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Nichols et al.

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(54) **MICROPLATE KIT**

(75) Inventors: **Michael J. Nichols**, Roslindale, MA (US); **Louis J. Guarracina**, Topsfield, MA (US)

(73) Assignee: **HighRes Biosolutions, Inc.**, Woburn, MA (US)

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(22) Filed: **Jan. 14, 2008**

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(51) **Int. Cl.**
B01L 3/00 (2006.01)

(52) **U.S. Cl.** **422/102**; 422/63; 422/65; 422/66; 422/67; 422/99; 436/47; 436/43; 436/48; 294/15; 294/16; 294/17; 294/131; 206/710; 206/711

(58) **Field of Classification Search** 422/102; 294/15, 16, 17, 131; 436/47, 43, 48; 206/710, 206/711

See application file for complete search history.

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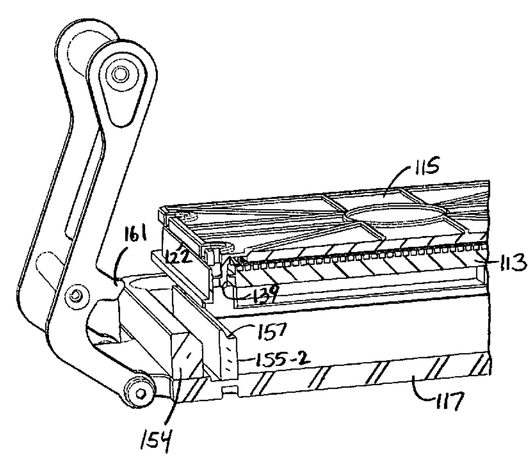
Primary Examiner—Jill Warden
Assistant Examiner—Sally A Sakelaris
(74) *Attorney, Agent, or Firm*—Hoffman Warnick LLC

(57) **ABSTRACT**

A reusable microplate kit for use in the life sciences industry includes a microplate and a removable lid. The microplate includes a sample area with a plurality of individual wells and a hollow outer frame formed around the sample area, the frame being shaped to include a plurality of openings in its top surface. The lid includes a plate, a plurality of latches formed on the underside of the plate and a compressible gasket affixed to the underside of the plate. In use, the lid is mounted on the microplate by inserting each latch through a corresponding opening until the latch snaps into engagement with the frame. In this manner, the plate and gasket together serve to seal off each well from the outside environment. The microplate kit additionally includes a tool for disengaging the lid from the microplate and thereby assist in their separation.

17 Claims, 16 Drawing Sheets



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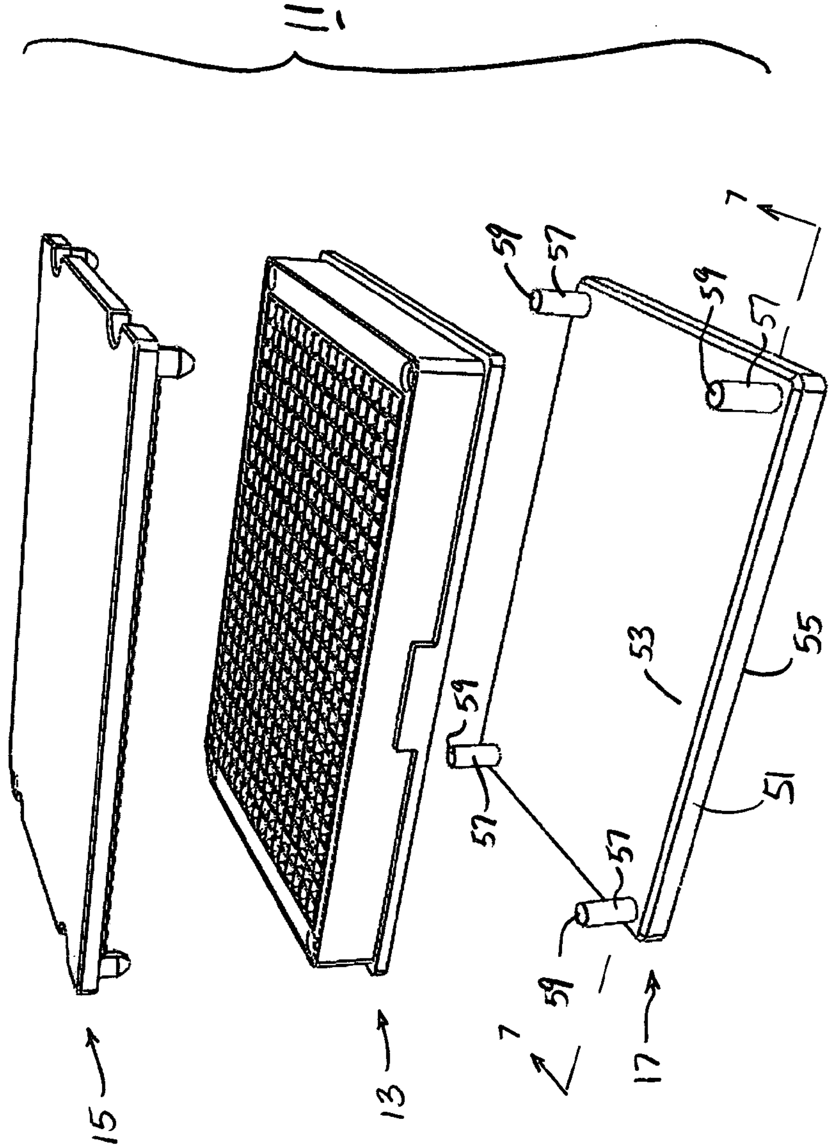

