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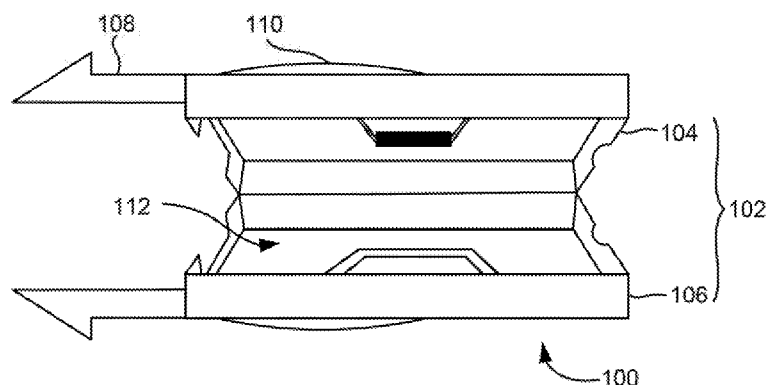


FIG. 1A

(57) Abstract: In one example, a latch assembly may include a housing defining a cavity to house an input/output (IO) connector. The housing may include first and second clamshell components that are pivotally connected to one another and defining the cavity. Further, the latch assembly may include a latch member to project axially from the housing. The latch member may mate with a latch receptacle when the IO connector is inserted into a connector receptacle. Furthermore, the latch assembly may include a release button disposed on a surface of the housing and coupled to the latch member.



LATCH ASSEMBLIES FOR INPUT/OUTPUT CONNECTORS

BACKGROUND

[0001] Computer platform architecture design may encompass different interfaces to connect one device to another device. For example, computing systems may use interfaces to connect to peripheral devices, such as data storage devices, printers, virtual reality (VR) devices, and scanners. The interfaces may provide input/output (IO) for computing devices and peripherals, and may use a variety of protocols and standards to provide the IO. The differing interfaces may also use different hardware structures to provide the interface. For example, computer systems may include multiple ports with corresponding connection interfaces, as implemented by physical connectors and plugs at the ends of the cables connecting the devices. Example connector types may include a Universal Serial Bus (USB) subsystem with a number of associated USB plug interfaces, High Definition Multimedia Interface (HDMI), Firewire (as set forth in IEEE 1394), or other connector types. For example, a USB type-C connector may be used to connect a VR head-mounted display (HMD) and a host computing system.

BRIEF DESCRIPTION OF THE DRAWINGS

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

[0003] FIG. 1A is a perspective view of an example latch assembly, depicting first and second clamshell components that are pivotally connected to one another to house an input/output (IO) connector;

[0004] FIG. 1B is a perspective view of the example latch assembly of FIG. 1A, depicting additional features;

[0005] FIG. 1C is a side view of the example latch assembly of FIG. 1A, depicting first and second clamshell components that are locked together using a locking mechanism;

[0006] FIG. 2A is a perspective view of an example latch assembly, depicting first and second latch members extending from first and second clamshell components, respectively;

[0007] FIG. 2B is an open view of the example latch assembly of FIG. 2A, depicting additional features;

[0008] FIG. 3A is an open view of an example latch assembly, depicting first and second clamshell components that are pivotally connected together to encase an IO connector;

[0009] FIG. 3B is an open view of the example latch assembly of FIG. 3A, depicting additional features; and

[0010] FIG. 3C is a cross-sectional side view of the example latch assembly of FIG. 3A, depicting a resilient layer formed on an inner surface of the first and second clamshell components to frictionally engage the IO connector.

DETAILED DESCRIPTION

[0011] Devices may connect to each other using input/output (IO) connectors made up of a number of wires assigned to pins located in connectors at an end of the cable. The IO connectors may be based on a standard with an agreed upon sizes and configurations. Some IO connectors may be proprietary and require the original equipment manufacturer to supply replacement cables. Example IO connector types may include a Universal Serial Bus (USB) connector with a number of associated USB plug interfaces, High Definition Multimedia Interface (HDMI), Firewire (as set forth in Institute of Electrical and Electronics Engineers (IEEE) 1394), or other connector types. Some IO connectors such as USB connectors may have desirable features and advantages as compared to predecessor IO connectors. However, such USB connectors may have relatively low resistance to unintended disconnection due to incidental axial pull-out forces, e.g., when a cable is inadvertently pulled. In some example environments, unintended disconnection of an IO connector may affect user experience, while in

other applications, unintended disconnection can have considerable damages. For example, a single USB type-C connection may be used in virtual reality (VR) devices to facilitate a connection between a VR head-mounted display (HMD) and a host computing system. However, in the VR applications involving significant movement, the standard extraction force of the USB type-C may not be enough to hold the USB type-C connection between the VR HMD and the host computing system.

[0012] In other examples, certain institutions may require an IO connection between a computing device and a peripheral device to be secure from accidental removal. In example institutions such as hospitals and financial institutions, accidental removal of the peripheral device may result in financial losses or affect health of a patient in the scenarios where the peripheral device provides medical support. To safeguard against such accidental removal of IO connectors, some methods may tie or tape the cable to the back of the computing device. Some manufacturers may offer secure latches for cables to ensure they are not accidentally removed from the intended coupled devices. Such cables may provide screws which require tools or internal spring type mechanisms, which are expensive to tool for production. However, as protocols improve and devices become smaller, IO connections may have miniaturized as well. With the miniaturization of peripheral devices, computing systems, and IO connectors, little space may be left for latching mechanisms to securely attach these devices in a manner which safeguards against accidental removal.

[0013] Examples described herein may provide a latch assembly for an IO connector (e.g., a male IO connector). The latch assembly may include a housing defining a cavity to receive the IO connector. In one example, the housing may be formed of first and second clamshell components that are pivotally connected to one another and defining the cavity. Further, the latch assembly may include a latch member to project axially from the housing. The latch member may mate with a latch receptacle when the IO connector is inserted into a connector receptacle. Further, the latch assembly may include a release button disposed on a surface of the housing and coupled to the latch member. The release button can be pressed

to release the latch member from the latch receptacle, and then the IO connector can be plugged out.

