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(54) **METHOD AND APPARATUS FOR SUPPORTING MICROELECTRONIC SUBSTRATES**

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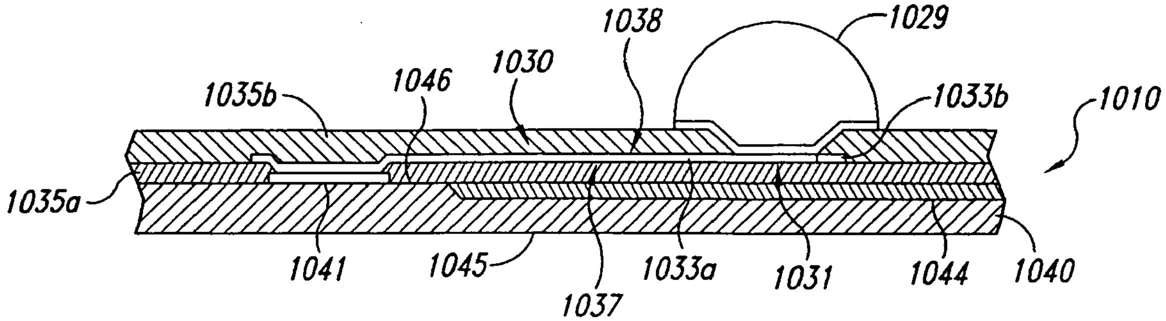
(57) **ABSTRACT**

A method and apparatus for supporting a microelectronic substrate. The apparatus can include a microelectronic substrate and a support member carrying the microelectronic substrate. The apparatus can further include a first connection structure carried by the support member. The first connection structure can have a first bond site configured to receive a flowable conductive material, and can further have at least two first elongated members connected and extending outwardly from the first bond site. Each first elongated member can be configured to receive at least a portion of the flowable conductive material from the first bond site, with none of the first elongated members being electrically coupled to the microelectronic substrate. The assembly can further include a second connection structure that is electrically coupled to the microelectronic substrate and that can include second elongated members extending away from a second bond site. The number of second elongated members can be equal to the number of first elongated members.



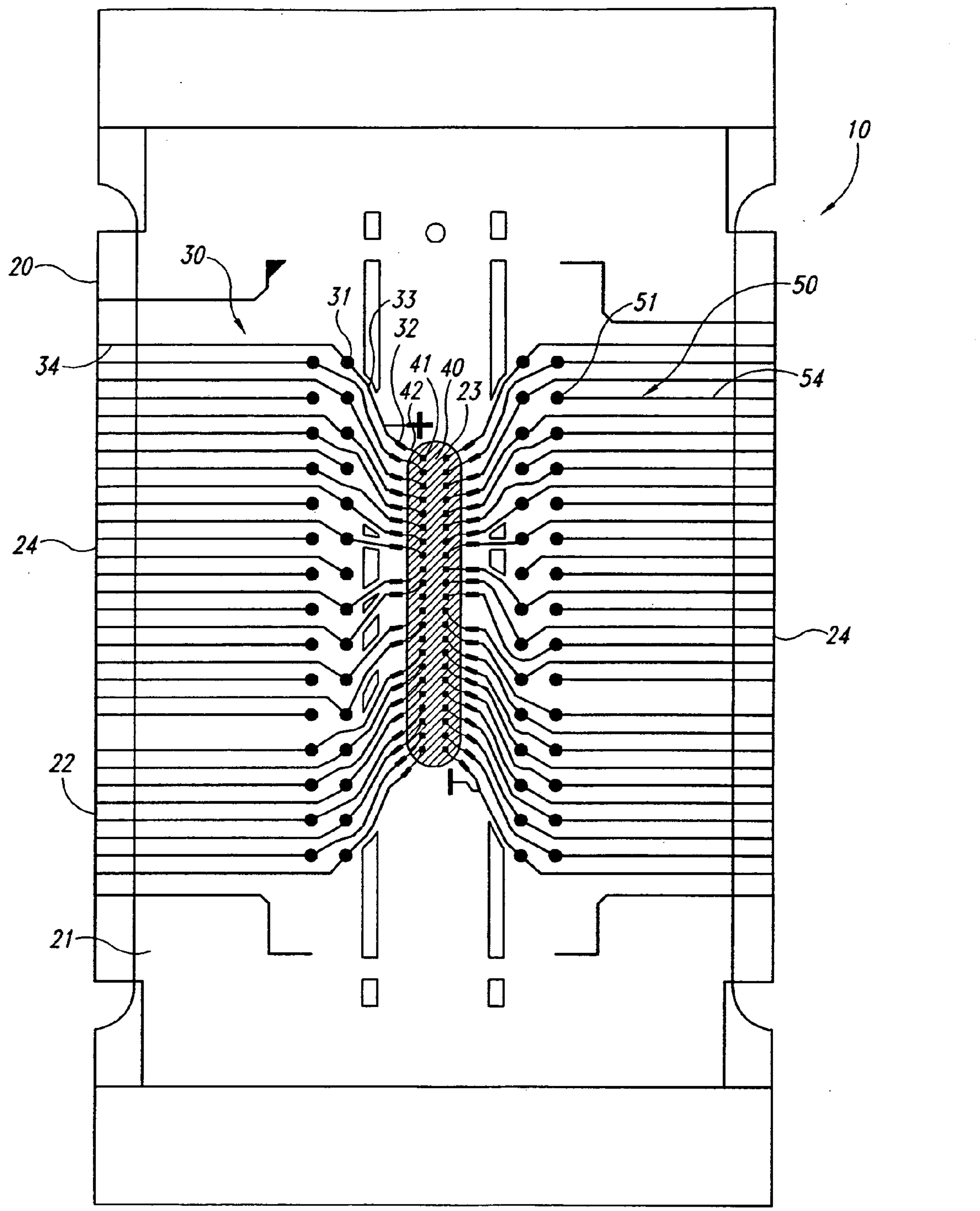


Fig. 1
(Prior Art)

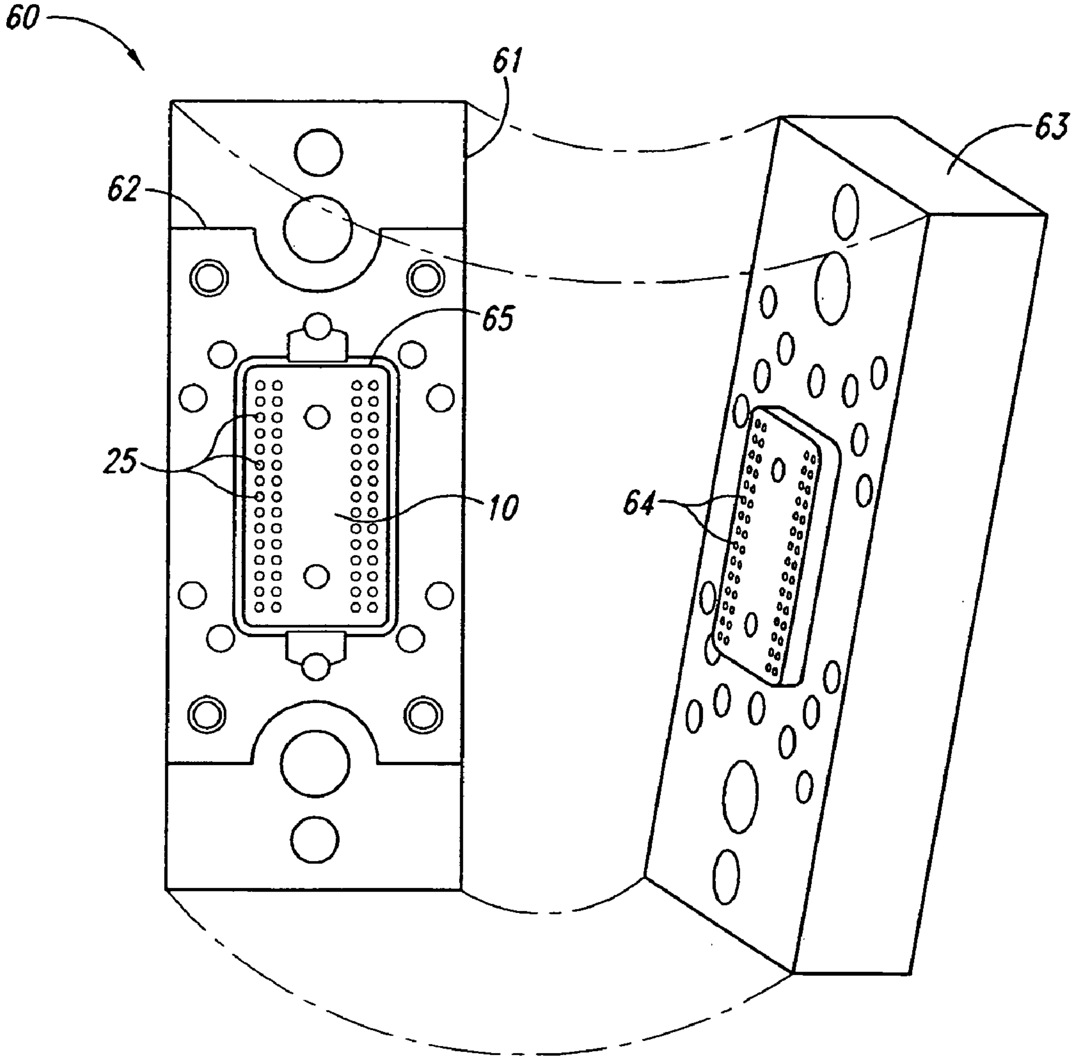


Fig. 2
(Prior Art)

