US012390065B2

(12) **United States Patent**
Mathias et al.

(10) **Patent No.: US 12,390,065 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **LOW COST CLEANING DEVICES**

(71) Applicant: **SharkNinja Operating LLC**, Needham, MA (US)

(72) Inventors: **Richard Mathias**, Needham, MA (US); **Brandon J. Suleski**, Cambridge, MA (US)

(73) Assignee: **SharkNinja Operating LLC**, Needham, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 627 days.

(21) Appl. No.: **17/653,557**

(22) Filed: **Mar. 4, 2022**

(65) **Prior Publication Data**

US 2022/0280000 A1 Sep. 8, 2022

Related U.S. Application Data

(60) Provisional application No. 63/238,579, filed on Aug. 30, 2021, provisional application No. 63/234,204, filed on Aug. 17, 2021, provisional application No. 63/156,901, filed on Mar. 4, 2021.

(51) **Int. Cl.**

A47L 9/06	(2006.01)
A47L 5/28	(2006.01)
A47L 7/00	(2006.01)
A47L 9/14	(2006.01)
A47L 13/16	(2006.01)
A47L 13/20	(2006.01)

(52) **U.S. Cl.**

CPC ***A47L 9/0673*** (2013.01); ***A47L 5/28*** (2013.01); ***A47L 7/0009*** (2013.01); ***A47L 9/14*** (2013.01); ***A47L 13/16*** (2013.01); ***A47L 13/20*** (2013.01)

(58) **Field of Classification Search**

CPC A47L 9/0673; A47L 13/44; A47L 13/46; A47L 13/258; A47L 5/28; A47L 7/0009; A47L 9/14; A47L 13/16; A47L 13/20

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

11,800,962	B2	10/2023	Zorzo
2021/0045601	A1	2/2021	Douglas et al.

FOREIGN PATENT DOCUMENTS

DE	29822052	U1	2/1999
EP	2215947	A2	8/2010
JP	2008188375	A	8/2008

OTHER PUBLICATIONS

DE29822052U1 (machine translation) (Year: 1999).*

International Search Report and Written Opinion received for PCT Application No. PCT/US2022/070971, mailed on Jun. 22, 2022, 13 pages.

U.S. Appl. No. 17/653,558, filed Mar. 4, 2022, Low Cost Cleaning Head for Cleaning Devices.

* cited by examiner

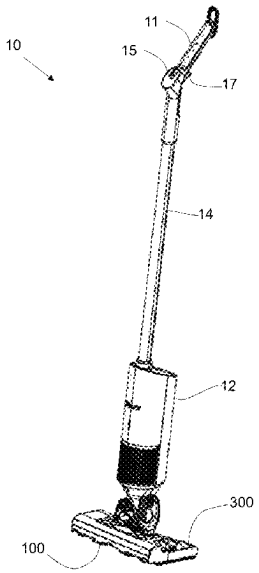
Primary Examiner — Andrew A Horton

(74) *Attorney, Agent, or Firm* — Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C.

(57) **ABSTRACT**

A cleaning device connector is provided having a connector housing with a front wall, a rear wall, a bottom surface, and a top surface. A cavity is arranged within the bottom surface of the housing. A bracket is arranged within the cavity of the housing. A pin extends from the rear wall of the housing. A release button is positioned on the housing and configured to move the bracket and the pin from a first position to a second position.