[0014] In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present techniques. It will be apparent, however, to one skilled in the art that the present apparatus, devices and systems may be practiced without these specific details. Reference in the specification to “an example” or similar language means that a particular feature, structure, or characteristic described may be included in at least that one example, but not necessarily in other examples.

[0015] Referring now to the figures, FIG. 1A is a perspective view of an example latch assembly 100, depicting a first clamshell component 104 and a second clamshell component 106 that are pivotally connected to one another to house an IO connector. The IO connector may be a male connector adapted to mate with a female connector. For example, the IO connector may include a cable having connector inserts, or plug portions, on one or both ends. The connector inserts may plug into connector receptacles on electronic devices, thereby forming one or more conductive paths between the electronic devices for signals and power. Example IO connector may include a USB type-C connector.

[0016] Example latch assembly 100 may include a housing 102 defining a cavity 112 to house the IO connector. In one example, housing 102 may be removable from the IO connector. Example housing 102 may include an elastic material to frictionally engage the IO connector. Example housing 102 may include first clamshell component 104 and second clamshell component 106 that are pivotally connected to one another and defining cavity 112.

[0017] Further, latch assembly 100 may include a latch member 108 to project axially from housing 102. In one example, latch member 108 may mate with a latch receptacle on an electronic device when the IO connector is inserted into a connector receptacle on the electronic device. Furthermore, latch assembly 100 may include a release button 110 disposed on a surface of housing 102 and coupled to latch member 108. In one example, release button 110 can be pressed

to release latch member 108 from the latch receptacle, and then the IO connector can be plugged out. For example, latch member 108 and housing 102 may be comprised of same material or different materials.

[0018] FIG. 1B is a perspective view of example latch assembly 100 of FIG. 1A, depicting additional features. For example, similarly named elements of FIG. 1B may be similar in structure and/or function to elements described with respect to FIG. 1A. As shown in FIG. 1B, an IO connector 162 may be disposed in housing (e.g., housing 102 as shown in FIG. 1A) such that a plug portion 164 of IO connector 162 is to protrude axially from housing 102.

[0019] Further as shown in FIG. 1B, first clamshell component 104 may be pivotally connected to second clamshell component 106 at a first end (e.g., 152). Further, first clamshell component 104 and second clamshell component 106 may include a locking mechanism 156 at a second end (e.g., 154) to firmly hold IO connector 162 within cavity 112. First clamshell component 104 and second clamshell component 106 may be pivotally connected at first end 152 and releasably connected at second end 154 to define housing 102.

[0020] Example locking mechanism 156 may include a male locking component 156A and a female locking component 156B. In one example, first clamshell component 104 may include male locking component 156A and second clamshell component 106 may include female locking component 156B. Male locking component 156A may mate with and be releasably engaged and retained by female locking component 156B. Example locking mechanism 156 may include a press fit, a snap-fit, a friction-fit, a latch mechanism, or the like. FIG. 1C is a side view of example latch assembly 100 of FIG. 1A, depicting first clamshell component 104 and second clamshell component 106 that are locked together using locking mechanism 156. For example, similarly named elements of FIG. 1C may be similar in structure and/or function to elements described with respect to FIGs. 1A and 1B.

[0021] Further as shown in FIG. 1B, latch member 108 may include an arm 158 having a first end and a second end. Second end of arm 158 may extend

beyond housing 102. In one example, arm 158 may extend forwardly in cantilever fashion from a forward end of housing 102. Furthermore, latch member 108 may include a hook 160 coupled to second end of arm 158. In this example, hook 160 may engage with the latch receptacle when IO connector 162, particularly plug portion 164, is inserted into the connector receptacle of the electronic device. Thus, hook 160 may be inserted into and engaged with the latch receptacle to secure IO connector 162 from accidental disengagement from the electronic device.

[0022] FIG. 2A is a perspective view of an example latch assembly 200, depicting a first latch member 212 and a second latch member 214 extending from a first clamshell component 204 and a second clamshell component 206, respectively. Example latch assembly 200 may include a housing 202. In one example, housing 202 may be formed of first clamshell component 204 and second clamshell component 206 that are pivotally connected together to encase an IO connector 208 such that a plug portion 210 of IO connector 208 is to protrude axially from housing 202.

[0023] Further, latch assembly 200 may include first latch member 212 extending from first clamshell component 204 axially alongside and spaced from a first side (e.g., a top side 226) of plug portion 210. Furthermore, latch assembly 200 may include second latch member 214 extending from second clamshell component 206 axially alongside and spaced from a second side (e.g., a bottom side 228) of plug portion 210. The second side may be opposite to the first side. First latch member 212 and second latch member 214 may project axially outward from a side of housing 202, near to but spaced from and diverging slightly from plug portion 210. In some examples, first latch member 212 and second latch member 214 may be mirror images of each other and symmetrically located on opposite sides of plug portion 210.

[0024] In this example, first latch member 212 and second latch member 214 may engage with a first latch receptacle 220 and a second latch receptacle 222, respectively, when plug portion 210 is inserted into a connector receptacle 218. For example, first latch receptacle 220, second latch receptacle 222, and connector receptacle 218 may be disposed or installed in an electronic device

housing 216. For example, electronic device housing 216 may include a housing of a tablet computer, desktop computer, laptop, all-in-one computer, wearable computing device, smartphone, navigation system, VR device, or the like. Electronic device housing 216 may have a substantially planar face through which first latch receptacle 220, second latch receptacle 222, and connector receptacle 218 may be formed. First latch receptacle 220 and second latch receptacle 222 may mate with a respective one of first latch member 212 and second latch member 214 in a manner that allows latch assembly 200 to be releasably secured to electronic device housing 216. In one example, first latch member 212 and second latch member 214 may include a respective hook that may be captured behind a peripheral edge of electronic device housing 216 in which connector receptacle 218 (e.g., a female connector) is located.