FIG. 1

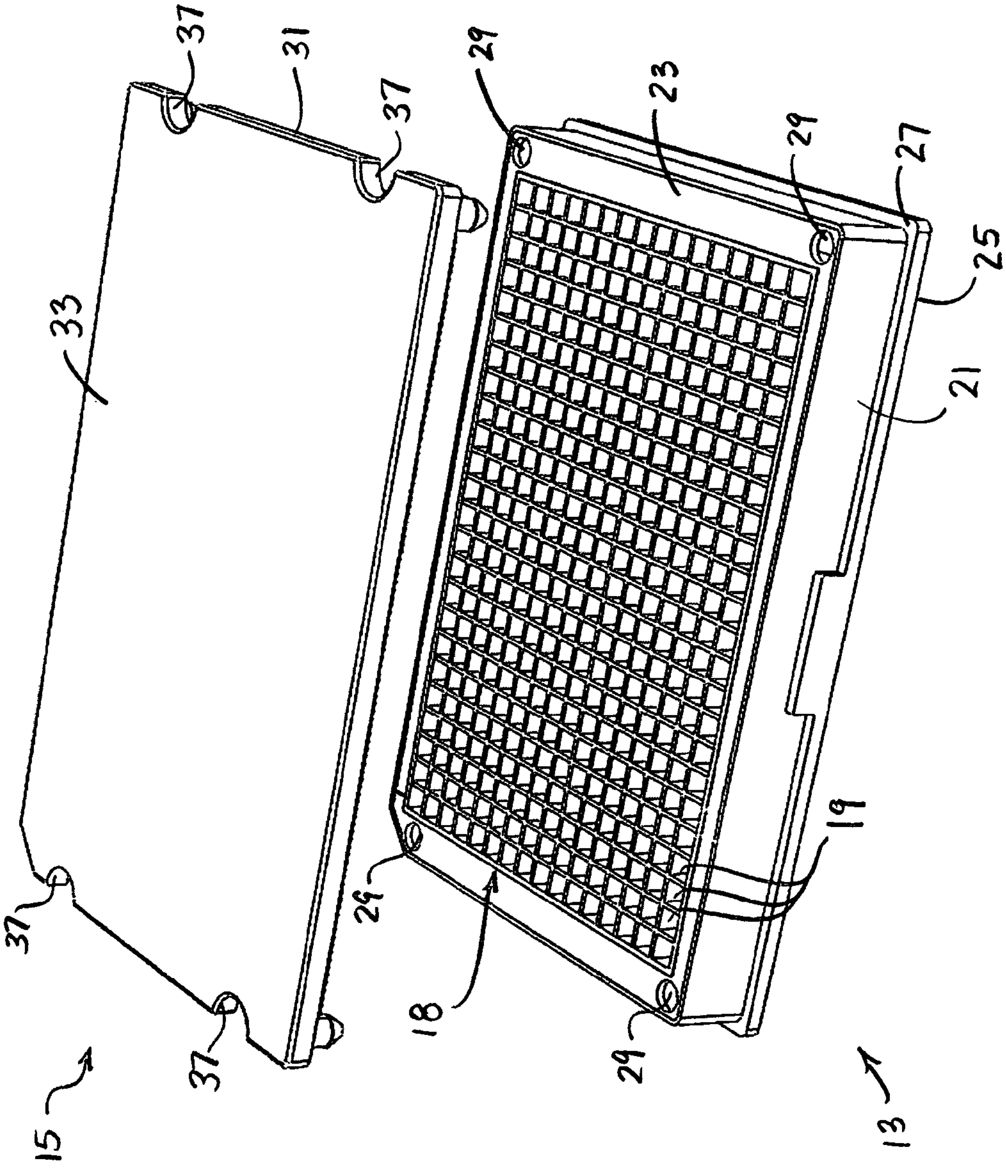

FIG. 2

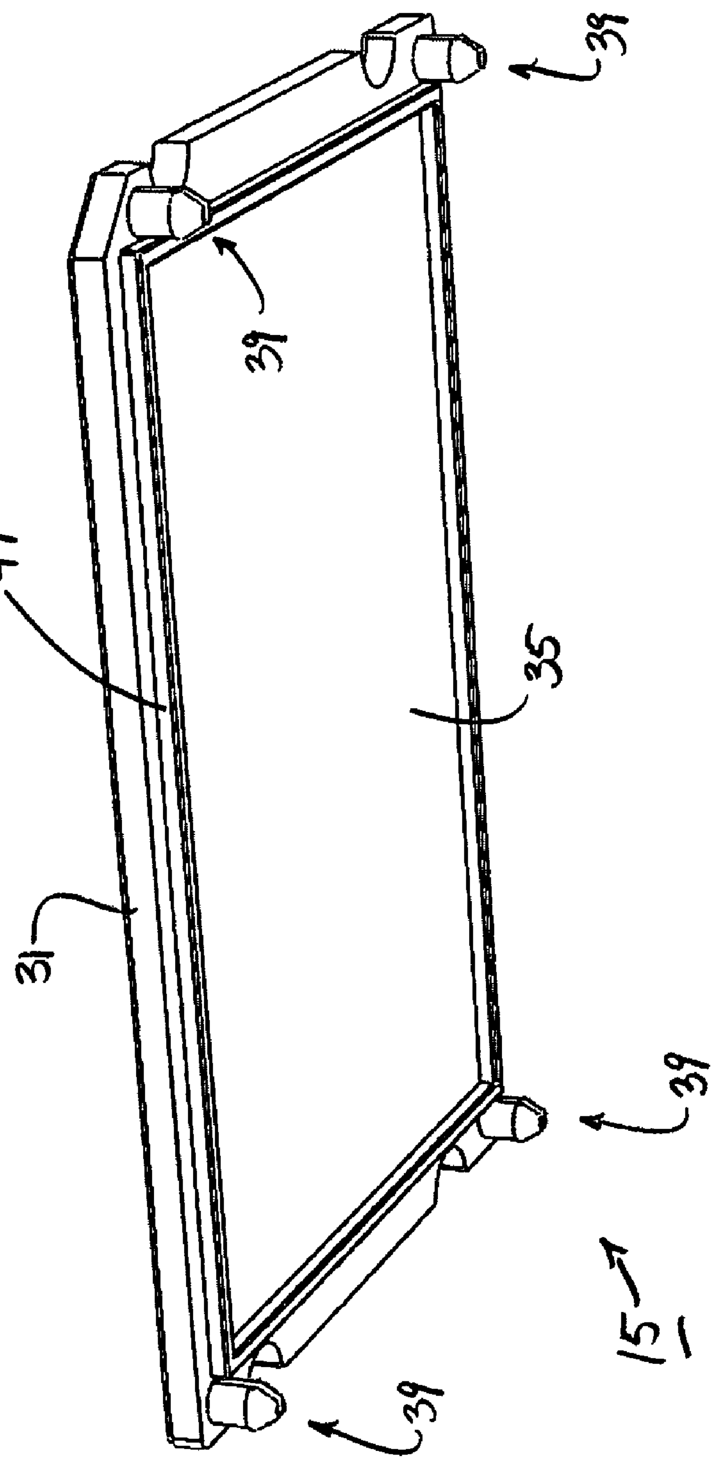

FIG. 3

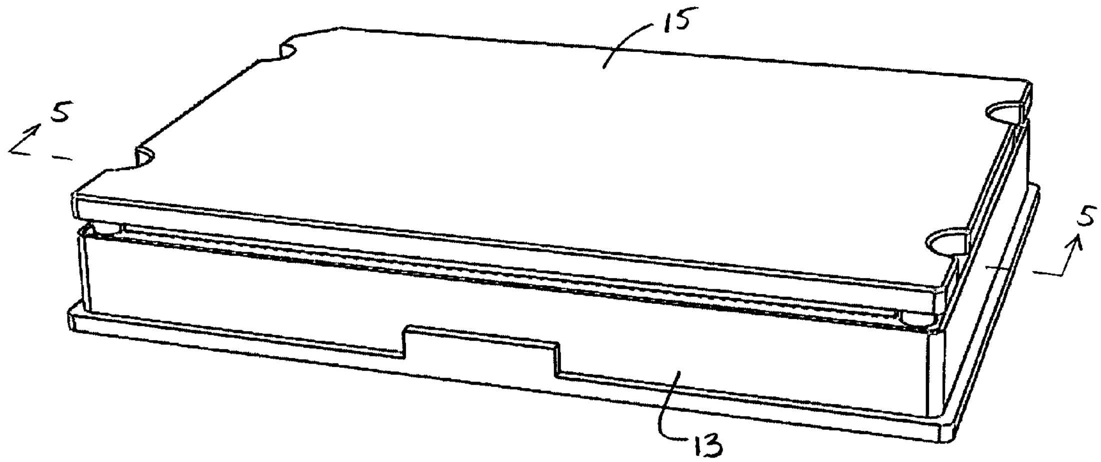

FIG. 4(a)

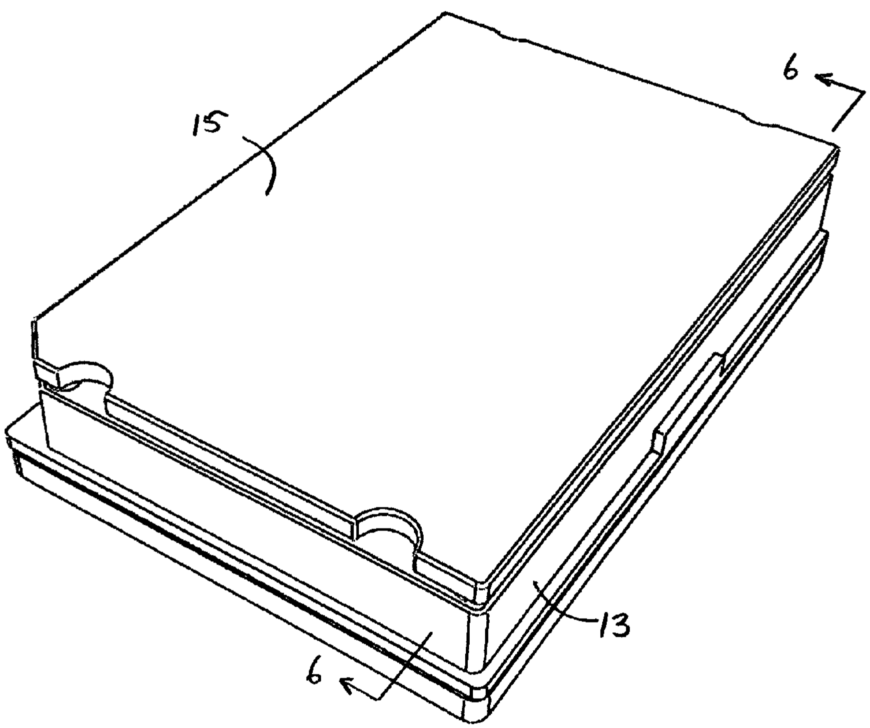

FIG. 4(b)

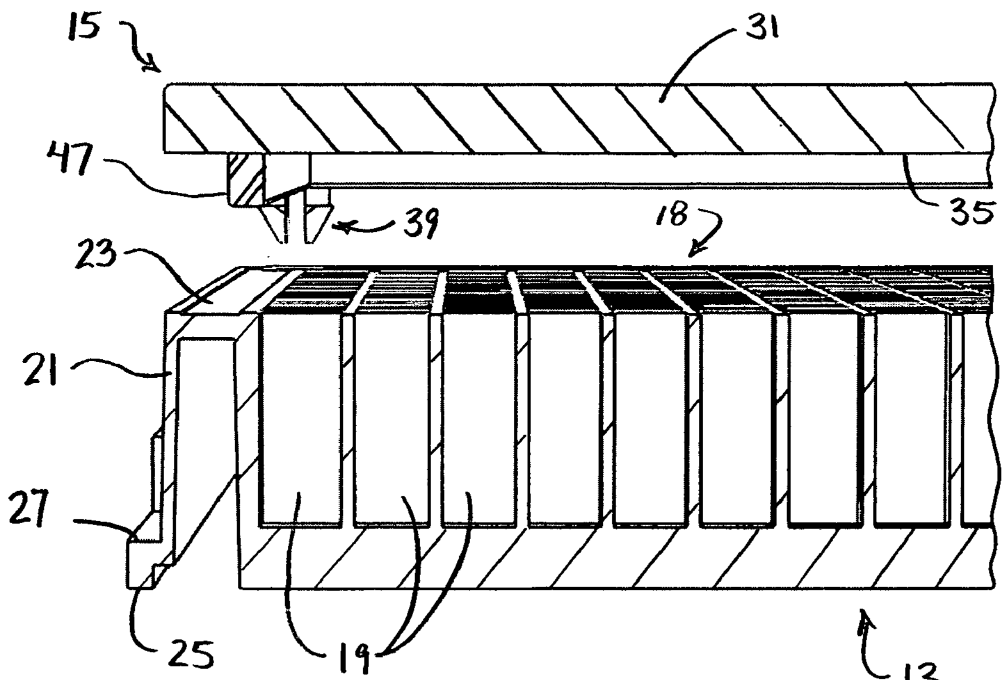

FIG. 5(a)

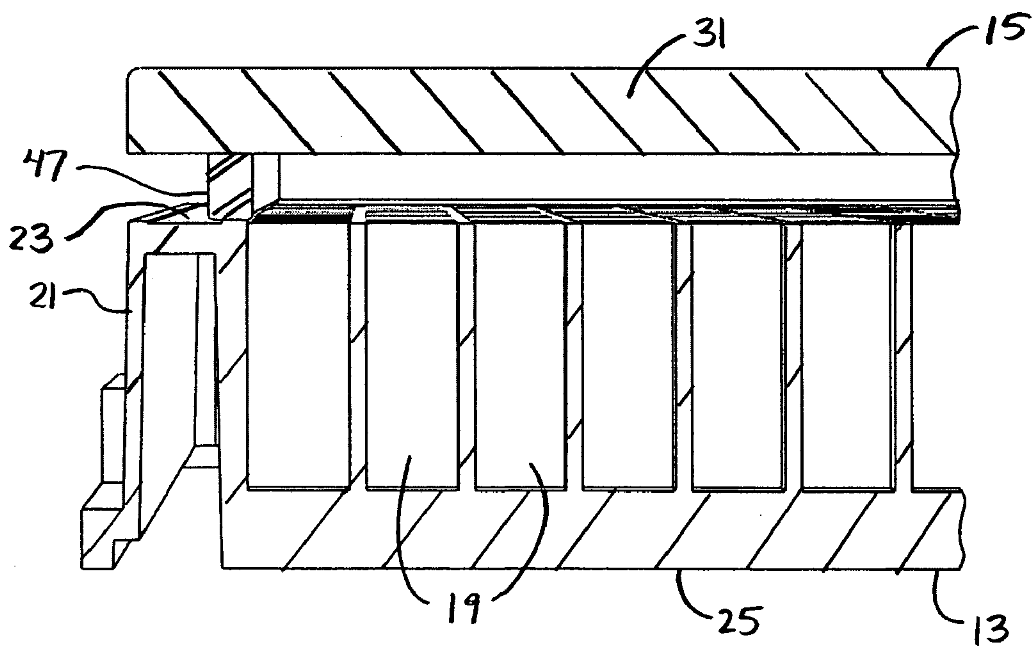

FIG. 5(b)

