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(54) **Sliding door**

(57) A sliding door or "pocket door" includes two opposing door surfaces. An actuator is coupled to both surfaces. When the door is installed and in a closed position, the two door surfaces sit at least partially in a wall cavity or "pocket". During an opening motion of the door, the

door surfaces slide out of the wall cavity, and the actuator moves the surfaces away from each other. During a closing motion of the door, the actuator moves the surfaces toward each other, and the surfaces slide into the wall cavity.

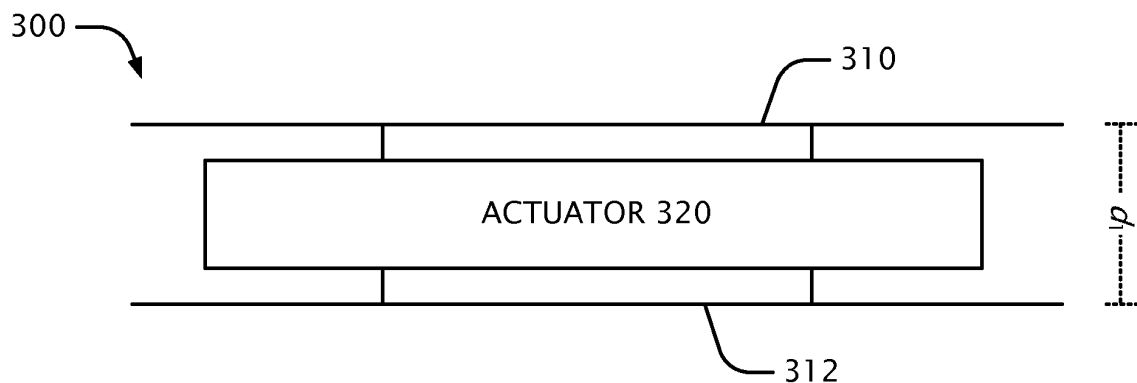


FIG. 3A

Description

[0001] This disclosure relates to sliding doors.

[0002] Traditional swinging doors require space through which the door moves while opening and closing. In many cases, this space could be used for other purposes.

[0003] US20080006594A1 describes a so-called "pocket door" that is sized and shaped to fit into a pocket opening in a wall. The door can slide into and out of the pocket opening.

[0004] Further options for sliding doors could be advantageous. This is addressed by at least some of the embodiments covered by the claims.

[0005] A sliding door or "pocket door" includes two opposing surfaces. An actuator is coupled to both surfaces. When the door is installed and in an open position, the two surfaces sit at least partially in a wall cavity or "pocket". During a closing motion of the door, the surfaces slide out of the wall cavity, and the actuator moves the surfaces away from each other. During an opening motion of the door, the actuator moves the surfaces toward each other, and the surfaces slide into the wall cavity.

[0006] In some embodiments, a door comprises: a first door surface; a second door surface, the first and second door surfaces being opposed; and an actuator coupled to the first and second door surfaces, the actuator moving the first and second door surfaces toward each other during an opening motion of the door, and the actuator moving the first and second door surfaces away from each other during a closing motion of the door. The door slides into a wall cavity during the opening motion after the actuator moves the first and second door surfaces toward each other, and the door slides out of the wall cavity during the closing motion before the actuator moves the first and second door surfaces away from each other, the wall cavity being formed by a first wall and a second wall. In some cases, the first door surface is flush with the first wall when the door is in a closed position, and the second door surface is flush with the second wall when the door is in the closed position.

[0007] The door can further comprise a flange coupled to the first door surface, the flange engaging a portion of the first wall when the door is in a closed position. The flange can have an L-shaped cross-section. In particular embodiments, the flange is a first flange and is arranged at a first end of the first door surface, and the door further comprises a second flange arranged at a second end of the first door surface and engaging another portion of the first wall when the door is in the closed position. Further embodiments comprise third and fourth flanges, the third flange being arranged at a first end of the second door surface, the fourth flange being arranged at a second end of the second door surface, the third flange engaging a portion of the second wall when the door is in the closed position, and the fourth flange engaging another portion of the second wall when the door is in the closed position. The flange provides sound attenuation when the door is

in a closed position, or the flange reinforces the door against being broken down while the door is in the closed position.

[0008] In some embodiments, the first door surface comprises a first plurality of panels, and the second door surface comprises a second plurality of panels, the door being a telescoping door.

[0009] The actuator can be coupled to an electric opening component. The electric opening component can be coupled to a user interface component. The actuator can also be coupled to a mechanical opening component. The door can further comprise a handle for opening and closing the door by hand.

[0010] Further embodiments comprise a computer-based device configured to perform one or more of the disclosed methods.

[0011] In some embodiments of a method of operating a door, the door comprising a first door surface, a second door surface, and an actuator coupled to the first and second door surfaces, the first and second door surfaces being opposed, the method comprises: using the actuator, moving the first and second door surfaces toward each other; moving the first and second door surfaces into a wall cavity; moving the first and second door surfaces out of the wall cavity; and using the actuator, moving the first and second door surfaces away from each other. The method can further comprise: receiving a command to open the door, the moving the first and second door surfaces toward each other and the moving the first and second door surfaces into the wall cavity being performed in response to the command to open the door; and receiving a command to close the door, the moving the first and second door surfaces out of the wall cavity and the moving the first and second door surfaces away.

[0012] At least some embodiments of the disclosed methods can be implemented using a computer or computer-based device that performs one or more method acts, the computer or computer-based device having read instructions for performing the method acts from one or more computer-readable storage media. The computer-readable storage media can comprise, for example, one or more of optical disks, volatile memory components (such as DRAM or SRAM), or nonvolatile memory components (such as hard drives, Flash RAM or ROM). The computer-readable storage media do not cover pure transitory signals. The methods disclosed herein are not performed solely in the human mind.

[0013] The disclosure refers to the following figures, in which:

FIG. 1 shows a block diagram of an exemplary embodiment of a door system.

FIGS. 2A-2C provide an exemplary context for use of at least some embodiments of the disclosed doors.

FIGS. 3A-3E show top views of an exemplary embodiment of a door.

FIG. 4 shows a block diagram of an exemplary method for operating a door.

FIGS. 5A-5E show top views of an exemplary embodiment of a door.

FIG. 6 shows a front view of the door of FIGS. 5A-5E.

FIG. 7 shows a block diagram of an exemplary embodiment of a computer.

[0014] FIG. 1 shows a block diagram of an exemplary embodiment of a door system 100. The system 100 comprises two opposing door surfaces 110, 112, which extend generally parallel to each other. The door surfaces 110, 112 form the sides of the door. The surfaces 110, 112 are both coupled to an actuator 120, which moves the surfaces 110, 112 toward or away from each other. Operation of the actuator 120 is explained in more detail below. The system 100 further comprises an opening and closing mechanism 130, which provides power to the actuator 120 and which moves the door surfaces 110, 112 into or out of a wall cavity. The mechanism 130 can be electrically, hydraulically, or mechanically powered. In some embodiments, the mechanism 130 is powered by hand. In embodiments where the mechanism 130 is at least partially electrically powered (directly or indirectly), the system 100 further comprises a control system 140. The control system 140 comprises, for example: a switch; a computer-based control unit; or another type of component. The control system 140 can be coupled to a user interface device 150. The device 150 exchanges information with the control system 140, including commands for operating the door system 100. In particular embodiments, the user interface device 150 is a PORT terminal device from the Schindler Group of Switzerland.