[0025] Furthermore, latch assembly 200 may include a release button 224 disposed on a surface of housing 202 and compressively coupled to first latch member 212 and second latch member 214. In one example, release button 224 may include a first portion disposed on a surface of first clamshell component 204 and a second portion disposed on a surface of second clamshell component 206. In this example, the first portion may be compressively coupled to first latch member 212 and the second portion may be compressively coupled to second latch member 214. In one example, latch assembly 200 may include separate release buttons on first and second clamshell components 204 and 206 to compressively engage with respective latch members 212 and 214 provided on a respective clamshell component 204 or 206. Alternatively, latch assembly 200 may include a single release button disposed on one of first clamshell component 204 and second clamshell component 206 and compressively engage with latch members provided on housing 202 through a compression mechanism.

[0026] In one example, first latch member 212 and second latch member 214 may be movable relative to one another in a first direction when release button 224 is released (i.e., not compressed) and movable relative to one another in a second direction (e.g., opposite the first direction) when release button 224 is compressed. In this example, first latch member 212 and second latch member 214 may be in an unlocked position relative to first latch receptacle 220 and second

latch receptacle 222, respectively, when release button 224 is pressed. When release button 224 is released, first latch member 212 and second latch member 214 may be in a locked position relative to first latch receptacle 220 and second latch receptacle 222, respectively.

[0027] FIG. 2B is an open view of example latch assembly 200 of FIG. 2A, depicting additional features. For example, similarly named elements of FIG. 2B may be similar in structure and/or function to elements described with respect to FIG. 2A. As shown in FIG. 2B, first clamshell component 204 may pivotally connect to second clamshell component 206 at a first end, for instance, via a hinge 252. Further, first clamshell component 204 and second clamshell component 206 may include a locking mechanism at a second end to firmly hold IO connector (e.g., IO connector 208 as shown in FIG. 2A) within housing (e.g., housing 202 as shown in FIG. 2A). Example locking mechanism may include a male locking component 254A and a female locking component 254B. First clamshell component 204 and second clamshell component 206 may include male locking component 254A and female locking component 254B, respectively, such that male locking component 254A may be fastened to and retained by female locking component 254B to form housing 202.

[0028] Further as shown in FIG. 2B, latch assembly 200 may include a third latch member 256 extending from first clamshell component 204 axially alongside and spaced from the first side of plug portion (e.g., plug portion 210 of FIG. 2A). In this example, third latch member 256 may be spaced from first latch member 212. Also, latch assembly 200 may include a fourth latch member 258 extending from second clamshell component 206 axially alongside and spaced from the second side of plug portion 210. In this example, fourth latch member 258 may be spaced from second latch member 214.

[0029] In one example, first latch member 212, second latch member 214, third latch member 256, and fourth latch member 258 may extend axially from housing 202 at four corners of plug portion 210. In another example, first latch member 212, second latch member 214, third latch member 256, and fourth latch member 258 may extend axially from housing 202 at four sides of plug portion 210.

In other examples, latch assembly 200 may include any number of latch members extending from housing 202 axially alongside and spaced from a side of plug portion 210 to inhibit unintentional disconnection of IO connector 208 from connector receptacle 218 (i.e., to inhibit unintentional disconnection of the male connector and the female connector).

[0030] FIG. 3A is an open view of an example latch assembly 300, depicting a first clamshell component 304 and a second clamshell component 306 that are pivotally connected together to encase an IO connector (e.g., an IO connector 352 as shown in FIG. 3B). FIG. 3B is an open view of example latch assembly 300 of FIG. 3A, depicting additional features. For example, similarly named elements of FIG. 3A may be similar in structure and/or function to elements described below with respect to FIG. 3B.

[0031] As shown in FIG. 3B, IO connector 352 may include a polymeric body 354, a cable 358 connected to polymeric body 354 at one end, and a plug portion 356 that projects axially from polymeric body 354 at another end. Example plug portion 356 may be a metallic male plug that projects outwardly from polymeric body 354.

[0032] Further, latch assembly 300 may include a housing 302 defining a first opening 308 and a second opening 310 opposite first opening 308. For example, first opening 308 and second opening 310 may be defined on opposite sides of housing 302. Housing 302 may include first clamshell component 304 and second clamshell component 306 that are pivotally connected together at a first end to encase IO connector 352 such that plug portion 356 may protrude axially from first opening 308 and cable portion 358 may protrude from second opening 310. In one example, housing 302 may encase polymeric body 354. Further, first clamshell component 304 and second clamshell component 306 may include a locking mechanism 360 at a second end to lock first clamshell component 304 and second clamshell component 306 together and define a cavity (e.g., a cavity 362 as shown in FIG. 3C) to house IO connector 352.

[0033] Latch assembly 300 may include a resilient layer 312 formed on an inner surface of first clamshell component 304 and second clamshell component 306 to frictionally engage IO connector 352. Further, latch assembly 300 may include a latch member 314 extending from housing 302 axially alongside and spaced from a side of plug portion 356. In one example, latch member 314 may include an arm 316 having an outer end extending beyond housing 302 and a hook 318 defined at the outer end.

[0034] Furthermore, latch assembly 300 may include a release button 320 disposed on an outer surface of housing 302 and compressively coupled to latch member 314. In one example, latch member 314 may move in a first direction away from plug portion 356 while releasing/freeing of release button 320 (e.g., to lock latch member 314 in a latch receptacle) and to move in a second direction towards plug portion 356 while compressing release button 320 (e.g., to release latch member 314 from the latch receptacle).