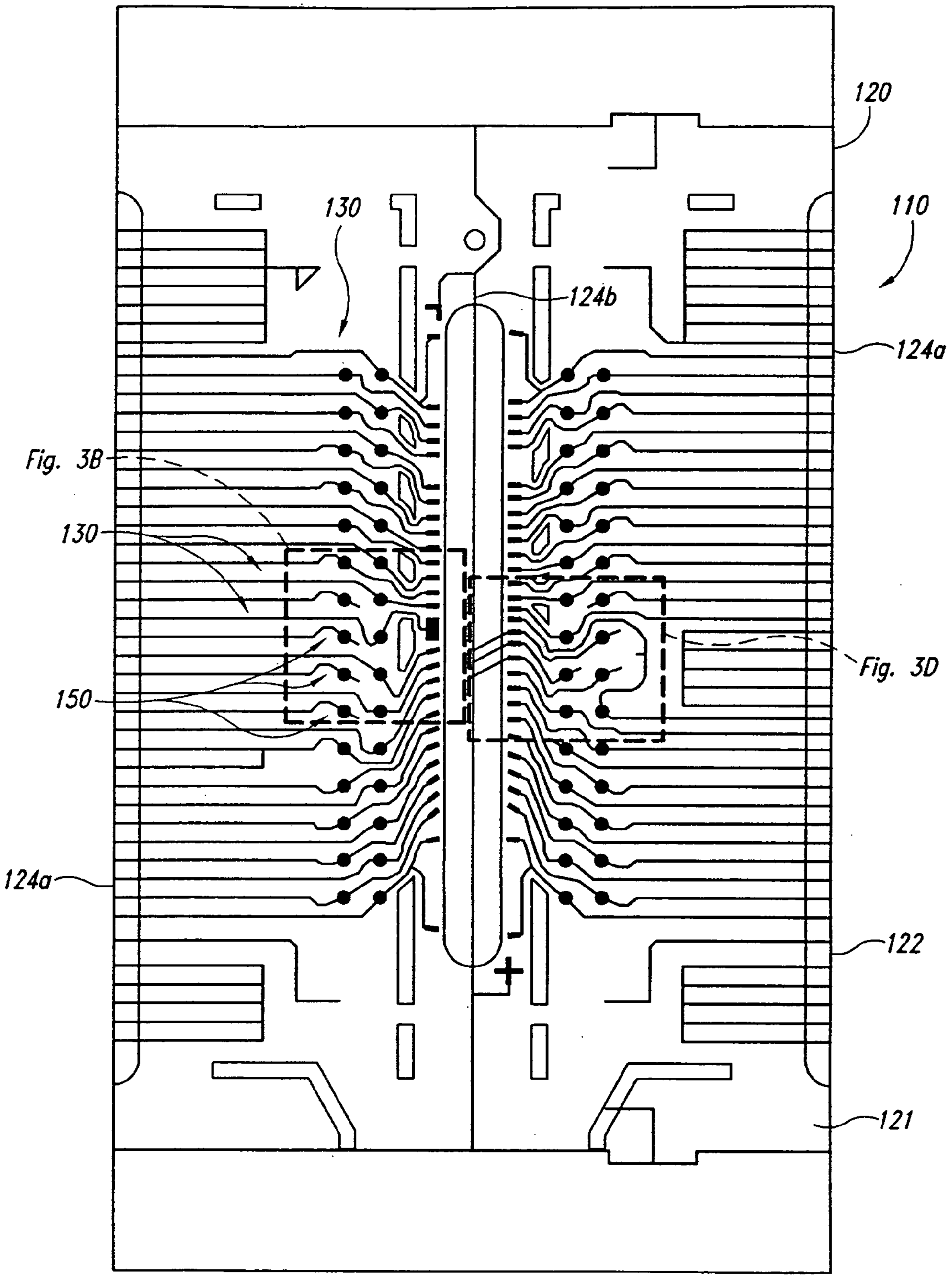
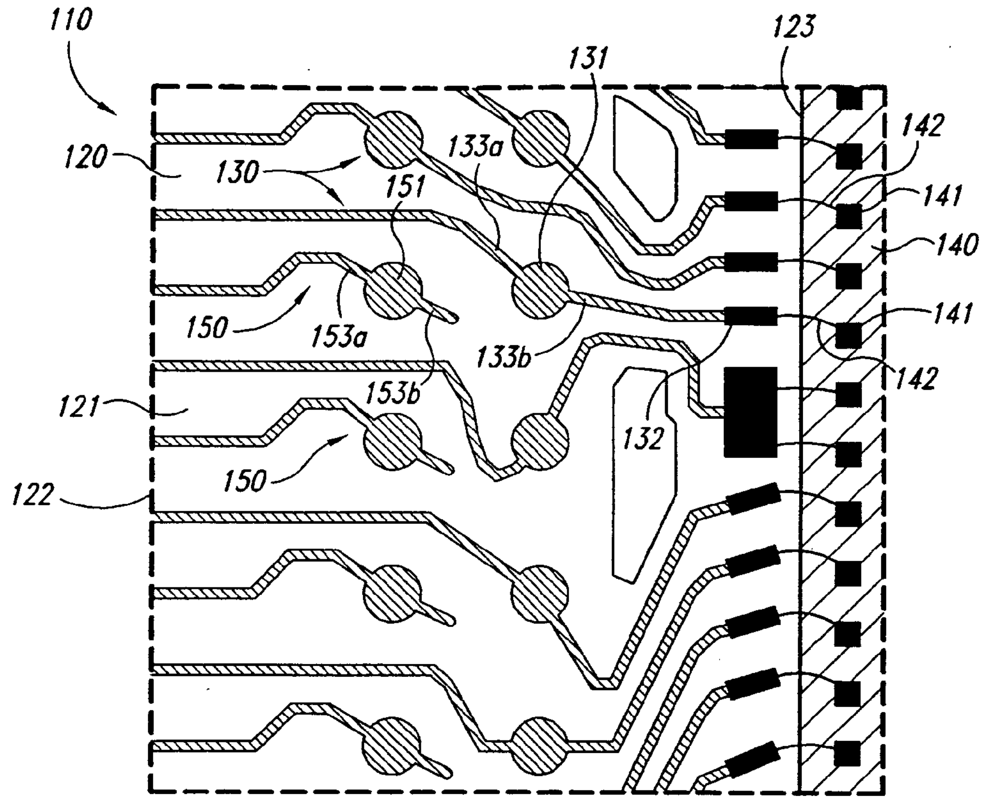


Fig. 3A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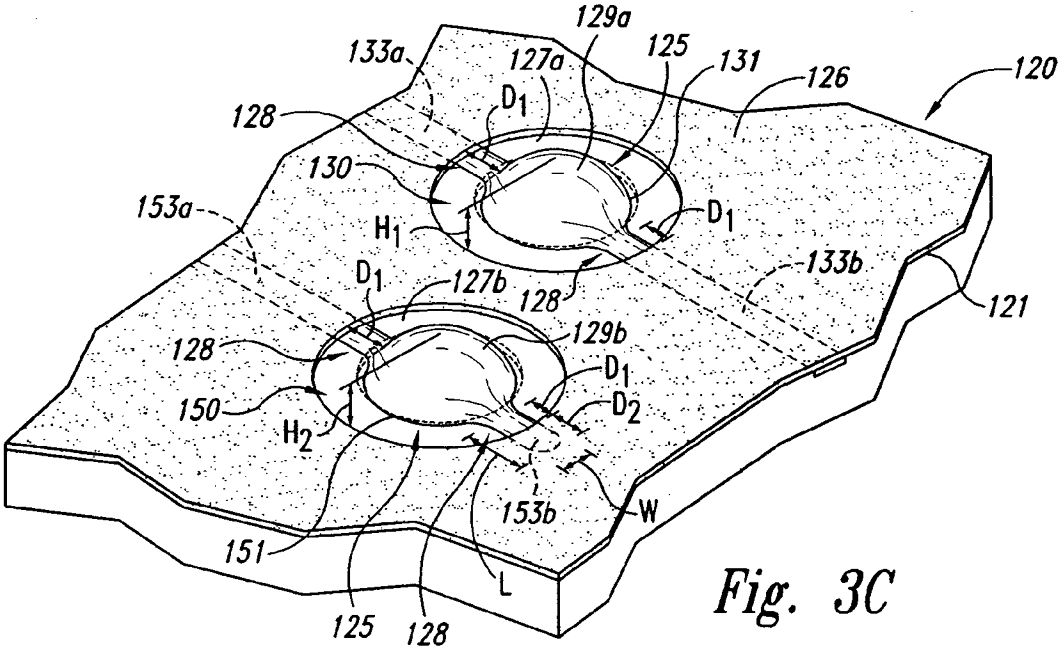
123
131
120
142
133a
130
151
141
140
150
153a
141
133b
142
153b
121
132
150
122

Fig. 3B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133a
127a
125
131
126
120
128
D1
130
153a
H1
D1
133b
128
121
D1
127b
128
129b
150
D1
H2
D2
151
153b
W
125
128
L

