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(54) **BIN HAVING ELECTRONIC LOW PROFILE LOCKING ASSEMBLY**

(57) A rectangular shaped lockable bin (150) is defined by four walls and a bottom wall. A lid (151) is hingedly mounted to the rear wall and has a slot (152) located in a front portion thereof. A lock (402) having a latch (420) is pivotably mounted to the front wall of said bin at a pivot point (460) and is configured to be selectively rotated

between a locked position and an unlocked position by an actuator (400). A tail (451) extending from the lock contacts a post (452) located on the wall of the bin and bias the lock (402) to the unlocked position. A series of such bins may be received in a delivery module (110), which may be received in a drawer (101).

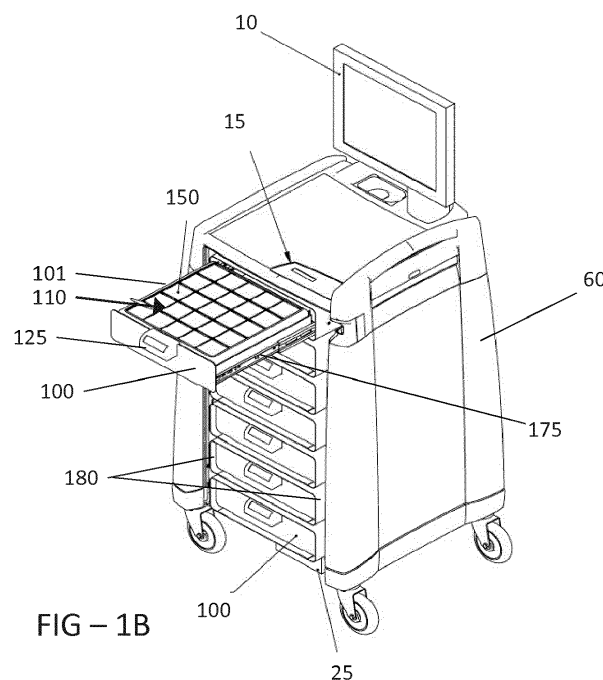


FIG - 1B

Description

Technical Field

[0001] The present invention generally relate to bins having an electronic low profile locking assembly.

Background of the Art

[0002] The transporting, storing, dispensing, and returning/disposal of medical supplies and medications is a daunting task in view of the complexity of modern healthcare systems. Any system or method for serving this industry must provide security and traceability, as well as provide an easy platform for incorporating the system into the daily routine for healthcare professionals.

[0003] Electronically controlled locking bins may be used in a variety of applications, including but not limited to storing medical devices, prescription drugs, jewelry and other small valuables, as well as other articles where access must be monitored and tightly controlled.

Summary of the Invention

[0004] According to the present invention there is provided an apparatus for transporting, storing, dispensing, or returning drugs and medical supplies comprising a plurality of individually lockable bins, wherein each of said bins is substantially rectangular in shape and comprises four side walls, a bottom wall, and a lid forming a slot located on a front portion thereof, wherein said lid is hingedly mounted to one of the side walls such that that the lid may be selectively moved between an opened position and closed position; a plurality of locking mechanisms, each associated with one of said plurality of individually lockable bins and comprising; a lock plate wherein said lock plate is pivotably mounted to the front wall of the lockable bin at a pivot point and has an upper portion located above said pivot point and a lower portion located below said pivot point, a latch located on the upper portion of said lock plate, wherein said lock plate is configured to be selectively rotated about said pivot point between a locked position, whereby the latch engages said slot, and an unlocked position, whereby the latch is located wholly outside of said slot, an actuator configured for horizontal movement so as to contact the lower portion of the lock plate, thereby rotating the lock plate between the locked position and the unlocked positions, a post located on the front wall of the bin, and a tail extending from lower portion of the lock plate and configured to deflect when contacting the post so as to bias the lock plate in the unlocked position; and a delivery module configured to receive said plurality of lockable bins.

[0005] The exemplary embodiments herein provide a medical cart having a drawer with a post which extends upwardly from a bottom surface of the drawer. The cart further includes a removable medication delivery module having four sidewalls and a bottom wall as well as a plu-

rality of individually-lockable bins placed above the bottom wall and within the four sidewalls. A lock may be positioned above the bottom wall and below the plurality of individually-lockable bins with an aperture on the lock which engages with the post and a hole in the bottom wall sized to accept the post.

[0006] Exemplary embodiments also provide a low profile locking assembly. Each bin may be defined by four tapered side walls and a bottom wall. The tapered side walls may define a gap between adjacent bins and between a bin and the sidewall of a delivery module. The gap may be sized to accept the low profile locking assembly. Each bin may include a lid having a slot for receiving a latch located on a lock. The lock may be rotated about a pivot point such that the latch selectively engages the slot in order to lock and unlock the bin. An electronic signal from a PCB may control the actuator. An actuator spring may be used to bias the lock into the slot. In an exemplary embodiment, the locking assembly is placed on the front wall of the bin and may not be visible or accessible to a user, even when the lid of the bin has been opened. In another exemplary embodiment, the locking assembly is placed on the same side of the bin as the hinge axis.

Brief Description of the Drawings

[0007] A better understanding of an exemplary embodiment will be obtained from a reading of the following detailed description and the accompanying drawings wherein identical reference characters refer to identical parts and in which:

FIGURE 1A is a perspective illustration of an exemplary embodiment of a medical cart, having an exposed central column.

FIGURE 1B is a perspective illustration of another exemplary embodiment of a medical cart, having a housing which contains a plurality of sleeves.

FIGURE 2 is a perspective view of an exemplary embodiment for inserting and removing the delivery module from the sleeves.

FIGURE 3 is a bottom perspective view of the embodiment of the delivery module shown in Figure 2.

FIGURE 4 is a top perspective view of the embodiment shown in Figure 2.

FIGURE 5 is a top perspective view of an exemplary embodiment of the delivery module.

FIGURE 6 is a front elevation view of the embodiment of the delivery module shown in Figure 5 where the section line A-A has been indicated.

FIGURE 7 is a side section view, taken along section line A-A and indicating the location of Detail A and Detail B.

FIGURE 8 is a detailed section view of Detail A.

FIGURE 9 is a detailed section view of Detail B.

FIGURE 10 is a front elevation view of the embodiment of the delivery module shown in Figure 5 where

the section line B-B has been indicated.

FIGURE 11 is a top section view, taken along section line B-B.

FIGURE 12 is a top perspective view of the embodiment of the delivery module shown in Figure 5 where the delivery module has had several bins removed and where the location for Detail C has been indicated.

FIGURE 13 is a detailed view of Detail C.

FIGURE 14 is a top perspective view of the embodiment of the delivery module shown in Figure 5 where each bin (except for one) has been removed along with the printed circuit board for the delivery module.

FIGURE 15 is a partial section view of an exemplary embodiment of the delivery module when locked within the drawer and where the location for Detail D has been indicated.

FIGURE 16 is a detailed view of Detail D.

FIGURE 17 is a rear partial section view of an exemplary embodiment of a bin where the bin has been locked and where the location for Detail E has been indicated.

FIGURE 18 is detailed view of Detail E.

FIGURE 19 is a rear partial section view of the bin embodiment shown in Figure 17 where the bin has been opened and where the location for Detail F has been shown.

FIGURE 20 is a detailed view of Detail F.

FIGURE 21 is an electrical block diagram of an exemplary embodiment of the medical cart.

FIGURES 22-25 are logical flowcharts for performing a method of controlling access to medications.

FIGURE 26 is a top perspective view of another exemplary embodiment of the delivery module where the delivery module has had several bins removed and where the location for Detail G has been indicated.

FIGURE 27 is a detailed view of Detail G.

FIGURE 28 is a rear view of the bin of Figure 26 shown in isolation where the bin is in a closed and locked position and where the location of Detail H has been indicated.

FIGURE 29 is a detailed view of Detail H.

FIGURE 30 is a rear view of the bin of Figure 28 where the bin is in a closed and unlocked position and the location of Detail I has been indicated.

FIGURE 31 is a detailed view of Detail I.

Detailed Description

[0008] The invention is described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully con-

vey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

[0009] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0010] Embodiments of the invention are described herein with reference to illustrations that are schematic illustrations of idealized embodiments (and intermediate structures) of the invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0011] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0012] FIGURE 1A is a perspective illustration of an exemplary embodiment of a medical cart, having an exposed central column 70. The cart is supported by a base 26 which preferably contains a set of wheels or casters for moving the cart. A battery 25 and associated electronics may be placed within the base 26 and is electrically connected through the central column 70 to a computer 10, which includes a display, processor, and memory. In some embodiments, the computer 10 may be a touch screen and will contain the processor and memory within the housing for the display touch screen. In other embodiments, the computer 10 may have a display positioned as shown in the figure, with a processor and memory being placed somewhere else on the cart.

[0013] A sleeve 180 extends from the cart and away from the column 70, to provide an envelope for accepting a drawer 101. Preferably, a pair of drawer slides 175 are used to allow the drawer 101 to be translated in/out of the sleeve 180. A delivery module 110 can be inserted/removed from the drawer 101, and preferably contains a plurality of bins 150 which are preferably individually-lockable and trackable. A protrusion 125 preferably extends from the delivery module 110 and out of the drawer

101. The protrusion 125 preferably extends away from the front facia 100 of the drawer 101.

[0014] A wireless power transmitter 501 is placed on the cart to communicate with a wireless power receiver 500 as described below. The wireless power transmitter 501 is preferably in electrical connection with the battery 25 and associated electronics found within the base 26. A wireless data transmitter/receiver 551 is also placed on the cart to communicate with a wireless data transmitter/receiver 550 as described below. The wireless data transmitter/receiver 551 is preferably in electrical connection with the computer 10 and its associated processor.

[0015] FIGURE 1B is a perspective illustration of another exemplary embodiment of a medical cart, having a housing 60 which contains a plurality of sleeves 180. In this embodiment, the column 70 may be placed inside the housing 60 or may not be used at all. A battery 25 and associated electronics may be placed below the housing 60 or within a bottom portion of the housing 60 and would again be in electrical connection with the computer 10. In this embodiment, a user interface 15 may be placed on or near the top surface of the housing 60, and allows the user to input various types of identifying information, such as biometrics (finger print, retina scan, hand print, etc.) or a key card (magnetic strip, RFID, etc.) for gaining access to the cart generally. As will be described below, access to particular drawers 101 or even specific bins 150 within a drawer may still be restricted, even after general access to the cart has been given. The sleeves 180 preferably have a rectangular cross-section and may completely cover the top, sides, and bottom of the delivery module 110.

[0016] FIGURE 2 is a perspective view of an exemplary embodiment for inserting and removing the delivery module 110 from the drawers 101 within the sleeves 180. As shown, the drawer 101 may be translated out of the sleeve 180 until the rear wall of the drawer 101 is nearly outside of the sleeve 180. The delivery module 110 can then be lowered vertically into the drawer 101, until the locking mechanism 200 is engaged to lock the delivery module 110 within the drawer 101. One or more springs 260 may be placed on the bottom surface of the drawer 101, where the spring 260 could be any type of compression spring, leaf spring, or other type of spring that would simply bias the delivery module 110 upwardly and away from the bottom of the drawer 101. One or more posts 250 also preferably extend from the bottom surface of the drawer 101.

[0017] As described further below, the posts 250 should be sized and positioned to engage with the locking mechanism 200 to secure the delivery module 110 within the drawer 101. In an exemplary embodiment, a front facia 100 may be positioned outside of the drawer 101 and on the front surface of the drawer 101, where the facia 100 has a surface area that is larger than the surface area of the front surface of the drawer 101, and where the facia 100 is sized to fit within the sleeve 180.

[0018] FIGURE 3 is a bottom perspective view of the embodiment of the delivery module 110 shown in Figure 2. A plurality of short pillars 115 may extend from the bottom surface 109 of the delivery module 110. Aligned generally with the bottom surface 109 is an optional bottom plate 255, which covers the locking mechanism 200, which preferably comprises a lock 270 which rotates about a pivot point 272, which is preferably near the center of the lock 270. The lock 270 can take on many forms, but is preferably elongate with a pair of apertures on the opposing ends of the lock 270 which engage with the posts 250 in the drawer 101. One or more holes 251 may be positioned to align with each post 250 and accept the post 250 into the delivery module 110, or if the bottom plate 255 is used the holes 251 would be placed within the plate 255 to allow each post 250 to pass through the plate 255.

[0019] FIGURE 4 is a top perspective view of the embodiment shown in Figure 2. To install the delivery module 110 within the drawer 101, the posts 250 are aligned with the holes 251 on the bottom of the delivery module 110 as it is lowered into the drawer 101. A notch 105 is preferably located at the front of the drawer 101, and generally comprises a rectangular section of material that is removed from the front wall of the drawer 101. When using the front facia 100, a corresponding rectangular section of material is also preferably removed from the facia 100. In this way, the protrusion 125 is permitted to extend out of the front wall of the drawer 101 and the facia 100 (if used). Another piece of material is preferably removed from the rear wall of the drawer 101 to create the rear wall aperture 102, which is preferably aligned with the wireless power receiver 500.

[0020] FIGURE 5 is a top perspective view of an exemplary embodiment of the delivery module 110. On the rear portion of the delivery module 110 may be a wireless power receiver 500 along with a wireless data transmitter/receiver 550. Both the wireless power receiver 500 and the wireless data transmitter/receiver 550 are preferably in electrical connection with the PCB 300. The protrusion 125 preferably contains an electronic display 126 which could be any flat panel display including but not limited to: LCD, OLED, or any form of luminescent polymers. The protrusion 125 preferably begins near the top of the delivery module 110 and extends downwardly until near the midpoint of the vertical height of the delivery module 110. The protrusion 125 is preferably placed near the horizontal midpoint of the delivery module 110.

[0021] FIGURE 6 is a front elevation view of the embodiment of the delivery module 110 shown in Figure 5 where the section line A-A has been indicated. Again it is noted that an exemplary embodiment includes a plurality of short pillars 115 which raise the bottom surface 109 of the delivery module 110 off the bottom surface of the drawer 101. The bottom plate 255 is preferably aligned horizontally with the bottom surface 109. It should be noted that in some embodiments, the bottom plate 255 may not be used, and instead the bottom surface

109 would simply be extended and would provide the structure in this area, such that the lock 272 and spring 295 would simply be attached to the bottom of the delivery module 110. In this type of embodiment, rather than referring to the plate 255 it would be more appropriate to refer to the bottom wall instead, which could reference both use of a plate as well as simply extending the bottom surface 109 of the delivery module 110.

[0022] FIGURE 7 is a side section view, taken along section line A-A and indicating the location of Detail A. A printed circuit board 300 (PCB) is preferably positioned under the bins 150 and generally has at least a portion of the PCB 300 underneath each bin 150. The PCB 300 includes a number of different components and circuits, which can vary depending on the particular embodiment. Generally speaking, the PCB 300 would at least include a processor and electronic data storage. Each bin 150 should contain its own electromechanical actuator 400, which is used to lock each bin 150 individually. The actuator 400 may be an SMA wire actuator or motor and is preferably placed in between adjacent bins 150 and is not underneath the bin 150, but this is not required. An illuminating device 350 may be placed underneath each bin 150 or incorporated into the bottom of each bin 150. The illuminating device 350 is preferably one or more light emitting diodes (LEDs), ideally a grouping that includes a red, a green, and a blue LED, but can also be an electroluminescent polymer. The actuator 400 and illuminating device 350 of each bin 150 is preferably in electrical connection with the PCB 300, which is in turn in electrical connection with the wireless data transmitter/receiver 550.

[0023] FIGURE 8 is a detailed section view of Detail A. An exemplary protrusion 125 may contain a sidewall portion 127 which begins at the top of the front face of the delivery module 110 and then extends horizontally and away from the delivery module 110. The sidewall portion 127 then contains an arc or radius such that the sidewall portion 127 turns downwardly until travelling substantially vertically until reaching the distal end, which is preferably near the midpoint of the vertical height of the delivery module 110. This exemplary protrusion 125 also preferably contains an opening or hollow portion 128 which is defined by the space below the sidewall portion 127 and between the sidewall portion 127 and the front face of the delivery module 110.

