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(54) **MINIATURE SMOKE ALARM**

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Description

Technical Field

[0001] The present invention relates to a smoke detector, and in particular, to a micro smoke detector.

Background Art

[0002] The principle of a smoke detector is that: an alarm unit in the smoke detector detects smoke, and the smoke detector can make an internal buzzer make a sound, so as to warn a user. One of the main problems regarding the smoke detector in this field is that the volume of the smoke detector is large. To obtain a structure that has particular reliability and low costs, in the prior art, a smoke detection chamber in the smoke detector is designed to have a relatively large volume. Therefore, the known smoke detectors are not popular in most families due to relatively large sizes thereof, and their designs are seldom added to home decoration schemes. In a conventional smoke detection chamber is adjusted by changing a fin structure of a detection apparatus, so as to design a small-sized smoke detector. However, a button of this type of smoke detector is disposed on a side surface of a housing, and the small-sized smoke detector is set to have a small enough volume. Usually, the smoke detector is disposed on a ceiling three meters above the floor, and when the smoke detector is stopped or tested, a relatively small button needs to be pressed from a side surface. Therefore, the smoke detector is extremely inconvenient for use.

[0003] GB 2 517 975 A discloses an activating button with an integrated sound/noise generator as well as a smoke detector in which an activating button according to the invention is incorporated.

[0004] EP 2 503 525 A1 discloses a housing for a smoke detector used in an alarm system with an anti-mounting unit that prevents mounting of the sensor to the base without a battery.

Summary of the Invention

[0005] An objective of the present invention is to provide a micro smoke detector, to make it convenient for a user to stop chirping of the smoke detector and to test the smoke detector.

[0006] According to the invention, a micro smoke detector includes a base and a cover body axially moving along the base, wherein the cover body is provided therein with a detection part for detecting smoke concentration, a sound production part for generating sound waves, and a control circuit board for controlling the detection part and the sound production part; a side wall of the cover body is provided with a smoke inlet hole for smoke to enter the detection part; an elastic part that drives the cover body away from the base by means of an elastic effect is disposed between the cover body and the base; a limiting part that limits, by means of an abutting effect, the cover body from breaking away from the base is disposed between the cover body and the base; a surface, facing towards the base, of the control circuit board is provided with a first button triggered by movement of the cover body to the base; the first button controls test and stop of the smoke detector; and the detection part and the sound production part are electrically connected to a power supply in the base.

[0007] By using the foregoing technical solution, when this type of micro smoke detector is mounted to a top inside a house, a user presses the cover body on the top, to make the cover body move towards the base; the first button on the control circuit board is triggered by the base, and the user can stop chirping of the smoke detector and test the smoke detector in this manner. The smoke detector set in this manner is relatively small, and in the manner of trigging by using the cover body, the area of the cover body occupies more than 90% of the area of an orthographic projection of a base, and the smoke detector can be triggered provided that the cover body is pressed. In addition, after being pressed, the cover body is made, by using the elastic part between the base and the cover body, away from the location where the first button is triggered.

[0008] According to the invention, the base includes a mounting plate and a tubular part connected to the mounting plate; a bottom of the tubular part is provided with a partition board; the partition board is recessed along an axial direction of the tubular part to form a battery cavity for accommodating a battery, and a top of the tubular part is provided with an opening for movement of the cover body.

[0009] By using the foregoing technical solution, the battery is mounted into the base by using the battery cavity formed by the partition board, to reduce an occupied space. The tubular part implements two functions: first, the height of the tubular part is a location where battery accommodation is provided; because the battery needs to meet a life span of 5 to 10 years of the smoke detector, the battery has a relatively large volume, and this limits the size of the micro smoke detector to some extent; and second, the cover body is mounted to the tubular part by using the opening, and the height of the tubular part also needs to meet a downward stroke of the cover body.

[0010] Preferably, the elastic part includes a shaping hole disposed on an outer side wall of the battery cavity and an elastic piece that obliquely extends towards the opening along the side wall of the shaping hole.

[0011] By using the foregoing technical solution, the elastic piece is obliquely disposed towards the opening, so that the cover body is reset by using elastic restoring force of itself. Moreover, because the elastic piece is formed by the side wall of the shaping hole, the problem of stress concentration between the elastic piece and the battery cavity side wall is reduced, and the shaping holes facilitates drafting by the elastic piece, and the injection

molding difficulty is also reduced.

[0012] Preferably, at least two shaping holes are disposed in a radial direction of the tubular part, and projections of adj acent elastic pieces in a vertical direction are staggered.

[0013] By using the foregoing technical solution, the elastic pieces that are disposed in a staggered manner implement a function of balanced outward pushing on the control circuit board by means of elastic deformation, thereby avoiding excessively large force application to a single point on the control circuit board.

[0014] Preferably, the limiting part includes a first limiting block disposed on the cover body, and a second limiting block that is disposed on an inner wall of the tubular part and that is located in a movement direction of the first limiting block.

[0015] By using the foregoing technical solution, in a mounting process, deformation in a horizontal direction is performed on the first limiting block and the second limiting block to make the cover body connected to the tubular part. In a use process, when the cover body moves outwards due to an effect of the elastic part, the first limiting block abuts against the second limiting block in an axial direction of the cover body, to prevent the cover body from breaking away from the tubular part.

[0016] According to the invention, a switch button that controls switch-on and switch-off of a power supply is disposed between the base and the tubular part.

[0017] By using the foregoing technical solution, the switch button controls startup of the power supply, to prevent the smoke detector from wasting electric energy in the transportation or storage process, to improve the life span of the smoke detector, and also prevent the smoke detector from erroneously making a sound.

[0018] According to the invention, the partition board is recessed towards the opening along an axial direction to form a groove; the groove extends along a circumferential direction of a tubular object to form a limiting plate; a retaining groove is formed between a bottom surface of the limiting plate and a bottom surface of the groove; a limiting block that can slide into the retaining groove is disposed on the mounting plate; a side wall of the groove is provided with a first positioning block, and a side wall of the limiting block is provided with a first positioning groove that is matched with the first positioning block to limit rotation of the partition board. By using the foregoing technical solution, a fixing function is implemented on the mounting plate and the tubular part of the micro smoke detector. In an axial direction of the tubular part, when a limiting block is rotated into the retaining groove, the tubular part is limited from breaking away from the mounting plate by means of an abutting effect, and when the limiting block is rotated out, the tubular part can break away from the mounting plate; in a rotation direction of the tubular part, after the mounting plate rotates relative to the tubular part, the first positioning block is clamped into the first positioning groove, and a deformation force between the first positioning block and the first positioning groove limits relative rotation between the mounting plate and the tubular part.

[0019] Preferably, a second positioning block extends from a bottom of the mounting plate along an axial direction, and the partition board is provided with a second positioning groove that extends along a circumferential direction for rotation of the second positioning block.

[0020] By using the foregoing technical solution, for the individual second positioning block and second positioning groove, the mounting plate can be rotatably mounted with the tubular part only after the second positioning block is embedded into the second positioning groove, and the forward and reverse mounting sequence of the mounting plate is specified, to avoid reverse mounting of the mounting plate and the tubular part.

[0021] According to the invention, the switch button includes a lifting column and a button base that is disposed on one side, facing towards the opening, of the partition board, and a channel for sliding of the lifting column thais disposed in the button base and a second button is disposed on the control circuit board ; the lifting column triggers, by means of relative movement between the mounting plate and the tubular part, the second button to perform an action; an elastic member that drives the lifting column away from the second button by means of an elastic effect is disposed between a top of the lifting column and the second button; a through hole is disposed, in a through manner, in the channel towards an interior of the groove, and a bottom of the lifting column is provided with a startup block that runs through the through hole; and the startup block is provided with a guide bevel that drives, by means of contact with the limiting block during rotation, the lifting column to contact the second button.

[0022] By using the foregoing technical solution, for irreplaceable batteries, a battery is mounted in a battery cavity in a production process, and the battery cannot be taken out, and therefore a switch button needs to start the battery; when the mounting plate is not mounted to the base, the lifting column gets away from the second button under an effect of the elastic member; and when the mounting plate is mounted to the base, the limiting block gets into contact with the guide bevel, to drive the lifting column to overcome elastic force of the elastic member and move towards the second button, and the second button is triggered, and the power supply is started.

[0023] In an unclaimed embodiment, a side wall of the battery cavity is provided with a sliding hole; the retaining groove is provided with a stop groove running through the partition board, and a sliding block is slidably connected in the tubular part; the sliding block includes a triggering block that is slidably connected to the sliding hole and that extends into the battery cavity; the sliding block includes a stop block that is slidably connected to the stop groove and that extends into the retaining groove; a torsion spring is disposed in the tubular part, and one end of the torsion spring is connected to or is in

contact with the tubular part; the other end of the torsion spring is connected to the triggering block; when a battery is not loaded, the torsion spring drives, by means of an elastic effect, the triggering block to move towards the battery cavity, and the stop block is located in the retaining groove and limits rotation of the limiting block; and after the battery is loaded, the triggering block leaves the battery cavity and drives the torsion spring to deform, and the stop block gets away from the retaining groove and is used for rotation of the limiting block.

[0024] By using the foregoing technical solution, when no battery is mounted in the battery cavity, the torsion spring drives the stop block to move into the retaining groove. That is, the stop block is located in a rotation range of the limiting block, to prevent the mounting plate from being mounted to the tubular part; in the process of mounting a battery in the battery cavity, the side wall of the battery abuts against the triggering block, and pushes the sliding block to move outwards along a radial direction of the tubular part, and to drive the torsion spring to deform; moreover, the stop block moves outwards; the limiting block can rotate in the retaining groove, to implement fixation of the mounting plate and the tubular part.

[0025] In an unclaimed embodiment, the base includes a truncated pyramid tube and a fixing plate; a top of the truncated pyramid tube is slidably connected to a bottom of the cover body along an axial direction of the cover body; the fixing plate is slidably clamped and embedded with a bottom of the truncated pyramid tube along a circumferential direction; a supporting plate for triggering the first button is disposed in the truncated pyramid tube, and an accommodating cavity for accommodating a battery is disposed between the supporting plate and the fixing plate.

[0026] In an unclaimed embodiment, the fixing plate is provided with a switch plate, and a travel switch is disposed in the truncated pyramid tube; and when the fixing plate and the truncated pyramid tube rotate along a circumferential direction, the switch plate moves relative to the travel switch and is in contact with the travel switch, so that the switch plate presses to close the travel switch to control the power supply to supply power to a circuit board.

Brief Description of the Drawings

[0027]

FIG. 1 is a schematic structural diagram of Embodiment 1, for reflecting a structure of a micro smoke detector;

FIG. 2 is a schematic exploded view of Embodiment 1, for reflecting a location relationship among a mounting plate, a tubular part, and a top cover;

FIG. 3 is a schematic structural diagram of a top cover of Embodiment 1;

FIG. 4 is a schematic cross sectional view of Embodiment 1, for reflecting a location relationship among a supporting rod, flow deflector and an arc-shaped partition board;

FIG. 5 is a schematic structural diagram of a detection part of Embodiment 1;

FIG. 6 is a schematic structural diagram of a top surface of a tubular part of Embodiment 1;

FIG. 7 is a schematic cross sectional view of a location where a cover body is connected to a tubular part side wall of Embodiment 1;

FIG. 8 is a schematic longitudinal cross sectional view of Embodiment 1, for reflecting locations of a first button and a second button;

FIG. 9 is a schematic structural diagram of a bottom surface of a tubular part of Embodiment 1;

FIG. 10 is a schematic structural diagram of a mounting plate of Embodiment 1;

FIG. 11 is a schematic structural diagram of a bottom surface of a tubular part of Embodiment 2;

FIG. 12 is a schematic structural diagram of a top surface of a tubular part of Embodiment 2;

FIG. 13 is a schematic structural diagram of a tubular part of Embodiment 4;

FIG. 14 is a schematic cross sectional view of an elastic part of Embodiment 4;

FIG. 15 is a schematic cross sectional view of Embodiment 5, for reflecting a structure of a switch button;

FIG. 16 is a schematic structural diagram of Embodiment 6;

FIG. 17 is a schematic exploded view 1 of Embodiment 6; and

FIG. 18 is a schematic exploded view 2 of Embodiment 6.

