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(54) **SELF-ALIGNING BACK PLATE FOR AN ELECTRONIC DEVICE**

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Related U.S. Application Data

(60) Provisional application No. 61/800,637, filed on Mar. 15, 2013.

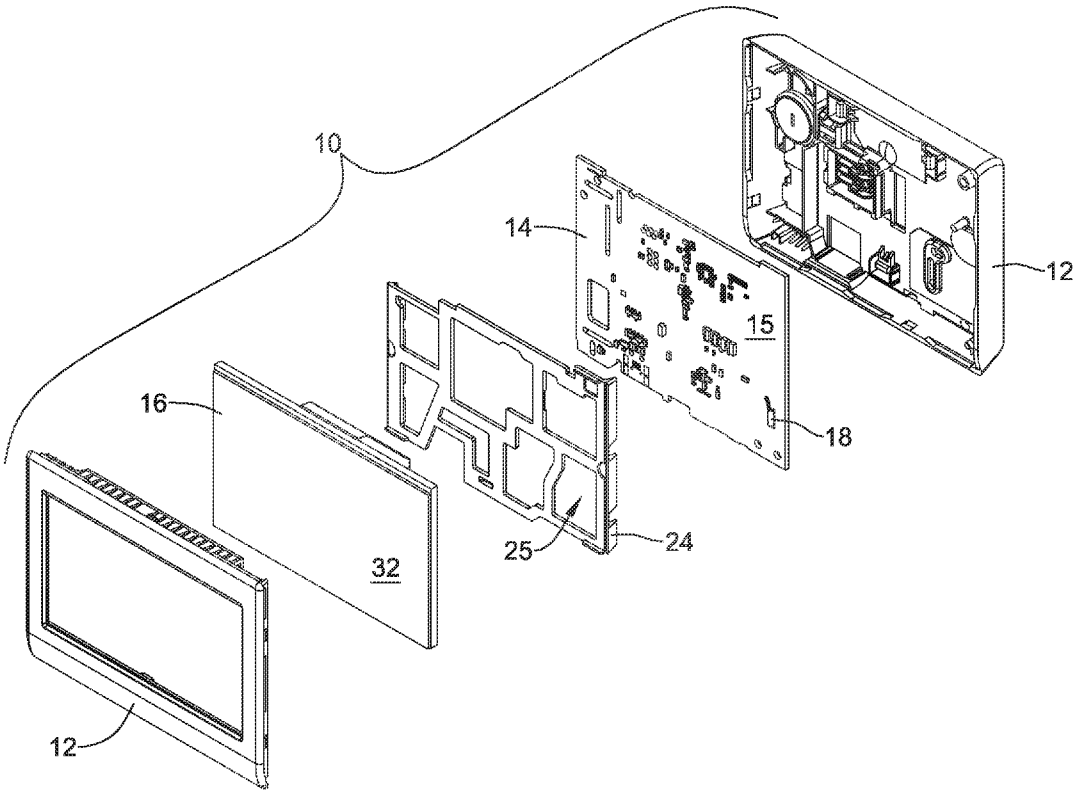
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H02G 3/14 (2006.01)

(52) **U.S. Cl.**
CPC ***H02G 3/14*** (2013.01)
USPC **174/480**; 29/428

(57) **ABSTRACT**

An illustrative electronic assembly includes a housing and a wall plate, where the wall plate is releasably connectable to the housing. The housing and the wall plate may be configured such that the housing and the wall plate may be able to initially engage each other with the wall plate misaligned relative to the housing. The housing and the wall plate may be configured to guide one another into alignment as the housing and the wall plate are moved together.



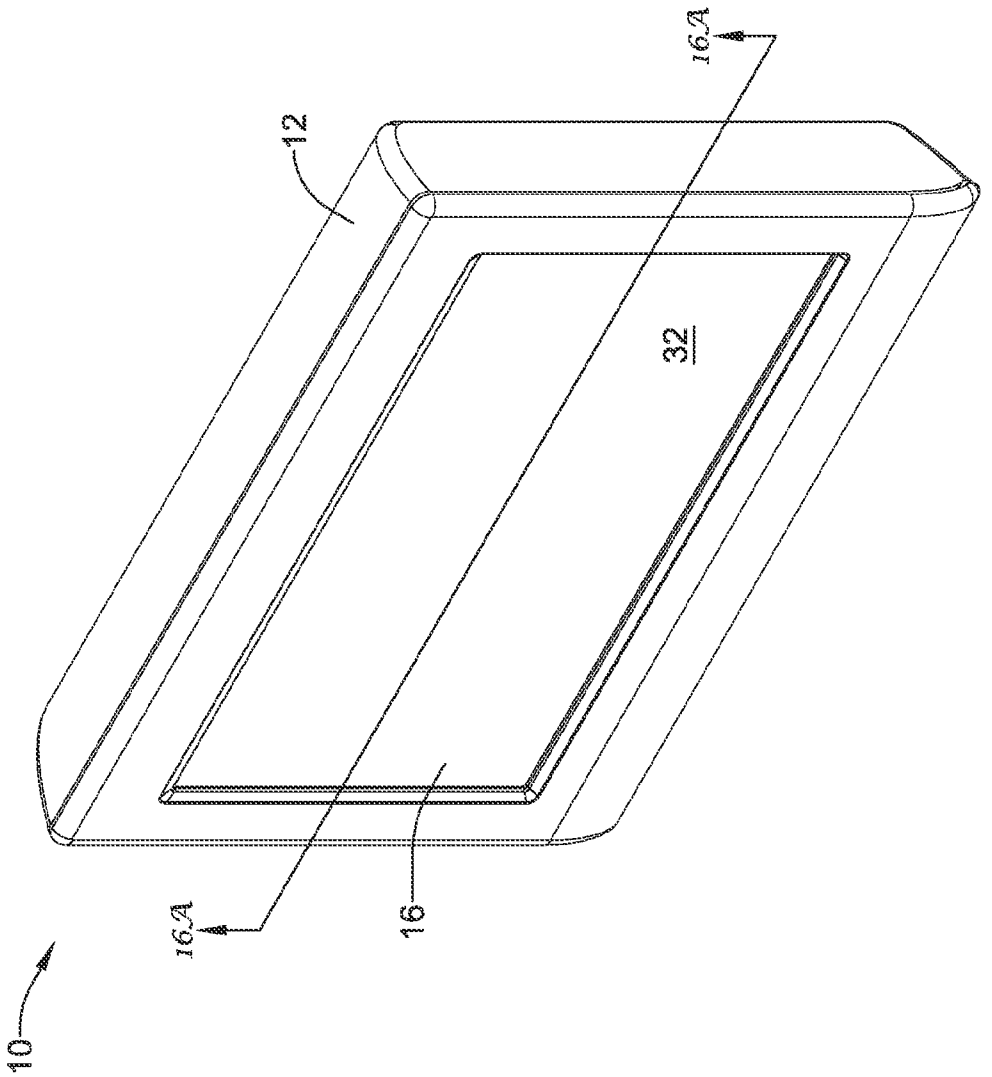


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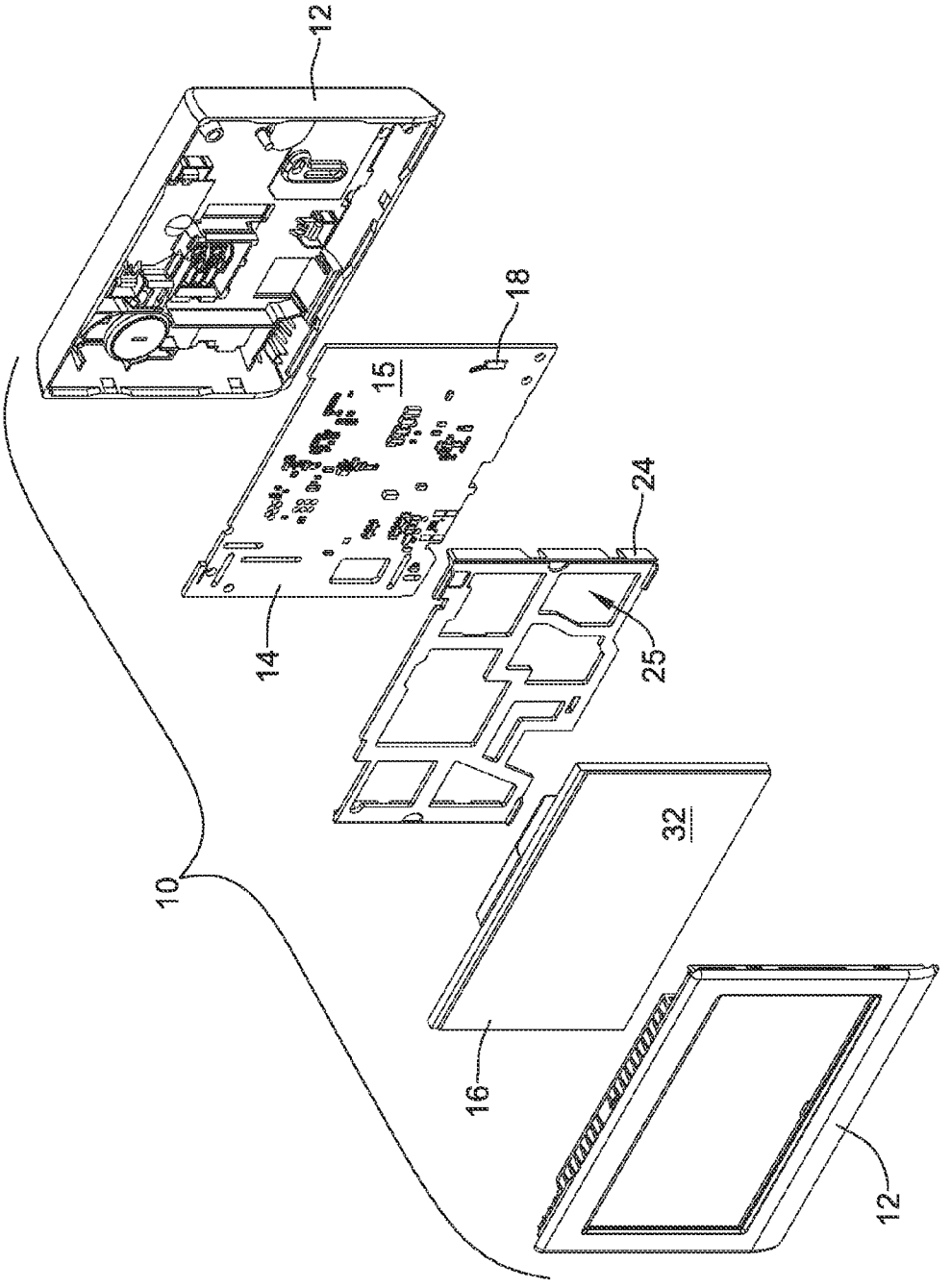


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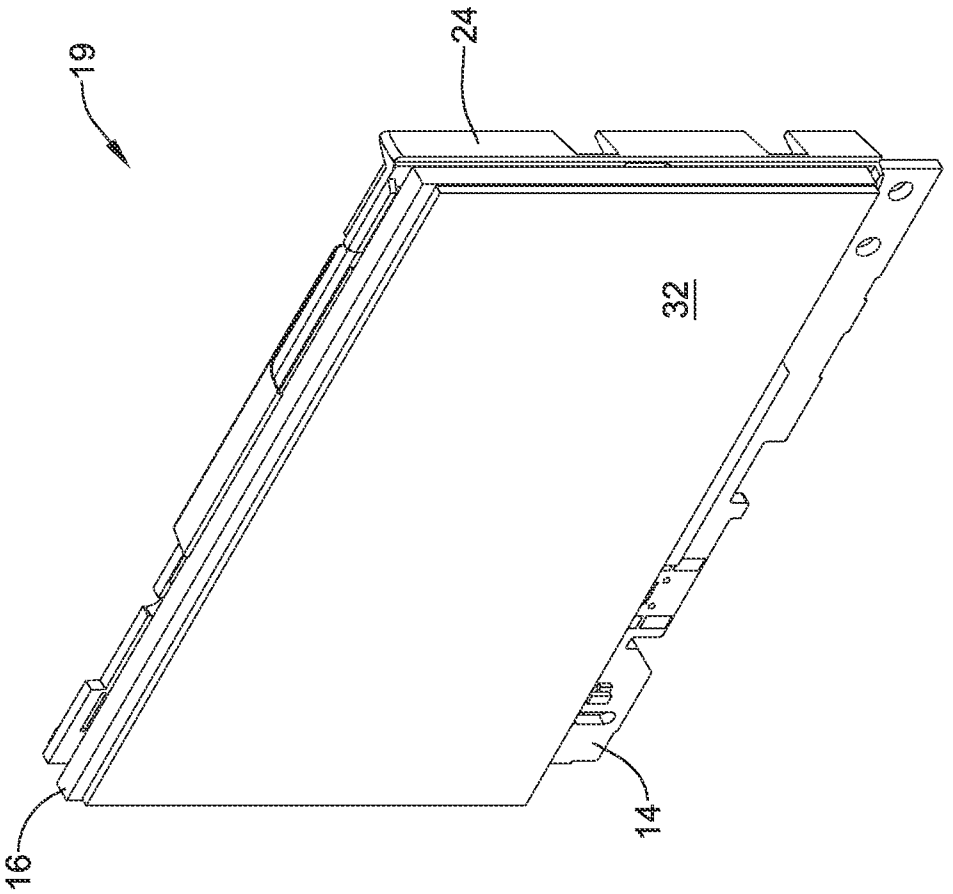


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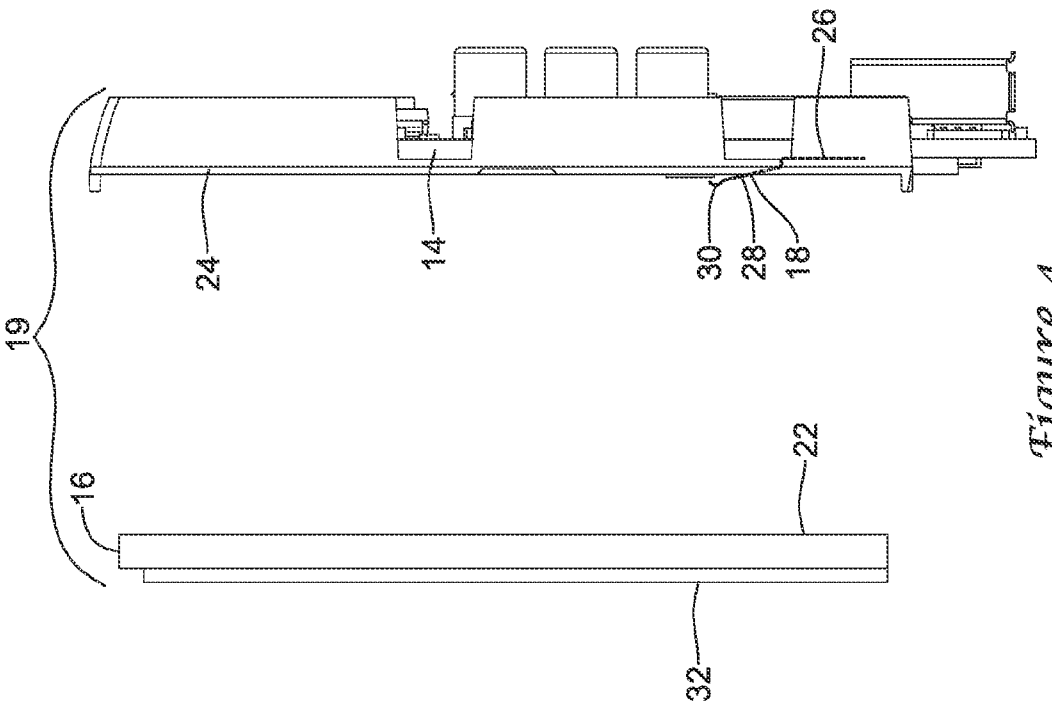


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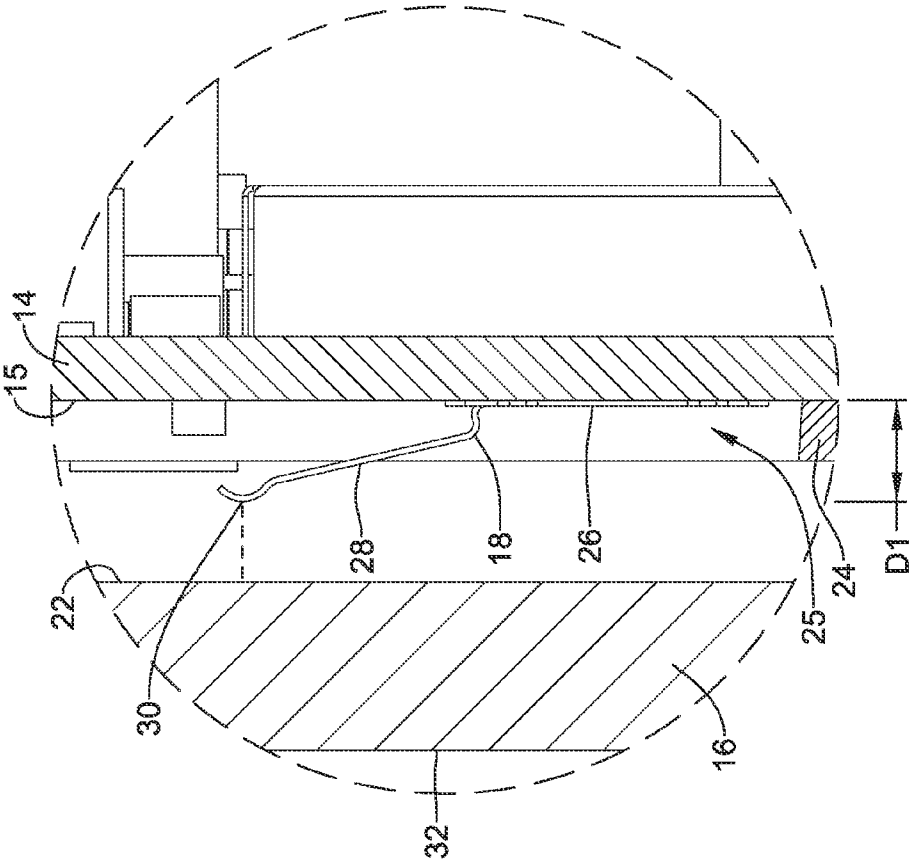


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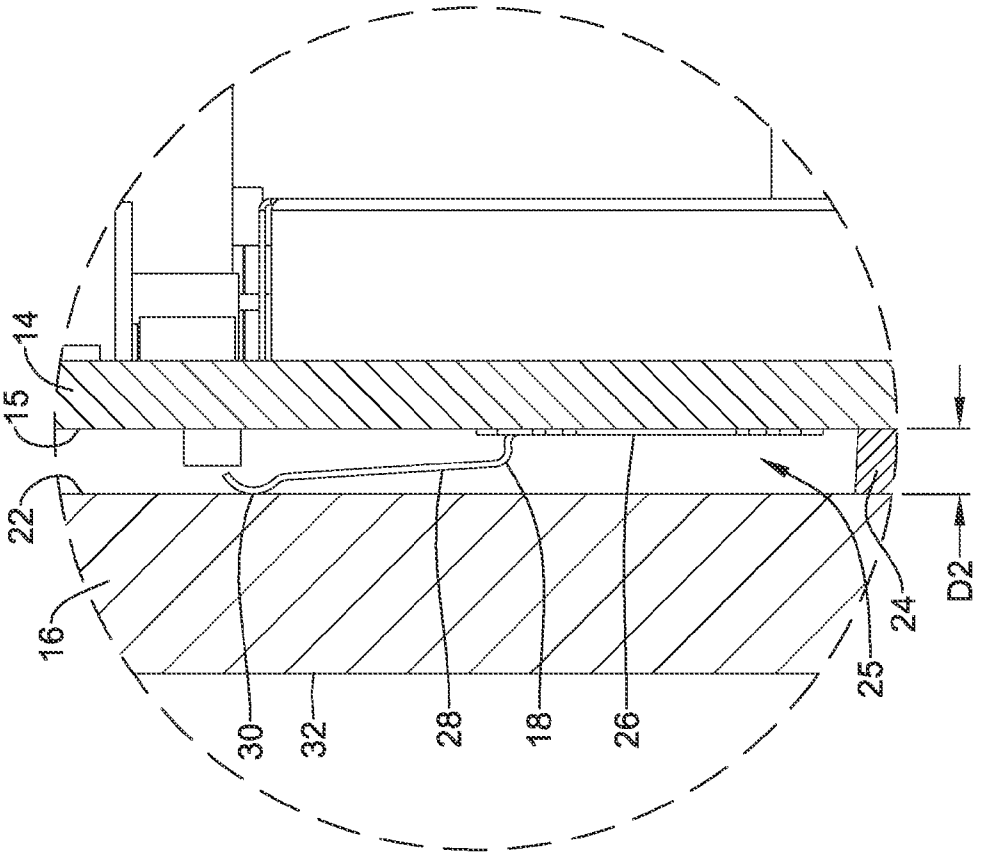


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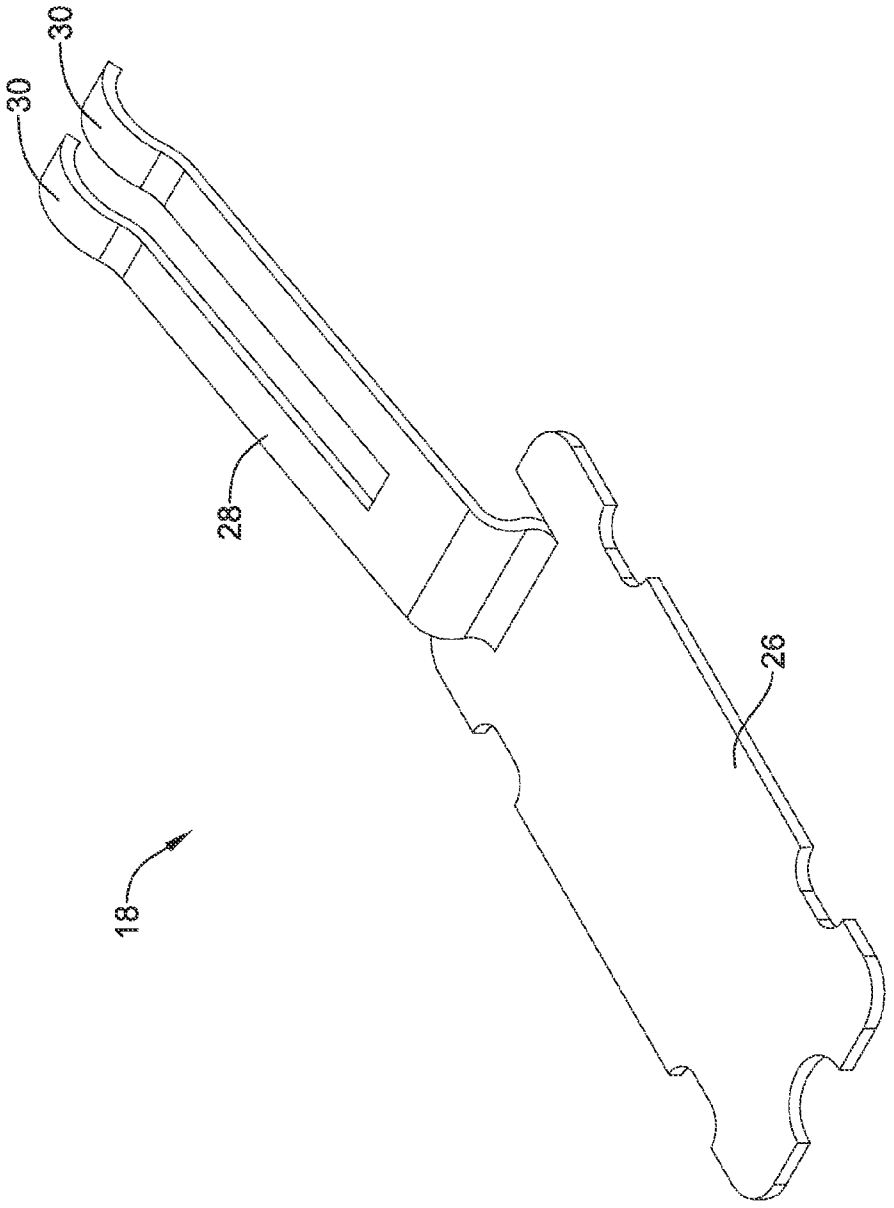


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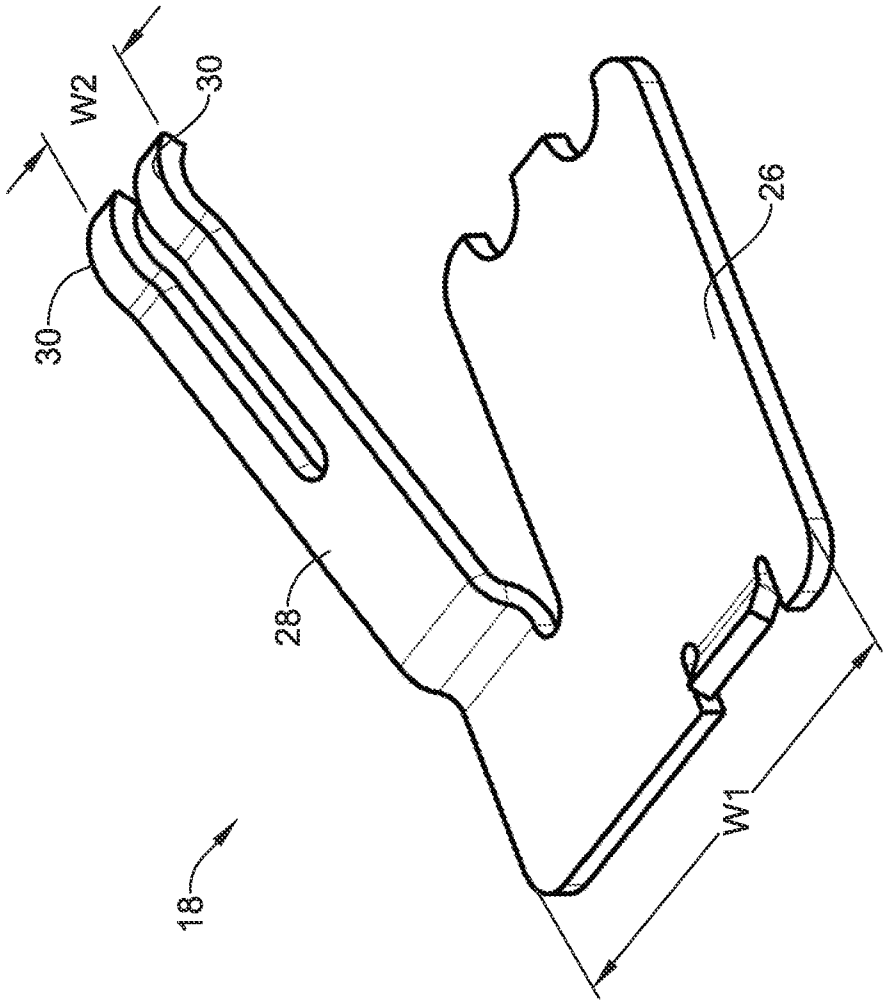


