United States Patent Application Publication	20250260114
Kind Code	A1
Publication Date	August 14, 2025
Inventor(s)	Yebka; Bouziane et al.

SCREWLESS ENGAGEMENT ASSEMBLY

Abstract

In one aspect, a device includes one or more elements that are configured to screwlessly and removably engage a component of the device with a housing of the device. The device may even include the component itself.

Inventors: **Yebka; Bouziane (Morrisville, NC), Wong; Tin-Lup (Morrisville, NC), Jakes; Philip J (Morrisville, NC)**

Applicant: **Lenovo (Singapore) Pte. Ltd.** (Singapore, SG)

Family ID: **1000007696057**

Appl. No.: **18/438853**

Filed: **February 12, 2024**

Publication Classification

Int. Cl.: **H01M50/262** (20210101)

U.S. Cl.:

CPC **H01M50/262** (20210101);

Background/Summary

FIELD
[0001] The disclosure below relates to technically inventive, non-routine solutions that produce concrete technical improvements. In particular, the disclosure below relates to screwless engagement assemblies for electronic devices.
BACKGROUND

[0002] As recognized herein, removable battery packs are sometimes used in laptop computers and other devices. However, when these battery packs are removed and then reinstalled in the device in the field, the relatively small screws used to secure the pack to the device can become dislodged and drop down into the chassis of the device. There, the screws might not be retrievable but can still get wedged between the battery pack and rest of the device when the pack is reinstalled. Not only does this interfere with proper placement of the battery pack within the device, but this can also create a pressure point between the battery pack and chassis at the location of the wedged screw. This in turn can lead to safety hazards and device inoperability due to battery pack ruptures that can be caused by the pressure point. No adequate solutions currently exist for the foregoing problems.

SUMMARY

[0003] Accordingly, in one aspect a device includes one or more elements configured to screwlessly and removably engage a component of the device with a housing of the device.

[0004] In one example embodiment, the one or more elements may include one or more bays into which respective protrusions on the component are slidable. If desired, the one or more bays may include a first bay on the housing, where the first bay may be configured to receive a first protrusion on the component. The one or more elements may also include a slider on the housing that is configured to slide into a second bay on the component.

[0005] Also in one example embodiment, the one or more elements may include one or more protrusions configured to engage respective clips on the component. In certain specific examples, the one or more protrusions may be one or more first protrusions and the one or more elements may include one or more bays into which respective second protrusions on the component are slidable. Also in certain examples, the device may include the component and each respective clip on the component may be established at least in part by a U-shaped member. The U-shaped member may be configured to flex inward to disengage the respective clip from the respective protrusion.

[0006] Further, in one example embodiment the one or more elements may include a first tooth configured to interlock with a second tooth on the component. In certain specific examples, the device may include the component and the first and second teeth may be disengageable from each other through a first opening on the housing and a second opening on the component. Each respective opening may be independently usable to disengage the first and second teeth from each other. Additionally, if desired the respective openings may be configured to receive a tool inserted into the respective opening manually. The respective openings may have respective long axes that are orthogonal to each other.

[0007] Still further, in an example embodiment, the one or more elements may include a socket. In one specific example, a ball on the component is receivable in the socket. In another specific example, a member on the component is receivable in the socket, with the socket in this particular instance including a first area configured to receive a convex surface of the member and including a second area configured to receive a rectangular protrusion of the member.

[0008] Also in an example embodiment, the one or more elements may include a fastener configured to receive a retainer on the component.

[0009] In an example embodiment, the one or more elements may include first and second convex members configured to engage respective oblique surfaces on the component. If desired, the first and second convex members may be established by respective first and second leaf springs that engage the respective oblique surfaces under spring bias.

[0010] In various examples, the device may include the component. The component may be a battery and/or a memory card.

[0011] In another aspect, a method includes providing a device and providing one or more elements on the device. The one or more elements are configured to screwlessly and removably engage a component of the device with a housing of the device.

[0012] In some examples, the method may also include screwlessly and removably engaging the

component with the housing using the one or more elements.
[0013] In another aspect, an assembly configured to engage a housing of a device includes one or more elements configured to screwlessly and removably engage the assembly with the housing of the device.
[0014] The details of present principles, both as to their structure and operation, can best be understood in reference to the accompanying drawings, in which like reference numerals refer to like parts, and in which:

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0015] FIG. **1** is a block diagram of an example system consistent with present principles;
[0016] FIG. **2** is a bottom plan view of an example laptop computer consistent with present principles;
[0017] FIGS. **3**A and **3**B show a first example screwless embodiment consistent with present principles;
[0018] FIGS. **4**A and **4**B show a second example screwless embodiment consistent with present principles;
[0019] FIGS. **5**A and **5**B show a third example screwless embodiment consistent with present principles;
[0020] FIGS. **5**C and **5**D show a fourth example screwless embodiment consistent with present principles;
[0021] FIGS. **6**A and **6**B show a fifth example screwless embodiment consistent with present principles;
[0022] FIGS. **7**A and **7**B show a sixth example screwless embodiment consistent with present principles;
[0023] FIGS. **8**A and **8**B show a seventh example screwless embodiment consistent with present principles;
[0024] FIGS. **9**A and **9**B show an eighth example screwless embodiment consistent with present principles;
[0025] FIGS. **10**A-**14** show a ninth example screwless embodiment consistent with present principles;
[0026] FIGS. **15**A and **15**B show a tenth example screwless embodiment consistent with present principles;
[0027] FIG. **16** shows a flowchart of an example method consistent with present principles;
[0028] FIG. **17** shows two side views of an example rounded screw to demonstrate another embodiment consistent with present principles;
[0029] FIG. **18** shows top plan views of various screw head designs that may be used for a rounded screw consistent with present principles; and
[0030] FIG. **19** shows top plan and side views of an example rounded screw with various markings to demonstrate rounded screw features consistent with present principles.
DETAILED DESCRIPTION
[0031] Among other things, the detailed description below provides screwless-based securing solutions for batteries and other components of a device, such as network cards, SID cards, peripheral devices, modular USB ports, etc. For batteries in particular, principles below may increase battery safety by providing enhanced mechanical strength solutions that also eliminate use of screws, provide device integrity, and provide ease of serviceability for replacement or recycling. Example embodiments described below may also save space within the device that might otherwise be used for securing the component to the device. The example screwless embodiments described

below may be combined with each other and interchanged consistent with present principles.

[0032] Prior to delving further into the details of the instant techniques, note with respect to any computer systems discussed herein that a system may include server and client components, connected over a network such that data may be exchanged between the client and server components. The client components may include one or more computing devices including televisions (e.g., smart TVs, Internet-enabled TVs), computers such as desktops, laptops and tablet computers, so-called convertible devices (e.g., having a tablet configuration and laptop configuration), and other mobile devices including smart phones. These client devices may employ, as non-limiting examples, operating systems from Apple Inc. of Cupertino CA, Google Inc. of Mountain View, CA, or Microsoft Corp. of Redmond, WA. A Unix® or similar such as Linux® operating system may be used, as may a Chrome or Android or Windows or macOS operating system. These operating systems can execute one or more browsers such as a browser made by Microsoft or Google or Mozilla or another browser program that can access web pages and applications hosted by Internet servers over a network such as the Internet, a local intranet, or a virtual private network.

[0033] As used herein, instructions refer to computer-implemented steps for processing information in the system. Instructions can be implemented in software, firmware or hardware, or combinations thereof and include any type of programmed step undertaken by components of the system; hence, illustrative components, blocks, modules, circuits, and steps are sometimes set forth in terms of their functionality.

[0034] A processor may be any single-or multi-chip processor that can execute logic by means of various lines such as address lines, data lines, and control lines and registers and shift registers. Moreover, any logical blocks, modules, and circuits described herein can be implemented or performed with a system processor such as a central processing unit (CPU), a digital signal processor (DSP), a field programmable gate array (FPGA) or other programmable logic device such as an application specific integrated circuit (ASIC), discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A processor can also be implemented by a controller or state machine or a combination of computing devices. Thus, the methods herein may be implemented as software instructions executed by a processor, suitably configured application specific integrated circuits (ASIC) or field programmable gate array (FPGA) modules, or any other convenient manner as would be appreciated by those skilled in the art. Where employed, the software instructions may also be embodied in a non-transitory device that is being vended and/or provided, and that is not a transitory, propagating signal and/or a signal per se. For instance, the non-transitory device may be or include a hard disk drive, solid state drive, or CD ROM. Flash drives may also be used for storing the instructions. Additionally, the software code instructions may also be downloaded over the Internet (e.g., as part of an application ("app") or software file). Accordingly, it is to be understood that although a software application for undertaking present principles may be vended with a device such as the system **100** described below, such an application may also be downloaded from a server to a device over a network such as the Internet. An application can also run on a server and associated presentations may be displayed through a browser (and/or through a dedicated companion app) on a client device in communication with the server.

[0035] Software modules and/or applications described by way of flow charts and/or user interfaces herein can include various sub-routines, procedures, etc. Without limiting the disclosure, logic stated to be executed by a particular module can be redistributed to other software modules and/or combined together in a single module and/or made available in a shareable library. Also, the user interfaces (UI)/graphical UIs described herein may be consolidated and/or expanded, and UI elements may be mixed and matched between UIs.

[0036] Logic when implemented in software, can be written in an appropriate language such as but not limited to hypertext markup language (HTML)-5, Java®/JavaScript, C #or C++, and can be stored on or transmitted from a computer-readable storage medium such as a hard disk drive (HDD) or solid state drive (SSD), a random access memory (RAM), read-only memory (ROM), electrically erasable programmable read-only memory (EEPROM), a hard disk drive or solid state drive, compact disk read-only memory (CD-ROM) or other optical disk storage such as digital versatile disc (DVD), magnetic disk storage or other magnetic storage devices including removable thumb drives, etc.