16 Claims, 41 Drawing Sheets



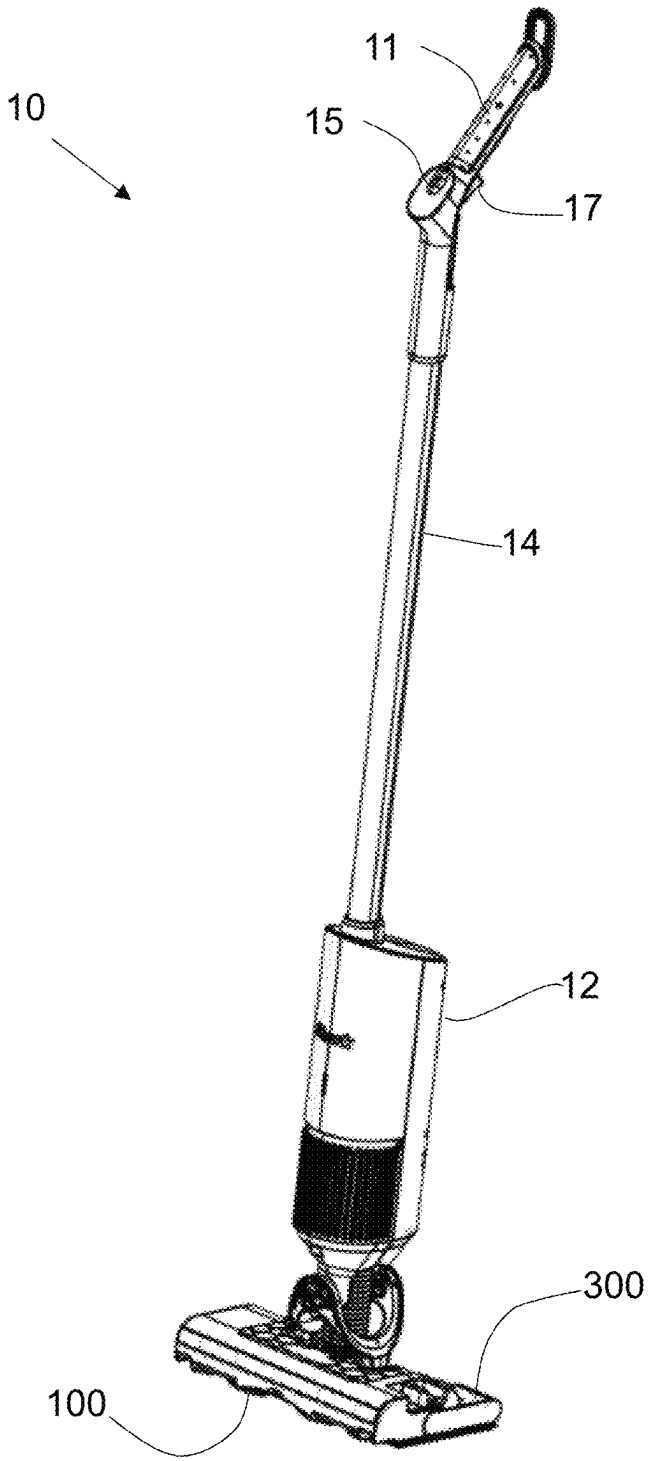


FIG. 1

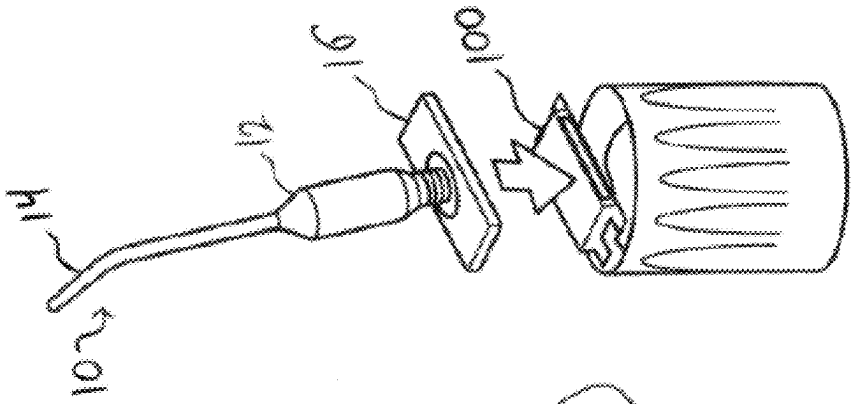


FIG. 2D

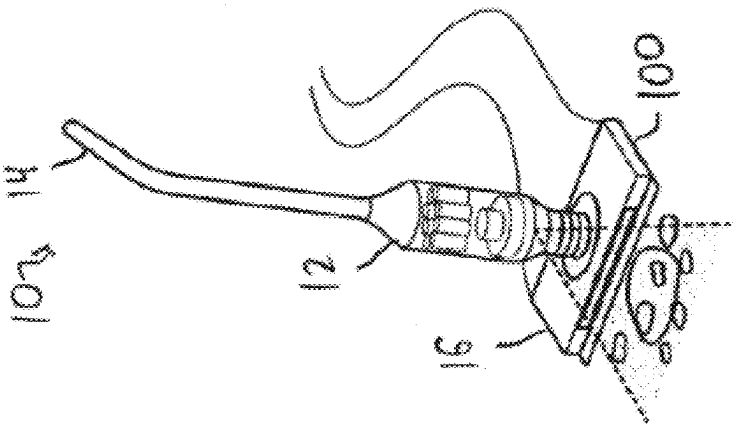


FIG. 2C

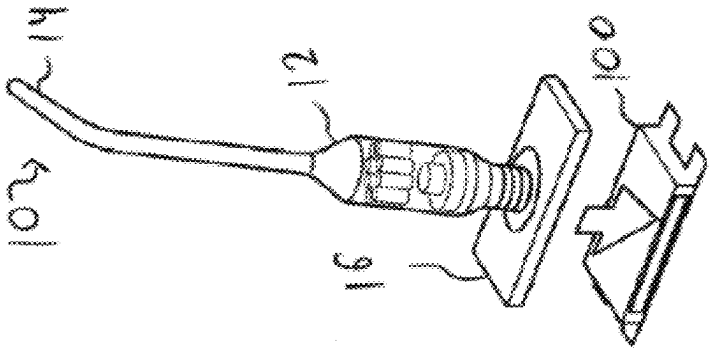


FIG. 2B

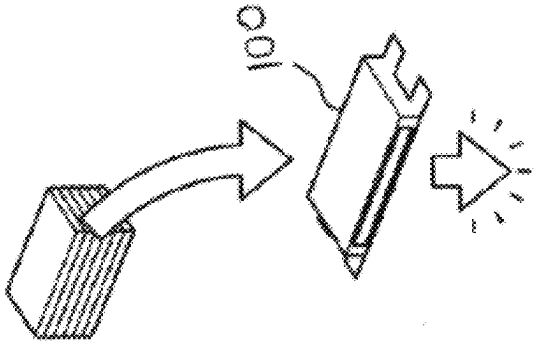


FIG. 2A

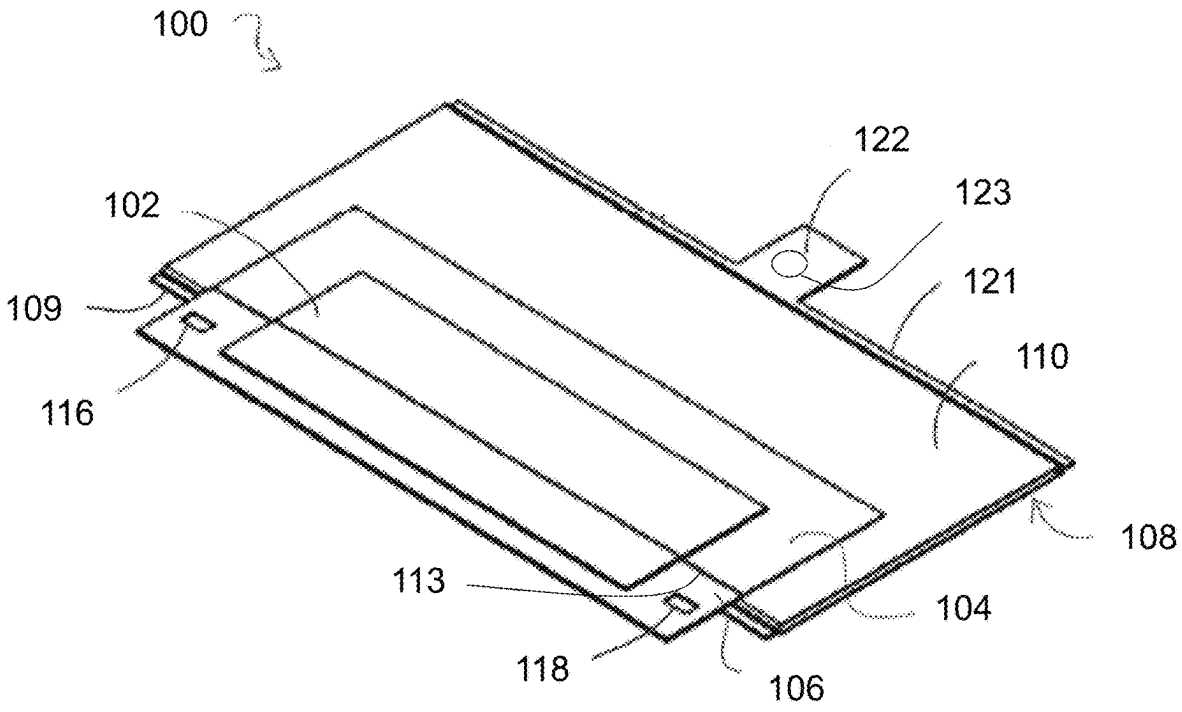

100
122
123
102
121
109
110
116
108
113
104
118
106

FIG. 3

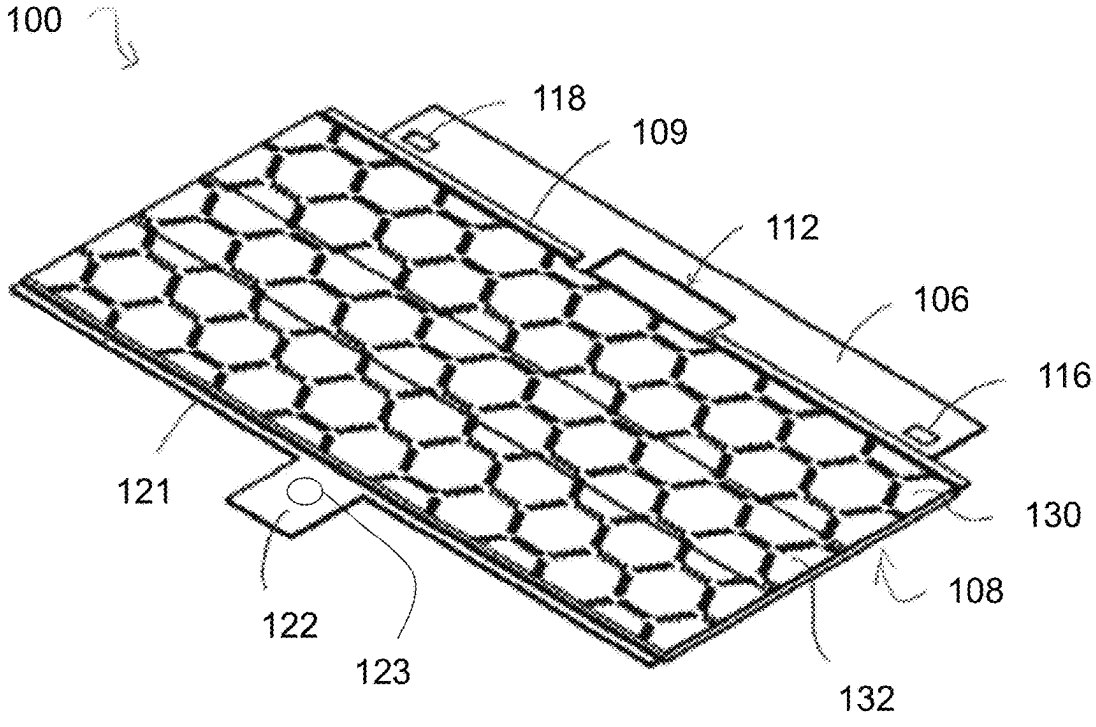

100
118
109
112
106
116
121
130
108
122
123
132

FIG. 4

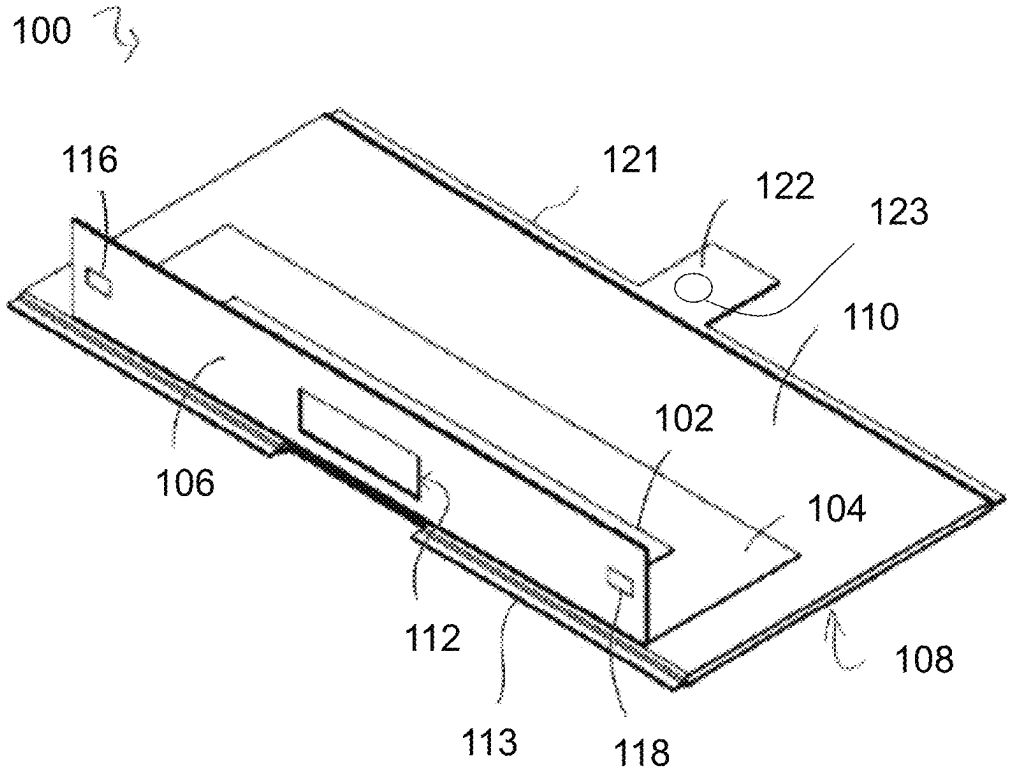


FIG. 5

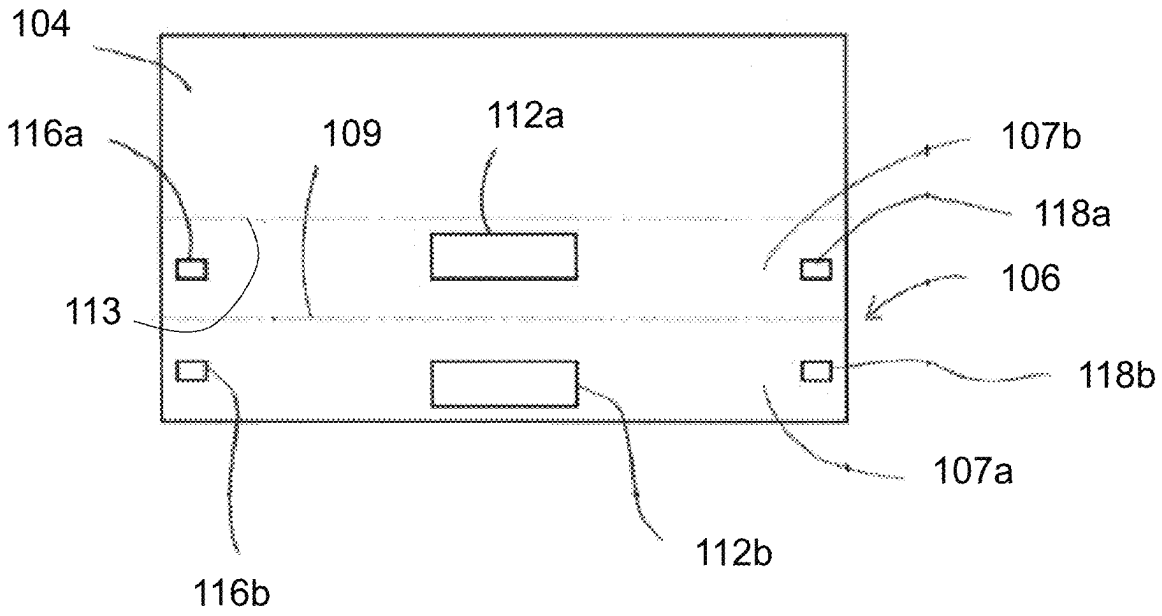

104
116a
109
112a
107b
118a
106
113
118b
107a
112b
116b

FIG. 6A

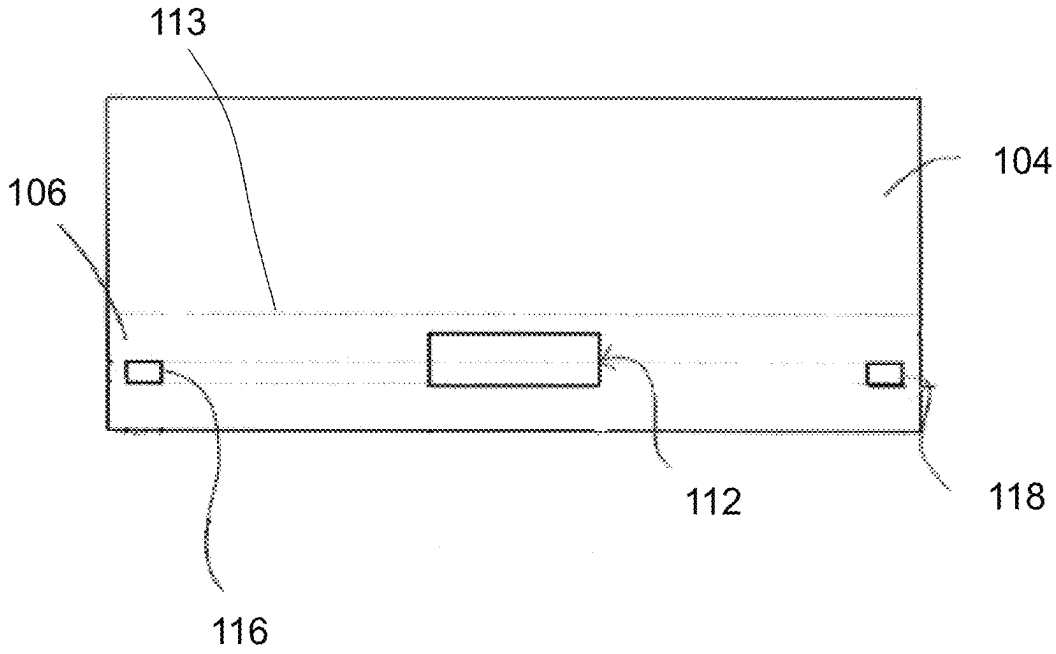

113
104
106
112
118
116

FIG. 6B

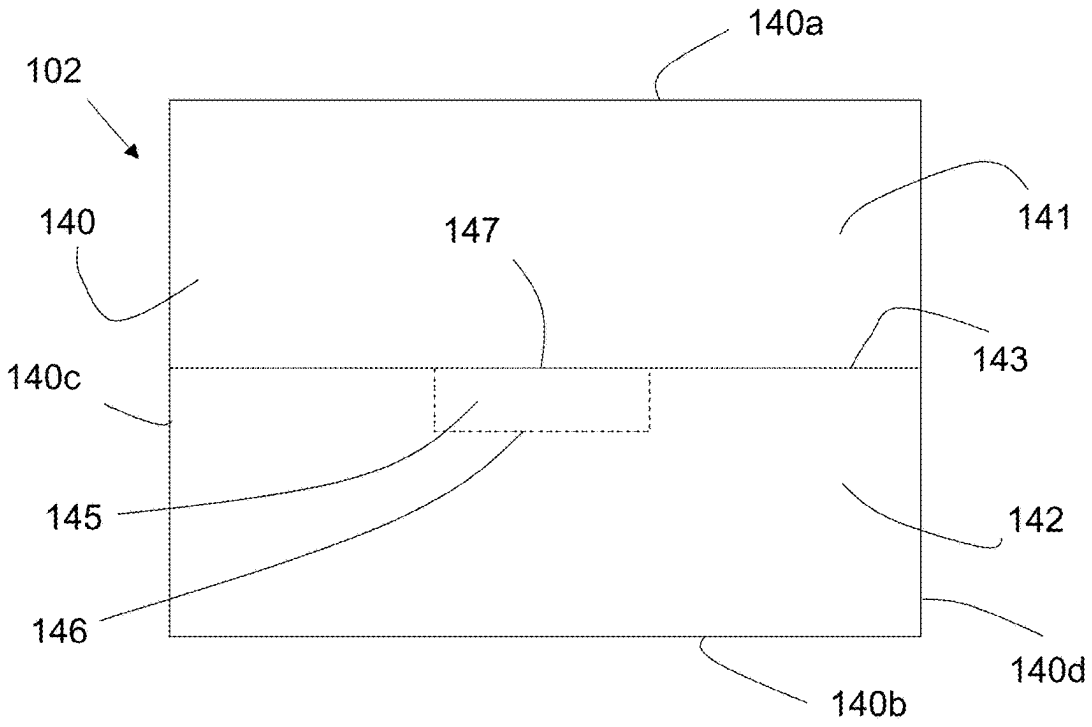

140a
102
140
147
141
143
140c
145
142
146
140d
140b

FIG. 7A

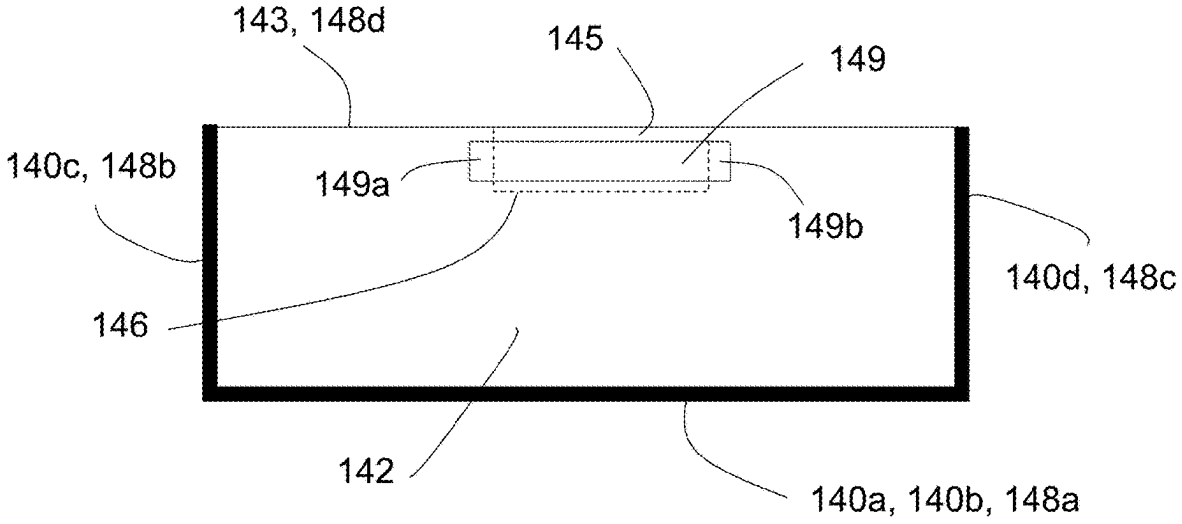

143, 148d
145
149
140c, 148b
149a
149b
140d, 148c
146
142
140a, 140b, 148a

FIG. 7B

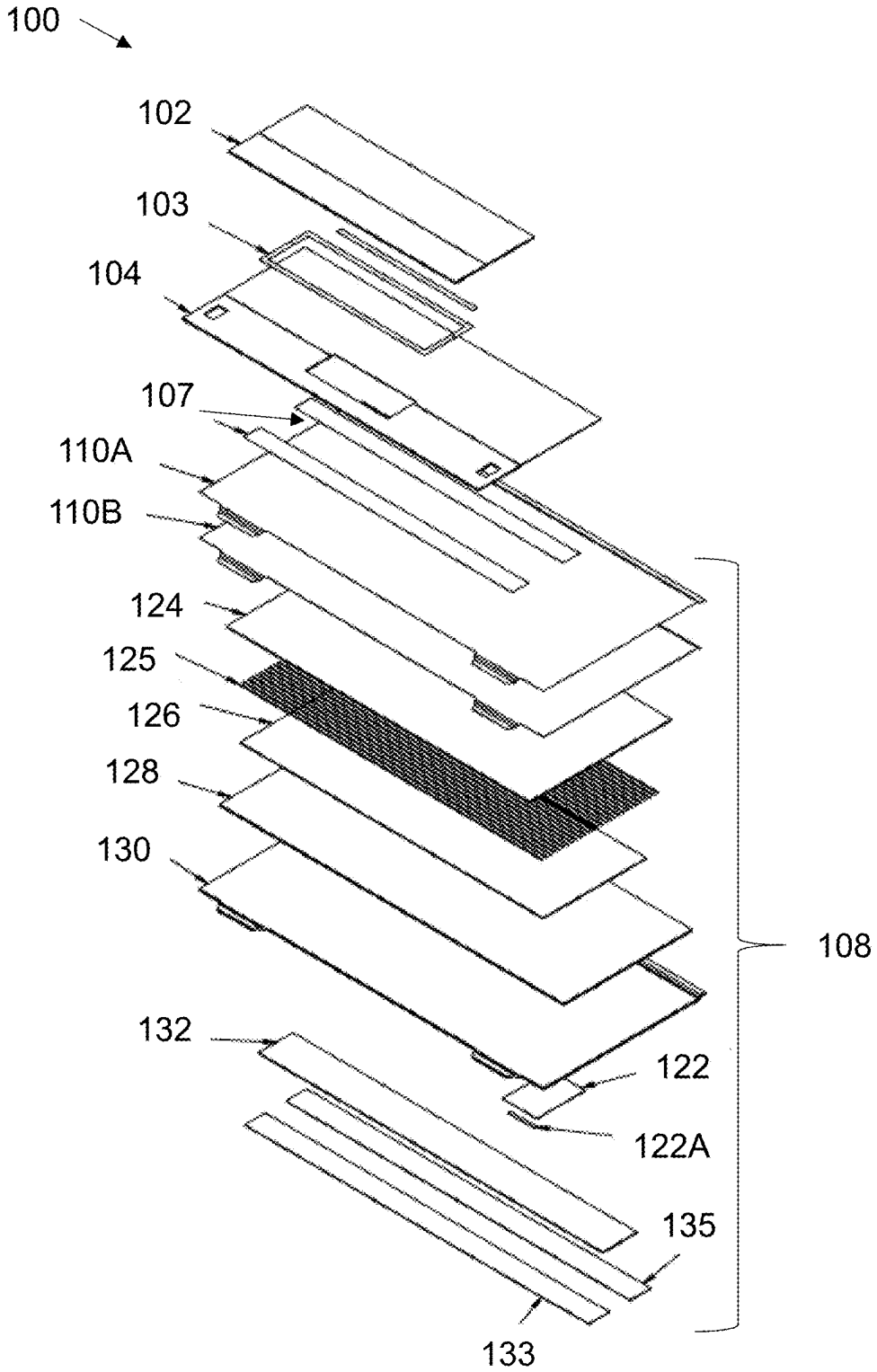

100
102
103
104
107
110A
110B
124
125
126
128
130
132
122
122A
135
133
108

FIG. 8A

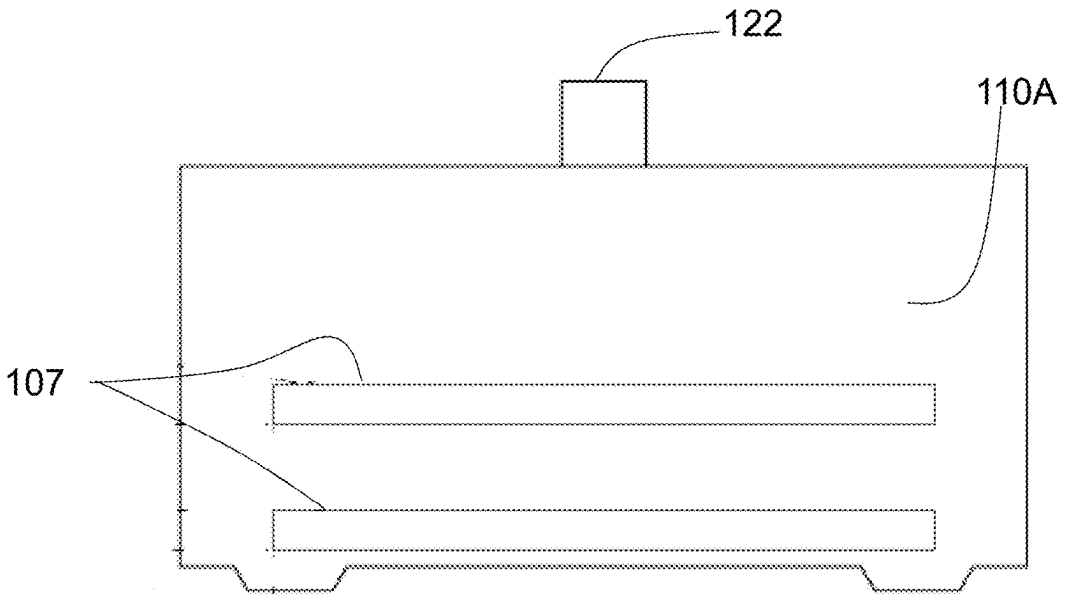


FIG. 8B

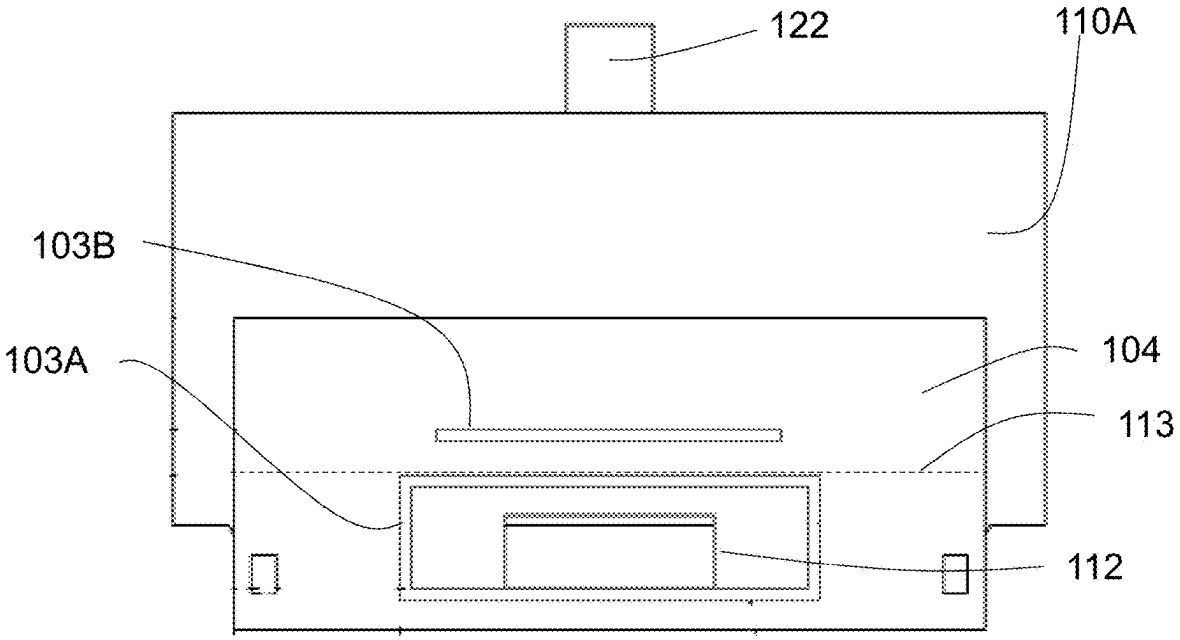


FIG. 8C

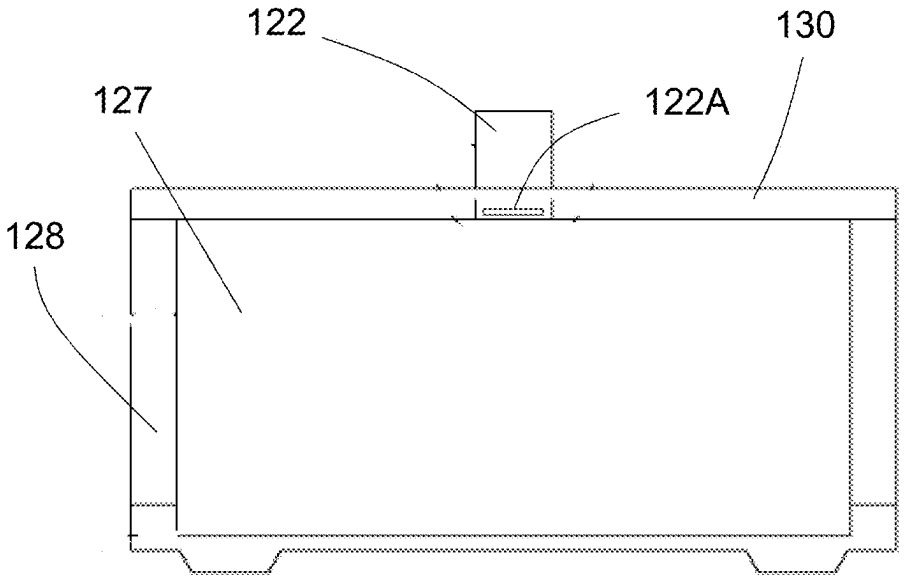


FIG. 8D

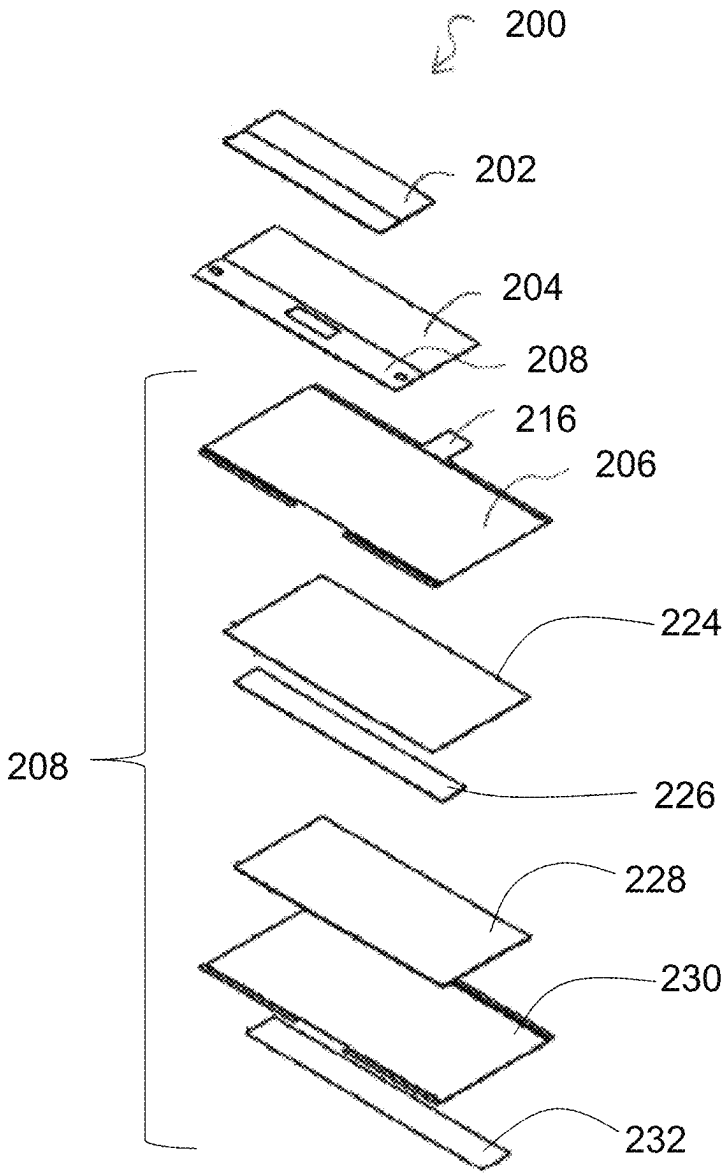


FIG. 8E

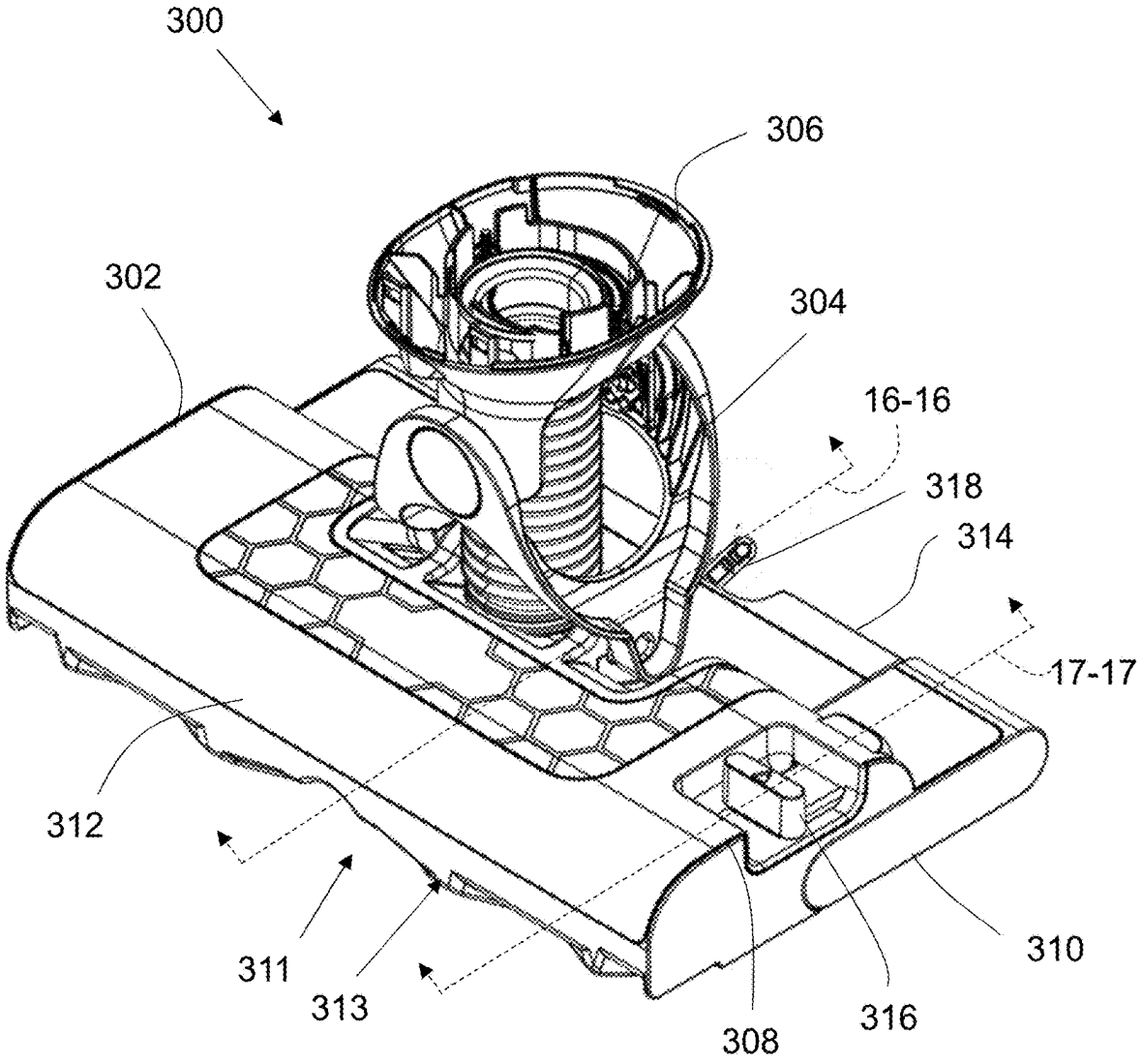


FIG. 9

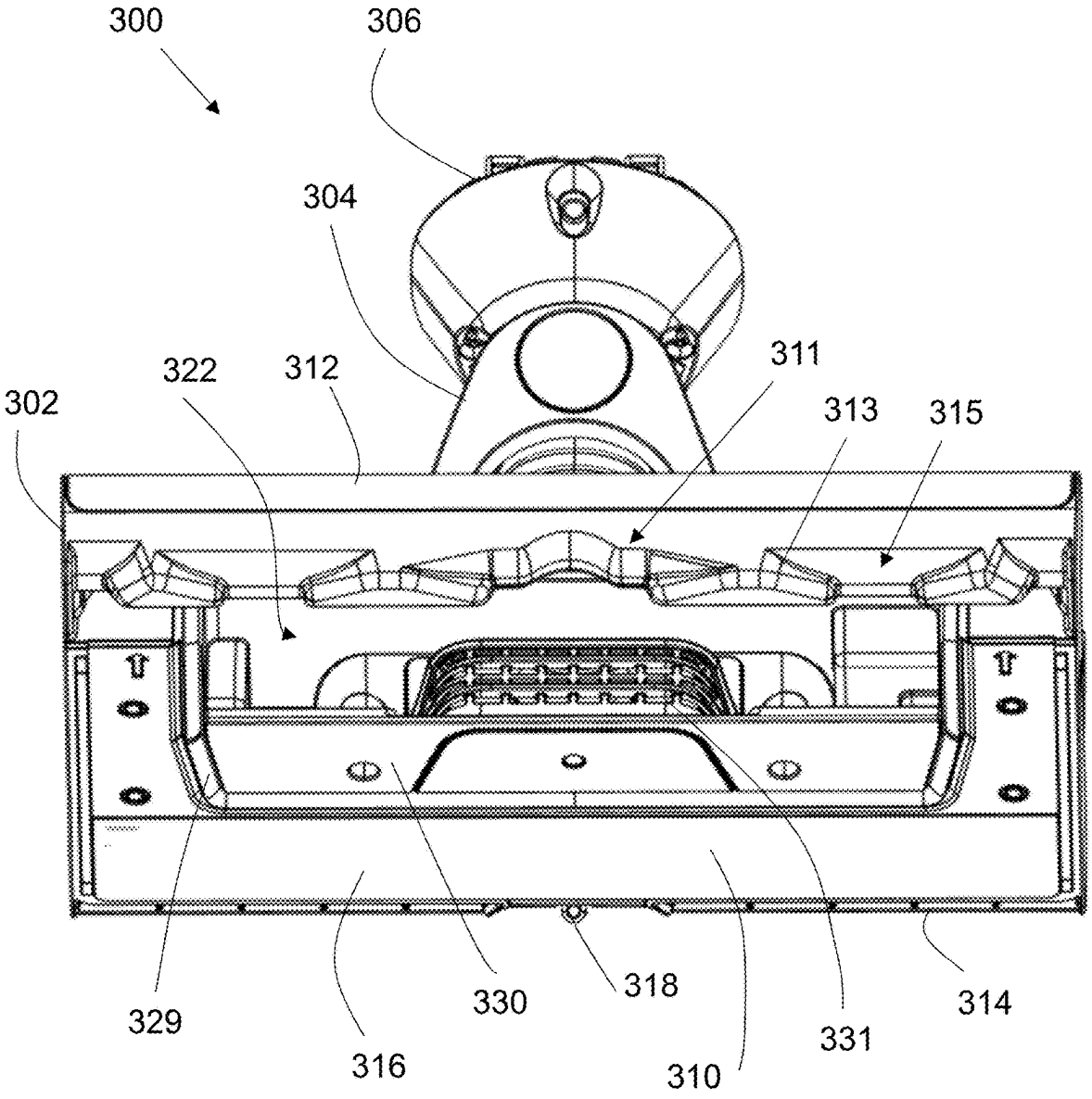


FIG. 10

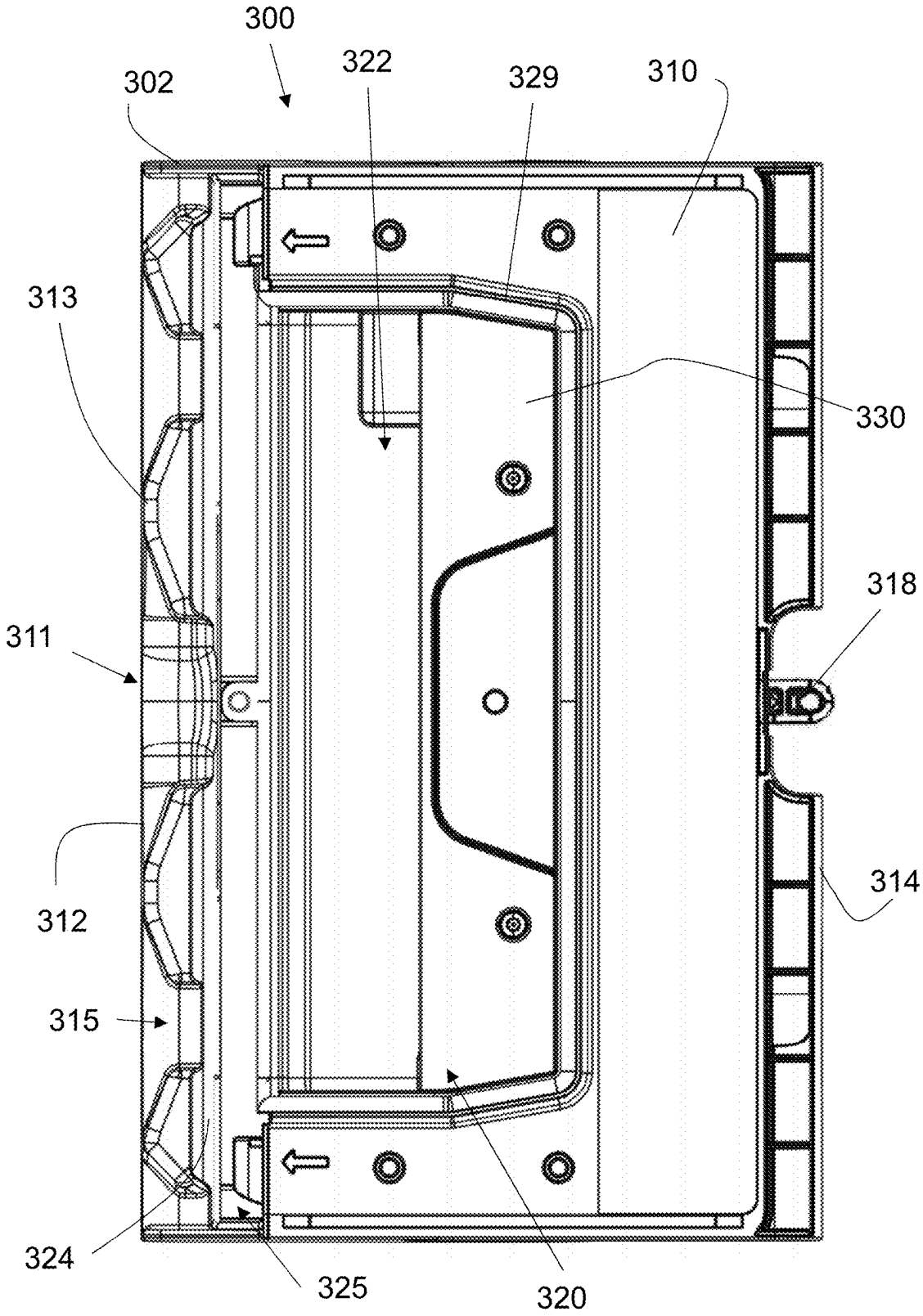


FIG. 11

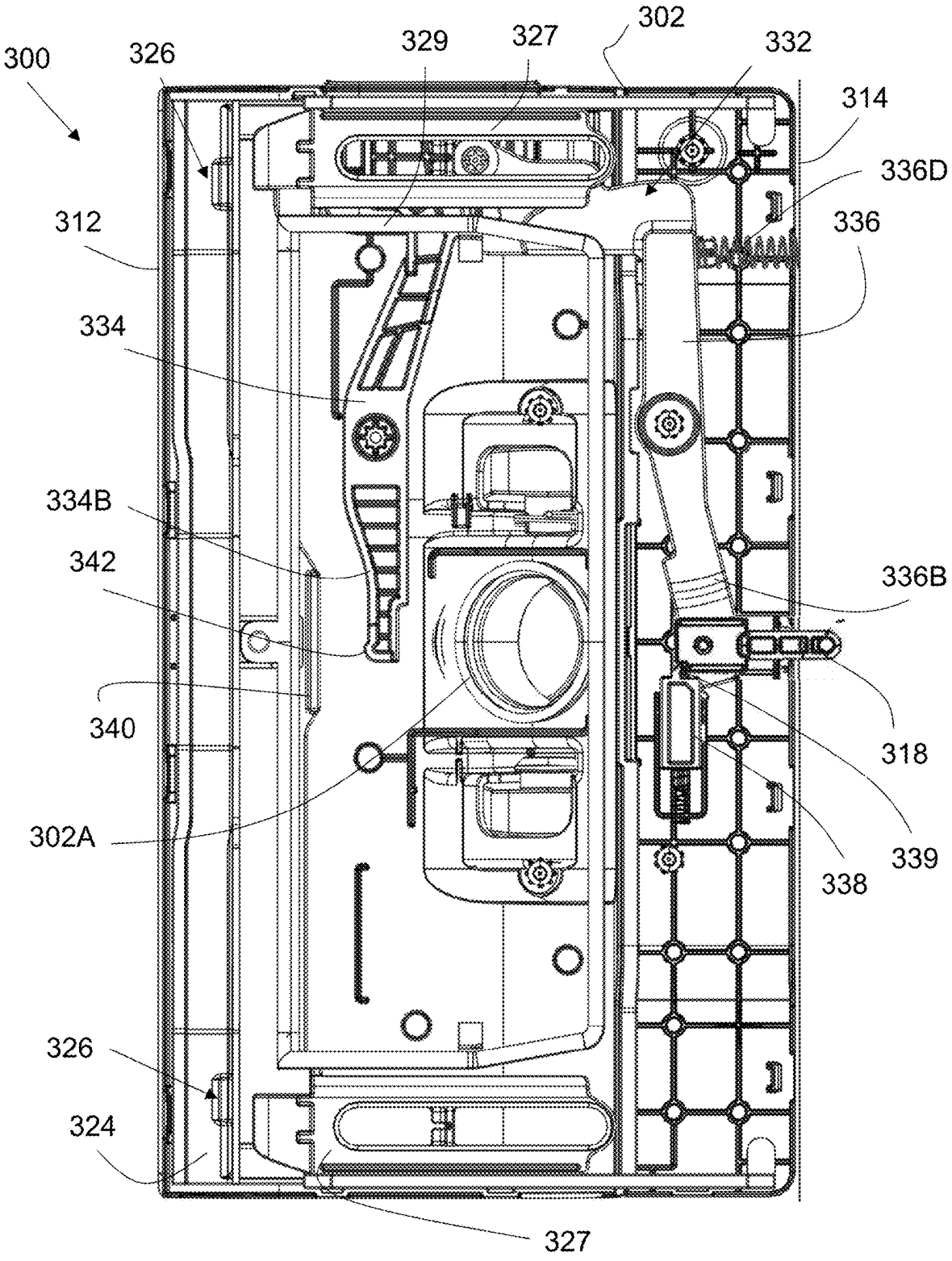

300
326
329
327
302
332
314
336D
336
312
334
334B
342
336B
340
318
339
302A
338
326
324
327

FIG. 12

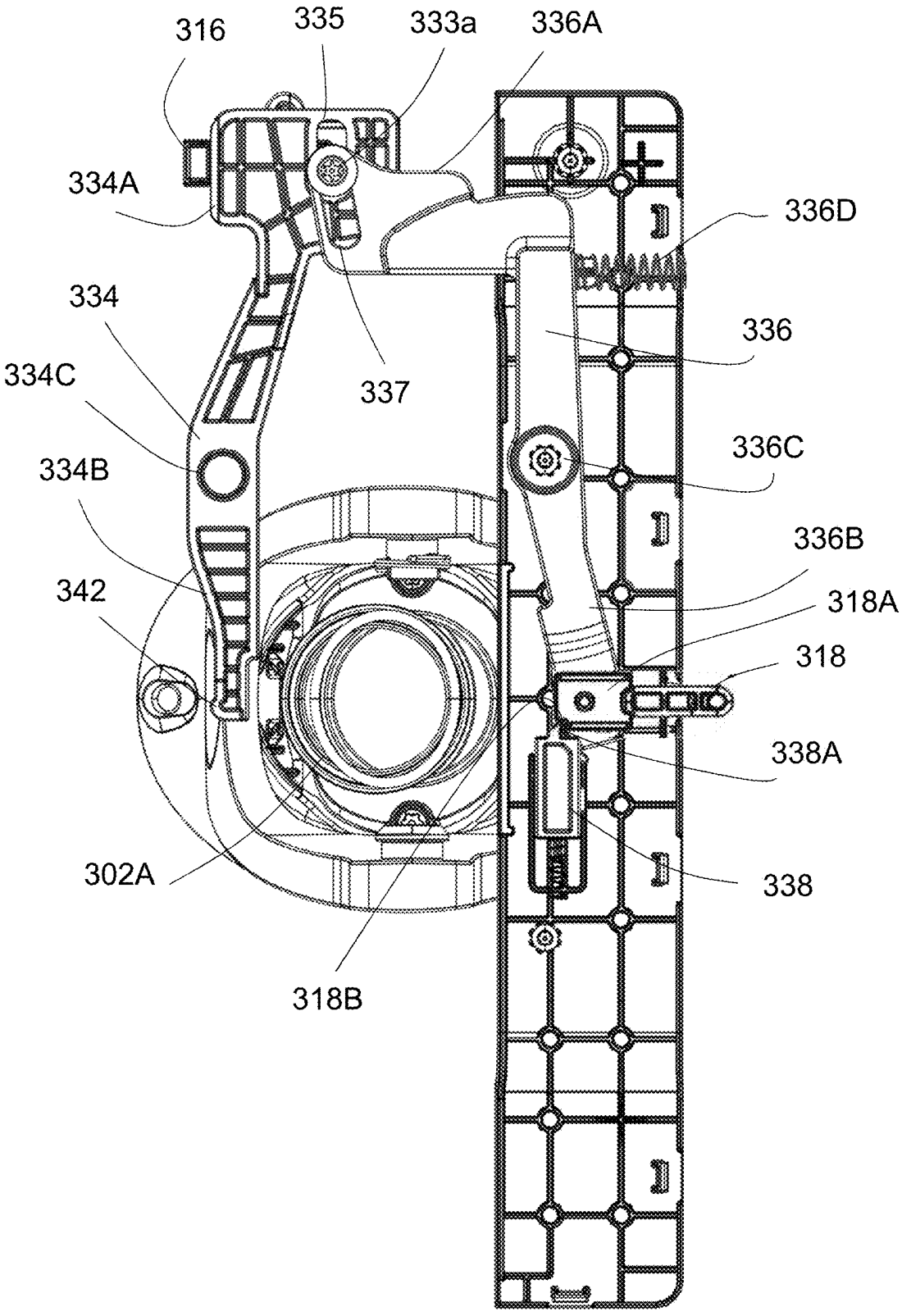

316
335
333a
336A
334A
336D
334
336
334C
337
336C
334B
336B
342
318A
318
338A
302A
338
318B

FIG. 13

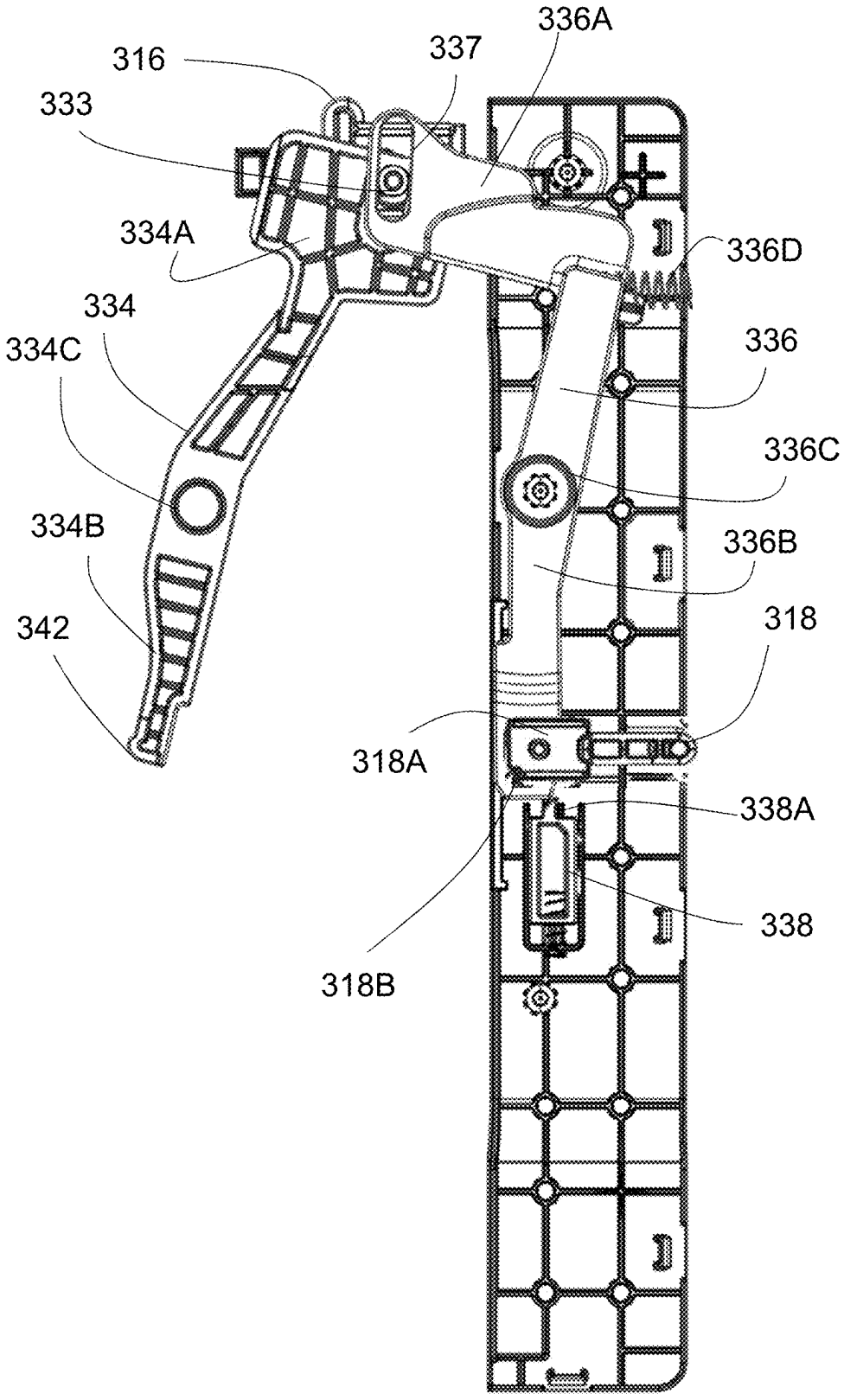

316
337
336A
333
334A
336D
334
334C
336
336C
334B
336B
342
318
318A
338A
338
318B

FIG. 14

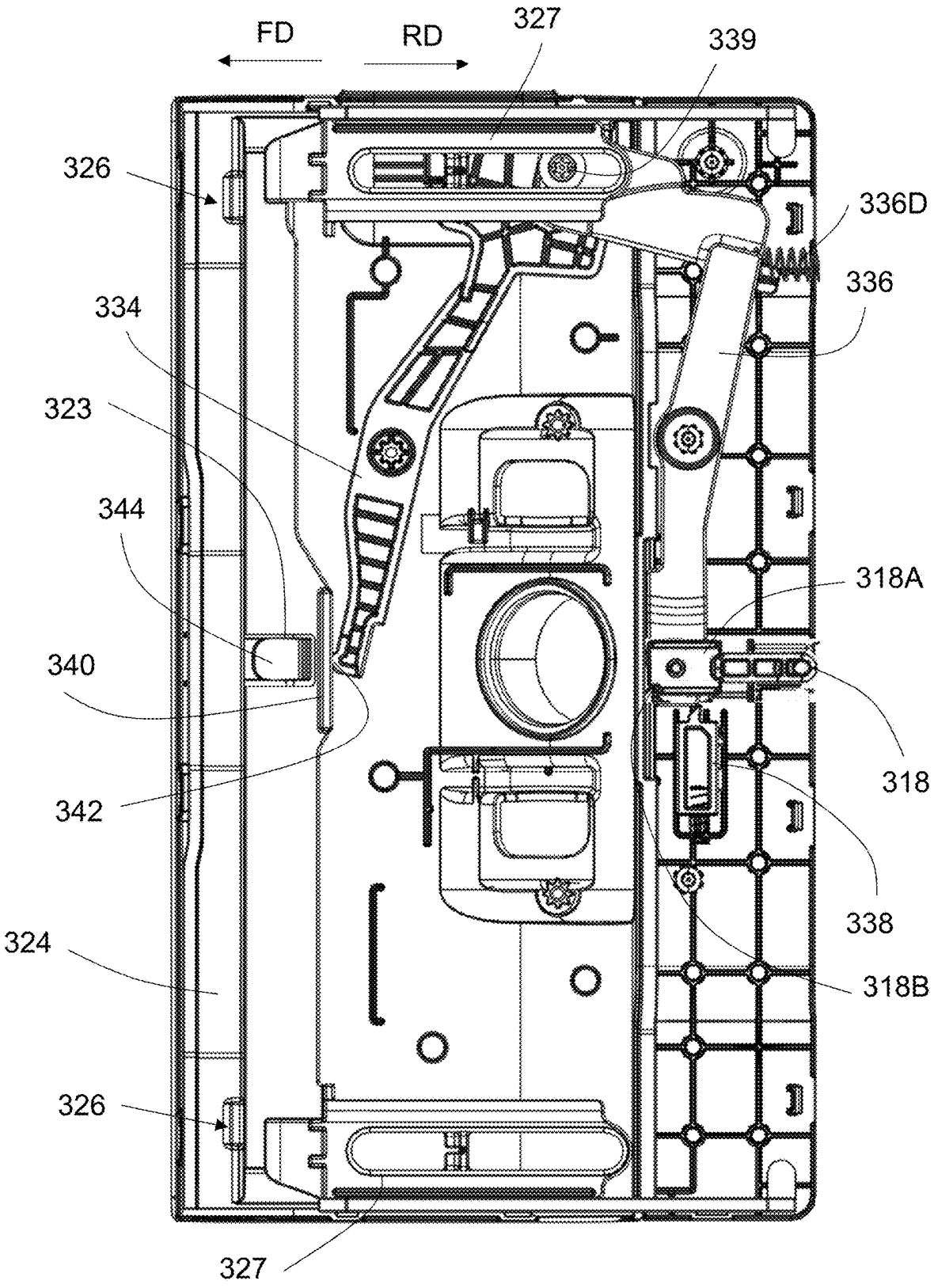

FD
RD
327
339
326
336D
336
334
323
344
318A
340
318
342
338
324
318B
326
327

FIG. 15

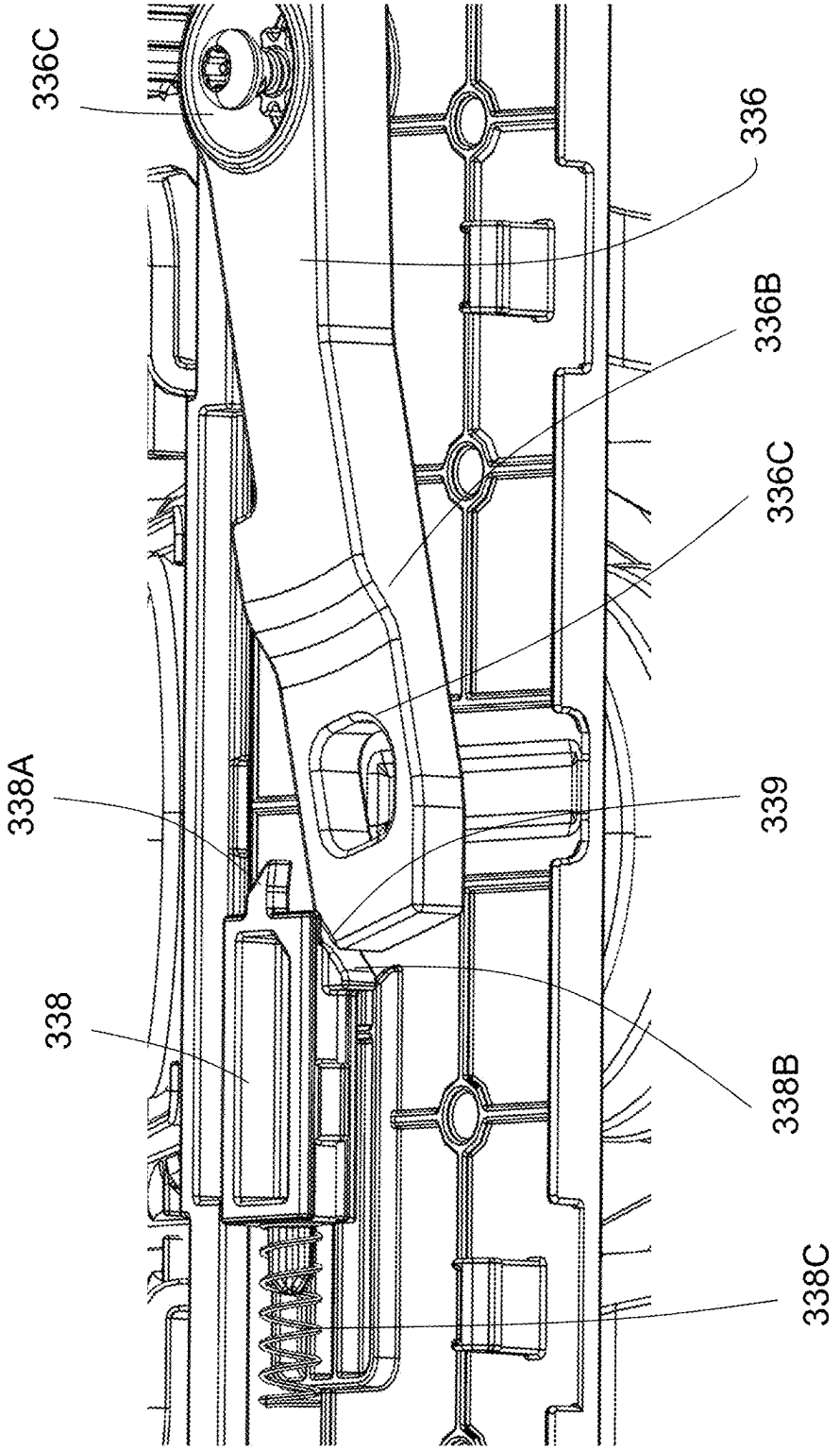


FIG. 15A

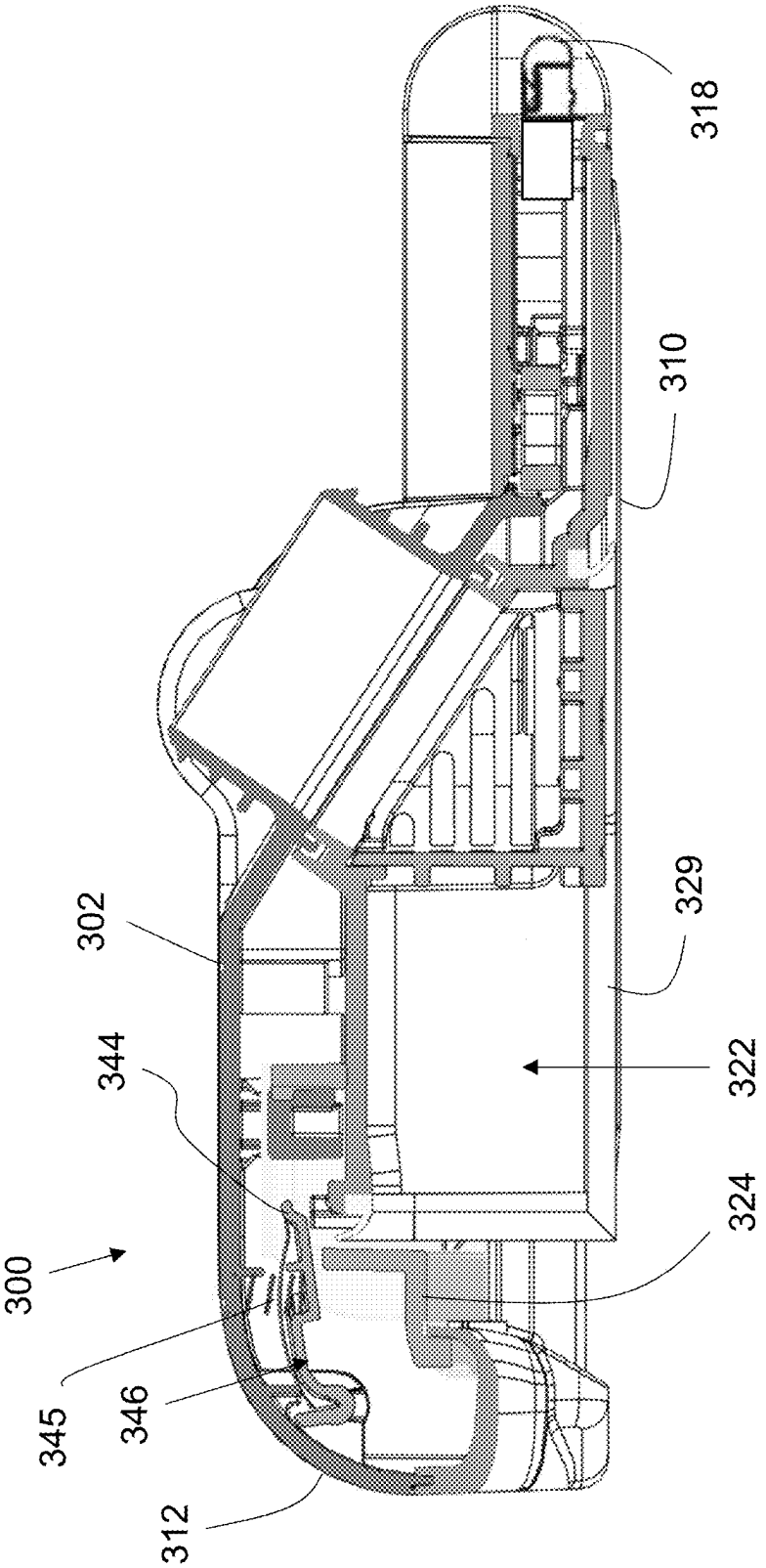


FIG. 16

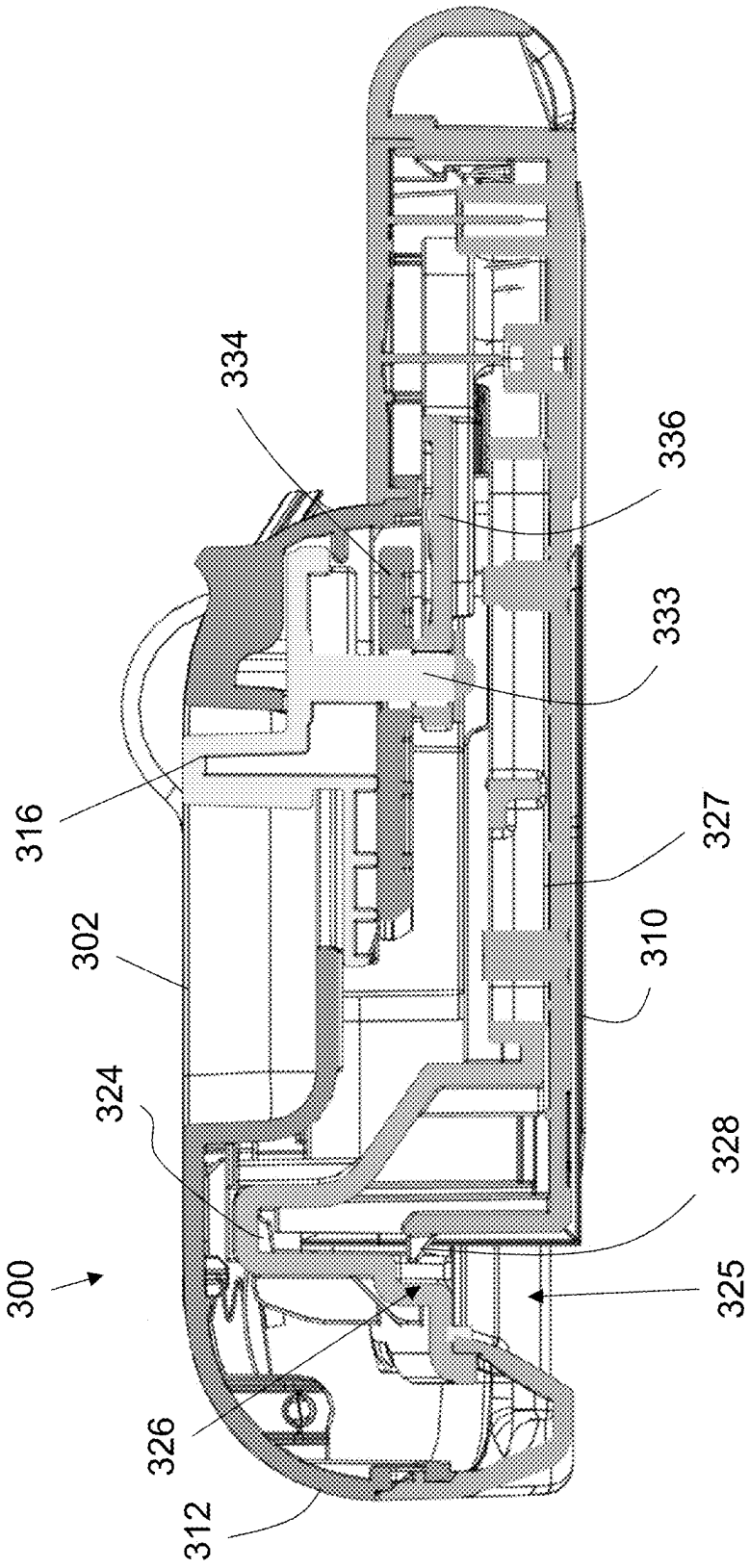


FIG. 17

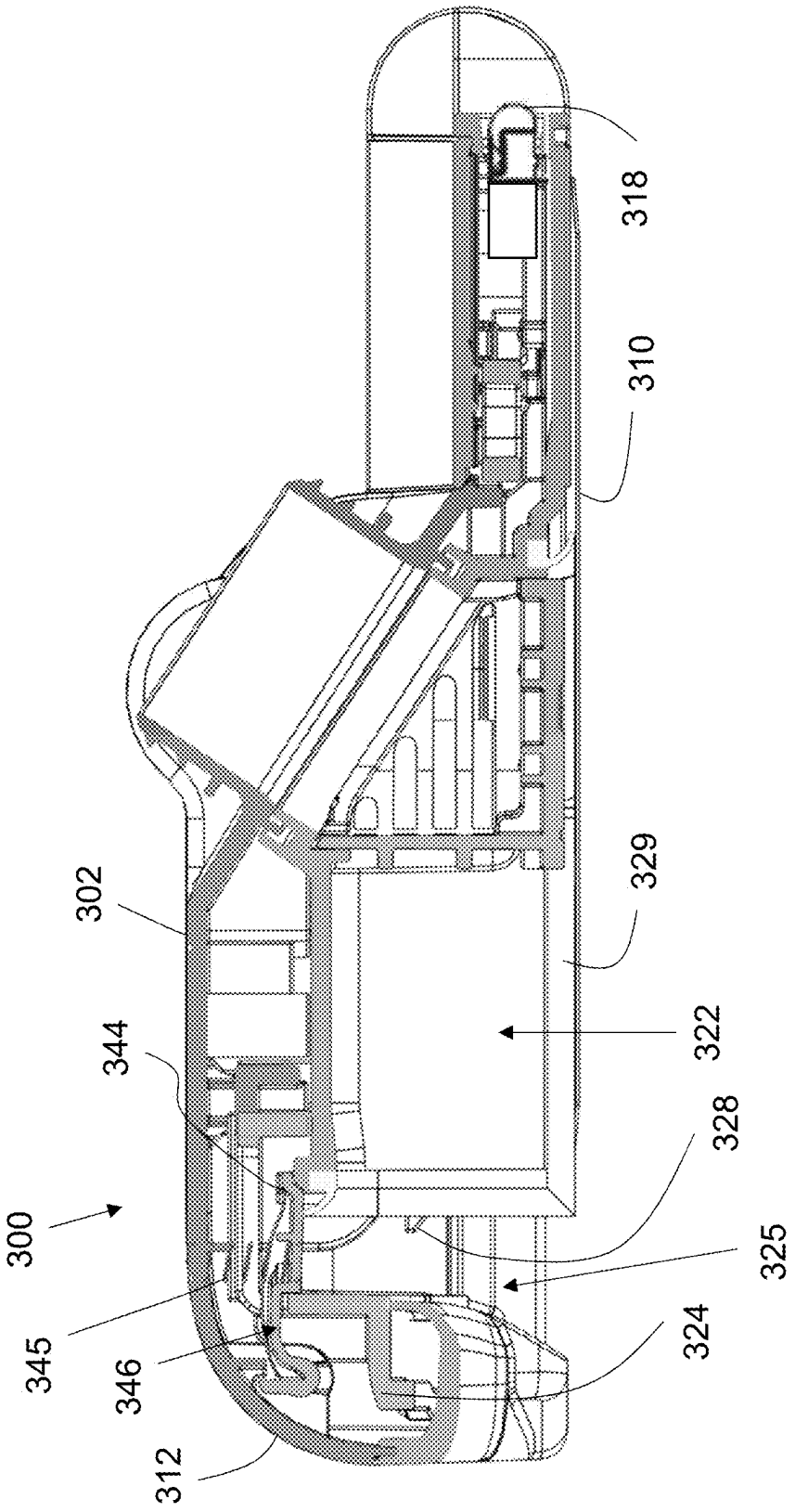


FIG. 18

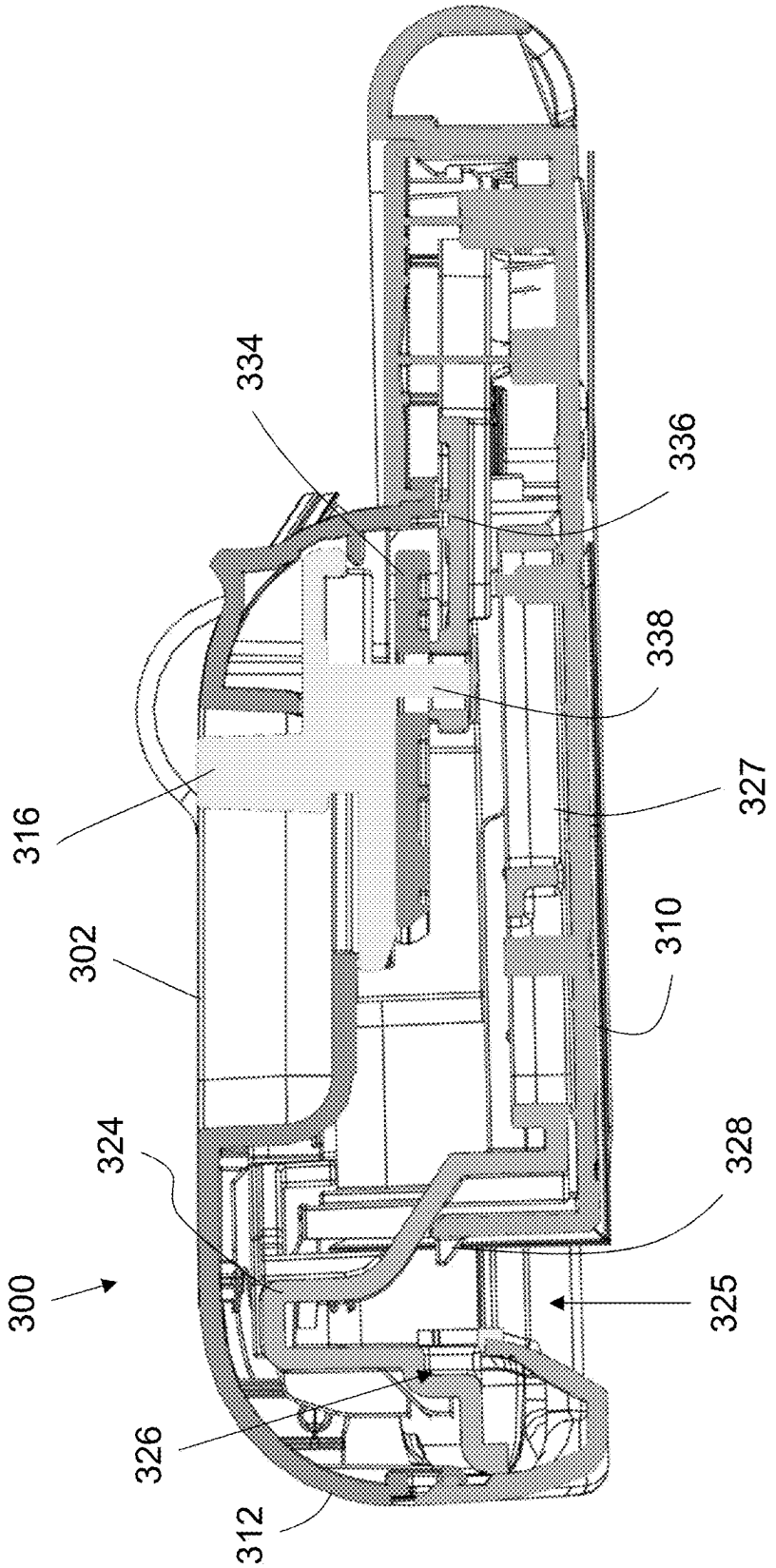


FIG. 19

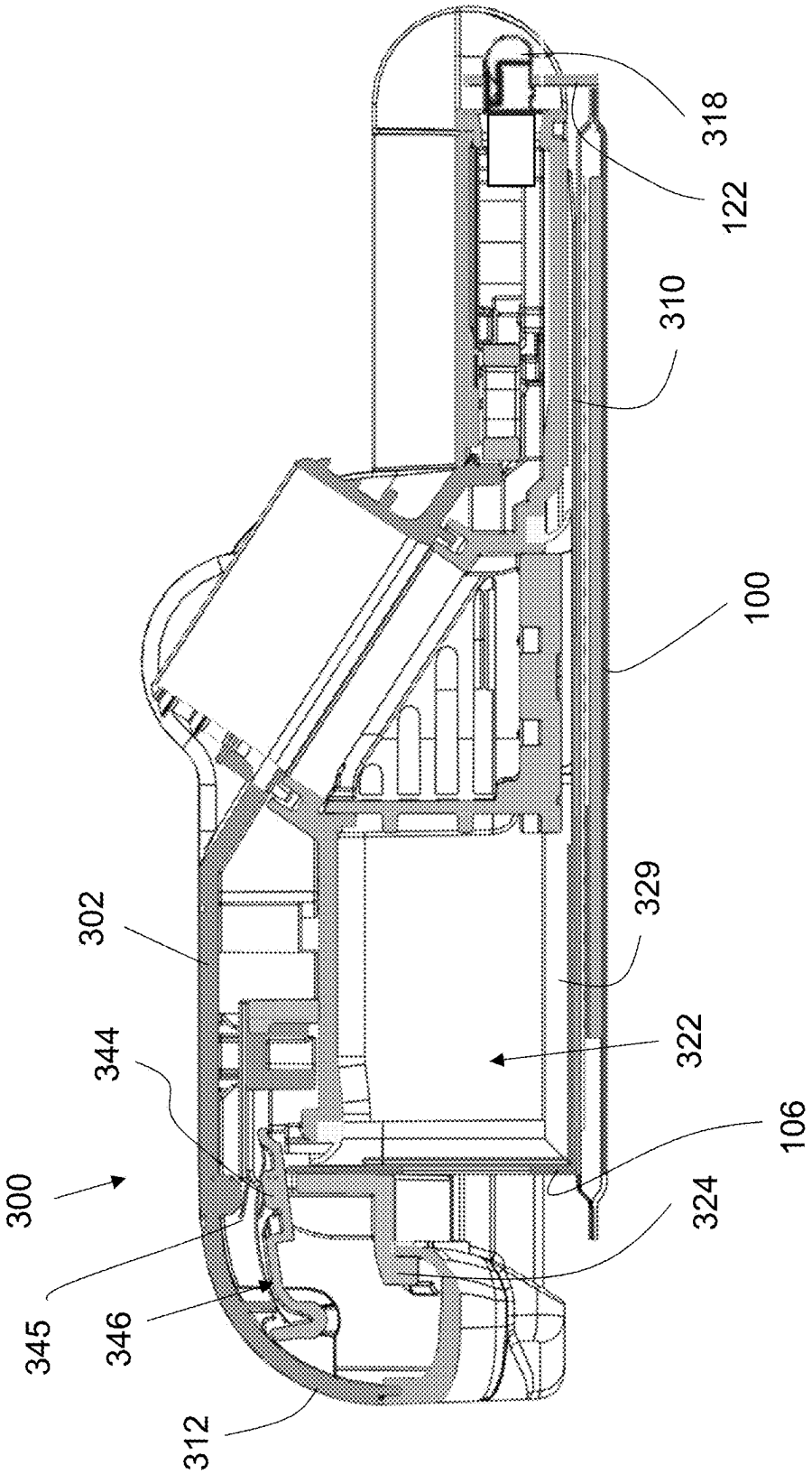


FIG. 20

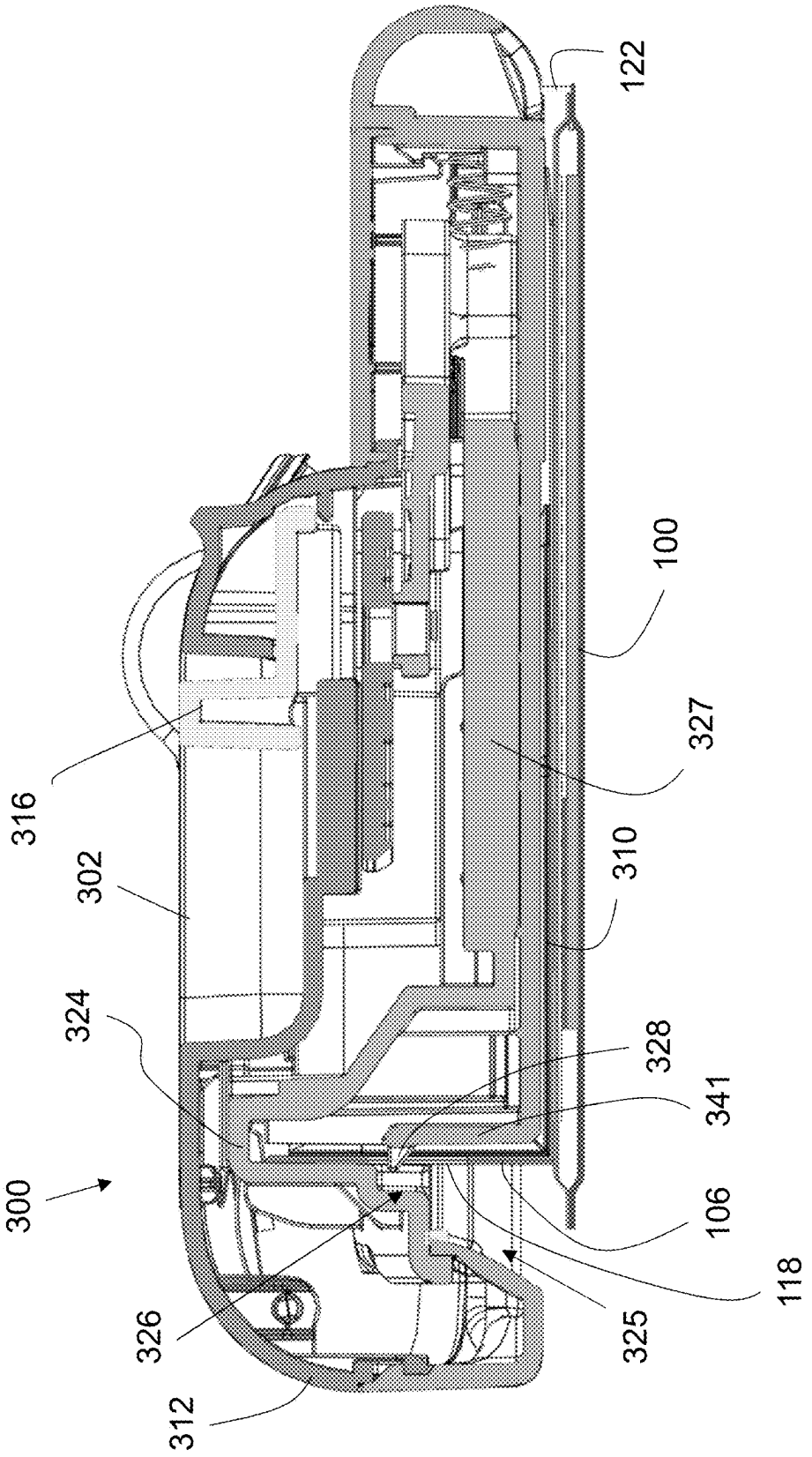


FIG. 21

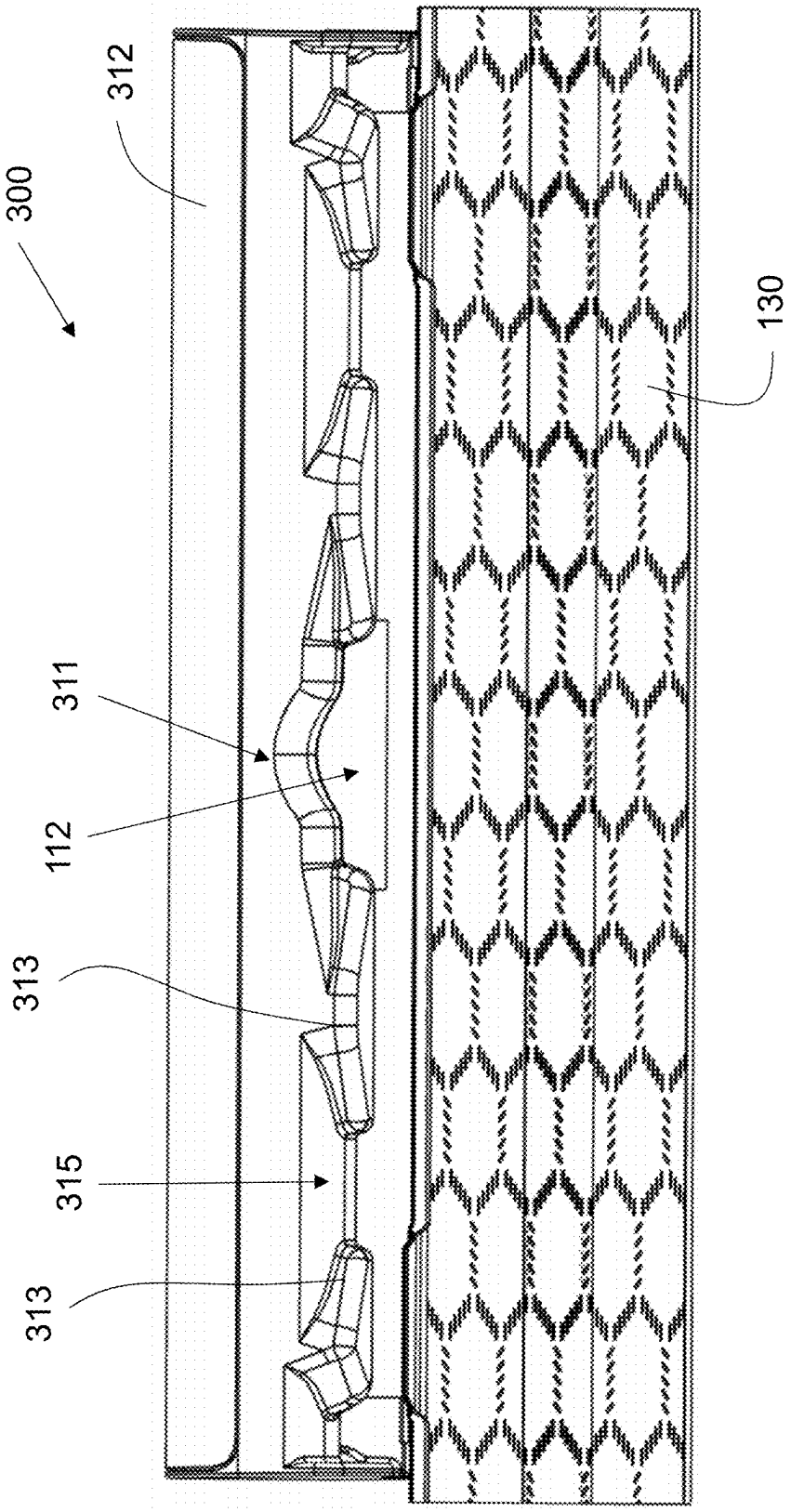


FIG. 22

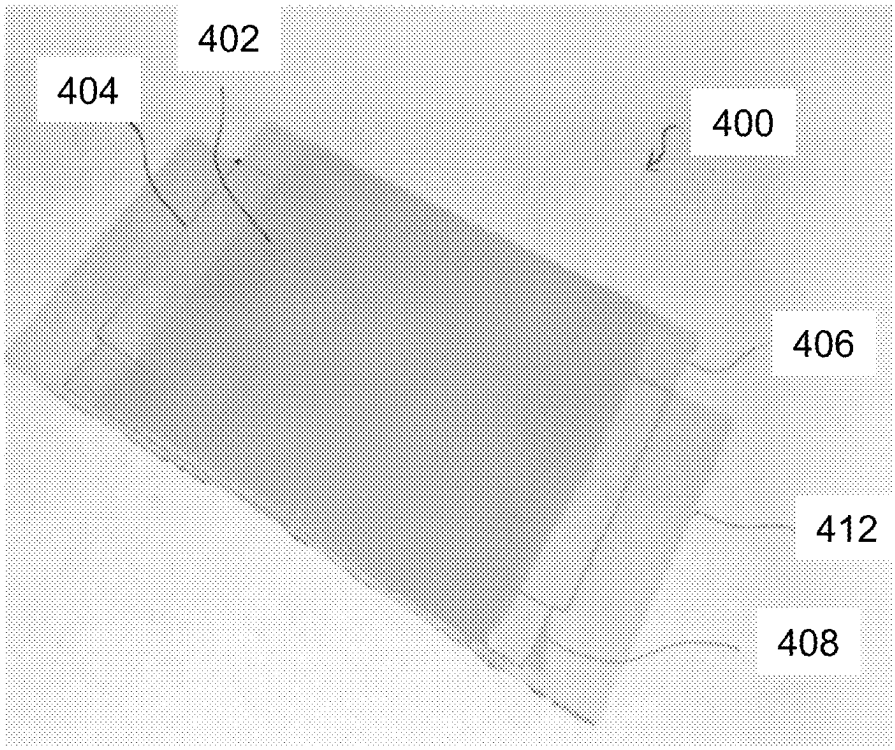


FIG. 23

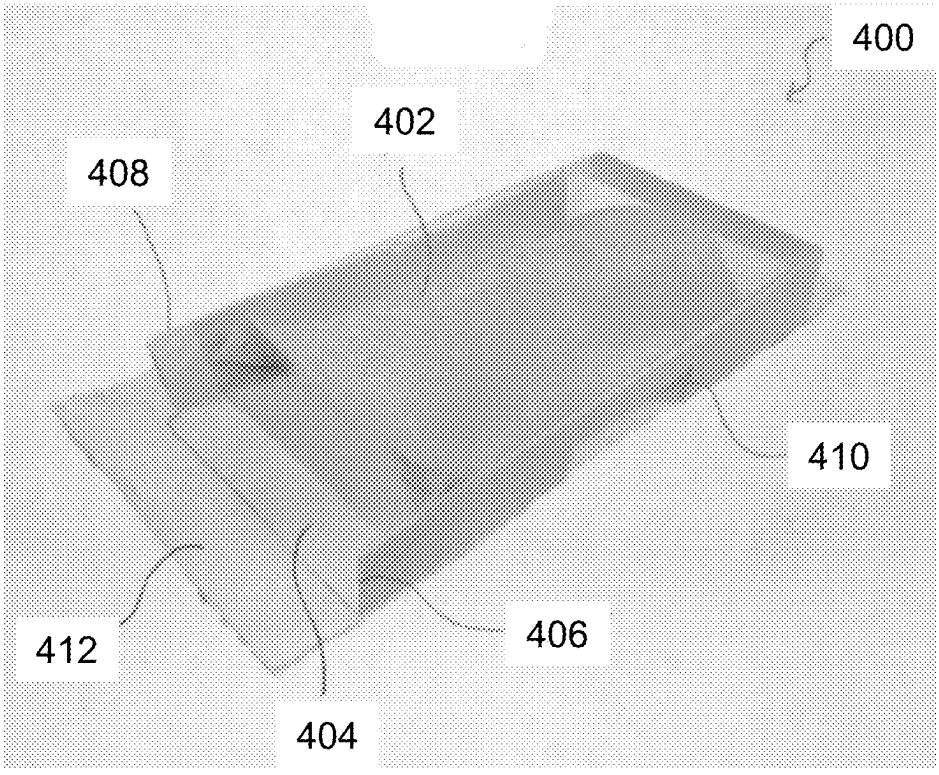


FIG. 24

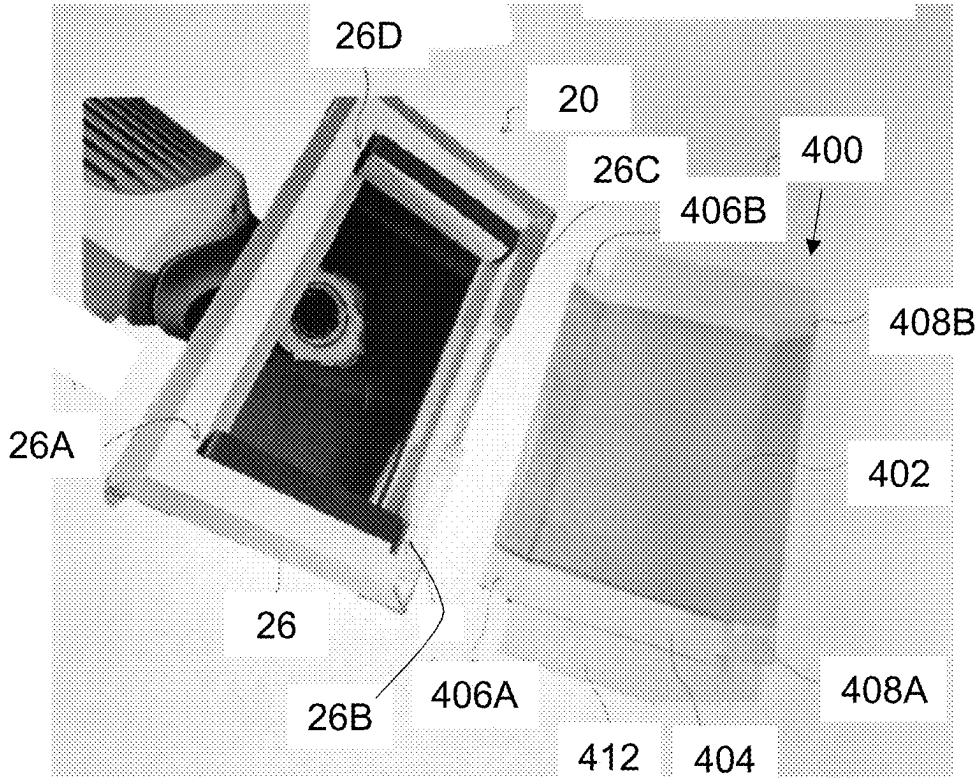

26D
20
400
26C
406B
408B
26A
402
26
406A
408A
26B
412
404

FIG. 25

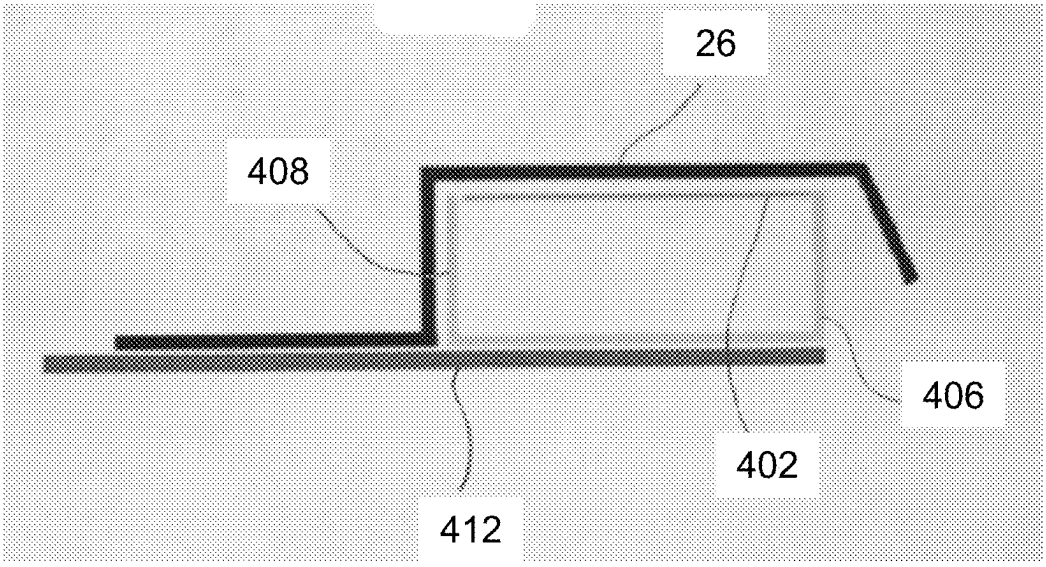

26
408
406
402
412

FIG. 26

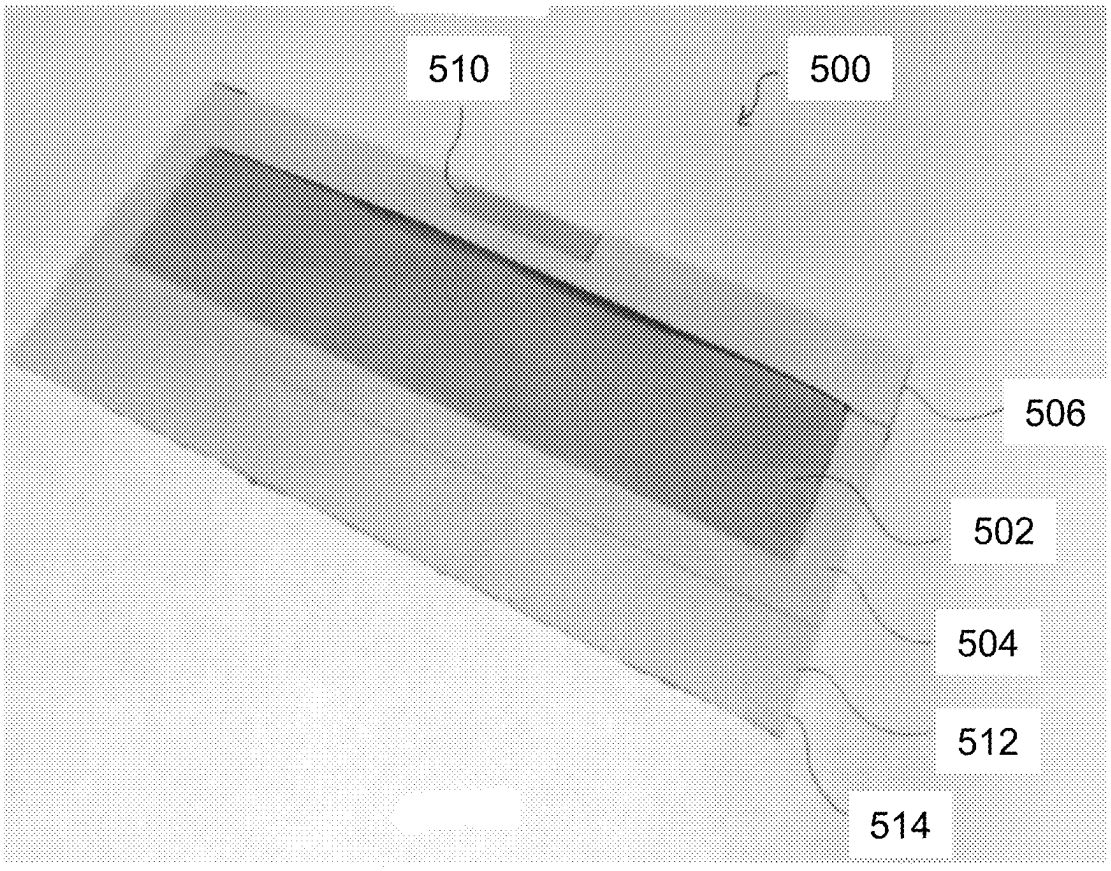


FIG. 27

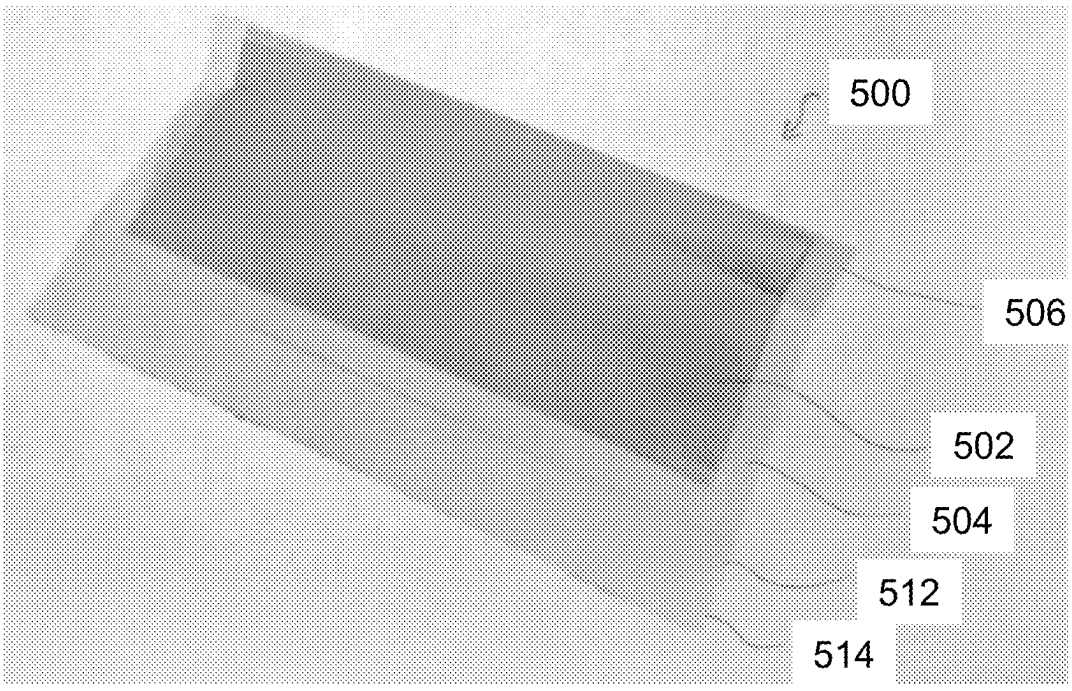


FIG. 28

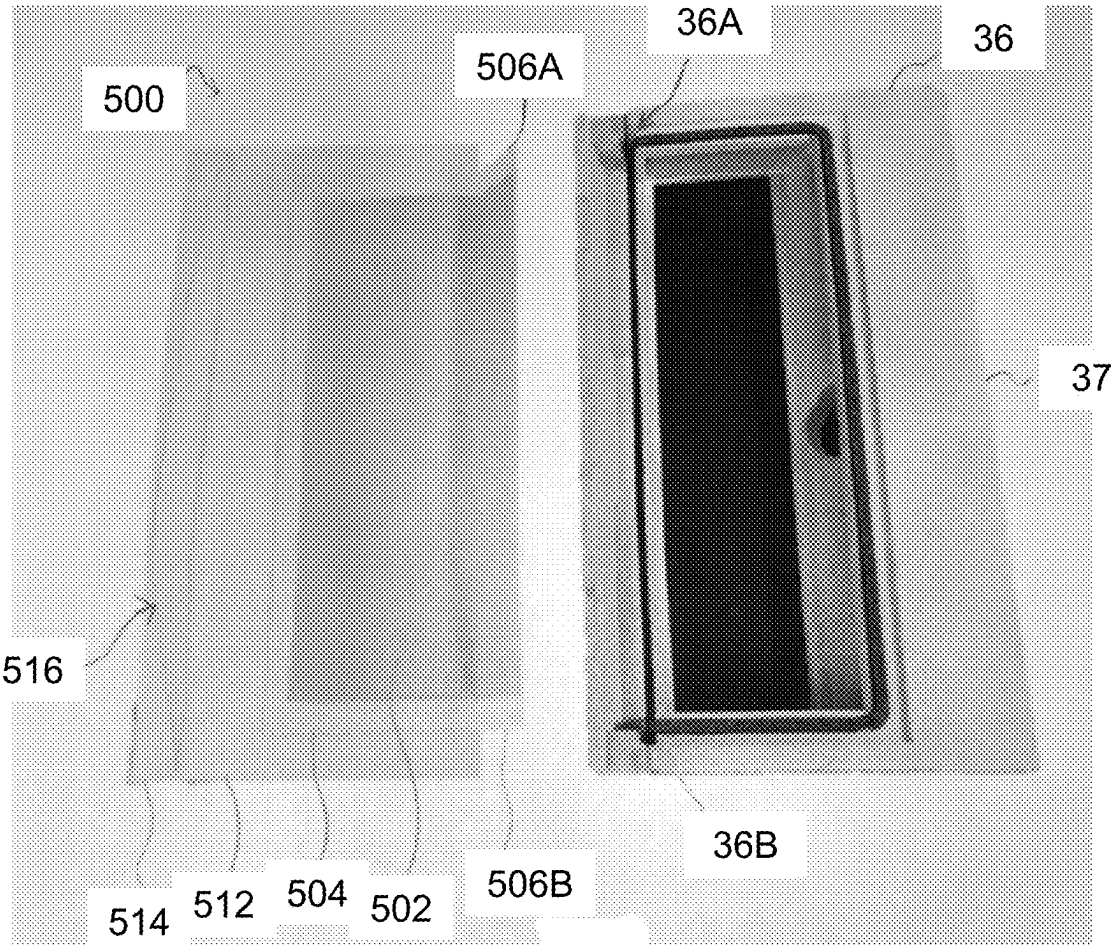


FIG. 29

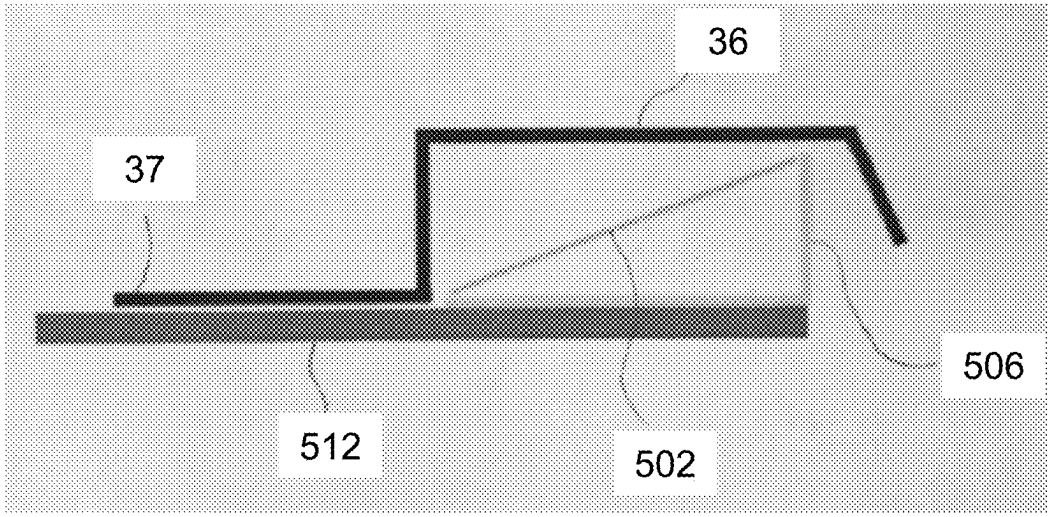


FIG. 30

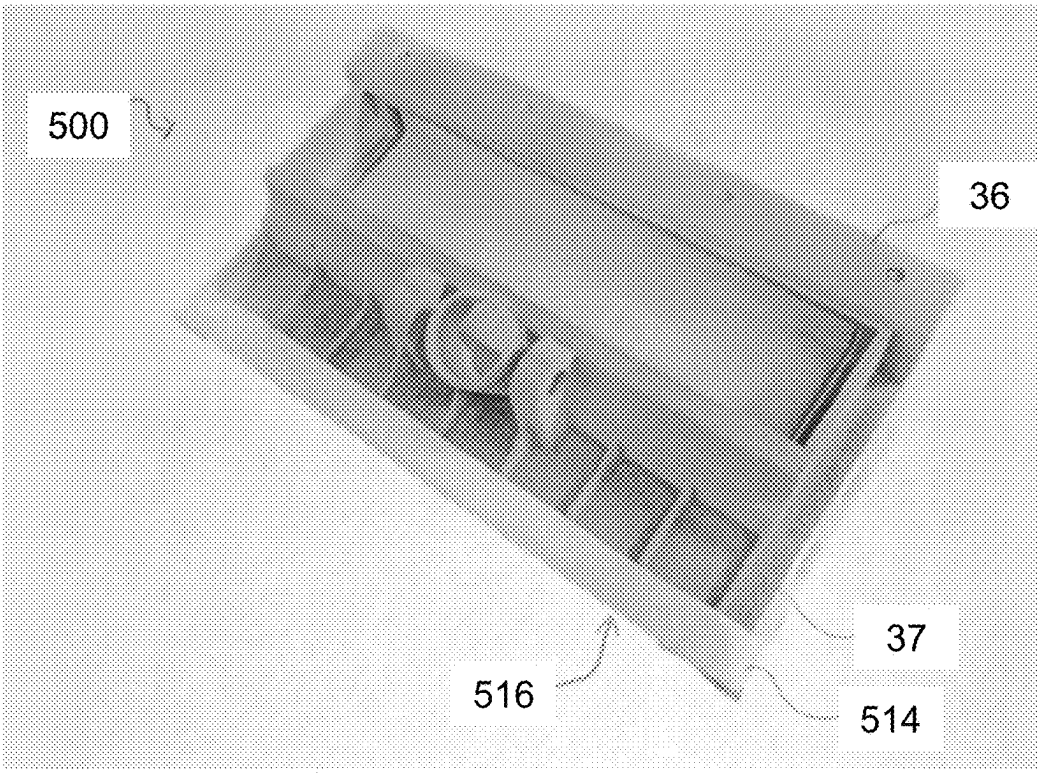


FIG. 31

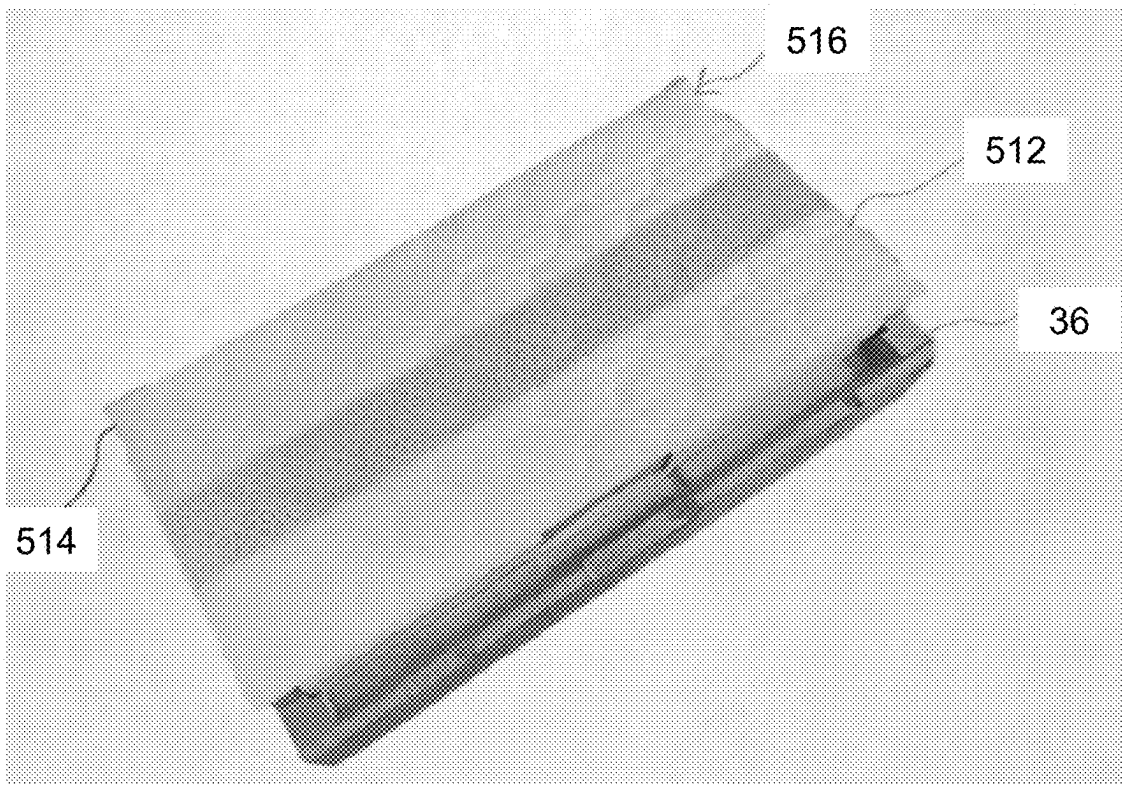


FIG. 32

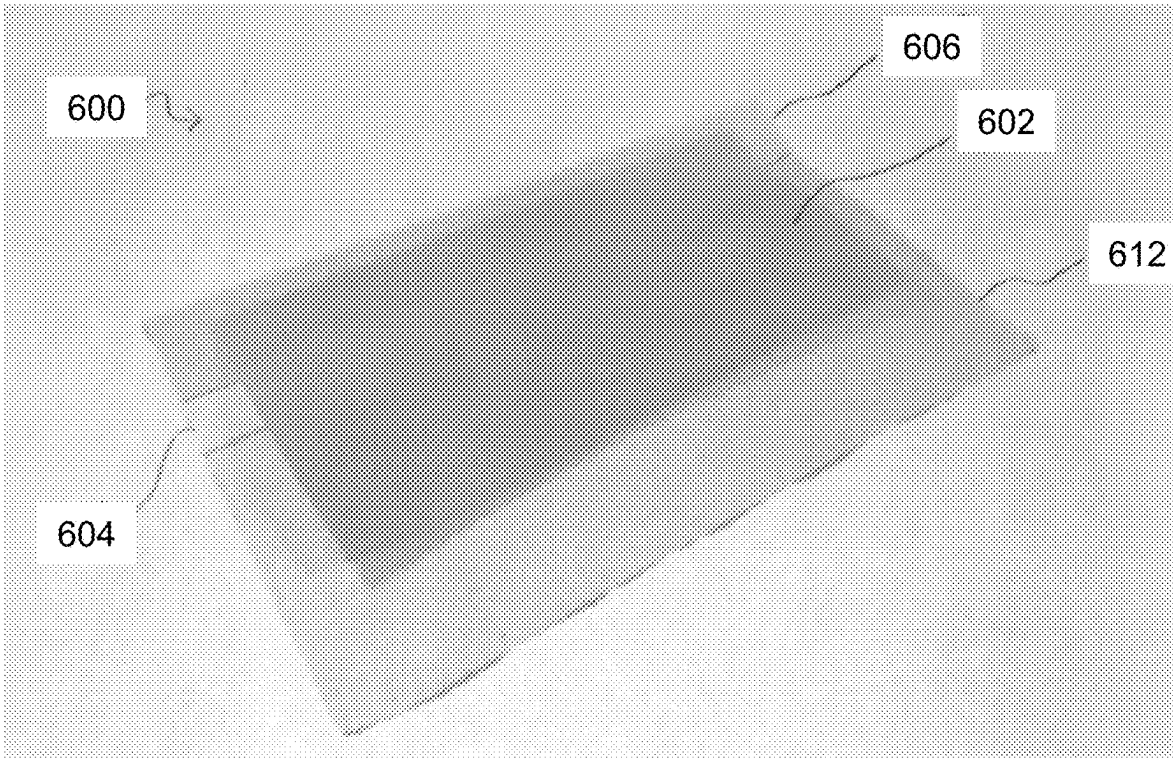


FIG. 33

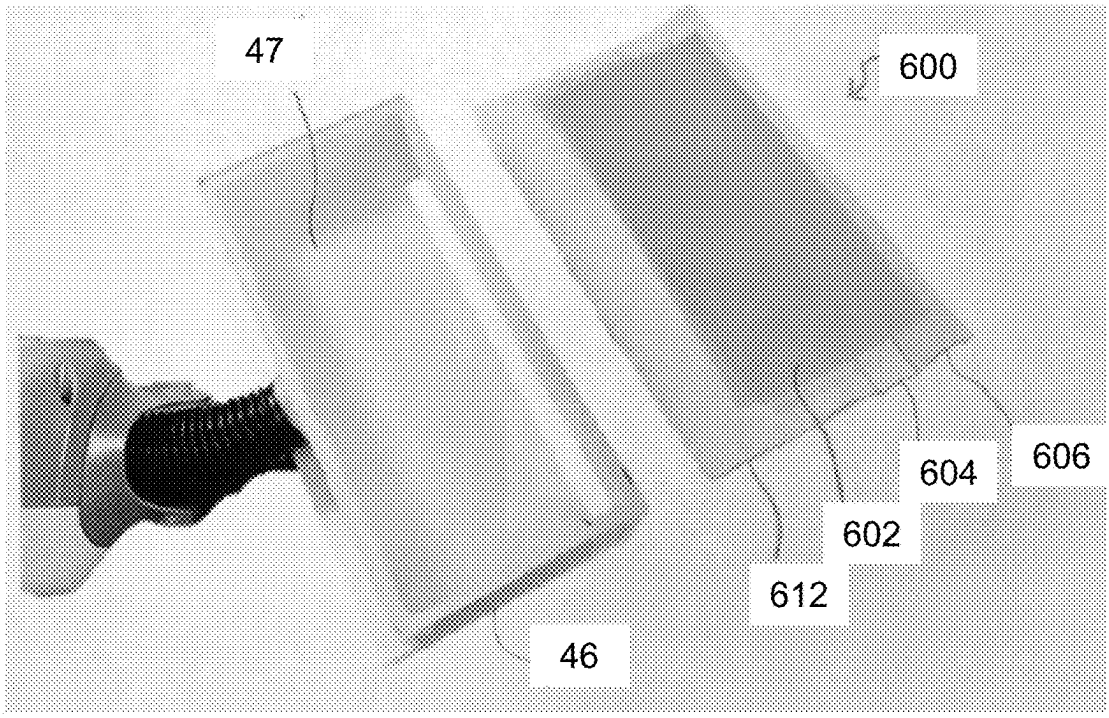


FIG. 34

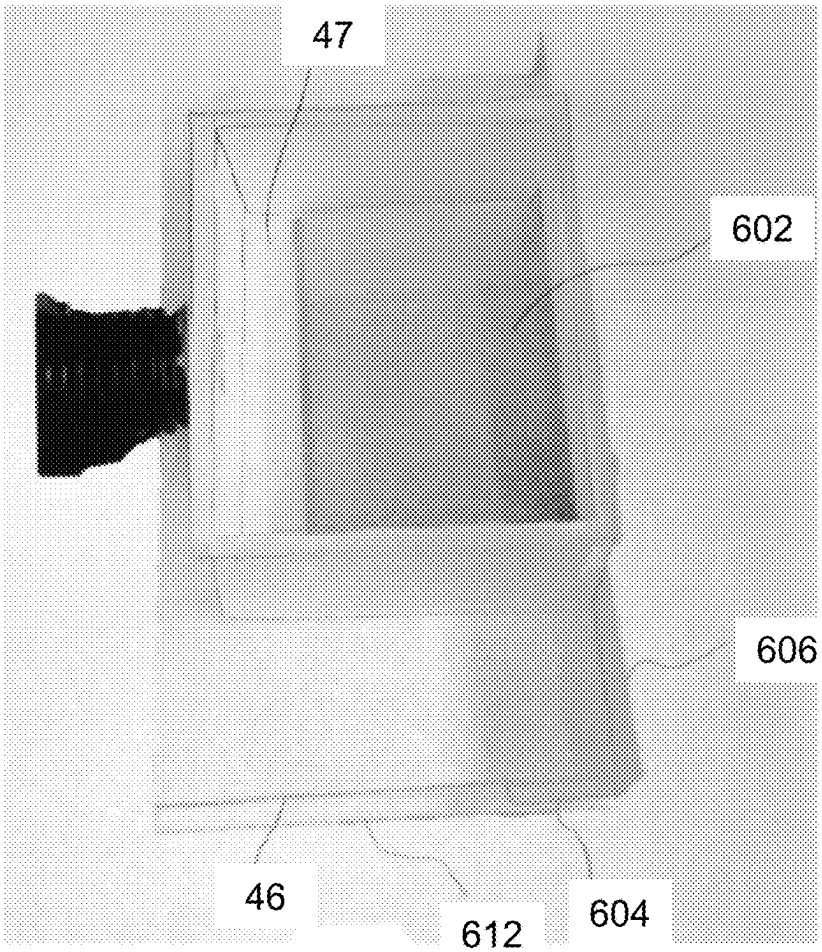


FIG. 35

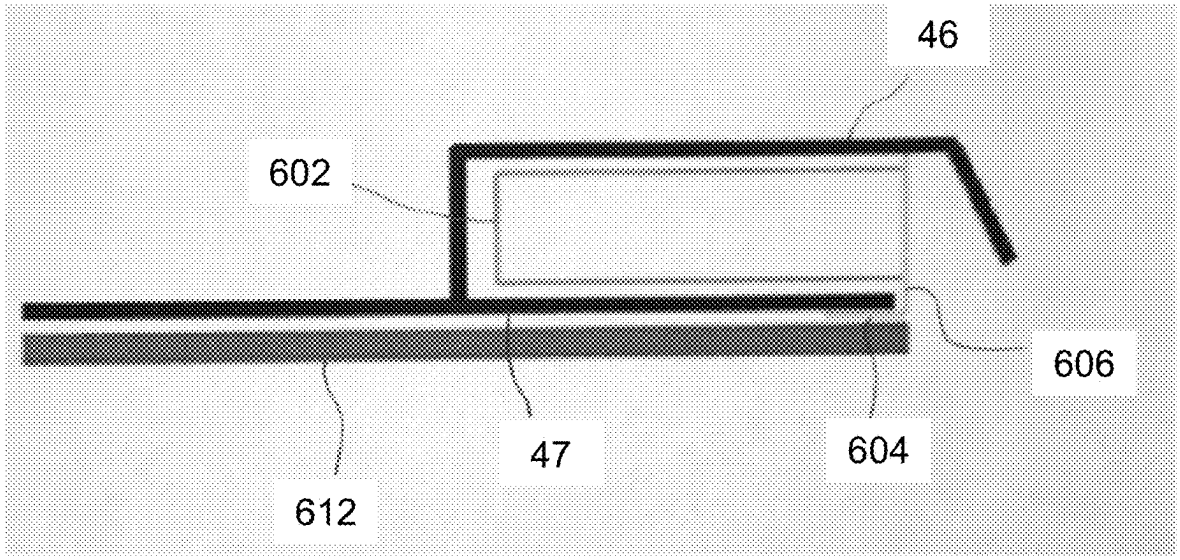


FIG. 36

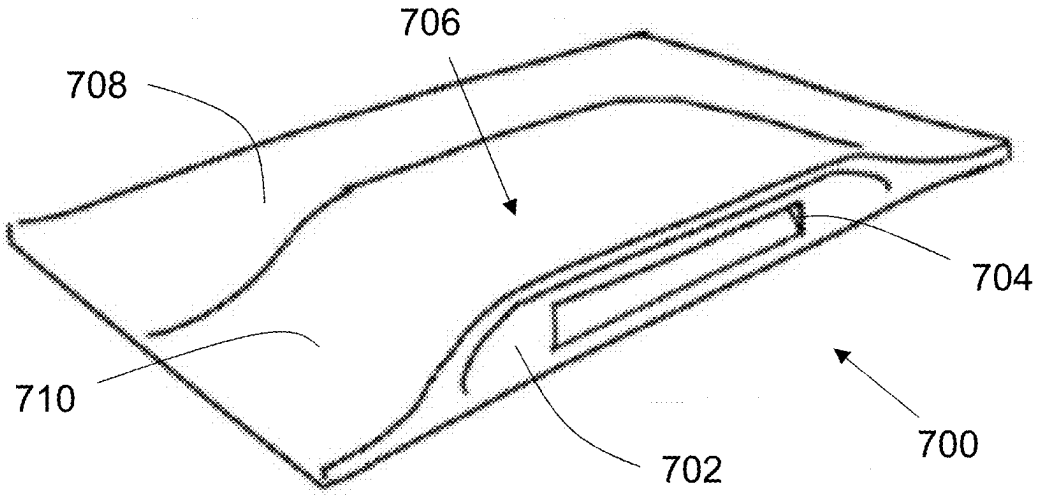


FIG. 37

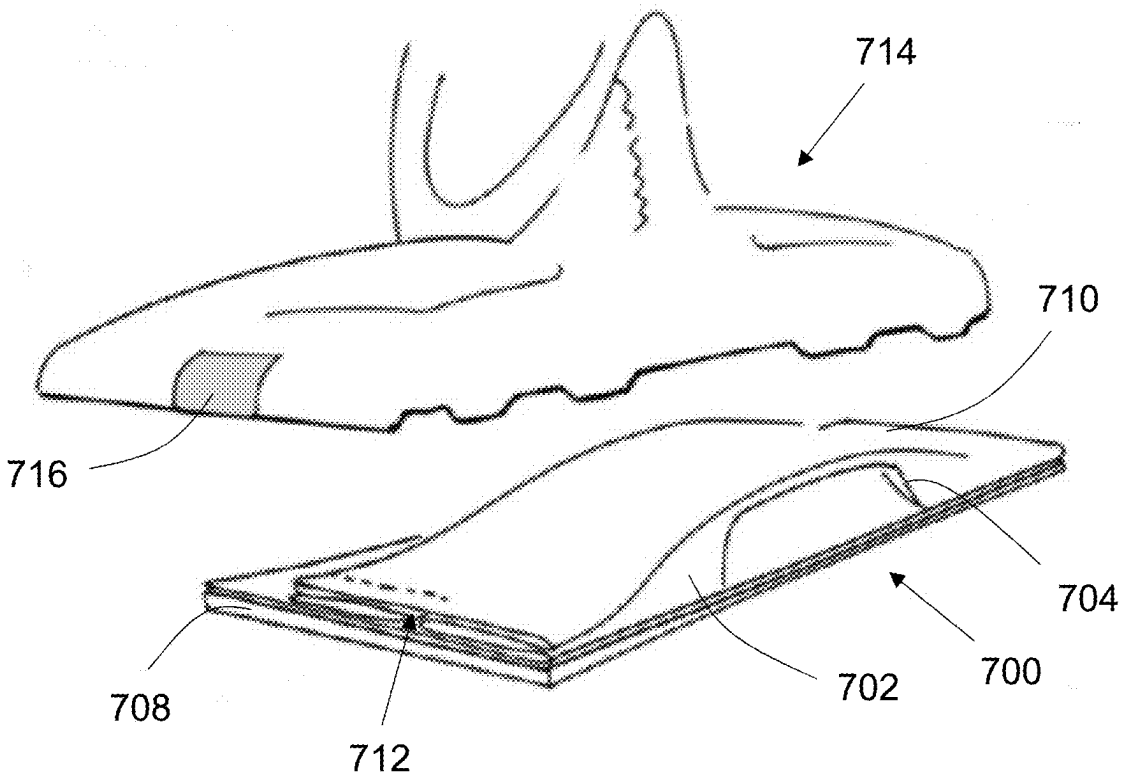


FIG. 38

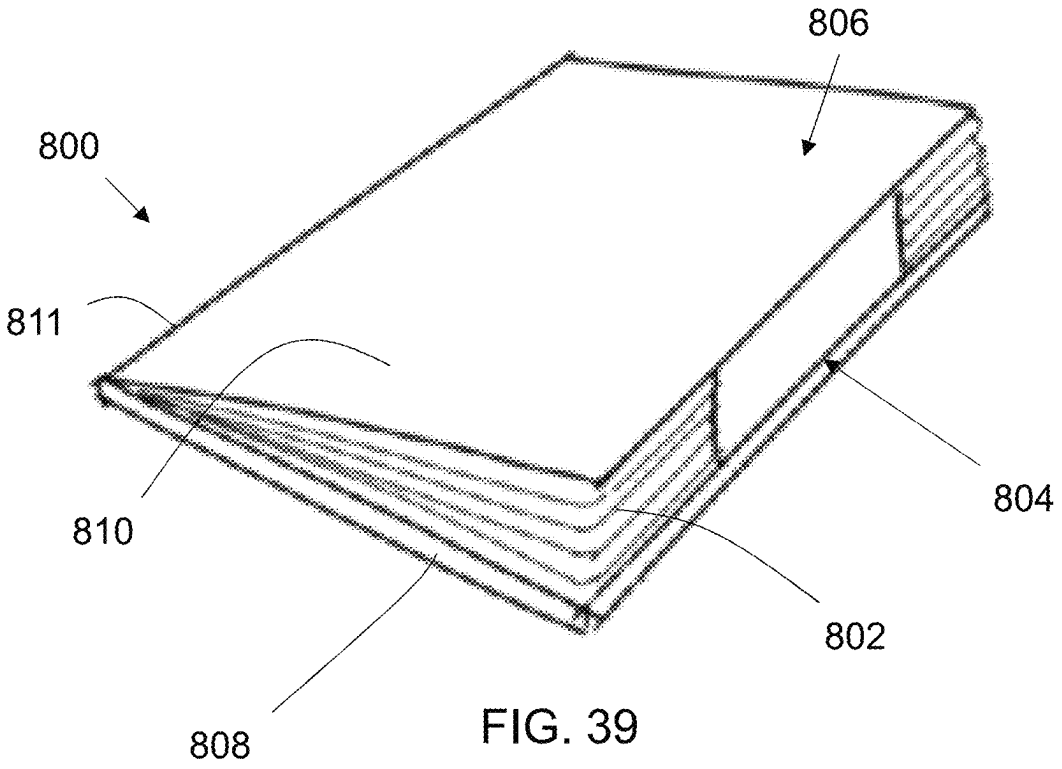


FIG. 39

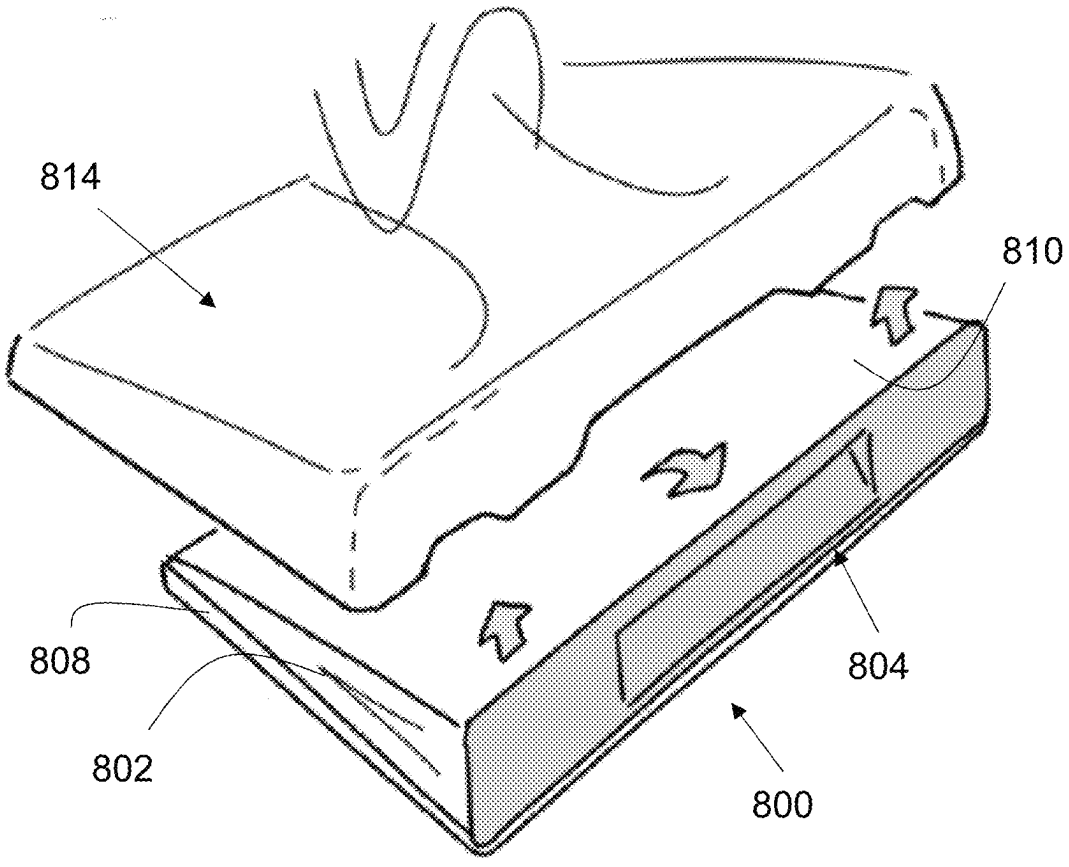


FIG. 40

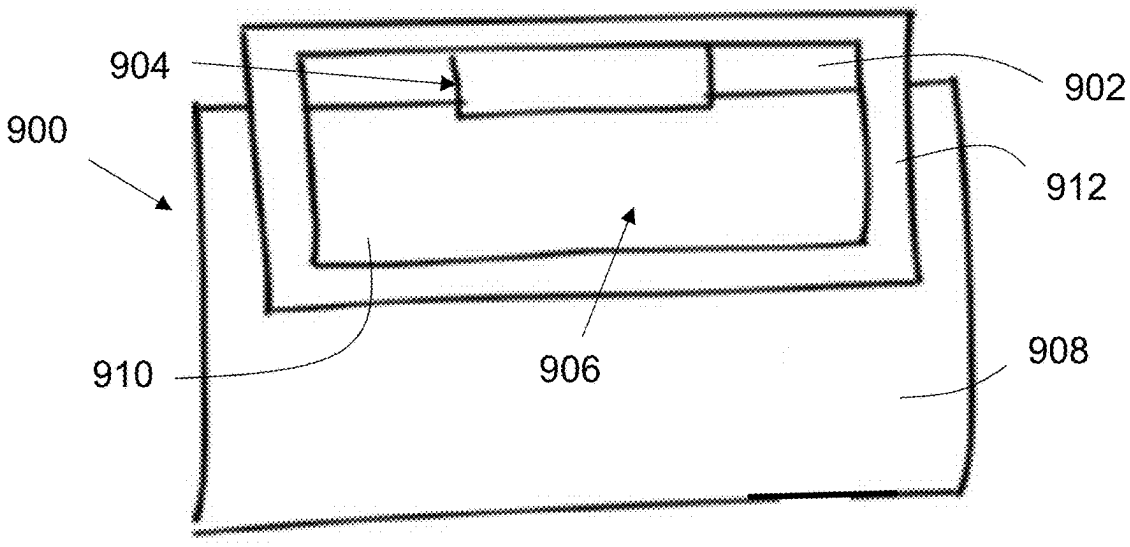


FIG. 41

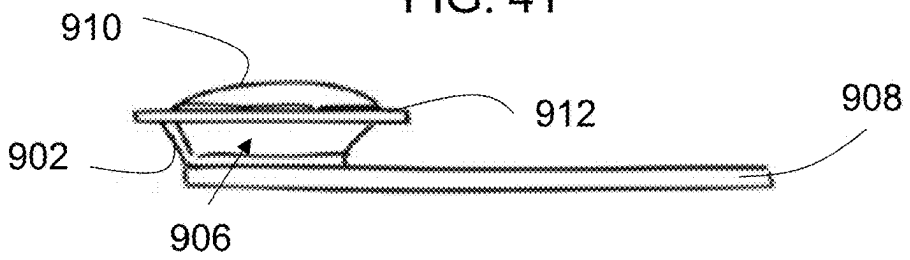


FIG. 42

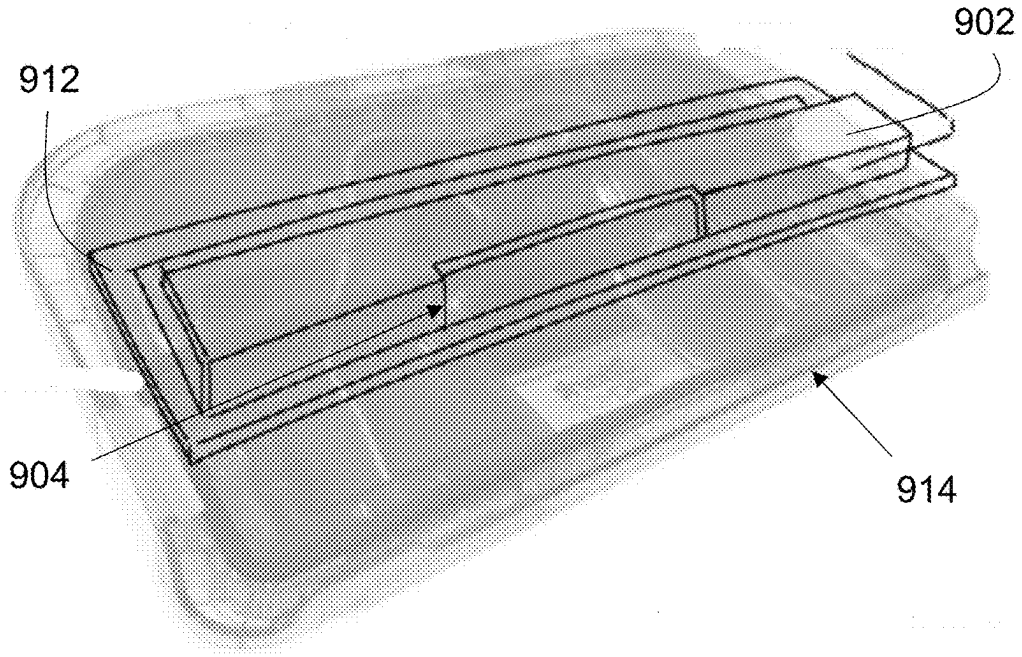


FIG. 43

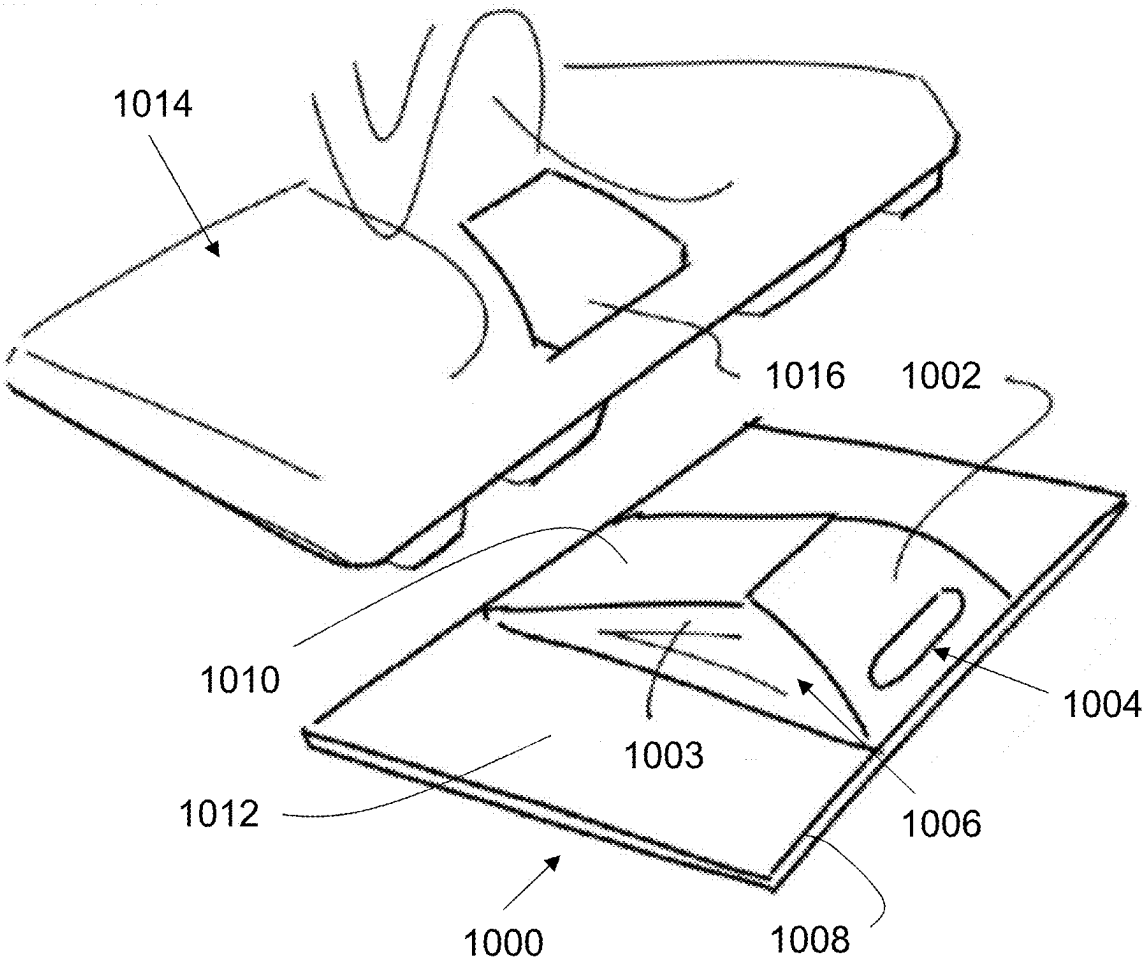


FIG. 44

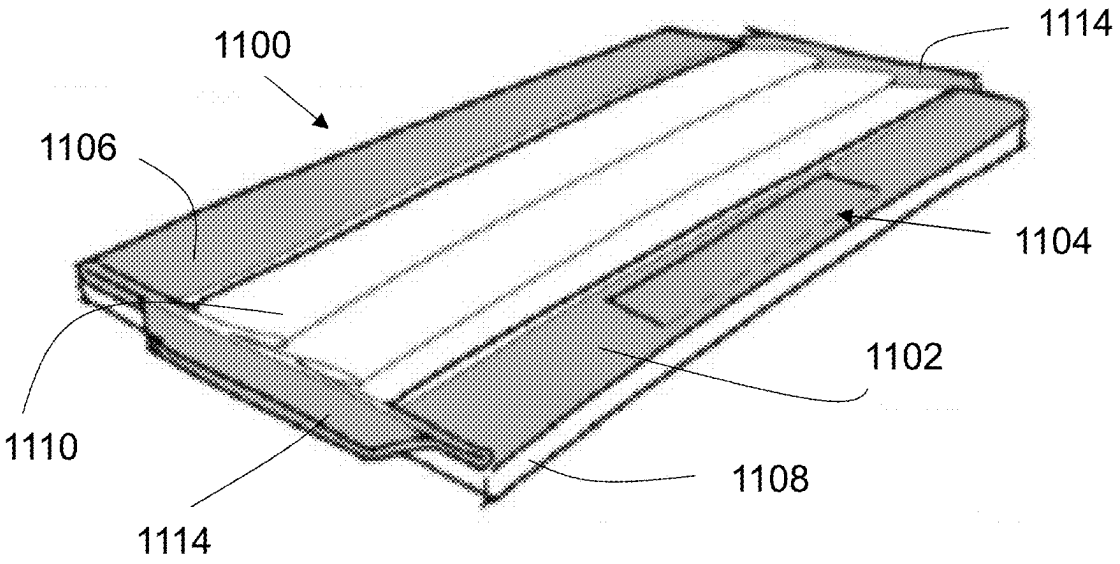

1100
1114
1106
1104
1102
1110
1108
1114

FIG. 45

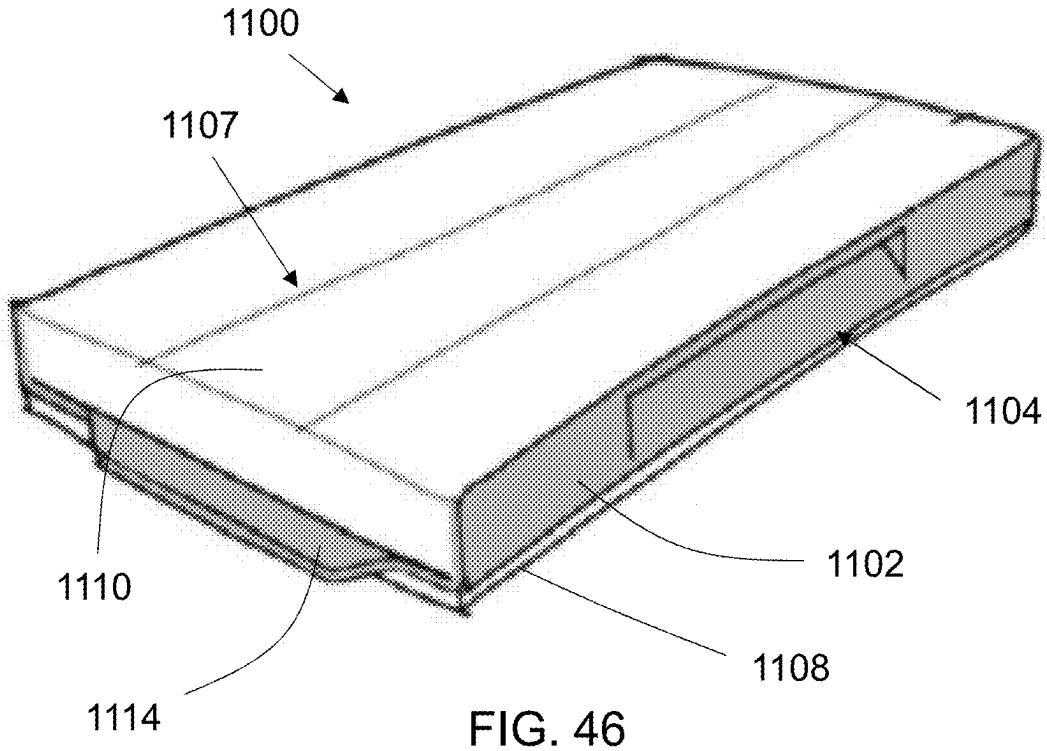

1100
1107
1104
1102
1110
1108
1114

FIG. 46

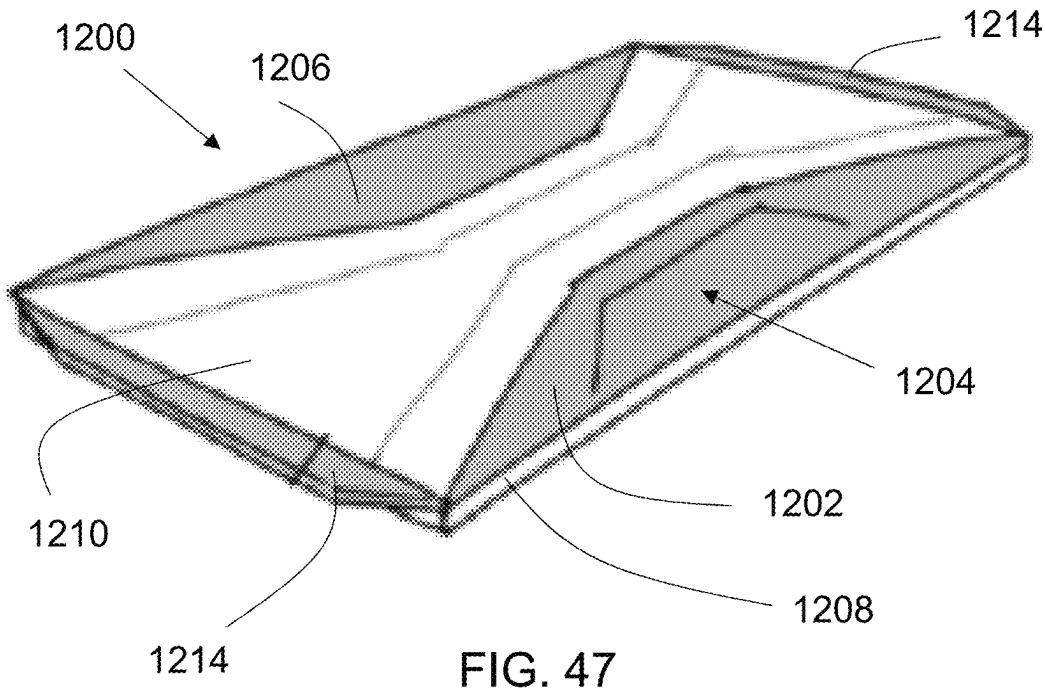

1200
1206
1214
1204
1202
1210
1208
1214

FIG. 47

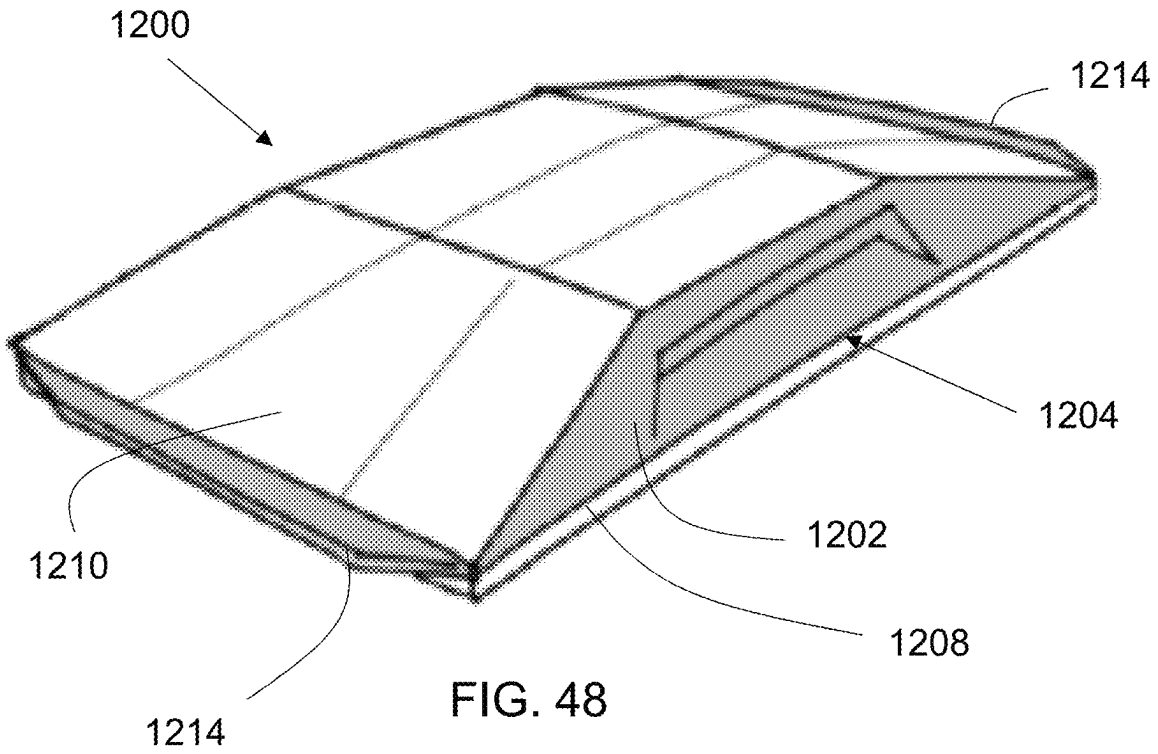

1200
1214
1204
1202
1210
1208
1214

FIG. 48

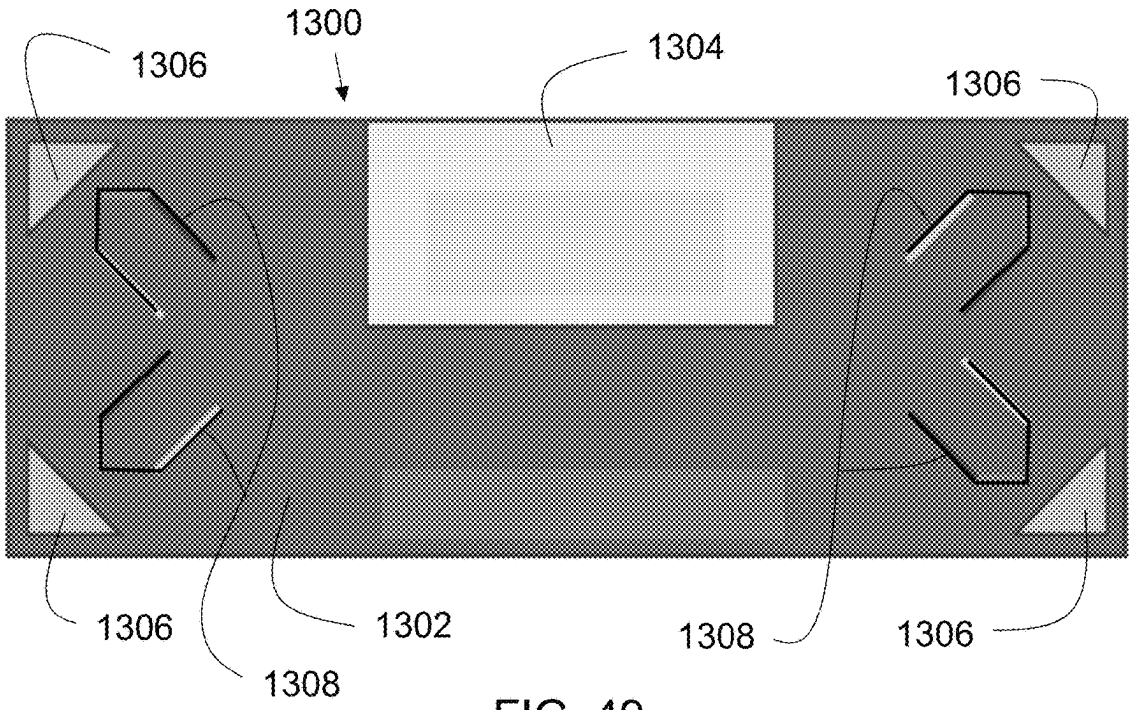

1300
1306
1304
1306
1306
1302
1308
1308
1306

FIG. 49

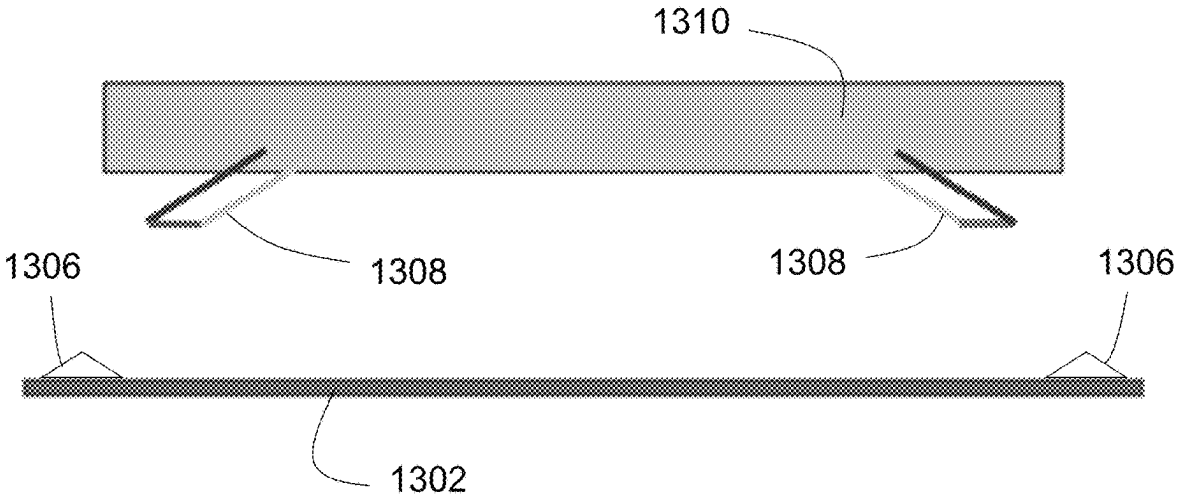

1310
1306
1308
1308
1306
1302

FIG. 50

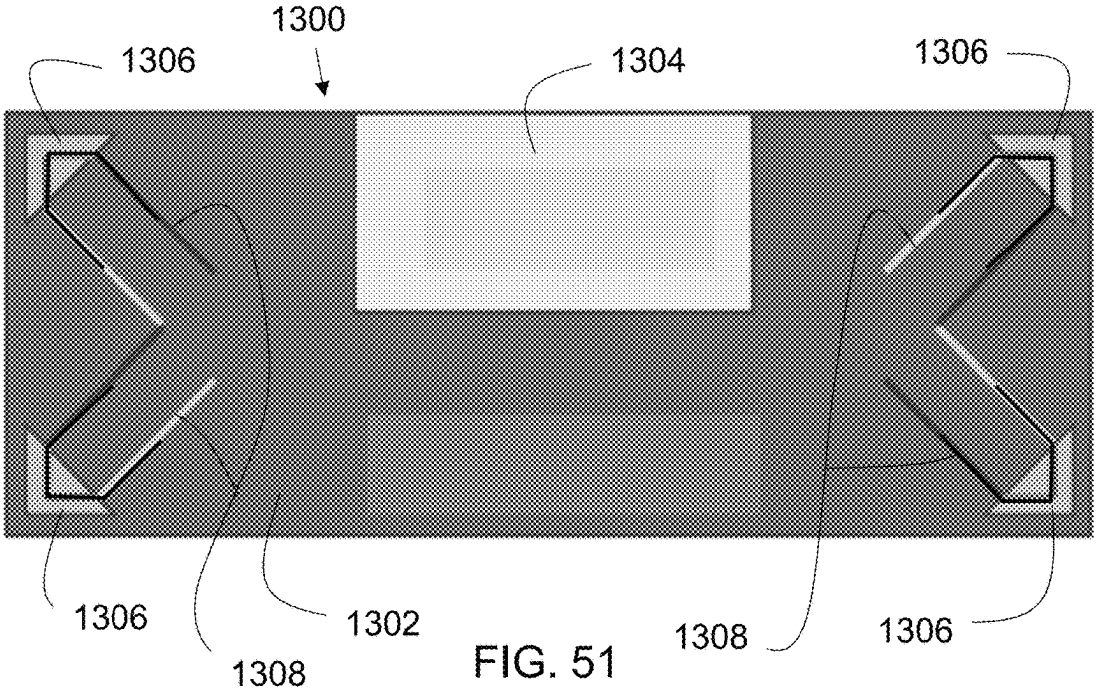

1300
1306
1304
1306
1306
1308
1302
1308
1306

FIG. 51

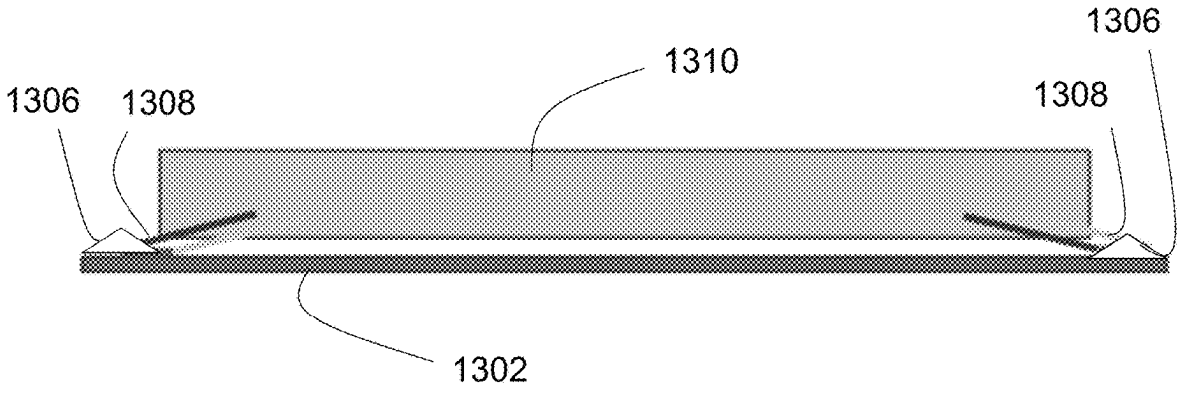

1306
1310
1306
1308
1308
1302

FIG. 52

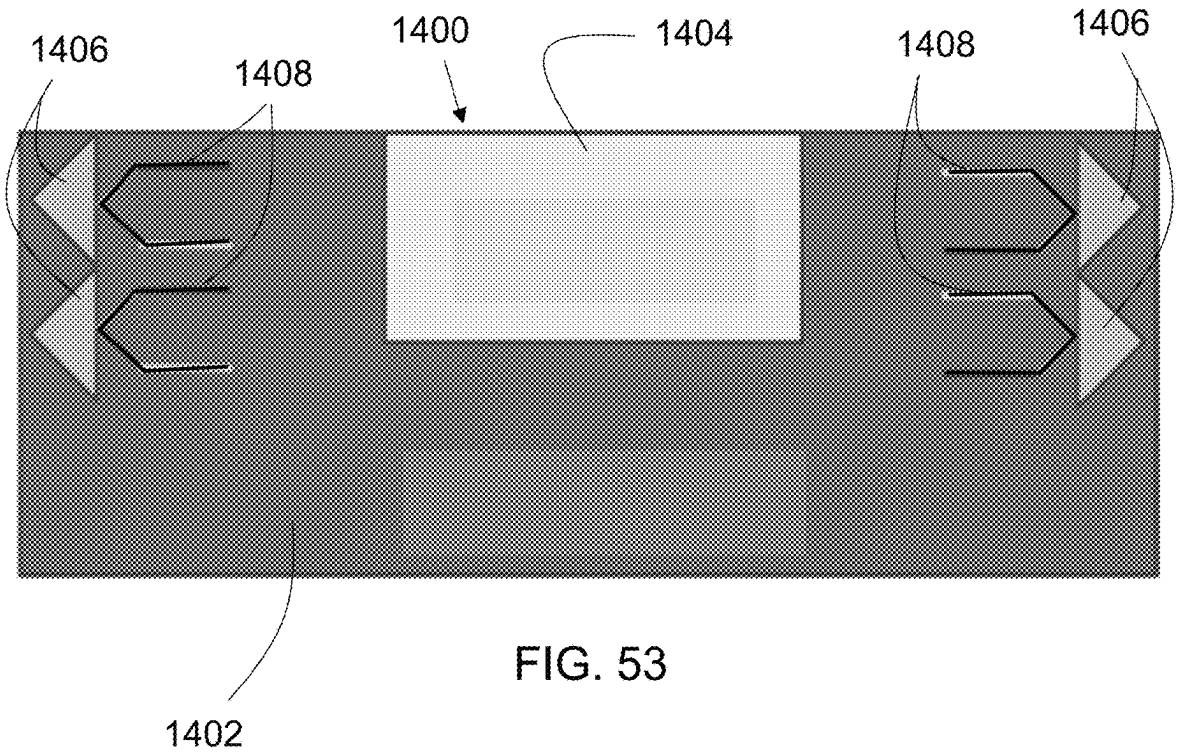


FIG. 53

LOW COST CLEANING DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority under 35 U.S.C. § 119(e) to U.S. Provisional Patent Application No. 63/156,901 filed on Mar. 4, 2021, U.S. Provisional Patent Application No. 63/234,204 filed on Aug. 17, 2021, and U.S. Provisional Patent Application No. 63/238,579 filed on Aug. 30, 2021, the entire contents of which are hereby expressly incorporated by reference herein.

FIELD

The present application generally relates to cleaning devices, connectors, and cleaning heads for use with a cleaning device.