[0024] Another illuminating device 131 may be placed within the front wall of the delivery module 110, so that it can illuminate the opening 128. In the embodiment shown, the illuminating device 131 is positioned behind a portion of the sidewall 127 which, in this embodiment, also runs parallel to the front wall of the delivery module 110. In this situation, it is preferable that the sidewall 127 either contains a physical opening to allow the light to pass through the sidewall 127. Alternatively, the sidewall 127 can be constructed with a translucent, semi-translucent, or transparent material that would allow the light to pass through the sidewall 127. The illuminating device

131 is preferably one or more light emitting diodes (LEDs), ideally a grouping that includes a red, a green, and a blue LED, but can also be an electroluminescent polymer. The illuminating device 131 and the display 126 are preferably in electrical connection with the PCB 300. In some embodiments, where the sidewall portion 127 has adequate strength, a user can utilize the opening 128 in combination with the sidewall portion 127 as a handle for transporting the delivery module 110. In this way, the opening 128 is sized to accept a portion of several fingers of the user, in order to obtain adequate grip of the sidewall portion 127.

[0025] FIGURE 9 is a detailed section view of Detail B. The bottom plate 255 is generally co-planar with the bottom surface 109 and in this embodiment the bottom plate 255 has a generally U-shaped cross-section, sized to fit within a rectangular opening in the bottom surface 109. The hole 251 in this embodiment is found within the plate 255, which permits the post 250 to pass through the plate 255 and engage with the lock 270.

[0026] FIGURE 10 is a front elevation view of the embodiment of the delivery module shown in Figure 5 where the section line B-B has been indicated.

[0027] FIGURE 11 is a top section view, taken along section line B-B. One or more batteries 169 are preferably placed along one or more sides of the delivery module 110. In an exemplary embodiment, the batteries 169 are not placed along the front or rear portions of the delivery module 110. Also in an exemplary embodiment, the battery 169 is positioned between a row of bins 150 and the interior surface of the delivery module 110. The batteries 169 are preferably in electrical connection with the PCB 300, which includes a charging circuit that is in electrical connection with the wireless power receiver 500.

[0028] FIGURE 12 is a top perspective view of the embodiment of the delivery module shown in Figure 5 where the delivery module has had several bin removed and where the location for Detail C has been indicated. The PCB 300 is preferably underneath each bin 150, and could be a single structure or could be multiple separate PCBs.

[0029] FIGURE 13 is a detailed view of Detail C. The electromechanical actuator 400 preferably contains a connector 360 which connects with the PCB 300. The illuminating device 350 is preferably mounted atop, and in electrical connection with the PCB 300. Each bin 150 preferably contains a lock 402 which is biased with a spring 401 to be in the locked condition, and requires an electrical actuation in order to be opened. Thus, to lock the bin 150 once it has been opened, the lid 151 is preferably rotated about the hinge 155 until the lock 402 is engaged and the bin 150 is closed and locked, without requiring any electrical actuation. In this way, it can be described as having been mechanically locked, and not electrically locked. Other embodiments may provide for electrically locking the bin 150, but for the exemplary embodiments this would be done mechanically. Further, the locked state can remain, even when power is lost.

[0030] FIGURE 14 is a top perspective view of the embodiment of the delivery module shown in Figure 5 where each bin 150 (except for one) has been removed along with the printed circuit board 300. The lock 270 is preferably pivotally attached to the bottom plate 255 at the pivot point 272. A linkage 280 may be used to connect the lock 270 with an electromechanical actuator 290, which can be an SMA wire actuator or motor. The linkage 280 preferably connects to the lock 270 about halfway in between the pivot point 272 and the aperture 275. A spring 295 may be used to bias the lock 270 in the closed position, so that when the module is pressed downwardly into the drawer, the lock 270 engages mechanically, without requiring any electrical input. In this way, it could be referred to as having been mechanically locked, and not electrically locked. Further, the locked state can remain, even when power is lost.

[0031] In this embodiment, a tension spring is attached at one end to the plate 255 and at a second end to the lock 270. It is preferable that the distance from the spring 295 attachment point to the pivot point 272 is substantially the same as the distance from the linkage 280 attachment point to the pivot point 272. In other words, the attachment points for the spring 295 and linkage 280 should be symmetrical about the pivot point 272, although this is not required.

[0032] As noted above, the lock 270 preferably contains one or more apertures 275 for accepting a post 250. Here, there are apertures 275 placed on both opposing ends of an elongate lock 270. The apertures 275 are preferably placed above the holes 251 in the plate 255.

[0033] From the view of this embodiment, the delivery module 110 could generally be described as having a floor and four sidewalls which define a tray 600, which accepts a plurality of individually lockable bins 150. Preferably, when each bin 150 is closed, it does not extend above the sidewalls 650 of the tray 600. Each bin 150 preferably contains a lid 151 with a hinge 155 that is located on the rear edge of the bin 150 (i.e. opposite the front edge of the delivery module 110 which contains the protrusion 125).

[0034] FIGURE 15 is a partial section view of an exemplary embodiment of the delivery module when locked within the drawer 101 and where the location for Detail D has been indicated.

[0035] FIGURE 16 is a detailed view of Detail D. The post 250 extends from the bottom of the drawer 101 with a shaft 251 having a diameter D1. At the top of the shaft 251 there is preferably a shoulder, as shaft 252 extends upwardly from shaft 251 and has a diameter D2, where it is preferred that $D2 < D1$. A tip 253 is preferably attached to the top of shaft 252 and is preferably conical with a base having diameter D3, where it is preferred that $D3 > D2$. In some embodiments, D1 is substantially equal to D3. When the lock 270 is engaged with the post 250, both the lock 270 as well as the bottom plate 255 should preferably surround at least a portion of the shaft 252. In other words, the bottom plate 255 and the lock 270 should

be between shaft 251 and the tip 253. A gap is preferably defined between the bottom surface 109 of the delivery module and the bottom of the drawer 101, where the gap is generally defined by the height of the short pillars 115.

[0036] FIGURE 17 is a rear partial section view of an exemplary embodiment of a bin 150 where the bin has been locked and where the location for Detail E has been indicated. The lock 402 is preferably pivotally attached to the bin 150 at the pivot point 460. The lock 402 is also preferably pivotally attached to the actuator 400 at the pivot point 465. An actuator spring 450 may be attached at a first end to the bin 150 or a piece that is fixed relative to the bin, and attached at a second end to the pivot point 465. In this way, the spring 450 is positioned to bias the lock 402 in a closed position. A lock spring 401 is preferably attached at a first end to the lock 402 and at a second end to the bin 150 or a piece that is fixed relative to the bin 150. In this way, the spring 401 is also preferably positioned to bias the lock 402 in a closed position. Although not required, both springs 450 and 401 are preferably extension springs. Also preferably by not required, springs 450 and 401 are positioned on opposite sides of the lock 402.

[0037] FIGURE 18 is detailed view of Detail E. A hook 420 is preferably located at the top of the lock 402 and preferably contains a rounded tip 421 which is formed at the end of a narrow body. The narrow body preferably fits within a slot 152 in the lid 151. The lid 151 preferably contains an open space 153 which is adjacent to the slot 152 and preferably has a larger cross-sectional area than the slot 152. As shown, when the lock 402 is fully engaged, the narrow body of the hook 420 is inserted into the slot 152 as far as possible, preferably until the rounded tip 421 contacts the deepest point in the slot 152 which may be the same point at which the two opposing rounds of the lid 151 and hook 420 are contacting.

[0038] FIGURE 19 is a rear partial section view of the bin embodiment shown in Figure 17 where the bin 150 has been opened and where the location for Detail F has been shown. When the bin 150 is opened, each of the springs 401 and 450 may be stretched due to the movement of the actuator 400.

[0039] FIGURE 20 is a detailed view of Detail F. When the bin 150 is unlocked, the lock 402 may rotate so that the hook 420 moves away from the slot 152 and into the open space 153. In this way, the hook 420 is disengaged from the lid 151 so that it can open. When open, a top portion of the hook 420 may be in contact with or close to contact with the top portion of the open space 153. As the lid 151 is closed, the top portion of the open space 153 should contact the top portion of the hook 420, in order to guide the hook 420 into the slot 152 in order to re-lock the bin 150. In an exemplary embodiment, the rounded tip 421 of the hook 420 may contact a portion of the open space 153 or the opening of the slot 152 in order to further guide the tip 421 into the slot 152 and thus ensure that the hook 420 becomes engaged within the slot 152.

[0040] FIGURE 21 is an electrical block diagram of an exemplary embodiment of the medical cart.

[0041] The delivery module 110 includes a PCB 300 which preferably has both a processor and electronic storage. A number of different types of data can be stored on this electronic storage, including but not limited to: destination for the module 110, date/time for the last time the module 110 was opened and which bin 150 was accessed, battery 169 levels, and identifying information data for the module 110 (serial number, model number, customer number, etc.). Any of this data can be stored on the display module 110 and displayed on the display 126, before/after/during delivery or transportation and because of the geometry of the protrusion and drawer, can even display to a user when the module 110 is closed within a drawer. Any of this data can also be transmitted to the processor either on the computer 10 or the cart electronics 25 either once the module 110 has been installed within the drawer and electrical communication between the wireless data transmitter/receivers 550 and 551 is established. Any of this data can also be transmitted to the processor either on the computer 10 or the cart electronics 25 either once the module 110 has been installed within the drawer and electrical communication between the wireless data transmitter/receivers 550 and 551 is established or through the internet/network connection with the computer 10, which can be a wired or wireless connection. Thus, the cart can receive the data for the module 110 through the internet/network connection prior to the module 110 actually being installed within the cart. In this way, the cart knows the modules 110 that are intended for install and when the cart recognized that a module 110 is not intended for the cart and (1) an error message can be displayed and/or (2) the lock 270 can be electronically unlocked when the data for the module 110 does not match the data for a module 110 that is intended for the cart.

[0042] FIGURES 22-25 are logical flowcharts for performing a method of controlling access to medications. In Figure 22, the mechanical lock 402 on the bins 150 should preferably engage automatically by the system once the lid 151 has been lowered adequately. As described above, the spring(s) are preferably biased to maintain a locked orientation, such that even if the battery 169 were to lose power, the bin 150 would remain locked.

[0043] Regarding Figure 24, as noted above there is a number of different types of data regarding the module and its contents which can be transmitted to the cart, either through the module 110 itself or through the network/internet connection on the cart. When medications are placed within a bin 150, the medication data (optionally including the patient for whom the medication is intended) can be stored, preferably including the module 110 and bin 150 containing the medication. This can be stored on a server or computer and accessed by the system through the network/internet connection on the computer 10. When a user accesses the cart, specific medications stored in a module 110 may be searched for, or

specific patients may be searched for, in order to find their corresponding medications. All of this data can be input, searched, and/or accessed through the electronic storage and processors outlined above with a user interface that can be accessed from computer 10 and various input means described above. Once the bin 150 and/or module 110 containing the requested medication has been located, the bin 150 or the module 110 can optionally be illuminated as described above. When there is waste medication, either already removed and was not administered or medication that was never removed, the data stored can be updated to indicate the waste medication and the module 110 and bin 150 that now contain the waste medication. Any module 110 containing waste (i.e. waste module) can then have each bin 150 locked before being transported to a medication waste location, which can either be returned to the original pharmacy or distribution center or can be taken to a waste-specific location that is not necessarily the origin of the medications.

[0044] It is respectfully noted that although power to the delivery module is preferably shown as wireless power 500/501, this is not required, as any person of ordinary skill could also use connectors which would establish an electrical connection when the delivery module is installed within the drawer. Similarly, although electronic data transmission to and from the delivery module is shown as wireless data 550/551, this is not required, as connectors could be used for this as well.

[0045] It should be noted that the bins 150 can be used to store and transport any item that requires some type of security. Generally, this would include medications and medical supplies (such as instruments, devices, etc.) but could also apply to any item having value, either from being rare or from a high price point for purchase. Thus, although described as a "medical cart" herein, the structure and teachings can be used for any other small items that require tracking and secure transport.

[0046] FIGURE 26 through FIGURE 31 illustrate another exemplary embodiment of the bins 150. Each bin 150 may be defined by a series of walls 399. The walls 399 may include four sidewalls 399 and a bottom wall 399 such that each bin 150 is substantially rectangular in shape, however, any number of walls 399 in to form any shape or size bin 150 is contemplated. The top of the bin 150 may be open, thus rendering the contents located therein accessible, when not covered by the lid 151. All of the bins 150, whether located in a delivery module 110 or otherwise, may be of the same size, shape, and positioned in the same orientation or may be of different sizes, shapes, and be positioned in different orientations. In exemplary embodiments, the side walls 399 may be tapered such that a gap is formed between adjacent bins 150 and between the bins 150 and the side-wall of the delivery module 110.

[0047] In this exemplary embodiment, the lock 402 (also referred to herein as the "lock plate") is located on the front wall 399 of the bin 150. The corresponding slot 152

may be located on the bottom surface of the front portion of the lid 151 or on the front surface of the lid 151 such that the latch 420 may selectively engage the slot 152. The lock 402 may be mounted to the front wall 399 in a rotatable fashion such that the lock 402 may rotate about the pivot point 460. The lock 402 may be rotated between a locked position where the latch 420 engages the slot 152 and an unlocked position whereby the latch 420 is located wholly outside of the slot 152.

[0048] When the lock 402 is in the locked position, the lid 151 may be secured in a closed position. When the lock 402 is in the unlocked position, the lid 151 may be free to move into the opened position. The lid 151 may be biased in the opened or shut position, though such is not required. The pivot point 460 may be located at substantially the midpoint of the lock 402, though any location is contemplated. In exemplary embodiments, the portion of the lock 402 extending above the pivot point 260 may comprise the latch 420 having the rounded tip 421 which interacts with the slot 152, though any shape latch 420 and corresponding slot 152 is contemplated.

[0049] The actuator 400 may be configured for horizontal movement which causes the lock 402 to rotate about the pivot point 460. More specifically, the portion of the lock 402 extending below the pivot point 460 may be configured to interact with or be secured to the actuator 400 at the pivot point 465. In this way, the horizontal movement of the actuator 400 may be translated to rotation of the lock 402, thus moving the lock 402 between a locked and an unlocked position. In exemplary embodiments, the actuator 400 may be biased by the actuator spring 450 in a direction that corresponds with the lock 402 in the locked position, though the lock 402 may move independently of the actuator 400, and may only move the lock 402 into the unlocked position when the actuator 400 is powered.

[0050] A tail 451 may extend from the portion of the lock 402 located below the pivot point 460, though it is contemplated that the tail 451 may extend from any portion of the lock 402. In exemplary embodiments, the tail 451 is comprised of a resiliently deformable material, such as but not limited to plastic, such that the tail 451 may act as a spring. A post 452 may be located on the sidewall 399 of the bin 150 to prevent the tail 451 from extending therebeyond. The tail 451 may be integrally formed with, adhered, or fastened to the lock 402.

[0051] When the lock 402 is located in the locked position, the tail 451 may be rotated upward such that it rests against, or is deflected when contacting, the post 452. In this way, the tail 451 may provide springing forces for moving the lock 402 into the unlocked position. Stated another way, the tail 451 may be configured to bias the lock 402 in the unlocked position. However, it is contemplated that the tail 451 and the post 452 may be located and configured to bias the lock 402 in the locked position. In such exemplary embodiments, the tail 451 may instead be located above the post 452, such that the tail 451 is deflected when the lock 402 is rotated into the unlocked

position.

[0052] For example, but not to serve as a limitation, the actuator 400 may be biased by the actuator spring 450 in a direction that corresponds with the lock 402 being located in the locked position. However, the actuator 400 may be periodically powered to move the actuator 400 such that the lock 402 rotated into the unlocked position. When the actuator 400 is no longer powered, the actuator spring 450 may horizontally translate the actuator 400 to its original position, thereby returning the lock 402 to the locked position. When the actuator 400 is powered and moved such that the lock 402 is placed in the unlocked position, the tail 451 may be rotated with the lock 402 such that the tail 451 contacts the post 452 and likewise biases the lock 402 in the locked position.