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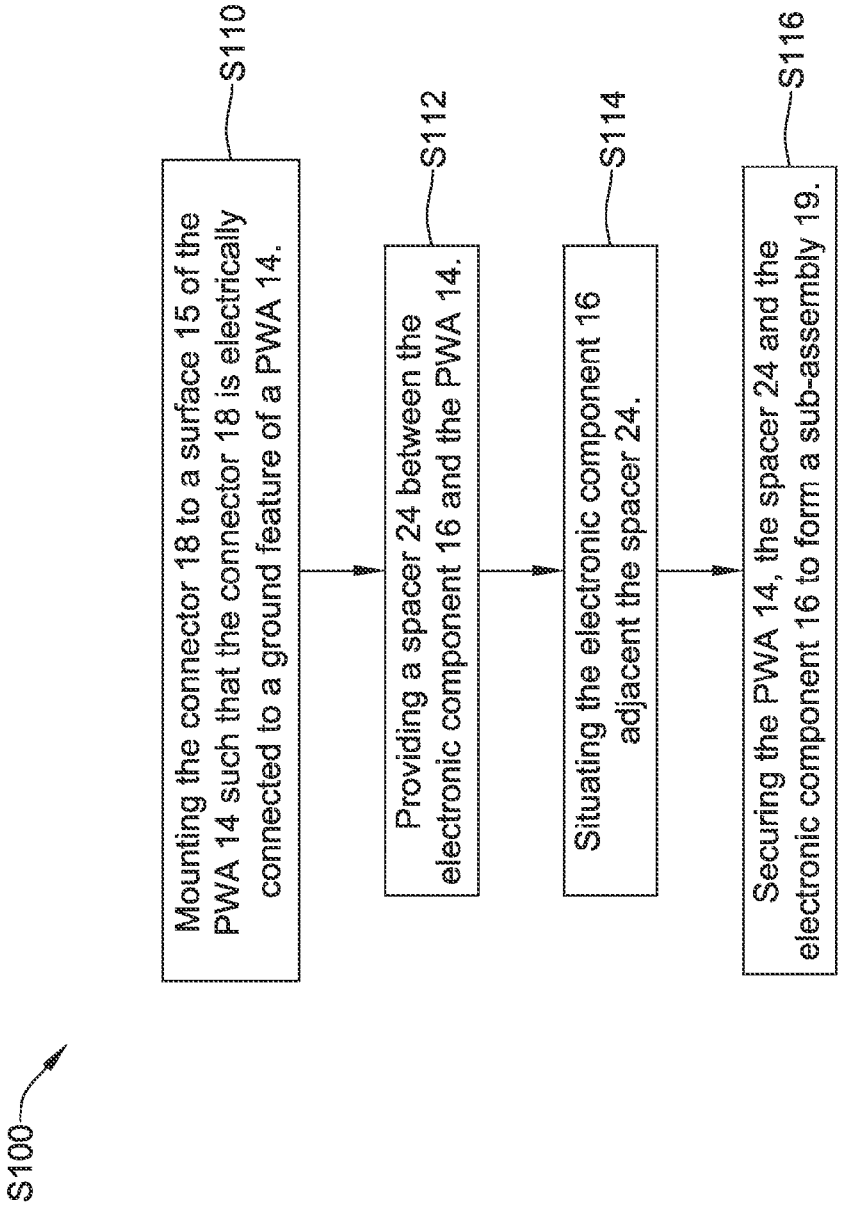

S100
Mounting the connector 18 to a surface 15 of the PWA 14 such that the connector 18 is electrically connected to a ground feature of a PWA 14.
S110
Providing a spacer 24 between the electronic component 16 and the PWA 14.
S112
Situating the electronic component 16 adjacent the spacer 24.
S114
Securing the PWA 14, the spacer 24 and the electronic component 16 to form a sub-assembly 19.
S116

Figure 9

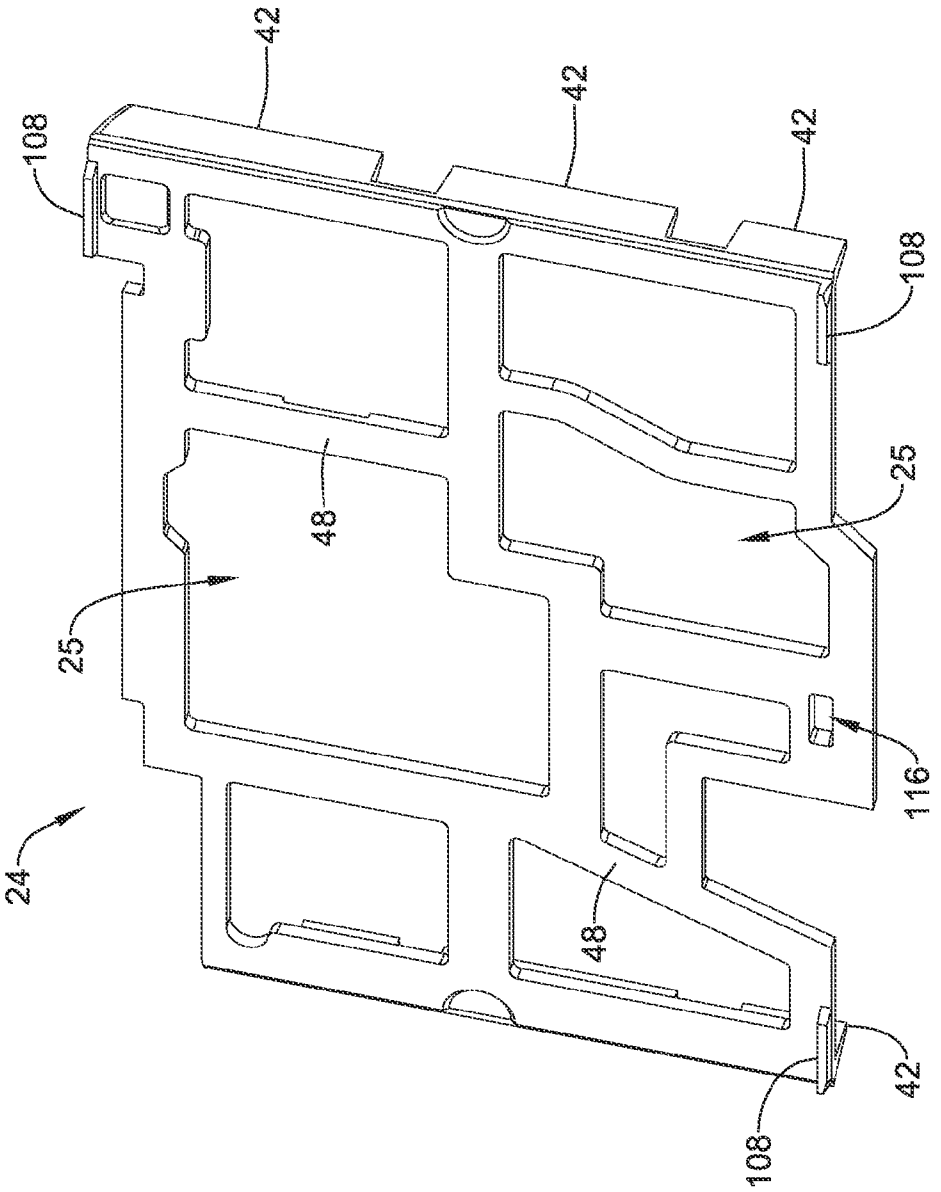


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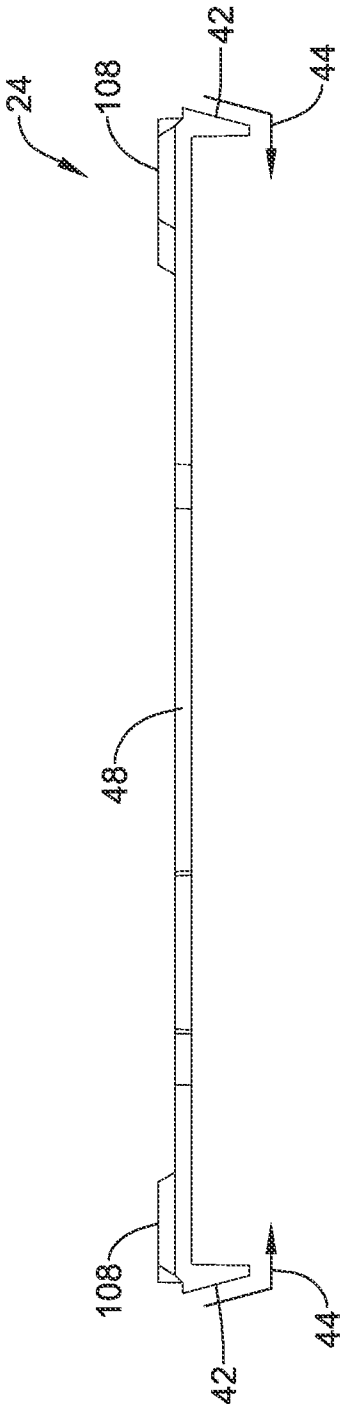


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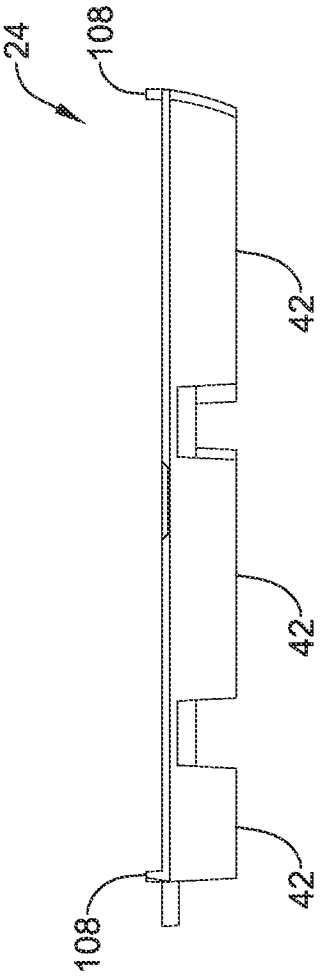


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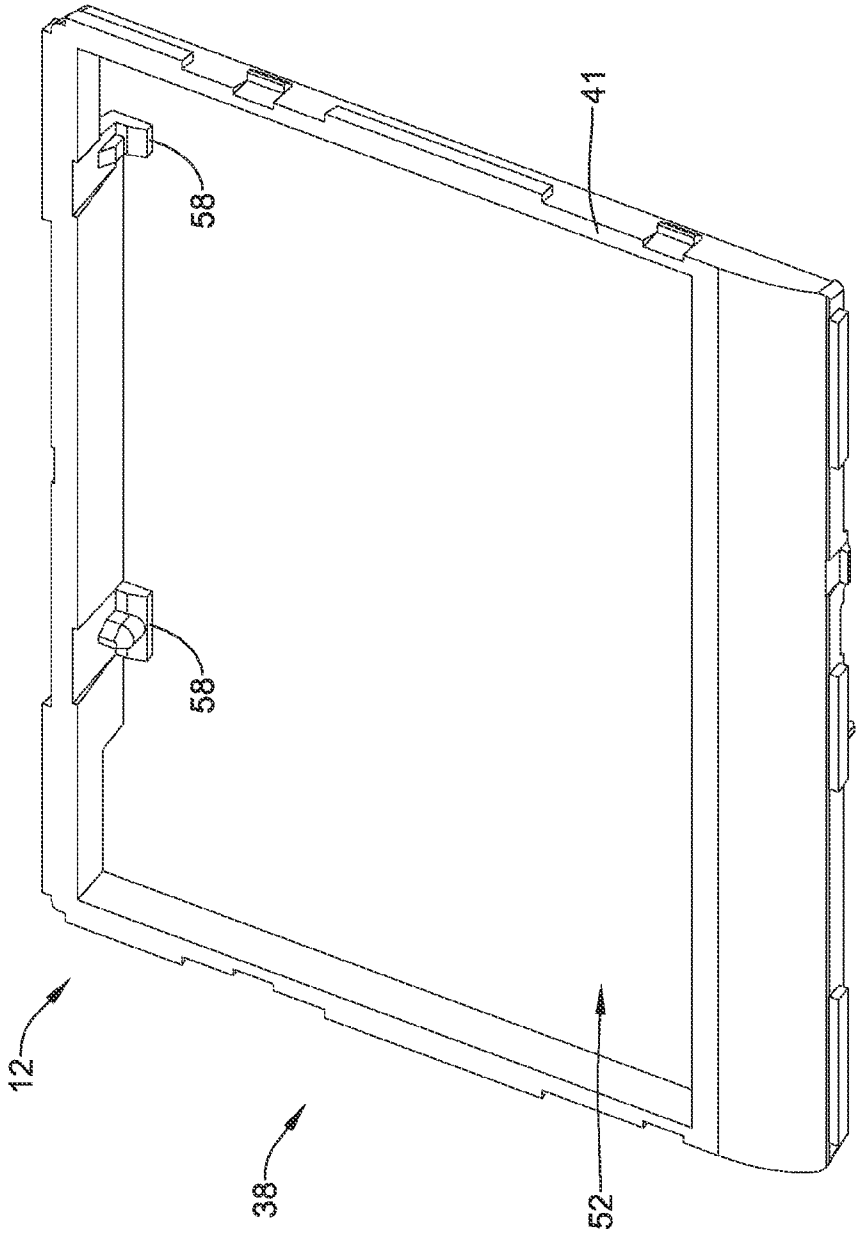


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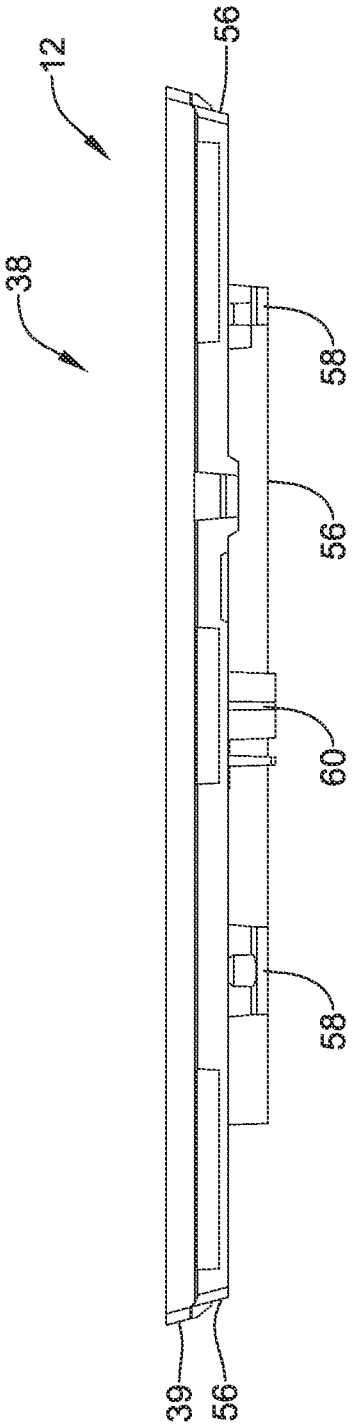


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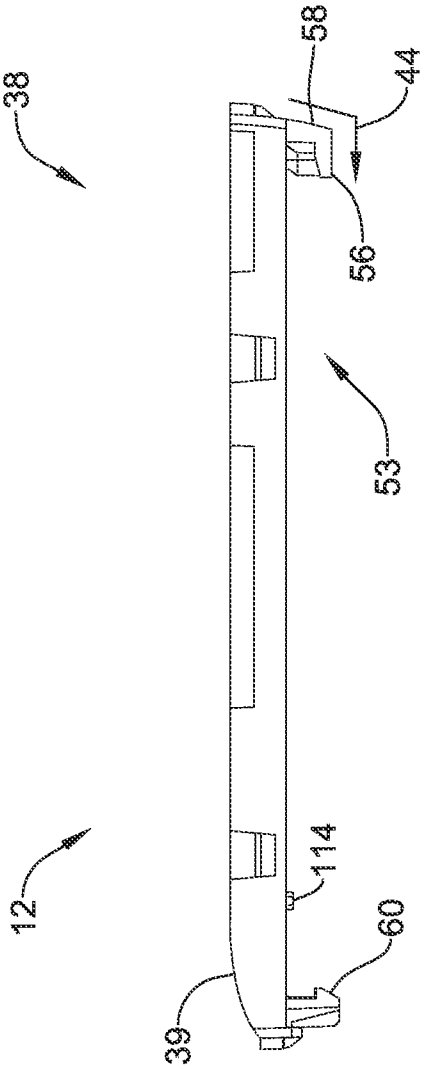


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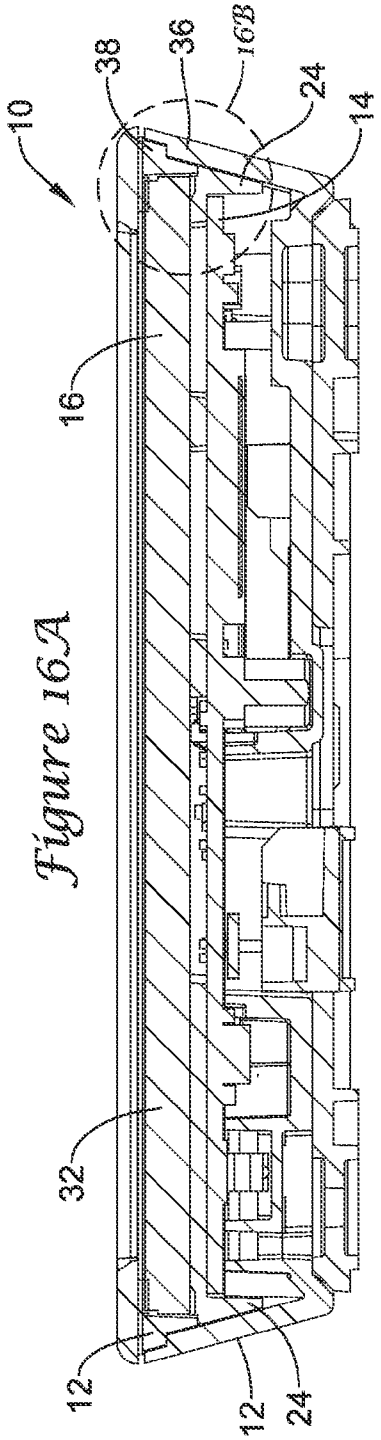


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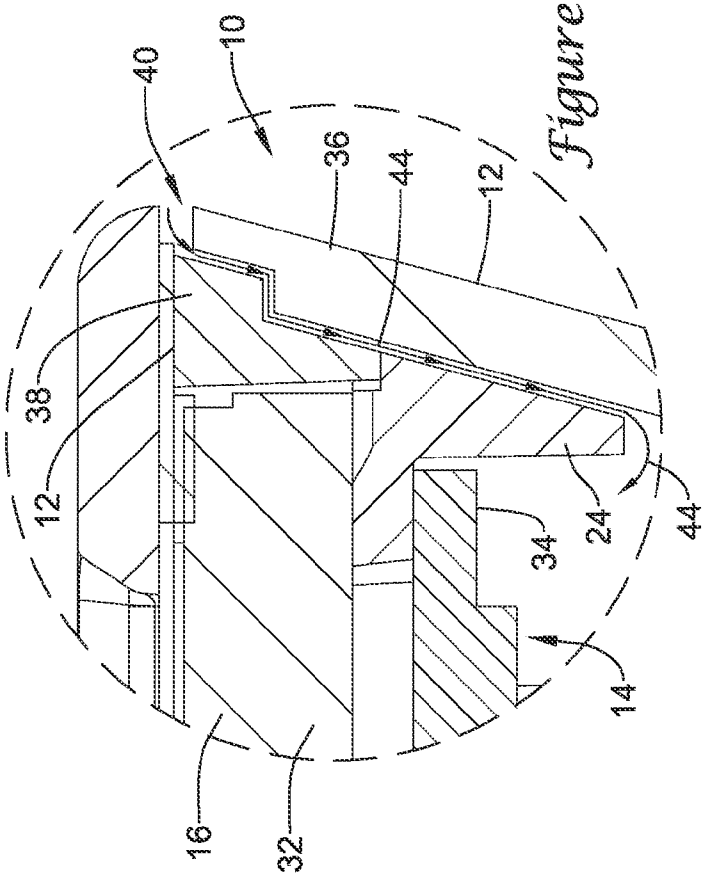


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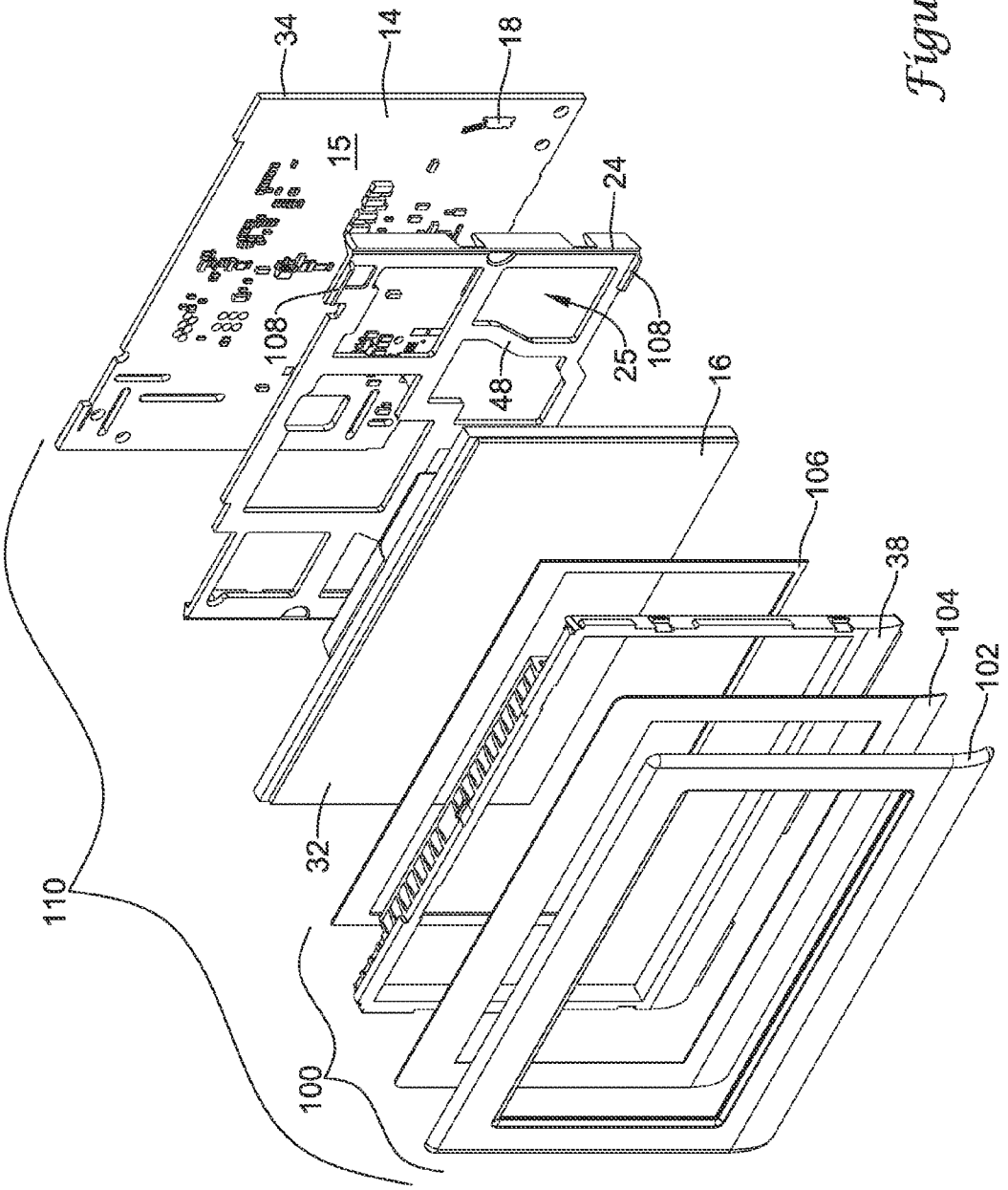


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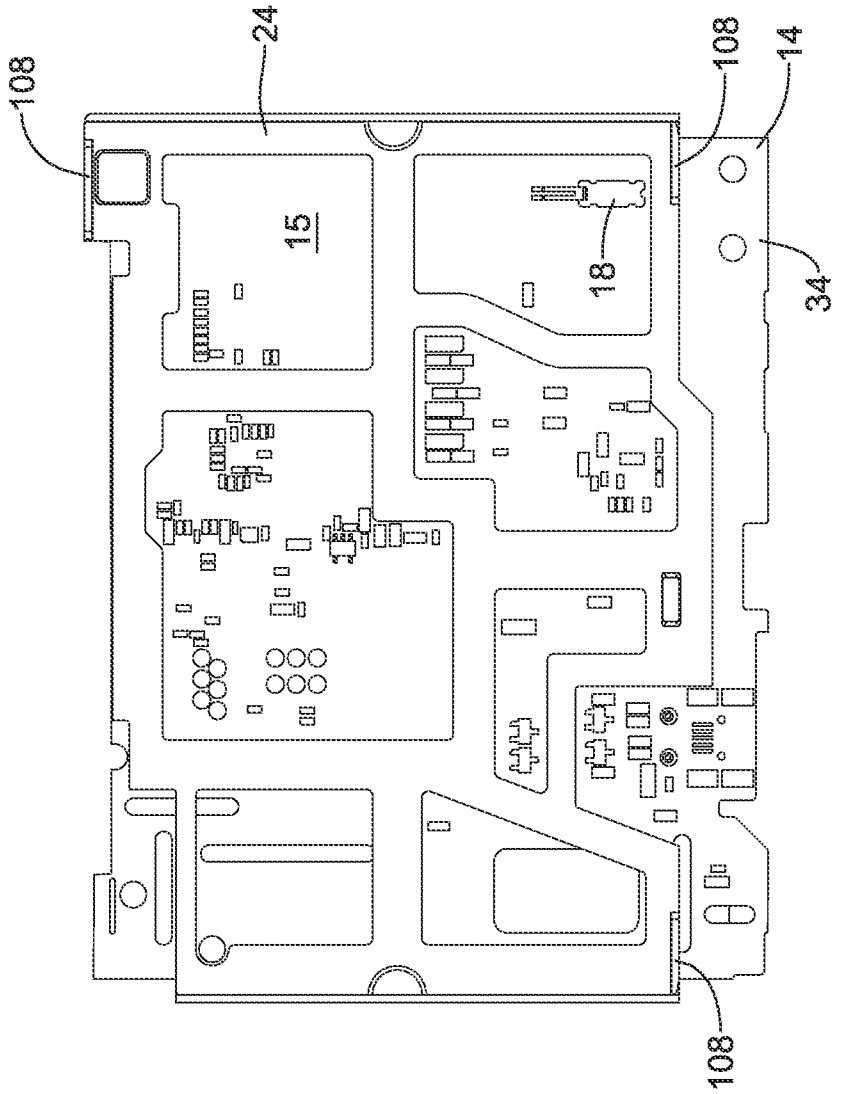