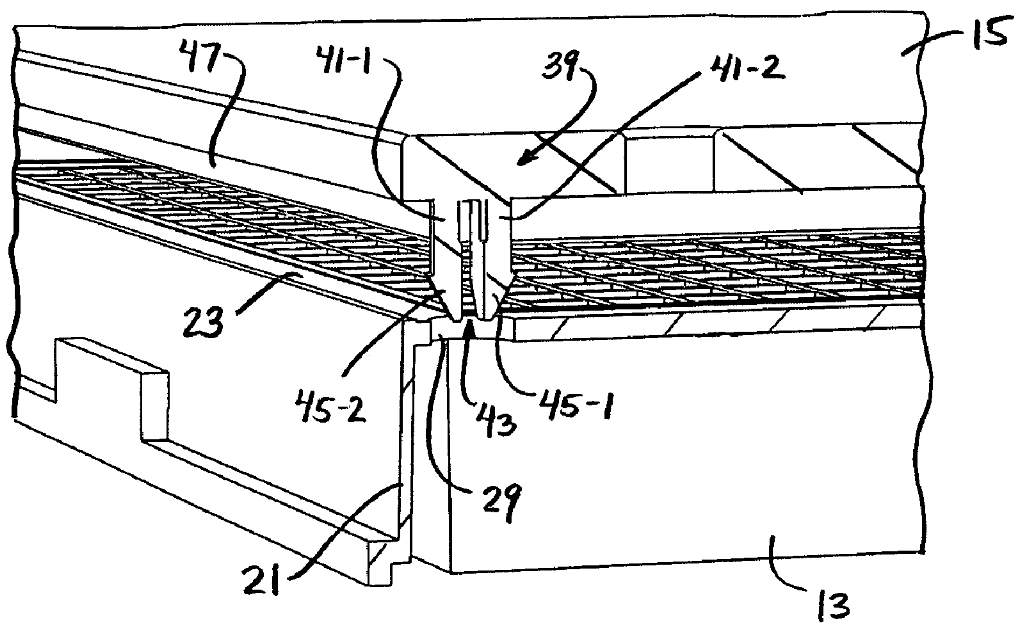
47
41-1
39
41-2
15
23
45-2
43
45-1
29
21
13

FIG. 6(a)

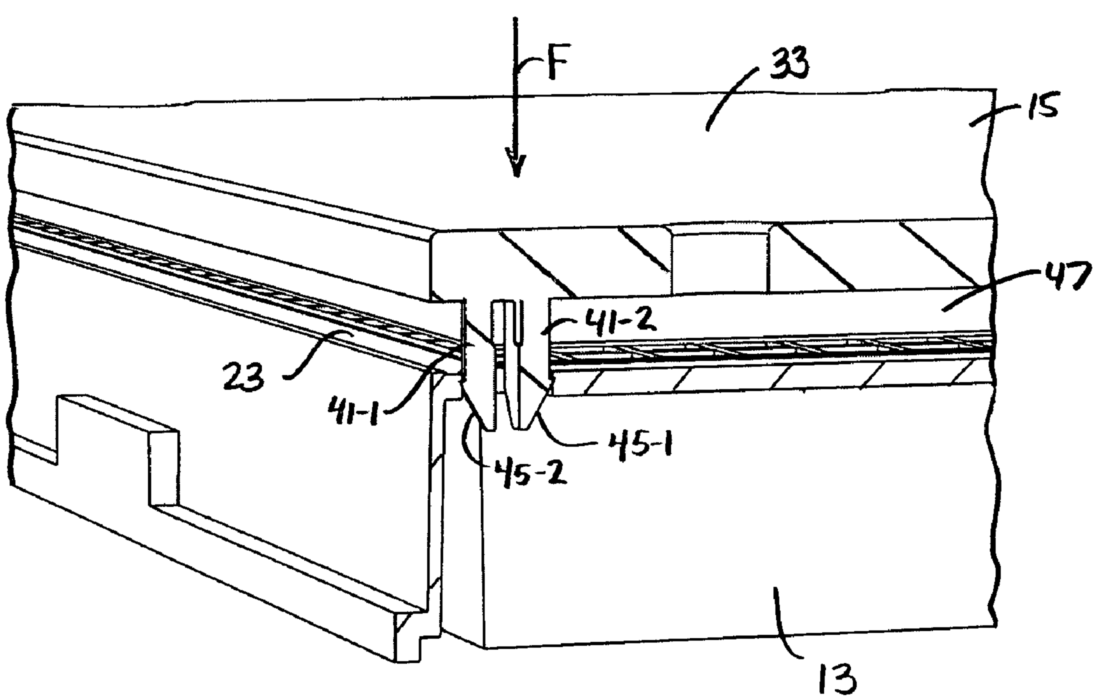
F
33
15
47
41-2
23
41-1
45-1
45-2
13

FIG. 6(b)

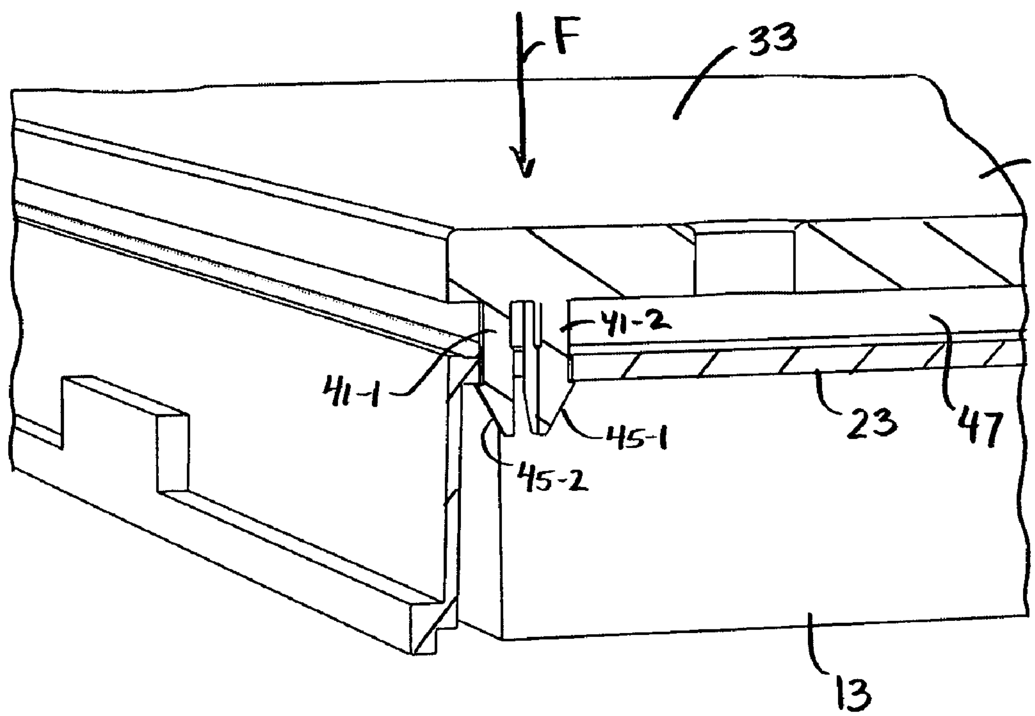

FIG. 6(c)

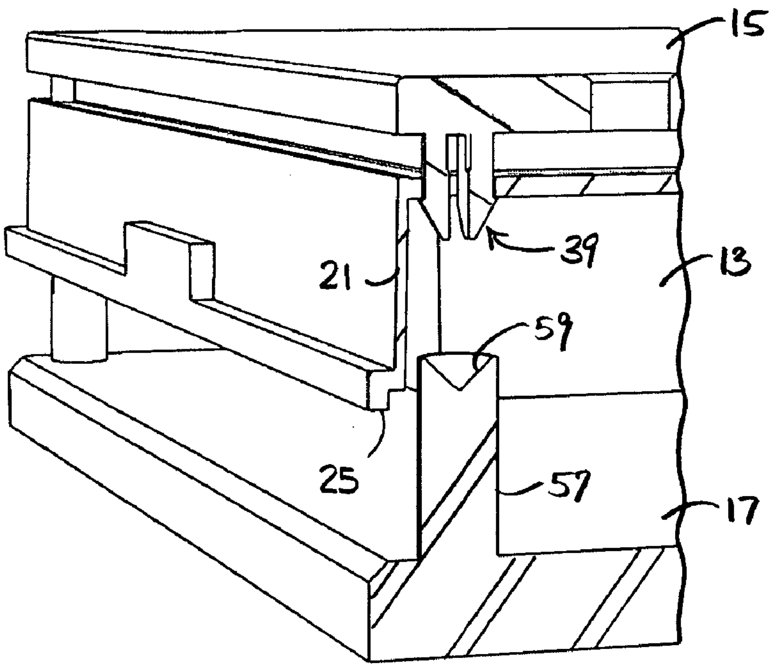

FIG. 7(a)

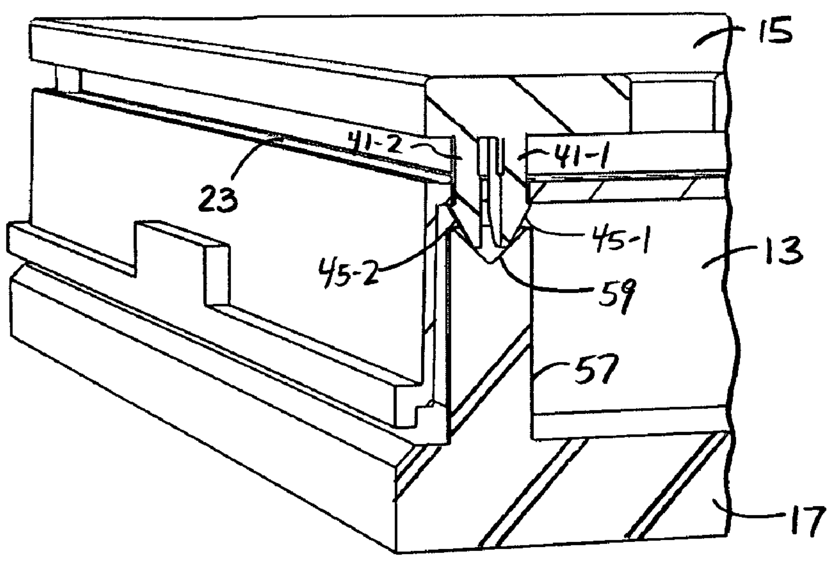

FIG. 7(b)

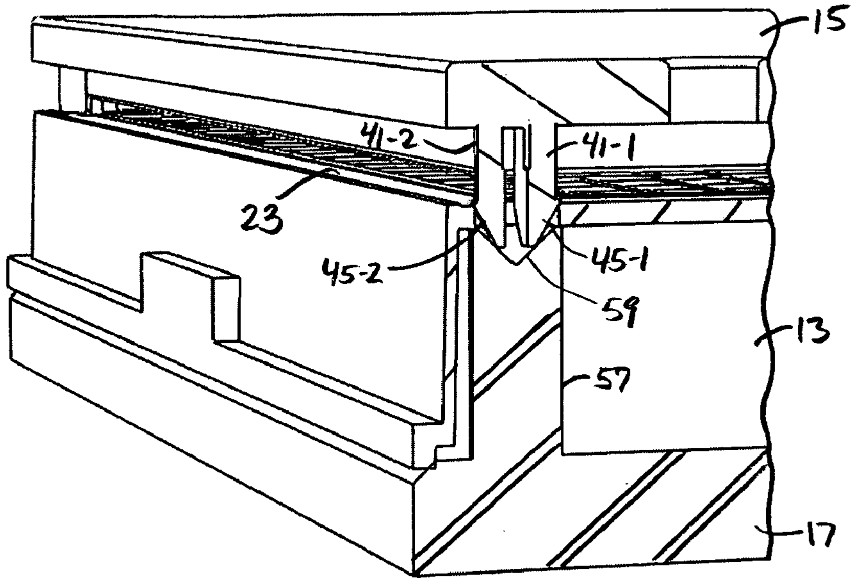

FIG. 7(c)