[0028] In the figures, 1, base; 11, mounting plate; 12, tubular part; 13, cover body; 14, clamping and embedding block; 15, opening; 16, connection structure; 17, sound production hole; 18, partition board; 19, battery cavity; 2, detection part; 21, sound production part; 22, supporting rod; 23, flow deflector; 24, arc-shaped partition board; 25, light emitting diode; 26, through slot; 3, sliding hole; 31, stop groove; 32, sliding block; 33, triggering block; 34, stop block; 35, torsion spring; 36, circular slot; 4, control circuit board; 41, first button; 42, second button; 43, salient point; 5, smoke inlet hole; 6, elastic part; 61, shaping hole; 62, elastic piece; 63, spring seat; 64, spring bore; 65, compression spring; 66, trigger switch; 67, trigger piece; 7, limiting part; 71, first limiting block; 72, second limiting block; 731, truncated pyramid tube; 732, fixing plate; 733, supporting plate; 734, accommodating cavity; 735, switch plate; 736, travel switch; 8, switch button; 81, lifting column; 82, button base; 83, channel; 84, elastic member; 85, through hole; 86, start-up block; 87, guide bevel; 88, fixing base; 9, groove; 91, limiting plate; 92, retaining groove; 93, limiting block; 94, first positioning block; 95, first positioning groove; 96, second positioning block; 97, second positioning groove; 98, bolt hole; 99, cover plate.

Detailed Description of the Invention

[0029] The present invention will be further described in detail below with reference to the accompanying drawings.

[0030] Specific embodiments of the present invention are used only for explaining the present invention, and are not intended to limit the present invention. A person skilled in the art can make amendments without inventive contribution to the embodiments of the present invention after reading this specification, but the amendments are protected by the patent law provided that they fall within the scope of the claims of the present invention.

[0031] The examples of embodiments 2 to 6 are not covered by the subject-matter of the claims.

[0032] The present invention is aimed to resolve the problems during miniaturization of the smoke detector in the overall structure.

[0033] Embodiment 1, according to the invention:
A micro smoke detector, as shown in FIG. 1 and FIG. 2, includes three parts from bottom to top: a mounting plate 11, a tubular part 12, and a cover body 13 respectively, which are all formed by means of injection molding; as shown in FIG. 10, the mounting plate 11 is provided with a bolt hole 98, and the mounting plate 11 is fixed on a wall surface or a ceiling by using a screw passing through the bolt hole 98.

[0034] As shown in FIG. 2 and FIG. 6, the shape of the tubular part 12 is tubular, and a partition board 18 is integrally formed on a bottom of the tubular part 12; an opening 15 is disposed on a top of the tubular part 12; the tubular part 12 implements a function of connecting the cover body 13 to the mounting plate 11; a connection structure 16 is disposed between the bottom of the tubular part 12 and the mounting plate 12; a limiting part 7 that limits the cover body 13 from breaking away from the tubular part 12 is disposed between the top of the tubular part 12 and the cover body 13; a detection part 2 for detecting smoke concentration, a sound production part 21 for generating sound waves, and a control circuit board 4 of the detection part 2 and the sound production part 21 are disposed from top to bottom in the cover body 13; an elastic part 6 that drives the cover body 13 to move away from the base 1 along an axial direction of the base 1 is disposed between the cover body 13 and the tubular part 12 (as shown in FIG. 6).

[0035] As shown in FIG. 3, an external structure of the cover body 13 is: the cover body 13 is in a tubular structure; a top of the cover body 13 is provided with a sound production hole 17; a side wall of the circumference of the cover body 13 is provided with a smoke inlet hole 5 for entrance of the smoke; smoke inlet holes 5 are uniformly distributed on the side wall of the cover body 13, for entrance of the smoke into the detection part 2.

[0036] As shown in FIG. 3, a smaller size of the smoke detectors indicates a smaller air inflow per unit of the smoke inlet hole 5. For the micro smoke detector, the location and the shape of the smoke inlet hole 5 greatly affect the sensitivity of the micro smoke detector. To overcome the foregoing problem, as shown in FIG. 3 and FIG. 4, the smoke inlet hole 5 is formed by a supporting rod 22 that extends along an axial direction of the cover body 13, a flow deflector 23 disposed between adjacent supporting rods 22, and an arc-shaped partition board 24 that extends along a circumferential direction. The flow deflector 23 is obliquely disposed. As shown in FIG. 2, the sound production part 21 is a sheet-shaped buzzer, and the buzzer is disposed below the sound production hole 17 (FIG. 3).

[0037] As shown in FIG. 5, the detection part 2 is a photoelectric smoke alarming structure; a bottom of the detection part 2 is provided with two opposite light emitting diodes 25; because the internal space of the cover body 13 is relatively small, the space for response of the detection part 2 is relatively small, and the sensitivity of smoke alarming is affected to some extent; however, a control circuit board 4 is disposed below the detection part 2, and therefore the control circuit board 4 is provided with two through slots 26 for embedment of the light emitting diodes 25, to reduce the height of the detection part 2 plus the control circuit board 4; within the same height, the height of the detection part 2 may be increased to improve the sensitivity of detection.

[0038] As shown in FIG. 5, a first button 41 is disposed at a central location of the bottom of the control circuit board 4. The first button 41 is pressed to send pulse to a control circuit in the control circuit board 4, to trigger the control circuit in the control circuit board 4 to drive the detection part 2 and the sound production part 21 in FIG. 2 to perform an action; moreover, the first button 41 is a button that automatically springs back after being triggered.

[0039] As shown in FIG. 6, the specific structure of the tubular part 12 includes: a partition board 18 disposed on the bottom of the tubular part 12 and a battery cavity 19 that is formed by recessing, by the partition board 18, towards the cover body 13; the battery cavity 19 is located on a back surface of the partition board 18 in FIG. 6; a battery is disposed in the battery cavity 19; the battery and the battery cavity 19 are integrally encapsulated; that is, the battery is an irreplaceable battery, and positive and negative electrodes of the battery are connected to the control circuit board 4 in FIG. 2 by using a wire, and the wire extends towards the cover body 13 after running through the side wall of the battery cavity 19; An end, opposite to the partition board 18 in an axial direction, of the tubular part 12 is an opening 15 for entrance of a cable in the cover body 13 for connecting to the battery cavity 19.

[0040] As shown in FIG. 6, the elastic part 6 is a shaping hole 61 and an elastic piece 62 that are disposed on an outer side wall of the battery cavity 19; one shaping hole 61 corresponds to one elastic piece 62; there are two shaping holes 61; the shaping holes 61 extend along a width direction of the battery cavity 19; the two shaping holes 61 are symmetrically disposed about a centre of

an upper surface of the battery cavity 19; one end of the elastic piece 62 is connected to an end portion of a length direction of the shaping hole 61, and the other end of the elastic piece 62 obliquely extends towards the opening 15; projections of two elastic pieces 62 in a vertical direction are staggered; as shown in FIG. 8, an oblique end of the elastic piece 62 abuts against a bottom of the control circuit board 4, and converts a downward deformation force into an elastic force that drives the cover body 13 to move upwards.

[0041] As shown in FIG. 6 and FIG. 8, a salient point 43 is disposed at a central location outside the battery cavity 19; after the cover body 13 is covered on the tubular part 12, the salient point 43 corresponds to the first button 41; when the cover body 13 moves towards the tubular part 12, the salient point 43 contacts the first button and presses the first button 41; in this process, the salient point 43 reduces the movement stroke of the cover body 13.

[0042] As shown in FIG. 7 and FIG. 8, the limiting part 7 includes a clamping and embedding block 14 that extends downwards along a lower surface of the cover body 13; the clamping and embedding block 14 is annular; an outer surface of the annular clamping and embedding block 14 is adhered to an inner wall at the location of the opening 15 of the tubular part 12, and the clamping and embedding block 14 makes the outer surface of the cover body 13 flush with the outer surface of the tubular part 12.

[0043] As shown in FIG. 7 and FIG. 8, the limiting part 7 further includes a first limiting block 71 disposed on an outer surface of the cover body 13 (that is, the outer surface of the clamping and embedding block 14), and a second limiting block 72 that is disposed on the inner wall of the tubular part 12 and that is located in the movement direction of the first limiting block 71; the first limiting block 71 corresponds to the second limiting block 72; and two first limiting blocks 71 are disposed in the circumferential direction of the tubular part 12; during mounting, the first limiting block 71 and the second limiting block 72 move back to back in a horizontal direction to deform, so that the cover body 13 is embedded into the tubular part 12; in a use process, the first limiting block 71 and the second limiting block 72 abut against each other in a height direction, to limit the cover body 13 from breaking away the tubular part 12; in this process, the limiting part 7 implements a function of connecting the cover body 13 to the tubular part 12.

[0044] As shown in FIG. 8, the partition board 18 is provided with a switch button 8 for controlling switch-on and switch-off of a battery; the switch button 8 is applicable to cases in which a battery is irreplaceable, to avoid false triggering of the micro smoke detector; if a replaceable battery is used, before transportation and use of the smoke detector, the battery is not loaded into the battery cavity 19.

[0045] As shown in FIG. 8, the switch button 8 includes a button base 82 disposed on one side, facing towards the cover body 13, of the partition board 18; the button base 82 is provided with a channel 83 in a through manner along an axial direction of the button base 82; a lifting column 81 and a second button 42 that is disposed on the control circuit board 4 are slidably connected in the channel 83; switch-on and switch-off of the second button 42 control power-on and power-off of the battery; the structure of the second button 42 is the same as that of the first button 41; the button base 82 is disposed directly below the second button 42; a startup block 86 is disposed on a lower end of a length direction of the lifting column 81; a part, located below the channel 83, of the partition board 18 is provided with a through hole 85 for the startup block 86 to pass through; an elastic member 84 is disposed on an upper end of a length direction of the lifting column 81 (that is, the elastic member 84 is disposed between the control circuit board 4 and the lifting column 81); a spring is used as the elastic member 84; and the size of the internal space of the spring is greater than that of the second button 42, to prevent the spring from triggering the second button 42. In a use process, the startup block 86 is pressed on one side of the battery cavity 19 of the partition board 18 to drive the lifting column 81 to move and to trigger the second button 42 to perform an action, and subsequently the elastic member 84 drives the lifting column 81 away from the second button 42.

[0046] As shown in FIG. 10, the diameter of the mounting plate 11 is greater than the diameter of the tubular part 12; and the connection structure 16 between the mounting plate 11 and the tubular part 12 includes a circular slot 36 disposed on the mounting plate 11 for embedment of the tubular part 12.

[0047] As shown in FIG. 9 and FIG. 10, the partition board 18 of the tubular part 12 is recessed towards the opening 15 along an axial direction of the partition board 18, to form a groove 9; an outward part of the groove 9 extends along a circumferential direction of the tubular part 12 to form a limiting plate 91; a retaining groove 92 is formed between a bottom surface of the limiting plate 91 and a bottom surface of the groove 9; a limiting block 93 that can slide into the retaining groove 92 is disposed in the circular slot 36 of the mounting plate 11; two limiting blocks 93 are disposed in the circumferential direction of the circular slot 36 and are symmetrically distributed; a bolt hole 98 is disposed on each limiting block 93.

[0048] As shown in FIG. 8, in a use process, the mounting plate 11 and the tubular part 12 are rotated, and the limiting block 93 is embedded into the retaining groove 92; the mounting plate 11 is prevented, by means of an abutting effect of the limiting block 93 and the retaining groove 92, from breaking away from the tubular part 12.

[0049] As shown in FIG. 9 and FIG. 10, after the limiting block 93 and the retaining groove 92 are fixed at suitable locations, to prevent the mounting plate 11 from loosening from the tubular part 12 in the circumferential direction, a first positioning block 94 is disposed on a side wall of the groove 9; as shown in FIG. 10, a first positioning groove 95 is disposed on a side wall of the limiting block

93, and the shapes of the cross sections of the first positioning block 94 and the first positioning groove 95 are semicircular; in the process in which the mounting plate 11 rotates relative to the tubular part 12, with the rotation of the mounting plate 11, the first positioning block 94 deforms to enter the first positioning groove 95, to implement clamping and fixation between the mounting plate 11 and the tubular part 12.