BACKGROUND

Cleaning devices are used in the home and office to clean floors and other surfaces. Various types of cleaning devices are known, such as vacuum cleaners and mops, which use a removable component such as a cleaning pad or the like that are removably attached to the base of the device.

Cleaning a surface, such as a hard floor or carpeted surface, can be challenging when there are a variety of different types of debris and spills, such as wet, dry, or mixed media spills. Cleaning devices are often suited for cleaning wet or dry debris, but not for cleaning both. As such, users typically need to use multiple cleaning devices to clean their floors. For example, the user may use a broom and/or vacuum cleaner to remove dry debris and then use a mop to clean up wet spills and/or to remove stains. In some instances, even with debris that is of the same type, a user may need to use multiple cleaning devices. For example, a vacuum may be successful at picking up large particles but may not capture smaller dust particles, and thus a mop may be needed. Using multiple cleaning devices can be time consuming. For example, not only may the user need to use multiple cleaning devices, the user may need to use the same cleaning device more than once to fully clean the floor. For example, a user may need to sweep and/or vacuum the floor before mopping and then again after mopping, such as to pick up debris that was not removed from the surface prior to mopping or to pick up dirt or debris that was formed during mopping.

Using multiple cleaning devices can also be messy and/or can require long setup time or after-use maintenance. For example, in some instances, the user may prefer to use a broom instead of a vacuum because of the readiness of the broom as compared to the time to set up the vacuum cleaner. With the broom, a user will sweep up and dispose of the dirt particles. Vacuums may require the user to either remove a bag from within the vacuum or repeatedly empty a dirt cup. Some cleaning devices have attempted to handle both wet and dry media, but some of these devices can have higher-set up times than using a broom and then a mop to clean a floor. Additionally, the after-use maintenance can be high for such devices, especially when cleaning liquids are involved. For example, some combination tools can become unsanitary or develop an odor if not properly cleaned after each use.

SUMMARY

Cleaning devices and removable cleaning heads for use therewith are provided.

In one embodiment, a cleaning device connector is provided having a connector housing with a front wall, a rear wall, a bottom surface, and a top surface. A cavity is arranged within the bottom surface of the housing. A bracket is arranged within the cavity of the housing. A pin extends from the rear wall of the housing. A release button is positioned on the housing and configured to move the bracket and the pin from a first position to a second position.

The housing can have a variety of configurations. For example, in some embodiments, the housing can include at least one projection disposed within the cavity. The bracket can include at least one bore aligned with the at least one projection. In some embodiments, the at least one projection can be configured to be positioned within the at least one bore when the bracket is in the second position. In other embodiments, the housing can include a securement tab configured to lock the bracket in the second position. The securement tab can be configured to release the bracket from the second position in response to insertion of a cleaning head into the cavity.

In some embodiments, a linkage assembly can be arranged within the housing, where the linkage assembly includes a front arm connected to the release button and the bracket, and a rear arm connected to the release button and the pin. In other embodiments, the front and rear arms can be pivotally connected to the housing.

In some embodiments, the actuation of the release button can be configured to simultaneously move the bracket and the pin from the first position to the second position.

In some embodiments, the pin can be partially retracted within the housing in the second position.

In some embodiments, the bracket can be configured to slide longitudinally within the cavity between the first position and the second position.

In another embodiment, a cleaning device assembly is provided that includes a cleaning device and a cleaning head. The cleaning device includes a body having a proximal end and a distal end, a vacuum source positioned within the body, a handle coupled the proximal end of the body, and a connector housing is coupled to the distal end of the body. The connector housing includes a front wall, a rear wall, a bottom surface, and a top surface. A cavity is arranged within the bottom surface of the housing. A bracket can be arranged within the cavity of the housing, and a pin can extend from the rear wall of the housing. A release button can be positioned on the connector housing and it can be configured to move the bracket and the pin to move the bracket and the pin from a first position to a second position. The cleaning head is removably attached to the connector housing of the cleaning device. The cleaning head can have a foldable portion configured to connect to the bracket of the connector housing, an attachment tab configured to connect to the pin of the connector housing, and a cleaning pad.

