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(54) Title: KEYBOARD ASSEMBLY FOR AN ELECTRONIC DEVICE

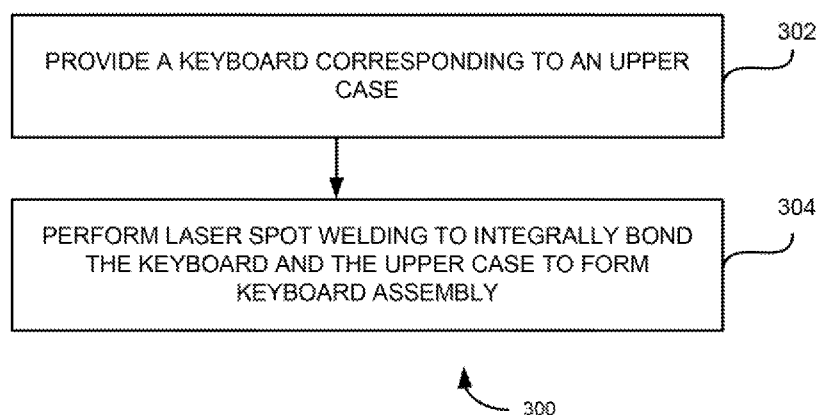


FIG. 3

(57) Abstract: In one example, a keyboard assembly for an electronic device is disclosed. The keyboard assembly may include a keyboard and an upper case having a space for accommodating the keyboard. The keyboard may be bonded to the upper case by at least one laser spot weld.



KEYBOARD ASSEMBLY FOR AN ELECTRONIC DEVICE

BACKGROUND

[0001] Electronic devices, such as notebook type personal computers, may include a casing, a printed circuit board housed inside the casing, and a keyboard attached to the casing. For example, the casing may consist of a bottom case and an upper case. The upper case may include a space for accommodating the keyboard that acts as an interface to provide inputs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] Examples are described in the following detailed description and in reference to the drawings, in which:

[0003] Fig. 1 depicts a perspective view of an example keyboard assembly;

[0004] Fig. 2A depicts a perspective view of another example keyboard assembly;

[0005] Fig. 2B illustrates an example electronic device depicting the keyboard assembly of Fig. 2A, formed using at least one laser spot weld; and

[0006] Fig. 3 depicts an example flow chart of forming a keyboard assembly for an electronic device.

DETAILED DESCRIPTION

[0007] An electronic device may include a display panel and a main body. The main body may include a housing consisting of an upper case and a lower case. The upper case may include a space for accommodating a keyboard. In some examples, a plastic frame may be adhesively bonded to the upper case/top case, for instance, using glue and then hot-melted plastic posts may be used to attach the keyboard with the upper case with the plastic frame disposed between the upper case and the keyboard. For example, the hot plastic posts may be disposed corresponding to openings defined in the keyboard and then hot-melted to attach

the keyboard to the upper case. The aforementioned process may be complex and need significant amount of verification time, thus effecting the early yield process.

[0008] Examples described herein may provide keyboard assembly for an electronic device. The keyboard assembly may include a keyboard and an upper case having a space for accommodating the keyboard. In one example, the keyboard may be bonded to the upper case by at least one laser spot weld. The keyboard may be bonded to the upper case by directing a laser beam through the upper case and/or the keyboard to form at least one laser spot weld between the upper case and the keyboard.

[0009] Examples described herein may not involve a plastic frame and hot-melted plastic posts to combine the top case and the keyboard. Further, the examples described herein may obviate processes such as plastic tooling, bonding fixture, and hot-melt fixture for securing the plastic frame to keyboard assembly, thereby reducing verification time and improving yield rate. Examples described herein may reduce manufacturing cost, thickness and weight of the electronic device.

[0010] Referring now to figures, Fig. 1 depicts a perspective view of an example keyboard assembly 100 for an electronic device. For example, the electronic device may include a main body to accommodate battery, storage devices, integrated circuits (e.g., a motherboard to which the electronics are mounted or connected), and the like. The main body may include a housing formed of an upper case 104 and a lower case (e.g., 216 as shown in Fig. 2B). As shown in Fig. 1, keyboard assembly 100 may be formed by attaching a keyboard 102 to upper case 104 (e.g., top C case). Example upper case 104 may be made of a metal. Example keyboard 102 may include plurality of keys that are electrically connected to the integrated circuits via respective connectors.

