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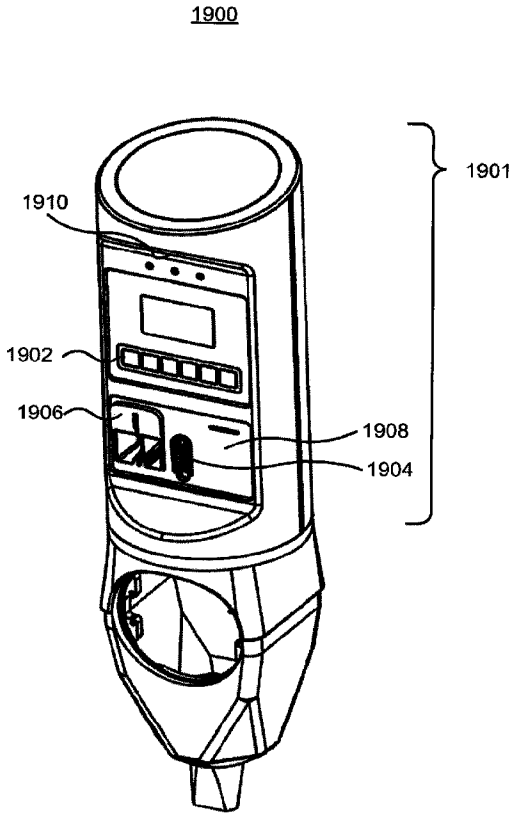

(57) Abrégé/Abstract:
A single space parking meter assembly for retrofitting onto an existing coin vault assembly includes a number of parking meter components enclosed within a protective outer covering that is rotatably or slidably engageable with the coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the coin vault assembly. A locking mechanism secures the protective outer covering to the coin vault assembly when the protective outer covering is engaged with the coin vault assembly.

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ABSTRACT

A single space parking meter assembly for retrofitting onto an existing coin vault assembly includes a number of parking meter components enclosed within a protective outer covering that is rotatably or slidably engageable with the coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the coin vault assembly. A locking mechanism secures the protective outer covering to the coin vault assembly when the protective outer covering is engaged with the coin vault assembly.

SINGLE SPACE PARKING METER RETROFIT

TECHNICAL FIELD

The current disclosure relates to single space parking meters and in particular to single space parking meters that may be retrofit to existing coin vault housings.

BACKGROUND

Traditional single space parking meters comprise a number of components. The metering functionality is provided by a meter mechanism that is received within a protective lower housing. An upper housing may be secured to the lower housing to retain the meter mechanism within the protective housing. The lower housing is secured on top of a coin vault housing that contains a coin canister that stores coins inserted into the parking meter. The functionality of the parking meter may be updated by replacing the meter mechanism while retaining the housing components.

Most upgrades or retrofits to these traditional single space parking meters are based and/or rely upon the use of the existing metal casings or housings, as these parts are almost indestructible, being primarily made of cast iron or other metal alloys. This saves a city or municipality on overall retrofit cost, as they only need to purchase the internal parking meter mechanism that will fit into these existing metal housings.

Notwithstanding the advantages of using the physical traditional meter housing that the parking meter mechanism is typically placed into, such traditional housing acts as a constraint on which and how features may be offered in a newer electronic parking meter and how such features may be offered. Features in this regard include, but are not limited to, display, customer input/interaction, power generation and storage, wireless communications, and payment-related features. Often the above features included in electronic parking meter retrofits which involve traditional housings are limited or compromised in some fashion by the constraints of existing traditional housings. For example a traditional housing can restrict the size of a display, a solar panel, and a battery, as well as placement of payment devices. Integrating new features into a smaller constrained space also introduces serviceability challenges. Traditional single space parking meter housings are further restricted by their requirement to

provide a method to interlock with and secure the parking meter mechanism within the existing traditional lower housings. Retrofit solutions which introduce a new electronic parking meter that reuses the physical meter housing may also introduce a new housing cap, cover or other panel-like component to secure and protect the new parking meter mechanism while attempting to increase available space or add new meter features. These housing caps, covers, or panels may unintentionally introduce gaps, or tolerance sloppiness such that the retrofit solution does not offer the same level of physical security as provided with the original housing cap or cover. Further, if the meter mechanism has to be removed and a replacement meter mechanism is not available, the open housing is exposed to the elements and vandalism, and, furthermore, exposed metal edges of the open housing pose an injury risk to the public.

An electronic parking meter, including protective housing, that offers advantages over previous electronic parking meter retrofit approaches, and that is not constrained to use an existing lower housing of a single space parking meter, is desirable.

SUMMARY

In accordance with the present disclosure, there is provided a single space parking meter for retrofitting onto an existing coin vault housing, the parking meter comprising: a saddle plate adapted to be received over a portion of the existing coin vault housing; and a parking meter assembly comprising: parking meter components for metering parking time; a rear cover; a front cover separable from the rear cover; a bottom plate adapted to releasably secure to the saddle plate; and a locking mechanism adapted to secure the front cover and rear cover together and secure the bottom plate to the saddle plate.

In accordance with a further embodiment of the parking meter, the rear cover is attached to the bottom plate to form a rear assembly.

In accordance with a further embodiment of the parking meter, the parking meter components are coupled to the front cover to form a front assembly.

In accordance with a further embodiment of the parking meter, the front assembly is

slidably engageable with the rear assembly.

In accordance with a further embodiment of the parking meter, the rear assembly comprises one or more rails on which the front assembly is slidably engageable.

In accordance with a further embodiment of the parking meter, the one or more rails are located on edges of the rear cover.

In accordance with a further embodiment of the parking meter, one or more rail guides of the front assembly are slidably engageable with the rear assembly.

In accordance with a further embodiment of the parking meter, the one or more rail guides of the front assembly are formed as separate components and attached to the edges of the front cover of the front assembly.

In accordance with a further embodiment of the parking meter, the locking mechanism prevents the front assembly from sliding relative to the rear assembly when the locking mechanism is engaged.

In accordance with a further embodiment of the parking meter, the locking mechanism is attached to a lower lock plate attached to the front assembly.

In accordance with a further embodiment of the parking meter, the locking mechanism is attached to a lower lock plate attached to the rear assembly.

In accordance with a further embodiment of the parking meter, the bottom plate comprises an elevated overhang extending upwards through the lower lock plate when the parking meter is assembled, and wherein the locking mechanism comprises at least one moveable arm positioned under the elevated overhang in a locked position to secure the front assembly to the rear assembly.

In accordance with a further embodiment of the parking meter, wherein the saddle plate is secured to the existing coin vault housing using a plurality of bolts having a non-threaded portion extending away from the saddle plate when secured and having a large diameter head.

In accordance with a further embodiment of the parking meter, the bottom plate comprises a plurality of key holes having a large diameter opening aligned with the large diameter head of the bolts securing the saddle plate to the coin vault housing, the key holes further comprising a smaller diameter opening extending from the larger diameter opening to allow the non-threaded portion of the bolts to be received when the bottom plate is rotated or twisted, the large diameter head of the bolts preventing the bottom plate from separating from the saddle plate when the non-threaded portion of the bolts is received in the smaller diameter opening.

In accordance with a further embodiment of the parking meter, the locking mechanism prevents rotation of the bottom plate relative to the saddle plate when engaged.

In accordance with a further embodiment of the parking meter, the locking mechanism interferes with the saddle plate to prevent the rotation of the bottom plate.

In accordance with a further embodiment of the parking meter, the front assembly and the rear assembly when secured together provide a protective housing having a generally cylindrical shape.

In accordance with a further embodiment of the parking meter, the front cover comprises a flat recessed portion providing a location for user interaction components.

In accordance with a further embodiment of the parking meter, the user interaction components comprise a display for presenting information to a user and one or more input controls allowing the user to interact with the parking meter.

In accordance with a further embodiment of the parking meter, the display and input controls are provided by a touch screen display.

In accordance with a further embodiment of the parking meter, the user interaction components further comprise one or more payment means.

In accordance with a further embodiment of the parking meter, the payment means comprises a coin chute for receiving coins of different denominations.

In accordance with a further embodiment of the parking meter, the payment means comprises a magnetic stripe and/or chip card reader for receiving payment information from a payment card.

In accordance with a further embodiment of the parking meter, the payment means comprises a contactless payment reader for receiving payment information from a contactless payment device.

In accordance with a further embodiment of the parking meter, an antenna for the contactless payment reader is located within the flat recessed portion of the front cover.

In accordance with a further embodiment of the parking meter, the antenna for the contactless payment reader surrounds at least a portion of, or is in close proximity to, the display.

In accordance with a further embodiment of the parking meter, the antenna for the contactless payment reader is located on a portion of the front cover transitioning from the flat recessed portion of the front cover to the generally cylindrical portion of the front cover.

In accordance with a further embodiment of the parking meter, wherein the front cover comprises a cylindrical recess at a top of the parking meter assembly.

In accordance with a further embodiment, the parking meter further comprises a solar panel located within the cylindrical recess.

In accordance with a further embodiment of the parking meter, an arcuate portion of the cylindrical recess is further recessed to form an antenna recess.

In accordance with a further embodiment, the parking meter further comprises a cellular antenna located within the antenna recess.

In accordance with a further embodiment of the parking meter, the front assembly comprises a battery compartment for receiving at least one battery.

In accordance with a further embodiment of the parking meter, the battery compartment comprises a primary battery compartment and a secondary battery compartment.

In accordance with a further embodiment of the parking meter, the battery compartment is pivotally attached to the front assembly to allow the battery compartment to pivot outwards to provide access to the batteries.

In accordance with a further embodiment of the parking meter, the battery compartment comprises a latching mechanism for preventing the battery compartment from pivoting outwards unintentionally.

In accordance with a further embodiment of the parking meter, the rear cover is formed from an extrusion.

In accordance with a further embodiment of the parking meter, the rear cover is formed out of folded stainless steel.

In accordance with a further embodiment of the parking meter, the bottom plate is attached to the rear cover by a plurality of threaded bolts or rods passing through the bottom plate and extended cylindrical extrusions on the rear cover.

In accordance with a further embodiment of the parking meter, the the bottom plate and rear cover are formed out of stainless steel and welded together.

In accordance with a further embodiment of the parking meter, the bottom plate is made from injection molded plastic, the rear cover is formed out of stainless steel and the bottom plate is attached to the rear cover by using bolts through a series of mounting holes that align to the stainless steel rear cover.

In accordance with a further embodiment of the parking meter, wherein the saddle plate comprises: a lower profile matching an upper profile of the existing coin vault housing; an upper profile matching a lower profile of the parking meter assembly; and a transition section transitioning from the lower profile to the upper profile.

In accordance with a further embodiment of the parking meter, the saddle plate is rigidly

and fixedly attached to the coin vault housing and the parking meter assembly is rotatably engageable with the saddle plate.

In accordance with a further embodiment of the parking meter, a plurality of bolts secure the saddle plate to the coin vault housing, and the bottom plate comprises a plurality of key holes engageable with the plurality of bolts when the parking meter assembly is rotated.

In accordance with a further embodiment, the parking meter further comprises a solar panel assembly that is removably engageable with the parking meter assembly, wherein the solar panel assembly comprises a solar panel.

In accordance with a further embodiment of the parking meter, the solar panel is rotatably adjustable.

In accordance with a further embodiment of the parking meter, the solar panel can be vertically angled or sloped to two or more different positions.

In accordance with the present disclosure, there is further provided a single space parking meter assembly for retrofitting onto an existing coin vault assembly, the coin vault assembly comprising a coin vault housing, the parking meter assembly comprising: a locking mechanism; at least one battery for supplying power for the parking meter assembly; a display; at least one payment means for accepting payment for parking time selected from the group comprising a coin chute, a card slot and a contactless payment reader; a radio transceiver; and a protective outer covering that at least partially houses the locking mechanism, the at least one battery, the display, the at least one payment means, and the radio transceiver; and wherein the protective outer covering is rotatably or slidably engageable with the coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the coin vault assembly, and the locking mechanism secures the protective outer covering to the coin vault assembly when the protective outer covering is engaged with the coin vault assembly.

In a further embodiment of the parking meter assembly, the existing coin vault assembly

is fitted with a saddle plate adapted to be received over a portion of the coin vault housing, wherein the saddle plate is rigidly and fixedly attached to the coin vault housing, and the protective outer covering is rotatably or slidably engageable with the coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the saddle plate.

In a further embodiment of the parking meter assembly, the protective outer covering comprises a front cover, a rear cover and a bottom plate.

In a further embodiment of the parking meter assembly, the protective outer covering comprises a front cover, a rear cover and a bottom plate, wherein the front cover and rear cover are slidably engageable with one another, and wherein the bottom plate is rotatably or slidably engageable with the coin vault assembly when the bottom plate is positioned against or adjacent to an upper surface of the coin vault assembly.

In a further embodiment of the parking meter assembly, the locking mechanism when engaged prevents rotation or sliding of the bottom plate, and prevents sliding of the front cover relative to the rear cover.

In a further embodiment, the parking meter assembly, further comprises a solar panel assembly that is removably engageable with the parking meter assembly, wherein the solar panel assembly comprises a solar panel.

In a further embodiment of the parking meter assembly, the solar panel is rotatably adjustable.

In a further embodiment of the parking meter assembly, the solar panel can be vertically angled or sloped to two or more different positions.

In accordance with the present disclosure, there is further provided a method for retrofitting a single space parking meter assembly onto an existing coin vault assembly, the coin vault assembly comprising a coin vault housing, the method comprising: disassembling an existing parking meter to the existing coin vault housing; rotatably or slidably engaging a protective outer covering of the parking meter assembly with the

coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the coin vault assembly; and securing by way of a locking mechanism the protective outer covering to the coin vault assembly once the protective outer covering has been engaged with the coin vault assembly.

In a further embodiment of the method, the step of rotatably or slidably engaging a protective outer covering of the parking meter assembly with the existing coin vault assembly also comprises the step of rigidly and fixedly attaching a saddle plate to the coin vault housing, wherein the saddle plate is adapted to be received over a portion of the existing coin vault housing, and the protective outer covering rotatably or slidably engages the saddle plate.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments are described herein with reference to the appended drawings, in which:

Figure 1 depicts a front isometric view of a single space parking meter;

Figure 2 depicts a rear isometric view of the single space parking meter;

Figure 3A depicts a front isometric view of the parking meter with the meter mechanism fully removed;

Figure 3B depicts a front isometric view of the parking meter with the meter mechanism partially removed;

Figure 4 depicts a front isometric view of a coin vault housing and retrofit saddle;

Figure 5 depicts the retrofit saddle attached to the coin vault housing;

Figure 6 depicts an isometric view of a rear assembly comprising a rear cover and bottom plate;

Figure 7 depicts an isometric view of the rear cover;

Figure 8 depicts an isometric view of the bottom plate;

Figure 9 depicts a top view of the rear cover and bottom plate;

Figure 10 depicts a rear isometric view of the parking meter mechanism;

Figure 11 depicts a rear isometric view of the parking meter mechanism's front cover;

Figure 12 depicts a front isometric view of the parking meter mechanism's inner frame;

Figure 13 depicts a rear isometric view of the parking meter mechanism's inner frame;

Figure 14 depicts a battery housing;

Figure 15 depicts a locking mechanism;

Figure 16 depicts isolated components of the locking mechanism of Figure 15;

Figure 17 depicts a method of retrofitting an existing parking meter;

Figure 18 depicts a top view of an alternative bottom plate;

Figure 19 depicts a front isometric view of an alternative single space parking meter;

Figure 20 depicts an internal isometric view of the front cover;

Figure 21 depicts a side view of the front cover and solar panel assembly; and

Figure 22 depicts a side view of the front cover and radio assembly.

DETAILED DESCRIPTION

A single space parking meter is described that can be retrofit to an existing coin vault housing. By retrofitting the existing coin vault to fit the single space parking meter, it is possible to provide improved designs that are not constrained by having to fit a meter mechanism within an existing lower housing as with previous parking meter mechanisms. As described further herein, the retrofit parking meter comprises a saddle plate that may be mounted to the existing coin vault housing. A single space parking meter may be mounted directly to the saddle plate, and as such the design is not constrained by a meter mechanism having to be received within, or be secured to, an existing lower housing. The parking meter may comprise a rear assembly that includes a bottom plate for connecting the rear assembly to the saddle plate. A front assembly, providing the main parking meter mechanism components, may be connected to the rear assembly. The retrofit parking meter may allow an improved user interface and user experience since the parking meter mechanism is not constrained by an existing housing.