The cleaning head can have a variety of configurations for allowing the cleaning head to be removably attached to the connector housing on the cleaning device. For example, in some embodiments, the foldable portion of the cleaning head can be configured to be secured between the bracket of the connector housing and an internal surface of the cavity. In other embodiments, a receptacle defining a dirt collection chamber can be arranged within the cavity of the cleaning head.

In other embodiments, the vacuum source can be configured to apply a suction force to the dirt collection chamber.

In some embodiments, a linkage assembly can be arranged within the housing, and the linkage assembly having a front arm connected to the release button and the

bracket, and a rear arm connected to the release button and the pin. In other embodiments, the pin of the connector housing can be arranged within a through-bore of the attachment tab.

In another embodiment, a method of detaching a cleaning head to a cleaning device includes actuating a release button positioned on a connector housing of a cleaning device to cause a bracket within the connector housing to move from a closed position to an open position, and to cause a pin within the connector housing to move from an extended position to a retracted position, such that a cleaning head engaged by the bracket and pin are released from the connector housing.

In another embodiment, a cleaning head is provided that includes a support structure having a front edge. A foldable portion is coupled to the support structure at least partially along the front edge. A receptacle is connected to the foldable portion and defining a chamber therein. A suction inlet is arranged within the foldable portion for allowing debris to flow into the chamber. A cleaning pad is positioned underneath the support structure. An attachment tab extends from a rear edge of the cleaning pad.

In some embodiments, the receptacle can be partially formed from an air permeable filter configured to allow a suction force to be applied therethrough and through the suction inlet while retaining debris within the chamber. In other embodiments, the receptacle can be configured to expand when a suction force is applied to the chamber.

In some embodiments, a valve can be arranged within the receptacle and can be movable relative to the suction inlet in response to a suction force applied to the chamber. The valve can be arranged to allow debris to enter the chamber while limiting debris from exiting the chamber.

The foldable portion can have a variety of configurations. For example, in some embodiments, the front edge of the support structure can form a living hinge with the foldable portion. In other embodiments, the foldable portion can be configured to move from a first position substantially parallel to the cleaning pad, to a second position substantially perpendicular to the cleaning pad. In some embodiments, the foldable portion can include apertures formed in opposite sides of the suction inlet.

The attachment tab can also have a variety of configurations. For example, in some embodiments, the attachment tab can include an aperture formed therethrough. In other embodiments, the attachment tab can be configured to move from a first position substantially parallel to the cleaning pad, to a second position substantially perpendicular to the cleaning pad.

In some embodiments, a total area of the support structure can be less than a total area of the cleaning pad.

In another embodiment, a cleaning device is provided that includes a body having a proximal end and a distal end. A vacuum source is positioned within the body, a handle is coupled to the proximal end of the body, and a connector housing coupled to the distal end of the body. The connector housing having a cavity formed in a bottom surface of the connector housing, and a pin extending from a rear wall of the connector housing. A cleaning head can be configured to removably attach to the connector housing. The cleaning head can include a support structure including a front edge, and a foldable portion coupled to the support structure at least partially along the front edge. The foldable portion can be configured to extend into the cavity. A receptacle can be connected to the foldable portion and define a cavity, and a suction inlet can be arranged within the foldable portion for allowing debris to flow into the chamber. A cleaning pad can be positioned underneath the support structure, and an attachment tab can extend from a rear edge of the cleaning pad and can be configured to connect with the pin of the connector housing.

