



US008337224B2

(12) **United States Patent**
Bychkov et al.

(10) **Patent No.:** **US 8,337,224 B2**
(45) **Date of Patent:** ***Dec. 25, 2012**

(54) **PUSH-TO-INSERT, PUSH-TO-EJECT AND PULL-TO-EXTRACT CARD CONNECTOR**

(75) Inventors: **Eyal Bychkov**, Hod Hasharon (IL); **Yaniv Maydar**, Raanana (IL); **Noam Bernstein**, Tel Aviv (IL); **Itay Cohen**, Raanana (IL)

(73) Assignee: **Google Inc.**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

5,628,055 A	5/1997	Stein
5,809,115 A	9/1998	Inkinen
5,818,691 A	10/1998	McMahan et al.
5,893,037 A	4/1999	Reele et al.
5,907,815 A	5/1999	Grimm et al.
6,188,917 B1	2/2001	Laureanti
6,201,867 B1	3/2001	Koike
6,243,578 B1	6/2001	Koike
6,477,357 B1	11/2002	Cook
6,516,202 B1	2/2003	Hawkins et al.
6,572,392 B2	6/2003	Motojima
6,640,113 B1	10/2003	Shim et al.
6,690,947 B1	2/2004	Tom
6,773,280 B2 *	8/2004	Sasaki et al. 439/159
6,898,283 B2	5/2005	Wycherley et al.
6,907,264 B1	6/2005	Sterkel

(Continued)

(21) Appl. No.: **13/211,300**

(22) Filed: **Aug. 16, 2011**

(65) **Prior Publication Data**

US 2012/0040549 A1 Feb. 16, 2012

Related U.S. Application Data

(63) Continuation of application No. 12/481,632, filed on Jun. 10, 2009, now Pat. No. 7,997,914.

(60) Provisional application No. 61/060,522, filed on Jun. 11, 2008.

(51) **Int. Cl.**
H01R 13/62 (2006.01)

(52) **U.S. Cl.** **439/159**

(58) **Field of Classification Search** 439/159, 439/155, 923

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,936,790 A	6/1990	De La Cruz
5,323,291 A	6/1994	Boyle et al.
5,548,484 A	8/1996	Kantner
5,625,673 A	4/1997	Grewe et al.

FOREIGN PATENT DOCUMENTS

EP 1871075 A1 12/2007

(Continued)

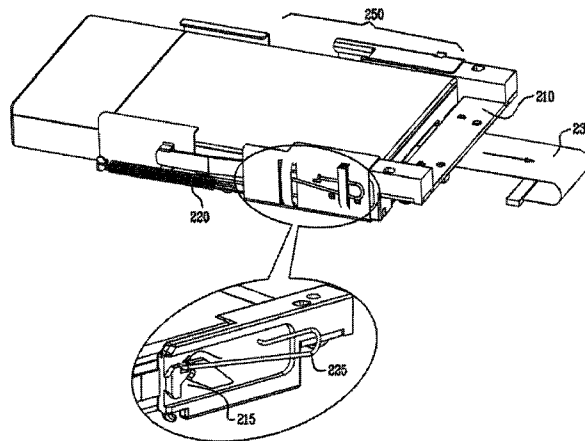
Primary Examiner — Neil Abrams

(74) *Attorney, Agent, or Firm* — Soquel Group LLC

(57) **ABSTRACT**

An apparatus, including a chassis having an opening into which an electrical component is insertable, means for coupling to the electrical component, the means for coupling slidably movable, relative to the chassis, in a first direction generally away from the opening, and in a second direction generally toward the opening to a first position in response to force in the first direction exerted upon the means for coupling, and to a second position in response to force in the first direction exerted upon the means for coupling when the means for coupling is in the first position, wherein the first position is different, with respect to the chassis, than the second position.

20 Claims, 18 Drawing Sheets



U.S. PATENT DOCUMENTS

6,948,956 B2 9/2005 Ngo
 6,999,792 B2 2/2006 Warren
 7,018,222 B2 3/2006 Chang
 7,085,542 B2 8/2006 Dietrich et al.
 7,156,683 B2 1/2007 Gupta et al.
 7,194,285 B2 3/2007 Tom
 7,266,391 B2 9/2007 Warren
 7,300,295 B2 11/2007 Kimura et al.
 7,477,919 B2 1/2009 Warren
 7,515,937 B2 4/2009 Lee
 2002/0090980 A1 7/2002 Wilcox et al.
 2002/0151327 A1 10/2002 Levitt
 2004/0233930 A1 11/2004 Colby, Jr.
 2004/0268005 A1 12/2004 Dickie
 2005/0159184 A1 7/2005 Kerner et al.
 2006/0003804 A1 1/2006 Liu
 2006/0105722 A1 5/2006 Kumar

2006/0190321 A1 8/2006 Martins Nicho et al.
 2006/0219776 A1 10/2006 Finn
 2006/0241353 A1 10/2006 Makino et al.
 2007/0004450 A1 1/2007 Parikh
 2007/0018957 A1 1/2007 Seo
 2007/0079030 A1 4/2007 Okuley et al.
 2007/0161404 A1 7/2007 Yasujima et al.
 2007/0288583 A1 12/2007 Rensin et al.
 2008/0009325 A1 1/2008 Zinn et al.
 2008/0040354 A1 2/2008 Ray et al.
 2008/0140886 A1 6/2008 Izutsu