In addition to providing greater flexibility for the design of a parking meter mechanism,

the retrofit parking meter described herein may provide improved security and/or safety. In previous parking meters, when the parking meter mechanism is removed from the lower housing, for example for repair, and a replacement is not immediately available, an open lower housing remains on the street. The open lower housing presents a target for vandalism, which may require subsequent costly replacement of the lower housing. In the retrofit parking meter described herein, when a parking meter assembly is removed from the street, the coin vault housing remains, optionally along with the saddle plate. As such, an open lower housing is not present on the street.

Further, the current parking meter design may be manufactured using a number of techniques that improve manufacturability. For example, portions of the parking meter housing may be manufactured using metal extrusions, or formed and welded stainless steel, rather than more expensive metal or alloy castings. Further, portions of the housing or outer covering of the parking meter may be formed using high strength plastics, co-polymers and or resins. Such plastics may be made by way of injection molding.

Further still, while the current retrofit parking meter provides greater flexibility for the design of, as well as the feature set provided by, the parking meter, the existing coin vault housing is still retained. Municipalities and cities may have a large existing investment in coin collection methods and equipment based on the use and design of existing coin vault housings and coin canisters contained therein, and as such it may be undesirable to change the coin vault housing design and/or operation.

Further as the use of coin as a payment option diminishes, some municipalities may decide to offer these same current retrofit parking meters without a coin payment option, or they may not offer this payment option in areas with high vandalism or theft. The parking public would still have multiple non-cash payment options and a standard user experience. Such non-coin payment retrofit meters may alternatively have a saddle plate that transitions directly to a pole adapter rather than to the existing coin vault housing.

Although various retrofit parking meter designs are possible, Figures 1 to 17 describe

details for one specific design. It will be appreciated that other specific designs are possible based on the use of a saddle plate to allow a new parking meter assembly to be secured to a coin vault assembly comprising an existing coin vault housing.

Although the following description refers to single space parking meters, it is possible for the parking meters to provide metering functionality for two or more spaces. It will be appreciated that a single space parking meter refers to a style of parking meters that historically metered only a single parking space. Single space parking meters are typically located along a street and affixed to posts adjacent to the parking spaces being metered. As an example of metering multiple parking spots, a single space parking meter located on a post in between two parking spots may be configured to provide metering of the parking space located to the left of the parking meter as well as the parking space located to the right of the parking meter. Single space parking meters are typically differentiated from multi-space meters, such as pay-and-display meters, pay-by-space meters and pay-by-plate meters, by their size. Multi space meters, which are typically provided in larger cabinets, are typically located one or a few per block, or per parking area such as a parking lot. In contrast, multiple single space meters, even when metering multiple parking spots, are typically located on a single block, or parking area such as a small parking lot. The single space meters are typically much smaller in size than multi-space meters.

Figure 1 depicts a front isometric view of a retrofit single space parking meter 100. The parking meter 100 comprises a parking meter assembly 101 that is connected to a coin vault assembly 103. The coin vault assembly 103 may comprise a saddle plate 106, which in turn may be secured to a coin vault housing 108. The coin vault housing provides an opening 110, secured by a door or covering (not shown), through which a coin vault or canister can be inserted and removed. The coin vault assembly may include or be attached to a lower protrusion 112 for use in directly securing the coin vault assembly, and indirectly the attached parking meter assembly 101, to a post or other structure. As described in further detail with reference to Figures 4 and 5, the saddle plate 106 is secured to the coin vault housing 108 and provides a mounting structure to which the parking meter assembly 101 may be releasably secured.

Alternatively, a saddle plate may be attached to any non-coin vault housing base structure that provides a mounting structure or surface that may transition or connect to a post or other structure.

The parking meter assembly 101 comprises a protective outer covering. As depicted, the protective outer covering comprises a rear cover 102, a front cover 104 and a bottom plate (not visible in Figure 1). As described further herein, the protective outer covering may engage with the coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the coin vault assembly. The parking meter assembly further includes a number of parking meter components for providing a functioning parking meter. Particular components included in a parking meter may vary depending upon the specific requirements of a city, municipality, or other potential purchaser of parking meters. The front cover 104 and rear cover 102 may be securely joined together in order to provide a secure housing to protect the parking meter components against an external environment, including dirt, dust, rain and snow, as well as from vandalism. Although the secure housing is depicted as being provided by two interacting housing components, namely, the front cover 104 and the rear cover 102, it is contemplated that additional covers, or portions of the housing, may be provided. When in use, the rear cover 102, front cover 104, parking meter components and bottom plate are coupled together and secured to the saddle plate 106 by a locking mechanism. The locking mechanism may be provided by a single locking component securing all of the parking meter assembly components to the saddle plate. Alternatively, the locking mechanism may include a plurality of locking components. For example, one locking component may secure the rear cover 102, the front cover 104 and the bottom plate together, and a second locking component may secure the bottom plate, and as such the rest of the parking meter assembly 101, to the saddle plate 106. The separate locking components may be operated or actuated individually. Although it is possible for the individual locking components to be operated individually, it may be desirable to operate all of the locking components together. As described further with regard to Figures 15 and 16, a locking mechanism may be provided that operates a plurality of locking components from a single actuator, namely, a locking cylinder.

The rear cover 102 and the front cover 104 of the parking meter assembly 101 may provide a generally cylindrical appearance to or shape for the parking meter assembly. Although the appearance of the parking meter assembly 101 may be a design aesthetic that may be varied based on different design factors, a cylindrical appearance may provide a more attractive parking meter assembly than a non-cylindrical assembly. In addition to providing a visually pleasing appearance, the cylindrical shape may improve the strength of the parking meter to withstand physical attacks since the cylindrical nature of the housing eliminates, or at least reduces, the number of corners in the housing, as a corner may provide a weak point. The front cover 104 may have a recessed flat portion 114 that provides a location for user interaction. The recessed flat portion 114 may comprise an information area 116 for presenting information to a user as well as providing input controls for interacting with and controlling the parking meter assembly 101. The recessed flat portion may also include a payment area 118 for providing a plurality of different payment mechanisms. For example, a coin chute, including an opening 120 for inserting coins into the coin chute, may be provided along with a card slot 122 for accepting payment via a magnetic stripe or chip card. The card slot 122 as depicted is vertically-oriented. Optionally, the card slot may be horizontally-orientated and/or angled so as to shed away any water in the vicinity of the card slot (e.g., the card slot may be sloped downwardly in the direction away from the parking meter). The payment area 118 may also have an area 124 for making payment via a contactless payment device. The tap area 124 may include an industry-recognized logo and/or a message such as “tap here” for directing a user with respect to where the contactless payment device should be held to effect payment. The tap area 124 may also include one or more progress indicators, which may for example be a band of light emitting diodes (LEDs) 126 for providing an indication of the progress of the transaction, which may include color-based indications (e.g., green indicates a successful transaction). Although depicted as a separate tap area 124 in the payment area 118, contactless payment readers may be provided at other locations including, for example surrounding, or in close proximity to, the display 130, or on a lower non-vertical or angled surface 134 that provides a transition from the recessed flat portion 114 to the cylindrical perimeter of the front cover 104. In addition, and depending on the layout of

components, either the information area 116 or payment area 118 may include a keypad (not shown) for entering information, such as a PIN for carrying out transactions. Further, the recessed flat portion 114 that provides a location for user interaction may be illuminated with one or more lights (not shown), such as LED-type lights, that may be positioned at or near where the top of the flat portion 114 transitions from the recessed flat portion 114 to the cylindrical perimeter of the front cover 104.

As depicted in Figure 1, the information area 116 may include one or more input controls 128 for interacting with and controlling the parking meter. For example, the input controls 128 may include buttons for increasing and decreasing an amount of time to be purchased, an OK button, a cancel button and one or more additional input controls which may be used for navigating one or more options or menus presented on a display 130. For example, if the parking meter is for two parking spots, left and right buttons may be included so that a user may indicate which spot he/she is paying for. Individual buttons may alternatively be combined into a keypad array, arranged horizontally above or below the user display or vertically to the left or right of the display. In addition to the display 130 for presenting information to a user, the information area 116 may further include one or more status LEDs 132 for communicating a status of the parking meter at a distance. For example, the status LEDs may be used by parking enforcement personnel to determine which parking meters have expired time, have purchased time remaining, are malfunctioning, etc. without having to closely inspect the meter. The status LEDs may employ one color or more than one color in order to convey one or more statuses to parking enforcement personnel with respect to the parking meter, which, for example, may be a parking meter for a single parking spot or two parking spots. It is possible to replace the status LEDs 132 with other indications that can be understood from a distance, such as flashing of the display. However, the status LEDs draw relatively very little power, and as such are preferable for remaining on for long periods of time, whereas powering the relatively large display 130, even if only flashing, may consume a significantly greater amount of power. Additionally, although depicted as separate display and input components, it is contemplated that the input controls 128 and the display 130 may be provided by a single touch screen display, which may or may not provide color graphics. Although different types of touch

screen sensors may be used, the chosen technology would preferably offer relatively low power consumption, which preferably allows the touch screen sensor circuits to remain active during operational periods, even when the main display is off, so that any tap or touch to the display screen by the user will activate the meter. A touch screen display may allow some or all other user input controls to be eliminated. Alternatively, an additional touch or proximity sensor that has a relatively low power consumption may be used to detect an initial user interaction with the parking meter, which may permit the parking meter to power on additional components such as the touch screen display. The touch screen sensor would preferably be robust, resistant to abuse and vandalism, and function reliably in outdoor environments, including extreme heat and cold, as well as with a gloved finger. Although not depicted in the Figures, the parking meter may comprise a printer, including paper roll, and opening in the front cover for dispensing receipts for users upon payment of parking time.

As is well understood, single space parking meters are powered by internal battery packs. The batteries may be supplemented, and/or charged, by a solar panel 136. Although other positions are possible, locating a solar panel 136 at the top of the parking meter assembly is a desirable location. While the solar panel 136 is depicted in the Figures as being in a fixed, forward sloping orientation, it will be appreciated that the cylindrical shape of the exterior housing allows for an adjustable solar panel assembly that can be rotated at the time of installation such that the solar panel is orientated to point in any direction, which is typically due south for the northern hemisphere, and also allow it to be adjusted to any one of two or more vertical slopes or angles relative to the horizon. Although not depicted in the Figures, the solar panel 136 at the top of the meter may also be optionally augmented with one or more additional flexible type solar panels attached to the exterior of the smooth cylindrical surface of the rear cover 102.

Figure 2 depicts a rear isometric view of a single space parking meter. The parking meter 100 comprises the rear cover 102, which may be a generally smooth cylindrical extrusion. The rear cover may include one or more rear status LEDs 204. The rear status LEDs 204 may serve a similar purpose as the status LEDs 132 located on the front cover 102. The rear status LEDs 204 allow a parking enforcement agent to

determine the status of the parking meter from a distance.

Figure 3A depicts a front isometric view of the parking meter 300a with the meter mechanism fully removed. Figure 3B depicts a front isometric view of the parking meter 300b with the meter mechanism partially removed. As depicted, the parking meter assembly 101 may be comprised of two sub-assemblies, namely, a front assembly 302, and a rear assembly 304. The rear assembly 304 may be secured to the saddle plate 106 as described in further detail with reference to Figures 5 to 9. The rear assembly 304 may comprise a bottom plate 306 and the rear cover 102, which may be secured to the bottom plate 306. The front assembly 302 may be slidably engageable with the rear assembly 304 to allow the front assembly 302 to be removed from the rear assembly. As depicted, the front assembly 302 may be fully removed (Figure 3A), or partially removed or partially installed (Figure 3B). That is, the front assembly 302 may engage with and slide down or up rails or profiles of the rear assembly 304 in order to secure the front assembly 302 to the rear assembly 304. The front assembly 302 may be locked to the rear assembly 304 using a locking mechanism, which may be operated via a keyhole 202 in the rear cover 102 as depicted in Figure 2. The front assembly 302 may be removed and replaced as a complete assembly. Partially or fully raising the front assembly 302 from the rear assembly 304 may be done to, for example, inspect components or perform routine maintenance such as replacing batteries or clearing card reader or coin chute blockages. The rails may provide a spring-catch assembly (not shown) that allows the front assembly 302 to be lifted and held at any one of multiple partially raised positions which allows hands free service work and testing of the meter to be carried out while in the partially raised or lifted position. Releasing the spring-catch would release the front assembly 302 allowing it to freely slide up or down on the rails or profiles. The ability to raise the front assembly in this regard is advantageous for more openly exposing some or all of the internal parking meter components as compared with traditional single space parking meters. This may make repair, servicing and/or replacement of such components easier and/or quicker. With respect to the coin chute, a mirror (not shown) may be positioned just above a coin inspection slot or opening for the purpose of facilitating or making easier the inspection of the coin chute for blockages. Alternatively, payment devices may have quick release

knobs allowing them to be disengaged from a normally fixed/rigid position on the front cover, such that they can be quickly and easily inspected, serviced and/or removed without the use of tools.

Figure 4 depicts a front isometric view of a coin vault assembly 103. The coin vault assembly 103 may comprise a coin vault housing 108 and retrofit saddle plate 106. A parking meter assembly may be engaged to the coin vault assembly. The saddle plate 106 and bolts 402 allow a parking meter mechanism to be connected to existing coin vault housing 108. The saddle plate 106 can provide flexibility in designing the parking meter mechanism since it does not need to be received within, or otherwise mate with, an existing lower housing. The saddle plate 106 further allows new parking meter designs, such as the parking meter assembly 101 described herein, to operate with existing coin vault housings 108, which is beneficial since cities and municipalities, or other purchasers of parking meters, may have invested in collection equipment, such as coin carts, as well as training of coin collection agents regarding collection methods. Accordingly, it is desirable to allow new parking meter designs to function with existing coin vaults.

A bottom portion of the saddle plate 106 is adapted to fit over a top of the coin vault housing 108. In this regard, the saddle plate has a lower profile 404 that generally matches the profile of the coin vault housing. The lower profile 404 includes a cutout to allow a door (not shown) to the coin vault housing, which would be located at opening 110, to open and close thereby permitting insertion and removal of a coin vault or canister. The saddle plate 106 further comprises an upper profile 406 that generally matches a lower profile of the parking meter assembly 101. As described above, the parking meter assembly is generally cylindrical in shape, and as such the upper profile 406 of the saddle plate 106 is generally circular. The saddle plate 106 may provide a smooth transition between the lower profile 404 and the upper profile 406. In addition to providing an appealing visual appearance to the parking meter, the transition that the saddle plate may provide may also reduce potential areas of attack by vandals by presenting a smoother exposed surface.

Existing coin vault housings generally conform to a common bolt pattern used for securing a traditional lower housing to the coin vault housing. The upper surface of the coin vault housing 108 also includes a coin opening 412 through which coins can enter the coin vault housing 108. Above the coin vault housing 108, coins may pass through a corresponding coin opening 414 in the saddle plate 106. The coin vault housing 108 further has an upper surface that includes a plurality of threaded holes 410. The saddle plate 106 may include a plurality of matching holes 408 that align with the threaded holes 410 of the coin vault housing to allow the saddle plate 106 to be rigidly connected to the coin vault housing 108. It will be appreciated that while the saddle plate may be removed from the coin vault housing 108, such removal is generally considered to be infrequent. The saddle plate 106 provides a securing mechanism for securing the saddle plate 106 to the coin vault housing 108. The saddle plate 106 also provides a securing mechanism that allows the parking meter assembly 101 to be secured to the saddle plate 106, and as such to the coin vault housing 108. Although described above as two separate securing mechanisms, the two securing mechanisms may be inter-related. For example, as depicted in Figure 4, the saddle plate 106 may be secured to the coin vault housing 108 using a plurality of bolts 402. Each of the bolts 402 may comprise a threaded portion 416 and a non-threaded portion 418 that provides a shoulder extending radially past the threaded portion 416 as depicted in Figure 4. The bolts may be inserted through the holes 408 in the saddle plate 106 and threaded into the threaded holes 410 of the coin vault housing 108. The larger non-threaded shoulder portion 418 acts as a bolt head in securing the saddle plate 106 to the coin vault housing 108. The non-threaded shoulder portion 418 that acts as a bolt head also provides a standoff with respect to a larger diameter head 420 of bolt 402. The larger diameter head 420 may pass through corresponding large diameter holes in the bottom plate 306 of the parking meter assembly 101. Details regarding the bottom plate 306 are discussed below with respect to Figures 8 and 9. By placing the parking meter assembly 101 on the saddle plate 106, and twisting or rotating the parking meter assembly 101, which includes the bottom plate 306 of such assembly 101, the standoff non-threaded portion 418 of the bolts 402 may enter a smaller diameter or spaced opening of the bottom plate 306 that is connected to the larger diameter opening. The

combination of the larger diameter head 420 and smaller opening will, as a result, prevent retraction or lifting of the parking meter assembly 101, including bottom plate 306. Accordingly, the bolts 402, in cooperation with matching components such as threaded holes and appropriately sized openings in the bottom plate 306 of the parking meter assembly 101, may provide both the securing mechanism for securing the saddle plate 106 to the lower housing 108 as well as the securing mechanism for securing the parking meter assembly 101 to the saddle plate 106. Securing the parking meter assembly 101 as a whole to the saddle plate 106, and having the ability to easily or quickly remove the parking meter assembly 101 as a whole from the saddle plate 106, all as described herein, is advantageous in that the typical approach of leaving behind a traditional lower housing with exposed metal edges may be avoidable.