The removable connection between the connector housing and the cleaning head can have a variety of configurations. For example, in some embodiments, the pin can be configured to extend through an aperture formed in the attachment tab. In other embodiments, the pin can be configured to retract within the connector housing to remove the pin from the aperture of the attachment tab. In some embodiments, the foldable portion can include apertures arranged on opposed sides of the suction inlet, and each aperture can be configured to align with a protrusion formed in the cavity to connect the cleaning head to the connector housing. In certain embodiments, the foldable portion and the support structure can be configured to contact a gasket arranged within the bottom surface of the connector housing.

The connector housing can also have a variety of configurations. For example, in some embodiments, the connector housing can include a moveable bracket which is configured to clamp the foldable portion between an internal wall and the bracket. In other embodiments, the bracket can be configured to move away from the internal wall to release the foldable portion from the connector housing. In certain embodiments, the receptacle can be configured to expand within the cavity when a suction force is applied to the cavity. In other embodiments, the bottom surface of the connector housing can be configured to contact the cleaning pad when the cleaning head is connected to the connector housing.

In another embodiment, a method of connecting a cleaning head to a cleaning device is provided and includes moving a foldable portion of a cleaning head positioned along a front edge of a support structure from a first position to a second position, moving an attachment tab positioned along a rear edge of a cleaning pad arranged underneath the support structure from a first position to a second position, and to position the attachment tab on a pin of a connector housing on a cleaning device, positioning the foldable portion within a cavity of the connector housing, and actuating a clamping mechanism on the connector housing to cause the foldable portion to be clamped between a moveable bracket and an internal wall of the cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features will be more readily understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a front perspective view of one embodiment of a cleaning device having a cleaning head removably coupled thereto;

FIG. **2**A is a top perspective view of a kit of cleaning heads including the cleaning head of FIG. **1**, shown detached from the cleaning device;

FIG. **2**B is a top perspective view of showing the cleaning device of FIG. **1** about to be attached to the cleaning head;

FIG. **2**C is a top perspective view showing the cleaning device and cleaning head of FIG. **2**B in use;

FIG. **2**D is a top perspective view of the cleaning device and the cleaning head of FIG. **2**C, showing the cleaning head detached for disposal;

FIG. **3** is a top perspective view of the cleaning head of FIG. **1**;

FIG. **4** is a bottom perspective view of the cleaning head of FIG. **3**;

FIG. **5** is a top perspective view of the cleaning head of FIG. **3** in a folded configuration;

FIG. **6**A is top view of an unfolded support structure of the cleaning head of FIG. **3**;

FIG. **6**B is a top view of a folded support structure of the cleaning head of FIG. **6**A;

FIG. **7**A is top view of an unfolded receptacle of the cleaning head of FIG. **3**;

FIG. **7**B is a top view of a folded receptacle of the cleaning head of FIG. **7**A;

FIG. **8**A is an exploded view of the cleaning head of FIG. **3**;

FIG. **8**B is a top view of a portion of the cleaning head of FIG. **3**;

FIG. **8**C is a top view of a portion of the cleaning head of FIG. **3**;

FIG. **8**D is a top view of a portion the cleaning head of FIG. **3**;

FIG. **8**E is an exploded view of a cleaning head according to another embodiment;

FIG. **9** is a top perspective view of a connector housing of the cleaning device of FIG. **1**;

FIG. **10** is a bottom perspective view of the connector housing of FIG. **9**;

FIG. **11** is a bottom view of the connector housing of FIG. **9**;

FIG. **12** is a bottom view of the connector housing of FIG. **9** with the outer housing removed, depicting a linkage assembly in a first position;

FIG. **13** is a bottom view of the connector housing of FIG. **9** showing a portion of the linkage assembly in a first position with the outer housing removed;

FIG. **14** is a bottom view of the linkage assembly of FIG. **13** in a second position with the outer housing removed;