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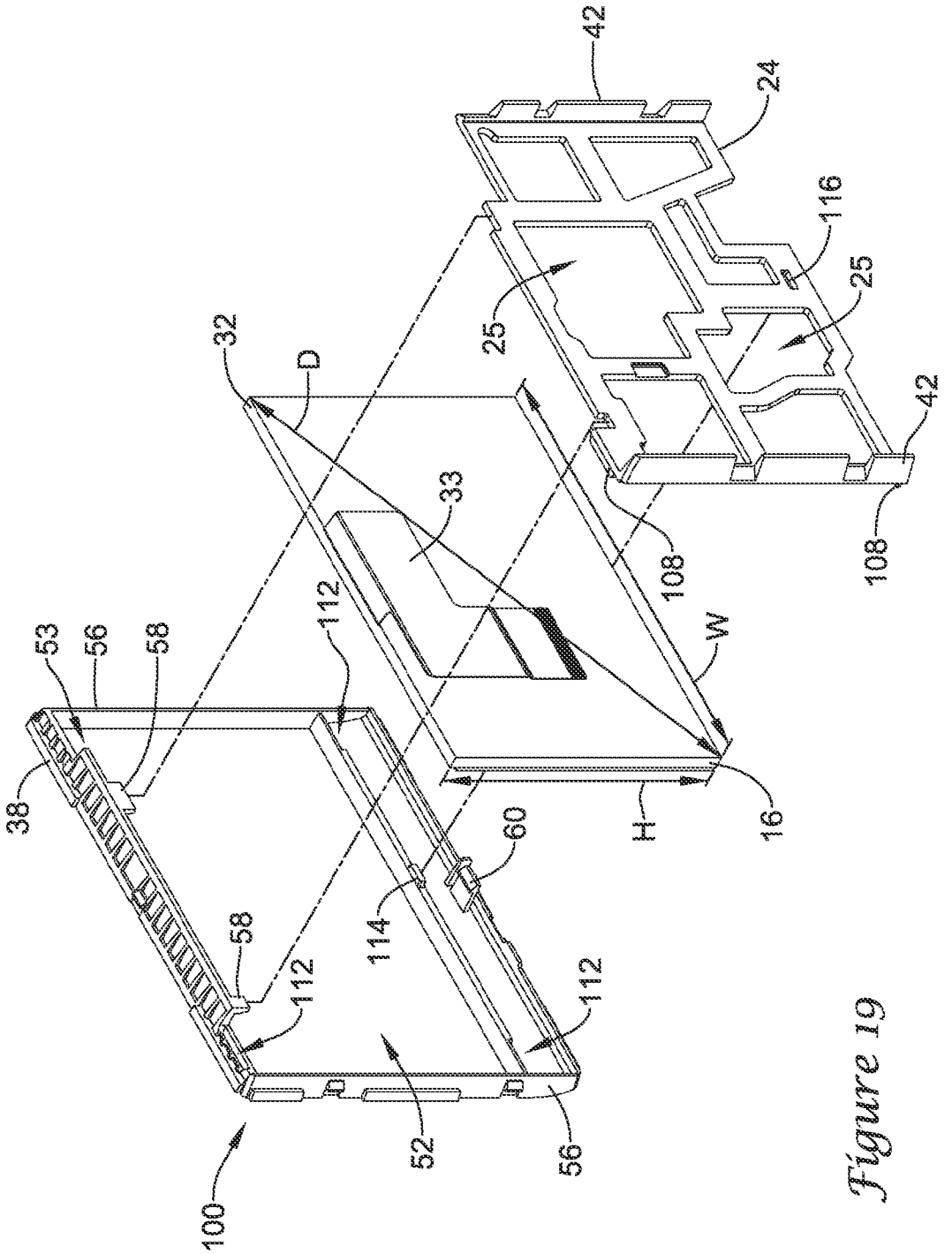

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Figure 19

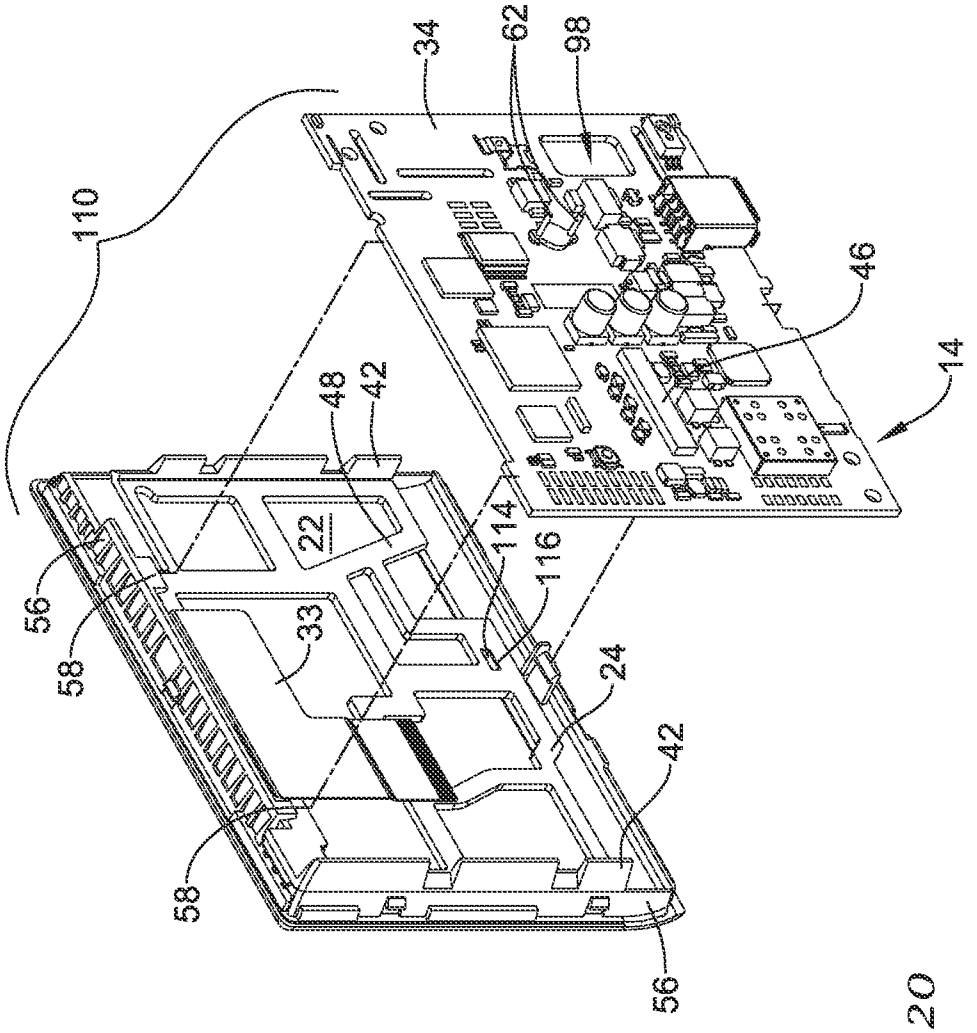


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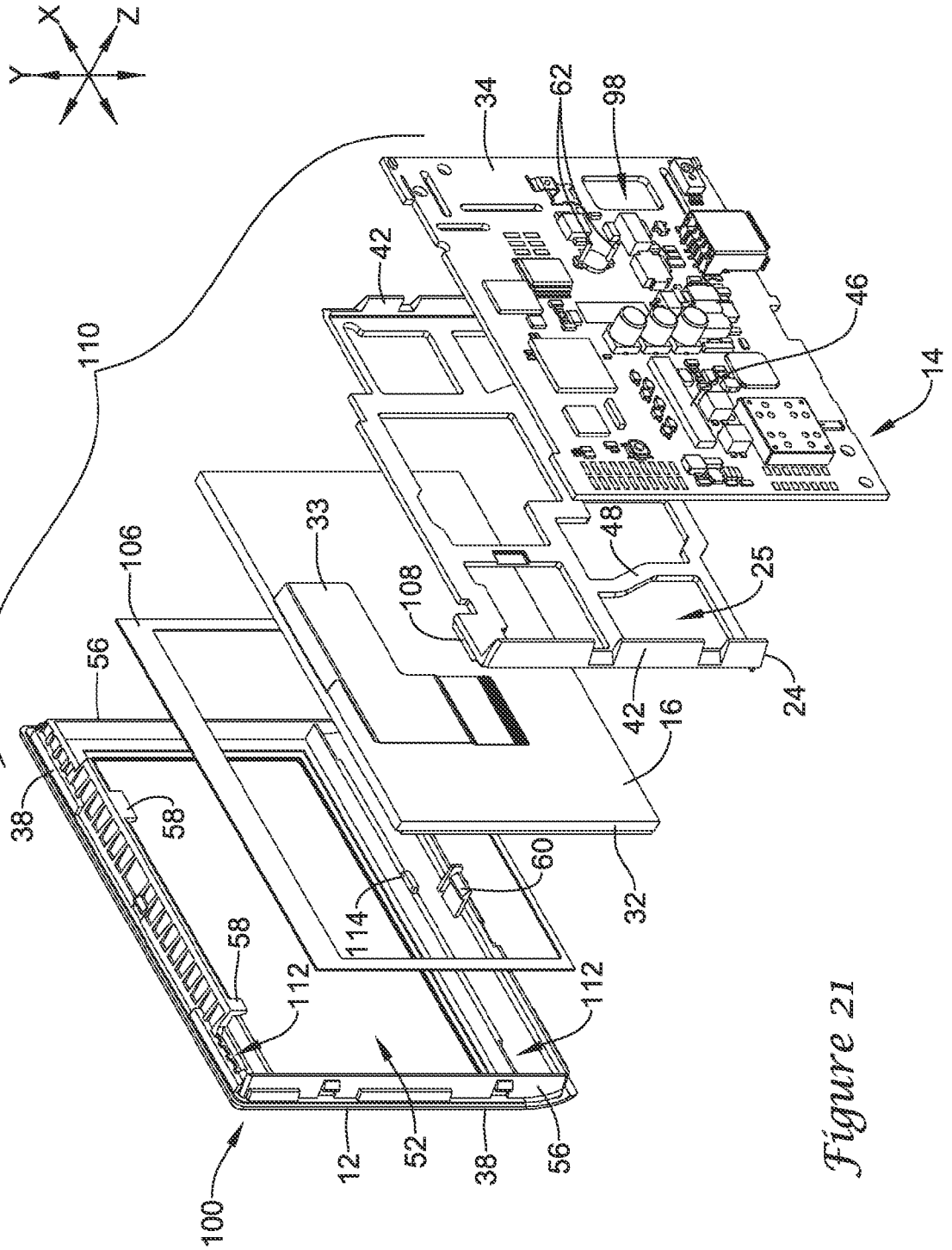

X
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Figure 21

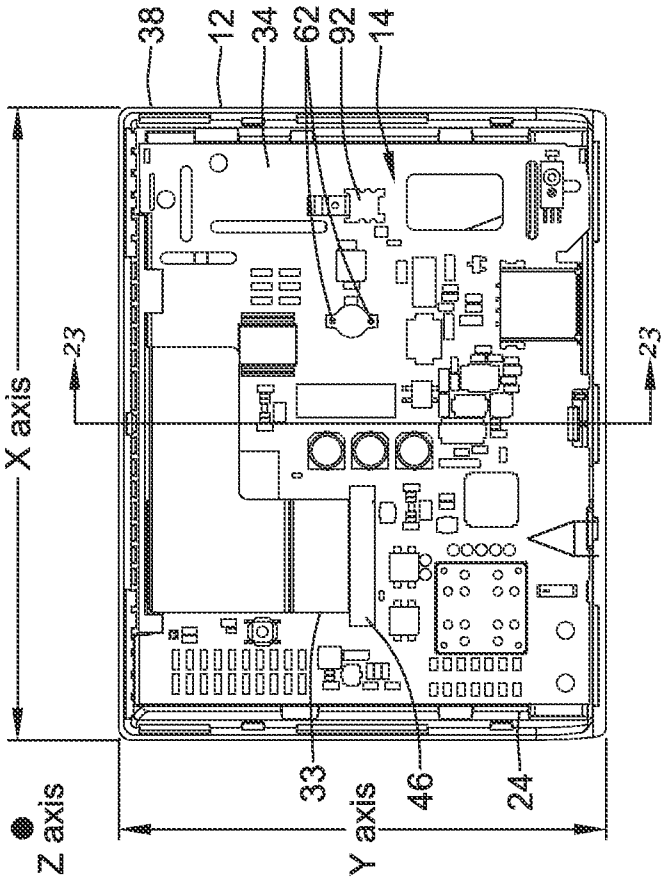


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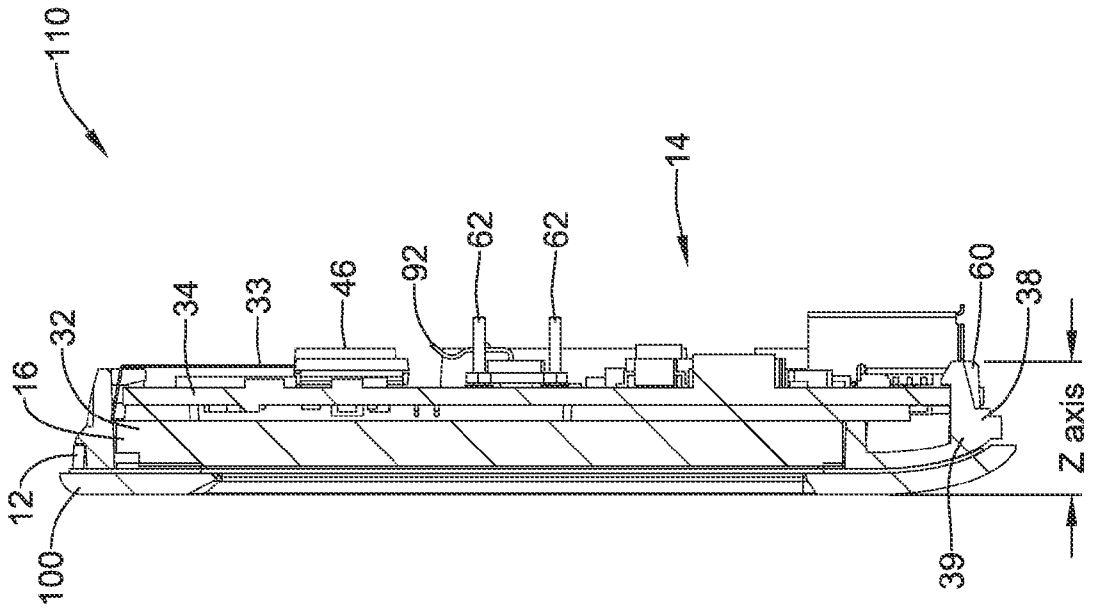


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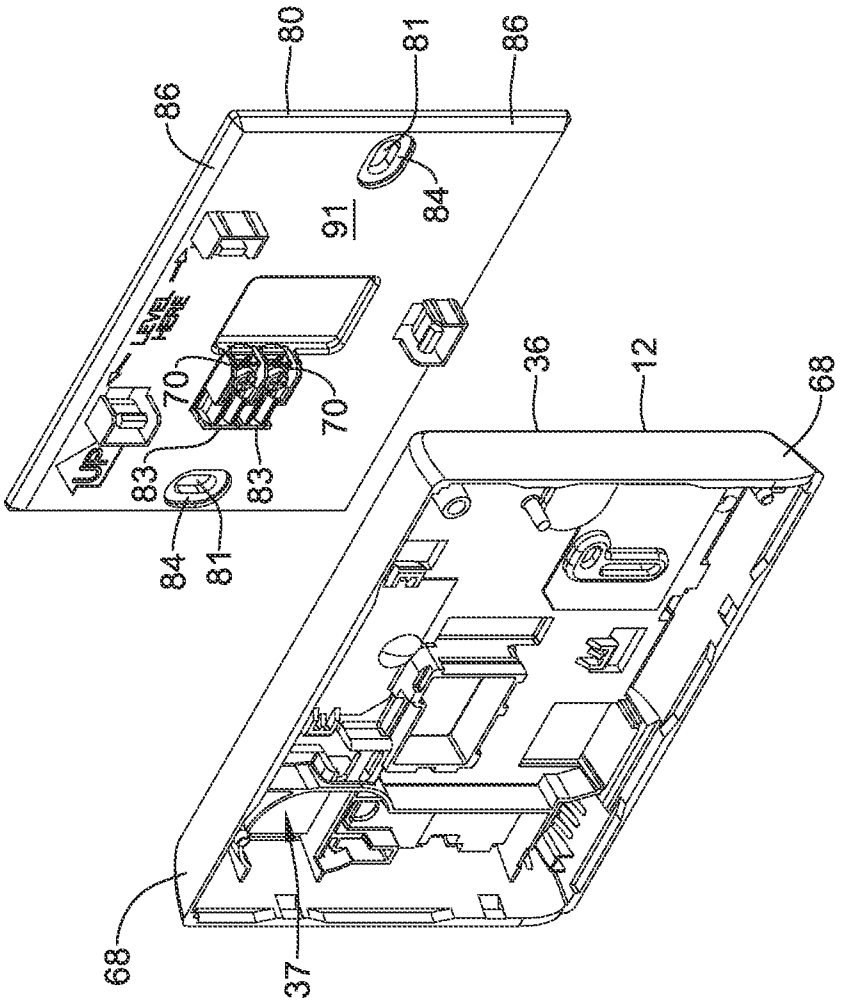


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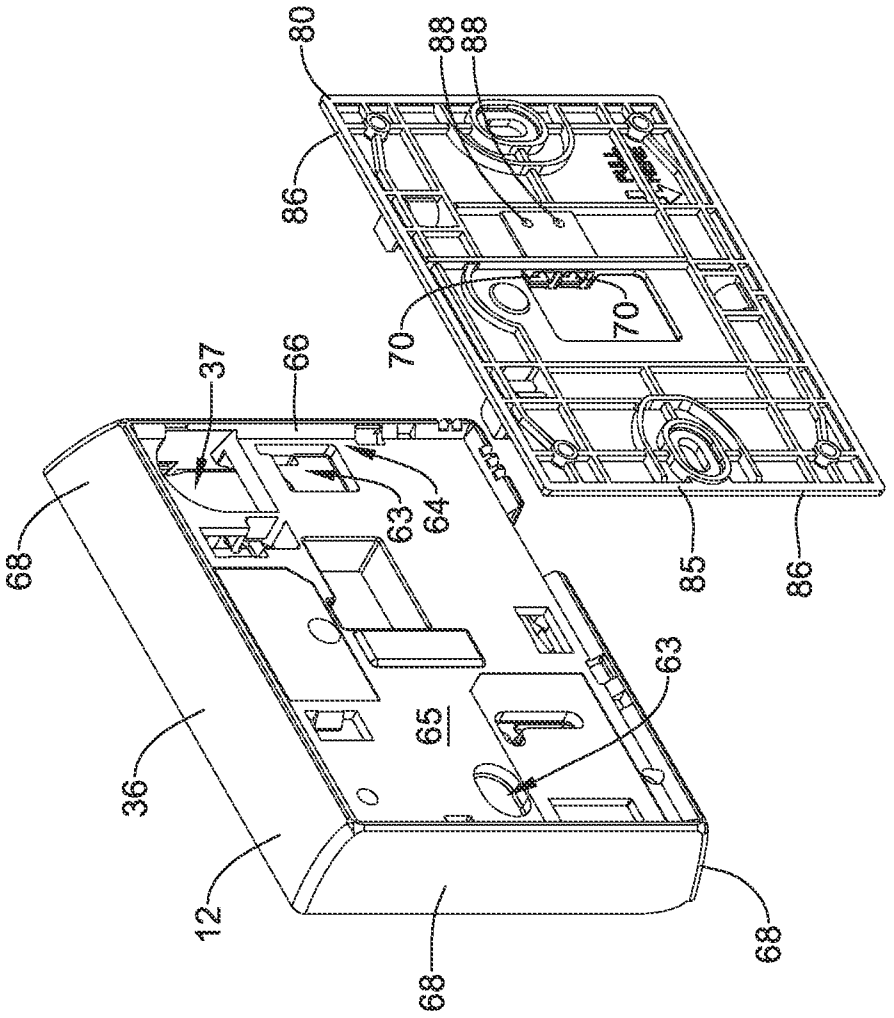


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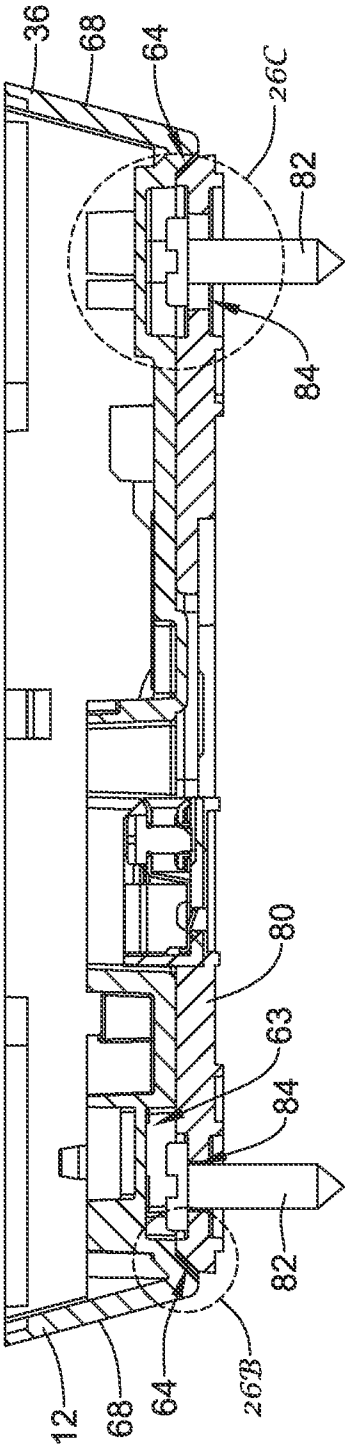


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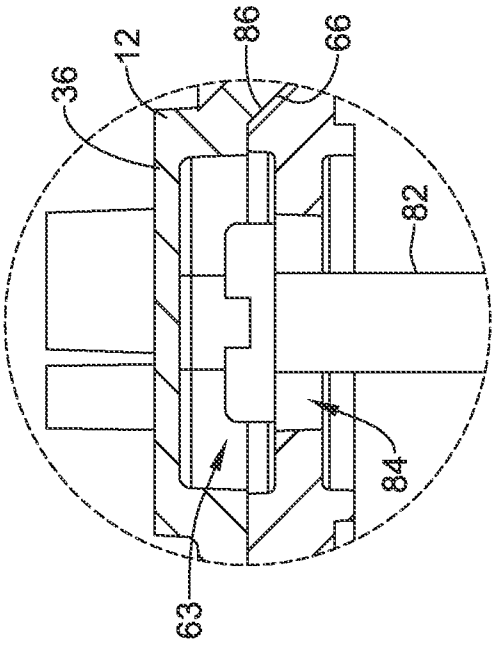


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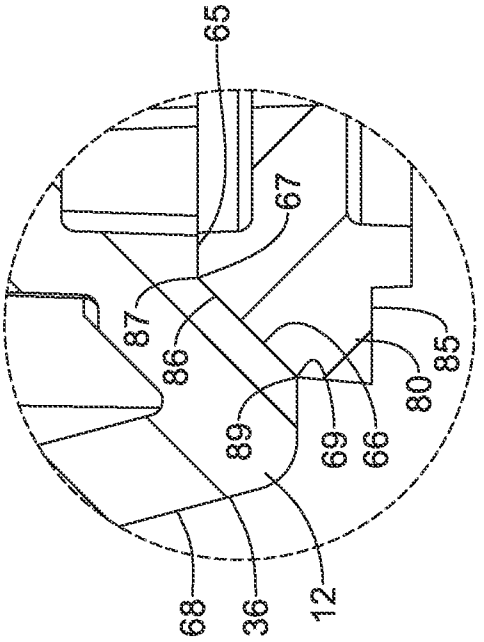


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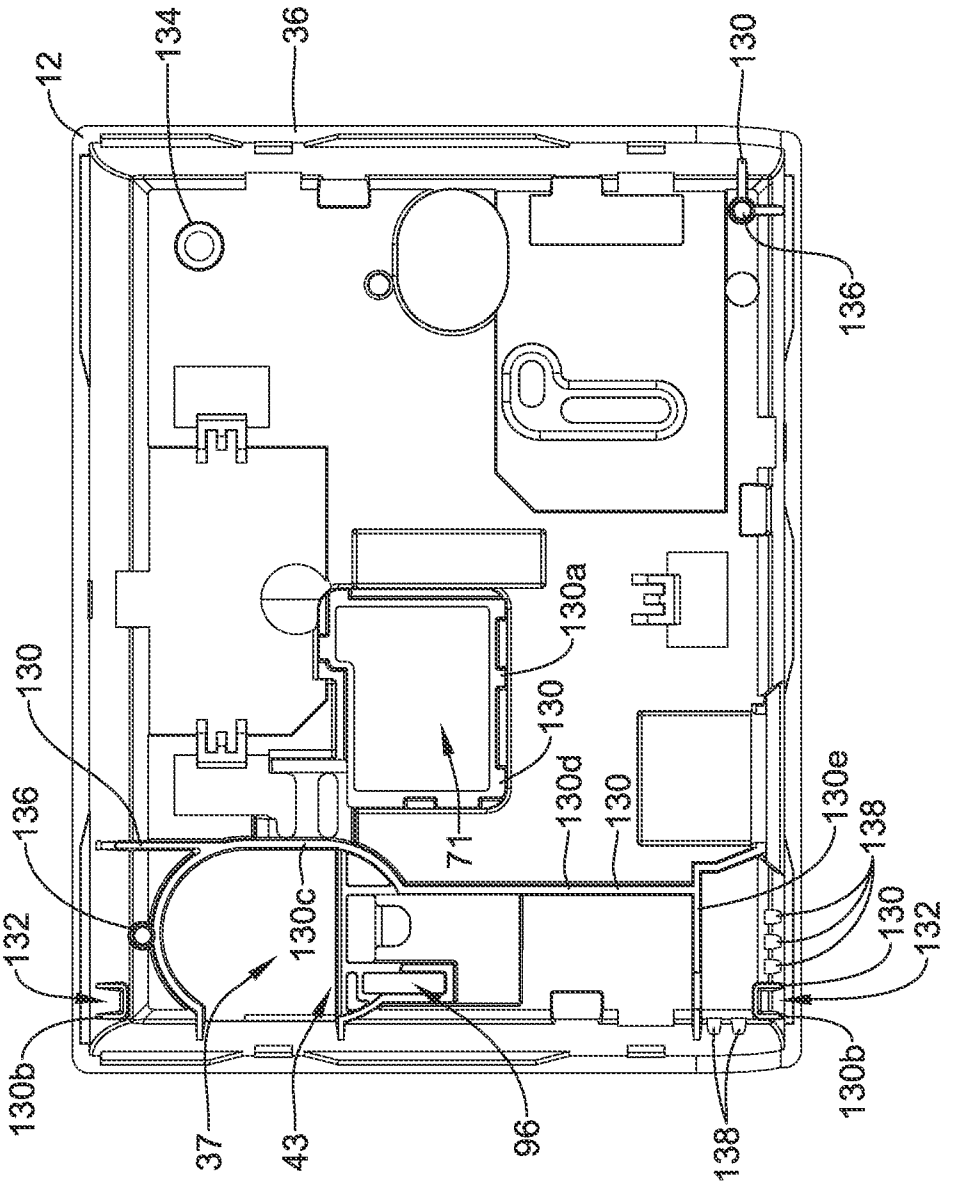

12
134
36
130
136
130a
130
130d
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130
132
130c
132
136
130
130b
37
43
96
138
130b