Figure 5 depicts the coin vault assembly 103 comprising the retrofit saddle 106 attached to the coin vault housing 108. As depicted, the bolts 402 may be threaded into the threaded holes of the coin vault housing, and the shoulders of the non-threaded portions of the bolts 418 also secure the saddle plate 106 to the coin vault housing 108. Once fully threaded into the threaded holes of the coin vault housing 108, the non-threaded portions of the bolts 418 stand off from the saddle plate and allow a bottom plate to capture the non-threaded portion 418 in an opening. The large diameter head 420 of the bolts 402 prevents the bottom plate from being withdrawn from the saddle plate 106, including from the bolts 402. The securing mechanism for securing the parking meter assembly 101, including in particular the bottom plate 306 of the parking meter assembly 101, is described in further detail with regard to Figures 6 to 9.

Alternatively, the coin vault assembly may be provided without the saddle plate. By way of example only, bolts 402 as described above may be secured to the coin vault housing 108, and the parking meter assembly, including bottom plate, rear cover and front cover, may be coupled to the bolts and coin vault housing in the manner described herein. Such a parking meter assembly may or may not take a cylindrical form. Further, although referred to as a coin vault assembly, it is possible to provide an assembly that allows a parking meter assembly to be secured to a post or other structure without providing an actual housing for a coin vault. Such assemblies may be useful to allow

cities or municipalities to provide similar parking meters, some of which include coin vaults and some of which do not include coin vaults. Having a mix of parking meters available may be useful for addressing areas of high vandalism or theft.

Figure 6 depicts an isometric view of a rear assembly. The rear assembly 304 may comprise the rear cover 102 described above, which provides a portion of a protective housing for the parking meter, as well as the bottom plate 306. As described in further detail with reference to Figure 6, the rear cover 102 may be formed as an extrusion that is cut to the required length and subsequently machined to provide the desired component. Alternatively the rear cover 102 may be formed from rolled and formed stainless steel. As depicted, the extrusion may include a plurality of extended cylindrical portions 604 that extend down a length of the rear cover. The extrusion may be machined to remove an upper most portion from the extended cylindrical portions 604. A bolt (not visible in Figure 6) may extend through the bottom plate 306 and the extended cylindrical portions 604. A nut 606 may be used to secure the bolt. With the bolt secured within the extended cylindrical portion 604, the bottom plate 306 may be secured to the rear cover 102. Alternatively a rear cover 102 formed from rolled and formed stainless steel may be welded to the bottom plate 306.

Figure 7 depicts an isometric view of the rear cover. As depicted, the rear cover 102 may be formed as an extrusion that has been machined to provide additional features. The machining may include boring a hole for a lock as well as machining a location for the rear status LEDs 204. The extrusion of the rear cover 102 includes rails, protrusions or similar structures 702 that the front assembly can engage with, and slide up and down on. The rails 702 may be located on the circumferential ends of the semi-circular rear cover 102. As depicted in Figure 7, the extended cylindrical portions 604 may comprise a slit running the length of each extended cylindrical portion 604. The slits allow the rear cover 102 to be formed as an extrusion. An upper portion 704 of the rear cover extrusion is machined to remove an upper portion of the rails 702 and an upper portion of the extended cylindrical portions 604. The machining of the upper portion 704 of the rear cover allows the front assembly 302 to be received within the rear cover 102. While a rear cover formed as an extrusion as described above may

include formed rails 702 that the front assembly can engage with, it should be recognized that equivalent rails, protrusions or structures can be created using a rear cover created from formed and folded stainless steel.

Figure 8 depicts a rear isometric view of the bottom plate. The bottom plate 306 includes a plurality of key holes 802a, 802b, 802c, 802d (referred to collectively as key holes 802) that allow the bottom plate 306 to be secured to the saddle plate 106. Each of the key holes 802 comprise a large diameter opening 804 and an extended opening of a smaller diameter 806 connected to the large diameter opening 804. It is noted that the large diameter opening 804 and smaller diameter opening are only labeled for key hole 802b for simplicity of the Figure. As described above, the saddle plate 106 may be secured by bolts 402 that have a non-threaded portion 418 extending away from the saddle plate 106 when secured and a large diameter head 420. The large diameter head 420 of the bolts 402 can pass through the large diameter opening 804 of the key holes 802. The bottom surface of the large diameter head 420 passes over, although it may contact, the upper surface of the bottom plate 306 in the region of the key holes 802. When the bottom plate is rotated or twisted in a clockwise direction, the non-threaded portion 418 of the bolts 402 enters into the extended smaller diameter opening 806 of the key holes 802. Since the larger diameter heads 420 of the bolts 402 are larger than and therefore cannot pass through the smaller diameter openings 806 of the key holes 802, the bottom surfaces of the large diameter heads 420 engage with the upper surface of the bottom plate in the vicinity of the key holes 802 and secure the bottom plate 306 to the saddle plate 106. The upper surface of each of the key holes 802 may be machined or tapered such that the overall thickness at the end of the extended opening of a smaller diameter 806 that is away from the large diameter opening 804 is higher than at the start of the extended opening of a smaller diameter 806 (i.e., the end of the extended opening of a smaller diameter 806 that meets the large diameter opening 804), such that as the bottom plate is rotated or twisted in a clockwise direction, any clearance gap between the bottom surfaces of the large diameter heads 420 and the upper surfaces of the keyholes 802 is eliminated or minimized at or near the end of the clockwise rotation. The bottom plate 306 may be secured to the rear cover 102 by bolts or rods extending through mounting holes 808a,

808b, 808c, 808d, 808e, 808f (referred to collectively as holes 808). The holes 808 may have a recess for receiving a lower portion of the extruded features of the rear cover 102. The bottom plate may include a raised lip 814 at the front to provide a secure mating surface at the bottom of the front cover of the front assembly. The bottom plate may further include a coin opening 818 that aligns with the coin opening 412 of the coin vault housing 108. The bottom plate is depicted with large openings 820a, 820b, which may simply reduce an amount of material required for the bottom plate. The bottom plate 306 may further include a securing component used to secure the front assembly to the bottom plate, and as such to the rear cover and rear assembly as a whole. The securing components may comprise elevated overhangs 816a, 816b that can engage with a corresponding finger, bar or similar structure of a lock to prevent vertical movement of the front assembly relative to the rear assembly, including relative to bottom plate 306. A particular lock is described further with reference to Figures 15 and 16.

As described above, the rear cover may include rails, protrusions or similar structures that can engage with corresponding features of the front assembly. Accordingly, the front assembly may be engaged to the rear cover 102 by sliding the front assembly down the rails 702 of the rear cover. The rear cover 102 may be secured to the bottom plate 306 by bolts extending through the extended cylindrical portions 604 on the interior of the rear cover 102. Alternatively, the bottom plate 306 may be welded to the rear cover 102. The bottom plate 306 may be secured to the saddle 106 plate by a twist or rotation lock mechanism on the extended bolts 402 securing the saddle plate 106 to the coin vault housing 108. Accordingly, if the bottom plate 306 is prevented from rotating, the bottom plate 306 and the attached rear cover 102 will not be able to be removed from the saddle plate 106 and coin vault housing 108. Further, if the front assembly 302 is prevented from being slid vertically on or along the rear cover rails 702, the entire parking meter assembly 101 will be rigidly secured to the existing coin vault housing 108.

While the above has described the bottom plate 306 as being secured to the saddle plate, or bolts securing the saddle plate to the coin vault housing, it is contemplated that

the bottom plate 306 may be secured to a coin vault assembly that does not include a saddle plate in a similar manner. Further, the bottom plate may be secured to a mounting assembly, which may provide the same or similar mounting points as the coin vault assembly for engaging with the parking meter assembly; however, the mounting assembly may not include a coin vault housing.

Figure 9 depicts a top view of the rear cover 102 and bottom plate 306 secured to the saddle plate 106. As depicted in Figure 9, when the bottom plate 306 is rotated or twisted in the clockwise direction, the large diameter heads 420 of the bolts 402 secure the bottom plate 306 to the saddle plate 106. The nuts 606 secure the bolts passing through the extended cylindrical portions 604 of the rear cover 102 to the bottom plate 306. The rail like structures 702 upon which the front assembly may slidably engage are depicted in the Figure.

Figure 10 depicts a rear isometric view of the front assembly. The front assembly 302 may provide a removable parking meter mechanism. The front assembly 302 comprises a front cover 104 and attached parking meter components. The front assembly 302 may include rail guides 1004 that engage with the rails 702 of the rear cover 102. The rail guides 1004 of the front assembly 302 may be formed as part of the front cover 104, or may be provided as separate components that may be attached to the front cover 104. If provided as separate components, the rail guides 1004 may be formed from metal and secured to the front cover by screws or bolts. In addition to providing a strong connection to the rear assembly, the engagement of the metal rails 702 with the rail guides 1004 may provide additional strength against vandalism. The front assembly 302 comprises a plurality of parking meter components mounted, either directly or indirectly, to the front cover 104. The parking meter components comprise a coin chute component 1006 that can discriminate a value of a coin inserted into the parking meter mechanism. The parking meter components may also comprise a magnetic stripe and chip card reader 1008, as well as a contactless payment reader 1010 for carrying out transactions. An inner frame 1012, which is depicted in greater detail in Figures 12 and 13, is mounted to the front cover 104 and may be used to mount electronic components, including, for example, a main processing board

comprising a processor and associated memory for storing and executing control code to provide the desired software functionality of the parking meter. As well, a radio module or modem may be mounted to or in the vicinity of the inner frame 1012. A battery compartment 1014, described in further detail with reference to Figure 14, may be pivotally connected to the inner frame 1012. The battery compartment 1014 may include a main battery compartment (not visible in Figure 10) and rechargeable battery compartment 1016. The pivotally connected battery compartment 1014 may be secured in the position depicted in Figure 10 by clasps or similar structures. The battery compartment 1014 may be released from the inner frame 1012, and so rotated outwards to allow replacement of the batteries, by pressing release tabs 1018. The front assembly 302 may further include a radio transceiver 1020 as well as a solar panel 136 located at the top of the front assembly 302. Further, the front assembly 302 may include a locking mechanism 1022 for securing the front assembly to the rear assembly 304, as well as for preventing the joined front and rear assemblies from rotating when connected to the saddle plate. Alternatively, the rear assembly 304 may include the locking mechanism 1022 for securing the front assembly 302 to the rear assembly 304, as well as for preventing the joined front and rear assemblies from rotating when connected to the saddle plate.

Figure 11 depicts a rear isometric view of the front assembly's front cover or housing. The front cover 104 may be formed from plastic or other high strength materials, including, for example, metals or alloys. Advantages of high strength plastic include lower interference with wireless communications from the parking meter and stronger protection of internal components (as compared to prior parking meters that included antennas with no high strength housing protection). The front cover 104 may be molded or otherwise machined to provide the exterior surface, as well as to provide a plurality of mounting points for connecting the parking meter components. The front cover 104 may include rearward projecting protrusions 1102 that may extend toward the rear cover. The rearward projecting protrusions 1102 may provide screw or bolt holes for securing a lock plate, described further below with particular reference to Figures 15 and 16. The front cover 104 may include a recess 1104 at the top of the front cover 104 for receiving a solar panel. The solar panel recess 1104 may include a secondary radio

antenna recess 1106 located towards the front of the front cover 104. The radio antenna recess 1106 may provide a location for a flexible antenna that may be used for various communications, including for example cellular data communications related to authorization of payment transactions, verification of parking meter status, and/or updating of parking meter functions. Preferably, the antenna is located at or close to the curved inner surface of the front cover 104 within the recess 1106. Alternatively, the antenna may be integrated into or surface mounted to the top facing surface of the solar panel. The solar panel recess 1104 and radio antenna recess 1106 may be fixedly part of, or rigidly attached to, the front cover 104. In the alternative, the solar panel 136 may be provided in a solar panel assembly that slidably engages with or is removably coupled or secured to the front cover 104, and further electrically engages with a battery of the parking meter when the solar panel assembly is fully engaged with the front cover. The solar panel assembly allows the solar panel to be replaceable/serviceable in the event of vandalism, failure or other damage. Such solar panel assembly may include the one or more lights, such as LED-type lights, that may be positioned at or near where the top of the flat portion 114 transitions from the recessed flat portion 114 to the cylindrical perimeter of the front cover 104. Such solar panel assembly may further include status LEDs or holes for permitting the visibility of such status LEDs. In addition to the alternative solar panel assembly, the radio antenna may alternatively be provided in a radio antenna compartment that slidably engages with or is removably coupled or secured to the front cover 104, and further electrically engages with the main electronics board when the radio antenna compartment is fully engaged with the front cover. This allows the radio and antenna combination to be quickly and easily swapped out in the field for maintenance/service, to replace/inspect a SIM card, or to switch the meter from one cellular network to another alternative network that may have better coverage or signal strength than the original network. The inside surface of the front cover 104 comprises a number of mounting locations for other components. The mounting points may include, for example, a mounting location for display and input components 1108, a mounting location for a contactless reader 1110, a mounting location for a magnetic stripe and chip reader 1112 as well as a mounting location for a coin chute 1114. Although a specific molding of a front cover is depicted, it will be

appreciated that the particular locations of the mounting points and other features may vary, and will depend upon the specific components incorporated into the parking meter.

Figure 12 depicts a front isometric view of the parking meter mechanism's inner frame. Figure 13 depicts a rear isometric view of the parking meter mechanism's inner frame. The inner frame 1012 may be mounted to the front cover in the display and input control mounting area 1108. The inner frame 1012 may include one or more expanded openings 1202, which may be shaped to allow different cable connectors to pass through, or may be oversized to allow different connectors to pass through. The inner frame 1012 may further incorporate standoffs 1204 or mounting points for securing main board electronics, or possibly other components, to the inner frame 1012. The inner frame 1012 may also include pivotal connection openings 1206 located on opposite side walls towards a lower end of the inner frame 1012. The pivotal connection openings 1206 may receive pivotal connection pins on the battery compartment and allow the battery compartment to pivot outwards about the pivot connection openings. The side walls of the frame also include slots or openings 1208 that engage with clasps on the battery compartment in order to prevent the battery compartment from pivoting outwards unexpectedly or unintentionally. The inner frame 1012 may include a rear status LED mounting location 1210 for holding rear status LEDs. Clear acrylic light pipes or alternatively a clear lexan material may be used in front of the rear as well as front status LEDs.

Figure 14 depicts a battery compartment housing. The battery compartment 1014 comprises a pair of pivot connection pins 1402 located on either side of the compartment. The pivotal connection pins 1402 may be located on a depressible portion of 1404 of the sides of the battery compartment 1014. The depressible portion 1404 may be provided by cutout at least partially surrounding the pivot connection pin 1402, thereby providing a resilient hinge at an end of the depressible portion 1404. The battery compartment 1014 may further comprise depressible release tabs 1018 on either side of the battery compartment 1014. The depressible release tabs 1018 may include outwardly extending clasps 1406 that can engage with openings 1208 in the side of the inner frame 1012. When pressed, the release tabs 1018 withdraw the clasps

out of the openings 1208 of the inner frame 1012 to allow the battery compartment 1014 to pivot outwards. The battery compartment 1014 may include a main battery compartment 1410 for receiving a main power supply of the parking meter, as well as a secondary battery compartment 1016 for receiving a rechargeable battery that may be periodically charged by a solar panel. It will be appreciated that either battery compartment 1410 or 1016 may contain a battery that can supply power to the parking meter. Further battery compartment 1410 may alternatively accept a rechargeable battery that may also be periodically charged by a solar panel.