[0011] Further, upper case 104 may include a space 106 for accommodating keyboard 102. In one example, keyboard 102 may be bonded to upper case 104 by at least one laser spot weld 108. Fig. 1 depicts an example partial cross

sectional view 110 of keyboard assembly 100 showing laser spot welds 108 to secure keyboard 102 to upper case 104.

[0012] In one example, as shown in Fig. 1, space 106 may be defined by a recess with a depth extending from a top surface to a lower surface of upper case 104, such that keyboard 102 may be bonded to the top surface of upper case 104. In another example, space 106 may include a plurality of openings to receive keys provided in keyboard 102. In this case, each key may be exposed through a corresponding one of the openings from the bottom surface of upper case 104 (e.g., as shown in Fig. 2A).

[0013] In the example shown in FIG. 1, upon disposing keyboard 102 onto space 106 from the top (e.g., as shown by arrow direction in Fig. 1), keyboard 102 may be bonded to upper case 104 by laser spot welds 108. In one example, keyboard 102 may be bonded to upper case 104 by directing a laser beam through upper case 104 or keyboard 102 to form laser spot welds 108 between upper case 104 and keyboard 102. The "laser spot weld" may be formed by a welding technique (e.g., laser spot welding technique) that uses a laser to create a single laser spot weld. In the example of Fig. 1, keyboard 102 may be bonded to a top surface of upper case 104 using the laser spot welding.

[0014] During the laser spot welding, a laser beam from a laser spot welder may be irradiated/focused through upper case 104 and/or keyboard 102 at a weld region. Upon irradiating the laser beam at the weld region, a portion of upper case 104 and keyboard 102 may get volatilized such that a keyhole bounded by molten material may be formed at the weld region. Example molten material may be material of upper case 104 and/or keyboard 102. Example upper case 104 may be made of material selected from aluminium, magnesium, aluminium alloy, magnesium aluminum alloy and/or the like. Example keyboard 102 may be made of material selected from plastic, thermoplastic resin, polyester and/or the like. After laser irradiation, the molten material may get solidified and filled into the keyhole to create laser spot welds 108 extending along an interface between upper case

104 and keyboard 102. Example laser spot welding can be carried out within a few milliseconds.

[0015] In one example, laser spot welds 108 may be formed between upper case 104 and keyboard 102 by creating multiple spot welds (e.g., 108 of Fig. 1) at scattered points between upper case 104 and keyboard 102. In another example, laser spot welds 108 may be formed between upper case 104 and keyboard 102 by creating a laser-seam-weld by performing a series of overlapping spot welds (e.g., 208 of Fig. 2A) between upper case 104 and keyboard 102. Example multiple spot welds and laser-seam-weld may be created in a same way as described in the aforementioned laser spot welding technique.

[0016] Fig. 2A depicts a perspective view of another example keyboard assembly 200A. Fig. 2B illustrates an example electronic device 200B depicting keyboard assembly 200A of Fig. 2A, formed by laser spot welds 208A-208N. Example electronic device 200B may be a notebook personal computer, laptop computer, a tablet computer, or the like. Electronic device 200B may include a display unit 218 and a base portion 220 connected to display unit 218. For example, base portion 220 may accommodate battery, storage devices, integrated circuits (e.g., a motherboard to which the electronics are mounted or connected), and the like.

[0017] Base portion 220 may include a housing formed of an upper case 204 and a lower case 216. Further, base portion 220 may include a keyboard 202 having a plurality of keys 210. Upper case 204 may include a plurality of openings 212 (e.g., as shown in Fig. 2A) to receive keys 210 provided in keyboard 202. In one example, upper case 204 may include a space 206 having plurality of openings 212. Further, openings 212 may be formed to sizes corresponding respectively to keys 210 provided at keyboard 202. In the example shown in Figs. 2A and 2B, keyboard 202 may be disposed underneath upper case 204 such that keys 210 are exposed through respective openings 212 provided in upper case 204 (e.g., as shown by arrow direction in Fig. 2A).