Fig. 3C

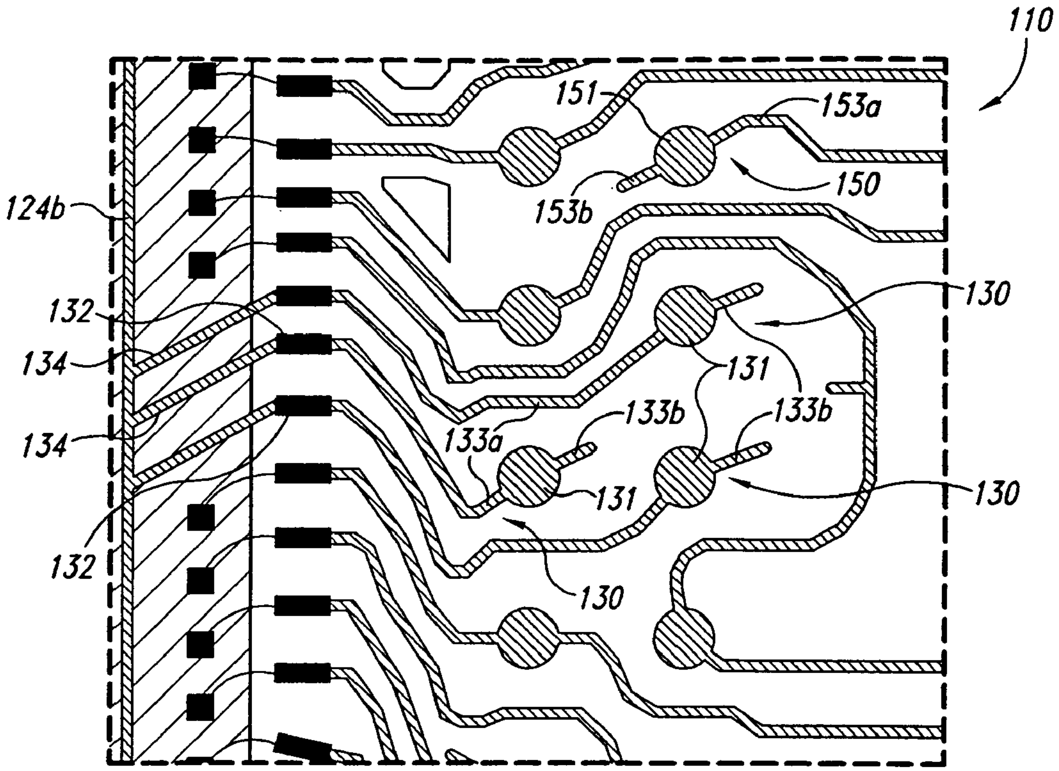

110
151
153a
150
153b
124b
130
132
134
131
134
133b
133b
133a
131
130
132
130

Fig. 3D

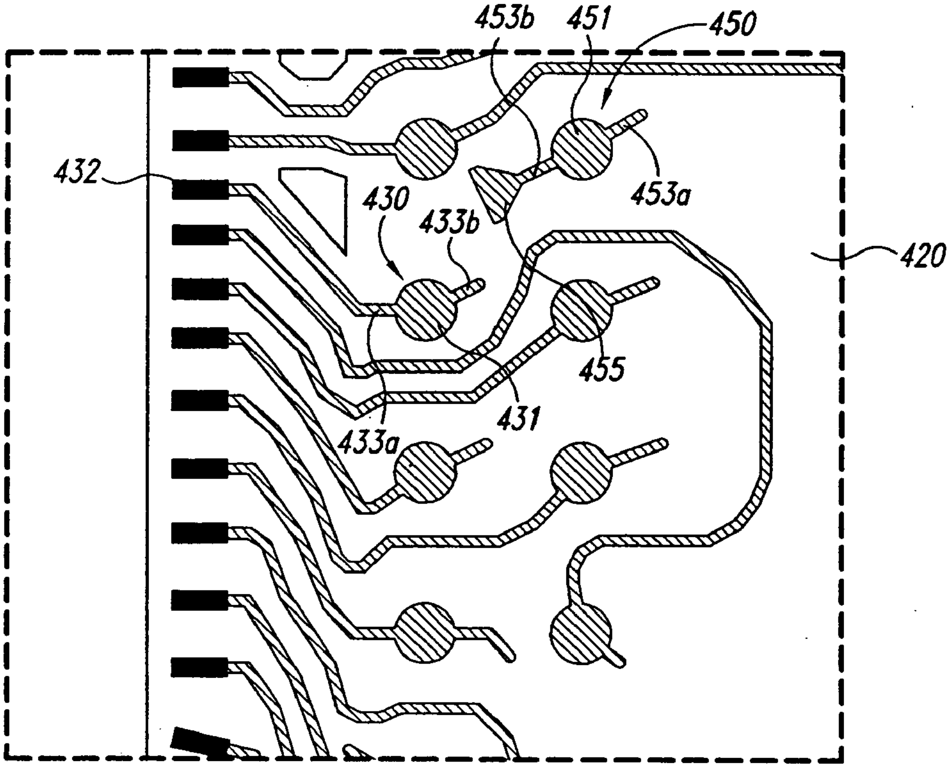

453b
451
450
432
453a
430
433b
420
455
433a
431

Fig. 4

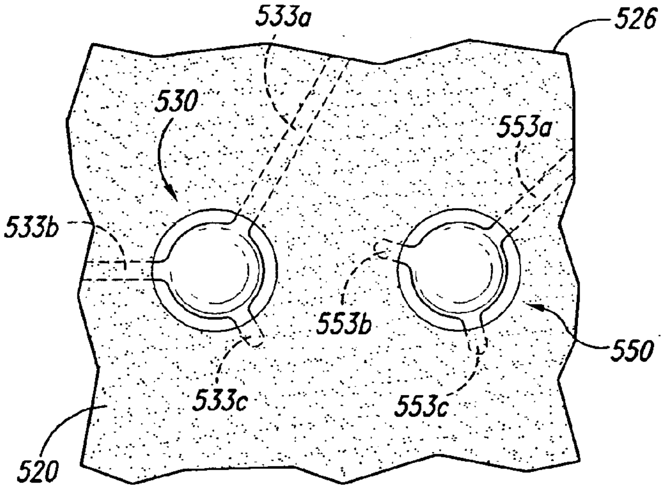


Fig. 5

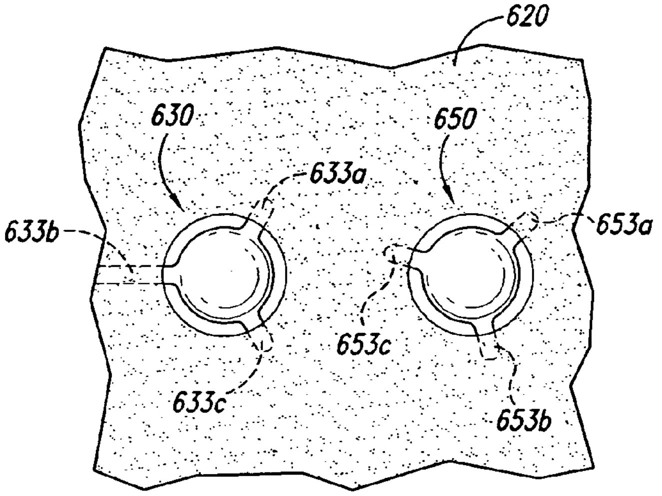


Fig. 6

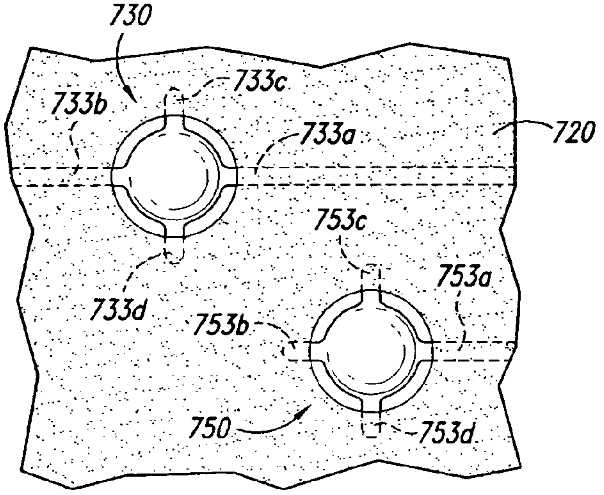


Fig. 7

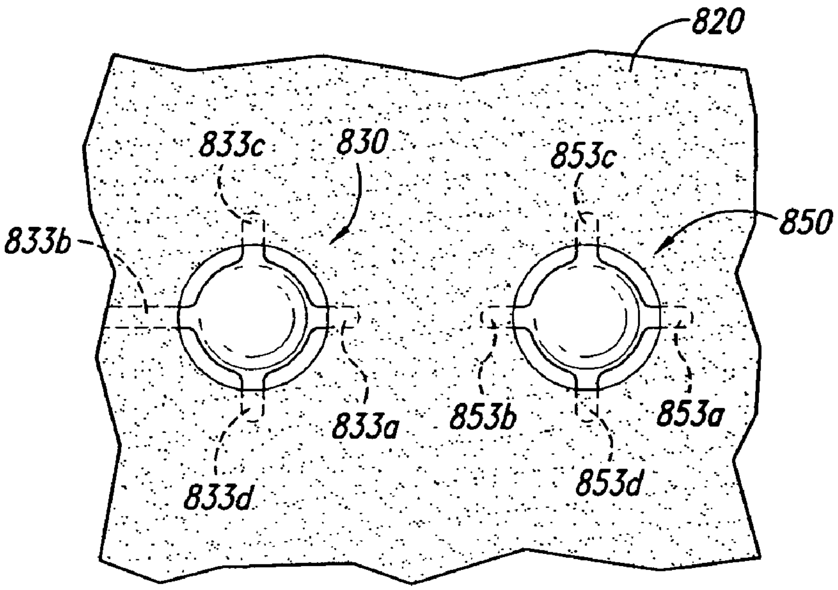
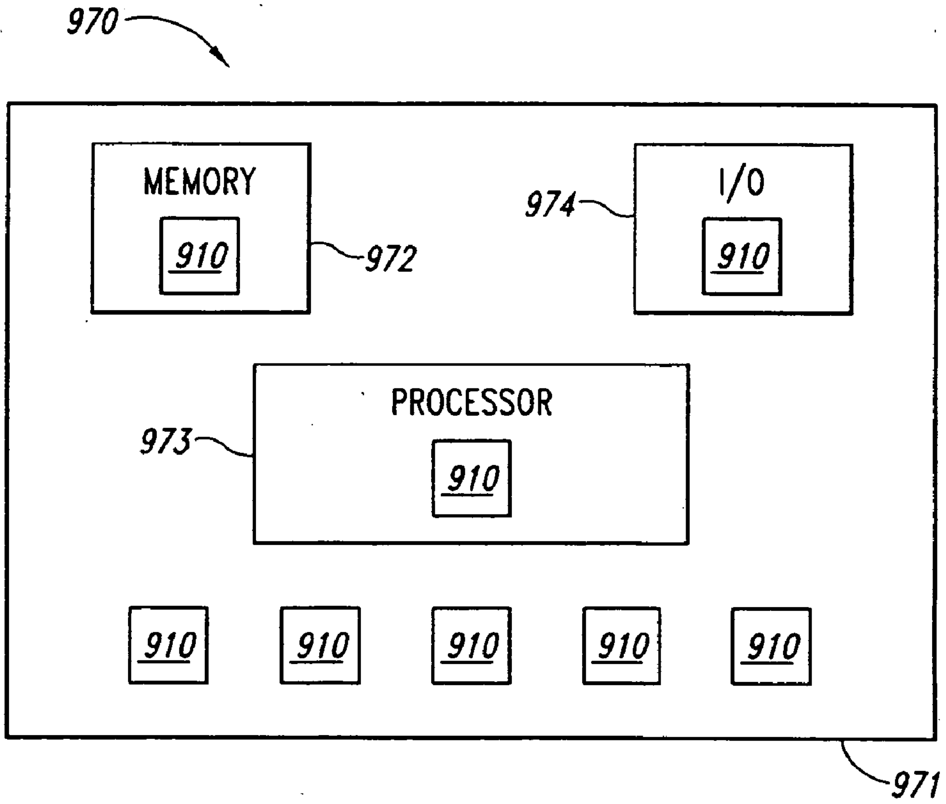

820
833c
830
853c
850
833b
833a
853b
853a
833d
853d

Fig. 8


970
MEMORY
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I/O
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PROCESSOR
973
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Fig. 9

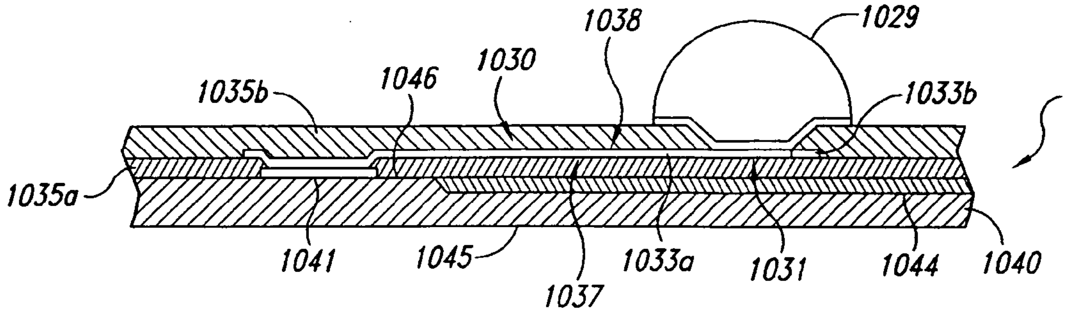
1038
1029
1030
1046
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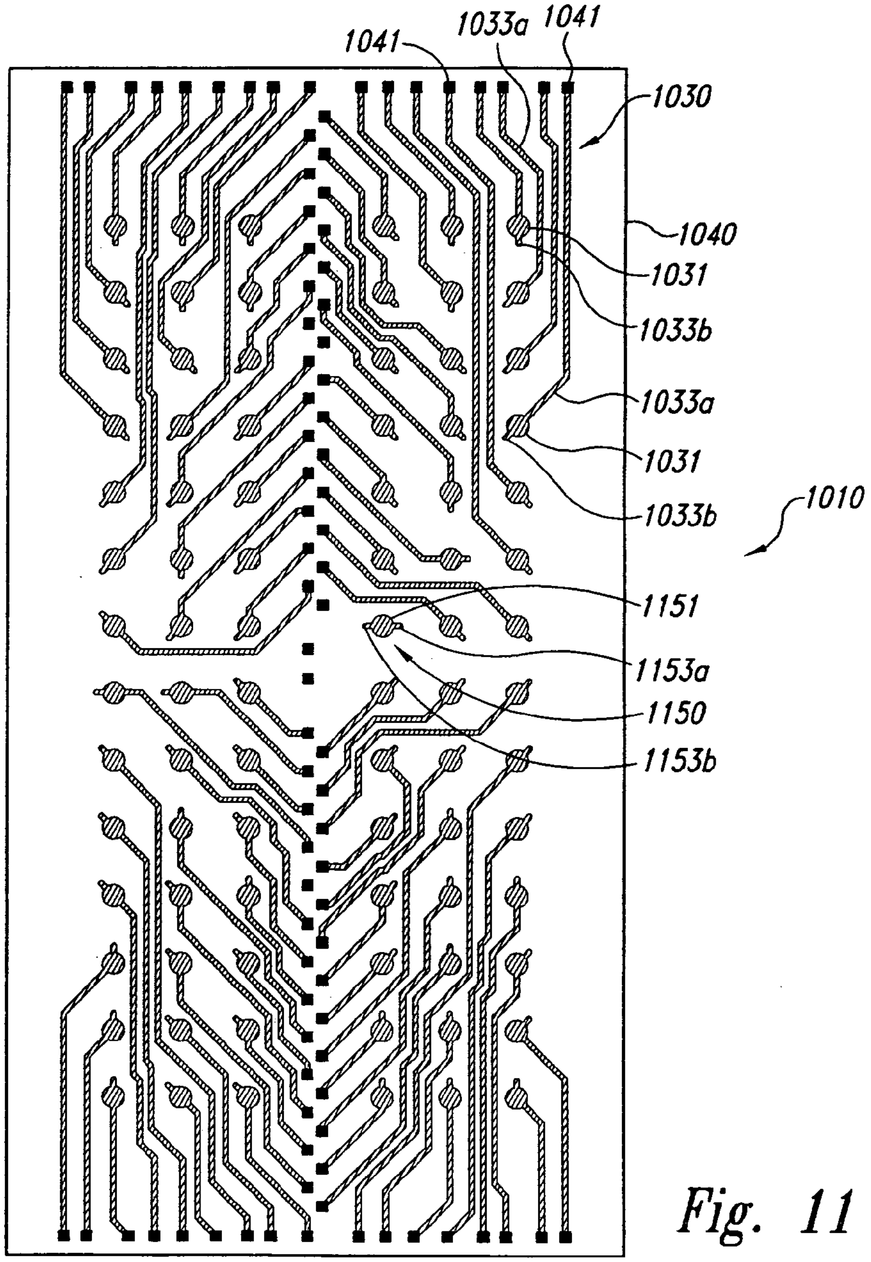
Fig. 10


