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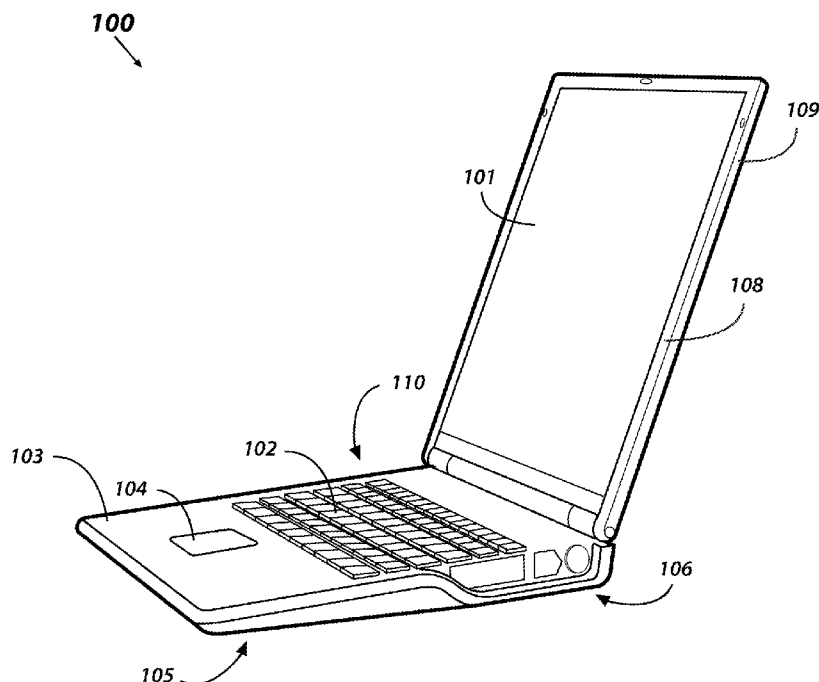
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(54) **Title:** SCREW-LESS HOUSING DESIGN FOR COMPUTER SYSTEMS AND ELECTRONIC DEVICES

FIGURE 1



(57) **Abstract:** An apparatus, system, and method consistent with the present disclosure includes a first housing portion which includes at least one multi-metal latch. The first housing portion is to couple to a second housing portion in response to the at least one multi-metal latch being at a temperature in a first temperature range. In addition, the first housing portion is to decouple from the second housing portion in response to the at least one multi-metal latch being at a temperature in a second temperature range

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SCREW-LESS HOUSING DESIGN FOR COMPUTER SYSTEMS AND ELECTRONIC DEVICES

FIELD

5 This disclosure pertains to computing systems, in particular (but not exclusively) a screw-less housing design for computer systems and electronic devices.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram illustrating a laptop computing system consistent with one embodiment of the present disclosure.

10 FIG. 2 is a diagram illustrating a bottom view of a first housing portion of a prior art laptop computing system having a plurality of screws there through.

FIG. 3 is a diagram illustrating a first housing portion and a second housing portion of a computing system prior to assembly, according to one embodiment of the present disclosure.

15 FIG. 4A is a diagram illustrating a cross section of a first housing portion and a second housing portion assembled in a computing system consistent with an embodiment of the present disclosure.

FIG. 4B is a diagram illustrating a first housing portion having a bi-metal latch in a deflected state, according to one embodiment of the present disclosure.

20 FIG. 5A is a diagram illustrating a bottom view of a first housing portion having a plurality of bi-metal latches in a first state, according to one embodiment of the present disclosure.

FIG. 5B is a diagram illustrating a bottom view of a first housing portion having a plurality of bi-metal latches in a second state, according to one embodiment of the present disclosure.

FIG. 6 is a diagram illustrating a manner of coupling a first housing portion to a second housing portion within a computing system assembly consistent with the present disclosure.

FIG. 7 is a flowchart of a method for assembling housing portions within a computing system, according to one embodiment of the present disclosure.

DETAILED DESCRIPTION

In the following description, numerous specific details are set forth, such as examples
5 of specific types of processors and system configurations, specific hardware structures, specific architectural and micro-architectural details, specific register configurations, specific instruction types, specific system components, specific measurements/heights, specific processor pipeline stages and operation, etcetera, in order to provide a thorough understanding of the present disclosure. It will be apparent, however, to one skilled in the art that these specific details need
10 not be employed to practice the present disclosure. In other instances, well known components or methods, such as specific and alternative processor architectures, specific logic circuits/code for described algorithms, specific firmware code, specific interconnect operation, specific logic configurations, specific manufacturing techniques and materials, specific compiler implementations, specific expression of algorithms in code, specific power-down and gating
15 techniques/logic, and other specific operational details of computer system, have not been described in detail in order to avoid unnecessarily obscuring the present disclosure.

Although the following embodiments may be described with reference to energy conservation and energy efficiency in specific integrated circuits, such as in computing platforms or microprocessors, other embodiments are applicable to other types of integrated
20 circuits and logic devices. Similar techniques and teachings of embodiments described herein may be applied to other types of circuits or semiconductor devices that may also benefit from better energy efficiency and energy conservation. For example, the disclosed embodiments are not limited to desktop computer systems or Ultrabooks™, but may be also used in other devices, such as handheld devices, tablets, other thin notebooks, systems on a chip (SOC) devices, and

embedded applications. Some examples of handheld devices include cellular phones, Internet protocol devices, digital cameras, personal digital assistants (PDAs), and handheld PCs. Embedded applications typically include a microcontroller, a digital signal processor (DSP), a system on a chip, network computers (NetPC), set-top boxes, network hubs, wide-area network (WAN) switches, or any other system that may perform the functions and operations taught below. Moreover, the apparatuses, methods, and systems described herein are not limited to physical computing devices but may also relate to software optimizations for energy conservation and efficiency. As will become readily apparent in the description below, the embodiments of methods, apparatuses, and systems described herein (whether in reference to hardware, firmware, software, or a combination thereof) are vital to a 'green technology' future balanced with performance considerations.

As computing systems are advancing, the components therein are becoming more complex. As a result, the interconnect architecture to couple and communicate between the components is also increasing in complexity to ensure bandwidth requirements are met for optimal component operation. Furthermore, different market segments demand different aspects of interconnect architectures to suit the market's needs. For example, servers require higher performance while the mobile ecosystem is sometimes able to sacrifice overall performance for power savings. However, it is a singular purpose of most fabrics to provide the highest possible performance with maximum power savings. Below, a number of interconnects are discussed, that would potentially benefit from aspects of the disclosure described herein.

While the present disclosure has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. The appended claims are intended to cover all such modifications and variations as fall within the true spirit and scope of this present disclosure.

A design may go through various stages, from creation to simulation to

fabrication. Data representing a design may represent the design in a number of manners. First, as is useful in simulations, the hardware may be represented using a hardware-description language or another functional description language. Additionally, a circuit-level model with logic and/or transistor gates may be produced at some stages of the design process. Furthermore, most designs, at some stage, reach a level of data representing the physical placement of various devices in the hardware model. In the case where conventional semiconductor fabrication techniques are used, the data representing the hardware model may be the data specifying the presence or absence of various features on different mask layers for masks used to produce the integrated circuit. In any representation of the design, the data may be stored in any form of a machine-readable medium. A memory or a magnetic or optical storage such as a disc may be the machine-readable medium to store information transmitted via optical or electrical wave modulated or otherwise generated to transmit such information. When an electrical carrier wave indicating or carrying the code or design is transmitted, to the extent that copying, buffering, or re-transmission of the electrical signal is performed, a new copy is made. Thus, a communication provider or a network provider may store on a tangible, machine-readable medium, at least temporarily, an article, such as information encoded into a carrier wave, embodying techniques of embodiments of the present disclosure.