FIG. **15** is a bottom view of the connector housing of FIG. **9** showing the linkage assembly in the second position;

FIG. **15**A is a detailed bottom perspective view of the connector housing of FIG. **9** showing a portion of the linkage assembly of FIG. **13** and a locking mechanism;

FIG. **16** is a cross-sectional view of the connector housing of FIG. **9** depicting a bracket and a pin in a first position;

FIG. **17** is a cross-sectional view of the connector housing of FIG. **9** depicting the bracket in the first position;

FIG. **18** is a cross-sectional view of the connector housing of FIG. **16** depicting the bracket and the pin in a second position;

FIG. **19** is a cross-sectional view of the connector housing of FIG. **17** depicting the bracket in the second position;

FIG. **20** is a cross-sectional view of the connector housing of FIG. **16** depicting the bracket and the pin in the first position and showing the cleaning head of FIG. **1** coupled thereto;

FIG. **21** is a cross-sectional view of the connector housing and cleaning head of FIG. **20** depicting the bracket and the pin in the first position;

FIG. **22** is a bottom perspective view of the connector housing and cleaning head of FIG. **20**;

FIG. **23** is a top perspective view of a cleaning head according to another embodiment;

FIG. **24** is a top perspective view of the cleaning head of FIG. **23** in a folded configuration;

FIG. **25** is a top perspective view of the cleaning head of FIG. **24** about to be attached to another embodiment of a connector housing of a cleaning device;

FIG. **26** is a schematic view showing the cleaning head mated to the connector housing of FIG. **25**;

FIG. **27** is a top perspective views of a cleaning head according to another embodiment;

FIG. **28** is a top perspective view of the cleaning head of FIG. **27** in a folded configuration;

FIG. **29** is a top perspective view of the cleaning head of FIG. **28** about to be attached to another embodiment of and a connector housing of a cleaning device;

FIG. **30** is a schematic view showing the cleaning head mated to the connector housing of FIG. **29**;

FIG. **31** is a top perspective view of the cleaning head mated to the connector housing of FIG. **29**;

FIG. **32** is a bottom perspective view of the cleaning head mated to the connector housing of FIG. **29**;

FIG. **33** is a top perspective view of a cleaning head according to another embodiment;

FIG. **34** is a top perspective view of the cleaning head of FIG. **33** about to be attached to another embodiment of a connector housing of a cleaning device;

FIG. **35** is a top perspective view of the cleaning head mated to the connector housing of FIG. **34**;

FIG. **36** is a schematic view showing the cleaning head mated to the connector housing of FIG. **35**;

FIG. **37** is a top perspective view of a cleaning head according to another embodiment;

FIG. **38** is a top perspective view of the cleaning head of FIG. **37** about to be attached to another embodiment of a connector housing of a cleaning device;

FIG. **39** is a top perspective view of a cleaning head according to another embodiment;

FIG. **40** is a top perspective view of the cleaning head of FIG. **39** about to be attached to another embodiment of a connector housing of a cleaning device;

FIG. **41** is a schematic view showing a cleaning head of a cleaning device;

FIG. **42** is a side view of the cleaning head of FIG. **41**;

FIG. **43** is a bottom perspective view of the cleaning head of FIG. **41** attached to another embodiment of a connector housing of a cleaning device;

FIG. **44** is a top perspective view of a cleaning head about to be attached to another embodiment of a connector housing of a cleaning device;

FIG. **45** is a top perspective view of a cleaning head according to another embodiment in an unfolded configuration;

FIG. **46** is a top perspective view of the cleaning head of FIG. **45** in a folded configuration;

FIG. **47** is a top perspective view of a cleaning head according to another embodiment in an unfolded configuration;

FIG. **48** is a top perspective view of the cleaning head of FIG. **47** in a folded configuration;

FIG. **49** is a schematic view showing a cleaning head and connector housing according to another embodiment in a disengaged position;

FIG. **50** is a schematic view showing the cleaning head and connector housing of FIG. **49** in a disengaged position;

FIG. **51** is a schematic view showing the cleaning head and connector housing of FIG. **49** in an engaged position;

FIG. **52** is a schematic view showing the cleaning head and connector housing of FIG. **51** in an engaged position; and

FIG. **53** is a schematic view showing a cleaning head and connector housing according to another embodiment in a disengaged position.

