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Schonig

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(54) **METHODS AND APPARATUS FOR CONNECTING PRINTED CIRCUIT BOARDS USING ZERO-INSERTION WIPING FORCE CONNECTORS**

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H01R 13/15 (2006.01)

(52) **U.S. Cl.** **439/65**; 439/259; 439/310

(58) **Field of Classification Search** 439/65, 439/259, 310

See application file for complete search history.

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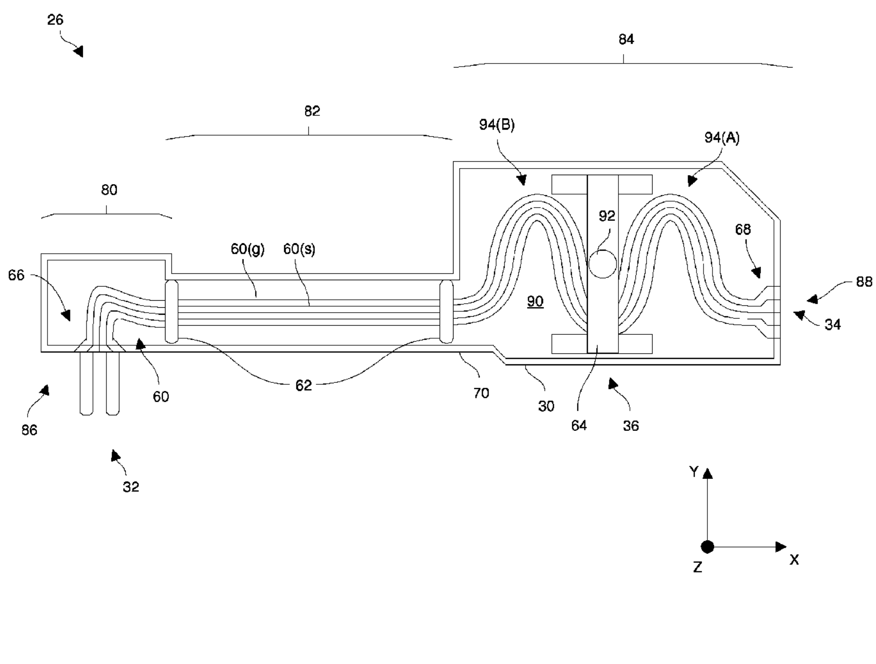
(57) **ABSTRACT**

A circuit board assembly includes a primary board, and a connector mounted to a mounting location of the primary board. The connector includes compliant conductors, each compliant conductor having a first end and a second end. The connector further includes a connector body supported by the primary board. The connector body constrains the first end of each compliant conductor at the mounting location and the second end of each compliant conductor at an interface location. The connector further includes a movable member which is capable of moving relative to the connector body along an axis extending between the mounting location and the interface location. The movable member is constructed and arranged to control tension of the compliant conductors while the connector body constrains the first end of each compliant conductor at the mounting location and the second end of each compliant conductor at the interface location.