A module as used herein refers to any combination of hardware, software, and/or firmware. As an example, a module includes hardware, such as a micro-controller, associated with a non-transitory medium to store code adapted to be executed by the micro-controller. Therefore, reference to a module, in one embodiment, refers to the hardware, which is specifically configured to recognize and/or execute the code to be held on a non-transitory medium. Furthermore, in another embodiment, use of a module refers to the non-transitory medium including the code, which is specifically adapted to be executed by the microcontroller to perform predetermined operations. As may be inferred, in yet another embodiment, the term module (in this example) may refer to the combination of the microcontroller and the non-

transitory medium. Often module boundaries that are illustrated as separate commonly vary and potentially overlap. For example, a first and a second module may share hardware, software, firmware, or a combination thereof, while potentially retaining some independent hardware, software, or firmware. In one embodiment, use of the term “logic” includes hardware, such as transistors, registers, or other hardware, such as programmable logic devices.

Use of the phrase “to” or “configured to,” in one embodiment, refers to arranging, putting together, manufacturing, offering to sell, importing and/or designing an apparatus, hardware, logic, or element to perform a designated or determined task. In this example, an apparatus or element thereof that is not operating is still “configured to” perform a designated task if it is designed, coupled, and/or interconnected to perform said designated task. As a purely illustrative example, a logic gate may provide a 0 or a 1 during operation, a logic gate “configured to” provide an enable signal to a clock does not include every potential logic gate that may provide a 1 or 0. Instead, the logic gate is one coupled in some manner that during operation the 1 or 0 output is to enable the clock. Note once again that use of the term “configured to” does not require operation, but instead focuses on the latent state of an apparatus, hardware, and/or element, wherein the latent state the apparatus, hardware, and/or element is designed to perform a particular task when the apparatus, hardware, and/or element is operating.

Furthermore, use of the phrases “capable of/to,” and or “operable to,” in one embodiment, refers to some apparatus, logic, hardware, and/or element designed in such a way to enable use of the apparatus, logic, hardware, and/or element in a specified manner. Note as above that use of to, capable to, or operable to, in one embodiment, refers to the latent state of an apparatus, logic, hardware, and/or element, where the apparatus, logic, hardware, and/or element is not operating but is designed in such a manner to enable use of an apparatus in a specified manner.

A value, as used herein, includes any known representation of a number, a state, a logical state, or a binary logical state. Often, the use of logic levels, logic values, or logical values is

also referred to as 1's and 0's, which simply represents binary logic states. For example, a 1 refers to a high logic level and 0 refers to a low logic level. In one embodiment, a storage cell, such as a transistor or flash cell, may be capable of holding a single logical value or multiple logical values. However, other representations of values in computer systems have been used.

5 For example the decimal number ten may also be represented as a binary value of 1010 and a hexadecimal letter A. Therefore, a value includes any representation of information capable of being held in a computer system.

Moreover, states may be represented by values or portions of values. For example, a first value, such as a logical one, may represent a default or initial state, while a second value, such as a logical zero, may represent a non-default state. In addition, the terms "reset" and "set," in one

10 embodiment, refer to a default and an updated value or state, respectively. For example, a default value potentially includes a high logical value, i.e. reset, while an updated value potentially includes a low logical value, i.e. set. Note that any combination of values may be utilized to represent any number of states.

15 The embodiments of methods, hardware, software, firmware or code set forth above may be implemented via instructions or code stored on a machine-accessible, machine readable, computer-accessible, or computer-readable medium which is executable by a processing element. A non-transitory machine-accessible/readable medium includes any mechanism that provides (i.e., stores and/or transmits) information in a form readable by a machine, such as a

20 computer or electronic system. For example, a non-transitory machine-accessible medium includes random-access memory (RAM), such as static RAM (SRAM) or dynamic RAM (DRAM); ROM; magnetic or optical storage medium; flash memory devices; electrical storage devices; optical storage devices; acoustical storage devices; other forms of storage devices for holding information received from transitory (propagated) signals (e.g., carrier waves, infrared

signals, digital signals); etcetera, which are to be distinguished from the non-transitory mediums that may receive information there from.

Instructions used to program logic to perform embodiments of the disclosure may be stored within a memory in the system, such as DRAM, cache, flash memory, or other storage.

5 Furthermore, the instructions may be distributed via a network or by way of other computer-readable media. Thus, a machine-readable medium may include (but is not limited to) any mechanism for storing or transmitting information in a form readable by a machine (e.g., a computer) floppy diskettes, optical disks, Compact Disc, Read-Only Memory (CD-ROMs), and magneto-optical disks, Read-Only Memory (ROMs), Random Access Memory (RAM), Erasable
10 Programmable Read-Only Memory (EPROM), Electrically Erasable Programmable Read-Only Memory (EEPROM), magnetic or optical cards, flash memory, or a tangible, machine-readable storage used in the transmission of information over the Internet via electrical, optical, acoustical, or other forms of propagated signals (e.g., carrier waves, infrared signals, digital signals, etcetera). Accordingly, the computer-readable medium includes any type of tangible
15 machine-readable medium suitable for storing or transmitting electronic instructions or information in a form readable by a machine (e.g., a computer).

FIG. 1 is a diagram illustrating a laptop computing system **100** consistent with one embodiment of the present disclosure. As shown, laptop computing system **100** includes a plurality of housing portions **109**, **101**, **110**, **105** having features and sub-devices therein (or
20 thereon) consistent with conventional laptop systems.

One having ordinary skill in the art may appreciate that a computing system consistent with the present disclosure may include computing system assemblies other than laptop computing system **100**. For example, alternative computing system assemblies consistent with the present disclosure may include a standard one-piece clamshell that has a keyboard in one housing and a
25 display in the other. In addition, computing system assembly may include a 2-in-1 detachable

device that includes a keyboard in one housing and display in the other. In this implementation, the two sides may detach and reattach such that a touch-screen display may be used as a tablet in the detached state. Furthermore, computing system assembly may include a device which does not have a conventional keyboard but rather two touch screens, one in either housing. In this
5 implementation, at least one of the touch screens may be used to create a virtual touch-screen keyboard to replace a standard keyboard. As such, a computing system consistent with the present disclosure may include any desktop computer, laptop computing system, computer tablet, computer notebook, mobile phone, smartphone, etcetera which includes housing portions or covers to contain a chassis, electronic components, and devices therein.

10 Laptop computing system **100** includes an “A” housing **109**, “B” housing **101**, “C” housing **110**, and “D” housing **105**. In the present disclosure, a “housing” or “housing portion” may refer to an entire cover on one side of a computing system assembly or a portion thereof depending on the context given in a specific embodiment or implementation. However, one having ordinary skill in the art may appreciate that the present disclosure is not limited thereto.

