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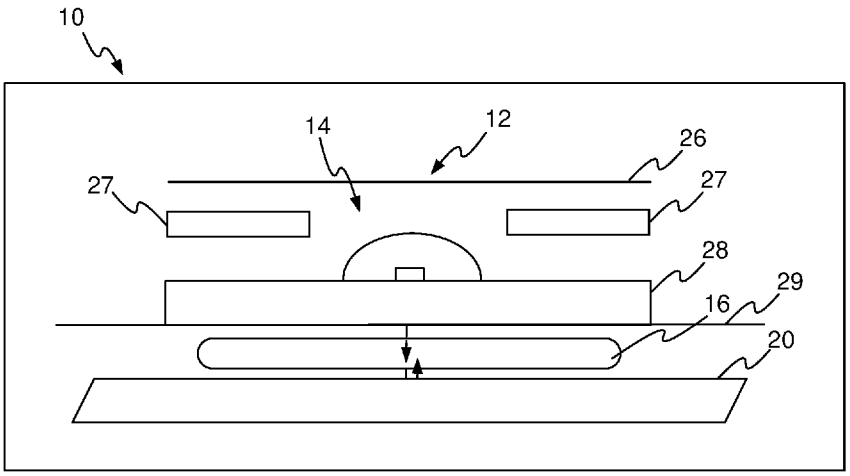


Fig. 3b

(57) Abstract: A keypad device (10) for controlling an entrance system (1) is provided. The keypad device (10) comprises: at least one mechanical switch (14), each mechanical switch (14) being associated with a key (12) of the keypad device (10) a proximity sensor (16) configured to detect human proximity; and a control unit (20) operatively connected to the at least one mechanical switch (14) and the proximity sensor (16), the control unit (20) being configured to operatively control the movement of at least one movable member (3) of the entrance system (1) wherein the control unit (20) is configured to only allow movement of the at least one movable member (3) of the entrance system (1) if the at least one mechanical switch (14) is active and the proximity sensor (16) also detects human proximity.

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KEYPAD DEVICE FOR CONTROLLING AN ENTRANCE SYSTEM

Technical Field

The present invention relates to a keypad device for controlling an entrance system, such an entrance system, a method for controlling such an entrance system and a capacitive proximity sensor for use in such an entrance system.

Background

Many entrance systems have movable members, such as a revolving door, a fold-up hangar door or a hinged leaf door. Some moving members may be automated; however for certain systems automated movement may be unwanted. In any entrance system, clamping injuries are a serious concern. For entrance systems with heavy or fast moving members, clamping injuries may be lethal. In these types of entrance systems, manual control of the movable members is usually preferred to reduce the risk of injuries.

A keypad device with a number of mechanical switches, as it is simple and intuitive to use and simple to manufacture, is usually used to control the movable members. However, these mechanical switches may fail, either by not being able to be activated or by always being active. This may be caused by short-circuiting due to e.g. wear, water damage or electromagnetic interference. The real danger in this is when mechanical switches are always active due to faulty mechanical switches.

An object of the present invention is therefore to provide a keypad device where always active mechanical switches are not possible.

Summary

Thusly, the present invention strives to solve at least some of the above problems and to eliminate or at least mitigate some of the drawbacks of prior-art systems. This object has now been achieved in accordance with the invention by the novel technique set forth in the appended independent claims; preferred embodiments being defined in the related dependent claims.

According to a first aspect of the invention, the above and other objects of the invention are achieved, in full or in part, by a keypad device for controlling an entrance system. The keypad device comprises: at least one mechanical switch, each mechanical switch being associated with a key of the keypad device; a proximity sensor configured to detect human proximity; and a control unit operatively connected to the at least one mechanical switch and the proximity sensor, the control unit being configured to operatively control the movement of at least one movable member of the entrance system; wherein the control unit is configured to only allow movement of the at least one movable member of the entrance system if the at least one mechanical switch is active and the proximity sensor also detects human proximity.

According to one embodiment, the proximity sensor is a capacitive proximity sensor.

The capacitive proximity sensor is advantageous in that it is simple to manufacture and gives an efficient detection of proximity that may be attuned specifically to humans.

According to another embodiment, the proximity sensor is a capacitive loop.

The capacitive loop is advantageous in that it is simple to manufacture and easy to integrate with existing keypad devices.

According to yet another embodiment, the at least one mechanical switch is a collapsible dome switch.

The collapsible dome switch is advantageous in that it is intuitive to use and has a pleasing and clear feedback.

According to one more embodiment, the at least one mechanical switch and the proximity sensor are arranged in the same layer.

The same layer is advantageous in that it is fast to manufacture and uses space efficiently.

According to yet one more embodiment, the proximity sensor is a capacitive loop arranged around the at least one mechanical switch.

The loop arranged around the switch(es) is advantageous in that it uses space efficiently and is easy to align with the switch(es).

According to a further embodiment, the at least one mechanical switch and the proximity sensor are arranged in different layers.

The different layers are advantageous in that they are easy to integrate with prior art systems and simple to manufacture.

According to a yet further embodiment, the keypad device further comprises a display operatively connected to the control unit, the control unit being further configured to activate the display when the proximity sensor detects human proximity.

The display is advantageous in that it is easy to use and provides feedback. The display activating when human proximity is detected is advantageous in that it saves electricity.

According to another further embodiment, the control unit is further configured to recalibrate the proximity sensor.

The recalibration is advantageous in that variations in ambience e.g. different lighting conditions or humidity changing the environmental capacitance may otherwise disrupt the sensor.

According to yet another further embodiment, the control unit is further configured to only allow specific movement of at least one movable member of the entrance system if the at least one mechanical switch is active and the proximity sensor does not detects human proximity.

The limited movement is advantageous in that e.g. a specific movement axis or a specific movable member may be safer than another is, therefore limited movement may be safely allowed without detecting human proximity.

According to one more yet another further embodiment, the control unit is further configured to not allow specific movement of at least one movable member of the entrance system that has a high risk of causing accidents unless the at least one mechanical switch is active and the proximity sensor also detects human proximity.

Not allowing specific movement is advantageous in that e.g. a specific movement axis or a specific movable member may be more dangerous than another is, therefore such movement may not be safely allowed without detecting human proximity.

According to a second aspect of the invention, an entrance system is provided. The entrance system comprises: a keypad device according to the first aspect of the invention; at least one movable member such as a door leaf or a fold-out ramp being movable between an open and closed position; and a drive unit operatively connected to and controlled by the control unit of the keypad device, the drive unit being configured to cause movement of the at least one movable member between an open and closed position; wherein the control unit is further configured to only cause movement of the at least one movable member from the open position to the closed position if the at least one mechanical switch of the keypad device is active and the proximity sensor of the keypad device also detects human proximity.

According to a third aspect of the invention, a method for controlling an entrance system according to a second aspect of the invention is provided. The method comprises the steps of: checking the state of at least one mechanical switch and a proximity sensor; and only if the at least one mechanical switch is active; and the proximity sensor detects human proximity; are both true at the same time, performing a further step of: causing movement of at least one movable member of the entrance system.