1041
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1033b
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1153a
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1153b

Fig. 11

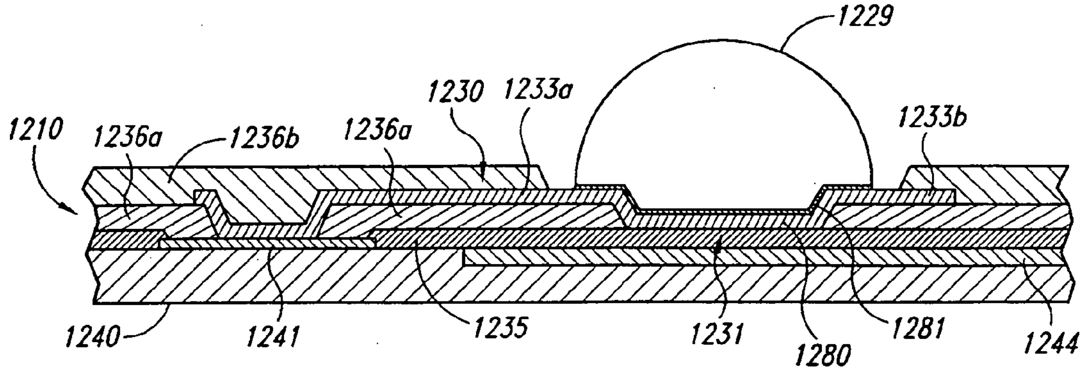


Fig. 12A

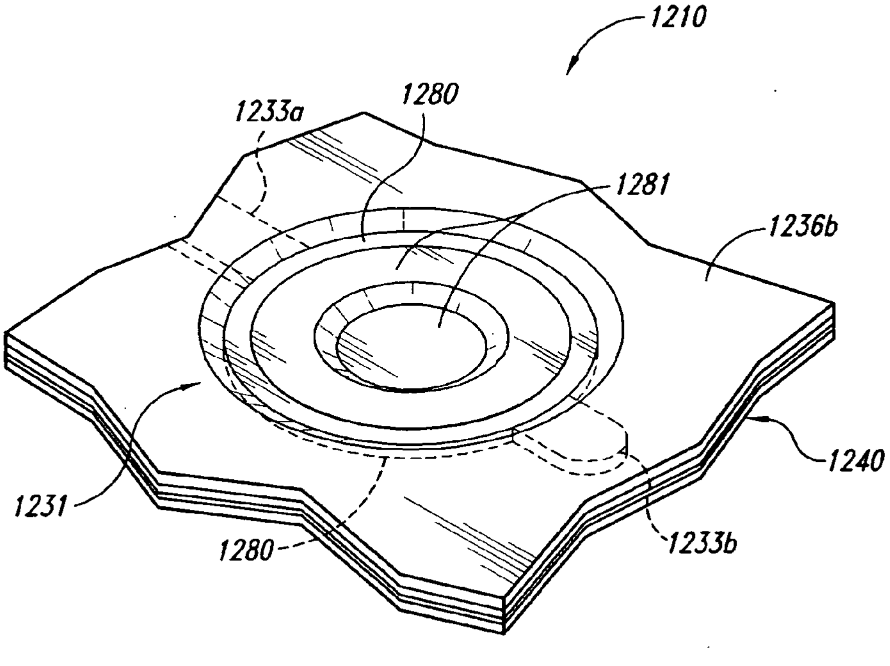


Fig. 12B

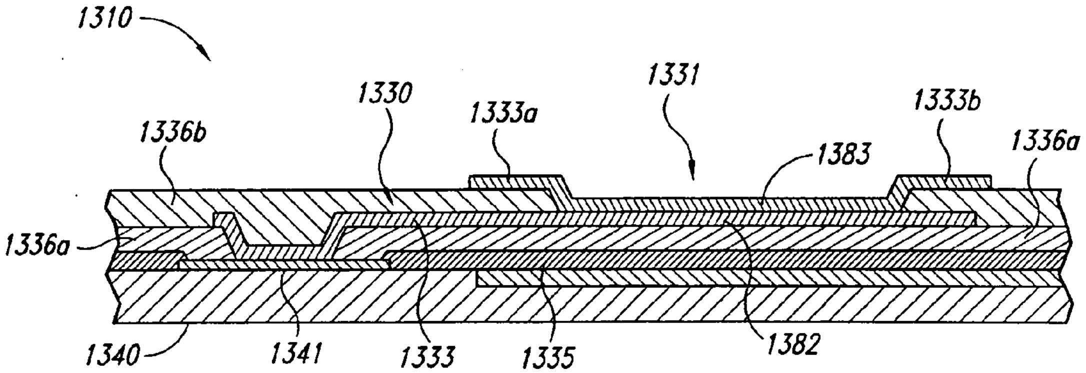


Fig. 13A

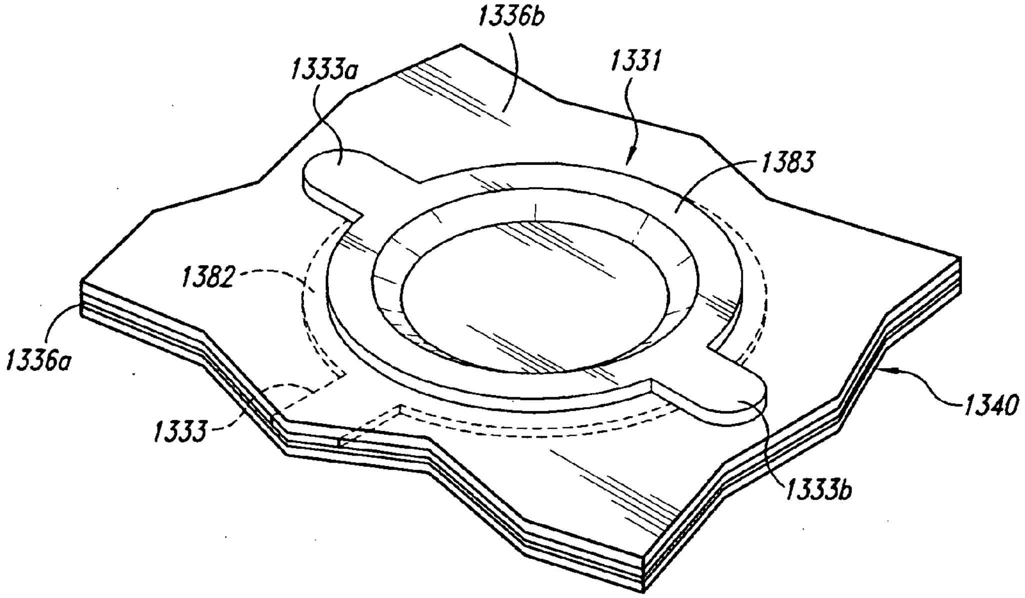
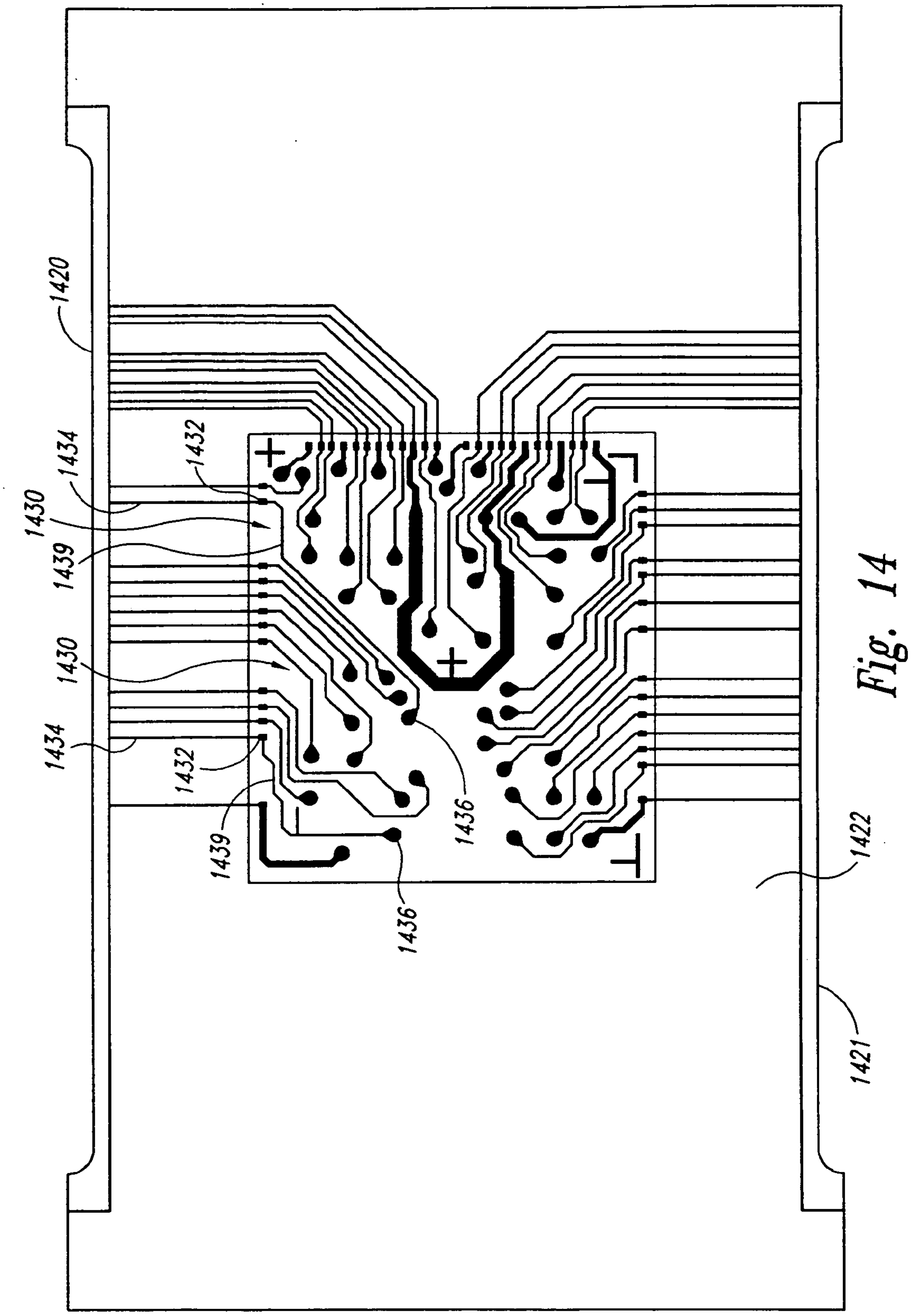