15 In addition, laptop computing system **100** includes a display (within “B” housing portion **101**), keypad **102**, palm rest **103**, track pad **104**, (all within or thereon housing portion **110**) and exhaust vent **106**. One having ordinary skill in the art may appreciate that laptop computing system **100** may have more or less than the type and number of features and sub-devices shown in FIG. 1.

20 One having ordinary skill in the art may appreciate that various features and devices may be integrated therein, thereon, and between the housing portions. Accordingly, the present disclosure is not limited to any specific configuration as long as the housing portions are able to provide housing for one or more electronic components and sub-devices.

FIG. 2 is a diagram illustrating a bottom view of a first housing portion **201** of a prior art
25 laptop computing system **200** having a plurality of screws **214** there through. In FIG. 2, eight

screws **214** are shown which fasten the first housing portion **201** to a chassis (not shown) or second housing portion (not shown). Typically, a second housing portion is disposed on the opposite side of the first housing portion **201**, and both the first housing portion **201** and the second housing portion (not shown) provide housing for a chassis and electronic components disposed there between.

In one or more embodiments, first housing portion **201** is a “B” housing portion for a computing system, such as a laptop, whereas a second housing portion thereto is an “A” housing portion for the computing system. Alternatively, first housing portion **201** is a “D” housing portion for a laptop computing system **200** whereas the second housing portion (not shown) coupled thereto is a “C” housing portion for the laptop computing system **200**.

Notably, each of the screws **214** must be removed to disassemble the first housing portion **201** which may take a considerable amount of time. Therefore, care must be taken to prevent one from misplacing the screws **214** when the first housing portion **201** is disassembled. In addition, screws and other similar fasteners are rarely considered as top choices for fasteners in industrial designs of computing systems (e.g., desktop computer, laptop computing system, computer tablet, computer notebook, mobile phone, smartphone, and the like) being that more aesthetically pleasing components are preferred.

Further, a pair of hinges **203** is coupled to the first housing portion **201** such that another body, having a chassis and electronic components therein, may be integrated within the computing system **200**. For example, another body defined by third and fourth housing portions, having a chassis and electronic components disposed therein, may be coupled to the first housing portion **201** via hinges **203**.

One having ordinary skill in the art may appreciate that housing portions present within conventional computing systems may be coupled to a chassis or other housing portion via an adhesive. In these configurations, an end user may be instructed to ship the system to the

manufacturer to resolve defects therein. As such, it is desirable to have an aesthetically pleasing system that includes housing portions which allow assembly and disassembly with relative ease.

FIG. 3 is a diagram illustrating a first housing portion **301** and a second housing portion **302** of a computing system **300** prior to assembly, according to one embodiment of the present disclosure. As shown, first housing portion **301** is loosely coupled to second housing portion **302**. In particular, one end of first housing portion **301** rests on the extension **307** (from the base **309**) and slot structure **303** of the second housing portion **302**. However, the other end of first housing portion **301** is shown disposed beneath the slot structure **303** of second housing portion **302**.

In one embodiment of the present disclosure, first housing portion **301** may be characterized as being in a “cold condition” state. When the first housing portion **301** is in a “cold condition” state, no heating has been applied thereto and therefore the multi-metal latches are straight and un-deformed. Accordingly, in one embodiment, the multi-metal latches **308** of first housing portion **301** are not deformed because no overt heating has been applied to the latches **308**. Therefore, sub-metal layers **304**, **305** extend in a parallel direction from the first housing portion **301**.

The present disclosure, however, is not limited to the configuration of the first housing portion **301** shown in the FIG. 3 prior to assembly. Alternatively, the multi-metal latches **308** of the first housing portion **301** may be pre-heated before the housing portion **301** is assembled into the computing system **300**. In one embodiment, pre-heating causes the multi-metal latches **308** to contract and bend thereby making assembly into the computing system easier.

FIG. 4A is a diagram illustrating a cross section of a first housing portion **401** and a second housing portion **402** assembled in a computing system **400** consistent with an embodiment of the present disclosure. As shown, second housing portion **402** includes extensions **407** which extend from a base component **409**. In addition, slot structures **403** are configured such that first

housing portion **401** may receive second housing portion **402** there through. Advantageously, the first and second housing portions **401**, **402** provide housing for a chassis **413** and electronic components **414** within using screws, bolts, adhesives, or other conventional fasteners.

Each multi-metal latch **408** may include two or more sub-metal layers which have significantly different coefficient of thermal expansion (CTE) material properties. In some embodiments of the present disclosure, at least one of the sub-metal layers exhibits a high CTE material property and at least one of the sub-metal layer exhibits a low CTE material property.

Moreover, the multi-metal latches **408** may have varying material compositions for each sub-metal layer. For example, a first multi-metal latch **408** may have a sub-metal layer comprising an iron and copper alloy and another sub-metal layer may comprise a nickel, chromium, and iron alloy. A second multi-metal latch **408** may have a sub-metal layer comprising a nickel, manganese, and iron alloy whereas another sub-metal layer comprises a nickel and iron alloy.

Each sub-metal layer of the multi-metal latches **408** may include a pure metal or alloy depending on the material properties desired. For example, a sub-metal layer may be chosen for a desirable CTE material property.

In one embodiment of the present disclosure, the multi-metal latches **408** include two sub-metal layers such that each multi-metal latch is a bi-metal latch **408**. For instance, a first sub-metal layer **404** may exhibit a low CTE material property whereas a second sub-layer **405** may exhibit a high CTE material property such that the bi-metal latch **408** bends a predetermined degree upon application of a high or low temperature. Alternatively, a pure or alloy metal layer may simply contract or expand when heating or cooling is applied.

In contrast, when heating or cooling is applied to the bi-metal latches **408**, the latches **408** may either contract and/or deflect (e.g., bend) or expand. In one embodiment, upon heating, the bi-metal latches **408** contract and/or deflect, whereas upon cooling, the latches **408** expand into a straight or semi-straight position.

It should be appreciated by one having ordinary skill in the art that the present disclosure is not limited to a multi-metal latch (e.g., bi-metal latch) which behaves according to the aforementioned construction. As such, in some embodiments of the present disclosure, the bi-metal latches **408** may contract and/or deflect upon cooling and expand upon heating.

5 In some embodiments, first sub-metal layer **404** includes an alloy comprising nickel, manganese, and iron which collectively exhibits a relative high CTE property of 27.7×10^{-6} m/m K. The material composition of the exemplary first layer **404** may be the following: 10% nickel, 72% manganese, and 18% copper.

10 Other high-CTE metal materials which are suitable for the bi-metal latches **408** are the following: TM1 (22% nickel, 3% chromium, and 75% iron); TM5 (25% nickel, 8.5% chromium, and 66.5% iron); TM20 (18% nickel, 11.5% chromium, and 70.5% iron); TB0965 (20% nickel, 6% manganese, and 74% iron); TB1075 (16% nickel, 11% chromium, and 73% iron); and TB20110 (10 – 16% nickel, 65.5-79.5% manganese, 10 – 18% copper, and 0.5% iron).

15 Further, second sub-metal layer **405** may include an alloy, comprising nickel and iron, which exhibits a relatively low CTE property of 1.5×10^{-6} m/m K. The material composition of the exemplary second sub-metal layer **405** may be the following: 36% nickel and 64% copper.