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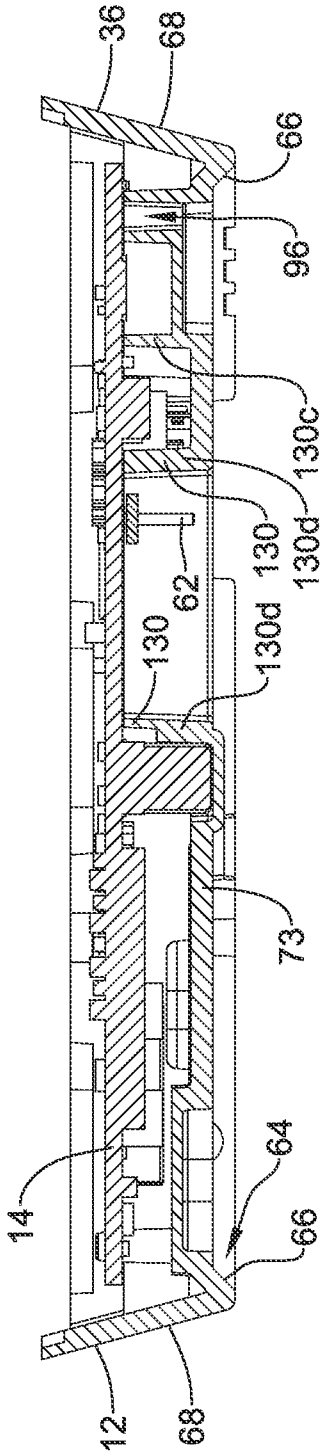


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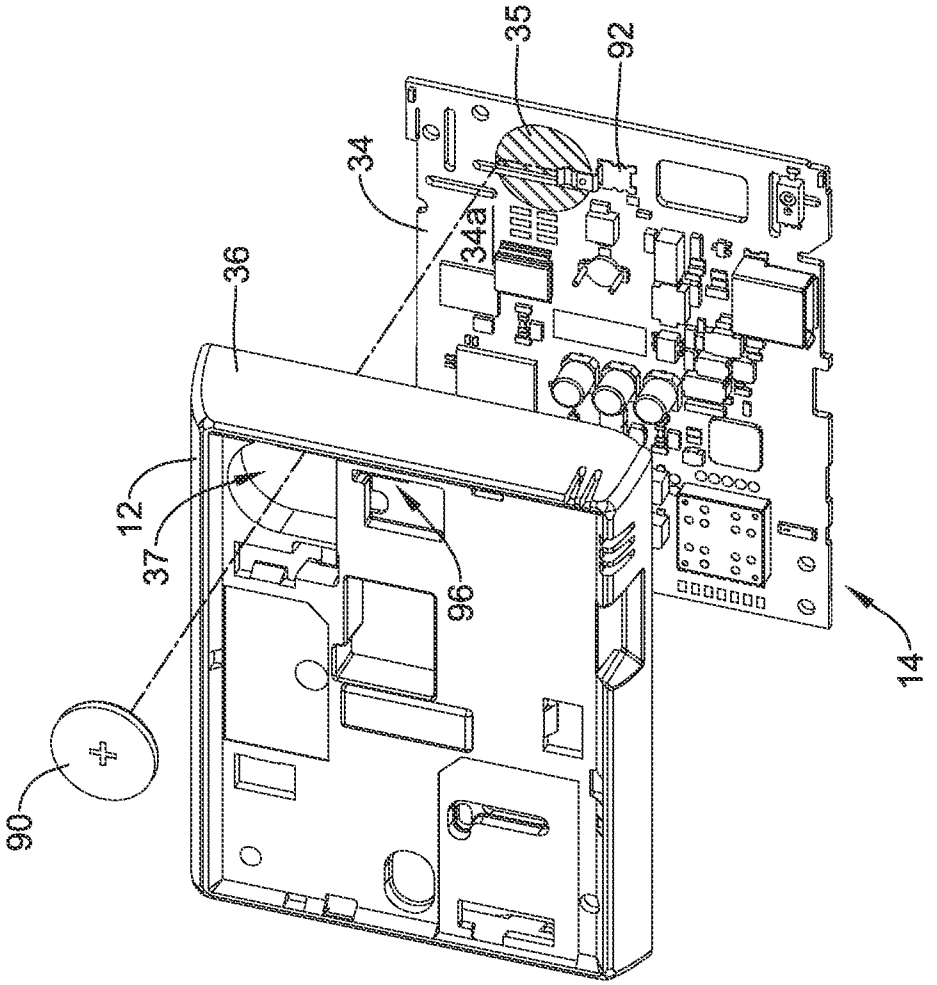


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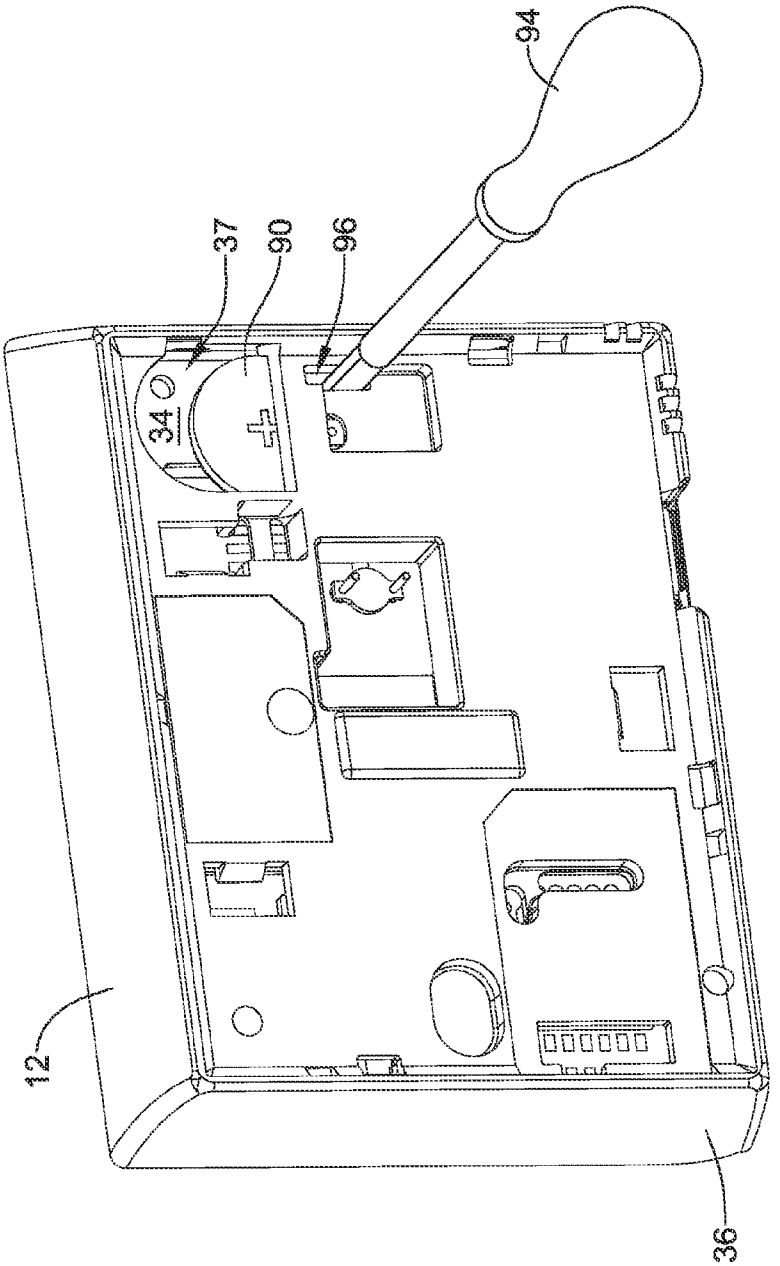


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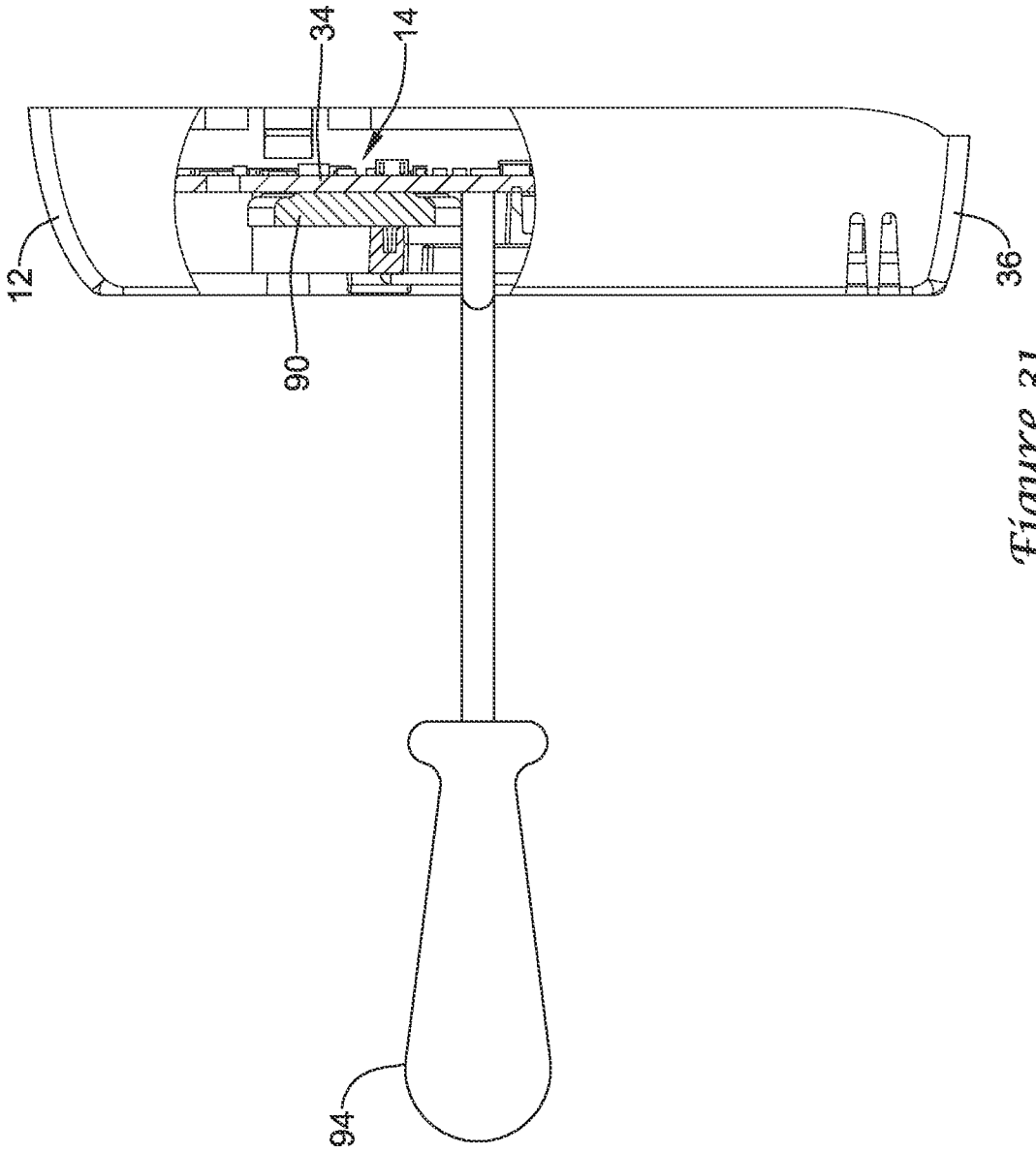


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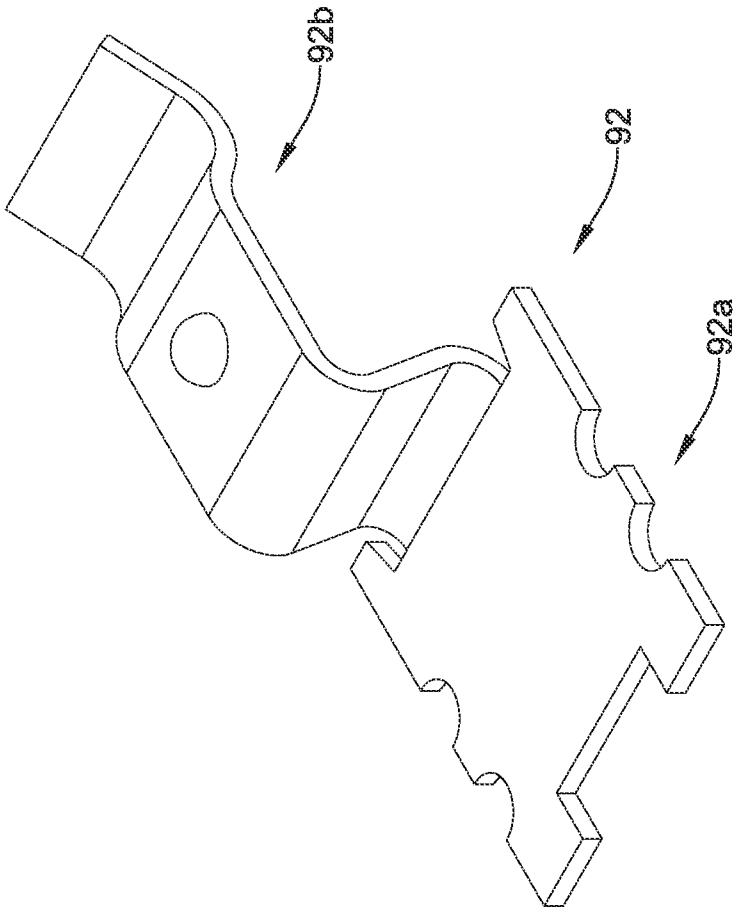


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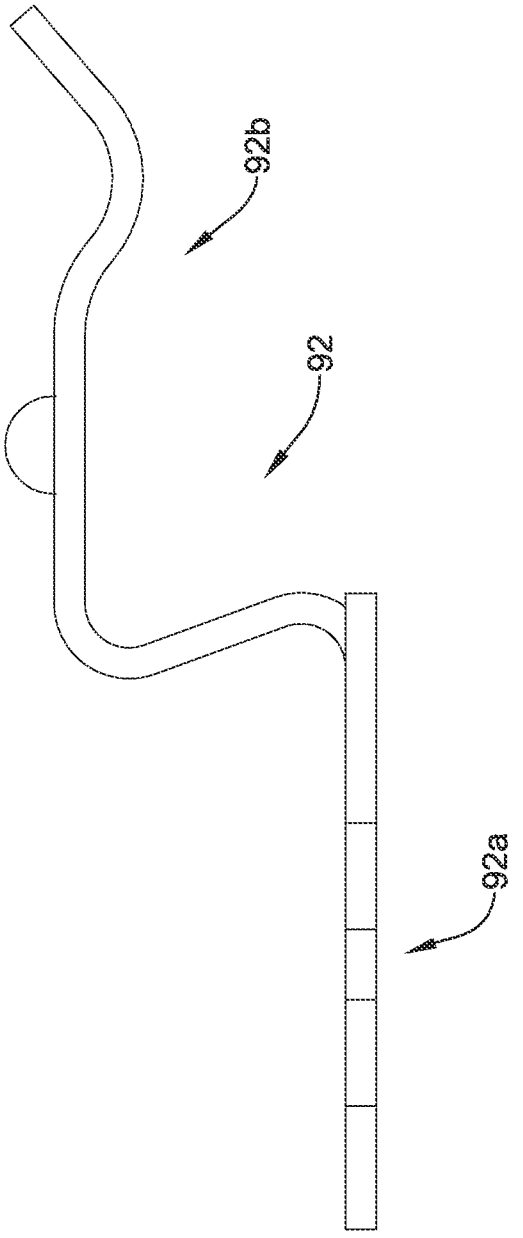


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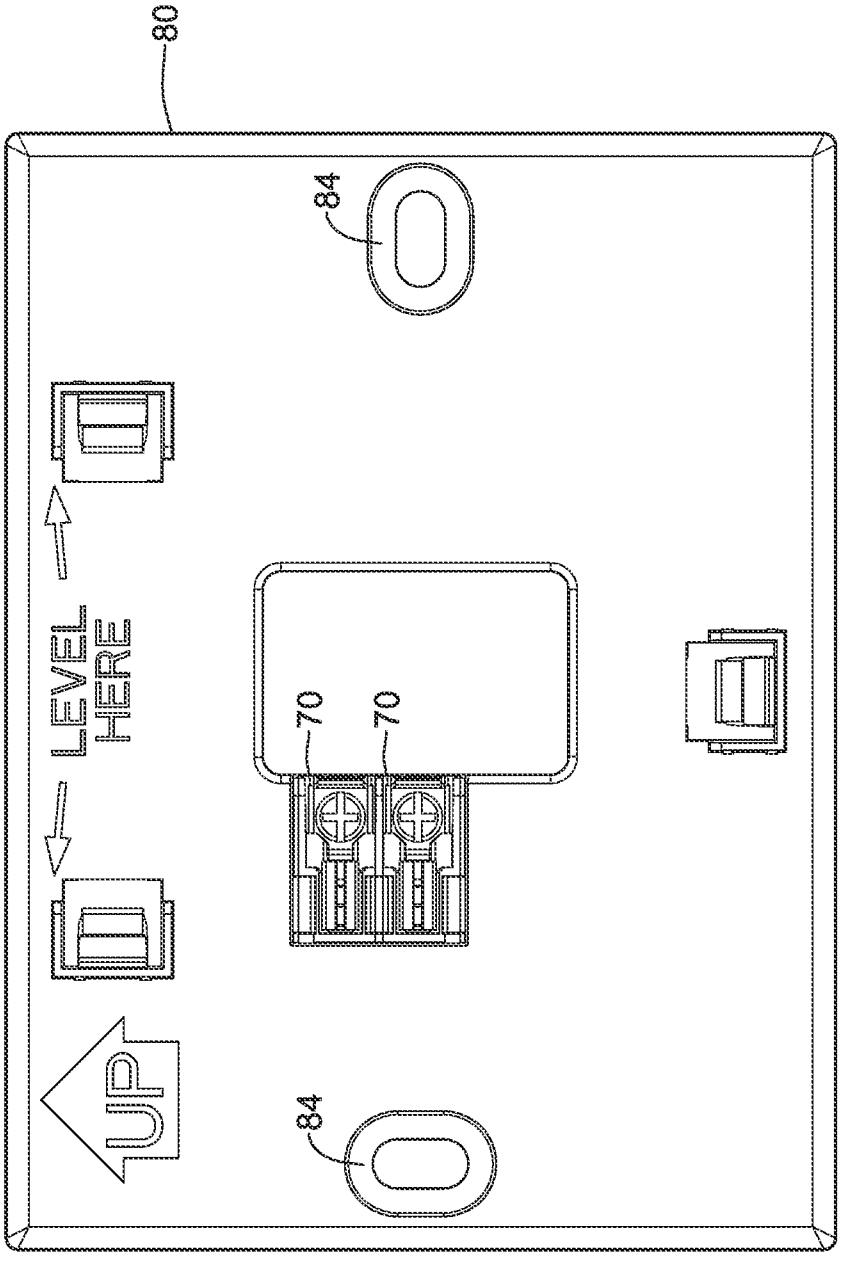


Figure 34A

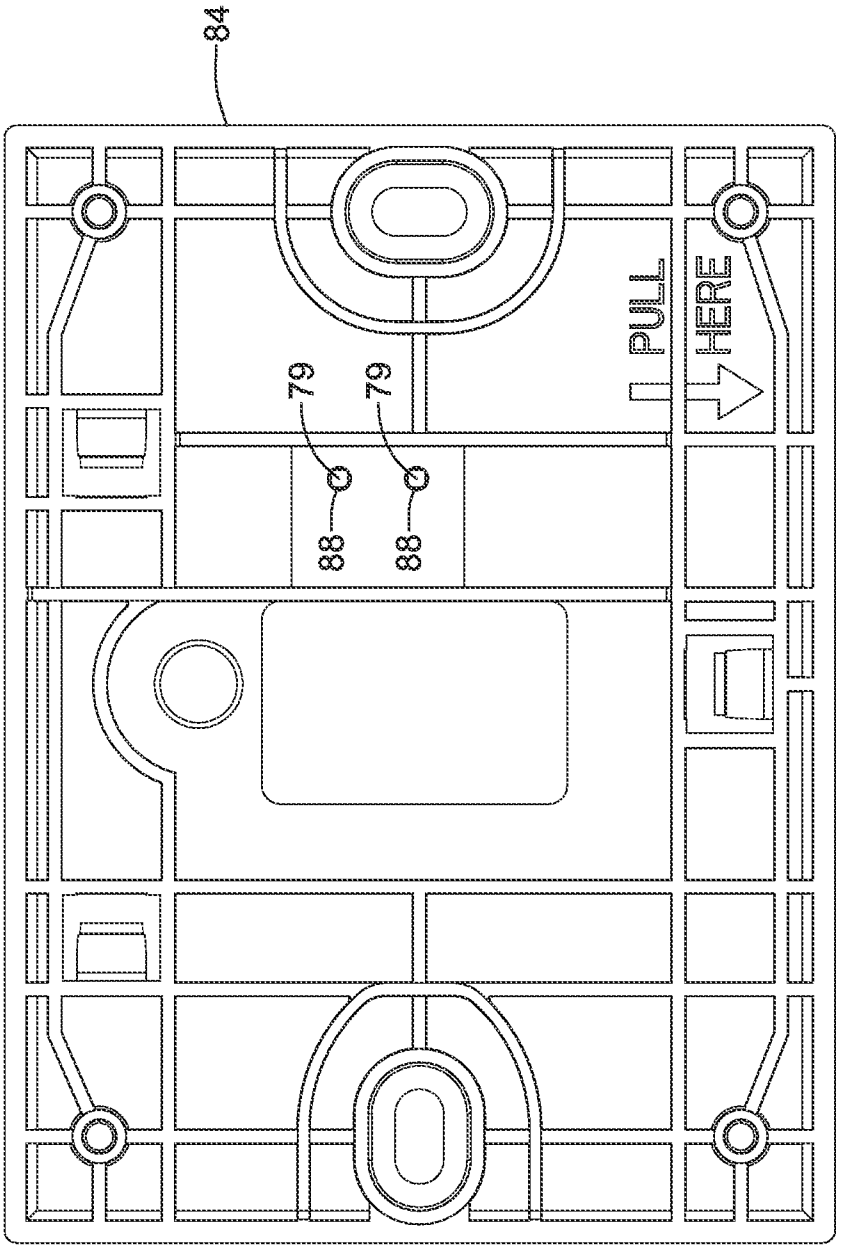


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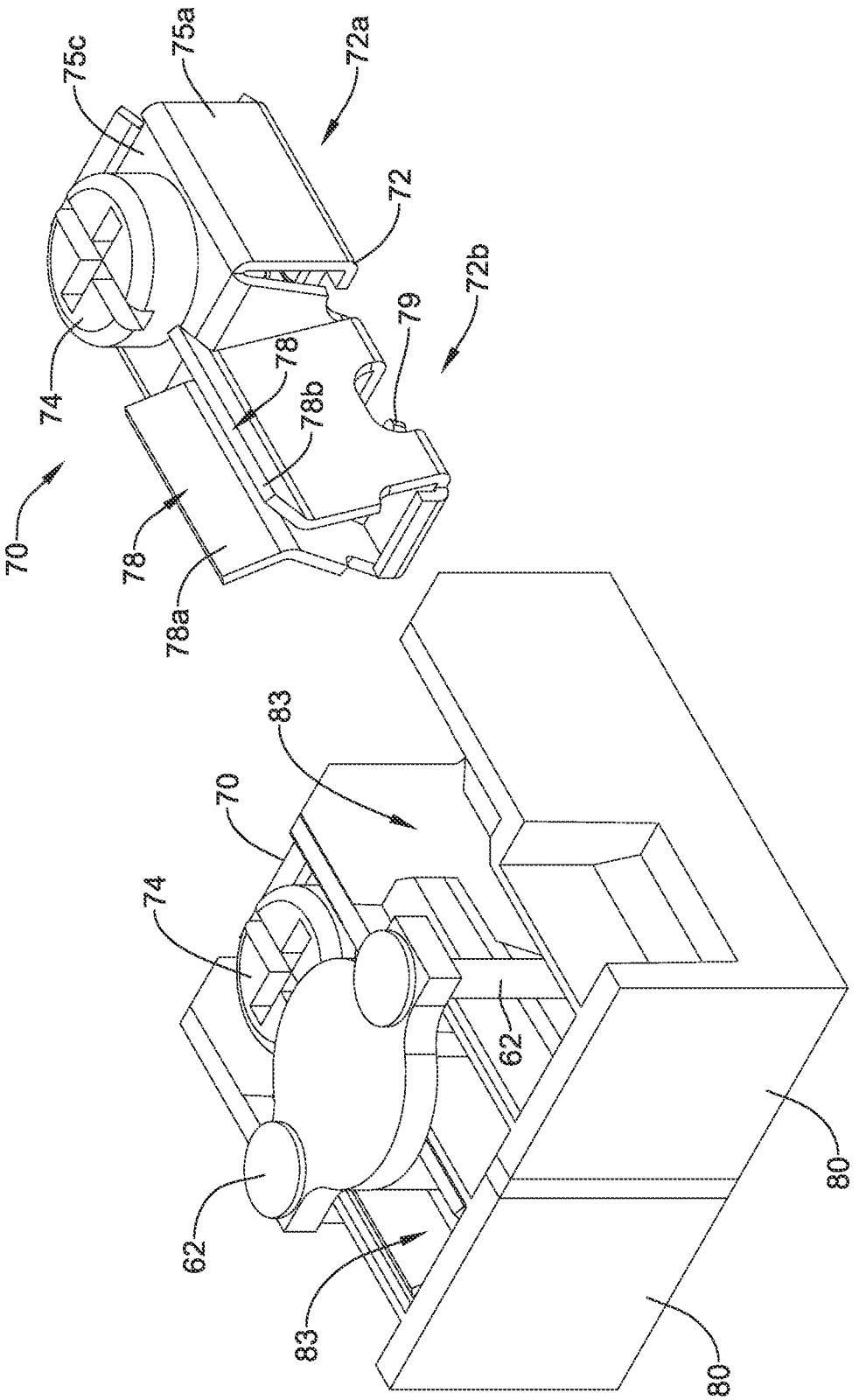


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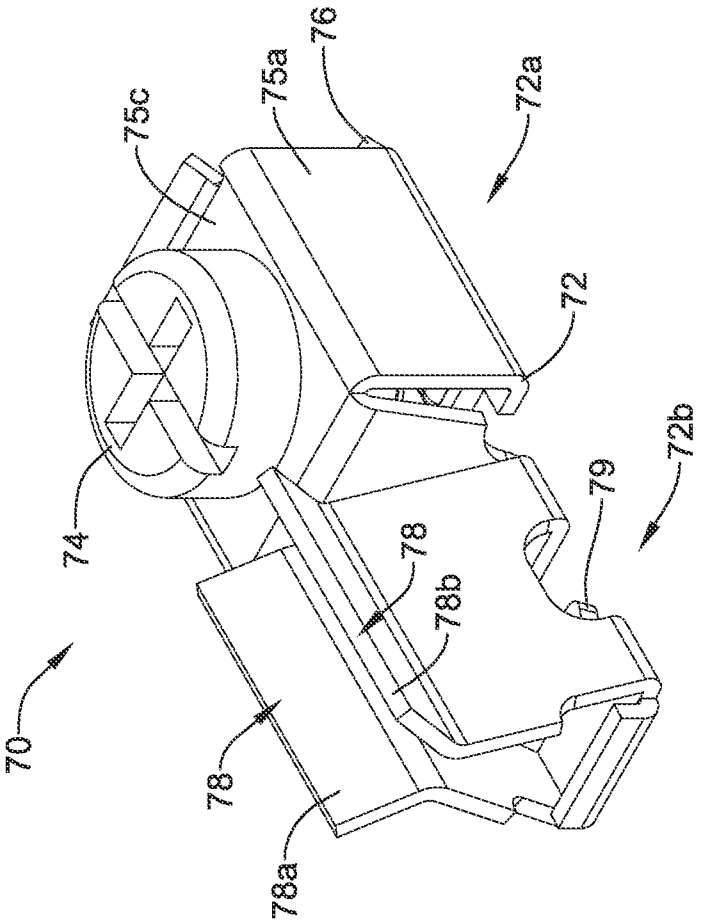