[0015] In some cases, the control system 140 is coupled to a network 160, through which the control system 140 communicates with one or more other electronic devices.

[0016] FIGS. 2A-2C provide an exemplary context for use of at least some embodiments of the disclosed doors. In FIG. 2A, a door 210 is in a closed position between two walls 220, 222. In this particular embodiment, a user interface device 230 is mounted on the wall 220, and a mechanism 240 for opening and closing the door 210 is located within the wall 222. A cavity 250 exists within the wall 222 and is accessible through an opening on the left-hand edge of the wall 222. For clarity, the door 210 is shown as having a patterned fill, but the door 210 can have any appearance.

[0017] In FIG. 2B, the door 210 is sliding into the cavity 250 in the wall 222 and is partly opened. The door 210 can slide, for example, along one or more tracks mounted above or below the door. In FIG. 2C, the open door 210 is completely within the cavity 250.

[0018] Depending on the embodiment, components such as the user interface device 230 and the mechanism

240 can be located in positions other than those shown in FIGS. 2A-2C.

[0019] For example, the user interface device 230 can be mounted on the door 210. In some cases, the user interface device 230 is positioned toward an edge of the door 210, such as the door edge 212. The door 210 can be configured such that, in an open position, a portion of the door 210 protrudes from the cavity 250, such that the user interface device 230 is still accessible. The user interface device 230 can be positioned on one or both sides of the door 210 (inside or outside).

[0020] As another example, any of the disclosed embodiments can be modified such that the mechanism 240 for opening and closing the door 210 can also be incorporated into the door 210.

[0021] In particular embodiments, both the user interface device 230 and the mechanism 240 are located within the door 210.

[0022] In additional embodiments, the door 210 is configured to be opened and closed by hand. Depending on the embodiment, the hand-powered configuration can be the only option for operating the door, or it can be an alternative to another type of configuration, such as an electrically powered operation (e.g., as a backup option, or as a supplement). Devices for hand-powered operation can have various forms. For example, a handle (not shown) can be located on the door 210. In cases where the user interface device 230 is located on the door 210, a handle could be located behind the device 230, possibly accessible using a key, using a mechanical device (e.g., a pushbutton), or using both. For example, on an inward-facing side of the door 210 (i.e., facing an interior of a building or an area), the handle can be accessible using the mechanical device, while on an outward-facing side of the door 210 (i.e., facing the exterior of the building or an area), the handle can be accessible using the key.

[0023] In further embodiments, a recessed handle appears on the outward-facing side of the door, on the inward-facing side of the door, or on both sides. In some cases, use of a handle can be controlled by requiring a key or by turning a switch or lever.

FIG. 3A shows a top view of an exemplary embodiment of a door 300, which can be used in the door system 100 or in a context similar to that of FIGS. 2A-2C. The door 300 comprises two opposing door surfaces 310, 312 and an actuator 320. The actuator 320 can comprise, for example, one or more of: a cam (e.g., a desmodromic system or other arrangement); a spring; a motor; a lever; a gear; a rod; or one or more other components that can change the distance between the surfaces 310, 312. FIG. 3A shows the surfaces 310, 312 set apart from each other. FIG. 3B, on the other hand, shows the door 300 after the actuator 320 has moved the surfaces 310, 312 closer to each other. Moving the surfaces 310, 312 relative to each other changes the thickness of the door 300. For example, in FIG. 3A, when

the surfaces 310, 312 are "expanded" or set apart from each other, the thickness of the door 300 is d_1 . In FIG. 3B, after the surfaces 310, 312 have been "retracted" or moved closer together, the thickness of the door 300 is d_2 , where $d_1 > d_2$.

FIGS. 3C-3E show top views of how the door 300 can be used when installed at a door opening defined by two wall portions 330, 332. FIG. 3C shows the door 300 in a closed position between the wall portions 330, 332. In this position, the door surfaces 310, 312 are set apart from each other. In some embodiments, when the door 300 is closed, one or both of the surfaces 310, 312 is flush or nearly flush with a respective side of the wall portions 330, 332. For example, FIG. 3C shows the surface 310 as being flush with a side 340 of the wall portion 330, and with a side 344 of the wall portion 332. Likewise, the surface 312 is flush with a side 342 of the wall portion 330, and with a side 346 of the wall portion 332. In further embodiments, when the door 300 is in the closed position, only one of the surfaces 310, 312 is flush with sides of the wall portions.

FIG. 3D shows the surfaces 310, 312 retracted inward. The door 300 is now thin enough to slide into a cavity 350 within the wall portion 332. The cavity 350 is defined by the wall sides 344, 346. FIG. 3E shows the door 300 partially within the cavity 350.

FIG. 4 shows a block diagram of an exemplary method 400 for operating any of the disclosed door embodiments. In a method act 410, when the door is in a closed position, the actuator moves the two door surfaces toward each other. In a method act 420, the door (including the two surfaces) is moved completely or partially into a wall cavity.

[0024] After the method act 420, the door is in an open position or a partially open position. In a method act 430, the door is moved out of the wall cavity. Once the door is out of the wall cavity, the two door surfaces are moved away from each other in a method act 440. After the method act 440, the door is in a closed position.

[0025] This particular embodiment of the method 400 applies in a scenario where the door moves from a closed position to an open or partially open position, and then back to a closed position. In other variations of the method 400, the door moves from closed to partially open or open, or from partially open or open to closed.

[0026] In some cases, the method 400 is performed by an electronic device, such as the control system 140 of FIG. 1.

[0027] FIG. 5A shows a top view of another exemplary embodiment of a door 500, which can be used in the door system 100 or in a context similar to that of FIGS. 2A-2C. The door 500 is, in some ways, similar to the door 300. The door 500 comprises two opposing door surfaces

510, 512 and an actuator 520. The actuator 520 can comprise, for example, one or more of: a cam (e.g., a desmotic system or other arrangement); a spring; a motor; a lever; a gear; a rod; or one or more other components that can change the distance between the surfaces 510, 512. FIG. 5A shows the surfaces 510, 512 set apart from each other. FIG. 5B, on the other hand, shows the door 500 after the actuator 520 has moved the surfaces 510, 512 closer to each other. Moving the surfaces 510, 512 relative to each other changes the thickness of the door 500. For example, in FIG. 5A, when the surfaces 510, 512 are "expanded" or set apart from each other, the thickness of the door 500 is d_3 . In FIG. 5B, after the surfaces 510, 512 have been "retracted" or moved closer together, the thickness of the door 500 is d_4 , where $d_3 > d_4$.

