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(54) **Title**: BICYCLE DOCKING STATION

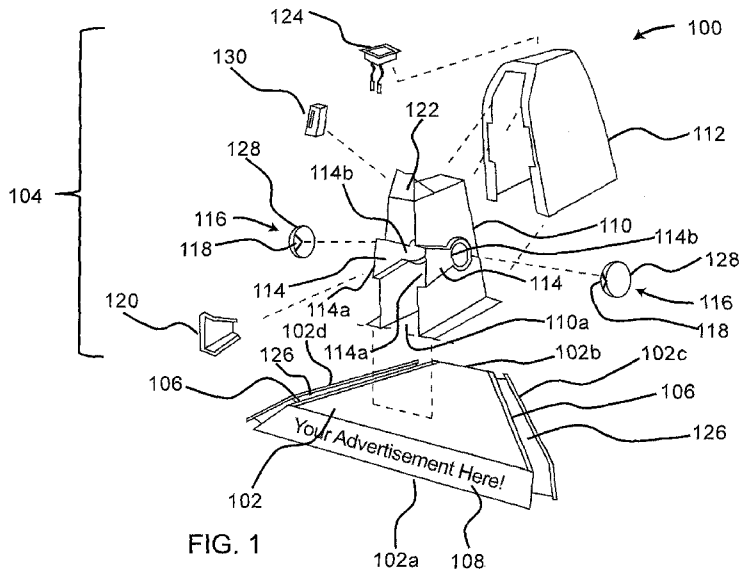


FIG. 1

(57) **Abstract**: A bicycle docking system is provided, wherein a bicycle is provided with a latch engaging structure including a striker portion and a bicycle docking station is provided with a complementary latching assembly. The striker portion can be attached to an end portion of a hub of a front or rear axle of the bicycle and respective front or rear axle slots in the forks of the bicycle. The striker portion can be of a pin striker type, such as a mushroom head lug, or a loop striker type, such as a hook-shaped striker. The latch engaging structure is coupled to an anti-rotation lug, which is mounted to the hub of the front or rear axle. The bicycle docking station may serve as a charging station for e-bicycles, or for bicycles equipped with power modules or other electronic equipment.

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BICYCLE DOCKING STATION

FIELD OF THE INVENTION

[0001] The present invention relates to bicycle docking stations and more particularly to a bicycle docking station for making bicycles available to the public.

BACKGROUND OF THE INVENTION

[0002] With rapidly increasing urbanization, traffic congestion and carbon emissions concerns, bicycles are fast becoming an efficient and environmentally preferred way to travel. Of course, using a bicycle for transportation also increases the physical activity level of the rider, thereby contributing to a healthier lifestyle.

[0003] Unfortunately, it is not always practical or convenient to use a bicycle for transportation. For instance, bicycles are best suited for relatively short travel distances during moderate weather conditions. As is well known, many individuals in urban settings have long commutes to work or to other destinations, thereby requiring an individual to use an automobile or public transportation on a daily basis. In such instances an individual may be forced to transport a bicycle during their commute, the bicycle to be used for traveling shorter distances after the individual arrives at their destination. However, crowded train cars, limited bicycle rack capacity on busses and small cargo spaces in passenger vehicles often makes it very difficult, if not impossible, to transport a bicycle during a daily commute. In addition, if it is raining early in the day and an individual chooses not to use bicycle transportation, then that individual may not have access to a bicycle later in the day if the weather improves unexpectedly. Of course, tourists or other visitors to an urban center

would also benefit from having access to a bicycle while sightseeing, traveling to-and-from meetings, etc.

[0004] Systems for renting bicycles to the public are known. Typically, bicycle rental kiosks are provided at a plurality of accessible locations within a geographic area. An individual wishing to use a bicycle to travel to a destination may rent a bicycle at a kiosk location that is nearby and convenient, and then after use return the rented bicycle to another kiosk location that is close to their destination. One such system is disclosed by Le Gars in United States Patent No. 7,471,191. In the system that is disclosed by Le Gars, each bicycle includes a blocking device and an electrical lock device to prevent the bicycle from being used in a normal fashion unless it is rented in a proper manner. In particular, a user inserts a payment card and enters a security code to cause a controller to transmit a signal for unlocking the electronic lock device. The user must then pivot the blocking device out of the way and rotate the handlebars prior to riding the bicycle. When the bicycle is returned, the user is required firstly to rotate the handlebars through 90° and secondly to correctly pivot the blocking device to prevent rotation of the handlebars in the opposite direction. The controller verifies that the blocking device is properly positioned and then engages the electronic locking device. As such, the system that is disclosed by Le Gars is inconvenient and requires the user to possess a certain level of skill in order to properly checkout and return a rental bicycle.

[0005] Dallaire et al. in United States Patent Application Publication 2009/0266673 discloses another system for renting bicycles to the public. Each bicycle includes a male connector mounted to the front fork assembly, with a tapered front portion thereof extending in a forward direction. The male connector includes a downwardly extending locking finger with a locking aperture. A complementary female connector is incorporated into a bicycle

stand, and is shaped for guiding the male connector into engagement therewith. A movable locking member is associated with the female connector, and is electronically actuatable between a locked position and an unlocked position. When it is sensed that the male connector is aligned correctly with the female connector, then the movable locking member is moved to the locked position such that it is engaged at both ends in the female connector through the locking aperture of the male connector. As a result, the male connector and the female connector become pivotally coupled together. Unfortunately, the electronic lock that is disclosed by Dallaire et al. is complicated and requires precise alignment to ensure that the male connector and the female connector are securely coupled together. As the surfaces and the components of the electronic lock become worn with use, it becomes more difficult to precisely align the male connector and the female connector. Additionally, the male connector is disposed immediately above the front wheel of the bicycle, such that the locking aperture is subject to fouling by dirt or mud etc. that may be spayed up from the road surface. Since the movable locking member and the locking aperture are dimensioned very similarly, it is likely to be difficult to actuate the movable locking member into the locking aperture when the locking aperture is fouled with debris such as dirt or mud, etc.

[0006] Prins et al. in PCT publication No. WO 98/09254 discloses still another system for renting bicycles to the public. According to Prins et al., each bicycle is locked into a storage position comprising two synchronously moving supporting legs, between which a front wheel hub of the bicycle is secured. Mounted on the front wheel hub are "bushes," which are received one each within a slot that is defined on each of the two supporting legs when the two supporting legs are in an "open" position. Pushing the bicycle forward causes the two supporting legs to pivot about a pin, which is disposed outside the circumference of the front wheel, to a "closed" position in which a sliding

element is moved into a position for retaining the bushes within the slots. Prins et al. also discloses providing an electrical contact in one of the bushes, by means of which voltage can be supplied to a battery to ensure that sufficient voltage will be available at all times for a lighting system and for a transponder that are disposed aboard the bicycle.

[0007] Of course, individuals may wish to use a privately owned bicycle instead of renting a bicycle. In this case, it can be very difficult for the individual to secure the bicycle when it is not in use, such as for instance when the individual is working or when the individual must proceed on foot to complete an errand. Locking devices have been used to prevent the theft of parked bicycles, but this may involve locking the bicycle to a structure such as a parking meter or a bench, etc. When the bicycle is secured to a structure that is not designated for that purpose, the individual runs the risk of being fined. In any case, the individual must carry with them a locking device to be used to secure the bicycle when it is not in use, and the locking device may be susceptible to being cut or tampered with resulting in loss of, or damage to, the bicycle.

[0008] It would be advantageous to provide a system and method that overcomes at least some of the above-mentioned limitations of the prior art.

SUMMARY OF THE INVENTION

[0009] In accordance with at least one aspect of the present invention, a bicycle docking station is disclosed. The bicycle docking station serves as a stand wherein a bicycle can be parked and locked. Optionally, the bicycle docking station also serves as a charging station for e-bicycles, or for bicycles equipped with power modules or other electronic equipment.

[0010] In accordance with at least one aspect of the instant invention, the bicycle docking station is used as a docking station for rental bikes or the like. In accordance with this aspect, the docking station may be equipped with a user interface or a token reader so that a user can rent a bicycle from the docking station. For example, the user can present a card or another similar token to be read by the token reader, or enter a personal access code into the user interface, which releases a locking mechanism so that a bicycle can be removed from the docking station. In accordance with this aspect of the instant invention, the docking station may be equipped with a time sensing device so that the user can be charged a rental fee at a predetermined rate, beginning from the time that the bicycle is removed from the docking station and ending when the bicycle is returned to the same docking station or to a different docking station.

[0011] In accordance with an aspect of the instant invention, a bicycle docking system is provided wherein a bicycle is provided with a latch engaging structure including a striker portion and a bicycle docking station is provided with a complementary latching assembly. The striker portion can be attached to an end portion of a hub of a front or rear axle of a bicycle and respective front or rear axle slots in the forks of the bicycle. The striker portion can be of a pin striker type, such as a mushroom head lug, or a loop striker type, such as a hook-shaped striker. The latch engaging structure is coupled to an anti-rotation lug, which is mounted to the hub of the front or rear axle.

[0012] In accordance with an aspect of the invention there is provided a bicycle docking system for securing a bicycle having a wheel that is rotationally mounted to a frame of the bicycle via a hub, the bicycle docking system comprising: a first latch-engaging structure mechanically coupled to a first end of the hub of the bicycle, the first latch-engaging structure comprising a first striker portion and a first retaining portion; a bicycle docking stand for

being secured to a surface and comprising a first rotary latch having a first latch plate with a first slot for receiving the first striker portion, the first latch plate being rotatable about a pivot pin between a first orientation in which the first slot is aligned with a guide channel of the bicycle docking stand for guiding the first striker portion into the first slot and a second orientation in which the first slot is other than aligned with the guide channel of the bicycle docking stand such that the first striker portion is prevented from exiting the first slot, the pivot pin disposed inside the circumference of the bicycle wheel, and the first rotary latch locking automatically upon the first latch plate being rotated into the second orientation from the first orientation; a controller for authorizing use of the bicycle that is secured in the bicycle docking stand and for providing a control signal indicative of an authorization; and, an actuator in communication with the controller for releasing the first latch plate from the locked second orientation in response to receiving the control signal from the controller, so as to enable rotation of the first latch plate from the second orientation to the first orientation to enable authorized use of the bicycle, wherein the first latch plate is disposed within an engagement zone that is defined between the hub of the bicycle and the first retaining portion of the first latch-engaging structure when the bicycle is secured in the bicycle docking stand.

[0013] In accordance with an aspect of the invention there is provided a bicycle docking system for securing a bicycle having a wheel that is rotationally mounted to a frame of the bicycle via a hub about an axle, the bicycle docking system, comprising: a first latch-engaging structure mechanically coupled to one end of the hub, the first latch-engaging structure having a first retaining portion that is spaced away from the hub in a direction parallel to the axle and having a first striker portion that is disposed within an engagement zone between the first retaining portion and the hub of the bicycle, the first striker portion other than co-axially aligned with the axle; a bicycle

docking stand for being secured to a surface and comprising a first rotary latch having a first latch plate with a first slot for receiving the first striker portion, the first rotary latch being rotatable about a pivot pin between a first orientation in which the first slot is aligned with a guide channel of the bicycle docking stand for guiding the first striker portion into the first slot and a second orientation in which the first slot is other than aligned with the guide channel of the bicycle docking stand such that the first striker portion is prevented from exiting the first slot, the pivot pin disposed inside the circumference of the bicycle wheel, and the first rotary latch locking automatically upon being rotated into the second orientation from the first orientation; a controller for authorizing use of the bicycle that is secured in the stand; and, an actuator in communication with the controller for releasing the first latch plate from the locked second orientation in response to receiving a control signal from the controller, so as to enable rotation of the first latch plate from the second orientation to the first orientation to enable authorized use of the bicycle.

[0014] In accordance with an aspect of the invention there is provided a method for securing a bicycle having a wheel that is rotationally mounted to a frame of the bicycle via a hub, comprising: providing a latch-engaging structure that is mechanically coupled to at least one end of the hub, the latch-engaging structure having a retaining portion that is spaced away from the hub in a direction along the axle and having a striker portion that is disposed within an engagement zone between the retaining portion and the wheel of the bicycle; aligning the striker portion of the latch-engaging structure with a receiving slot defined in a rotary latch of a bicycle docking stand; pushing the bicycle toward the bicycle docking stand through a first distance such that the latch-engaging structure engages the slot of the rotary latch; and, engaging a locking mechanism of the rotary latch by pushing the bicycle through a second distance in addition to the first distance, such that the striker portion causes the

rotary latch to rotate into a locked orientation by rotation about a pivot pin that is defined within the circumference of the wheel.

[0015] In accordance with an aspect of the invention there is provided a bicycle docking system for use with a bicycle that is equipped with a rechargeable battery, the bicycle docking system comprising: a latch-engaging structure mechanically coupled to one end of a hub of the bicycle; a pickup coil of an inductive charger system disposed aboard the bicycle and in electrical communication with the rechargeable battery; a bicycle docking stand comprising a latch assembly for receiving the latch-engaging structure of the bicycle when the bicycle is in a docked condition, and comprising a charging coil of the inductive charger system, the charging coil disposed on the bicycle docking stand at a location that is adjacent to the pickup coil when the bicycle is in a docked condition; and, a controller for controlling charging of the rechargeable battery via the inductive charger system including the pickup coil and the charging coil.

[0016] In accordance with an aspect of the invention there is provided a bicycle docking system for use with a bicycle that is equipped with a rechargeable battery, the bicycle docking system comprising: a first induction coil disposed on the bicycle and in electrical communication with the rechargeable battery; a bicycle docking stand for supporting the bicycle when the bicycle is in a docked condition; a second induction coil disposed on the bicycle docking stand at a location that is in proximity to the first induction coil that supports charging of the rechargeable battery when the bicycle is in the docked condition; and, a controller for controlling charging of the rechargeable battery by inductive charging via the first induction coil and the second induction coil.

[0017] In accordance with an aspect of the invention there is provided a method of charging a rechargeable battery carried by a bicycle when the

bicycle is docked to a bicycle docking stand, the bicycle having a pickup coil coupled to the battery and the bicycle docking stand having a charging coil coupled to a power source, the method comprising: aligning a latch-engaging structure of the bicycle with a latch mechanism of the bicycle docking stand; moving the bicycle into a docked condition in which the latch-engaging structure is locked into the latch mechanism and the pickup coil is disposed adjacent to the charging coil; and, inductively charging the battery by providing power from the power source via the pickup coil and the charging coil.

