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(54) **ELECTRICAL DEVICE AND ACTUATOR FOR TACT SWITCH**

(57) The present disclosure relates to an electrical device, and an actuator for a tact switch. The electrical device comprises: a housing (10); a tact switch configured to be pressed to close an electrical circuit in the electrical device and configured to be released to open the electrical circuit; and an actuator (40) mounted in the housing (10) and being movable between a first position (P1) and a second position (P2) to selectively set the tact switch to an ON state or an OFF state, wherein at the first position (P1), the actuator (40) presses the tact switch to set the tact switch to the ON state, and at the second position, the actuator (40) is separated from the tact switch to set the tact switch to the OFF state. The electrical device according to embodiments of the present disclosure facilitates operation by a user.

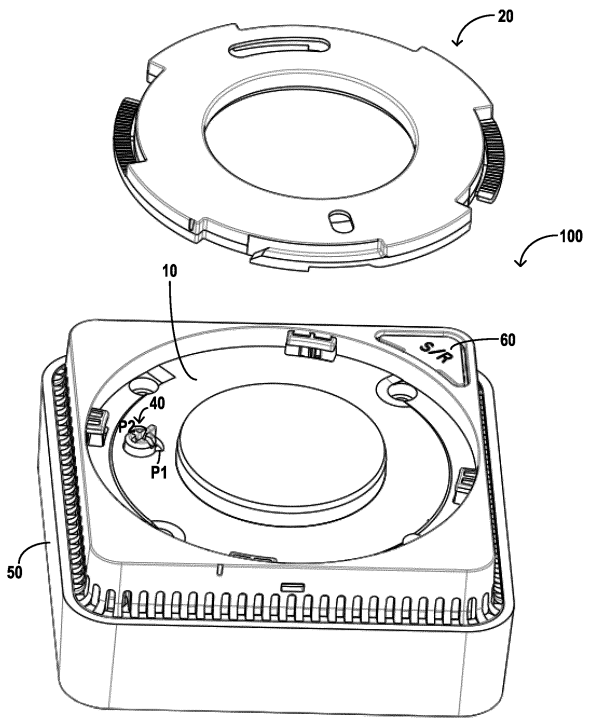

Fig.3

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Description

FIELD

[0001] Embodiments of the present disclosure generally relate to an electrical device including a tact switch, and in particular, to an actuator for the tact switch.

BACKGROUND

[0002] An electrical device such as a smoke alarm is typically provided with a tact switch. The tact switch is a switch that closes an electrical circuit when being pressed and opens the electrical circuit after the pressure is removed (i.e., released). This requires that the tact switch of the electrical device must be kept in a pressed state in order to realize the closed state of the electrical circuit, which is inconvenient in many practical applications. It is desirable to improve the electrical device comprising the tact switch to improve the convenience in use.

SUMMARY

[0003] Embodiments of the present disclosure provide an electrical device and an actuator for a tact switch to address one or more of the above problems and other potential problems.

[0004] According to a first aspect of the present disclosure, an electrical device is provided. The electrical device comprises: a housing; a tact switch configured to be pressed to close an electrical circuit in the electrical device and configured to be released to open the electrical circuit; and an actuator mounted in the housing and being movable between a first position and a second position to selectively set the tact switch to an ON state or an OFF state, wherein at the first position, the actuator is configured to press the tact switch to set the tact switch to the ON state, and at the second position, the actuator is configured to be separated from the tact switch to set the tact switch to the OFF state.

[0005] According to the electrical device of the embodiment of the present disclosure, the state of the tact switch may be conveniently changed via the actuator, thereby improving application convenience and user-friendliness of the electrical device.

[0006] In some embodiments, the housing may comprise a thorough opening in a pressing direction, wherein the actuator is rotatably mounted in the opening in an embedded manner.

[0007] In some embodiments, the actuator is rotatably disposed to the housing, wherein the actuator is at different circumferential positions relative to the housing when the actuator is at the first position and second position.

[0008] In some embodiments, the actuator may comprise a triggering end and an actuating end opposite to the triggering end, the triggering end is configured to be rotated to change the position of the actuator, and the actuating end is adapted to press the tact switch.

[0009] In some embodiments, the triggering end may further comprise a toggle portion projecting radially outward from a body of the triggering end, the actuator being moved between the first position and the second position by rotating the toggle portion.

[0010] In some embodiments, the actuator may be eccentrically mounted with respect to a mounting axis of the electrical device.

[0011] In some embodiments, the toggle portion may protrude further toward the mounting axis at the first position than at the second position.

[0012] In some embodiments, the electrical device may further comprise a mounting plate adapted to be fixed to a fixed body, and the housing is rotatably mounted to the mounting plate, wherein the mounting plate comprises a pushing portion such that in a process for the rotatably mounting housing to the mounting plate, the toggle portion is pushed via the pushing portion to move the actuator from the first position to the second position.

[0013] In some embodiments, the mounting plate may comprise a protruding rib on a side facing the housing, the protruding rib configured to press the actuator to keep the tact switch in the ON state when the housing is fitted with the mounting plate.

[0014] In some embodiments, the triggering end may further comprise a tool slot.

[0015] In some embodiments, the actuating end may comprise a positioning arm projecting radially outwardly from the body of the triggering end, and the housing comprises a circumferential channel providing a movement path for the positioning arm.

[0016] In some embodiments, the circumferential channel may comprise a first stopping portion and a second stopping portion adapted to position the positioning arm at different heights, wherein positions of the first stopping portion and second stopping portion correspond to the first position and second position of the actuator, respectively.

[0017] In some embodiments, the circumferential channel may be formed on a cylinder protruding from the housing, the cylinder including an inclined wall providing a path for movement of the positioning arm.

[0018] In some embodiments, the actuator may comprise pawls to removably mount the actuator into the housing.

[0019] In some embodiments, the actuator may be an integrally-formed member.

[0020] In some embodiments, the electrical device may comprise a smoke alarm.