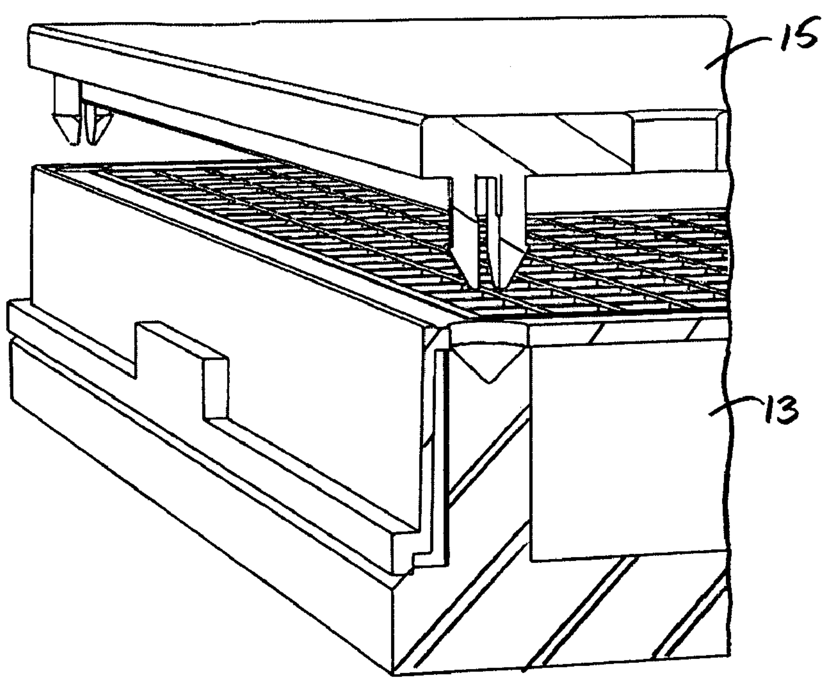

FIG. 7(d)

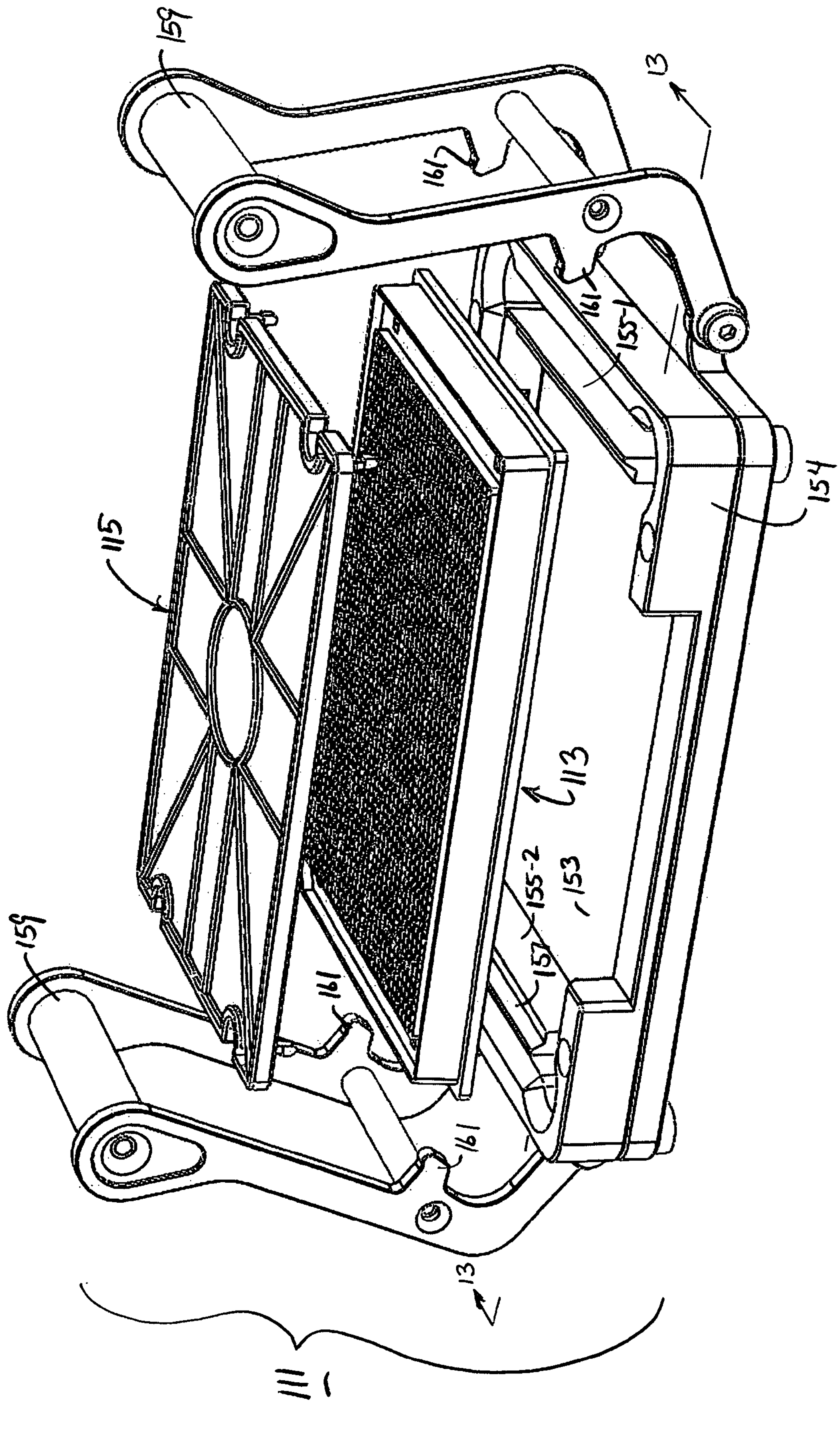

FIG. 8

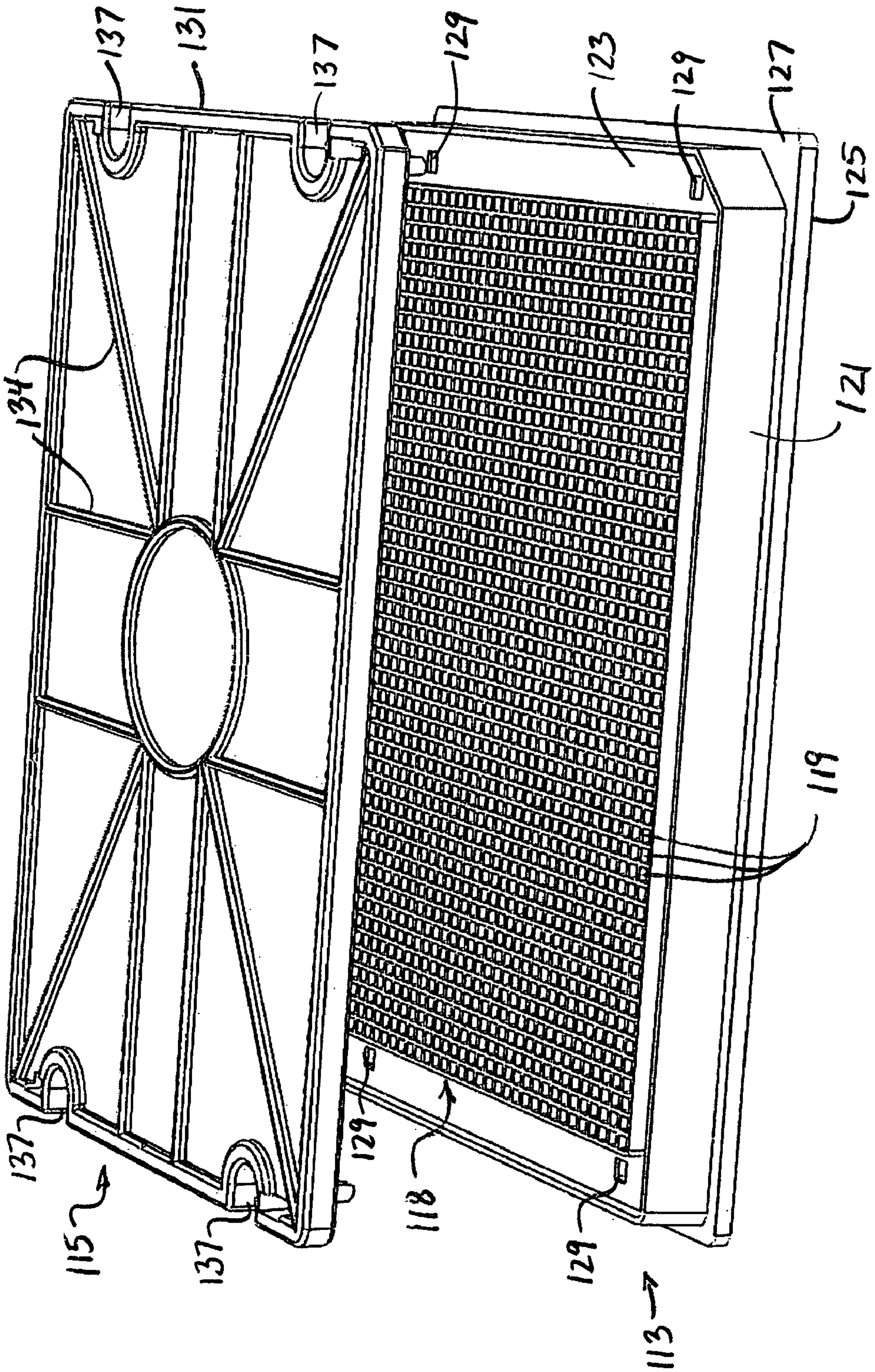
137
131
137
129
123
129
127
125
121
134
119
118
129
129
137
115
137
113