It is noted that the drawings are not necessarily to scale. The drawings are intended to depict only typical aspects of the subject matter disclosed herein, and therefore should not be considered as limiting the scope of the disclosure.

DETAILED DESCRIPTION

Certain exemplary embodiments will now be described to provide an overall understanding of the principles of the structure, function, manufacture, and use of the devices and methods disclosed herein. One or more examples of these embodiments are illustrated in the accompanying drawings. Those skilled in the art will understand that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary embodiments and that the scope of the present invention is defined solely by the claims. The features illustrated or described in connection with one exemplary embodiment may be combined with the features of other embodiments. Such modifications and variations are intended to be included within the scope of the present invention.

In general, cleaning devices and removable cleaning heads are provided. In an exemplary embodiment, a cleaning device is provided having a connector housing configured to removably engage a cleaning head. The cleaning head can include a support structure configured to attach to the connector housing on the cleaning device. A receptacle defining a dirt collection chamber and a cleaning pad for cleaning a surface can both be coupled to the support structure. The entire cleaning head can have a configuration that reduces manufacturing costs, and that allows the cleaning head to be discarded after use. In certain embodiments, the support structure can be formed from a low cost material, such as cardboard, and it can have a generally planar configuration providing a relatively low profile for packaging and shipping. The support structure can be configured to unfold or otherwise expand to facilitate attachment to a cleaning device. The receptacle can be formed from a low cost material as well, such as a fabric material that defines a chamber therein for collecting debris, but that also functions as an air filter to prevent debris from being drawn into the cleaning device. The cleaning pad can be mated to the bottom surface of the support structure for cleaning a floor surface.

FIG. **1** illustrates one embodiment of a cleaning device **10**. As shown, the cleaning device **10** generally includes a body **12** having a handle **14** coupled to a proximal end thereof, and a connector housing **300** coupled to a distal end thereof. A cleaning head **100** is removably mated to the connector housing **300**. The body **12** can include various features to facilitate operation of the device, such as a fluid reservoir (not shown) which can store and dispense a cleaning fluid on a surface to be cleaned, and a motor and vacuum source (not shown) configured to apply a suction force through the connector housing **300** and cleaning head **100**. The handle **11** can be coupled to the body **12** for manipulating the device. For example, an elongate shaft **14** can extend proximally from the body **12**, and a handle **11** can be formed on the proximal end of the elongate shaft **14**. The shaft **14** can have a length that is adjustable to allow a user to adjust the height of the cleaning device. For example, the shaft **14** may be telescoping to increase or decrease the length of the shaft. Additionally, in some embodiments, the handle **11** may include switches **15** and **17** arranged thereon. Switch **15** can have any configuration, such as a rocker switch configured to control to output of a cleaning fluid from the body **12** or connector housing **300**. In one exemplary embodiment, the switch **15** can control two different output modes for the cleaning fluid, including a burst spray and a continuous spray. In said embodiment, the burst spray may consist of separate pulses of cleaning fluid or delivery of a greater volume of cleaning fluid. Additionally, switch **17** can be used to activate the vacuum source to apply a suction force through the connector housing **300** and cleaning head **100**. A person skilled in the art will appreciate that the cleaning device can have a variety of other configurations and can include various features, and that the illustrated cleaning device is merely one exemplary embodiment.

FIGS. **2**A-**2**D illustrate a process for attaching the cleaning head **100** to the cleaning device **10**. As shown in FIG. **2**A, a user may select the cleaning head **100** from a kit or box of disposable cleaning heads. As shown in FIG. **2**B, the user attaches the selected cleaning head **100** to the cleaning device **10**. This can be achieved by positioning the cleaning head **100** on the floor, and aligning the cleaning device **10** over the cleaning **100**. The cleaning device **100** can then be lowered toward the cleaning head **100** to cause a portion of the cleaning head **100** to extend into a cavity in the cleaning device **10**. As will be discussed in more detail below, the cleaning device **10** can include features that engage the cleaning head **100** to mate the cleaning head to the cleaning device **10**. Once attached, the cleaning device **10** can be operated, as shown in FIG. **2**C, to suction dirt through a suction nozzle and into the dirt collection chamber of the cleaning head. In some embodiments, the user can activate the cleaning device **10** to apply a liquid to the surface to be cleaned, and a pad on the cleaning head **100** can be used to clean any fluid sprayed onto the surface, thereby cleaning the surface. Once cleaning is complete, the cleaning head **100** can be ejected from the cleaning device, as shown in FIG. **2**D, and it can be disposed of in a trash receptacle.

The cleaning head can have various configurations which allow the cleaning head to mate to the cleaning device. Additionally, the various configurations of the cleaning head can be designed such that the cleaning head can be folded or arranged substantially flat to allow for greater shipping efficiency. The cleaning head can then be unfolded to form an internal volume with a dirt collection chamber for collecting dirt during vacuuming.

FIGS. **3**-**8**D illustrate one embodiment of cleaning head **100** having a support structure **104**, a cleaning sheet **108** coupled to a bottom surface of the support structure **104**, and a receptacle **102** coupled to a top surface of the support structure **10**. While the support structure can have a variety of configurations, in the illustrated embodiment the support structure **104** is in the form of a planar rectangular sheet, e.g., a cardboard or paperboard sheet, that includes a foldable portion **106**, which is arranged along one side of the support structure **104**. The foldable portion **106** can be defined by a fold line **113** formed in the support structure **104**. The fold line **113** can be scored or pre-folded to aid in the mobility of the foldable portion **106** relative to the support structure **104**. The fold line **113** can be positioned such that a length of the foldable portion as measured from a leading edge to the fold line **113** is less than a length of the remainder of the support structure **104**. In use, the foldable portion **106** can be moved relative to the support structure **104** about the fold line **113**, thus allowing the foldable portion **106** to extend substantially perpendicular to the support structure **104**. When folded, the fold line **113** will define a leading edge of the support structure **104**.

In an exemplary embodiment, the foldable portion **106** is thicker than the remainder of the support structure **104** to provide rigidity to the foldable portion **106**. This can be

achieved by folding a first foldable section **107***a* onto a second foldable section **107***b* about fold line **109** such that the free edge of the first foldable section **107***a* aligns with fold line **113**. The two sections **107***a*, **107***b* can be permanently affixed to one another, such as by an adhesive.

A person skilled in the art will appreciate that the foldable portion **106** can be formed using a variety of other techniques, rather than being integrally formed as part of the support structure. For example, the foldable portion **106** can be a separate structure made from the same or different material as the remainder of the support structure, and it can be mated to the support structure in a manner that allows the foldable portion to move relative to the support structure. Further, in other embodiments, the foldable portion need not be foldable and instead can be positioned at a fixed angle relative to the support structure. In some embodiments, the foldable portion **106** and the support structure can be formed from 16 pt paper board with a density of 322 gsm.

As best shown in FIG. **5**, the foldable portion **106** can further include two apertures **116**, **118**, which can be arranged on opposed sides of a receptacle **102** coupled to the support structure **104**, discussed in further detail below. The apertures **116**, **118** can be positioned adjacent to the sides of the support structure **104**, and can each have a configuration that aids in securing the cleaning head **100** to a connector on a cleaning device when the foldable portion **106** is in a folded configuration (e.g., bent 90° relative to the polyfilm layer **110**A, as will also be discussed in more detail below. The apertures **116**, **118** can be formed in the foldable portion **106** after the foldable sections **107***a*, **107***b* are affixed to one another, or each foldable section **107***a*, **107***b* can include apertures **116***a*, **116***b*, **118***a*, **118***b* formed therein as shown in FIG. **6**A. When the foldable sections **107***a*, **107***b* are joined together, apertures **116***a*, **118***a* will align with apertures **116***b*, **118***b*, respectively.

The foldable portion **106** can also include a suction inlet **112** formed therein, as shown in FIG. **5**, for allowing debris to be suctioned into the receptacle **102**. Similar to the apertures, the suction inlet **112** can be formed after the foldable sections **107***a*, **107***b* are joined, or as shown in FIG. **6**A each foldable section **107***a*, **107***b* can include an aperture **112***a*, **112***b* therein that align with one another once the foldable sections **107***a*, **107***b* are joined together.

As previously indicated, the cleaning head **100** can further include a receptacle **102** that defines the dirt collection chamber for collecting debris. While the receptacle **102** can have a variety of configurations, in an exemplary embodiment, the receptacle **102** is made from a permeable material to allow a suction force to pass through the receptacle **102**. For example, the permeable material of the receptacle **102** can be a 44 grams per square meter SMS (spunbond melt-blown spunbond) coated material. In some embodiments, the permeable material of the receptacle **102** may be hydrophobic. The receptacle **102** can be formed using various techniques, but as shown in FIGS. **7**A and **7**B, in an exemplary embodiment the receptacle **102** is formed from a substantially rectangular material **140** that is folded in half along a fold line **143**. The rectangular material **140** includes tops edge **140***a*, bottom edge **140***b*, and side edges **140***c*, **140***d*, with the fold line **143** arranged substantially in the center of the rectangular material **140** and separating the rectangular material **140** into a first portion **141** and a second portion **142**. In order to form the receptacle **102** from the rectangular material **140**, the first portion **141** is folded onto the second portion **142** at the fold line **143**. The top and bottom edges **140***a*, **140***b* can be sealed together to form a sealed edge **148***a*, and the side edges **140***c*, **140***d* can be sealed together to form sealed edges **148***b*, **148***c*, respectively. The sealed edges **148***a*, **148***b*, **148***c*, along with folded edge **148***d* formed at the folded line **143**, define a dirt collection chamber within the receptacle **102**.

In order for dirt and debris to be collected within the receptacle **102**, an opening can be formed in the second portion **142** by cutting the material along a cut line **146**. In an embodiment, the cut line **146** can be a 3-sided rectangle, with the folded edge **148***d* forming the forth side. This creates a living hinge **147** which can form a valve **145** that is configured to pivot along the fold line **143**. The valve **145** can be configured to move inward to an open position to allow debris to enter into the chamber in response to a suction force applied to the chamber, and it can be configured to return to a resting substantially closed position when no suction force is applied.

In one embodiment, a backing plate **149** can be arranged on an internal surface of the valve **145**, within the chamber, in order to prevent the valve **145** from moving forward out of the receptacle **102**. The backing plate **149** can have a length that is greater than a length of the valve **145** such that end portions **149***a*, **149***b* of the backing plate **149** extend from opposite sides of the valve **145** beyond the cut line **146**. Due to the arrangement of the end portions **149***a*, **149***b*, the valve **145** is prevent from moving away from the second portion **142**, thus retaining the valve in the closed position and preventing debris from falling out the chamber when no suction force is applied.

In order to secure the receptacle **102** to the support structure **104**, the receptacle **102** can be positioned on the support structure **104** and on the foldable portion **106** to align the cut line **146** in the receptacle **102** with the suction inlet **112** in the support structure **104**, as shown in FIG. **5**. When secured to the support structure **104**, the valve **145** is likewise aligned with the suction inlet **112**. The receptacle **102** can be attached to the support structure **104** using any technique, such as adhesive. In an exemplary embodiment, an adhesive layer is **103***a* applied adjacent to and around the outer edge of the cut line **146** so that the valve **145** stays aligned with the suction inlet **112** when a suction force is applied to the receptacle **102** and through the suction inlet **112**. The remaining portion of the second portion **142** can be secured to the support structure **104** along a middle span of the second section **142**, and/or along the sealed edges **148***a*, **148***b*, **148***c*, **148***d*.

As indicated above, the support structure **104** can also include a cleaning sheet **108** attached to the lower surface of the support structure **104**, opposite the receptacle **102**. In this embodiment, the cleaning sheet **108** has a length extending between leading and trailing edges that is greater than a length of the support structure **104**. The support structure **104** can thus be mounted with the fold line **109** aligned with the leading edge of the cleaning sheet **108**, such that the cleaning sheet **108** extends a distance behind and trails the support structure **104**.

The cleaning sheet **108** can be formed multiple layers of material having various properties. In an exemplary embodiment, as shown in FIGS. **8**A-**8**D, the cleaning sheet **108** can include in order from top to bottom apoly film layer **110**A, an adhesive layer **110**B, a top acquisition layer **124**, an adhesive layer **125**, a superabsorbent polymer (SAP) layer **126**, a bottom acquisition layer **128**, a face layer **130**, and multi-functional strips **132**, **133**, and **135**. In some embodiments, the acquisition layer is formed from 50-100 gsm, 70% pulp, 30% bi-component polyethylene/polypropylene (BICO). The SAP layer **126** can be formed of a 50 gsm laminate. The face layer can be formed of a 75 gsm

spunbound material having 3-dimensional features embossed therein. The multi-function strip can be formed of a 40 gsm meltblown polypropylene. Additionally, poly film layer **110**A can be arranged underneath the support structure **106** and can be in the form of a planar rectangular sheet. The poly film layer **110**A can be secured to the support structure **106** by, for example, adhesive strips **107**. In an exemplary embodiment, the poly film layer **110**A is formed of a polyethylene film with a 0.0008 gauge size. The poly film layer **110**A and the face layer **130** can include tabs which are used to seal the layers of the cleaning sheet **108** together using a heat sealing method and/or the adhesive layer **110**B, which also include corresponding tabs.

In order to couple the support structure **104** to the poly film layer **110**A, the adhesive strips **107** an be arranged between the poly film layer **110**A and the support structure **104**. The adhesive strips **107** can extend the width of the support structure **104**, and can include a single or multiple adhesive strips. Since the support structure **104** is arranged on the forward half of the cleaning sheet **108**, the adhesive strips **107** can also be arranged on the forward half of the poly film layer **110**A.

Additionally, the receptacle **102** can be coupled to the support structure **104** and foldable portion **106** through the use of adhesive layers **103**A and **130**B. Adhesive layer **103**A is arranged forward of the fold line **113**, while the adhesive layer **103**B is arranged rearward of the fold line **113**. The adhesive layers **103**A, **103**B ensure that the receptacle stays secured to both the support structure **104** and the foldable portion **106** regardless of the position of the foldable portion **106** relative to the support structure **104**.

The various layers of the cleaning sheet can be held together using various mating techniques, such as via adhesive layers arranged between the layers, or securement techniques such as ultrasonic welding. In some embodiments, the cleaning sheet **108** can include multiple SAP layers **126** and multiple multi-functional strips **132**, **133**, and **135**, and each strip can be made from either the same or different materials. SAP materials generally swell when exposed to liquid. In embodiments with multiple SAP strips, said SAP strips may be placed such that they keep the surface of the cleaning sheet level when they absorb cleaning liquid. For instance, a first SAP strip positioned towards the front of the cleaning sheet and a second SAP strip positioned towards the back of the cleaning sheet. Where the multi-functional strips **132**, **133**, and **135** are made from different materials they can have different functions (e.g., scrubbing, polishing, disinfecting). In some embodiments, a multi-functional strip can be a scrubbing strip formed of 49 gsm material formed from 40% thermoplastic, 50% Lyosell and 10% polypropylene. The scrubbing strip may undergo heat treatment to melt some fibers and create a coarser scrubbing surface.

The cleaning head **100** can also include additional features to aid in attachment of the cleaning head **100** to a cleaning device. In the illustrated embodiment, the cleaning head includes a layer having an attachment tab **122** that extends from the trailing edge **121** of the cleaning sheet **108**. In this embodiment, only a single attachment tab **122** is centered on the trailing edge **121** of the cleaning sheet **108**, however the cleaning sheet **108** can include more than one attachment tab arranged on the trailing edge **121** thereof. If the cleaning sheet **108** includes more than one attachment tab, the attachment tabs can be spaced apart along the trailing edge **121**. Each attachment tab **122** can include an aperture **123** formed therethrough which can be configured to receive a pin on the cleaning device to allow the tab to engage the pin and thereby aid in retaining the cleaning head **100** on the cleaning device. Alternatively, the attachment tab **122** can be secured within a slot or similar feature on the cleaning device. In certain exemplary embodiments, the attachment tab(s) **122** can be formed as part of the polyfilm layer **110**A of the cleaning sheet **108**. In some embodiments, the attachment tab **122** is not integrally formed with a layer of the cleaning sheet **108**, but rather is a separate attachment tab **122** that is secured to the face layer **130** of the cleaning sheet **108** using an adhesive strip **122**A along the trailing edge of the cleaning sheet **108**, as shown in FIG. **8**D. In some embodiments, the attachment tab **122** is formed from a 103 gsm Elastic Laminate material. An adhesive, welding, or other techniques can be used to secure such an attachment tab to the edge of the cleaning sheet or between separate layers of the cleaning use.

In use, when attached to a cleaning device, the receptacle **102** can be configured to be arranged within a confinement volume formed in the cleaning device, the foldable portion **106** can extend along a leading edge of the device, and the cleaning sheet **108** can extend along the underside of the device. This arrangement separates the receptacle **102** from the cleaning sheet **108**, and allows for a shorter support structure **104** to be used since the confinement volume can support the receptacle **102** and a lower support structure on the cleaning device and support the cleaning sheet **108** while in use.

FIG. **8**E is an exploded view of another exemplary embodiment of a cleaning head **200**. The cleaning head **200** is substantially similar to the cleaning head **100**, except that the cleaning pad of the cleaning head **200** includes less layers within the cleaning pad **208** that the cleaning pad **108** of the cleaning head **100**. The cleaning head **200** still includes a receptacle **202**, a support structure **204**, and a cleaning pad **208**. The support structure **204** includes a foldable portion **208** having a suction inlet **210**, and apertures **212**, **214** for securing the cleaning head **200** to a cleaning device. Additionally, the cleaning sheet includes an attachment tab **216**, e.g., on the barrier layer **206**, which is substantially similar to the attachment tab **522** of cleaning head **100**. The cleaning head **200** can be formed from a plurality of layers, including an acquisition layer **224**, a SAP strip **226**, another acquisition layer **228**, a face layer **230**, and a multi-functional strip **232**. The various layers can be held together using various mating techniques, such as via adhesive layers arranged between the layers, or securement techniques such as ultrasonic welding.

FIGS. **9-22** illustrate the connector housing **300** of the cleaning device of FIG. **1**. The connector housing **300** is configured to operate with a cleaning head attached thereto, such as cleaning head **100** described above. As shown, the connector housing **300** generally includes a body **302**, a hinge connector **304**, and a tube **306**. The tube **306** is configured to connect to a suction source downstream of the connector housing **300** to allow suction to be applied through the body **302** and within the cleaning head.

The illustrated body **302** is in the form of a rectangular housing that generally includes a top surface **308**, a bottom surface **310**, a front surface **312**, and a rear surface **314**. In this embodiment, the connector housing **300** includes a release button **316** arranged in the top surface **308** of the body **302**. As will be described below, the release button **316** is connected to an internal linkage assembly **332** which is configured to releasably secure a cleaning head to the bottom surface **310** of the connector housing **300**.

The front surface **312** includes a central opening **311** that is configured to align with the suction inlet **112** of a cleaning

head connected to the connector housing **300**. Additionally, the front surface can include castellations **313**, with openings **315** arranged therebetween. The castellations **313** can be configured to increase the suction force being applied to debris outside of the connector housing **300** in order to draw more debris into the suction inlet **112**. In one embodiment, the castellations **313** can be in the form of triangles of various sizes extending downward from the connector head **320**. The castellations **313** can also act as filters for very large debris which would not fit through the suction inlet **112**.

The bottom surface **310** of the connector housing **300** includes an opening **320** therein. The opening is configured to allow access to an internal cavity **322** of the body **302** where a receptacle defining a dirt collection chamber of a cleaning head can be arranged. In the illustrated embodiment, the connector housing **300** includes a gasket **329** arranged around the opening **320** in order to help create a seal with a cleaning head when the cleaning head is attached to the connector housing **300**. Additionally, a wall **330** is arranged within the cavity **320** in order to aid in keeping a cleaning head flush with a surface to be cleaned and to prevent the cleaning head from being sucked into the cavity **322** by a suction force. Additionally, the wall **330** can include a cage **331** configured to prevent large debris from passing into the body **12** through the central opening **302**A.

The connector housing **300** can further include a linkage assembly **332** to removably secure the cleaning head to the connector housing **300**. In the illustrated embodiment, the linkage assembly **332** generally includes a pin **318**, a bracket **324**, a front pivoting lever **334**, and a rear pivoting lever **336**. As described in detail below, the components of the linkage assembly **332** operate in unison through actuation of the release button **316** by simultaneously retracting the pin **318** while also increasing the engagement slot **325** by moving the bracket **324** forward within the body **302**.

The front and rear pivoting levers **334**, **336** can have a variety of configurations, but in general the front pivoting lever **334** is configured to mate to the bracket **324** and the rear pivoting lever **336** is configured to mate to the pin **318**. Each pivoting lever **334**, **336** can have a generally elongate configuration but can be bowed around a mid-portion. A first end **334**A of the front pivoting lever **334** can extend at an angle in a rearward direction for allowing a slot **335** formed therein to slidably receive a post **333** formed on the release button **316**. A second end **334**B of the front pivoting lever **334** can be positioned forward of the central opening **302**A for abutting a mid-portion of the bracket **324**. The mid-portion of the front pivoting lever **334** can include a pivot joint **334**C for allowing the front pivoting lever **334** to pivot relative to the body **302**. Similarly, a first end **336**A of the rear pivoting lever **336** can extend at an angle in a forward direction for allowing a slot **337** formed therein to slidably receive the post **333** formed on the release button **316**. A second end **336**B of the rear pivoting lever **336** can be positioned rearward of the central opening **302**A for pivotally engaging a pin housing **318**A coupled to the pin **318**. The mid-portion of the rear pivoting lever **336** can include a pivot joint **336**C for allowing the rear pivoting lever **336** to pivot relative to the body **302**. The front and rear pivoting levers **334**, **336** can be connected to the release button **316** by a post **333** extending from the bottom of the release button **316** and into the body **302**. In particular, the post **333** can extend through the slots **335**, **337**. A screw **333***a* can be connected to the post **333** in order to prevent the front and rear pivoting levers **334**, **336** from being dislodged from the post **333**.

As best shown in FIGS. **17-18**, the bracket **324** is movably disposed within the cavity **322** such that an engagement slot **325** is formed between the bracket **324** and the body **302**. In this embodiment, the bracket **324** is mechanically connected to the release button **316** such that when the release button **316** is actuated to a release position, the bracket **324** will move to increase a size of the engagement slot **325** thereby releasing a cleaning head mated to the cleaning device. In the illustrated embodiment, the bracket **324** includes bores **326** which are aligned with projections **328** extending from an internal wall **341** of the body **302**. As will be described in detail below, as the bracket **324** slides within the body **302**, the projections **328** can extend into the bores **326** to encapsulate and clamp a portion of a cleaning head, such as a foldable portion **106**, between the bracket **324** and the internal wall **341**. In particular, the projections **328** can extend through the apertures **116**, **118** within the foldable portion **106** to secure the cleaning head **100** to the connector housing **300**. The bracket **324** can further include elongate arms **327** extending rearwardly from opposed terminal ends thereof. The arms **327** include slides that are configured to slidably receive projections (not shown) within the connector housing **302** in order to allow the bracket to slide forward and backward within the body **302**. The bracket **324** also includes a tab **340** configured to receive an input force from the second end **334**B of the front pivoting lever **334** to slide the bracket **324** within the housing, as discussed further below.

As indicated above, the linkage assembly **332** also includes a retractable pin **318** arranged on the rear surface **314** of the body **302**. The pin **318** is configured to project from the housing in order to secure a portion of a cleaning head, such as an aperture of the attachment tab **122** to the cleaning head. The pin **318** is also configured to be retracted into the housing to release the cleaning head. In the illustrated embodiment, the pin **318** is mated to a pin housing **318**A that is spring-biased in a direction that retracts the pin **318** into the housing. The pin housing **318**A mated to the pin has an indent **318**B formed therein that is configured to aid in locking the pin **318** in the extended position.

A locking mechanism **338** can be provided to prevent the pin **318** from retracting into the body **302** without the release button **316** being actuated. As shown in more detail in FIG. **15**A, the illustrated locking mechanism **338** includes a spring-biased member having a tab **338**A formed on the end thereof that engages the indent **318**B in the pin housing **318**A. The pin housing **318**A is pivotally connected to the rear pivoting lever **336** at the through-bore **336**C. The locking mechanism **338** also includes an angled surface **338**B on the end thereof that interacts with an angled surface **339** on the second end **336**B of the rear pivoting arm **336**. With the tab **338**A in engagement with the indent **318**B in the pin housing **318**A such that the pin **318** is locked in the extended position, movement of the second end **336**B of the rear pivoting lever **336** in a forward direction causes the angled surface **339** to push against the angled surface **338**B on the locking mechanism **338**, thereby causing the locking mechanism **338** to move against the bias of the spring **338**C thus moving the tab **338**A out of engagement with the indent **318**B. The spring bias on the pin housing **318**A thereafter causes the pin housing **318**A to move forwardly, retracting the pin **318** into the body **302**.

In certain exemplary embodiments, the body **302** and pin **318** can have different configurations. For example, in an exemplary embodiment, the body **302** can have two pins extending from the rear surface **314** of the body **302**. The body **302** can also include tabs (not shown) extending from

the upper edge or side edges of the rear surface **314** of the body **302** to aid in aligning attachment tabs of a cleaning head **300** with the pins. The body **302** can also include exterior tabs (not shown) and interior tabs (not shown) extending from the rear surface **314** of the body **302** to aid in aligning attachment tabs of a cleaning head **300** with the pins. The exterior tabs and interior tabs form a slot which further can secure an attachment tab of a cleaning head **300** to the pins. As in the embodiments described above, the pins can retract and extend within and from the housing.

FIGS. **12-15** illustrate the linkage assembly **332**, while omitting the body **302** and bracket **324** for clarity. In the illustrated embodiment, the release button **316** can slide within the body **302**, which moves both the front and rear pivoting levers **334**, **336**. In particular, as the release button **316** is moved in a release direction RD, the post **333** translates that motion to the first end **334**A, **336**A of the front and rear pivoting levers **334**, **336** in order to pivot the second end **334**B of the front pivoting lever forward in the body **302**, and to pivot the second end **336**B of the rear pivoting layer away from the rear of the body **302**.

Pivotal movement of the second end **336**B of the rear pivoting lever **336** releases the locking mechanism **338**, thus allowing the pin **318** to move to the retracted position within into the body **302**. When the release button **316** is released, the rear pivoting lever **336** returns to its initial position against the bias of a spring **336**D, causing the second end **336**B of the rear pivoting lever **336** to move rearwardly to push the pin housing **318**A thereby causing the pin **318** to extend from the body **302**. With the pin housing **318**A moved rearwardly, the tab **338**A will engage the indent **318**B in the pin housing **318**A, thereby retaining the pin **318** in the extended position.

Pivotal movement of the second end **334**B of the front pivoting lever **334** causes a projection **342** arranged on the second end **334***b* to contact the tab **340** such that the bracket **324** is pushed forward. Since the bracket **324** can move relative to the body **302**, this forward movement of the bracket **324** enlarges the engagement slot **325** so that a portion of a cleaning head (e.g., foldable portion **106**) can be inserted into the engagement slot **325**. With a portion of a cleaning head inserted, the bracket can be slid backwards within the body **302** in order to secure the cleaning head between the bores **326** and projections **328**.

FIGS. **16-21** show cross-sectional views taken at lines **16-16** and **17-17** in FIG. **9**, further illustrating the bores **326** and the projection **328**. As illustrated, the bracket **324** is in a retention position, where the engagement slot **325** has a minimal width and the projections **328** extend into the bores **326**. However, once the bracket **324** is actuated as detailed above, the bracket **324** moves in a forward direction FD, increasing the width of the engagement slot **325** and removing the projections **328** from the bores **326**. Even though only two channels and two projections are illustrated, a person skilled would appreciate that more or less channels or projections can be used, as well as other types of mechanical connections in order to secure a cleaning head to the connector housing **300**.