Fig. 13B


1420
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1421

Fig. 14

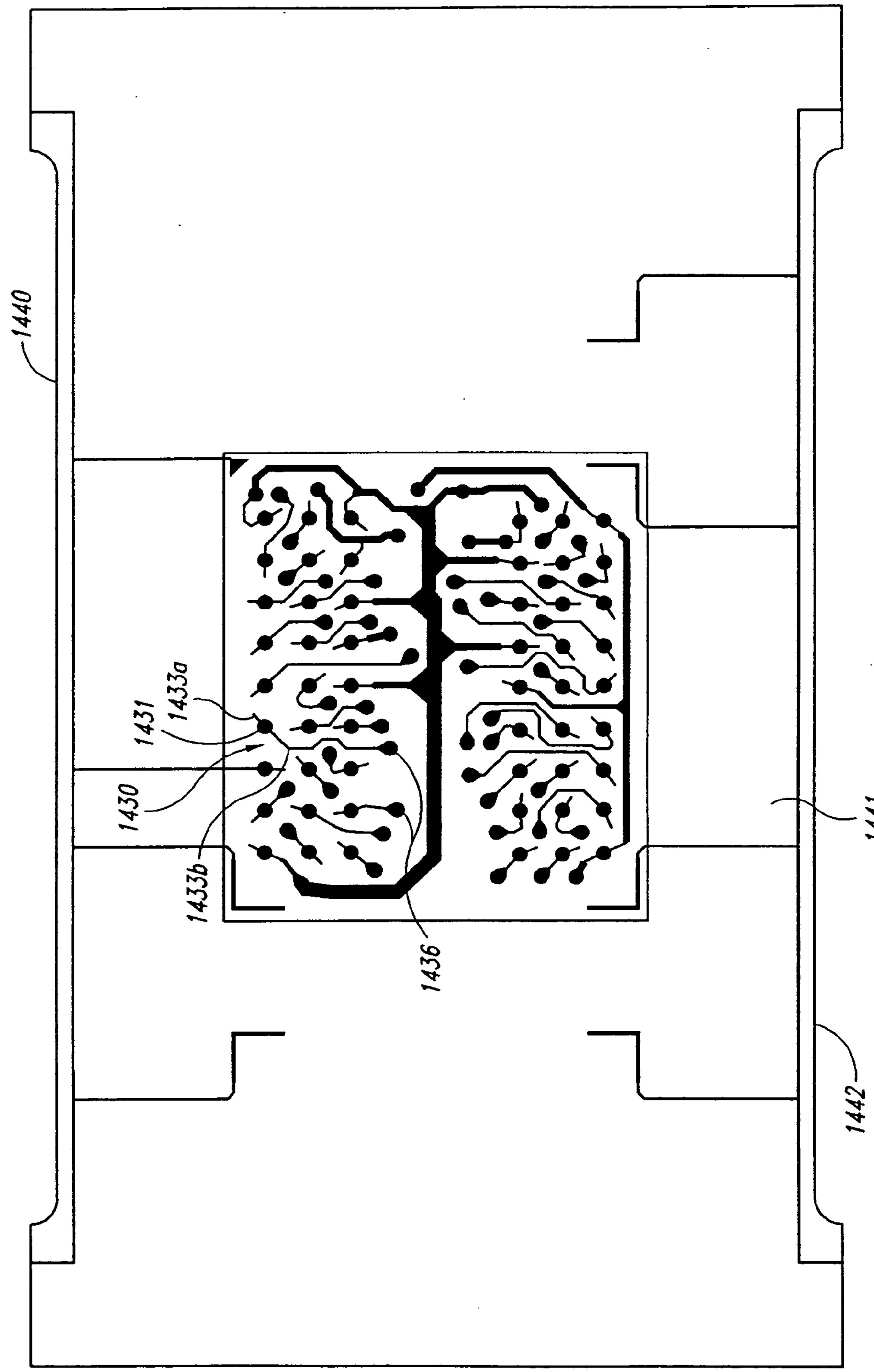

Fig. 15

METHOD AND APPARATUS FOR SUPPORTING MICROELECTRONIC SUBSTRATES

BACKGROUND

[0001] The present invention is directed toward methods and apparatuses for supporting microelectronic substrates. Conventional microelectronic device packages typically include a microelectronic substrate mounted on a support member and packaged with an encapsulant. In one conventional arrangement shown in **FIG. 1**, a microelectronic device package **10** can include a support member **20** having a front surface **21** and a rear surface **22** facing opposite the front surface **21**. The support member **20** can also have a slot **23** extending from the front surface **21** to the rear surface **22**. A microelectronic substrate **40** (visible through the slot **23**) is attached to the rear surface **22**, and has wire bond pads **41** that are accessible through the slot **23** for coupling to the support member **20**. Accordingly, the support member **20** can include active trace patterns **30**, each of which has a wire bond pad **32**, a ball bond pad **31**, and a connecting trace **33** extending between the wire bond pad **32** and the ball bond pad **31**. Each active trace pattern **30** can also include an electroplating trace **34** coupled to an electroplating bus **24** to provide electrically conductive coatings on the active trace pattern **30** during the formation of the support member **20**.

[0002] In operation, the wire bond pads **32** of the active trace patterns **30** are connected to corresponding wire bond pads **41** of the microelectronic substrate **40** with wire bonds **42**. A solder ball (not shown in **FIG. 1**) can then be disposed on each ball bond pad **31**. The wire bonds **42** and the wire bond pads **41** and **32** can then be covered with an encapsulating material for protection, while the solder balls remain exposed. The exposed solder balls can be connected to other devices to provide for communication between those devices and the packaged microelectronic substrate **40**.

[0003] In order to conform with industry standards, similar device packages **10** are often required to have the same number of solder balls, even if not all the solder balls are required to provide communication with the microelectronic substrate **40**. Accordingly, the support member **20** can include inactive trace patterns **50**. Each inactive trace pattern **50** can include a ball bond pad **51** that supports a solder ball, and an electroplating trace **54** for electroplating conductive coatings on the inactive trace pattern **50**. The inactive trace patterns **50** do not include a wire bond pad **32** or a corresponding connecting trace **33**. Accordingly, the inactive trace patterns **50** do not provide electrical communication to or from the microelectronic substrate **40**. However, the inactive trace patterns **50** can support solder balls which, together with the solder balls on the active trace patterns **30**, define a uniform pattern of solder balls that can be compatible with a variety of devices in which the package **10** is installed and/or tested.

[0004] **FIG. 2** illustrates a conventional test apparatus **60** for testing device packages such as the package **10** described above with reference to **FIG. 1**. In one aspect of this arrangement, the test apparatus **60** can include a base **61** that supports the device package **10**. An overlying frame **62** secures the package **10** to the base **61**. When the package **10** is secured to the base **61**, solder balls **25** of the package **10** remain exposed through an opening **65** in the frame **62**. A test jig **63** is then aligned with the base **61** such that test contacts **64** of the jig **63** make physical and electrical contact with the solder balls **25** of the package **10**. The test jig **63** is then used to test the operational characteristics of the device package **10**.

[0005] One drawback with the foregoing arrangement is that the test jig **63** can partially or completely dislodge some of the solder balls **25** and/or the trace patterns to which the solder balls **25** are connected. The dislodged solder balls **25** and/or trace patterns can increase the incidence of short circuits in the package **10**, and accordingly packages with these defects are typically discarded.

SUMMARY

[0006] The present invention is directed toward methods and apparatuses for supporting microelectronic substrates. An apparatus in according with one aspect of the invention includes a microelectronic substrate, a support member carrying the microelectronic substrate, and a connection structure carried by the support member. The connection structure can have a bond site configured to receive a flowable conductive material, such as solder, and the connection site can further have at least two elongated members connected to and extending outwardly from the bond site. Each elongated member can be configured to receive at least a portion of the flowable conductive material from the bond site, and none of the elongated members is electrically coupled to the microelectronic substrate.

[0007] In a further aspect of the invention, the connection structure can be a first connection structure and the elongated members can be first elongated members. The apparatus can include a second connection structure carried by the support member and having a second bond site configured to receive a flowable conductive material. The second connection structure can be electrically coupled to the microelectronic substrate and can have second elongated members extending outwardly from the second bond site, with each of the second elongated members configured to receive at least a portion of the flowable conductive material from the second bond site. The number of second elongated members for each second connection structure can equal the number of first elongated members for the first connection structure.

[0008] The invention is also directed to a method for coupling a flowable conductive material to a microelectronic substrate. The method can include aligning a support member to receive the flowable conductive material, with the support member having a support surface configured to carry a microelectronic substrate, and further having a first connection structure and second connection structure. The first connection structure can have a first bond site configured to receive the flowable conductive material and can be configured to remain decoupled from the microelectronic substrate when a support member carries the microelectronic substrate. The second connection structure can have a second bond site configured to receive the flowable conductive material, and can be configured to be electrically coupled to the microelectronic substrate when the support member carries the microelectronic substrate. The method can further include disposing a first quantity of the flowable conductive material on the first bond site, wicking a first portion of the first quantity of flowable material along first elongated members connected to and extending outwardly from the first bond site, and disposing a second quantity of the flowable conductive material on the second bond site. The method can further include wicking a second portion of the second quantity of flowable conductive material along second elongated members extending outwardly from the second bond site, with the second portion of the flowable conductive material having a volume approximately equal to a volume of the first portion. The first quantity of flowable conductive material can form a first conductive coupler, the second quantity can form a second conductive coupler, and each conductive coupler can project from the support member by approximately the same distance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** is a bottom view of a microelectronic device package in accordance with the prior art, with selected features shown schematically.

[0010] **FIG. 2** is a partially exploded illustration of a test apparatus for testing microelectronic device packages in accordance with the prior art.

[0011] **FIG. 3A** is a plan view of a support member having active and inactive connection structures in accordance with an embodiment of the invention.