[0018] In accordance with an aspect of the invention there is provided a bicycle docking system, comprising: a first bicycle docking stand for supporting a first bicycle via a latch engaging structure mounted to a hub of a wheel of the bicycle, the first bicycle docking stand comprising a first rotary latch having a first latch plate with a first slot for receiving the latch engaging structure of the first bicycle, the first latch plate being rotatable about a first pivot pin between a first orientation in which the first slot is aligned with a guide channel of the first bicycle docking stand for guiding the first latch engaging structure of the first bicycle into the first slot and a second orientation in which the first slot is other than aligned with the guide channel of the first bicycle docking stand such that the latch engaging structure of the first bicycle is prevented from exiting the first slot, the first pivot pin disposed inside the circumference of the wheel of the first bicycle, and the first rotary latch locking automatically upon the first latch plate being rotated into the second orientation from the first orientation; a first base member having a first mounting structure disposed on a first face thereof for mounting the first bicycle docking stand, the first base member having a first edge and a second edge that is opposite the first edge, the first edge and the second edge being non-parallel; a second bicycle docking stand for supporting a second bicycle via a latch engaging structure mounted to a hub of a wheel of the bicycle, the

second bicycle docking stand comprising a second rotary latch having a second latch plate with a second slot for receiving the latch engaging structure of the second bicycle, the second latch plate being rotatable about a second pivot pin between a first orientation in which the second slot is aligned with a guide channel of the second bicycle docking stand for guiding the second latch engaging structure of the second bicycle into the second slot and a second orientation in which the second slot is other than aligned with the guide channel of the second bicycle docking stand such that the latch engaging structure of the second bicycle is prevented from exiting the second slot, the second pivot pin disposed inside the circumference of the wheel of the second bicycle, and the second rotary latch locking automatically upon the second latch plate being rotated into the second orientation from the first orientation; and, a second base member having a second mounting structure disposed on a first face thereof for mounting the second bicycle docking stand, the second base member having a third edge and a fourth edge that is opposite the third edge, the third edge and the second edge being non-parallel, wherein the first edge is coupleable to the third edge for configuring a linear bicycle docking system, and wherein the first edge is coupleable to the fourth edge for configuring a non-linear bicycle docking system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Exemplary embodiments of the invention will now be described in conjunction with the following drawings, wherein like numerals refer to elements having similar function, in which:

[0020] FIG. 1 shows an exploded view of a docking station in accordance with an embodiment of the instant invention;

[0021] FIG. 2a is a top view showing two base plates coupled together to form a linear section, in accordance with an embodiment of the instant invention;

[0022] FIG. 2b is a top view showing three base plates coupled together to form a corner section and a linear section, in accordance with an embodiment of the instant invention;

[0023] FIG. 3 is an enlarged cross section view showing coupling between two base plates, in accordance with an embodiment of the instant invention;

[0024] FIG. 4 is a cross sectional view showing a latch engaging structure mounted to a front fork of a bicycle, in accordance with an embodiment of the instant invention;

[0025] FIG. 5 shows a first latch engaging structure, in accordance with an embodiment of the instant invention;

[0026] FIG. 6 shows a second latch engaging structure, in accordance with an embodiment of the instant invention;

[0027] FIG. 7a shows a shows a front view of a mushroom-head lug including slot structure for retaining a tamper proof cover, in accordance with an embodiment of the instant invention;

[0028] FIG. 7b shows a side cross section view of the mushroom-head lug of FIG. 7a;

[0029] FIG. 8a shows the mushroom-head lug of FIG. 7a and a tamper proof cover, in accordance with an embodiment of the instant invention;

[0030] FIG. 8b is a bottom view of the tamper proof cover, showing a pin structure for engaging the slot structure of the mushroom-head lug of FIG. 7a, in accordance with an embodiment of the instant invention;

[0031] FIG. 8c is a side cross section view of the tamper proof cover of FIG. 8a;

[0032] FIG. 9a shows a bicycle docking station prior to receiving a striker portion of a bicycle mounted latch engaging structure, in accordance with an embodiment of the instant invention;

[0033] FIG. 9b shows the striker portion of FIG. 9a engaging a latch module of the bicycle docking station when the bicycle is in an unsecured condition;

[0034] FIG. 9c shows the striker portion of FIG. 9a engaging a latch module of the bicycle docking station when the bicycle is in a secured condition;

[0035] FIG. 10 is a simplified diagram showing a bicycle secured within a docking station, in accordance with an embodiment of the instant invention;

[0036] FIG. 11 is a simplified diagram showing a bicycle secured within a docking station equipped with a bumper member, in accordance with an embodiment of the instant invention;

[0037] FIG. 12 is a perspective view of a latch engaging structure comprising a loop striker, in accordance with an embodiment of the instant invention;

[0038] FIG. 13 is a perspective view showing the latch engaging structure of FIG. 12 engaged in a complementary latching module of a bicycle docking station, in accordance with an embodiment of the instant invention;

[0039] FIG. 14 is a perspective view showing the latch engaging structure of FIG. 12 engaged in a complementary latching module of a bicycle docking station, with the latch module cover removed, in accordance with an embodiment of the instant invention;

[0040] FIG. 15 is another perspective view showing the latch engaging structure of FIG. 12 engaged in a complementary latching module of a bicycle docking station, with the latch module cover removed, in accordance with an embodiment of the instant invention;

[0041] FIG. 16a is a simplified diagram showing the latch engaging structure of FIG. 12 in a fully open condition;

[0042] FIG. 16b is a simplified diagram showing the latch engaging structure of FIG. 12 in a condition that is intermediate the fully open condition and a secured condition;

[0043] FIG. 16c is a simplified diagram showing the latch engaging structure of FIG. 12 in the secured condition;

[0044] FIG. 17 shows a bicycle docking station with an inductive charging system, in accordance with an embodiment of the instant invention;

[0045] FIG. 18 shows a bicycle docking station with an inductive charging system, in accordance with another embodiment of the instant invention;

[0046] FIG. 19 is a top cross section view showing the front wheel and axle portion of a bicycle that is docked to the bicycle docking station of FIG. 18;

[0047] FIG. 20 is a perspective view showing a stationary charging contact and a complementary set of contacts for a contact charging system of a bicycle docking station, in accordance with another embodiment of the instant invention;

[0048] FIG. 21a is a simplified diagram showing a bicycle docking station with a height adjustable latching module and guide channel according to an embodiment of the instant invention, prior to receiving a bicycle;

[0049] FIG. 21b shows the bicycle docking station of FIG. 21a with a bicycle secured in the latching module;

[0050] FIG. 22a is a simplified diagram showing a bicycle docking station with a height adjustable guide channel according to an embodiment of the instant invention, prior to receiving a bicycle;

[0051] FIG. 22b shows the bicycle docking station of FIG. 22a with a bicycle secured in the latching module;

[0052] FIG. 23a shows a bicycle aligned with a wall mounted bicycle docking station according to an embodiment of the instant invention; and,

[0053] FIG. 23b shows the bicycle docking station of FIG. 23a with a bicycle secured in the latching module.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0054] The following description is presented to enable a person skilled in the art to make and use the invention, and is provided in the context of a particular application and its requirements. Various modifications to the disclosed embodiments will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the scope of the invention. Thus, the present invention is not intended to be limited to the embodiments disclosed, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

[0055] Fig. 1 is an exploded view of a bicycle docking station 100, in accordance with an embodiment of the instant invention. The bicycle docking station 100 comprises a base plate 102 that is fabricated from a suitable material, such as for instance cast aluminum. The base plate 102 provides a

mounting surface for supporting and stabilizing a docking stand, which is shown generally at 104. In the specific and non-limiting example that is shown in FIG. 1, the base plate 102 is trapezoidal in shape with parallel front and back edges 102a and 102b, respectively, and with non-parallel side edges 102c and 102d. Water management channels 106 are provided along the side edges 102c and 102d of base plate 102 for collecting water, and for draining the collected water from the base plate 102. Optionally, the base plate 102 includes an advertising panel 108 for displaying advertisements and/or bicycle rental instructions, etc. Further optionally, the shape of the base plate 102 is other than trapezoidal, such as for instance: square, rectangular, triangular, curved, etc.

[0056] The docking stand 104 comprises an inner pedestal 110 and an outer pedestal 112. The outer pedestal 112 is fastened to the inner pedestal 110, and the inner pedestal 110 is fastened to the base plate 102, when the bicycle docking station 100 is in an assembled condition. In particular, tamper proof fasteners (not shown) are used to fasten the outer pedestal 112 to the inner pedestal 110 from inside of the inner pedestal 110. The inner pedestal 110 is fabricated from a suitable material, such as for instance cast aluminum, and the outer pedestal 112 is also fabricated from a suitable material, such as for instance cast aluminum.

[0057] The inner pedestal 110 defines a pair of guide channels 114, and also supports a pair of latch modules 116, which are shown in a very schematic manner in FIG. 1. In particular, each latch module 116 is a rotary latch comprising a latch plate 128 with a slot 118. Each one of the guide channels 114 has a first open end 114a and a second open end 114b. The first open end 114a is larger than the second open end 114b, and the guide channel 114 is tapered from the first open end 114a to the second open end 114b. The first open end 114a of each guide channel 114 is defined at an open face 110a of

the inner pedestal 110. The open face 110a of the inner pedestal 110 is dimensioned to receive a wheel of a bicycle. Each one of the latch modules 116 is disposed adjacent to the second open end 114b of one the pair of guide channels 114. The latch plates 128 are rotatable about a not illustrated pivot pin between a first orientation in which the slot 118 of each latch plate 128 is aligned with the second open end 114b of a respective one of the guide channels 114, and a second orientation in which the slot 118 of each latch plate 128 is other than aligned with the second open end 114b of the respective one of the guide channels 114. In particular, the not illustrated pivot pin is within the circumference of the wheel of the bicycle, when the wheel of the bicycle is received within the open face 110a of the inner pedestal 110.

[0058] A wear guide 120 is disposed within each one of the guide channels 114. The wear guides 120 are fabricated from a suitable material, such as for instance stainless steel. The wear guides 120 assist in guiding a latch engaging structure, which is mounted to a hub of an axle of the bicycle, along the guide channels 114 between the first and second open ends 114a and 114b, respectively, and into the slots 118 of the latch plates 128, when the latch plates 128 are in the first orientation.

[0059] Optionally, a bumper member 130 is mounted to a mounting structure 122 on the inner pedestal 110. The bumper member 130 is fabricated from a suitable material, such as for instance a block of rubber.

[0060] In at least one embodiment, an optional user interface 124 is mounted to the outer pedestal 112. For instance, the user interface 124 comprises at least one of a keypad, a token reader and a biometric sensor. By way of a specific and non-limiting example, the token reader is for reading one of an RFID fob and a magnetic stripe card, etc. The user interface 124 is in communication with a not illustrated actuator, such as for instance an electromechanical solenoid, via not illustrated wiring extending therebetween.

Alternatively, the user interface 124 communicates wirelessly with the not illustrated actuator. The not illustrated actuator is for controllably releasing a not illustrated locking mechanism of the rotary latch 116. In particular, the rotary latch is locked automatically after the latch plate 128 is rotated from the first orientation to the second orientation. When the not illustrated actuator releases the not illustrated locking mechanism of the rotary latch 116, then the latch plate 128 may be rotated from the second orientation back to the first orientation.

[0061] Additional wiring (not shown in FIG. 1), such as may be needed for providing communication between the user interface 124 and a central controller and/or for providing electrical power from AC mains to the user interface 124 and/or to the not illustrated locking mechanism and/or the not illustrated actuator, is run along the underside of the base plate 102 and then up to the docking stand 104 in a manner that is described in greater detail below.

[0062] Referring still to FIG. 1, the open face 110a of the inner pedestal 110 is shown as being aligned parallel to the front edge 102a of the base plate 102. Alternatively, the docking stand 104 is secured to the base plate 102 such that the open face 110a is arranged at a predetermined angle, such as for instance 45°, to the front edge 102a. Alternatively, the docking stand 104 is secured to the base plate 102 such that the open face 110a is parallel to the back edge 102b of the base plate 102. Each base plate 102 further comprises a coupling section 126 for use in coupling two or more base plates 102 together, as is described in greater detail below.

[0063] Referring now to FIG. 2a, shown is a top view of two base plates 102 coupled together to form a linear section. Figure 2b is a top view showing three base plates 102 coupled together to form a corner section and a linear section. As is shown in FIGS. 2a and 2b, the inside angle that is formed

between the front edge 102a and the side edges 102c or 102d of each base plate 102 is 45°. Optionally, an angle other than 45° is formed between the front edge 102a and the side edges 102c or 102d. Due to the modular nature of the bicycle docking system, a plurality of base plates 102 may be assembled together in different ways in order to form differently shaped footprints for a docking station kiosk, the kiosk supporting a plurality of docking stands 104. In this way, kiosks may be configured to make optimal use of available space in a variety of different urban settings.

[0064] In an embodiment, the kiosk includes a self-serve rental booth including a central controller that is in communication with each of the plurality of docking stands 104. When at least one bicycle is available for being rented, an individual may use the self-serve rental booth to select and pay for a bicycle rental. To this end, the rental booth includes a card reader for reading credit card or debit card information and/or a slot for accepting cash payment. Upon successfully verifying payment for a bicycle rental, the central controller provides a control signal to the not illustrated actuator of one of the plurality of docking stands 104 for releasing the not illustrated locking mechanism, thereby releasing the bicycle from the docking stand 104. Alternatively, a personal access code is displayed or printed on a card and the individual must correctly key in the personal access code via the user interface 124 of the docking stand 104 in order to release the bicycle.

[0065] Optionally, central controllers of different kiosks are in communication one with the other via a communications network. Further optionally, the central controller of each kiosk is in communication with a sensor that is associated with each one of the docking stands 104 at that kiosk. When a particular bicycle is removed from a docking stand 104, the sensor provides a first signal to the central controller. At a later time, when the particular bicycle is returned to a docking stand 104 at the same kiosk or at a different kiosk, a

second signal is provided from the docking stand to the central controller. The time that elapses between the first signal and the second signal may be used to determine an appropriate rental fee based on the length of time the bicycle was being used. Optionally, the central controllers of different kiosks are in communication with a centralized operations system, which supports the time-based billing for bicycle rentals and coordination of bicycle returns to different kiosks based on the availability of empty docking stations at each kiosk.

[0066] Referring now to FIG. 3, shown is an enlarged cross-section view taken along either one of the lines A—A in FIGS. 2a or 2b. Each one of the two base plates 102 shown in FIG. 3 is secured to a ground surface (not shown) via anchors (not shown) that are retained in through-holes 300. For instance, lag bolts are used to anchor the base plates 102 into a concrete sidewalk surface, or into the asphalt surface of a roadway. When coupled together, the coupling section 126 along one edge of one of the base plates 102 is parallel to the coupling section 126 along an adjacent edge of the other one of the base plates 102, thereby forming a parallel channel structure between the respective upper surfaces of the two base plates 102. Electrical wiring 302 is routed along the lower surface of each base plate 102, and passes through a port 304 into the parallel channel structure along the coupled edge of a respective base plate. The electrical wiring 302 of two adjacent base plates is coupled together via an electrical junction 306. A cosmetic cover 308 is disposed over the coupling sections 126, providing a substantially level surface between the two base plates 102 and preventing tampering with the electrical wiring 302 and/or anchors.

[0067] Fig. 4 is a cross section view showing the front fork 400 of a not illustrated bicycle and a latch engaging structure in the form of a mushroom-head type lug 404. A lock engagement zone 402 is defined along a shaft portion 412 of the mushroom-head type lug 404, which is mechanically

coupled to an end portion 406 of a hub 408 of a front axle 410 of the not illustrated bicycle. The hub 408 includes a not illustrated anti-rotation lug for preventing rotation of the mushroom-head type lug 404 when the bicycle is in use. The shaft-portion 412 of the mushroom-head type lug 404, which is within the lock engagement zone 402, defines a striker portion for engaging the slot 118 of one of the latch plates 128 of the rotary latches 116. The mushroom-head portion of the mushroom-head type lug 404 defines a retaining portion 414 for limiting lateral movement of the bicycle wheel, along a direction parallel to the axle 410.

