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(54) AN ALARM PERIPHERAL WITH AN ANTI-TAMPERING ARRANGEMENT AND AN ANTI-TAMPERING ARRANGEMENT

(57) An alarm peripheral (10) comprising a tamper detection element (18) and a housing (12) arranged to be mounted on a surface, the tamper detection element (18) being biased towards a first position and arranged to be displaced away from the first position when the housing (12) is mounted on the surface, the peripheral being arranged to generate an alarm signal in response to the detection of the movement of the tamper detection element towards the first position when the peripheral is removed from the surface.

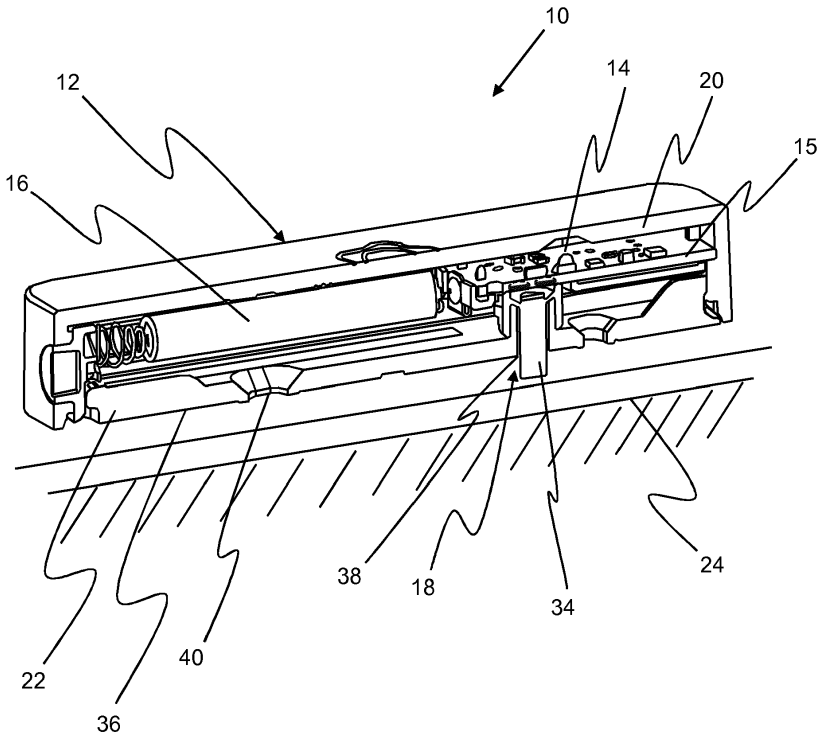

Fig. 1

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Description

TECHNICAL FIELD

[0001] The invention relates to an alarm peripheral unit in general and an anti-tampering arrangement.

SUMMARY OF THE INVENTION

[0002] In a first aspect, the invention relates to an alarm peripheral comprising a tamper detection element and a housing arranged to be mounted on a surface, the element being biased towards a first position and arranged to be displaced away from the first position when the housing is mounted on the surface, the peripheral being arranged to generate an alarm signal in response to the detection of the movement of the element towards the first position when the peripheral is removed from the surface. Movements of he tamper detection element are detected by a magnet sensor, optical means and other non-contacting means or by a direct mechanical coupling. The alarm peripheral can be used in alarm systems for detecting presence of intruders, opening of doors or windows and similar purposes.

[0003] In another aspect, the invention relates to an electronic device comprising a housing, an electronic circuit arranged within the housing, a power source for providing electrical power to the electronic circuit, and an anti-tampering arrangement comprising an electrical element, and a mechanical element coupled to the electrical element and a portion of the mechanical element extending from a surface of the housing. Coupling in this context comprises mechanical coupling, electrical coupling, magnetic coupling, optical coupling and other non-contacting means.

[0004] In various embodiments, the mechanical element is configured to attain a first position from a second position when the surface of the housing is mounted on a use-surface, and wherein in the first position the electrical element contacts the electronic circuit for closing an electrical connection between a first contact pad and a second contact pad of the electronic circuit to avoid generation of an alarm signal, and in the second position the electrical element moves away from the electronic circuit for opening the electrical connection between the first contact pad and the second contact pad of electronic circuit to generate the alarm signal.

[0005] The arrangement of elements in the electronic device is such that the mechanical element protrudes from the device. The protruding mechanical element is pushed inside the housing to the first position, where the electrical element is brought in contact with the electronic circuit. When the protruding mechanical element again is unloaded it will regain to the original position or form. Hence, this arrangement results in a simple mechanism which can be easily mounted by either screws or adhesive element. It also has the added advantage of not relying on a break out section, and can be re-mounted without replacement of all parts. Further, the electronic device according to the present invention lacks a mechanical switch for the activation thereof, which allows simplification of designing and manufacturing of the electronic circuit of the device. This in turn results in a cost-efficient production and assembly of the electronic device. Moreover, a space between the anti-tampering arrangement and the electronic circuit can be effectively sealed off and thus prevents the ingress of dust, which may affect the functioning of the electronic device over a period of time.

[0006] The housing of the electronic device can include a first half configured to support the electronic circuit and the power source thereon, and a second half configured to support the anti-tampering arrangement thereon, wherein the second half includes the surface having an opening configured to allow the portion of the mechanical element to extending therethrough. The housing as described is that of a conventional electronic device wherein the first half houses the power source and the electronic circuit, and may have a removable cover for replacement of the power source. The second part houses the ant-tampering arrangement and is typically on the side of the device used for mounting to a suitable use-surface, and the mechanical element protruding out of the opening on the second half enables the anti-tampering arrangement to function.

[0007] The second half can further include at least one hole configured to receive at least one screw for mounting the housing on the use-surface, or an adhesive element arranged on the surface of the housing to enable mounting of the housing on the use-surface. This arrangement allows for mounting of the device in multiple ways.