FOREIGN PATENT DOCUMENTS

WO 9421058 A1 9/1994
 WO 0059247 A1 10/2000
 WO 0186922 A1 11/2001
 WO 03103174 A1 12/2003

* cited by examiner

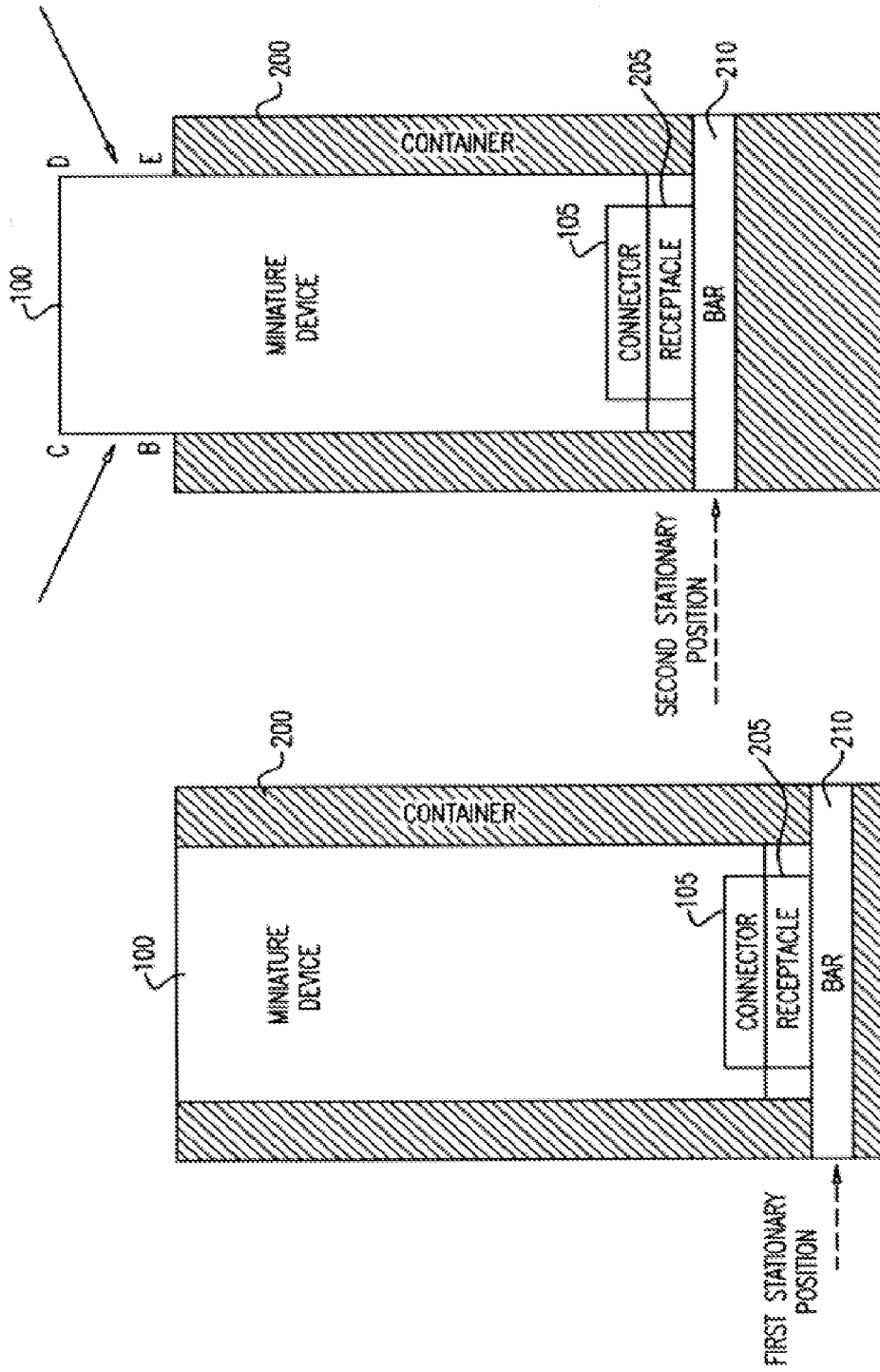


FIG. 1

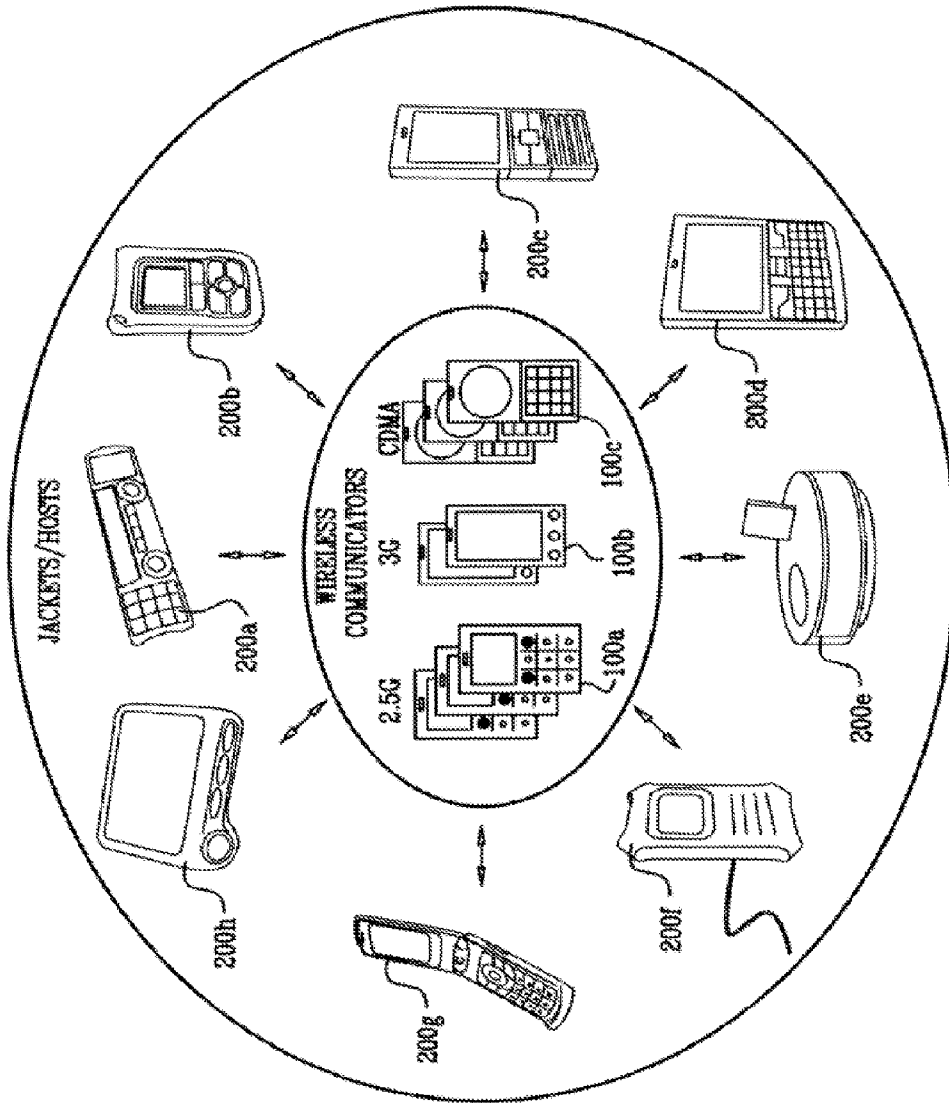


FIG. 2

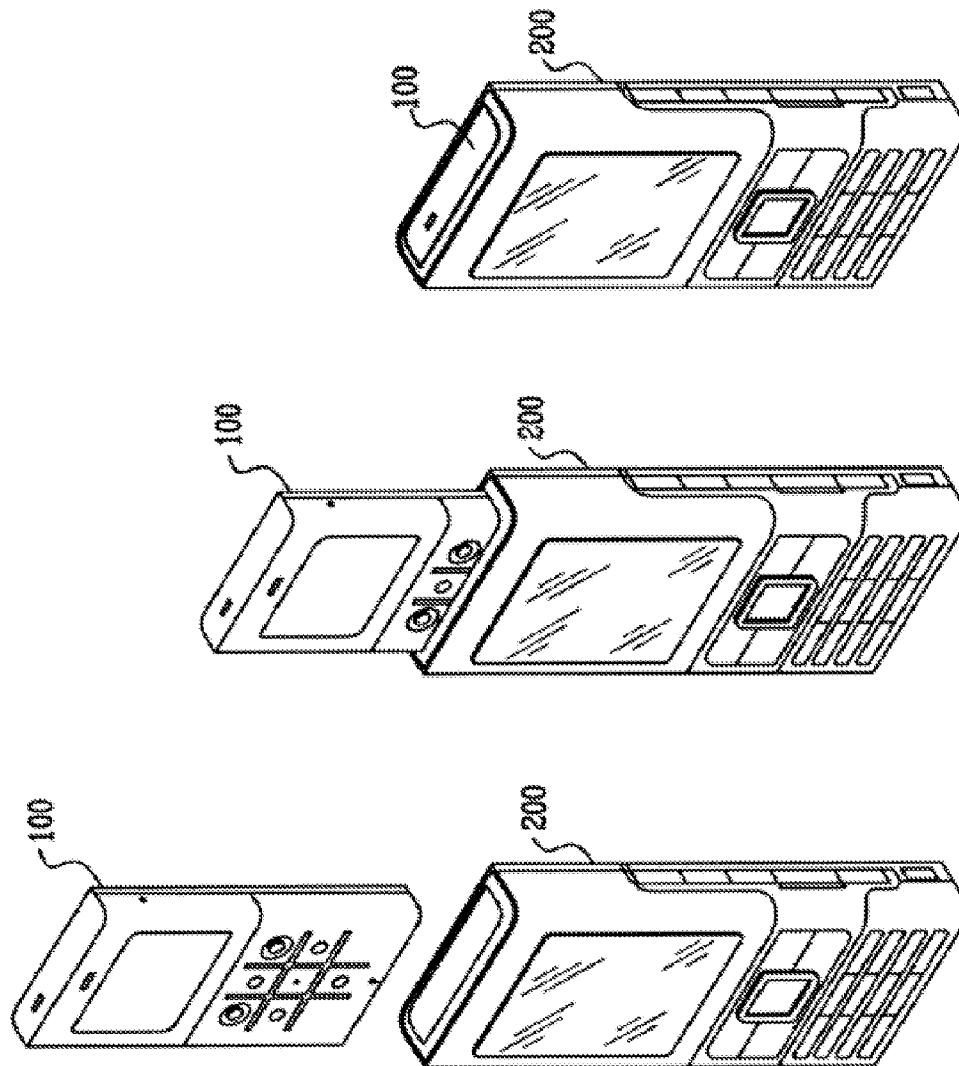


FIG. 3

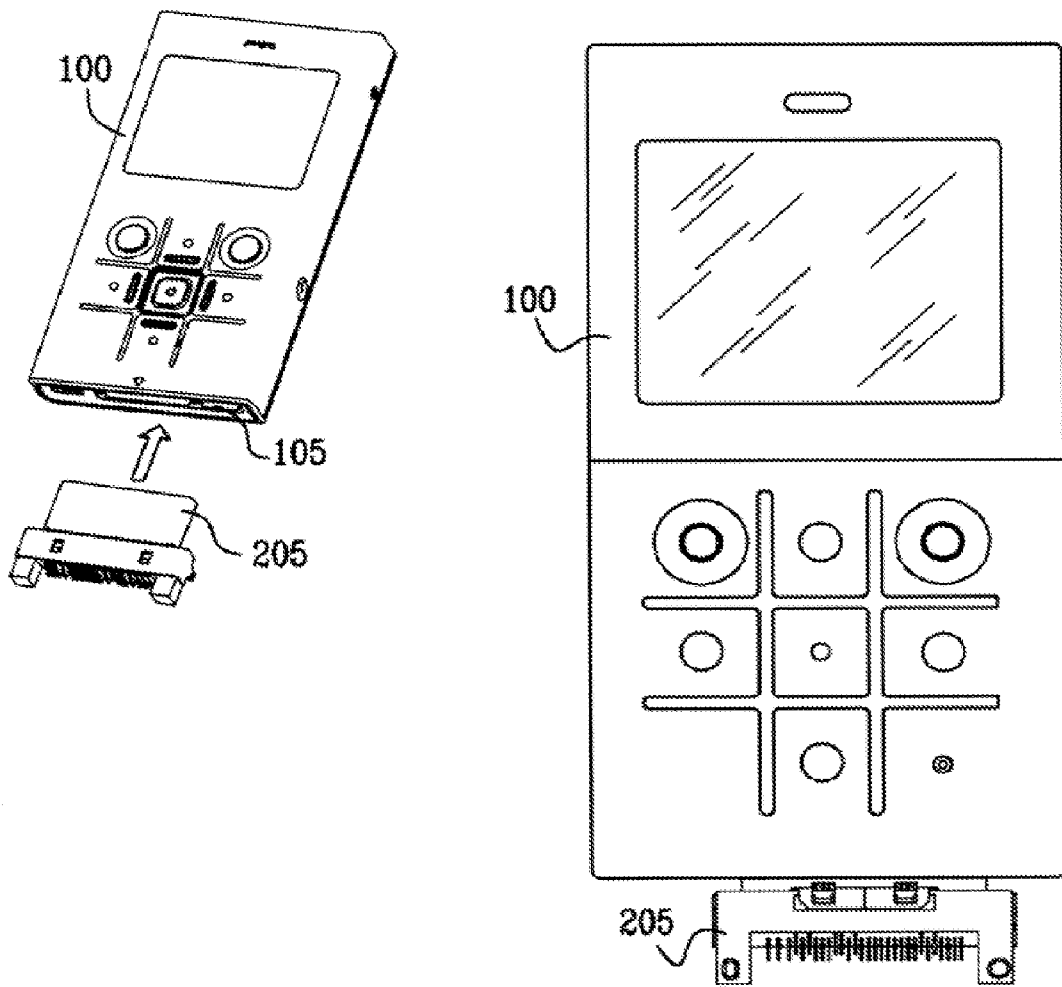


FIG. 4A

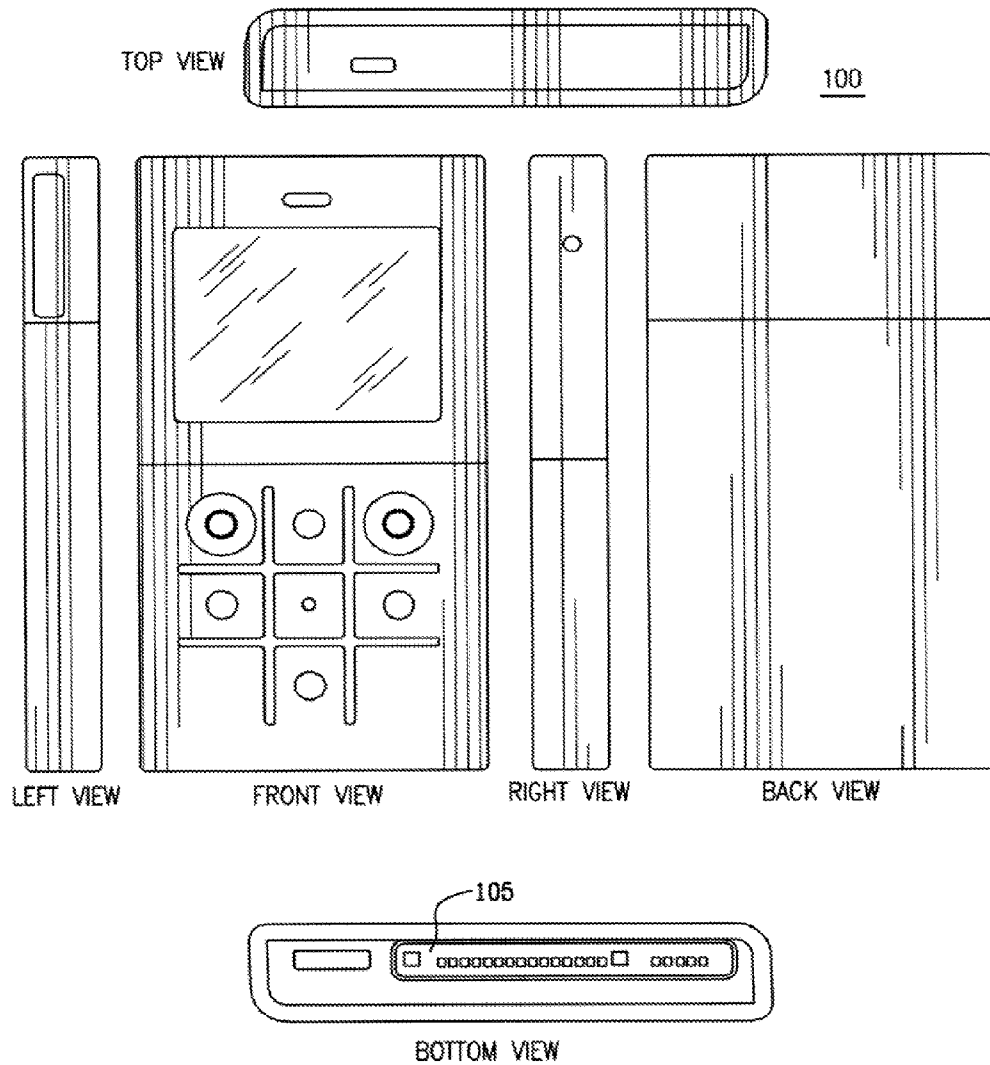


FIG. 4B

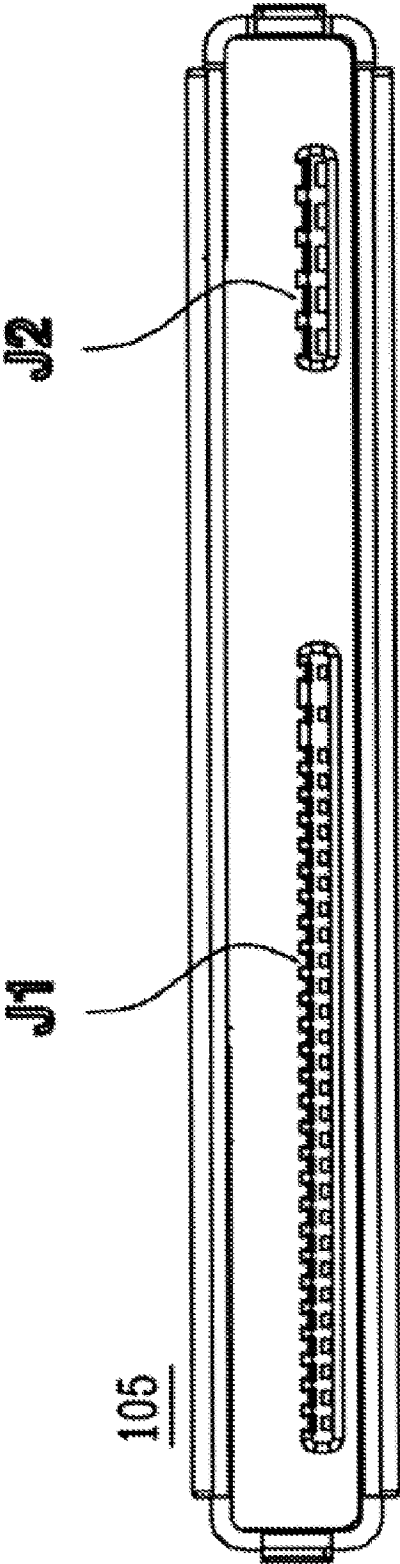


FIG. 5

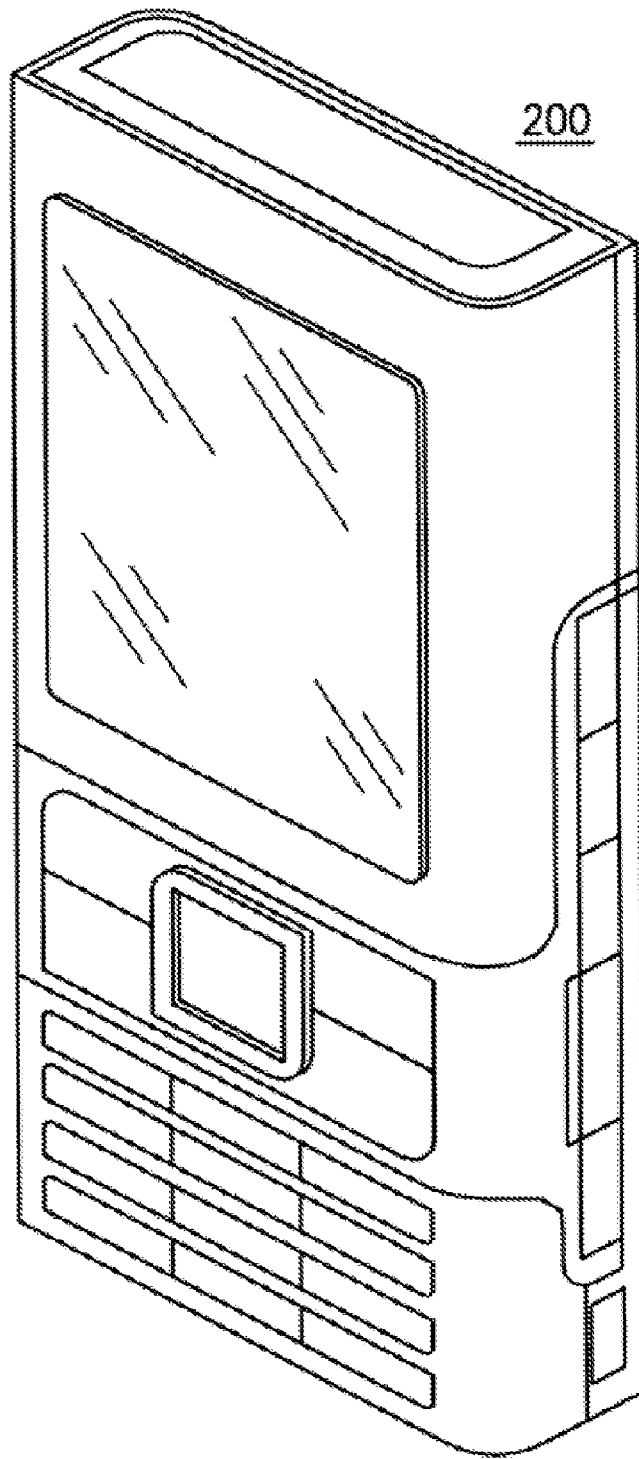


FIG. 6A

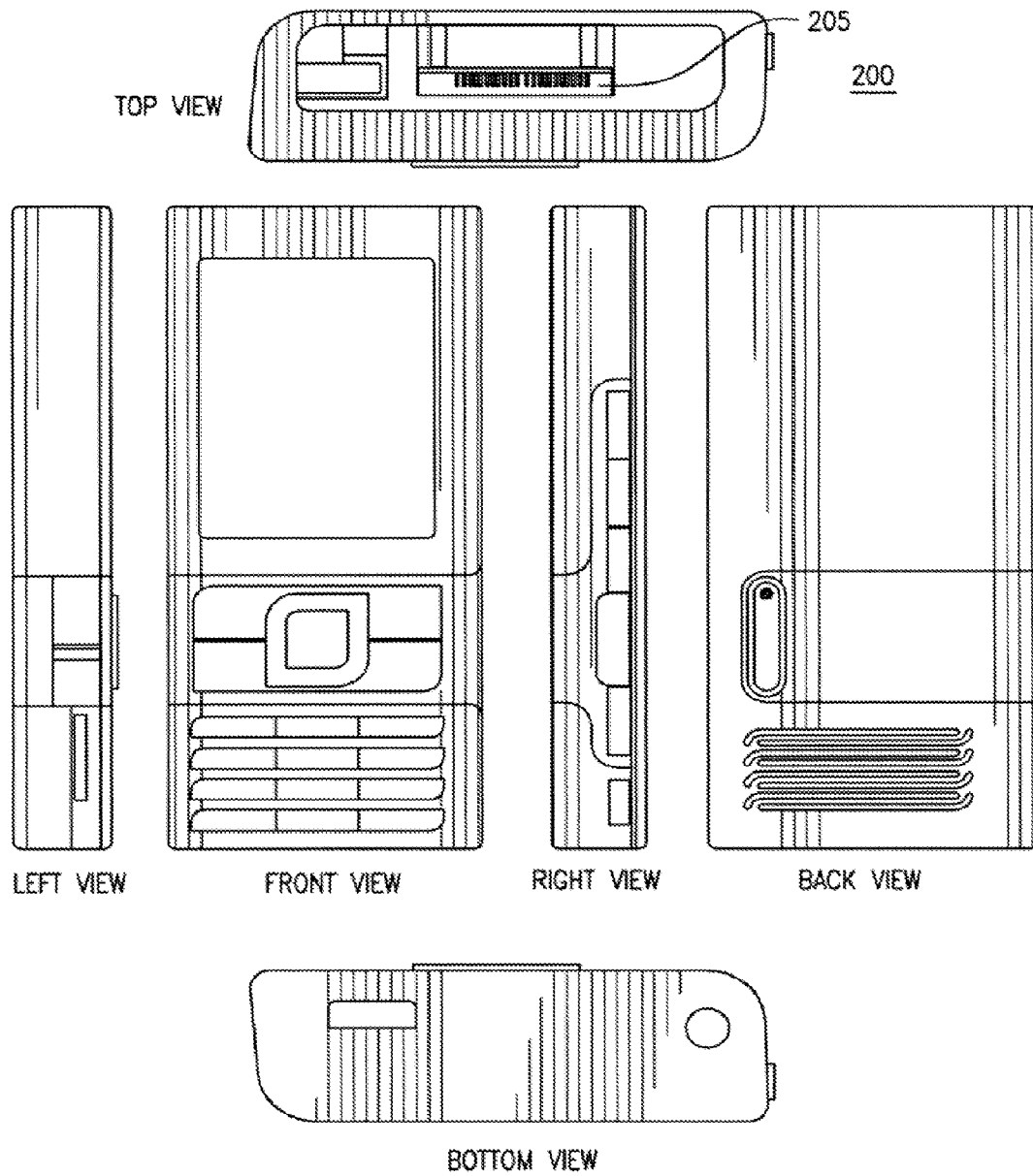


FIG. 6B

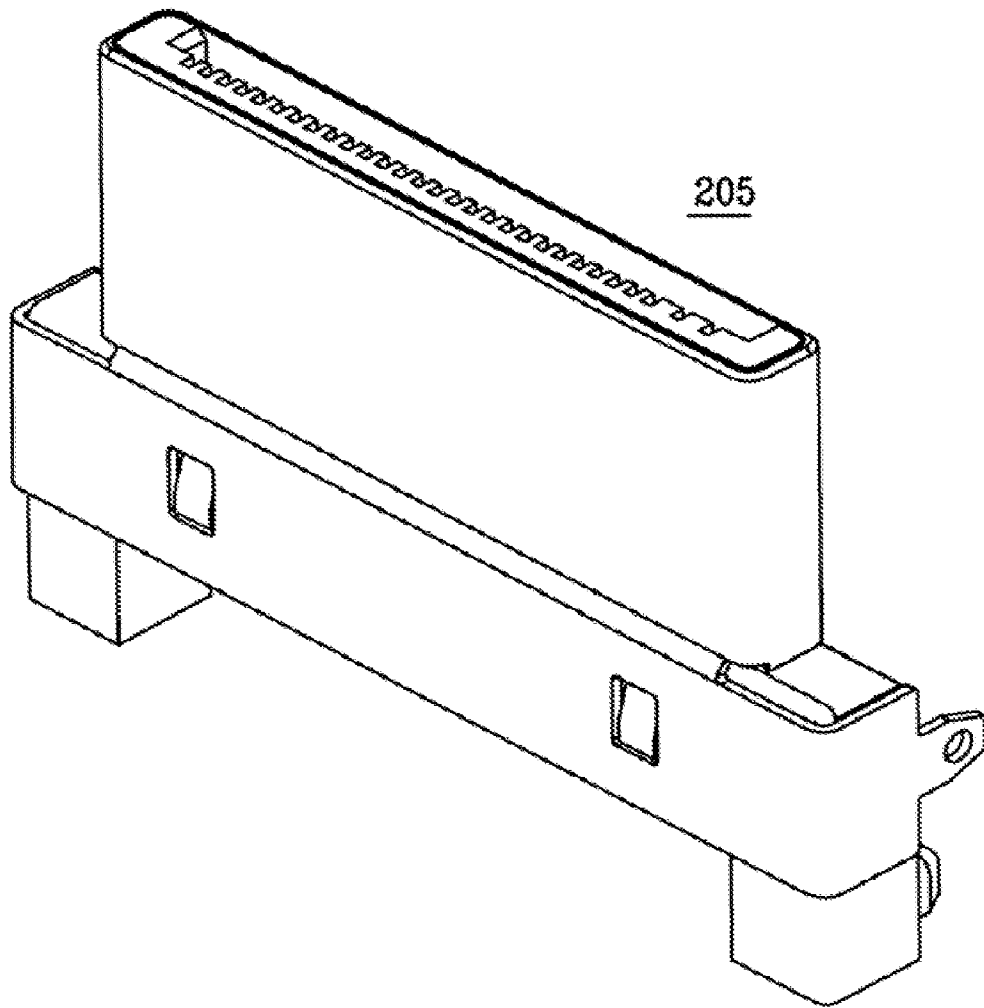


FIG. 7

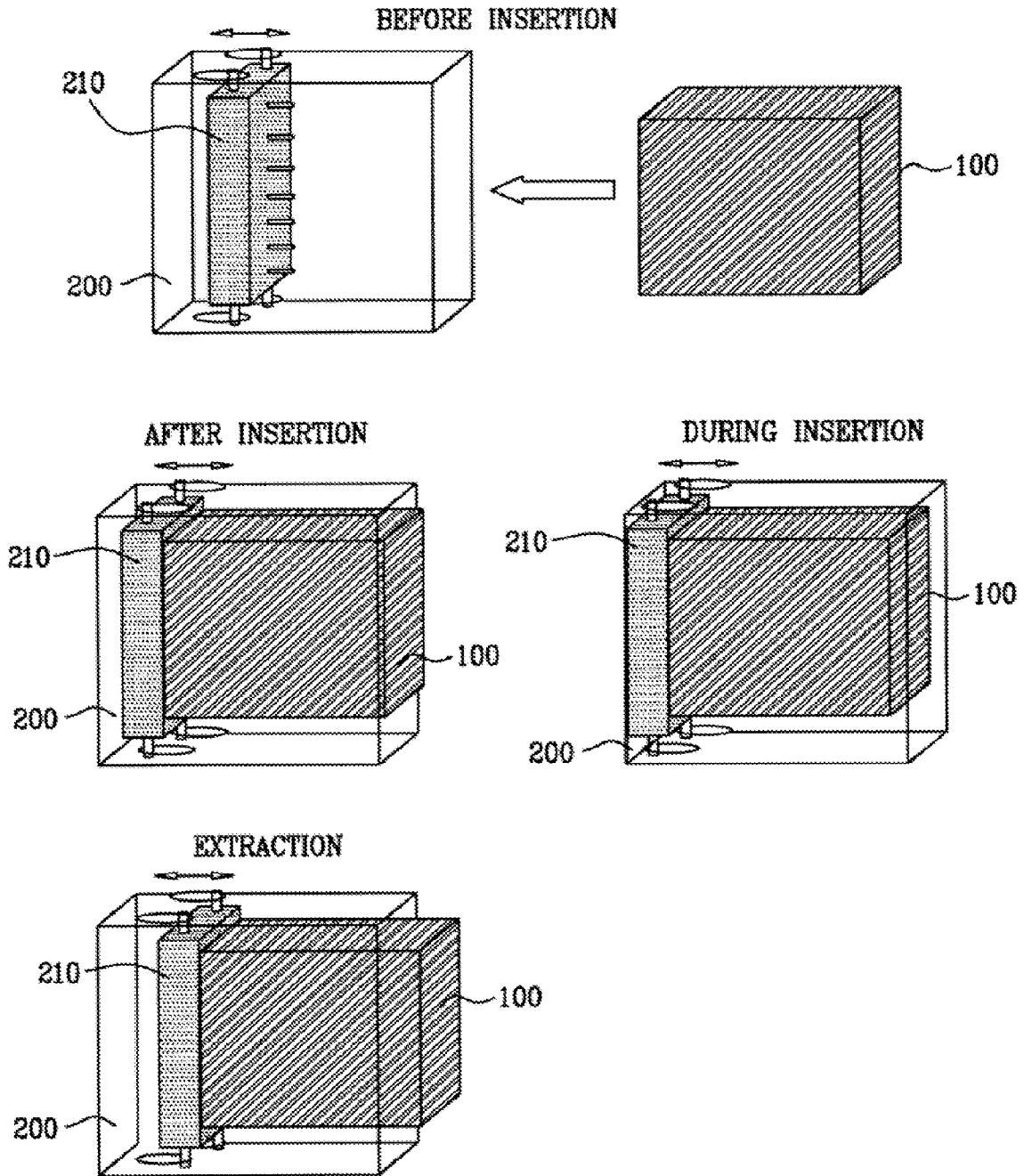


FIG. 8

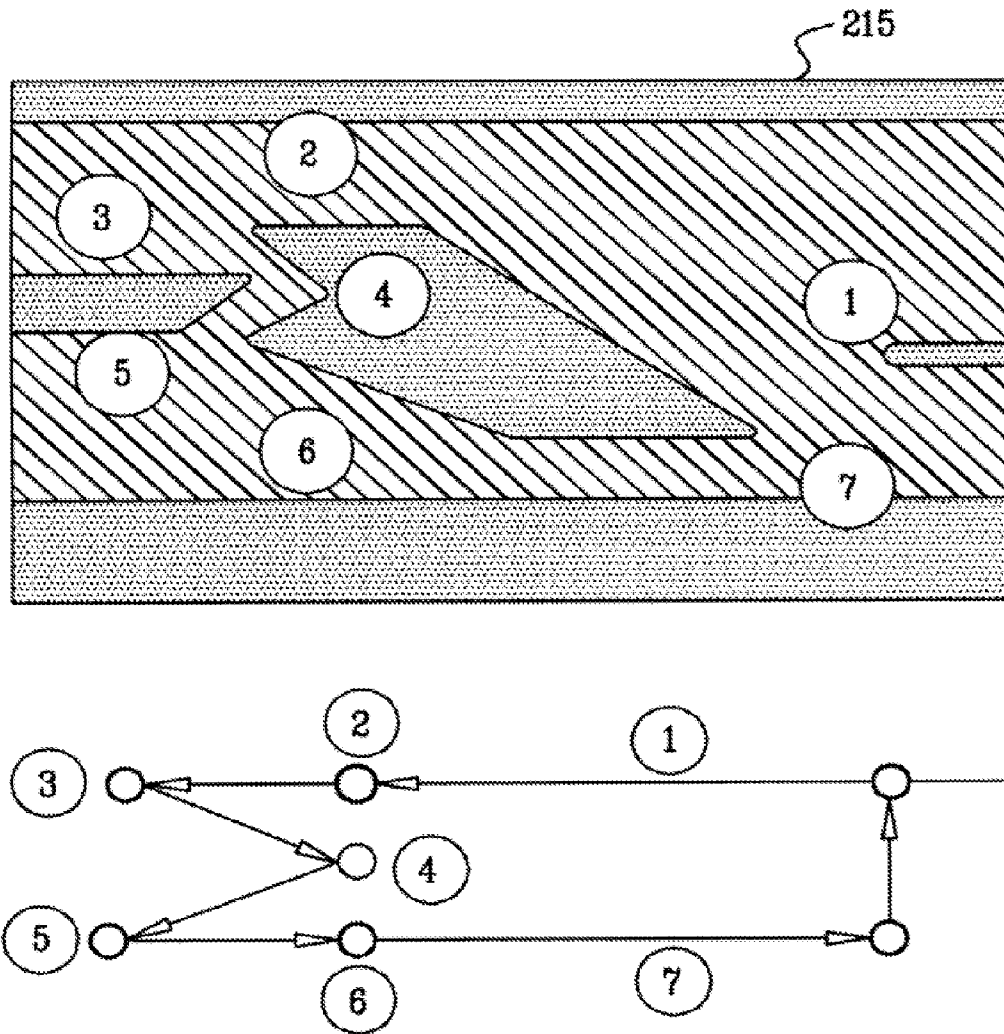


FIG. 9

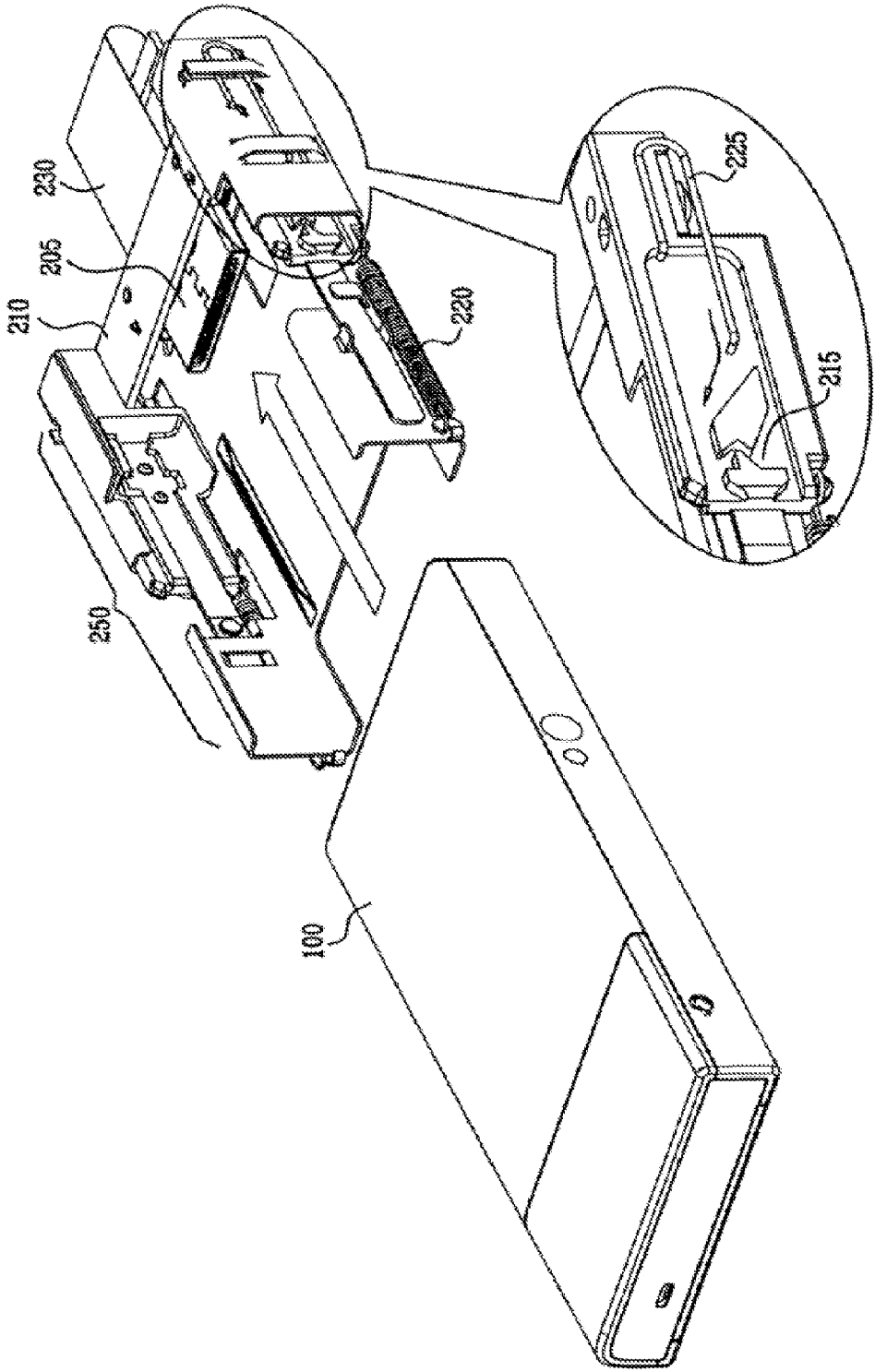


FIG. 10

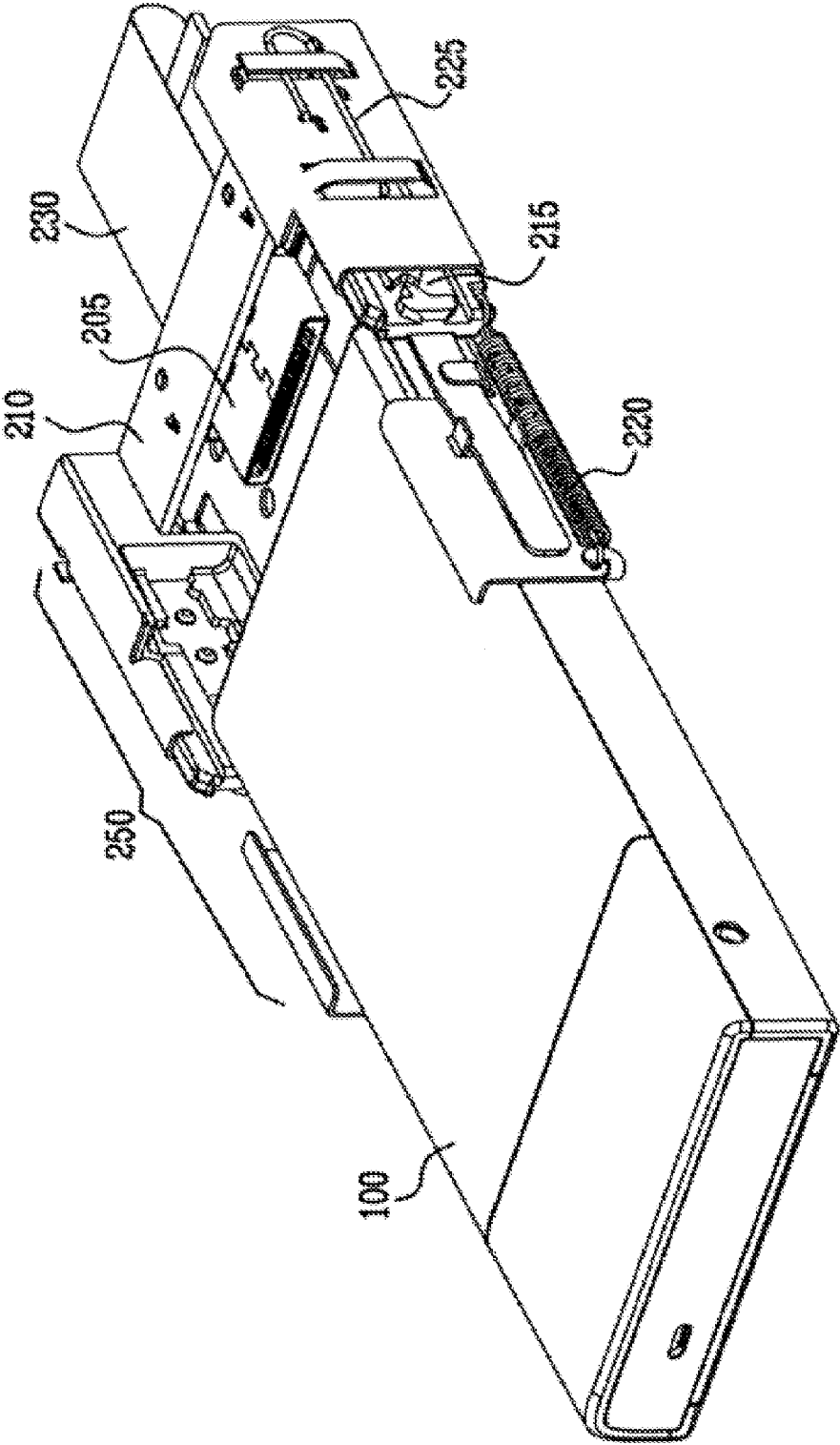


FIG. 11

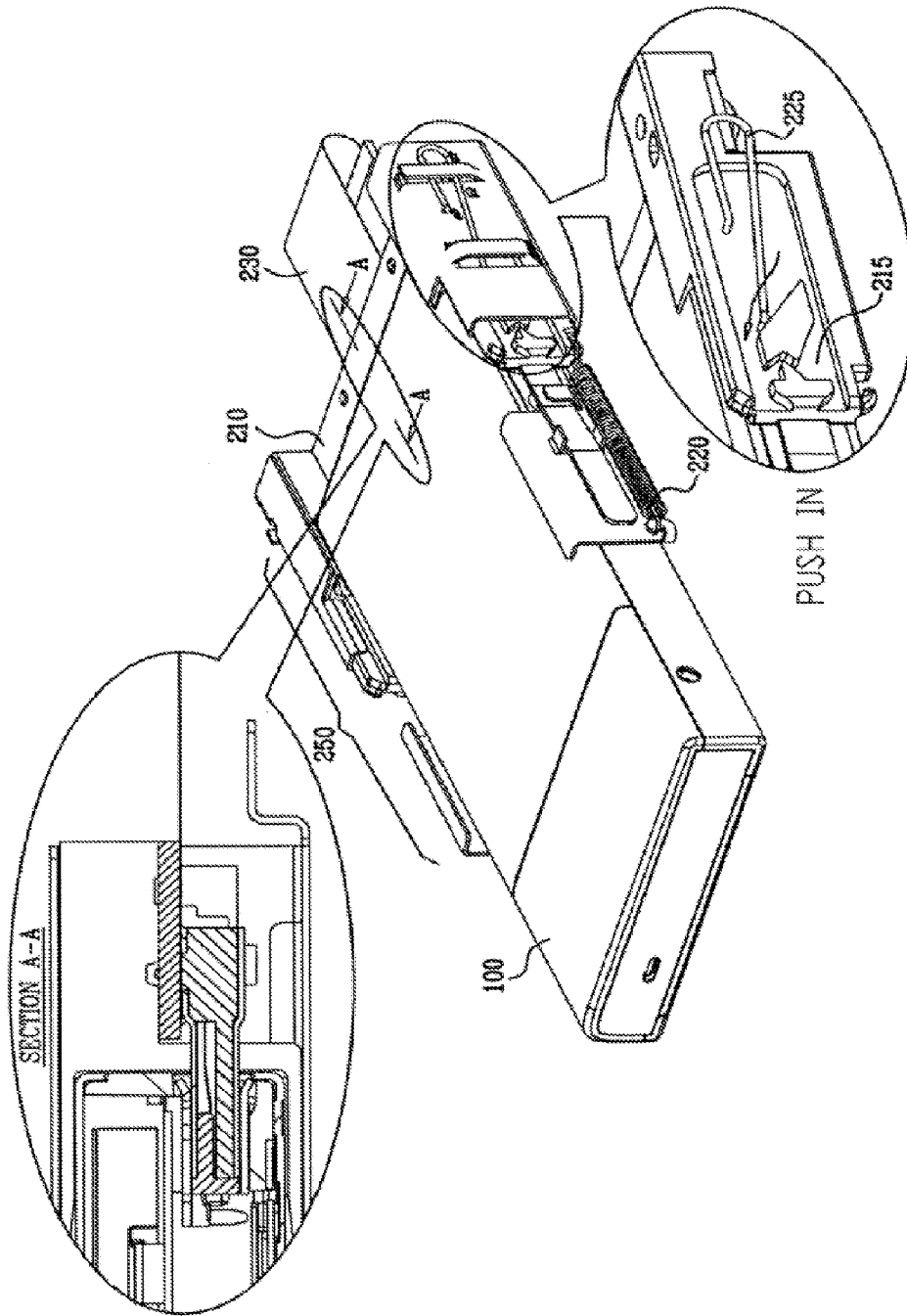


FIG. 12

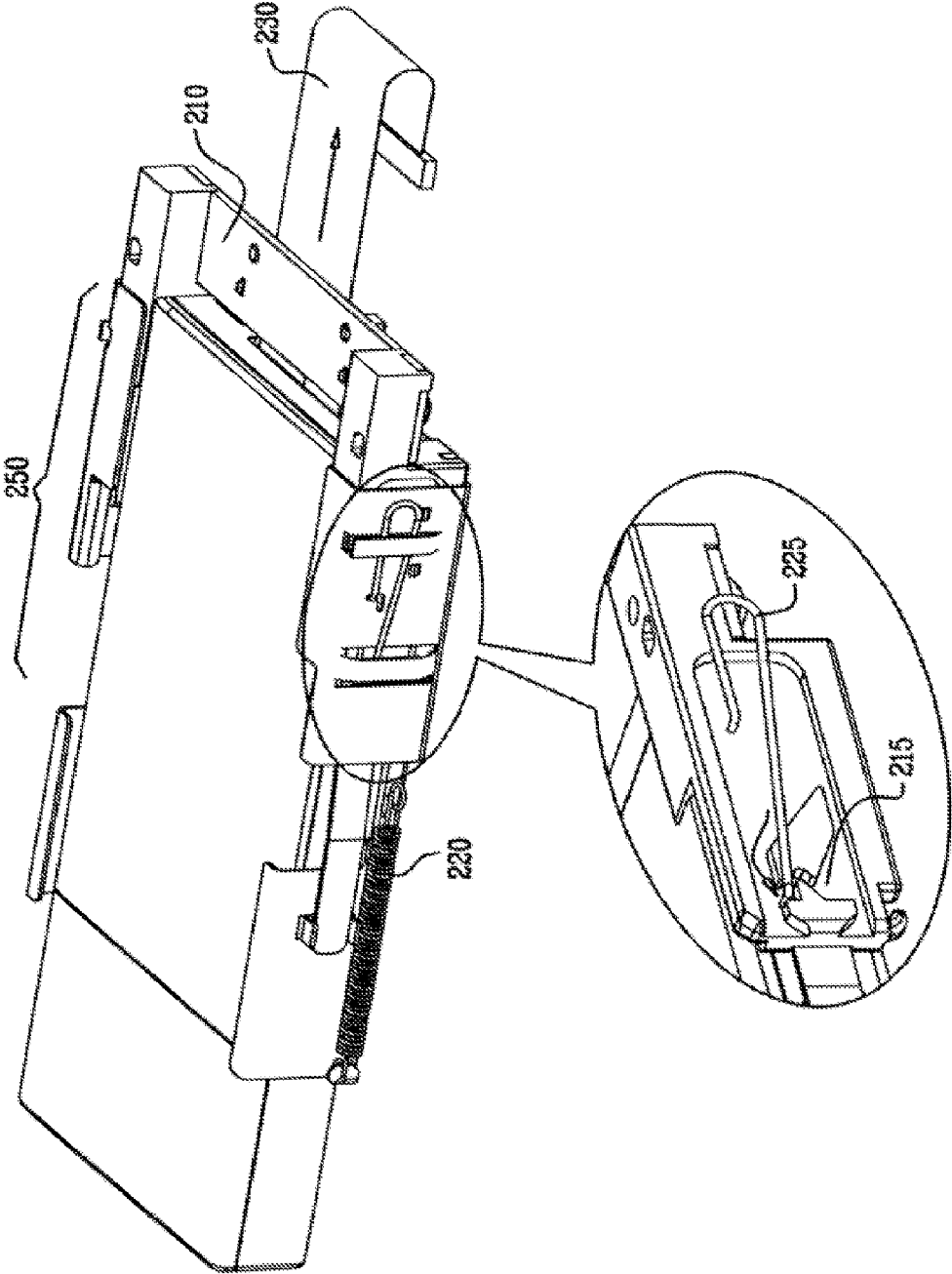


FIG. 13

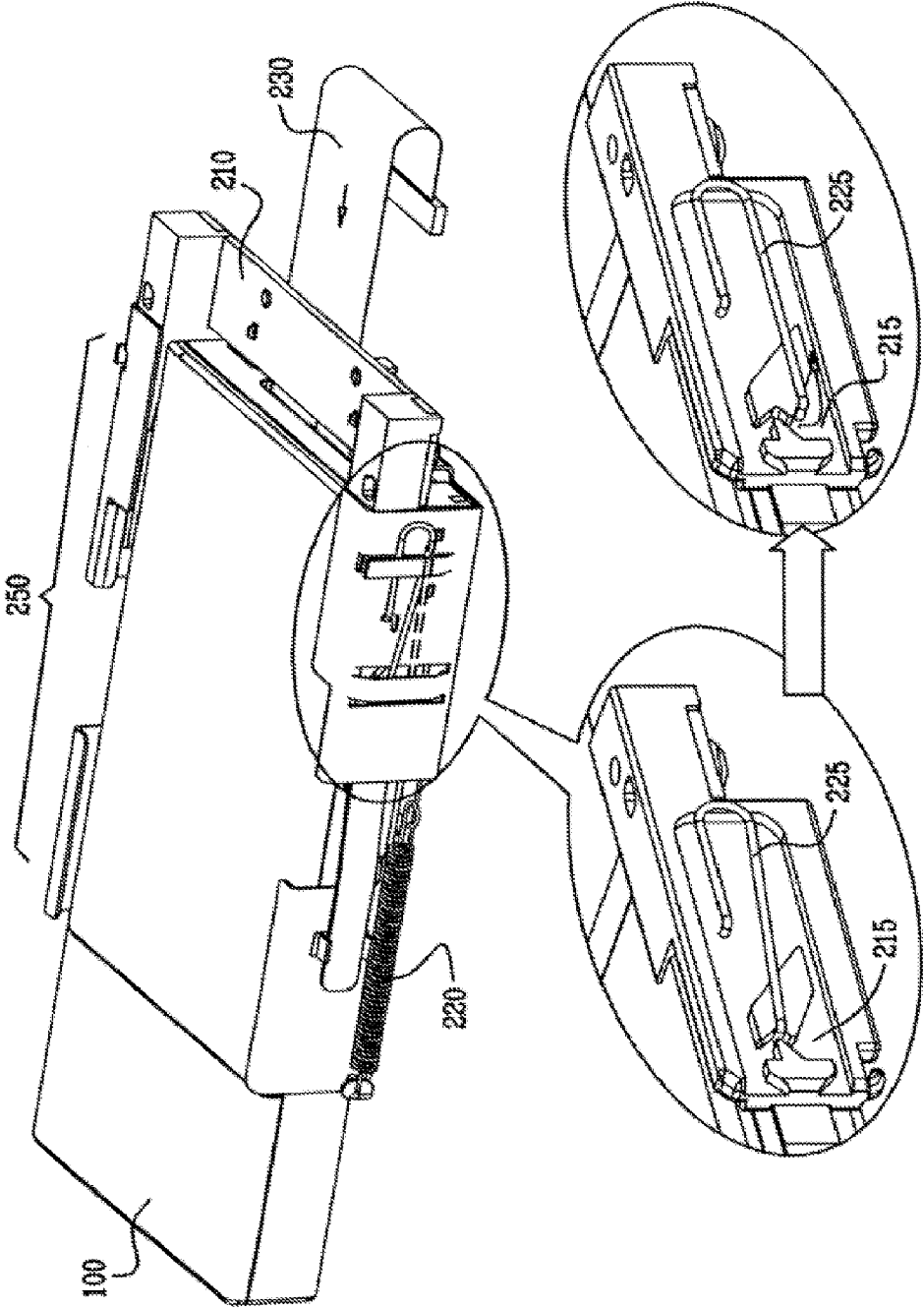


FIG. 14

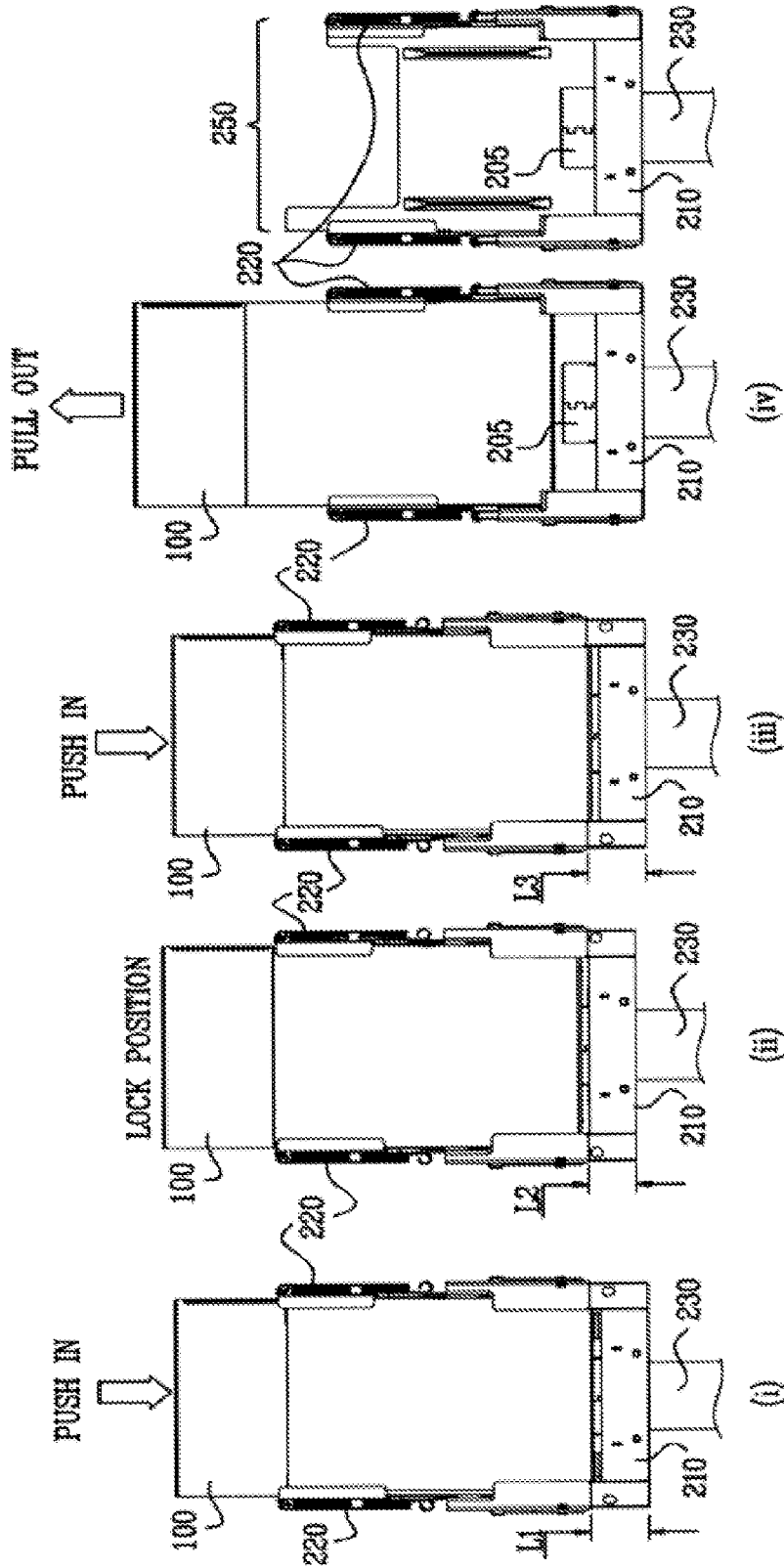


FIG. 15

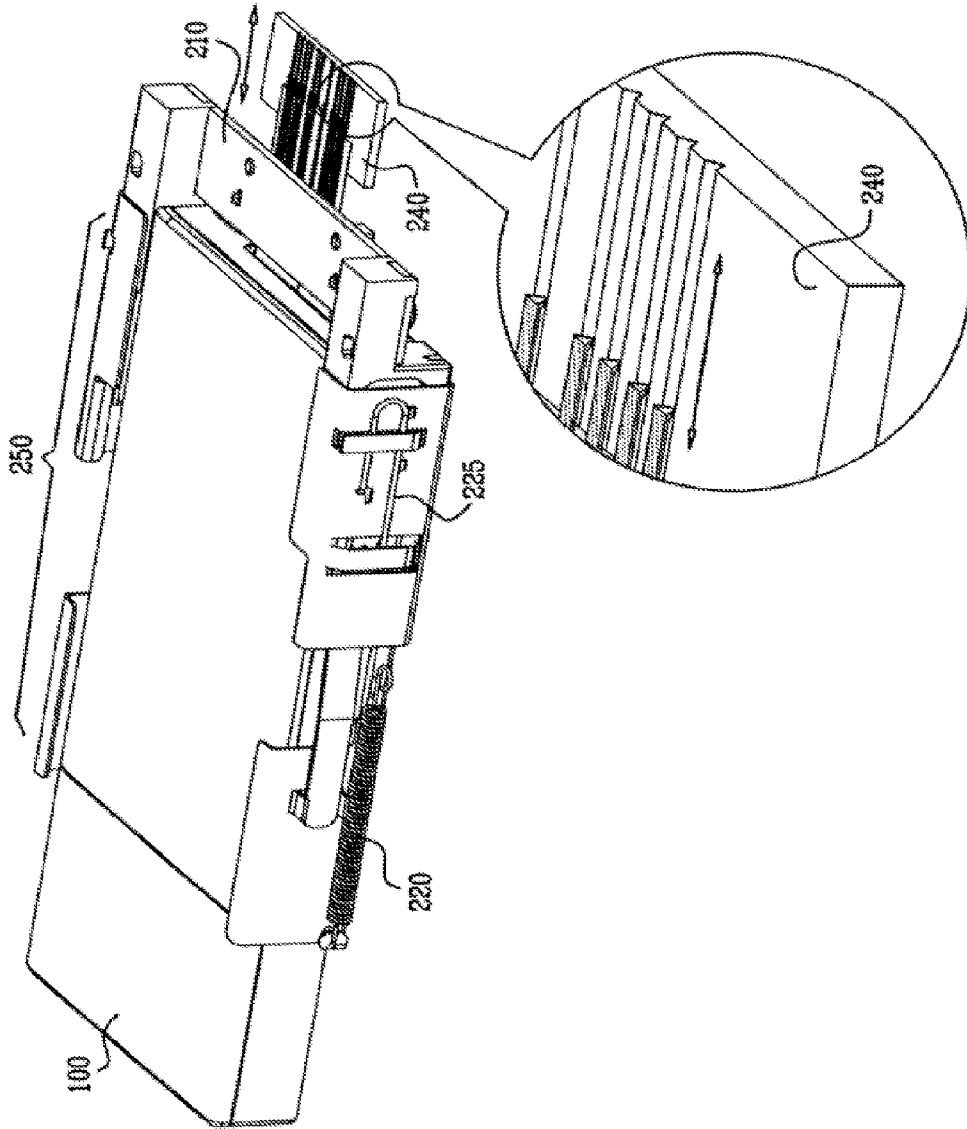


FIG. 16

1

**PUSH-TO-INSERT, PUSH-TO-EJECT AND
PULL-TO-EXTRACT CARD CONNECTOR**PRIORITY REFERENCE TO RELATED
APPLICATIONS