Other low CTE metal materials which are suitable for the bi-metal latches **408** are the following: TM5 (50% nickel and 50% iron); TB0965 (46% nickel and 54% iron); TB1075 (20% nickel, 8% chromium, 46% iron, and 26% cobalt); and TB1170A (42% nickel and 58% iron).

20 In addition, sub-metal layers **404**, **405** may exhibit a relatively high flexivity material property. For instance, the aforementioned first and second sub-metal layers **404**, **405** exhibit a flexivity of $38.7 \pm 5\%$ and $39.0 \pm 5\%$ ($\times 10^{-6} \text{ K}^{-1}$), respectively.

The flexivity of bi-metal latches **408** may be defined as a thermal activity metric which represents the change of a curvature of the longitudinal center line per unit temperature change

of unit thickness. Most notably, a relative high flexivity value may enable the bi-metal latches **408** to deflect and bend to a greater degree upon heating or cooling.

Sub-metal layers **404**, **405** may respond to varying temperatures. In some embodiments, first layer **404** may respond to temperatures that range from -18°C to 204°C. Second layer **405** may respond to temperatures that range from -20°C to 200°C.

One having ordinary skill in the art may appreciate that the sub-metal layers **404**, **405** are not limited to responding to temperatures within the aforementioned temperature range. As such, sub-metal layers **404**, **405** may respond to any temperature within a suitable temperature such that bi-metal latches **408** expand or deflect according to the temperature applied to the latches **408**.

The present disclosure is not limited to a multi-metal latch, such as bi-metal latch **408**. Any material which can change from one physical state to another state, upon application of cooling upon application of heating such that a latching function may be provided in one of the states is within the spirit and scope of the present disclosure. For example, a memory metal may be substituted for the bi-metal materials as latches disposed on the housing portions of the computing systems and electronic device assemblies.

FIG. 4B is a diagram illustrating a first housing portion **401** having a bi-metal latch **408** in a deflected state, according to one embodiment of the present disclosure. Notably, the bi-metal latches **408** are deformed such that sub-metal layers **404**, **405** are bent (e.g., in an upwards direction) relative to the positions of the extension **407** and slot structure **403** due to the difference in CTE material property between sub-metal layer **404** and sub-metal layer **405**.

In one embodiment of the present disclosure, bi-metal latches **408** deflect or bend upon the application of heating or cooling depending upon the number of contact points of the latches **408**. For the embodiment shown in FIG. 5A, which is a single contact point configuration for the bi-metal latches **408**, the amount of deflection (D) may be measured accordingly: $D(\text{mm}) =$

$(0.53K\Delta TL^2)/t$ wherein t is the thickness of the bi-metal latch **408** and L is the length of the latch **408**.

In some embodiments, the bi-metal latches **408** may have a dual contact-point configuration. In this embodiment, the amount of deflection can be determined as follows: $D(\text{mm}) =$
5 $(0.53K\Delta TL^2)/4t$.

In some implementations, the amount of deflection/bending needed to transition the bi-metal latches **408** between a latch state to an un-latch state may be a few millimeters. For example, upon heating, the bi-metal latches **408** may deflect 1 mm for the latches **408** to transition from a latch state to an un-latch state according to one embodiment of the present disclosure.

10 FIG. 5A is a diagram illustrating a bottom view of a first housing portion **501** having a plurality of bi-metal latches **502** in a first state, according to one embodiment of the present disclosure. In the embodiment shown, three bi-metal latches **502** are disposed on one end of the first housing portion **501**. However, the present disclosure is not limited thereto. For instance, the number of bi-metal latches **502** incorporated in the assembly may depend upon the
15 dimensions of the first housing portion **501**. In some embodiments, the bi-metal latches **502** are placed in locations upon the first housing portion **501** where a conventional screw or other fastener would be inserted through the housing portion **501** to another chassis or opposing housing portion.

[0001] In addition, the bi-metal latches **502** are shown coupled on the bottom surface on the
20 end of the first housing portion **501**. However, in one embodiment, the bi-metal latches **502** may be disposed on an edge of the first housing portion **501** as shown in FIG. 3 and FIGS. 4A – 4B.

[0002] The bi-metal latches **502** shown in FIG. 5A have a first set of dimensions which is a function of the temperature of the latches **502**. In one embodiment, the dimensions of the bi-metal latches **502** are a function of the amount of heating or cooling applied to the latches **502**. For

example, heating has been applied to the bi-metal latches **502** in FIG. 5A as evident by the relative size of the bi-metal latches **502** when compared to the size of the bi-metal latches **502** in FIG. 5B.

[0003] It should be understood by one having ordinary skill in the art that the dimensions of the bi-metal latches **502** shown in FIGS. 5A and 5B are not drawn to scale. Therefore, the exact temperature of the bi-metal latches **502**, or the amount of heating or cooling applied thereto, may not necessarily be determined from the first set of dimensions of the latches **502** shown in the figure.

[0004] FIG. 5B is a diagram illustrating a bottom view of a first housing portion **501** having a plurality of bi-metal latches **502** in a second state, according to one embodiment of the present disclosure. Most notably, the second set of dimensions of the bi-metal latches **502** is greater than the first set of dimensions of the latches **502** in FIG. 5A.

[0005] In one embodiment of the present disclosure, the increase in size of the bi-metal latches **502** is due to cooling applied to the bi-metal latches **502**. As such, bi-metal latches **502** may expand upon cooling and contract and/or deflect to some degree when heated. One having ordinary skill in the art may appreciate that the present disclosure is not so limited and that, alternatively, the bi-metal latches **502** may expand upon heating and contract and/or deflect upon cooling.

[0006] The bi-metal latches **502** may be heated and cooled a plurality of cycles. For example, the bi-metal latches **502** may be heated and cooled over 1,000 cycles without impairing the physical integrity and performance of the latches **502**.

[0007] In one or more embodiments of the present disclosure, the bi-metal latches **502** may be cooled to a temperature within a temperature range of 40°C – 50°C. Notably, during normal operation, the temperature of the computing system and the bi-metal latches **502** therein may fall within this temperature range. Furthermore, when the computing system “powers down” from use, the temperature of the bi-metal latches **502** may fall considerably below the 40°C – 50°C temperature range and remain in a latch state.

[0008] In some embodiments, when the bi-metal latches **502** are cooled, or during normal operation, the latches **502** expand into a near straight position as shown in FIG. 4A. Alternatively, when the bi-metal latches **502** are heated within a temperature range of 200°C – 300°C, the latches **502** contracts into a deflected state as shown in FIG. 4B.

5 [0009] It should be understood by one having ordinary skill in the art that the bi-metal latches **502** may be heated or cooled by any of a number of techniques and that the present disclosure is not limited to any one in particular. For example, a heating and/or cooling device may be placed in close proximity to the bi-metal latches **502** and the latches **502** will behave according to the temperature achieved from placing the heating and/or cooling device in close proximity thereto.

10 [0010] FIG. 6 is a diagram illustrating a manner of coupling a first housing portion **601** to a second housing portion **621** within a computing system assembly **600** consistent with the present disclosure. As shown, first housing portion **601** is slidably coupled along slot structures **622** (see FIGS. 4A and 4B) of second housing portion **621** such that the first housing portion **601** fits within the area underneath the second housing portion **621**.