[0037] In an example, a processor can access information over its input lines from data storage, such as the computer readable storage medium, and/or the processor can access information wirelessly from an Internet server by activating a wireless transceiver to send and receive data. Data typically is converted from analog signals to digital by circuitry between the antenna and the registers of the processor when being received and from digital to analog when being transmitted. The processor then processes the data through its shift registers to output calculated data on output lines, for presentation of the calculated data on the device.

[0038] Components included in one embodiment can be used in other embodiments in any appropriate combination. For example, any of the various components described herein and/or depicted in the Figures may be combined, interchanged or excluded from other embodiments.

[0039] The term “a” or “an” in reference to an entity refers to one or more of that entity. As such, the terms “a” or “an”, “one or more”, and “at least one” can be used interchangeably herein.

[0040] “A system having at least one of A, B, and C” (likewise “a system having at least one of A, B, or C” and “a system having at least one of A, B, C”) includes systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.

[0041] The term “circuit” or “circuitry” may be used in the summary, description, and/or claims. The term “circuitry” includes all levels of available integration, e.g., from discrete logic circuits to the highest level of circuit integration such as VLSI, and includes programmable logic components programmed to perform the functions of an embodiment as well as processors (e.g., special-purpose processors) programmed with instructions to perform those functions.

[0042] Now specifically in reference to FIG. **1**, an example block diagram of an information handling system and/or computer system **100** is shown that is understood to have a housing for the components described below. Note that in some embodiments the system **100** may be a desktop computer system, such as one of the ThinkCentre® or ThinkPad® series of personal computers sold by Lenovo (US) Inc. of Morrisville, NC, or a workstation computer, such as the ThinkStation®, which are sold by Lenovo (US) Inc. of Morrisville, NC; however, as apparent from the description herein, a client device, a server or other machine in accordance with present principles may include other features or only some of the features of the system **100**. Also, the system **100** may be, e.g., a game console such as XBOX®, and/or the system **100** may include a mobile communication device such as a mobile telephone, notebook computer, and/or other portable computerized device.

[0043] As shown in FIG. **1**, the system **100** may include a so-called chipset **110**. A chipset refers to a group of integrated circuits, or chips, that are designed to work together. Chipsets are usually marketed as a single product (e.g., consider chipsets marketed under the brands INTEL®, AMD®, etc.).

[0044] In the example of FIG. **1**, the chipset **110** has a particular architecture, which may vary to some extent depending on brand or manufacturer. The architecture of the chipset **110** includes a core and memory control group **120** and an I/O controller hub **150** that exchange information (e.g., data, signals, commands, etc.) via, for example, a direct management interface or direct media interface (DMI) **142** or a link controller **144**. In the example of FIG. **1**, the DMI **142** is a chip-to-chip interface (sometimes referred to as being a link between a “northbridge” and a “southbridge”).

[0045] The core and memory control group **120** includes a processor assembly **122** (e.g., one or more single core or multi-core processors, etc.) and a memory controller hub **126** that exchange information via a front side bus (FSB) **124**. A processor assembly such as the assembly **122** may therefore include one or more processors acting independently or in concert with each other to execute an algorithm, whether those processors are in one device or more than one device. Additionally, as described herein, various components of the core and memory control group **120** may be integrated onto a single processor die, for example, to make a chip that supplants the "northbridge" style architecture.

[0046] The memory controller hub **126** interfaces with memory **140**. For example, the memory controller hub **126** may provide support for DDR SDRAM memory (e.g., DDR, DDR2, DDR3, etc.). In general, the memory **140** is a type of random-access memory (RAM). It is often referred to as "system memory."

[0047] The memory controller hub **126** can further include a low-voltage differential signaling interface (LVDS) **132**. The LVDS **132** may be a so-called LVDS Display Interface (LDI) for support of a display device **192** (e.g., a CRT, a flat panel, a projector, a touch-enabled light emitting diode (LED) display or other video display, etc.). A block **138** includes some examples of technologies that may be supported via the LVDS interface **132** (e.g., serial digital video, HDMI/DVI, display port). The memory controller hub **126** also includes one or more PCI-express interfaces (PCI-E) **134**, for example, for support of discrete graphics **136**. Discrete graphics using a PCI-E interface has become an alternative approach to an accelerated graphics port (AGP). For example, the memory controller hub **126** may include a 16-lane (×16) PCI-E port for an external PCI-E-based graphics card (including, e.g., one or more GPUs). An example system may include AGP or PCI-E for support of graphics.