This application is a continuation of U.S. application Ser. No. 12/481,632, now U.S. Pat. No. 7,997,914, entitled PUSH-TO-INSERT, PUSH-TO-EJECT AND PULL-TO-EXTRACT CARD CONNECTOR, filed on Jun. 10, 2009 by inventors Eyal Bychkov, Yaniv Maydar, Noam Bernstein and Itay Cohen, which claims benefit of U.S. Provisional Application No. 61/060,522, entitled PUSH-TO-INSERT, PUSH-TO-EJECT AND PULL-TO-EXTRACT CARD CONNECTOR, filed on Jun. 11, 2008 by inventors Eyal Bychkov, Yaniv Maydar, Noam Bernstein and Itay Cohen.

FIELD OF THE INVENTION

The field of the present invention is connectors for electronic devices.

BACKGROUND OF THE INVENTION

The feats of miniaturization are astounding. Given Imaging, Ltd. of Yoqneam, Israel, manufactures a miniature 11 mm×26 mm video camera that fits inside a pill that is swallowed by a patient. SanDisk Corporation of Milpitas, Calif., manufactures a 16 GB MicroSDHC card having physical dimensions 15 mm×11 mm×0.7 mm, which is the size of a fingernail. Western Digital Corporation of Lake Forest, Calif. now manufactures a 320 GB portable hard drive having physical dimensions 126 mm×79 mm×15 mm, which is the size of a passport, and weighs 180 g. Three of these passport drives together contain almost a terabyte of data, weigh slightly over half a kilogram, and can be held in the palm of one's hand.