[0068] Figs. 5 and 6 show optional configurations of the latch engaging structure of FIG. 4. In particular, Fig. 5 shows a mushroom headed nut 500 having an internal wrench feature 502. The mushroom headed nut 500 can replace a standard hub-fixing nut. Fig. 6 shows a configuration in which a mushroom-head lug 600 includes an integrated washer portion 602 and is held in place with a nut 604, e.g. one of a lock nut, an acorn nut, and a jam nut. A decorative cover 606, which optionally is tamper proof, may be provided on either one of the mushroom headed nut 500 or the mushroom-head lug 600, as described in greater detail below.

[0069] FIG. 7a is an end view of a latch engaging structure in the form of a mushroom head lug 700, which has a structure for receiving a tamper proof cover. FIG. 7b is a cross section side view of the mushroom head lug 700. FIG. 8a is a perspective view of a tamper proof cover 800 aligned with the mushroom head lug 700. FIG. 8b is a bottom view of the tamper proof cover 800. FIG. 8c is a cross section side view of the tamper proof cover 800 taken along the line B—B in FIG. 8b. The decorative and tamper proof cover 800 optionally includes a logo or another similar type of design 802 on a first side thereof. By way of a specific and non-limiting example, the decorative and tamper proof cover 800 and the mushroom-head lug 700 are coupled one to the

other via a bayonet connector system. As is shown in FIGS. 8b and 8c, the tamper proof cover 800 comprises a plurality of circumferentially spaced-apart pins 804 on a second side thereof that is opposite the first side. In the instant example, the pins 804 are generally L-shaped. The mushroom-head lug 700 has a circumferential lip 702, which projects beyond end-face 704 so as to define a central recess for receiving the tamper proof cover 800. A plurality of slots 706 is arranged circumferentially around the end-face 704, with spacing between the slots being similar to spacing between the pins 804 of the tamper proof cover 800. To secure the tamper proof cover 800 to the mushroom-head lug 700, the pins 804 are aligned with the slots 706 and the tamper proof cover 800 is pressed into the central recess that is formed by the circumferential lip 702. When the tamper proof cover 800 is positioned within the central recess, such that the pins 804 are received within a corresponding slot 706, then a tool is used to rotate the tamper proof cover 800 relative to the mushroom-head lug 700, such that the pins 804 frictionally engage the opposite side of the end-face 704. A similar slot-like structure may be provided on the mushroom-head lug 404, 600 or the mushroom headed nut 500 for securing a tamper proof cover thereto in a similar manner.

[0070] The operation of the latch modules 116 of the bicycle docking station 100 will now be described in greater detail, with reference being made to FIGS. 9a-9c. Referring now to FIG. 9a specifically, a striker portion 906 of a latch-engaging structure is shown. It is to be understood that the latch-engaging structure is mechanically coupled to at least one end of a hub of an axle of a not illustrated bicycle. By way of a specific and non-limiting example, the latch-engaging structure is the mushroom-head type lug 404 that is described above with reference to FIG. 4. Accordingly, the striker portion 906 that is shown in FIG. 9a is defined along the shaft portion 412 of the mushroom-head type lug 404.

[0071] In order to secure the not illustrated bicycle in the docking station 100, a user first aligns the striker portion 906 of the latch-engaging structure with the first open end 114a of the guide channel 114 of the inner pedestal 110. The latch plate 128 is in the first orientation in FIG. 9a, such that the slot 118 is aligned with the second open end 114b of the guide channel 114. When the user pushes the bicycle along the direction that is indicated by the arrow F, the striker portion 906 is guided through the guide channel 114 from the first open end 114a toward the second open end 114b, and finally into slot 118 as is shown in FIG. 9b. The user then pushes the bicycle by an additional amount along the same direction F, causing the latch plate 128 to rotate about a pivot pin 900 from the first orientation that is shown in FIGS. 9a-9b to the second orientation that is shown in FIG. 9c. When the latch plate 128 is in the second orientation as shown in FIG. 9c, the slot 118 is other than aligned with the second open end 114b of the guide channel 114. Accordingly, the striker portion 906 cannot be removed from the slot 118 and the bicycle is secured.

[0072] When the latch-engaging structure is mechanically coupled to only one end of the hub of the axle of the bicycle, then the striker portion 906 engages only one of the latch modules 116 of the docking station 100. In particular, the striker portion 906 engages a latch module 116 on the side of the docking station 100 that faces the latch-engaging structure when the bicycle is in a docked condition. Optionally, a docking station comprises only a single latch module, and bicycles are standardized to include a latch-engaging structure on only one end of the hub of the axle. Since the latch-engaging structure includes a retaining portion for limiting lateral movement of a docked bicycle along the direction of the axle, such as for instance a mushroom head having a diameter that is larger than that of the striker portion, the bicycle may be docked securely using only the single latch module.

[0073] Alternatively, a latch-engaging structure is mechanically coupled to both ends of the hub of the axle of the bicycle. In this case, a striker portion 906 on one side of the bicycle engages the latch module 116 on one side of the docking station 100 and a striker portion 906 on the other side of the bicycle engages the latch module 116 on the other side of the docking station 100.

[0074] Referring now to FIG. 10, shown is a simplified diagram of a bicycle 1000 engaged in a docking station 100 according to an embodiment of the instant invention. In this embodiment the docking station 100, which is indicated with a dashed line, does not include the optional bumper member 130. Bicycle 1000 is secured via its front wheel hub 1002, thereby preventing the possibility of the front wheel 1004 being detached from the frame 1006. Alternatively, the locking point is provided about the rear hub 1008 of the bicycle 1000. When the bicycle 1000 is secured in docking station 100 as shown in FIG. 10, there is a rotational degree of freedom about the front axle 1002 and about the steer tube axis 1010, but not about the longitudinal axis 1012 of the bicycle 1000.

[0075] Referring now to FIG. 11 shown is a simplified diagram of a bicycle engaged in a docking station 100 according to an embodiment of the instant invention. In this embodiment the docking station 100, which is indicated with a dashed line, includes the optional bumper member 130. The bumper member 130 is provided on the docking station 100 to restrict the motion of the bicycle 1000 that is docked in the docking station 100 if a user lifts the bicycle 1000 from the rear. The bumper member 130 is fabricated from a pliant or deformable material, and also acts to prevent damage occurring to bicycle 1000 if it is lifted from the rear, either inadvertently or maliciously.

[0076] FIG. 12 shows a perspective view of an alternate latch-engaging structure, in the form of a loop striker 1200. The loop striker 1200 comprises an end portion 1202, which is mechanically coupled to one end of a not

illustrated hub about an axle of a bicycle. An anti-rotation lug 1207 is provided to ensure the striker 1200 is substantially horizontal. The loop striker 1200 extends from the end portion 1202, and is shaped to define a striker portion 1204 and a retaining portion 1206. The striker portion 1204 is for engaging the slot 118 of one of the latch plates 128 of FIG. 1. The retaining portion 1206 of the loop striker 1200 is for limiting lateral movement of the bicycle wheel, in a direction along the striker portion 1204, as described in greater detail below.

[0077] FIG. 13 show the loop striker 1200, which is mounted to one end of an axle 1208 of a not illustrated bicycle, engaged in a latch module 116 of the bicycle docking station 100, which is not shown in this figure for clarity reasons. By way of a specific and non-limiting example, the axle 1208 is the front axle of the bicycle. The striker portion 1204 of the loop striker 1200 is seated within slot 118 of latch plate 128. Furthermore, the latch plate 128 is disposed between the end portion 1202 and the retaining portion 1206 of the loop striker 1200. The latch plate 128 stops the retaining portion 1206 and thereby limits the travel of the loop striker 1200 in a direction along the axle 1208.

[0078] FIGS. 14 and 15 show interior views of the latch module 116, with the loop striker 1200 engaged therewith. The latch module 116 includes a locking mechanism, in the form of a ratchet and pawl mechanism. To this end, a series of notches 1400a and 1400b are provided along the perimeter of the latch plate 128 for being engaged by a pawl (not shown in FIGS. 14 and 15). When the latch plate 128 is rotated about pivot pin 1402 into the second orientation, as is illustrated in FIGS. 14 and 15, the pawl automatically engages the notch 1400b of the latch plate 128 and prevents rotation of the latch plate 128 from the second orientation to the first orientation. Also shown in FIG. 14 is a release mechanism 1404 for the latch module 116. By way of a specific and non-

limiting example, the release mechanism 1404 is an electromechanical solenoid. In response to receiving a control signal, the release mechanism 1404 releases the not illustrated pawl from the notch 1400b, thereby unlocking the locking mechanism and making it possible to rotate the latch plate 128 about the pivot pin 1402 from the second orientation to the fully open first orientation. Thereafter, the bicycle may be removed from the docking station 100.

[0079] FIGS. 16a-c are simplified diagrams showing the latch module 116 of FIG. 12 in the fully open first orientation, in an intermediate orientation, and in the secured second orientation, respectively. Referring specifically to FIG. 16a, when the latch module is in the fully open first orientation, the slot 118 of the latch plate 128 is directed toward a not illustrated opening in the latch module 116 for receiving the latch engaging structure that is mounted to the hub of a bicycle. The pawl 1600, which is mounted to the latch module 116 via pivot pin 1602, is at rest against the curved edge of the latch plate 128. When a bicycle is being pushed into secure engagement within the docking station 100, the latch plate 128 is caused to rotate clockwise (in FIGS. 16a-c) about the pivot pin 1402. The pawl 1600 runs along the curved edge of the latch plate 128 and drops into the first notch 1400a, in the intermediate orientation that is shown in FIG. 16b. As the bicycle is pushed further and finally secured within the docking station 100, the latch plate 128 is caused to rotate clockwise (in FIGS. 16a-c) by an additional amount and the pawl 1600 rides up out of notch 1400a and drops into the second notch 1400b, as shown in FIG. 16c. As discussed supra the release mechanism 1404 must release the pawl 1600 from the second notch 1400b before the bicycle can be removed from the latch module 116.

[0080] In accordance with another embodiment of the instant invention, a bicycle docking station can be used as a charging station when an electric

bicycle or a bicycle that is equipped with a rechargeable power module is docked therein. The charging of a power module is achieved optionally using a contact or a non-contact charging system, as discussed in greater detail with reference to FIGS. 17-20.

[0081] Referring now to FIG. 17, shown is a non-contact or inductive charging system in accordance with an embodiment of the instant invention. Inductive charging systems use an induction coil to create an alternating electromagnetic field from within a charging base station, and a second induction coil in a portable device to take power from the electromagnetic field and convert it back into electrical current for charging a battery. The two induction coils in proximity combine to form an electrical transformer. FIG. 17 shows a bicycle 1700 docked in a bicycle docking station 1702 via a front axle 1704. The bicycle 1700 comprises a battery pack 1706 and a pick-up coil 1708. The pick-up coil 1708 is disposed at a location on the bicycle such that, when the bicycle 1700 is moved into the dock, the pick-up coil 1708 is brought into close proximity to a charging coil 1710 on the bicycle docking station 1702. By way of a specific and non-limiting example, the pick-up coil 1708 is disposed along the underside of a basket 1712, which is mounted in front of the handlebars 1714. The battery pack 1706 includes a not illustrated circuit for rectifying the induced current in the pick-up coil to charge the battery cells in the battery pack.

[0082] Referring now to FIG. 18, shown is an alternative arrangement for an inductive charging system according to an embodiment of the instant invention. In the system that is shown in FIG. 18, a pick-up coil 1800 is mounted to one of the front forks 1802 of a not illustrated bicycle. In this case the charging coil 1804 is mounted along one side of docking station 100, above both the guide channel 114 and the latch module 116. When the bicycle is secured in the docking station 100, such that the latch module 116 retains a

striker portion of a latch engaging assembly 1806 that is mounted to the front axle 1808 of the bicycle, the pick-up coil 1800 is in close proximity to the charging coil 1804.

[0083] FIG. 19 is a cross sectional top view showing front wheel 1900 of the bicycle received within the inner pedestal 110 of the docking station 100, such that the bicycle is in a docked condition. The pick-up coil 1800 is aligned with charging coil 1804, with a small air gap between the two coils.

[0084] Referring now to FIG. 20, shown is a connector assembly that is suitable for use with a contact-charging system. A stationary contact 2000 is mounted to the bicycle docking station 100, at a location that is accessible when a bicycle is docked in the bicycle docking station 100. A complementary set of contacts 2002 is mounted to the bicycle and in communication with a battery pack that is to be recharged. When the bicycle is docked in the docking station, a user inserts the complementary set of contacts 2002 into the stationary contact 2000, causing electrical power to flow from the bicycle docking station 100 to the battery pack that is to be recharged.

[0085] Referring now to FIG. 21a-b, shown is a bicycle docking station 2100 in accordance with an embodiment of the instant invention. As is shown in FIG. 21a, a latch module 2102 and guide channel 2104 structure of the bicycle docking station 2100 is biased at a maximum height using spring element 2106. When a latch engaging structure 2110 of a bicycle 2108 is secured in the latch module 2102 of the bicycle docking station 2100, the weight of the bicycle 2108 compresses the spring element 2106 and the latch module 2102 and guide channel 2104 structure move downward. In this way, the same bicycle docking station 2100 accommodates different sized bicycles.

[0086] Referring now to FIG. 22a-b, shown is a bicycle docking station 2200 in accordance with an embodiment of the instant invention. A latch module 2202 is mounted to the docking station 2200, for receiving a striker portion of a latch engaging structure 2204 that is mounted to a hub of a bicycle 2206. A guide channel 2208, for guiding the latch engaging structure 2204 of the bicycle 2206 into the latch module 2202, is biased in an upward-angled orientation using spring element 2210. When the latch engaging structure 2204 of bicycle 2206 slides along the guide channel 2208 toward the latch module 2202, the weight of the bicycle 2206 compresses the spring element 2210 and the guide channel 2208 pivots downward. In this way, the same bicycle docking station 2200 accommodates different sized bicycles.

[0087] Referring now to FIGS. 23a-b, shown is a wall-mounted bicycle docking station 2300 according to an embodiment of the instant invention. A support element or bracket 2302 is secured to a wall 2304, or to another vertical surface. A rotational latch module 2306 is mounted to the bracket 2302, such that a slot 2308 in a latch plate thereof is directed generally away from the wall. Preferably, the slot is directed generally upward prior to receiving a latch engaging structure 2312 mounted to a hub of a bicycle 2310. During use, the latch engaging structure 2312 mounted to the hub of the bicycle 2310 is positioned within the slot 2308 and the bicycle 2310 is pushed toward the wall 2304, causing the latch plate of rotational latch module 2306 to rotate about pivot pin 2314, from a first orientation shown in FIG. 23a to a second orientation shown in FIG. 23b. In the second orientation that is shown in FIG. 23b the slot 2308 faces a surface 2316, which prevents the latch engaging structure 2312 from being removed from the slot 2308. The latch module locks automatically when the latch plate is rotated about pivot pin 2314 from the first orientation to the second orientation. Accordingly, the bicycle in FIG. 23b is secured in a locked condition.

[0088] It should be appreciated that the foregoing description is merely illustrative in nature and that the present invention includes modifications, changes, and equivalents thereof, without departure from the scope of the invention.