[0048] In examples in which it is used, the I/O hub controller **150** can include a variety of interfaces. The example of FIG. **1** includes a SATA interface **151**, one or more PCI-E interfaces **152** (optionally one or more legacy PCI interfaces), one or more universal serial bus (USB) interfaces **153**, a local area network (LAN) interface **154** (more generally a network interface for communication over at least one network such as the Internet, a WAN, a LAN, a Bluetooth network using Bluetooth 5.0 communication, etc. under direction of the processor(s) **122**), a general purpose I/O interface (GPIO) **155**, a low-pin count (LPC) interface **170**, a power management interface **161**, a clock generator interface **162**, an audio interface **163** (e.g., for speakers **194** to output audio), a total cost of operation (TCO) interface **164**, a system management bus interface (e.g., a multi-master serial computer bus interface) **165**, and a serial peripheral flash memory/controller interface (SPI Flash) **166**, which, in the example of FIG. **1**, includes basic input/output system (BIOS) **168** and boot code **190**. With respect to network connections, the I/O hub controller **150** may include integrated gigabit Ethernet controller lines multiplexed with a PCI-E interface port. Other network features may operate independent of a PCI-E interface. Example network connections include Wi-Fi as well as wide-area networks (WANs) such as 4G and 5G cellular networks.

[0049] The interfaces of the I/O hub controller **150** may provide for communication with various devices, networks, etc. For example, where used, the SATA interface **151** and/or PCI-E interface **152** provide for reading, writing or reading and writing information on one or more drives **180** such as HDDs, SSDs or a combination thereof, but in any case the drives **180** are understood to be, e.g., tangible computer readable storage mediums that are not transitory, propagating signals. The I/O hub controller **150** may also include an advanced host controller interface (AHCI) to support one or more drives **180**. The PCI-E interface **152** allows for wireless connections **182** to devices, networks, etc. The USB interface **153** provides for input devices **184** such as keyboards (KB), mice and various other devices (e.g., cameras, phones, storage, media players, etc.).

[0050] In the example of FIG. **1**, the LPC interface **170** provides for use of one or more ASICs **171**, a trusted platform module (TPM) **172**, a super I/O **173**, a firmware hub **174**, BIOS support **175** as well as various types of memory **176** such as ROM **177**, Flash **178**, and non-volatile RAM (NVRAM) **179**. With respect to the TPM **172**, this module may be in the form of a chip that can be used to authenticate software and hardware devices. For example, a TPM may be capable of

performing platform authentication and may be used to verify that a system seeking access is the expected system.
[0051] The system **100**, upon power on, may be configured to execute boot code **190** for the BIOS **168**, as stored within the SPI Flash **166**, and thereafter processes data under the control of one or more operating systems and application software (e.g., stored in system memory **140**). An operating system may be stored in any of a variety of locations and accessed, for example, according to instructions of the BIOS **168**.
[0052] Additionally, though not shown for simplicity, in some embodiments the system **100** may include a gyroscope that senses and/or measures the orientation of the system **100** and provides related input to the processor assembly **122**, an accelerometer that senses acceleration and/or movement of the system **100** and provides related input to the processor assembly **122**, and/or a magnetometer that senses and/or measures directional movement of the system **100** and provides related input to the processor assembly **122**. Still further, the system **100** may include an audio receiver/microphone that provides input from the microphone to the processor assembly **122** based on audio that is detected, such as via a user providing audible input to the microphone. The system **100** may also include a camera that gathers one or more images and provides the images and related input (e.g., metadata like an image timestamp) to the processor assembly **122**. The camera may be a thermal imaging camera, an infrared (IR) camera, a digital camera such as a webcam, a three-dimensional (3D) camera, and/or a camera otherwise integrated into the system **100** and controllable by the processor assembly **122** to gather still images and/or video. Also, the system **100** may include a global positioning system (GPS) transceiver that is configured to communicate with satellites to receive/identify geographic position information and provide the geographic position information to the processor assembly **122**. However, it is to be understood that another suitable position receiver other than a GPS receiver may be used in accordance with present principles to determine the location of the system **100**.
[0053] It is to be understood that an example client device or other machine/computer may include fewer or more features than shown on the system **100** of FIG. **1**. In any case, it is to be understood at least based on the foregoing that the system **100** is configured to undertake present principles.
[0054] FIG. **2** shows a bottom plan view of a bottom panel of a laptop computer **200**. However, note that present principles may be used to engage device components with other types (and sides) of devices as well, including desktop computers, smartphones, tablet computers, mixed reality headsets, smart glasses, smart watches, other wearable devices, etc. Present principles may also be used in heavy machinery implementations, automotive implementations, aerospace implementations, freight implementations, and still other implementations.
[0055] In any case, here the bottom panel of the laptop **200** may include a keyboard and internal computer circuitry such as a CPU, RAM, a HDD and/or SSD, etc., while a different (upper) panel of the laptop **200** may bear the laptop's display. And as shown in FIG. **2**, the laptop **200** may include respective components **210**, **220**. The component **210** may be a secure digital (SD) memory card and the component **220** may be a battery/battery pack that powers the laptop **200**.
[0056] Consistent with present principles, the components **210**, **220** may be screwlessly and removably engaged with the housing **205** of the bottom panel of the laptop **200**. When engaged, the components **210**, **220** may be closely received into respective bays on the housing **205**, with the components **210**, **220** then sitting flush with the rest of the bottom surface of the bottom panel. This helps to prevent component/device damage and malfunction that might otherwise result.
[0057] Now in reference to FIGS. **3**A and **3**B, a first example embodiment is shown for screwless engagement of a battery pack component **300** with a housing **310** of a device **320** (e.g., the laptop **200**). As shown in these figures, the device **320** may include one or more bays into which respective protrusions on the component **300** are slidable, including at least a first bay **330** in the housing **310** into which a protrusion **340** on the component **300** is slidable/receivable. The bay(s) may be established by notches, rectangular or other openings, indentations, etc. in various