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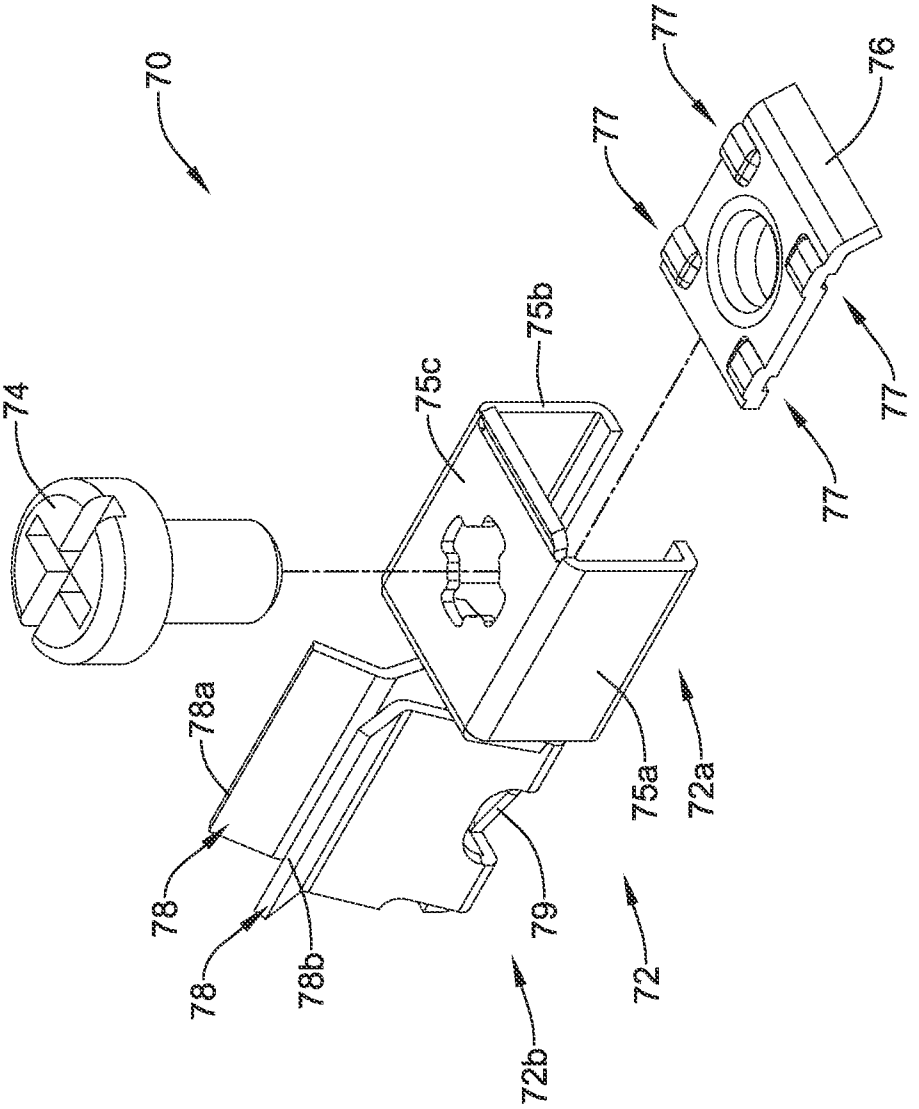


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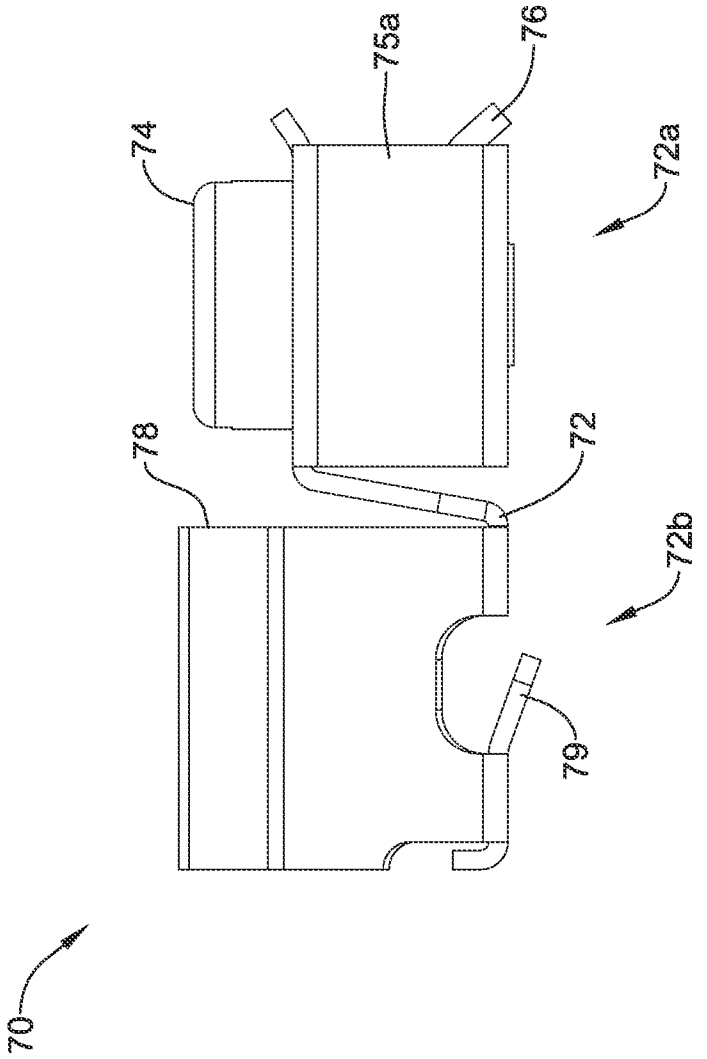


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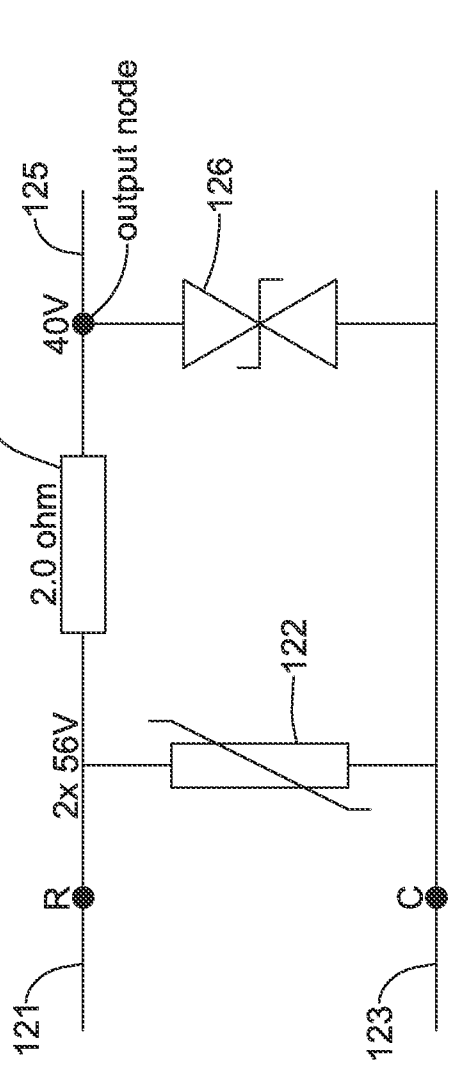


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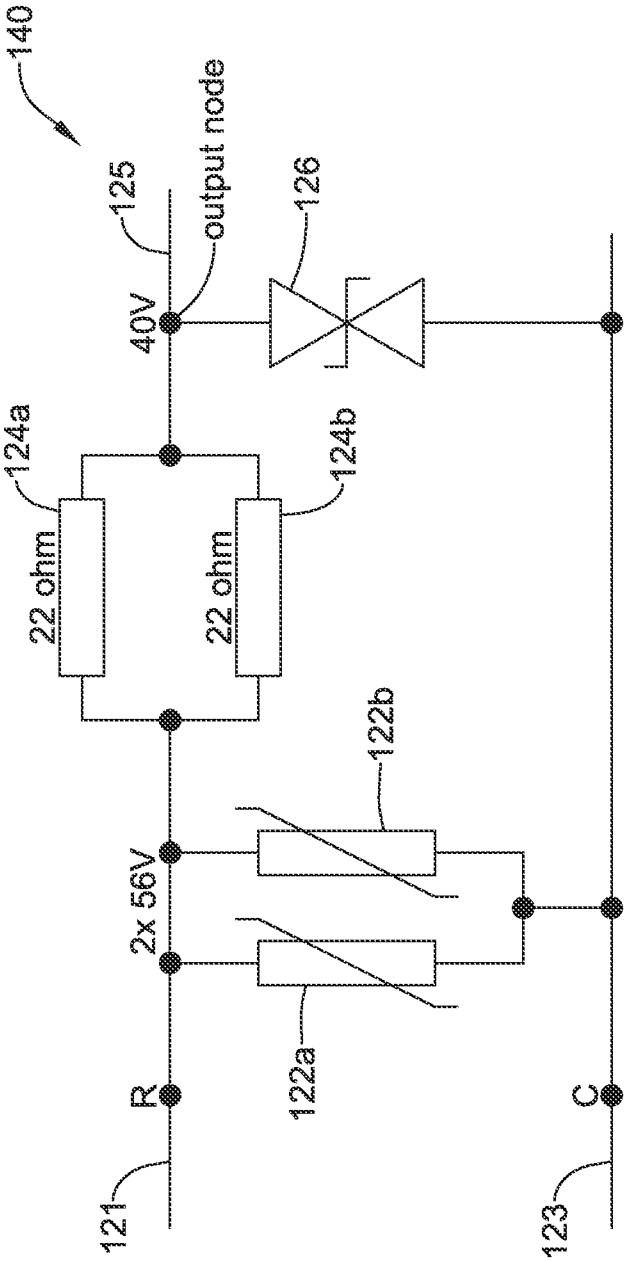

140
output node
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126
40V
124a
124b
22 ohm
22 ohm
122b
2x 56V
122a
R
C
121
123

Figure 40

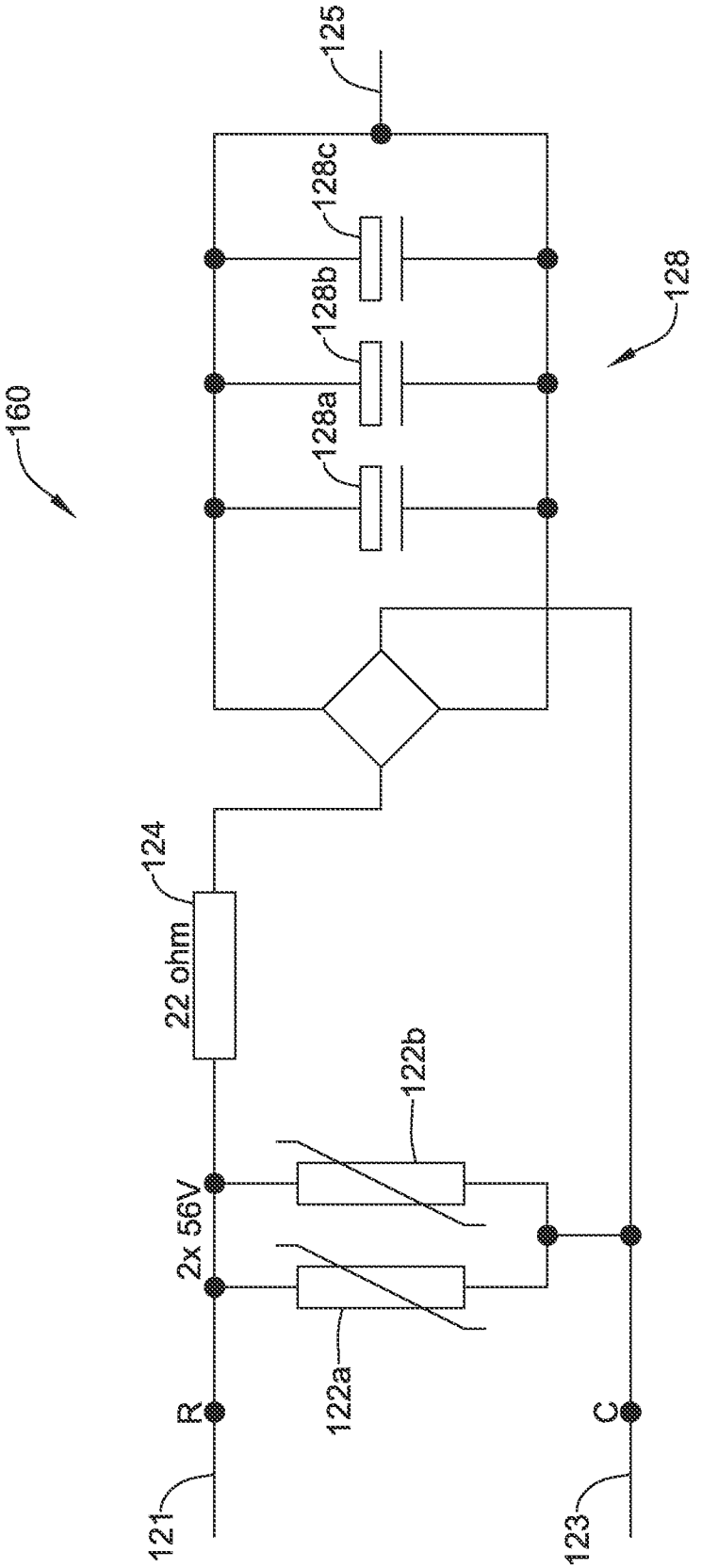

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Figure 41

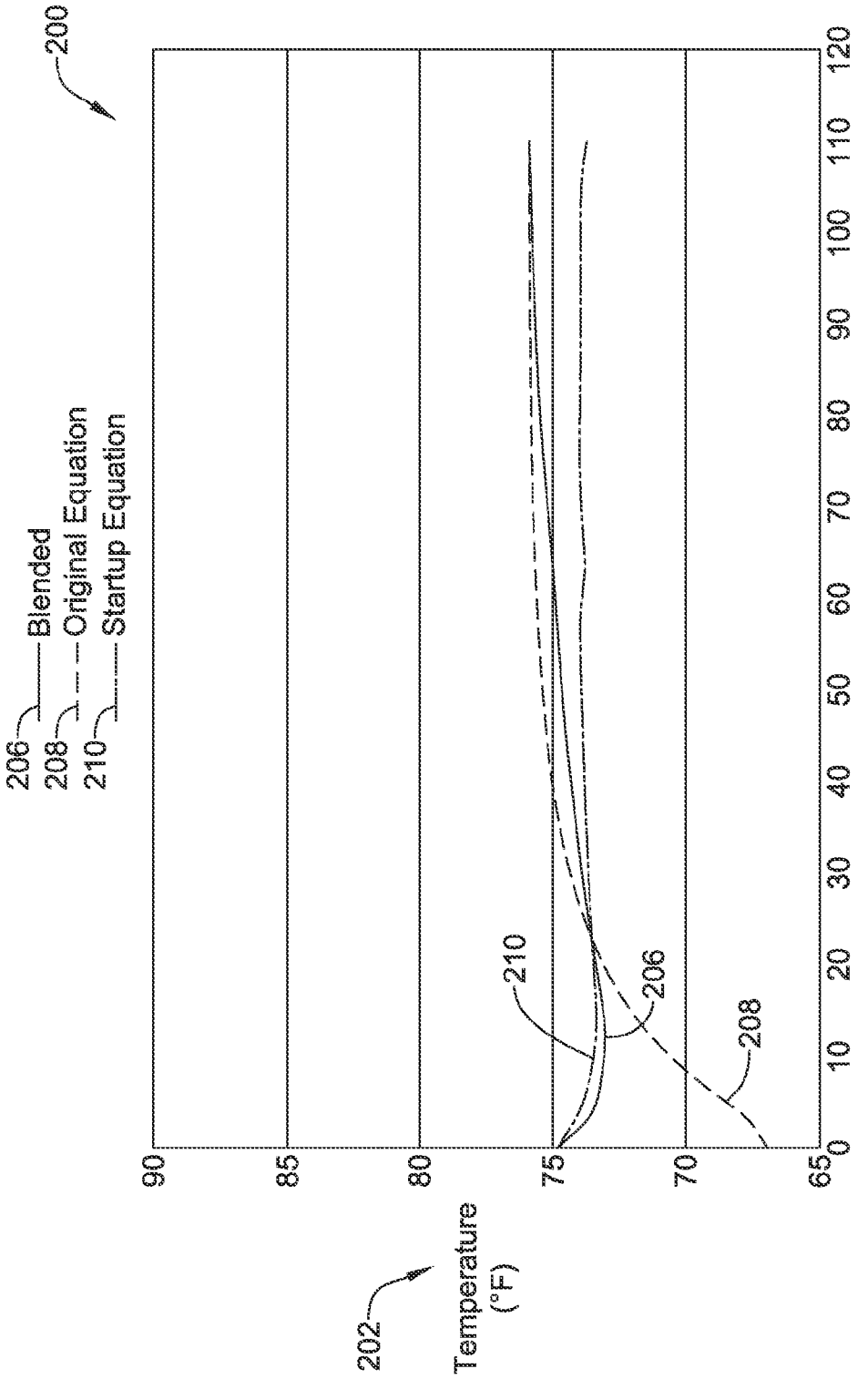

200
206 Blended
208 Original Equation
210 Startup Equation
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65
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Temperature (°F)
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100
110
120
Time (Minutes)
204
210
206
208

Figure 42

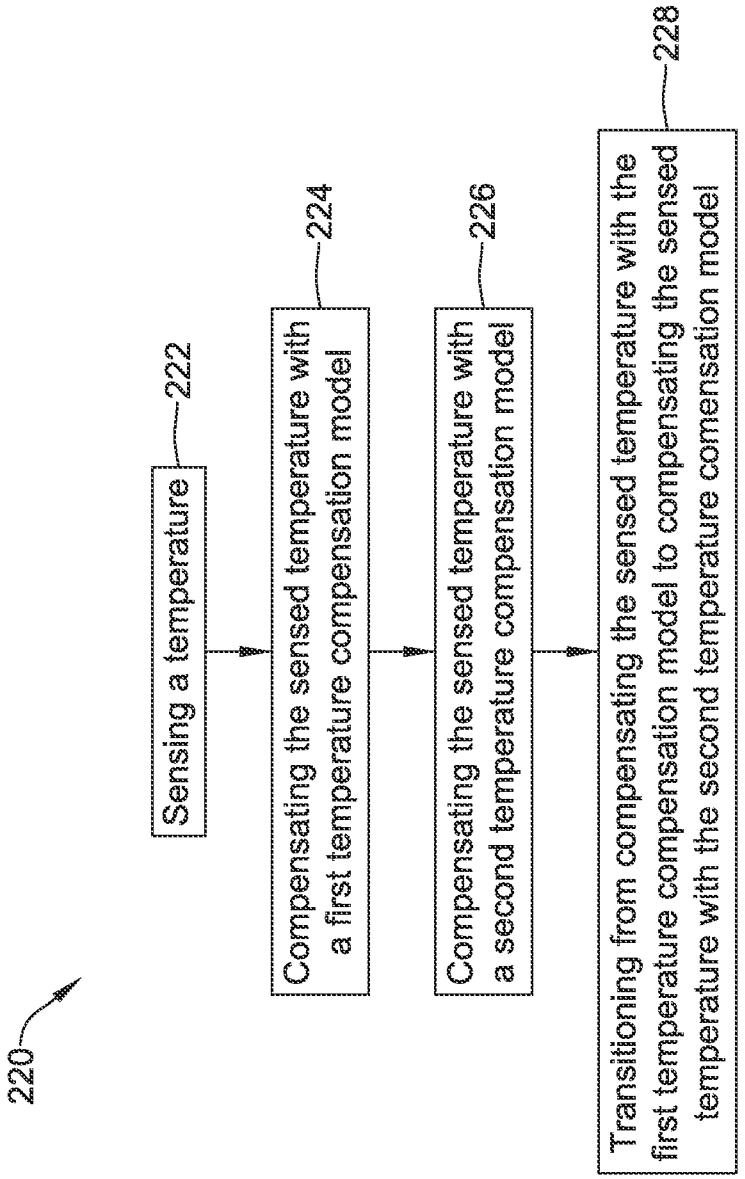

220
Sensing a temperature
222
Compensating the sensed temperature with a first temperature compensation model
224
Compensating the sensed temperature with a second temperature compensation model
226
Transitioning from compensating the sensed temperature with the first temperature compensation model to compensating the sensed temperature with the second temperature comensation model
228

Figure 43

SELF-ALIGNING BACK PLATE FOR AN ELECTRONIC DEVICE

[0001] This application claims priority to U.S. Provisional Application Ser. No. 61/800,637, filed Mar. 15, 2013 and entitled "Electronic Device and Methods", which is incorporated herein by reference.

TECHNICAL FIELD

[0002] This disclosure generally relates to electronic devices, and more particularly to improved use, assembly, construction, and reliability of such electronic devices.

BACKGROUND

[0003] Electronic devices, such as Heating, Ventilation, and Air Conditioning (HVAC) control panels, security system control panels, lighting control panels, irrigation control panels as well as other electronic devices are commonly used today. What would be desirable is an electronic device that has improved ease of use, ease of assembly, better construction and/or increased reliability over what is available today.

SUMMARY

[0004] This disclosure relates to electronic devices such as HVAC controller devices, and more particularly, to improved use, assembly, construction, and reliability of such electronic devices.

[0005] In one example, an electronic assembly may include a housing and a wall plate. The housing and the wall plate may be configured such that the housing and the wall plate may be able to initially engage each other with the wall plate misaligned relative to the housing. The housing and the wall plate may be configured to guide one another into alignment as the housing and the wall plate are moved together. In one example, the housing may have a back side that defines a recess for receiving at least part of the wall plate. The recess in the back side of the housing may be defined by a recessed back wall and recess side walls. The recess side walls may be tilted, slanted, angled, beveled, chamfered or otherwise configured to receive and help guide the wall plate into proper alignment with the housing. In some cases, the wall plate may have side walls that mate or otherwise cooperate with the recessed side walls of the housing to help guide one another into alignment as the housing and the wall plate are moved together.

[0006] The preceding summary is provided to facilitate an understanding of some of the innovative features unique to the present disclosure and is not intended to be a full description. A full appreciation of the disclosure can be gained by taking the entire specification, claims, drawings, and abstract as a whole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The disclosure may be more completely understood in consideration of the following description of various embodiments in connection with the accompanying drawings, in which:

[0008] FIG. **1** is a schematic perspective view of an illustrative electronic assembly;

[0009] FIG. **2** is a schematic exploded perspective view of the illustrative electronic assembly of FIG. **1**;

[0010] FIG. **3** is a schematic perspective view of an illustrative sub-assembly of an illustrative electronic assembly;

[0011] FIG. **4** is a schematic partially exploded side view of the illustrative sub-assembly of the illustrative electronic assembly of FIG. **3**;

[0012] FIG. **5** is a schematic cross-sectional partially-exploded view of the features of the illustrative electronic assembly of FIG. **3** with the electrostatic discharge clip in an original position;

[0013] FIG. **6** is a schematic cross-sectional view of the features of the illustrative electronic assembly of FIG. **3** with the electrostatic discharge clip in an articulated position;

[0014] FIG. **7** is a schematic perspective view of an illustrative electrostatic discharge clip of an electronic assembly;

[0015] FIG. **8** is a schematic perspective view of another illustrative electrostatic discharge clip of an electronic assembly;

[0016] FIG. **9** is a schematic flow diagram of an illustrative method of grounding an electronic component of an electronic device;

[0017] FIG. **10** is a schematic perspective view of an illustrative spacer of an electronic assembly;

[0018] FIG. **11** is a schematic side view of the illustrative spacer of FIG. **10**;

[0019] FIG. **12** is a further schematic side view of the illustrative spacer of FIG. **10**;

[0020] FIG. **13** is a schematic perspective view of an illustrative front cover of an electronic assembly;

[0021] FIG. **14** is a schematic side view of the illustrative front cover of FIG. **13**;

[0022] FIG. **15** is a further schematic side view of the illustrative front cover of FIG. **13**;

[0023] FIG. **16**A is a schematic cross-sectional view of the illustrative electronic assembly of FIG. **1**, taken along line **16**A-**16**A of FIG. **1**;

[0024] FIG. **16**B is a further schematic cross-sectional view of the illustrative electronic assembly of FIG. **1**, take along line **16**A-**16**A of FIG. **1**, enlarging the portion contained in the dotted circle **16**B of FIG. **16**A;

[0025] FIG. **17** is a schematic exploded perspective front view of an illustrative front cover, gasket, electronic component, spacer, and printed wiring assembly of an illustrative electronic assembly;

[0026] FIG. **18** is a schematic front view of an illustrative spacer engaged with an illustrative printed wiring assembly of an illustrative electronic assembly;

[0027] FIG. **19** is a schematic exploded perspective back view of an illustrative front cover, electronic component, and spacer of the illustrative electronic assembly of FIG. **17**;

[0028] FIG. **20** is a schematic partially exploded view of an illustrative printed wiring assembly exploded from an illustrative front cover, electronic device, and spacer of the illustrative electronic assembly of FIG. **17**;

[0029] FIG. **21** is a schematic exploded perspective view of an illustrative front cover, gasket and electronic component of the illustrative electronic assembly of FIG. **17**;

[0030] FIG. **22** is a schematic back view of the illustrative electronic assembly of FIG. **17**;

[0031] FIG. **23** is a schematic cross-sectional view of the illustrative electronic assembly of FIG. **22**, taken along line **23**-**23**;

[0032] FIG. **24** is a schematic front perspective view of an illustrative back cover and wall plate of an illustrative electronic assembly;

[0033] FIG. **25** is a schematic exploded back perspective view of an illustrative back cover and wall plate of an illustrative electronic assembly;

[0034] FIG. **26**A is a schematic cross-sectional view of an illustratively assembled back cover and wall plate;

[0035] FIG. **26**B is a schematic magnified view of illustrative mating walls between an assembled back cover and wall plate, taken from FIG. **26**A;

[0036] FIG. **26**C is a schematic magnified view of illustrative pockets in the assembled back cover and wall plate, taken from FIG. **26**A;

[0037] FIG. **27** is a schematic front view of an illustrative back cover of an electronic assembly; and

[0038] FIG. **28** is a schematic cross-sectional view of an illustrative PWA and a back cover of an illustrative electronic assembly;

[0039] FIG. **29** is a schematic exploded perspective view of an illustrative back cover, printed wiring assembly, and battery of an illustrative electronic assembly;

[0040] FIG. **30** is a schematic perspective view of an illustrative electronic assembly with a tool inserted therein;

[0041] FIG. **31** is a schematic side view of the illustrative electronic assembly with a tool inserted therein, having a portion of the illustrative electronic assembly housing removed;

[0042] FIG. **32** is a schematic perspective view of an illustrative battery holder;

[0043] FIG. **33** is a schematic side view of the illustrative battery holder of FIG. **32**;

[0044] FIG. **34**A is a schematic front view of an illustrative wall plate of an illustrative electronic assembly;

[0045] FIG. **34**B is a schematic back view of the illustrative wall plate of FIG. **34**A;

[0046] FIG. **35** is a schematic partially exploded view of an illustrative screw terminal of an illustrative electronic assembly;

[0047] FIG. **36** is a schematic perspective view of an illustrative screw terminal of an electronic assembly;

[0048] FIG. **37** is a schematic exploded view of the illustrative screw terminal of FIG. **36**;

[0049] FIG. **38** is a schematic side view of the illustrative screw terminal of FIG. **36**;

[0050] FIG. **39** is a schematic diagram of an illustrative electric circuit for an electronic assembly;

[0051] FIG. **40** is a schematic diagram of another illustrative electric circuit for an electronic assembly;

[0052] FIG. **41** is a schematic diagram of another illustrative electric circuit for an electronic assembly;

[0053] FIG. **42** is a schematic graph depicting an illustrative thermal compensation model over time; and

[0054] FIG. **43** is a schematic flow diagram of an illustrative method of compensating a sensed temperature.