CLAIMS

What is claimed is:

1. A bicycle docking system for securing a bicycle having a wheel that is rotationally mounted to a frame of the bicycle via a hub, the bicycle docking system comprising:

a first latch-engaging structure mechanically coupled to a first end of the hub of the bicycle, the first latch-engaging structure comprising a first striker portion and a first retaining portion;

a bicycle docking stand for being secured to a surface and comprising a first rotary latch having a first latch plate with a first slot for receiving the first striker portion, the first latch plate being rotatable about a pivot pin between a first orientation in which the first slot is aligned with a guide channel of the bicycle docking stand for guiding the first striker portion into the first slot and a second orientation in which the first slot is other than aligned with the guide channel of the bicycle docking stand such that the first striker portion is prevented from exiting the first slot, the pivot pin disposed inside the circumference of the bicycle wheel, and the first rotary latch locking automatically upon the first latch plate being rotated into the second orientation from the first orientation;

a controller for authorizing use of the bicycle that is secured in the bicycle docking stand and for providing a control signal indicative of an authorization; and,

an actuator in communication with the controller for releasing the first latch plate from the locked second orientation in response to receiving the control signal from the controller, so as to enable rotation of the first latch plate from the second orientation to the first orientation to enable authorized use of the bicycle,

wherein the first latch plate is disposed within an engagement zone that is defined between the hub of the bicycle and the first retaining portion of the first latch-engaging structure when the bicycle is secured in the bicycle docking stand.

2. A bicycle docking system according to claim 1, wherein the first retaining portion of the first latch-engaging structure is dimensioned larger than the first slot, for retaining the first striker portion within the first slot when the first latch plate is in the second orientation.

3. A bicycle docking system according to claim 1 or 2, wherein the first latch-engaging structure is one of a mushroom-head lug and a mushroom head nut.

4. A bicycle docking system according to claim 1 or 2, wherein the first latch-engaging structure is a loop striker.

5. A bicycle docking system according to any one of claims 1 to 4, comprising a second latch-engaging structure coupled to a second end of the hub that is opposite the first end, the second latch-engaging structure comprising a second striker portion and a second retaining portion.

6. A bicycle docking system according to claim 5, comprising a second rotary latch having a second latch plate with a second slot for receiving the second striker portion.

7. A bicycle docking system according to claim 6, wherein the first latch-engaging structure and the second latch-engaging structure are mounted on the bicycle docking stand in a spaced-apart facing relationship.

8. A bicycle docking system according to claim 6 or 7, wherein the second rotary latch rotates substantially in unison with the first rotary latch between the first orientation and the second orientation.

9. A bicycle docking system according to any one of claims 1 to 8, comprising a bumper member disposed on the bicycle docking stand for limiting rotation of the bicycle about the axle when the bicycle is secured in the bicycle docking stand.

10. A bicycle docking system according to any one of claims 1 to 9, wherein the hub is the front hub of the bicycle.

11. A bicycle docking system according to any one of claims 1 to 9, wherein the hub is the rear hub of the bicycle.

12. A bicycle docking system according to any one of claims 1 to 11, wherein the surface to which the bicycle docking stand is secured comprises a base plate having a mounting structure defined along an upper face thereof for engaging a complementary mounting structure of the bicycle docking stand.

13. A bicycle docking system according to any one of claims 1 to 11, wherein the surface to which the bicycle docking stand is secured is a vertical surface.

14. A bicycle docking system according to any one of claims 1 to 13, wherein the bicycle comprises a rechargeable battery pack in electrical communication with a pickup coil and the bicycle docking stand comprises a charging coil in electrical communication with an electrical power source, and wherein the pickup coil is disposed in proximity to the first induction coil so as to support

charging of the rechargeable battery when the bicycle is in the docked condition, for inductively charging the rechargeable battery pack.

15. A bicycle docking system according to any one of claims 1 to 13, wherein the bicycle comprises a rechargeable battery pack in electrical communication with a recharging connector and the bicycle docking stand comprises a complementary recharging connector in electrical communication with an electrical power source, and wherein the recharging connector is mated with the complementary recharging connector when the bicycle is secured in the bicycle docking stand for charging the rechargeable battery pack.

16. A bicycle docking system for securing a bicycle having a wheel that is rotationally mounted to a frame of the bicycle via a hub about an axle, the bicycle docking system, comprising:

a first latch-engaging structure mechanically coupled to one end of the hub, the first latch-engaging structure having a first retaining portion that is spaced away from the hub in a direction parallel to the axle and having a first striker portion that is disposed within an engagement zone between the first retaining portion and the hub of the bicycle, the first striker portion other than co-axially aligned with the axle;

a bicycle docking stand for being secured to a surface and comprising a first rotary latch having a first latch plate with a first slot for receiving the first striker portion, the first rotary latch being rotatable about a pivot pin between a first orientation in which the first slot is aligned with a guide channel of the bicycle docking stand for guiding the first striker portion into the first slot and a second orientation in which the first slot is other than aligned with the guide channel of the bicycle docking stand such that the first striker portion is prevented from exiting the first slot, the pivot pin disposed inside the circumference of the bicycle wheel, and the first rotary latch locking

automatically upon being rotated into the second orientation from the first orientation;

a controller for authorizing use of the bicycle that is secured in the stand; and,

an actuator in communication with the controller for releasing the first latch plate from the locked second orientation in response to receiving a control signal from the controller, so as to enable rotation of the first latch plate from the second orientation to the first orientation to enable authorized use of the bicycle.

17. A bicycle docking system according to claim 16, wherein the first retaining portion for the first latch-engaging structure is dimensioned larger than the first slot, for retaining the first striker portion within the first slot when the first latch plate is in the second orientation.

18. A bicycle docking system according to claim 16 or 17, wherein the first latch-engaging structure is a loop striker.

19. A bicycle docking system according to any one of claims 16 to 18, comprising a second latch-engaging structure coupled to a second end of the hub that is opposite the first end, the second latch-engaging structure comprising a second striker portion and a second retaining portion.

20. A bicycle docking system according to claim 19, comprising a second rotary latch having a second latch plate with a second slot for receiving the second striker portion.

21. A bicycle docking system according to claim 20, wherein the first latch-engaging structure and the second latch-engaging structure are mounted on the bicycle docking stand in a spaced-apart facing relationship.

22. A bicycle docking system according to claim 20 or 21, wherein the second rotary latch rotates substantially in unison with the first rotary latch between the first orientation and the second orientation.

23. A bicycle docking system according to any one of claims 16 to 22, comprising a bumper member disposed on the bicycle docking stand for limiting rotation of the bicycle about the axle when the bicycle is secured in the bicycle docking stand.

24. A bicycle docking system according to any one of claims 16 to 23, wherein the hub is one of the front hub and the rear hub of the bicycle.

25. A bicycle docking system according to any one of claims 16 to 24, wherein the surface to which the bicycle docking stand is secured comprises a base plate having a mounting structure defined along an upper face thereof for engaging a complementary mounting structure of the bicycle docking stand.

26. A bicycle docking system according to any one of claims 16 to 24, wherein the surface to which the bicycle docking stand is secured is a vertical surface.

27. A method for securing a bicycle having a wheel that is rotationally mounted to a frame of the bicycle via a hub, comprising:

providing a latch-engaging structure that is mechanically coupled to at least one end of the hub, the latch-engaging structure having a retaining portion that is spaced away from the hub in a direction along the axle and

having a striker portion that is disposed within an engagement zone between the retaining portion and the wheel of the bicycle;

aligning the striker portion of the latch-engaging structure with a receiving slot defined in a rotary latch of a bicycle docking stand;

pushing the bicycle toward the bicycle docking stand through a first distance such that the latch-engaging structure engages the slot of the rotary latch; and,

engaging a locking mechanism of the rotary latch by pushing the bicycle through a second distance in addition to the first distance, such that the striker portion causes the rotary latch to rotate into a locked orientation by rotation about a pivot pin that is defined within the circumference of the wheel.

28. A bicycle docking system for use with a bicycle that is equipped with a rechargeable battery, the bicycle docking system comprising:

a latch-engaging structure mechanically coupled to one end of a hub of the bicycle;

a pickup coil of an inductive charger system disposed aboard the bicycle and in electrical communication with the rechargeable battery;

a bicycle docking stand comprising a latch assembly for receiving the latch-engaging structure of the bicycle when the bicycle is in a docked condition, and comprising a charging coil of the inductive charger system, the charging coil disposed on the bicycle docking stand at a location that is adjacent to the pickup coil when the bicycle is in a docked condition; and,

a controller for controlling charging of the rechargeable battery via the inductive charger system including the pickup coil and the charging coil.

29. A bicycle docking system according to claim 28, wherein the latch-engaging structure comprises a first latch-engaging structure mechanically

coupled to a first end of the hub of the bicycle and a second latch-engaging structure mechanically coupled to a second end of the hub of the bicycle.

30. A bicycle docking system according to claim 29, wherein the first latch-engaging structure comprising a first striker portion and a first retaining portion and the second latch-engaging structure comprising a second striker portion and a second retaining portion.

31. A bicycle docking system according to claim 30, wherein the latch assembly comprises a first latch assembly having a first latch plate with a first slot and a second latch assembly having a second latch plate with a second slot, the first and second slots for retaining the first and second striker portions, respectively, when the bicycle is in the docked condition.

32. A bicycle docking system for use with a bicycle that is equipped with a rechargeable battery, the bicycle docking system comprising:

a first induction coil disposed on the bicycle and in electrical communication with the rechargeable battery;

a bicycle docking stand for supporting the bicycle when the bicycle is in a docked condition;

a second induction coil disposed on the bicycle docking stand at a location that is in proximity to the first induction coil that supports charging of the rechargeable battery when the bicycle is in the docked condition; and,

a controller for controlling charging of the rechargeable battery by inductive charging via the first induction coil and the second induction coil.

33. A bicycle docking system according to claim 32, wherein the bicycle docking stand supports the bicycle via a latch engaging structure mounted to a hub of a wheel of the bicycle.

34. A bicycle docking system according to claim 33, wherein the bicycle docking stand comprises a rotary latch having a latch plate with a slot for receiving the latch engaging structure of the bicycle, the latch plate being rotatable about a pivot pin between a first orientation in which the slot is aligned with a guide channel of the bicycle docking stand for guiding the latch engaging structure of the bicycle into the slot and a second orientation in which the slot is other than aligned with the guide channel of the bicycle docking stand such that the latch engaging structure of the bicycle is prevented from exiting the slot, the pivot pin disposed inside the circumference of the wheel of the bicycle, and the rotary latch locking automatically upon the latch plate being rotated into the second orientation from the first orientation.

35. A method of charging a rechargeable battery carried by a bicycle when the bicycle is docked to a bicycle docking stand, the bicycle having a pickup coil coupled to the battery and the bicycle docking stand having a charging coil coupled to a power source, the method comprising:

aligning a latch-engaging structure of the bicycle with a latch mechanism of the bicycle docking stand;

moving the bicycle into a docked condition in which the latch-engaging structure is locked into the latch mechanism and the pickup coil is disposed adjacent to the charging coil; and

inductively charging the battery by providing power from the power source via the pickup coil and the charging coil.

36. A bicycle docking system, comprising:

a first bicycle docking stand for supporting a first bicycle via a latch engaging structure mounted to a hub of a wheel of the bicycle, the first bicycle docking stand comprising a first rotary latch having a first latch plate with a

first slot for receiving the latch engaging structure of the first bicycle, the first latch plate being rotatable about a first pivot pin between a first orientation in which the first slot is aligned with a guide channel of the first bicycle docking stand for guiding the first latch engaging structure of the first bicycle into the first slot and a second orientation in which the first slot is other than aligned with the guide channel of the first bicycle docking stand such that the latch engaging structure of the first bicycle is prevented from exiting the first slot, the first pivot pin disposed inside the circumference of the wheel of the first bicycle, and the first rotary latch locking automatically upon the first latch plate being rotated into the second orientation from the first orientation;

a first base member having a first mounting structure disposed on a first face thereof for mounting the first bicycle docking stand, the first base member having a first edge and a second edge that is opposite the first edge, the first edge and the second edge being non-parallel;

a second bicycle docking stand for supporting a second bicycle via a latch engaging structure mounted to a hub of a wheel of the bicycle, the second bicycle docking stand comprising a second rotary latch having a second latch plate with a second slot for receiving the latch engaging structure of the second bicycle, the second latch plate being rotatable about a second pivot pin between a first orientation in which the second slot is aligned with a guide channel of the second bicycle docking stand for guiding the second latch engaging structure of the second bicycle into the second slot and a second orientation in which the second slot is other than aligned with the guide channel of the second bicycle docking stand such that the latch engaging structure of the second bicycle is prevented from exiting the second slot, the second pivot pin disposed inside the circumference of the wheel of the second bicycle, and the second rotary latch locking automatically upon the second latch plate being rotated into the second orientation from the first orientation; and,

a second base member having a second mounting structure disposed on a first face thereof for mounting the second bicycle docking stand, the second base member having a third edge and a fourth edge that is opposite the third edge, the third edge and the second edge being non-parallel,

wherein the first edge is coupleable to the third edge for configuring a linear bicycle docking system, and wherein the first edge is coupleable to the fourth edge for configuring a non-linear bicycle docking system.

37. A bicycle docking system according to claim 36, wherein the first base member and the second base member are trapezoid-shaped.