[0053] A first sensor 453 may be positioned and configured to detect the location of the lid 151, such as but not limited to, whether the lid 151 is in the open or the closed position. For example, without limitation, the first sensor 453 may be positioned to detect the presence or non-presence of the portion of the lid 151 forming the slot 152 in a location that would require the lid 151 be in a closed position. In this way, activation of the first sensor 453 may determine that the lid 151 is shut. Likewise, non-activation of the first sensor 453 may determine that the lid 151 is open.

[0054] A second sensor 454 may be positioned and configured to detect the location of the lock 402, such as but not limited to, whether the lock 402 is in the locked or unlocked position. In exemplary embodiments, an arm 455 may extend from the lock 402 such that the arm 455 is rotated or moved with the lock 402. The arm 455 may extend from the portion of the lock 402 located adjacent to the pivot point 460, though any location is contemplated. For example, without limitation, the second sensor 454 may be located to detect the presence or non-presence of the arm 455 or other portion of the lock 402 in a location that would require the lock 402 be in the locked position. In this way, activation of the second sensor 454 may determine that the lock 402 is locked. Likewise, non-activation of the second sensor 454 may determine that the lock 402 is unlocked.

[0055] The first sensor 453 and the second sensor 454 may be in electrical connection with a printed circuit board (PCB) 301. The PCB 301 may be located on the front wall 399 of the bin 150, though any location is contemplated. The PCB 301 may also be in electrical communication with the actuator 400. The PCB 301 may further be in communication with an illumination element 350 located on the PCB 301 or located on or adjacent to the bottom wall of the bin 150, though any location is contemplated. The illumination element 350 may be a light emitting diode (LED), luminescent polymer, or the like. The lid 151 may be transparent or translucent, so that the luminance from the illumination element 350 may be visible through the lid 151 without having to open the bin 150.

[0056] In exemplary embodiments, the lock 402 and

related components are configured to be located in the gap between adjacent bins 150 and the gap between the bins 150 and the delivery module 110. Such related components may include, but are not limited to: the actuator 400, the pivot point 465, the actuator spring 450, the tail 451, the post 452, the pivot point 460, the latch 420 and rounded tip 421, the first sensor 453, and the second sensor 454.

[0057] Having shown and described a preferred embodiment of the invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention and still be within the scope of the claimed invention. Additionally, many of the elements indicated above may be altered or replaced by different elements which will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

Claims

1. An apparatus for transporting, storing, dispensing, or returning drugs and medical supplies comprising:

a plurality of individually lockable bins, wherein each of said bins is substantially rectangular in shape and comprises:

four side walls,
a bottom wall, and
a lid forming a slot located on a front portion thereof, wherein said lid is hingedly mounted to one of the side walls such that that the lid may be selectively moved between an opened position and closed position;

a plurality of locking mechanisms, each associated with one of said plurality of individually lockable bins and comprising:

a lock plate wherein said lock plate is pivotably mounted to the front wall of the lockable bin at a pivot point and has an upper portion located above said pivot point and a lower portion located below said pivot point,
a latch located on the upper portion of said lock plate, wherein said lock plate is configured to be selectively rotated about said pivot point between a locked position, whereby the latch engages said slot, and an unlocked position, whereby the latch is located wholly outside of said slot,

an actuator configured for horizontal movement so as to contact the lower portion of the lock plate, thereby rotating the lock plate between the locked

position and the unlocked positions,
a post located on the front wall of the bin, and

a tail extending from lower portion of the lock plate and configured to deflect when contacting the post so as to bias the lock plate in the unlocked position; and
a delivery module configured to receive said plurality of lockable bins.

2. The apparatus of claim 1 wherein:

at least one of said four side walls of each bin is tapered so as to form a gap between adjacent bins;
and the locking mechanism of each respective bin is located in the respective gap.

3. The apparatus of any of claims 1-2 wherein: the pivot point is located at substantially the midpoint of the lock plate.

4. The apparatus of any of claims 1-3 further comprising:
an actuator spring configured to bias the actuator in the direction that places the lock plate in the locked position.

5. The apparatus of any of claims 1-4 wherein: the slot is located on the bottom surface of the lid.

6. The apparatus of any of claims 1-5 further comprising:
a printed circuit board (PCB) located on the side wall the lockable bin having the lock plate mounted thereto.

7. The apparatus of claim 6 further comprising:
a first sensor electrically connected to said PCB and positioned to detect whether the lid is in the opened position or the closed position.

8. The apparatus of claim 7 wherein:
said first sensor is positioned to contact the portion of the lid forming said slot.

9. The apparatus of any of claims 6-8 further comprising:
a second sensor electrically connected to said PCB and positioned to detect whether the lock plate is in the locked or unlocked position.

10. The apparatus of claim 9 further comprising:
an arm extending from said lock plate, wherein said second sensor is positioned to contact said arm.

11. The apparatus of any of claims 6-10 further comprising:

ing:

an illumination device in electrical connection with the PCB.

12. The apparatus of claim 11 wherein:
said illumination element is located adjacent to the
bottom wall of said bin; and said lid is comprised of
a translucent or transparent material such that the
illumination element is viewable through the lid. 5 10
13. The apparatus of any of claims 1-12 further comprising:
a second pivot point located on said actuator, wherein
said second pivot point is configured to interact
with the lower portion of the lock plate. 15
14. The apparatus of any of claims 1-13 further comprising:
a drawer configured to accommodate said delivery
module; and a portable cart configured to accommodate
said drawer. 20
15. The apparatus of any of claims 1-14 wherein:
said plurality of bins are all oriented in the same direction. 25

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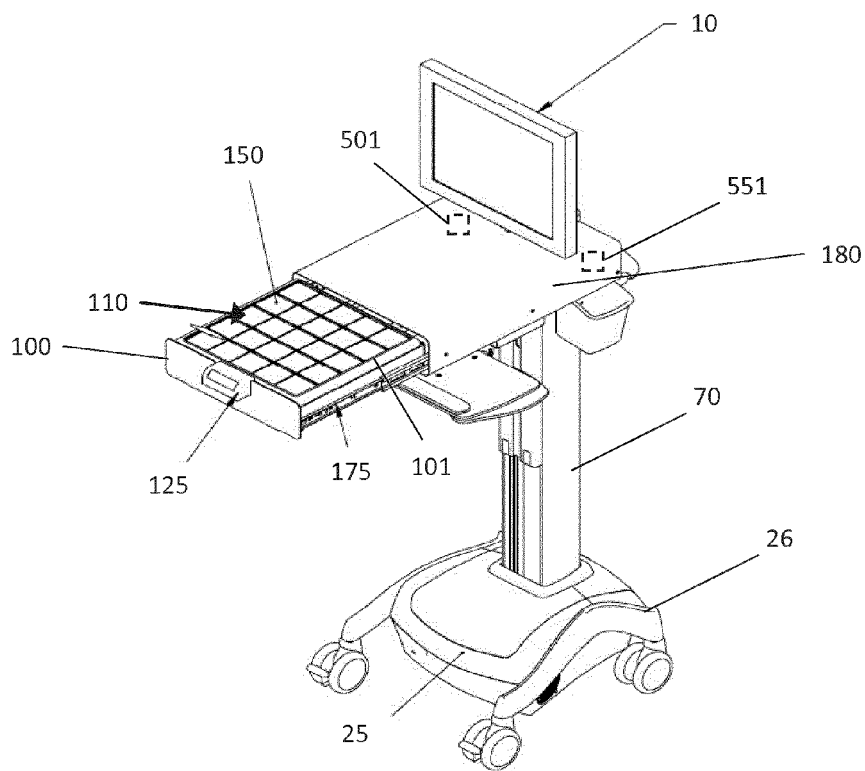


FIG - 1A

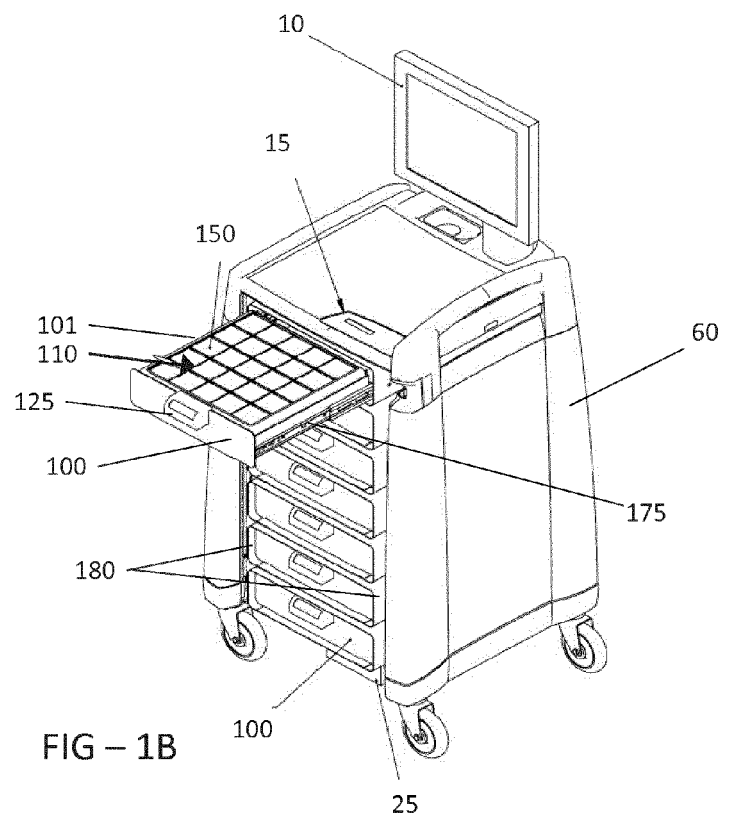
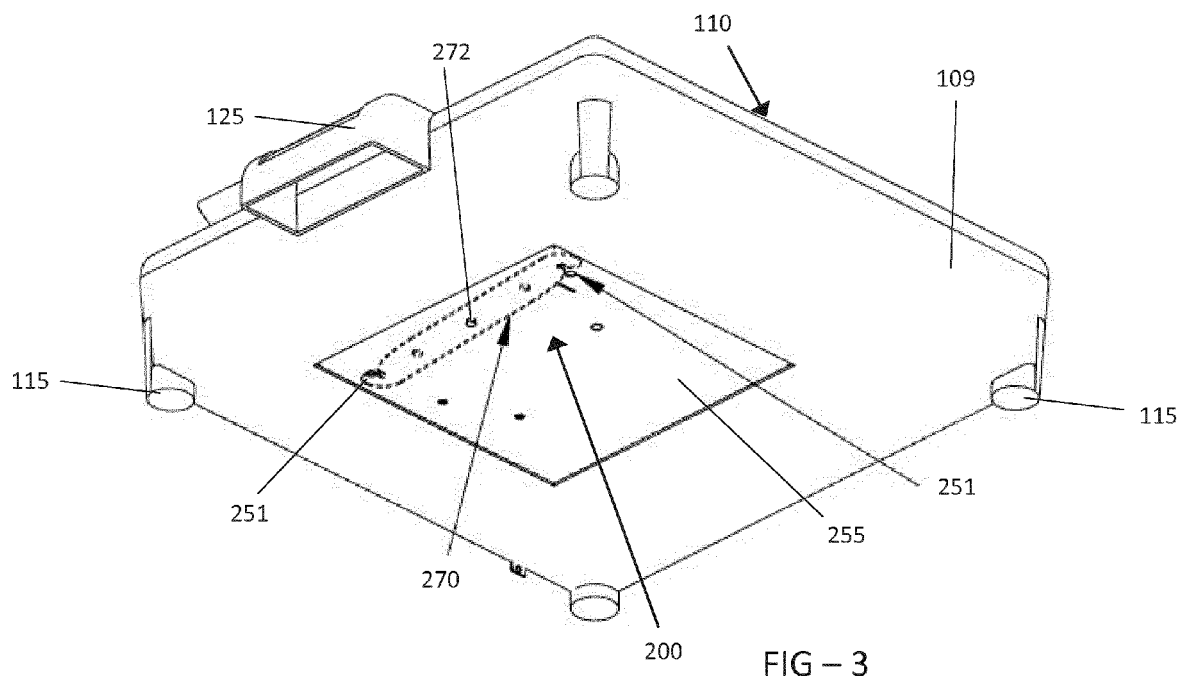
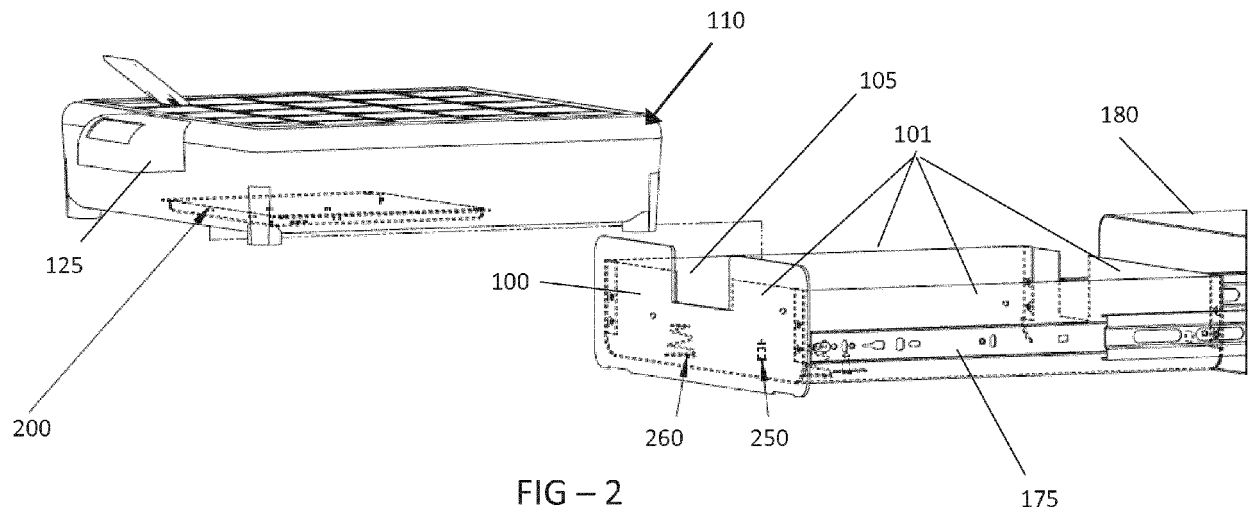