15 [0011] During assembly, the first housing portion **601** may be inserted in direction **623** at a first end **611** (e.g., near a hinge side of computing system assembly **600**) of the second housing portion **621** until the first housing portion **601** reaches a second end **612** (near palm rest **610** of computing system assembly **600**) underneath the second housing portion **621**. The plurality of bi-metal latches **602** extend to the slot structure **603**. In some embodiments, the second end **612** of the
20 first housing portion **601** may be closed such that the first housing portion **601** is assembled only from the first end **611** of the second housing portion **621**.

[0012] FIG. 7 is a diagram illustrating a flowchart **700** of a method for assembling housing portions within a computing system, according to one embodiment of the present disclosure. In one embodiment, the method begins with providing a first housing portion having structures which
25 define a pair of slots (block **701**). Next, block **702** provides coupling the first housing portion to a

second housing portion by way of the pair of slots of the first housing portion. Further, the second housing portion comprises a plurality of multi-metal latches coupled thereto which provide the aforementioned advantages.

[0013] In one embodiment, the second housing portion comprises a multi-metal material body which may expand or contract (and deflect) when the multi-metal material is heated or cooled by a temperature source. As such, because the second housing portion comprises a multi-metal material body, there is no need for a plurality of multi-metal latches to be coupled thereto according to this embodiment of the present disclosure.

[0014] After the first housing portion is coupled to the second housing portion, the multi-metal latches are cooled to lock the second housing portion into place (block 703). In one embodiment, the bi-metal latches may be also pre-heated to cause the multi-metal latches to contract, deflect and bend for easy assembly into the computing system.

[0015] Lastly, block 704 provides heating the bi-metal latches to unlock the second housing portion from the first housing portion thereby disassembling the second housing portion from a computing system. Accordingly, the second housing portion can be assembled to and disassembled from a computing system (e.g., desktop, laptop system, smartphone, etc.) using the method disclosed in flowchart 700 many times without affecting the physical integrity of the multi-metal latches.

[0016] While the present disclosure has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present disclosure.

[0017] Reference throughout this specification to “some embodiments” or “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present

disclosure. Thus, the appearances of the phrases “in one embodiment” or “in some embodiments” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

5 [0018] In the foregoing specification, a detailed description has been given with reference to specific exemplary embodiments. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the disclosure as set forth in the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative sense rather than a restrictive sense. Furthermore, the
10 foregoing use of embodiment and other exemplarily language does not necessarily refer to the same embodiment or the same example, but may refer to different and distinct embodiments, as well as potentially the same embodiment.

What is claimed is:

1. An apparatus, comprising:
a first housing portion that includes at least one multi-metal latch,
wherein the first housing portion is to couple to a second housing portion in response to the
5 at least one multi-metal latch being at a temperature in a first temperature range and wherein the first
housing portion is to decouple from the second housing portion in response to the at least one multi-
metal latch being at a temperature in a second temperature range.
2. The apparatus of claim 1 further comprising a third housing portion which has a surface
that is exposed to the second housing portion in addition to a fourth housing portion on an opposite
10 surface of the third housing portion, wherein the third housing portion and the fourth housing
portion provides housing for a second chassis and at least one electronic component.
3. The apparatus of claim 1, wherein the first housing portion, second housing portion, and
the at least one multi-metal latch are components of a mobile phone, smartphone, computer tablet,
laptop, or desktop computer.
- 15 4. The apparatus of claim 1, wherein the at least one multi-metal latch comprises three,
four, or five latches.
5. The apparatus of claim 1, wherein the at least one multi-metal latch includes at least one
bi-metal latch.
6. The apparatus of claim 1, wherein the at least one multi-metal latch is disposed on one
20 end of the first housing portion.
7. The apparatus of claim 1, wherein the at least one multi-metal latch includes a first

sub-metal layer which has a first coefficient of thermal expansion and a second sub-metal layer which has a second coefficient of thermal expansion.

8. The apparatus of claim 1, wherein the first housing portion comprises a multi-metal material body.

5 9. A system, comprising:

a first housing;

a hinge to couple the first housing to a second housing; and

the second housing to include a first and second housing portion, wherein the first

housing portion includes at least one multi-metal latch, wherein the first housing portion is to couple

10 to the second housing portion in response to the at least one multi-metal latch being at a temperature

in a first temperature range and wherein the first housing portion is to decouple from the second

housing portion in response to the at least one multi-metal latch being at a temperature in a second temperature range.

10. The system of claim 9, wherein each multi-metal latch has a first set of dimensions when

15 the temperature of each multi-metal latch is within the first temperature range and wherein each

multi-metal latch has a second set of dimensions when the temperature of each multi-metal latch is within the second temperature range.

11. The system of claim 9, wherein the first and second housing portions provide housing for a chassis and at least one electronic component.

20 12. The system of claim 9, wherein each least one multi-metal latch is equally spaced on the surface of the first housing portion.

13. The system of claim 9, wherein the first temperature range is 50°C – 200°C and the

second temperature range is 0°C – 40°C.

14. The system of claim 9, wherein the first housing portion is in a contracted position when the at least one multi-metal latch is at a temperature within a first temperature range and wherein the first housing portion is in an extended position when the at least one multi-metal latch is at a temperature within a second temperature range.

15. The system of claim 9, wherein at least one sub-metal layer of the at least one multi-metal latch includes nickel, manganese, and copper and wherein at least one other sub-metal layer includes nickel and iron.

16. The system of claim 9, wherein the second housing portion has a closed end which limits the horizontal displacement of the first housing portion when assembled.

17. A method, comprising:

providing a first housing portion of a computing system having at least one slot structure; assembling the first housing portion into the computing system by coupling the first housing portion to a second housing portion by way of the at least one slot structure of the first housing portion,

wherein the second housing portion includes a plurality of bi-metal latches thereon, wherein the first housing portion and the second housing portion provide housing for a chassis and at least one electronic component; and

cooling the plurality of bi-metal latches to lock the second housing portion into place.

18. The method of claim 17 further comprising pre-heating the plurality of bi-metal latches prior to assembling the second housing portion into the computing system.

19. The method of claim 17 further comprising heating the plurality of bi-metal latches to

disassemble the second housing portion from the computing system.