[0050] As shown in FIG. 9 and FIG. 10, to prevent reverse mounting of the mounting plate 11 and the tubular part 12, a second positioning block 96 extends from the bottom of the mounting plate 11 along an axial direction; the partition board 18 is provided with a second positioning groove 97 that extends along the circumferential direction and that is used for rotation of the second positioning block 96; when the limiting block 93 on the mounting plate 11 is mounted to a wrong location, the second positioning block 96 cannot enter the second positioning groove 97; that is, the limiting block 93 and the retaining groove 92 are staggered in the height direction and cannot clamped and embedded with each other, to prevent the reverse mounting of the mounting plate 11 and the tubular part 12.

[0051] As shown in FIG. 9 and FIG. 10, to automatically start the power supply in the process of mounting the mounting plate 11 and the tubular part 12, a guide bevel 87 that can contact a surface of the limiting block 93 is disposed on the startup block 86; in the process in which the limiting block 93 slides into the retaining groove 92, the guide bevel 87 gradually contacts the limiting block 93, and the lifting column 81 gradually moves upwards to press the second button 42.

[0052] The mounting process of Embodiment 1: the mounting plate 11 is fixed to a wall surface or a ceiling by using a screw; the battery is fixed in the battery cavity 19 of the tubular body; the limiting block 93 is clamped into the groove 9; then the mounting plate 11 is rotated, and the limiting block 93 enters the retaining groove 92; at the same time, the lifting column 81 is toggled to move upwards to trigger the second button 42 and power is supplied to the control circuit board 4; when moving to a location where the first positioning block 94 is clamped with the first positioning groove 95, the mounting plate 11 is fixed to the tubular part 12.

[0053] The use process of Embodiment 1: the cover body 13 is pressed, and the salient point 43 triggers the first button 41 (when there is no salient point 43 an outer side wall of the battery cavity 19 can also trigger the first button 41), and the control circuit board 4 controls the sound production part 21 to make a sound in a short time period or stop making a sound; when smoke enters the cover body 13 from the smoke inlet hole 5, the detection part 2 sends an electric signal to the control circuit board 4, and the control circuit board 4 drives the sound production part 21 to make a sound, to remind a user that there is fire.

Embodiment 2:

[0054] Regarding a micro smoke detector, Embodiment 2 differs from Embodiment 1 in that, in Embodiment 2, the structure of the tubular part 12 is different, and a structure of a replaceable battery is used in the tubular part 12.

[0055] Because a battery is loaded only in a use process, a switch button 8 does not need to be disposed in the micro smoke detector; therefore, the problem to be resolved is: to confirm that there is a battery in the mounted micro smoke detector.

[0056] As shown in FIG. 11 and FIG. 12, a sliding hole 3 is disposed on one side of the inside of the tubular part 12; a retaining groove 92 is provided with a stop groove 31 running through a partition board 18; a sliding block 32 is slidably connected in the stop groove 31; one end, facing towards a battery cavity 19, of the sliding block 32 forms a triggering block 33; in a slide process of the sliding block 32, the triggering block 33 can be moved into the battery cavity 19; the sliding block 32 further includes a stop block 34 that is slidably connected to the stop groove 31 and that extends into the retaining groove 92; a torsion spring 35 is disposed in the tubular part 12; one end of the torsion spring 35 abuts against the tubular part 12; the other end of the torsion spring 35 is connected to the triggering block 33; the torsion spring 35 can drive the slidable sliding block 32 to reset; the partition board 18 is connected to a fixing base 88 by using a bolt; the fixing base 88 limits a slide direction of the sliding block 32 and limits the sliding block 32 from breaking away from a sliding hole 3.

[0057] In addition, to prevent the replaceable battery from falling off, a cover plate 99 (see FIG. 2) is clamped and embedded on the battery cavity 19, and the cover plate 99 prevents detachment of the battery.

[0058] The mounting process of Embodiment 2 is: the mounting process of Embodiment 2 is the same as that of Embodiment 1, and has a mounting step of a battery: when a battery is not loaded, the torsion spring 35 drives, by means of an elastic effect, the triggering block 33 to move towards the battery cavity 19, and the stop block 34 is located in the retaining groove 92 and limits rotation of the limiting block 93; and after the battery is loaded, the triggering block 33 leaves the battery cavity 19 and drives the torsion spring 35 to deform, and the stop block 34 gets away from the retaining groove 92 and is used for rotation of the limiting block 93, to implement fixation of the mounting plate 11 and the tubular part 12.

Embodiment 3:

[0059] Regarding a micro smoke detector, Embodiment 3 differs from Embodiment 1 in that, a cable power supply manner is used in Embodiment 2; in Embodiment 3, as shown in FIG. 1 and FIG. 2, a tubular part 12 and a mounting plate 11 do not need to rotate; that is, the tubular part 12 and the mounting plate 11 integrally form

a base 11; a detection part 2, a sound production part 21, and a control circuit board 4 in the base 1 are connected to a cable in the house.

[0060] The mounting process of Embodiment 3: the costs of Embodiment 3 are relatively low, and the use time is relatively long, provided that a cable is connected to a terminal on the base 1. The use process of Embodiment 3 is the same as that of Embodiment 1, and details are not described herein.

Embodiment 4:

[0061] As shown in FIG. 13 and FIG. 14, regarding a micro smoke detector, Embodiment 4 differs from Embodiment 1 in that: in Embodiment 4, to improve the life span of the micro smoke detector, an elastic part 6 does not use a form of an elastic piece; the elastic part 6 in Embodiment 4 includes a spring seat 63 disposed on the partition board 18; two spring seats 63 are disposed on each side of the battery cavity 19.

[0062] As shown in FIG. 13 and FIG. 14, a spring hole 64 is disposed in the spring seat 63; the spring hole 64 extends along a height direction of the spring seat 63; a compression spring 65 is disposed in the spring hole 64; when the cover body 13 (not shown in the figure) is covered on the tubular part 12, the compression spring 65 abuts against a bottom of the control circuit board 4, and the compression spring 65 is in a compressed state.

[0063] In the use process of Embodiment 4, the cover body 13 (not shown in the figure) is popped up by means of an elastic effect of the compression spring 65; compared with the elastic piece 62, the compression spring 65 made of metal has a longer life span.

Embodiment 5:

[0064] As shown in FIG. 15, regarding a micro smoke detector, Embodiment 5 differs from Embodiment 1 in that, in Embodiment 4, to simplify the production process, a switch button 8 is simplified; the switch bottom 8 of Embodiment 5 uses a form of a trigger switch 66; the trigger switch 66 includes a trigger piece 67 obliquely disposed downwards; an end portion of the trigger piece 67 is semicircular; a through hole 85 is used for passing through by the semicircular end portion of the trigger piece 67, and the semicircular end portion of the trigger piece 67 protrudes from a lower surface of the through hole 85.

[0065] The use process and acting process of Embodiment 5 are the same as those of Embodiment 1, and the only difference is that a second button 42 (not shown in the figure) and a lifting column 81 (not shown in the figure) are replaced with the trigger switch 66; when a mounting plate 11 is rotated, a limiting block 93 contacts the semicircular end portion of the trigger piece 67 to jack up the trigger piece 67; the trigger switch 66 transmits a model to the control circuit board 4 (not shown in the figure), to control startup of the power supply.

[0066] Embodiment 6: regarding a micro smoke detector, Embodiment 6 differs from Embodiments 1-5 in that, as shown in FIG. 16, the shape and the internal structure of the base 1 are adjusted. As shown in FIG. 17, the tubular part 12 of the micro alarm is changed to a shape of a truncated pyramid (referred to as a truncated pyramid tube 731 below), which has a tapering shape and round corner processing is performed in the circumferential direction.

[0067] Therefore, the base 1 includes two parts, which are respectively a truncated pyramid tube 731 and a fixing plate 732. The top of the truncated pyramid tube 731 is slidably clamped and embedded with the bottom of the cover body 13, and the truncated pyramid tube 731 and the cover body 13 cannot break away from each other.

[0068] A supporting plate 733 is disposed at the middle location inside the truncated pyramid tube 731; the supporting plate 733 is connected to an inner side wall of the truncated pyramid tube 731.

[0069] A salient point 43 is disposed at the center of the supporting plate 733; the salient point 43 is matched with a first button 41 on a PCB board; when the cover body 13 moves downwards, the first button 41 abuts against the salient point 43, to trigger startup of the first button 41; the salient point 43 implements the function of reducing the movement stroke of the cover body 13.

[0070] The fixing plate 732 is rotatably clamped with the bottom of the truncated pyramid tube 731; the fixing plate 732 is penetrated through by a fixing member such as a screw, so as to be fixed to a wall surface; The configuration, opposite to the configuration on the fixing plate 732, of the truncated pyramid tube 731 is clamped by a structure similar to the limiting block 93, to prevent detachment.

[0071] As shown in FIG. 18, an accommodating cavity 734 for accommodating a battery is formed between the supporting plate 733 and the fixing plate 732; the shape of the battery is a lithium battery having a shape of a cuboid (shown in FIG. 17); the shape of the lithium battery is used to reduce the height of the truncated pyramid tube 731.

[0072] As shown in FIG. 18, in the truncated pyramid tube 731, a travel switch 736 is disposed below the supporting plate 733; a trigger location of the travel switch 736 is on a side surface; as shown in FIG. 17, a switch plate 735 is disposed on the fixing plate 732. When the fixing plate 732 and the truncated pyramid tube 731 rotate along a circumferential direction, the switch plate 735 moves relative to the travel switch 736 and is in contact with the travel switch 736, so that the switch plate 735 presses to close the travel switch 736 to control the power supply to supply power to a circuit board.

Claims

1. A micro smoke detector, comprising a base (1) and a cover body (13) axially moving along the base (1),

wherein the cover body (13) is provided therein with a detection part (2) for detecting smoke concentration, a sound production part (21) for generating sound waves, and a control circuit board (4) for controlling the detection part (2) and the sound production part (21); a side wall of the cover body (13) is provided with a smoke inlet hole (5) for smoke to enter the detection part (2); an elastic part (6) configured to drive the cover body (13) away from the base (1) by means of an elastic effect is disposed between the cover body (13) and the base (1); a limiting part (7) that limits, by means of an abutting effect, the cover body (13) from breaking away from the base (1) is disposed between the cover body (13) and the base (1); a surface, facing towards the base (1), of the control circuit board (4) is provided with a first button (41) triggered by movement of the cover body (13) to the base (1); the first button (41) is configured to control test and stop of the smoke detector; and the detection part (2) and the sound production part (21) are electrically connected to a power supply in the base (1), the base (1) comprises a mounting plate (11) and a tubular part (12) connected to the mounting plate (11); a bottom of the tubular part (12) is provided with a partition board (18); the partition board (18) is recessed along an axial direction of the tubular part (12) to form a battery cavity (19) for accommodating a battery; and a top of the tubular part (12) is provided with an opening (15) for movement of the cover body (13),

the micro smoke detector being **characterized by** a switch button (8) configured to control switch-on and switch-off of the power supply is disposed between the base (1) and the tubular part (12),
the partition board (18) is recessed towards the opening (15) along an axial direction to form a groove (9); the groove (9) extends along a circumferential direction of a tubular object to form a limiting plate (91); a retaining groove (92) is formed between a bottom surface of the limiting plate (91) and a bottom surface of the groove (9); a limiting block (93) configured to slide into the retaining groove (92) is disposed on the mounting plate (11); a side wall of the groove (9) is provided with a first positioning block (94), and a side wall of the limiting block (93) is provided with a first positioning groove (95) that is matched with the first positioning block (94) to limit rotation of the partition board (18),
the switch button (8) comprises a lifting column (81) and a button base (82) that is disposed on one side, facing towards the opening (15), of the partition board (18), wherein a channel (83) for sliding of the lifting column (81) is disposed and a second button (42) that is disposed on the control circuit board (4); the lifting column (81) is configured to trigger, by means of relative movement between the mounting plate (11) and the tubular part (12), the second button (42) to perform an action; an elastic member (84) configured to drive the lifting column (81) away from the second button (42) by means of an elastic effect is disposed between a top of the lifting column (81) and the second button (42); a through hole (85) is disposed, in a through manner, in the channel (83) towards an interior of the groove (9), and a bottom of the lifting column (81) is provided with a startup block (86) that runs through the through hole (85); and the startup block (86) is provided with a guide bevel (87) configured to drive, by means of contact with the limiting block (93) during rotation, the lifting column (81) to contact the second button (42).