[0028] One possible difference between the door 500 and the door 300 is the presence of one or more door flanges on the surface 510, the surface 512, or both. In the embodiment of FIGS. 5A-5E, the door flanges 560, 562 are fixed to respective ends of the surface 510. The door flanges 564, 566 are fixed to respective ends of the surface 512. Each of the flanges 560, 562, 564, 566 comprises L-shaped protrusions. In further embodiments, a flange can have a different shape (e.g., curved, or another shape). Additionally, multiple flanges coupled to a door or to a particular door surface 510, 512 can have two or more different shapes.

[0029] FIG. 6 shows a front view of the door 500. In some embodiments, including that shown in FIG. 6, each of the flanges 560, 562, 564, 566 extends along the entire vertical length of the surfaces 510, 512. In further embodiments, one or more of the flanges 560, 562, 564, 566 extends along only a portion of the vertical length of the surfaces 510, 512. Any of the flanges 560, 562, 564, 566 can comprise a single flange portion. Alternatively, a door flange can comprise multiple, non-continuous flange portions. For example, a door flange can comprise an upper flange portion and a lower flange portion.

[0030] In some embodiments, one or more of the door flanges 560, 562, 564, 566 is shaped to conform to a particular surface that the flange engages when the door 500 is in a closed position. For example, FIG. 5C shows the door 500 in a closed position. FIG. 5C also shows how a wall portion 530 comprises wall flanges 570, 572, which form a cavity 580. In the closed position, the wall flange 570 receives the door flange 560, and the wall flange 572 receives the door flange 564. Similarly, the door flanges 562, 566 receive the respective ends 574, 576 of wall sides 544, 546.

[0031] In particular embodiments, a gasket is positioned along all or part of at least one of: one or more of the door flanges 560, 562, 564, 566; one or both of the wall flanges 570, 572; or one or both of the wall portion ends 574, 576. A gasket at one or more of these locations can improve a seal between one or both of the door surfaces 510, 512 and one or both of the wall portions 530, 532.

[0032] FIG. 5D shows the door 500 with the door surfaces 510, 512 retracted and ready to slide into a cavity 550 of the wall portion 532. The cavity 550 is defined by the wall sides 544, 546. FIG. 5E shows the door 500 partially within the cavity 550.

[0033] Additionally, in some embodiments, one or both door surfaces comprise a top flange. For example, FIG. 6 shows an optional top flange 602, which is affixed to the door surface 512 and extends horizontally along the surface 512. A top flange can comprise a single flange portion. Alternatively, a top flange can comprise multiple non-continuous flange portions. When the door is closed, the top flanges on the respective door surfaces can engage respective ceiling portions (not shown). In some cases, a gasket is positioned along all or part of at least one of: one or both of the ceiling portions; and one or both of the top flanges.

[0034] FIG. 7 shows a block diagram of an exemplary embodiment of a computer 700 (e.g., part of a control system, part of user interface device) that can be used with one or more technologies disclosed herein. The computer 700 comprises one or more processors 710. The processor 710 is coupled to a memory 720, which comprises one or more computer-readable storage media storing software instructions 730. When executed by the processor 710, the software instructions 730 cause the processor 710 to perform one or more of the method acts described in this application. Further embodiments of the computer 700 can comprise one or more additional components. The computer 700 can be connected to one or more other computers or electronic devices through an input/output component (not shown). In at least some embodiments, the computer 700 can connect to other computers or electronic devices through a network 740.

[0035] Although many of the disclosed embodiments are described as doors for use in a building (e.g., to control access to apartments, offices, bedrooms, or other rooms of a building), particular embodiments can be adapted for use with elevator installations. For example, the elevator shaft door and the elevator cabin door can each serve as an opposing door surface.

[0036] Any of the disclosed embodiments can be modified such that the door is formed of two door portions or "halves." The door portions can be the same size or different sizes. The two portions can come together from opposing ends of a door way when the door is in a closed position.

[0037] Any of the disclosed embodiments can be modified to comprise a telescoping door. In a closed position, each of the two door surfaces comprises a respective plurality of panels. In this position, the panels on a given side are flush with each other. During an opening movement, the panels slide inward in varying amounts so that some of the panels can slide underneath an adjacent panel.

[0038] At least some of the disclosed embodiments allow for sliding doors that do not consume floor space for swinging open or closed. Thus, use of the sliding door

embodiments can increase the space available for placing furniture or for other uses.

[0039] Additionally, some of the disclosed embodiments allow for a sliding door whose panels are flush with the neighboring wall surfaces when the door is in a closed position. This feature can provide, for example, a desired appearance.

[0040] Furthermore, certain door embodiments can serve as sound-reducing or sound-proof doors. For example, embodiments with door surfaces having flanges can reduce sound transmission through doorways. This reduction results from the flanges on the door surfaces engaging with corresponding features of respective wall portions. An example of such flanges appears in FIGS. 5A-5E. FIG. 5C shows how the flanges engage with the wall portions. In some cases, the sound-insulating abilities of a door can be improved by placing pliable gaskets on the flanges, the wall portions, or both. This can improve the seal between the flanges and the wall portions.

[0041] Additionally, certain door embodiments can inhibit or prevent the passage of smoke, fire, or both.

[0042] At least some of the disclosed door embodiments provide improved security compared to other doors, including other sliding doors. For example, in embodiments with door surfaces having flanges, the flanges can abut against one or both of the wall portions and thus strengthen the door against being broken down.

[0043] Although some embodiments of the various methods disclosed herein are described as comprising a certain number of method acts, further embodiments of a given method can comprise more or fewer method acts than are explicitly disclosed herein. In additional embodiments, method acts are performed in an order other than as disclosed herein. In some cases, two or more method acts can be combined into one method act. In some cases, one method act can be divided into two or more method acts.

[0044] Unless stated otherwise, a phrase referring to "at least one of" a list of items refers to any combination of those items, including single members. As an example, "at least one of: a, b, or c" is intended to cover: a; b; c; a and b; a and c; b and c; and a, b and c. As another example, "at least one of: a, b, and c" is intended to cover: a; b; c; a and b; a and c; b and c; and a, b and c.

[0045] Having illustrated and described the principles of the disclosed technologies, it will be apparent to those skilled in the art that the disclosed embodiments can be modified in arrangement and detail without departing from such principles. In view of the many possible embodiments to which the principles of the disclosed technologies can be applied, it should be recognized that the illustrated embodiments are only examples of the technologies and should not be taken as limiting the scope of the invention. Rather, the scope of the invention is defined by the following claims and their equivalents. I therefore claim as my invention all that comes within the scope of these claims.