14 Claims, 4 Drawing Sheets



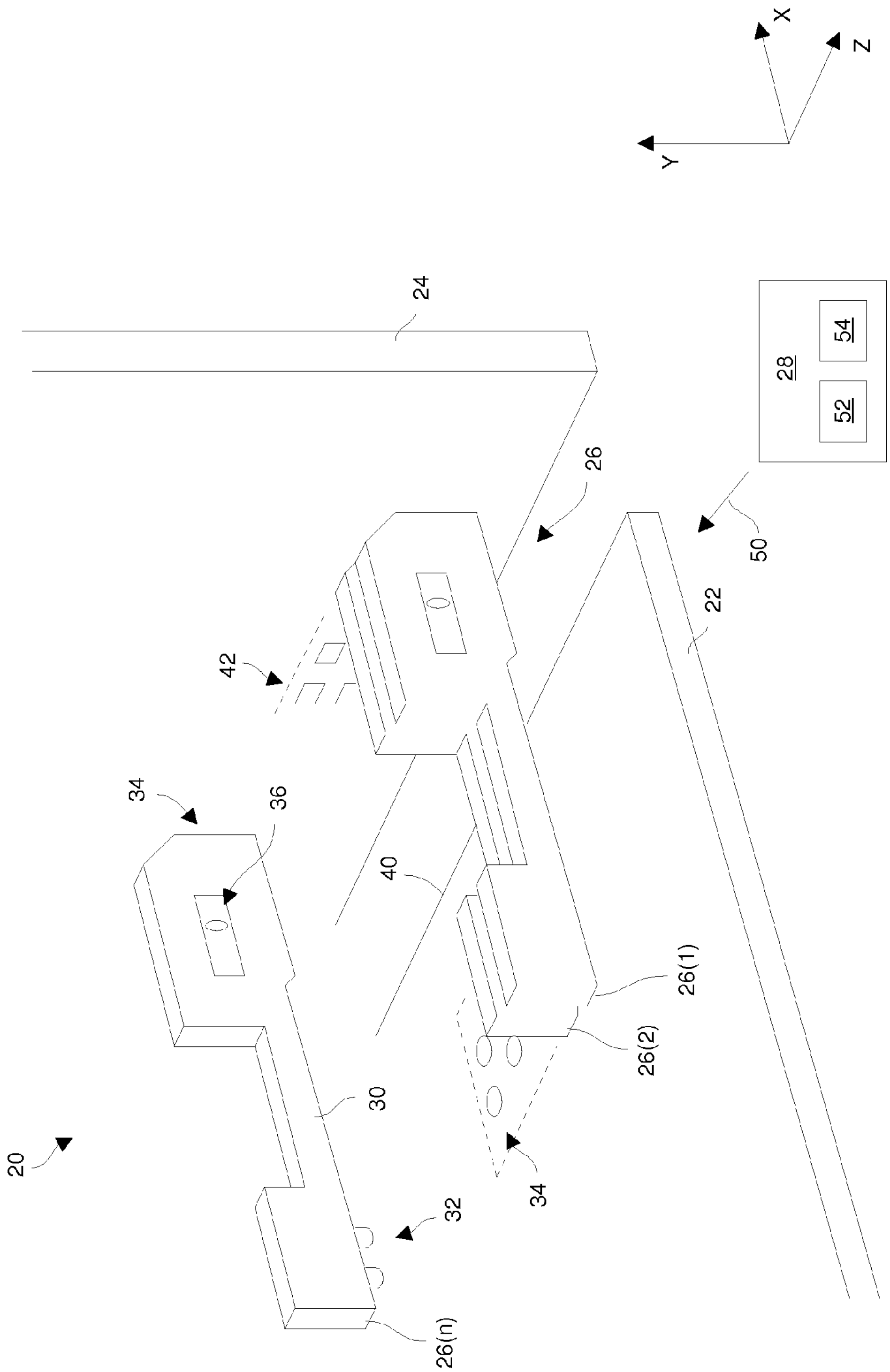
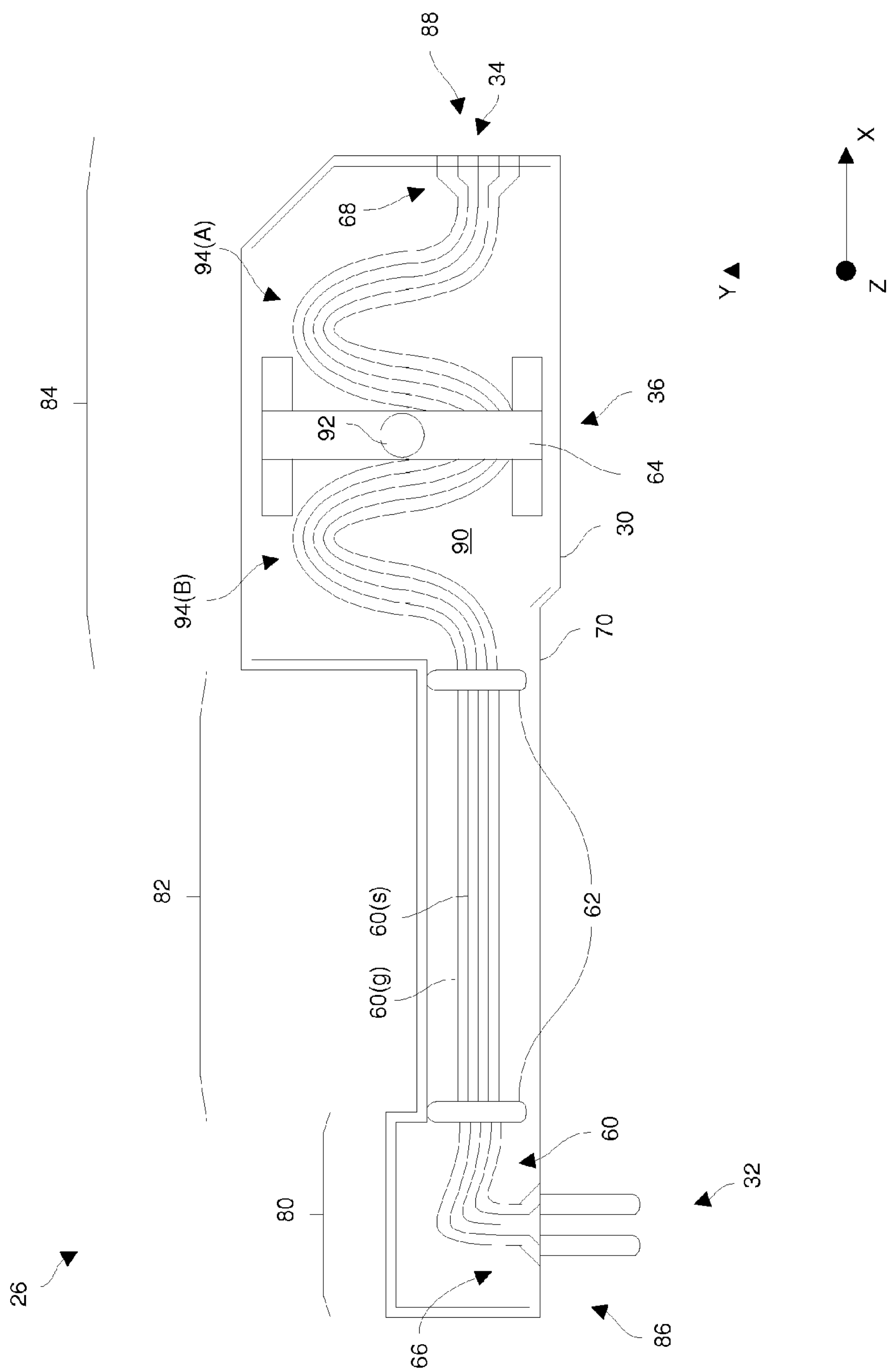


FIG. 1


88
34
68
94(A)
84
92
36
64
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30
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32
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FIG. 2