[0035] FIG. 3C is a cross-sectional side view of example latch assembly 300 of FIG. 3A, depicting resilient layers 312A and 312B formed on an inner surface of first clamshell component 304 and second clamshell component 306, respectively, to frictionally engage IO connector 352 (e.g., as shown in FIG. 3B). Example resilient layers 312A and 312B may include rubber or a material having the characteristics of rubber. In some examples, resilient layers 312A and 312B may provide a frictional surface that can be resistant to relative movement between polymeric body 354 and an inner surface of housing 302. Resilient layers 312A and 312B may minimize or eliminate any movement of polymeric body 354.

[0036] Further as shown in FIG. 3C, an example structure of latch member 314 may include arm 316 having an inner end originating at housing 302 and an outer end spaced axially from housing 302 and defining a hook 318. In this example, hook 318 may include an inclined surface 318B that is arranged to converge from an elevated point 318A towards the outermost end of plug portion 356 as inclined surface 318B extends axially away from housing 302. A locking surface 318C may extend between elevated point 318A of inclined surface 318B

and arm 316, i.e., locking surface 318C may terminate inclined surface 318B at elevated point 318A.

[0037] During the process of mating IO connector 352 into a connector receptacle, inclined surface 318B may engage the peripheral edge of an electronic device housing which causes arm 316 to deflect towards plug portion 356, until inclined surface 318B move axially inward beyond the peripheral edge through the latch receptacle so that latch member 314 may be able to move resiliently away from plug portion 356, where locking surface 318C may be captured behind the peripheral edge of the electronic device housing. Further, release button 320 can be pressed to release latch member 314 from the latch receptacle (i.e., to deflect arm 316 towards plug portion 356), and then IO connector 352 can be plugged out.

[0038] In some examples, the IO connector (e.g., IO connector 162, 208, or 352 as shown in FIGs. 1B, 2A, and 3B, respectively) may connect to various types of devices such as portable computing devices, tablet computers, desktop computers, laptops, all-in-one computers, wearable computing devices, cell phones, smart phones, media phones, storage devices, portable media players, navigation systems, monitors, power supplies, adapters, remote control devices, chargers, VR devices, or any other devices. Further, example IO connector may be compliant with various standards such as Universal Serial Bus (USB), USB2, USB3, USB Type-C, High-Definition Multimedia Interface® (HDMI), Digital Visual Interface (DVI), Ethernet, DisplayPort, Thunderbolt™, Lightning™, Joint Test Action Group (JTAG), test-access-port (TAP), Directed Automated Random Testing (DART), universal asynchronous receiver/transmitters (UARTs), clock signals, power signals, and other types of standard, non-standard, and proprietary interfaces and combinations thereof that have been developed, are being developed, or will be developed in the future. In other examples, interconnect paths provided by these IO connectors can be used to convey power, ground, signals, test points, voltage, current, data, or other information.

[0039] Examples described herein may provide the latch assembly that can be used with a standard IO connector and an external custom electronic device housing with the latch receptacles, thereby providing a secure connection.

Examples described herein may enhance the extraction force and the wrenching strength of USB type-C connection for VR applications usage scenarios.

[0040] 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.

[0041] 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.

[0042] 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 latch assembly comprising:
 - a housing defining a cavity to house an input/output (IO) connector, the housing comprising:
 - first and second clamshell components that are pivotally connected to one another and defining the cavity;
 - a latch member to project axially from the housing, wherein the latch member is to mate with a latch receptacle when the IO connector is inserted into a connector receptacle; and
 - a release button disposed on a surface of the housing and coupled to the latch member.
2. The latch assembly of claim 1, wherein the first clamshell component is to pivotally connect to the second clamshell component at a first end, and wherein the first and second clamshell components comprise a locking mechanism at a second end to firmly hold the IO connector within the cavity.
3. The latch assembly of claim 1, wherein the latch member comprising:
 - an arm having a first end and a second end, the second end of the arm extending beyond the housing; and
 - a hook coupled to the second end of the arm, wherein the hook is to engage with the latch receptacle when the IO connector is inserted into the connector receptacle.
4. The latch assembly of claim 1, wherein the housing comprises an elastic material, and wherein the IO connector is disposed in the housing such that a plug portion of the IO connector is to protrude axially from the housing.
5. The latch assembly of claim 1, wherein the IO connector is a universal serial bus (USB) type-C connector.

6. A latch assembly comprising:
 - a housing comprising:
 - first and second clamshell components that are pivotally connected together to encase an input/output (IO) connector such that a plug portion of the IO connector is to protrude axially from the housing;
 - a first latch member extending from the first clamshell component axially alongside and spaced from a first side of the plug portion;
 - a second latch member extending from the second clamshell component axially alongside and spaced from a second side of the plug portion, the second side is opposite the first side, and wherein the first and second latch members are to engage with first and second latch receptacles, respectively, when the plug portion is inserted into a connector receptacle; and
 - a release button disposed on a surface of the housing and compressively coupled to the first latch member and the second latch member.
7. The latch assembly of claim 6, wherein the first clamshell component is to pivotally connect to the second clamshell component at a first end, and wherein the first and second clamshell components comprise a locking mechanism at a second end to firmly hold the IO connector within the housing.
8. The latch assembly of claim 6, further comprising:
 - a third latch member extending from the first clamshell component axially alongside and spaced from the first side of the plug portion, wherein the third latch member is spaced from the first latch member; and
 - a fourth latch member extending from the second clamshell component axially alongside and spaced from the second side of the plug portion, wherein the fourth latch member is spaced from the second latch member.
9. The latch assembly of claim 6, wherein the first latch member and the second latch member are movable relative to one another in a first direction when the release button is released and are movable relative to one another in a second direction when the release button is compressed.

10. The latch assembly of claim 6, wherein the first latch member and the second latch member are in an unlocked position relative to the first and second latch receptacles, respectively, when the release button is pressed, and wherein the first latch member and the second latch member are in a locked position relative to the first and second latch receptacles, respectively, when the release button is released.