Claims

1. A door, comprising:
 - a first door surface (110);
 - a second door surface (112), the first and second door surfaces being opposed;
 - and
 - an actuator (120) coupled to the first and second door surfaces (110, 112), the actuator (120) moving the first and second door surfaces (110, 112) toward each other during an opening motion of the door, and the actuator (120) moving the first and second door surfaces (110, 112) away from each other during a closing motion of the door.
2. The door of claim 1, the door sliding into a wall cavity (250) during the opening motion after the actuator (120) moves the first and second door surfaces (110, 112) toward each other, and the door sliding out of the wall cavity (250) during the closing motion before the actuator (120) moves the first and second door surfaces (110, 112) away from each other, the wall cavity (250) being formed by a first wall side (344) and a second wall side (346).
3. The door of claim 2, the first door surface (110) being flush with the first wall side (344) when the door is in a closed position, and the second door surface (112) being flush with the second wall side (346) when the door is in the closed position.
4. The door of any preceding claim, further comprising a flange (560) coupled to the first door surface (110), the flange (560) engaging a portion of the first wall side (344) when the door is in a closed position.
5. The door of claim 4, the flange (560) having an L-shaped cross-section.
6. The door of claim 4 or 5, the flange (560) being a first flange, the first flange (560) being arranged at a first end of the first door surface, the door further comprising a second flange (562), the second flange (562) being arranged at a second end of the first door surface (110) and engaging another wall portion (570) when the door is in the closed position.
7. The door of claim 6, further comprising third and fourth flanges (564, 566), the third flange (564) being arranged at a first end of the second door surface (112), the fourth flange (566) being arranged at a second end of the second door surface (112), the third flange (564) engaging a further wall portion (572) when the door is in the closed position, and the fourth flange (566) engaging a portion of the second wall side (346) when the door is in the closed
- position.
8. The door of claim 4 or 5, the flange (560) providing sound attenuation when the door is in a closed position, or the flange (560) reinforcing the door against being broken down while the door is in the closed position.
9. The door of any preceding claim, the first door surface (110) comprising a first plurality of panels, the second door surface (112) comprising a second plurality of panels, the door being a telescoping door.
10. The door of any preceding claim, the actuator (120) being coupled to an electric opening component (130).
11. The door of claim 10, the electric opening component (130) being coupled to a user interface component (150).
12. The door of any preceding claim, the actuator (120) being coupled to a mechanical opening component (130).
13. The door of any preceding claim, further comprising a handle for opening and closing the door by hand.
14. A method of operating a door, the door comprising a first door surface (110), a second door surface (112), and an actuator (120) coupled to the first and second door surfaces (110, 112), the first and second door surfaces (110, 112) being opposed, the method comprising:
 - using the actuator (120), moving the first and second door surfaces (110, 112) toward each other;
 - moving the first and second door surfaces (110, 112) into a wall cavity (250);
 - moving the first and second door surfaces (110, 112) out of the wall cavity (250);
 - and
 - using the actuator (120), moving the first and second door surfaces (110, 112) away from each other.
15. The method of claim 14, further comprising:
 - receiving a command to open the door, the moving the first and second door surfaces (110, 112) toward each other and the moving the first and second door surfaces (110, 112) into the wall cavity (250) being performed in response to the command to open the door; and
 - receiving a command to close the door, the moving the first and second door surfaces (110, 112) out of the wall cavity (250) and the moving the

first and second door surfaces (110, 112) away from each other being performed in response to the command to close the door.

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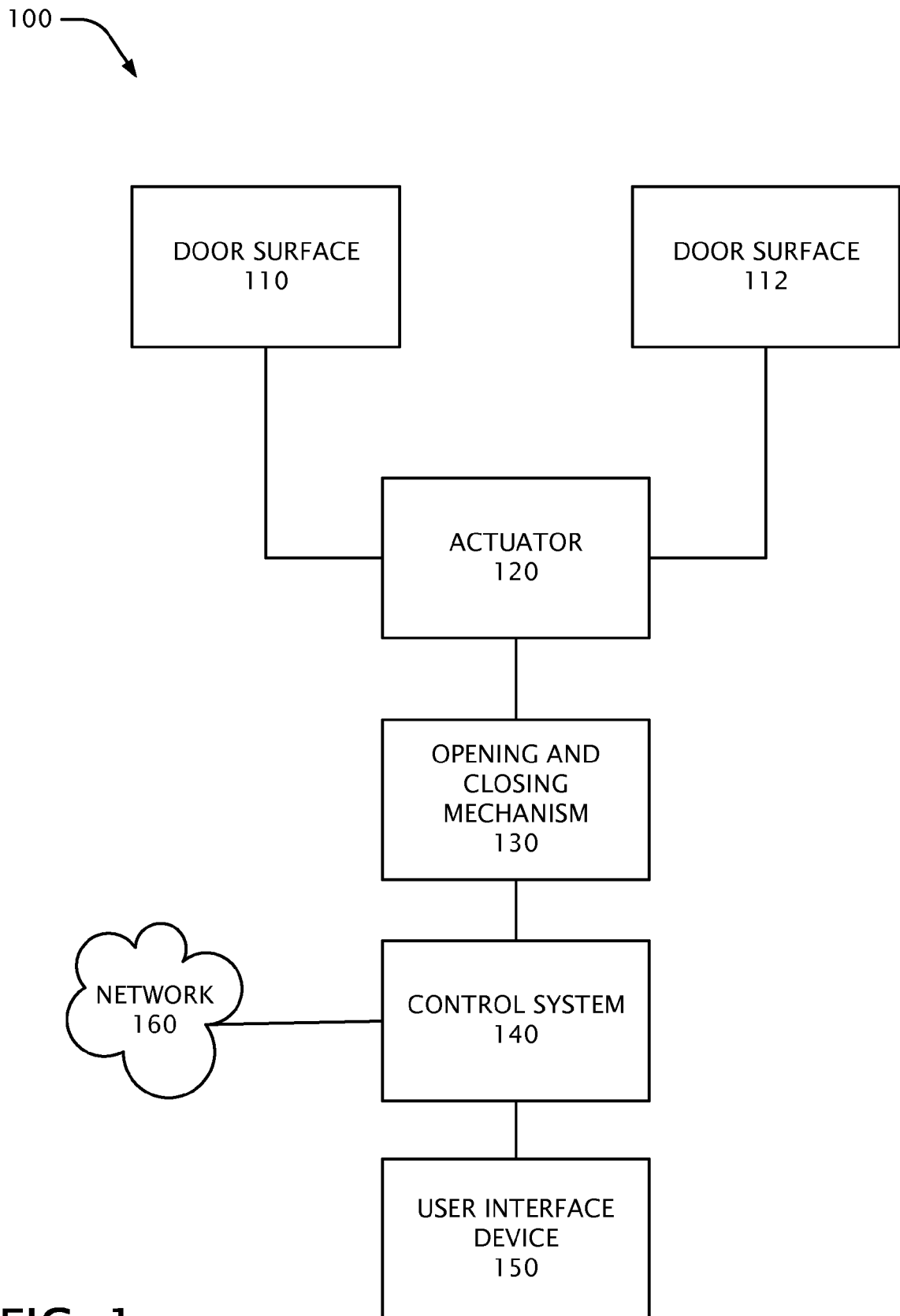