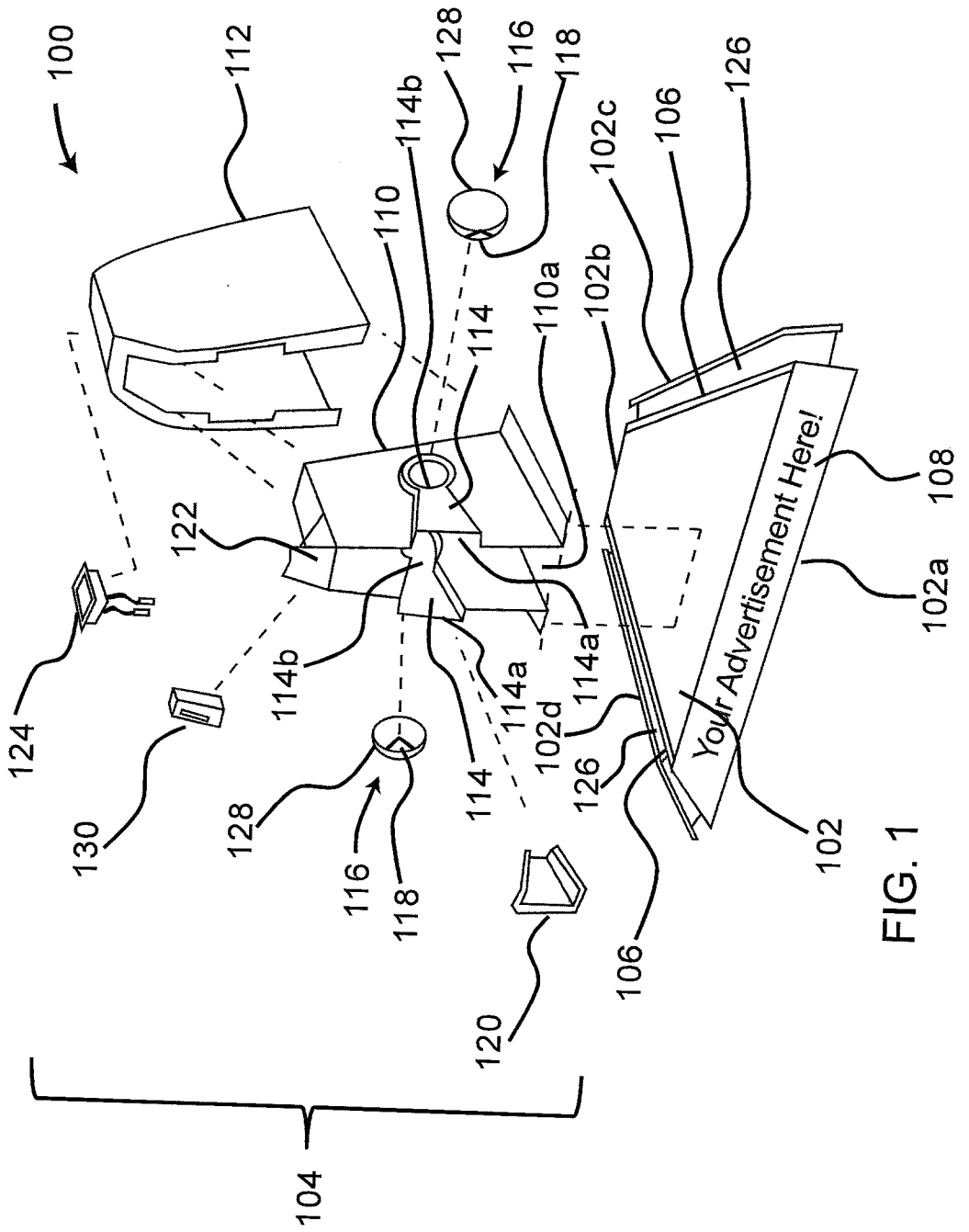

100
112
128
116
118
114b
110
102c
106
126
110a
114
102b
122
108
102a
114b
114a
102d
114a
124
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102
Your Advertisement Here!
120
104