Figure 15 depicts a locking mechanism. Figure 16 depicts components of the locking mechanism of Figure 15. The locking mechanism 1022 may be secured to the front cover 104 and used to secure the front assembly 302 to the rear assembly 304, and also to prevent rotation of the rear assembly 304, and in particular to prevent rotation of the bottom plate 306, relative to the saddle plate 106. Alternatively, the locking mechanism 1022 may be secured to the rear cover 102 and used to secure the front assembly 304 to the rear assembly 302, and also to prevent rotation of the rear assembly 302. In particular, the locking mechanism 1022 in this regard may prevent rotation of the bottom plate 306 relative to the saddle plate 106. As depicted, the locking mechanism 1022 comprises a lower lock plate 1506 that is secured to the front cover 104. The lower lock plate 1506 includes openings 1518a, 1518b through which the elevated overhangs 816a, 816b of the bottom plate 306 may be received. The lower lock plate 1506 comprises an upwardly turned portion 1508 that provides a mounting location for other locking mechanism components, including a cylinder lock 1502. The cylinder lock has a rotating barrel that rotates when an appropriate key is turned. The rotating barrel is attached to an actuating cam plate 1504 that rotates and extends or retracts locking arms 1514a, 1514b attached to the cam plate. It is noted that the connection between the rotating cam plate 1504 and the locking arms 1514a, 1514b is not depicted in Figure 15 for simplicity. A capture plate 1510 may be secured to the upturned section 1508 of the lower lock plate 1506. The capture plate 1510 may have bent sections 1512 on either end of the capture plate 1510. When attached to the lock plate 1506, the capture plate 1510, and in particular the bent sections 1512, provide a guide channel through which the lock arms 1514a, 1514b may pass. The guide

channels allow the locking arms 1514a, 1514b to move inwards and outwards when the lock is turned. In Figure 15, the locking arms 1514a, 1514b are depicted in the locked position. In the locked position, horizontal surfaces of the locking arms 1514a, 1514b, which are parallel to the lower lock plate 1506, are located under lower surfaces of the elevated overhangs 816a, 816b and adjacent to openings 1518a, 1518b, respectively. With the locking arms 1514a, 1514b retained or secured under the elevated overhangs 816a, 816b of the bottom plate 306 of the rear assembly 304, the locking mechanism 1022, and the attached front assembly 302 become rigidly coupled to the rear assembly 304. As a result, vertical separation of the front assembly 302 from the rear assembly 304 is prevented. In addition to vertically securing the front assembly to the rear assembly, the locking mechanism 1022 also prevents rotation of the bottom plate 306 relative to the saddle plate 106, as openings 1516a, 1516b engage the large diameter heads 420 of the bolts 402, which are stationary relative to the locking mechanism 1022 of the front assembly 302 when fully inserted into and engaged with the rear assembly 304. In the unlocked position, the horizontal surfaces of the locking arms 1514a, 1514b as described above are retracted out from under the elevated overhangs 816a, 816b, and as such the front assembly 302 may be slid vertically upward on or along the rear assembly 304, and in such situation the rear assembly 304 including bottom plate 306 may be rotated, thus permitting rotation of the full parking meter assembly 101. Having the ability to vertically slid the front assembly 302 alone in an upward direction when in the unlocked position is advantageous, as it allows, for example, maintenance personnel access to the electronic and other components of the front assembly 302 in the event that repair or replacement is required, or inspection of components (such as coin or card payment components) is desirable.

Although the locking mechanism described herein contemplates it being rigidly secured to the front assembly and engageable with the rear assembly, it will be appreciated that the opposite could be implemented, namely, a locking mechanism that is rigidly secured to the rear assembly and engageable with the front assembly.

Although the locking mechanism is described herein with regard to an actuating cam plate 1504 that rotates and extends or retracts locking arms 1514a, 1514b attached to

the cam plate to prevent or allow vertical movement of the front assembly 302 relative to the rear assembly 304, as well as to prevent or allow rotation of the bottom plate 306 relative to the saddle plate 106, it will be appreciated that alternative locking methods or mechanisms are possible. To prevent rotation, a locking mechanism will preferably cause interference between some or all of the parking meter assembly and the coin vault housing, e.g., interference between the bottom plate and the saddle plate. A plurality of methods or locking mechanism designs could be employed to achieve this. For example, rotation of the bottom plate relative to the saddle plate can be prevented or allowed by manually engaging or disengaging a second, manually engageable set of locking arms during the retrofit process while the front assembly is elevated vertically relative to the rear assembly. Once manually engaged to prevent rotation, the front assembly can be lowered into place, and an additional and relatively simpler lock used to prevent or allow vertical movement of the front assembly 302 relative to the rear assembly 304. Thus, the locking mechanism in this example comprises a manually engageable set of locking arms to govern rotational movement, and an additional lock to govern vertical movement.

Figure 17 depicts a method of retrofitting an existing parking meter. The method 1700 begins with removing all of the existing parking meter components from the coin vault housing (1702). This may include removing a front or upper housing that is secured to a lower housing. A removable meter mechanism may be removed from the lower housing and the lower housing may be subsequently removed from the coin vault housing. Once the existing parking meter is disassembled to the coin vault, a saddle plate is connected to the coin vault housing (1704) and the retrofit parking meter may be coupled to the saddle plate (1706). The parking meter may then be locked (1706) to the saddle plate to prevent subsequent removal of the parking meter from the saddle plate and coin vault housing.

A parking meter assembly has been described above that engages with a coin vault assembly when a bottom surface of a protective outer covering of the parking meter assembly is positioned against or adjacent to an upper surface of the coin vault assembly. Although described above in detail, variations may be made to the above

described parking meter assembly. For example, the display and/or user input buttons, as well as the payment means, may be arranged in different configurations and/or locations, or using an alternative size or type of display, input means, or payment means. Additionally, the locking, or engaging mechanism securing the parking meter assembly to the coin vault assembly may differ from the rotationally engageable mechanism described above.

Figure 18 depicts a further bottom plate. The bottom plate 1800 may be used in the alternative to the bottom plate 306 described above. As described above, the bottom plate engages with the coin vault assembly to secure the parking meter assembly to the coin vault assembly. The above has described the bottom plate as engaging with the coin vault assembly by rotation. As depicted in Figure 18, other types of engagement are possible. For example, the bottom plate 1800 provides a sliding engagement with the coin vault assembly. The keyhole openings 1802a, 1802b, 1802c, 1802d (referred to collectively as keyhole openings 1802) are arranged in the same orientation as each other. As such, when the bottom plate 1800 is placed over the large diameter bolt heads of the coin vault assembly, and the bolt heads pass through the large diameter openings of the keyholes 1802, the parking meter assembly with the bottom plate 1800 can slidably engage the bolts by sliding the parking meter assembly to the right (vis-à-vis Figure 18) such that the bolts will be positioned in the smaller diameter openings of the keyholes 1802. The bottom plate 1800 may be secured to the rear cover of the parking meter assembly in various ways, including nuts and bolts as described above with reference to bottom plate 306. Alternatively, if the bottom plate is made from a metal, it is possible to weld the bottom plate 1800 to the rear cover. Other types of connections are possible for securely attaching the bottom plate 1800 to the remainder of the parking meter assembly. Alternatively, the bottom plate and the rear cover, or other portions of a protective outer covering of the parking meter assembly, may be integrally formed as a single component. As described above, the parking meter assembly, which may include bottom plate 1800, may provide a protective outer covering to protect the internal parking meter components. It is possible to secure the parking meter assembly to the coin vault assembly by positioning a bottom surface of the protective outer covering against or adjacent to an upper surface of the coin vault

assembly. The protective outer covering may then be slid in order to secure the parking meter assembly to the coin vault assembly.

Figure 19 depicts a further parking meter. The parking meter 1900 is similar to the parking meter 100 described above. In particular, a parking meter assembly providing a protective outer covering to internal parking meter components includes a bottom plate for securing the parking meter assembly to a coin vault assembly. The protective outer covering may engage the coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the coin vault assembly. Various components and features of the parking meter 1900 are substantially similar to those of parking meter 100 and, as such, only differences in the parking meters are described as follows.

The parking meter 1900 provides a low-profile parking meter assembly 1901 that can be secured to a coin vault assembly, or similar structure. The parking meter assembly comprises a plurality of input controls 1902 arranged horizontally below a display. It will be appreciated that other arrangements of input controls are possible. Further, in order to reduce an overall height of the parking meter assembly 1901, the payment means are all located in the same general horizontal area. That is, the coin chute 1904 is located horizontally adjacent to the card slot 1906 for the card reader as well as a tap target, or antenna location, 1908 for the contactless payment reader. As depicted in Figure 19, the payment means 1904, 1906 and 1908 are generally horizontally aligned with each other. This is in contrast to the coin chute 120 of parking meter 100, which is vertically offset from, and so not generally horizontally aligned with, the other payment means 122, 124. The parking meter 1900 may further comprise an overhead light 1910 projecting downwards from the front cover in order to illuminate at least a portion of the parking meter to facilitate user interactions in the evening.

Figure 20 depicts an internal isometric view of the front cover. The internal structure of the front cover 2002 may provide mounting features to allow the payment components, such as coin chute 1904, card reader 1906 and contactless payment reader 1908 to be releasably secured. As an example, the payment components may be secured to the

front cover 2002 using thumbscrews 2004. The thumbscrews allow the components to be easily disengaged from the meter housing or covering for inspection, service, or removal from the meter housing or covering if necessary. For example, during routine maintenance on the street, a coin chute 1904 may be quickly replaced with another coin chute by unscrewing the thumbscrew or thumbscrews and removing the coin chute 1904 as depicted in Figure 20. Additionally or alternatively, unscrewing the thumbscrew may allow the payment component to be moved to a partially attached position which allows the payment component to be easily inspected while not be fully separated from the parking meter. For example, the payment components may be pivotally connected to the parking meter cover. Unscrewing the thumbscrew may allow the payment component to become partially disengaged from the meter housing or covering and swing outwards into a disengagement position. Such a disengagement position may provide improved visibility for inspection and improved access for service without actual removal of the payment component from the parking meter. Once inspection or service has been completed, the payment component may be swung or rotated back to a fully engaged position and the thumbscrew re-attached to secure the payment device in the fully engaged position. If upon inspection or servicing it is determined that the payment component should be replaced, it can be removed from the disengagement position and a replacement component secured to the parking meter.

Figure 21 depicts a side view of the front cover and solar panel assembly. As described further above, the parking meter may include a solar panel that is located in a solar panel assembly 2102 that can be inserted into the front cover, and further electrically engages with a battery of the parking meter when the solar panel assembly is fully engaged with the front cover. This allows the solar panel assembly to be easily replaceable and/or serviceable in the event of vandalism, failure or other damage. The solar panel assembly 2102 may include the one or more lights 2104 that can be exposed through a small opening in the front cover 2002 and illuminate the user interface of the parking meter. The solar panel assembly 2102 may further include status LEDs or holes 2106 for permitting the visibility of such status LEDs. Figure 21 also depicts rotatable battery compartment 2108 as well as the card payment reader 1906.

Figure 22 depicts a side view of the front cover and radio assembly. In addition to the slidable solar panel assembly 2102 described above, the radio antenna of the parking meter may be provided in a radio antenna compartment 2202 that slidably engages with or is removably coupled or secured to the front cover 2002 and further electrically engages with the main electronics board when it is fully engaged onto the front cover. This allows the radio and antenna combination to be quickly and easily swapped out in the field for maintenance/service, to replace/inspect a SIM card, or to switch the meter from one cellular network to another alternative network that may have better coverage or signal strength than the original network.

Although various individual features and/or functionality may have been described with reference to a specific embodiment, such features and/or functionality may be incorporated into other embodiments.

A parking meter retrofit to existing coin vaults has been described by way of examples. It will be appreciated that components of one example may be incorporated into another example. Furthermore, although specific embodiments of a retrofit parking meter are described, it will be appreciated that other parking meter designs, including other parking meter components or configurations of parking meter components, may be implemented. Variations and modifications not described herein will be apparent to one of ordinary skill in the art having regard to the description herein.

WHAT IS CLAIMED IS:

1. A single space parking meter assembly for retrofitting onto an existing coin vault assembly, the coin vault assembly comprising a coin vault housing, the parking meter assembly comprising:

    at least one battery for supplying power for the parking meter assembly;

    a display;

    at least one payment means for accepting payment for parking time selected from the group comprising a coin chute, a card slot and a contactless payment reader;

    a radio transceiver;

    a protective outer covering that at least partially houses the at least one battery, the display, the at least one payment means, and the radio transceiver, the protective outer covering comprising at least one feature which engages with at least one corresponding feature on the coin vault assembly to prevent the protective outer covering from being separated from the coin vault assembly when the protective outer covering is rotated or slid relative to the coin vault assembly with a bottom surface of the protective outer covering positioned against or adjacent to an upper surface of the coin vault assembly; and

    a locking mechanism at least partially housed within the protective outer covering, the locking mechanism having a locked position that locks the protective outer covering to the coin vault assembly by preventing rotation or sliding of the protective outer covering relative to the coin vault assembly when the at least one feature of the protective outer covering is engaged with the at least one corresponding feature of the coin vault assembly.

2. The parking meter assembly of claim 1, wherein the existing coin vault assembly is fitted with a saddle plate adapted to be received over a portion of the coin vault housing, wherein the saddle plate is rigidly and fixedly attached to the coin vault housing, and the protective outer covering is rotatably or slidably engageable with

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the coin vault assembly when a bottom surface of the protective outer covering is positioned against or adjacent to an upper surface of the saddle plate.

3. The parking meter assembly of any one of claims 1 to 2, wherein the protective outer covering comprises a front cover, a rear cover and a bottom plate.

4. The parking meter assembly of any one of claims 1 to 2, wherein the protective outer covering comprises a front cover, a rear cover and a bottom plate, wherein the front cover and rear cover are slidably engageable with one another, and wherein the bottom plate is rotatably or slidably engageable with the coin vault assembly when the bottom plate is positioned against or adjacent to an upper surface of the coin vault assembly.

5. The parking meter assembly of claim 4, wherein the locking mechanism when engaged prevents rotation or sliding of the bottom plate, and prevents sliding of the front cover relative to the rear cover.

6. The parking meter assembly of any one of claims 1 to 5, further comprising a solar panel assembly that is removably engageable with the parking meter assembly, wherein the solar panel assembly comprises a solar panel.

7. The parking meter assembly of claim 6, wherein the solar panel is rotatably adjustable.

8. The parking meter of claim 6 or 7, wherein the solar panel can be vertically angled or sloped to two or more different positions.

9. A method for retrofitting a single space parking meter assembly onto an existing coin vault assembly, the single space parking meter assembly comprising a protective outer covering and a locking mechanism at least partially housed within the protective outer covering, and the coin vault assembly comprising a coin vault housing, the method comprising:

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disassembling an existing parking meter to the existing coin vault housing;

positioning a bottom surface of the protective outer covering against or adjacent to an upper surface of the coin vault assembly

rotating or sliding the protective outer covering of the parking meter assembly relative to the coin vault assembly to engage at least one feature on the protective outer covering with at least one corresponding feature on the coin vault assembly; and

securing by way of the locking mechanism the protective outer covering to the coin vault assembly once the protective outer covering has been engaged with the coin vault assembly by preventing rotation or sliding of the protective outer covering relative to the coin vault assembly.

10. The method of claim 9, wherein the step of rotatably or slidably engaging a protective outer covering of the parking meter assembly with the existing coin vault assembly also comprises the step of rigidly and fixedly attaching a saddle plate to the coin vault housing, wherein the saddle plate is adapted to be received over a portion of the existing coin vault housing, and the protective outer covering rotatably or slidably engages the saddle plate.