[0008] The electronic device with anti-tampering arrangement according to the present invention can be mounted on a surface such as a wall, a door, a window frame, etc. The anti-tampering arrangement according to the present invention can be used to provide an alarm or other indication of removal of the electronic device from its mounting on the intended surface. The anti-tampering arrangement gets activated upon physically mounting the electronic device on the intended surface, which in turn may activate the electronic device for performing the assigned function, i.e. to sense and/or measure signal, movement and so forth. The electronic device can also be activated by other means.

[0009] The electrical element can be a conductive carbon pill. The conductive carbon pill can be mounted at one end of the mechanical element, such that it is connected to the electronic circuit in the first position. Alternatively, the electrical element can be a microswitch. The microswitch can be either arranged on the electronic circuit or coupled to the mechanical element and activated by moving the mechanical element.

[0010] In various embodiments the mechanical element includes a shaft having a first end portion coupled to the electrical element and a second end portion, opposite to the first end portion, configured to extend from the surface of the housing. The function of the shaft will

be like the function of a spring with a spring constant. The mechanical element also includes a lateral flange extending from the first end portion of the shaft, a longitudinal flange coupled to the lateral flange and extending along the shaft, and a pair of connecting pieces coupled to the longitudinal flange, the pair of connecting pieces configured to engage with connecting tabs configured within the housing. The lateral flange will allow movement of the mechanical element. The lateral flange will also act as a spring acting on the mechanical element and forcing it to move when the electronic device is not mounted. The connecting tabs are configured on the second half of the housing, and the pair of connecting pieces is configured to engage with the connecting tabs for supporting the anti-tampering arrangement on the second half of the housing.

[0011] The shaft can be configured to actuate with the help of the lateral flange to allow the mechanical element to attain the first position and the second position with the mounting and removal of the housing, respectively. At least a portion of the mechanical element may be made flexible such that the shaft actuates. For example, the lateral flange may be in the form of a bellow that allows movement of the mechanical element when it is pushed against a surface for mounting the device. The various portions, such as the shaft, the lateral flange, the longitudinal flange and the pair of connecting pieces, of the mechanical element may be made of silicon or any other material with similar elastic properties. Further, the lateral flange may be configured to have lesser thickness compared to other portions of the mechanical element allowing the lateral flange to be flexible enough to accommodate actuation of the shaft with the application of force, i.e. upon mounting and removing the housing from the use-surface. In various embodiments, the mechanical element is a wire spring.

[0012] The present invention also relates to an anti-tampering arrangement for an electronic device having housing, an electronic circuit and a power source, the anti-tampering arrangement comprising an electrical element, and a mechanical element coupled to the electrical element and a portion of the mechanical element extending from a surface of the housing, wherein the mechanical element is configured to attain a first position from a second position when the surface of the housing is mounted on a use-surface, and wherein, in the first position the electrical element contacts the electronic circuit for closing an electrical connection between the electronic circuit and the power source to avoid generation of an alarm signal, and in the second position the electrical element moves away from the electronic circuit for opening the electrical connection between the electronic circuit and the power source to generate the alarm signal.

[0013] The anti-tampering arrangement may be used along with various kinds of electronic devices that are mounted on a surface like a wall, door or window, and so forth.

BRIEF DESCRIPTION OF DRAWINGS

[0014] Different embodiments of this invention are illustrated by way of example and not limiting in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

Fig. 1	is a schematic cross-sectional view of an electronic device comprising a housing, an electronic circuit arranged within the housing, a power source for providing electrical power to the electronic circuit, and an anti-tampering arrangement,
Fig. 2	is a schematic perspective view of the anti-tampering arrangement, of Fig. 1, having an electrical element and a mechanical element,
Fig. 2A	is a schematic perspective view of an alternative embodiment of an anti-tampering arrangement having an electrical element and a mechanical element comprising two springs,
Fig. 3	is a schematic cross-sectional view of the anti-tampering arrangement of Fig. 2,
Fig. 4	is a schematic perspective view of a second half of the electronic device housing of Fig. 1 with the anti-tampering arrangement attached thereto,
Fig. 5	is a schematic enlarged view of a portion of the Fig. 4 depicting attachment of the anti-tampering arrangement,
Figs. 6-7	are schematic enlarged cross-sectional views of the electronic device of Fig. 1 with the mechanical element of the anti-tampering system in second and first positions, respectively, and
Fig. 8	is a schematic enlarged cross-sectional view of an alternative embodiment of an electronic device comprising a switch with the mechanical element of the anti-tampering system in second position.

DETAILED DESCRIPTION

[0015] With reference to Fig. 1, an electronic device 10 according to one embodiment of the invention is illustrated. The electronic device 10 comprises a housing 12, an electronic circuit 14 arranged within the housing 12, a power source 16 for providing electrical power to the electronic circuit 14, and an anti-tampering arrangement 18. The electronic circuit 14 comprises a printed circuit

board, PCB 15. The housing 12 includes a first half 20 configured to support the electronic circuit 14 and the power source 16 thereon. The housing 12 also includes a second half 22 configured to support the anti-tampering arrangement 18 thereon. For example, the electronic device 10 may be a device typically mounted on a use-surface 24 like a wall, a door, a window frame, etc. For example, the electronic device 10 may be sensor device for an anti-burglary system, or a sensor device for a process indicator system such as a level indicator, or a device for private or public use such as smoke sensor, security camera, public phone and so forth. Electronic circuit 14 may comprise a radio unit for communicating with a central unit of an alarm system.

[0016] With reference to Fig. 2, the anti-tampering arrangement 18 according to one embodiment of the invention is illustrated. The anti-tampering arrangement 18 comprises an electrical element 30, and a mechanical element 32 coupled to the electrical element 30. A portion 34 of the mechanical element 32 extends from a surface 36 of the housing 12 (as shown in Fig. 1).