[0021] According to a second aspect of the present disclosure, there is provided an actuator for a tact switch, the tact switch configured to be pressed to close an electrical circuit in the electrical device and configured to be released to open the electrical circuit. The actuator comprises: a cylindrical body including a first end and an opposite second end; a toggle portion protruding radially outward from the body at the first end, the toggle portion

being rotated such that the actuator rotates between a first position and a second position, wherein at the first position, the body is adapted to press the tact switch to set the tact switch to an ON state, and at the second position, the body is adapted to be away from the tact switch by a distance to set the tact switch to an OFF state; and a positioning arm projecting radially outwardly from the body of the triggering end at the second end, the positioning arm configured to position the actuator in a pressing direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The above and other objectives, features, and advantages of example embodiments of the present disclosure will become more apparent from the following detailed description with reference to the accompanying drawings. In the figures, several embodiments of the present disclosure are shown in an exemplary but unrestrictive manner.

FIG. 1 shows a schematic perspective view of a smoke alarm according to an embodiment of the present disclosure as viewed from a working side.

FIG. 2 shows a schematic perspective view of a smoke alarm according to an embodiment of the present disclosure as viewed from a mounting side.

FIG. 3 shows an exploded view of the smoke alarm shown in FIG. 2.

FIG. 4 shows a perspective view of a mounting plate according to an embodiment of the present disclosure.

FIG. 5 shows a perspective view of an actuator according to an embodiment of the present disclosure.

FIG. 6 shows a perspective view of an actuator according to an embodiment of the present disclosure as viewed from a different angle from FIG. 5.

FIG. 7 shows a schematic view from one side of an actuator according to an embodiment of the present disclosure when in an OFF position.

FIG. 8 shows a schematic view from the other side of an actuator according to an embodiment of the present disclosure when in the OFF position.

FIG. 9 shows a schematic view from one side of an actuator according to an embodiment of the present disclosure when in an ON position.

FIG. 10 shows a schematic view from the other side of an actuator according to an embodiment of the present disclosure when in the ON position.

[0023] In all figures, the same or corresponding reference numbers denote the same or corresponding parts.

DETAILED DESCRIPTION OF EMBODIMENTS

[0024] Preferred embodiments of the present disclosure will be described as follows in greater detail with reference to the drawings. Although preferred embodiments of the present disclosure are illustrated in the drawings, it is to be understood that the present disclosure described herein can be implemented in various manners, not limited to the embodiments illustrated herein. Rather, these embodiments are provided to make the present disclosure described herein clearer and more complete and convey the scope of the present disclosure described herein completely to those skilled in the art.

[0025] As used herein, the term "comprises" and its variants are to be read as open-ended terms that mean "comprises, but is not limited to." The term "or" is to be read as "and/or" unless the context clearly indicates otherwise. The term "based on" is to be read as "based at least in part on." The term "one example implementation" and "an example implementation" are to be read as "at least one example implementation." The term "another implementation" is to be read as "at least one other implementation." The terms indicating placement or positional relationship such as "up", "down", "front" and "rear" are based on the orientation or positional relationship shown in the figures, and are only for the convenience in describing the principles of the present disclosure, rather than indicating or implying that the designated elements must have a particular orientation, be constructed or operated in a particular orientation, and thus should not be construed as limiting the present disclosure. The structural details and working principles of the limiting device (also referred to as a damper) according to embodiments of the present disclosure will be described in detail with reference to figures.

[0026] Operation principles of an electrical device including a tact switch according to the present disclosure is described below with a smoke alarm as an example of the electrical device. It should be appreciated that this is merely exemplary; the inventive concept according to the present disclosure may be applied to any other electrical devices that comprises the tact switch.

[0027] FIG. 1-FIG. 3 each show a perspective view of a smoke alarm 100 according to an embodiment of the present disclosure. As shown in FIG. 1-FIG. 3, the smoke alarm 100 may comprise a device body 50 that may house a sensor, a power supply module, and an alarm module. The device body 50 may be mounted by a mounting plate 20 to an appropriate position of a building, such as a ceiling, a wall, or a support post of the building. The device body 50 may comprise a fixed housing 10. The housing is, for example, in the form of a plate and is adapted to house electrical means within the device body 50.

[0028] As shown in FIG. 3, a tact switch (not shown)

may also be housed within the device body 50 of the smoke alarm 100. An actuator 40 may be mounted above the tact switch and can move up and down relative to the tact switch. When the actuator 40 is moved downwardly to press the tact switch, the tact switch is pressed to close an electrical circuit in the smoke alarm 100. When the actuator 40 is moved upward to release the tact switch, the tact switch is released to open the electrical circuit.

[0029] As shown, the actuator 40 is mounted in the housing 10 and is movable between a first position P1 and a second position P2 to selectively set the tact switch to an ON state or an OFF state, wherein at the first position P1, the actuator 40 presses the tact switch such that the tact switch is in the ON state, and at the second position P2, the actuator 40 is separated from the tact switch such that the tact switch is in the OFF state.

[0030] According to the smoke alarm 100 of an embodiment of the present disclosure, by the additionally-provided actuator 40, the tact switch may be conveniently set to the ON state or the OFF state by moving the actuator 40 without requiring the user to always press to trigger the switch with one hand. Thereby, the hands of the user may be freed, which has a significant advantage in practice.

[0031] In some applications, the smoke alarm 100 may further be provided with a networking module 60. In order to realize a network connection of the networking module 60, the tact switch needs to be in the ON state, and therefore the user needs to keep pressing the tact switch and meanwhile also needs to operate the networking module, which is very inconvenient in practice. In accordance with the smoke alarm 100 of an embodiment of the present disclosure, the user may selectively set the tact switch to the ON state and then operate the networking module 60 to achieve network interconnection. After interconnection of the networking module 60 is completed, the smoke alarm 100 may be mounted to, for example, a ceiling via the mounting plate 20.