[0055] While the disclosure is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit aspects of the disclosure to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the disclosure.

DESCRIPTION

[0056] The following description should be read with reference to the drawings wherein like reference numerals indicate like elements throughout the several views. The description and drawings show several embodiments which are meant to be illustrative in nature.

[0057] For convenience, the present disclosure may be described using relative terms including, for example, left, right, top, bottom, front, back, upper, lower, up, and down, as well as others. It is to be understood that these terms are merely used for illustrative purposes and are not meant to be limiting in any manner.

[0058] An electronic device or assembly **10** is shown in FIGS. **1** and **2**. It is contemplated that the electronic device or assembly **10** may be, for example, a Heating, Ventilation, and Air Conditioning (HVAC) control panel, security system control panel, lighting control panel, irrigation control panel, or any other suitable device. In one example, the electronic device **10** may be a thermostat, but his is not required.

[0059] In some instances, as shown in FIG. **2**, the illustrative electronic assembly **10** may include a housing **12**, a PWA **14**, an electronic component **16**, and an electrically conductive extender or connector **18**, where the PWA **14** and the electronic component **16** may be positioned at least partially within the housing **12**. In some cases, a conductive shield may be provided adjacent the PWA **14**, such as between the PWA **14** and the electronic component **16**. In the illustrative example shown in FIGS. **1** and **2**, the electronic component **16** may be a touch screen display that itself includes a conductive metal backing which can function as a conductive shield. The conductive shield may be electrically coupled to the ground feature of the PWA **14** via the connector **18**, as further described below.

[0060] As noted above, the PWA **14** may include a grounding feature, such as a ground plane or other grounding feature (e.g., a grounding point, grounding terminal, ground pad, etc.). In some instances, the grounding feature or grounding plane may be an area of copper foil or other conductive material connected to a grounding point of the PWA **14**. The grounding feature or grounding plane may serve as a return path for current from electronic components of the electronic assembly **10**. The grounding feature or grounding plane is not specifically identified in the Figures, but may take the form of a conductive layer of the PWA **14**, a terminal or pad on the PWA **14**, or any other form as desired.

[0061] Electronic devices and their electronic assemblies **10**, such as the illustrative thermostat shown in FIGS. **1** and **2**, may be susceptible to electrostatic discharge (ESD) events. Such ESD events may occur when, for example, the electronic assemblies **10** are contacted by users and static electricity is discharged from the user to the electronic assembly **10**. Such ESD events may be harmful to the electronic assemblies **10**, as the electronic components of the electronic assemblies **10** may be short circuited or otherwise damaged by the ESD events. Providing some level of ESD protection in configuring an electronic assembly **10** is thus desirable in many situations.

[0062] From a hardware perspective, electronic devices and their electronic assemblies **10** may be at least partially protected from ESD events by, for example, including a conductive path for passing the electrostatic discharge safely to ground, and bypassing sensitive electronic components of the electronic assemblies **10**. As indicate above, the electronic assembly **10** may include a printed wiring assembly (PWA) **14** that includes a ground feature, such as a ground plane. When provided, the ground plane may itself help shield sensitive electronic components from an outside ESD event.

[0063] As indicated above, and in some instances, the electronic component **16** may have a metal backing **22** (e.g., a zinc plating, sheet metal, and/or other metal or conductive material), a portion of a backing that is metal, or a metal feature extending adjacent the back of the electronic component **16**. While a metal backing is used in this example, it is contemplated that any suitable conductive layer or shield may be used, if present. In one example, the electronic component **16** may be a display **32** (e.g., a liquid crystal display (LCD) or other display) that is at least partially enclosed by a metal box structure, where at least a back side of the display **32** (e.g., a side opposite a front side for viewing the display **32**, where side walls may extending between the front side and the back side) includes a metal backing **22** (see FIG. **4**). In some cases, the perimeter sides (e.g., side walls) of the display **32**, and even a border around the front side of the display **32**, may be covered by the metal box structure. Where the electronic component **16** includes metal backing **22** or another conductive feature extending adjacent the back of the electronic component **16**, an electrically conductive extender or connector **18** may provide an electrical connection between the metal backing **22** or the other conductive feature and the ground feature of the PWA **14**. Such an electrical connection **18** between the PWA **14** and the electronic component **16** may, for example, help ground the metal backing **22** of the electronic component **16** and reduce the chances that an ESD event will cause damage to electronic components mounted on or near the PWA **14**.

[0064] In some instances, the electronic component **16** and the PWA **14** may be spaced apart from each other when mounted in the housing **12**. In one example, the metal backing **22** may be spaced from the PWA **14** and/or from components on the PWA **14** by a distance greater than about two (2) millimeters, greater than about three (3) millimeters, greater than about five (5) millimeters, greater than about ten (10) millimeters, or any other distance as desired. Such a space may provide sufficient space to accommodate one or more electrical components that may be mounted to the side of the PWA facing a spacer **24** and/or electronic component **16**, and in some cases, may help dissipate or distribute heat generated by the PWA **14** and/or electronic component **16** within the housing.

[0065] In some instances, to help maintain the space between the electronic component **16** and the PWA **14**, the spacer **24** may be provided, as shown in for example FIGS. **2-4** and **10-12**. The spacer **24** may be made from any suitable material(s). For example, the spacer **24** may be made from one or more polymers or other materials having desirable material properties. The spacer **24** may be made from an electrically insulating material, such that the spacer **24** does not create a short circuit between any conductive traces or other components on the PWA **14** and the electronic component **16**. Further, the spacer **24** may be configured to help support the electronic component **16** both when users are interacting with the electronic component **16** and when the electronic component **16** may be operating on its own.

[0066] In some instances, the spacer **24** may take on a web-like form, such as shown best in perhaps FIGS. **2**, **10**, **17**, **19**, and **21**, and may have openings **25** (e.g., one or more openings **25**, two or more openings **25**, etc.) between structural portions **48**. The openings **25** of the spacer **24** may allow for air gaps between the back side of the display **32** and the PCB **34** of the PWA **14**, when the spacer is positioned therebetween (see, discussion of the positioning of the spacer **24** below). The spacer **24** may have spacer side walls **42** extending from and/or forming one or more edges of the spacer **24**, as best seen in perhaps FIGS. **10-12**. Illustratively, the spacer side walls **42** may extend in the direction of the PWA **14** and/or may extend along an entire edge of the spacer **24** or may extend a partial distance along an edge of the spacer **24**, as seen in FIGS. **10** and **12**. When in use with the housing **12**, the spacer side walls **42** of the spacer **24** may be formed to mate with the housing **12**, which may help provide an ESD path **44** that travels around the ends of the spacer walls **24**, as best shown in perhaps FIGS. **11** and **16**B. Because the length of the ESD path **44** is increased by the spacer side walls **42**, the PWA **14** may be better protected from an ESD event originating from outside of the housing **12**.

[0067] In some instances, the web-like configuration of the spacer **24** may allow for a double sided PWA **14** component placement, whereas a spacer **24** without openings **25** may not permit component placement on the side of the PWA **14** adjacent the electronic component **16**. The openings **25** in the spacer **24** may allow components to be mounted on both sides of the PCB **34** without interfering with the electronic component **16** (e.g., display **32**) of the electronic assembly **10**, by providing space for the components on the side of the PCB **34** facing the component **16**.

[0068] In some instances, the electrically conductive extender or connector **18** may have one or more portions **26**, **28**, as shown in FIGS. **7** and **8**. Illustratively, the electrically conductive extender or connector **18** may have a first portion or connector portion **26**, and a second portion or spring portion **28** (e.g., a flexible beam or other feature). In one example, the first portion or connector portion **26** may be integrally formed with the second portion or spring portion **28**, as shown in FIGS. **7** and **8**. In another example, the first portion or connector portion **26** may be formed separate from the second portion or spring portion **28** and combined in any manner, as desired, to form the electrically conductive extender or connector **18**. Illustratively, the electrically conductive extender or connector **18** may have a form that differs from that of the electrically conductive extender or connector **18** shown in FIG. **7**. In one example, the electrically conductive extender or connector **18** may have first portion **26** with a width W1 and second portion **28** with a width W2, where width W2 may have a smaller value than width W1, as shown in FIG. **8**. In this example, where width W1 is greater than width W2, the second portion **28** may be located off-center with respect to the first portion **26**, as shown in FIG. **8**, but this is not required.

[0069] When the first portion or connector portion **26** and the second portion or spring portion **28** are in combination, the electrically conductive extender or connector **18** may have the form of a clip, a spring, a clasp, or other form having a configuration that may be connected to the PWA **14**. In some instances, the electrically conductive extender or connector **18** may take on a clip form and may include a first portion or connector portion **26** and second portion or a spring portion **28**. The first portion or connector portion **26** may be configured to mechanically connect to the PWA **14**, and the second portion or of the spring portion **28** may be configured to mechanically contact and electrically connect to the metal backing **22**. In some cases, the first portion or connector portion **26** of the electrically conductive extender or connector **18** may mechanically connect to the PWA **14** via surface mount technology ("SMT"). In other examples, the first portion or connector portion **26** of the electrically conductive extender or connector **18** may mechanically connect to the

PWA **14** via mounting techniques that differ from SMT. In some illustrative instances, the first portion **26** of the electrically conductive extender or connector **18** may be soldered to a surface **15** of the PWA **14**, such that the second portion or spring portion **28** of the electrically conductive extender or connector **18** may extend away from the surface **15** of the PWA **14** and toward the electronic component **16**, as best seen in FIGS. **5-6**. In some cases, the first portion **26** of the electrically conductive extender or connector **18** may be soldered to a conductive pad, such as a ground feature or ground plane.

[0070] The electrically conductive extender or connector **18** may have a feature that is configured to contact the metal backing **22** of the electronic component **16**. In one example, the second portion or spring portion **28** of the electrically conductive extender or connector **18** may have a contact portion **30** for contacting the metal backing **22** of the electronic component **16**. The contact portion **30** of the second portion or spring portion **28** may take on any shape and/or size. Illustratively, the contact portion **30** may have the shape of a protrusion or a bump that has a peak rising above any other portion of the electrically conductive extender or connector **18**, where, for reference, the electronic component **16** is considered to be above the PWA **14**.

[0071] In some instances, the electrically conductive extender or connector **18** may be resilient, such that the material and/or form of the electrically conductive extender or connector **18** has mechanically resilient properties. Illustratively, an electrically conductive resilient extender or connector **18** may be configurable between an original configuration or position, as best shown in FIG. **5**, and an articulated configuration or position, as best shown in FIG. **6**, where the electrically conductive resilient extender or connector **18** may provide a spring force back toward the original configuration. Where the electrically conductive resilient extender or connector **18** is in the articulated configuration (see FIG. **6**), the spring force of the conductive resilient extender or connector **18** may be exerted against the metal backing **22** of the electronic component **16**, the PWA **14**, or the metal backing **22** of the electronic component **16** and the PWA14.

[0072] In some instances, when the electrically conductive extender or connector **18** is configurable between an original configuration or position and an articulated configuration or position, the distance between a top portion or the contact portion **30** of the electrically conductive extender or connector **18** and the PWA **14** may vary depending on the configuration. For example, when the electrically conductive extender or connector **18** is in the original configuration, the top portion or the contact portion **30** of the electrically conductive extender or connector **18** may be 1.0-5.0 millimeters, 2.2-2.8 millimeters, 2.4-2.6 millimeters, 2.0-2.5 millimeters, 2.5-3.0 millimeters, or in any other range of distances D1 from the PWA **14**, as best shown in FIG. **5**. When the electrically conductive extender or connector **18** is in the articulated position, the top portion or the contact portion **30** of the electrically conductive extender or connector **18** may be 0.0-2.0 millimeters, 1.0-2.0 millimeters, 1.2-2.8 millimeters, 1.4-1.6 millimeters, 1.0-1.5 millimeters, 1.5-2.0 millimeters, or in any other range of distances D2 from the PWA **14**, as best shown in FIG. **6**.

[0073] Illustratively, the force between the electrically conductive extender or connector **18** and, for example, the metal backing **22** of the electronic component **16** may be relatively small when in the articulated position. In one example, the force between the electrically conductive extender or connector **18** and the metal backing **22** in the articulated position may be such that the performance of the display **32** is not affected by the contact force applied to the metal backing **22** from the electrically conductive extender or connector **18** (e.g., such that display **32** is devoid of any color areas or other display of sensitivity to a force acting on the metal backing **22** of the display).

[0074] In some instances, large contact forces or resistances between the metal backing **22** and the electrically conductive extender or connector **18** may not be necessary to provide ESD protection. For example, because ESD events typically have relatively high voltage (e.g., approximately 10 kV or other value) and the electric breakdown of the surrounding air is up to 3 kV/mm (e.g., at dry air), an electrostatic discharge may find its way to the electrically conductive extender or connector **18** rather than jump across the space created by the spacer **24** and to an ESD sensitive electrical component mounted on the PWA **14**, despite the relatively low contact force between the metal backing **22** and the electrically conductive extender or connector **18**.

[0075] The electrically conductive extender or connector **18** may be made from any of one or more materials. In some instances, the electrically conductive extender or connector **18** may be made from an electrically conductive material, a resilient material, any other material having desirable properties, and/or any combination of materials having these or other properties. For example, the electrically conductive extender or connector **18** may be made from a phosphor bronze (e.g., a copper alloy), steel, a conductive polymer, or any other suitable material. In some instances, the electrically conductive extender or connector **18** may be used in an illustrative method (S **100**) of grounding an electronic component **16** of an electronic device or assembly **10**, as depicted in FIG. **9** (where the steps listed may be performed in the order depicted or in another order, if at all, as desired). The grounding of the electronic component **16** of the electronic device or assembly **10** may help reduce or prevent electrical damage to one or more electrical components of the electronic device or assembly **10** in response to an ESD event.

[0076] Illustratively, the method (S **100**) may include electrically connecting an electrically conductive extender or connector **18** (e.g., a resilient electrically conductive extender or connector) to a grounding connection or feature of a PWA **14** of the electronic device or assembly **10**. In some instances, the method (S **100**) may include mounting the electrically conductive extender or connector **18** to the surface **15** of the PWA **14** (S**110**). The electrically conductive extender or connector **18** may be mounted to the surface **15** of the PWA **14** with surface mount technology or any other mounting technique. Illustratively, a first portion or connector portion **26** of the electrically conductive extender or connector **18** may be mounted directly or indirectly to the PWA **14**. In some cases, the first portion or connector portion **26** of the electrically conductive extender or connector **18** may be mounted to the PWA **14** via an interference type connector such as a screw type connector, a bayonet type of connector, or any other type of interference type connector. In some cases, the first portion or connector portion **26** may be soldered to the surface **15** of the PWA **14**. In any event, the electrically conductive extender or connector **18** may be mounted such that the second portion or spring portion **28** thereof may extend away from the surface **15** of the PWA **14** and toward the electronic component **16**.

[0077] In some instances, the method may include providing a spacer **24** between the electronic component **16** and the PWA **14** (S**112**) and situating the electronic component **16** adjacent the spacer **24** (S**114**). In one example of situating the electronic component **16** adjacent the spacer **24** (S**114**), the electronic component **16** may be situated such that the electrically conductive extender or connector **18** may extend from the PWA **14**, through an opening **25** in the spacer **24**, and make electrical and mechanical contact with a metal backing **22** or other electrically conductive feature of the electronic component **16**. In this example, the electrically conductive extender or connector **18** may be in a flexed or other configuration such that it exerts a spring force against the metal backing **22** or other electrically conductive feature of the electronic component **16**. In some cases, the spring force of the electrically conductive extender or connector **18** exerted on the metal backing **22** or other electrically conductive feature of the electronic component **16** may be configured and/or set to maintain an electrical connection with the metal backing **22** or other electrically conductive feature of the electronic component **16**. The spring force exerted by the electrically conductive extender or connector **18** may maintain an electrical connection with the metal backing **22** or other electrically conductive feature of the electronic component **16** over a range of spacing between a surface **15** of the PWA **14** and the metal backing **22** of the electronic component **16**. Illustratively, the range of spacing may be 0.0-3.0 millimeters, 0.0-2.8 millimeters, 0.0-2.6 millimeters, 0.0-2.5 millimeters, 0-2.0 millimeters or any other range of spacing between the PWA **14** and the electronic component **16**.

[0078] In some instances, the method (S**100**) may include securing the PWA **14**, the spacer **24**, and the electronic component **16** together to form a sub-assembly **19** (S**116**) (see FIGS. **3-4**). Securing the PWA **14**, the spacer **24**, and the electronic component **16** together may be performed using any connecting technique and/or connecting features, as desired. For example, the spacer **24** may clip to the PWA **14** and the electronic component **16**, the spacer **24** may be glued to the PWA **14** and the electronic component **16**, or the PWA **14**, the spacer **24**, and the electronic component **16** may be connected in any other manner as desired to form a sub-assembly **19** (see FIG. **4**).

[0079] Illustratively, the mounting of the electrically conductive extender or connector **18** to the PWA **14** may include performing the mounting before or after the sub-assembly **19** is assembled. When mounted before, the contact portion **30** of the electrically conductive extender or connector **18** may move laterally along the surface **15** of the metal backing **22** as the electronic component **16** is moved toward the PWA **14** and as the electrically conductive extender or connector **18** moves from the original position (see FIG. **5**) to the articulated position (see FIG. **6**). In some cases, the lateral motion may help the contact portion **30** of the electrically conductive extender or connector **18** make a good electrical contact with the metal backing **22** of the electronic component **16**. As best shown in FIGS. **2**, and **4-6**, in some instances, the electrically conductive extender or connector **18** may be mounted to the PWA **14** such that it extends through an opening **25** in the spacer **24**.

[0080] In instances where the electronic component **16** is a display **32** or other electronic component **16** that may produce heat, the display **32** or other electronic component **16** may be an unintended heat generator, which may heat and/or influence thermistors located at the PWA **14**, if such thermistors are present. The spacer **24** may be configured to provide an air gap between the display **32** and the PWA **14** due to its, optional, web-like configuration. The web-like configuration may limit the heat transfer to the PWA **14** from the display **32**, while maintaining an overall thin profile of the electronic assembly **10**. Further, to prevent direct heat transfer to the thermistors (if present) on the PWA **14** through the material of the spacer **24**, the material of the spacer **24** may be cut away in, around and/or over any such thermistors.

[0081] The electronic assembly **10** may have internal, unintended heat sources (e.g., the display **32**, electronic component on the PWA **14**, and/or other unintended heat sources) that may affect the ability of the electronic assembly **10** (e.g., a thermostat as shown in FIGS. **1-43**) to accurately sense an ambient temperature. Generally, the internal heat generated by electronic components of the electronic assembly **10** may be related to the input voltage of the electronic assembly **10**. In some instances, the input voltage may vary, which may cause the internal temperatures to similarly vary regardless of the actual ambient temperature. Additionally, or alternatively, initial conditions of the electronic device (e.g., before, during, and/or after powering up the electronic device of the electronic assembly **10** or a feature thereof) may affect sensing of the ambient temperature. Illustratively, "powering up" may refer to any time a microprocessor of the electronic assembly **10** comes out of reset or powers on after being powered down (e.g., any time the microprocessor receives power after not receiving power, after an error recover reset, after a self-imposed test, etc.).

[0082] An example of when an initial condition may affect sensing of the ambient temperature may include when an electronic device **10** is powered up after it has been in an OFF state for an amount of time such that the whole device may have cooled down/warmed up to the surrounding temperature. On the other hand, if the electronic device is quickly re-powered or re-started, the electronic device may not have cooled down/warmed up from its operating temperature. Further, in some instances, where the electronic device was forced into restarting, the electronic device may not have immediate access to temperature histories and has to start temperature compensation for unintended heat over. All of these considerations may affect the sensing of an ambient temperature and the ability of the electronic assembly **10** to compensate a sensed ambient temperature for unintended heat sources inside of the housing.

[0083] A temperature compensation model may be developed for steady state conditions (e.g., when unintended heat within an electronic device reaches a steady state, that is, when the electronic device has been powered on for a period of time post-start up). Further, it has been found that using the temperature compensation model that was developed for steady state conditions to calculate compensated sensed ambient temperatures at initial startup (e.g., during an initial transient period), may result in providing sensed temperatures that represent relatively large errors from the actual ambient temperature.

[0084] Illustratively, to increase ambient temperature estimation accuracy and/or for other purposes, the electronic assembly **10** may use a compensation method upon powering up the electronic device (e.g. during a transient power state) that differs from a compensation method used after running the electronic device for a period of time (e.g. during a steady power state). For example, the electronic assembly **10** may be configured to read an input voltage and/or sense other condi-

tions and use the input voltage levels and/or other sensed conditions in temperature compensation models to provide offsets configured to be used to provide calculated compensated ambient temperatures for use by the electronic assembly **10**. Other sensed conditions may include, but are not limited to, an amount of time a screen of the thermostat has been lit over a period of time, a signal from one or more thermistors in the housing, a radio activity status, an LED status, and a power level at user interface buttons.

[0085] Using two or more temperature compensation models (which may or may not be combined to form a single model) may increase the accuracy of temperature compensation. For example, a first model may be used to accurately resolve or compensate a sensed temperature for initial and/or transient conditions, where this first model may or may not accurately compensate temperatures during steady states, and a second model may be used to accurately resolve or compensate a sensed temperature for steady state conditions (e.g. at a time post powering up), where the second model may or may not accurately compensate temperatures during initial transient conditions. In some instances, the two or more models may be used concurrently, such that the initial model may fade out (e.g. may be weighted less) as time and/or voltage input or other conditions change and the second or further model fades in (e.g. may be weighted more) as time and/or voltage input or other conditions change. Such a combination of compensation models/methods may result in more accurate compensation for sensed temperature calculations under different electronic assembly **10** operating conditions.

[0086] It is contemplated that a first "transient" temperature compensation model may be used during any transient period, and not just during an initial power up of the electronic assembly **10**. For example, in some cases, the display **32** may consume relatively large amounts of power, and thus generate a relatively large amount of heat, when activated by a user. Moreover, the display **32** may consume a relatively lower amount of power when in a sleep mode. It is contemplated that a first "transient" temperature compensation model may be used during the transient periods, such as for a period after the user activates the display **32** and/or for a period after the display **32** returns to a sleep mode. A second "steady state" temperature compensation model may be used during steady state periods between the transient periods.

[0087] Illustratively, a method **220**, as shown in FIG. **43**, may be utilized to compensate a temperature reading of an electronic assembly **10** (e.g., a thermostat, etc.), wherein the electronic assembly **10** may include a housing **12** and one or more temperature sensors for sensing a temperature within the housing **12**. In some instances, a processor and/or memory of an electronic assembly may perform compensation of a temperature reading or sensed temperature by the electronic assembly **10**.

[0088] The method **220** may include sensing **222** a temperature using the one or more temperature sensors of the electronic assembly **10**. In the method **220** the sensed temperature may be compensated by a plurality of temperature compensation models. In one example, the sensed temperature may be compensated **224** with a first temperature compensation model and the sensed temperature may be compensated **226** with a second temperature compensation model. During compensation of the sensed temperature, the method **220** may include transitioning **228** through two or more of the plurality of temperature compensation models. In one example, the transitioning **228** may include transitioning from compensating the sensed temperature with the first temperature compensation model to compensating the sensed temperature with the second temperature compensation. In some instances, the transitioning feature **228** of the method **220** may include transitioning over time and/or independent of the sensed temperature and/or any other sensed temperature.

[0089] In some instances, weights may be applied to the temperature compensation models to facilitate transitioning from compensating the sensed temperature with the first temperature compensation model to compensating the sensed temperature with the second temperature compensation model. Illustratively, the weighting of the temperature compensation models with respect to one another may be adjusted over time and/or as a function of some other variable. In one example, when the temperature compensation models are weighted with respect to one another and/or over time, the sensed temperature may be compensated with two or more compensation models simultaneously.

[0090] In instances when the sensed temperature is compensated by a first temperature compensation model and a second temperature compensation model, weights applied to the temperature compensation models may be adjusted over time such that the first temperature compensation model may be more heavily weighted than the second temperature compensation model near a time of an initial power on of the electronic assembly **10** and the second temperature compensation model may be more heavily weight near a time when the electronic assembly **10** may be reaching a steady state. In one example, a weight that is adjusted over time or that changes over time may be applied to a first temperature compensation model (e.g. an initial condition or transient temperature compensation model), where the weight may have a greater weight at a time of powering up of the electronic assembly **10** than at a time of powering up plus a period of time. Additionally, or alternatively, a weight that is adjusted over time or that changes over time may be applied to a second temperature compensation model (e.g., a steady state temperature compensation model), where the weight may have a greater weight at a time of powering on plus a period of time than at a time of powering on of the electronic assembly **10**.

[0091] FIG. **42** depicts a schematic graph **200**, with temperature **202** on the y-axis and time **204** on the x-axis, of a compensated sensed temperature, where the sensed temperature is compensated with only a first (e.g., a transient, startup, power up, and/or initial) temperature compensation model **210**, with only a second (e.g., an original or steady state) temperature compensation model **208**, and with a blended temperature compensation model **206** combining the first and second temperature compensation models **210**, **208**. In FIG. **42**, the illustrated temperature from the blended temperature compensation model **206** is a result of weighting the first temperature compensation model **210** and the second temperature compensation model **208** with respect to one another and modifying the weights over time.