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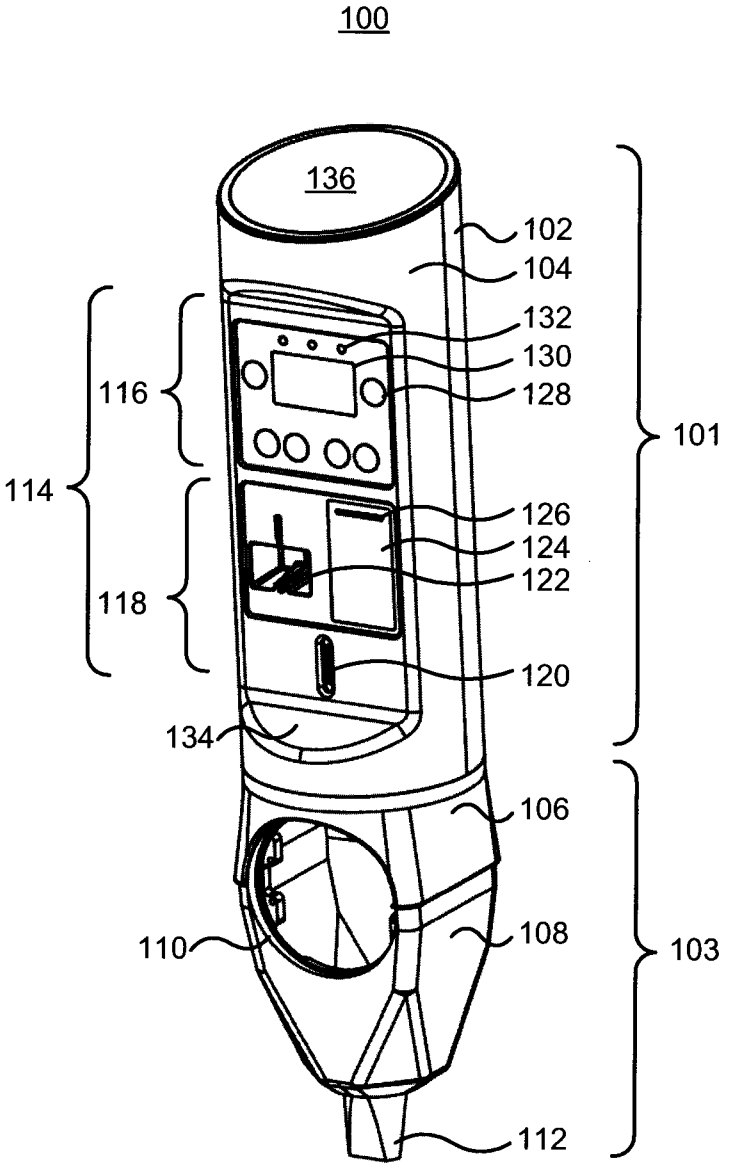
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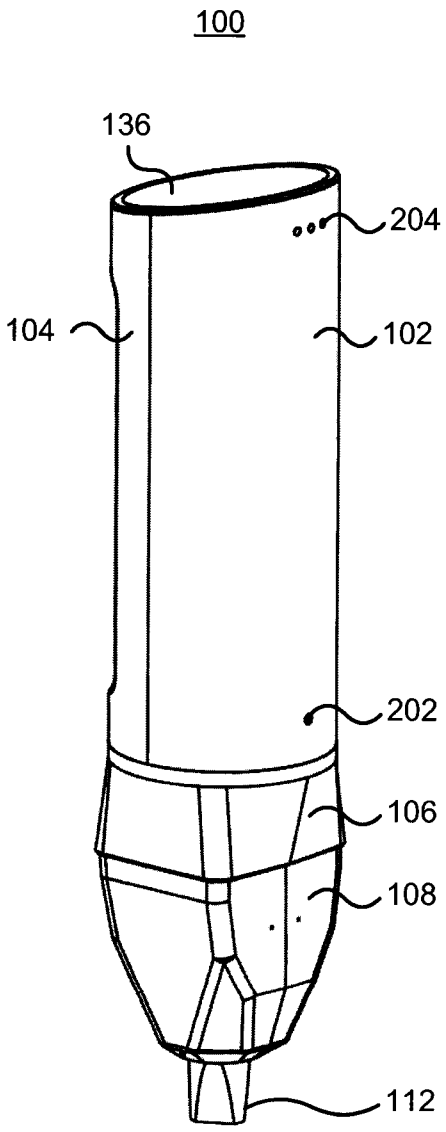
Figure 1



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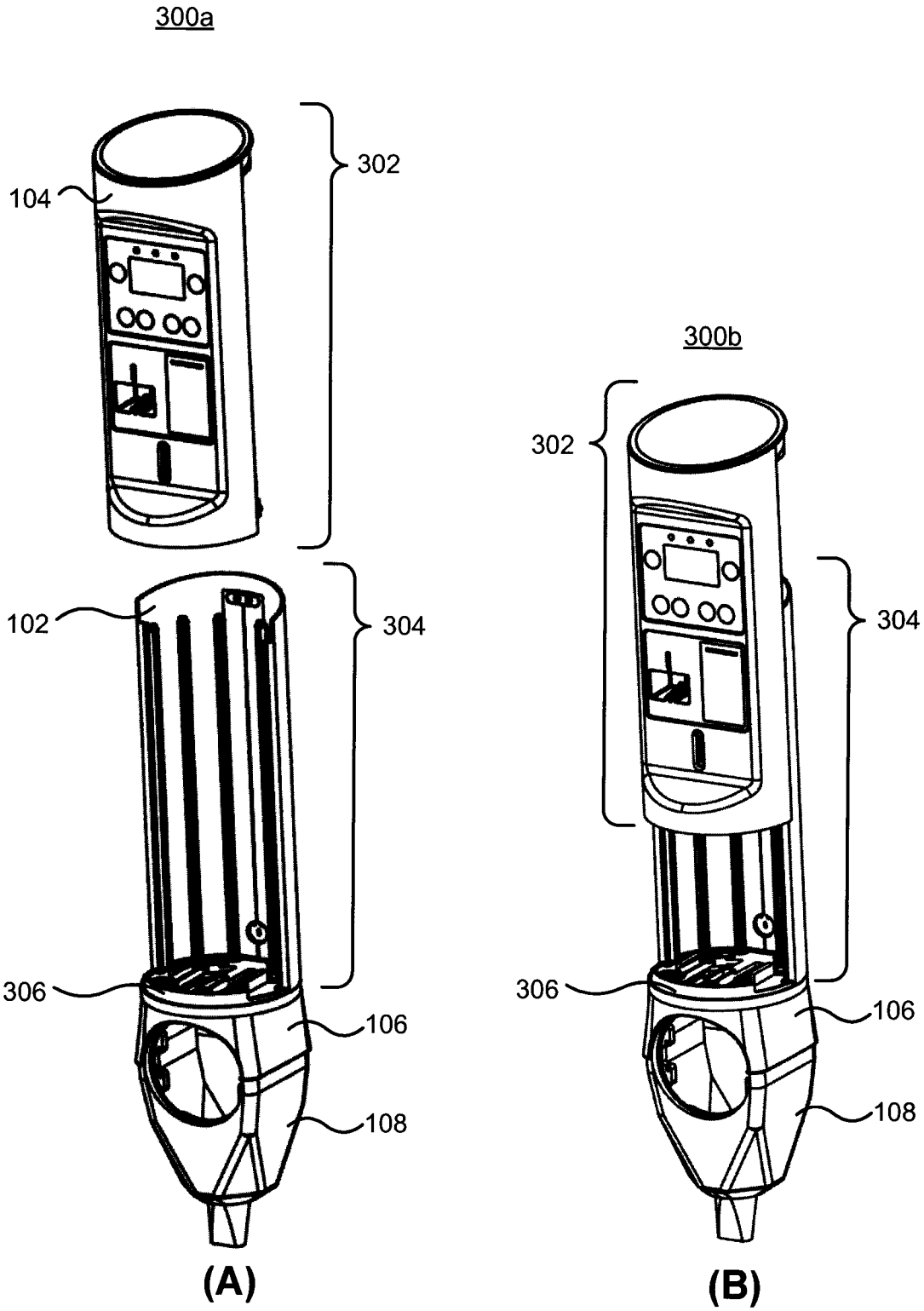

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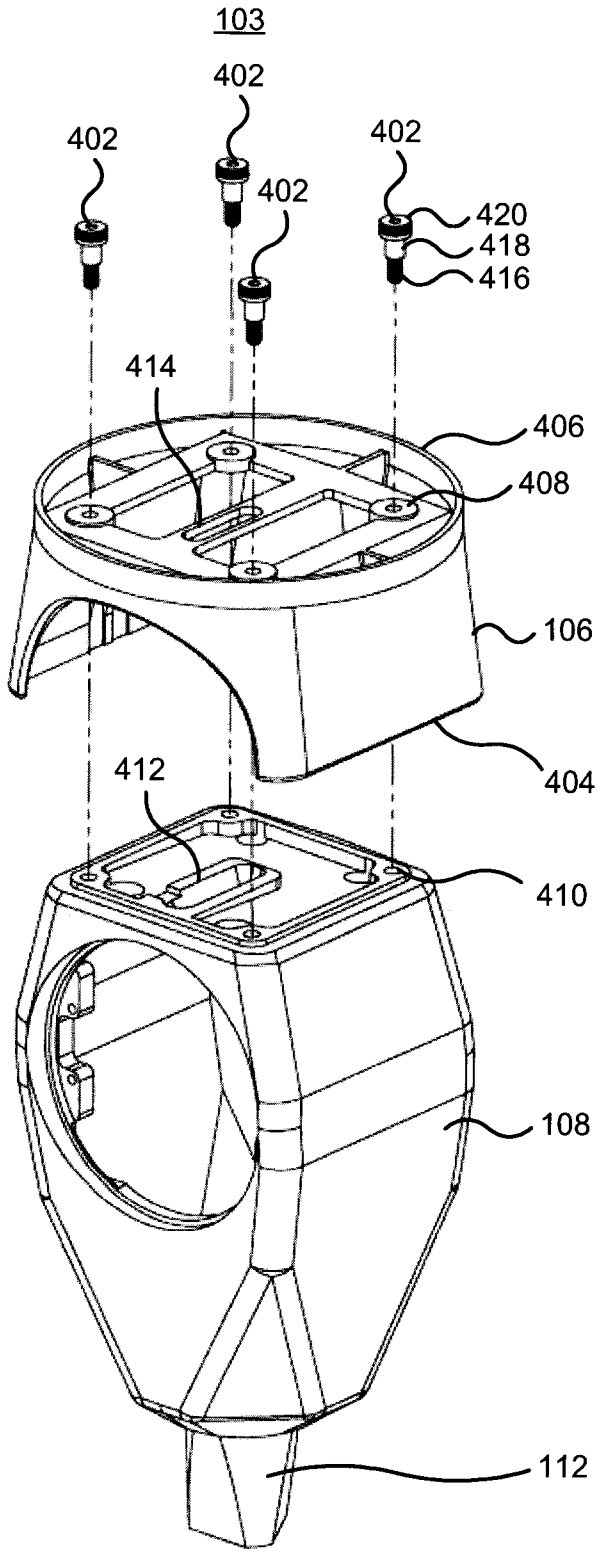
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Figure 4

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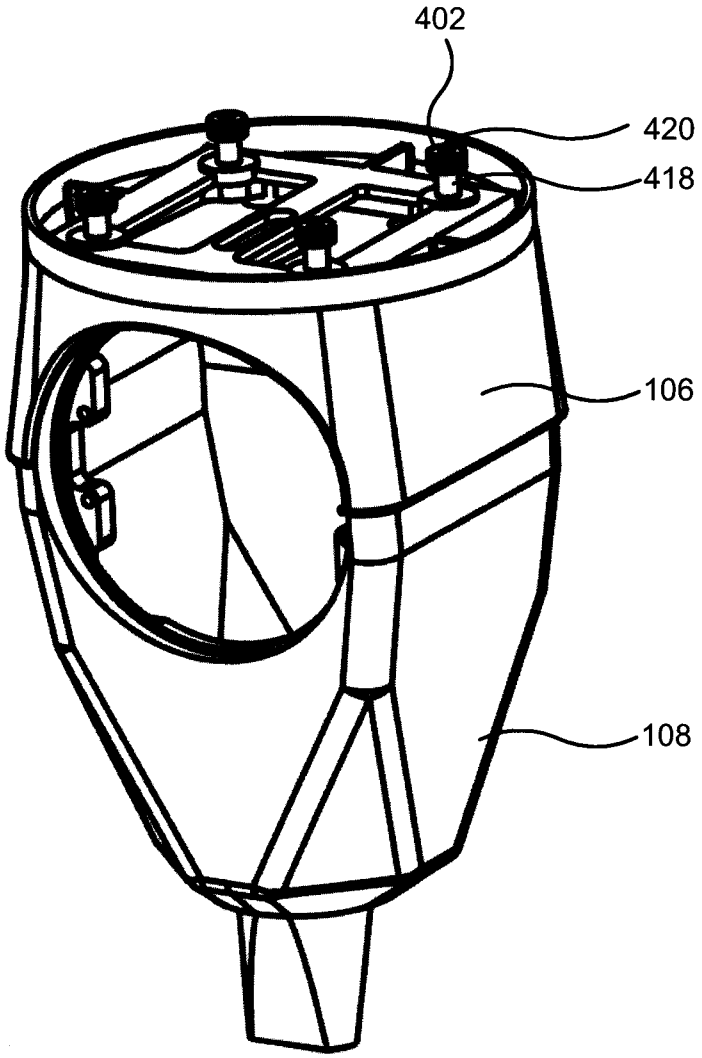

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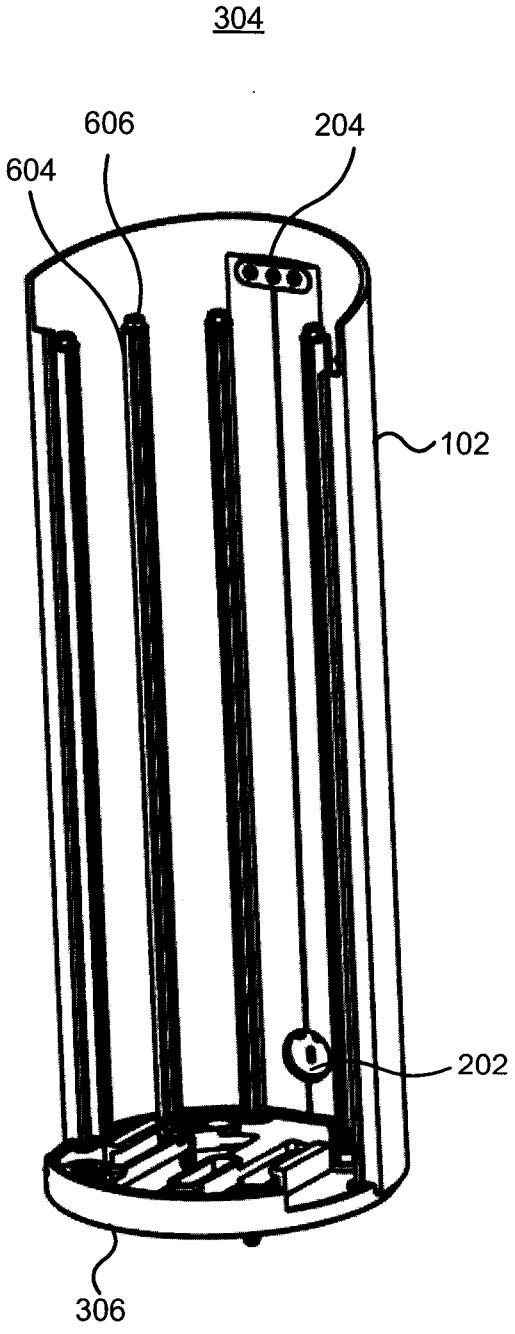