Many difficult challenges are encountered when attempting to miniaturize devices, relating to electronic circuitry, power management, heat generation, mechanical structures, and more. Conventional electronic and mechanical components generally require specific amounts of space, and thus limit the ability to miniaturize. As such, miniaturization often involves developing new components and new designs. Reductions in size by as little as 1 mm are often breakthrough achievements in miniaturization.

As miniature electronic devices are often attached to larger devices, they require suitable connector plugs for connecting them to the larger devices. To make electrical connection, a connector plug is engaged with metal contact pins housed in a receptacle for the connector. Conventional receptacles have insert and eject mechanisms, for inserting a connector plug into a receptacle and for extracting the connector plug from the receptacle, respectively. However, the insert/eject mechanisms impose limitations on miniaturization, which is one of the challenges that must be overcome in order to reduce sizes of electronic devices.

One type of conventional receptacle, used for SD cards and memory sticks, uses as a "push-to-insert and push-to-eject" mechanism. An example of such a receptacle is the Pitch ExpressCard® Ejector, manufactured and distributed by Molex Incorporated of Lisle, Ill. For insertion, a user pushes the card/memory stick into a host device until it locks into its receptacle, and for extraction, the user again pushes the card/memory stick into the host device until the lock is released and the card/memory stick pops out. Such receptacles require that the card/memory stick has slack length to span movement