[0092] In the example of FIG. **42**, at time=0 minutes, the weight of the first temperature compensation model **210** is 1 and the weight of the second temperature compensation model **208** is 0, whereas at time=112 minutes the weight of the first temperature compensation model **210** is 0 and the weight of the second temperature compensation model **208** is 1. In this example, a time for the transition from the first temperature compensation model **210** to the second tempera-

ture compensation model **208** is one hundred twelve (112) minutes, and in the blended temperature compensation model **206**, the weights are linearly transitioned from the first temperature compensation model **210** to the second temperature compensation model **208** over the one hundred twelve (112) minute transition period. Thus, when the blended temperature compensation equation is utilized to compensate a sensed temperature, at time=0 minutes the compensated temperature from the blended temperature compensation model **206** equals the compensated temperature of the first temperature compensation model **210** and the at time=112 minutes the compensated temperature from the blended temperature compensation model **206** equals the compensated temperature of the second temperature compensation model **208**.

[0093] The temperature compensation models may be weighted with respect to one another as a function of time and the weights may be adjusted over time in any manner to facilitate transitioning from one temperature compensation model to another temperature compensation model. In one instance, as in the example shown in FIG. **42**, the weights applied to the temperature compensation models may be adjusted linearly over a set period of time (e.g., a set transition period of time). Alternatively, or in addition, transitioning from one temperature compensation model to another temperature compensation model over time may be accomplished by adjusting the weights associated with the temperature compensation models in a non-linear manner over a time period.

[0094] In one illustrative example of compensating a sensed temperature, an equation or function may be utilized to transition from a first temperature compensation model, F_{first}, (e.g. an initial condition or transient temperature compensation model) to a second temperature compensation model, F_{second}, (e.g., a steady state temperature compensation model). The equation may comprise:

$$Temp_{comp}=F_{blend}(TIME)=((T-TIME)/T)*F_{first}+(TIME/T)*F_{second}$$

[0095] wherein:

[0096] T=time of transition (e.g., a predetermined time of transition, which may be determined for a particular electronic assembly **10** or other time of transition) from initial power up of the electronic assembly to steady state of the electronic assembly;

[0097] TIME=the time from initial power up, where TIME=0;

[0098] F_{first}=function of the first temperature compensation model (e.g., a temperature compensation model based on multiple input sources that may be configured to compensate a sensed temperature during a variety of electronic assembly **10** startup or power up conditions);

[0099] F_{second}=function of the second temperature compensation model (e.g., a temperature compensation model based on multiple input sources that may be configured to compensate a sensed temperature at steady state conditions of the electronic assembly **10**);

[0100] F_{blend}=Function resulting in a compensated sensed temperature at a time=TIME; and

[0101] $Temp_{comp}$=compensated temperature for a sensed temperature.

Such an illustrative equation may allow the weights associated with the first and second temperature compensation models to be adjusted over time (e.g., linearly adjusted over time) to provide an accurate compensated sensed temperature for the purpose of accounting for unintended heat sources and/or conditions. The multiple inputs or variables may include, but are not limited to, a voltage level at the thermostat, an amount of time a screen of the thermostat has been lit over a period of time, a signal from one or more thermistors in the housing, a radio activity status, an LED status, a power level at user interface buttons, and/or any other variable or input that may affect the temperature at an electronic assembly **10**.

[0102] Although weighting of temperature compensation models is primarily discussed herein with respect to weighting over time in a linear manner, it is contemplated other adjustments of weights of the temperature compensation models may be utilized. For example, the weights may be applied to the temperature compensation models on a non-linear basis (e.g., on an exponential or other basis), such that the weights are adjusted slowly over time at times near the startup and near the steady state of the electronic assembly **10**, but the weights are adjusted relatively rapidly in between times near startup and times near steady state of the electronic assembly **10**. Alternatively, the weights may be applied to the temperature compensation models such that the weights are adjusted rapidly over time at times near the startup and near the steady state of the electronic assembly **10**, the weights are adjusted relatively slowly in between times near startup and times near steady state of the electronic assembly **10**.

[0103] Referring now to FIG. **13**, the housing **12** may have a front cover **38**. In the example shown, the front cover **38** may generally be a frame for receiving an electronic component (e.g., a touch screen component or other component or device) and may have an opening **52** extending therethrough, as best shown in FIGS. **13-15**, **17**, and **21**. In some instances, the front cover **38** may include one or more front cover walls **56**, where the front cover walls **56** may be configured to mate with surfaces of a back cover **36** of the housing **12** and/or the spacer **24**, as shown in for example FIGS. **16**A and **16**B. Similar to the spacer walls **42**, the front cover walls **56** may help define an ESD path **44** for the ESD events, as seen in FIG. **15**, which may enter the housing **12** through a gap in the housing **12** at a parting line **40** or at any other location. It is known that ESDs travel through a medium or travel along surfaces by following the shortest possible ESD path **44** with the least resistance when discharged from a user or other device or source. A parting line between portions of the housing of an electronic device may be a suitable inlet through which ESD may travel to the inside of the electronic device. For example, where the front cover **38** and the back cover **36** of the housing **12** meet, a parting line **40** may be formed, as best shown in FIGS. **16**A and **16**B, and it has been found that ESDs may travel to the inside of the electronic assembly **10** through this parting line **40**.

[0104] During testing, it was determined that ESDs may carry voltage of up to about 15 kilovolts (kV) or more (although, voltage of an ESD may vary greatly), which is a relatively high voltage. Generally, the electric breakdown strength of dry air in substantially ideal conditions is approximate 3 kV/millimeter (mm). This means that in ideal conditions, a gap having a distance greater than 5 mm is needed to prevent a discharge directly from an electronic component **16** to the PWA **14**. In some instances, the ESD may not dissipate as expected due to materials (e.g., mating walls, dirt, humidity) or other factors slowing the dissipation of the ESD and thus, the ESD may travel farther than it is expected to travel in ideal conditions.

[0105] As a result of ESDs traveling farther than they would be expected to travel in ideal conditions, it is desirable to extend the ESDs' path of least resistance with the goal of the ESD dissipating prior to it reaching any electronic components of the electronic assembly **10**. As shown in FIGS. **16**A and **16**B, the parting line **40**, which may provide an avenue through which ESDs make their path to an interior of the of the electronic assembly **10** to the closest electrically sensitive area, may be extended a distance by the placement of the mating walls of the electronic assembly (e.g., the front cover **38**, the back cover **36**, and the spacer walls **42** of spacer **24**).

[0106] For example, the spacer **24** may be positioned within the housing **12**, such that the spacer **24** contacts the front cover **38** and the back cover **36**. Such positioning of the mating surfaces may extend the distance the ESD must travel to contact an electrically sensitive area within the housing **12** to a distance equal to a length of protective walls **56** of the front cover **38** starting at a gap at an outer surface of the housing **12** between the front cover **38** and the back cover **36** plus a length of the spacer walls **42**. In some illustrative instances, the extended distance the ESD may have to travel to an electrically sensitive area may be set at least 5 mm, at least 8 mm, at least 10 mm, or other distances of travel greater than 10 mm.

[0107] In some instances, and as disclosed further herein, the spacer **24** may be situated between the electronic component **16** and the PWA **14**, and in some cases, may engage both the facing surfaces of the electronic component **16** and the PWA **14**. When the spacer **24** is situated between the electronic component **16** and the PWA **14**, a component on the PWA **14** may extend through an opening **25** in the spacer **24**. For example, the electrically conductive extender or connector **18** extending from the PWA **14** may extend through an opening **25** in the spacer **24**, as shown in FIGS. **2**, **5** and **6**. In one example, the electrically conductive extender or connector **18** may extend from the PWA **14**, through an opening **25** in the spacer **24**, and may mechanically engage and electrically connect to the metal backing **22** of the electronic component **16**, as best shown in FIG. **6**.

[0108] In some instances, the front cover walls **56** of the front cover **38** may be configured to engage and/or align other features of the electronic assembly **10**. For example, wall extensions **58** may extend from the front cover walls **56** or other portions of the front cover **38** and interact with the PWA **14** or other feature to align the PWA **14** within housing **12**, and in some cases, to at least partially secure the PWA **14** within the front cover **38**. Additionally, or alternatively, a clip **60** of the front cover **38** may extend from a base **39** of the front cover **38** and optionally engage and/or align the PWA with the front cover **38**. Further, in some instances, the front cover walls **56** may have beveled or chamfered outside edges (e.g. beveled or chamfered vertical edges when the electronic assembly **10** is attached to a wall structure), as shown in FIG. **15**) that may engage and/or abut mating chamfered or beveled walls of the back cover **36**, as shown in FIGS. **16**A and **16**B.

[0109] Generally, the features of the electronic assembly **10** may be configured to give the electronic assembly **10** a slimming look and a thin or minimalist configuration. In some instances, and as best shown in FIGS. **24-25**, one or more terminal blocks **70** that may receive electrical wiring configured to connect power and/or control signals to the electronic assembly **10** may be positioned on a wall plate **80** and recessed into the housing **12** so as to not extend the profile of the electronic assembly **10** away from the wall. Despite being designed to create a thin profile, the electronic assembly **10** may be configured to allow plastic material to surround all electronics of the electronic assembly **10** and prevent substantially all of the electronics from being seen by a user from outside of the electronic assembly **10**.

[0110] In some instances where the electronic component **16** may be or may include a display **32** (e.g., a liquid crystal display (LCD) or other display, where the display **32** may be a color display or other display), the front cover **38** may be or may include a display holder (e.g., an LCD display holder or other display holder). In such instances, and possibly other instances, the electronic assembly's **10** foot print and/or components may be configured around the size of the display **32**. For example, the display **32** may include a display having an approximate diagonal D of 4.3 inches with a height H of approximately 3 inches and a width W of approximate 4 inches, as best shown FIG. **19**. The display **32** of the electronic component **16** may have other dimensions, as desired.

[0111] In some examples, where the size of the display **32** is approximately 4.3 inches diagonal (approximately 4 inches wide and 3 inches tall), the PCB **34** of the PWA **14** may be slightly taller than three inches. This extra length of the PCB **34** may accommodate an antenna (e.g., a Wifi antenna or other antenna) that would otherwise be shielded or blocked by metal backing **22** of the electronic component **16** (e.g. display **32**). As a result, the base size of the PCB **34** may be approximately 4 inches wide and 3.35 inches tall, and all of the electronics may be consolidated and/or packaged close together to fit within this footprint. Additionally, or alternatively, the electronics may be packaged along with the display **32**, which may allow the device to have a thin profile.

[0112] Further, the opening **52** of the front cover **38** may be sized to allow a user to view and/or interact with the display **32** or other electronic component **16**, while protecting the electronic component **16**. For example, the opening **52** in the front cover **38** may be sized to allow free access to a touch pad of the electronic component **16**, sized to cover the visual area viewing angles, sized to protect the PWA against contamination, sized to prevent the cover from interacting with an active touch pad area of the electronic component **16**, and/or sized for any other purpose.

[0113] In some illustrative instances, the front cover **38** may be configured to accept the electronic component in the X and Y directions, as shown in FIGS. **21-23**, in a tight to loose fit. In the Z direction, the fit may be tight to prevent the electronic component **16** from rattling while a user interacts with the electronic assembly **10**. Such a tight fit in the Z direction may be facilitated by using the gasket **106**, which may compress to fill any extra space resulting from manufacturing tolerances of the front cover wall **56** and the front cover **38**.

[0114] In some instances, the front cover **38** may have a bezel formed at least partially from the base **39** that wraps around the product and which may allow a user to contact the electronic assembly **10** without interacting with the electronic component **16** (e.g., the display **32**). Further, the front cover **38** may be a front window assembly (FWA) front cover **100** of the housing **12**, as best shown in FIG. **17**. The FWA front cover **100** may operate like a rigid display **32** and PWA **14** holder, such that the FWA front cover **100**, the display **32** and the PWA **14** may be placed in the final electronic assembly **10** as a single sub-assembly **110**.

[0115] The FWA front cover **100** may be made from a front window **102**, adhesive layer **104**, front cover **38** (e.g., a dis-

play holder), and gasket **106** (e.g., a sealing gasket or other gasket), as best shown in FIG. **17-20**. These parts may be supplied to an assembly line as a single part, separate parts, or a combination of single parts and combined parts, as desired.

[0116] The front cover **38** or display holder may include a recess **53** for receiving at least part of the display **32** (see, FIG. **19**). When the front cover **38** or display holder receives the display **32**, the gasket **106** may be positioned between the front cover **38** and the display **32** (e.g., the front side of the display **32**). The display **32** may be placed within the front cover **38** of the FWA front cover **100** through the recess **53** of the front cover **38** or display holder such that the front cover or display holder may extend adjacent part of the front side of the display **32** and adjacent at least part of the side walls of the display **32**.

[0117] The spacer **24** may be positioned adjacent the display **32**, and the sub-assembly **110** may be closed by adding the PWA **14** adjacent to the spacer **24** and securing the PWA **14** to the front cover **38** or display holder adjacent the back side of the display **32** (see, FIG. **20**). Such a configuration may sandwich the display **32** between the front cover **38** or the display holder and the PCB **34** of the PWA **14**. The term "sandwich" or "sandwiched", as used herein, means positioned between or positioned in any other similar position.

[0118] The PCB **34** of the PWA **14** may include a front side configured to face the front cover **38** or display holder and/or the display **32**, a back side opposite the front side, and side walls extending between the front side and the back side. The spacer **24** may have spacer side walls **42** that, when the spacer **24** is positioned between the PCB **34** and the display **32**, may extend adjacent to at least part of the side walls of the PCB **34** and/or beyond the back side of the PCB **34**, when desired.

[0119] In some instances, the display **32**, spacer **24**, and PWA **14** may be held in position in the sub-assembly **110** with one or more features of the front cover **38** or display holder, such as one or more hinges or wall extensions **58** (e.g., releasable hinges or wall extensions), one or more latches or clips **60** extending from the base **39** of the front cover **38**, and/or one or more other features. In one instance, the one or more features of the front cover **38** or display holder may be configured to sandwich the display **32** and the spacer between the front cover **38** or display holder and the PCB **34** of the PWA **14**. Alternatively, or additionally, the hinges or wall extensions **58** of the front cover **38** or display holder may hinge the PCB **34** of the PWA **14** with respect to the front cover **38** or display holder until the latch(es) or clip(s) **60** latch or clip the PCB **34** of the PWA **14** relative to the front cover **38** or display holder. Further, the sub-assembly **110** may be configured such that a flex tail **33** of the display **32** may be inserted into a connector **46** on the PWA **14**, as best shown in FIG. **23**, to place the PWA **14** and the PCB **34** thereof in electrical communication with the display **32**.

[0120] As discussed, the front cover **38** may receive the display **32** therein. In some instances, the display **32** (e.g., the front of the display) may rest against the gasket **106** within the front cover **38**. The gasket **106** may have several purposes. For example, the gasket **106** may prevent liquid from getting into the electronic assembly **10**, the gasket **106** may help create a tighter fit for the components of the electronic assembly **10**, the gasket **106** may help prevent ESDs from entering the electronic assembly **10**, etc.

[0121] In some instances, the spacer **24** and the front cover **38** or display holder may be mating components and may contain several positioning features that do not allow an operator to assemble them in an incorrect orientation. These orientation features include, but are not limited to: ribs **108** in the spacer **24** configured to engage pockets **112** in the front cover **38** or display holder to assist or help in aligning the spacer **24** with the front cover **38** or display holder; grooves in the edges of the spacer **24** and/or the front cover **38**; an alignment feature **114** (e.g., a rib, a pin, or other alignment feature) of the front cover **38** or display holder configured to engage an alignment feature **116** (e.g., a pocket, a pin hole, or other alignment feature) in the spacer **24** to align the spacer and the front cover or the display holder, as best shown in FIG. **19**; and/or other positioning features used in any uncombined or combined manner, as desired. In addition to facilitating the proper alignment of the front cover **38** and the spacer **24**, the positioning features may help prevent the spacer **24** from moving until the PWA **14** is assembled and the sub-assembly **110** may be fully assembled and locked together.

[0122] In some instances, the electronic assembly **10** may be at least partially powered with a battery **90** (e.g., a coin cell battery or other battery). Illustratively, to structurally facilitate use of the battery **90**, the back cover **36** may have a pocket, an opening, or an aperture **37** configured to receive the battery **90**, as seen in FIG. **29**. The pocket, opening, or aperture **37** may be at least partially defined by walls **130** of the housing **12** (e.g., walls **130***c* shown in FIGS. **27-28**). Through the pocket, opening, or aperture **37**, the battery **90** may be installed directly on a surface of the PCB **34** or other connection with the PWA **14**. As shown in FIG. **27**, walls **130***c* may at least partially form a recess **43** for receiving the battery **90** inserted through the pocket, opening, or aperture **37**, where the recess **43** and/or the walls **130***c* may limit access to electrical terminals of the PCB **34** from outside or exterior the housing **12**.

[0123] An illustrative method of using the battery **90** with the electronic assembly **10** may include inserting the battery **90** through the pocket, opening, or aperture **37** in the back cover **36** of the housing **12**. Once the battery **90** has been placed in the back cover **36**, it may be positioned against the PCB **34** within the housing **12** and slid down (e.g., in a lateral direction) to the recess **43** in the housing **12** and/or to a battery seat region **35** (see, for example, FIG. **29**) having electrical terminals for electrically connecting the battery **90** to the PCB **34** when the coin cell battery is place in the battery seat region **35**. In addition to or as an alternative to being electrically connected to the PCB **34**, the battery **90** may be removably secured to the PCB **34** when the battery **90** is at least partially positioned on the battery seat region **35**.

[0124] The battery **90** may extend along a primary plane and when the battery is positioned in the battery seat region **35**, the primary plane of the battery **90** may be substantially parallel to a surface (e.g., a main or major surface **34***a*, as shown in FIG. **29**) of the PCB **34**. The battery seat region **35** may at least partially overlap with and/or may be at least partially offset (e.g., laterally offset) from the pocket, opening, or aperture **37**, but the battery **90** may be accessible therethrough when positioned at the battery seat region **35**. In some instances, the battery **90** may be at least partially (e.g., a minor portion that may be less than half of the battery **90**, a major portion that may be half or more of the battery **90**, or other portion of the battery **90**) covered and/or protected by the housing **12** when it is positioned within the battery seat region **35**.

[0125] In some cases, the battery **90** may be held in place on the PCB **34** by a battery holder **92** (e.g., an electrical terminal

on the PCB **34**) having a contact and affixed to the PCB **34** and/or the back cover **36** (see, FIGS. **29**, **32-33**). In one example, a negative contact or electrical terminal may be located at the battery seat region **35** of the PCB **34** and a positive contact or electrical terminal may be formed adjacent (e.g., over or otherwise adjacent) the battery seat region **35** of the PCB **34** with the battery holder **92**. Alternatively, the contact polarity may be switched.

[0126] The battery holder **92** may include a mounting portion or mounting region **92***a* for mounting to the PCB **34** at or adjacent the battery seat region **35** (see FIGS. **32-33**). Additionally, or alternatively, the battery holder **92** may include an elongated spring region that may extend over and/or electrically contact a battery **90** positioned at least partially on or adjacent the battery seat region **35**. In one illustrative example, as shown in FIGS. **32** and **33**, the battery holder **92** may be a Z-shaped electrical terminal, but this is not required.

[0127] The battery holder **92** may be an electrical terminal for the battery **90** and may be made from electrically conductive material. For example, the battery holder **92** may be made from sheet metal and bent or otherwise formed to the desired shape (e.g., Z-shape or other shape) and may be configured to contact a positive (or alternatively, a negative side of the battery **90**). The battery holder **92** may be flexible enough to allow for battery **90** insertion and/or removal, while still applying pressure on the battery **90** with a required force to help assure proper electrical contact and maintaining the battery **90** at its position with friction forces or other forces. Further, the battery holder **92** may be protected from excessive loads by the surrounding material (e.g., plastic material) of the housing **12**.

[0128] When the battery **90** is correctly installed at the battery seat region **35**, the force from the battery holder **92** and gravity (e.g., when the electronic assembly **10** is mounted on a wall or other at least partially vertical structure) may help assure that the battery maintains good electrical contact with the connection on the PCB **34** and will remain in its desired position during handling of the electronic assembly **10**. Such design for battery **90** insertion into and removal from the electronic assembly **10** may simplify the assembly process because the battery may be delivered as a separate part and installed at an area where the electronic assembly **10** will be used as opposed to at a manufacturer or offsite. Additionally, or alternatively, the configuration of the electronic assembly for battery **90** insertion may facilitate placing and maintaining the battery **90** within the housing **12** without adjusting any part of the housing **12**.

[0129] In the illustrative method of using the battery **90** discussed above, the battery **90** may be removed by a user with the assistance of a screwdriver **94** or other tool, as best shown in FIGS. **30** and **31**, or in any other manner. For example, a user may insert the screwdriver **94** or other tool into a slot **96** in the back cover **36** of the housing **12**. The slot **96** may be configured to expose a portion of the battery **90** (e.g., an edge of the battery **90** when the battery **90** is positioned in the battery seat region **35**). The screwdriver **94** may be slid up along the slot **96** to push the battery **90** from below, which may cause the battery **90** to slide up and laterally out from the battery seat region **35** and/or the battery holder **92** toward the pocket, opening, or aperture **37** in the back cover **36** for removal through the pocket, opening, or aperture **37** from the housing **12** by hand or other tool.

[0130] In some instances, the slot **96** may be configured for a particular tool. For example, the slot may be an elongated slot and may be configured to receive a flat head screw drive. Alternatively, or additionally, other slot dimensions may be utilized for the slot **96** to accommodate a variety of tools.

[0131] Generally, there may be limited risk of the battery **90** shorting when removed with the tool or screwdriver **94** because the slot **96** may not allow the screwdriver **94** or other tool to touch the positive and negative battery contacts simultaneously. Additionally, or alternatively, the risk of shorting the PWA **14** may be limited by not locating conductive traces and electrical components on the PWA **14** near the slot **96**, so that the screwdriver **94** or tool may not contact any conductive traces and/or electrical components.

[0132] Turning now to FIGS. **27** and **28**, in some instances, the back cover **36** may be configured to support the PWA **14** and/or the electronic component **16** (e.g., display **32**). Supporting the PWA **14** and/or the electronic component **16** from a back side may assist in preventing unexpected bending of the PWA **14** and/or the electronic component **16** when a user is pressing against the display **32** or other front side features, which could contribute to the electronic device malfunctioning.

[0133] In one example, the back cover **36** may include an outer shell **73** and one or more inner walls **130** (e.g., inward extending walls or other inner walls) that extend from the outer shell **73** toward the PWA **14** to support the PWA **14** from the back side when it is fully assembled in the electronic assembly **10**. The inner walls **130** may have one or more functions. For example, the inner walls **130** may: provide mechanical support for the PWA **14** and/or the electronic component **16**; help to prevent ESDs from progressing to shielded areas of the PWA **14**; divide an inner volume between the PWA **14** and the back cover **36** into separate spaces (e.g., pockets and/or areas on the PWA **14**) and separate colder areas from warmer areas to assist in improving temperature sensing and/or compensation capabilities such as described in U.S. Pat. No. 8,280,637, which is incorporated herein by reference. Alternatively, or in addition, the inner walls **130** may have one or more other functions that may or may not be combined with the listed functions of the inner walls **130**.

[0134] In some instances, the inner walls **130** of the back cover **36** may have one or more portions. For example, as shown in FIG. **27**, the inner walls **130** of the back cover **36** may have: a wall portions **130***a* configured to surround the pins **62** on a region of the PWA **14** for connection to terminals **70** in the wall plate **80** (e.g., where the outer shell **73** may include an aperture **71** with wall portions **130***a* extending inward toward the PWA **14** to form a sidewall of the aperture **71** extending substantially to the PWA **14**), which may help prevent users from contacting electronic components on the PWA **14** other than the pins **62**; wall portions **130***b* configured to form thermistor pockets **132** and surround one or more thermistors or temperature sensors (e.g., a first temperature sensor and a second temperature sensor in a first area and/or a first pocket) on the PWA **14**; wall portions **130***c* forming a pocket and/or surrounding the battery aperture or opening **37** (e.g., where the wall portions **130***c* form a sidewall of the battery aperture or opening **37** and provide access to a region on the PWA **14** (see, for example, the discussion of the region with respect to the aperture **71** above) and one or more connectors (e.g., battery holder **92** or other connectors)), which may help prevent users from contacting other electronic components on the PWA **14** when installing and/or removing the battery **90**; wall portions **130***d* forming pockets separating

warm areas of the PWA **14** (e.g., the first area and/or the first pocket with air of a first temperature during operation of the electronic assembly **10**) from colder areas of the PWA **14** (e.g., a second area and/or second pocket with air of a second temperature that is cooler than the first temperature during operation of the electronic assembly **10**), which may improve the temperature sensing and/or compensating capabilities of the electronic assembly **10**; and wall portions **130***e* forming pockets and/or surrounding a humidity sensor attached to the PWA (e.g., where the humidity sensor is in one of the first pocket, the second pocket, a third pocket, and/or any other pocket). The regions on the PWA **14** discussed above may be regions including the pins **62**, the battery holder **92**, and/or is substantially devoid of ESD sensitive electronic components, electronic components other than one or more connectors such as a pin or battery connector, or any other electronic component.

[0135] Further, in some cases, an interior of the back cover **36** may have one or more alignment feature **136** configured to engage one or more openings in the PWA **14** and align the back cover **36** with respect to the PWA **14**, which may be within sub-assembly **110**. Additionally, the back cover **36** may include one or more PWA supports **134**, which may have the dual purpose of providing a testing opening through back cover **36**.

[0136] With the above illustrative structure of the back cover **36**, the wall portions **130** (e.g., wall portions **130***a*-**130***e*) may help support PWA **14** by touching or contacting a back side of the PWA **14** at some or at least substantially all of the positions atop the wall portions **130** when the printed circuit board is enclosed in the housing **12**. In some instances, the wall portions **130** may facilitate ESD shielding by, for example, walling off a central opening **71** for connecting pins **62** to terminal **70** on a wall plate **80**. Additionally, or alternatively, the wall portions **130** may improve temperature sensing accuracy by at least partially separating cold areas (e.g., an area surrounding the battery **90**) where there are no, or a limited number of, components generating unintended heat, from other areas. In the cold areas of the PWA **14** as defined, for example, by the wall portions **130***d* of the back cover **36**, one or more thermistors and/or one or more humidity sensors may be positioned so as to not be affected so much by heat creating electronic components on the PWA **14**.

[0137] As indicated by the placement of thermistor pockets **132** in the back cover **36**, the thermistors on the PWA **14** may be located at top and bottom edges (or in some cases opposite edges) of the PWA **14**. To further isolate at least some of the thermistors on the PWA **14** from unintended heat, the wall portions **130** of the thermistor pockets **132** may substantially entirely surround a thermistor and contact the surface of the PWA **14**. Such direct contact between the wall portions **130***b* and the PWA **14** may assist in isolating the thermistor pockets **132**. Dividing the inner volume between the PWA **14** and the back cover **36** into separate spaces (e.g., pockets and/or areas on the PWA **14**) and separate colder areas from warmer areas may assist in temperature sensing and/or compensation capabilities of the electronic device such as described in U.S. Pat. No. 8,280,637, which is incorporated herein by reference.

[0138] Additionally, or alternatively, the wall portions **130***d* surrounding a humidity sensor at the bottom of the PWA **14** may protect the humidity sensor and have vents **138** to help bring humidity changes to this compartment. In some illustrative instances, including optionally the examples above, the first thermistor pocket and the second thermistor pocket may be free from air vents **138** through the housing **12** to the external environment. The third pocket, which may house the humidity sensor, may include an air vent **138** extending through the housing **12** to an exterior environment. As a result of these features and others, the back cover **36** may be configured to support the PWA **14** and/or the electronic component **16**, protect features on the PWA **14**, and provide an electronic assembly **10** that has robust and accurate electronic sensing capabilities.