FIG. 1

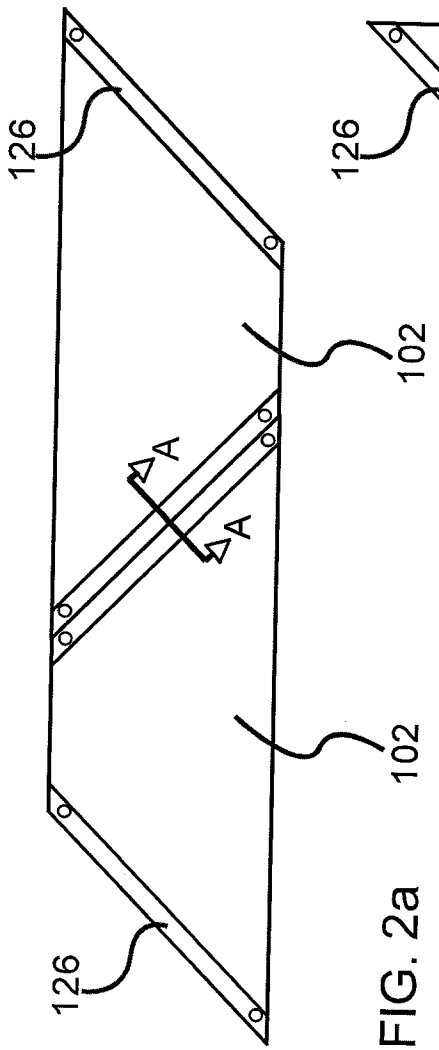


FIG. 2a

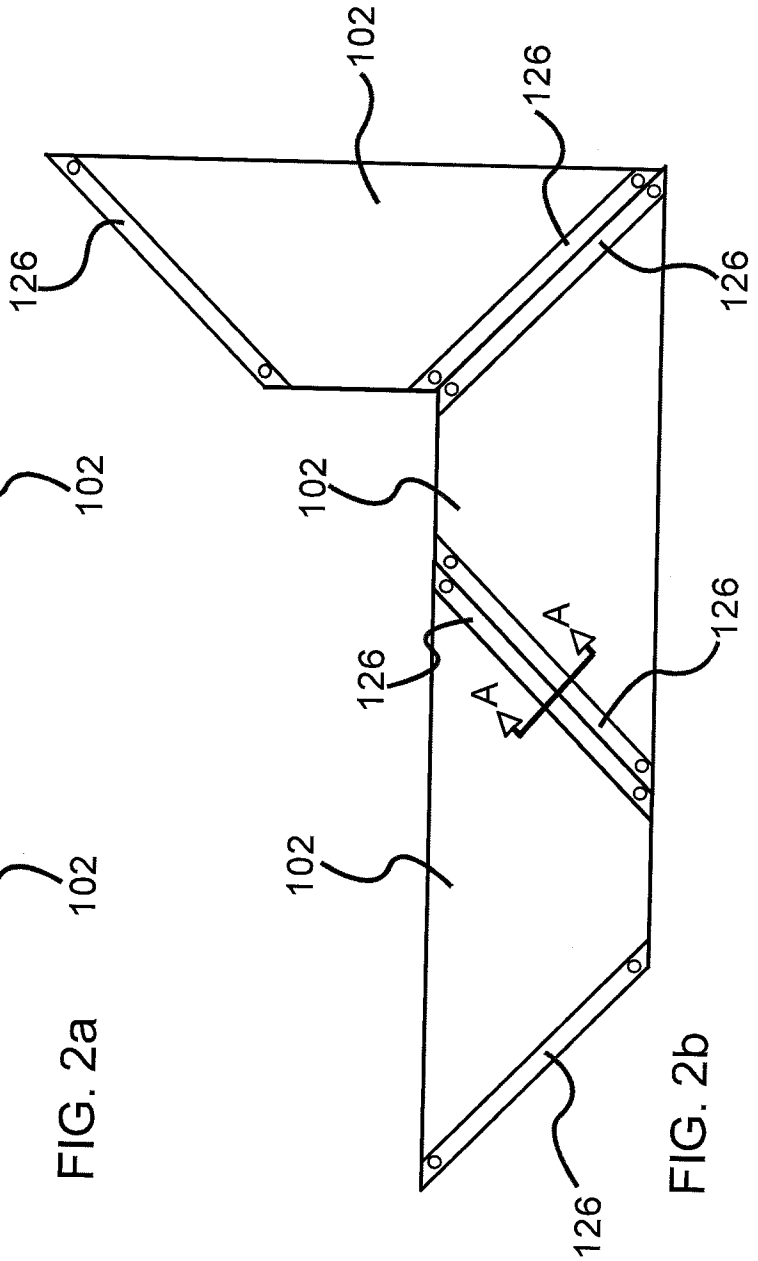


FIG. 2b

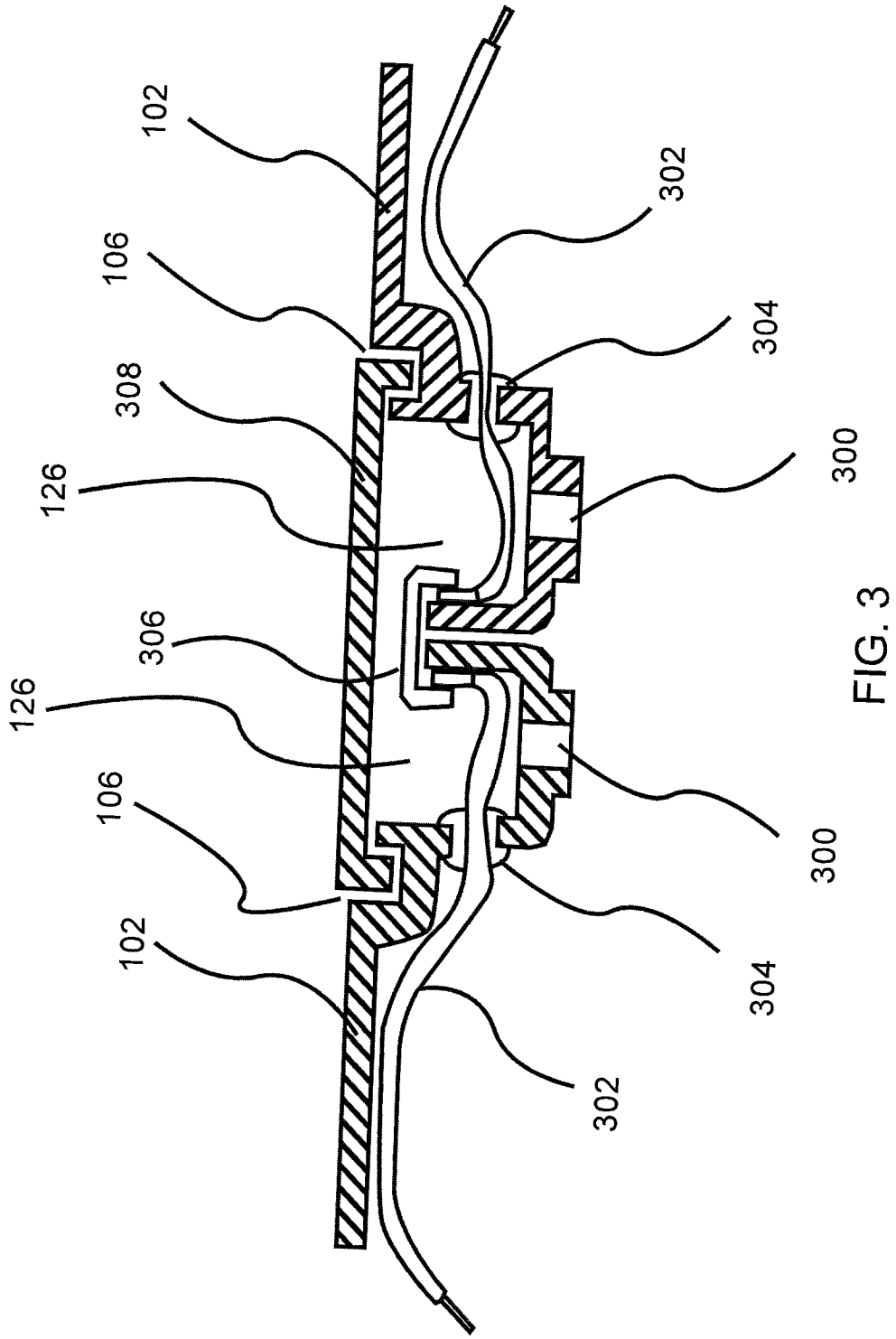


FIG. 3

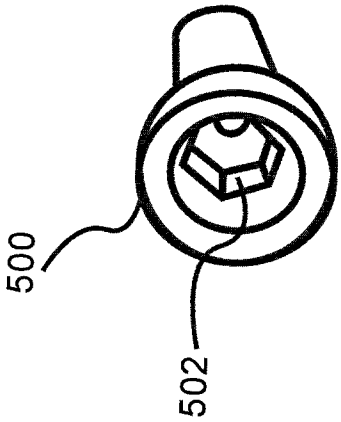


FIG. 5

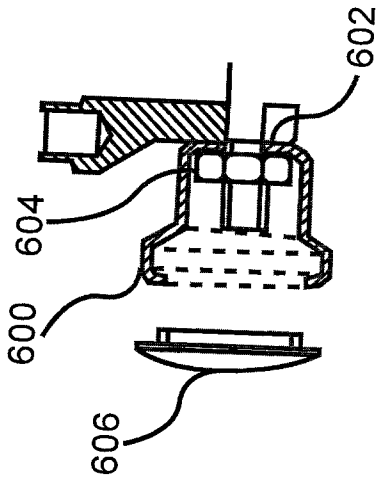


FIG. 6

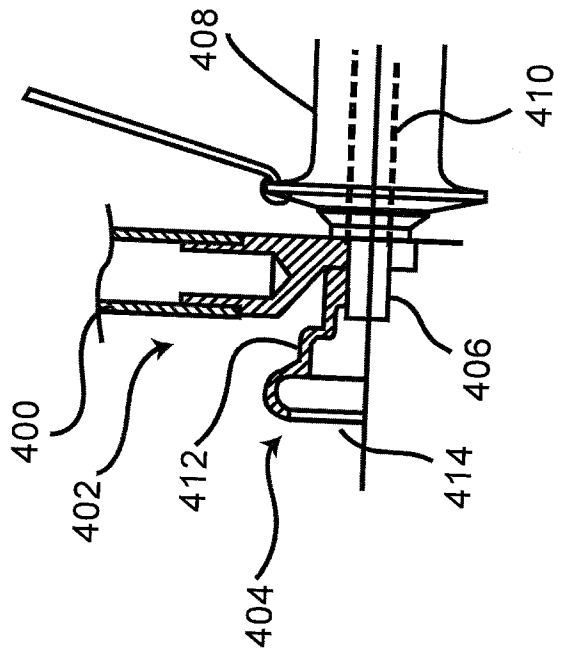


FIG. 4

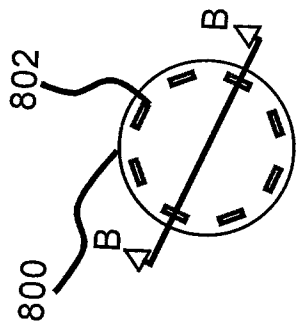


FIG. 8b



FIG. 8c

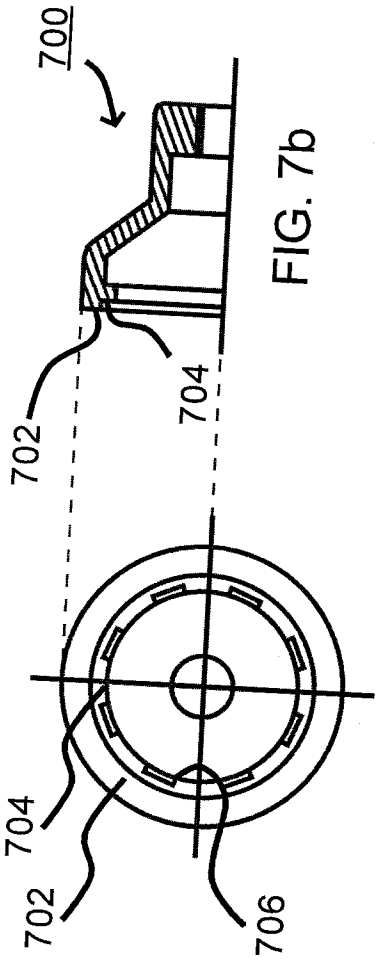


FIG. 7b

FIG. 7a

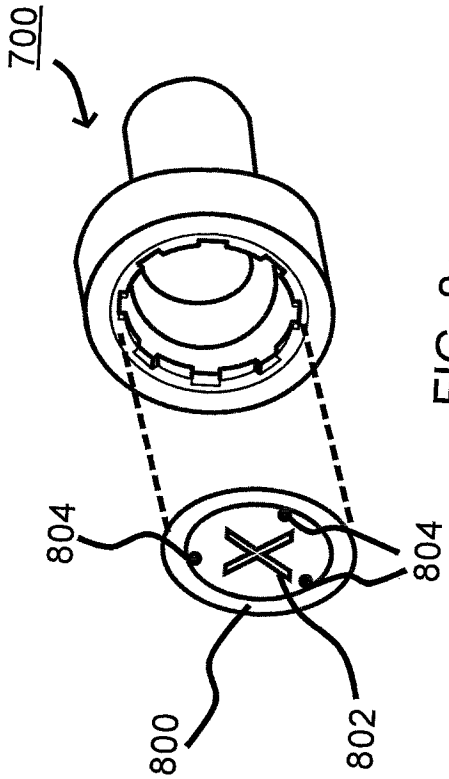


FIG. 8a

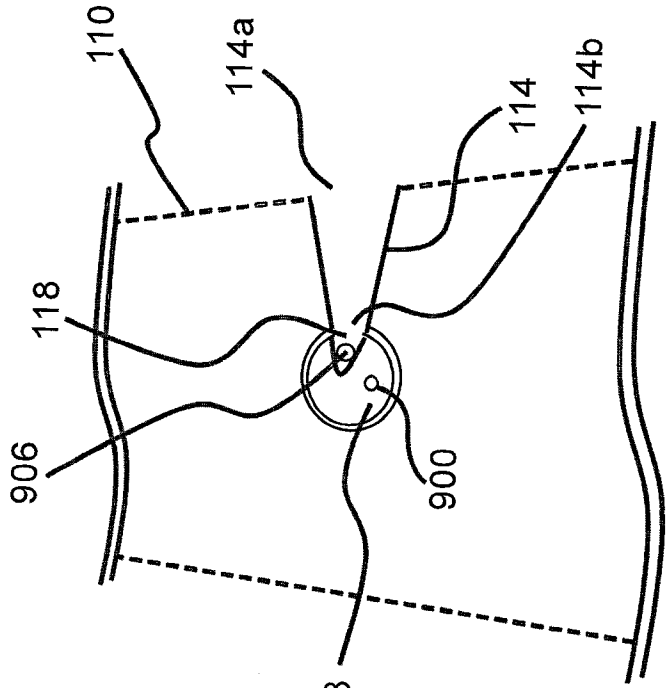

110
114a
114
114b
118
906
900
128

FIG. 9b

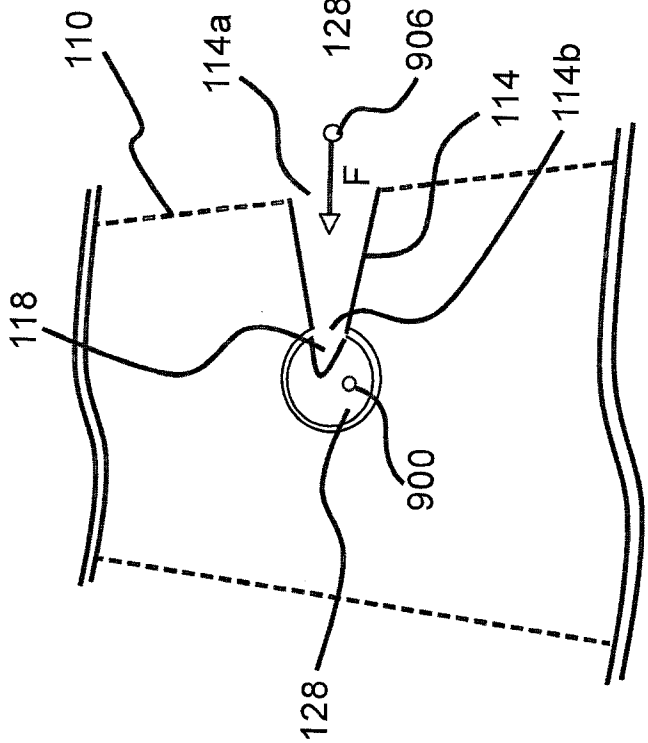

110
114a
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114b
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FIG. 9a