2. The micro smoke detector according to claim 1, **characterized in that** the elastic part (6) comprises a shaping hole (61) disposed on an outer side wall of the battery cavity (19) and an elastic piece (62) that obliquely extends towards the opening (15) along the side wall of the shaping hole (61).

3. The micro smoke detector according to claim 2, **characterized in that** at least two shaping holes (61) are disposed in a radial direction of the tubular part (12), and projections of adjacent elastic pieces (62) in a vertical direction are staggered.

4. The micro smoke detector according to claim 1, **characterized in that** the limiting part (7) comprises a first limiting block (71) disposed on the cover body (13), and a second limiting block (72) that is disposed on an inner wall of the tubular part (12) and that is located in a movement direction of the first limiting block (71).

5. The micro smoke detector according to claim 1, **characterized in that** a second positioning block (96) extends from a bottom of the mounting plate (11) along an axial direction, and the partition board (18) is provided with a second positioning groove (97) that extends along a circumferential direction for rotation of the second positioning block (96).

Patentansprüche

1. Mikro-Rauchmelder, umfassend einen Sockel (1) und einen Abdeckkörper (13), der sich axial entlang dem Sockel (1) bewegt, wobei der Abdeckkörper (13) mit einen Detektionsteil (2) zum Erfassen der Rauchkonzentration, einem Geräuscherzeugungsteil (21) zum Erzeugen von Schallwellen und einer Steuerplatine (4) zum Steuern des Detektionsteils (2) und des Geräuscherzeugungsteils (21) versehen

ist; eine Seitenwand des Abdeckkörpers (13) ist mit einer Raucheinlassöffnung (5) versehen, durch die Rauch in den Detektionsteil (2) eintreten kann; ein elastisches Teil (6), das so konfiguriert ist, dass es den Abdeckkörper (13) mittels elastischer Wirkung von dem Sockel (1) wegbewegt, ist zwischen dem Abdeckkörper (13) und dem Sockel (1) angeordnet; zwischen dem Abdeckkörper (13) und dem Sockel (1) ist ein Begrenzungsteil (7) angeordnet, das durch eine Stoßwirkung das Abreißen des Abdeckkörpers (13) vom Sockel (1) verhindert; eine dem Sockel (1) zugewandte Fläche der Steuerplatine (4) ist mit einer ersten Taste (41) versehen, die durch die Bewegung des Abdeckkörpers (13) zum Sockel (1) ausgelöst wird; die erste Taste (41) ist so konfiguriert, dass sie die Prüfung und die Abschaltung des Rauchmelders steuert; und das Detektionsteil (2) und das Geräuscherzeugungsteil (21) sind elektrisch mit einer Stromversorgung am Sockel (1) verbunden, der Sockel (1) besteht aus einer Montageplatte (11) und einem mit der Montageplatte (11) verbundenen röhrenförmigen Teil (12); die Trennwandplatte (18) ist entlang der axialen Richtung des röhrenförmigen Teils (12) vertieft, um einen Batteriehohlraum (19) zum Aufnehmen einer Batterie zu bilden; und eine Oberseite des röhrenförmigen Teils (12) ist mit einer Öffnung (15) zum Bewegen des Abdeckkörpers (13) versehen, wobei der Mikro-Rauchmelder **dadurch gekennzeichnet ist, dass** ein Schaltknopf (8), der zum Steuern des Ein- und Ausschaltens der Stromversorgung konfiguriert ist, zwischen dem Sockel (1) und dem rohrförmigen Teil (12) angeordnet ist, die Trennwandplatte (18) ist in Richtung der Öffnung (15) entlang der axialen Richtung zurückgesetzt, um eine Nut (9) zu bilden; die Nut (9) erstreckt sich entlang der Umfangsrichtung eines rohrförmigen Objekt, um eine Begrenzungsplatte (91) zu bilden; eine Rückhaltenut (92) ist zwischen einer Bodenfläche der Begrenzungsplatte (91) und einer Bodenfläche der Nut (9) gebildet; ein Begrenzungsblock (93), der konfiguriert ist, um in die Haltenut (92) zu gleiten, ist auf der Montageplatte (11) angeordnet; eine Seitenwand der Nut (9) ist mit einem ersten Positionierungsblock (94) versehen, und eine Seitenwand des Begrenzungsblocks (93) ist mit einer ersten Positionierungsnut (95) versehen, die an den ersten Positionierungsblock (94) angepasst ist, um die Drehung der Trennwandplatte (18) zu begrenzen,
der Schaltknopf (8) weist eine Hubsäule (81) und einen Knopfsockel (82) auf, der auf einer der Öffnung (15) zugewandten Seite der Trennwandplatte (18) angeordnet ist, wobei ein Kanal (83) zum Gleiten der Hubsäule (81) angeordnet ist, und ein zweiter Knopf (42), der auf der Steuerplatine (4) angeordnet ist; die Hubsäule (81) ist so konfiguriert, dass durch eine Relativbewegung zwischen der Montageplatte (11) und dem rohrförmigen Teil (12), den zweiten Knopf (42) auslöst, so dass er eine Aktion durchführt; ein elastisches Element (84), das so konfiguriert ist, dass es die Hubsäule (81) weg von dem zweiten Kopf (42) durch eine elastische Wirkung antreibt, ist zwischen einer Oberseite der Hubsäule (81) und dem zweiten Knopf (42) angeordnet; ein Durchgangsloch (85) ist in einer durchgehenden Weise in dem Kanal (83) in Richtung des Inneren der Nut (9)angeordnet, und ein Boden der Hubsäule (81) ist mit einem Anlaufblock (86) versehen, der durch das Durchgangsloch (85) verläuft; und der Anlaufblock (86) ist mit einer Führungsschräge (87) versehen, die durch Kontakt mit dem Begrenzungsblock (93) während der Drehung die Hubsäule (81) antreibt, so dass sie den zweiten Knopf (42) berührt.

2. Mikro-Rauchmelder nach Anspruch 1, **dadurch gekennzeichnet, dass** der elastische Teil (6) ein formgebendes Loch (61), das an einer äußeren Seitenwand des Batteriehohlraums (19) angeordnet ist, und ein elastisches Teil (62) umfasst, das sich schräg zur Öffnung (15) entlang der Seitenwand des formgebenden Lochs (61) erstreckt.

3. Mikrorauchmelder nach Anspruch 2, **dadurch gekennzeichnet, dass** mindestens zwei formgebende Löcher (61) in einer radialen Richtung des rohrförmigen Teils (12) angeordnet sind und Vorsprünge benachbarter elastischer Teile (62) in einer vertikalen Richtung versetzt sind.

4. Mikro-Rauchmelder nach Anspruch 1, **dadurch gekennzeichnet, dass** der Begrenzungsteil (7) einen ersten Begrenzungsblock (71) umfasst, der auf dem Abdeckkörper (13) angeordnet ist, und einen zweiten Begrenzungsblock (72), der auf einer Innenwand des rohrförmigen Teils (12) angeordnet ist und der sich in einer Bewegungsrichtung des ersten Begrenzungsblocks (71) befindet.

5. Mikrorauchmelder nach Anspruch 1, **dadurch gekennzeichnet, dass** ein zweiter Positionierungsblock (96) sich von einer Unterseite der Montageplatte (11) entlang einer axialen Richtung erstreckt, und die Trennwandplatte (18) mit einer zweiten Positionierungsnut (97) zur Drehung des zweiten Positionierungsblocks (96) versehen ist, die sich entlang der Umfangsrichtung erstreckt.

Revendications

1. Micro-détecteur de fumée comprenant une base (1) et un corps de couvercle (13) se déplaçant axialement le long de la base (1), dans lequel le corps de couvercle (13) comporte une partie de détection (2) pour détecter la concentration de fumée, une partie de production sonore (21) pour générer des ondes sonores, et une carte de circuit de commande (4)

pour commander la partie de détection (2) et la partie de production sonore (21) ; une paroi latérale du corps de couvercle (13) comporte un trou d'entrée de fumée (5) pour permettre à la fumée d'entrer dans la partie de détection (2) ; une partie élastique (6) conçue pour éloigner le corps de couvercle (13) de la base (1) par un effet élastique est disposée entre le corps de couvercle (13) et la base (1) ; une partie de limitation (7) qui empêche, par un effet de butée, le corps de couvercle (13) de se détacher de la base (1) est disposée entre le corps de couvercle (13) et la base (1) ; une surface, orientée vers la base (1), de la carte de circuit de commande (4) comporte un premier bouton (41) déclenché par le déplacement du corps de couvercle (13) vers la base (1) ; le premier bouton (41) est conçu pour commander le test et l'arrêt du détecteur de fumée ; et la partie de détection (2) et la partie de production sonore (21) sont électriquement connectées à une alimentation électrique dans la base (1), la base (1) comprend une plaque de montage (11) et une partie tubulaire (12) reliée à la plaque de montage (11) ; une partie inférieure de la partie tubulaire (12) comporte une cloison (18) ; la cloison (18) est en retrait le long d'un sens axial de la partie tubulaire (12) pour former une cavité de pile (19) pour loger une pile ; et une partie supérieure de la partie tubulaire (12) comporte une ouverture (15) pour le déplacement du corps de couvercle (13), le micro-détecteur de fumée étant **caractérisé par**

un bouton d'interrupteur (8) conçu pour commander la connexion et la déconnexion de l'alimentation électrique est disposé entre la base (1) et la partie tubulaire (12),
la cloison (18) est en retrait vers l'ouverture (15) le long d'un sens axial pour former une rainure (9) ; la rainure (9) s'étend le long d'un sens circonférentiel d'un objet tubulaire pour former une plaque de limitation (91) ; une rainure de retenue (92) est formée entre une surface inférieure de la plaque de limitation (91) et une surface inférieure de la rainure (9), un bloc limiteur (93) conçu pour coulisser dans la rainure de retenue (92) est disposé sur la plaque de montage (11) ; une paroi latérale de la rainure (9) comporte un premier bloc de positionnement (94), et une paroi latérale du bloc limiteur (93) comporte une première rainure de positionnement (95) qui est adaptée au premier bloc de positionnement (94) pour limiter la rotation de la cloison (18),
le bouton d'interrupteur (8) comprend une colonne de levage (81) et une base de bouton (82) qui est disposée sur un côté, orienté vers l'ouverture (15), de la cloison (18), en ce qu'un canal (83) pour coulisser la colonne de levage (81) est disposé et un second bouton (42) qui est disposé sur la carte de circuit de commande (4) ; la colonne de levage (81) est conçue pour déclencher, par un déplacement relatif entre la plaque de montage (11) et la partie tubulaire (12), le second bouton (42) pour effectuer une action ; un élément élastique (84) conçu pour éloigner la colonne de levage (81) du second bouton (42) par un effet élastique est disposé entre une partie supérieure de la colonne de levage (81) et le second bouton (42) ; un trou traversant (85) est disposé, de manière traversante, dans le canal (83) vers un intérieur de la rainure (9), et une partie inférieure de la colonne de levage (81) comporte un bloc de démarrage (86) qui traverse le trou traversant (85) ; et le bloc de démarrage (86) comporte un biseau de guidage (87) conçu pour entraîner, par contact avec le bloc limiteur (93) durant la rotation, la colonne de levage (81) à entrer en contact avec le second bouton (42).

2. Micro-détecteur de fumée selon la revendication 1, **caractérisé en ce que** la partie élastique (6) comprend un trou de formage (61) disposé sur une paroi latérale extérieure de la cavité de pile (19) et une pièce élastique (62) qui s'étend obliquement vers l'ouverture (15) le long de la paroi latérale du trou de formage (61).

3. Micro-détecteur de fumée selon la revendication 2, **caractérisé en ce qu'**au moins deux trous de formage (61) sont disposés dans un sens radial de la partie tubulaire (12), et des parties saillantes de pièces élastiques (62) adjacentes dans un sens vertical sont en quinconce.