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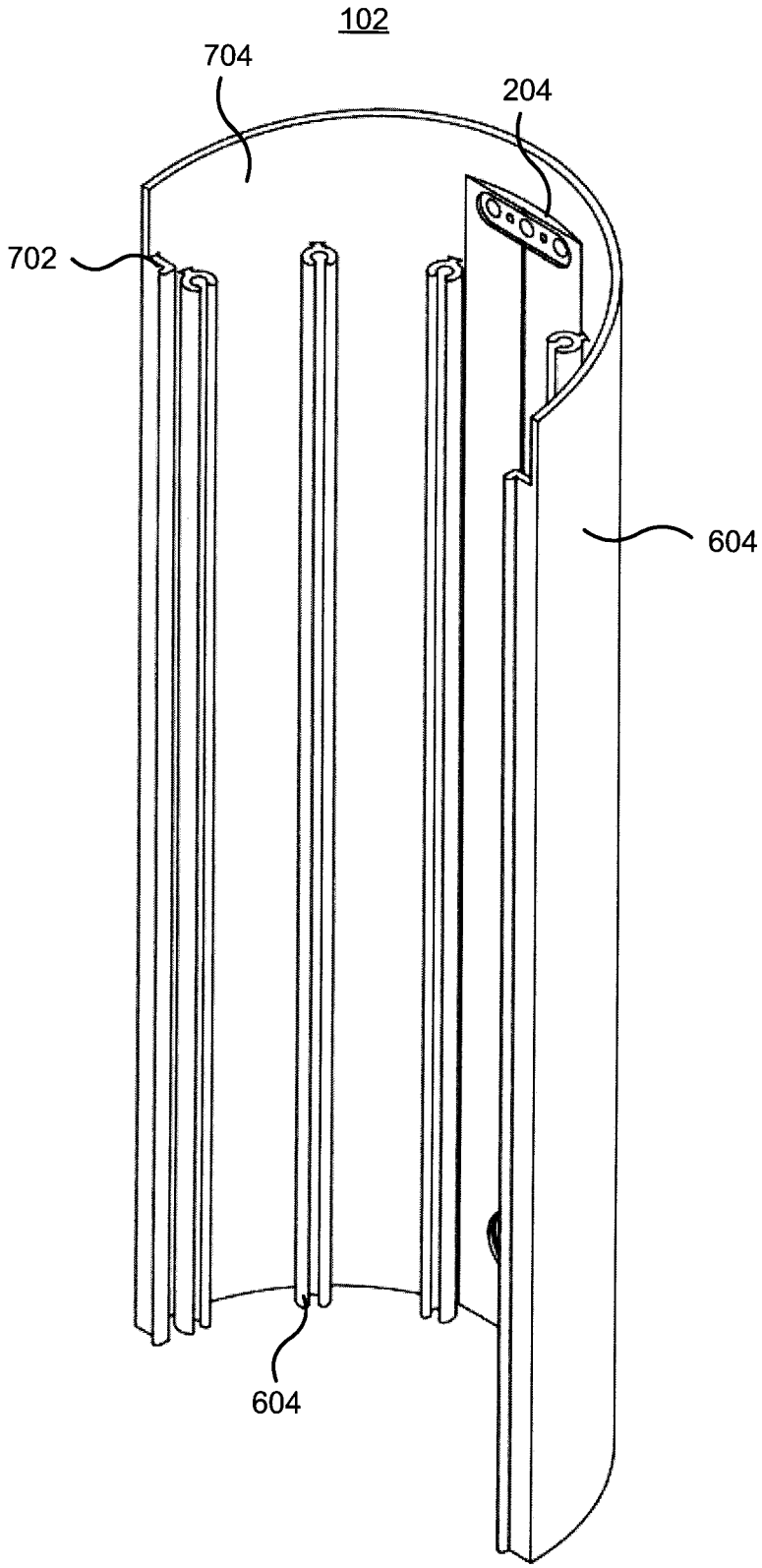

Figure 7

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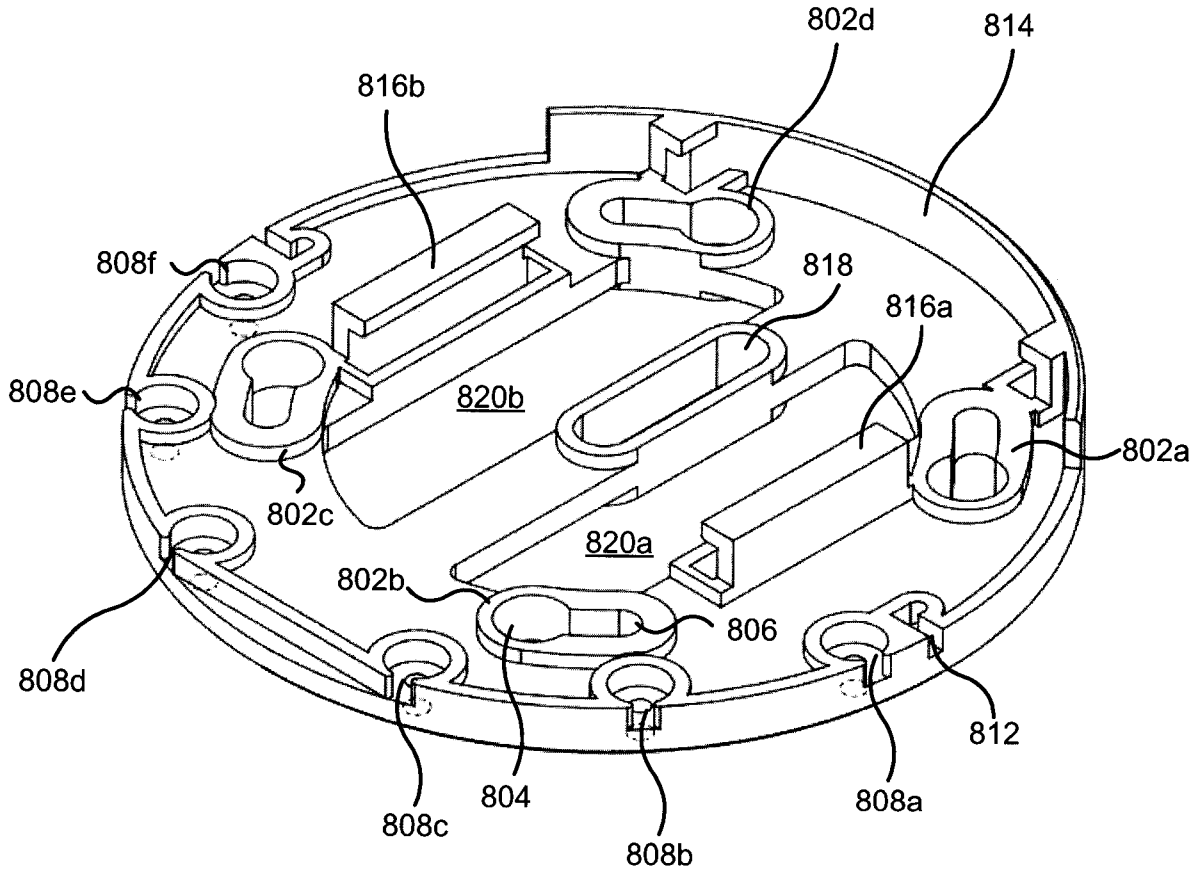
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Figure 8

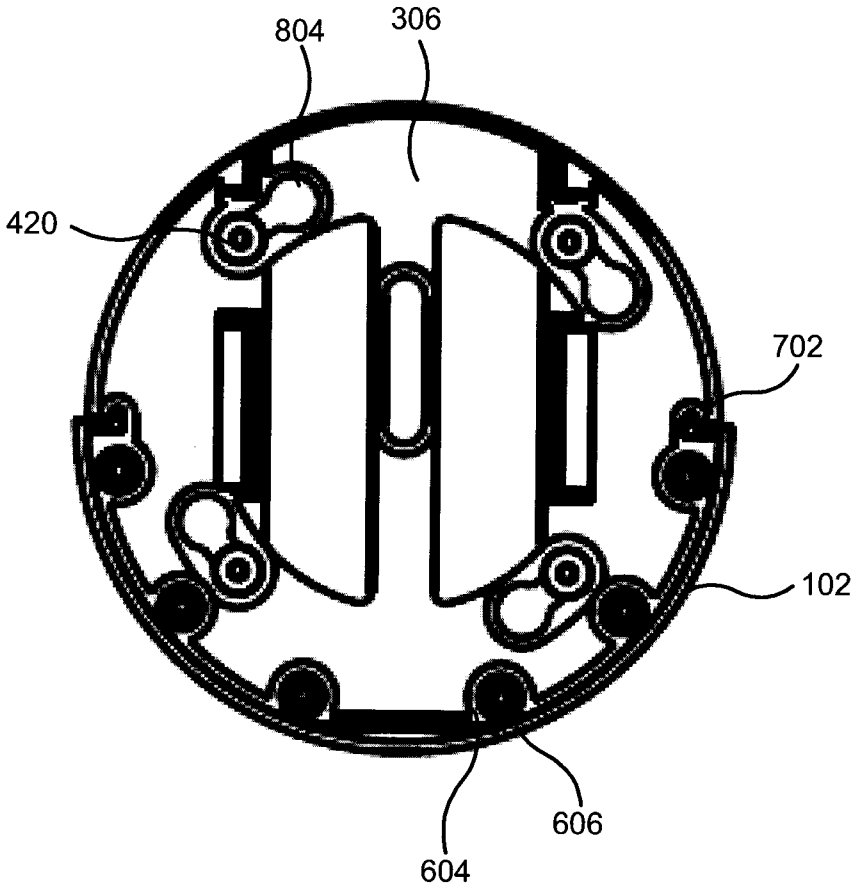

Figure 9

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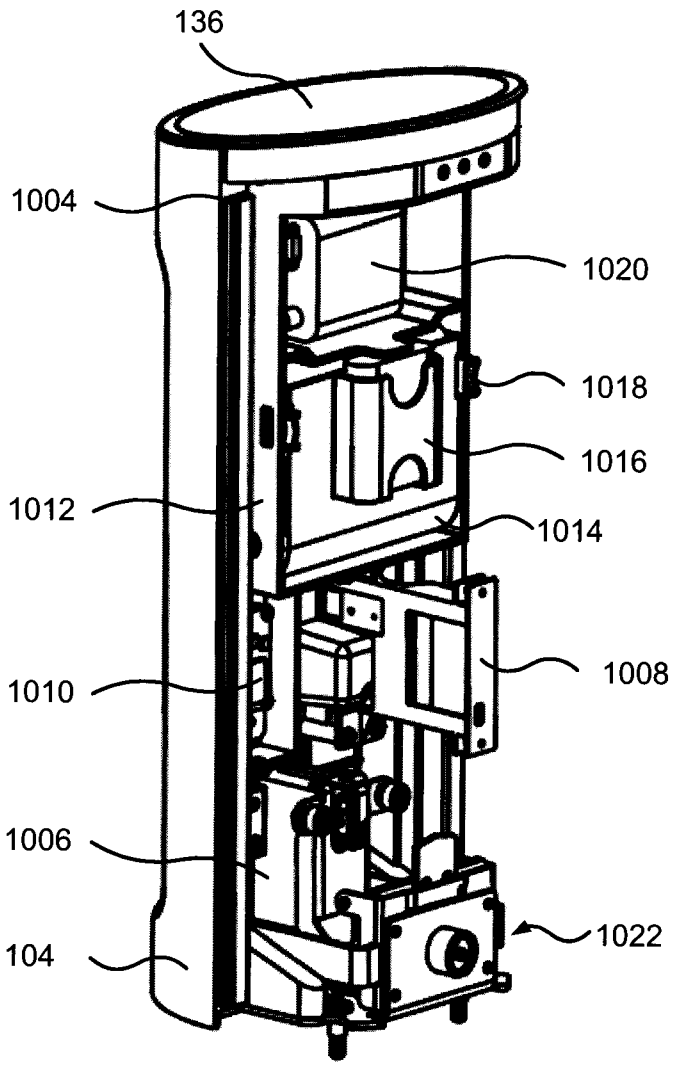

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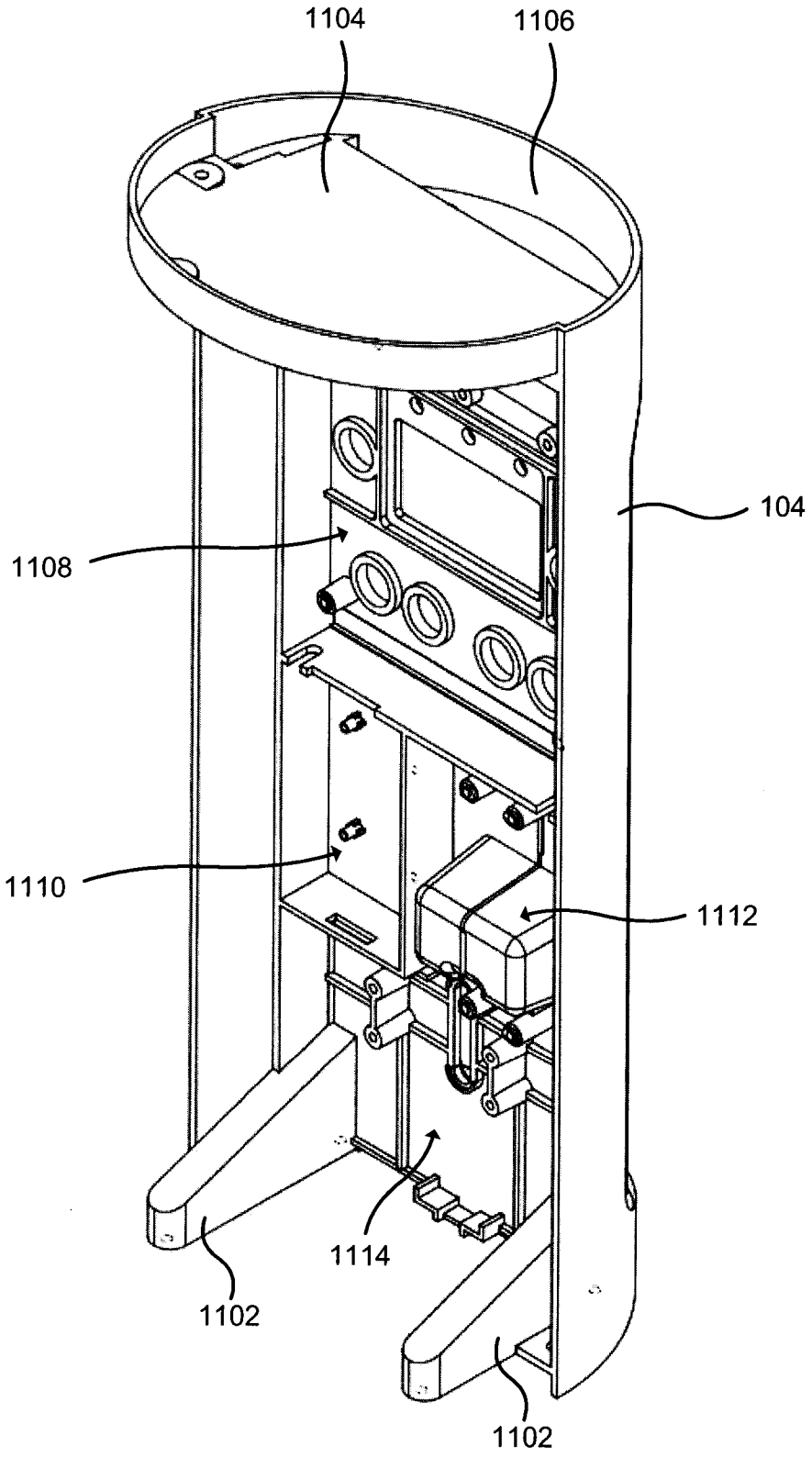