examples.

[0058] FIGS. **3**A and **3**B also show that in some examples, the device **320** may also include a slider **350** on the housing **310**. The slider **350** may be a mechanically movable tab or other element that slides along a track on the housing (not shown) to slide into a second bay **360** on the component **300** along a plane parallel to the external face of the component **300**/housing **310**.

[0059] Thus, FIG. **3**A shows that as a first step in screwlessly engaging the component **300** with the device **320**, the protrusion **340** may be extended into the bay **330** with the component **300** positioned at an oblique angle with respect to the component bay **370** in the housing **310** as shown. Arrow **391** illustrates oblique motion inserting the protrusion **340** into the bay **330**. The component **300** may then be extended/pressed down fully into the bay **370** as shown in FIG. **3**B and illustrated by motion arrow **392**. Then as a third step, the slider **350** may be subsequently slid into the bay **360**, screwlessly securing the component **300** to the device **320** (so that, in the present instance, the battery pack may engage electrical contacts on the device **320** to power the device **320**).

[0060] Moving on to FIGS. **4**A and **4**B, these figures show another example embodiment for screwless engagement of a battery pack component **400** with a housing **410** of a device **420** consistent with present principles. As shown in these figures, the device **420** may include one or more protrusions configured to engage respective clips **425** on the component **400**, including at least a first protrusion **430** formed into the housing **410** and defining a wall of a bay **440** as will be described in more detail below. If desired, the device **420** may also include one or more bays **450** into which a respective second protrusion **460** on the component **400** is slidable.

[0061] In the example shown, each respective clip **425** that is used (only one clip **425** being used in the present example) may be established at least in part by a U-shaped member **427**. The U-shaped member **427** may be configured to flex transversely inward manually using a person's fingers to disengage the clip **425** from the protrusion **430**, as illustrated via the arrow **470** shown in FIG. **4**B. As also shown in FIGS. **4**A and **4**B, a distal vertical arm of the U-shaped member **427** (distal for the component **400**) may have a tooth **429** that, when the component **400** is engaged with the housing **410** and the clip **425** exerts outward force under preconfigured spring/material bias, extends into the bay **440**. The upper surface of the tooth **429** may thus abut the bottom face of the first protrusion **430** (that establishes a wall of the bay **440** for the tooth **429**), screwlessly securing the component **400** to the device **420**.

[0062] It may therefore be appreciated that according to FIG. **4**A, the component **400** is screwlessly secured to the housing **410** with the tooth **429** of the clip **425** snapped into the bay **440** to lock the component **400** in the housing **410**. Then according to FIG. **4**B, the component **400** may be disengaged from the housing **410** by pressing the clip **425** inward to remove the tooth **429** from the bay **440** and to angle the clip **425** (and component **400**) up away from the first protrusion **430**. The user may then slide the second protrusion **460** out of the bay **450** on the other side of the component **400** (with the first end of the component **400** with the clip **425** already being free) to fully remove the component **400** from the housing **410**.

[0063] Continuing the detailed description in reference to FIGS. **5**A-**5**B, yet another example embodiment is shown for screwless snap release of a component with a device consistent with present principles. Specifically, these figures show closeup cutaway side views of an example component/device engagement interface that uses interlocking teeth. As shown, a housing **500** of the device has a vertical member **510** that includes a first tooth **520** configured to interlock with a second tooth **530** on the housing **540** of the removable component (e.g., battery pack).

[0064] FIGS. **5**A and **5**B also show a single outer side access/opening **550** on the removable component. The teeth **520**, **530** may therefore be disengageable from each other through the opening **550**, with the opening **550** receiving a tool **560** inserted manually into the opening **550** by a user as illustrated by arrow **570**. The tool **560** might be a flat head screwdriver, a frusto-conical or conical-tipped bar, etc., a distal end of which may be inserted into the opening **550**. The distal end of the tool **560** may therefore be extended through the opening **550** with pressure then applied to an upper oblique surface of the tooth **520** as shown to overcome material bias and force the tooth **520** away from its interlocked position with the tooth **530** so that the housing **510** (and hence component itself) can be disengaged from the device. This movement is illustrated in FIG. **5**B (with FIG. **5**A itself showing the teeth **520**, **530** in interlocked configuration).