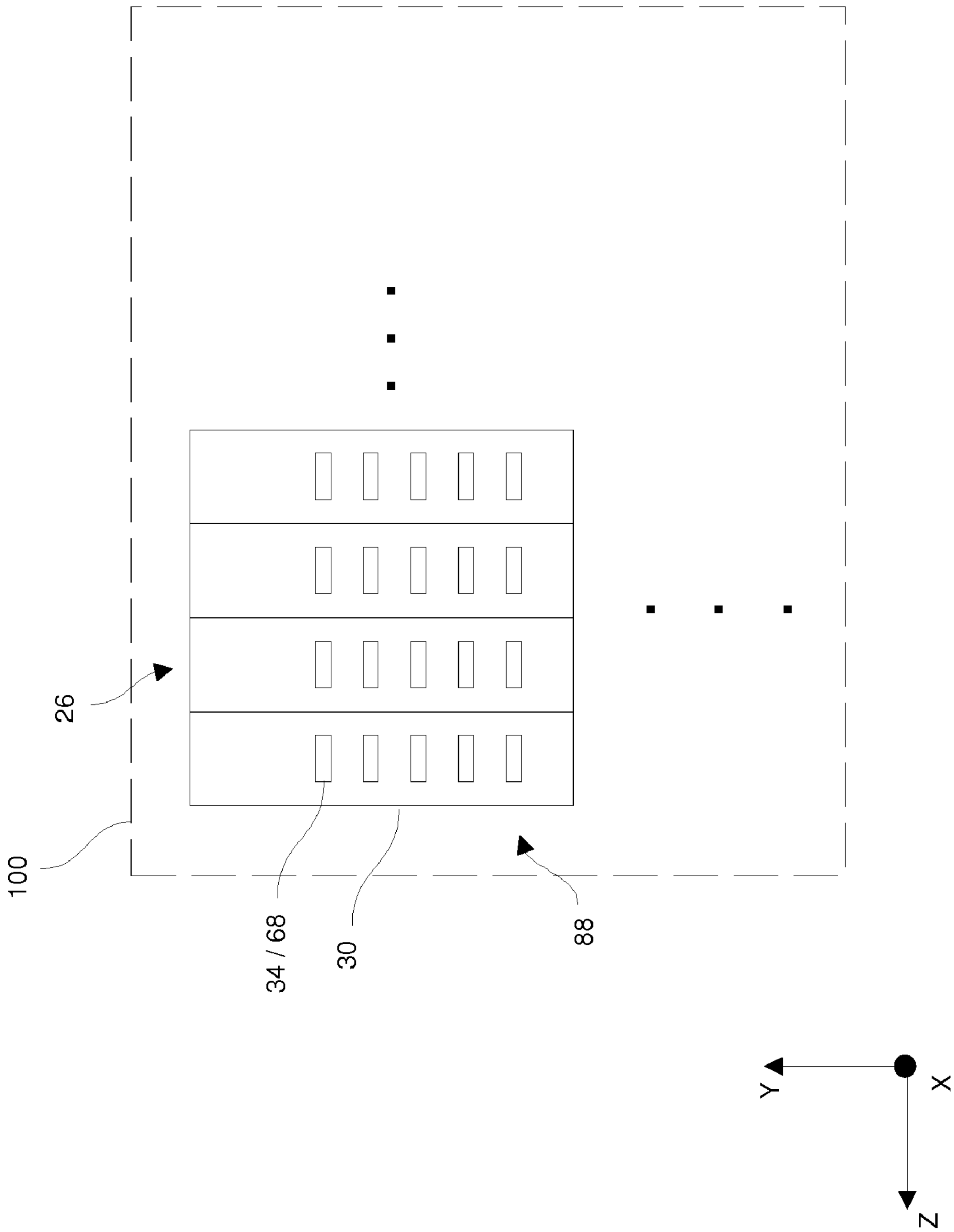

FIG. 3

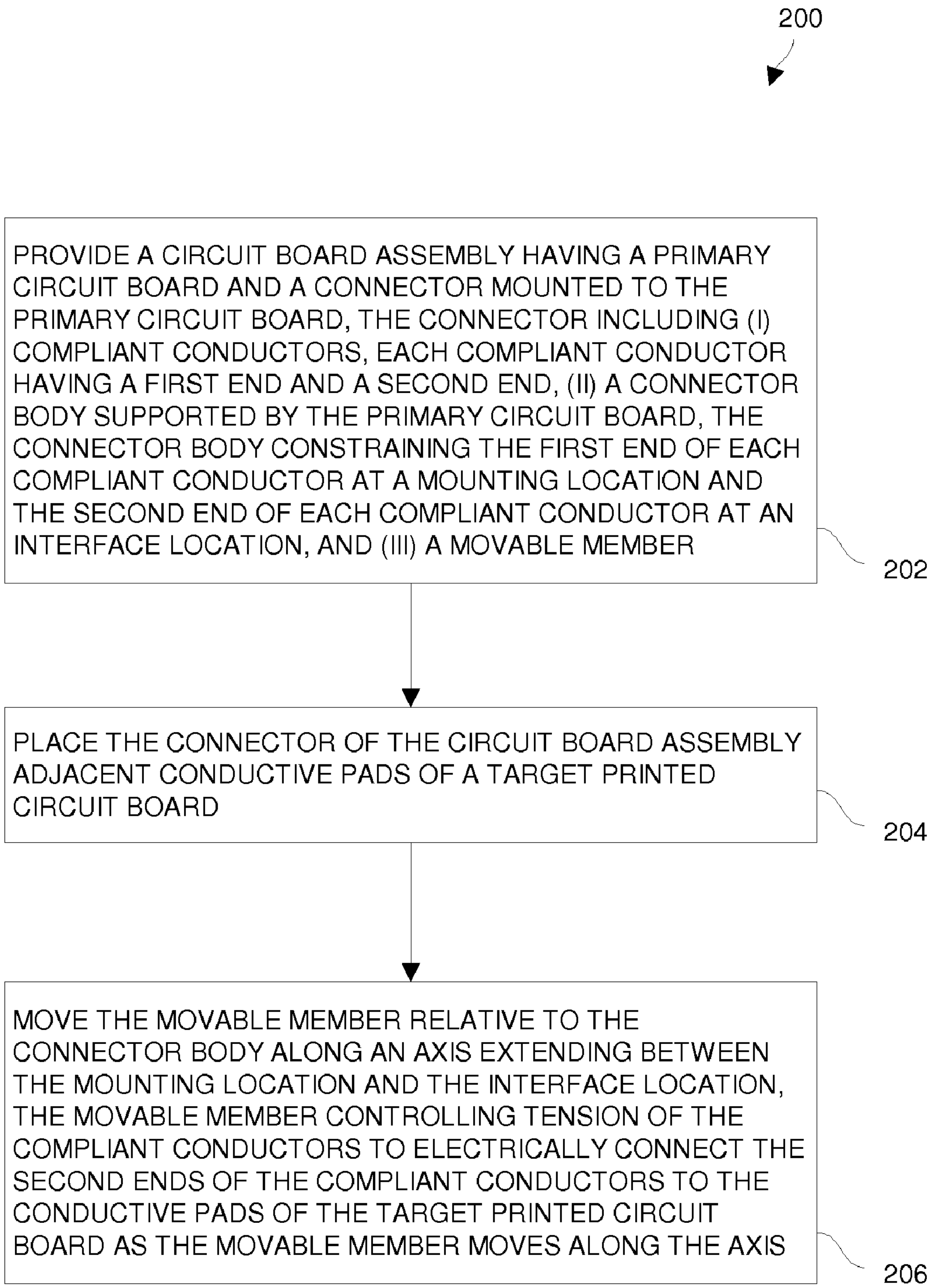
200
PROVIDE A CIRCUIT BOARD ASSEMBLY HAVING A PRIMARY CIRCUIT BOARD AND A CONNECTOR MOUNTED TO THE PRIMARY CIRCUIT BOARD, THE CONNECTOR INCLUDING (I) COMPLIANT CONDUCTORS, EACH COMPLIANT CONDUCTOR HAVING A FIRST END AND A SECOND END, (II) A CONNECTOR BODY SUPPORTED BY THE PRIMARY CIRCUIT BOARD, THE CONNECTOR BODY CONSTRAINING THE FIRST END OF EACH COMPLIANT CONDUCTOR AT A MOUNTING LOCATION AND THE SECOND END OF EACH COMPLIANT CONDUCTOR AT AN INTERFACE LOCATION, AND (III) A MOVABLE MEMBER
202
PLACE THE CONNECTOR OF THE CIRCUIT BOARD ASSEMBLY ADJACENT CONDUCTIVE PADS OF A TARGET PRINTED CIRCUIT BOARD
204
MOVE THE MOVABLE MEMBER RELATIVE TO THE CONNECTOR BODY ALONG AN AXIS EXTENDING BETWEEN THE MOUNTING LOCATION AND THE INTERFACE LOCATION, THE MOVABLE MEMBER CONTROLLING TENSION OF THE COMPLIANT CONDUCTORS TO ELECTRICALLY CONNECT THE SECOND ENDS OF THE COMPLIANT CONDUCTORS TO THE CONDUCTIVE PADS OF THE TARGET PRINTED CIRCUIT BOARD AS THE MOVABLE MEMBER MOVES ALONG THE AXIS
206

FIG. 4

METHODS AND APPARATUS FOR CONNECTING PRINTED CIRCUIT BOARDS USING ZERO-INSERTION WIPING FORCE CONNECTORS

BACKGROUND

A conventional approach to connecting two circuit board modules at a right angle to each other involves mating together respective connectors of the modules. For example, in an X-Y-Z coordinate system, suppose that a first module is oriented in the Y-Z plane, and has a first connector (e.g., a male connector) disposed generally near its center. Additionally, suppose that a second module is oriented in the X-Z plane and has a second connector (e.g., a female connector) disposed along its leading edge. As a result, the two modules are at a right angle to each other, with the leading edge of the second module nearest to the first module and with the respective connectors facing each other along the X-axis.

To connect the circuit board modules together, a user moves the second module toward the first module (e.g., the leading edge of the second module moves in the positive X-direction toward the first module). Eventually, the pins of the connectors make electrical contact and begin wiping against each other. The user applies substantial insertion force to enable the pins of the connectors to continue wiping against each other until the connectors are fully engaged.

To disconnect the circuit board modules from each other, the user moves the second module away from the first module (e.g., the leading edge of the second modules moves in the negative X-direction away from the first module). The user applies enough force (e.g., similar to the amount of insertion force) to enable the pins of the connectors to wipe against each other in the opposite direction as the connectors start to disengage. Finally, the connectors separate thus disconnecting the modules.

SUMMARY

Unfortunately, there are deficiencies to the above-described conventional approach to connecting two circuit board modules at a right angle. For example, there is a risk of bending one or more connector pins as the male and female connectors engage each other. Once a pin of a connector is bent, the connector must be replaced thus imposing a repair burden on the user (e.g., complicated circuit board rework).

Similarly, routine wiping between pins causes the pins to wear out over time. Eventually, the pin finish and/or the pin material of the connectors may become so worn or cluttered with metallic debris that it is necessary to replace the connector in order to prevent creation of a reliability concern.