[0032] In some embodiments, as shown in FIG. 3, the housing 10 comprises a through opening in a pressing direction. The actuator 40 is rotatably mounted in the opening in an embedded manner. The actuator 40, being mounted in the embedded manner, occupies only a small space, and the setting of the actuator thus does not cause an impact on the operation of the other components of the smoke alarm 100.

[0033] In some embodiments, as shown in FIG. 3, the actuator 40 is rotatably disposed relative to the housing 10. In the first position P1 and the second position P2, the actuator 40 is in different circumferential positions with respect to the housing 10. With this configuration, the user only needs to rotate the actuator 40 to realize different states of the tact switch.

[0034] FIG. 4 shows structural details of the mounting plate 20 according to an embodiment of the present disclosure. As shown in FIG. 4, the mounting plate 20 comprises a protruding rib 24 at a side facing the housing 10. In a state where the housing 10 is fitted with the mounting plate 20, the protruding rib 24 can press the actuator 40 to keep the tact switch in the ON state.

[0035] The mounting plate 20 may be mounted to the device body 50 in various manners. In some embodiments, the device body 50 is rotatably mounted relative to the mounting plate 20. This is simple to operate. In some embodiments, the mounting plate 20 may comprise a pushing portion 22. In a process that the device body 50 is rotatably mounted to the mounting plate 20, the actuator 40 (e.g., a pushable toggle portion 42) is pushed via the pushing portion 22 to move the actuator 40 from the first position P1 to the second position P2. Thus, in the simple mounting manner, the actuator 40 can be always switched to the second position P2 in the process that the device body 50 is rotatably mounted to the mounting plate 20 regardless of the initial state of the actuator 40. In a state that the second position P2 corresponds to the OFF position of the tact switch, the tact switch is maintained in the OFF state when the device body 50 is detached from the mounting plate 20, which makes it possible to always maintain the means within in the device body 50 in a power off state, thereby improving safety.

[0036] FIG. 5 and FIG. 6 show structural details of an actuator according to an embodiment of the present disclosure. As shown in FIG. 5 and FIG. 6, the actuator 40 comprises a triggering end and an actuating end opposite to the triggering end. The triggering end can be rotated to change the position of the actuator 40, and the actuating end is adapted to press the tact switch. The change of a state of the tact switch is conveniently achieved by operating the triggering end of the actuator 40 after the electronic means is mounted within the device body 50 in the smoke alarm.

[0037] In some embodiments, the triggering end further comprises a tool slot 48. The user may conveniently rotate the triggering end by using a tool such as a screwdriver to engage the tool slot 48. It is appreciated that although the tool slot 48 is shown as a cross shape in the illustrated embodiment, any other suitable shape may be employed in the present disclosure.

[0038] In some embodiments, the triggering end may further comprise a toggle portion 42 projecting radially outward from a body 45 of the triggering end, the actuator 40 being moved between the first position P1 and the second position P2 by rotating the toggle portion 42. In the case where the toggle portion 42 is provided, in addition to facilitating rotation, there is a significant advantage in the case where the device body 50 is mounted to the mounting plate 20. The toggle portion may be disposed at a position adapted to interact with the mounting plate 20. Thus, regardless of the initial state of the toggle portion 42, during mounting the device body 50 to the mounting plate 20, the toggle portion may be maintained at a predetermined orientation position by the interaction of the toggle portion with the mounting plate 20, so that the tact switch is always maintained at a predetermined ON/OFF state after the device body 50 is fixed to the

mounting plate 20.

[0039] In some embodiments, the actuator 40 is eccentrically mounted with respect to a mounting axis of the smoke alarm 100. In this case, during the mounting of the device body 50 with the mounting plate 20, adjustment of the position of the toggle portion may be accomplished by striking the toggle portion, and thus the tact switch is always maintained in a predetermined ON/OFF state after the device body 50 is fixed to the mounting plate 20.

[0040] In some embodiments, the toggle portion 42 projects further toward the mounting axis at the first position P1 than at the second position P2. Thus, with respect to the mounting axis, the toggle portion 42 projects further toward the mounting axis at the first position P1 than at the second position P2. Thus, in the process of mounting the device body 50 to the mounting plate 20, the toggle portion 42 at the second position P2, for example, is located on a rotational path of the pushing portion 22 and is pushed by the pushing portion 22. On the other hand, the toggle portion 42 at the first position P1, for example, is located outside the rotational path of the pushing portion 22, without causing interference with the relative rotation of the device body 50 and the mounting plate 20.

[0041] As shown in FIG. 5 and FIG. 6, the actuating end of the actuator 40 comprises a positioning arm 44 projecting radially outwardly from the body 45 of the triggering end. The positioning arm 44 may interact with the housing 10 to maintain the actuator in a predetermined circumferential position.

[0042] Correspondingly, the housing 10 may comprise a circumferential channel that provides a path of movement for the positioning arm 44. The circumferential channel may be formed in various forms. In the illustrated embodiment, the housing 10 may comprise a cylinder 65 protrudingly extending from the surface of the housing in the pressing direction. The circumferential channel may comprise a first stopping portion 64 and a second stopping portion 66 configured to position the positioning arm 44 at different heights. The positions of the first stopping portion and the second stopping portion correspond to the first position P1 and the second position P2 of the actuator 40, respectively. The first stopping portion 64 and the second stopping portion 66 may be formed in the shape of a recess, and the positioning arm 44 may be formed in the shape of adapted to engage with the recess of the first stopping portion 64 and the second stopping portion 66, respectively.

[0043] In the illustrated embodiment, the cylinder 65 comprises an inclined wall 62 that provides a track for movement of the positioning arm 44. Thereby, a height difference may be provided by the inclined wall, and the height difference may correspond, for example, to a movement stroke for triggering the tact switch to act. In some embodiments, the inclined wall may be formed in a smooth transition. In other embodiments, the inclined wall may be formed as a plurality of steps.