According to a fourth aspect of the invention, a capacitive proximity sensor configured to detect human proximity is provided. The capacitive proximity sensor comprises: a physical connection member for physically connecting the capacitive proximity sensor to a keypad device for controlling an entrance system; and an operative connection member for operatively connecting the capacitive proximity sensor to a control unit of the keypad device; wherein the capacitive proximity sensor causes a reconfiguration of the control unit to check if the capacitive proximity sensor detects human proximity during its operation logic.

According to another embodiment, the physical connection member is an adhesive.

The adhesive is advantageous in that it is simple and efficient to attach to prior art keypad devices in order to be able to use the method according to the third aspect of the invention.

According to yet another embodiment, the capacitive proximity sensor further comprises a memory with configuration instructions for the control unit to be installed to the control unit upon operatively connecting to the keypad device using the operative connection member.

The memory is advantageous in that it allows prior art keypad devices to be able to use the method according to the third aspect of the invention without further manipulation using e.g. an internet connected keypad device.

Other objectives, features and advantages of the present invention will appear from the following detailed disclosure, from the attached claims, as well as from the drawings. It is noted that the invention relates to all possible combinations of features.

It should be emphasized that the term “comprises/comprising” when used in this specification is taken to specify the presence of stated features, integers, steps, or components, but does not preclude the presence or addition of one or more other features, integers, steps, components, or groups thereof. All terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, step, etc.]" are to be interpreted openly as referring to at least one instance of the element, device, component, means, step, etc., unless explicitly stated otherwise.

Brief Description of the Drawings

By way of example, embodiments of the present invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a schematic view of an entrance system according to an embodiment of the invention;

Fig. 2 is a schematic front view of a keypad device according to an embodiment of the invention;

Fig. 3a is a schematic side view of a keypad device according to an embodiment of the invention;

Fig. 3b is a schematic side view of a keypad device according to another embodiment of the invention;

Fig. 4 is a schematic front view of a layer of a keypad device according to an embodiment of the invention;

Fig. 5 is a schematic front view of a capacitive proximity sensor according to an embodiment of the invention; and

Fig. 6 is a flowchart illustrating a method for controlling an entrance system according to an embodiment of the invention.

Detailed Description

Embodiments of the invention will now be described with reference to the accompanying drawings. The invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. The terminology used in the detailed description of the particular embodiments illustrated in the accompanying drawings is not intended to be limiting of the invention. In the drawings, like numbers refer to like elements.

Starting in Fig. 1, a schematic view of an entrance system 1 is found. The entrance system 1 comprises a keypad device 10 for controlling the entrance system 1. The keypad device 10 may be arranged in close proximity to the entrance system 1 and may be reachable from either side of the entrance system 1. The keypad device 10 may be a single or several units and in one embodiment, one unit is arranged on each side of the entrance system 1.

The entrance system 1 further comprises at least one movable member 3 such as a door leaf or a fold-out ramp being movable between an open and closed position. The entrance system 1 shown in Fig. 1 comprises a hangar door with a foldable, movable member 3; however, any entrance system 1 is possible.

Fig. 1 shows the movable member 3 in a closed position. In its open position, the movable member 3 is held by a frame 5 of the entrance system 1 above the area of the entrance in order to allow free movement in the area of the entrance below the frame 5. The movable member 3 is movable between the closed position and the open position using a drive strip 7. In the embodiment of Fig. 1, the open position is not considered as

a dangerous source of clamping injuries, as the movable member 3 is held in a position away from users. However, moving from the open position to the closed position is a dangerous source of clamping injuries, where the movable member 3 connects to the ground.

The entrance system 1 further comprises a drive unit 24 operatively connected to and controlled by a control unit 20 of the keypad device 1. The drive unit 24 is configured to cause movement of the movable member 3 between the open and closed position. The drive unit 24 may e.g. be an electric motor or an actuator operatively connected to the drive strip 7 and the movable member 3.

The control unit 20 is configured to only cause movement of the movable member 3 from the open position to the closed position if a mechanical switch 14 of the keypad device 10 is active and a proximity sensor 16 of the keypad device 10 also detects human proximity. This is because this movement from the open position to the closed position has a high risk of injuries, and requiring human proximity and active choice reduces this risk.

Details of the keypad device 10 will be disclosed further with regards to Figs. 3a-b.

Fig. 2 shows a keypad device 10 according to an embodiment. The keypad device 10 comprises three keys 12, though any number of keys 12 are possible such as one, two and ten. Each key 12 is preferably associated with a mechanical switch 14 and a specific movement of at least one movable member 3. The keys 12 may be push-buttons, flip-switches or any other keys with distinct on and off states.

The keypad device 10 further comprises a display 22. The display 22 is operatively connected to the control unit 20 of the keypad device 10. The control unit 20 may be configured to activate the display 22 when a proximity sensor 16 detects human proximity.

The display 22 may be an LED screen, a wall projection or any other suitable display 22. The display 22 is advantageous in that it is easy to use and may provide feedback such as what functions are available and active.

The display 22 may be configured to be always on, to activate upon activating at least one key 12 or to activate human proximity is detected. The display 22 activating

when human proximity is detected is advantageous in that it saves electricity and may help a user find the keypad 10.

Figs. 3a-b show different embodiments of a keypad device 10 with a metallic dome mechanical switch 14. Both embodiments are arranged in different layers.

The outermost layer is a plastic film 26. The plastic film 26 may be printed to provide information about the functions of the keys 12 to a user. The plastic film 26 is preferably thin and flexible.

Below the plastic film 26, a rigid layer 27 is arranged. The rigid layer 27 may be made of any rigid material such as a hard plastic, metal or wood. The rigid layer 27 comprises a number of openings to allow for a finger of a user to reach through and activate a mechanical switch 14. The plastic film 26 and the rigid layer 27 cooperate to provide guidance and feedback to a user in order to properly activate the mechanical switch 14.

Below the rigid layer 27, a mechanical switch 14 is arranged. The mechanical switch 14 may be any suitable switch such as a metallic dome switch, a toggle lever, a key switch, or a push contact switch. Several different mechanical switches 14 may be used in a single keypad device 10. Each mechanical switch 14 is associated with a key 12 of the keypad device 10.

The mechanical switch 14 has an active and an inactive state. The inactive state is defined as its resting state, even though in some embodiments the resting state may involve a constant electrical signal. The active state may e.g. be a pressed in dome, a toggled lever to a specific side, a rotated key switch, or similar depending on the mechanical switch 14.

The mechanical switch 14 is useful in that it is intuitive to use and provides feedback to the user.

In the same layer as the mechanical switch 14 or a different one, a proximity sensor 16 configured to detect human proximity is arranged. The proximity sensor 16 may be any suitable proximity sensor such as a capacitive proximity sensor, a motion sensor, or a camera with image processing to detect humans. The keypad device 10 may comprise only one proximity sensor 16, or several proximity sensors 16 being arranged

to detect proximity in different ways, e.g. one being capacitive and one being visual; or two cameras being directed in different directions.