[0018] Upon disposing keyboard 202 underneath upper case 204, keyboard 202 may be bonded to upper case 204 using laser spot welds 208A-208N. Keyboard 202 may be integrally bonded to upper case 204 by directing a laser beam through upper case 204 and/or keyboard 202 to form laser spot welds 208A-208N between upper case 204 and keyboard 202. Further, Fig. 2A depicts an example partial cross sectional view 214 of keyboard assembly 200A showing laser spot welds 208A-208N to secure keyboard 202 to upper case 204.

[0019] In one example, laser spot welds 208 may be formed by creating multiple spot welds (e.g., 208 as shown in Fig. 2B) at scattered points between upper case 204 and keyboard 202. Example multiple spot welds (e.g., 208) may be discretely formed between upper case 204 and keyboard 202, at gaps located between each adjacent keys 210. In another example, laser spot welds 208 may be formed by creating a laser-seam-weld (e.g., 208A-208N as shown in Fig. 2A) by performing a series of overlapping spot welds between upper case 204 and keyboard 202. Example laser-seam-weld may be formed between upper case 204 and keyboard 202, at a location where a continuous gap is formed between each row/column of keys 210 and/or boundary portions of upper case 204 and keyboard 202. In one example, laser spot welds 208A-208N may be of various joint geometries such as lap, butt, fillet, and the like. Further, each laser spot weld may be of equal or unequal width/depth and spaced at equal/unequal interval.

[0020] Fig. 3 depicts an example flow chart 300 of a process of forming a keyboard assembly for an electronic device. It should be understood that the process depicted in Fig. 3 represents generalized illustrations, and that other processes may be added or existing processes may be removed, modified, or rearranged without departing from the scope and spirit of the present application.

[0021] At 302, a keyboard may be provided corresponding to an upper case. Example keyboard may include a wired or wireless keyboard. For example, upper case may include a metal case of an electronic device, for instance, a notebook personal computer. In one example, the upper case may include a plurality of openings, that are formed to sizes corresponding respectively to a plurality of keys

of the keyboard. Further, the keyboard may be disposed beneath a lower surface of the upper case such that the keys are exposed through the respective openings (e.g., as shown in Fig. 2A). In another example, the keyboard may be bonded to a top surface of the upper case (e.g., as shown in Fig. 1).

[0022] At 304, the keyboard and the upper case may be laser spot welded to form the keyboard assembly. The keyboard assembly can be used for inputting data to the notebook personal computer. In one example, laser spot welds (e.g., 108 of Fig. 1) may be created by directing a laser beam to secure the keyboard to the upper case. Example upper case may be formed from a metal such as aluminum. In one example, multiple spot welds may be created at scattered points between the upper case and the keyboard. In another example, a laser-seam-weld may be created by performing a series of overlapping spot welds (e.g., 208A-208N of Fig. 2A) between the upper case and the keyboard. Further, automation of laser spot welding to secure the keyboard and the uppercase can be achieved by using a welding robot, thereby enhancing the productivity.

[0023] It may be noted that the above-described examples of the present solution are for the purpose of illustration only. Although the solution has been described in conjunction with a specific embodiment thereof, numerous modifications may be possible without materially departing from the teachings and advantages of the subject matter described herein. Other substitutions, modifications and changes may be made without departing from the spirit of the present solution. All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0024] The terms "include," "have," and variations thereof, as used herein, have the same meaning as the term "comprise" or appropriate variation thereof. Furthermore, the term "based on", as used herein, means "based at least in part

on.” Thus, a feature that is described as based on some stimulus can be based on the stimulus or a combination of stimuli including the stimulus.

[0025] The present description has been shown and described with reference to the foregoing examples. It is understood, however, that other forms, details, and examples can be made without departing from the spirit and scope of the present subject matter that is defined in the following claims.