[0044] In the illustrated embodiment, the actuator 40 may be an integrally-formed member. The actuating end of the actuator 40 may be implemented as a large-diameter portion, and the triggering end of the actuator may be implemented as a small-diameter portion. In this way, the actuator in the housing 10 may be conveniently disposed in the housing 10. In some embodiments, the actuator 40 may comprise a plurality of pawls 46, and the actuator 40 may be removably mounted into the housing 10 by elastic deformation of the pawls.

[0045] In some embodiments, the device body 50 may be bidirectionally mounted with the mounting plate 20. In some embodiments, the device body 50 may be mounted to the mounting plate 20 in a clockwise direction or in a counterclockwise direction. In this case, the actuator 40 may comprise a pair of positioning arms 44 arranged rotationally symmetrically. The housing 10 may comprise corresponding structures that are radially symmetric with and adapted to interact with actuator 40.

[0046] The operating principles of the actuator according to an embodiment of the present disclosure are described below with reference to FIG. 7-FIG. 10. As shown in FIG. 7 and FIG. 9, in a state that the device body 50 is not mounted to the mounting plate, the user may rotate the actuator 40 by operating the tool slot 50 with a tool such as a screwdriver so that the actuator 40 is in a predetermined orientation. Alternatively, the user may rotate the actuator 40 by operating the toggle portion 42 such that the actuator 40 is in a predetermined orientation.

[0047] In the state shown in FIG. 7 and FIG. 8, the actuator 40 is shown in the OFF state. As shown in FIG. 7 and FIG. 8, when the toggle portion 42 is in the second position P2, the positioning arm 44 is at the second stopping portion 66 of the circumferential channel; at the second stopping portion 66, the positioning arm 44 is at a low position with respect to the cylinder 65 of the housing. Thus, the tact switch below the actuator cannot be pressed and is in the OFF state.

[0048] In the state shown in FIG. 9 and FIG. 10, the actuator 40 is shown in the ON state. As shown in FIG. 9 and FIG. 10, when the toggle portion 42 is in the first position P1, the positioning arm 44 is at the first stopping portion 64 of the circumferential channel; at the first stopping portion 64, the positioning arm 44 is at a high position with respect to the cylinder 65 of the housing. Thus, the tact switch below the actuator is pressed, and is in the ON state while being pressed.

[0049] On the one hand, when the user needs to mount the device body 50 to the mounting plate 20, it is assumed that at this time the toggle portion 42 is initially in the second position P2, and the tact switch is released and is in the OFF state, as shown in FIG. 7 and FIG. 8. When the device body 50 rotates with respect to the mounting plate 20, along with the relative rotation therebetween, the toggle portion 42 is at the second position P2 and located out of the rotation path of the pushing portion 22, whereby the toggle portion 42 is not affected by the mounting action. After the mounting plate 20 and the de-

vice body 50 are mounted in place, the actuating end is pressed via the protruding rib 24 on the mounting plate to keep the tact switch in the ON state. When the user needs to detach the device body 50 from the mounting plate 20, the actuator is maintained at the second position P2. Thus, the device body 50 is not charged.

[0050] On the other hand, when the user needs to mount the device body 50 to the mounting plate 20, it is assumed that at this time the toggle portion 42 is initially in the first position P1 and the tact switch remains pressed in the ON state, as shown in FIG. 9 and FIG. 10. When the device body 50 rotates with respect to the mounting plate 20, along with the relative rotation therebetween, the pushing portion 22 of the mounting plate 20 pushes the toggle portion 42 to move the toggle portion 42 from the first position P1 to the second position P2, whereby the tact switch is switched to the OFF state. After the mounting plate 20 and the device body 50 are mounted in place, the actuating end is pressed via the protruding rib 24 on the mounting plate to keep the tact switch in the ON state. When the user desires to remove the device body 50 from the mounting plate 20, the actuator is maintained in the second position P2, thereby ensuring that the device body 50 is not charged.

[0051] According to a second aspect of the present disclosure, there is also provided an actuator 40 for a tact switch. The tact switch can be pressed to close the electrical circuit in the smoke alarm 100 and can be released to open the electrical circuit. The actuator comprises: a cylindrical body 45 including a first end and an opposite second end; a toggle portion 42 protruding radially outward from the body 45 at the first end, the toggle portion 42 being rotated such that the actuator 40 rotates between a first position P1 and a second position P2, wherein at the first position P1, the body 45 is adapted to contact the tact switch such that the tact switch is in an ON state, and at the second position P2, the body 45 is adapted to be away from the tact switch by a distance such that the tact switch is in an OFF state; and a positioning arm 44 projecting radially outwardly from the body 45 of the triggering end at the second end, the positioning arm 44 providing positioning in the pressing direction of the actuator 40.

[0052] It is appreciated that the above description is only exemplary to facilitate understanding the inventive concept according to the present disclosure. In other embodiments, the above arrangement may be reversed. For example, in other embodiments, in the first position P1, the tact switch may correspond to an OFF position, whereas in the second position P2, the tact switch may correspond to an ON position. This can be achieved for example merely by adjusting the height difference at the inclined wall 62 adaptively.

[0053] The actuator according to the embodiment of the present disclosure achieves the change the state of the tact switch with a simple structure in a narrow space.

[0054] In addition, while operations are depicted in a particular order, this should not be understood as requiring that such operations are performed in the particular order shown or in sequential order, or that all illustrated operations are performed to achieve the desired results. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, while several specific implementation details are contained in the above discussions, these should not be construed as limitations on the scope of the subject matter described herein, but rather as descriptions of features that may be specific to particular implementations. Certain features that are described in the context of separate implementations may also be implemented in combination in a single implementation. Rather, various features described in a single implementation may also be implemented in multiple implementations separately or in any suitable sub-combination.

[0055] Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter specified in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

[0056] The descriptions of the various embodiments of the present invention have been presented for purposes of illustration, but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein.

