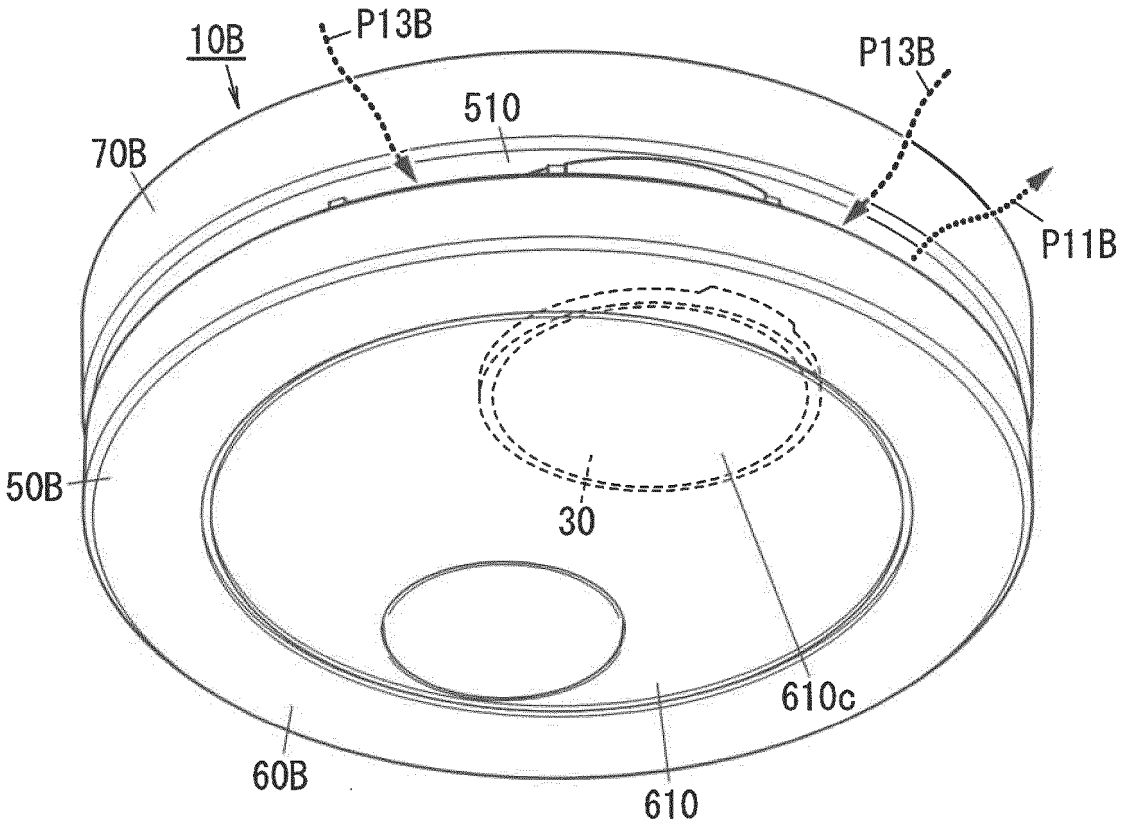
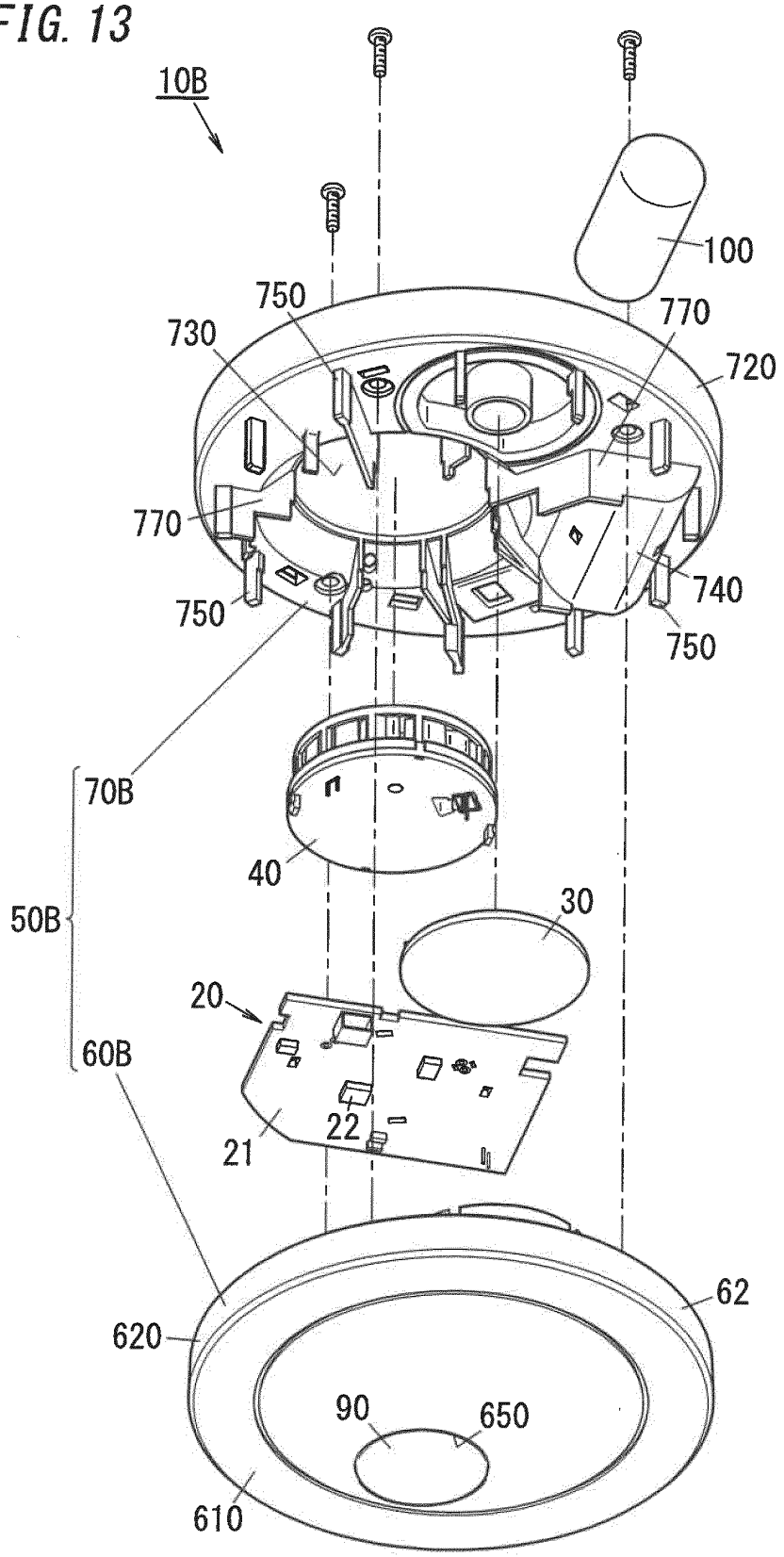