In the embodiments of Figs. 3a-b, the proximity sensor 16 is a capacitive loop. The capacitive loop is advantageous in that it is simple to manufacture and easy to integrate with existing keypad devices 10. The capacitive proximity sensor 16 detects a change in its surrounding capacitance. It may be calibrated to be especially sensitive to the capacitance of humans, in order to be selective to only humans.

Depending on the sensitivity of the proximity sensor 16, it may detect human proximity at distances of several meters or a few centimeters. The first case may be suitable for an embodiment where simple human observation is enough to reduce the risk of injuries to a satisfying level, while the second case may be suitable for an embodiment where a human must physically press down a specific key 12 in order to reduce the risk of injuries to a satisfying level.

Capacitive sensors are beneficial in that this sensitivity is easily adjusted and is not affected by factors such as cumbersome uniforms or length of the user.

In the embodiment of Fig. 3b, the mechanical switch 14 and the proximity sensor 16 are arranged in different layers. This is beneficial in that they are easy to integrate with prior art systems and simple to manufacture. For example, the proximity sensor 16 may be manufactured as a separate layer and added to a prior art system already comprising at least one mechanical switch 14 without having to integrate it with an already existing layer.

The keypad device 10 further comprises a flexible printed circuit board assembly (FPC-A) 28 for registering activations of the different mechanical switches 14. The FPC-A 28 may e.g. be made from plastics and/or silicon and further comprise a capacitive loop 16.

The keypad device 10 further comprises a cover 29 for protecting a control unit 20 from external factors such as physical impact or humidity. The cover 29 is preferably made from a hard and waterproof material such as plastic, fiber composite or metal. Electronic or mechanical signals from the mechanical switch 14, the proximity sensor 16 and/or the FPC-A 28 are preferably transmittable through the cover 29 e.g. through wireless electromagnetic communication or openings for electrical cords.

The keypad device 10 further comprises a control unit 20 operatively connected to the mechanical switch 14 and the proximity sensor 16. The control unit 20 is configured to operatively control the movement of at least one movable member 3 of the entrance system 1. The control unit 20 is configured to only allow movement of the at least one movable member 3 of the entrance system 1 if the mechanical switch 14 is active and the proximity sensor 16 also detects human proximity.

The control unit 20 may be implemented as one or more processors (CPU) or programmable logic controllers (PLC). It may be a single unit or divided into several parts. One controller 20 may be configured to control the operation of any number of keypad devices 10.

The control unit 20 is operatively connected to the mechanical switch 14 and the proximity sensor 16. Signals containing information regarding the state of the mechanical switch 14 and the detection of the proximity sensor 16 are sent from the mechanical switch 14 and the proximity sensor 16, respectively. The signals may be sent separately to the control unit 20 and processed individually as in Fig. 3a. Alternatively, the signals may be sent in unison as in Fig. 3b, e.g. the proximity sensor 16 receives the signal of the mechanical switch 14, partially process it, then sends some combination of information from both the mechanical switch 14 and the proximity sensor 16 to the control unit 20.

The control unit 20 may further be able to send signals to the mechanical switch 14 and/or the proximity sensor 16. These signals may e.g. comprise calibration instructions. In an embodiment where the keypad device 10 comprises a display 22, the control unit 20 may be configured to send and receive signals to/from the display 22. In one example embodiment, maintenance information is sent from the control unit 20 to the display 22 in order to provide instructions to the user.

In an embodiment where the control unit 20 is further configured to recalibrate the proximity sensor 16, calibration signals are sent to the proximity sensor 16 either periodically or when beneficial. Recalibration may be useful when variations in ambience e.g. different lighting conditions or humidity changing the environmental capacitance may otherwise disrupt the proximity sensor 16.

In an embodiment with a capacitive proximity sensor as the proximity sensor 16, recalibration may be beneficial. The capacitive proximity sensor 16 measures the capacitance within a predetermined distance based on its sensitivity. Humans have a specific capacitance that may be detected by the capacitive proximity sensor 16. However, ambient capacitance may change the signal detected and impact the predetermined distance that the capacitance is measured within. This may e.g. be caused by a change in humidity during rain.

In order to recalibrate the capacitive proximity sensor 16, some sort of reference is useful. This may e.g. be a stored value or the ambient capacitance measured by the capacitive proximity sensor 16 when the measured capacitance remains unchanged for a certain time. A separate sensor may also be used to e.g. measure the ambient capacitance with a lower sensitivity or to measure the air humidity near the keypad device 10.

The control unit 20 is configured to operatively control the movement of at least one movable member 3 of the entrance system 1. The control unit 20 may e.g. be connected directly to the movable member 3 or to the drive unit 24 being configured to cause movement of the movable member 3 between an open and closed position.

The movement of the movable member 3 may e.g. be initiated by the activation of a mechanical switch 14. Each mechanical switch 14 may correspond to a specific movement of one or more movable members 3. The movement may continue until the movable member 3 reaches a predetermined position or until the mechanical switch 14 is deactivated or reactivated.

For movements that have a high risk of resulting in injuries, such as closing of heavy doors or folding of members, further safety precautions may be employed using the proximity sensor 16.

The control unit 20 is configured to only allow movement of at least one movable member 3 of the entrance system 1 if the mechanical switch 14 is active and the proximity sensor 16 also detects human proximity. The potentially allowed movement may be a specific motion e.g. from an open to a closed position or all motion in general. In an embodiment with multiple movable members 3, only a subsection of all movable members 3 may be allowed to move only if human proximity is detected.

An example of an activation and corresponding movements is a key 12 that when pressed, activates a mechanical switch 14. If the proximity sensor 16 detects human proximity as the mechanical switch 14 is activated, the control unit 20 is configured to move two movable members 3 being a door and a foldable ramp. The door closes and the ramp folds back as long as the mechanical switch 14 is active and human proximity is detected. If the control unit 20 at any point no longer detects both signals, it may be configured to stop the movement of the door and/or ramp or trigger an alarm.

The control unit 20 may further be configured to only allow specific movement of at least one movable member 3 of the entrance system 1 if the mechanical switch 14 is active and the proximity sensor 16 does not detects human proximity.

Specific movement may comprise movement along a specific axis, a specific direction and/or of a specific movable member 3. For movements that do not have a high risk of resulting in injuries, it may not be necessary to make sure of human involvement, as long as an activation of the mechanical switch 14 occurs. A specific movement axis or a specific movable member 3 may be safer than another is, therefore limited movement may be safely allowed without detecting human proximity.

An example of such a movement may be opening the door from the previous example. The open position of the door may not be able to injure users, hence moving to this position may be allowed without human proximity. Therefore, the movement will continue in this limited direction no matter the signal from the proximity sensor 16 as long as the corresponding mechanical switch 14 is active.

The opening movement may be initiated by a different key 12 than the key 12 that activated the closing movement. The control unit 20 is configured to differentiate between the keys 12, either due to different mechanical switches 14 being activated or due to the same mechanical switch 14 being activated in a different way. The control unit 20 will then control different movements of said at least one movable member 3 depending on the signal(s) received and whether human proximity is detected.

The control unit 20 may further be configured to not allow specific movement of at least one movable member 3 of the entrance system 1 that has a high risk of

causing accidents unless the mechanical switch 14 is active and the proximity sensor 16 also detects human proximity.