FIG - 1B



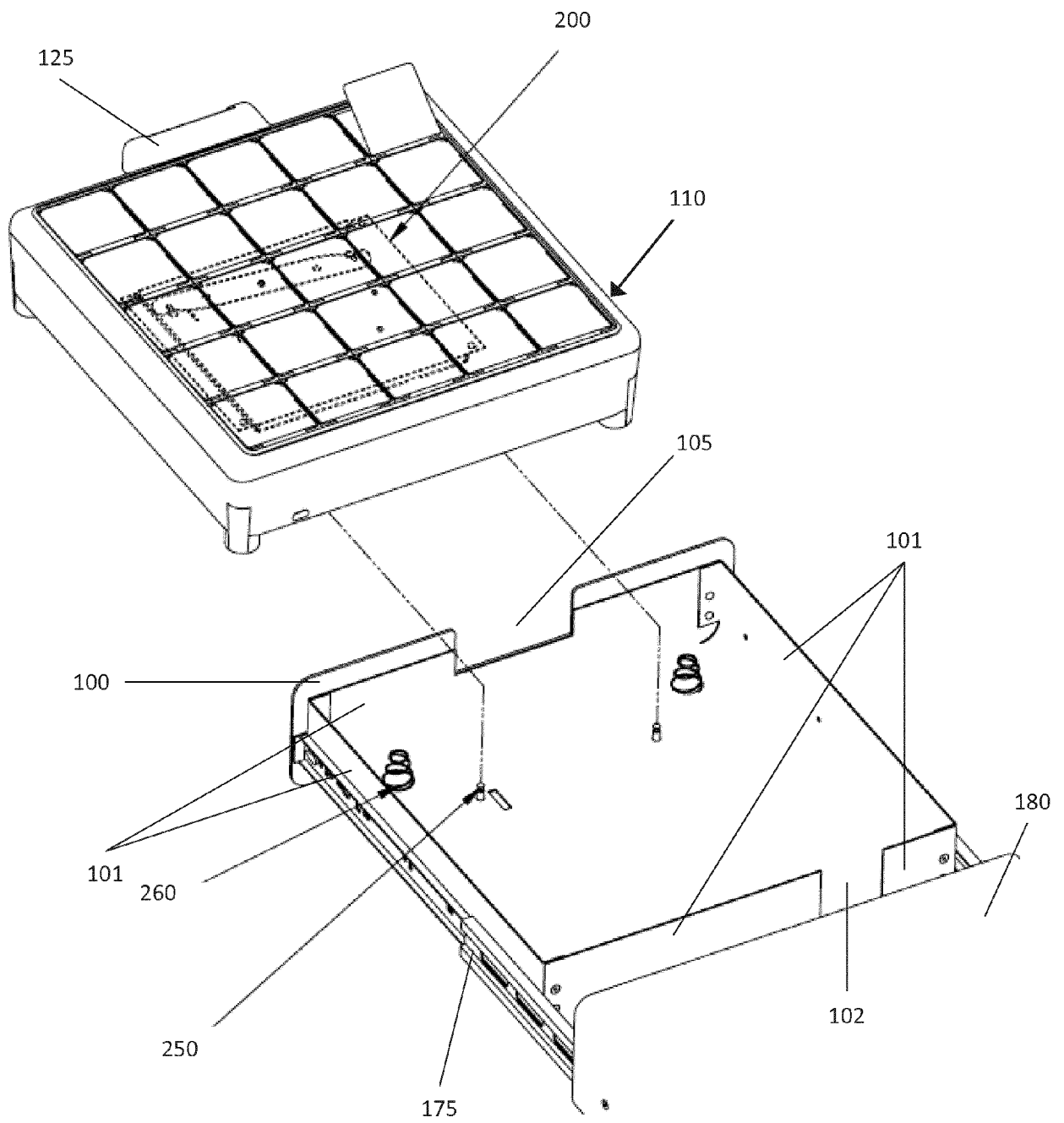
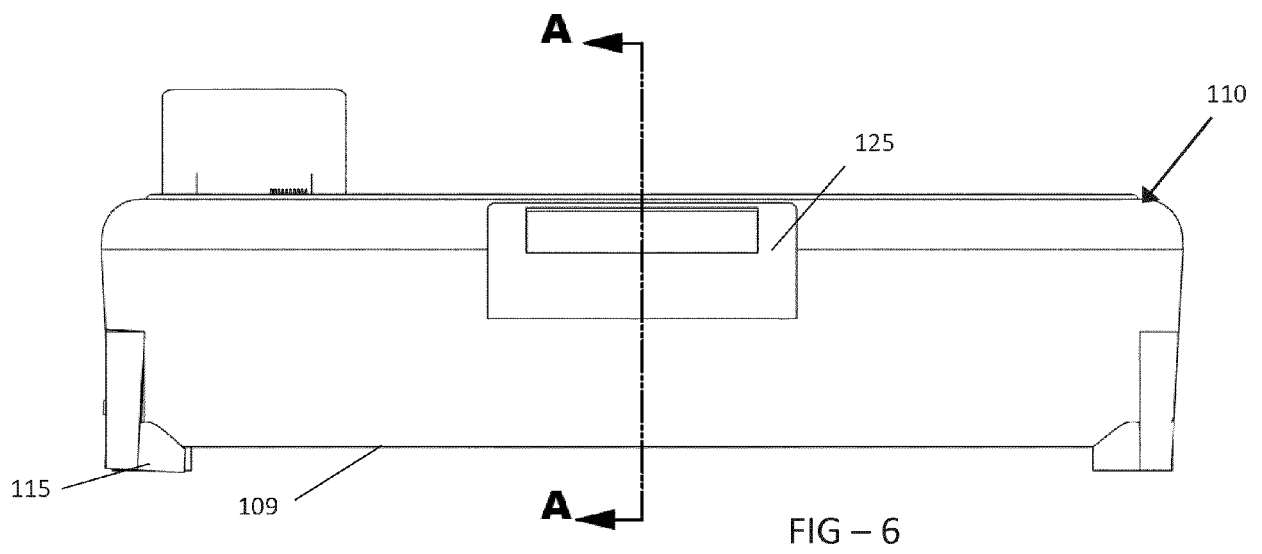
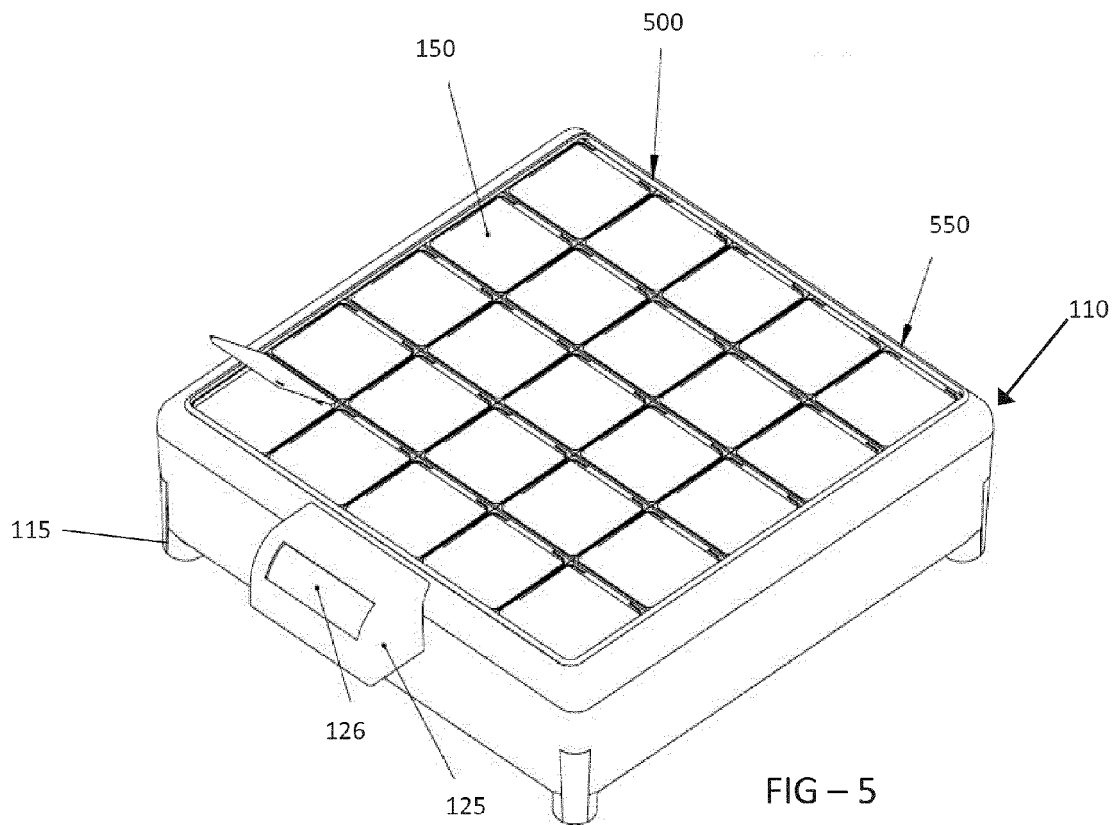


FIG - 4



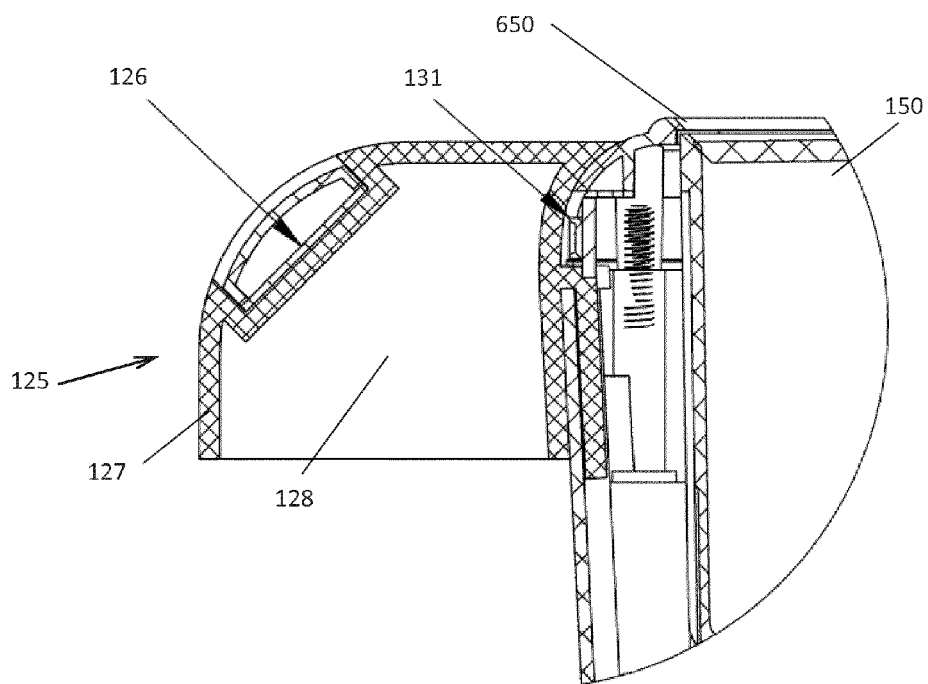
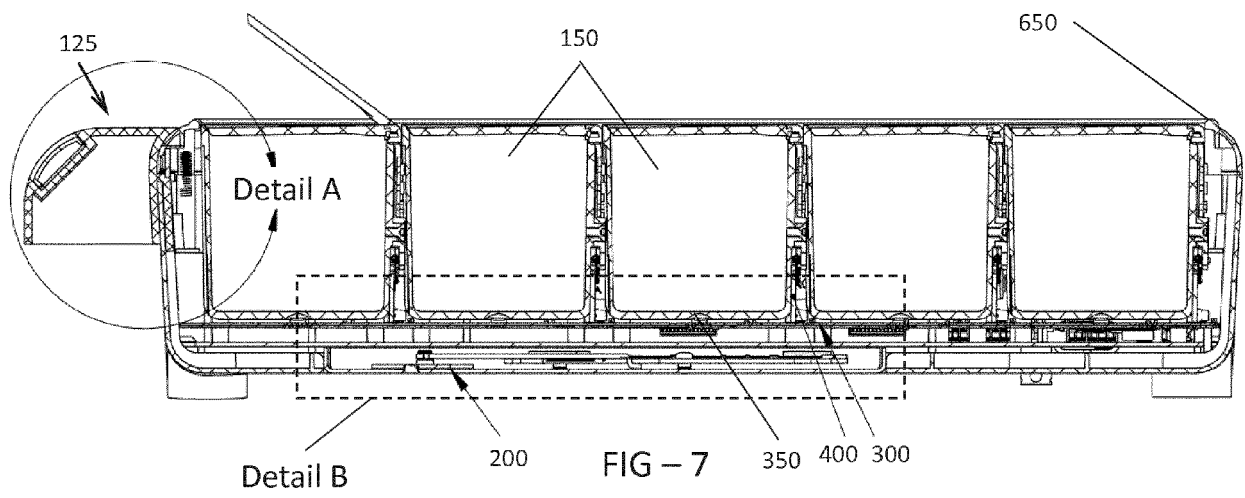