[0017] With reference to Fig. 2A the anti-tampering arrangement 18 according to an alternative embodiment of the invention is illustrated. The anti-tampering arrangement 18 comprises an electrical element 30, and a mechanical element 32 coupled to the electrical element 30. A portion 34 of the mechanical element 32 extends from a surface 36 of the housing 12 (as shown in Fig. 1). The mechanical element 30 comprises a first spring S1, a second spring S2 and a plate 33. A first end of first spring S1 and second spring S2 are firmly attached plate 33. A second end of first spring S1 is attached to second half 22. Spring constant of first spring S1 is smaller than spring constant of second spring S2. First spring S1 is coaxial with second spring S2. In various embodiments, first spring S1 is divided into two springs arranged at opposite sides of second spring S2. Total spring constant of the two springs is larger than spring constant of second spring S2.

[0018] With reference back to Fig. 1, the second half 22 includes the surface 36 having an opening 38 configured to allow the portion 34 of the mechanical element 32 to extend therethrough. In an example, the second half 22 may be a back panel of the housing 12 of electronic device 10 and includes the surface 36 habitually used for mounting the electronic device 10 on the use-surface 24. Further, the first half 20 may be an outer cover of the electronic device 10, and may be removable in order to provide access to the electronic circuit 14 and the power source 16. Moreover, according to an embodiment, the second half 22 also includes at least one hole 40 configured to receive at least one screw (not shown) for mounting the housing 12 on the use-surface 24. Alternatively, the second half 22 may include an adhesive element (not shown) arranged on the surface 36 of the housing 12 to enable mounting on the use-surface 24. In an example, the electronic device 10 may be screw-mounted and require an adequate number of holes 40 to accommodate a sufficient number of screws for mounting. As an alternative, mounting may be done by using the adhesive element, such as a two-sided tape, or a layer of glue, arranged on the surface 36 of the housing 12. It will be appreciated that the adhesive element would be placed so as not to interfere with the opening 38 on the surface 36 of the housing 12.

[0019] With reference to Fig. 3, cross-section of the anti-tampering arrangement 18 of Fig. 2 is illustrated according to one embodiment. As shown, the mechanical element 32 of the anti-tampering arrangement 18 includes a shaft 42 having a first end portion 44 coupled to the electrical element 30 and a second end portion (i.e. the portion 34 of the mechanical element 32) opposite to the first end portion 44 and configured to extend from the surface 36 of the housing 12, as shown in Fig. 1. The mechanical element 32 also includes a lateral flange 46 extending from the first end portion 44 of the shaft 42 and a longitudinal flange 48 coupled to the lateral flange 46 and extending along the shaft 42. The mechanical element 32 also includes a pair of connecting pieces 50 coupled to the longitudinal flange 48. The pair of connecting pieces 50 is configured to engage with connecting tabs 52 configured within the housing 12 (shown in Figs. 4 and 5).

[0020] With reference to Figs. 4 and 5, illustrated are the second half 22 of the housing 12 attached with the anti-tampering arrangement 18. Fig. 5 clearly illustrates the pair of connecting pieces 50 engages with the connecting tabs 52, configured on the second half 22 of the housing 12. This allows the anti-tampering arrangement 18 to be held securely with the second half 22, when the portion 34 of the mechanical element 32 protrudes out of the surface 36 of the housing 12. Further, the longitudinal flange 48 along with the connecting pieces 50 prevents any undesirable movement of the anti-tampering arrangement 18 with respect to the housing 12.

[0021] With reference to Figs. 6 and 7, operation of the anti-tampering arrangement 18 for the electronic device 10 is illustrated. In operation, the mechanical element 32 is configured to attain a first position (shown in Fig. 6) from a second position (shown in Fig. 7) when the surface 36 of the housing 12 is mounted on the use-surface 24 (shown in Fig. 1). Further, in the first position the electrical element 30 contacts the electronic circuit 14 for closing an electrical connection to avoid generation of an alarm signal. Moreover, in the second position the electrical element 30 moves away from the electronic circuit 14 for opening the electrical connection to generate the alarm signal.

[0022] In operation, the shaft 42 can be configured to actuate with the help of the lateral flange 46 to allow the mechanical element 32 to attain the first position and the second position with the mounting and removal of the housing 12, respectively, as shown in Figs. 6 and 7. For example, the lateral flange 46 may be in the form of a flexible bellow, allows a longitudinal movement of the shaft 42 with respect to the housing 12. Flexible bellow

will return to second position when unloaded. As mentioned above, the mechanical element 32 is composed of silicon, and different parts of the mechanical element 32 are configured to have different properties. For example, the longitudinal flange 48 is configured to be rigid in nature to prevent unnecessary movement of the mechanical element 32, whereas the shaft 42 and the lateral flange 46 are configured to be flexible in nature to accommodate longitudinal movement of the shaft 42 and to push electrical element 30 and shaft 42 to the second position when unloaded. Lateral flange 46, specifically when formed as a bellow, will provide a high resilience. A flexible character of shaft 42 and lateral flange 46 will result in a high resilience and a low pressure on the adhesive during installation. The high resilience also will lower the force exerted on the adhesive when the device is mounted.

[0023] With reference to Fig. 6, the electronic device 10 is illustrated in a mounted state (i.e. when the mechanical element 32 is in the first position). Upon mounting the housing 12 on the use-surface 24, pressure applied by the use-surface 24 against the shaft 42 pushes the lateral flange 46 towards the electronic circuit 14. This causes the electrical element 30 to be pressed against the electronic circuit 14. Therefore, when the electronic device 10 is fully mounted on the use-surface 24, either using screws or adhesive element, the portion 34 of the mechanical element 32 of the anti-tampering arrangement 18 is pressed. This results in the electrical element 30 closing electrical connection for the electronic circuit 14. It may be appreciated that a force, acts on the portion 34 of the mechanical element 32, which contradicts an adhesive force offered by an adhesive means used for mounting the electronic device 10 on the use-surface 24. However, such force acting on the portion 34 should be as small as possible to prevent weakening of the adhesive force, which allows mounting of the electronic device 10 on the use-surface 24. For example, if the electrical element 30 is a conductive carbon pill, the carbon pill is pressed against conductive pads on the electronic circuit 14 when the housing 12 is mounted on the use-surface 24 (i.e. the mechanical element 32 attains the first position), thus closing the electrical connection and providing a no-alarm condition. In another example, if the electrical element 30 is a microswitch 35, c.f. Fig. 8, mounted on the electronic circuit 14, the shaft 42 of the mechanical element 32 activates the microswitch upon being compressed by the use-surface 24.