A specific movement axis or a specific movable member 3 may be more dangerous than another is, therefore such movement may not be safely allowed without detecting human proximity. Hence, all such movement may be disallowed unless the control unit 20 receives both an active signal from one or more corresponding mechanical switches 14 and a signal indicating human proximity from the proximity sensor 16.

Another example of allowed and disallowed movements is a key 12 that controls a closing movement of a movable member 3. The key 12 activates a corresponding mechanical switch 14 that is associated with the closing movement as long as the key 12 is pressed. The control unit 20 is configured to interpret a held activation of the mechanical switch 14 differently than a pressed activation of the mechanical switch 14. If the mechanical switch 14 is held, human proximity is assumed and the signal from the proximity sensor 16 is ignored. As such, the closing movement will continue as long as the key 12 remains pressed. If the mechanical switch 14 is pressed once, the control unit 20 will interpret this signal as a request for automatic closing of the member 3, however this is deemed to be a risky operation without human observation. Therefore, the control unit 20 will not allow this movement unless human proximity is detected. As such, the movement is not allowed unless the mechanical switch 14 is activated at least once and the proximity sensor 16 also detects human proximity.

In one embodiment, at least one proximity sensor 16 is calibrated to not detect human proximity at a distance and direction that corresponds to a human being in risk. For example, if a doorway is a source of clamping injuries, it may be beneficial to specifically detect that there are humans that are not in the immediate zone of risk inside the doorway to act as supervisors.

In another embodiment, at least one proximity sensor 16 is calibrated to specifically detect human proximity at a distance and direction that corresponds to a human being in risk. In this embodiment, all logic involving human presence is reversed, meaning that human proximity is regarded as something negative when

determining whether a risky operation should be allowed. To use the preceding example, if human proximity is detected within the doorway, a closing movement of a door is disallowed.

These embodiments may further be combined, where a closing movement is only allowed if no human proximity is detected within the zone of risk and human proximity is detected outside of the zone of risk.

Fig. 4 shows a layer of the keypad device 10 comprising two mechanical switches 14 being collapsible dome switches and a proximity sensor 16 being a capacitive loop. In this embodiment, at least one mechanical switch 14 and the proximity sensor 16 are arranged in the same layer. The same layer is advantageous in that it is fast to manufacture and uses space efficiently.

Each collapsible dome switch comprises a metal dome 15 and five electrical islands 13. The metal dome 15 is made from a conductive metal such as aluminum and the electrical islands 13 are made from a conductive material that may be the same as the metal dome 15 and may not.

The electrical islands 13 are arranged as four outer islands and one center island, however any number is possible as long as each group has at least one electrical island 13. The outer islands are electrically isolated from the center island in the inactive state. The outer islands are electrically connected with the metal dome 15 and possibly with each other in the inactive state.

In the inactive state of the collapsible dome switch, the metal dome 15 is in a convex, rested state. The convex end of the metal dome 15 protrudes away from the keypad device 10 in general and the electrical islands 13 in particular.

A user pressing in the metal dome 15 from its convex side, collapsing the metal dome 15 into itself, activates the collapsible dome switch. This results in the metal dome 15 making contact with the center island, electrically connecting at least one outer island with the center island and possibly with each other. This connection is registered e.g. through a short circuit and sends a signal to the control unit 20 that the mechanical switch 14 is in an active state.

The metal dome 15 is preferably stiff enough to provide a spring force in the active state, such that it returns to the inactive state if no counterforce is provided. This

means that the resting state will always be the inactive state and the active state will only sustain while the metal dome 15 is pressed in. The metal dome 15 is preferably flexible enough to not be cumbersome for the user to activate.

In one embodiment, the metal dome 15 functions as a capacitive proximity sensor 16. This proximity sensor 16 may be in addition to another proximity sensor 16 or as an only proximity sensor 16. The metal dome 15 as a proximity sensor 16 is preferably tuned to specifically detect human presence on or near the corresponding mechanical switch 14.

In one embodiment, the proximity sensor 16 is a capacitive loop arranged around the mechanical switches 14 as seen in Fig. 4. This conserves space and allows for simple coupling of unified signaling to the control unit 20. It is further advantageous in that the capacitive loop will be aligned with the mechanical switches 14 so that even with a low sensitivity, human proximity will be detected during the activation of a mechanical switch 14.

Fig. 5 shows a capacitive proximity sensor 16 configured to detect human proximity. The capacitive proximity sensor 16 comprises a physical connection member 17 for physically connecting the capacitive proximity sensor 16 to a keypad device 10 for controlling an entrance system 1. The capacitive proximity sensor 16 also comprises an operative connection member 18 for operatively connecting the capacitive proximity sensor 16 to a control unit 20 of the keypad device 10.

The physical connection member 17 may be any suitable connection member such as a nail, screw or adhesive. In the embodiment shown in Fig. 5, the physical connection member 17 is an adhesive tape. The tape is configured to attach the capacitive proximity sensor 16 as a separate layer in the keypad device 10. The adhesive is advantageous in that it is simple and efficient to attach to prior art keypad devices 10.

The operative connection member 18 may be any suitable connection such as an electrical cable or an antenna. Once an operative connection is established between the capacitive proximity sensor 16 and the control unit 20, a prior art keypad device 10 without a proximity sensor 16 may be controlled by the control unit 20 as a keypad device 10 according to the invention.

The capacitive proximity sensor 16 may cause a reconfiguration of said control unit 20 to check if said capacitive proximity sensor 16 detects human proximity during its operation logic.

In order for a prior art keypad device 10 to function as a keypad device 10 according to the invention, the control device 20 is preferably configured to only accept an activation of at least one mechanical switch 14 of the keypad device 10 if the capacitive proximity sensor 16 also detects human proximity.

This configuration may be done independently from the capacitive proximity sensor 16, e.g. through a routine software update supplied through the internet or manually installed.

Alternatively, the capacitive proximity sensor 16 further comprises a memory 19 with configuration instructions for the control unit 20 to be installed to the control unit 20 upon operatively connecting to the keypad device 10 using the operative connection member 18.

The memory 19 may be implemented in the shape of one or more memory chips using any commonly known technology for computer-readable memories such as ROM, RAM, SRAM, DRAM, FLASH, DDR, SDRAM or some other memory technology. Preferably, the memory technology used is non-volatile. In a preferred embodiment, the memory capacity is relatively low to keep costs down, such as 256 kB. The capacity may be larger to support future demands. The skilled person will understand that this also puts restraints on how the data stored on the memory is encoded in order to be efficient.

The memory 19 is advantageous in that it allows control units 20 of prior art keypad devices 10 to be reconfigured to function as a keypad device 10 according to the invention without further manipulation by the user such as manually updating software.

This reconfiguration may occur immediately as soon as the capacitive proximity sensor 16 operatively connects to the keypad device 10 using the operative connection member 18. Alternatively, it may be initiated by the user or via remote command.

In Fig. 6, a flowchart illustrating a method 100 for controlling an entrance system 1 according to an embodiment is shown. The method 100 comprises a first step

110 of checking the state of at least one mechanical switch 14 and a proximity sensor 16 and a second step 120 of causing movement of at least one movable member 3 of an entrance system 1.