FIG. 1

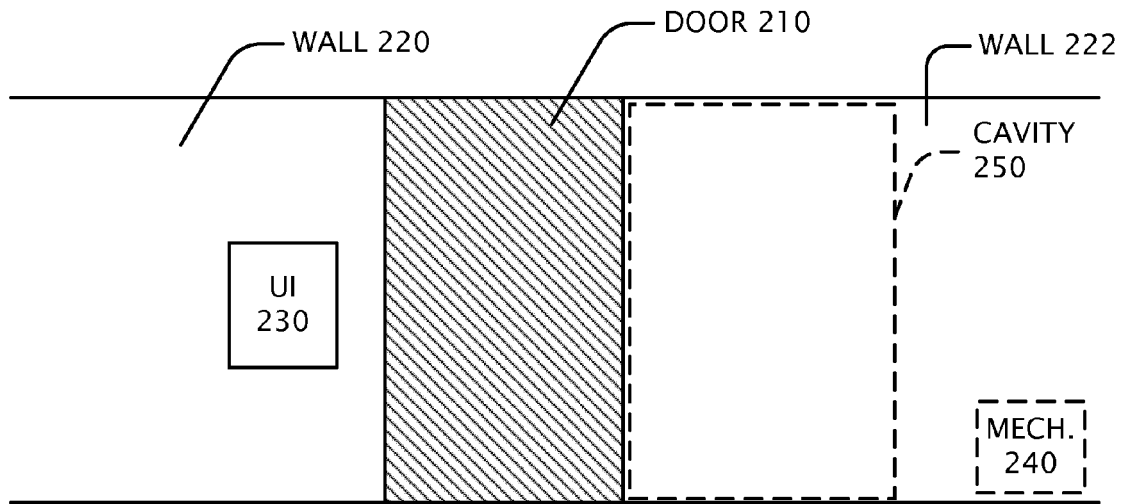


FIG. 2A

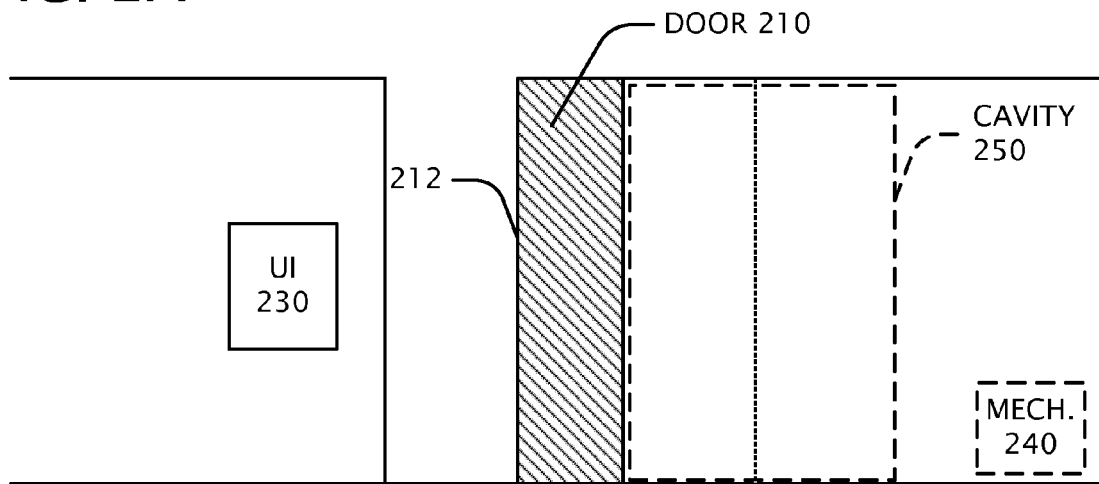


FIG. 2B

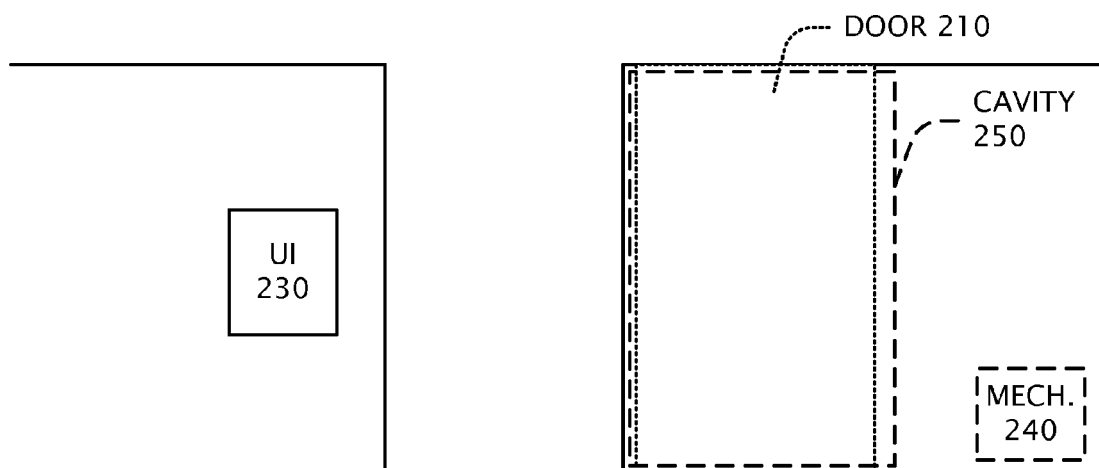


FIG. 2C

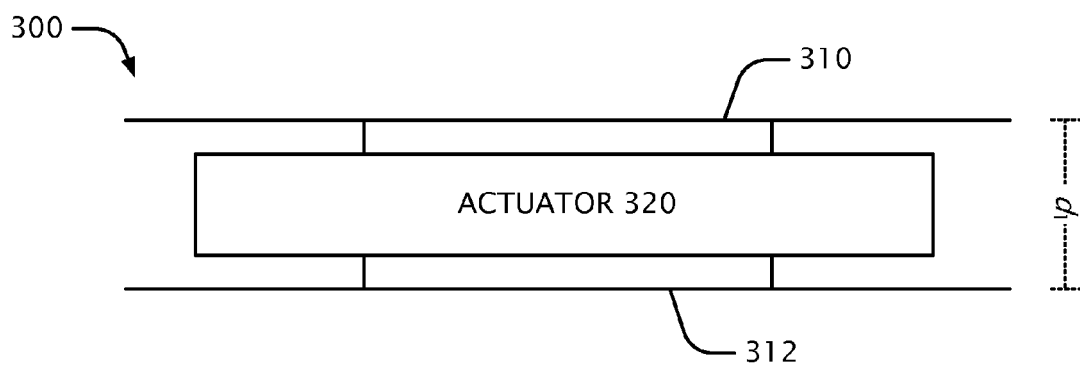


FIG. 3A