Additionally, during connector engagement and disengagement, stresses between the connectors tend to cause stresses and fatigue between the connectors and their respective circuit boards. In particular, during connector engagement, frictional resistance between the connectors as the connector mate with each other tends to strain the connections between the connectors and circuit boards in one direction. Furthermore, during connector disengagement, the frictional resistance between the connectors as the connectors pull away from each other strains the connections between the connectors and the circuit boards in the opposite direction. Eventually, the connections between the connectors and the circuit boards, and the adjacent circuit board traces can weaken and perhaps fail.

In contrast to the above-described conventional approach to connecting circuit board modules at right angles using male and female connectors which require substantial insertion force, improved connecting techniques utilize a zero-insertion wiping force (ZiWF) connecting device (or connector) to connect two circuit boards. Such a ZiWF connector requires little if any force to establish a robust and reliable electrical connection. Accordingly, there is less wear on the connector and less strain between the connector and the circuit board thus improving reliability and longevity among the various components.

One embodiment is directed to a circuit board assembly having a primary board, and a connector (e.g., a ZiWF connecting device) mounted to a mounting location of the primary board. The connector includes compliant conductors, each compliant conductor having a first end and a second end. The connector further includes a connector body supported by the primary board. The connector body constrains the first end of each compliant conductor at the mounting location and the second end of each compliant conductor at an interface location. The connector further includes a movable member which is capable of moving relative to the connector body along an axis extending between the mounting location and the interface location. The movable member is constructed and arranged to control tension of the compliant conductors while the connector body constrains the first end of each compliant conductor at the mounting location and the second end of each compliant conductor at the interface location. Such an embodiment is able to improving reliability and longevity in systems which involve routine removal and/or replacement of a circuit board such as device under test (DUT) board servicing in the context of automated test equipment (ATE).

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages will be apparent from the following description of particular embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of various embodiments of the invention.

FIG. **1** is a perspective view of a portion of an electronic system which utilizes zero-insertion wiping force connecting devices.

FIG. **2** is a cross-sectional side view of a zero-insertion wiping force connecting devices of the electronic system of FIG. **1**.

FIG. **3** is a view of a connection interface formed by the zero-insertion wiping force connecting devices of FIG. **1**.

FIG. **4** is a flowchart of a procedure which involves the use of the zero-insertion wiping force connecting devices of FIG. **1**.

DETAILED DESCRIPTION

An improved connecting technique utilizes a zero-insertion wiping force (ZiWF) connector to electrically connect two printed circuit boards (PCBs). Such a ZiWF connector requires little if any force to establish a robust and reliable electrical connection. As a result, there is less connector wear and less strain between the connector and the circuit board thus improving reliability and longevity among the various components.

FIG. **1** shows a portion of an electronic system **20** which utilizes ZiWF connecting techniques. The electronic system **20** includes a primary printed circuit board (PCB) **22**, a target

PCB **24**, a set of connectors **26**(**1**), **26**(**2**), . . . , **26**(*n*) (collectively, connectors **26**), and a controller **28**. Each connector **26** (e.g., see the connector **26**(*n*)) includes a connector body **30**, a set of contacts **32** for electrically connecting to the primary PCB **22**, a set of contacts **34** for electrically connecting to the target PCB **24**, and an actuation mechanism **36** which controls operation of the connector **26**. As will be described in further detail shortly, the controller **28** is constructed and arranged to actuate each connector **26** in a manner that results in application of a minimal amount of wiping force to the target PCB **24** during connection thus reducing wear and tear between the connector **26** and the target PCB **24**.

As shown in FIG. **1**, the primary PCB **22** extends substantially in a plane (e.g., the X-Z plane). The primary PCB **22** provides rigid support for a variety of other circuit board components (e.g., integrated circuits, discrete components, etc, which are not shown in FIG. **1** for simplicity) and for the connectors **26** which extend in a row along an edge **40** of the primary PCB **22**, i.e., parallel to the Z-axis. The electrical contacts **32** of the connectors **26** are constructed and arranged to electrically connect to complimentary electrical contacts **34** of the primary PCB **22** in a substantially long-lasting manner. In some arrangements, the primary PCB **22** and the connectors **26**, perhaps along with other parts, form a circuit board assembly which is rarely (if ever) dismantled as a unit. It should be understood that additional hardware can be provided to mechanically attach and physically support the connector bodies **30** of the connectors **26** relative to the primary PCB **22**. By way of example only, the contacts **32** of the connector **26** are compression fit pins and the contacts **34** of the primary PCB **22** are plated through holes (PTHs).

As further shown in FIG. **1**, the target PCB **24** extends substantially in a plane (e.g., the Y-Z plane). The electrical contacts **34** of the connectors **26** are constructed and arranged to electrically connect to complimentary electrical contacts **42** of the target PCB **24**. Preferably, the contacts **34** of the connectors **26** are probe-like conductor ends and the contacts **42** of the target PCB **24** are metallic surfaces, e.g., surface mount technology (SMT) pads.

During operation, the primary and target PCBs **22**, **24** are moved into position so that the PCBs **22**, **24** are substantially perpendicular to each other as shown in FIG. **1**. At this point, the connectors **26** are reliably fastened to the primary PCB **22** (e.g., using hardware), and electrically connected to the primary PCB **22** (e.g., via the contacts **32** and the PTHs **34**). Additionally, the target PCB **24** is precisely aligned with the primary PCB **22** and the connectors **26** so that the contacts **34** appropriately face corresponding contacts **42** of the target PCB **24**. Such positioning of the PCBs **22**, **24** can be facilitated using mechanical supporting structures and hardware which reliably and precisely hold the PCBs physically in place. An example of such a mechanical supporting structure is the framework which mounts a device under test (DUT) board to a test equipment interface (or an interposer) in the context of automated test equipment (ATE).