FIG. 9

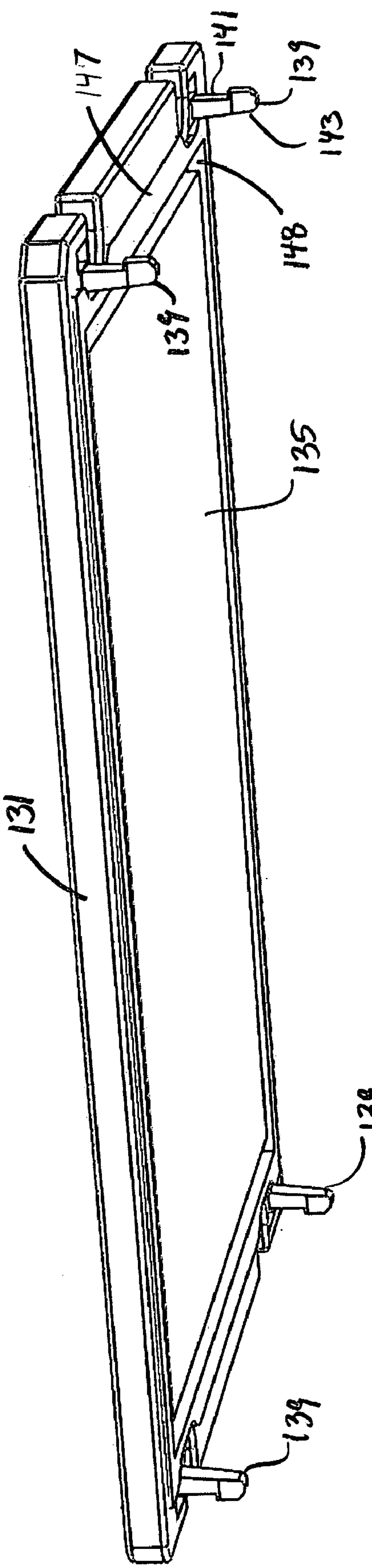

FIG. 10

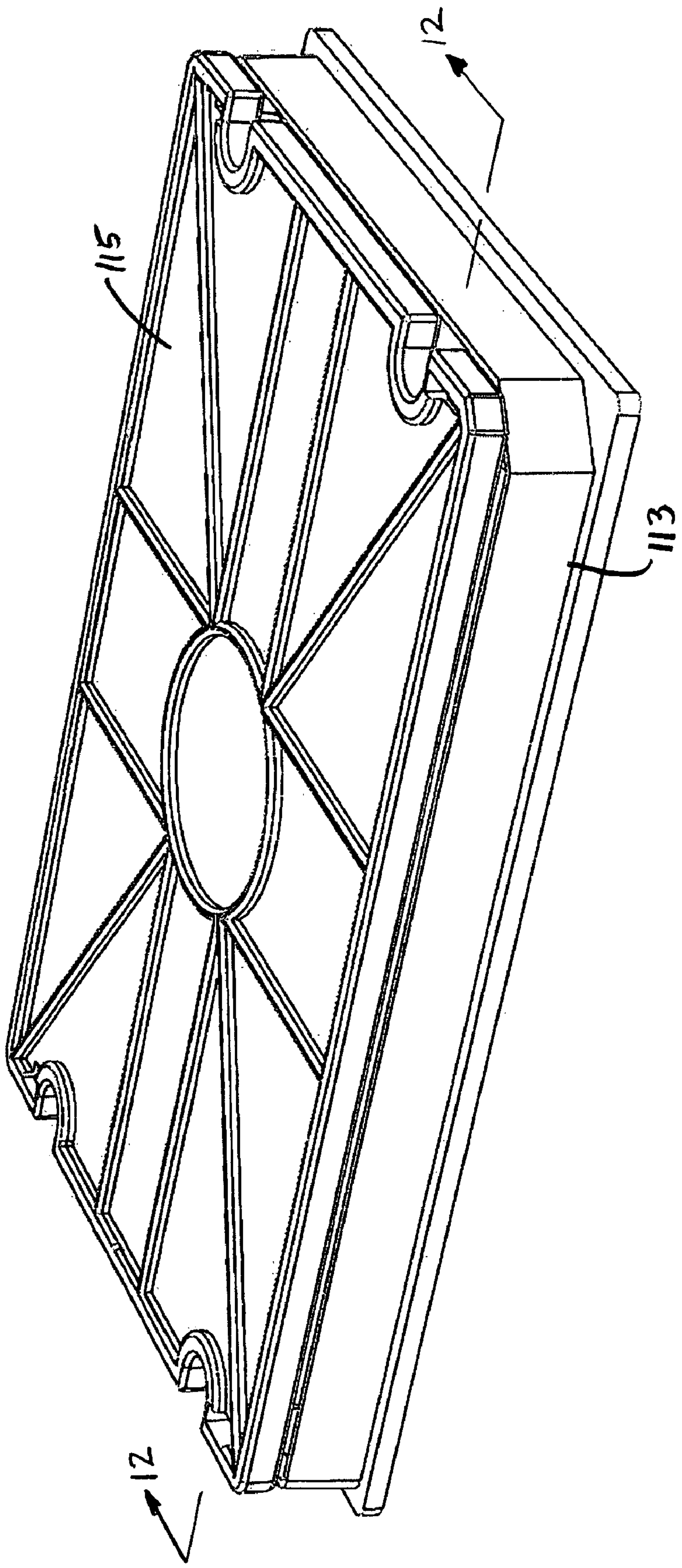

FIG. 11

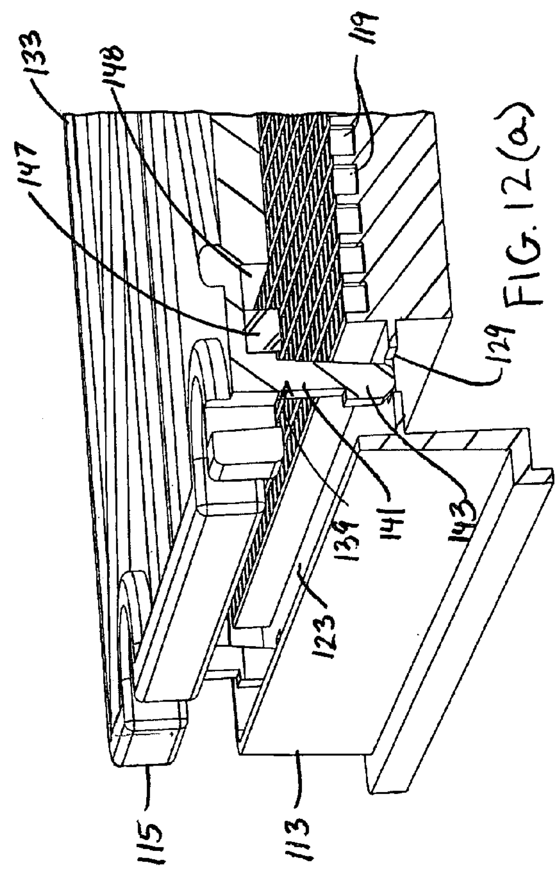

FIG. 12(a)

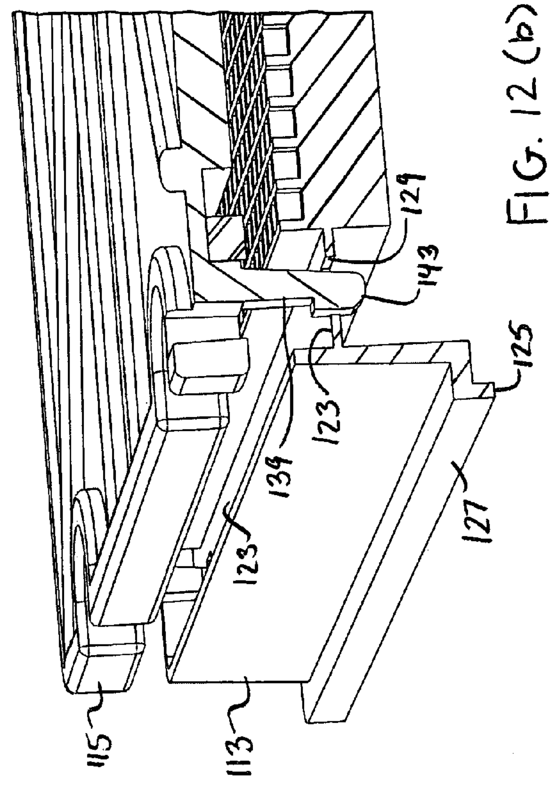

FIG. 12(b)

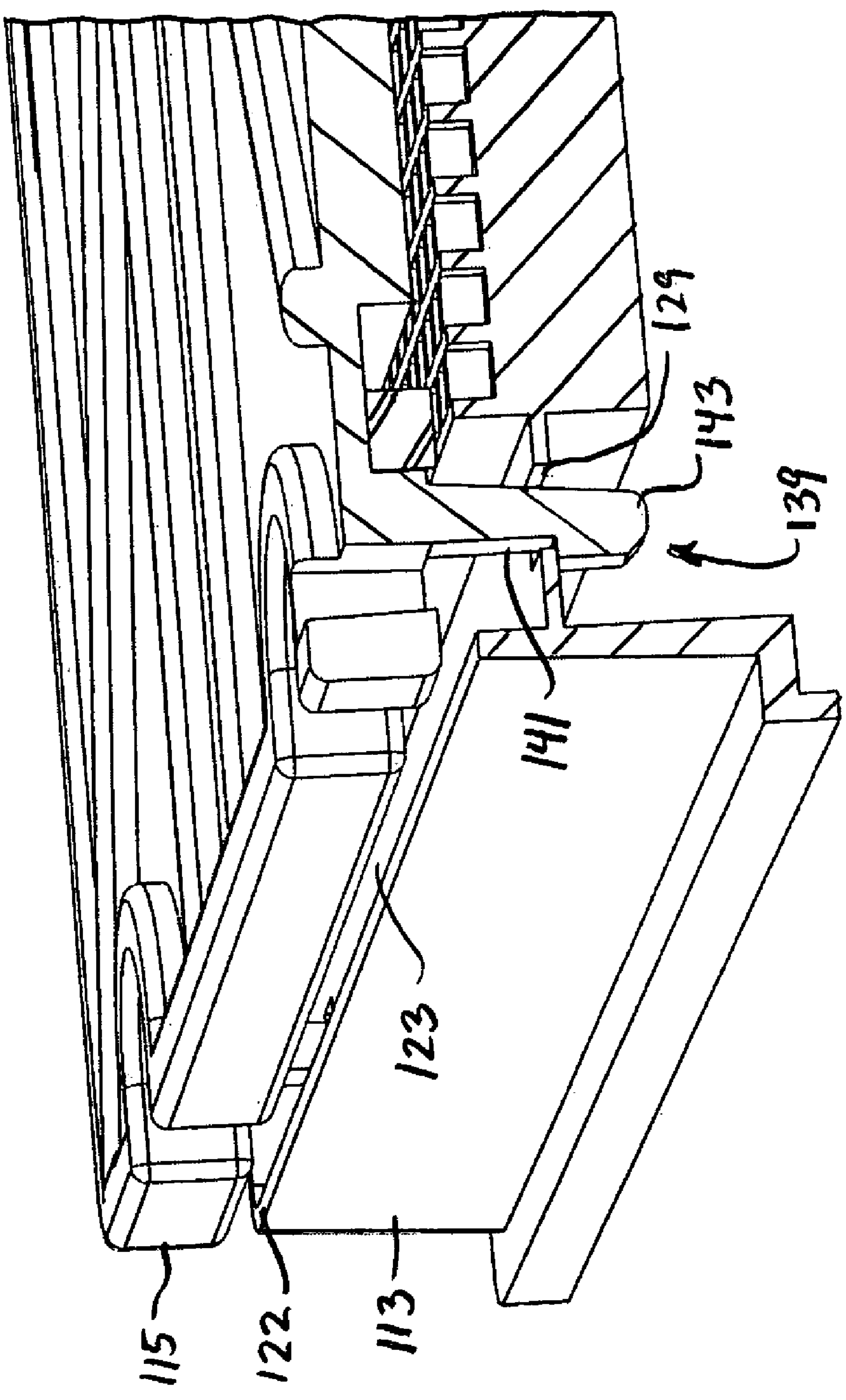

FIG. 12(c)