The method 100 is preferably performed by a control unit 20 of a keypad device 10 of the entrance system 1.

The first step 110 may occur periodically or continually. The first step 110 comprises performing two separate checks. These checks do not have to occur simultaneously, however both are preferably true simultaneously in order to move on to the second step 120. This may be implemented in that as soon as one check is true, the other check is immediately performed, or in that both checks are always simultaneous.

One check is if at least one mechanical switch 14 is active. This will usually be a result of a pressed key 12 of the keypad device 10, forcing at least one mechanical switch 14 from a rested, inactive state to an active state. This will usually be detected by the active mechanical switch(es) 14 being configured to send a signal to the control unit 20 corresponding to a true result of the check.

The other check is if a proximity sensor 16 detects human proximity. When human proximity is detected, the proximity sensor 16 is configured to send a signal to the control unit 20 corresponding to a true result of the check.

If either of the checks result in a false result, the second step 120 is not performed and the first step 110 is preferably re-done.

The second step 120 preferably only occurs if both checks in the first step 110 result in a true statement, meaning that at least one mechanical switch 14 is active and the proximity sensor 16 detects human proximity are both true at the same time. This may e.g. be implemented using an AND-gate in the logic of the control unit 20.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although the foregoing descriptions and the associated drawings describe exemplary

embodiments in the context of certain exemplary combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the appended claims. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated as may be set forth in some of the appended claims. In cases where advantages, benefits or solutions to problems are described herein, it should be appreciated that such advantages, benefits and/or solutions may be applicable to some example embodiments, but not necessarily all example embodiments. Thus, any advantages, benefits or solutions described herein should not be thought of as being critical, required or essential to all embodiments or to that which is claimed herein. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

CLAIMS

1. A keypad device (10) for controlling an entrance system (1), said keypad device (10) comprising:

at least one mechanical switch (14), each mechanical switch (14) being associated with a key (12) of the keypad device (10);

a proximity sensor (16) configured to detect human proximity; and

a control unit (20) operatively connected to said at least one mechanical switch (14) and said proximity sensor (16), the control unit (20) being configured to operatively control the movement of at least one movable member (3) of said entrance system (1);

wherein said control unit (20) is configured to only allow movement of said at least one movable member (3) of said entrance system (1) if said at least one mechanical switch (14) is active and said proximity sensor (16) also detects human proximity.

2. The keypad device (10) according to claim 1, wherein said proximity sensor (16) is a capacitive proximity sensor (16), preferably being a capacitive loop.

3. The keypad device (10) according to claim 1 or 2, wherein said at least one mechanical switch (14) is a collapsible dome switch.

4. The keypad device (10) according to any one of the previous claims, wherein said at least one mechanical switch (14) and said proximity sensor (16) are arranged in the same layer.

5. The keypad device (10) according to claim 4, wherein said proximity sensor (16) is a capacitive loop arranged around said at least one mechanical switch (14).

6. The keypad device (10) according to any one of the claims 1 to 4, wherein said at least one mechanical switch (14) and said proximity sensor (16) are arranged in different layers.

7. The keypad device (10) according to any one of the previous claims, further comprising a display (22) operatively connected to said control unit (20), said control unit (20) being further configured to activate said display (22) when said proximity sensor (16) detects human proximity.

8. The keypad device (10) according to any one of the previous claims, wherein said control unit (20) is further configured to recalibrate said proximity sensor (16).

9. The keypad device (10) according to any one of the previous claims, wherein said control unit (20) is further configured to only allow specific movement of said at least one movable member (3) of said entrance system (1) if said at least one mechanical switch (14) is active and said proximity sensor (16) does not detect human proximity.

10. The keypad device (10) according to any one of the previous claims, wherein said control unit (20) is further configured to not allow specific movement of said at least one movable member (3) of said entrance system (1) that has a high risk of causing accidents unless said at least one mechanical switch (14) is active and said proximity sensor (16) also detects human proximity.

11. An entrance system (1) comprising:

a keypad device (10) according to any one of the preceding claims;

at least one movable member (3) such as a door leaf or a fold-out ramp being movable between an open and closed position; and

a drive unit (24) operatively connected to and controlled by said control unit (20) of said keypad device (10), said drive unit (24) being configured to cause

movement of said at least one movable member (3) between the open and closed position;

wherein said control unit (20) is further configured to only cause movement of said at least one movable member (3) from said open position to said closed position if said at least one mechanical switch (14) of said keypad device (10) is active and said proximity sensor (16) of said keypad device (10) also detects human proximity.

12. A method (100) for controlling an entrance system (1), said method (100) comprising the steps of:

checking (110) the states of at least one mechanical switch (14) and a proximity sensor (16); and only if

said at least one mechanical switch (14) is active; and

said proximity sensor (16) detects human proximity;

are both true at the same time, performing a further step of:

causing (120) movement of at least one movable member (3) of said entrance system (1).

13. A capacitive proximity sensor (16) configured to detect human proximity, comprising:

a physical connection member (17) for physically connecting said capacitive proximity sensor (16) to a keypad device (10) for controlling an entrance system (1); and

an operative connection member (18) for operatively connecting said capacitive proximity sensor (16) to a control unit (20) of said keypad device (10);

wherein said capacitive proximity sensor (16) causes a reconfiguration of said control unit (20) to check if said capacitive proximity sensor (16) detects human proximity during its operation logic.

14. The capacitive proximity sensor (16) according to claim 13, wherein said physical connection member (17) is an adhesive.

15. The capacitive proximity sensor (16) according to claim 13 or 14, further comprising a memory (19) with configuration instructions for said control unit (20) to be installed to said control unit (20) upon operatively connecting to said keypad device (10) using said operative connection member (18).