WHAT IS CLAIMED IS:

1. A keyboard assembly for an electronic device, comprising:
a keyboard; and
an upper case having a space for accommodating the keyboard, wherein the keyboard being bonded to the upper case by at least one laser spot weld.
2. The keyboard assembly of claim 1, wherein the keyboard is bonded to the upper case by directing a laser beam to form the at least one laser spot weld between the upper case and the keyboard.
3. The keyboard assembly of claim 2, wherein the at least one laser spot weld is formed between the upper case and the keyboard, by at least one of:
creating multiple spot welds at scattered points between the upper case and the keyboard; and
creating a laser-seam-weld by performing a series of overlapping spot welds between the upper case and the keyboard.
4. The keyboard assembly of claim 1, wherein the keyboard is bonded to a top surface of the upper case.
5. The keyboard assembly of claim 1, wherein the upper case includes a plurality of openings, that are formed to sizes corresponding respectively to a plurality of keys provided at the keyboard, wherein the keyboard is integrally bonded to a lower surface of the upper case such that the keys are exposed through the corresponding openings.
6. The keyboard assembly of claim 1, wherein the upper case is made of material selected from a group consisting of aluminium, magnesium, aluminium alloy, and magnesium aluminum alloy.
7. The keyboard assembly of claim 1, wherein the keyboard is made of material selected from a group consisting of plastic, thermoplastic resin, and polyester.

8. An electronic device, comprising:
a display unit; and
a base portion connected to the display unit, wherein the base portion comprising:
a keyboard having a plurality of keys; and
an upper case including a plurality of openings, that are formed to sizes corresponding respectively to the plurality of keys provided at the keyboard, wherein the keyboard is bonded to the upper case using at least one laser spot weld.
9. The electronic device of claim 8, wherein the keyboard is bonded to the upper case by directing a laser beam through at least one of the upper case and the keyboard to form the at least one laser spot weld between the upper case and the keyboard.
10. The electronic device of claim 8, wherein the at least one laser spot weld is formed between the upper case and the keyboard, by at least one of:
creating multiple spot welds at scattered points between the upper case and the keyboard; and
creating a laser-seam-weld by performing a series of overlapping spot welds between the upper case and the keyboard.
11. The electronic device of claim 8, wherein the keyboard is disposed underneath the upper case such that the keys are exposed through the respective openings provided in the upper case.
12. A method of forming a keyboard assembly for an electronic device, the method comprising:
providing a keyboard corresponding to an upper case; and
laser spot welding the keyboard and the upper case to form the keyboard assembly.

13. The method of claim 12, wherein providing the keyboard corresponding to the upper case, comprises:

providing the upper case having a plurality of openings, that are formed to sizes corresponding respectively to a plurality of keys of the keyboard; and

disposing the keyboard beneath a lower surface of the upper case such that the keys are exposed through the respective openings.

14. The method of claim 13, wherein laser spot welding the keyboard and the upper case comprises:

forming at least one laser spot weld to secure the keyboard to the upper case by directing a laser beam.

15. The method of claim 14, wherein forming the at least one laser spot weld to secure the keyboard to the upper case, comprises at least one of:

creating multiple spot welds at scattered points between the upper case and the keyboard; and

creating a laser-seam-weld by performing a series of overlapping spot welds between the upper case and the keyboard.