FIG - 8

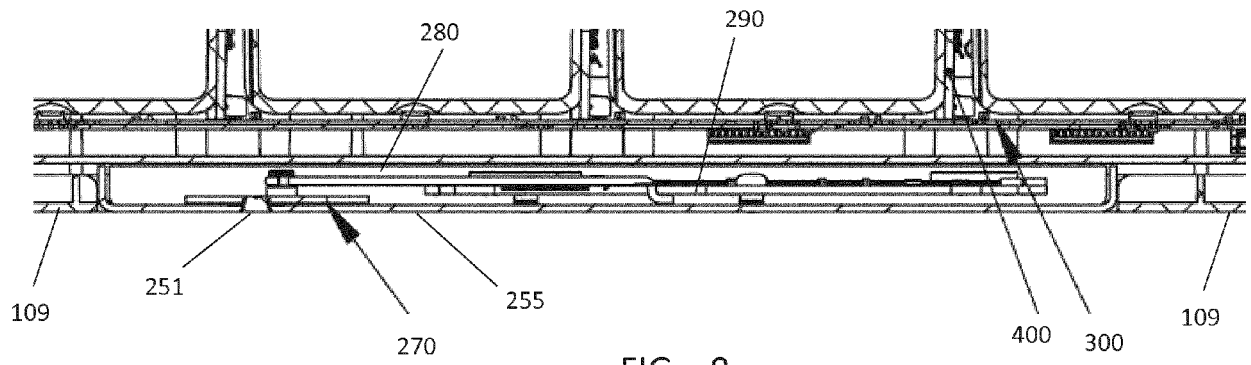


FIG - 9

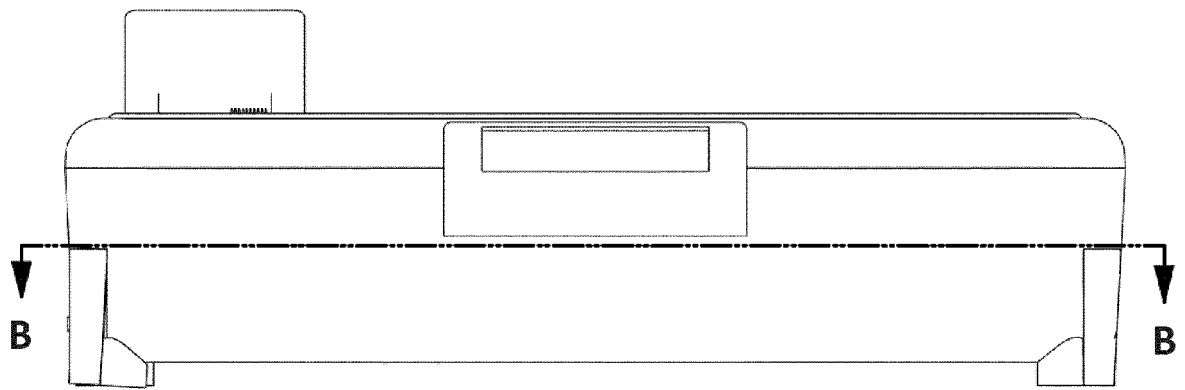


FIG - 10

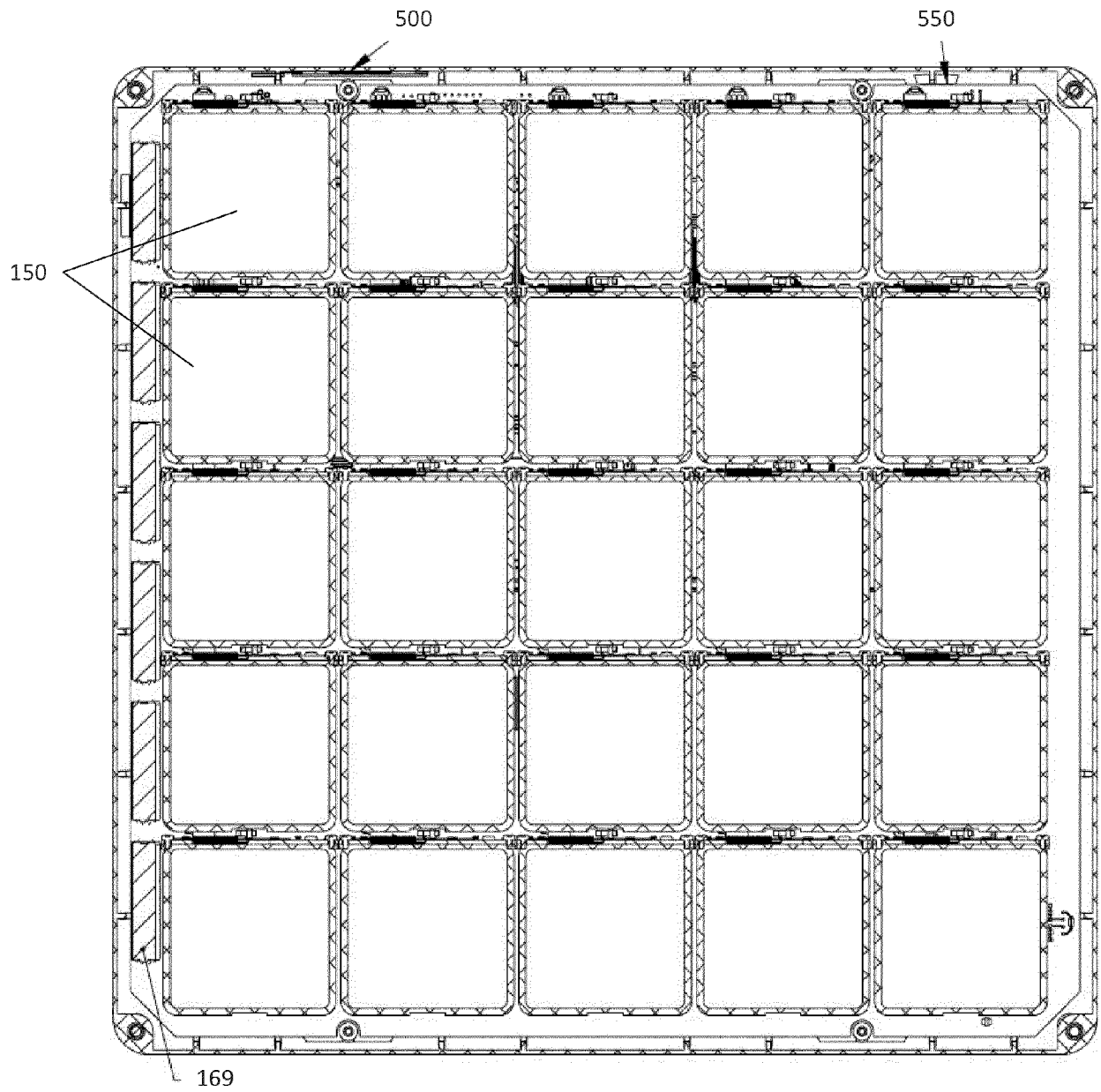
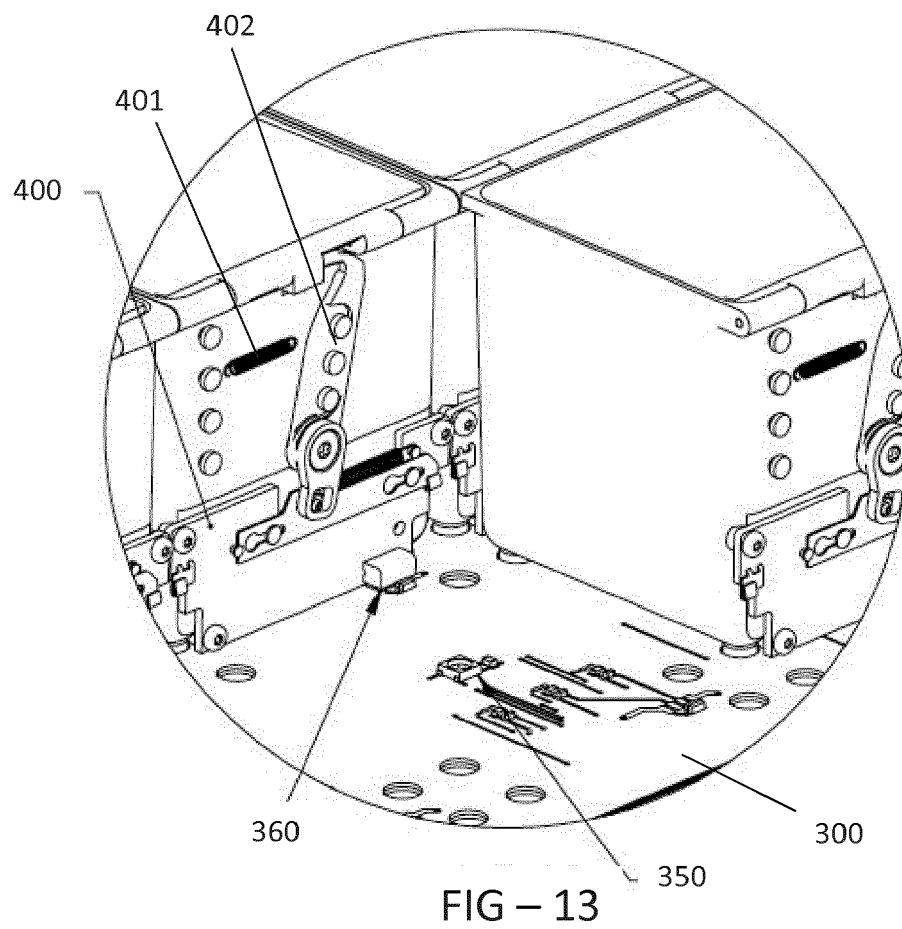
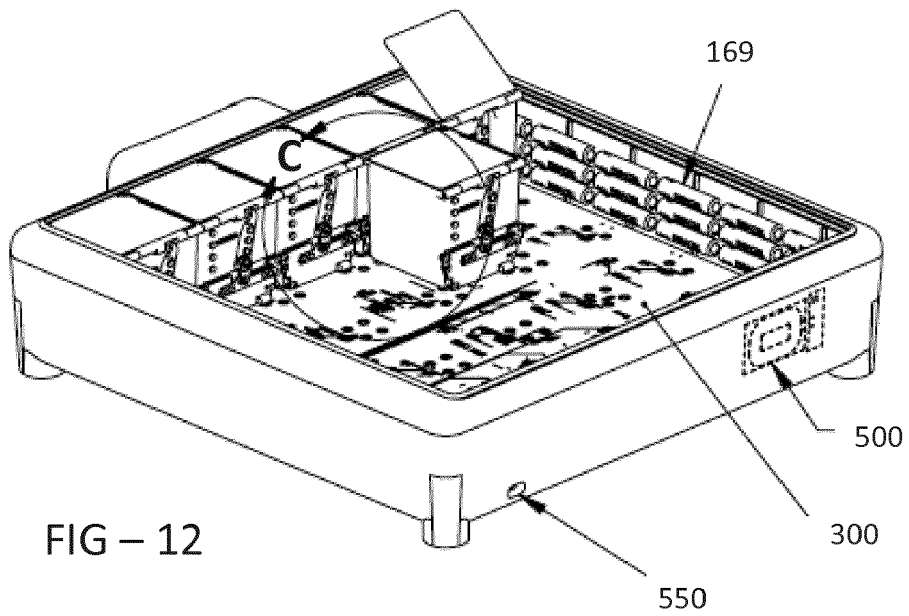


FIG – 11



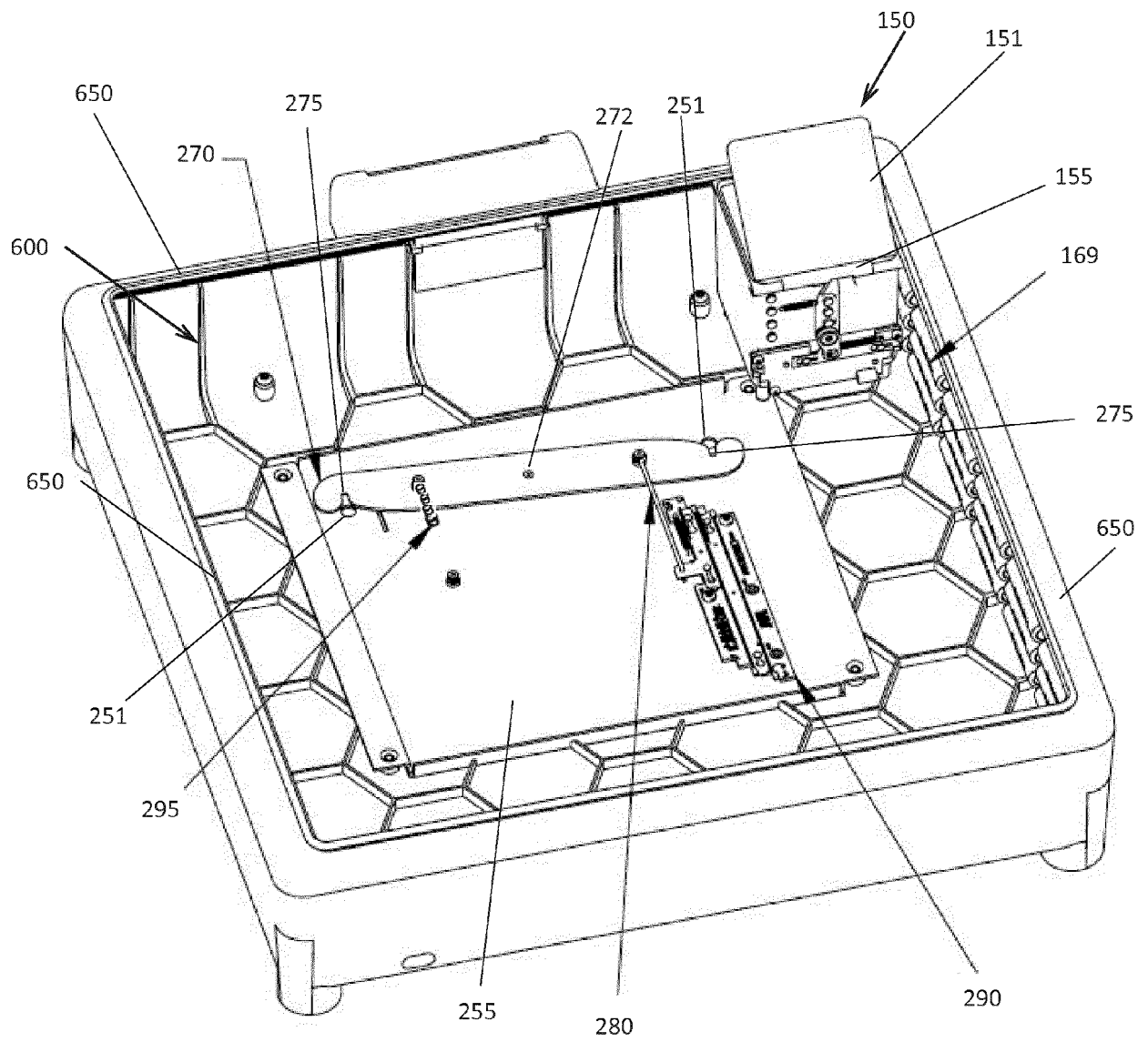
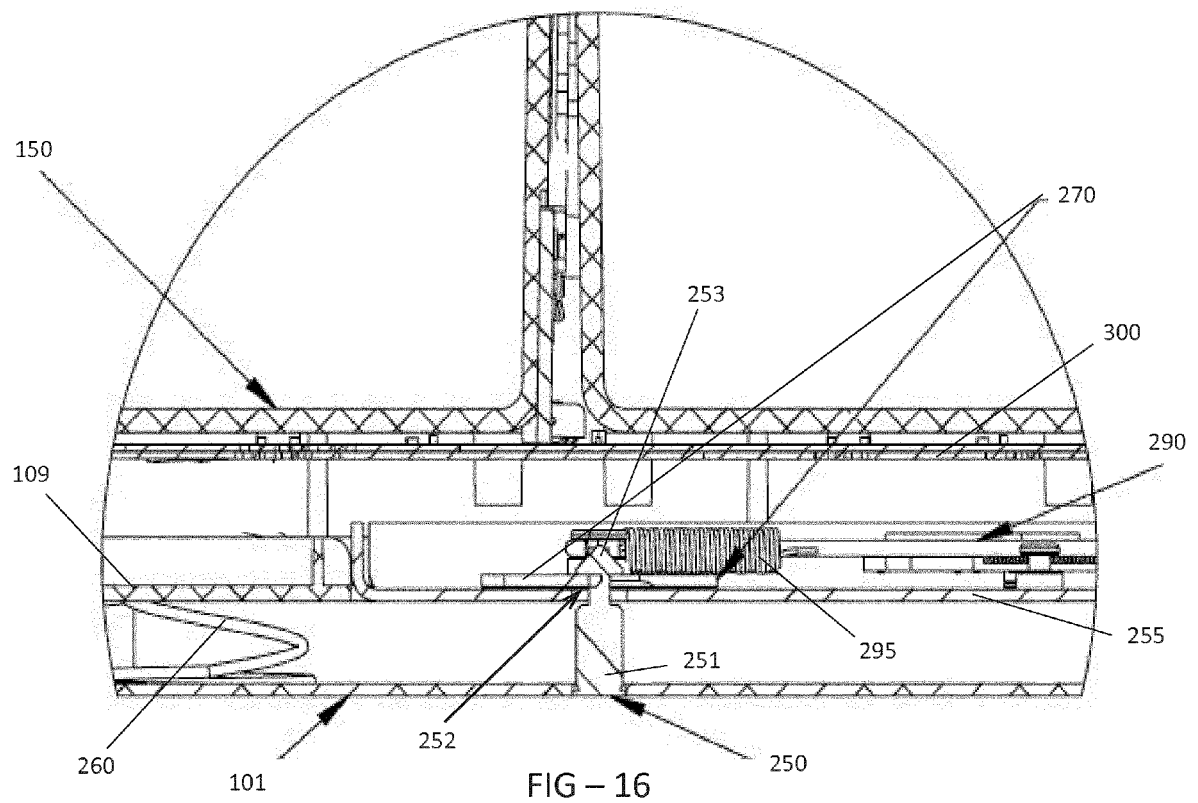
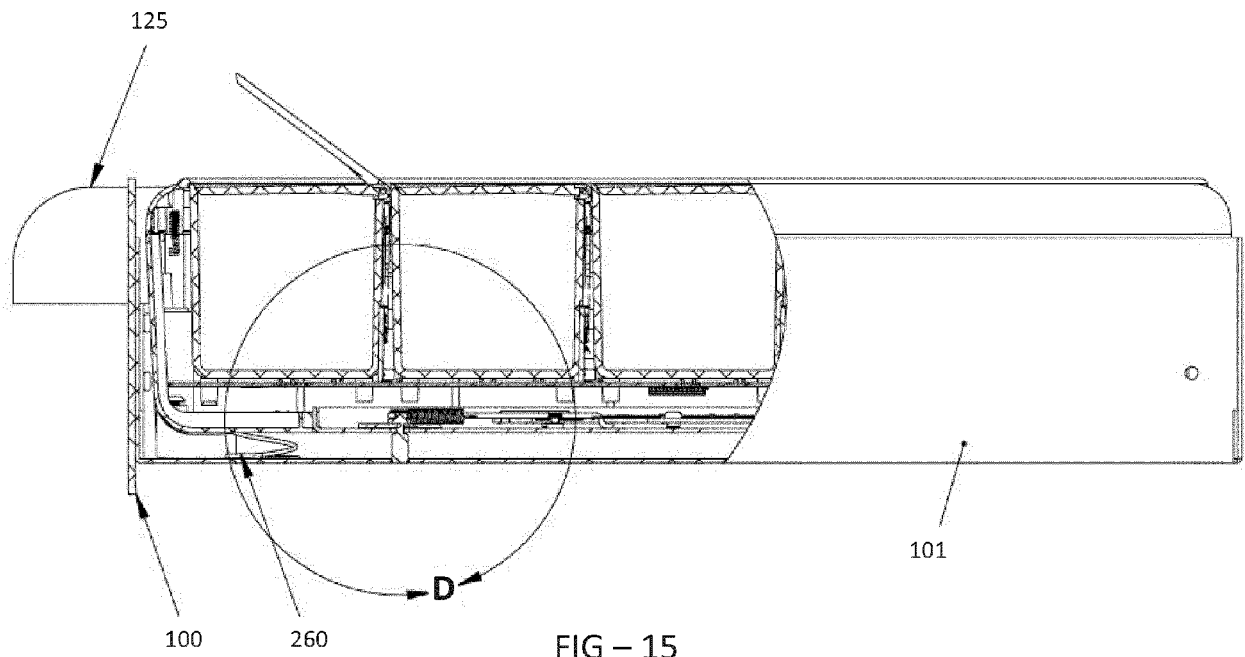
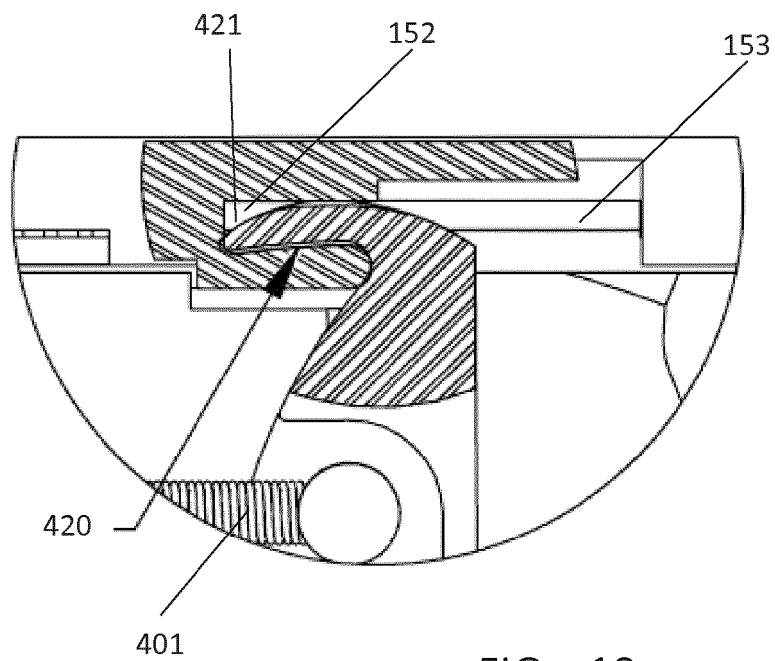
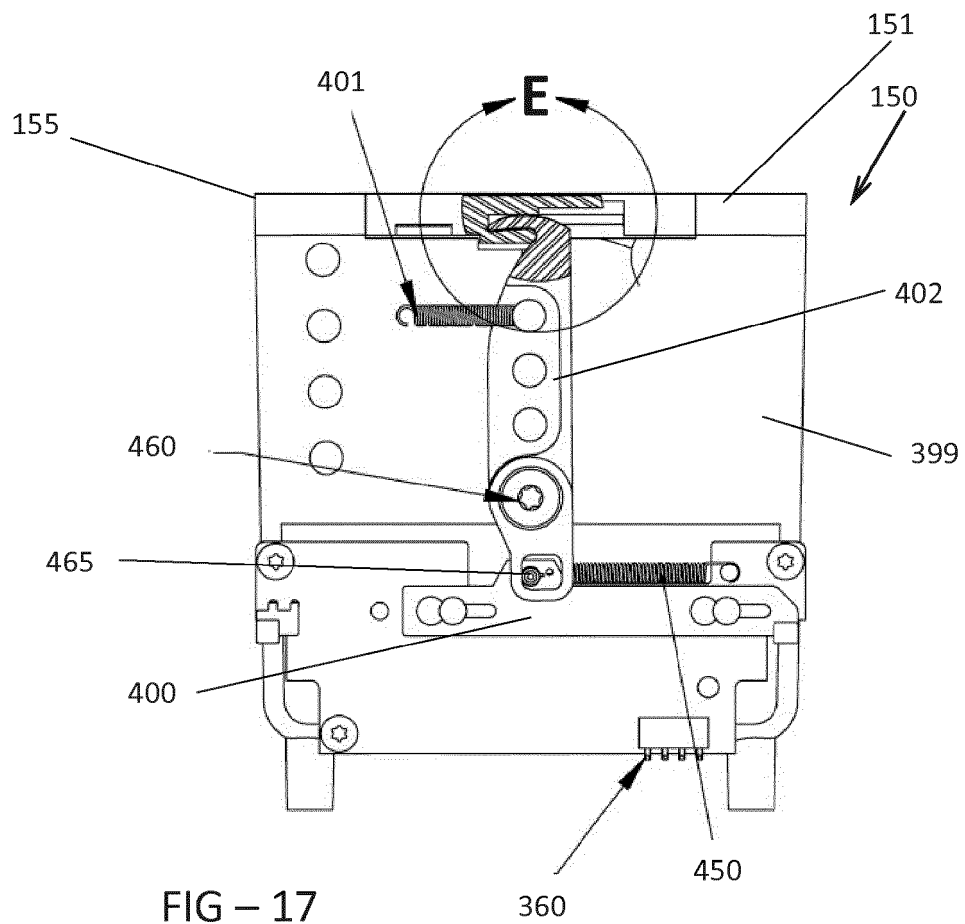