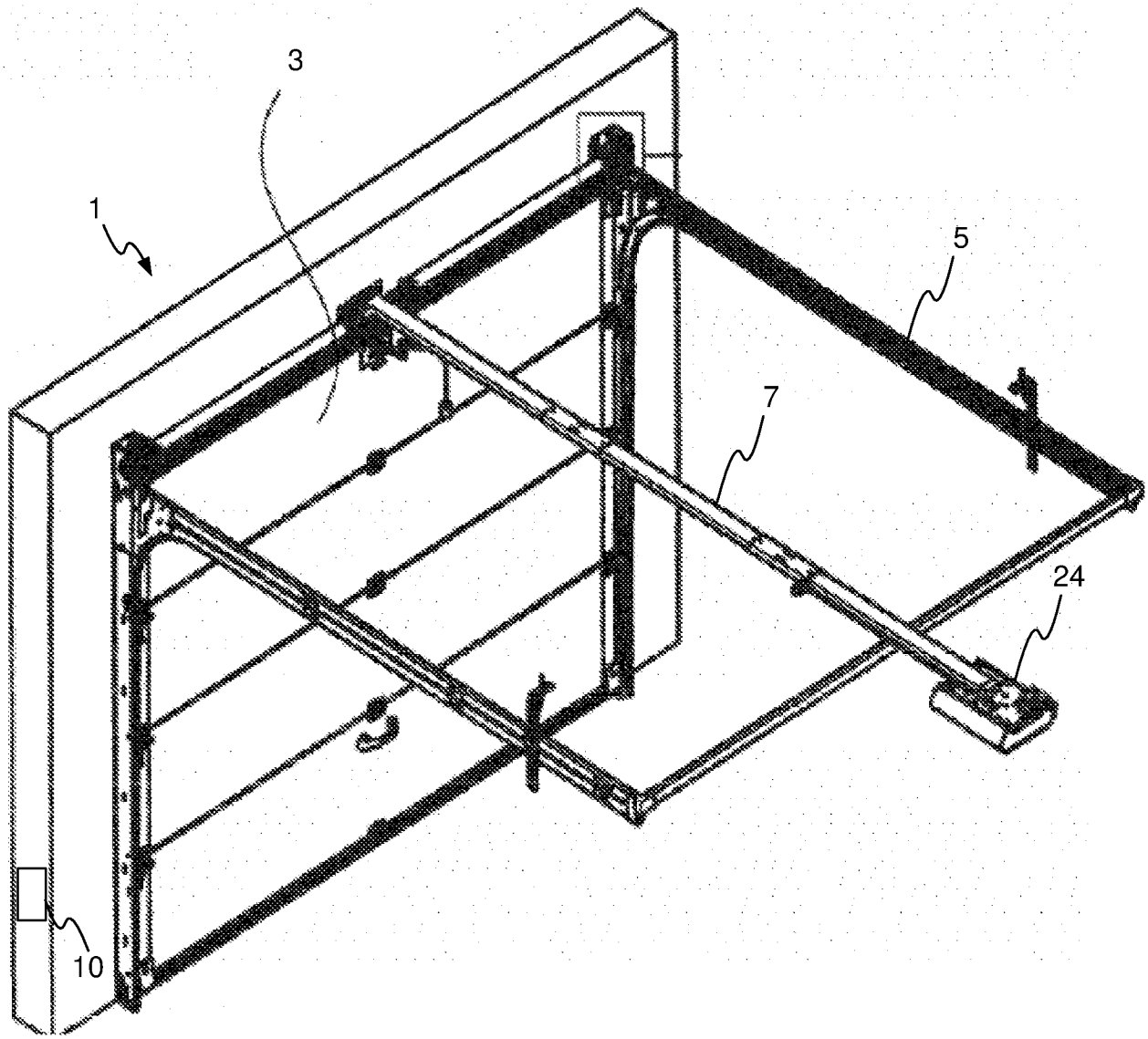


Fig. 1

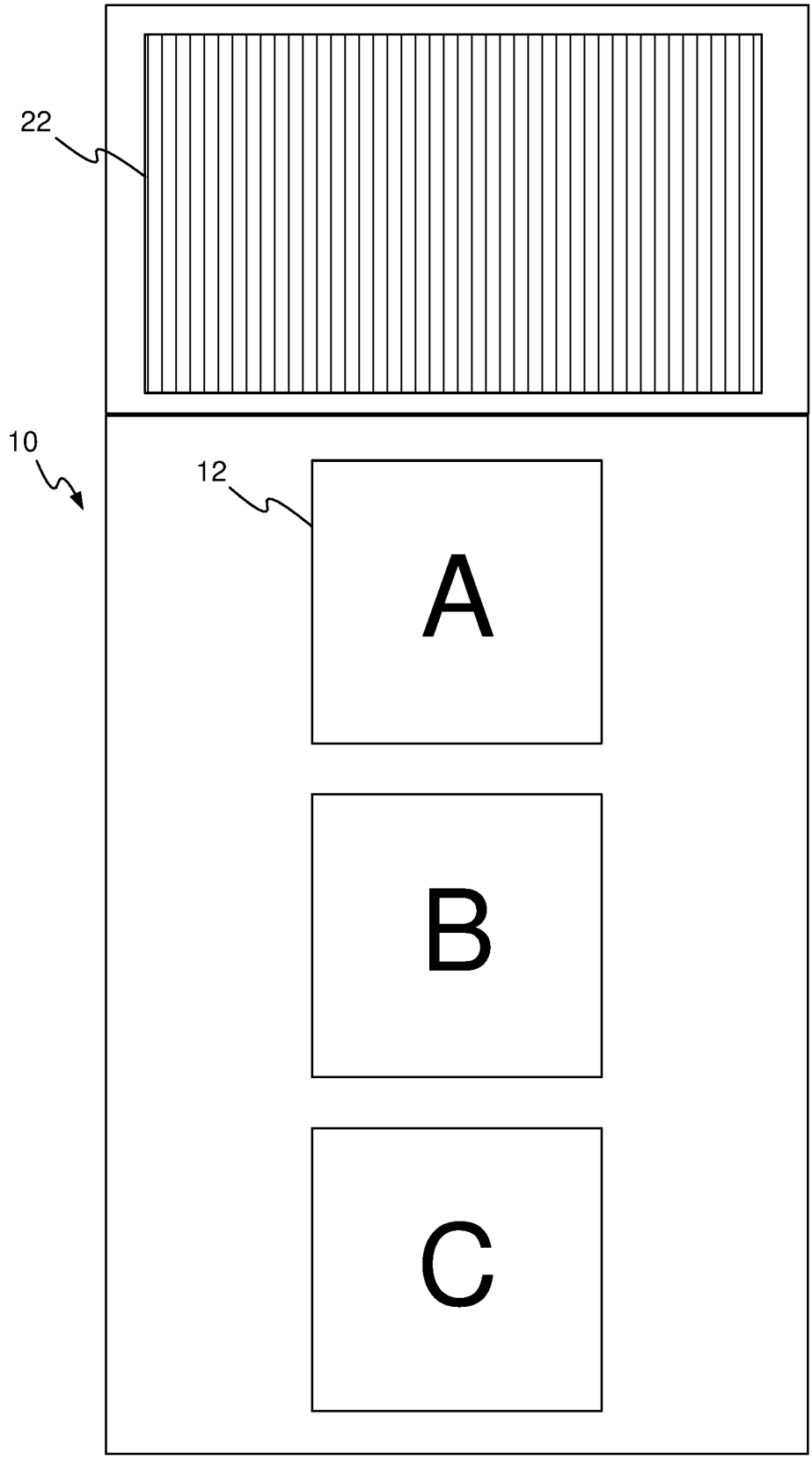


Fig. 2

SHEET INCORPORATED BY REFERENCE (RULE 20.6)