20. The method of claim 19, wherein the heating causes the plurality of bi-metal latches to contract and deflect.

FIGURE 1

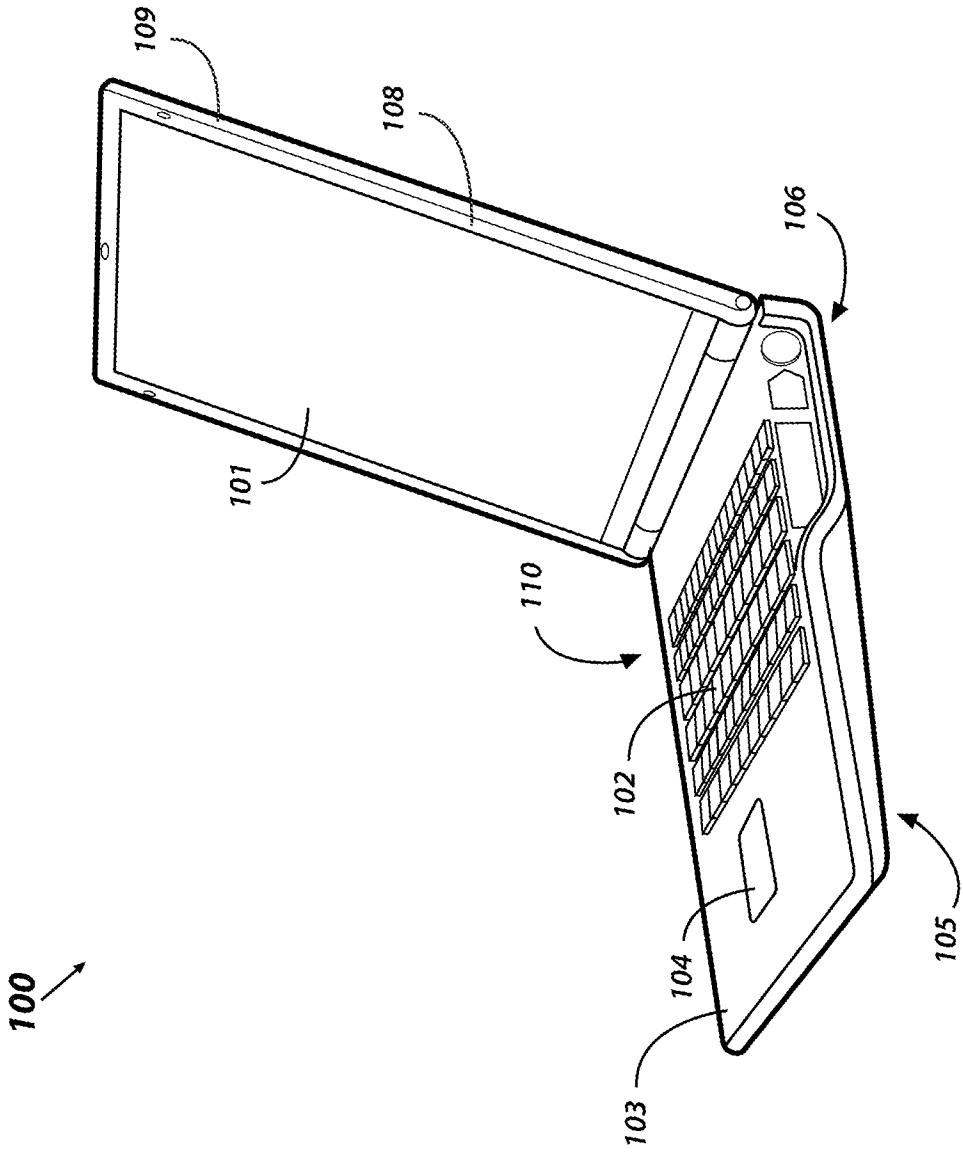


FIGURE 2
PRIOR ART

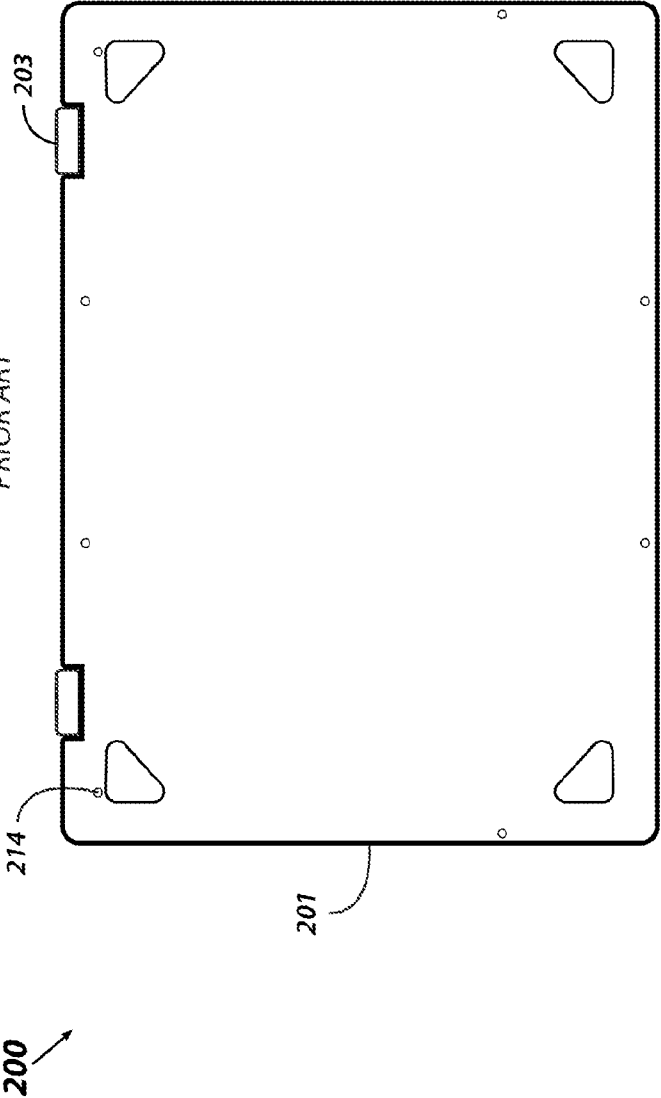
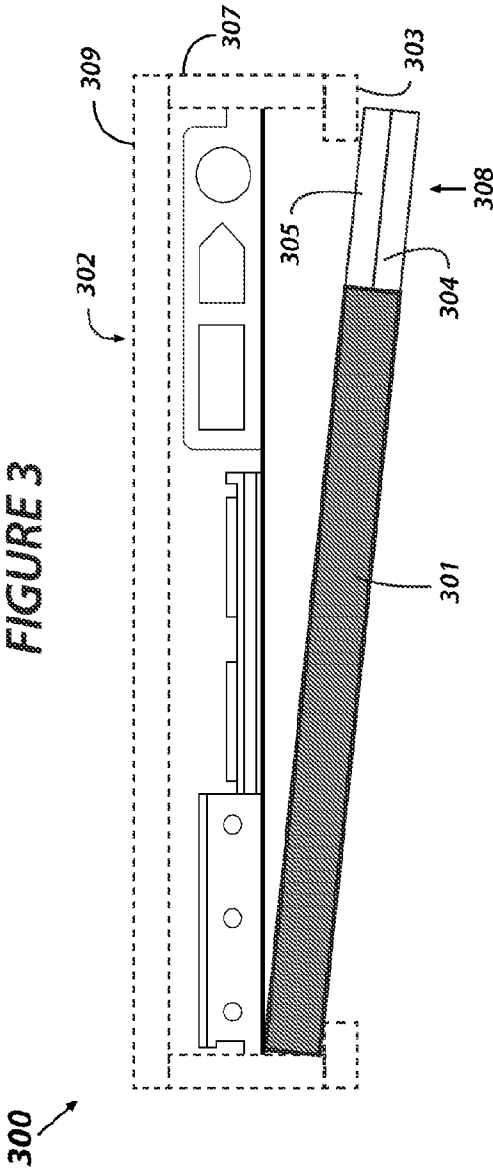