FIG - 14





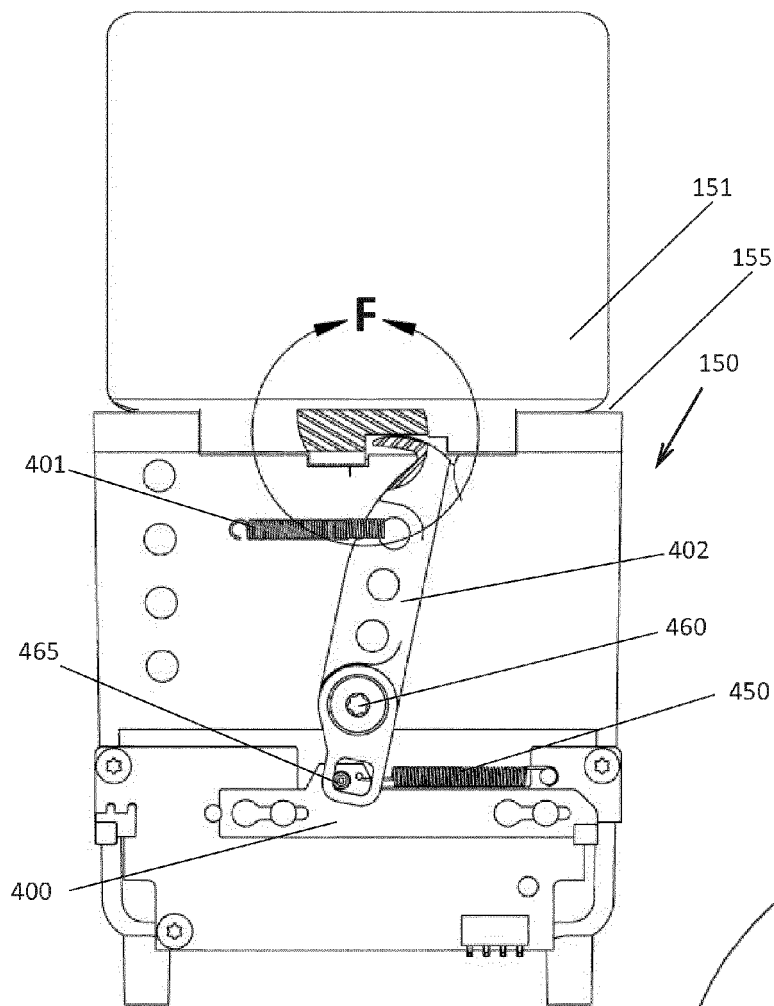


FIG - 19

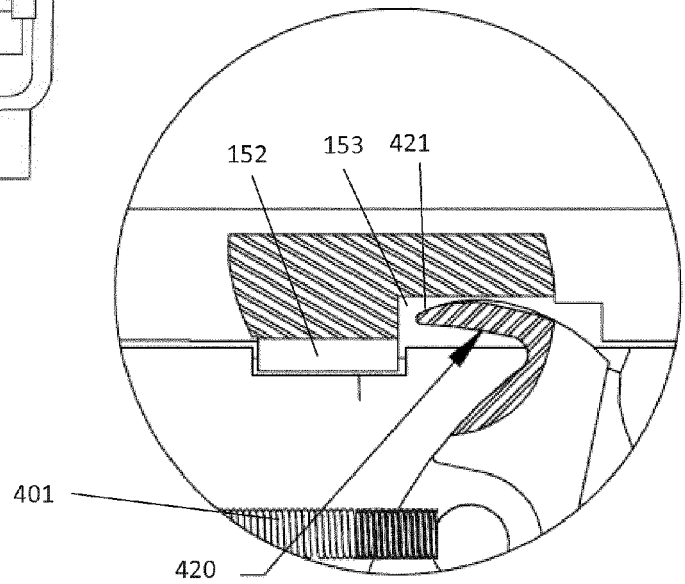


FIG - 20

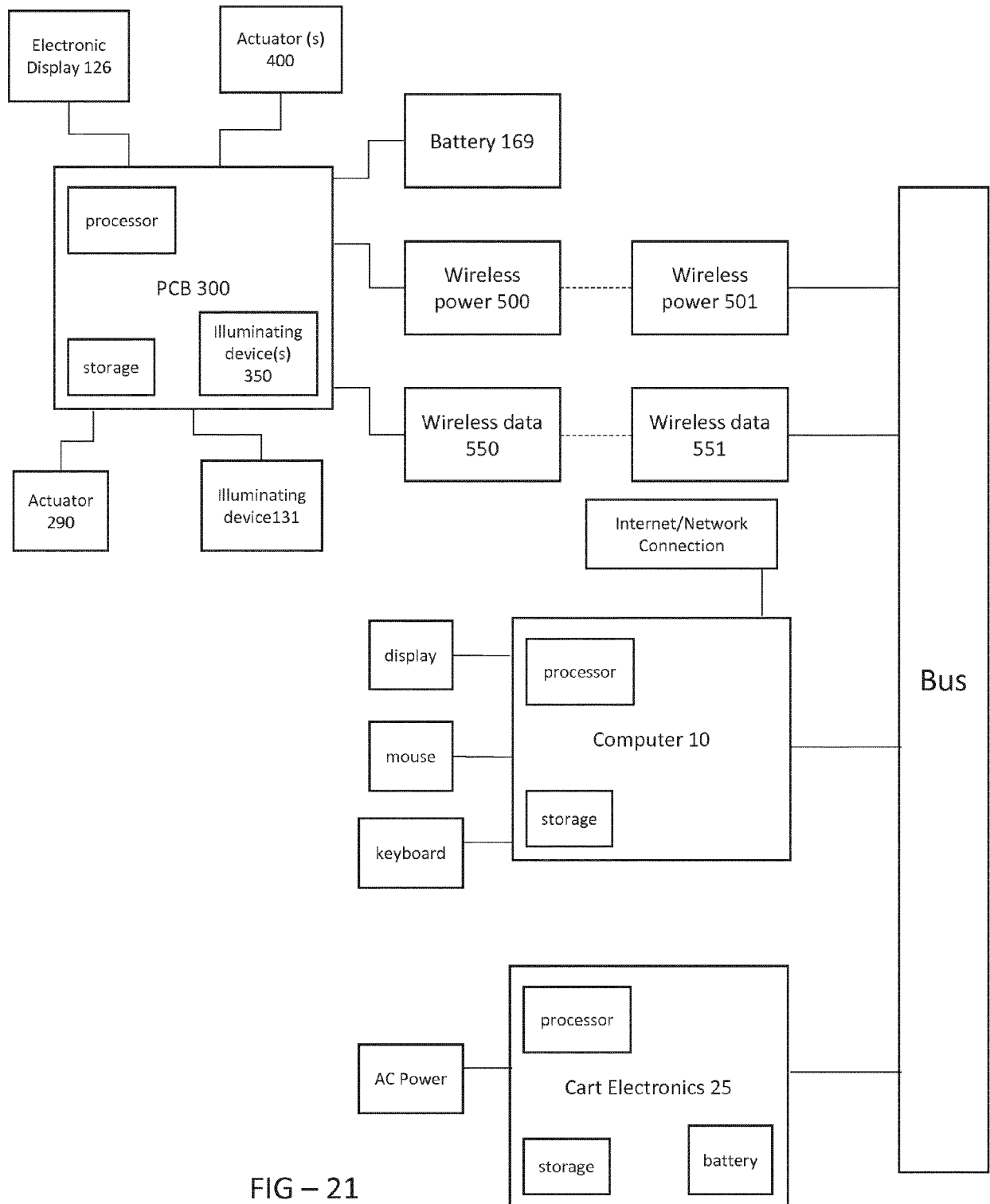


FIG – 21

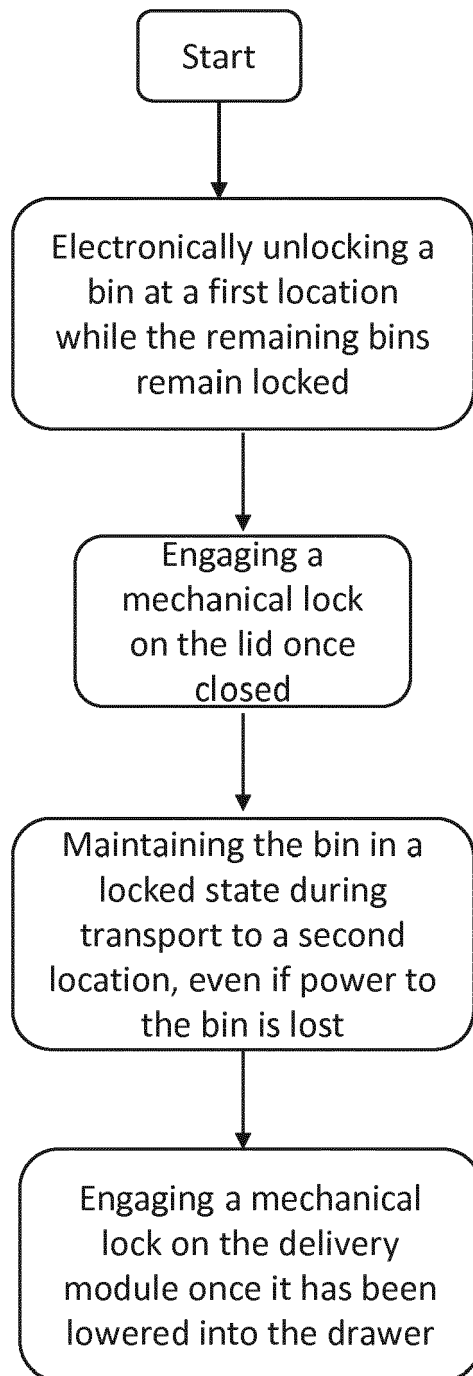


FIG – 22