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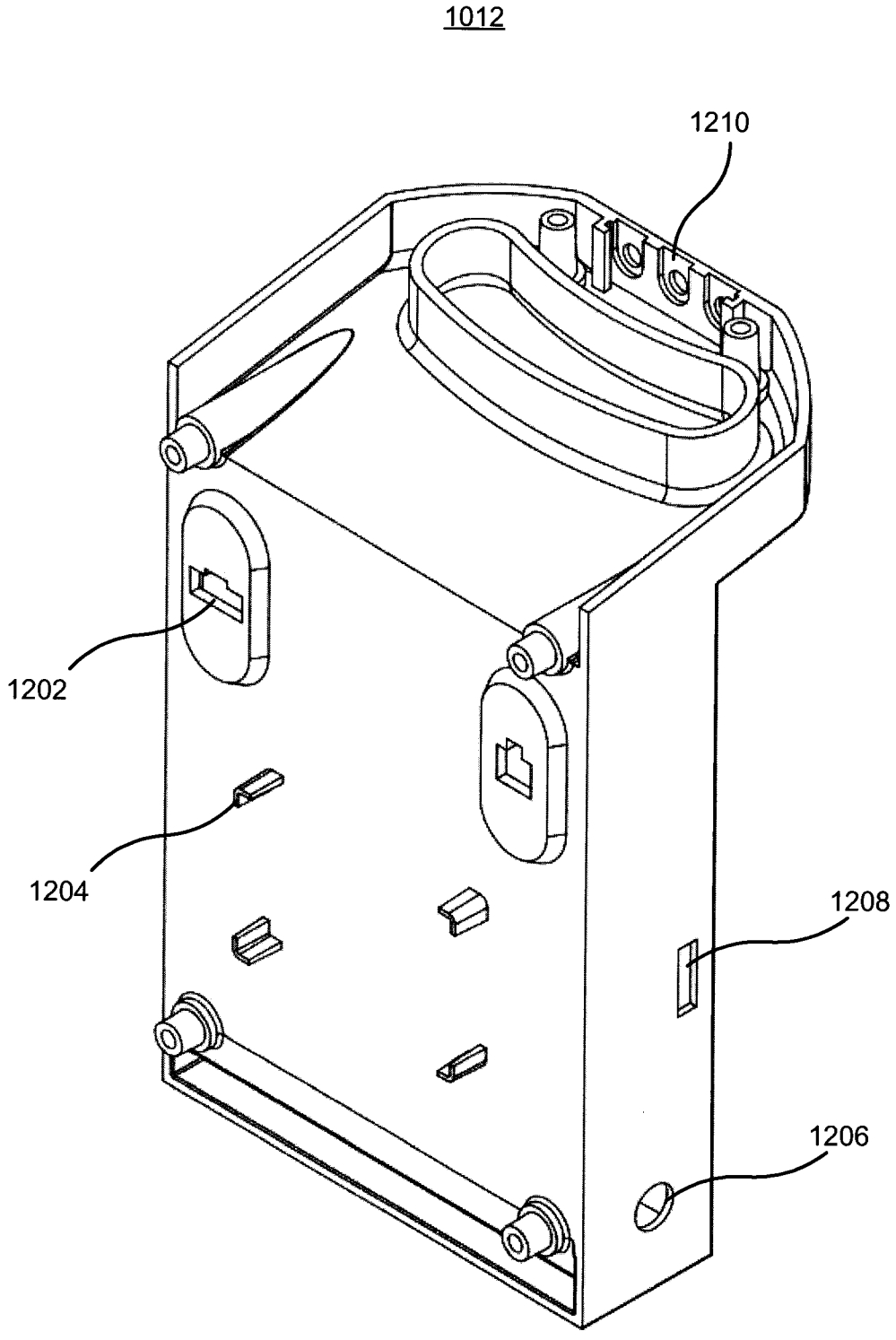

Figure 12

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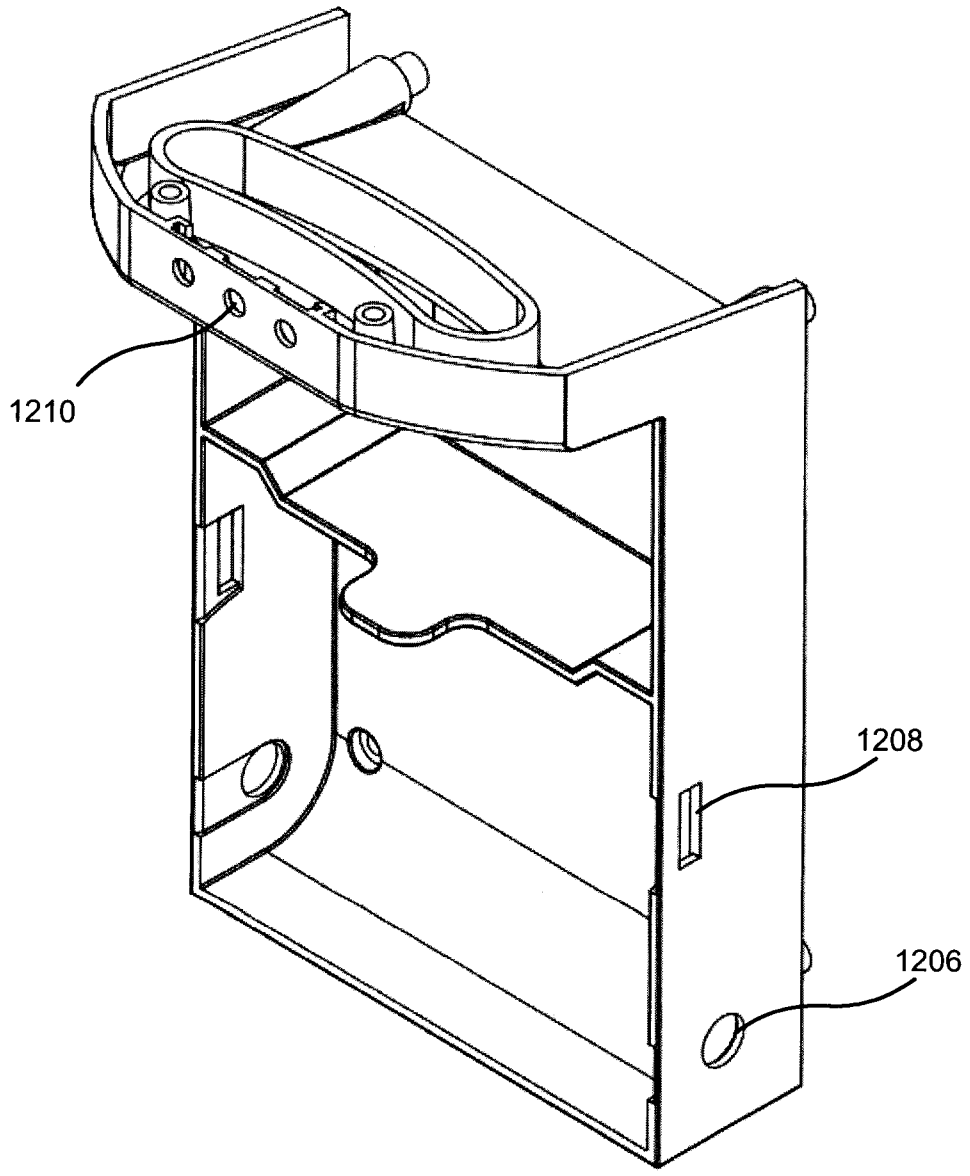

Figure 13

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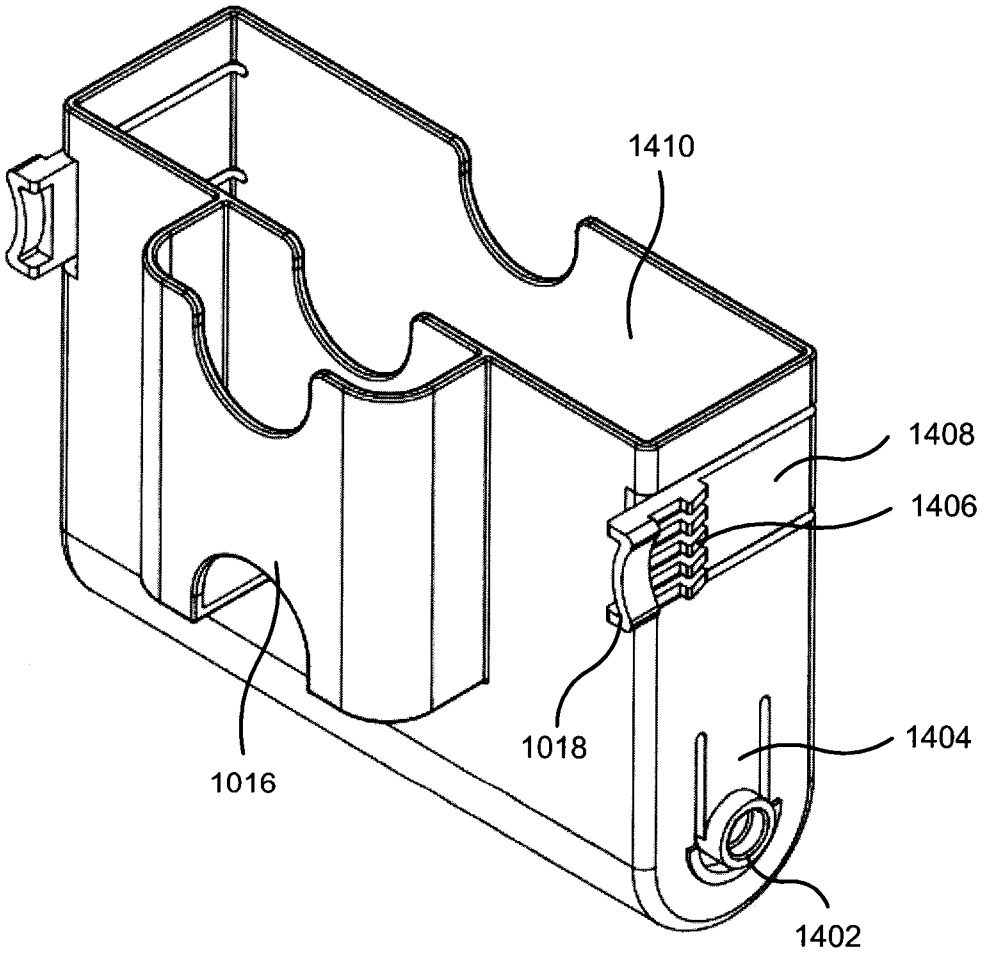

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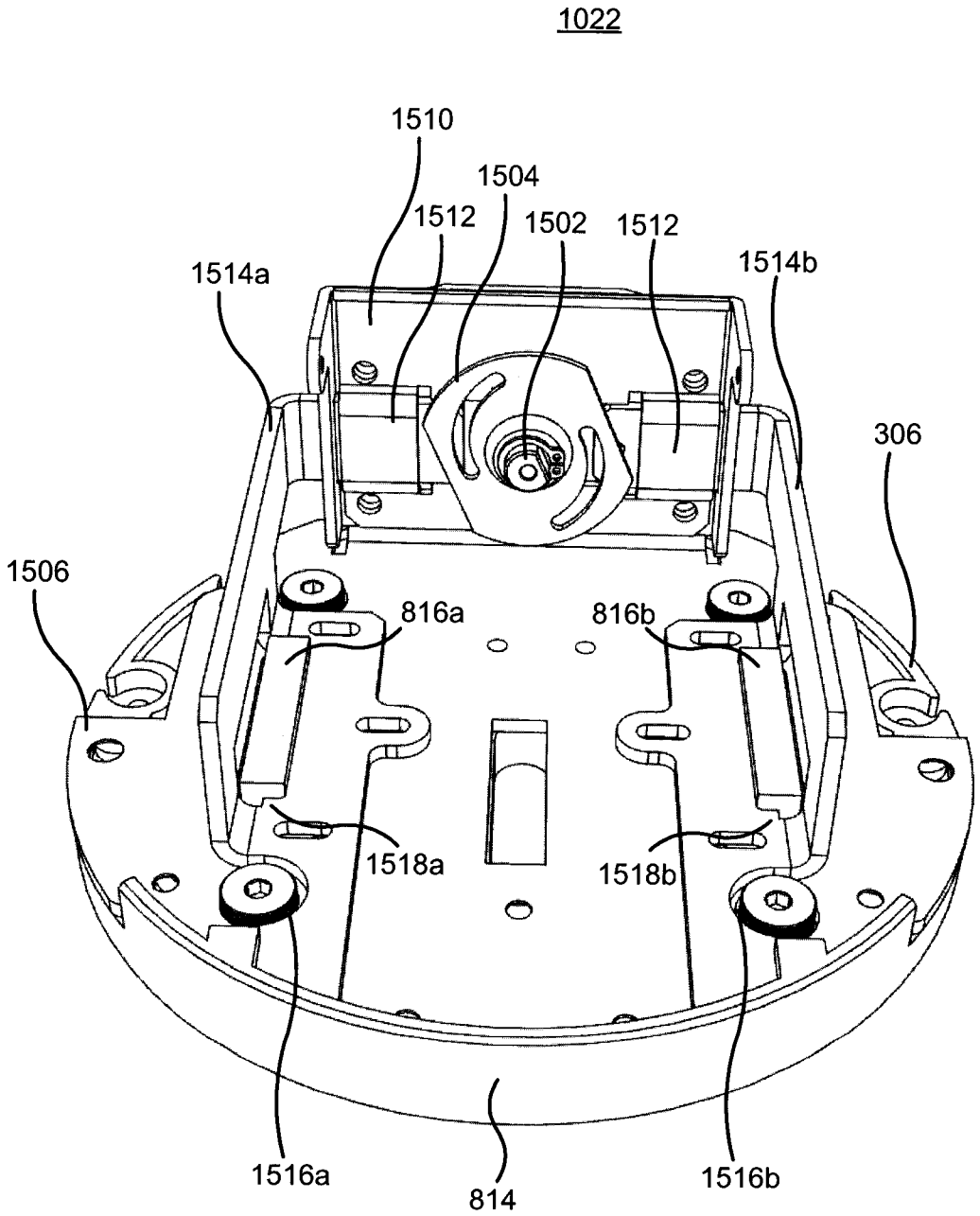
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Figure 15

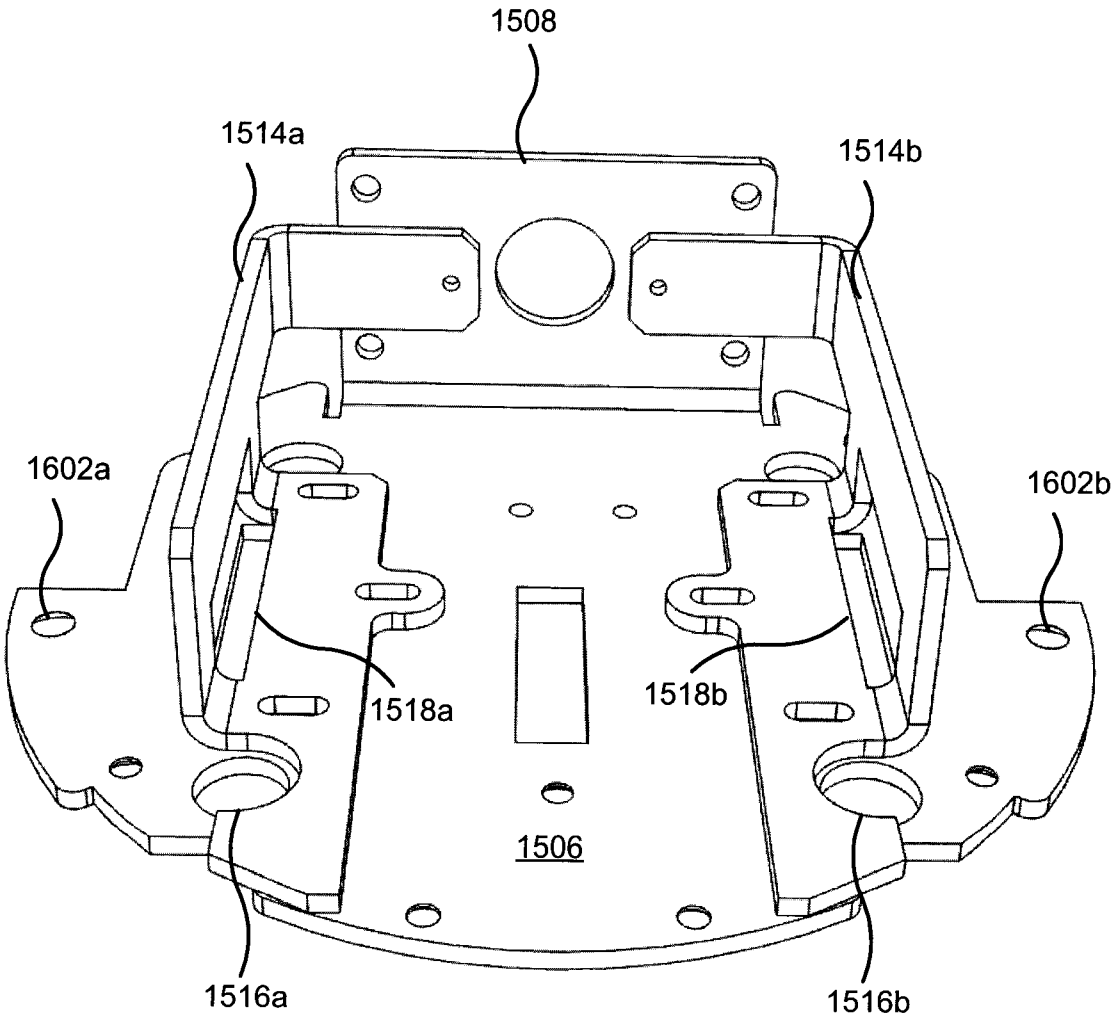

Figure 16

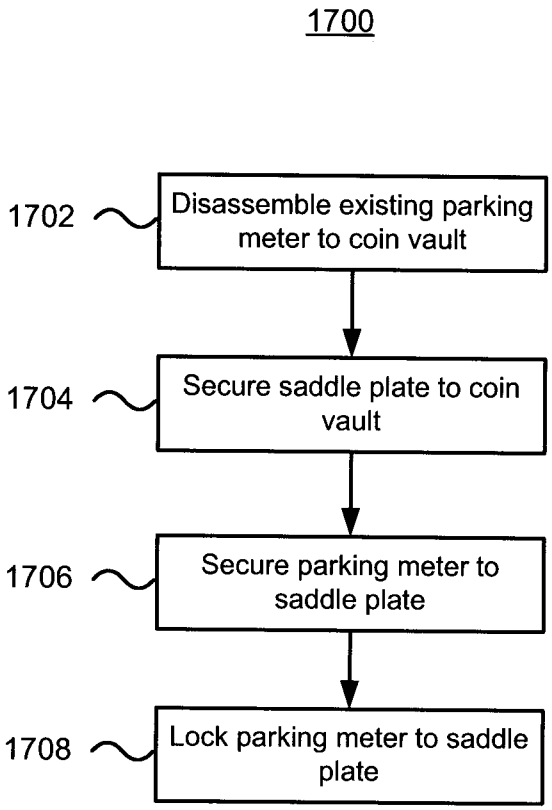
1700
1702
Disassemble existing parking meter to coin vault
1704
Secure saddle plate to coin vault
1706
Secure parking meter to saddle plate
1708
Lock parking meter to saddle plate