[0024] With reference to Fig. 7, the electronic device 10 is illustrated in an un-mounted state (i.e. when the mechanical element 32 is in the second position). In this state, the lateral flange 46 pushes the shaft 42 arranged with the electrical element 30 away from the electronic circuit 14. Accordingly, the mechanical element 32 of the anti-tampering arrangement 18 attains the second position from the first position, i.e. the portion 34 of the mechanical element 32 protrudes or extends out from the opening 38 (shown in Fig. 1) of the surface 36 of the housing 12. Consequently, tampering of the electronic device 10 will result in the mechanical element 32 of the anti-tampering arrangement 18 reverting to the second position, thus causing a tamper alarm signal. For example, if the electronic device 10 is forcefully removed from the use-surface 24 (shown in Fig. 6), the shaft 42 will decompress and the lateral flange 46 will move to its unloaded position, thus breaking contact of the electrical element 30 with the electronic circuit 14 and giving the tamper alarm signal. Similarly, if the first half 20 of the housing 12 is removed for repair or maintenance work, contact of the electronic circuit 14 with the electrical element 30 is lost, thus giving the tamper alarm signal.

[0025] With reference to Fig. 8, the electronic device 10 is illustrated in an un-mounted state (i.e. when the mechanical element 32 is in the second position). In this state, the lateral flange 46 pushes the shaft 42 arranged with the electrical element 30 away from a switch or micro switch 35 of the electronic circuit 14. Accordingly, the mechanical element 32 of the anti-tampering arrangement 18 attains the second position from the first position, i.e. the portion 34 of the mechanical element 32 protrudes or extends out from the opening 38 (shown in Fig. 1) of the surface 36 of the housing 12. Consequently, tampering of the electronic device 10 will result in the mechanical element 32 of the anti-tampering arrangement 18 reverting to the second position, thus causing a tamper alarm signal.

[0026] Upon mounting the housing 12 of the embodiment of the electronic device shown in Fig. 8 on the use-surface 24, pressure applied by the use-surface 24 against the shaft 42 pushes the lateral flange 46 towards the electronic circuit 14. This causes the shaft 42 to be pressed against the micro switch 35 of the electronic circuit 14. Therefore, when the electronic device 10 is fully mounted on the use-surface 24, either using screws or adhesive element, the portion 34 of the mechanical element 32 of the anti-tampering arrangement 18 is pressed. This results in the switch 35 closing electrical connection for the electronic circuit 14.

[0027] In various embodiments, the alarm peripheral comprises a tamper detection element and a housing arranged to be mounted on a surface, the element being biased towards a first position and arranged to be displaced away from the first position when the housing is mounted on the surface, the peripheral being arranged to generate an alarm signal in response to the detection of the movement of the element towards the first position when the peripheral is removed from the surface. The tamper detection element detects movements through a mechanical coupling or by a magnet sensor, optical means and other non-contacting means.

[0028] With reference to Figs.1 to 8, it will be appreciated that the present invention also illustrates an anti-tampering arrangement, such as the anti-tampering arrangement 18. The anti-tampering arrangement may be used in conjunction with an electronic device, such as the electronic device 10, having a housing, an electronic

circuit and a power source. Further, the electronic device may be designed to be mounted on a surface, such as the use-surface 24, for performing the assigned function.

[0029] The electronic device with anti-tampering arrangement according to the present invention can be mounted on a surface such as a wall, a door, a window frame, etc. The anti-tampering arrangement according to the present invention can be used to provide an alarm or other indication of removal of the electronic device from its mounting on the intended surface. The anti-tampering arrangement gets activated upon physically mounting the electronic device on the intended surface, which in turn may activate the electronic device for performing the assigned function, i.e. to sense and/or measure signal, movement and so forth. The electronic device can also be activated by other means.

Claims

1. An electronic device (10) comprising:

- a housing (12);
- an electronic circuit (14) arranged within the housing (12);
- a power source (16) for providing electrical power to the electronic circuit (14); and
- an anti-tampering arrangement (18) comprising:

  - an electrical element (30; 35); and
  - a mechanical element (32) coupled to the electrical element (30) and a portion (34) of the mechanical element (32) extending from a surface (36) of the housing (12), wherein the mechanical element (32) is configured to attain a first position from a second position when the surface (36) of the housing (12) is mounted on a use-surface (24), and wherein

    - in the first position the electrical element (30) acts on the electronic circuit (14) for closing an electrical connection of the electronic circuit (14) to avoid generation of an alarm signal; and
    - in the second position the electrical element (30) is not acting on the electronic circuit (14) for opening the electrical connection of electronic circuit (14) to generate the alarm signal.

2. An electronic device (10) according to claim 1, wherein electronic circuit (14) comprises a first contact pad (31) and a second contact pad (33) and wherein the electrical element (30) in said first position connects first contact pad (31) and second contact pad (33).

3. An electronic device (10) according to claim 1, wherein the housing (12) includes

- a first half (20) configured to support the electronic circuit (14) and the power source (16) thereon, and
- a second half (22) configured to support the anti-tampering arrangement (18) thereon, wherein the second half (22) includes the surface (36) having an opening (38) configured to allow the portion (34) of the mechanical element (32) to extending therethrough.