[0012] **FIG. 3B** is an enlarged view of a portion of the support member shown in **FIG. 3A**, connected to a microelectronic substrate in accordance with an embodiment of the invention.

[0013] **FIG. 3C** is an isometric view of portions of active and inactive connection structures, with certain features shown schematically in accordance with an embodiment of the invention.

[0014] **FIG. 3D** is an enlarged plan view of another portion of the support member shown in **FIG. 3A**, connected to a microelectronic substrate in accordance with an embodiment of the invention.

[0015] **FIG. 4** is an enlarged plan view of a portion of a support member in accordance with another embodiment of the invention.

[0016] **FIG. 5** is a plan view of a portion of a support member having active and inactive connection structures configured for electroplating in accordance with another embodiment of the invention.

[0017] **FIG. 6** is a plan view of a portion of a support member having active and inactive connection structures configured for electroless plating in accordance with another embodiment of the invention.

[0018] **FIG. 7** is a plan view of a portion of a support member having active and inactive connection structures configured for electroplating in accordance with yet another embodiment of the invention.

[0019] **FIG. 8** is a plan view of a portion of a support member having active and inactive connection structures configured for electroless plating in accordance with still another embodiment of the invention.

[0020] **FIG. 9** is a schematic illustration of a device that includes apparatuses in accordance with another aspect of the invention.

[0021] **FIG. 10** is a cross-sectional side view of an apparatus including a microelectronic substrate and a connection structure in accordance with another embodiment of the invention.

[0022] **FIG. 11** is a plan view of the apparatus shown in **FIG. 10** in accordance with an embodiment of the invention.

[0023] **FIG. 12A** is a cross-sectional side view of an apparatus including a microelectronic substrate and a connection structure having elongated members in accordance with yet another embodiment of the invention.

[0024] **FIG. 12B** is a top isometric view of a portion of the apparatus shown in **FIG. 12A**.

[0025] **FIG. 13A** is a cross-sectional side view of an apparatus including a microelectronic substrate and a connection structure in accordance with still another embodiment of the invention.

[0026] **FIG. 13B** is a top isometric view of a portion of the apparatus shown in **FIG. 13A**.

[0027] **FIG. 14** is a top plan view of a support member in accordance with another embodiment of the invention.

[0028] **FIG. 15** is a bottom plan view of the support member shown in **FIG. 14** in accordance with an embodiment of the invention.

DETAILED DESCRIPTION

[0029] The present disclosure describes packaged microelectronic substrates and methods for forming such packages. The term "microelectronic substrate" is used throughout to include substrates upon which and/or in which microelectronic circuits or components, data storage elements or layers, and/or vias or conductive lines are or can be fabricated. Many specific details of certain embodiments of the invention are set forth in the following description and in **FIGS. 3A-9** to provide a thorough understanding of these embodiments. One skilled in the art, however, will understand that the present invention may have additional embodiments, and that the invention may be practiced without several of the details described below.

[0030] As described above with reference to **FIGS. 1 and 2**, a drawback with some conventional arrangements is that the solder balls and/or trace patterns of the packaged device can become dislodged during testing, which typically requires discarding the package. In some cases, it has been observed that the inactive solder balls and traces may become dislodged more frequently than the active solder balls and traces. Accordingly, in several of the embodiments described below, the inactive traces (or connection structures) are more securely attached to the support member, and/or are configured to be symmetric with the active traces (or connection structures). Accordingly, the solder balls or other conductive couplers disposed on the inactive connection structures can have a size, shape and support generally similar to the size, shape and support of the conductive couplers disposed on the active connection structures. As a result, the package can be less likely to be damaged during testing or installation.

[0031] **FIG. 3A** is a plan view of an apparatus **110** having a support member **120** in accordance with an embodiment of the invention. The support member **120** can have a first surface **121** that supports active connection structures **130** and inactive connection structures **150**. The first surface **121** can also include plating buses **124** (shown in **FIG. 3A** as edge plating buses **124***a* and a central plating bus **124***b*) that provide current for plating conductive materials onto the active connection structures **130** and the inactive connection structures **150** as these structures are manufactured. The support member **120** can further include a second surface **122** facing in an opposite direction from the first surface **121** and configured to support a microelectronic substrate for coupling to the active connection structures **130**. The support member **120** can include a relatively thin sheet of flexible, epoxy resin, such as BT (bimaleimide triazine) or another suitable material.

[**0032**] **FIG. 3B** is a detailed plan view of a portion of the apparatus **110** described above with reference to **FIG. 3A**, attached to a microelectronic substrate **140**. As shown in **FIG. 3B**, the central plating bus **124** (**FIG. 3A**) has been removed to form a slot **123** that extends through the support member **120** from the first surface **121** to the second surface **122**. The microelectronic substrate **140** has been mounted to the second surface **122** of the support member **120** such that wire bond pads **141** of the microelectronic substrate **140** are accessible through the slot **123** for connecting to the active connection structures **130** on the first surface **121** of the support member **120**.

[**0033**] The active connection structures **130** can each include an active bond site **131**, such as a ball bond pad, which is configured to support a volume of a flowable conductive material, such as solder. When the flowable conductive material is disposed on the active bond site **131** and placed in a flowable state (for example, in a solder reflow oven), it can form an at least partially spherical or globular shape suitable for electrically and physically connecting the active connection structure **130** to other devices or circuit elements. The active connection structure **130** can further include two active elongated members **133**, shown in **FIG. 3B** as active elongated members **133***a* and **133***b*. The active elongated member **133***a* extends away from the slot **123** for connecting to the edge plating bus **124***a* (**FIG. 3A**). The active elongated member **133***b* extends between the active bond site **131** and a wire bond pad **132** positioned adjacent to the slot **123**. The wire bond pad **132** can be connected with a wire bond **142** to a corresponding one of the wire bond pads **141** of the microelectronic substrate **140** to provide electrical communication between the wire bond pad **141** and the active bond site **131**.

[**0034**] The inactive connection structures **150** can each include an inactive bond site **151**, such as a ball bond pad, coupled to two inactive elongated members **153**, shown in **FIG. 3B** as inactive elongated members **153***a* and **153***b*. Accordingly, the inactive bond site **151** can support a flowable conductive material, such as a solder ball. The inactive elongated member **153***a* extends away from the slot **123** for connecting to the edge plating bus **124***a* (**FIG. 3A**). The inactive elongated member **153***b* can be shorter than the inactive elongated member **153***a* to define an elongated tab shape, and can remain electrically decoupled from the microelectronic substrate **140**. Accordingly, the inactive bond sites **151** are not electrically connected to the microelectronic substrates **140**; however, the solder balls they support (in combination with the solder balls of the active bond sites **131**) can form a uniform pattern that is compatible with a variety of electronic devices and test fixtures.

[**0035**] **FIG. 3C** is an isometric view of a portion of the support member **120** showing an active connection structure **130** and an inactive connection structure **150**, each carrying a quantity of flowable conductive material **125** in accordance with an embodiment of the invention. Accordingly, the flowable conductive material **125** can form conductive couplers **129** (such as solder balls), shown in **FIG. 3C** as an active conductive coupler **129***a* supported by the active connection structure **130**, and an inactive conductive coupler **129***b* supported by the inactive connection structure **150**. In one aspect of this embodiment, the active elongated members **133***a,b* and the inactive elongated members **153***a,b* can include materials that are easily wetted by the flowable conductive material **125**. For example, when the flowable conductive material **125** includes solder, the elongated members **153***a,b* and **133***a,b* can include nickel, gold, and/or copper or other metallic constituents. Accordingly, when the flowable conductive material **125** is disposed on the bond sites **131** and **151**, it tends to wick along the elongated members **133***a,b* and **153***a,b*, respectively. When the flowable conductive material **125** solidifies to form the conductive couplers **129**, it can have an at least partially elipsoid shape.

[**0036**] In a further aspect of this embodiment, the support member **120** can optionally include a cover layer **126** attached to the first surface **121** with the connection structures **130** and **150** disposed between the cover layer **126** and the first surface **121**. In one embodiment, the cover layer **126** can include a solder mask, and in other embodiments, the cover layer **126** can include other materials. In any of these embodiments, the cover layer **126** can have apertures **127** (shown as apertures **127***a* and **127***b*) aligned with the bond sites **131** and **151**, respectively. The apertures **127** are sized to leave the bond sites **131** and **151** exposed, while covering at least part of each elongated member **133***a,b* and **153***a,b* to aid in securing the elongated members to the support member **120**. In an alternative embodiment (shown in dashed lines in **FIG. 3C**) the apertures are sized to leave the bond sites **131** and **151** exposed while covering each elongated member **133***a,b* and **153***a,b* up to the edge of the corresponding bond site **131**, **151**. In other embodiments, the elongated members **133***a,b* can be secured directly to the first surface **121** without the cover layer **126**.

[**0037**] In one embodiment, the bond sites **131** and **150** can each have a diameter of about 330 microns, and each elongated member **133***a,b* and **153***a,b* (and in particular, the inactive elongated member **153***b*) can have a length L of at least 250 microns. The apertures **127***a,b* in the cover layer **126** can have a diameter of about 430 microns. Accordingly, each bond site **131**, **151** can be completely exposed through the corresponding aperture **127***a*, **127***b*. A portion **128** of each elongated member **133***a,b* and **153***a,b* can also be exposed for a distance D_1 of about 50 microns, measured from the edge of the corresponding bond site **131**, **151**, respectively. The elongated member **153***b* can be covered by the cover layer **126** for a distance D_2 of about 200 microns, and the remaining elongated members can be covered for distances greater than D_2. In other embodiments, the foregoing dimensions can have other values.

[**0038**] In a further aspect of this embodiment, each elongated member **153***a,b* and **133***a,b* can have approximately the same width W in a direction transverse to the elongation direction to increase the likelihood that the flowable conductive material **125** will wick along each elongated member in at least approximately the same way. In yet a further aspect of this embodiment, the angular spacing between the active elongated members **133***a* and **133***b* can be about the same as the angular spacing between the inactive elongated members **131***a* and **131***b* (about 180° in FIGS. **3**A-C).

[**0039**] One feature of the foregoing arrangement is that the number of inactive elongated members **153** extending away from the inactive bond site **151** is equal to the number of active elongated members **133** extending away from the active bond site **131**. Accordingly, the cover layer **126** (or alternatively the elongated members alone) can provide approximately the same securing force to both the inactive connection structure **150** and the active connection structure **130**. As a result, the inactive elongated members **153***a,b* can be less likely to pull away from the support member **120** when subjected to stresses, such as shear stresses which may be imposed on the conductive couplers **129** during testing. This feature can apply when the cover layer **126** covers some or all of the elongated members, and/or when the cover layer **126** is not implemented. This is unlike some conventional arrangements (such as those described above with reference to **FIGS. 1 and 2**) for which the inactive connection structure may have fewer elongated members than the active connection structure and may accordingly be more likely to pull away from the support member when subjected to shear or other stresses.

[**0040**] Another feature of an embodiment of the arrangement described above with reference to FIGS. **3**A-C is that the inactive elongated members **153** can wick away the flowable conductive material **125** in generally the same manner and to generally the same extent as the active elongated members **133**. For example, because the number of inactive elongated members **153** extending away from each inactive bond site **151** can be the same as the number of active elongated members **133** extending away from each active bond site **131**, the flowable conductive material **125** will tend to wick away from both bond sites in generally the same way. Accordingly, approximately the same volume of flowable conductive material will tend to wick along each elongated member and away from each bond site, whether the bond site is active or inactive.