4. Micro-détecteur de fumée selon la revendication 1, **caractérisé en ce que** la partie de limitation (7) comprend un premier bloc limiteur (71) disposé sur le corps de couvercle (13), et un second bloc limiteur (72) qui est disposé sur une paroi intérieure de la partie tubulaire (12) et qui est situé dans un sens de déplacement du premier bloc limiteur (71).

5. Micro-détecteur de fumée selon la revendication 1, **caractérisé en ce qu'**un second bloc de positionnement (96) s'étend depuis une partie inférieure de la plaque de montage (11) le long d'un sens axial, et la cloison (18) comporte une seconde rainure de positionnement (97) qui s'étend le long d'un sens circonférentiel pour la rotation du second bloc de positionnement (96).

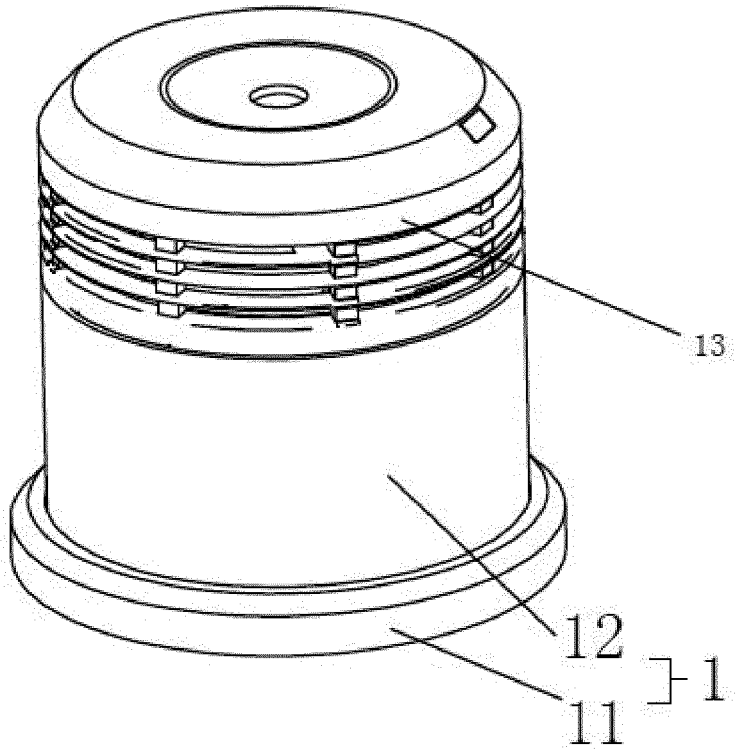

Fig.1

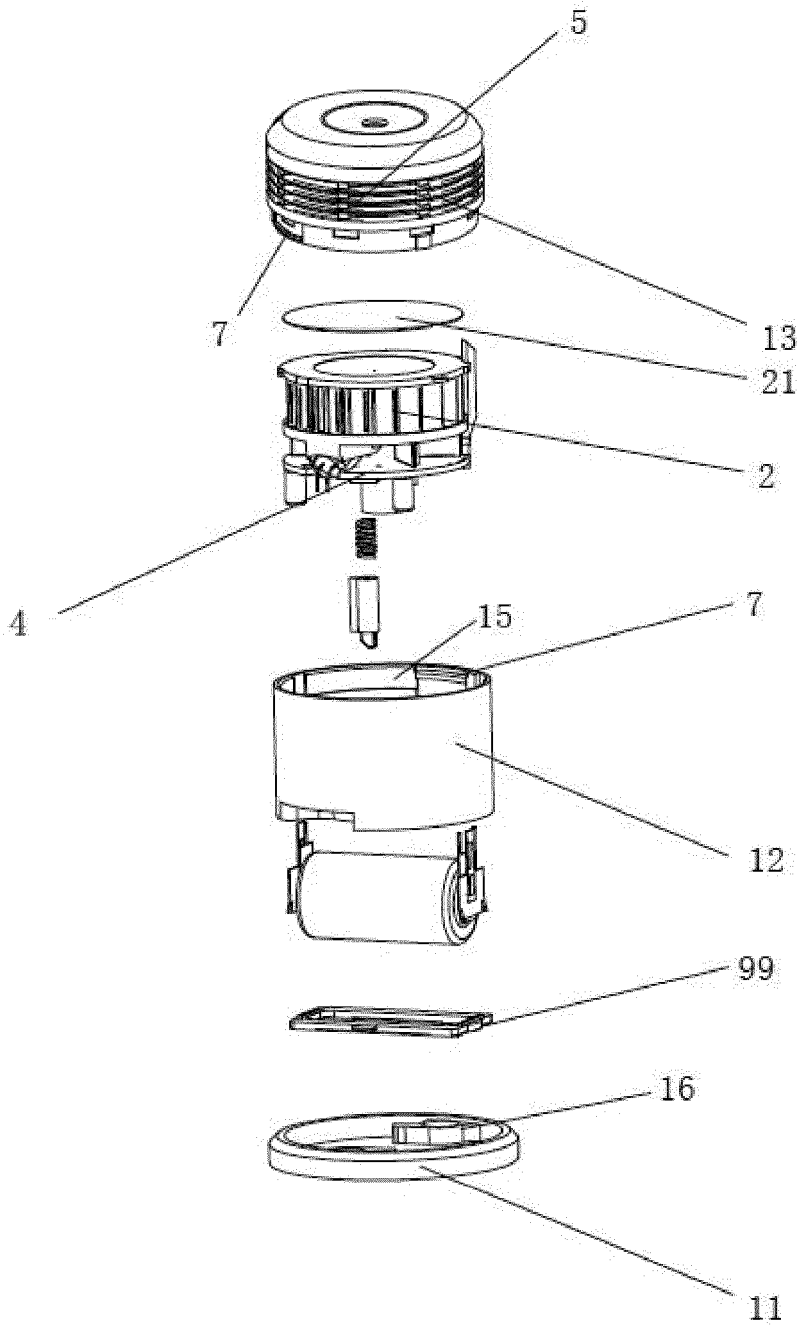

Fig.2

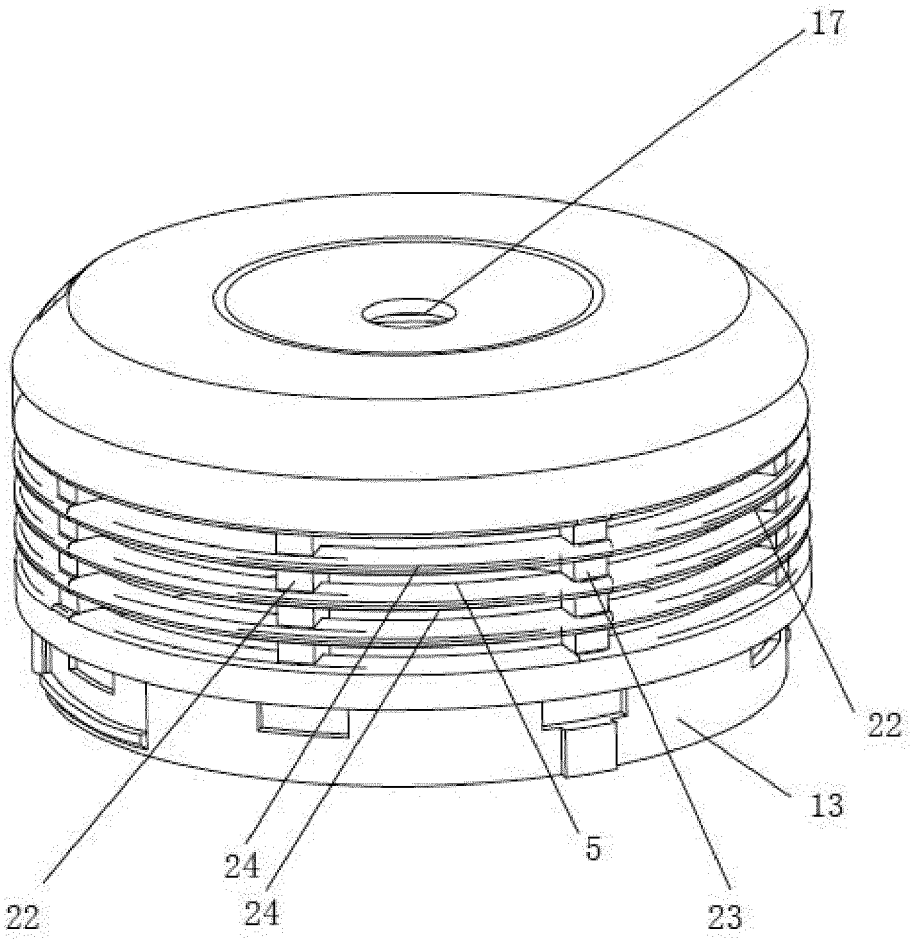