Claims

1. An electrical device, comprising:

a housing (10);

a tact switch configured to be pressed to close an electrical circuit in the electrical device and configured to be released to open the electrical circuit; and

an actuator (40) mounted in the housing (10) and being movable between a first position (P1) and a second position (P2) to selectively set the tact switch to an ON state or an OFF state, wherein at the first position (P1), the actuator (40) is configured to press the tact switch to set the tact switch to the ON state, and at the second position, the actuator (40) is configured to be separated from the tact switch to set the tact switch to the OFF state.

2. The electrical device according to claim 1, wherein the housing (10) comprises a through opening in a pressing direction, and wherein the actuator (40) is rotatably mounted in the opening in an embedded manner.

3. The electrical device according to claim 1, wherein the actuator (40) is rotatably disposed to the housing (10), and wherein the actuator (40) is at different circumferential positions relative to the housing (10) when the actuator is at the first position (P1) and second position (P2).

4. The electrical device according to claim 2, wherein the actuator (40) comprises a triggering end and an actuating end opposite to the triggering end, the triggering end is configured to be rotated to change the position of the actuator (40), and the actuating end is adapted to press the tact switch.

5. The electrical device according to claim 4, wherein the triggering end further comprises a toggle portion (42) projecting radially outward from a body (45) of the triggering end, the actuator (40) being moved between the first position (P1) and the second position (P2) by rotating the toggle portion (42).

6. The electrical device according to claim 5, wherein the actuator (40) is eccentrically mounted with respect to a mounting axis of the electrical device.

7. The electrical device according to claim 6, wherein the toggle portion (42) protrudes further toward the mounting axis at the first position (P1) than at the second position (P2).

8. The electrical device according to claim 7, wherein the electrical device further comprises a mounting plate (20) for fixing, and the housing (10) is rotatably mounted to the mounting plate (20),
wherein the mounting plate (20) comprises a pushing portion (22) such that in a process for rotatably mounting the housing (10) to the mounting plate (20), the toggle portion (42) is pushed via the pushing portion (22) to move the actuator (40) from the first position (P1) to the second position (P2).

9. The electrical device according to claim 8, wherein the mounting plate (20) comprises a protruding rib (24) on a side facing the housing (10), the protruding rib (24) configured to press the actuator (40) to keep the tact switch in the ON state when the housing (10) is fitted with the mounting plate (20).

10. The electrical device according to claim 4, wherein the triggering end further comprises a tool slot (48).

11. The electrical device according to any of claims 4-10, wherein the actuating end comprises a positioning arm (44) projecting radially outwardly from the body (45) of the triggering end, and the housing (10) comprises a circumferential channel providing a movement path for the positioning arm (44).

12. The electrical device according to claim 11, wherein the circumferential channel comprises a first stopping portion (64) and a second stopping portion (66) configured to position the positioning arm (44) at different heights, and wherein positions of the first stopping portion and second stopping portion correspond to the first position (P1) and second position (P2) of the actuator (40), respectively.

13. The electrical device according to claim 12, wherein the circumferential channel is formed on a cylinder (65) protruding from the housing (10), the cylinder (65) including an inclined wall configured to provide a movement path for the positioning arm (44).

14. The electrical device according to any of claims 1-10, 12 and 13, wherein the actuator (40) comprises pawls (46) to removably mount the actuator (40) into the housing (10).

15. The electrical device according to any of claims 1-10, 12 and 13, wherein the actuator (40) is an integrally-formed member.

16. The electrical device according to any of claims 1-10, 12 and 13, wherein the electrical device comprises a smoke alarm.

17. An actuator (40) for a tact switch, the tact switch configured to be pressed to close an electrical circuit in an electrical device and configured to be released to open the electrical circuit, the actuator comprising:

a cylindrical body (45) including a first end and an opposite second end;
a toggle portion (42) protruding radially outward from the body (45) at the first end, the toggle portion (42) being rotated such that the actuator (40) rotates between a first position (P1) and a second position (P2), wherein at the first position (P1), the body (45) is configured to press the tact switch set the tact switch to an ON state, and at the second position (P2), the body (45) is configured to be away from the tact switch by a distance to set the tact switch to an OFF state; and
a positioning arm (44) projecting radially outwardly from the body (45) at the second end, the positioning arm (44) configured to position in the actuator (40) in a pressing direction.