FIG. 13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730
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720
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740
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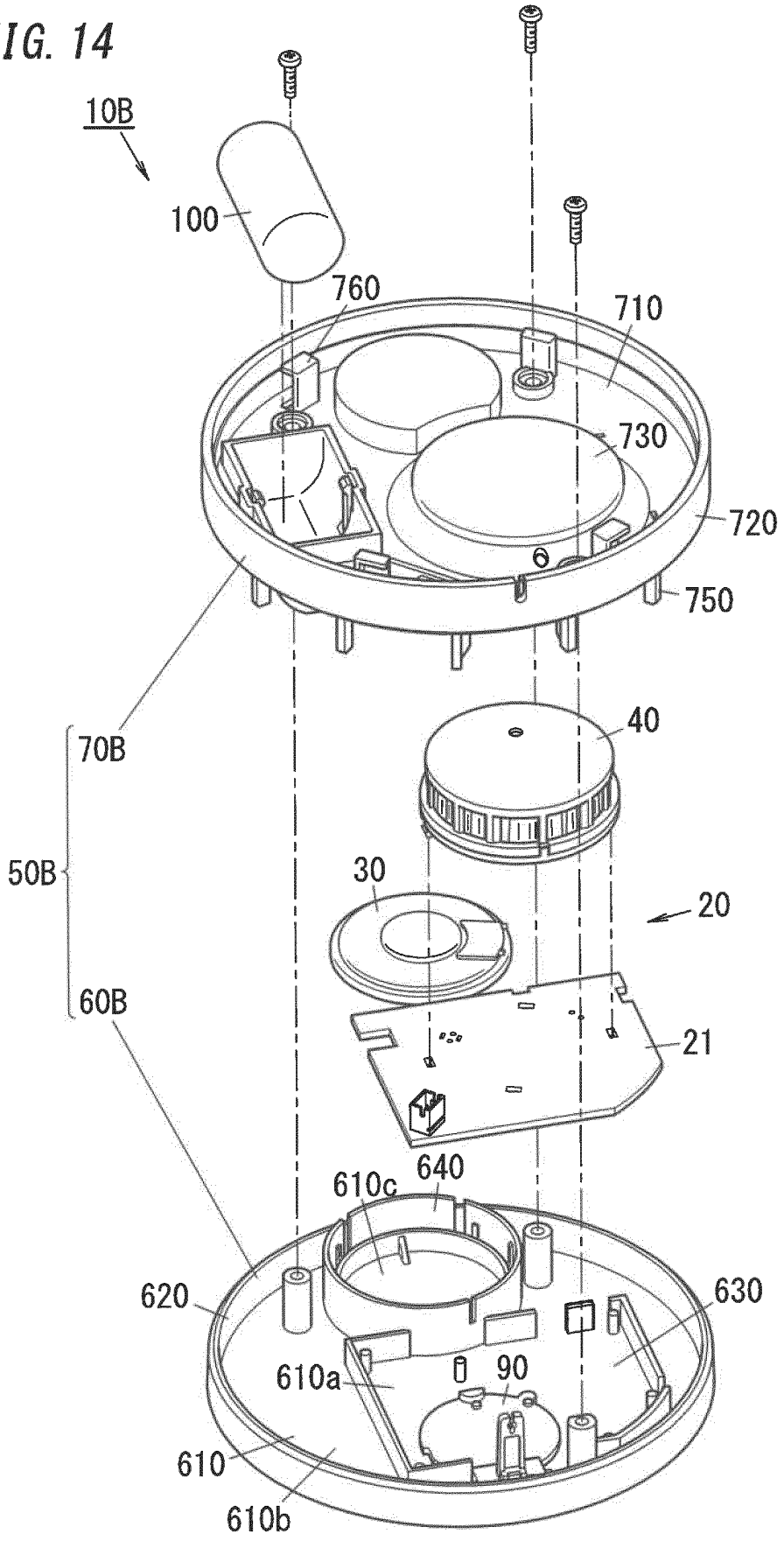
750
70B
40
50B
30
20
60B
22
21
62
620
90
650
610