Next, to electrically connect the connectors **26** to the target PCB **24**, the controller **28** provides mechanical actuation **50** to the actuation mechanisms **36** of the connectors **26**. For simplification, the controller **28** is represented in block diagram form and the mechanical actuation **50** is illustrated as an arrow. However, it should be understood that the controller **28** includes control circuitry **52** and electromechanical actuators **54** controlled by the control circuitry **52**. For example, through a hole or actuation tab defined by each actuation mechanism **36**, a rod can be inserted/attached (i.e., along the Z-axis) and then translated in the positive X-direction by the actuators **54** in response to electrical signals from the control circuitry **52**.

In response to the mechanical actuation **50**, the actuation mechanisms **36** of the connectors **26** establish electrical connection with the target PCB **24**. In particular, the contacts **34** of the connectors **26** gently but reliably scrub against the contacts **42** of the target PCB **24** in a direction toward the target PCB **24** (e.g., the positive X-direction) for consistent and robust electrical connectivity. Accordingly, with minimal wiping force, the contacts **34** of the connectors **26** make electrical contact with the contacts **42** of the target PCB **24**.

To electrically disconnect the connectors **26** from the target PCB **24**, the controller **28** again provides actuation **50** (i.e., the control circuitry **52** drives the actuators **54**), but this time, such actuation **50** moves the actuation mechanisms **36** of the connectors **26** in the reverse direction. In response to this subsequent actuation, the contacts **34** of the connectors **26** gently retract from the contacts **42** of the target PCB **24** (e.g., the negative X-direction). As a result, the PCBs **22**, **24** can now be physically separated from each other and the various components can be inspected, serviced, replaced, etc.

It should be understood that, while the contacts **34** of the connectors **26** are retracted, the contacts **34** are well-protected against damage by the connector bodies **30** of the connectors **26**. Additionally, due to the minimal wiping force between the connector contacts **34** and the contacts **42** of the target PCB **42**, there is minimal wear thus enabling electrical connection and disconnection to be repeated (perhaps frequently) without substantially wearing down components. Further details will now be provided with reference to FIG. **2**.

FIG. **2** is a cross-sectional side view of a connector **26** of the electronic system **20**. The connector **26** further includes a set of compliant conductors **60**, conductor supports **62**, and a movable member **64**. Each compliant conductor **60** is formed from metallic material (e.g., beryllium copper or similar material), and has a first end **66** which terminates at the contacts **32** and a second end **68** which forms a respective contact **34**. Dimensionally, the compliant conductors **60** have cross-sectional geometries and distances relative to other compliant conductors **60** which are similar to PCB signal traces. Accordingly, each compliant conductor **60** provides a reliable signal pathway with impedance characteristics similar to those of PCB traces.

It should be understood that portions of the compliant conductors **60** have a wave-shape or S-shape. In particular, each compliant conductor **60** defines a series of smooth curves between the first end **66** and the second end **68**. Preferably, the compliant conductors **60** do not bend out of the X-Y plane in the Z-direction. As will be described in further detail shortly, this feature enables different parts of the compliant conductors **60** to undergo subtle compression/tension changes.

The connector body **30** protects the compliant conductors **60**, holds the conductor supports **62** in place, and restricts movement of the movable member **64** to linear translation along the axis extending between the mounting location and the interface location of the connector **26** (i.e., along the X-axis in FIG. **2**). Preferably, the connector body **30** includes a metallic coating (or barrier) **70** which encapsulates the compliant conductors **60** for robust and reliable electromagnetic interference (EMI) shielding. Additionally, the connector body **30** can couple to a ground reference of the primary PCB **22** for safety purposes.

In some arrangements, the connector **26** includes five compliant conductors **60**, i.e., three grounding/baseline compliant conductors **60**(*g*) and two signal compliant **60**(*s*) conductors which are disposed in an interleaved/alternating manner. Such an arrangement is suitable for differential signals and broadside coupling. It should be understood that some of the compliant conductors **60** can optionally connect to the metallic coating **70** rather than a respective contact **32**. For example, as shown in FIG. **2**, the grounding/baseline compliant conductors **60**(*g*) can connect to the metallic coating **70** of the connector body **30** while only, the signal compliant conductors **60**(*s*) carry data signals and thus connect to the contacts **32** (e.g., pins) leading to the primary PCB **22**. Alternatively, the grounding/baseline conductors **60** also connect to the contacts **32** (e.g., pins) leading to the primary PCB **22**.

The conductor supports **62** stabilize the compliant conductors **60**. In some arrangements, the conductor supports **62** are integrated (i.e., unitary) with the connector body **30** of the connector **26**. For example, portions of the connector body **30** and/or the conductor supports **62** can be formed from plastic (injection molded, tooled, etc.) using a variety of techniques.

As shown in FIG. **2**, the connector body **30** divides the connector **26** into essentially three sections, namely, a base section **80**, a middle section **82**, and an interface section **84**. The base section **80** holds the first ends **66** of the compliant conductors **60** and the contacts **32** (e.g., pins) at a mounting location **86** which mounts to the primary PCB **22**. The middle section **82** supports the compliant conductors **60**. The interface section **84** houses the movable member **64**, and constrains and protects the ends **68** of the compliant conductors **60** at an interface location **88**. In some arrangements, the ends **68** remain substantially flush with the surface of the connector body **30**.