11. A latch assembly comprising:

- a housing defining a first opening and a second opening opposite the first opening, the housing comprising:

- first and second clamshell components that are pivotally connected together to encase an input/output (IO) connector such that a plug portion of the IO connector is to protrude axially from the first opening and a cable portion of the IO connector is to protrude from the second opening;

- a resilient layer formed on an inner surface of the first and second clamshell components;

- a latch member extending from the housing axially alongside and spaced from a side of the plug portion, the latch member comprising:

- an arm having an outer end extending beyond the housing; and

- a hook defined at the outer end; and

- a release button disposed on the housing and compressively coupled to the latch member.

12. The latch assembly of claim 11, wherein the latch member is to move in a first direction away from the plug portion while releasing of the release button and to move in a second direction towards the plug portion while compressing the release button.

13. The latch assembly of claim 11, wherein the IO connector comprises a polymeric body, a cable connected to the polymeric body at one end, and the plug portion that projects axially from the polymeric body at another end, and wherein the housing is to encase the polymeric body.

14. The latch assembly of claim 11, wherein the first clamshell component is to pivotally connect to the second clamshell component at a first end, and wherein the first and second clamshell components comprise a locking mechanism at a second end to lock the first and second clamshell components together and define a cavity to house the IO connector.

15. The latch assembly of claim 11, wherein the resilient layer comprises rubber, and wherein the IO connector is a universal serial bus (USB) type-C connector.

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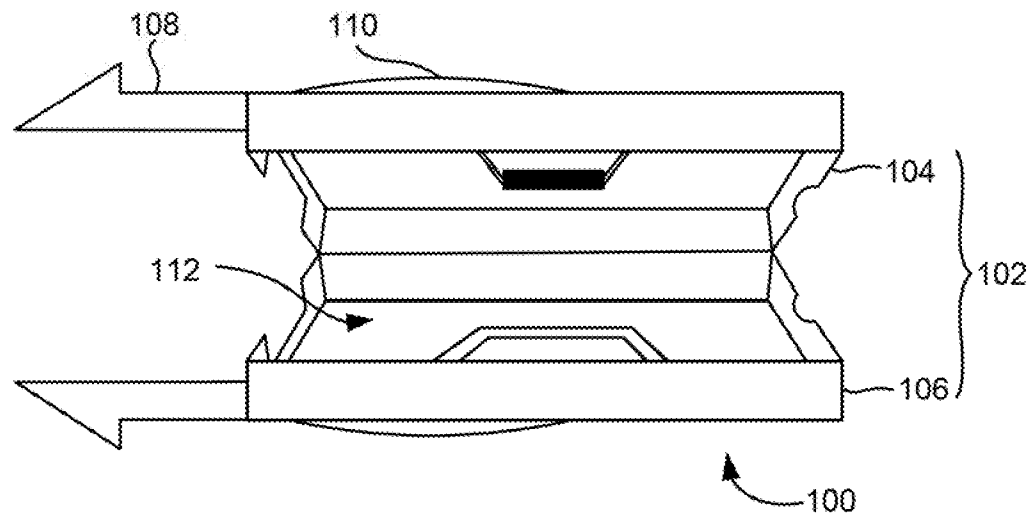