Fig.3

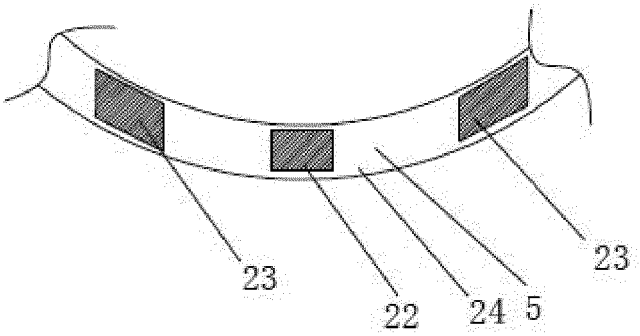

Fig.4

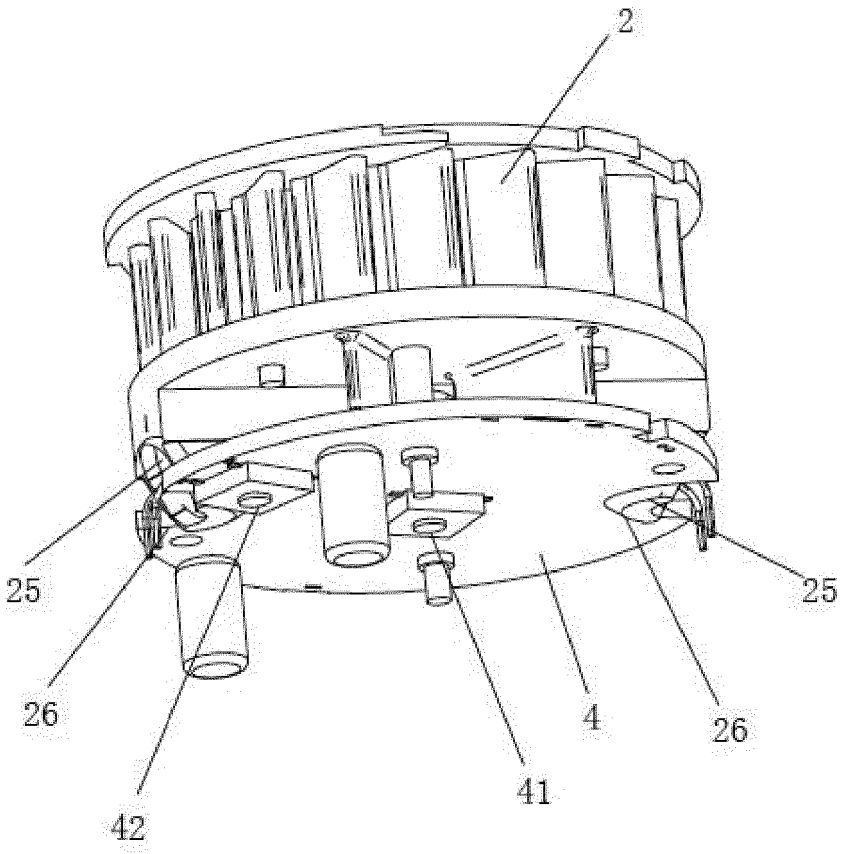

Fig.5

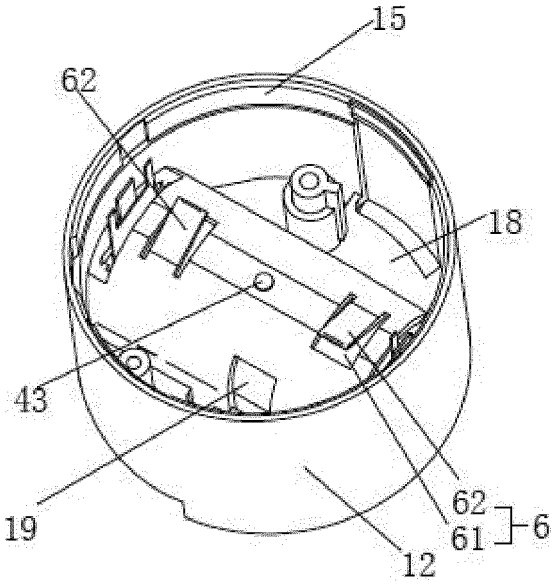

Fig.6

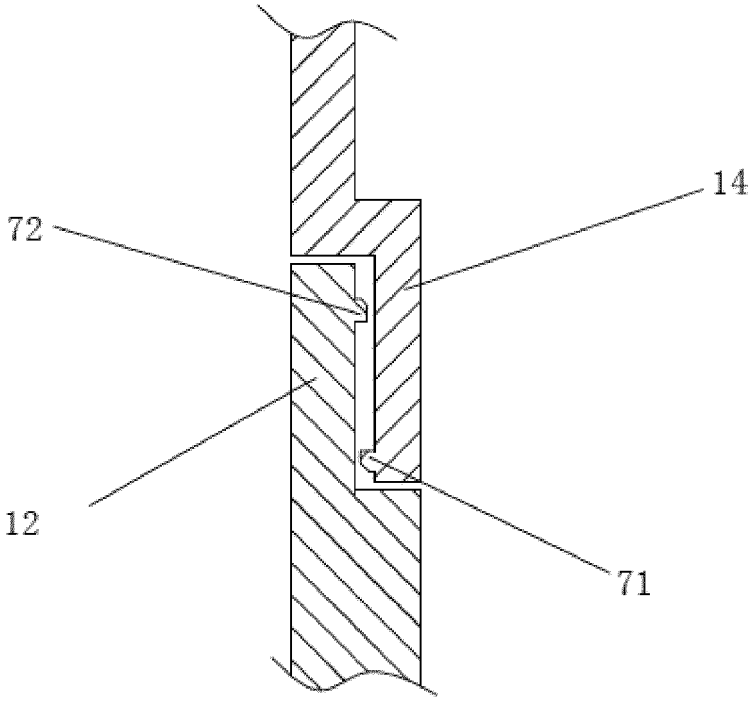

Fig.7

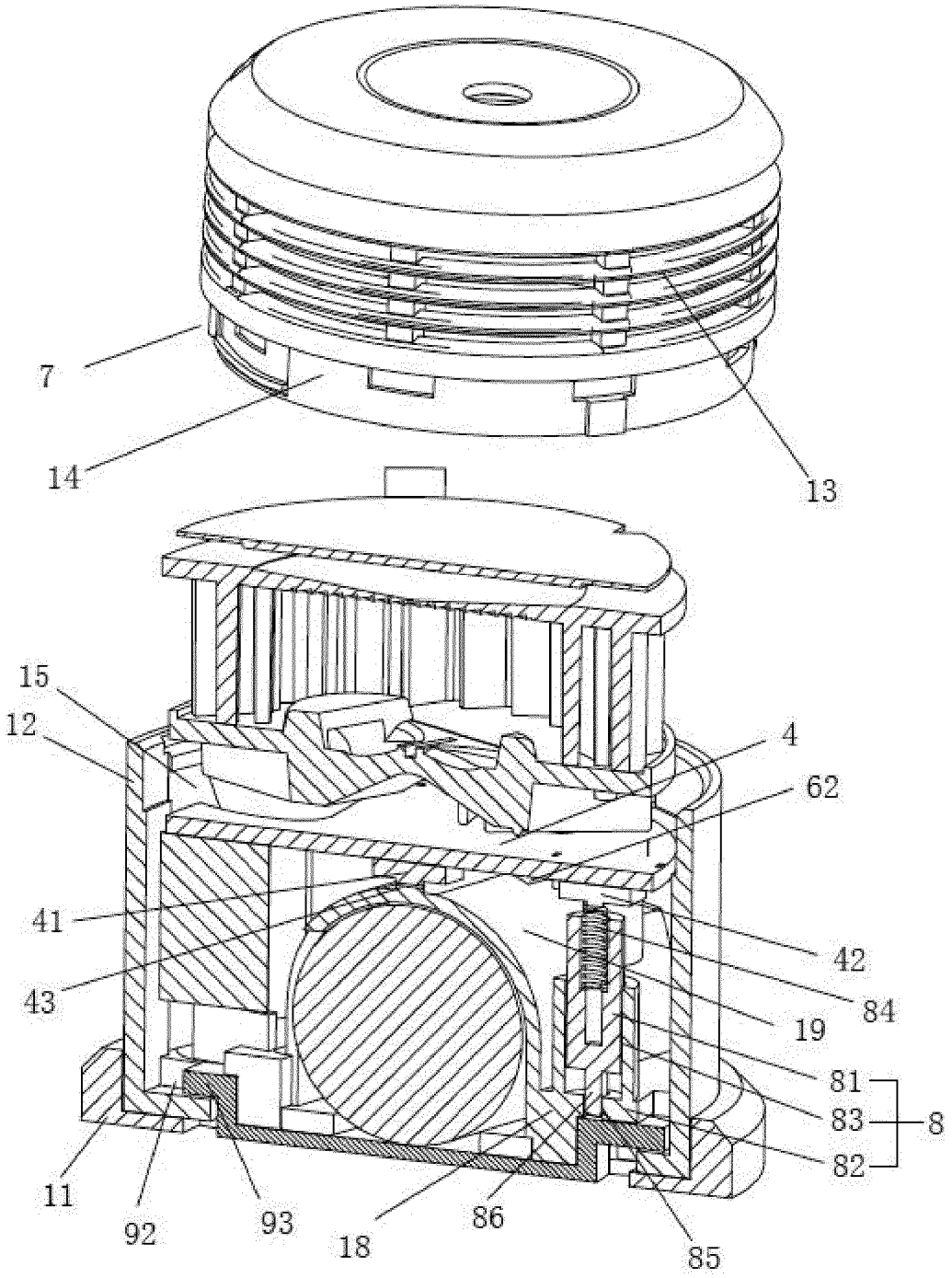

Fig.8

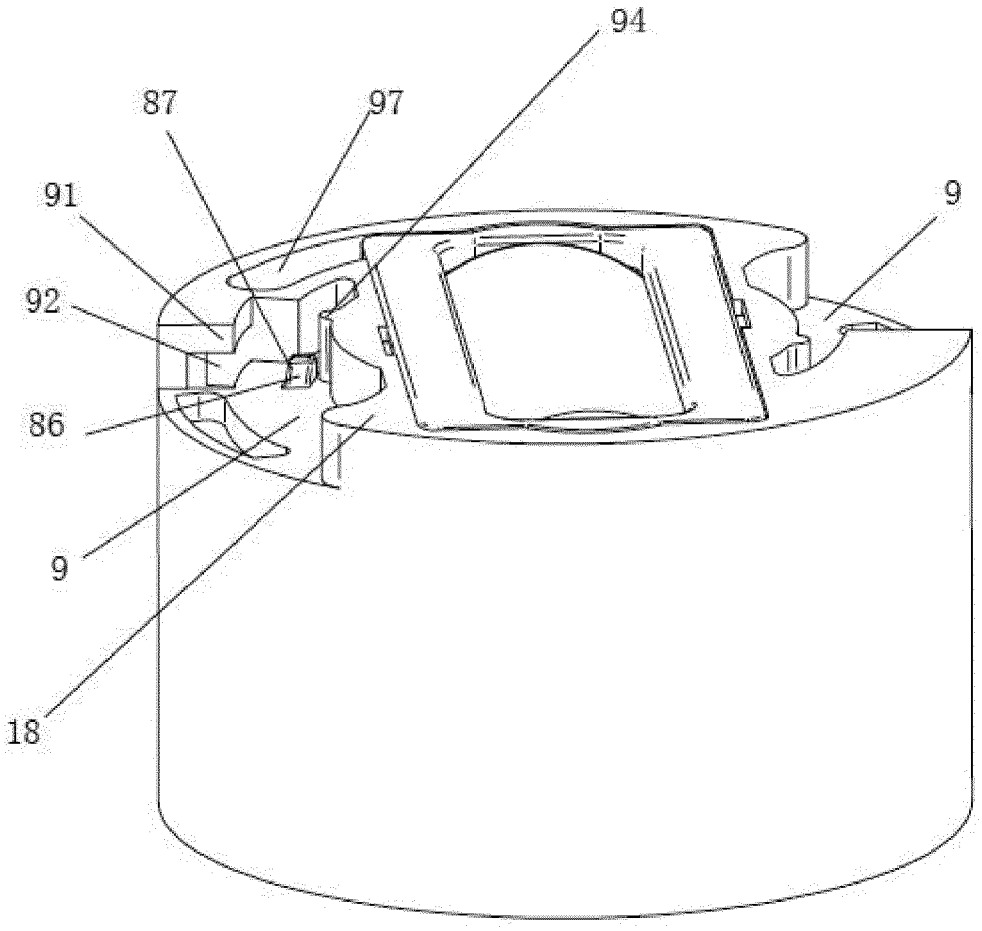

Fig.9

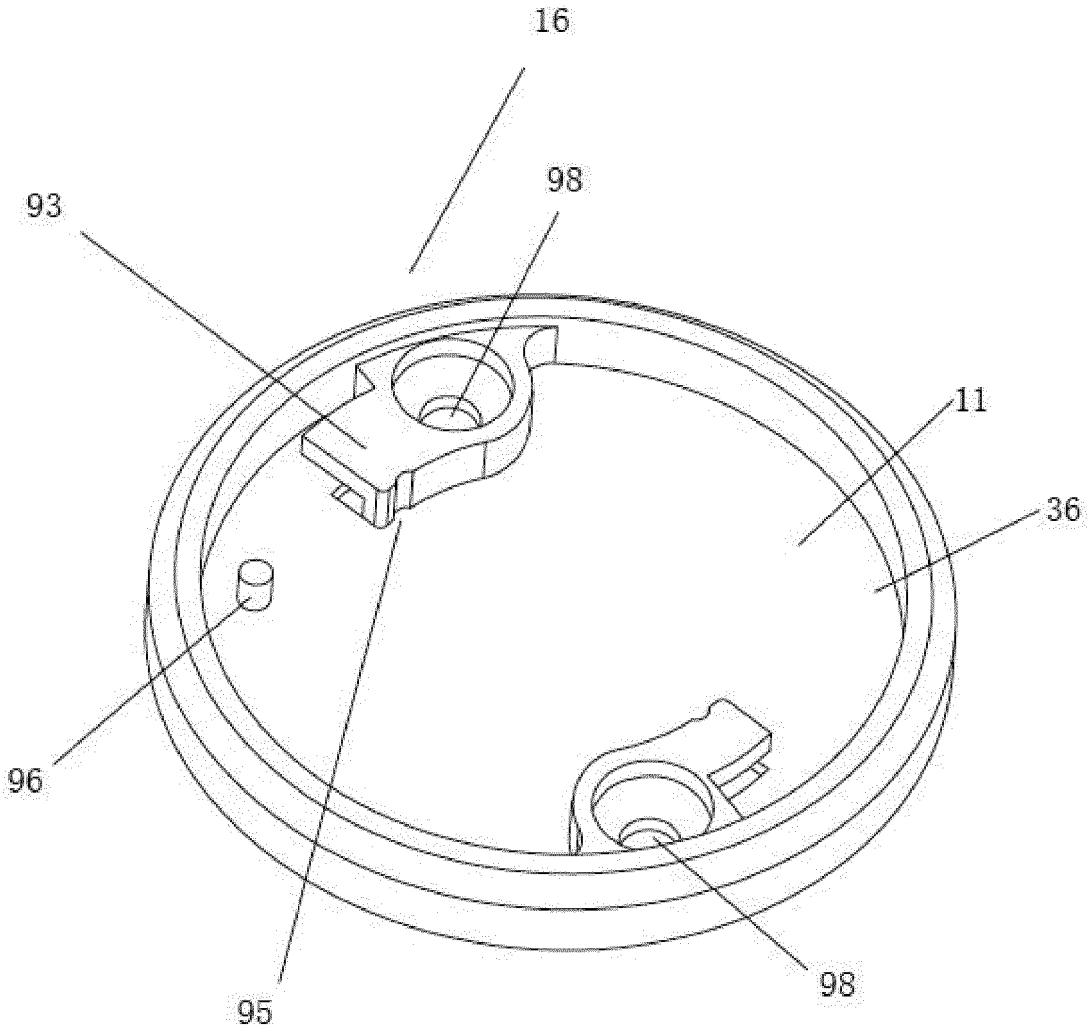

Fig.10

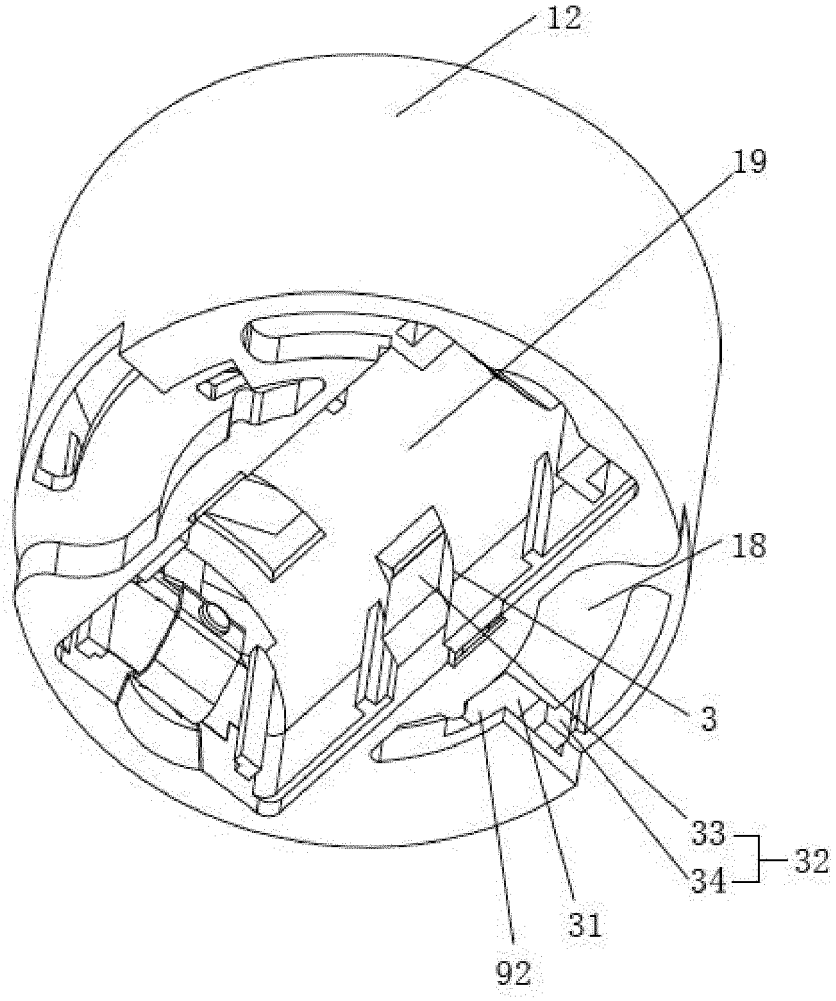

Fig.11