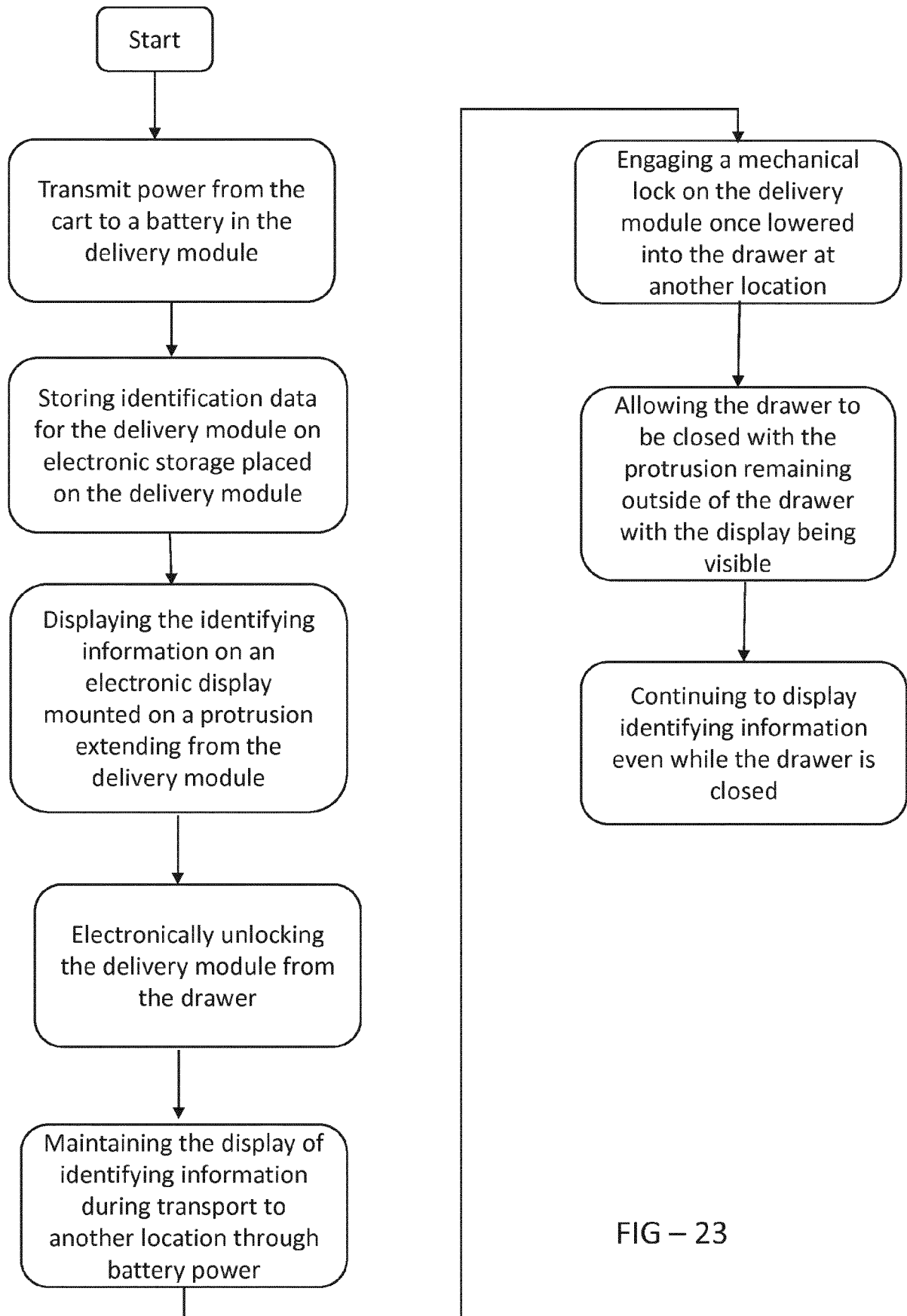


FIG - 23

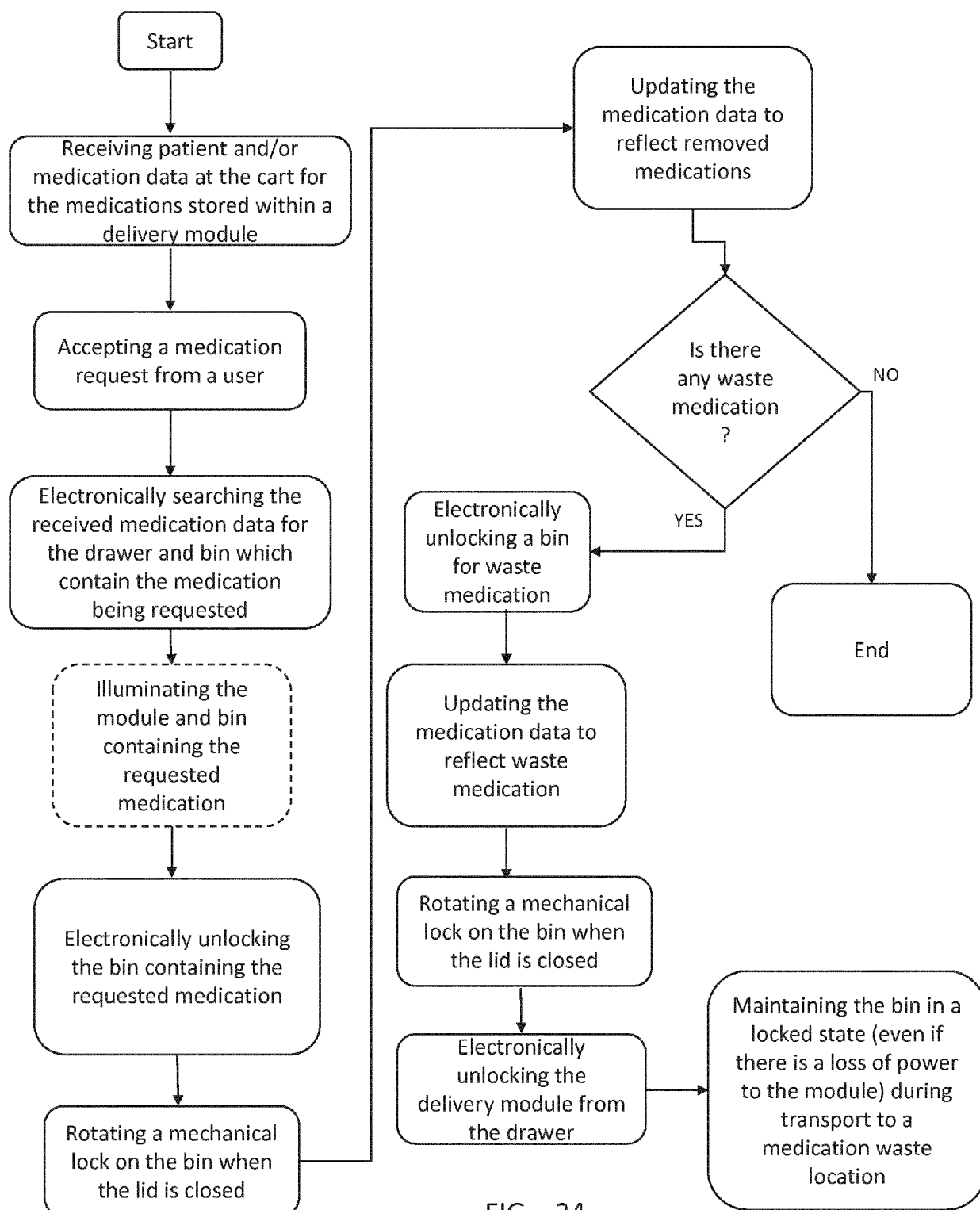
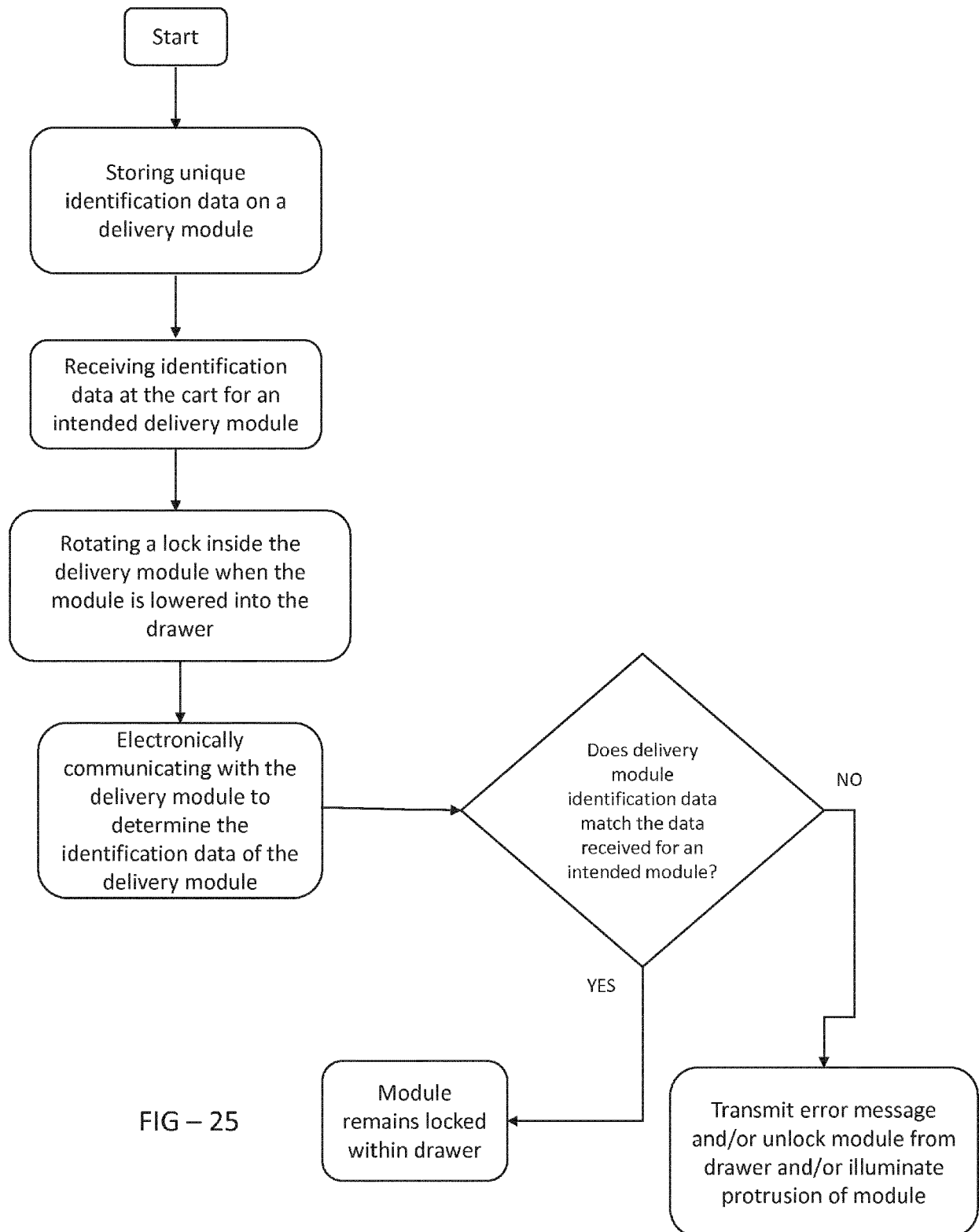


FIG - 24



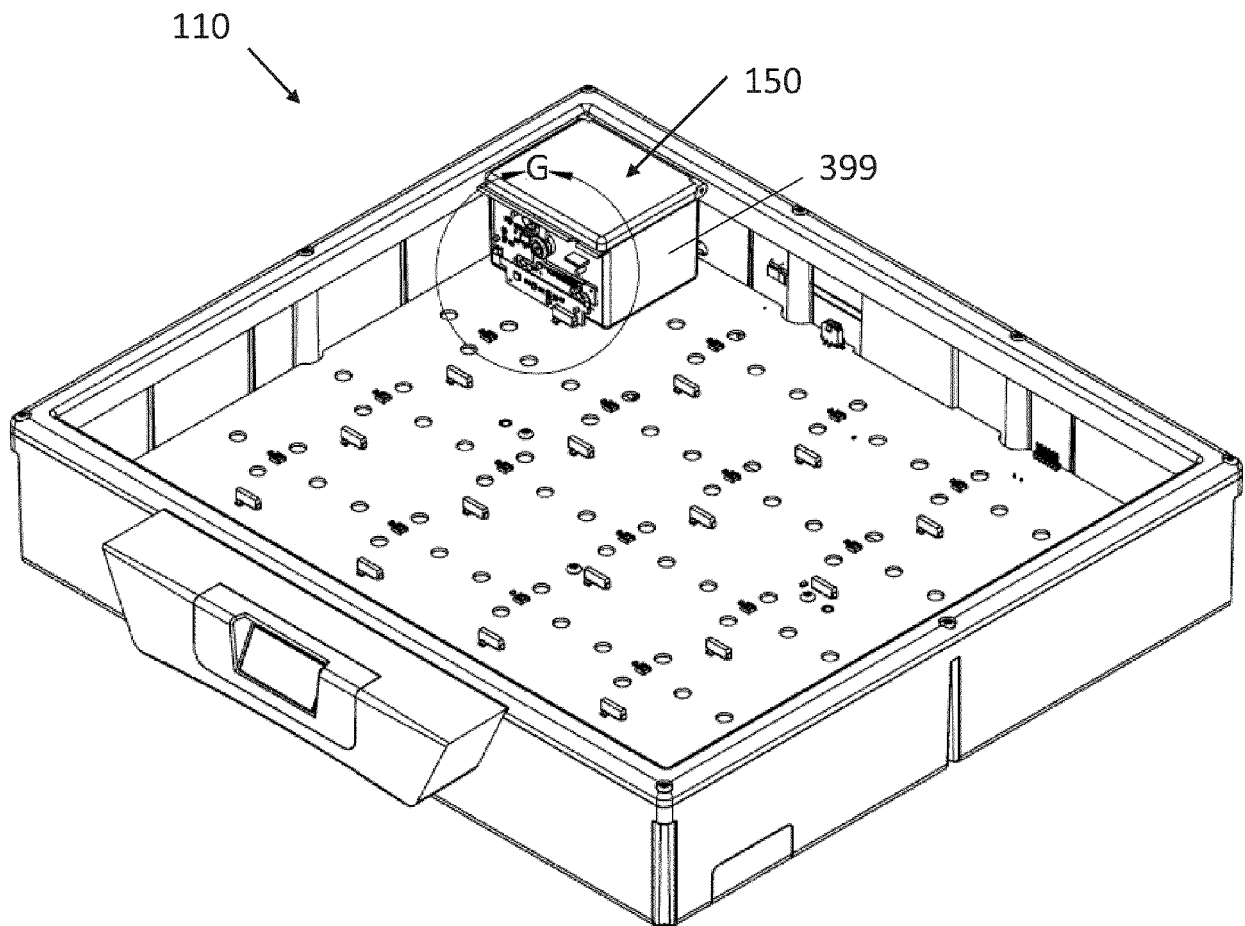
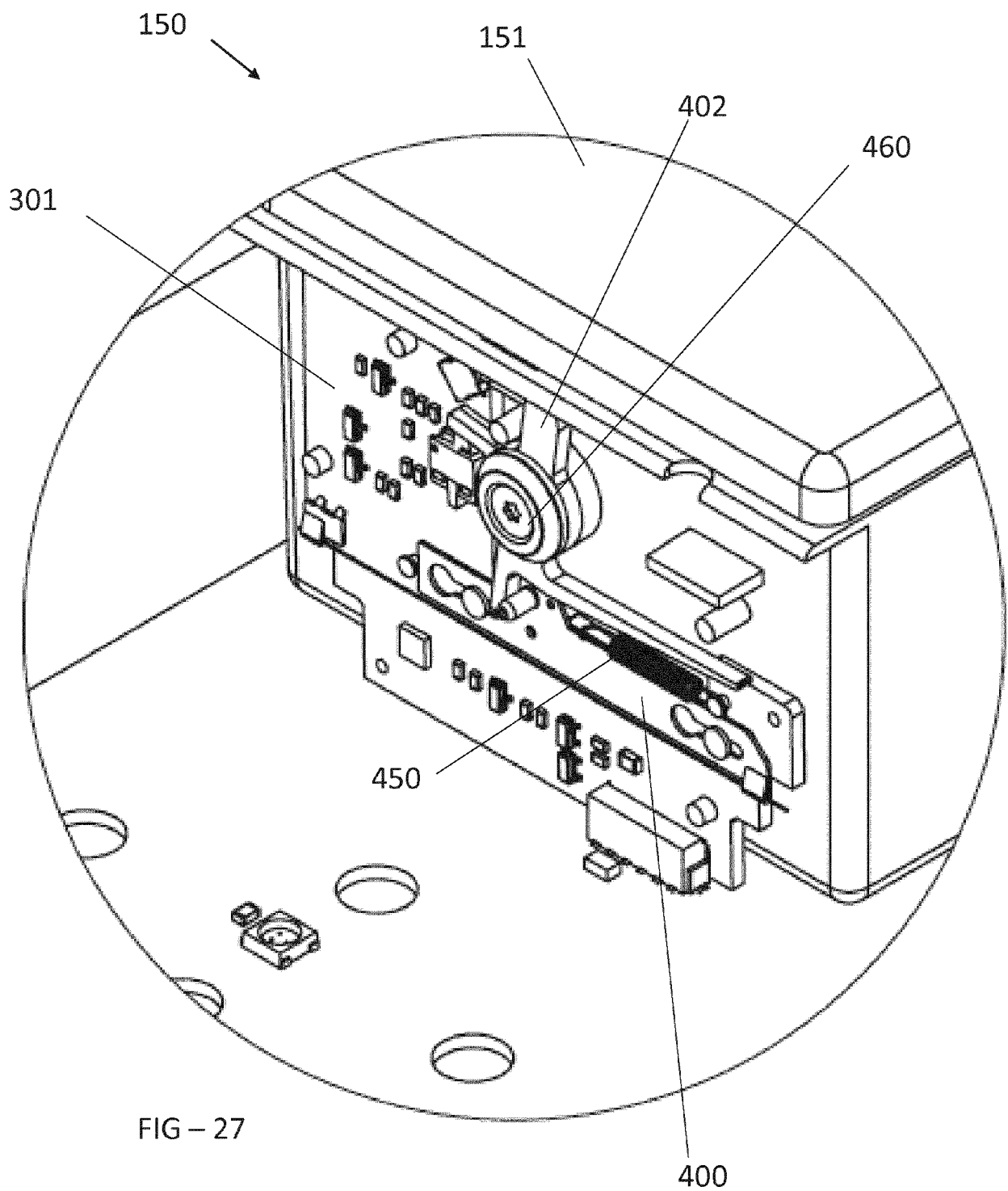