4. An electronic device (10) according to claim 3, wherein the second half (22) further includes at least one hole (40) configured to receive at least one screw for mounting the housing (12) on the use-surface (24).

5. An electronic device (10) according to claim 3, further comprising adhesive element arranged on the surface (36) of the housing (12) to enable mounting of the housing (12) on the use-surface (24).

6. An electronic device (10) according to any of the preceding claims, wherein the electrical element (30) is a conductive carbon pill.

7. An electronic device (10) according to any of the preceding claims, wherein the electrical element is a micro switch (35).

8. An electronic device (10) according to any of the preceding claims, wherein the mechanical element (32) includes:

- a shaft (42) having a first end portion (44) coupled to the electrical element and a second end portion (34), opposite to the first end portion (44), configured to extend from the surface (36) of the housing (12), and
- a resilient lateral flange (46) extending from the first end portion (44) of the shaft (42).

9. An electronic device (10) according to claim 8, wherein the shaft (42) is configured to actuate with the help of the lateral flange (46) to allow the mechanical element (32) to attain the first position and the second position with the mounting and removal of the housing (12), respectively.

10. An electronic device (10) according to any of the preceding claims, wherein the mechanical element (32) is made of silicon.

11. An anti-tampering arrangement (18) for an electronic device (10) having housing (12), an electronic circuit (14) and a power source (16), the anti-tampering ar-

rangement (18) comprising:

- an electrical element (30; 35); and
- a mechanical element (32) coupled to the electrical element (30) and a portion (34) of the mechanical element (32) extending from a surface (36) of the housing (12), wherein the mechanical element (32) is configured to attain a first position from a second position when the surface (36) of the housing (12) is mounted on a use-surface (24), and wherein

  - in the first position the electrical element (30) contacts the electronic circuit (14) for closing an electrical connection between a first contact pad (31) and a second contact pad (33) of the electronic circuit (14) to avoid generation of an alarm signal; and
  - in the second position the electrical element (30) moves away from the electronic circuit (14) for opening the electrical connection between the first contact pad (31) and the second contact pad (33) of electronic circuit (14) to generate the alarm signal.

12. An anti-tampering arrangement (18) according to claim 11, wherein the electrical element (32) is a conductive carbon pill.

13. An anti-tampering arrangement (18) according to claim 11, wherein the electrical element is a micro switch (35).

14. An anti-tampering arrangement (18) according to claims 11, 12 or 13, wherein the mechanical element (32) includes:

- a shaft (42) having a first end portion (44) coupled to the electrical element (30; 35) and a second end portion (34), opposite to the first end portion (44), configured to extend from the surface (36) of the housing (12),
- a lateral flange (46) extending from the first end portion (44) of the shaft (42),
- a longitudinal flange (48) coupled to the lateral flange (46) and extending along the shaft (42); and
- a pair of connecting pieces (50) coupled to the longitudinal flange (48), the pair of connecting pieces (50) configured to engage with connecting tabs (52) configured within the housing (12).

15. An anti-tampering device (18) according to claim 14, wherein the shaft (42) is configured to actuate with the help of the lateral flange (46) to allow the mechanical element (32) to attain the first position and the second position with the mounting and removal of the housing (12), respectively.

16. An anti-tampering arrangement (18) according to claims 11 to 15, wherein the mechanical element (32) is composed/made of silicon.

17. An alarm peripheral comprising a tamper detection element and a housing arranged to be mounted on a surface, the tamper detection element being biased towards a first position and arranged to be displaced away from the first position when the housing is mounted on the surface, the alarm peripheral being arranged to generate an alarm signal in response to the detection of the movement of the element towards the first position when the peripheral is removed from the surface.