A securement tab **344** can be arranged within the front surface **312** of the body **302**. The securement tab **344** can be spring biased downward into a retention position by a spring **345**. When in the retention position, the securement tab **344** rests on top of the bracket **324**, with the bracket **324** fully pushed backward in the body **302** to minimize the width of the engagement slot **325**. However, when a new cleaning head is to be secured to the connector housing **300**, the release button **316** is actuated causing it to move to a release position, which in turn moves the bracket **324** forward in the body **302** to a release position. With the pin **318** retracted and the projections **328** not engaged within the bores **326**, a used cleaning head can fall off the connector housing **300** or be easily removed with minimal force. This enables the removal of a soiled cleaning head without requiring physical contact between the user and the soiled material.

In the release position, as shown in FIG. **18**, the bracket **324** is moved forward such that the securement tab **344** is pushed upward until an aperture **323** of the bracket **324** reaches a notch **346** arranged in the securement tab **344**. With the notch **346** arranged within the aperture **323**, the bracket **324** cannot move back to the retention position and is locked in the release position. Additionally, even though the bracket **324** is in the release position, the release button **316** can slide back to a retention position, and the pin **318** can extend outward and return to the retention position. The bracket **324** slides back to the retention position once a cleaning head is inserted into the engagement slot **325** and releases the securement tab **344** from the aperture **323**.

In another exemplary embodiment, when the bracket **324** is in the release position, and since the bracket **324** is connected to the other components of the linkage assembly **332**, the pin **318** can remain retracted within the body **302** in the release position, and the release button **316** can remain in a release position. In this embodiment, as the bracket **324** moves to the retention position, the pin **318** would extend from the housing, simultaneously securing a cleaning head via the bracket **324** and the pin **318**.

In order to move the linkage assembly **332** and its components back to a retention position, a portion of a cleaning head (e.g., foldable portion **106**) is inserted into the engagement slot **325**. When the portion of the cleaning head is fully inserted into the engagement slot **325**, the cleaning head will push the securement tab **344** upward, releasing the bracket **324** from the notch **346**. Since the bracket **324** and/or linkage assembly **332** is spring biased to the retention position, once the securement tab **344** releases the bracket **324**, the bracket **324** slides backwards to the retention position, securing the portion of the cleaning head which abutted the securement tab **344** within the engagement slot **325**. With the foldable portion **106** secured to the body **302** and the attachment tab **122** secured to the body **302**, the cleaning head **100** is secured at both the leading edge and trailing edge of the cleaning head **100**. With a portion of the cleaning head secured to the connector housing **300**, a suction inlet of the cleaning head is secured at the front surface **312** of the body **302** such that the foldable portion cannot move relative to the body **302**. Additionally, a cleaning head **100** secured to the connector housing **300** by the pin **318** and bracket **324** will cover the opening **320** and create a suction seal with the gasket **329**, allowing a suction force to flow from a suction source, through the tube **306**, the cavity **322**, a dirt collection chamber of the cleaning head, and through the nozzle of the cleaning head to collect debris into the dirt collection chamber.

FIGS. **23-26** illustrate another embodiment of a cleaning head **400** having a support structure **404**, a dirt collection chamber **402** for collecting debris removed from the surface, and a cleaning sheet **412**. As shown, the support structure **404** can be in the form of a generally planar rectangular sheet, e.g., formed from cardboard. One or more sides of the support structure **404** can be configured to fold upward to form a sidewall around an outer perimeter thereof. In the illustrated embodiment, the support structure includes foldable portions **406**, **408** arranged along a leading and trailing edges of the support structure **404**. The support structure can

be pre-bent, e.g., with creases formed therein, to facilitate folding up of the portions **406**, **408**. The foldable portions **406**, **408** allow the cleaning head to be attached to a cleaning device, as will be discussed in detail below.

A suction inlet **410**, e.g., a cut-out, may be arranged in the leading foldable portion **406** to allow debris to be suctioned into the dirt collection chamber **402**. A valve (not shown) may be arranged within the suction inlet **410** in order to prevent debris from falling back through the suction inlet **410** from the dirt collection chamber **402** when suction is not applied to the dirt collection chamber **402**.

The dirt collection chamber can be in the form of a dirt cup, a dirt bin, or any other suitable container for collecting dirt such as dust or wet and/or dry media. In some embodiments, the dirt collection chamber **402** is pleated and folded in such a way that when the foldable portion **406**, **408** are folded from the stored configuration to the use configuration at approximately 90°, the dirt collection chamber **402** can be unfolded to form an internal volume. As a result, when the foldable portion **406** is folded up, the sheet will form a dirt collection chamber having a volume therein for receiving and retaining debris. In the illustrated embodiment, the dirt collection chamber **402** is in the form of a folded, fabric sheet that is arranged to form a bag-like structure. For example, the sheet can have an elongate rectangular configuration with opposed ends of the sheet being folded to create a pleat. The bottom of each pleat can be secured to opposed sides of the support structure, e.g., by glue, heat sealing, or any other permanent attachment technique. The leading edge of the sheet can be secured to leading foldable portion **406** and the trailing edge of the sheet can be secured to the support structure.

When the cleaning device is operated to apply a suction force to the dirt collection chamber **402**, the dirt collection chamber **402** can be drawn upwardly away from the support structure **404**. For purposes herein, the term "upwardly" means that the dirt collection chamber extends in a direction away from the surface being cleaned. The dirt collection chamber **402** can be made from a permeable material which allows the applied suction force to pull the dirt collection chamber **402** open to form an internal volume within the dirt collection chamber **402**.

As will be appreciated, the support structure and the dirt collection chamber need not be the same shape or size. For example, the support structure may be larger than the dirt collection chamber in some embodiments. In some embodiments, the support structure may have a substantially rectangular shape (top view) while the dirt collection chamber has a generally oval, racetrack, or otherwise curved shape (top view).

As indicated above, the cleaning head **400** can include a cleaning sheet **412**. The cleaning sheet may be attached to the lower surface of the cleaning head, such as to the support structure. The cleaning sheet can be positioned on a surface of the support structure that is opposite to the surface on which the dirt collection chamber is attached. In some embodiments, the cleaning sheet may be larger than the support structure, although it may be the same size as, or smaller than, the support structure in other embodiments. The support structure and cleaning sheet may be the same shape or they may have different shapes. In use, the cleaning sheet can contact the surface to be cleaning, whereas the support structure may be spaced apart from the surface to be cleaned. The suction inlet **410**, however, can be aligned with a leading edge of the cleaning sheet to allow debris to be drawn into the chamber as the cleaning sheet is moved along a surface.

The cleaning head **400** can be removably secured to a cleaning device, such as to a connector **26** on a cleaning device **20**. In some embodiments, the connector **26** can include retention slots **26**A-**26**D arranged about the connecter **26** such that the ends **406**A, **406**B of foldable portion **406** and the ends **408**A, **408**B of foldable portion **408** can be advanced into and engaged within the slots **26**A-**26**D to secure the cleaning head **400** to the device **20**. In some embodiments, the connection between the ends **406**A, **406**B, **408**A, **408**B and the slots **16**A-**16**D can be a positive mechanical connection where a device within the connector **26** grips onto the ends **406**A, **406**B, **408**A, **408**B within the slots **26**A-**26**D. In some embodiments, a release button or tab can be arranged on the connector so that the positive mechanical connection can be released when the button is depressed in order to remove the cleaning head **400** from the connector **26**. In other embodiments, the ends **406**A, **406**B, **408**A, **408**B can include cut outs that receive a protrusion or other engagement structure on the connector to positively secure the cleaning head to the device until a release mechanism is actuated to release the cleaning head.

Once assembled, the foldable portion **406** is positioned at a leading portion of the assembly to allow debris in front of the cleaning head to be drawn into the chamber just prior to advancing the cleaning sheet over the surface to be cleaned. The connector **26** can include a front guard feature extending forward of the cleaning head and downward toward the floor surface, thus defining a nozzle region for allowing the suction force to be directed toward the surface to be cleaned. The front guard preferably does not contact the floor surface.

As stated above, the cleaning head can have various configurations to secure to the cleaning device. FIGS. **27**-**32** illustrate another embodiment of a cleaning head **500** having a dirt collection chamber **502** to collect debris removed from a surface. In this embodiment, the cleaning head **500** has a support structure **504** that is substantially planar and that includes a leading foldable portion **506**, which is arranged on a single side of the support structure **504**. A suction inlet **510** may be arranged in the foldable portion **506** to allow debris to be suctioned into the dirt collection chamber **502**. A valve may be arranged within the suction inlet **510** in order to prevent debris from falling back through the suction inlet **510**.

Similar to cleaning head **200**, cleaning head **500** can include a dirt collection chamber **502** attached to the support structure, e.g., via glue, heat sealed, or otherwise permanently affixed to the support structure. In this embodiment, the dirt collection chamber **502** is a foldable bag which can protrude upwardly from the support structure **504**. The dirt collection chamber **502** can be formed from a sheet of fabric that is pleated and folded in such a way that when the foldable portion **506** is unfolded from the stored configuration to the use configuration at approximately 90°, the dirt collection chamber **502** forms an internal volume. The dirt collection chamber **502** can be made from a permeable material to allow unfolding of the dirt collection chamber **502** under suction.

The cleaning head **500** can also include a cleaning sheet **512**, similar to the cleaning sheet **412**. The cleaning sheet may be attached to the lower surface of the support structure and can extend past the edge of the support structure **504**. The lower surface of the support structure may be positioned opposite to the surface on which the dirt collection chamber is attached to the support structure.

Since the dirt collection chamber only has a single foldable portion for connecting to the connector at the leading edge of the cleaning head, the cleaning sheet **512** can include

a securement portion **514** which can aid in securing the cleaning head **500** to the connector **36**. The securement portion **514** can have various configurations, and can be in the form of a pocket that extends around a portion **37** of the connector **36**. In other embodiments, the securement portion can be a strap, an adhesive, or any other features configured to engage the connector on the cleaning device.

The cleaning head **500** can be removably secured to the connector **36**. As shown, the connector **36** can include retention slots **36**A, **36**B arranged about the connecter **36** such that the ends **506**A, **506**B of the foldable portion **506** are arranged within the slots **36**A, **36**B when the foldable portion **506** is in a use configuration. In some embodiments, the connection between the ends **506**A, **506**B and the slots **36**A, **36**B can be in the form of a positive mechanical connection, friction fit, or other suitable mechanical engagement, similar to cleaning head **200**. In some embodiments, to fully secure the cleaning head **500** to the connector **36**, both the ends **506**A, **506**B must be secured to the slots **36**A, **36**B and the pocket **516** must be secured on the portion **17'**. A release mechanism can also be provided for releasing the cleaning head from the connector on the device.

FIGS. **33-36** illustrate another embodiment of cleaning head **600** having a support structure **604** and a dirt collection chamber **602** to collect debris removed from the surface, similar to the cleaning head **200**. The illustrated support structure **604** is in the form of a planar rectangular sheet, e.g., a cardboard sheet, that includes a foldable portion **606**, which is arranged on a single side of the support structure **604**. In this embodiment, the support structure **604** has a length extending between the leading and trailing edges that is reduced, such that a length of the support structure is significantly less than that of the cleaning sheet. The support structure extends along only the front or leading portion of the cleaning head. A suction inlet can be arranged in the foldable portion **606** to allow debris to be suctioned into the dirt collection chamber **602**. A valve may be arranged within the suction inlet in order to prevent debris from falling back through the suction inlet.

The dirt collection chamber **602** can have a similar configuration to the aforementioned dirt collection chambers, however in this embodiment the dirt collection chamber **602** can be attached to the support structure along the leading edge only. As a result, the remainder of the chamber, which can be folded to form a bag, can extend freely from the support structure. Such a configuration allows a portion of the connector on the device to extend between the bag and the cleaning sheet to facilitate attachment, as will be discussed below. As with prior embodiments, the dirt collection chamber can be made from a permeable material to allow unfolding of the dirt collection chamber **602** under suction.

As further shown, the cleaning sheet **612** may be attached to the lower surface of the cleaning head **600** at the support structure **604**. The lower surface of the support structure may be positioned opposite to the surface on which the dirt collection chamber is attached to the support structure. Due to the reduced length of the support structure, the support structure is only attached to the leading portion of the cleaning sheet.

In order to removably attach the cleaning head **600** to the connector **46**, the connector **46** can include a lower support structure **47** and an upper housing structure defining a confinement volume therein arrange to receive the chamber. With the chamber **602** arranged within the confinement volume, the foldable portion **606** will extend along the leading edge, and the cleaning pad **612** will extend along the underside of the lower support structure **47**. This arrangement separates the dirt collection chamber **602** from the cleaning pad **612**, and allows for a shorter support structure **604** to be used since the confinement volume can support the dirt collection chamber **602** and the lower support structure **47** can support the cleaning pad **612** while in use.

As stated above, the cleaning heads can have a variety of configurations. FIGS. **37-38** depict another embodiment of a cleaning head **700**. The cleaning head **700** includes a front wall **702**, a nozzle **704** arranged in the front wall **702**, a dirt collection chamber **706**, and a cleaning pad **708**. The dirt collection chamber **706** can be formed from a single piece of material **710** arranged over and secured to a support structure **712**. During transportation and storage, the front wall **702** is folded parallel to the cleaning pad **708**. When the front wall **702** is folded to be substantially perpendicular to the cleaning pad **708**, the material **710** is raised up, creating a cavity between the support structure **712** and the material **710** to form the dirt collection chamber **706**. As the connector **714** is arranged on the cleaning pad **708**, a tab **716**, arranged on the side of the connector **714**, can deform or pivot in order to clasp the support structure **712** of the cleaning head **700** to secure the cleaning head **700** to the connector **714**.

FIGS. **39-40** depict another embodiment of a cleaning head **800**. The cleaning head **800** includes a pleated wall **802**, a nozzle **804** arranged in the pleated wall **802**, a dirt collection chamber **806**, and a cleaning pad **808**. The dirt collection chamber **806** can be formed from a top wall **810** and the cleaning pad **808**, with the pleated wall **802** encapsulating the sides and front of the dirt collection chamber **806**. The pleated wall **802** can include multiple folds, or can include no folds. Additionally, the top wall can be formed partially or fully from a filter material. During transportation and storage, the top wall **810** is folded parallel to the cleaning pad **808** at a hinged edge **811**. When the top wall **810** separated from the cleaning pad **808**, the pleated wall **802** extends at the pleats in order to expand the increased distance between the cleaning pad **808** and the top wall **810**. In some embodiments, the top wall **810** can be raised and the pleated wall **802** expanded after the cleaning head **800** is attached to the connector **814**. In certain embodiments, a suction force passing through the connector can create the force required to expand the pleated wall **802**, creating a cavity between the cleaning pad **808** and the top wall **810** to form the dirt collection chamber **806**. In an alternative embodiment, the dirt collection chamber is in the form of a foldable bag having a stiff front formed from cardboard or cardstock. The stiff front can be used to guide the cleaning head **800** into the cleaning device, and is secured to the cleaning device via the stiff front.

FIGS. **41-43** depict another embodiment of a cleaning head **900**. The cleaning head **900** includes a front wall **902**, a nozzle **904** arranged in the front wall **902**, a self-opening dust cup **906**, and a cleaning pad **908**. In this embodiment, the dirt collection chamber can include the self-opening dust cup **906** which opens up when placed under suction when the cleaning head **900** is arranged on a connector **914**. The dust cup **906** includes a filter member **910** and a support structure **912** to support the filter member **910**, where the filter member **910** is configured to allow a suction force to pass therethrough.

FIG. **44** depicts another embodiment of a cleaning head **1000**. The cleaning head **1000** includes a front wall **1002**, a pleated side wall **1003**, a nozzle **1004** arranged in the front wall **1002**, a dirt collection chamber **1006**, a cleaning pad **1008**, a top wall **1010**, and a support structure **1012**. The front wall **1002** can be a clear window in order to see the

contents of the dirt collection chamber **1006**. FIG. **23** is a perspective view of another exemplary embodiment of a cleaning head. In this embodiment, the dirt collection chamber **1006** is a foldable bag secured to the stiff front wall **1002**. The dirt collection chamber **1006** is arranged such that the chamber is substantially within the middle of the cleaning head **1000** and extends from the front edge to the back edge of the cleaning head **1000**. Additionally, the connector **1014** connected to the cleaning head **100** includes a front window **1016** as to no obstruct the view through the front wall **1002**.

FIGS. **45-46** depict another embodiment of a cleaning head **1100**. The cleaning head **1100** includes a front wall **1102**, a nozzle **1104** arranged in the front wall **1102**, a back wall **1106**, a cleaning pad **1108**, and a top wall **1110**. The top wall **1110** can include pleats which allow the top wall **1110** to expand when the cleaning head **1100** is unfolded. The front wall **1102**, back wall **1106**, and top wall **1110** encapsulate a dirt collection chamber **1107**. In this embodiment, the dirt collection chamber **1107** can be formed from stiff material that has been folded for shipping. The folded material can be unfolded in order to form an internal volume as the dirt collection chamber **1107**. The shape of the dirt collection chamber **1107** depends on the folds used to form the cleaning head **1100**. The cleaning head **1100** can further include tabs **1114** which snap into a retention feature on a cleaning device to secure the cleaning head **1100** within the cleaning device.

FIGS. **47-48** depict another embodiment of a cleaning head **1200**. The cleaning head **1200** is substantially similar to the cleaning head **1100**. Therefore, similar components will not be discussed. The cleaning head **1200** includes a front wall **1202**, a nozzle **1204** arranged in the front wall **1202**, a back wall **1206**, a cleaning pad **1208**, and a top wall **1210**. The cleaning head **1200** can further include tabs **1214** which snap into a retention feature on a cleaning device to secure the cleaning head **1200** within the cleaning device. The difference between the cleaning head **1100** and the cleaning head **1200** is that the top wall **1210** is formed from distinct panels, forming a trapezoidal shape for the dirt collection chamber.

FIGS. **49-52** depict another embodiment of a cleaning head **1300**. The cleaning head **1300** includes a cleaning pad **1302**, a dirt collection chamber **1304**, and multiple attachment points **1306** arranged at the corners of the cleaning pad **1302**. The attachment points are configured to allow the attachment arms **1308** of a connector **1310** to slide within each of the attachment points **1306**. The attachment arms **1308** of the connector **1310** can slide inward and outward such that when a user places the cleaning head **1300** on the floor, a user can place the connector **1310** on the top of the cleaning head **1300** and then actuate the attachment arms **1308** to extend into the attachment points **1306**. The attachment points **1306** can be pockets attached to the cleaning pad **1302**, indents in the cleaning pad **1302**, or a form of attachment feature, such as hook and loop fasters.

FIG. **53** depicts another embodiment of a cleaning head **1400**. The cleaning head **1400** is substantially similar to the cleaning head **1300**, expect that the attachment points **1306** are arranged on the sides of the cleaning head **1402** in a line, parallel and next to the dirt collection chamber **1404**, instead of being angled outward in the corners. As such, the attachment arms **1408** would move outward parallel to the front edge of the cleaning head **1402** instead of diagonally to the corners.

Another exemplary embodiment of a cleaning head can include a dirt collection chamber in the form of a box formed from a stiff material, such as cardboard or cardstock. The top of the dirt collection chamber can include a filter, which can be a permeable material which allows suction to be applied through the filter to the dirt collection chamber. The dirt collection chamber can also include tabs or slots arranged on the sides of the dirt collection chamber in order to secure the cleaning head to the cleaning device. The dirt collection chamber can also be secured to a cleaning pad.

In another exemplary embodiment of a cleaning head, the dirt collection chamber is in the form of a foldable box formed from a stiff material, such as cardboard or cardstock. The top of the dirt collection chamber includes a filter. The dirt collection chamber can be folded during transportation for increased shipping efficiency. When desired to be used the dirt collection chamber can be unfolded to create an internal volume. In order to keep the dirt collection chamber in a use configuration, end tabs, which can be integral to the dirt collection chamber, can be folded towards the internal volume of the dirt collection chamber to prevent collapse of the chamber.

In another exemplary embodiment of a cleaning head, the dirt collection chamber is in the form of a foldable box which is manufactured separately from the cleaning pad. When desired to be used, the dirt collection chamber can be unfolded and secured to the cleaning pad. The cleaning pad can include pockets or slots which can receive tabs on the dirt collection chamber.

In other exemplary embodiments of a cleaning head, the dirt collection chambers are each in the form of a foldable box. Each dirt collection chamber can further include tabs which are arranged on the top surface of the dirt collection chamber. The tabs can include a slot which the end tabs can fold into to further secure the dirt collection chamber in a use configuration. Additionally, the tabs can extend to allow the cleaning device to snap over the tabs to secure the cleaning head to the cleaning device.

In another exemplary embodiment of a cleaning head, the end tabs of a foldable dirt collection chamber can include two parts extending from the top surface and bottom surface of the chamber. The end tabs can be secured in a use configuration via tap or adhesive arranged on the end tabs. Additionally, the end tabs can be secured using tabs locks, which include one tab portion having a male connector, and other tab having a female connector, such as a slot.

In other exemplary embodiments of a cleaning head, each dirt collection chamber can be reusable, while the cleaning pad is not reusable. The dirt collection chamber can include an opening mechanism which allows for emptying the contents of the dirt collection chamber, such as a hinge connection. Additionally, the dirt collection chamber can include a removable drawer in order to empty the contents of the chamber.

In another exemplary embodiment of a cleaning head, the dirt collection chamber is in the form of a bag having a cleaning pad secured to the chamber. The chamber can include side pockets which allow arms of the cleaning device to slide within in order to secure the cleaning head to the cleaning device.

In another exemplary embodiment of a cleaning device, the cleaning device can include a vacuum mode and a mop mode. The handle of the cleaning device can be used to engage the vacuum mode or the mop mode, where suction is only applied in the vacuum mode and the cleaning pad is retracted into the cleaning device.

In other exemplary embodiments of a cleaning head, the dirt collection chamber is a foldable bag, and the cleaning head includes a semi-rigid layer that tucks into the front,

rear, and sides of the cleaning device. Additionally, in some embodiments, the cleaning head can include tabs which extend through the cleaning device to further secure the cleaning head to the cleaning device.

In other exemplary embodiments of a cleaning head, the cleaning head can be formed from minimal stiff material. The dirt collection chamber can be a foldable bag and include a partial from portion made from a stiff material. The cleaning head can further include tabs which snap into a retention feature on the cleaning device to secure the cleaning head within the cleaning device.

Various methods for forming a cleaning head are also provided herein. In general, a cleaning head can be manufactured in a flat, unfolded configuration to maximize shipping efficiency and cost. The cleaning head is then unfolded when desired to be used with a cleaning device, where the unfolding of the cleaning head creates an internal volume within the dirt collection chamber. The cleaning head can then be secured to the connector of the cleaning device and used with suction and a cleaning pad. When the cleaning head has been sufficiently soiled, the cleaning head, including the dirt collection chamber and the cleaning pad can be removed from the cleaning device and disposed of A new cleaning pad can then be unfolded and attached to the cleaning device to be used.

For purposes herein, dirt being suctioned into the dirt collection chamber may include dry and/or wet media. For example, in some embodiments, a liquid applied to the surface may be absorbed by a cleaning sheet and also suctioned by the vacuum into the dirt collection chamber. In some embodiments, the wet media may be absorbed by at least a portion of the material used to form the dirt collection chamber. In some embodiments, the dirt collection chamber may be formed of a material which allows for fluid absorption into the material but does not allow for fluid transfer through the material. In such embodiments, fluid may not travel through the dirt collection chamber. For example, the material used to form the dirt collection chamber may be absorptive on the inner side of the dirt collection chamber, but impermeable.

In some embodiments, the cleaning head includes a support structure to which the dirt collection chamber is attached. In such embodiments, the user may simply attach the cleaning head to the cleaning device, operate the cleaning device to move dirt from the surface and into the dirt collection chamber, remove the cleaning head, and dispose the cleaning head into a trash receptacle. Such a process may be repeated each time the user cleans the surface.

In some embodiments, the cleaning device may include a cleaning sheet and/or a liquid spray assembly to help with cleaning. In such embodiments, because the cleaning head may be the only part of the cleaning device to contact the surface and contain the wet and/or dry debris, the remainder of the cleaning device may remain clean throughout and after operation of the cleaning device.

In some embodiments, the cleaning head includes a suction inlet to move debris from the surface into the dirt collection chamber. In some embodiments, the suction inlet includes a suction nozzle that, in some embodiments, extends laterally across a front of the cleaning head. The suction nozzle may be permanently attached to the cleaning head in some embodiments. For example, the suction nozzle may be integrally formed with the support structure of the cleaning head. The suction nozzle also may be removably attached to the cleaning head in other embodiments. In some embodiments, the suction nozzle is fluidically connected to a vacuum source of the cleaning head.

In some embodiments, the dirt collection chamber is positioned on the upper side of the cleaning head. In some embodiments, the dirt collection chamber protrudes from the upper side of the cleaning head.

In some embodiments, the dirt collection chamber may be arranged to maintain the dirt within the dirt collection chamber once the dirt has been moved into the dirt collection chamber. In some embodiments, the dirt collection chamber includes a lip and internal valve that keeps dust, dry media, and/or wet media within the dirt collection chamber once the dirt has been moved into the chamber, thereby preventing dust and dry media from exiting via the suction inlet, such as when the vacuum is powered off. In some embodiments, the dirt collection chamber may include a selectively openable and closeable valve at or near the air flow conduit. In some embodiments, the valve may include one or more flaps that are pivotable between an open position when the cleaning device is turned on and a closed position when the cleaning device is turned off.

As will be appreciated, in some embodiments, the valve may be integrally formed with at least a portion of the cleaning head. For example, the valve may be integrally formed with the support structure. The valve also may be separately formed and attached to the cleaning head. For example, they valves may be fixedly attached to the dirt collection chamber.

In some embodiments, the cleaning device includes a body having a handle, a vacuum, source, and a connector to connect the cleaning head to the cleaning body. In some embodiments, the connector includes a first engagement element and the cleaning head includes a second engagement element arranged to engage with the first engagement element to connect the cleaning head to the body of the cleaning device. In such embodiments, the cleaning head is held to the connector once the first and second engagement elements are engaged with one another.

In some embodiments, when the cleaning head is attached to the cleaning device, at least a portion of the dirt collection chamber may be covered by the cleaning device. For example, in some embodiments, the dirt collection chamber may be covered by the connector used to connect the cleaning head to the cleaning device. In some embodiments, the dirt collection chamber may be formed at least in part by an air filter. In such embodiments, the air filter portion is covered by the connector when the cleaning head is attached to the cleaning device, and suction is applied to the air filter.

In some embodiments, the cleaning head is arranged to be disposable. For example, the cleaning head may include a support that is made of a thermoformed plastic or a cardboard pulp. In some embodiments, the cleaning heads are stackable. In some embodiments, the dirt collection chambers are arranged to be collapsible. For example, the dirt collection receptacle may include a bag.

Certain exemplary implementations have been described to provide an overall understanding of the principles of the structure, function, manufacture, and use of the systems, devices, and methods disclosed herein. One or more examples of these implementations have been illustrated in the accompanying drawings. Those skilled in the art will understand that the systems, devices, and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary implementations and that the scope of the present invention is defined solely by the claims. The features illustrated or described in connection with one exemplary implementation may be combined with the features of other implementations. Such modifications and variations are intended to be included within the

scope of the present invention. Further, in the present disclosure, like-named components of the implementations generally have similar features, and thus within a particular implementation each feature of each like-named component is not necessarily fully elaborated upon.

Approximating language, as used herein throughout the specification and claims, may be applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as "about," "approximately," and "substantially," are not to be limited to the precise value specified. In at least some instances, the approximating language may correspond to the precision of an instrument for measuring the value. Here and throughout the specification and claims, range limitations may be combined and/or interchanged, such ranges are identified and include all the sub-ranges contained therein unless context or language indicates otherwise.

One skilled in the art will appreciate further features and advantages of the invention based on the above-described implementations. Accordingly, the present application is not to be limited by what has been particularly shown and described, except as indicated by the appended claims. All publications and references cited herein are expressly incorporated by reference in their entirety.

What is claimed is:

1. A cleaning device connector, comprising:
- a housing having a front wall, a rear wall, a bottom surface, and a top surface;
- a cavity arranged within the bottom surface of the housing;
- a bracket arranged within the cavity of the housing;
- a pin extending from the rear wall of the housing;
- a release button positioned on the housing and configured to move the bracket and the pin from a first position to a second position; and
- a linkage assembly arranged within the housing, the linkage assembly including a front arm connected to the release button and the bracket, and a rear arm connected to the release button and the pin.

2. The connector of claim **1**, wherein the housing includes at least one projection disposed within the cavity.

3. The connector of claim **2**, wherein the bracket includes at least one bore aligned with the at least one projection.

4. The connector of claim **3**, wherein the at least one projection is configured to be positioned within the at least one bore when the bracket is in the second position.

5. The connector of claim **1**, wherein the front and rear arms are pivotally connected to the housing.

6. The connector of claim **1**, wherein actuation of the release button is configured to simultaneously move the bracket and the pin from the first position to the second position.

7. The connector of claim **1**, wherein the pin is partially retracted within the housing in the second position.

8. The connector of claim **1**, wherein the bracket is configured to slide longitudinally within the cavity between the first position and the second position.

9. The connector of claim **1**, wherein the housing further includes a securement tab configured to lock the bracket in the second position.

10. The connector of claim **9**, wherein the securement tab is configured to release the bracket from the second position in response to insertion of a cleaning head into the cavity.

11. A cleaning device assembly, comprising:
- a cleaning device, comprising
  - a body having a proximal end and a distal end;
  - a vacuum source positioned within the body;
  - a handle coupled to the proximal end of the body;
  - a connector housing coupled to the distal end of the body, the connector housing comprising:
    - a front wall, a rear wall, a bottom surface, and a top surface;
    - a cavity arranged within the bottom surface of the housing;
    - a bracket arranged within the cavity of the housing;
    - a pin extending from the rear wall of the housing; and
    - a release button positioned on the housing and configured to move the bracket and the pin from between a first position to a second position; and
- a cleaning head removably attached to the connector housing of the cleaning device, the cleaning head comprising:
  - a foldable portion configured to connect to the bracket of the connector housing;
  - an attachment tab configured to connect to the pin of the connector housing; and
  - a cleaning pad.

12. The cleaning device of claim **11**, wherein the foldable portion of the cleaning head is secured between the bracket of the connector and an internal surface of the cavity.

13. The cleaning device of claim **11**, wherein the pin of the connector is arranged within a through-bore of the attachment tab.

14. The cleaning device of claim **11**, wherein a receptacle defining a dirt collection chamber is arranged within the cavity of the cleaning head.

15. The cleaning device of claim **14**, wherein the vacuum source is configured to apply a suction force to the dirt collection chamber.

16. The cleaning device of claim **11**, wherein a linkage assembly is arranged within the housing, the linkage assembly having a front arm connected to the release button and the bracket, and a rear arm connected to the release button and the pin.

* * * * *