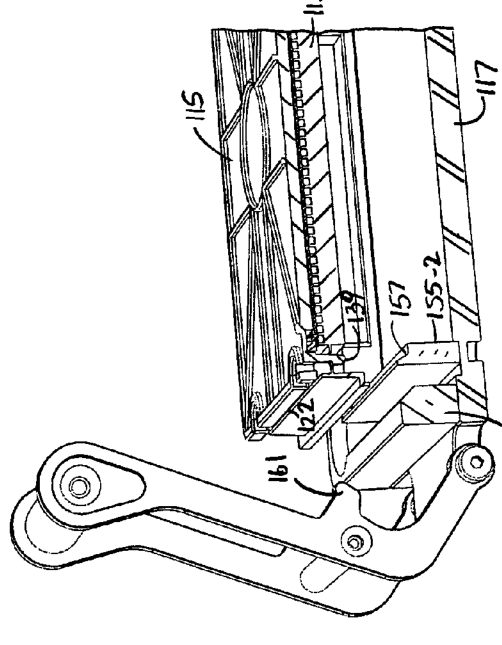

FIG. 13 (a)

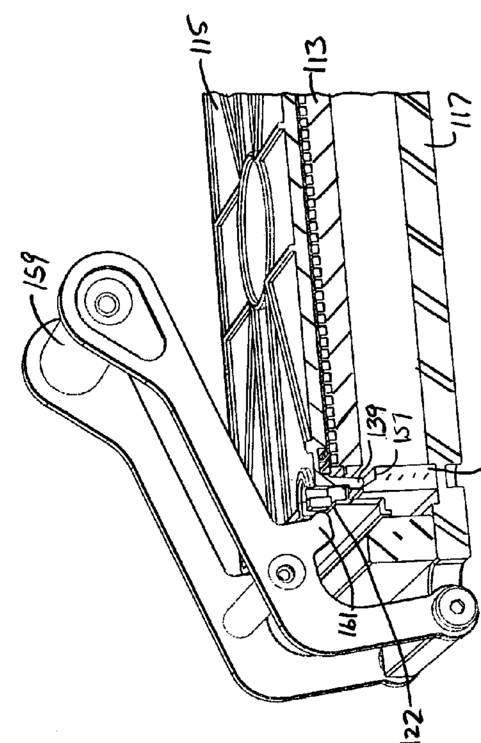

FIG. 13 (b)

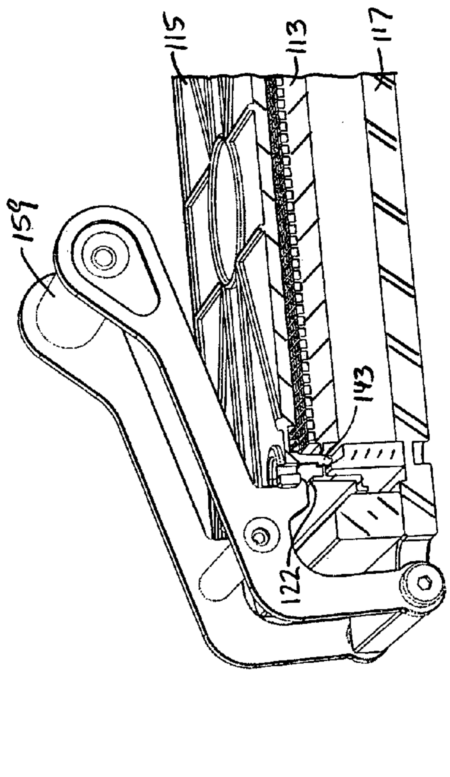

FIG. 13 (c)

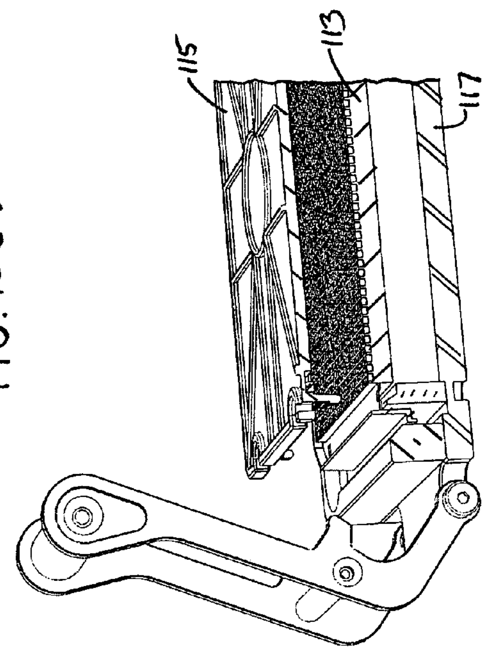

FIG. 13 (d)

MICROPLATE KIT

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit under 35 U.S.C. 119(e) of U.S. provisional Patent Application Ser. No. 60/880,173, filed on Jan. 12, 2007, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates generally to microplates that are typically used in the life sciences industry and more particularly to removable lids for sealing said microplates.

In the areas of biological, chemical and pharmaceutical research, it is a common practice to utilize microplates for storage and analytical purposes. Microplates (also commonly referred to in the art as multi-well plates, specimen plates and microtitre plates) have a block-shaped design and include a plurality of wells (e.g., 1, 2, 4, 6, 12, 24, 48, 96, 384, 1536, etc.) in its top surface, each well serving as an individualized receptacle for retaining a particular specimen.

It is well known in the art to seal the top surface of conventional microplates in order to, among other things, minimize the risk of contamination, degradation, moisture absorption and/or evaporation of specimens retained within each well. Presently, there are a number of different means for sealing conventional microplates.

As an example, it is well known for a foil seal to be affixed to the top surface of a microplate using a thermally activated adhesive. In order to access a particular well in the microplate after the foil seal has been applied (e.g., to retrieve a specimen retained therein), a laboratory technician either manually removes (i.e., peels off) at least a portion of the foil seal or punctures the portion of the foil that directly covers the particular well using a separate seal-piercing instrument.

Although widely used in the art, the use of a foil seal to enclose a microplate introduces a number of notable shortcomings. As a first shortcoming, it has been found to be rather difficult to adhere a secondary foil layer on a microplate after the primary foil layer has been removed or pierced, thereby precluding reuse of the microplate, which is highly undesirable. As a second shortcoming, it has been found to be rather difficult to determine the exact location of an individual well in a high density microplate (e.g., microplates with at least 1536 wells) through the foil seal. Accordingly, prior to locating the selected well using the foil piercing instrument, a laboratory technician often accidentally pierces the portion of the foil seal which directly covers one or more neighboring wells, which is highly undesirable.

As another example, in U.S. Pat. No. 6,534,014 to J. K. Mainquist et al, which is hereby incorporated by reference, there is disclosed a specimen plate lid that includes a sealing perimeter. In use, the lid is weighted so that when positioned on the specimen plate, the considerable weight of the lid compresses the seal against the sealing surface on the specimen plate.

Although known in the art, the lid described in the '014 patent suffers from two notable shortcomings. As a first shortcoming, the considerable weight associated with such a lid renders it difficult to use with most robots used in the life sciences market for picking and placing microtitre plates. As a second shortcoming, the footprint of such a lid is typically larger than the industry standard, thereby precluding its use with standard industry stackers, carousels and incubators.

As another example, in U.S. Pat. No. 6,939,516 to J. P. Hall et al., which is incorporated herein by reference, there is disclosed a multi-well plate cover that includes a lid and a gasket. The lid is formed of a resilient material and configured to apply a compressive spring force to the surface of the gasket to seal the wells in a multi-well plate when the cover is secured to the multi-well plate. The lid has members for mechanical manipulation and for attachment to the multi-well plate.

Although known in the art, the lid described in the '516 patent suffers from a notable shortcoming. Specifically, the lid described in the '516 patent is mechanically complex in nature. As a result, such a lid requires complicated and expensive machinery to assist in its sealing/removal through automated means, which is highly undesirable.

Other patents of interest include U.S. Pat. No. 6,254,833 to C. Shumate et al., and U.S. Pat. No. 6,543,203 to S. Thompson et al., both of these references being incorporated herein by reference.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a new and improved microplate kit which includes a microplate shaped to include a plurality of wells and a removable lid for enclosing the plurality of wells.

It is another object of the present invention to provide a microplate kit as described above which further includes a tool for assisting in the removal of the lid from the microplate.

It is still another object of the present invention to provide a microplate kit as described above which is reusable.

It is yet another object of the present invention to provide a microplate kit as described above which is both weighted and dimensioned for automated use.

It is yet still another object of the present invention to provide a microplate kit as described above includes a limited number of parts, which is easy to use and which is inexpensive to manufacture.

Accordingly, there is provided a microplate kit comprising (a) a microplate, the microplate comprising a sample area shaped to define a plurality of individual wells, and (b) a lid adapted to be mounted on the microplate to enclose the plurality of individual wells, (c) wherein at least one of the microplate and the lid is shaped to include an opening, (d) wherein the other of the microplate and the lid includes a projection dimensioned to project at least partially through the opening when the lid is mounted on the microplate.