[0065] FIGS. **5**C and **5**D illustrate a second example where, in addition to having the opening **550** for purposes described above, the housing **510** may also have its own side-access opening **580**. The teeth **520**, **530** may therefore also be disengaged from each other through this second opening **580**, with the opening **580** also configured for receiving the tool **560** as inserted manually into the opening **580** by a user as illustrated by arrow **590**. The distal end of the tool **560** may therefore be extended through the opening **580**, with pressure then being applied to a portion of the tooth **530** on the component (such as a vertical surface as shown) to overcome material bias and force the tooth **530** away from its interlocked position with the tooth **520** so that the housing **510** (and hence component itself) can be disengaged from the device.

[0066] This movement is illustrated in FIG. **5**D (with FIG. **5**C showing the teeth **520**, **530** in interlocked configuration). It may therefore be appreciated from FIGS. **5**C-**5**D that each respective opening **550**, **580** may be independently usable to disengage the teeth **520**, **530** from each other. It may also be appreciated that in the non-limiting example shown, the respective openings **550**, **580** may have respective long axes that are orthogonal to each other.

[0067] In reference now to FIGS. **6**A and **6**B, still another example embodiment is shown for screwless snap release of a component from a device. These figures show close up partial side views of component/device engagement. As shown, a housing **600** of the device **605** has a vertical member **610** that includes a first tooth **620** configured to interlock with a second tooth **630** on the housing of the removable component **640** (e.g., battery pack).

[0068] As shown in these figures, a triangular-shaped opening **650** is accessible from outside the housing **600** of the device **605** itself. A tool such as one of the ones described above may be used to insert the distal end of the tool into the opening **650** to abut an oblique upward face of the tooth **620**. The tool may then be angled to leverage the tooth **620** and vertical member **610** away from the tooth **630**, overcoming material bias and unlocking the teeth **620**, **630** from their interlocked configuration (FIG. **6**A) so that the component **640** may then be removed while the member **610** is extended away from the tooth **630** (FIG. **6**B). Note that in one non-limiting example, only a mere 4 mm of space on the device is taken by the screwless engagement mechanism while locked, and only a mere 8 mm of space is used while unlocked.

[0069] FIGS. **7**A-**7**B then show another example embodiment similar to FIGS. **6**A-**6**B save for differences noted next. Specifically, the teeth **720**, **730** form an interface of obliquely-oriented interlocking faces as shown, rather than an interface of vertically-interlocking faces per FIGS. **6**A-**6**B. Additionally, an opening **750** of an irregular shape is shown, as opposed to the opening **650** of right triangle-shape. Nonetheless, a tool may still be used as set forth above to unlock the teeth **720**, **730** (FIG. **7**B) from their locked position (FIG. **7**A). Note that in one non-limiting example, only a mere 3 mm of space on the device is taken by the screwless engagement mechanism while locked, and only a mere 5 mm of space is used while unlocked.

[0070] Reference is now made to FIGS. **8**A and **8**B, which show another example embodiment for release of a component from a device consistent with present principles. These figures show close up partial side views of component/device engagement. As shown, a housing **800** of the device **810** has a socket **820** into which a ball **830** on a component **840** (e.g., SD memory card) is receivable. As shown, the socket **820** may be semi-spherical, with an opening **850** at the top for the ball to be pressed up against the upper distal ends of the socket **820**, forcing those portions of the socket **820** open wider so that the ball **830** may pass therethrough to become seated within the socket **820**, screwlessly engaging the component **840** to the device **810**. Note that this motion may be effected by inserting a tool into a recess **860** in a vertical face of the housing **870** of the component **840** and then pushing the tool downward to push the ball **830** into the socket. The ball may also be disengaged with the socket by pulling up with the tool instead.

[0071] FIGS. **9**A-**9**B then show another example embodiment similar to FIGS. **8**A-**8**B save for differences noted next. Specifically, a socket **900** into which a member **905** on the component **840** is receivable may be used instead of the socket **820**. The socket **900** may include a first, concave area **910** configured to receive a convex/semispherical surface **920** on the member **905**. The socket **900** may also include a second area **930** that is configured to receive a rectangular protrusion **940** of the member **905**. This configuration of the interlocking socket **900** and member **905** provides stability from both horizontal and vertical jostling while in the locked configuration (FIG. **9**A). A tool may then be extended into an opening **950** created between respective faces of the socket **900** and member **905** to pull the housing **870** away from the housing **810** to disengage the component **840** from the device **810** or vice versa.