2

of the card/memory stick beyond the locked position. Additionally, in order to enable sufficient force to fully extract the connector plugs from the contact pins of the receptacles, such receptacles generally have a flat pad structure to minimize the friction, resulting in the pad being exposed on the surface of the host device.

It would thus be of advantage to have connectors and receptacles that do not require conventional insert/eject mechanisms.

SUMMARY OF THE DESCRIPTION

Aspects of the present invention relate to miniaturization of connector plugs for electronic devices. When attempts are made to reduce electronic devices to miniature sizes, the small available space makes it impossible or impractical to use many of the conventional mechanical structures. Thus challenges arise in finding alternative structures that require less space.

Embodiments of the present invention address the challenge of designing connector plugs, used for attaching one electronic device to another. Conventional receptacles use insert and eject mechanisms that require slack space for pushing a connector plug into a receptacle beyond its locked position, and thus impose limitations on how small a connector plug may be.

Embodiments of the present invention overcome the need for slack length on a connector plug by introducing a moveable receptacle for the connector plug. Whereas conventional receptacles are rigidly fixed to their chassis, the moveable receptacle slides, or "floats" in its chassis. The moveable receptacle has mechanical parts including a locking system, a flexible PCB, and a retractable mechanism. The moveable receptacle is designed so as to have two stationary positions. After the receptacle is pushed for inserting a connector plug therein, the receptacle locks into a first stationary position. After the receptacle is pushed to extract the connector plug therefrom, the receptacle rests in a second stationary position. The connector plug is still attached to and in electrical contact with the receptacle when the receptacle is in the rest position; however, the device housing the connector plug protrudes sufficiently so that a person can grasp the device and pull it out, thereby disengaging the connector plug from the pins of the receptacle. Such a "push-to-insert, push-to-eject and pull-to-extract" mechanism enables use of shorter connector plugs, by avoiding the need for slack space on the connector plug side, and requiring slack space only for movement of the receptacle.