FIG. 1A

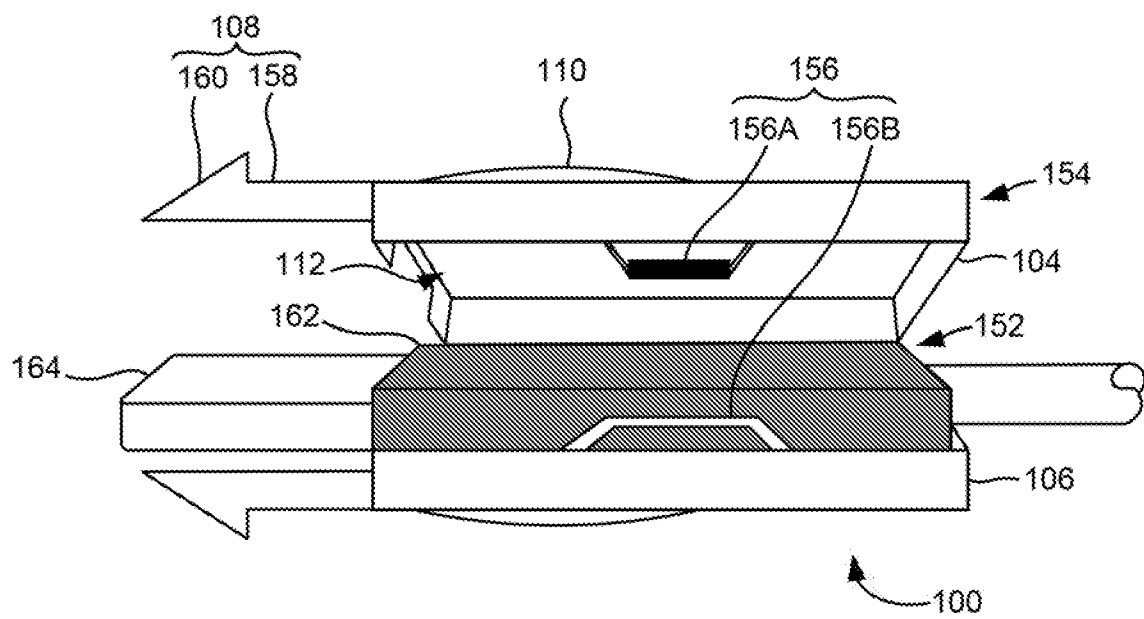


FIG. 1B

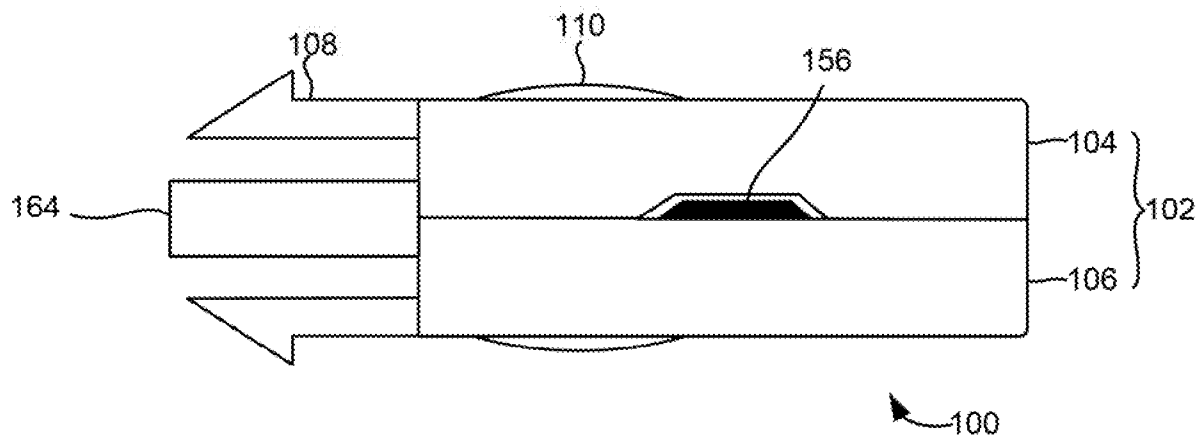


FIG. 1C

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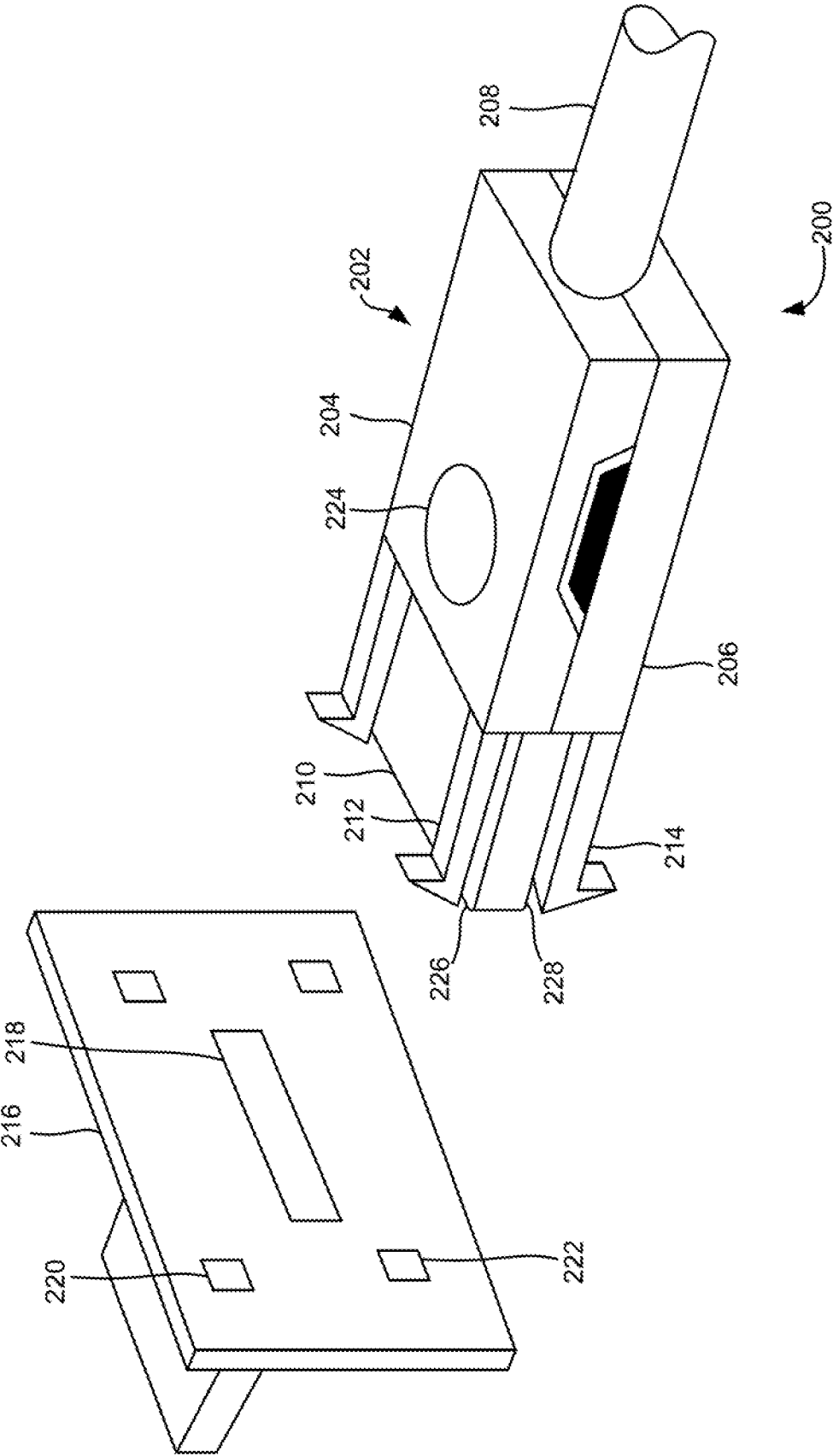