[0072] Note that in one non-limiting example, only a mere 3 mm of space on the device is taken by the screwless engagement mechanisms of FIGS. **8**A-**9**B while locked and unlocked.

[0073] Reference is now made to FIGS. **10**A and **10**B, which show another example embodiment for screwless release of a component from a device consistent with present principles. These figures show close up side views of an example retainer clip-type example. As shown in these figures, a housing **1000** of the device (e.g., smartphone) has a fastener **1010**. The fastener **1010** has a base **1012**. The fastener **1010** also has a vertical post **1015** with horizontally-extending protrusions **1020** thereon. The post **1015** is thus configured to receive a reciprocal retainer **1030** on the component (e.g., battery pack).

[0074] FIG. **10**A therefore shows the elements **1010**, **1030** prior to screwless engagement. FIG. **10**B then shows the screwless, locking engagement itself owing to the components **1010**, **1030** being pressed together so that the post **1015** extends into and through the opening **1040** of the retainer **1030** until the protrusions **1020** snap/lock into horizontal openings **1050** in the retainer **1030**. A shield retainer/fastener rivet clip/retainer clip-style configuration may thus be used to screwlessly engage the device with the component itself.

[0075] FIGS. **11**A and **11**B also show this embodiment in side partial view while FIGS. **12**A-**12**B show this embodiment in close-up partial view. FIGS. **11**A-**12**B illustrate the component **1100** being screwlessly engaged (FIGS. **11**A and **12**A) and disengaged (FIGS. **11**B and **12**B) from the housing **1000** of a laptop **1110**. Note that to disengage the component **1100** from the laptop **1110**, a specially-adapted release tool **1120** may be manually inserted into the upper portion of the retainer **1030** through the opening **1040**. This expands the distance between the openings **1050** to free the post **1015** so that a receiver/notch **1130** on a distal end segment of the tool **1120** may then be pushed down over top of the distal end segment of the post **1015**. The tool **1120** may then be used to push the post **1015** downward and away from the retainer **1030** to screwlessly disengage the component **1100** from the laptop **1110**, as illustrated by arrow **1140**.

[0076] FIGS. **13**A and **13**B show an example where the fastener **1010** and retainer **1030** are used in an existing screw hole **1300**, with FIG. **13**A showing the components **1010**/**1030** prior to engagement with the component **1100** and housing **1000** in the field. The post **1015** may then be glued down into or otherwise coupled to the bottom of the existing screw hole **1300** formed by the housing **1000**. The retainer **1030** may be glued onto or otherwise coupled to the component **1100**. With this done, the retainer **1030** may then be slid into the screw hole **1300** and over top of the post **1015** to thus screwlessly engage the component **1100** with the housing **1000** of the device, as shown in FIG. **13**B.

[0077] FIG. **14** then shows another example where, rather than the components **1010**/**1015** and **1030** being glued down as described above, the components **1010**/**1015** and **1030** may be respectively made integrally with the material of the housing of the component **1100** and material of the housing **1000** of the device.

[0078] Continuing the detailed description in reference to FIGS. **15**A and **15**B, yet another example screwless embodiment is shown. As shown, the housing **1500** of the device (e.g., laptop) may have a receptacle **1505** for receiving a component such as a battery pack **1510**. As shown, the housing **1500** may include first and second convex members **1520**, **1530** that may be clip fasteners/leaf springs configured to engage respective oblique surfaces **1540**, **1550** on the external surface/housing of the battery back **1510**, with oblique being relative to vertical.

[0079] As shown, the oblique surfaces **1540**, **1550** may slope downward and outward. Thus, the battery pack **1510** may be pushed into the receptacle **1505** so that the bottom portions of the oblique faces described above are pushed past the clips/springs **1530**, which provide spring bias resisting the push. Once fully pushed into the receptacle as shown in FIG. **15**B, the first and second convex members **1520**, **1530** may engage the respective oblique surfaces under spring bias to hold the battery pack **1510** screwlessly and securely within the receptacle **1505**. To accomplish this, the members **1520**, **1530** may be made of spring-memory plastic, metal, and/or hard polymer. To remove the pack, **1510**, the members **1520**, **1530** may then be pushed against spring bias using a flat head screw driver to free the pack **1510**.

[0080] It may now be appreciated that example embodiments have been discussed above for a screwless engagement mechanism that can be used for engaging a component with a device (e.g., for electrical connection, mechanical connection, fluid connection, etc.). Thus, an assembly on the component and assembly on the device housing itself may be used for relatively quick and easy screwless engagement and disengagement of the component from the device housing. The elements used to do so may be rigid save for when flex capability is mentioned above, and may be made of material such as aluminum and/or other metal, plastic and other polymers, or other suitable material.