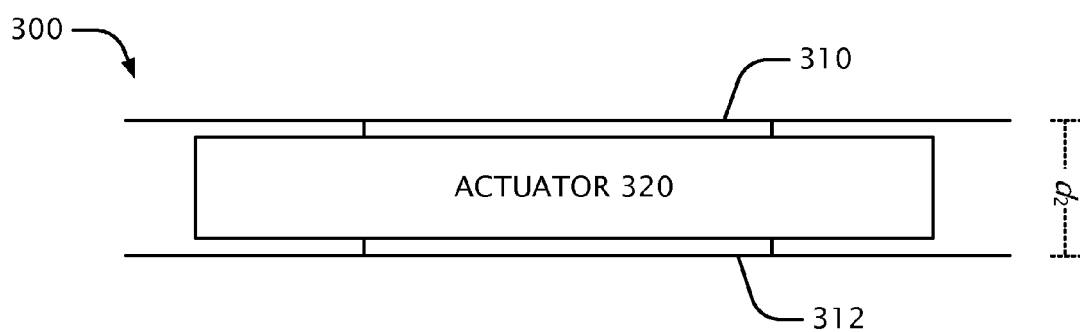


FIG. 3B

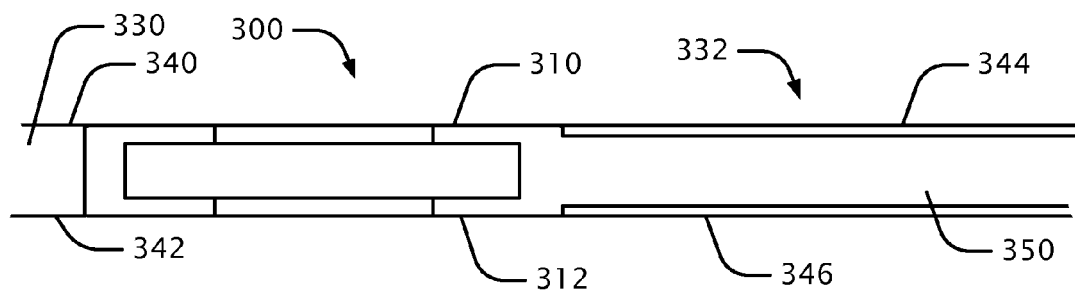


FIG. 3C

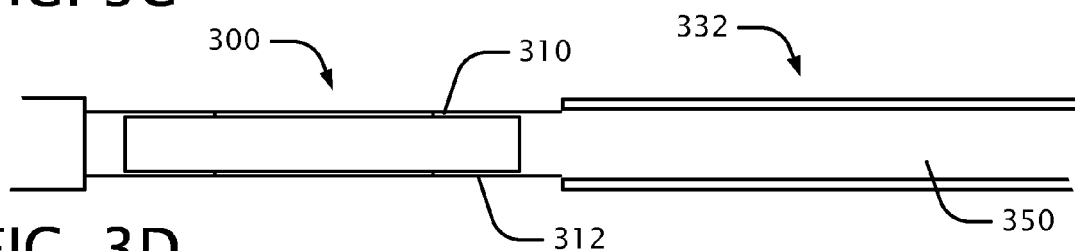


FIG. 3D

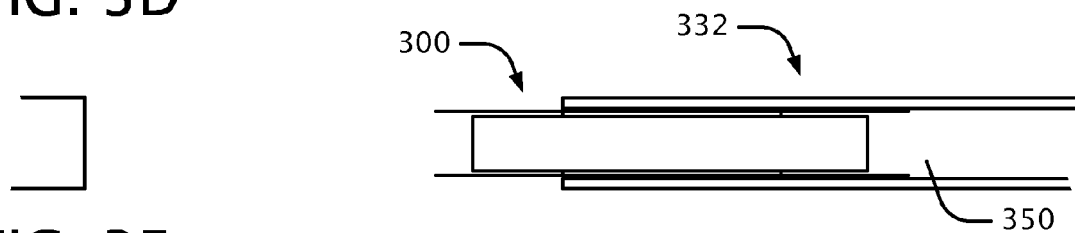


FIG. 3E

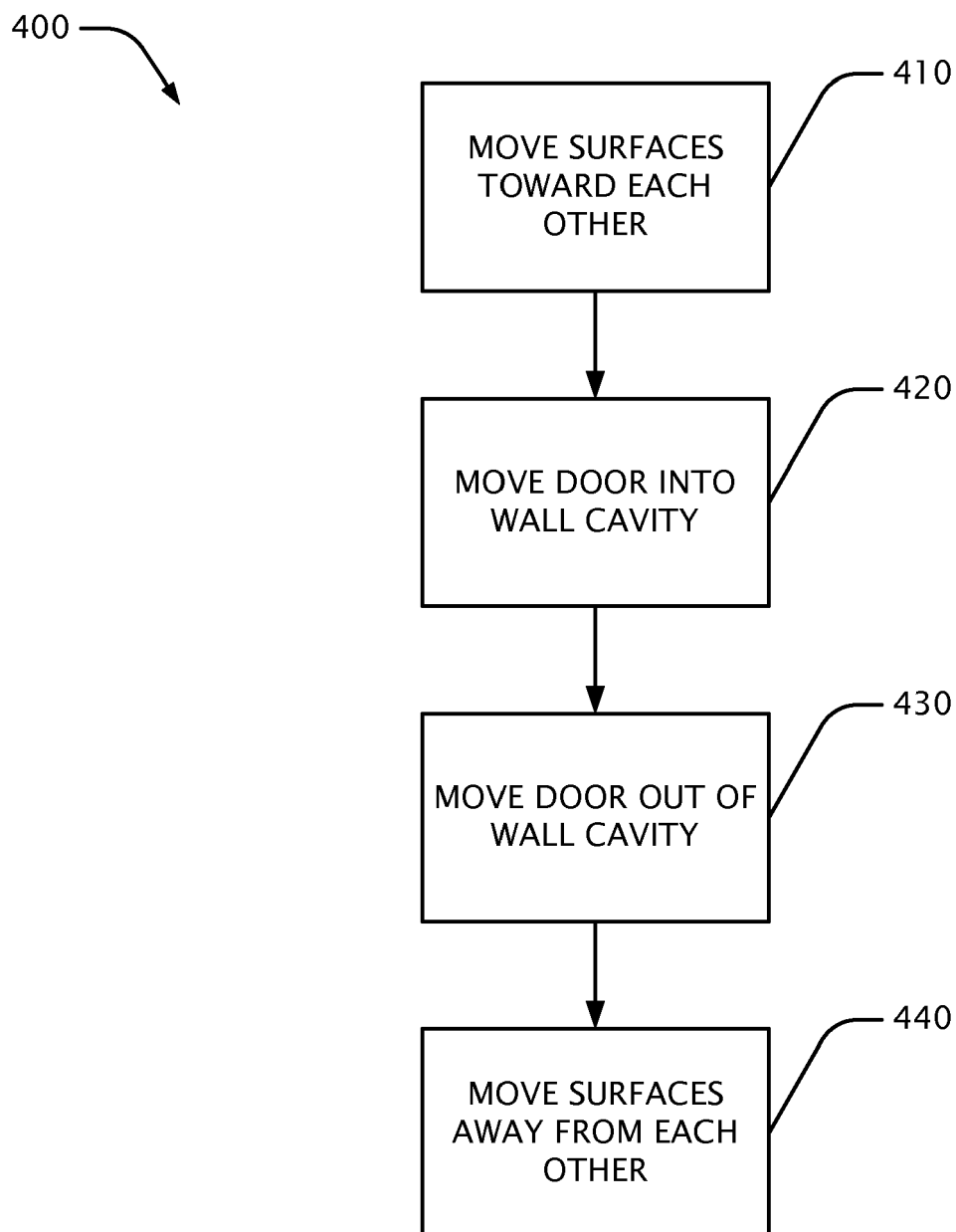