FIGURE 3



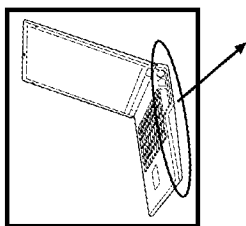


FIGURE 4A

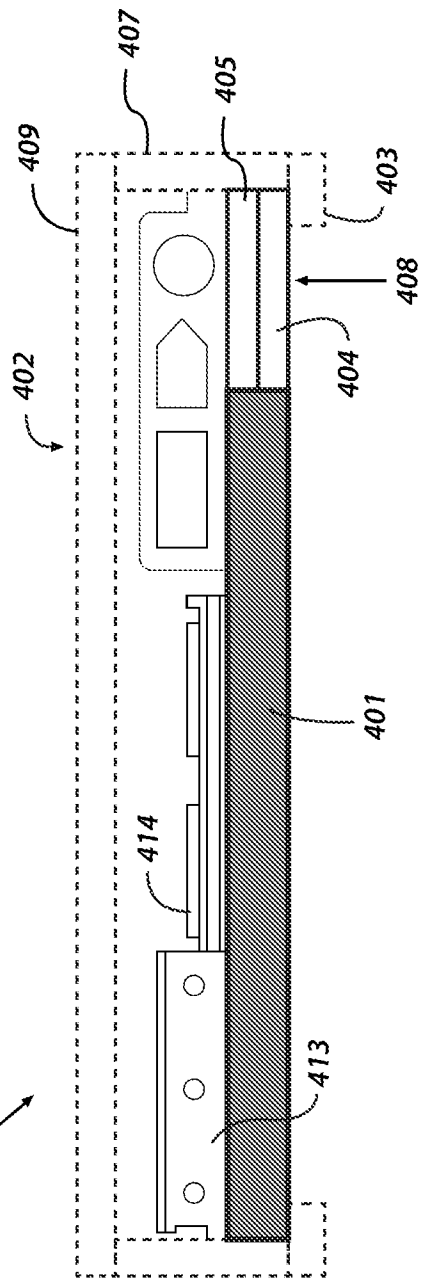


FIGURE 4B

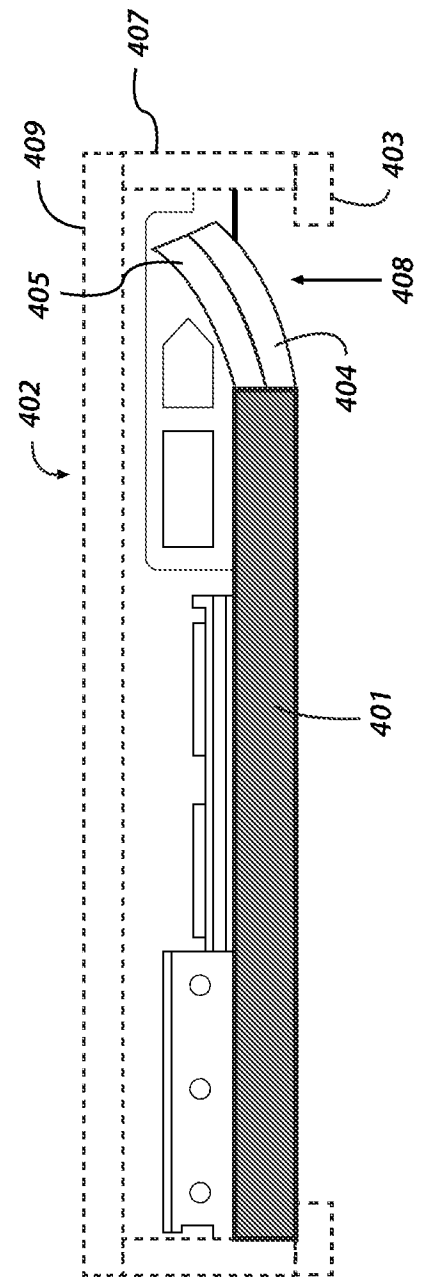


FIGURE 5A

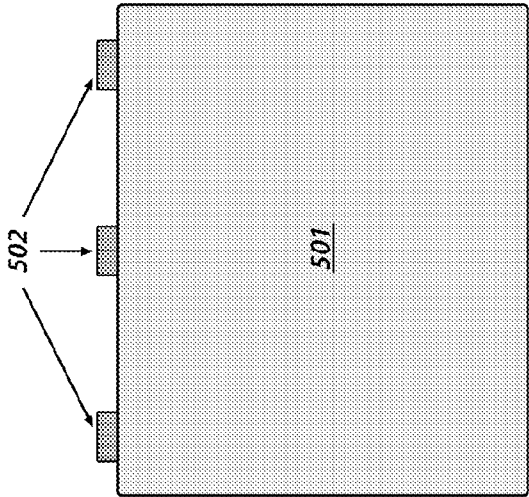


FIGURE 5B

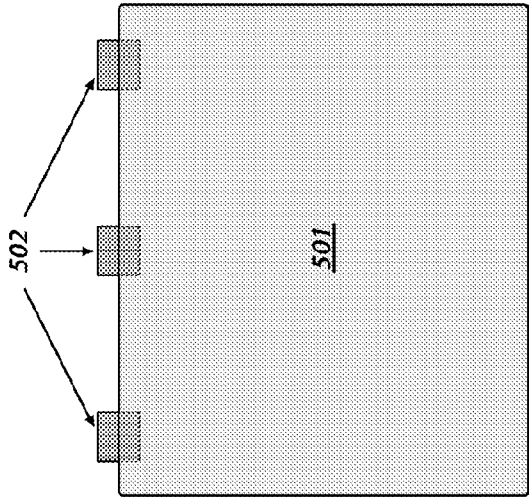
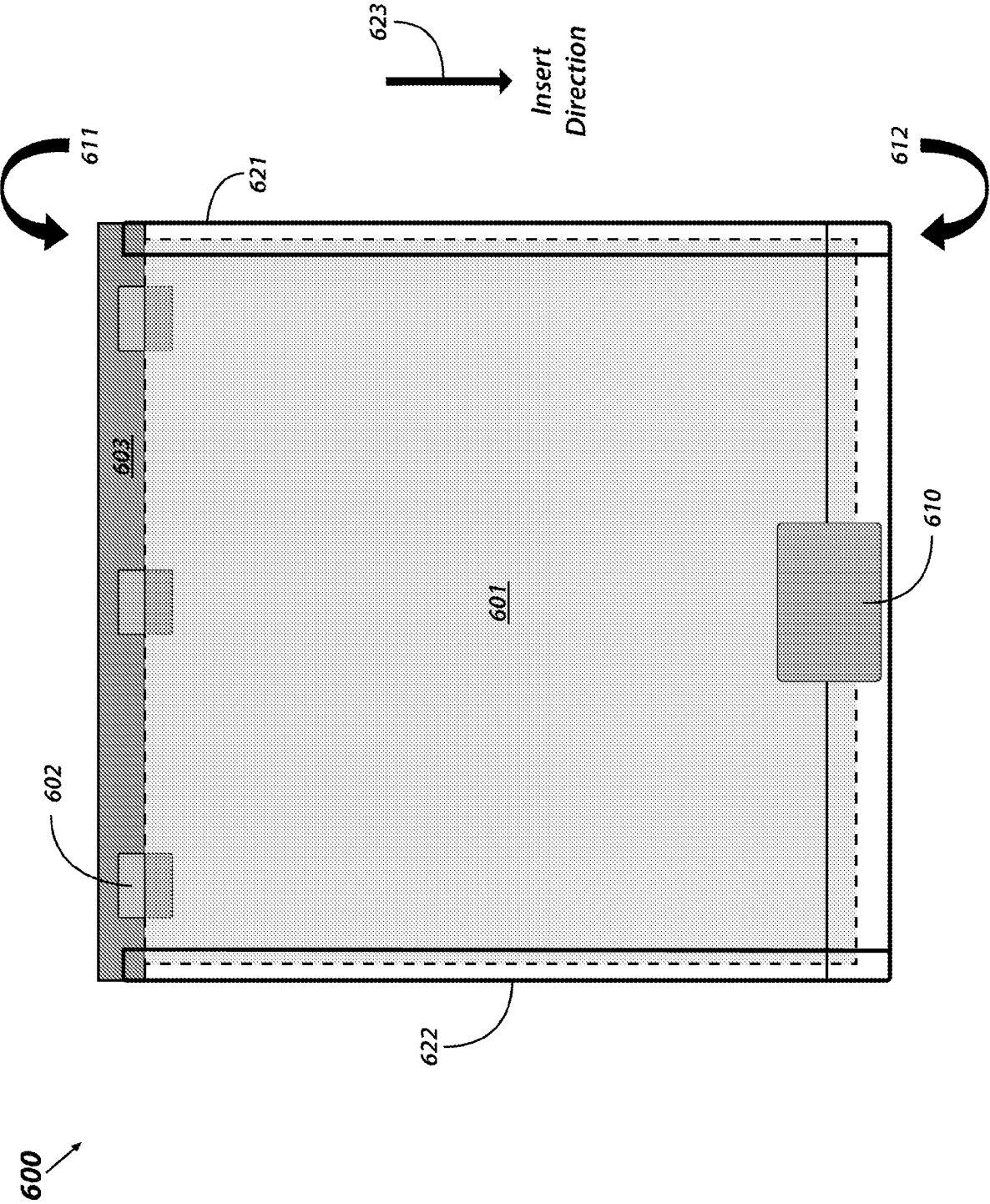
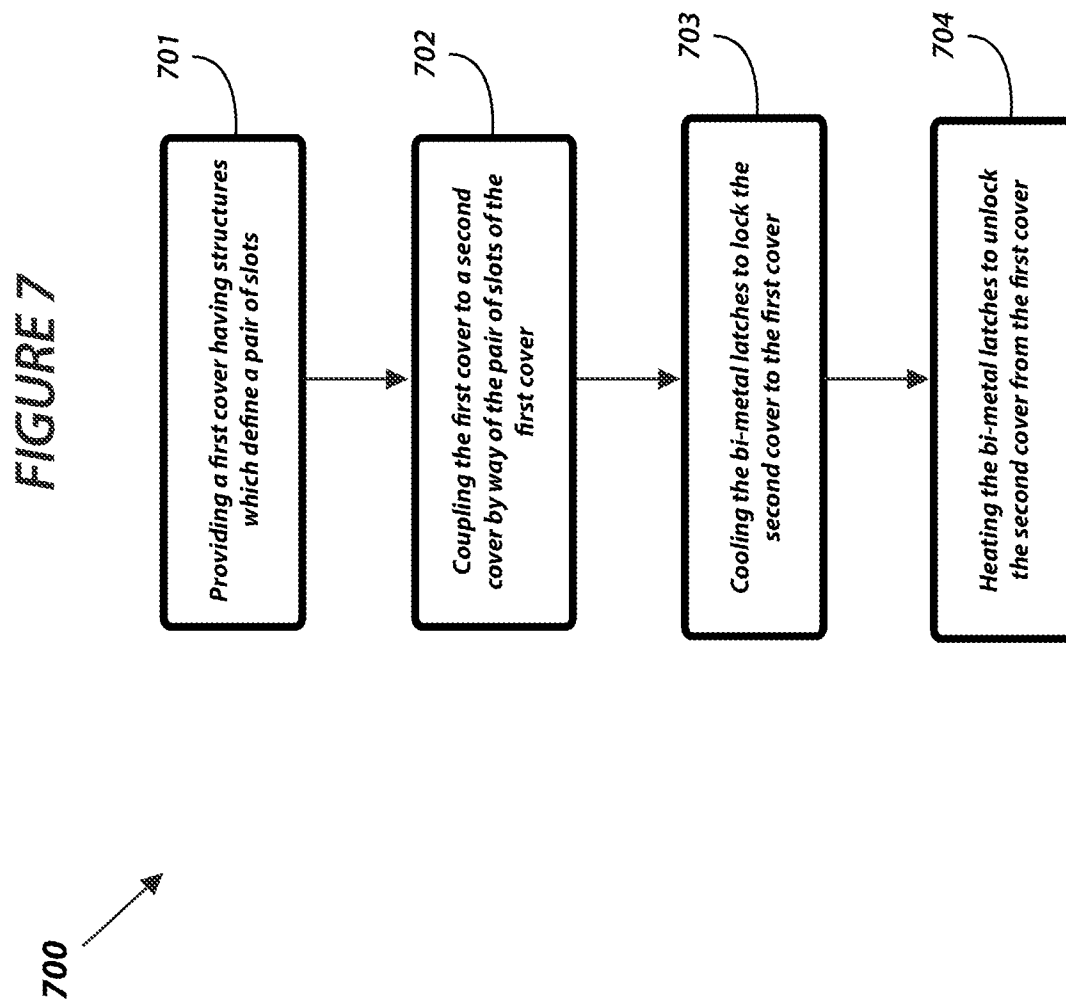


FIGURE 6





INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/032216**A. CLASSIFICATION OF SUBJECT MATTER****H05K 5/02(2006.01)i, G06F 1/16(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H05K 5/02; H05K 7/20; F16M 11/22; G06F 1/20; G06F 1/16; F28D 15/02

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: screwless, latch, housing, computer, desktop, temperature, hinge, chassis

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007-0109737 A1 (MICHAEL KRIEGE et al.) 17 May 2007 See paragraphs [0033]-[0063] and figures 1-6.	1-20
Y	US 6278607 B1 (ANDREW MOORE et al.) 21 August 2001 See column 2, lines 61-67, column 4, line 36 - column 5, line 48 and figures 4-6.	1-20
A	JP 2002-099356 A (TOSHIBA CORP.) 05 April 2002 See abstract, paragraphs [0037]-[0073] and figures 1-8.	1-20
A	US 2010-0193656 A1 (ERAN WILKENFELD) 05 August 2010 See abstract, paragraphs [0033]-[0045] and figures 1-2.	1-20
A	US 6507488 B1 (THOMAS MARIO CIPOLLA et al.) 14 January 2003 See column 5, line 14 - column 7, line 15, claim 1 and figures 1-4.	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

19 December 2014 (19.12.2014)

Date of mailing of the international search report

22 December 2014 (22.12.2014)

Name and mailing address of the ISA/KR

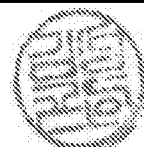
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/032216

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