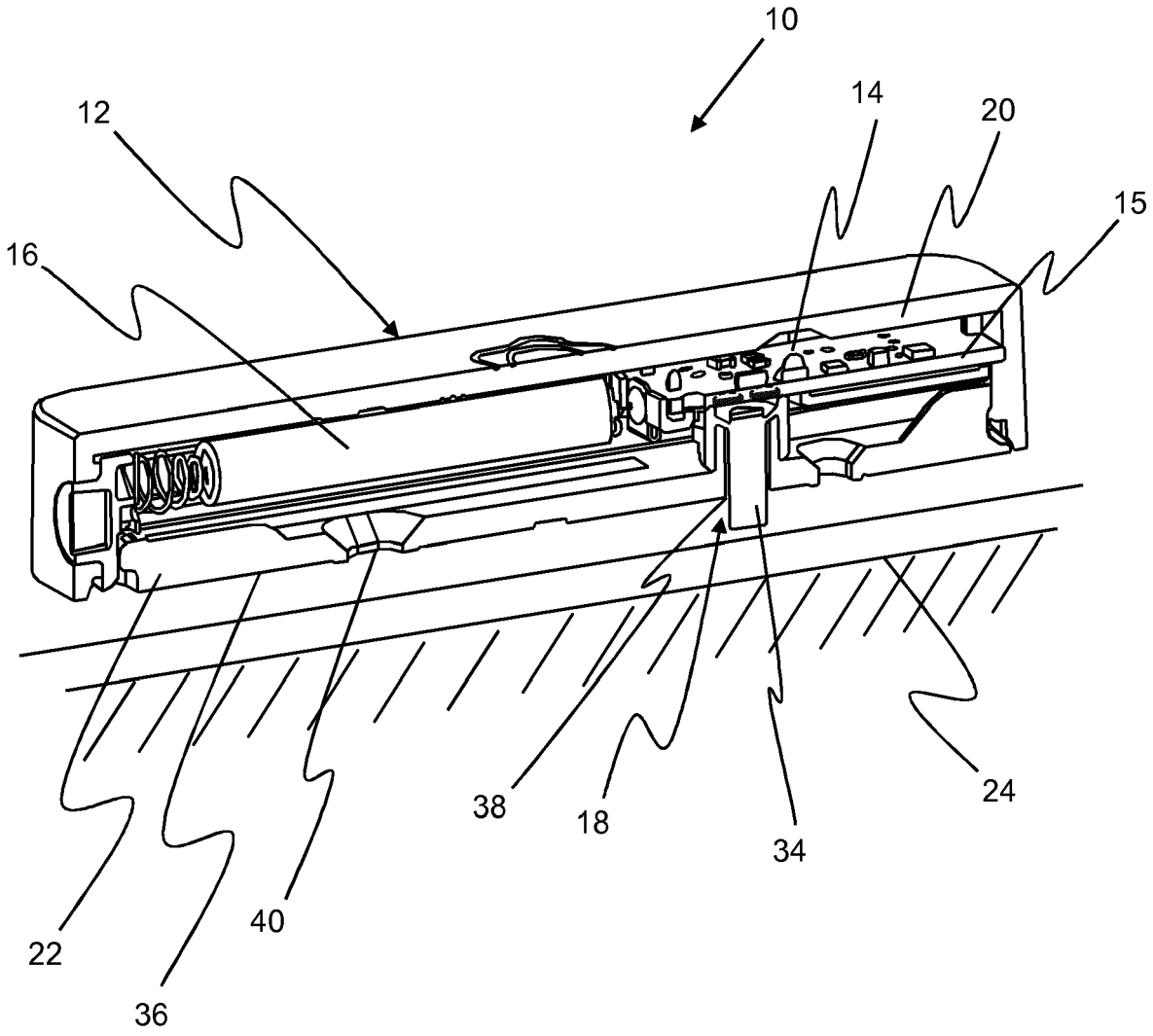

Fig. 1

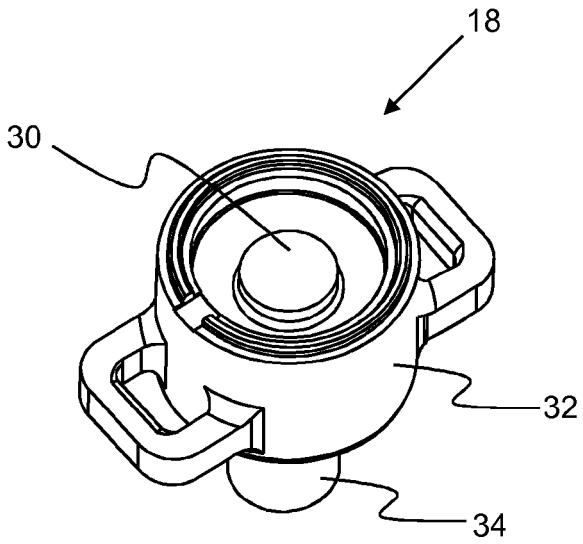

Fig. 2

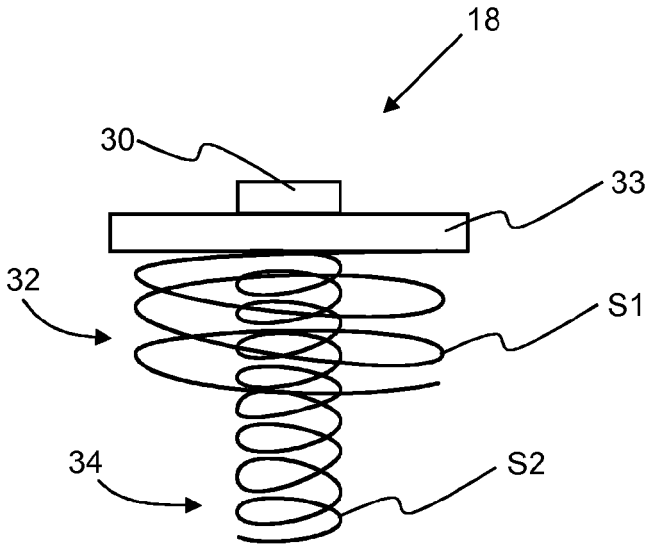

Fig. 2A

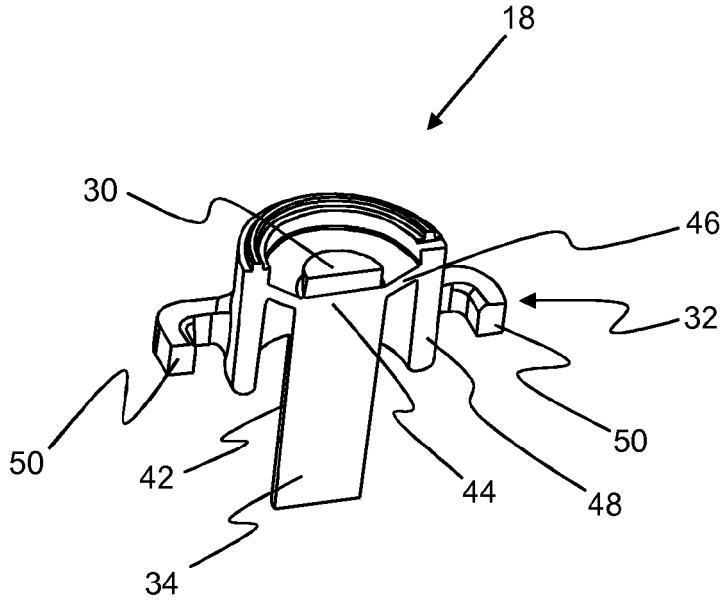

Fig. 3

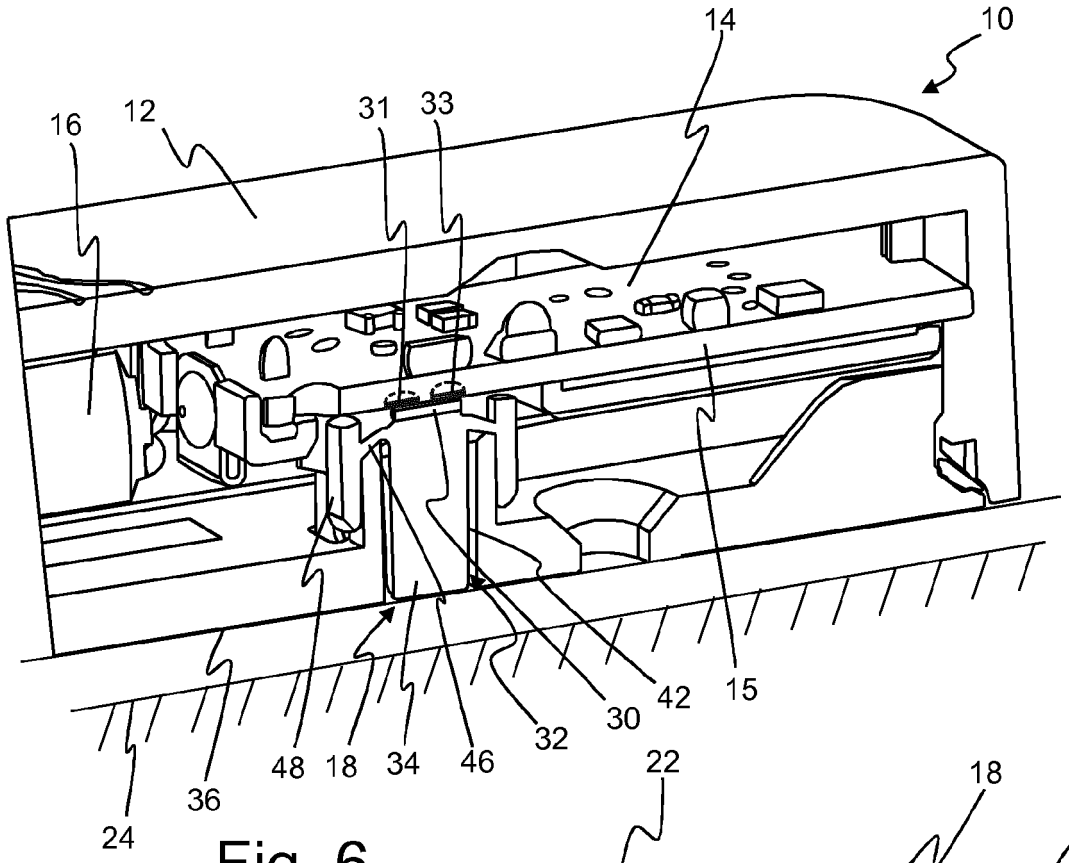