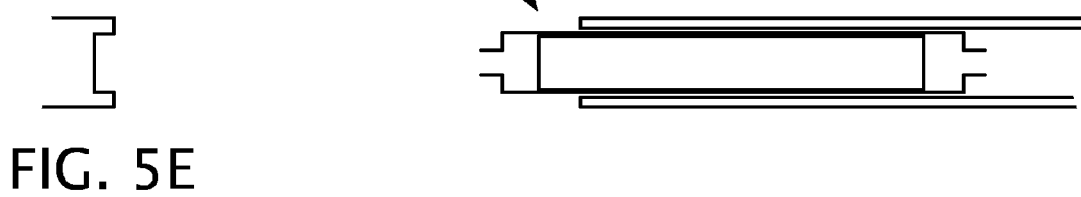
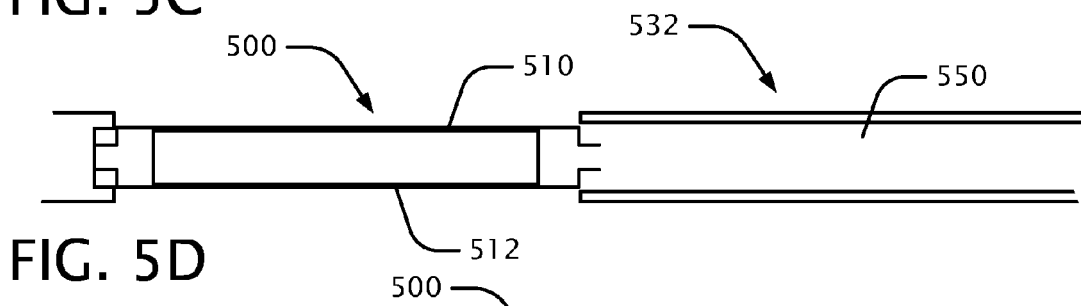
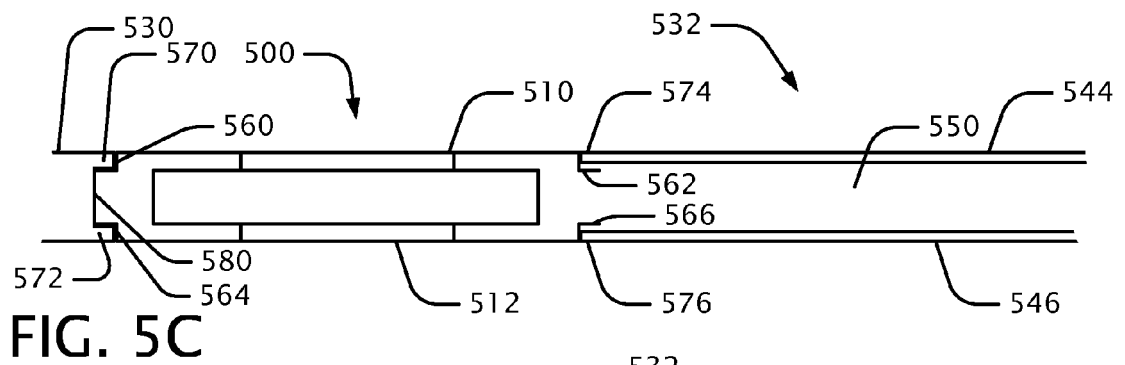
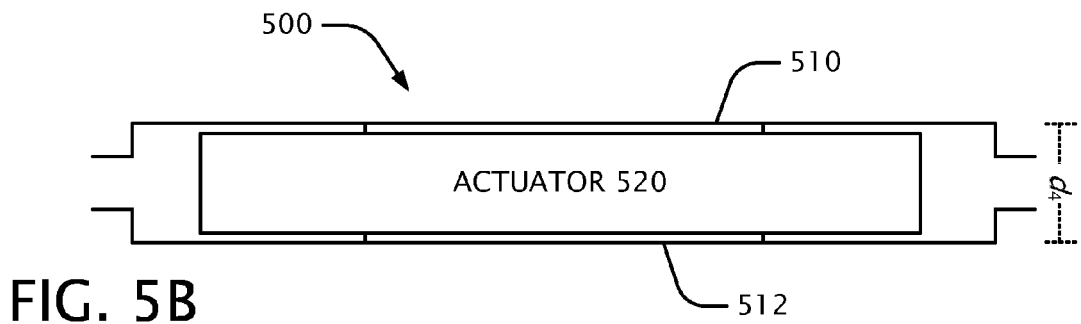
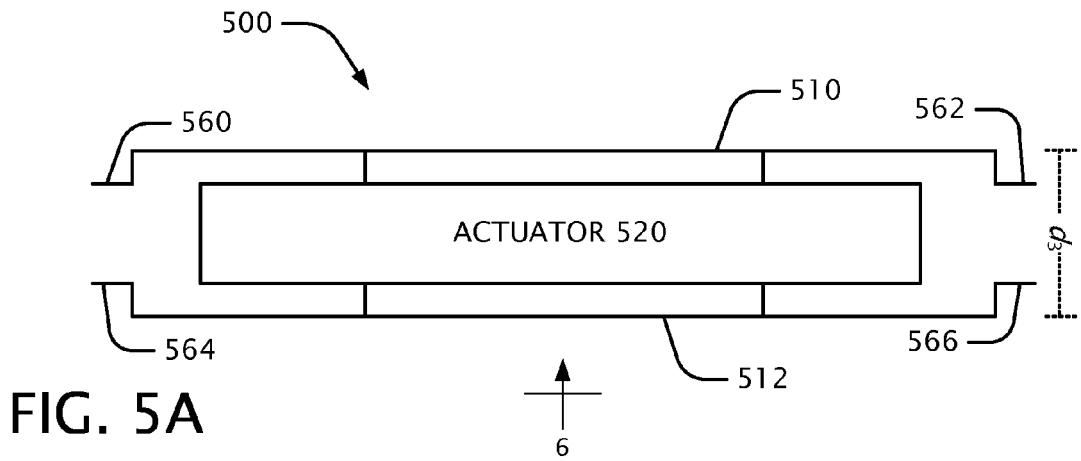