[**0041**] Another feature of an embodiment of the arrangement described above with reference to FIGS. **3**A-C is that the angular spacing between adjacent inactive elongated members **153** can be about the same as the angular spacing between adjacent active elongated members **133**. As a result, the overall size and shape of flowable conductive material **125** remaining on the inactive bond site **151** (forming the inactive conductive coupler **129***b*) can be approximately the same as the overall size and shape of the flowable conductive material **125** remaining on the active bond site **131** (forming the active conductive coupler **129***a*). For example, the height H_2 by which the inactive conductive coupler **129***b* projects from the support member **120** can be at least approximately the same as the height H_1 by which the active conductive coupler **129***a* projects from the support member **120**.

[**0042**] Yet another feature of an embodiment of the arrangement describe above with reference to FIGS. **3**A-C is that the distance D, can be at least approximately the same for both the active elongated members **133***a,b* and the inactive elongated members **153***a,b*. Accordingly, the flowable conductive material **125** (which tends to wick along the exposed portions of the elongated members, but not beneath the cover layer **126**) can wick away from the inactive bond site **151** in generally the same manner and to generally the same extent as it wicks away from the active bond site **131**. As a result, the shape of the inactive conductive coupler **129***b* can be at least approximately identical to the shape of the active conductive coupler **129***a*.

[**0043**] An advantage of the foregoing features is that the inactive conductive couplers **129***b* can be contacted by a conventional test fixture (such as the fixture **60** shown in **FIG. 2**) in generally the same manner as are the active conductive couplers **129***a* because the shapes and sizes of the conductive couplers **129***a,b* are about the same. This is unlike some conventional arrangements (such as the arrangement described above with reference to **FIG. 1**) in which the inactive solder balls may project from the support member by a greater distance than the active solder balls because the solder disposed on the inactive ball bond pads has fewer avenues along which to wick away. In such conventional arrangements, the inactive solder balls may come under greater stress during testing and may be more likely to become dislodged.

[**0044**] **FIG. 3D** is an enlarged plan view of another portion of the apparatus **110** described above with reference to **FIG. 3A**. Three of the active connection structures **130** shown in **FIG. 3D** have an electroplating trace **134** connected between the central plating bus **124***b* and the corresponding wire bond pad **132**. These active connection structures **130** also have an active elongated member **133***a* extending between the wire bond pad **132** and the corresponding bond site **131**. These active connection structures **130** can further include an active elongated member **133***b* having an elongated tab shape generally similar to that of the inactive elongated members **153***b* described above. Accordingly, the active connection structures **130** and the inactive connection structure **150** shown in **FIG. 3D** can each have the same number of elongated members extending from the corresponding bond sites, and can accordingly carry conductive couplers (not shown in **FIG. 3D**) having at least approximately similar shapes in a manner generally similar to that described above with reference to FIGS. **3**A-C.

[**0045**] **FIGS. 4-8** illustrate support members with connection structures having arrangements in accordance with further embodiments of the invention. For example, **FIG. 4** illustrates a support member **420** having an active connection structure **430** and an inactive connection structure **450**, neither of which includes an electroplating trace. Accordingly, the support member **420** can be processed electrolessly to plate the connection structures **430** and **450** during manufacturing. The active connection structure **430** can include an active bond site **431** having an active elongated member **433***a* connected to a corresponding wire bond pad **432** in a manner generally similar to that described above. The active connection structure **430** can also include a tab-shaped active elongated member **433***b* extending away from the active bond site **431**.

[**0046**] The inactive connection structure **450** can include an inactive bond site **451** and two inactive elongated members **453***a* and **453***b*. In a further aspect of this embodiment, the inactive elongated member **453***b* can include an anchor **455** which can increase the strength of the connection between the inactive connection structure **450** and the support member **420**. For example, the anchor **455** can provide more surface area beneath the corresponding cover layer **126** (not shown in **FIG. 4**), which can further reduce the likelihood for tearing the inactive connection structure **450** away from the support member **420** when the inactive connection structure **450** is subjected to a shear stress. In one embodiment, the anchor **455** can have a generally triangular shape, and in other embodiments, the anchor **455** can have other shapes. In still further embodiments, the anchor **455** can be included as part of any of the elongated members described above or below, when space permits.

[0047] **FIG. 5** illustrates an embodiment of a support member **520** having an active connection structure **530** with three active elongated members **533***a*, **533***b* and **533***c*. The support member **520** can further include an inactive connection structure **550** having three inactive elongated members **553***a*, **553***b* and **553***c*. The elongated members **533***a* and **553***a* can be coupled to an edge plating bus (not shown in **FIG. 5**), and the elongated member **533***b* can be coupled to a wire bond pad (not shown in **FIG. 5**) in a manner generally similar to that described above. The elongated members **533***a*, **533***b* and **553***a*, as well as the elongated members **533***c*, **553***b* and **553***c* (which are not connected to other conductive structures) can extend beneath a cover layer **526** to secure the connection structures to the support member **520**, as was generally discussed above. Alternatively, the cover layer **526** can be eliminated and the elongated members can be secured to the support member **520** with other techniques. In either embodiment, the active connection structure **530** and the inactive connection structure **550** can each include the same number of elongated members and can accordingly support conductive couplers having at least approximately similar shapes and sizes. In a further aspect of this embodiment, each elongated member can be angularly spaced apart from its neighbor by about 120°. In other embodiments, the angular spacing can have other values for which the angular spacings for the active elongated members **533***a-c* are at least generally similar to those for the inactive elongated members **553***a-c*.

[0048] **FIG. 6** illustrates a support member **620** having an active connection structures **630** and an inactive connection structures **650**. These connection structures are generally similar to the connection structures described above except that the connection structures **630** and **650** are configured for electroless plating. Accordingly, the active connection structure **630** can include an active elongated member **633***b* coupled to a wire bond pad (not shown in **FIG. 6**), and can also include two tab-shaped elongated members **633***a* and **633***c* that are not connected to other conductive structures. All three inactive elongated members **653***a-c* can be unconnected to other conductive structures.

[0049] **FIG. 7** illustrates a support member **720** having an active connection structure **730** with four active elongated members **733***a-d*, and an inactive connection structure **750** having four inactive elongated members **753***a-d*. The elongated members **733***a* and **753***a* are each configured to be coupled to a plating bus in a manner generally similar to that described above with reference to **FIGS. 3B and 5**. In one aspect of this embodiment, each elongated member is angularly spaced apart from its neighbor by about 90°. In other embodiments, the angular spacing can have other values with the angular spacing between adjacent active elongated members **733***a-d* being approximately the same as the angular spacing between inactive elongated members **753***a-d*, and the number of active elongated members **733** being the same as the number of inactive elongated members.

[0050] **FIG. 8** illustrates a support member **820** having an active connection structure **830** and an inactive connection structure **850**, each configured for electroless plating. Accordingly, the active connection structure **830** can have four active elongated members **833***a-d*. The inactive connection structure **850** can have four inactive elongated members **853***a-d*. As described above, the number of and spacing between active elongated members **833***a-d* can be at least approximately the same as for the inactive elongated members **853***a-d*.

[0051] In other embodiments, the active and inactive connection structures can have other shapes and arrangements for which the number of elongated members extending outwardly from an active bond site is equal to the number of elongated members extending outwardly from an inactive bond site. In any of these arrangements, the connection structures and, optionally, the corresponding cover layers, can support conductive couplers (such as solder balls) having generally similar shapes and similar behaviors, regardless of whether the conductive couplers are carried by an active bond site or an inactive bond site.

[0052] **FIG. 9** is a schematic illustration of an electronic device **970** that includes one or more apparatuses **910** in accordance with an embodiment of the invention. In one aspect of this embodiment, the electronic device can include a computer, a telecommunication device or another device that incorporates microelectronic components. Accordingly, the device **910** can include a housing **971** containing a processor **973**, a memory **972** and/or an input/output device **974**, each of which can include an apparatus **910** generally similar to any of the apparatuses described above with reference to **FIGS. 3A-8**. The device **910** can also include other apparatuses **910** in addition to or in lieu of the apparatuses incorporated into the processor **973**, the memory **972** and/or the input/output device **974**.

[0053] **FIG. 10** is a cross-sectional side view of an apparatus **1010** that includes a microelectronic substrate **1040** having a connection structure **1030** disposed on it in accordance with another embodiment of the invention. In one aspect of this embodiment, the microelectronic substrate **1040** can have a first surface **1045** and a second surface **1046** facing opposite from the first surface **1045**. The microelectronic substrate **1040** can further include active microelectronic features **1044** positioned proximate to the second surface **1046**, and a first bond site **1041** (such as a bond pad), also positioned proximate to the second surface **1046**.

[0054] The connection structure **1030** can include a second bond site **1031** spaced apart from the first bond site **1041**. The second bond site **1031** can include a solder ball pad, and can support a conductive coupler **1029**, such as a solder ball. Accordingly, the appuratus **1010** can have a "flip chip" configuration. In other embodiments, the second bond site **1031** can have other configurations and can support other types of conductive couplers. In any of these embodiments, the connection structure **1030** can include an electrically conductive material (such as a metal redistribution layer) and can have a first surface **1037** facing toward the second surface **1046** of the microelectronic substrate **1040**, and a second surface **1038** facing opposite from the first surface **1037**. The connection structure **1030** can further include elongated members **1033***a* and **1033***b* extending outwardly from the second bond site **1031**. In one aspect of this embodiment, the elongated member **1033***a* can be connected between the second bond site **1031** of the connection structure and the first bond site **1041** of the microelectronic substrate **1040**. The elongated member **1033***b* can have a generally tab-shaped configuration, generally similar to those described above.

[**0055**] In a further aspect of this embodiment, the apparatus **1010** can include passivation layers **1035** (shown as a first passivation layer **1035***a* and a second passivation layer **1035***b*) positioned between electrically conductive elements of the apparatus **1010** to at least partially isolate these elements from each other. For example, the first passivation layer **1035***a* can be positioned between the second surface **1046** (including the active microelectronic features **1044**) of the microelectronic substrate **1040**, and the first surface **1037** of the connection structure **1030**. The second passivation layer **1035***b* can be positioned adjacent to the second surface **1038** of the connection structure **1030**. In one aspect of this embodiment, the second passivation layer **1035***b* can perform at least some of the same functions as the cover layer **126** described above reference to **FIG. 3C**. Accordingly, the second passivation layer **1035***b* can aid in securing the connection structure **1030** to the microelectronic substrate **1044**. In one embodiment, the second passivation layer **1035***b* can extend over the entire lengths of the elongated members **1033***a*, **1033***b*, while leaving the second connection site **1031** exposed to receive the conductive coupler **1029**. Alternatively, the second passivation layer **1035***b* can leave portions of the elongated members **1033***a*, **1033***b* proximate to the second bond site **1031** exposed to allow the conductive coupler **1029** to wick along the elongated members **1033***a*, **1033***b*, generally as was described above with reference to **FIG. 3C**.