Fig. 6

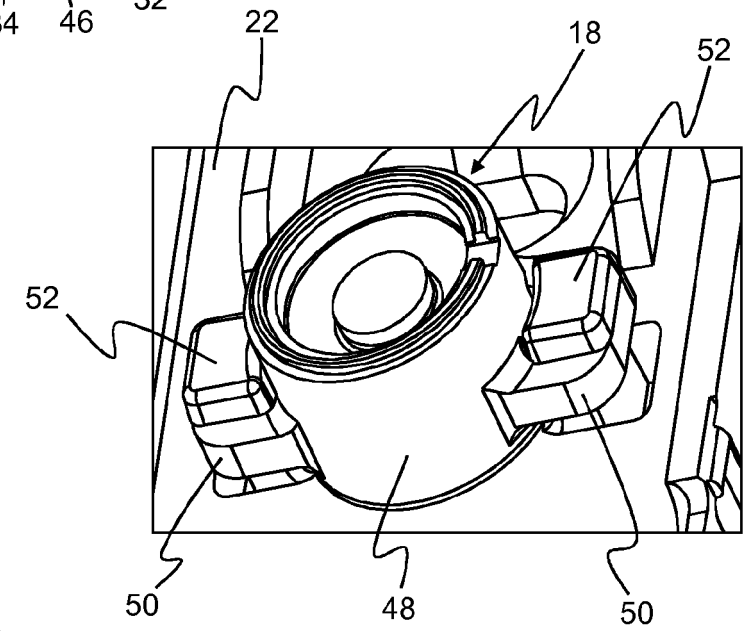

Fig. 5

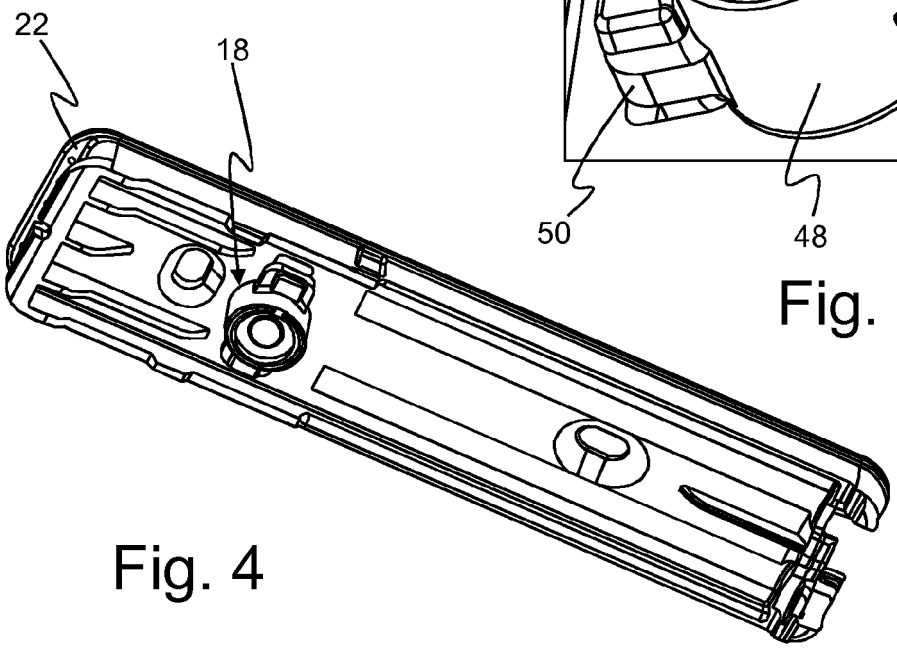

Fig. 4

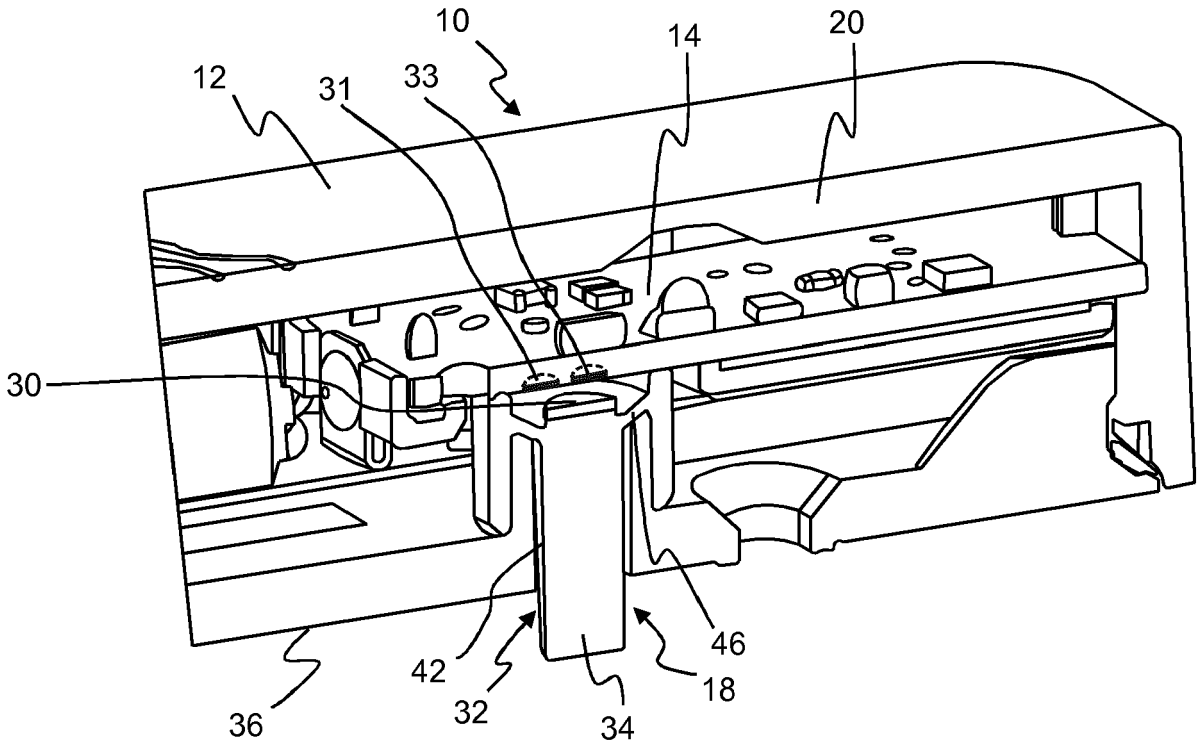

Fig. 7

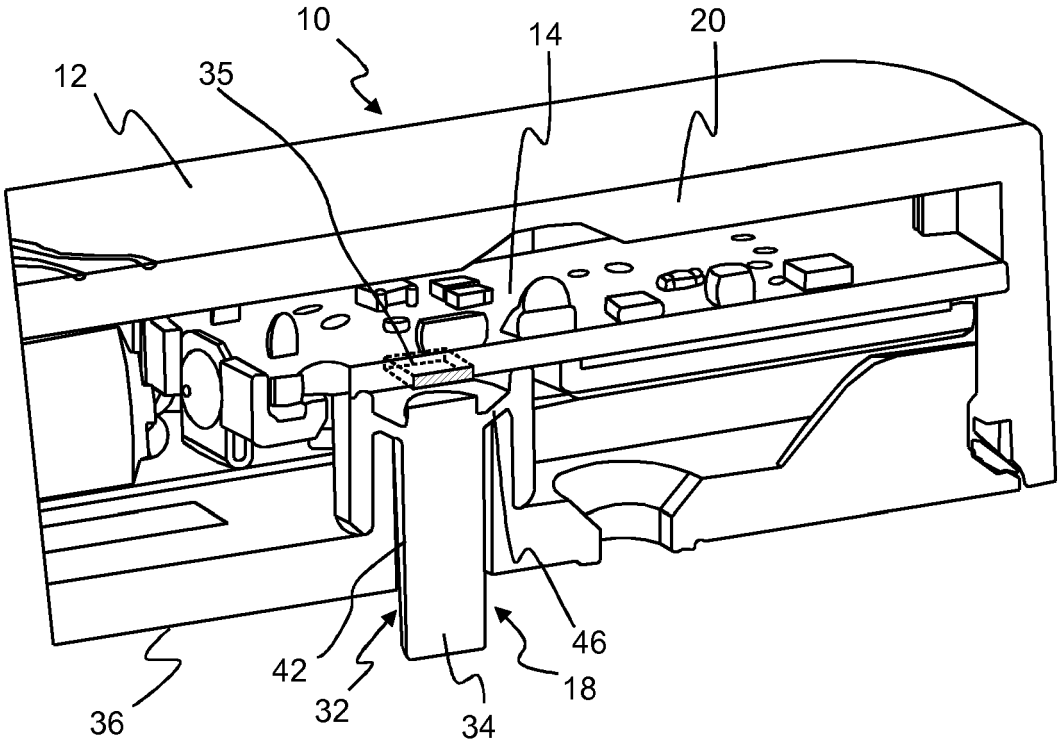

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 17 20 6895

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search	Date of completion of the search	Examiner
Munich	31 May 2018	Kurzbauer, Werner

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