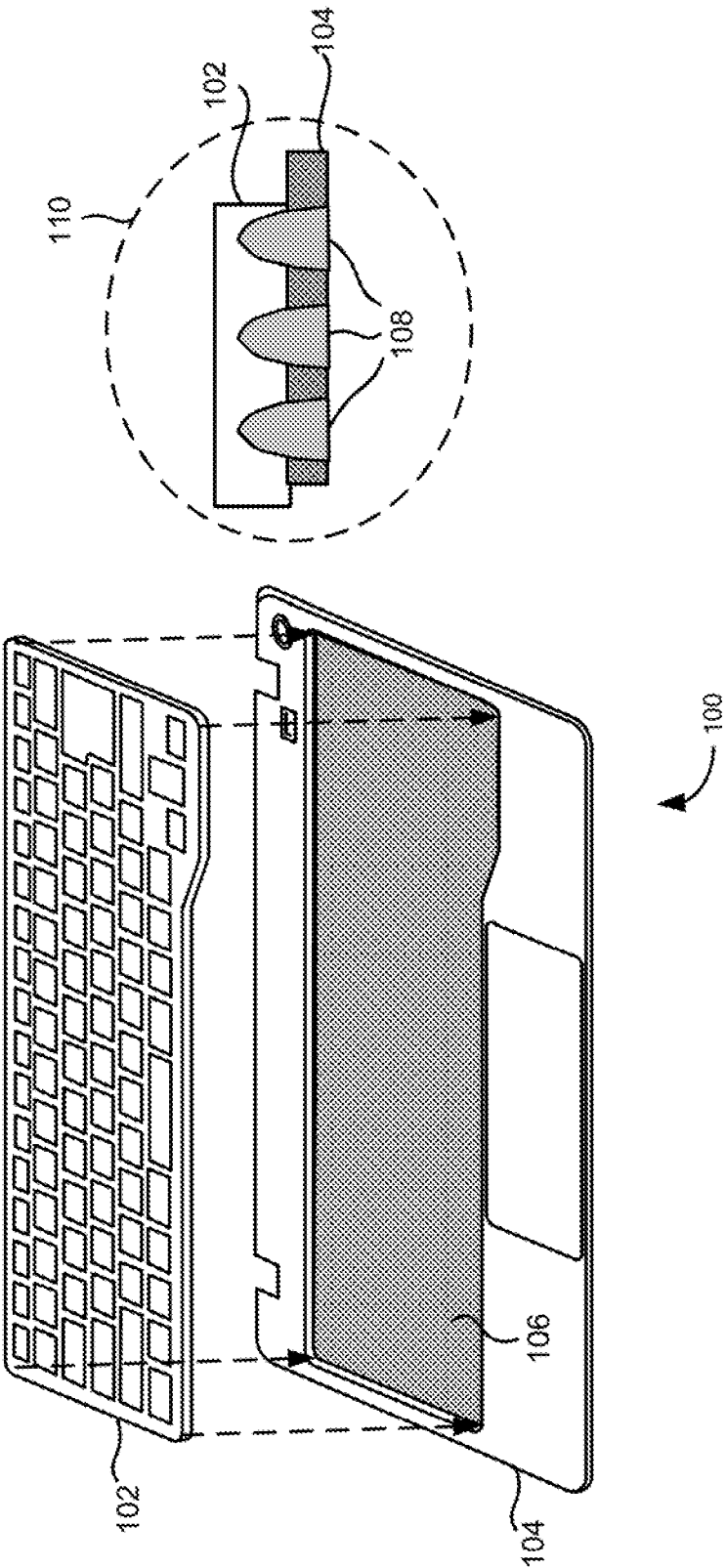


FIG. 1

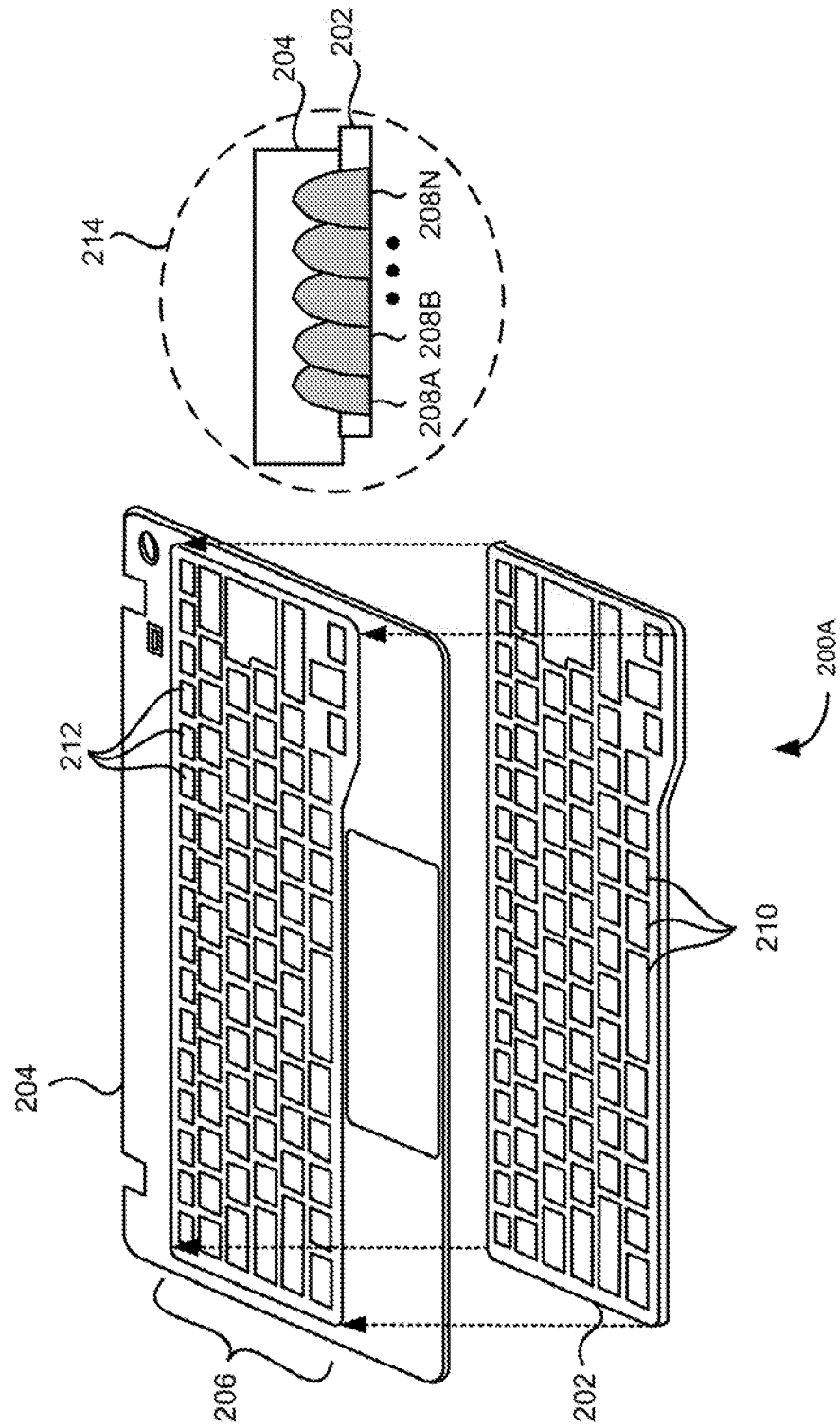


FIG. 2A

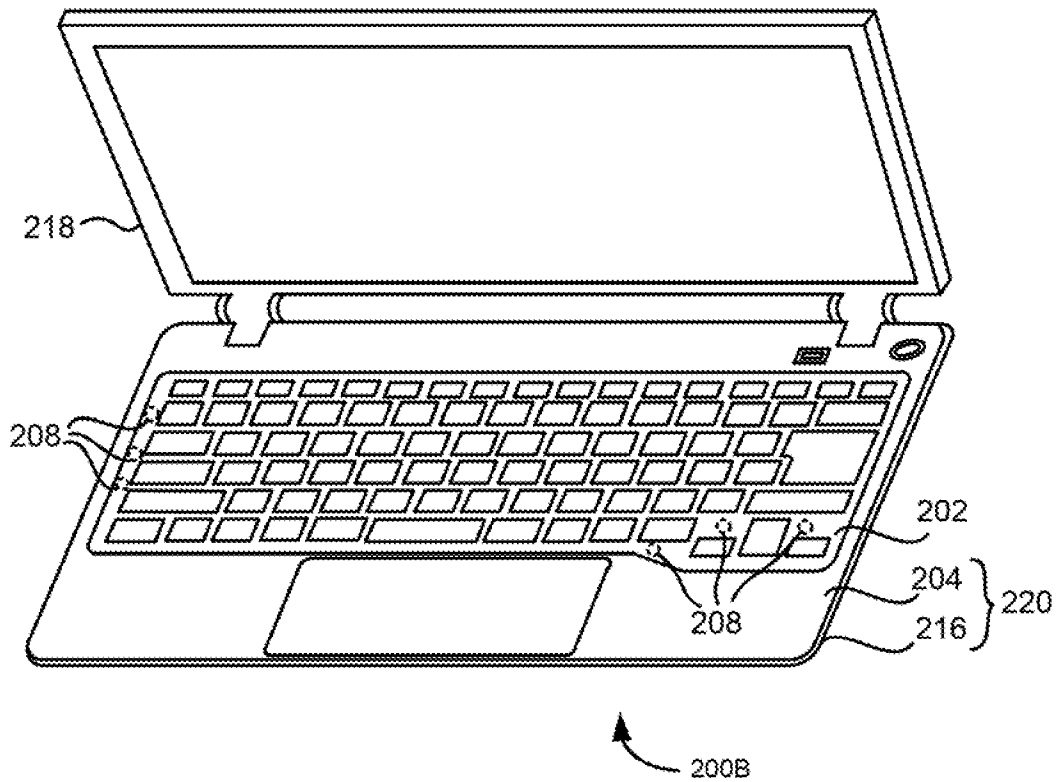


FIG. 2B

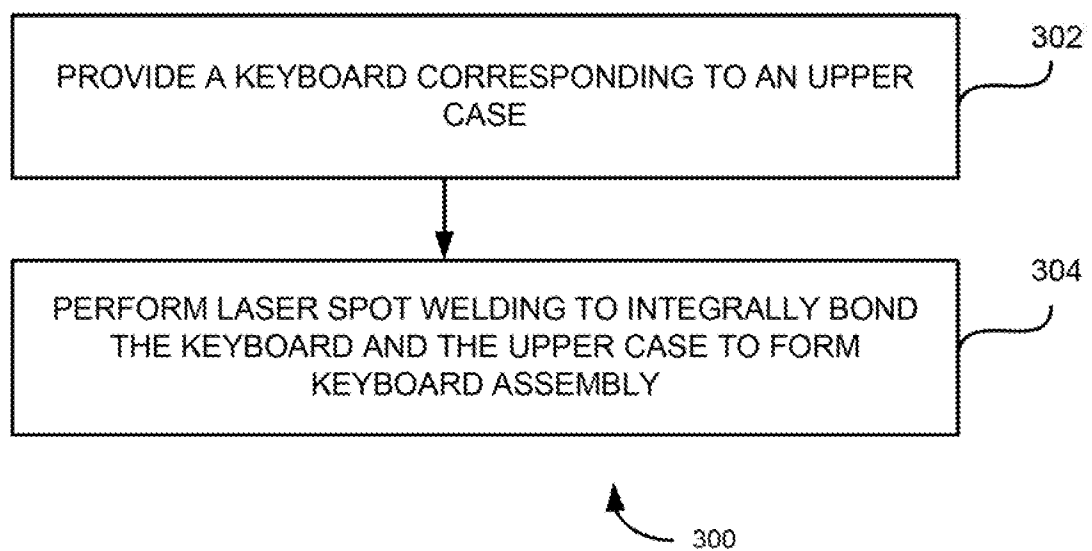


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2016/055608

A. CLASSIFICATION OF SUBJECT MATTER														
G06F 3/02 (2006.01) B23K 26/22 (2006.01) According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED														
Minimum documentation searched (classification system followed by classification symbols)														
G06F 3/00, 3/02, B23K 26/00-26/34, H05B 37/00, 37/02, H05K 3/00, 3/10, H01H 9/00, 13/00, 13/76														
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched														
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)														
PatSearch, esp@cenet, USPTO, Google														
C. DOCUMENTS CONSIDERED TO BE RELEVANT														
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.												
Y	US 6172867 B1 (KABUSHIKI KAISHA TOSHIBA) 09.01.2001, abstract, col. 7 lin. 62 - col. 8 lin. 7, 24-41, 52-58, col. 15 lin. 17-27, col. 21 lin. 25-31	1-15												
Y	US 2013/0107434 A1 (APPLE INC.) 02.05.2013, paragraphs [0007], [0037], [0039], [0049], [0052]	1-15												
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Date of the actual completion of the international search		Date of mailing of the international search report												
10 August 2017 (10.08.2017)		31 August 2017 (31.08.2017)												
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer S. Finoshin Telephone No. 8 (495)-531-64-81												