FIG. 2A

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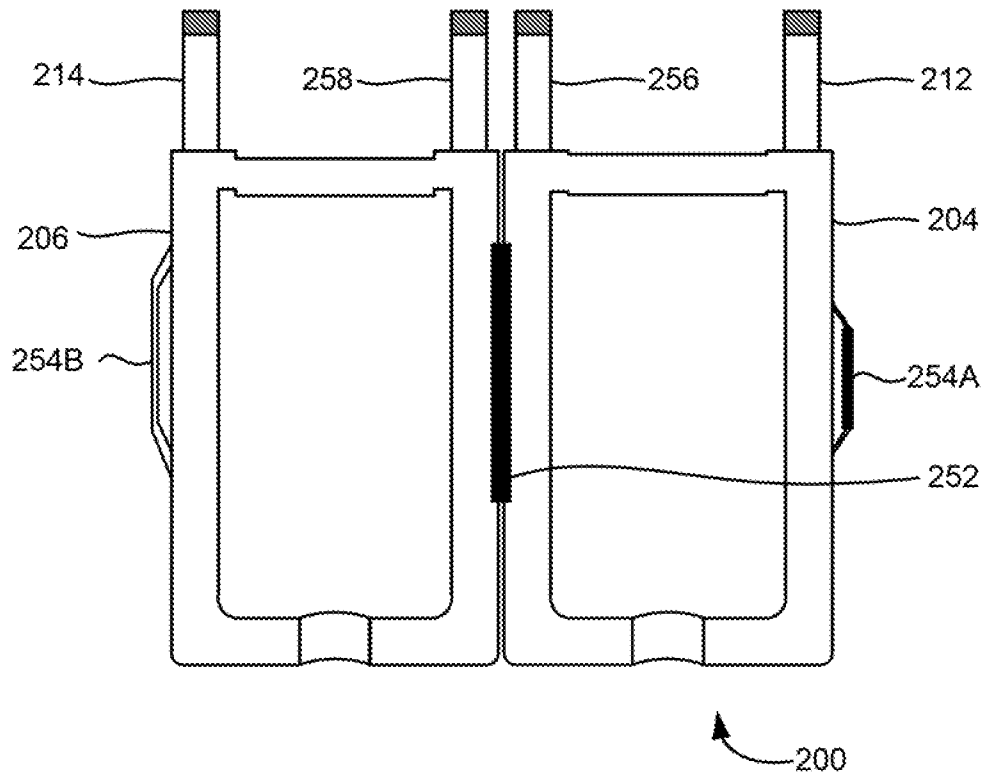