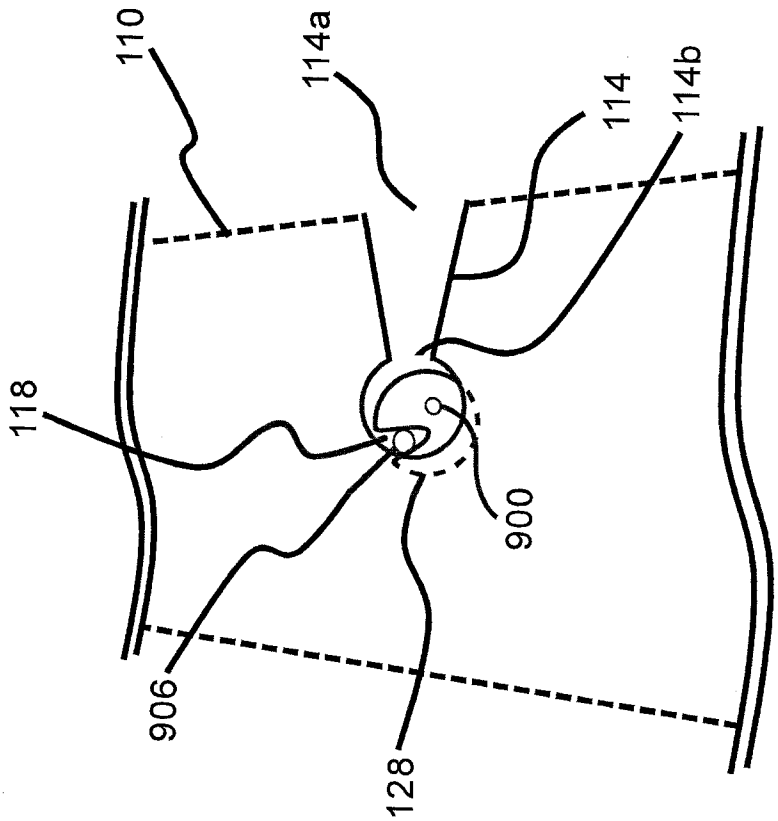


FIG. 9c

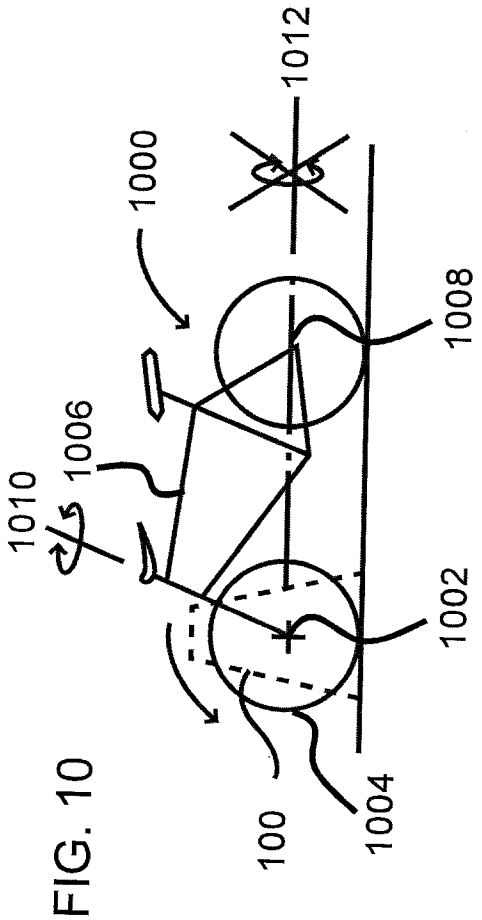


FIG. 10

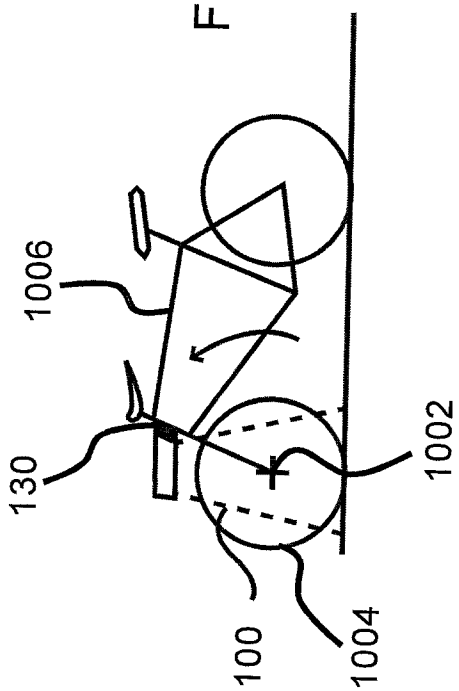


FIG. 11

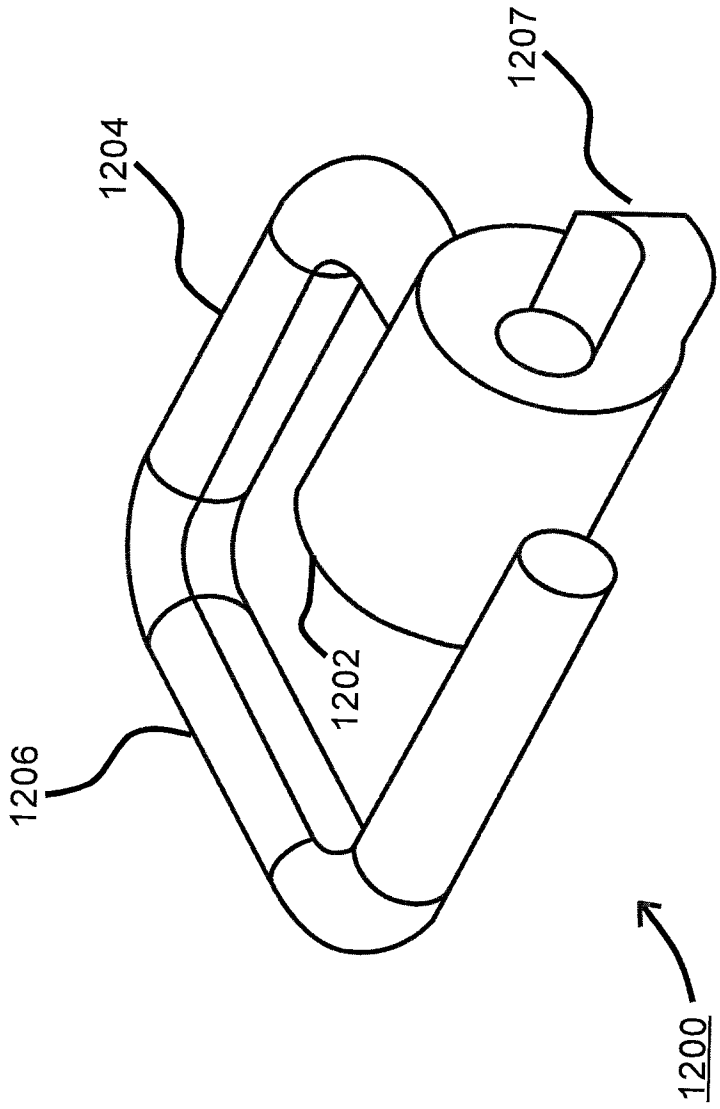


FIG. 12

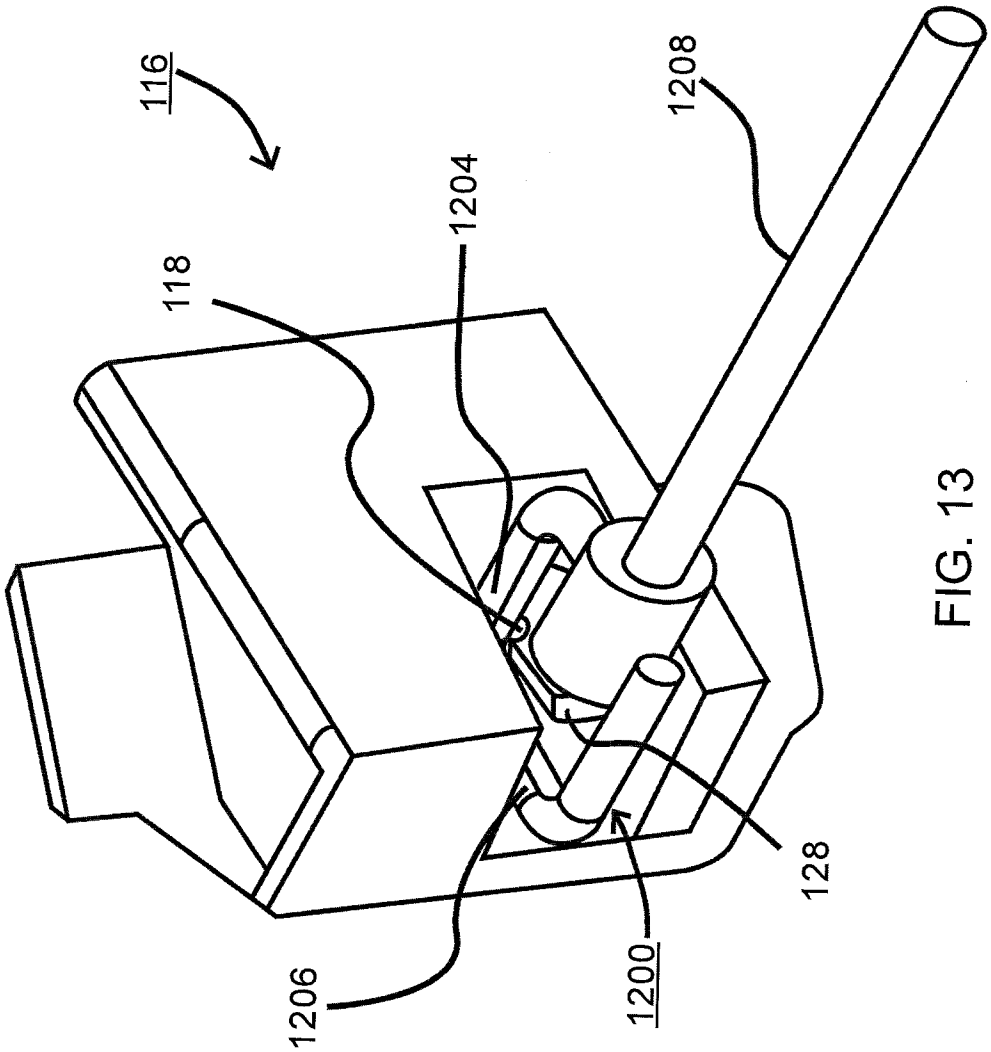


FIG. 13

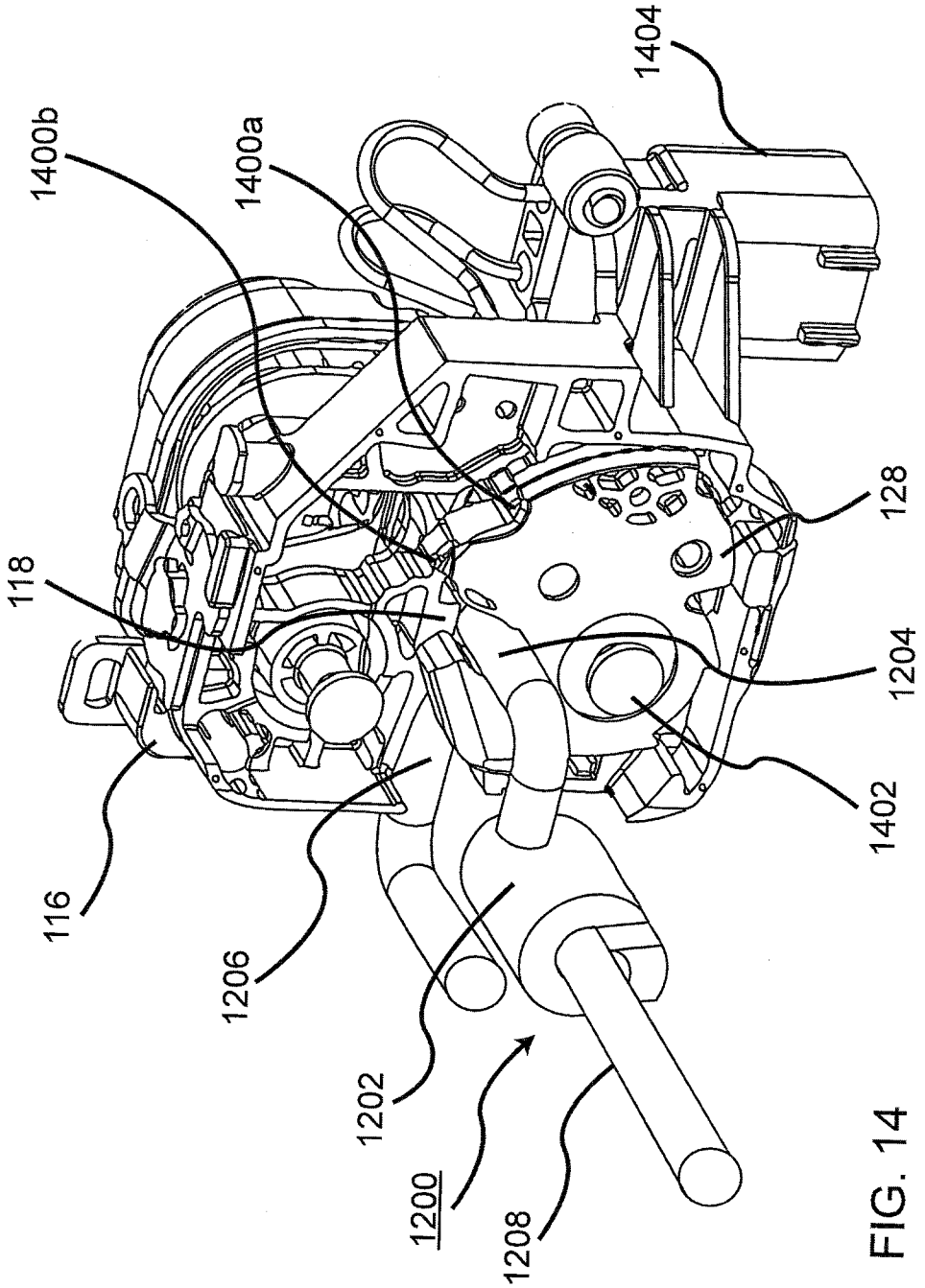


FIG. 14

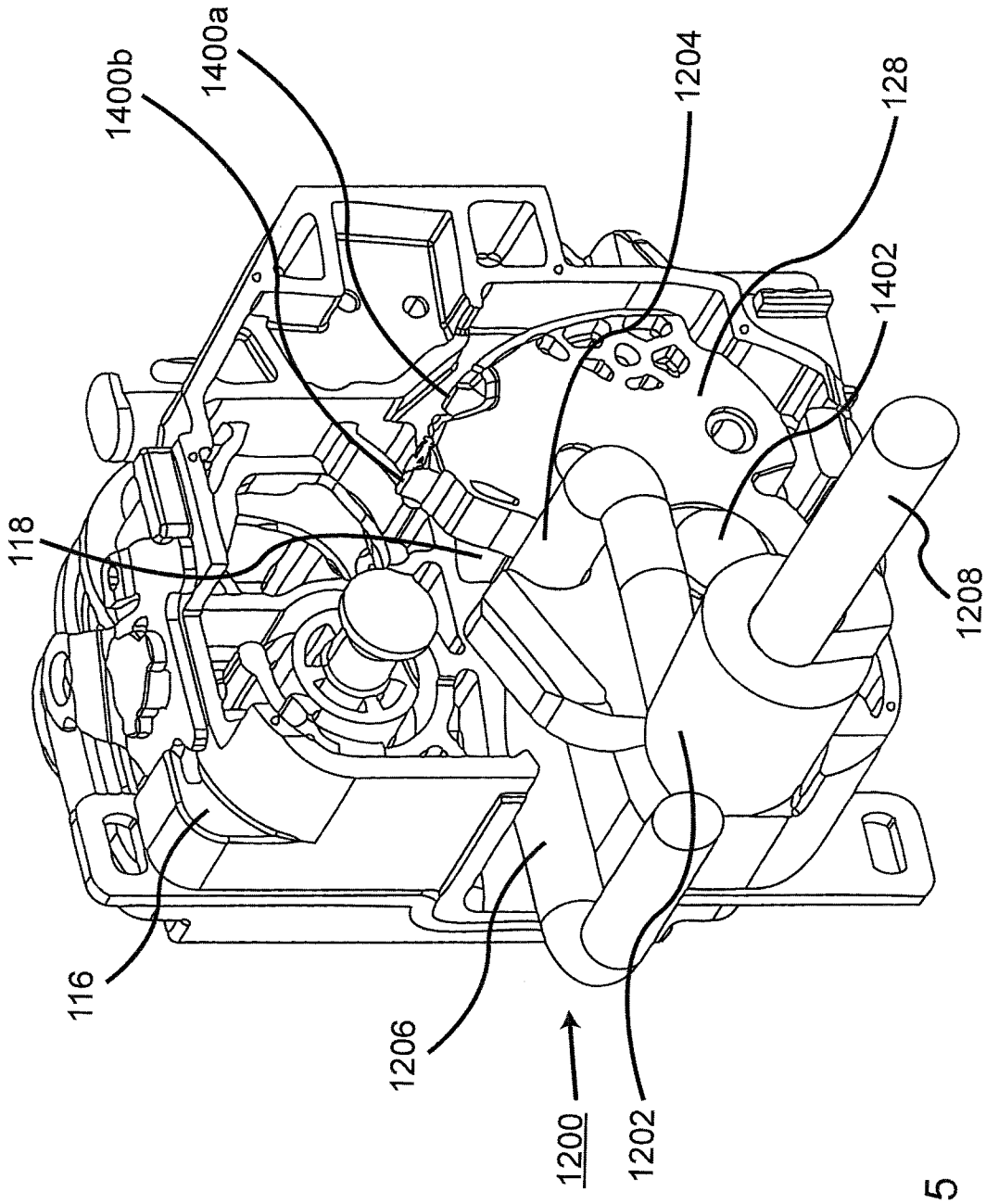


FIG. 15

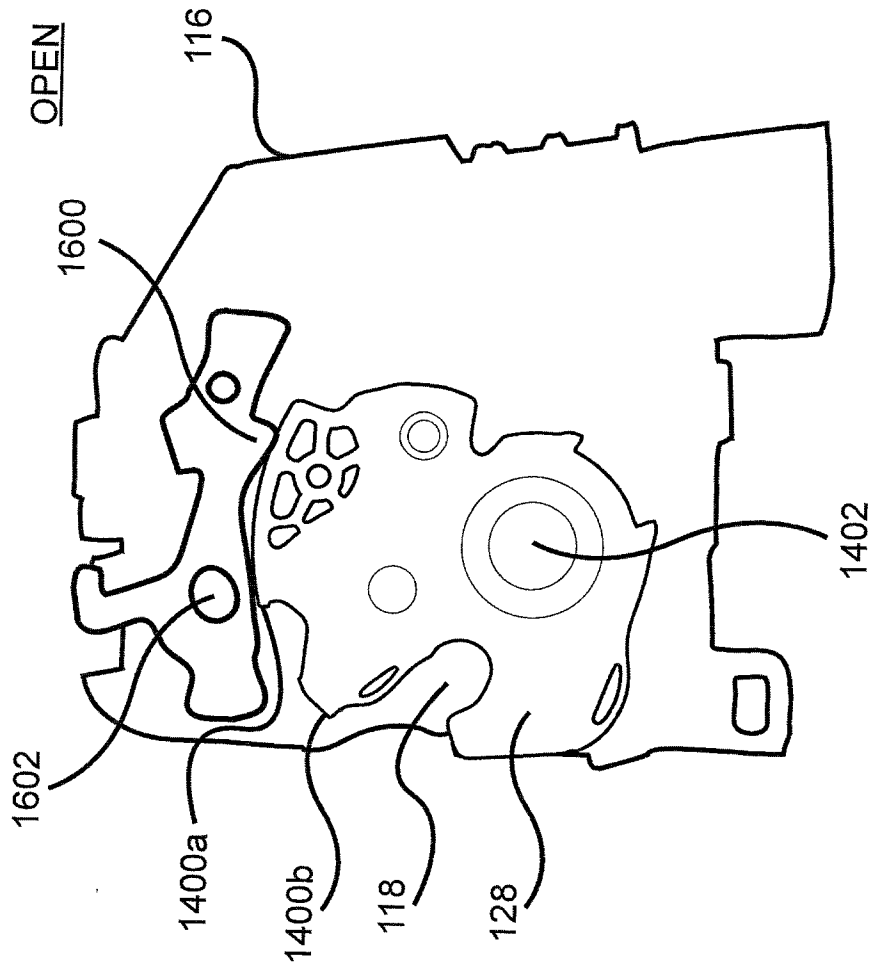


FIG. 16a

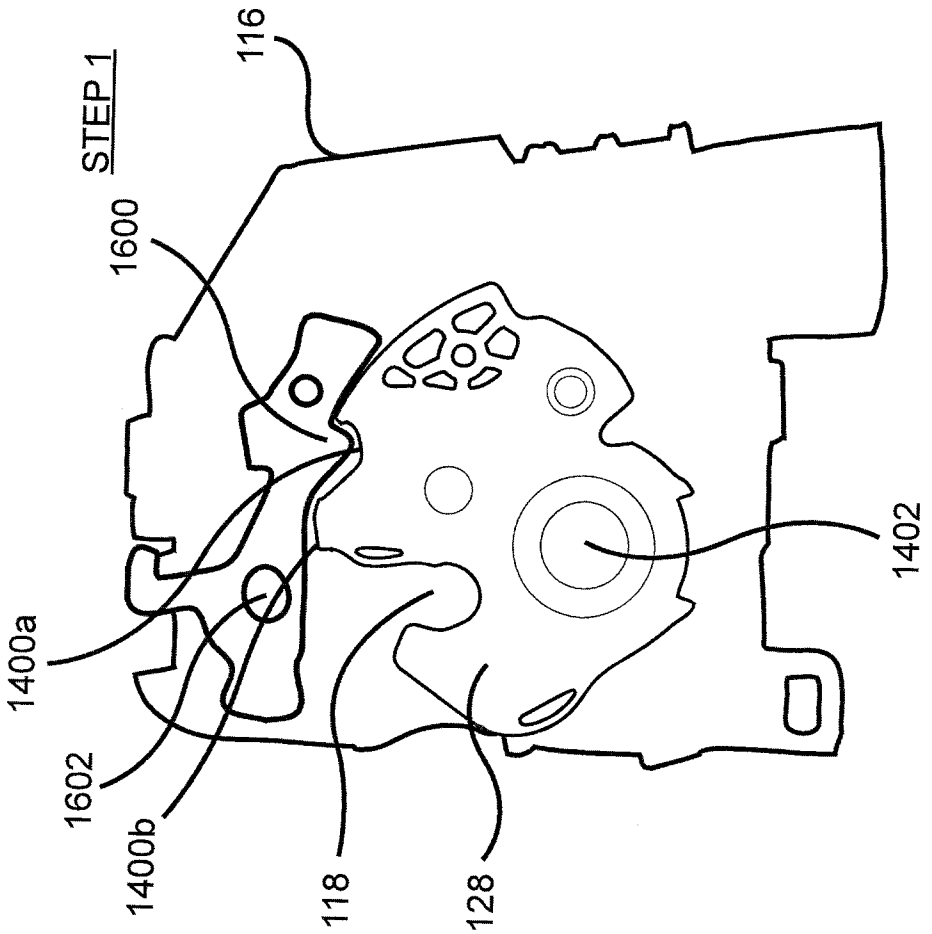


FIG. 16b

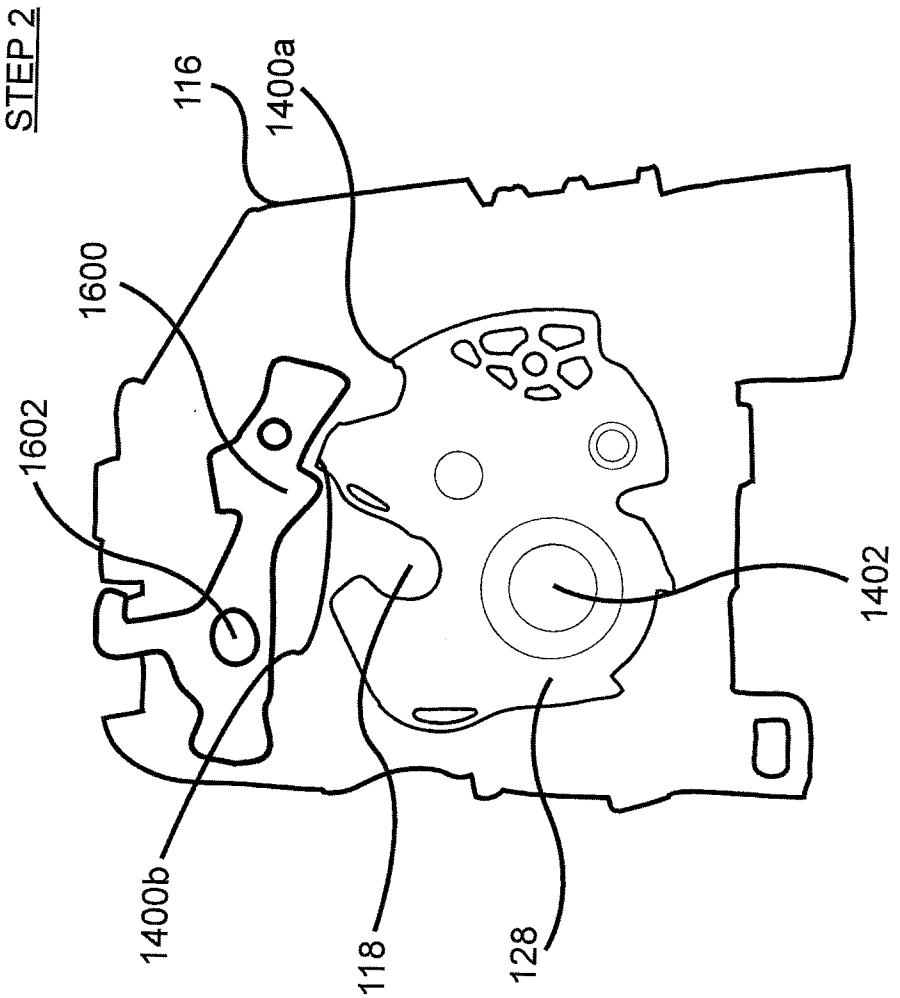


FIG. 16c

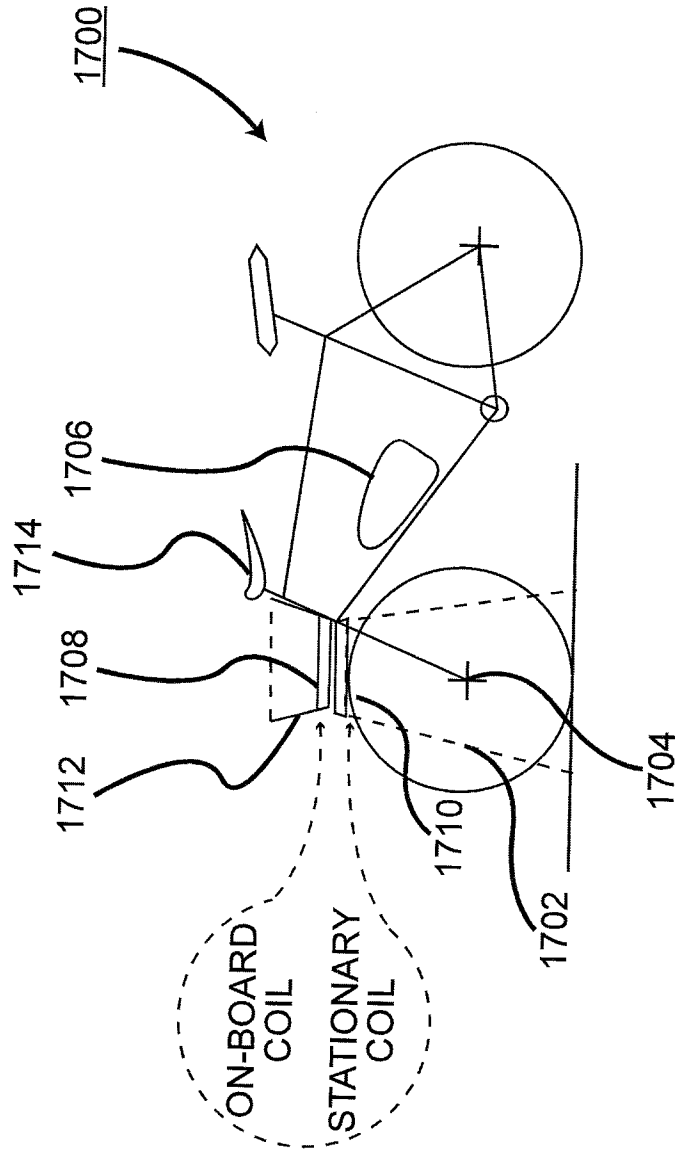

1700
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ON-BOARD COIL
STATIONARY COIL