FIG - 26



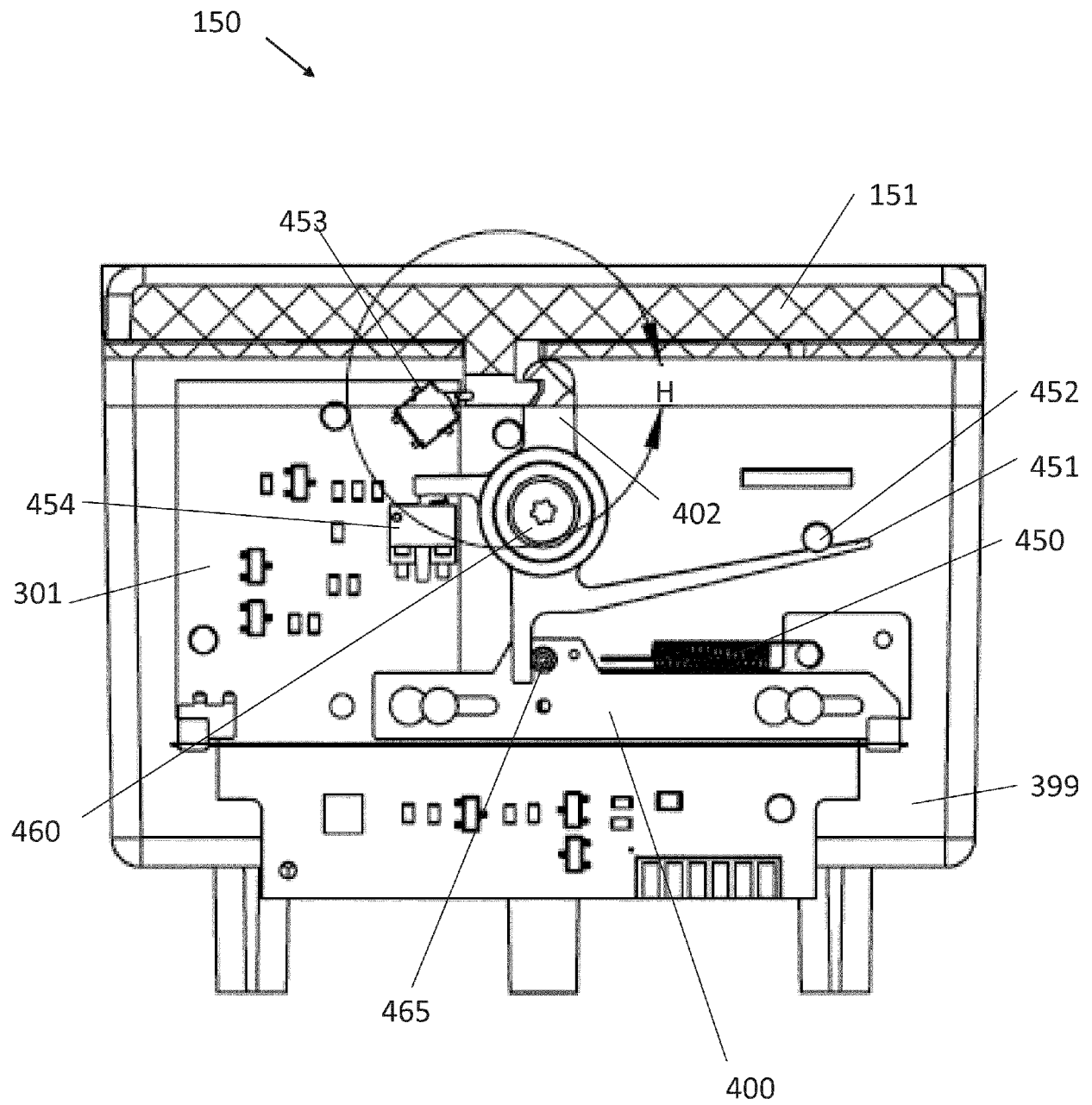


FIG - 28

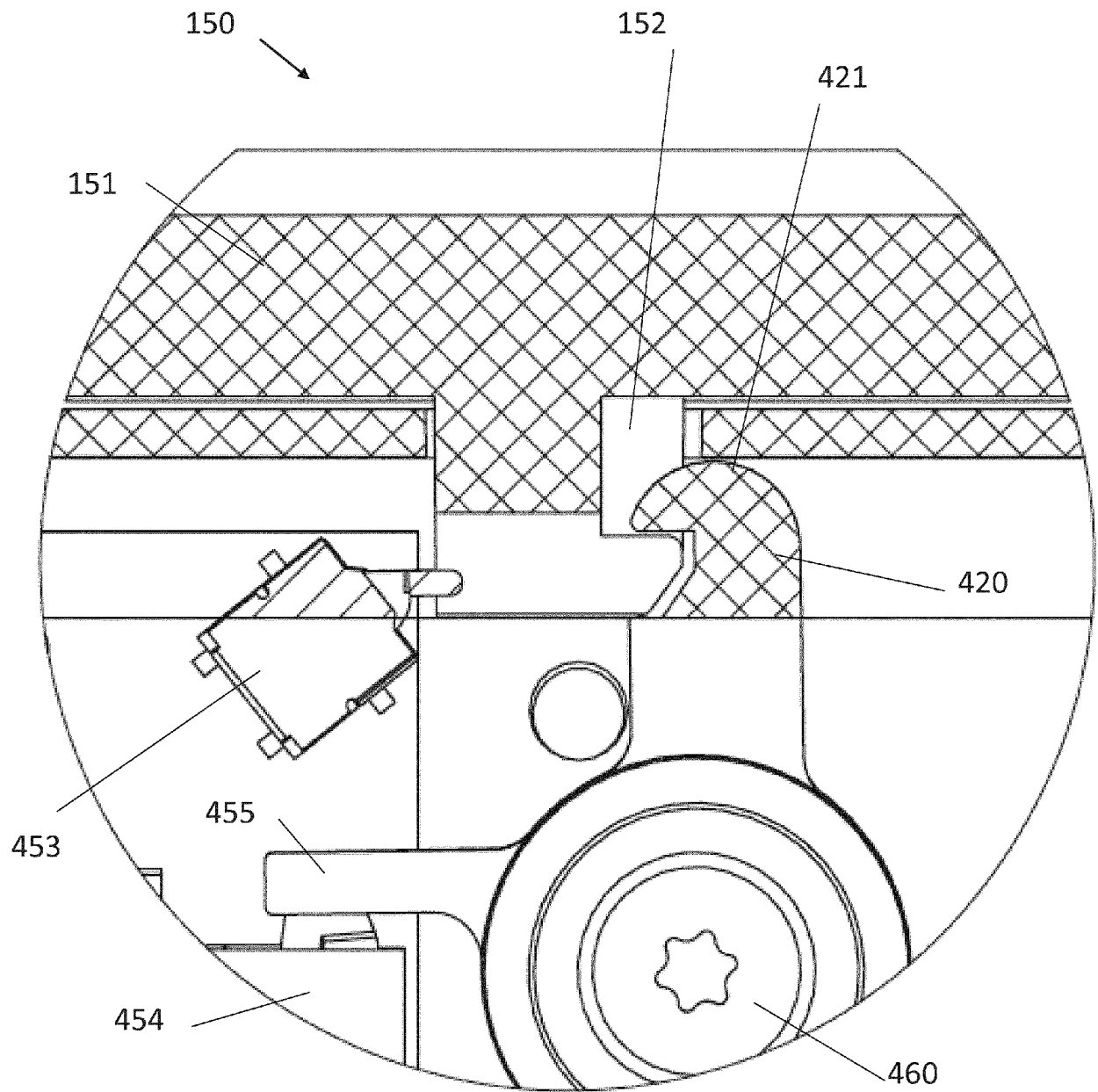
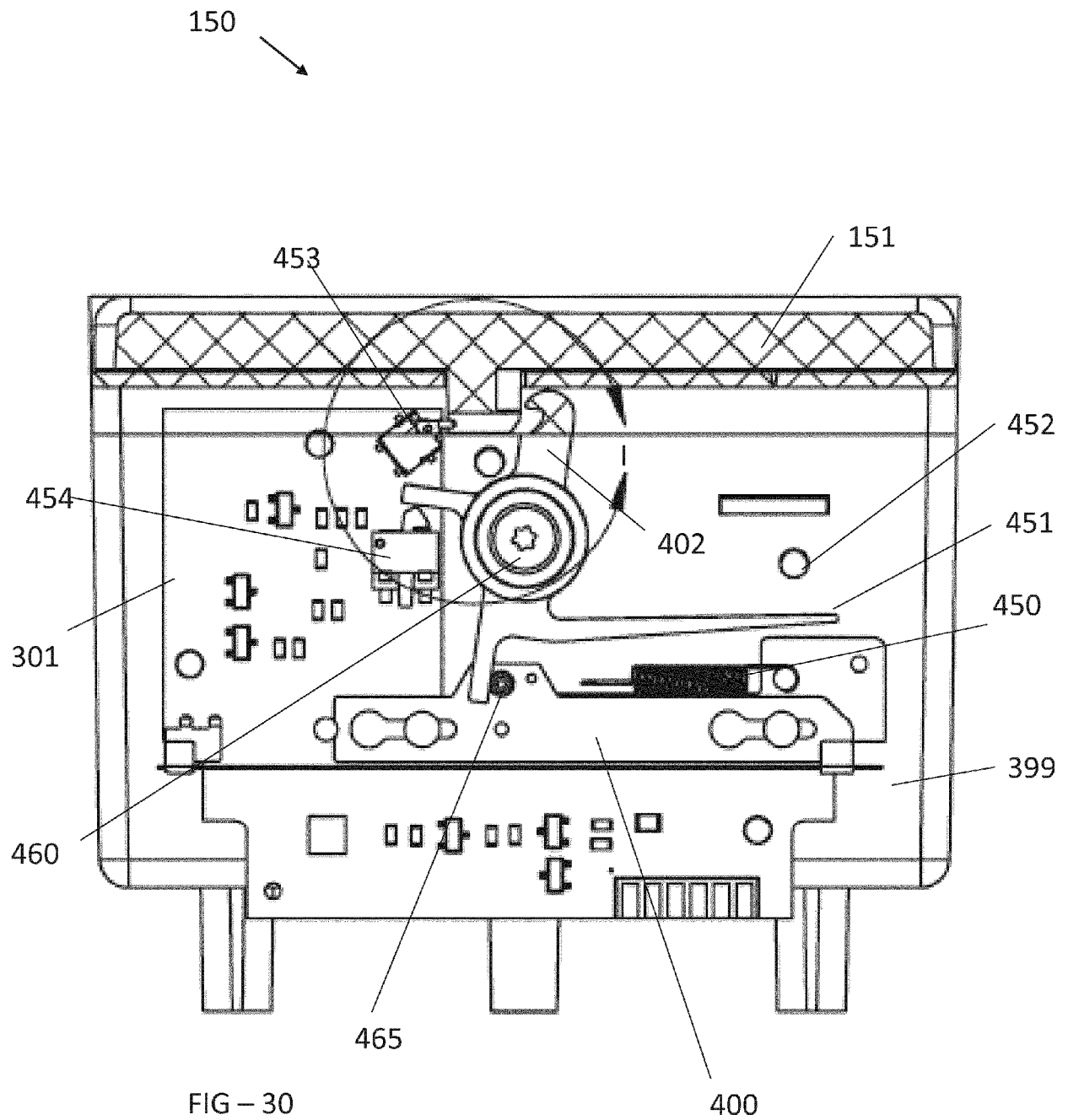


FIG - 29



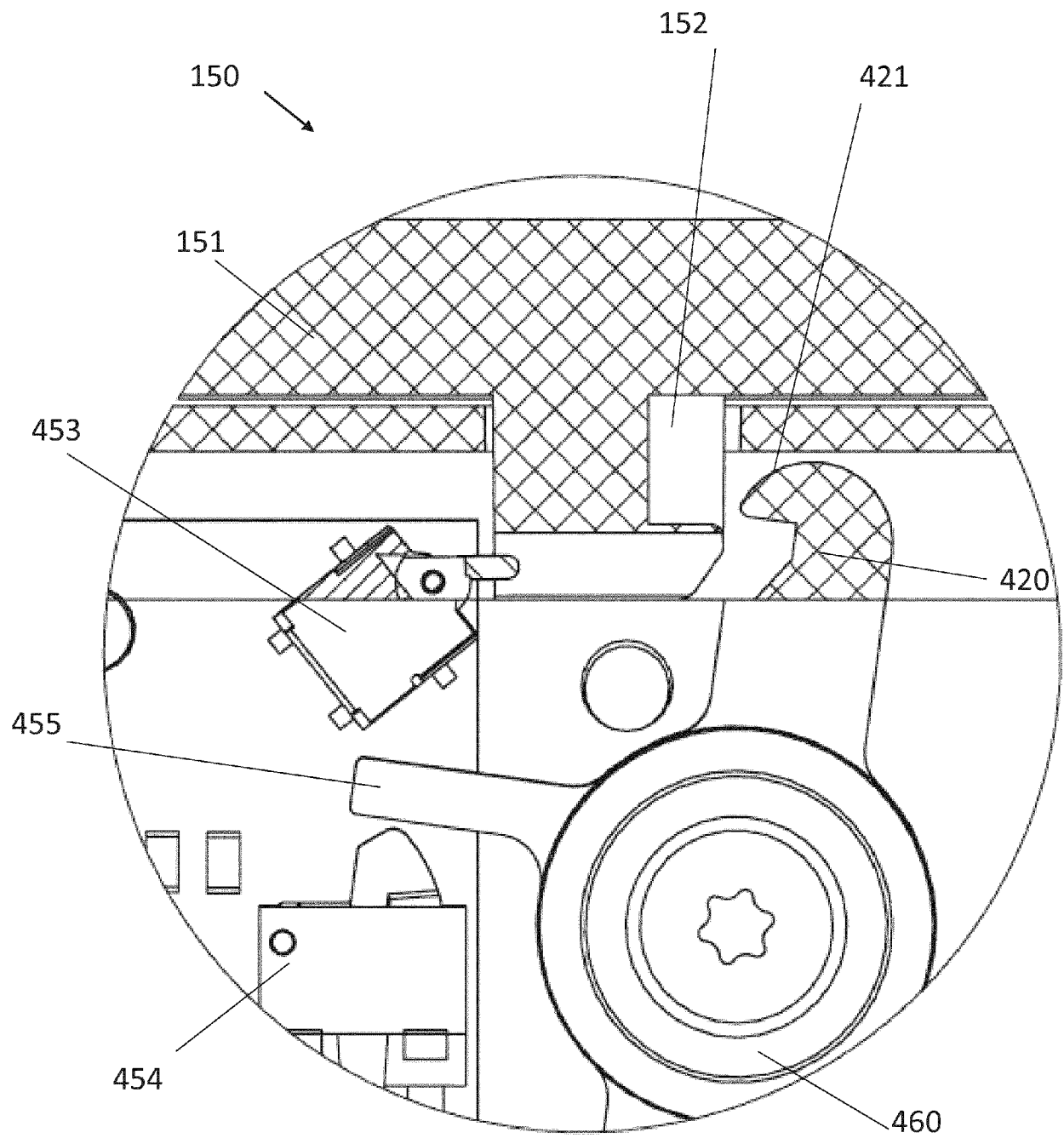


FIG - 31



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Application Number
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Place of search The Hague		Date of completion of the search 14 November 2018	Examiner Petzold, Jan
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