Various other features and advantages will appear from the description to follow. In the description, reference is made to the accompanying drawings which form a part thereof, and in which is shown by way of illustration, an embodiment for practicing the invention. The embodiment will be described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that structural changes may be made without departing from the scope of the invention. The following detailed description is therefore, not to be taken in a limiting sense, and the scope of the present invention is best defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are hereby incorporated into and constitute a part of this specification, illustrate various embodiments of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings, wherein like reference numerals represent like parts:

FIG. **1** is an exploded, top perspective view of a first embodiment of a microplate kit constructed according to the teachings of the present invention;

FIG. **2** is an exploded, top perspective view of the microplate and lid shown in FIG. **1**;

FIG. **3** is a bottom perspective view of the lid shown in FIG. **2**;

FIGS. **4**(*a*) and **4**(*b*) are front, top perspective and left end, top perspective views, respectively, of the microplate and lid shown in FIG. **2**, the lid being shown mounted on the microplate;

FIGS. **5**(*a*) and **5**(*b*) are fragmentary section views of the microplate and lid shown in FIG. **4**(*a*), taken along lines **5-5**, at various stages during the process of mounting the lid onto the microplate;

FIGS. **6**(*a*)-(*c*) are fragmentary section views of the microplate and lid shown in FIG. **4**(*b*), taken along lines **6-6**, at various stages during the process of mounting the lid onto the microplate;

FIGS. **7**(*a*)-(*d*) are fragmentary section views of the microplate kit shown in FIG. **1**, taken along lines **7-7**, at various stages during the process of removing the lid from the microplate using the lid removal tool;

FIG. **8** is an exploded, top perspective view of a second embodiment of a microplate kit constructed according to the teachings of the present invention;

FIG. **9** is an exploded, top perspective view of the microplate and lid shown in FIG. **8**;

FIG. **10** is a bottom perspective view of the lid shown in FIG. **9**;

FIG. **11** is a top perspective view of the microplate and lid shown in FIG. **9**, the lid being shown mounted on the microplate;

FIGS. **12**(*a*)-(*c*) are fragmentary section views of the microplate and lid shown in FIG. **11**, taken along lines **12-12**, at various stages during the process of mounting the lid onto the microplate; and

FIGS. **13**(*a*)-(*d*) are fragmentary section views of the microplate kit shown in FIG. **8**, taken along lines **13-13**, at various stages during the process of removing the lid from the microplate using the lid removal tool.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. **1**, there is shown an exploded, top perspective view of a first embodiment of a microplate kit that is constructed according to the teachings of the present invention and identified generally by reference numeral **11**.

Microplate kit **11** comprises a microplate **13**, a lid **15** and a lid removal tool **17**. As will be described in detail below, lid **15** is designed to be mounted on microplate **13**. Tool **17** is designed to assist in the removal (i.e., or delidding) of lid **15** when mounted on microplate **13**.

Referring now to FIG. **2**, microplate **13** has a generally block-shaped design and includes an enlarged sample area **18** that is provided with a plurality of individual, vertically-disposed wells **19**. In the present embodiment, microplate **13** is represented as having 384 wells. However, it is to be understood that the present invention is not limited to any particular density of wells **19**. Rather, the number of wells **19** could be modified to any density without departing from the spirit of the present invention (e.g., 96, 1536 or even greater than 1536 wells).

A hollow outer frame, or sidewall, **21** is formed directly around the periphery of sample area **18**, sidewall **21** having an inverted U-shaped configuration in lateral cross-section (as seen most clearly in FIG. **5**(*a*)). Sidewall **21** is shaped to define a thin, substantially flat top surface **23**, a substantially open bottom surface **25** and an outwardly extending registration edge, or flange, **27** along bottom surface **25**. As can be appreciated, registration edge **27** facilitates the accurate positioning of microplate **13** in an automated environment.

Sidewall **21** is additionally shaped to define a plurality of vertically disposed openings, or holes, **29** in top surface **23**, with one hole **29** located in each corner of sidewall **21**, as seen most clearly in FIG. **2**. It should be noted that each hole **29** is generally circular in lateral cross-section, extends completely through top surface **23** and is accessible from the underside of microplate **13** (i.e., through substantially open bottom surface **25**). As will be described further in detail below, lid **15** is releasably secured to microplate **13** through holes **29**.

As seen most clearly in FIGS. **2** and **3**, lid **15** preferably comprises a thin, generally rectangular plate **31** which includes a substantially flat top surface **33** and a substantially flat bottom surface **35**. Preferably, a plurality of arcuate notches **37** are formed along the outer edge of plate **31** to (i) facilitate handling of lid **15** and (ii) provide access to top surface **23** of sidewall **21** when lid **15** is mounted on microplate **13**, as will described in further detail below.

As seen most clearly in FIG. **3**, a plurality of vertical projections, or latches, **39** extend orthogonally out from bottom surface **35** of plate **31**, each latch **39** being represented herein as having a compressible, arrowhead-style design. Preferably, plate **31** and latches **39** are integrally formed together out of a plastic material through conventional molding techniques. As will be described further below, each latch **39** is dimensioned to snap-mount through a corresponding hole **29** in microplate **13**. In this manner, lid **15** can be used to cover microplate **13**, as seen most clearly in FIGS. **4**(*a*) and **4**(*b*).

As seen most clearly in FIG. **6**(*a*), each latch **39** is shaped to include a pair of semi-cylindrical legs **41-1** and **41-2** which are spaced slightly apart from one another so as to define a narrow slot **43** therebetween. A pair of outwardly extending barbs **45-1** and **45-2** are formed on the free ends of legs **41-1** and **41-2**, respectively, the function of each barb **45** to become apparent below.

Referring back to FIG. **3**, an open rectangular gasket **47** is affixed to bottom surface **35** in close proximity to the periphery of lid **15**. Gasket **47** is preferably constructed out of a highly compliant, chemical resistant material. Accordingly, as lid **15** is mounted on microplate **13**, gasket **47** is disposed firmly in contact against top surface **23**, as seen most clearly in FIGS. **5**(*a*) and **5**(*b*). Preferably, lid **15** is mounted on microplate **13** with such force that gasket **47** compresses considerably, with latches **39** engaging microplate **13** to retain lid **15** firmly mounted on microplate **13**. In this manner, it is to be understood that together gasket **47** and plate **31** effectively seal off wells **19** from the outside environment, which is highly desirable.

Gasket **47** is represented herein as having an O-ring style (i.e., an open rectangular configuration that extends along the periphery of plate **31**). In this manner, each well **19** is sealed off from the outside environment but is remains in fluid communication with the remaining wells **19** in microplate **13**, as seen most clearly in FIG. **5**(*b*). Accordingly, it is to be understood that alternative styles of gaskets could be used in place thereof without departing from the spirit of the present invention. For example, gasket **47** could be replaced by a single sheet gasket (i.e., a solid, or closed, rectangular gasket) that would serve to seal off each individual well **19** in microplate **13**, which may be desirable in certain applications.

Referring now to FIGS. **6**(*a*)-(*c*), there is shown a section view of microplate **13** at various stages during the process of mounting lid **15** thereon. In the first step of the lidding process, lid **15** is positioned above microplate **13** with each latch **39** disposed in coaxial alignment with a corresponding hole **29** in top surface **23** of microplate **13**, as shown in FIG. **6**(*a*).

Aligned as such, a downward force F is applied onto top surface **33** of lid **15** using manual or automated means, as shown in FIG. **6**(*b*). The downward force applied to lid **15** urges barbs **45-1** and **45-2** of each latch **39** into direct contact against the portion of top surface **23** that immediately surrounds each hole **29**. Due to the inclusion of slot **43**, the downward force causes each latch **39** to compress to the extent necessary so that barbs **45-1** and **45-2** can pass through each hole **29**.

As seen most clearly in FIG. **6**(*c*), the continued application of force F onto top surface **33** of lid **15** ultimately causes barbs **45-1** and **45-2** to penetrate entirely through hole **29**. At this point, legs **41-1** and **41-2** of each latch **39** snap resiliently back into their original configuration, with barbs **45-1** and **45-2** of each latch **39** firmly engaged against the underside of top surface **23**. In this manner, it is to be understood that latches **39** serve to lockably retain lid **15** tightly in place on microplate **13**, which is highly desirable.

As can be appreciated, the particular design of lid **15** introduces a number of notable advantages over prior art methods of sealing microplates.

As a first benefit, microplate lid **15** is relatively inexpensive to manufacture. To the contrary, many well-known microplate lids and sealing methods use either expensive materials (e.g., metals) or have complex designs.

As a second benefit, the snap-fastening engagement means between microplate **13** and lid **15** renders the above-described lidding process easy to accomplish. Furthermore, because the above-described lidding process requires only (i) the proper orientation of lid **15** relative to microplate **13** and (ii) the application of a suitable force F onto lid **15**, microplate **13** and lid **15** can be easily integrated into existing automated systems.

As a third benefit, the above-described design of lid **15** can be used in conjunction with a wide range of different microtitre plate sizes and densities, thereby increasing its range of potential applications.

As a fourth benefit, the particular design of lid **15** does not serve to increase the overall footprint (i.e., length and width) of the microplate **13**, thereby rendering said components usable in most, if not all, preexisting automated systems.

As noted briefly above, tool **17** is designed to assist in the removal (i.e., or delidding) of lid **15** from microplate **13**. Referring back to FIG. **1**, tool **17** comprises a rigid, rectangular base **51** with the same approximate footprint as microplate **13**, base **51** comprising a substantially flat top surface **53** and a substantially flat bottom surface **55**.

Tool **17** additionally includes a plurality of support members, or posts, **57** which extend orthogonally away from top surface **53**, posts **57** being located on base **51** in such a manner so that each post **57** coaxially aligns with a corresponding hole **29** in microplate **13**, as will be described further below. It is to be understood that the free end of each post **57** is provided with an inwardly sloped, or concave, surface **59** which appears conical in lateral cross-section, as seen most clearly in FIG. **7**(*a*), the function of concave surface **59** to become apparent below.

Referring now to FIGS. **7**(*a*)-(*d*), there is shown a section view of kit **11** at various stages during the process of removing lid **15** from microplate **13** using lid removal tool **17**. With lid **15** firmly mounted on microplate **13** as described in detail above, tool **17** is positioned beneath microplate **13** in such a manner so that each post **57** projects up through substantially open bottom surface **25** in sidewall **21** and into direct coaxial alignment with a corresponding latch **39** on lid **15**, as shown in FIG. **7**(*a*).

Aligned as such, microplate **13** is drawn down onto tool **17** until barbs **45-1** and **45-2** of each latch **39** directly contact concave surface **59** of a corresponding post **57** on tool **17**, as shown in FIG. **7**(*b*). At this time, a suitable downward force is applied to top surface **23** of microplate **13** (e.g., through notches **37**) using manual or automated means. This downward force causes barbs **45-1** and **45-2** of each latch **39** to slide inward along concave surface **59** which in turn causes legs **41-1** and **41-2** to flex slightly inward (i.e., compressing latch **39**).

As seen most clearly in FIG. **7**(*c*), the continued application of a downward force on top surface **23** of microplate **13** ultimately causes legs **41** of each latch **39** to flex inward to the extent necessary so that their corresponding barbs **45** disengage from the underside of top surface **23**. This disengagement causes the barbs **45** for each latch **39** to withdraw from its associated hole **29** in microplate **13** and thereby release lid **15** from microplate **13**. Disengaged lid **15** can then be fully separated from microplate **13** using either manual or automated means, as shown in FIG. **7**(*d*). In this manner, it is to be understood that lid **15** can be repeatedly mounted/released from microplate **13** as deemed necessary, which is a principal object of the present invention.