[0081] Methods of using such mechanisms are also contemplated consistent with present principles. As such and in reference now to the flow chart of FIG. **16**, an example method may include providing a device (step **1600**) and providing one or more elements on the device that are configured to screwlessly and removably engage a component of the device with a housing of the device (step **1610**). In some examples, the method may also include screwlessly and removably engaging the component with the housing using the one or more elements according to one or more the examples above (step **1620**). The method may be performed by a device manufacturer, end-user, field technician, etc.

[0082] Now in reference to FIGS. **17** and **18**, it is to be understood that while the foregoing screwless embodiments may be used to minimize damage to removable device components as mentioned above, in other examples specialized screws may be used in lieu of standard screw types to engage the component with the device. FIG. **17** therefore shows that screws **1700** may be used that have rounded heads **1710** and rounded shaft ends **1720**. Thus, if the screw **1700** were lost and became lodged between the component and receptacle in the housing of the device, the rounded nature of the screw reduces the chance of the screw puncturing the component or device housing, which might otherwise result in device damage and a safety hazard.

[0083] FIG. **18** shows top plan views of the head **1710** with different example tool hole receptacles/center drive recesses for receiving a reciprocal distal end of a screwdriver or other tool. Note that the top surface as shown in each example of FIG. **18** does not extend to the transverse outer circumference of the head **1710**, which would otherwise create non-rounded edges on the top of the head **1710** that might otherwise cause device damage when the screw **1700** gets wedged as described above. As shown in FIG. **18**, different types of Phillips receptacles may be used (A,B), as may a torx hole (C), spline hole (D), slot/flathead hole (E), and square/Robertson hole (F).

[0084] FIG. **19** further illustrates and demonstrates an advantage of the configuration of the screw **1700**. Specifically, when the length L of the screw shaft is greater than or equal to sixty five percent of the transverse maximum diameter of the screw head **1710**, it becomes much harder for the rounded screw **1700** to penetrate the mylars of a battery pack or to penetrate other device components.

[0085] Before concluding, note that components included in one embodiment can be used in other

embodiments in any appropriate combination. For example, any of the various components described herein and/or depicted in the Figures may be combined, interchanged or excluded from other embodiments.
[0086] It is to be understood that whilst present principals have been described with reference to some example embodiments, these are not intended to be limiting, and that various alternative arrangements may be used to implement the subject matter claimed herein. Accordingly, while particular techniques and devices are herein shown and described in detail, it is to be understood that the subject matter which is encompassed by the present application is limited only by the claims.

Claims

1. A device, comprising: one or more elements configured to screwlessly and removably engage a component of the device with a housing of the device.
2. The device of claim 1, wherein the one or more elements comprise one or more bays into which respective protrusions on the component are slidable.
3. The device of claim 2, wherein the one or more bays comprise a first bay on the housing, the first bay configured to receive a first protrusion on the component, and wherein the one or more elements further comprise a slider on the housing, the slider configured to slide into a second bay on the component.
4. The device of claim 1, wherein the one or more elements comprise one or more protrusions configured to engage respective clips on the component.
5. The device of claim 4, wherein the one or more protrusions are one or more first protrusions, and wherein the one or more elements comprise one or more bays into which respective second protrusions on the component are slidable.
6. The device of claim 4, comprising the component, each respective clip on the component established at least in part by a U-shaped member, the U-shaped member configured to flex inward to disengage the respective clip from the respective protrusion.
7. The device of claim 1, wherein the one or more elements comprise a first tooth configured to interlock with a second tooth on the component.
8. The device of claim 7, comprising the component, wherein the first and second teeth are disengageable from each other through a first opening on the housing and a second opening on the component, each respective opening being independently usable to disengage the first and second teeth from each other.
9. The device of claim 8, wherein the respective openings are configured to receive a tool inserted into the respective opening manually.
10. The device of claim 8, wherein the respective openings have respective long axes that are orthogonal to each other.
11. The device of claim 1, wherein the one or more elements comprise a socket into which a ball on the component is receivable.
12. The device of claim 1, wherein the one or more elements comprise a socket into which a member on the component is receivable, the socket comprising a first area configured to receive a convex surface of the member and comprising a second area configured to receive a rectangular protrusion of the member.
13. The device of claim 1, wherein the one or more elements comprise a fastener, the fastener configured to receive a retainer on the component.
14. The device of claim 1, wherein the one or more elements comprise first and second convex members configured to engage respective oblique surfaces on the component.
15. The device of claim 14, wherein the first and second convex members are established by respective first and second leaf springs that engage the respective oblique surfaces under spring

bias.
16. The device of claim 1, comprising the component, wherein the component is a battery.
17. The device of claim 1, comprising the component, wherein the component is a memory card.
18. A method, comprising: providing a device; and providing one or more elements on the device, the one or more elements configured to screwlessly and removably engage a component of the device with a housing of the device.
19. The method of claim 18, comprising: screwlessly and removably engaging the component with the housing using the one or more elements.
20. An assembly configured to engage a housing of a device, comprising: one or more elements configured to screwlessly and removably engage the assembly with the housing of the device.