FIG. 2B

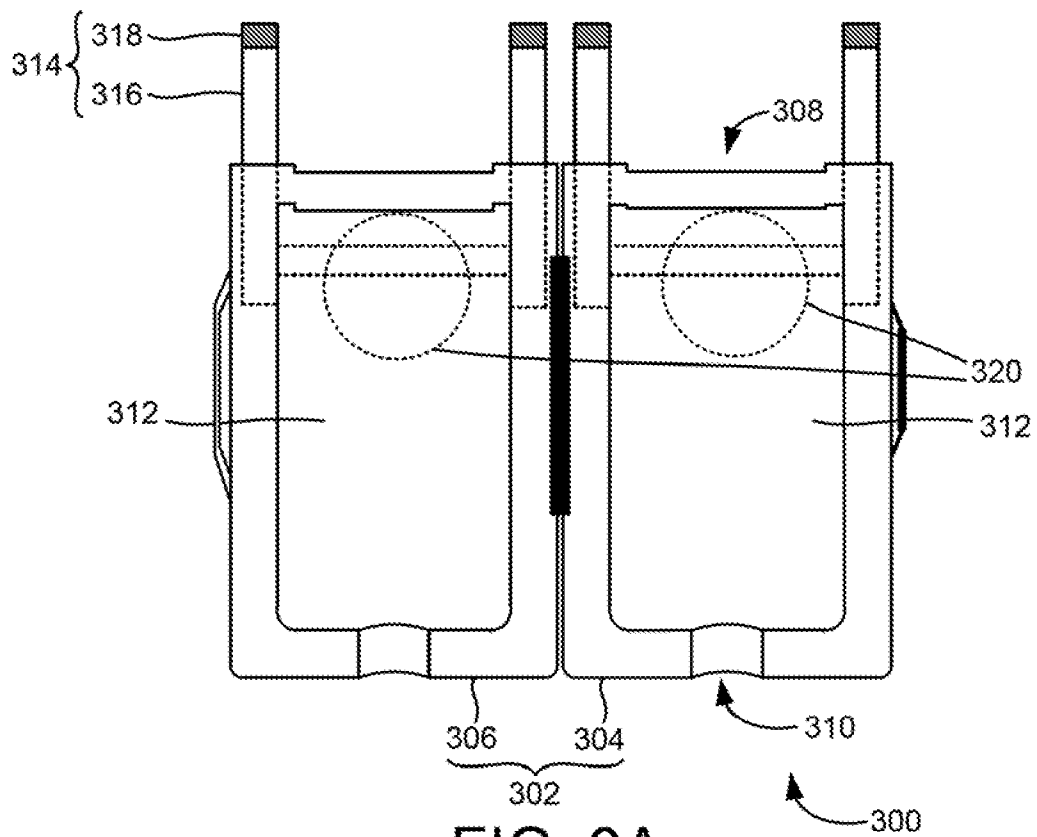


FIG. 3A

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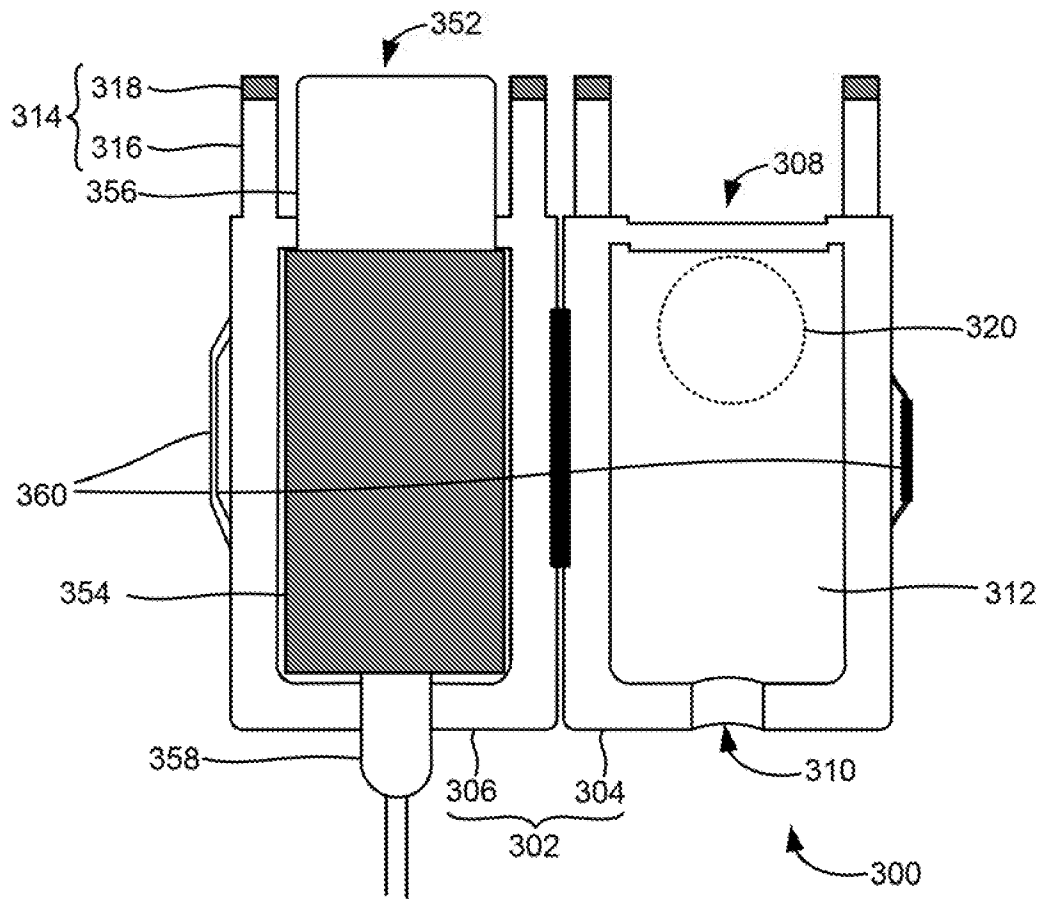


FIG. 3B

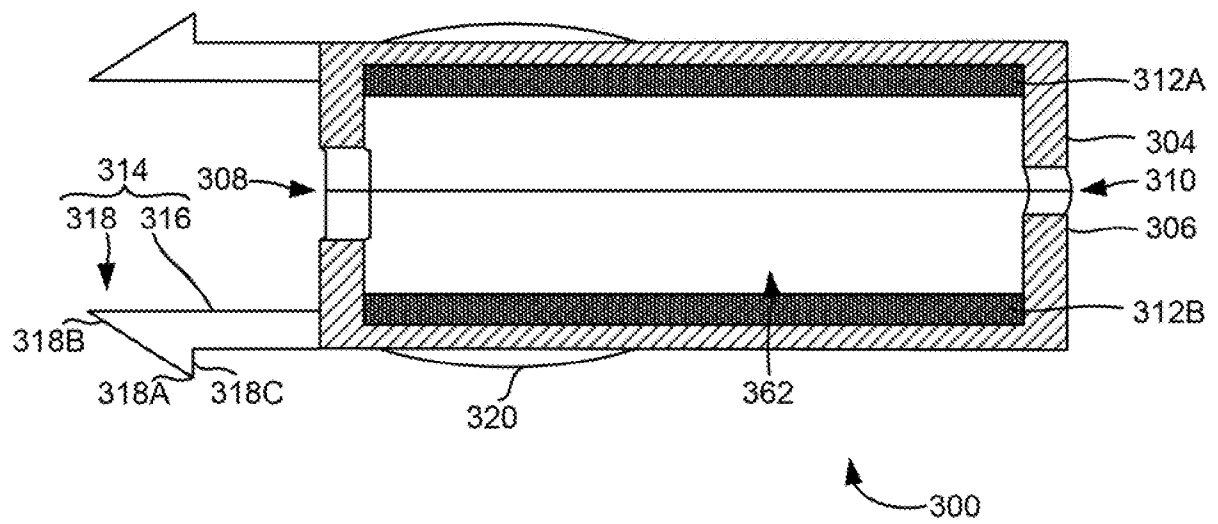


FIG. 3C

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2018/061402

A. CLASSIFICATION OF SUBJECT MATTER <i>H01R 13/627 (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)		
H01R 13/00, 13/02, 13/46, 13/516, 13/56, 13/58, 13/62, 13/627, 13/629, 13/631, 13/639, 31/00, 31/06, G02B 6/00, 6/24, 6/42		
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 (RUPTO Internal), USPTO, PAJ, Espacenet, Information Retrieval System of FIPS		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2002/0123262 A1 (JENS ANDRESEN et al.) 05.09.2002, fig. 1-5, paragraphs [0004] - [0006], [0018], [0026]	1, 3 2, 4-15
Y	DE 2939231 A1 (SIEMENS AG) 02.04.1981, abstract, fig. 1	6-10
Y	US 6431901 B1 (HON HAI PRECISION IND. CO., LTD.) 13.08.2002, fig. 1, 7, col. 2, lines 31-32, 55-60, col. 3, lines 40-50	6-10
Y	DE 4206568 A1 (SIEMENS AG) 17.09.1992, abstract, fig. 1, claims 1, 5, 6	4, 11-15
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 19 July 2019 (19.07.2019)		Date of mailing of the international search report 15 August 2019 (15.08.2019)
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhevskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer O. Tsykanovskaya Telephone No. 8(495) 531-64-81

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2018/061402

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3569914 A (HEWLETT-PACKARD COMPANY) 09.03.1971, abstract, fig. 4, col. 2, line 3 - col. 3, line 29	2, 7, 14
Y	WO 2018/195833 A1 (MICROSOFT TECHNOLOGY LICENSING, LLC et al.) 01.11.2018, abstract, fig. 1-3, paragraphs [0016] - [0017]	5, 13, 15
Y	US 8057248 B1 (NEIL S. SHERMAN) 15.11.2011, abstract, fig. 2	8