FIG. 14


10B
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710
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50B
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20
60B
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640
610c
620
630
610a
90
610
610b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/023237

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. G10K9/12(2006.01)i, G08B17/00(2006.01)i, G08B17/10(2006.01)i, G10K9/22(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)
Int.Cl. G10K9/12, G08B17/00, G08B17/10, G10K9/22

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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.
X Y A	JP 2009-230546 A (PANASONIC ELECTRIC WORKS CO., LTD.) 08 October 2009, paragraphs [0027], [0037], [0078], fig. 1, 2, 11(b) & US 2011/0068936 A1, paragraphs [0109], [0119], [0160], fig. 1, 2, 11B & WO 2009/119402 A1 & EP 2264676 A1 & EP 2701129 A2 & AU 2009230183 A & CA 2718748 A & CN 101978400 A	1, 3 2, 4, 5 6-15

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Date of the actual completion of the international search	Date of mailing of the international search report
19 August 2019 (19.08.2019)	27 August 2019 (27.08.2019)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/023237

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2014-86636 A (NEW COSMOS ELECTRIC CO., LTD.) 12 May 2014, paragraphs [0021], [0022], fig. 3 (Family: none)	2, 4, 5
X	JP 2011-186643 A (NEW COSMOS ELECTRIC CO., LTD.) 22 September 2011, paragraphs [0019], [0025], fig. 1, 3 (Family: none)	1
A	JP 2013-525897 A (SPRUE SAFETY PRODUCTS LTD.) 20 June 2013, entire text, all drawings & US 2013/0093594 A1, entire text, all drawings & GB 201006683 D & GB 201006683 DO & WO 2011/131938 A1 & EP 2561496 A1 & CA 2796976 A & ES 2469191 T & DK 2561496 T & PT 2561496 E & AU 2011244148 B	1-15

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Patent documents cited in the description

- JP 2016128989 A **[0004]**