Embodiments of the present invention are of advantage to a wide variety of devices, including inter alia miniature devices, such as small memory cards and small communication cards, that are attached to larger devices, such as computers, cameras, cell phones and game stations. One embodiment of the present invention applies to a miniature wireless communicator that attaches to a container device that provides a user interface therefor.

There is thus provided in accordance with an embodiment of the present invention an assembly for a receptacle for an electrical connector plug, including a chassis for inserting an electrical connector plug therein, two slideable grooved latches mounted on two opposite sides of the chassis, that slide along the two opposite sides under applied force, two springs fastened to respective ones of the two slideable latches, mounted on the two opposite sides of the chassis, a bar mounted between the two slideable latches, and a receptacle for the connector plug, mounted on the bar and including a plurality of contact pins for electrical contact with the con-

3

necter plug, wherein (i) the two slideable latches are pushed away from respective ones of the two springs, causing the two springs to stretch and to exert tensions thereon, when the connector plug is pushed into the receptacle, and (ii) the two slideable latches are pulled towards respective ones of the springs, when the connector plug is extracted from the receptacle.

There is additionally provided in accordance with an embodiment of the present invention an assembly for a receptacle for an electrical connector plug, including a chassis for sliding an electrical connector plug therein, two slideable latches mounted on two opposite sides of the chassis, that slide along the two opposite sides under applied force, a bar mounted between the two slideable latches, and a receptacle for the connector plug mounted on the bar, including a plurality of contact pins for making electrical contact with the connector plug, wherein (i) the slideable guides advance along the two opposite surfaces of the chassis when the connector plug is pushed into the chassis for insertion into the receptacle, and (ii) the slideable guides advance and then retract along the two opposite sides of the chassis when the connector plug is pushed into the chassis for extraction from the receptacle.

There is further provided in accordance with an embodiment of the present invention a system including a device including an electrical connector plug, and a container for the device including a housing with a cavity for inserting the device therein, two moveable latches mounted in the housing, that move relative to the housing under applied force, a bar mounted between the two slideable latches, and a receptacle for the connector plug, mounted on the bar, including a plurality of contact pins for making electrical contact with the connector plug, wherein (i) the slideable latches advance to allow the device to sit fully within the cavity when the device is pushed into the container for insertion of the connector plug into the receptacle, and (ii) the slideable latches advance and retract such that the device extends out of the cavity and may be pulled for release from the receptacle when the device is pushed into the housing for extraction of the connector plug from the receptacle.

There is yet further provided in accordance with an embodiment of the present invention an assembly for a receptacle for an electrical connector plug, including a chassis, and a receptacle mounted within the chassis that moves relative to the chassis into a locked position in response to an electrical connector plug being pushed into the chassis for insertion into the receptacle, and that moves relative to the chassis into a rest position in response to the electrical connector plug being pushed into the chassis for extraction from the receptacle, wherein the rest position is different than the locked position relative to the chassis.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings in which:

FIG. 1 is a simplified generic block diagram of a miniature device connected to a container, in accordance with an embodiment of the present invention;

FIG. 2 is a simplified illustration of a communication system constructed and operative in accordance with an embodiment of the present invention;

FIG. 3 is an illustration of a miniature wireless communicator being inserted into a jacket or host, in accordance with an embodiment of the present invention;

4

FIGS. 4A and 4B are mechanical drawings of an embodiment of a miniature wireless communicator in accordance with an embodiment of the present invention;

FIG. 5 is an illustration of a miniature connector plug, in accordance with an embodiment of the present invention;

FIGS. 6A and 6B are mechanical drawings of an embodiment of a jacket or host in accordance with an embodiment of the present invention;

FIG. 7 is an illustration of a miniature receptacle, in accordance with an embodiment of the present invention;

FIG. 8 is a simplified illustration of a device being inserted into and extracted from a container, in accordance with an embodiment of the present invention;

FIG. 9 is a simplified diagram of a grooved latch that controls movement of a slideable bar, in accordance with an embodiment of the present invention;

FIG. 10 is an illustration of the slideable bar in its rest state within a chassis, prior to insertion of the device, in accordance with an embodiment of the present invention;

FIG. 11 is an illustration of insertion of the device into the chassis, prior to the connector plug being engaged with the receptacle, in accordance with an embodiment of the present invention;

FIG. 12 is an illustration of the device pushed into the chassis, with the connector plug engaged with the receptacle, in accordance with an embodiment of the present invention;

FIG. 13 is an illustration of the latch locked into place by the clip, and the slideable bar in its locked stationary position, in accordance with an embodiment of the present invention;

FIG. 14 is an illustration of extraction of the device from the chassis, in accordance with an embodiment of the present invention;

FIG. 15 is a sequence of illustrations of the device (i) being pushed into the chassis for insertion, then (ii) being locked into its locked stationary position, then (iii) being pushed into the chassis for extraction, then (iv) being pulled out for disengagement, in accordance with an embodiment of the present invention; and

FIG. 16 is an illustration of an alternate embodiment of the present invention, wherein the receptacle is connected to an array of wires instead of to a flex, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

Embodiments of the present invention relate to a miniature electrical connector plug for an electronic device, and a receptacle therefor. A miniature electrical connector plug is set into a surface of an electronic device, and a receptacle is mounted into a container chassis. Due to its small size, the miniature connector plug may not have the necessary slack length for use with a conventional push-push insert/eject mechanism, whereby the connector plug must be pushed into the chassis beyond its locked engaged position in order to fully disengage the connector plug with pins in the receptacle.

To overcome this limitation, embodiments of the present invention introduce a receptacle mounted on a slideable bar that has two stationary positions. The first stationary position, a locked position, is attained after the electronic device is pushed into the housing of the receptacle for insertion of the connector plug into the receptacle. The second stationary position, a rest position, is attained after the device is again pushed into the housing of the receptacle for extraction of the connector plug from the receptacle. When the bar is in the rest position the connector plug is still attached to and in electrical contact with the receptacle, but the miniature device extends

5

outside out of the housing for the receptacle, enabling one to grasp and pull the device, and thereby free the connector plug from the receptacle.

It will be appreciated by those skilled in the art that embodiments of the present invention have widespread application to an unlimited variety of electronic devices that connect to one another; e.g., small communication cards that attach to computers, small memory cards that attach to cameras or to cell phones or game stations, and small cameras that attach to personal digital assistants (PDAs).

Reference is made to FIG. 1, which is a simplified generic block diagram of a miniature device **100** connected to a container **200**, in accordance with an embodiment of the present invention. Device **100** has a miniature connector plug **105**, and container **200** has a receptacle **205** for connector plug **105**. Device **100** may be inter alia a communication card, a memory card or a camera. Container **200** may be inter alia a computer, a camera, a cell phone, a game station or a PDA.

In an embodiment of the present invention, receptacle **205** is mounted on a slideable bar **210** inside of container **200**, which has two stationary positions. When slideable bar **210** is in the first stationary position, a locked position, device **100** is substantially enclosed by container **200**. When slideable bar **210** is in the second stationary position, a rest position, device **100** protrudes out of container **200**. In the rest position, connector plug **105** is still engaged and in electrical contact with receptacle **205**, and a person can grasp and pull device **100** to free connector plug **105** from receptacle **205**, as indicated in FIG. 1. The portion of device **100** protruding out of container **200** is indicated by area BCDE in FIG. 1. For the embodiment of the present invention to modular wireless communicators described hereinbelow, the length BC is on the order of 8 mm, which is sufficient for grasping by a person. Mechanical structures for implementing slideable bar **210** and its chassis in container **200** are described in detail below with reference to FIGS. 9-16.

In one embodiment, the present invention applies to a small modular wireless communicator that attaches to container devices. There are two general types of container devices to which the wireless communicator may be attached; namely, "jackets" and "hosts". A jacket is a device that provides a user interface for the wireless communicator, enriches the capabilities of the wireless communicator, and is not able to operate independently when the wireless communicator is not connected thereto. A host is a device that is able to operate independently when the wireless communicator is not attached thereto, and whose capabilities are enriched by the wireless communicator when the wireless communicator is attached thereto. Generally a host does not have communication functionality independent of the wireless communicator.

Reference is made to FIG. 2, which is a simplified illustration of a communication system constructed and operative in accordance with an embodiment of the present invention. Shown in FIG. 2 are a variety of wireless communicators **100a-100c**, including 2.5 G communicators for a GSM network, 3 G communicators for a GSM network, and CDMA communicators for a CDMA network. It will be appreciated by those skilled in the art that the networks illustrated in FIG. 2 are exemplary of a wide variety of networks and communication protocols that are supported by the wireless communicators of the present invention, such networks and communication protocols including inter alia WiFi, Bluetooth and WiMax.

Also shown in FIG. 2 are a variety of jackets and hosts **200a-200h**. In accordance with an embodiment of the present invention, each wireless communicator **100a-100c** may be attached to any of the jackets and hosts **200a-200h**, so as to

6

operate in combination therewith. The wireless communicators **100a-100c** are substantially of the same form factor and, as such, are able to be attached to the various jackets and hosts **200a-200h**.

Reference is made to FIG. 3, which is an illustration of a miniature wireless communicator **100** being inserted into a jacket or host **200**, in accordance with an embodiment of the present invention. Jacket or host **200** as shown in FIG. 3 includes a hollow cavity at the top for insertion of wireless communicator **100** therein.

Reference is made to FIGS. 4A and 4B, which are mechanical drawings of an embodiment of wireless communicator **100** in accordance with an embodiment of the present invention. Wireless communicator **100** is miniature; in one embodiment, its dimensions are approximately 72 mm×38 mm×8 mm. Use of the present invention achieves a reduction in length of wireless communicator **100**, on the order of 3 mm or more. Those skilled in the art will appreciate that the present invention is of advantage when wireless communicator **100** is manufactured with other dimensions, as well.

As shown in FIGS. 4A and 4B, wireless communicator **100** includes miniature connector plug **105**, which attaches to receptacle **205**. Reference is made to FIG. 5, which is an illustration of connector plug **105**, in accordance with an embodiment of the present invention. The specific connector plug shown in FIG. 5 includes a 24-pin proprietary connector, labeled **31**, and also includes a 5-pin mini-USB connector, labeled **J2**.

Reference is made to FIGS. 6A and 6B, which are mechanical drawings of an embodiment of a jacket or host **200** in accordance with an embodiment of the present invention.

As shown in FIG. 6B, jacket or host **200** includes miniature receptacle **205** for connector plug **105**. Reference is made to FIG. 7, which is an illustration of receptacle **205** and its contact pins, in accordance with an embodiment of the present invention. Receptacle **205** generally engages the 24-pin connector **J1** of connector plug **105**, and not the 5-pin connector **J2**.

The ensuing description refers generically to a first device **100** having a connector plug **105**, which attaches to a container **200** having a receptacle **205** for connector plug **105**. Device **100** may be, inter alia, a wireless communicator as described hereinabove, a small memory card or a small camera. Container **200** may be, inter alia, a jacket or host for the wireless communicator as described hereinabove, a computer, a cell phone, a camera, a game station or a PDA.

Reference is made to FIG. 8, which is a simplified illustration of device **100** being inserted into and extracted from container **200**, in accordance with an embodiment of the present invention. Shown in FIG. 8 are device **100** and container **200** with a slideable bar **210** that slides forward and back within container **200**. Device **100** has a connector plug that engages with a receptacle mounted on slideable bar **210**. In order to electrically connect device **100** and container **200**, the connector plug must engage with contact pins of the receptacle.

Four stages are illustrated in FIG. 8; namely, a first stage prior to insertion of device **100** into container **200**, a second stage during insertion of device **100** into container **200**, a third stage after insertion of device **100** into container **200**, and a fourth stage during extraction of device **100** from container **200**. In the first stage, slideable bar **210** is at rest in a retracted position. The first stage is further illustrated in FIGS. 10 and 11, as described hereinbelow.

In the second stage, slideable bar **210** is advanced far into container **200**, in response to device **100** being pushed into container **200**. The second stage is further illustrated in FIG. **12**, as described hereinbelow.