[0139] In some instances, the housing **12**, particularly the front cover **38** and the back cover **36**, may be formed by any desirable manufacturing process and may be made from any desirable material. For example, the housing **12** may be molded and made from a plastic material. Alternatively, or in addition, the housing may be made from a different mechanical process and/or a different material.

[0140] As shown in FIGS. **24-26**C, the back cover **36** (e.g., a back side of a housing **12** having a back side and a front side) may engage a wall plate **80** (e.g., in a releasably connectable manner), where the wall plate **80** may be a portion of the electronic assembly that is used to hang the electronic assembly **10** (e.g., a thermostat) on a wall or other structure. In some cases, the wall plate **80** may have a perimeter defined or at least partially defined by side walls **86**, and in some cases, the engaged back cover **36** may partially or substantially enclose the wall plate **80**.

[0141] In some instances, the wall plate **80** may be secured to a wall or other structure with screws **82** or other fastening mechanisms. The wall plate **80** may include one or more apertures **81** extending through the wall plate **80** that are configured to receive one or more screws or other fastening mechanisms. Where screws **82** are used to fasten the wall plate **80** to a wall or other structure, it is contemplated that the wall plate **80** and/or the back cover **36** may include pockets **84** (e.g. relief features) in the wall plate **80** and/or pockets **63** (e.g., relief features) in the back cover **36** to accommodate a portion of a screw head to help ensure the heads of the screws **82** do not act as a limiting factor in the thinness or thickness of the electronic assembly **10**. In instances where there are pockets **84** in the wall plate **80** and pockets **63** in the back cover, the pockets **84**, **63** may be aligned with one another.

[0142] The housing **12** (e.g., the back cover **36** or other portion of the housing **12**) and the wall plate **80** may be provided and/or configured such that the housing **12** and the wall plate **80** initially engage one another, with the wall plate **80** misaligned relative to the housing **12**. As the wall plate **80** and the housing **12** are moved (e.g., slid or otherwise guided) together or toward one another, the housing **12** and wall plate **80** may be guided into alignment with one another.

[0143] In some instances, the back cover **36** may have a raised perimeter **64** at least partially defining a recess that is configured to accept and/or receive at least a part or portion of the wall plate **80**, where the recess may include a recess back wall **65**. The recess may have a depth and the wall plate **80** may have a thickness such that the volume of the recess of the housing **12** may receive at least a majority of the thickness of the wall plate **80**. Alternatively, or in addition, the wall plate **80** may have a raised portion in a front wall **91** that at least partially defines a recess that is configured to accept and/or receive at least a part or portion of the back cover **36** or other portions of the housing **12**, where the recess may include a recessed front wall (not explicitly shown).

[0144] Although the engaging and aligning related features are discussed herein with respect to the recess being posi-

tioned in the back cover **36** of housing **12**, similar engaging and/or aligning related features may be incorporated into the electronic assembly **10** having a recess in the wall plate **80** that receives at least part of the back cover **36** or other portion of the housing **12**.

[0145] Referring to FIGS. **24-25**, the raised perimeter **64** of the back cover **36** may have recess side walls **66** that may correspond with wall plate side walls **86** of the wall plate **80**, and may allow at least a part or portion of the side walls **86** of the wall plate **80** to mate with the recess side walls **66** of the back cover **36** of the housing **12**. In some cases, the side walls **86** of the wall plate **80** are tilted or slanted at an angle relative to the back wall **65**, and the recess side walls **66** of the back cover **36** may be similarly titled or slanted at an angle to mate with the side walls **86** of the wall plate **80**. More generally, in some instances, the recess side walls **66** may have a first perimeter **67** adjacent the recessed back wall **65** and a second perimeter **69** toward the back side of the housing **12** and the wall plate **80**, where the second perimeter **69** is larger than the first perimeter **67**. Likewise, the side walls **86** of the wall plate **80** may have a first perimeter **87** adjacent the housing **12** when the wall plate **80** is engaging the housing **12** and a second perimeter **89** closer to a mounting surface **85** of the wall plate than the first perimeter, where the second perimeter **89** is larger than the first perimeter **87** (see, for example, FIG. **26**B).

[0146] In some cases, the respective walls **66**, **86** may be used to self align the back cover **36** with the wall plate **80**. For example, in some instances, the side walls **66** of the housing and the side walls **86** of the wall plate **80** may be configured such that the recess in the back of the housing **12** may receive the wall plate **80** with the wall plate **80** misaligned relative to the housing **12**, and then as the housing **12** is moved toward the wall plate **80**, the side walls **66** of the housing and the side walls **86** of the wall plate **80** progressively further align the housing **12** with the wall plate **80**.

[0147] In a similar manner, it is contemplated that a recess in the wall plate **80** (not explicitly shown) in conjunction with the back cover **36** or other portion of the housing **12** may be configured such that the recess of the wall plate **80** may initially receive the back cover **36** or other portion of the housing **12** with the wall plate misaligned relative to the back cover **36** or other portion of the housing **12**, and then progressively further align the back cover **36** or other portion of the housing **12** with the wall plate **80** as the back cover **36** or other portion of the housing **12** are moved closer to one another.

[0148] A method of securing a back cover of a housing **12** and a wall plate **80** may include moving the wall plate **80** into engagement with the back cover **36** (or back side of the housing **12**) and sliding an aligning surface of the wall plate **80** (e.g., tilted, slanted, angled, beveled, chamfered side walls **86**) along an aligning surface of the housing (e.g., tilted, slanted, angled, beveled, chamfered side walls **66**) to align the wall plate **80** with the housing **12** as the wall plate **80** is moved further towards the housing **12**.

[0149] The tilted, slanted, angled, beveled, or chamfered side walls **66**, **86** may be angled at any angle or have any other suitable configuration. For example, the side walls **66**, **86** may be angled at between zero (0) degrees and ninety (90) degrees, ten (10) degrees and eighty (80) degrees, twenty (20) degrees and seventy (70) degrees, thirty (30) degrees and sixty (60) degrees, forty (40) degrees and fifty (50) degrees relative to the recess back wall **65** or the mounting surface **85**, respectively. In one illustrative example, the side walls **66**, **86** may be angled at a forty-five (45) degree angle with respect to the recess back wall **65** or the mounting surface **85**, respectively. Alternatively, the side walls **66**, **86** may have different angles with respect to one another relative to the respective recess back wall **65** or the mounting surface **85**.

[0150] In some instances, the back cover **36** may be further configured to have a limited profile. For example, the side walls **68** of the back cover **36** may extend inward, such that the front of the back cover **36** that is adjacent the front cover **38** defines a larger circumference/perimeter than a circumference/perimeter defined by a back of the back cover **36** that is adjacent the wall plate **80**.

[0151] Referring now to FIGS. **34**A and **34**B, electronic assemblies **10** having a display **32** and/or other circuitry may need robust electrical connection(s) for bringing power thereto. As shown in FIGS. **34**A and **34**B, terminals or terminal assembly **70** (e.g., electrical terminals or electrical terminal blocks) may be built into a wall plate **80** or other feature of the electronic assembly **10**. Illustratively, the terminals **70** (e.g., one terminal **70**, two terminals **70**, as shown in FIG. **24**, or more terminals **70**) may be positioned within the wall plate **80** such that when the housing **12** of the electronic assembly **10** is attached to the wall plate **80**, pins **62** affixed to the PCB **34** of the PWA **14** (where the pins **62** may be connected to the PCB **34** via a soldering technique or other mounting technique) may removably electrically connect to the terminals **70** (e.g., each pin **62** may engage a separate terminal **70** or multiple pins **62** may engage a single terminal). As seen in FIG. **35**, in some instances, two terminals **70** (e.g., a first terminal and a second terminal) may be configured to engage plastic or other material of the wall plate **80**, and pins **62** connected to the PCB **34** (not shown) may thereafter engage the terminals **70** (e.g., a first pin **62** may engage a first terminal **70** and a second pin **62** may engage a second terminal **70**).

[0152] In some instances, the terminals **70** may define a cage **72** (made of metal or other electrically conductive material), a screw **74**, and a nut **76**, as best shown in FIGS. **36-38**. As discussed above, the terminals **70** may be supported by the material (e.g., plastic or other material) of the wall plate **80** and one or more terminals **70** (e.g., a single terminal) may be placed in (e.g., slid in, snapped in, and/or otherwise positioned in) each of one or more pockets, recesses, or openings **83** in the wall plate **80**.

[0153] The cage **72** of the terminal **70** may include a first portion **72***a* having an area for receiving a screw **74** and a nut **76**. In some cases, the first portion **72***a* of the cage **72** may have a first side **75***a*, an opposing second side **75***b* and a third side **75***c*. In some cases, the first side **75***a*, the second side **75***b* and the third side **75***c* of the first portion **72***a* of the cage **72** may be formed from a single piece of bent metal.

[0154] The first portion **72***a* of the cage **72** may be used for connecting a wire. The wire may, for example, power the electronic assembly **10** or communicate a control signal. In some cases, a wire may be wrapped around the screw **74** by an installer, and then the screw **74** may be tightened to secure the wire between the head of the screw and an outside surface of the third side **75***c* of the first portion **72***a* of the cage **72**. Alternatively, a wire may be inserted between the nut **76** and the first portion **72***a* of the cage **72** by the installer, and then the screw **74** may be tightened to secure the wire between the nut **76** and an inside surface of the third side **75***c* of the first portion **72***a* of the cage **72**.

[0155] As noted above, the first portion **72***a* of the cage **72** may be configured to receive an end of a wire (e.g., a power or control wire). A second portion **72***b* of the cage **72** may be

positioned adjacent the first portion **72***a* of the cage **72**. The second portion **72***b* of the cage **72** may be formed from, or have, flange **78** that may be configured to receive and/or to be placed in electrical contact with the pins **62** soldered, or otherwise connected to, the PCB **34** or other feature of the PWA **14**. Flange **78** of the second portion **72***b* of the cage **72** may be configured to fit within openings **83** in the wall plate **80** that are configured to receive the second portion **72***b* of the cage **72** (see, for example, FIG. **35**). The configuration of the first portion **72***a* and the second portion **72***b* of the cage **72** may be configured to electrically connect a pin **62** to a wire.

[0156] In some cases, the cage **72** of the terminal **70** may include a latch **79** (e.g., a one-way latch, a two-way latch, etc.), as best shown in FIG. **38**. Illustratively, the latch **79** may be configured to engage (e.g. slide into, snap into, etc.) a hole **88** (e.g., a latching hole or other hole) in the wall plate **80**, as best shown in FIG. **34**B, or connect to the wall plate **80** in any other manner after or as the terminal **70** is positioned in the opening **83** of the wall plate **80**. In one example, the latch **79** may snap into the hole **88** in the wall plate **80** and lock the terminal **70** in the opening **83** of the wall plate **80** by preventing removal of the terminal.

[0157] Illustratively, the cage **72** may be formed form any combination of electrically conductive materials. For example, the cage **72** may be formed from one or more metal and in one example, the cage **72** may be formed from phosphor bronze, a phosphor bronze alloy, and/or other material.

[0158] The material of the cage **72** may be formed into the cage **72** in any manner. For example, the material of the cage **72** may be bent, molded, welded, and/or otherwise formed into the cage **72**. Additionally, or alternative, the cage **72** may be formed from a single piece of metal (e.g., a metal plate) or formed from a plurality of pieces of metal or other material. In some cases, the first portion **72***a* of the cage **72** and the second portion **72***b* of the cage **72** may be formed from a single piece of bent metal.

[0159] The screw **74** of terminal **70** may be a self-locking screw or other screw that extends at least partially through and/or within the first portion **72***a* of the cage **72**, where a recess under the screw head and/or special flanges (not shown) extending from the cage **72** may help hold the screw at a desired position (e.g., a desired position for maintaining the nut **76** within the cage **72**). The head of the screw **74** may allow for use with any desired tool. For example, the head of the screw **74** may allow for the use of a flat-head screwdriver, a Phillips head screwdriver (e.g., Phillips PH1, or other Phillips screwdriver), an Allen wrench/hex key tool, or other tool. The screw **74** may be formed from steel, hardened steel, or any other suitable material.

[0160] The nut **76** may be configured to engage the screw **74** in a threaded manner or a different manner at least partially within the first portion **72***a* of the cage **72**. In some instances, the nut **76** may be completely unscrewed from the screw **74**, but due to its positioning within the first portion **72***a* of the cage **72** the nut may not drop from the terminal **70** and the screw **74** may be engaged by the screw **74** again.

[0161] In some instances, and as shown in FIG. **37**, the nut **76** may include features (e.g., grooves **77**, dimples, bumps, or other features) to help engage an end of a wire. This may help protect the electronic assembly **10** from unintended wire pull-out when the screw **74** is tightened to nominal torque (e.g., 1 lb-in-6 lb-in, 2 lb-in-5 lb-in, 3 lb-in-4 lb-in, such as 3.5 lb-in or any other torque level less than 1 lb-in or greater than 6 lb-in).

[0162] The terminal **70** may be placed in a suitable pattern to match the pattern of the pins **62** attached to the PCB **34** of the PWA **14**. A nominal pin **62** spacing may be configured to be a particular distance (e.g., 1 mm, 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 7 mm, 8 mm, 9 mm, 10 mm, or other distance). In some instances, two pins **62** may be connected to the PCB **34**, which may be used to power the electronic assembly with a 24 volt alternate current (AC) or other current, where one wire connected to a terminal **70** may be a ground wire and the other wire connected to a terminal **70** may be live wire (e.g., carrying 24 V AC or other voltage). As the pins **62** of the electronic assembly **10** are configured to slidingly engage the flange **78** of the terminal **70** within the wall plate **80**, the housing **12** and the contents therein may be removed from the wall plate **80** without disconnecting the wires from the terminals **70** of the wall plate.

[0163] The terminals **70** of the wall plate **80** may be used in a method of electrically connecting a wire to the PCB **34** that may be at least partially or substantially housed in the housing **12** of the electronic assembly **10**. The terminal **70** may be inserted into an openings **83** in the wall plate **80**, and a latch of the terminal **70** may be snapped into or may otherwise engage a hole **88** in the opening **83** to secure the terminal relative to the wall plate **80**. In one illustrative instance, a wire may be slid adjacent the nut **76** of the first portion **72***a* of the cage **72** of the terminal **70** in the wall plate **80**. The screw **74**, extending at least partially through the first portion **72***a* of the cage **72**, may then be rotated and tighten the nut **76** so as to capture the wire between the nut **76** and the third side **75***c* of the first portion **72***a* of the cage **72**. The flange **78** of the second portion **72***b* of the cage **72** may engage the pin **62**, where the pin **62** may extend from the PCB **34** through an aperture in the housing **12**.

[0164] In some instances, the electronic assemblies **10** powered from line power transformers may need to be able to withstand surge energy which may come from the power line, through a transformer, to the electronic assembly **10**. During surge events, a voltage at a loaded transformer may exceed an absolute maximum rating of power supply voltage for the electronic assembly **10**. In other words, the overall energy may be high. To protect the electronic assembly **10** against such power surges (or event ESD events), suitable over voltage protection components in electrical communication with the pins **62** may be utilized on the PWA **14**.

[0165] One approach for such surge protection may involve splitting a surge voltage. For example, the surge energy may be split and directed to two or three (or four or more) components. As in the circuit diagrams **120**, **140**, **160** in FIGS. **39-41**, respectively, a first component may be one or more varistors **122** (e.g., a small varistor or a large varistor) having a clamping voltage (e.g., a low clamping voltage or a high clamping voltage), a second component may be one or more resistors **124** (e.g., a serial resistor or a parallel resistor), and a third component include one or more diodes **126** (e.g., a Transient Voltage Suppressor (TVS) diode or other diode) with a small clamping voltage or a large clamping voltage. In the above example, the resistor **124** may be the component that allows the surge energy to be split between the varistor **122** and the diode **126** in a suitable ratio. Optionally, some part of the surge voltage may be absorbed by a first capacitor or a capacitor **128** (e.g., a 47 uF-FK bulk capacitor, other bulk capacitor, or other capacitor) as best shown in FIG. **41**.

[0166] The varistors **122** may be any type of varistor. In some instances, one or more of the varistors **122** may be a 56

volt varistor or other type of varistor. The resistors **124** may be any type of resistor. In some instances, one or more of the resistors **124** may be a thin film resistor or a thick film resistor. In some cases, the resistors **124** may be wire-wound resistors or resistors of other configurations. The diodes **126** may be any type of diodes. In some instances, the diodes **126** may be Transient Voltage Suppressor (TVS) diodes or any other type of diodes. The capacitor **128**, when present, may be any type of capacitor. In some instances, the capacitors **128** may be bulk capacitors (e.g., 17 uF bulk capacitors) or any other type of capacitor.

[0167] In some instances, the surge protection circuit may be configured on a printed circuit/wiring board (e.g., PCB **34** or PWA **14**). For example, a varistor **122**, a resistor **124**, a diode **126**, and/or a capacitor **128** may each be separately secured to the printed circuit/wiring board or secured to the printed circuit/wiring board in combination or in any other manner. In some cases, one or more of the varistor **122**, resistor **124**, diodes **126**, and/or capacitor **128** may be surface mounted to the printed circuit/wiring board (e.g., PCB **34** or PWA **14**).

[0168] As shown in FIGS. **39-41**, a varistor **122** (e.g., a first voltage clamp) of the circuit diagrams **120**, **140**, **160** of surge protection circuits may be positioned between a power input terminal **121** at the R node and a common terminal **123** at the C node of the electronic assembly **10** (e.g., an HVAC device). A resistor **124** and a diode **126** (e.g., a second voltage clamp, where the second voltage clamp may be less than the first voltage clamp) of the circuit diagram **120**, **140**, **160** may be positioned between the power input terminal **121** and the common terminal **123** of the electronic assembly **10**, in parallel with the varistor **122**. In some instances, the resistor **124** may be connected in series with the diode **126** at an output node **125**. The output node **125** and common terminal **123** may provide a surge delimited power supply to the printed circuit/wiring board (e.g., PCB **34** or PWA **14**).

[0169] In some instances, as shown for example in FIGS. **39** and **40**, the resistor(s) **124** may be connected or located between the power input terminal **121** and the output node **125**, the diode(s) **126** may be positioned between the output node **125** and the common terminal **123**, and the varistor(s) **122** may be positioned between the input terminal **121** and the common terminal **123**. In circuit diagram **140** of FIG. **40**, a first varistor **122***a*, a second varistor **122***b*, a first resistor **124***a*, and a second resistor **124***b* are depicted. In some instances, the first varistor **122***a* and the second varistor **122***b* are connected in parallel as shown. Alternatively, or additionally, the first resistor **124***a* and the second resistor **124***b* are connected in parallel. Although not shown, the surge protection circuit may have a first varistor **122***a*, a second varistor **122***b*, and a single resistor **124**. Alternatively, the surge protection circuit may have a single varistor **122**, and a first resistor **124***a* and a second resistor **124***b*.

[0170] FIG. **41** depicts circuit diagram **160**. In circuit diagram **160**, a first varistor **122***a*, a second varistor **122***b*, a resistor **124**, and a capacitor **128** (e.g., a bulk capacitor) are depicted. In some instance, the first varistor **122***a* and the second varistor **122***b* may be connected in parallel as shown. The first varistor **122***a* and the second varistor **122***b* may be a first voltage clamp positioned and/or connected between the power input terminal **121** and the common terminal **123**. The resistor **124** is shown connected between the power input terminal **121** and a first terminal of capacitor **128**, and a second terminal of capacitor **128** is shown connected to the common terminal **123**. The first terminal of capacitor **128** corresponds to the output node **125** of the illustrative power surge protector circuit. The capacitor **128**, when included in the power surge protector circuit, may be configured to absorb voltage spikes at the output port **125**.

[0171] In some instances, the capacitor **128** may include one or a plurality of capacitors **128**. In one illustrative example shown in FIG. **41**, the power surge circuit protector **160** may include a first capacitor **128***a*, a second capacitor **128***b*, and a third capacitor **128***c*. The plurality of capacitors **128** may be positioned in series or in parallel with respect to one another.

[0172] A more detailed example of the operation of the power surge circuit protector of FIG. **39** will now be provided. Typical maximum peak surge current may be around 44 amps (A). The protective circuitry may be analyzable as a direct current (DC) circuit powered from a 44 A current source because energy dissipation is proportional to the actual current value, and the 44 A peak current may represent a worst case scenario. The 44 A input current may be split at R node **121** (e.g., a power node) into 15 A that travels through a 56V varistor **122**, and **29**A that travels through the resistor **124** and diode **126**. Voltage levels between the R node and a C node (e.g., a common node) may be limited to the clamping voltage of the varistor **122**, which may be 110V, for example. On the serial combination of resistor **124** and diode **126**, the clamping voltage may be defined by the properties of the diode (54V) **126**, which may result in a voltage to the resistor of, for example, 110V−54V=56V. Because the 56V is defined by differences between the clamping voltages of the varistor **122** and the diode **126**, the current through the diode **126** may be given by the voltage difference divided by the resistance of the resistor. Thus, if 29 A is desired to pass through resistor **124** and diode **126**, the resistor should have a value of about 2 ohms. As can be seen, the value of resistor **124** may be chosen to achieve a desired split of the 44 A input current between the varistor(s) **122** and the diode(s) **126**.

[0173] Although, particular surge protecting schematic block diagrams are discussed herein and shown in the Figures, other similar and dissimilar circuit layouts may be utilized to help protect the electronic assembly **10** from undesirable surges of energy or power.

[0174] In a method of operation, such as a method of protecting an electronic device or assembly **10** from damage to electronic components **16** thereon caused by power surges received from line power connected to the electronic device or assembly **10** or power surges from other sources, may include providing a printed circuit/wiring board **14**, **34** and providing a power surge protector circuit thereon. Illustratively, the power surge circuit protector may include one or more of a varistor **122**, a resistor **124** (e.g., a serially positioned resistor or other resistor), diode **126** (e.g., transient voltage suppressor diode or other diode), and/or a capacitor **128**. Surge voltages may then be split between two or more electronic components **16** (e.g., a varistor **122**, a diode **126**, and/or a capacitor **128**) on the printed circuit/wiring board **14**, **34**. In some instances, the value of a resistor **124** may determine the split of the surge current between the two or more electronic components in the power surge protector circuit.

[0175] Those skilled in the art will recognize that the present disclosure may be manifested in a variety of forms other than the specific embodiments described and contemplated herein. Accordingly, departure in form and detail may

be made without departing from the scope and spirit of the present disclosure as described in the appended claims.

What is claimed is:

1. An electronic assembly that is mountable to a mounting surface, comprising:

a housing having a front side and a back side;

a wall plate releasably connectable to the housing;

the back side of the housing defining a recess for receiving at least part of the wall plate, wherein the recess is defined by a recessed back wall and recess side walls, wherein the recess side walls have a first perimeter adjacent the recessed back wall and a second perimeter positioned rearward the first perimeter toward the back side of the housing, wherein the second perimeter is larger than the first perimeter; and

the wall plate having a perimeter that is defined by side walls, wherein at least part of the side walls of the wall plate are configured to mate with at least part of the recess side walls of the housing.

2. The electronic assembly of claim **1**, wherein the side walls of the wall plate have a first perimeter adjacent the housing and a second perimeter toward a mounting surface, wherein the second perimeter is larger than the first perimeter.

3. The electronic assembly of claim **1**, wherein the recess and the wall plate are configured such that the recess can initially receive the wall plate with the wall plate misaligned relative to the housing, and then progressively further align the housing and the wall plate as the housing and wall plate are moved together.

4. The electronic assembly of claim **1**, wherein the wall plate has a thickness and the recess has a depth, wherein the depth of the recess is sized to receive at least a majority of the thickness of the wall plate.

5. The electronic assembly of claim **1**, wherein the side walls of the wall plate include an angled surface that substantially matches an angled surface of the recess side walls.

6. The electronic assembly of claim **5**, wherein the angled surface of the wall plate extends at an angle of between 20 and 70 degrees relative to the mounting surface when the wall plate is mounted to the mounting surface.

7. The electronic assembly of claim **5**, wherein the angled surface of the wall plate extends at an angle of between 30 and 60 degrees relative to the mounting surface when the wall plate is mounted to the mounting surface.

8. The electronic assembly of claim **1**, wherein the wall plate includes an aperture for receiving a screw for attaching the wall plate to the mounting surface, and wherein the recessed back wall includes a relief feature that aligns with the aperture in the wall plate.

9. The electronic assembly of claim **8**, wherein the screw has a screw head, and the relief feature is configured to accommodate at least part of the screw head.

10. The electronic assembly of claim **1**, wherein the housing has housing side walls that extend from a front of the housing to a back of the housing, wherein the housing side walls taper inward from the front of the housing to the back of the housing.

11. An electronic assembly that is mountable to a mounting surface, comprising:

a housing having a front side and a back side;

a wall plate releasably connectable to the back side of the housing; and

wherein the housing and the wall plate are configured such that the housing and wall plate can initially engage each other with the wall plate misaligned relative to the housing, and to guide the housing and the wall plate into alignment as the housing and wall plate are moved further together.

12. The electronic assembly of claim **11**, wherein the back side of the housing defines a recess for receiving at least part of the wall plate, wherein the recess and the wall plate are configured such that the recess can initially receive the wall plate with the wall plate misaligned relative to the housing, and then progressively align the housing and the wall plate as the housing and wall plate are moved further together.

13. The electronic assembly of claim **12**, wherein the recess is defined by a recessed back wall and recess side walls, wherein the recess side walls have a first perimeter adjacent the recessed back wall and a second perimeter rearward toward the back side of the housing, wherein the second perimeter is larger than the first perimeter, and wherein side walls of the wall plate have a first perimeter adjacent the housing and a second perimeter toward a mounting surface, wherein the second perimeter is larger than the first perimeter.

14. The electronic assembly of claim **13**, wherein the side walls of the wall plate include an angled surface that substantially matches an angled surface of the recess side walls.

15. The electronic assembly of claim **13**, wherein an angled surface of the wall plate extends at an angle of between 30 and 60 degrees relative to the mounting surface when the wall plate is mounted to the mounting surface.

16. The electronic assembly of claim **13**, wherein the wall plate includes an aperture for receiving a screw for attaching the wall plate to the mounting surface, and wherein the recessed back wall includes a relief feature that aligns with the aperture in the wall plate.

17. The electronic assembly of claim **16**, wherein the screw has a screw head, and the relief feature is configured to accommodate at least part of the screw head.

18. The electronic assembly of claim **12**, wherein the wall plate has a thickness and the recess has a depth, wherein the depth of the recess is sized to receive at least a majority of the thickness of the wall plate.

19. The electronic assembly of claim **11**, wherein the front side of the wall plate defines a recess for receiving at least part of the back side of the housing, wherein the recess in the wall plate and the back side of the housing are configured such that the recess can initially receive the back side of the housing with the wall plate misaligned relative to the housing, and then progressively align the housing and the wall plate as the housing and wall plate are moved further together.

20. A method of assembling an electronic assembly, the method comprising:

providing a housing having a front side and a back side;

providing a wall plate;

moving the wall plate into engagement with the back side of the housing; and

sliding an aligning surface of the wall plate along an aligning surface of the housing to align the wall plate with the housing as the wall plate is moved further towards the housing.

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