FIG. 4



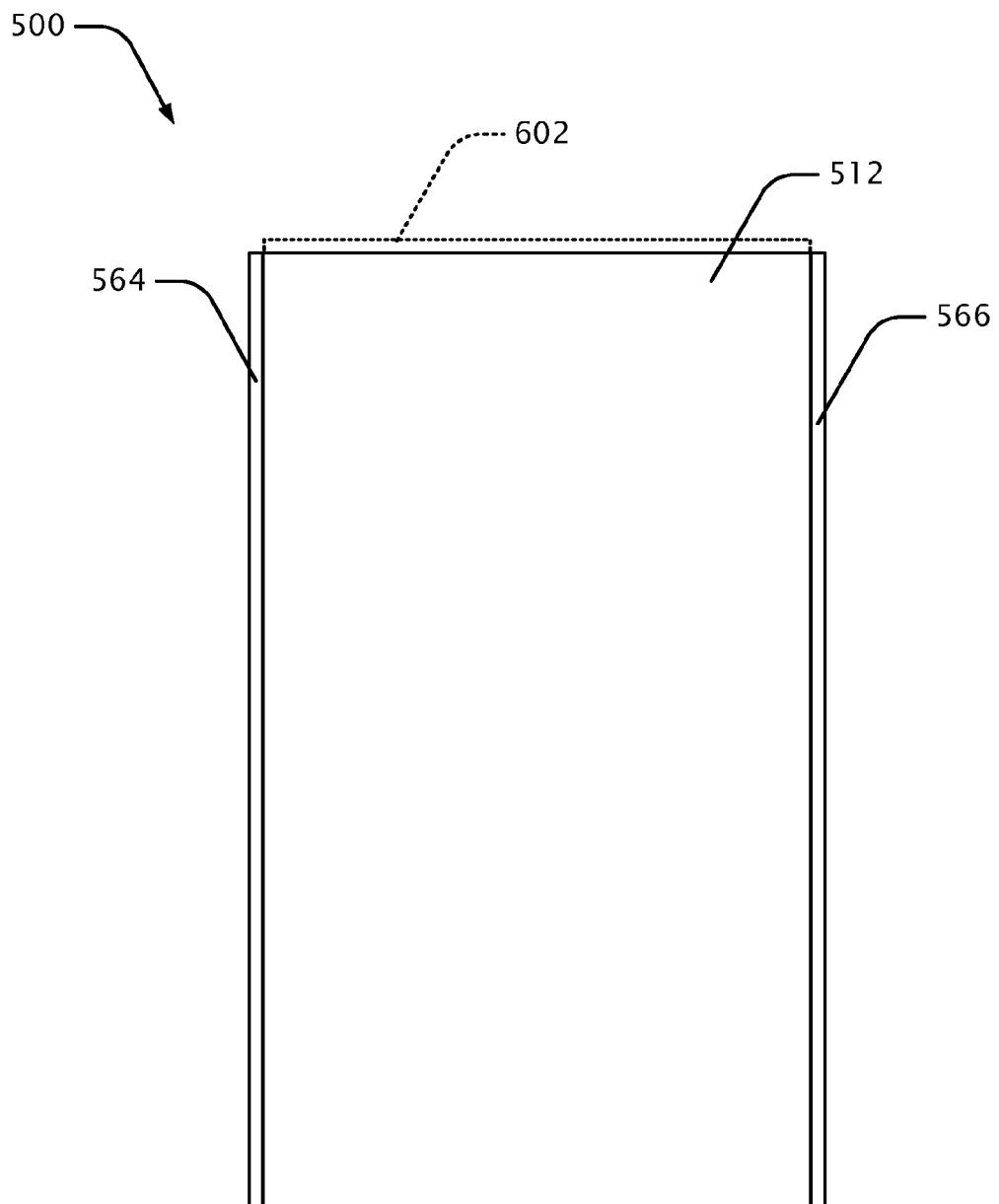


FIG. 6

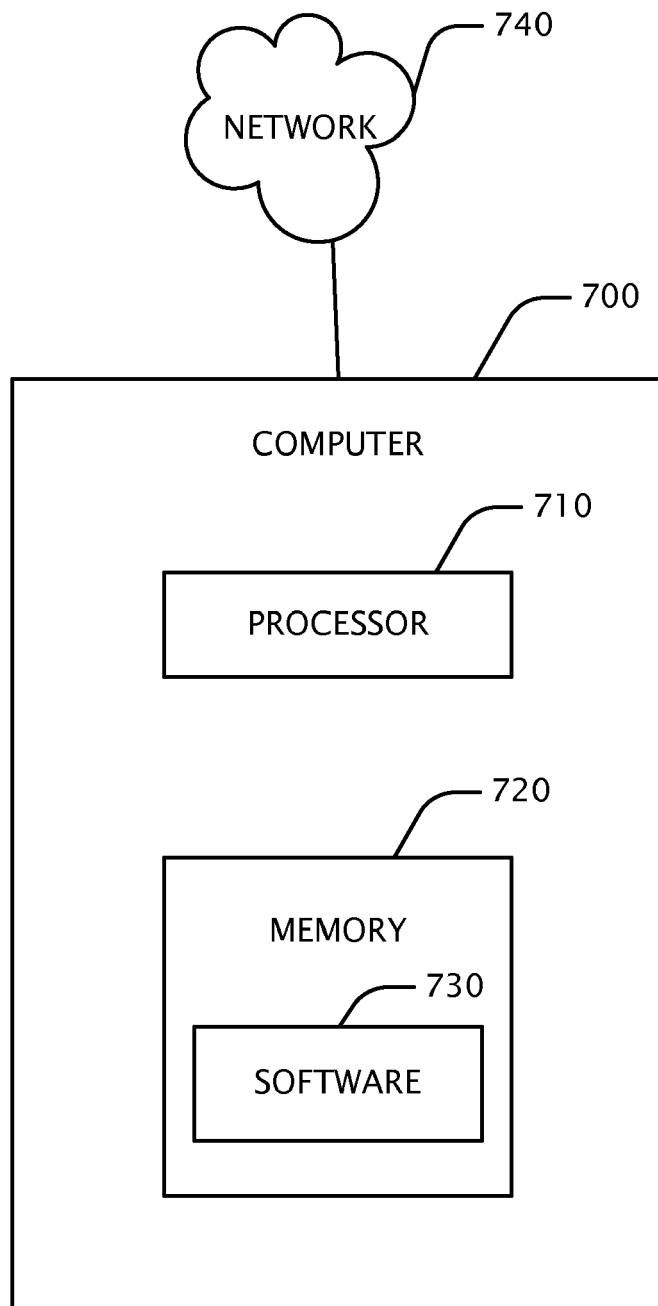


FIG. 7



EUROPEAN SEARCH REPORT

Application Number
EP 13 19 4474

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 101 63 061 A1 (WELTER ADRIEN [DE]) 5 June 2003 (2003-06-05) * paragraphs [0025] - [0030], [0034] - [0035]; figures 1-3 *	1-15	INV. E06B3/46
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 28 January 2014	Examiner Hellberg, Jan
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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REFERENCES CITED IN THE DESCRIPTION

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