The movable member **64**, which forms part of the actuation mechanism **36** (also see FIG. **1**), is constructed and arranged to translate linearly within an internal chamber (or cavity) **90** of the connector body **30**. To this end, the movable member **64** defines a hole (or tab) **92** which enables convenient capturing and actuation of the movable member **64** (e.g., by an actuator, rod or bar). That is, the movable member **64** is capable of sliding along the X-axis within the interface section **84** of connector body **30**, and the walls of the connector body **30** restrict the movable member **64** in other directions.

The movable member **64** holds a mid-section of the wave-shaped portion of the compliant conductors **60** in proper spatial separation relative to each other for electrical isolation (i.e., air insulation) as well as for controlled signal integrity purposes (e.g., impedance control). Such a spatial relationship between compliant conductors **60** is well-suited for broadside coupling.

Furthermore, as the movable member **64** moves along the X-axis, the movable member **64** adjusts tension within the compliant conductors **60**. Accordingly, the movable member **64** is able to change (e.g., tune) the signal characteristics of the compliant conductors **60** by translating along the X-axis within the interface section **84**. For example, moving the movable member **64** in the positive X-direction provides compression on portions **94**(A) of the compliant conductors **60** and opposite tension on portions **94**(B) of the compliant conductors **60**. As a result, such movement is able to modify the amount of scrubbing which is performed by the ends **68** of the compliant conductors **60** at the interface location **88**, as well as adjust the electrical characteristics between the compliant conductors **60** due to minute positioning changes.

It should be understood that the movement of the ends **68** relative to the connector body **30** and the contacts **42** of the target PCB **24** does not need to be linear. Rather, the ends **68** can be constructed and arranged to roll over tabs or pass through grooves of the connector body **30** so that the ends **68** move in an arc or so that the ends **68** have an angular component which is not perpendicular to the contacts **42** of the target PCB **24**. As a result, effective and efficient wiping occurs between the ends **68** and the contacts **42**, but the wiping force is minimal thus reducing wear and tear on the connecting components. Further details will now be provided with reference to FIG. **3**.

FIG. **3** shows a connection interface **100** which is formed by aligning the interface locations **88** (FIG. **2**) of multiple connectors **26** end-to-end. Accordingly, the contacts **34** form a two-dimensional array of connector contacts. Such an arrangement provides the ability to move many signals from one circuit board (e.g., the primary PCB **22**) to another circuit board (e.g., the target PCB **24**) in a high density manner. In terms of circuit board real estate, only the footprint of the two-dimensional array is consumed for corresponding circuit board contacts **42** (FIG. **2**).

As best seen in FIG. **2**, the ends **68** of the compliant conductors **60** are constrained by the connector body **30** at the interface location **88**. In particular, each end **68** is substantially flush with the connector body **30**. Accordingly, the ends **68** remain well protected against damage (e.g., uncontrolled movement/activity external to the connector **26**). Additionally, when the connector body **30** abuts the connection location of the target PCB **24** (also see the dashed area in FIG. **1**), the ends **68** are able to conveniently make contact with the corresponding contacts **42** of the target PCB **24** in response to actuation of the actuation mechanism **36**.

By way of example only, each connector **26** provides a column (or row) of five contacts **34**, i.e., ends **68** of compliant conductors **60** (FIG. **2**). Other numbers of contacts **34** are suitable for use as well (e.g., four, six, eight, etc.). Accordingly, the number of contacts **34** in the array can be increased by including more contacts **34** in each connector **26** and/or by adding connectors **26**. Moreover, connectors **26** may be mounted to both sides of a single circuit board thus potentially doubling the number of contacts **34**.

In this efficient and organized manner, the array of the connection interface **100** may be configured to have a fine pitch so that a large number of signals can be conveniently transferred between the perpendicularly oriented PCBs **22**, **24** (e.g., 48, 72, 100, etc.). Further details will now be provided with reference to FIG. **4**.

FIG. **4** is a flowchart of a procedure **200** which involves the use of the connectors **26** to establish connections between the PCBs **22**, **24** (also see FIGS. **1-3**). In the context of ATE, the procedure **200** may be performed when preparing the ATE to test a series of devices (e.g., integrated circuits (ICs), packaged ICs, IC modules, circuit boards, etc.).

In step **202**, a user provides a circuit board assembly having the primary PCB **22** and a set of connectors **26** mounted to the primary PCB **22**. As described earlier, each connector **26** includes compliant conductors **60**, a connector body **30** supported by the primary PCB **22**, and a movable member **64** that moves within the connector body **30**.

In step **204**, the user places the set of connectors **26** of the circuit board assembly adjacent contacts **42** of a target PCB **24** (e.g., SMT pads), also see FIG. **1**. This step may involve the use of mechanical support structures to securely hold and align the PCBs **22**, **24** relative to each other.

In step **206**, the user moves the movable member **64** relative to the connector body **30** of each connector **26**. In particular, the user controls the movable member **64** using a controller **28** (i.e., the control circuitry **52** in combination with the electromechanical actuators **54**) to control tension of the compliant conductors **60**. Accordingly, the ends **68** of the compliant conductors **60** electrically connect to the contacts **42** of the target PCB **24**. In some arrangements, the compliant conductor ends **68** move toward the contacts **42** in a direction which is non-parallel to X-axis of FIGS. **1** and **2**) to provide effective wipe with minimal force.