Figure 17

1800

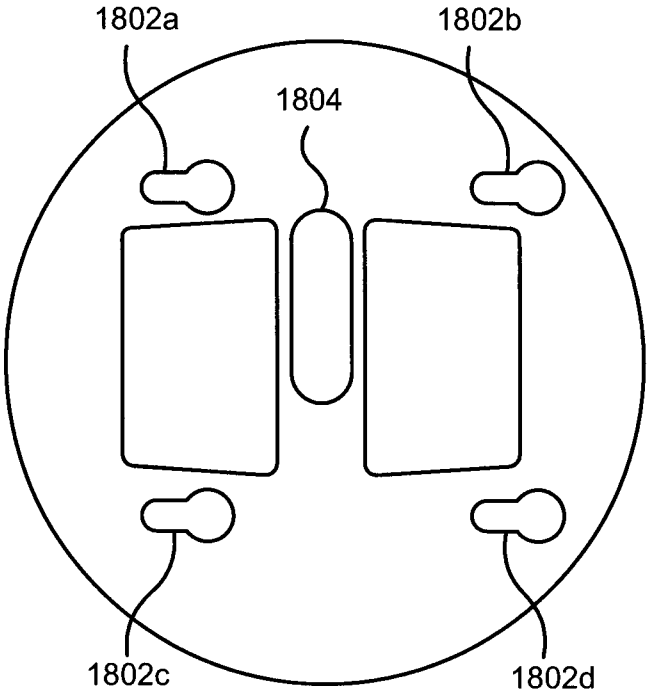

Figure 18

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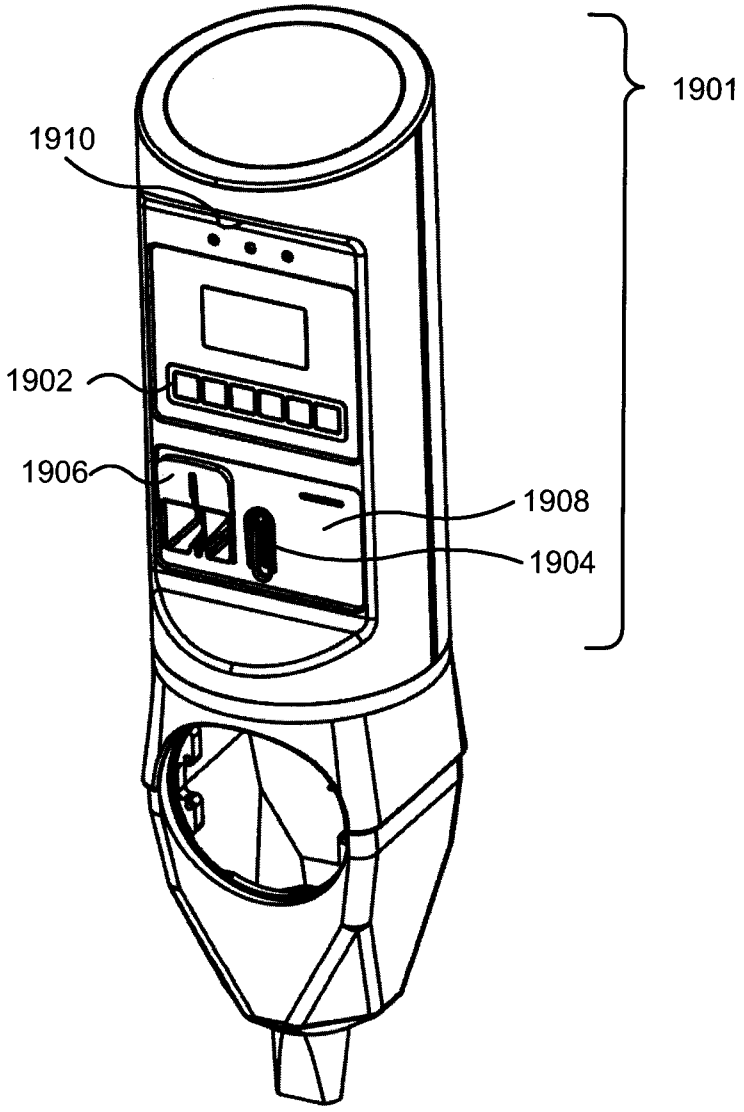

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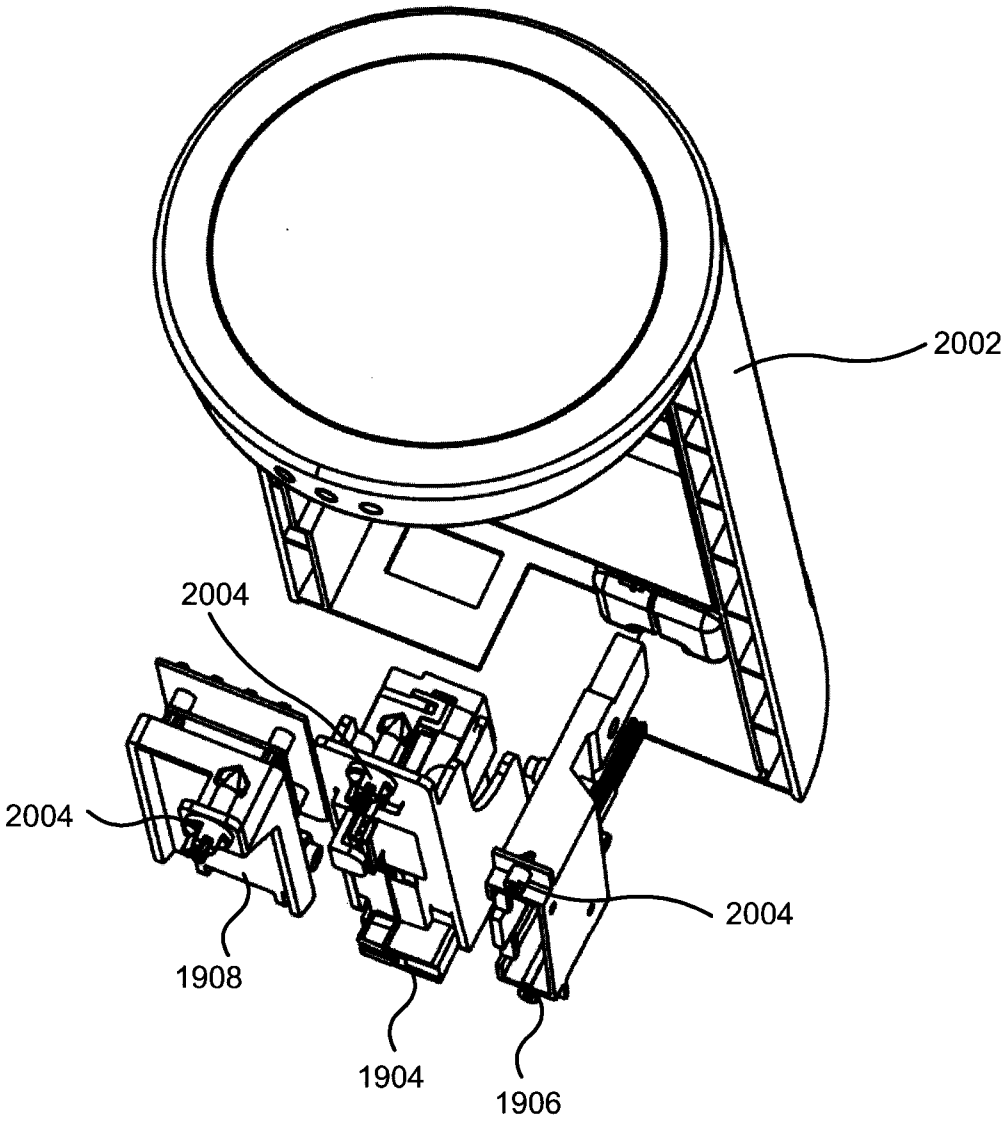

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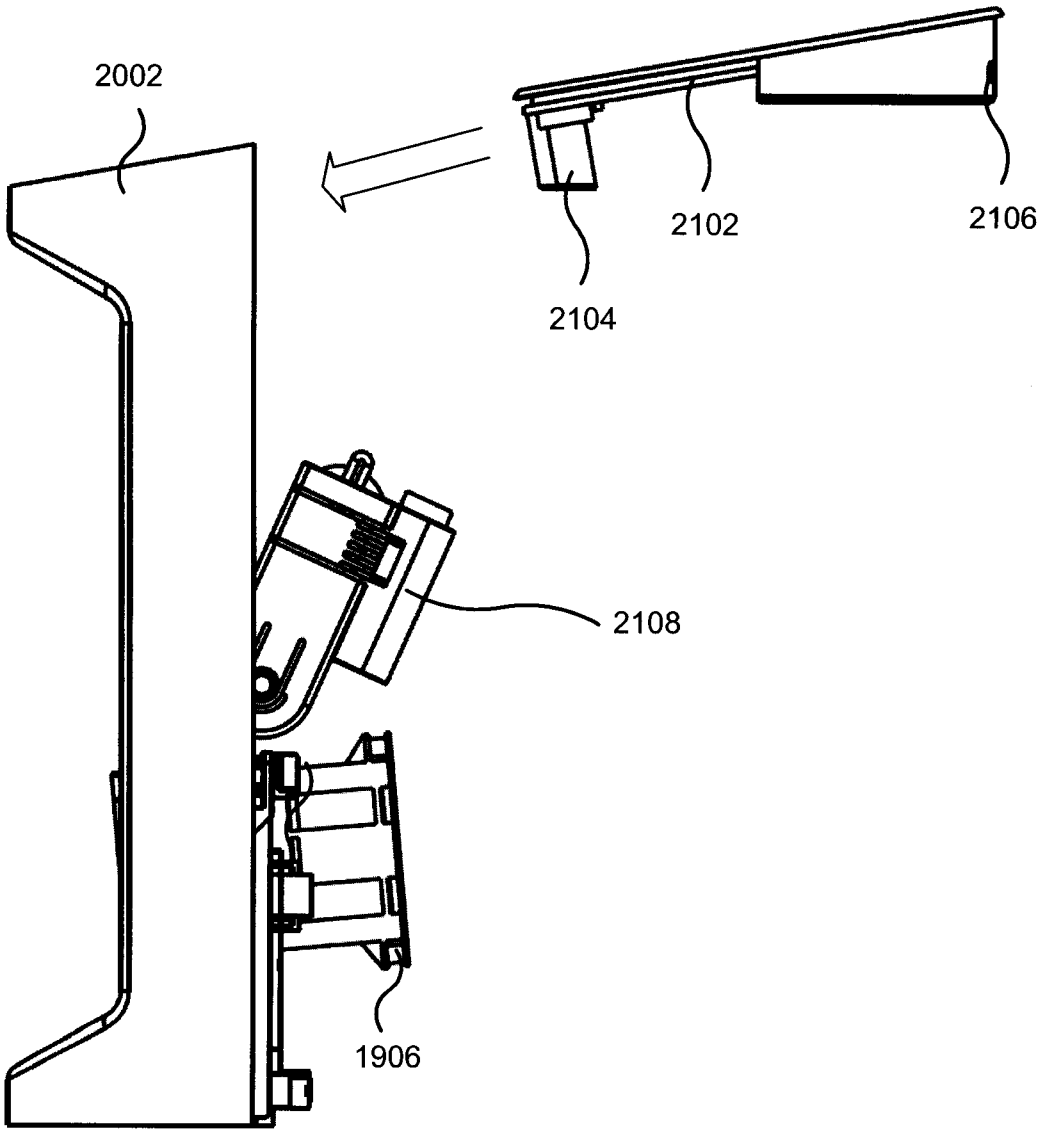

Figure 21

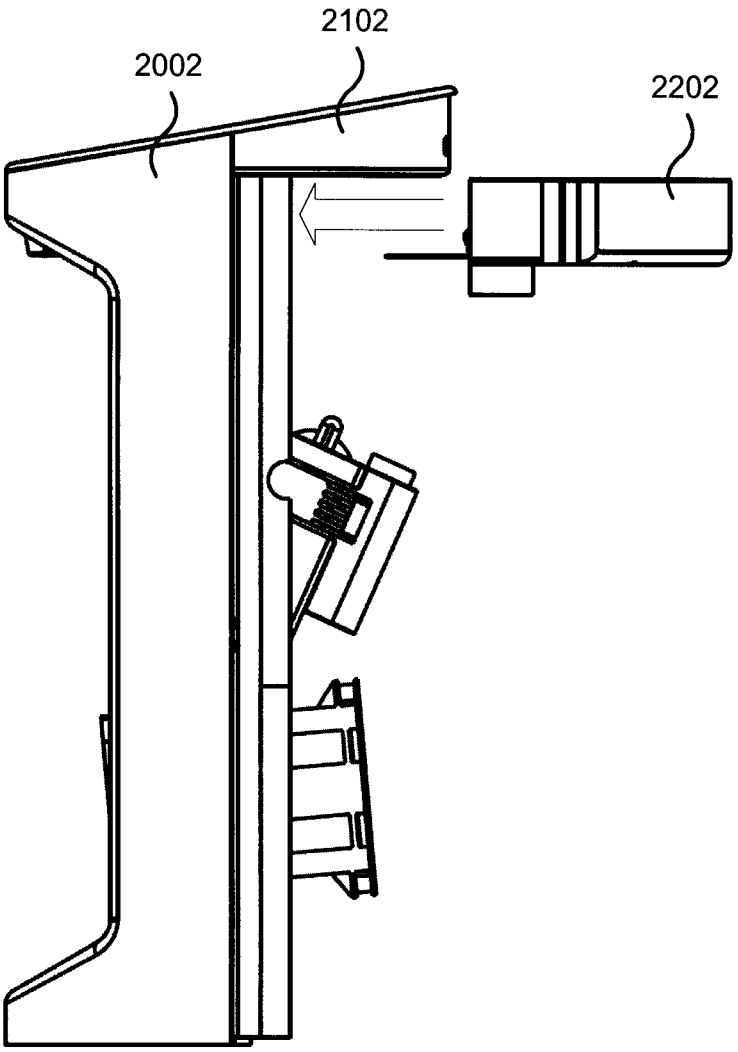

Figure 22

1900