[**0056**] **FIG. 11** is a plan view of an embodiment of the apparatus **1010** described above with reference to **FIG. 10**. In one aspect of this embodiment, each of the elongated members **1033***a* can extend between the corresponding first bond site **1041** of the microelectronic substrate **1040** and the corresponding second bond site **1031**, and can be generally co-planer with each other. In an alternative embodiment, the elongated members **1033***a* can cross over each other, for example, by extending into different planes normal to the plane of **FIG. 11** to avoid electrical contact with the elongated members over which they pass.

[**0057**] In a further aspect of this embodiment, the apparatus **1010** can include an inactive connection structure **1150** having a second bond site **1151**. Elongated members **1153***a*, **1153***b* can extend outwardly from the second bond site **1151**, without being electrically connected to the microelectronic substrate **1040**. Accordingly, the inactive connection structures **1150** can support a conductive coupler to provide uniformity with a pre-selected pattern of conductive couplers, in a manner generally similar to that described above.

[**0058**] FIGS. 12A-B illustrate a cross-sectional side view and top isometric view, respectively, of an apparatus **1210** in accordance with another embodiment of the invention. In one aspect of this embodiment, the apparatus **1210** can include a microelectronic substrate **1240** having a first bond site **1241**, and a connection structure **1230** having a second bond site **1231**. The microelectronic substrate **1240** can include active devices **1244** electrically coupled to the first bond site **1241**. The connection structure **1230** can include a plurality of elongated members **1233** (two are shown in FIGS. 12A-B as elongated members **1233***a*, **1233***b*) extending outwardly from the second bond site **1231**. In one aspect of this embodiment, the elongated member **1233***a* can be coupled between the first bond site **1241** and the second bond site **1231** and the elongated member **1233***b* can include an elongated tab-shaped member generally similar to those described above. The bond site **1231** can include a support portion **1280** carrying a wettable portion **1281**. The support portion **1280** can have a composition generally similar to that of the elongated members **1233***a*-**1233***b* (for example, a composite of aluminum, nickel, copper and titanium), and the wettable portion **1281** can have a different composition (such as a composite of nickel and copper). Accordingly, the wettable portion **1281** can be configured to be wetted by a flowable conductive material (such as solder) to support and electrically couple to a conductive coupler **1229**.

[**0059**] In a further aspect of this embodiment, the apparatus **1210** can include a die passivation layer **1235** positioned between the active devices **1244** and the connection structure **1230**. A first dielectric layer **1236***a* can be disposed between the passivation layer **1235** and the elongated members **1233***a*, **1233***b*, and a second dielectric layer **1236***b* can be disposed on top of the connection structure **1230**. In one aspect of an embodiment shown in **FIGS. 12A** and B, the elongated members **1233***a*, **1233***b* are not wetted by the conductive coupler **1229** because the wettable portion **1281** of the second bond site **1231** does not extend over the elongated members. In an alternate embodiment, the elongated members **1233***a*, **1233***b* can be wetted by the conductive coupler **1229** in a manner generally similar to that described above with reference to **FIG. 3C**.

[**0060**] **FIG. 13A** is a cross-sectional side view of an apparatus **1310** having a connection structure **1330** in accordance with another embodiment of the invention. **FIG. 13B** is a top isometric view of a portion of the apparatus **1310** shown in **FIG. 13A**. Referring first to **FIG. 13A**, the apparatus **1310** can include a microelectronic substrate **1340** having a first bond site **1341**, a passivation layer **1335**, and a first dielectric layer **1336***a* disposed on the passivation layer **1335**. The connection structure **1330** can be disposed on the first dielectric layer **1336***a* and can include a second bond site **1331** electrically connected to the first bond site **1341** with a connecting trace **1333**.

[**0061**] Referring now to **FIGS. 13A and 13B**, the second bond site **1331** can include a generally circular first portion **1382** positioned on the first dielectric layer **1336***a* and electrically connected to the connecting trace **1333**. A second dielectric layer **1336***b* can be disposed on the connection structure **1330**, including the first portion **1382** of the second bond site **1331**. The second bond site **1331** can further include a second portion **1383** electrically connected to the first portion **1382** and having at least two elongated members **1333***a*, **1333***b* extending outwardly therefrom over the second dielectric layer **1336***b*. In one aspect of this embodiment, the first portion **1382** can include a composite of titanium and either copper or aluminum, and the second portion **1383** can include a composite of titanium, copper, and nickel. In other embodiments, these components can include other constituents. In any of these embodiments, the elongated member **1333***a*, **1333***b* can provide some or all of the advantages described above with reference to the foregoing figures.

[**0062**] **FIG. 14** illustrates a top plan view of a support member **1420** for supporting a microelectronic substrate in accordance with another embodiment of the invention. In one aspect of this embodiment, the support member **1420** can include a first surface **1421** and a second surface **1422** facing opposite from the first surface **1421**. The second surface **1422** can be configured to carry a microelectronic substrate. The support member **1420** can include connection structures **1430** for connecting the microelectronic substrate supported on the support member **1420** to other electronic or microelectronic devices. In one aspect of this embodiment, each connection structure **1430** can include a first bond site (such as a solder pad) described below with reference to **FIG. 15**, and a second bond site **1432**, such as a wire bond pad, configured to be electrically coupled to corresponding terminals of the microelectronic substrate. The connection structure **1430** can further include electroplating traces **1434** configured to connect to a source of electrical potential for plating the connection structure **1430**, generally in a manner similar to that described above. Alternatively, the connection structures **1430** can be plated with an electroless process.

[**0063**] The connection structures **1430** can further include a connecting trace **1439** that extends outwardly from the second bond site **1432**. The connecting trace **1439** can be coupled to a via **1436** that extends from the second surface of the support member **1420** to the first surface **1421**. The via **1436** can be electrically coupled to the first bond site of the support member **1420**, as described in greater detail below with reference to **FIG. 15**.

[**0064**] **FIG. 15** is a bottom plan view of an embodiment of the support member **1420** described above with reference to **FIG. 14**. As shown in **FIG. 15**, each of the vias **1436** of the connection structures **1430** can extend through the support member **1420** to the first surface **1421**. Each via **1436** can be electrically connected to a corresponding first bond site **1431** (such as a solder ball pad), to provide for electrical communication between the first bond site **1431** and the second bond site **1432** (**FIG. 14**) on the opposite side of the support member. Accordingly, each connection structure **1430** can include at least two elongated members **1433***a*, **1433***b* extending outwardly from the first bond site **1431**. The elongated member **1433***b* can extend between the first bond site **1431** and the via **1436** to provide for electrical communication between these two components of the connection structure **1430**. The elongated member **1433***a* can include a generally tab-shaped structure generally similar to those described above. Accordingly, the elongated members **1433***a*, **1433***b* can provide some or all of the functions and advantages described above with reference to **FIGS. 3A-8**. For example, in one aspect of this embodiment, the elongated members **1433***a*, **1433***b* can aid in securing the first bond site **1431** to the first surface **1421** of the support member **1420**. The support member **1420** can include a cover layer generally similar to that described above with reference to **FIG. 3C** to aid in attaching the connection structure **1430** to the first surface **1421**. Accordingly, the cover layer can be configured to either allow or prevent wicking of a flowable conductive material along the elongated members **1433***a*, **1433***b*.

[**0065**] From the foregoing, it will be appreciated that specific embodiments of the invention have been described herein for purposes of illustration, but that various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.

1-61. (canceled)

62. An electronic device, comprising:

a housing;

a microelectronic substrate positioned within the housing;

a support substrate carrying the microelectronic substrate in the housing; and

a connection structure carried by the support substrate, the connection structure having a bond site configured to receive a flowable conductive material, the connection structure further having at least two elongated members, each of which is connected to and extends outwardly from the bond site, each elongated member being configured to receive at least a portion of the flowable conductive material from the bond site, and neither of which is electrically connected to the microelectronic substrate.

63. The device of claim 62 wherein each elongated member is configured to receive at least a portion of the flowable conductive material from the bond site.

64. The device of claim 62 wherein the connection structure is a first connection structure and the elongated members are first elongated members configured to receive at least a portion of the flowable conductive material from the first bond site, and wherein the apparatus further comprises a second connection structure carried by the support substrate, the second connection structure having a second bond site configured to receive a flowable conductive material, the second connection structure having a third bond site electrically coupled to the microelectronic substrate, the second connection structure further having second elongated members extending outwardly from the second bond site, wherein each of the second elongated members is configured to receive at least a portion of the flowable conductive material, and wherein and at least one of the second elongated members extends between the second and third bond sites.

65. The device of claim 62 wherein the elongated members are configured to be wetted by the flowable conductive material when the flowable conductive material is in a flowable state.

66. The device of claim 62 wherein the conductive structure includes two elongated members extending away from opposite sides of the bond site.

67. The device of claim 62, further comprising a layer disposed on the elongated members and attached to the support substrate, the layer having an aperture aligned with the bond site.

68. The device of claim 62, further comprising a layer disposed on the elongated members and attached to the support substrate, the layer having an aperture aligned with the bond site, and wherein a covered portion of each elongated member extends between the layer and the support substrate, and an exposed portion of each elongated member is exposed through the aperture, further wherein each exposed portion has approximately the same length.

69. The device of claim 62 wherein the connection structure includes at least one electrically conductive metallic material.

70. The device of claim 62 wherein the bond site includes a solder ball pad, and wherein the apparatus further comprises a solder ball disposed on the solder ball pad.

71. The device of claim 62 wherein at least one of the elongated members has a first end connected to the bond site and a second end spaced apart from the bond site, and wherein the elongated member includes an anchor toward the second end to secure the elongated member to the support substrate.

72. The device of claim 62 wherein the support substrate has a first surface coupled to the microelectronic substrate and a second surface facing opposite from the first surface, the connection structure being disposed on the second surface, and wherein the support substrate includes a slot extending between the first and second surfaces, and wherein the device further comprises wires extending through the slot between the second connection structure and the microelectronic substrate.

73-81. (canceled)

82. An apparatus for supporting a microelectronic substrate, comprising:

a support member having a first surface and a second surface facing opposite from the first surface, the second surface being configured to carry a microelectronic substrate; and

a connection structure carried by the support member, the connection structure including:

first and second bond sites, the first bond site being positioned at least proximate to the first surface of the support member, the second bond site being positioned at least proximate to the second surface of the support member, the second bond site being configured to be electrically coupled to the microelectronic substrate when the support member carries the microelectronic substrate, the first bond site being configured to receive a flowable conductive material; and

at least two elongated members connected to and extending outwardly from the first bond site, at least one of the elongated members being coupled between the first and second bond sites.

83. The apparatus of claim 82 wherein the at least one elongated member includes a first portion in a first plane generally parallel to the first surface, a second portion in a second plane generally parallel to the second surface and spaced apart from the first plane, and a third portion connected between the first and second portions.

84. The apparatus of claim 82, further comprising a solder ball disposed on the first bond site.

85. The apparatus of claim 82, further comprising:

a microelectronic substrate carried by the support member; and

a conductive link electrically coupled between the microelectronic substrate and the second bond site.

86. The apparatus of claim 82, further comprising:

a microelectronic substrate carried by the support member; and

a wire bond electrically coupled between the microelectronic substrate and the second bond site.

87. The apparatus of claim 82 wherein each elongated member is configured to receive at least a portion of a flowable material from the first bond site.

88-124. (canceled)

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