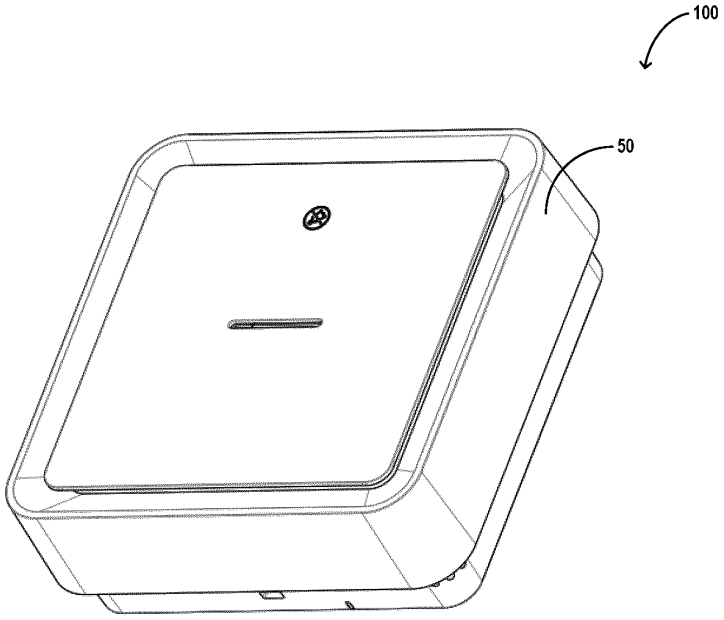

Fig.1

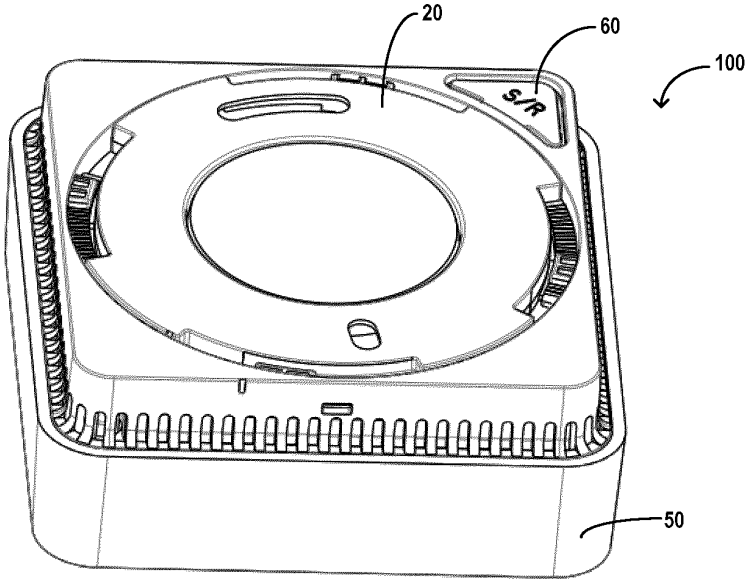

Fig.2

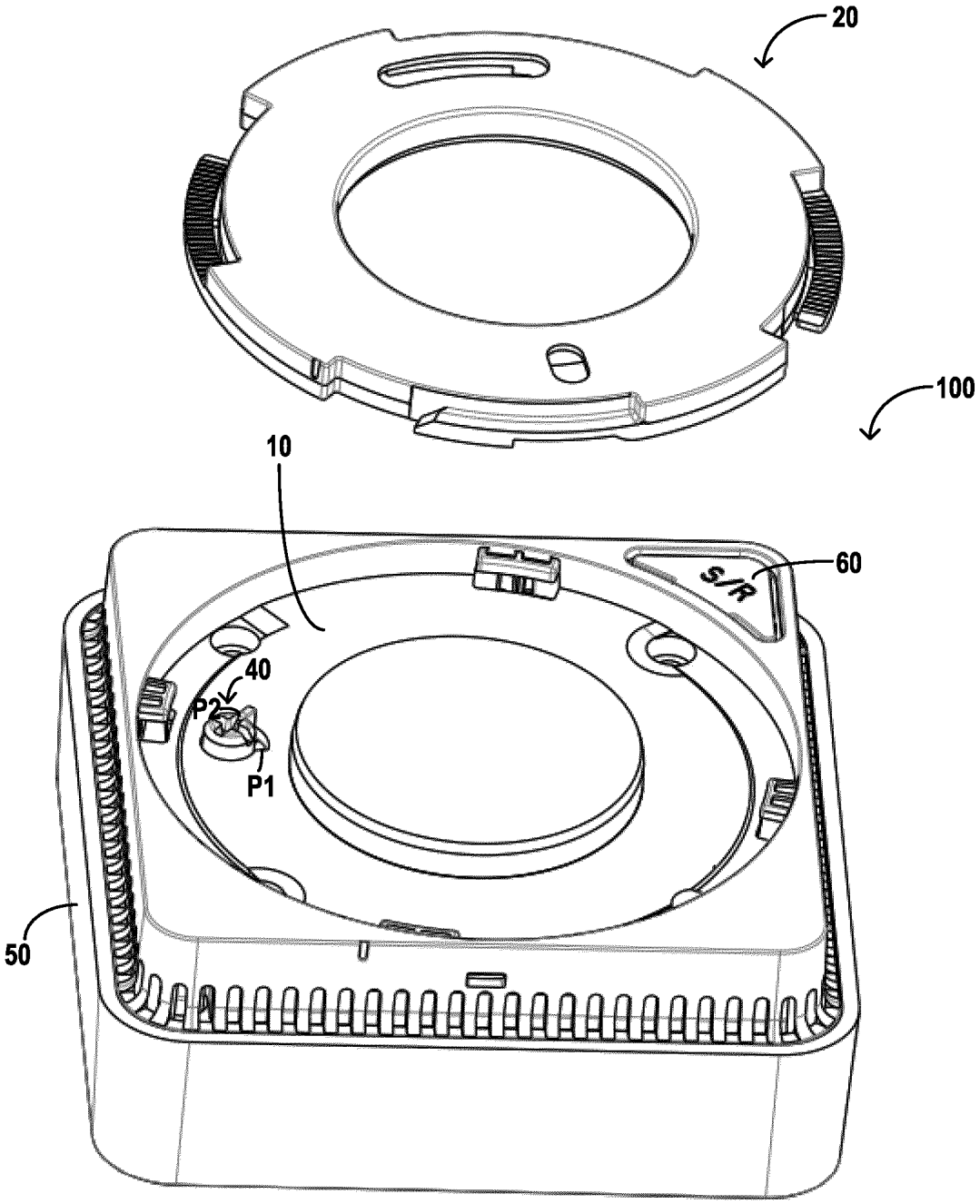

Fig.3

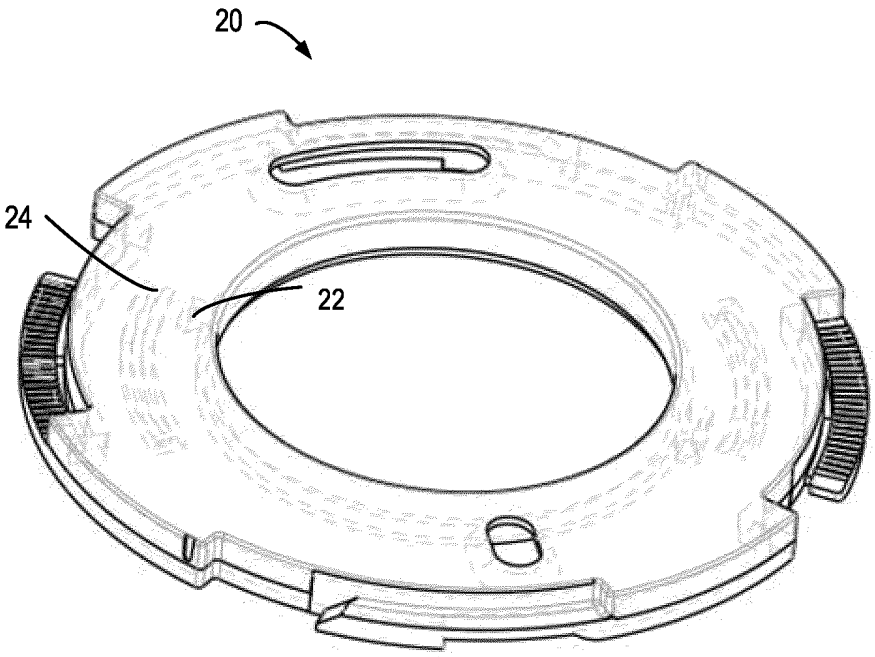

Fig.4

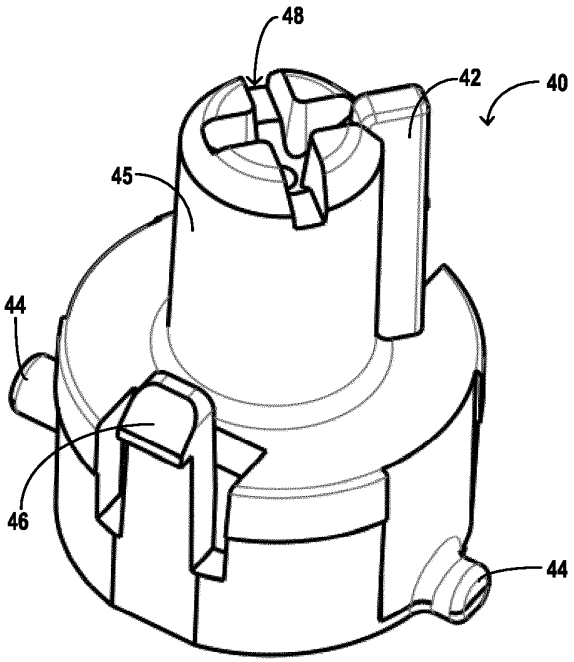

Fig.5

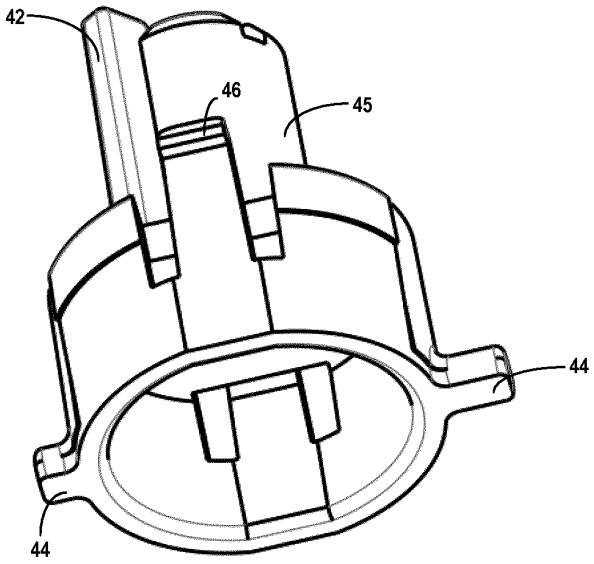

Fig.6

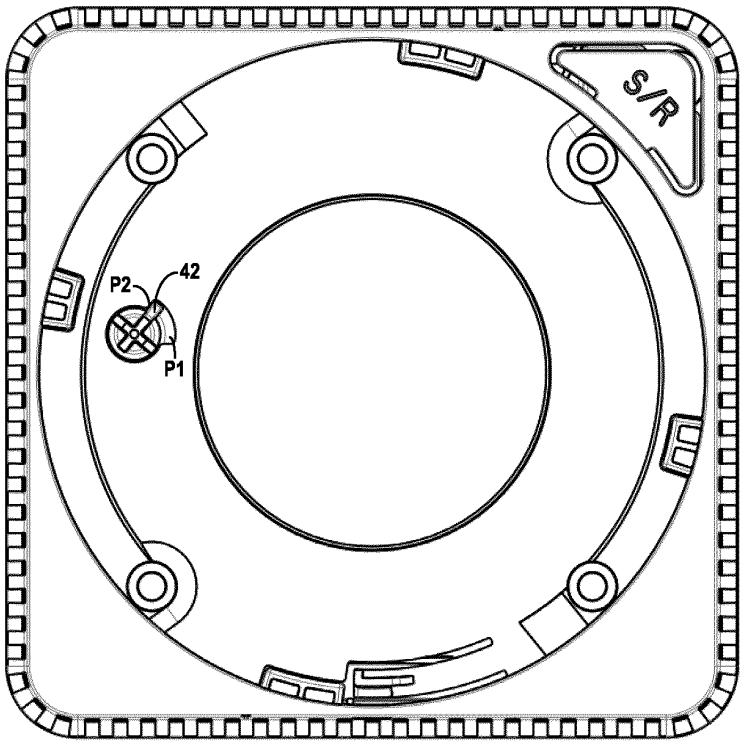

Fig.7

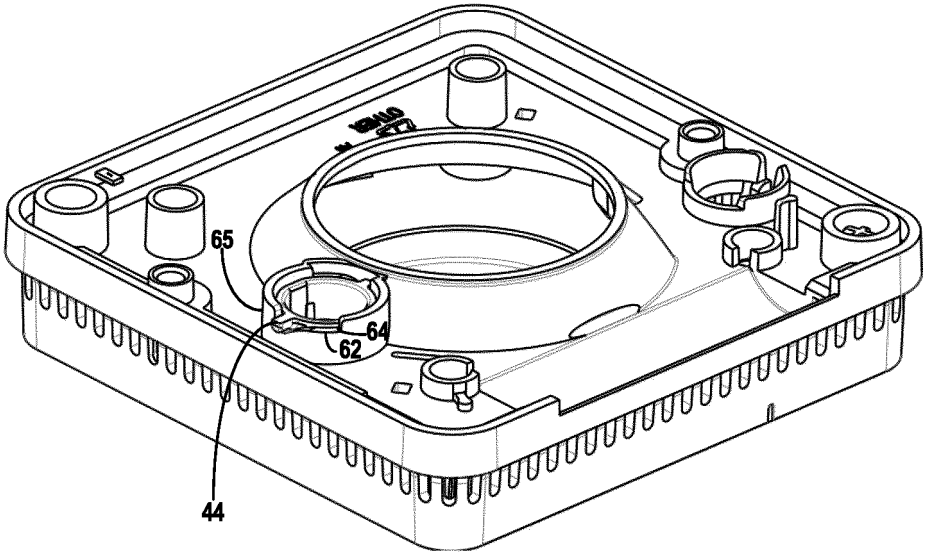

Fig.8

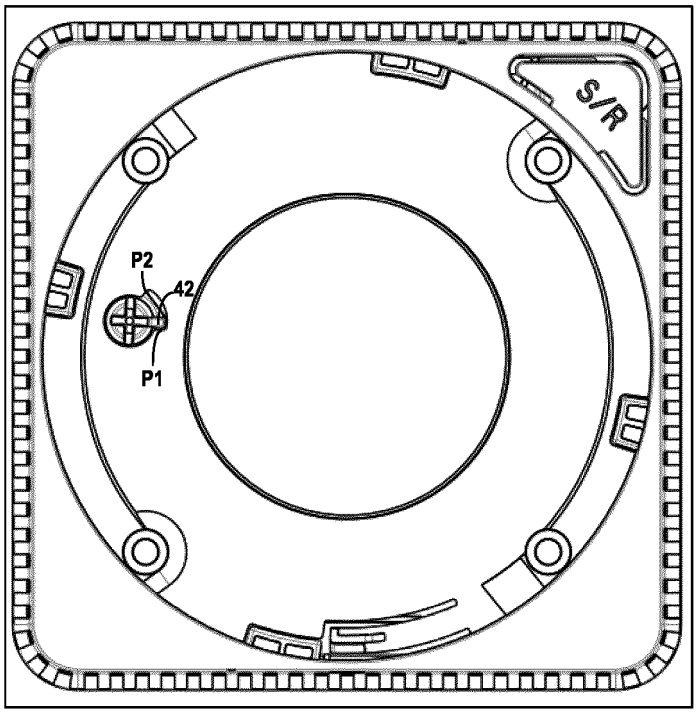

Fig.9

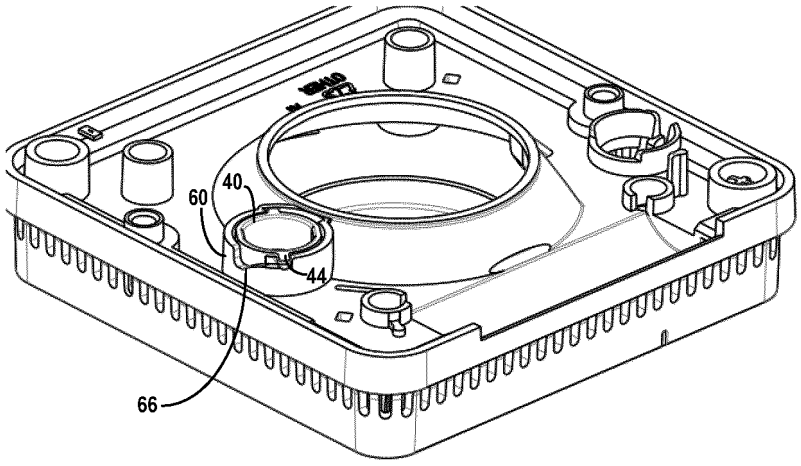

Fig.10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/144323

A. CLASSIFICATION OF SUBJECT MATTER

H01H25/06(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)

H01H

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

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