In the third stage, slideable bar **210** has retracted somewhat and is locked in an advanced position. The third stage is further illustrated in FIG. **13**, as described hereinbelow.

In the fourth stage, slideable bar **210** is at rest in the retracted position again, and device **100** protrudes outside of container **200**. In the fourth stage, the connector plug is still engaged with the contact pins of the receptacle. However, device **100** protrudes far enough out of container **200** such that it can be grasped and pulled out of container **200**, thereby disengaging the connector plug from the contact pins of the receptacle. The fourth stage is further illustrated in FIG. **14**, as described hereinbelow.

It will be appreciated by those skilled in the art that there are two stationary positions for slideable bar **210**; namely, the rest position in stages one and four, and the locked position in stage three. The position in stage two is not a stationary position, and shows slideable bar **210** pushed into container **200** beyond its locked position. As soon as device **100** stops being pushed, slideable bar **210** retracts to its locked position. When slideable bar **210** is in its locked position, device **100** does not substantially protrude out of container **200**. When slideable bar **210** is in its rest position, device **100** protrudes out of container **200** such that it can be grasped and pulled.

It will be appreciated by those skilled in the art that whereas conventional connector plugs and receptacles are rigidly fixed, slideable bar **210** provides a “floating” receptacle. A mechanical structure for enabling the floating receptacle, in accordance with an embodiment of the present invention, includes two latches, two springs for applying tensions to the latches, two clips for locking the latches into place, and means for electrically connecting the receptacle pins to an electrical circuit while accommodating movement of the receptacle, as described hereinbelow.

Reference is made to FIG. **9**, which is a simplified diagram of a grooved latch **215** that controls movement of slideable bar **210**, in accordance with an embodiment of the present invention. As shown below in FIGS. **10-14**, a clip is used to lock latch **215** into place, in accordance with an embodiment of the present invention. The end of the clip extends at a right angle into the grooves of latch **215**, and catches on the contours of the grooves. When device **100** is pushed into container **200**, latch **215** is pushed accordingly, and the contours of the grooves of the latch abut against the clip, raising and lowering the end of the clip.

Two such latches **215** and two such clips are mounted on two opposite sides of the housing, and slideable bar **210** is mounted between the two latches. When latches **215** are pushed forward, they advance alongside of the clips. The clips remain in rigid positions, but tilt at an angle due to the raising and lowering of the ends of the clips by the contours of the grooves in latches **215**.

Shown in FIG. **9** are seven locations on latch **215**, numbered 1-7. These locations correspond to positions of the end of the clip when device **100** is inserted in container **200** and extracted therefrom. The first stage of FIG. **8** corresponds to the end of the clip being located at position 1. The second stage of FIG. **8** occurs when device **100** is pushed into container **200** for insertion. Latch **215** is pushed accordingly so that the end of the clip is raised to position 2, and then to position 3. The third stage of FIG. **8** occurs when the push force on device **100** is released, and latch **215** retracts so that the end of the clip lodges and locks at position 4, which is a locked stationary position. The fourth stage of FIG. **8** occurs

when device **100** is pushed into container **200** for extraction. Latch **215** is pushed accordingly so that the end of the clip is lowered to position 5. When the push force on device **100** is released, latch **215** retracts and the end of the clip moves to position 6 and then to position 7 and then up to position 1, which is a stationary rest position. When the end of the clip rests at position 1, device **100** protrudes out of container **200**, and can then be grasped and pulled completely out of container **200**.

As noted hereinabove with respect to FIG. **8**, slideable bar **210** has two stationary positions; namely, a locked state corresponding to the end of the clip being lodged at position 4 of latch **215**, and a rest state corresponding to the end of clip **225** being at position 1 of latch **215**.

Reference is made to FIG. **10**, which is an illustration of slideable bar **210** in its rest state within a chassis **250**, prior to insertion of device **100**, in accordance with an embodiment of the present invention. The chassis **250** for the wireless communicator shown in FIGS. **4A** and **4B** is approximately 43 mm wide and 9 mm deep.

Chassis **250** holds two grooved latches **215**, two springs **220** and two clips **225** mounted on opposite sides. The two springs **220** attach to respective ones of latches **215**, and the two clips **225** lodge in grooves of respective ones of latches **215** to lock them into place. When device **100** is pushed into container **200**, latches **215** are pushed accordingly and move to the various positions relative to clip **225** shown in FIG. **9**.

Receptacle **205** is attached to a flex **230**, which connects the contact pins of receptacle **205** to a printed circuit board (PCB) that is fastened to container **200**. Flex **230** accommodates movement back and forth of receptacle **205**.

Reference is made to FIG. **11**, which is an illustration of insertion of device **100** into chassis **250**, prior to connector plug **105** being engaged with receptacle **205**, in accordance with an embodiment of the present invention. FIG. **11** shows device **100** being pushed into chassis **250**, along the direction of the arrow shown in FIG. **10**. Latches **215** are pushed towards clips **225** accordingly. At the stage illustrated in FIG. **11**, the ends of clips **225** are at position 1 of latches **215**, as indicated in FIG. **9**, and connector plug **105** is not yet engaged with receptacle **205**.

Reference is made to FIG. **12**, which is an illustration of device **100** pushed into chassis **250** with connector plug **105** engaged with receptacle **205**, in accordance with an embodiment of the present invention. As device **100** is pushed, latch **215** moves so that clip **225** is at position 2 and then at position 3, as indicated in FIG. **9**. Whereas clip **225** is horizontally aligned with chassis **250** in FIG. **11**, clip **225** is inclined at an angle in FIG. **12**.

Reference is made to FIG. **13**, which is an illustration of latch **215** locked into place by clip **225**, and slideable bar **210** in its locked stationary position, in accordance with an embodiment of the present invention. When the pushing force on device **100** is released, latch **215** retracts under tension of spring **220**, and the end of clip **225** lodges into a groove of latch **215**, locking it into place. The end of clip **225** is at position 4 of latch **215**, as indicated in FIG. **9**, and is inclined at an angle.

Reference is made to FIG. **14**, which is an illustration of extraction of device **100** from chassis **250**, in accordance with an embodiment of the present invention. Device **100** is pushed into chassis **250** so that latch **215** moves and the end of clip **225** is released from its lodged position in the groove of latch **215**. The end of clip **225** is then at position 5 of latch **215**. When the pushing force on device **100** is released, latch **215** retracts under tension of spring **220**, and the end of clip **225** moves to position 6 and then to position 7 of the latch. Con-

nector plug **105** is still engaged and in electrical contact with receptacle **205**, but device **100** protrudes out of chassis **250**, making it possible to grasp and pull on device **100** and thereby disengage connector plug **105** from receptacle **205**.

Reference is made to FIG. **15**, which is a sequence of illustrations of device **100** (i) being pushed into chassis **250** for insertion, then (ii) being locked into its locked stationary position, then (iii) being pushed into chassis **250** for extraction, then (iv) being pulled out for disengagement, in accordance with an embodiment of the present invention.

Reference is made to FIG. **16**, which is an illustration of an alternate embodiment of the present invention, wherein receptacle **205** is connected to an array of wires **240** instead of to flex **230**, in accordance with an embodiment of the present invention. As receptacle **205** advances and retracts, it slides forward and back along wires **240** all the while maintaining electrical contact between the pins of receptacles **205** and the PCB of container **200**.

It will thus be appreciated by those skilled in the art that the “push-to-insert, push-to-eject and pull-to-extract” embodiment of the present invention offers many advantages. It yields reduction in length of device **100**. It allows for continued operation of devices **100** and **200** during ejection, since connector plug **105** is still engaged with receptacle **205** during the “push-to-eject” movement. It also provides an early warning that the user is removing device **100** from device **200**, prior to the “pull-to-extract” movement.

In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made to the specific exemplary embodiments without departing from the broader spirit and scope of the invention as set forth in the appended claims. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. An assembly for a receptacle for an electrical connector plug, comprising:

- a chassis;
- a slideable component mounted between two sides of the chassis; and
- a receptacle for an electrical connector plug, mounted on the slideable component,

wherein the slideable component moves along the two sides of the chassis relative to the chassis into a locked position, without forming a separation gap between the chassis and the side of the slideable component that faces the electrical connector plug, in response to the electrical connector plug being pushed into the chassis for insertion into the receptacle, and moves along the two sides of the chassis relative to the chassis into a rest position in response to the electrical connector plug being pushed into the chassis for extraction from the receptacle, wherein the rest position is different than the locked position relative to the chassis, and wherein the electrical connector plug is electrically coupled to the receptacle after being pushed into said the chassis when the slideable component moves into the rest position, and after being pushed into the chassis when the slideable component moves into the locked position.

2. The assembly of claim **1** further comprising a spring-loaded locking mechanism coupled with the slideable component, for locking the slideable component into the locked position.

3. The assembly of claim **2** wherein the slideable component advances and then retracts along the two sides of the chassis, under tension of the spring-loaded mechanism, in

response to the electrical connector plug being pushed into the chassis for extraction from the receptacle.

4. The assembly of claim **1** wherein the receptacle comprises contact pins, the assembly further comprising a flexible printed circuit for connecting the contact pins to a printed circuit board when the slideable component is in the rest position and when the slideable component is in the locked position.

5. An apparatus, comprising:

- a chassis having an opening into which an electrical component is insertable;
- a slideable component mounted between two sides of the chassis; and

means for coupling to the electrical component, mounted on the slideable component,

wherein the slideable component is slidably movable along the two sides of the chassis, relative to the chassis, in a first direction generally away from the opening, without forming a separation gap between the chassis and the side of the slideable component that faces the opening, and in a second direction generally toward the opening: to a first rest position in response to force in the first direction exerted upon the means for coupling; and to a second rest position in response to force in the first direction exerted upon the means for coupling when the means for coupling is in the first rest position, wherein the first rest position is different, with respect to the chassis, than the second rest position.

6. The apparatus of claim **5**, wherein the means for coupling comprises a receptacle for a connector plug of the electrical component.

7. The apparatus of claim **6** wherein the receptacle comprises contact pins, the apparatus further comprising a flexible printed circuit for connecting the contact pins to a printed circuit board when the slideable component is in the first rest position and when the slideable component is in the second rest position.

8. The apparatus of claim **6** comprising two spring-loaded latches coupled with the slideable component.

9. The apparatus of claim **5** wherein the electrical component, when coupled with the means for coupling, is fully inserted into the chassis when the slideable component is in the first rest position.

10. The apparatus of claim **5** wherein the electrical component, when coupled with the means for coupling, protrudes from the chassis when the slideable component is in the second rest position.

11. The apparatus of claim **5** wherein the electrical component is a wireless communicator.

12. The apparatus of claim **5** wherein the electrical component is a memory card.

13. An apparatus, comprising:

- a chassis having an opening into which an electrical component is insertable;
- a slideable component mounted between two sides of the chassis; and

means for coupling to the electrical component, mounted on the slideable component,

wherein the slideable component is slidably movable along the two sides of the chassis, relative to the chassis, in a first direction generally away from the opening, without forming a separation gap between the chassis and the side of the slideable component that faces the opening, to a first rest position and, in a second direction generally toward the opening, to a second rest position, wherein the first rest position is different, with respect to the chassis, than the second rest position, and wherein the

11

electrical component, when electrically coupled with the means for coupling when the means for coupling is in the first rest position, remains electrically coupled therewith when the slideable components moves from the first rest position to the second rest position.

14. The apparatus of claim **13**, wherein the means for coupling comprises a receptacle for a connector plug of the electrical component.

15. The apparatus of claim **14** wherein the receptacle comprises contact pins, the apparatus further comprising a flexible printed circuit for connecting the contact pins to a printed circuit board when the slideable component is in the first rest position and when the slideable component is in the second rest position.

12

16. The apparatus of claim **14** further comprising two spring-loaded latches coupled with the slideable component.

17. The apparatus of claim **13** wherein the electrical component, when coupled with the means for coupling, is fully inserted into the chassis when the slideable component is in the first rest position.

18. The apparatus of claim **13** wherein the electrical component, when coupled with the means for coupling, protrudes from the chassis when the slideable component is in the second rest position.

19. The apparatus of claim **13** wherein the electrical component is a wireless communicator.

20. The apparatus of claim **13** wherein the electrical component is a memory card.

* * * * *