It should be understood that the movable member **64** can be actuated in the reverse direction as well. For example, suppose that the primary PCB **22** is a relatively sensitive and critical portion of an ATE system, and that the target PCB **24** is a DUT board which requires replacement. Here, the user (controlling the actuation mechanism **36** using the controller **28**, FIG. **1**) moves the movable member **64** in the opposite direction (i.e., away from the interface location **88**, FIG. **2**). As a result, the ends **68** retract so that they are again flush with the surface of the connector body **30** and are thus well-protected.

As described above, improved connecting techniques utilize a ZiWF connecting device to connect two circuit boards. In this context, ZiWF represents a wiping force that is minimal thus lowering wear and tear on the connecting components. Such a ZiWF connector requires little if any force to establish a robust and reliable electrical connection. As a result, there is less wear on the connector and less strain between the connector and the circuit board thus improving reliability and longevity among the various components.

While various embodiments of the invention have been particularly shown and described, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

For example, the controller **28** was described above as being electronically-based. In some arrangements, the controller **28** may probe the electrical characteristics of the compliant conductors **60** (e.g., through the primary PCB **22** and/or the target PCB **24**) and make fine adjustments to the movable member **64** based on such probing. In other arrangements, the controller **28** is programmed to simply switch between two positions, i.e., a connect position in which the ends **68** connect to the contacts **42** of the target PCB **24** and a disconnect position in which the end retract away from the contacts **42** of the target PCB **24**. As yet another alternative, the movable member **64** is manually actuated by a user. Such modifications and enhancements are intended to belong to various embodiments of the electronic system **20**.

What is claimed is:

1. A printed circuit board connector, comprising:

compliant conductors, each compliant conductor having a first end and a second end;

a connector body which constrains the first end of each compliant conductor at a mounting location and the second end of each compliant conductor at an interface location; and

a movable member which is capable of moving relative to the connector body along an axis extending between the mounting location and the interface location, the movable member being constructed and arranged to control tension of the compliant conductors while the connector body constrains the first end of each compliant conductor at the mounting location and the second end of each compliant conductor at the interface location.

2. A printed circuit board connector as in claim **1** wherein the connector body includes:

a base portion which holds the first ends of the compliant conductors in positions to connect with a connector mounting location of a printed circuit board; and

an interface portion coupled to the base portion, the interface portion (i) defining a flat surface and (ii) holding the second ends of the compliant conductors substantially flush with the flat surface to provide protection to the second ends of the compliant conductors.

3. A printed circuit board connector as in claim **2** wherein the interface portion of the connector body arranges the second ends of the compliant conductors in a column to form a portion of a two-dimensional array of connector contacts.

4. A printed circuit board connector as in claim **3** wherein each compliant conductor defines a series of smooth curves in a direction along the axis extending between the mounting location and the interface location.

5. A printed circuit board connector as in claim **4** wherein the movable member contacts a mid-section of each compliant conductor, the movable member being constructed and arranged to compress one-side of each compliant conductor in response to translation along the axis extending between the mounting location and the interface location while concurrently maintaining electrical isolation between the compliant conductors.

6. A printed circuit board connector as in claim **5** wherein the second end of each compliant conductor is constructed and arranged to move in direction which is non-parallel to the axis extending between the mounting location and the interface location.

7. A printed circuit board connector as in claim **3** where each compliant conductor has a rectangular cross-section; and wherein the compliant conductors run in a substantially parallel manner relative to each other.

8. A printed circuit board connector as in claim **7** wherein the connector body defines an internal chamber to provide air insulation between neighboring compliant conductors of the compliant conductors.

9. A printed circuit board connector as in claim **8** wherein the compliant conductors reside in a spatial relationship which is constructed and arranged to provide broadside coupling.

10. A printed circuit board connector as in claim **8** wherein the connector body includes a layer of conductive material which substantially encapsulates the compliant conductors.

11. A circuit board assembly, comprising:

a primary printed circuit board; and

a printed circuit board connector mounted to a mounting location of the primary printed circuit board, the printed circuit board connector including:

compliant conductors, each compliant conductor having a first end and a second end,

a connector body supported by the primary printed circuit board, the connector body constraining the first end of each compliant conductor at the mounting location and the second end of each compliant conductor at an interface location, and

a movable member which is capable of moving relative to the connector body along an axis extending between the mounting location and the interface location, the movable member being constructed and arranged to control tension of the compliant conductors while the connector body constrains the first end of each compliant conductor at the mounting location and the second end of each compliant conductor at the interface location.

12. A circuit board assembly as in claim **11**, further comprising:

a target printed circuit board having conductive pads which electrically connect to the second ends of the compliant conductors at the interface location when the primary printed circuit board is oriented in a substantially perpendicular manner relative to the target printed circuit board.

13. A circuit board assembly as in claim 12 wherein the primary printed circuit board forms a portion of an automated test equipment system; and

wherein the target printed circuit board is a device interface board which operates as an interface between the automated test equipment system and a device under test.

14. A connection method, comprising:

providing a circuit board assembly having a primary printed circuit board and a connector mounted to the primary printed circuit board, the connector including (i) compliant conductors, each compliant conductor having a first end and a second end, (ii) a connector body supported by the primary printed circuit board, the connector body constraining the first end of each compliant conductor at a mounting location and the second end of each compliant conductor at an interface location, and (iii) a movable member;

placing the connector of the circuit board assembly adjacent conductive pads of a target printed circuit board; and

moving the movable member relative to the connector body along an axis extending between the mounting location and the interface location, the movable member controlling tension of the compliant conductors to electrically connect the second ends of the compliant conductors to the conductive pads of the target printed circuit board as the movable member moves along the axis.

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