CNABS; CNTXT; DWPI; VEN; USTXT; WOTXT; EPTXT; CNKI; IEEE: 致动, 触发, 开关, 状态, 位置, 轻触, 旋转, 转动, 锁, actuate, trigger, switch, state, position, touch, rotate, roll, lock

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 216818186 U (SCHNEIDER ELECTRIC AUSTRALIA CO., LTD.) 24 June 2022 (2022-06-24) description, paragraphs 36-63, and figures 1-10	1-17
X	CN 211294928 U (OMRON CORP.) 18 August 2020 (2020-08-18) description, paragraphs 50-92, and figures 1-12	1-7, 10-17
Y	CN 211294928 U (OMRON CORP.) 18 August 2020 (2020-08-18) description, paragraphs 50-92, and figures 1-12	8-9
Y	CN 210373938 U (DAIKIN INDUSTRIES LTD.) 21 April 2020 (2020-04-21) description, paragraphs 76-93, and figures 1-13	8-9
X	CN 1677595 A (SEIKO INSTRUMENTS INC.) 05 October 2005 (2005-10-05) description, pages 3-11, and figures 1-15	1, 15
X	CN 202268260 U (ZTE CORP.) 06 June 2012 (2012-06-06) description, paragraphs 18-30, and figures 1-5	1, 3, 15
A	US 5861591 A (GSEG LLC) 19 January 1999 (1999-01-19) entire document	1-17

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

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 February 2023	**01 March 2023**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/144323

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 216818186 U	24 June 2022	None	
CN 211294928 U	18 August 2020	None	
CN 210373938 U	21 April 2020	None	
CN 1677595 A	05 October 2005	US 2005219954 A1	06 October 2005
		US 7382695 B2	03 June 2008
		JP 2005285660 A	13 October 2005
		JP 4369784 B2	25 November 2009
CN 202268260 U	06 June 2012	None	
US 5861591 A	19 January 1999	None	

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