Referring now to FIG. **8**, there is shown an exploded, top perspective view of a second embodiment of a microplate kit that is constructed according to the teachings of the present invention and identified generally by reference numeral **111**.

Microplate kit **111** is similar to microplate kit **11** in that microplate kit **111** comprises a microplate **113**, a lid **115** designed to be removably mounted onto microplate **113** and a tool **117** designed to assist in the removal of lid **115** when mounted on microplate **113**.

Referring now to FIG. **9**, microplate **113** is similar to microplate **13** in that microplate **113** is generally block-shaped in its design and includes an enlarged sample area **118** that is provided with a plurality of individual, vertically-disposed wells **119**. Microplate **113** similarly includes a hollow outer frame, or sidewall, **121** that is formed directly around the periphery of sample area **118**, sidewall **121** having an inverted U-shaped configuration in lateral cross-section (as seen most clearly in FIG. **12**(*a*)). Specifically, sidewall **121** is shaped to define a thin, substantially flat top surface **123**, a substantially open bottom surface **125** and an outwardly extending registration edge, or flange, **127** along bottom surface **125**. Furthermore, sidewall **121** is additionally shaped to define a plurality of vertical holes **129** in top surface **123**, with one hole **129** located in each corner of sidewall **121**, as seen most clearly in FIG. **9**.

It should be noted that microplate **113** differs from microplate **13** principally in that (i) microplate **113** includes a higher density of wells **119** (notably, 1536 wells as opposed to 384 wells in microplate **13**) and (ii) microplate **113** includes holes **129** which are generally rectangular in lateral cross-section (as opposed to the circular holes **29** in microplate **13**).

As seen most clearly in FIGS. **9**, **10** and **12**(*a*), lid **115** is similar to lid **15** in that lid **115** comprises a thin, generally rectangular plate **131** which includes a top surface **133**, a bottom surface **135** and a plurality of arcuate notches **137** formed along its outer edge. It should be noted that the majority of top surface **133** is preferably recessed to reduce the amount of plastic required for its construction. A plurality of strengthening ribs **134** is preferably formed into top surface **133** to provide lid **115** with the necessary structural rigidity.

Lid **115** differs from lid **15** principally in that lid **115** comprises a plurality of vertical projections, or latches, **139** which are different in construction than latches **39**. Specifically, each latch **139** is represented herein as being in the form of a single, deflectable arm **141** which extends orthogonally out from bottom surface **135** of plate **31**, the free end of each arm **141** being shaped to include an enlarged engagement barb **143**. In use, latches **139** operate in a similar manner as latches **39** in that latches are dimensioned to snap-mount through corresponding openings **129** in microplate **113**, as will be described further in detail below.

As seen most clearly in FIGS. **10** and **12**(*a*), an open rectangular gasket **147** is secured within a corresponding rectangular groove **148** formed in bottom surface **135**. Gasket **147** is similar to gasket **47** in that, with lid **115** is mounted on microplate **113** (as represented in FIG. **11**), gasket **147** compresses to the extent necessary to adequately seal wells **119** from the outside environment.

Referring now to FIGS. **12**(*a*)-(*c*), there is shown a section view of microplate **113** at various stages during the process of mounting lid **115** thereon. In the first step of the lidding process, lid **115** is positioned above microplate **113** with each latch **139** disposed in coaxial alignment with a corresponding hole **129** in top surface **123** of microplate **113**, as shown in FIG. **12**(*a*).

Aligned as such, a downward force is applied onto top surface **133** of lid **115**. The downward force applied to lid **115** deflects each latch **139** inward to the extent necessary for its enlarged barb **143** to insert into its corresponding hole **129** in microplate **113**, as seen in FIG. **12**(*b*). The continued application of downward force onto top surface **133** of lid **115** ultimately causes barb **143** of each latch **139** to penetrate entirely through its corresponding hole **129**. Once barb **143** of each latch **139** passes through its corresponding hole **129**, latch **139** resiliently snaps back into its original configuration, with barb **143** firmly engaged against the underside of top surface **123**, as shown in FIG. **12**(*c*). In this manner, it is to be understood that latches **139** are similar in function with latches **39** in that latches **139** serve to lockably retain lid **115** tightly in place on microplate **113**, which is highly desirable.

Tool **117** functions in a similar manner as tool **17** in that tool **117** can be used to deflect latches **139** inward to the extent necessary so that lid **115** can be disengaged and subsequently removed from microplate **113**. Referring back to FIG. **8**, tool **117** comprises a flat, rectangular base **153** and an upstanding sidewall **154** formed along the periphery of base **153**. A pair of elongated support members **155-1** and **155-2** project orthogonally upward from opposite ends of the top surface of base **153**, each support member **155** being shaped to include an angled, or tapered, top surface **157**. In addition, a pair of opposing handles **159** are pivotally connected to base **153**, each handle **159** being shaped to include a pair of inwardly protruding fingers **161**, the function of fingers **161** to become apparent below.

Referring now to FIGS. **13**(*a*)-(*d*), there is shown a section view of kit **111** at various stages during the process of removing lid **115** from microplate **113** using lid removal tool **117**. With lid **115** firmly mounted on microplate **113** as described in detail above, tool **117** is positioned beneath microplate **113** in such a manner so that top surface **157** of each support member **155** is disposed in direct alignment beneath a corresponding pair of latches **139** on lid **115**, as shown in FIG. **13**(*a*).

Aligned as such, microplate **113** is drawn down onto tool **117** until barb **143** of each latch **139** rests directly upon a support member **155**. With microplate **113** supported by tool **117**, handles **159** are pivoted inward (either manually or automatically) until fingers **161** abut against a thin outer wall **122** on microplate **113** that protrudes vertically up from the periphery of top surface **123**, as shown in FIG. **13**(*b*). At this time, further pivotal displacement of handles **159** inward urges microplate **113** downward onto tool **117**. This downward force causes enlarged barb **143** of each latch **139** to ride inwardly along tapered surface **157** of a support member **155** which in turn causes latches **139** to deflect (i.e., articulate) inward to the extent necessary that latches **139** disengage from the underside of top surface **123**. This disengagement causes barb **143** of each latch **139** to withdraw from its associated hole **129** in microplate **113** and thereby release lid **115** from microplate **113**, as shown in FIG. **13**(*c*). Disengaged lid **115** can then be fully separated from microplate **113** using either manual or automated means, as shown in FIG. **13**(*d*).

The embodiments shown in the present invention are intended to be merely exemplary and those skilled in the art shall be able to make numerous variations and modifications without departing from the spirit of the present invention. All such variations and modifications are intended to be within the scope of the present invention as defined in the appended claims.

What is claimed is:

1. A microplate kit comprising:

(a) a microplate, the microplate comprising a sample area shaped to define a plurality of individual wells for retaining specimens, wherein the microplate includes an opening outside the sample area;

(b) a lid adapted to be mounted on the microplate to enclose the plurality of individual wells, wherein the lid includes a projection dimensioned to project at least partially through the opening when the lid is mounted on the microplate, and

(c) a tool, separate from the microplate and the lid, for disengaging the lid from the microplate when mounted thereon, wherein the tool comprises a base having a top surface and a bottom surface, a support member protruding up from the top surface of the base, and a handle pivotally connected to the base and wherein a tapered free end of the support member is designed to engage the latch of the lid to deflect the latch when the microplate is urged down upon the tool.

2. The microplate kit as claimed in claim **1** wherein the projection matingly engages the microplate upon insertion through the opening.

3. The microplate kit as claimed in claim **2** wherein the microplate further comprises an outer frame forming an inverted U-shaped channel directly around the sample area, the channel having a top surface substantially co-planar with the sample area and the opening extending through the top surface of the inverted U-shaped channel.

4. The microplate kit as claimed in claim **3** wherein the inverted U-shaped channel includes a substantially open bottom, the opening in the top surface being accessible through the open bottom.

5. The microplate kit as claimed in claim **3** wherein the lid comprises a generally rectangular plate having a top surface and a bottom surface.

6. The microplate kit as claimed in claim **5** wherein the footprint of the lid is substantially equal to the footprint of the microplate.

7. The microplate kit as claimed in claim **5** wherein the projection is in the form of a latch which protrudes orthogonally out from the bottom surface of the lid.

8. The microplate kit as claimed in claim **7** wherein, with the lid mounted on the microplate, the latch at least partially projects through the opening in the microplate and matingly engages the outer frame.

9. The microplate kit as claimed in claim **8** wherein the latch is in the form of a compressible arrowhead which includes a pair of legs spaced apart from one another so as to define a narrow slot therebetween, a free end of each leg being shaped to include an outwardly extending barb.

10. The microplate kit as claimed in claim **8** wherein the latch is in the form of a single deflectable arm with an outwardly extending barb formed on a free end of the deflectable arm.

11. The microplate kit as claimed in claim **5** wherein the lid further comprises a gasket affixed to the lid, the gasket protruding out beyond the bottom surface of the lid.

12. The microplate kit as claimed in claim **3** wherein with the tool disposed beneath the microplate, a free end of the support member extends through the opening in the inverted U-shaped channel and supports the latch of the lid that is mounted on the microplate.

13. The microplate kit as claimed in claim **1** wherein the handle is shaped to include a finger that is dimensioned to selectively contact the microplate.

14. The microplate kit as claimed in claim **1** wherein the microplate includes at least four openings, each opening positioned in a corner of the microplate; and the lid includes at least four projections, each projection positioned in a corner of the lid.

15. The microplate kit as claimed in claim **11** wherein the gasket is an O-ring gasket having an open rectangular shape and positioned along the periphery of the lid.

16. The microplate kit as claimed in claim **13** wherein a top surface of the lid includes at least one notch through which the finger of the handle can extend to contact the microplate.

17. A microplate kit comprising:

a microplate comprising a sample area shaped to define a plurality of individual wells for retaining specimens, the microplate further including:

an inverted U-shaped channel around the sample area, the channel having a top surface substantially co-planar with the sample area, and a substantially open bottom; and

an opening extending through the top surface of the channel, the opening in the top surface being accessible through the open bottom of the channel;

a lid for mounting on the microplate to enclose the plurality of individual wells, wherein the lid includes a projection dimensioned to project at least partially through the opening to matingly engage the microplate when the lid is mounted on the microplate; and

a tool, separate from the microplate and the lid, for disengaging the lid from the microplate when mounted thereon, wherein the tool comprises a base having a top surface and a bottom surface, a support member protruding up from the top surface of the base, and a handle pivotally connected to the base; and wherein a tapered free end of the support member is designed to engage the latch of the lid to deflect the latch when the microplate is urged down upon the tool.

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