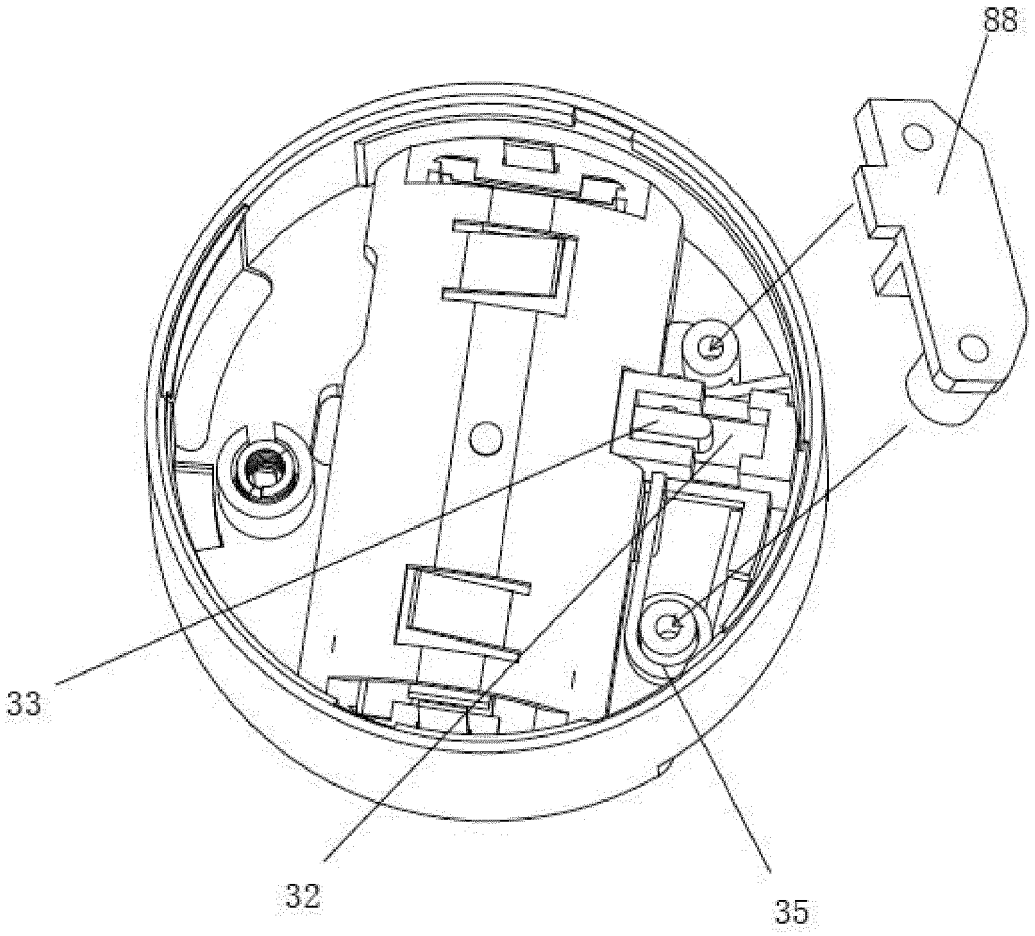

Fig.12

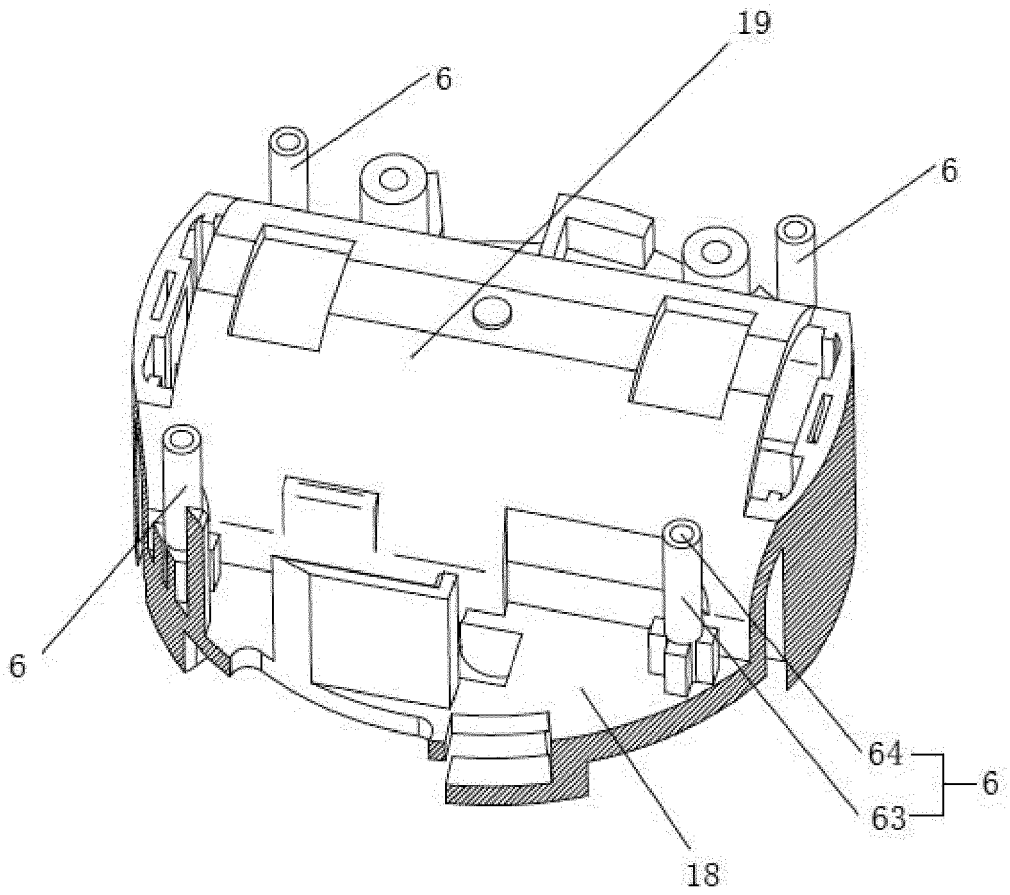

Fig.13

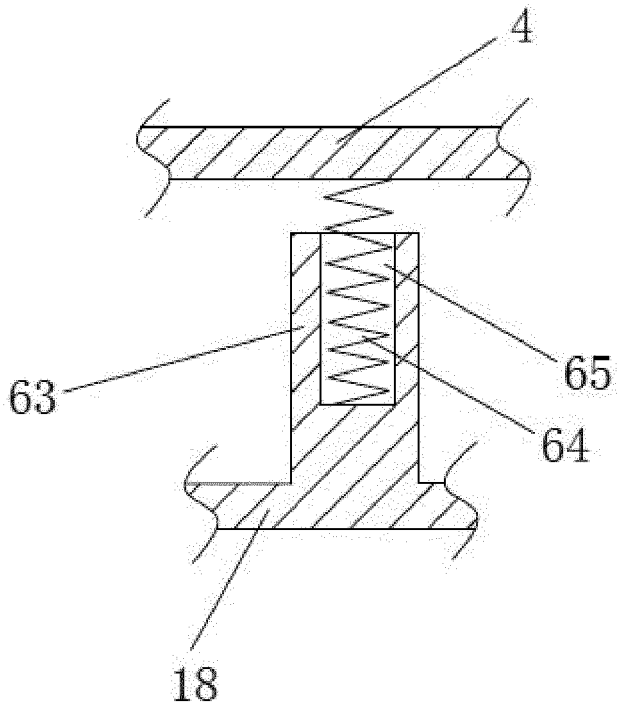

Fig.14

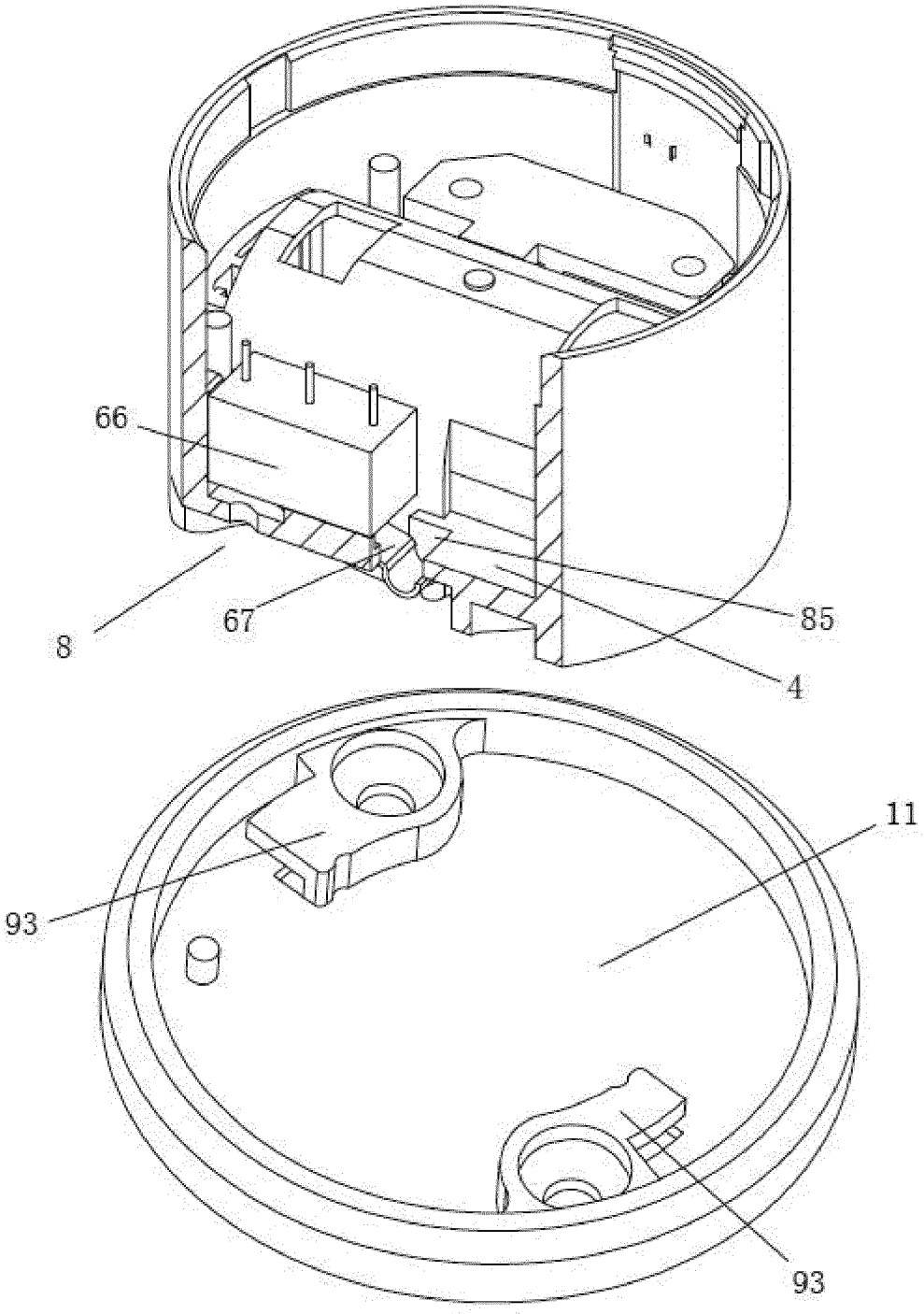

Fig.15

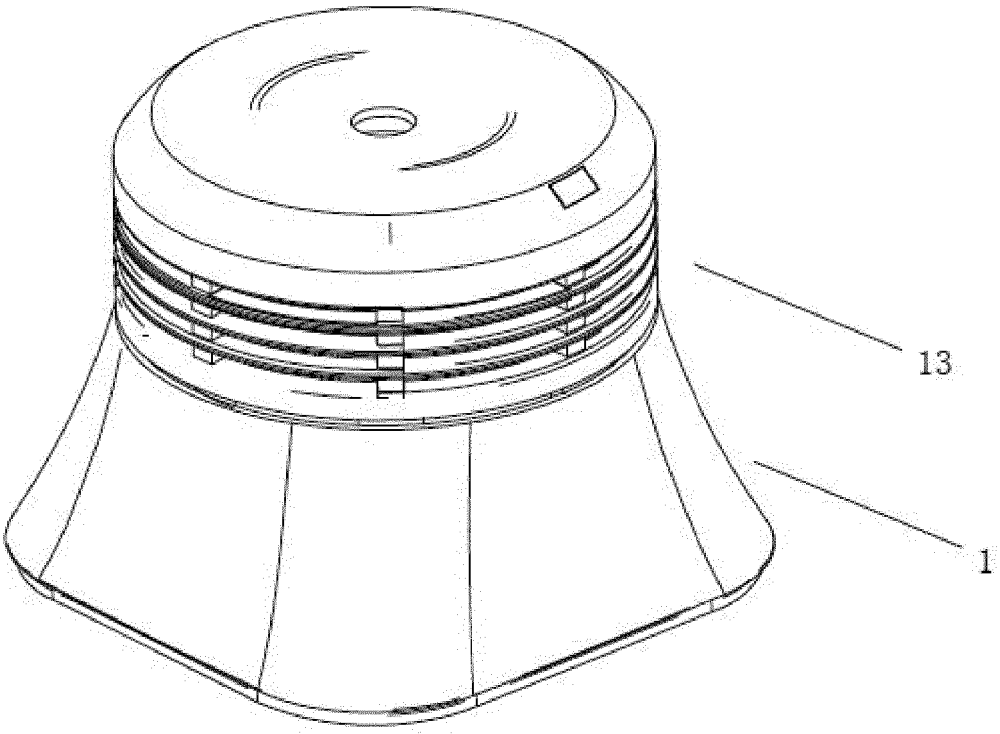

Fig.16

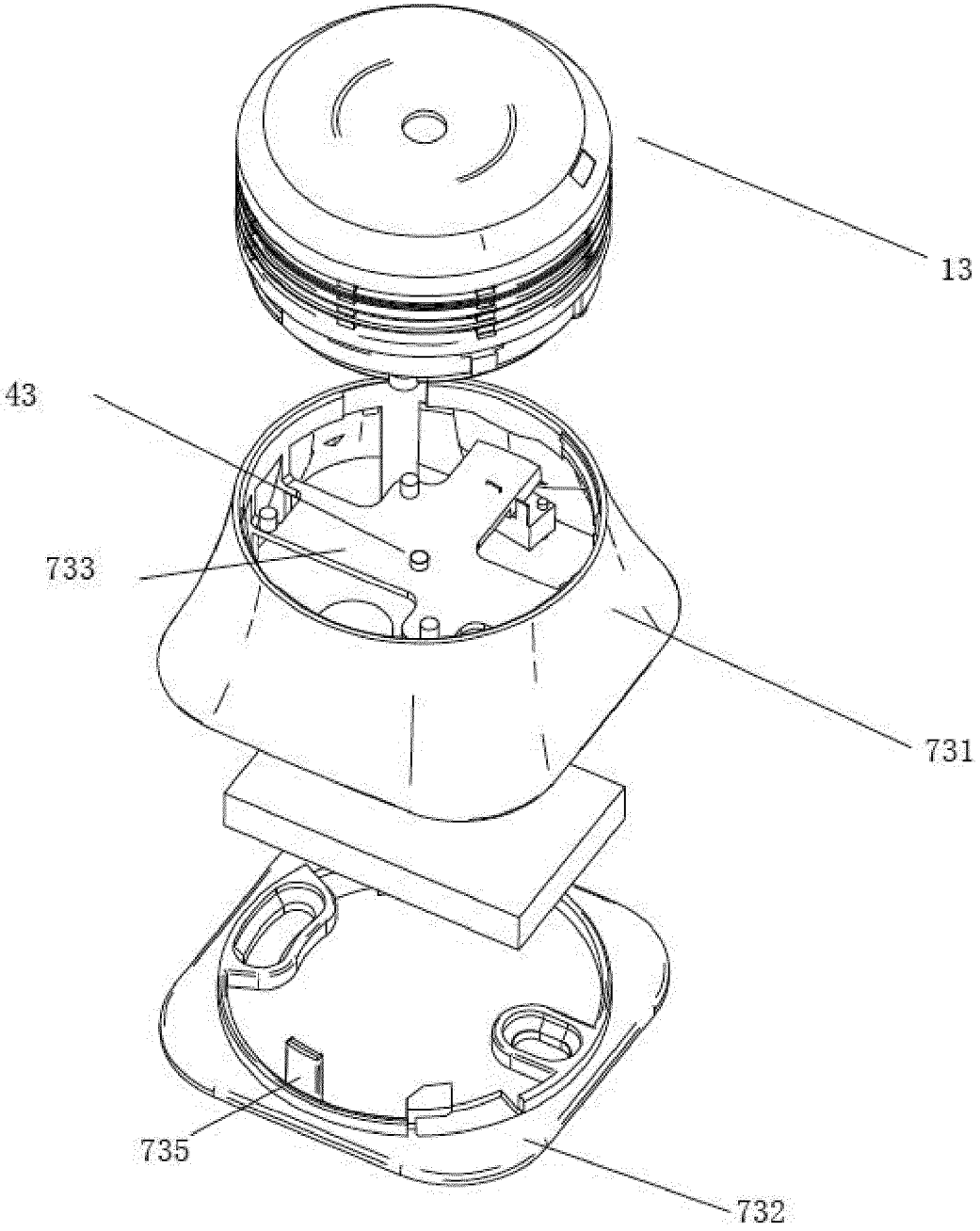

Fig.17

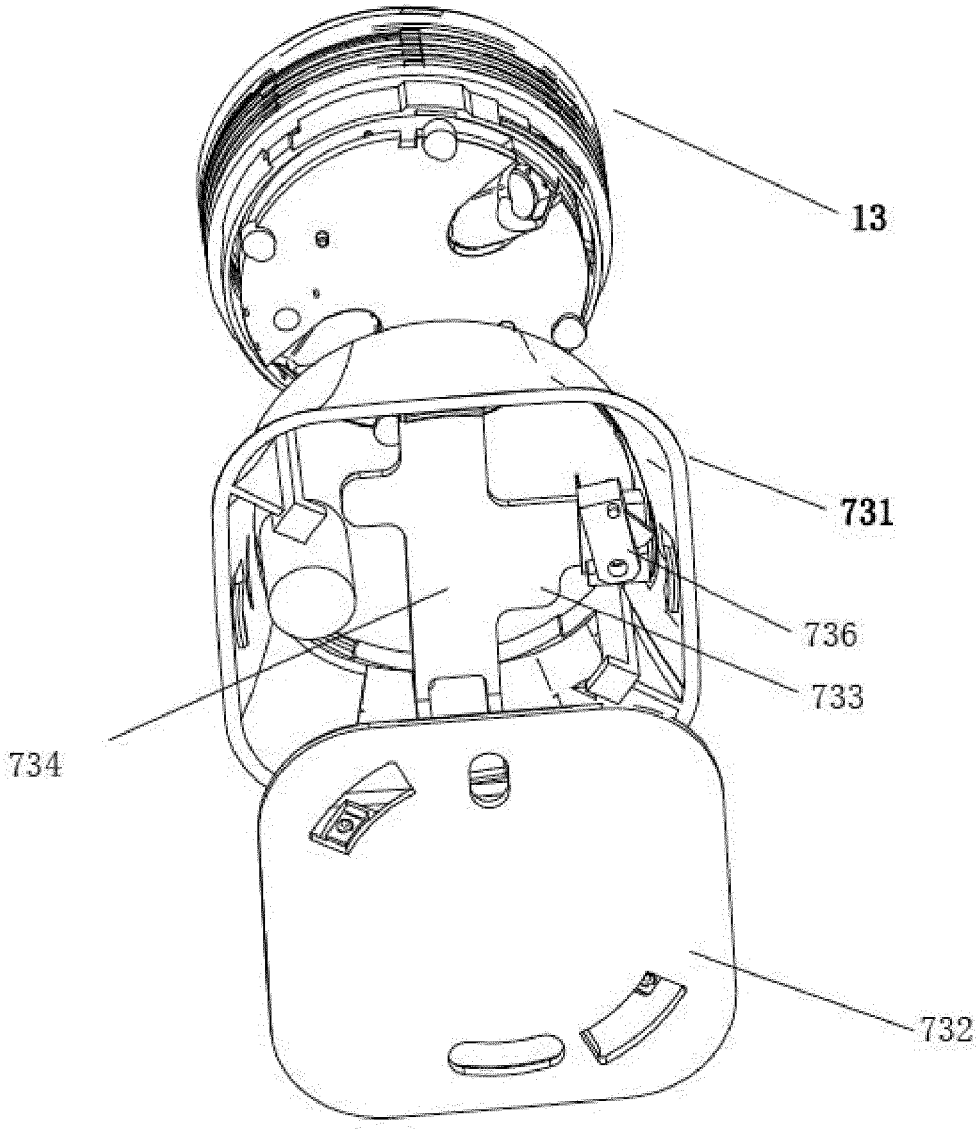

Fig.18

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 2517975 A **[0003]**
- EP 2503525 A1 **[0004]**