FIG. 17

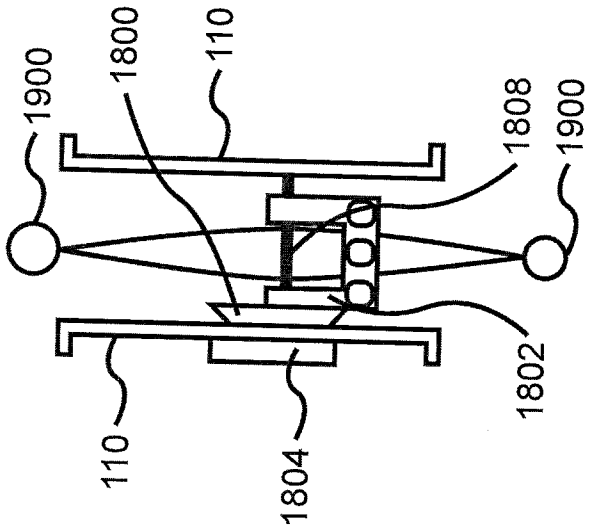


FIG. 19

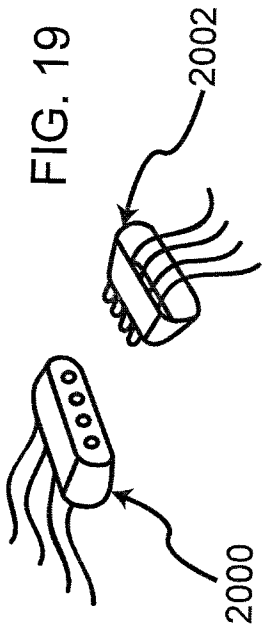


FIG. 20

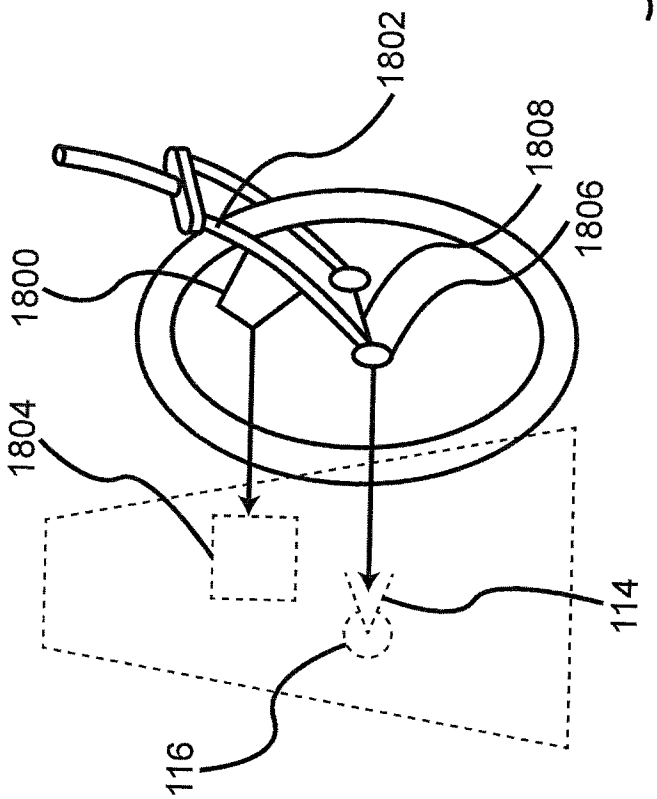


FIG. 18

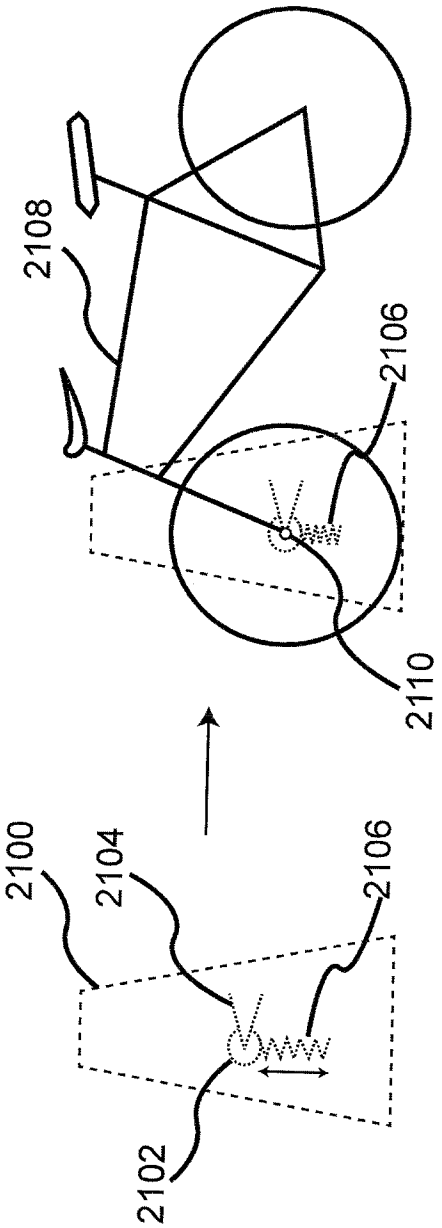


FIG. 21b

FIG. 21a

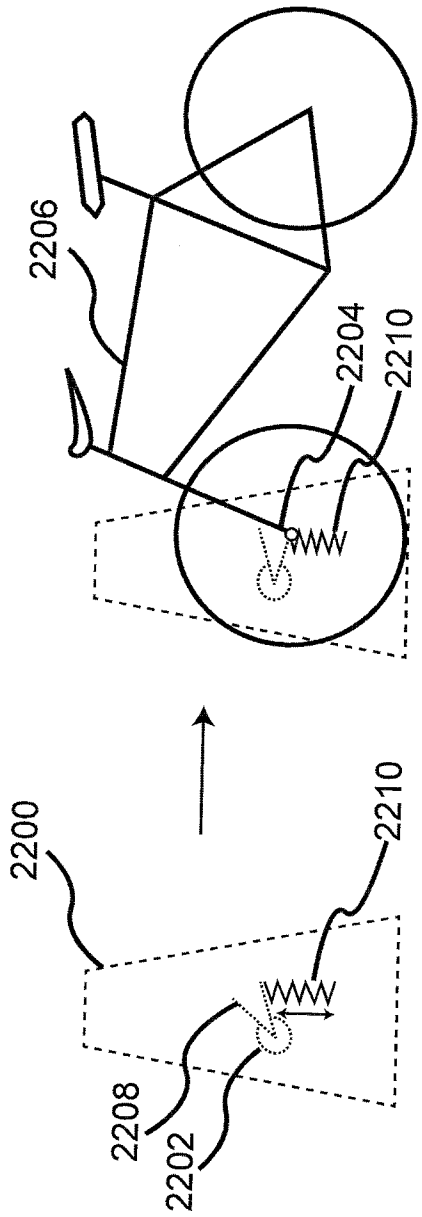


FIG. 22b

FIG. 22a

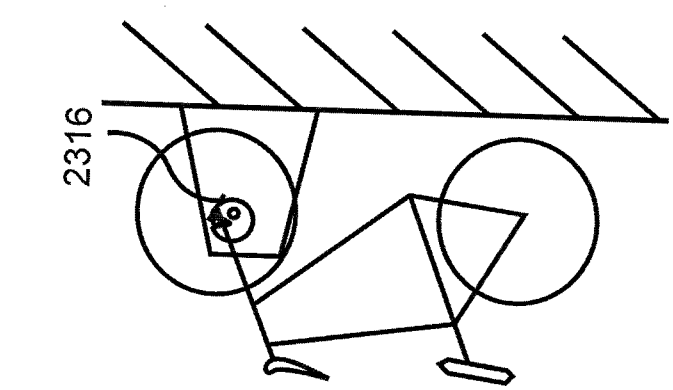


FIG. 23b

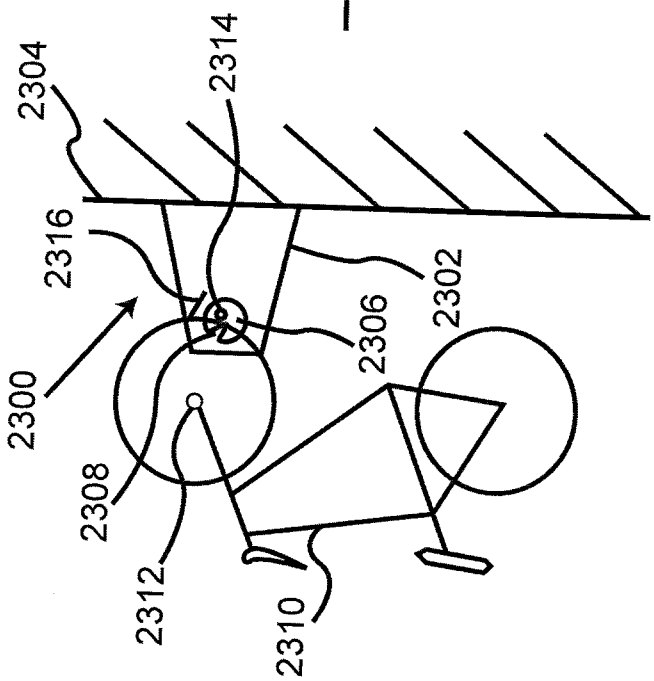


FIG. 23a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2010/000977

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***E05B 71/00*** (2006.01) , ***B62H 3/00*** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(2006.01): E05B 71/00, B62H 3/00, E05B, B62H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Databases: EPOQUE (Epodoc, X-Full), Canadian Patent Database **Keywords**: Bicycle, cycle, bike, dock+, stand, support, park+, latch+, lock+, hub, axle, wheel, communi+, control+, contactless, signal+, station, port, configur+, layout, pattern,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	CN 2828246 Y (XIE, R.) 18 October 2006 (18-10-2006) *figs.1-3; p.4, line 27 to p.5, line12; see machine translation from the Chinese Patent Information Center website*	1-13, 16-27, 37 36
Y	DE 3317885 A1 (SCHMID, A. et al.) 22 November 1984 (22-11-1984) *EPODOC abstract; all figures*	36
Y, P	EP 2130750 A2 (AYOTTE, A. et al.) 09 December 2009 (09-12-2009) *figs. 20A-E*	36
A, P	US 2010089846 A1 (RUIZ, B. et al.) 15 April 2010 (15-04-2010) *Entire document*	1-13, 16-27, 36, 37
A	WO 9809254 A2 (PRINS, A. et al.) 05 March 1998 (05-03-1998) *Entire document*	1-13, 16-27, 36, 37
A	SE 8206908 D0 (NILSSON, T.) 03 December 1982 (03-12-1982) *Entire document*	1-13, 16-27, 36, 37

[ ] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 September 2010 (21-09-2010)	25 October 2010 (25-10-2010)

Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Lena Santella (819) 934-2592

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2010/000977

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons :

1. [ ] Claim Nos. :
because they relate to subject matter not required to be searched by this Authority, namely :

2. [ ] Claim Nos. :
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically :

3. [ ] Claim Nos. :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows :

Group A: Claims 1-13, 16-27, 36, 37
A bicycle docking system for securing a bicycle via a latch engaging structure mounted to a hub of a bicycle wheel.

Group B: Claim 32
A bicycle docking system for recharging a bicycle battery via induction coils mounted on the docking station and bicycle.

[X] Continued on extra sheet

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos. :

4. [X] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos. : 1-13, 16-27, 36, 37

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

[ ] The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2010/000977

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
CN2828246Y	18 October 2006 (18-10-2006)	CN2828246Y	18 October 2006 (18-10-2006)
EP2130750A2	09 December 2009 (09-12-2009)	CA2699686A1	10 December 2009 (10-12-2009)
		US2009301976A1	10 December 2009 (10-12-2009)
		WO2009146543A1	10 December 2009 (10-12-2009)
US2010089846A1	15 April 2010 (15-04-2010)	EP2168848A1	31 March 2010 (31-03-2010)
WO9809254A2	05 March 1998 (05-03-1998)	AU4034497A	19 March 1998 (19-03-1998)
		EP1008113A2	14 June 2000 (14-06-2000)
		NL1003898C2	04 March 1998 (04-03-1998)
		WO9809254A3	07 May 1998 (07-05-1998)
SE8206908D0	03 December 1982 (03-12-1982)	SE8206908D0	03 December 1982 (03-12-1982)
		SE8206908A	12 June 1984 (12-06-1984)
		SE8206908L	12 June 1984 (12-06-1984)
DE3317885A1	22 November 1984 (22-11-1984)	DE3317885A1	22 November 1984 (22-11-1984)

Continuation of: Box No. III

Group C: Claims 14, 15, 28-31, 33-35
A bicycle docking system for securing a bicycle via a latch engaging structure and for recharging a bicycle battery via induction coils.

An analysis of the claims concluded that Group A pertains to a bicycle docking system for securing a bicycle via a latch engaging structure; and that Group B pertains to a bicycle docking system for recharging a bicycle battery via induction coils. The battery recharging system is solving a different problem than the latch engaging structure, and therefore is considered to be a separate invention. Furthermore, claims 14, 15, 28-31, 33-35 of Group C are considered linking claims comprising both alleged inventive concepts of Groups A and B, which is unacceptable in an application under Rule 13 of the PCT.