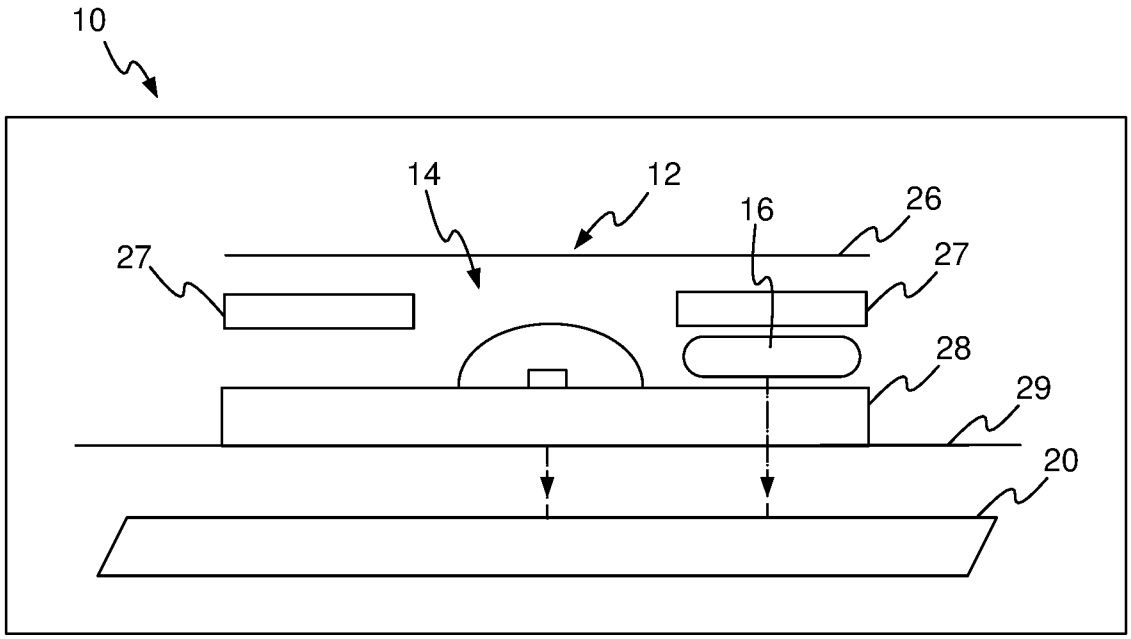


Fig. 3a

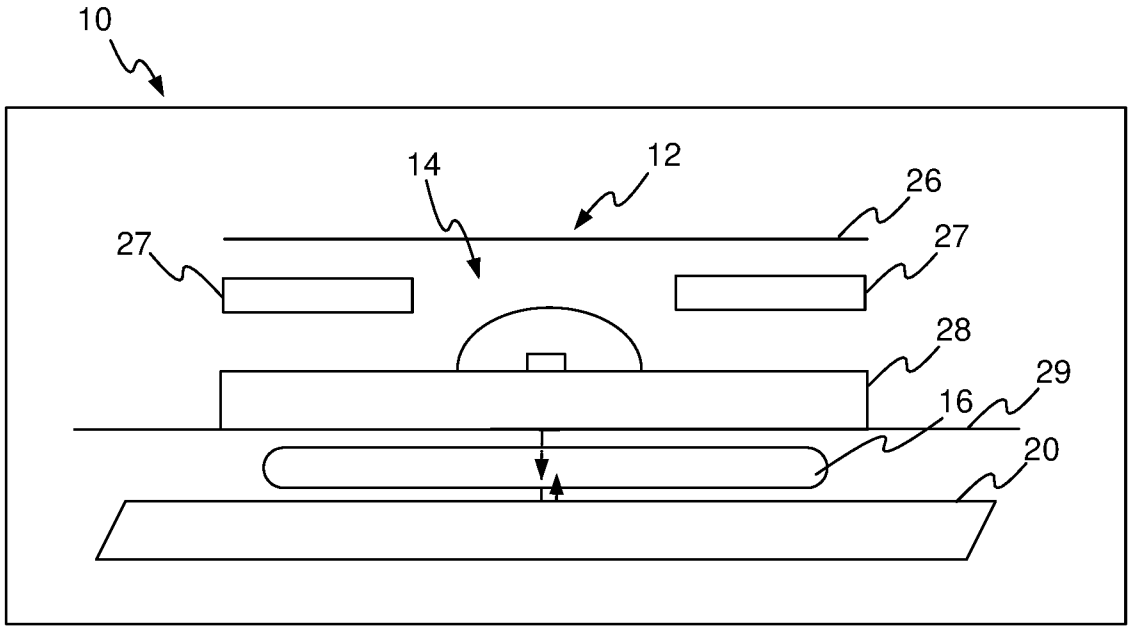


Fig. 3b

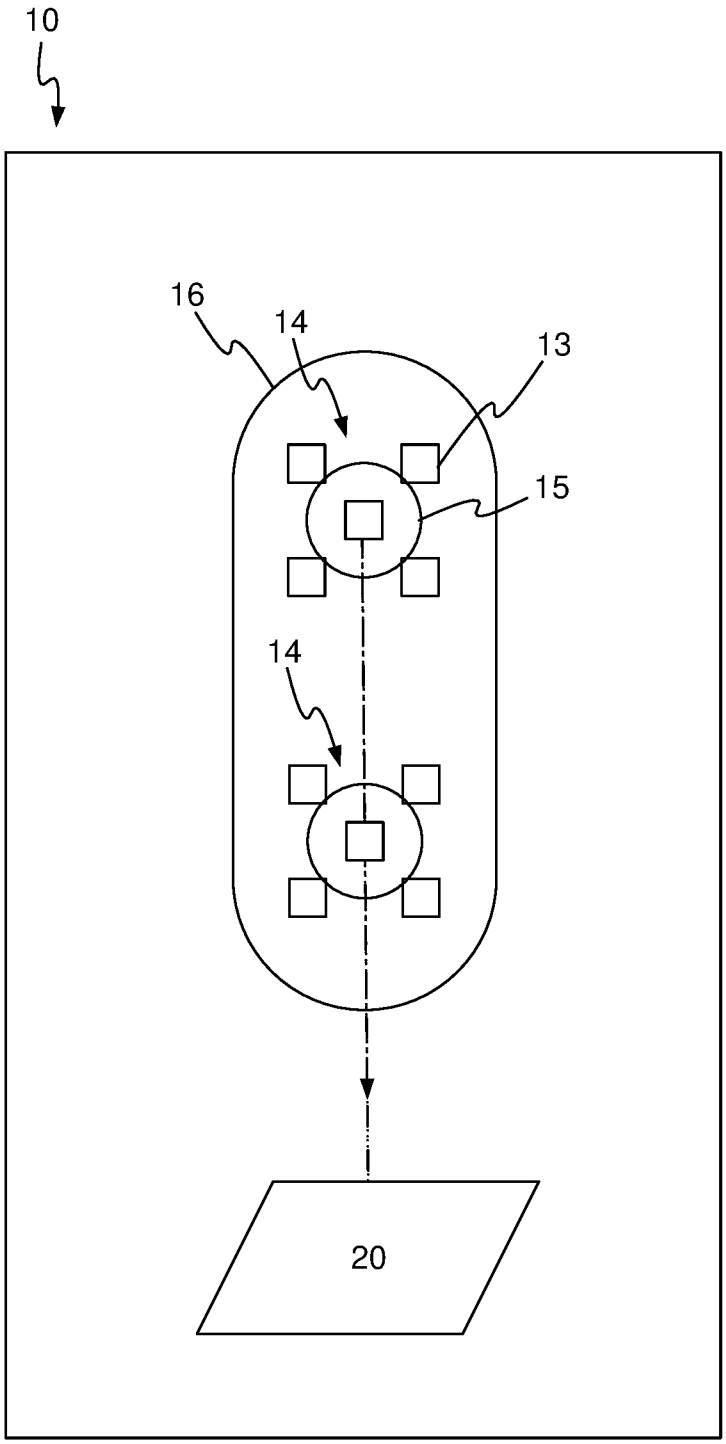


Fig. 4

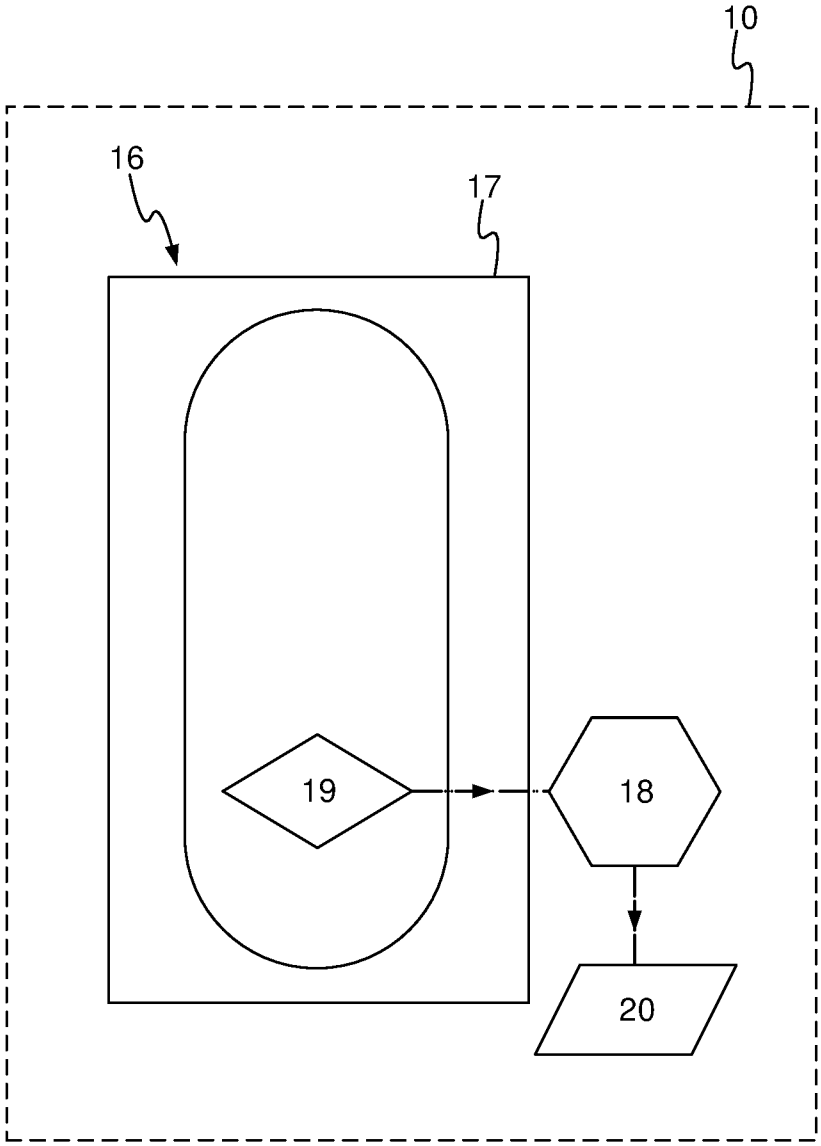


Fig. 5

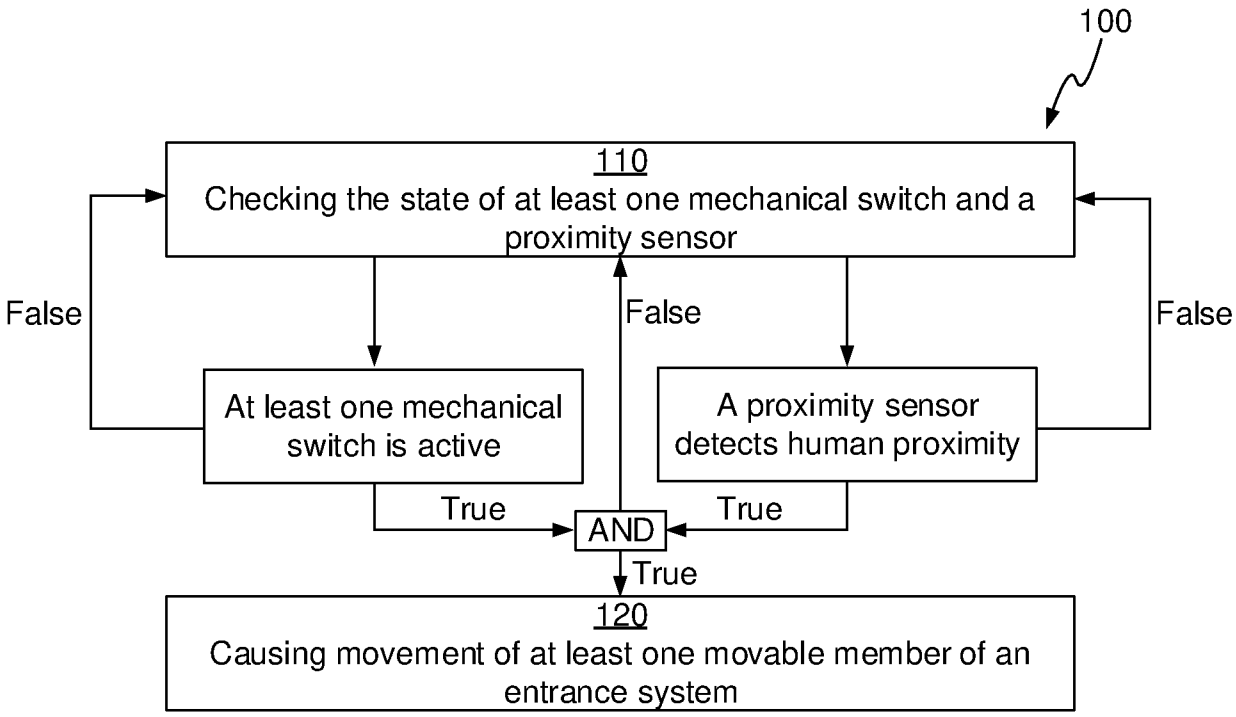

100
110
Checking the state of at least one mechanical switch and a proximity sensor
False
False
False
At least one mechanical switch is active
A proximity sensor detects human proximity
True
True
AND
True
120
Causing movement of at least one movable member of an entrance system

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/060817

A. CLASSIFICATION OF SUBJECT MATTER
INV. E05F15/40 H01H13/00 H03K17/955 H03K17/967
ADD.

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)
G07C H03K H01H E05F

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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 2011/227854 A1 (KOYA HIDETAKA [JP]) 22 September 2011 (2011-09-22) paragraphs [0014], [0015], [0017], [0018], [0021], [0051], [0053], [0082]; figures 2(a), 3	1-15
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 June 2020	03/07/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Verhoof, Paul

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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