



US007145352B2

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

(10) **Patent No.:** **US 7,145,352 B2**  
(45) **Date of Patent:** **Dec. 5, 2006**

(54) **APPARATUS, METHOD, AND KIT FOR PROBING A PATTERN OF POINTS ON A PRINTED CIRCUIT BOARD**

(75) Inventors: **Brock J. LaMeres**, Colorado Springs, CO (US); **Brent Holcombe**, Colorado Springs, CO (US); **Kenneth Johnson**, Colorado Springs, CO (US)

(73) Assignee: **Agilent Technologies, Inc.**, Palo Alto, CA (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/918,134**

(22) Filed: **Aug. 13, 2004**

(65) **Prior Publication Data**  
US 2006/0033513 A1 Feb. 16, 2006

(51) **Int. Cl.**  
**O01R 31/02** (2006.01)  
**G01R 33/00** (2006.01)  
**G01R 31/26** (2006.01)

(52) **U.S. Cl.** ..... **324/754**; 324/758; 324/761;  
439/638; 439/296

(58) **Field of Classification Search** ..... 324/754,  
324/758; 439/296, 638  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,818,248	A *	10/1998	St. Onge	.....	324/761
6,194,908	B1 *	2/2001	Wheel et al.	.....	324/761
6,359,452	B1 *	3/2002	Mozzetta	.....	324/754
2003/0210067	A1 *	11/2003	Miller	.....	324/765

**OTHER PUBLICATIONS**

Brent A. Holcombe, et al., Connector-Less Probe, U.S. Appl. No. 10/373,820, filed Feb. 25, 2003.

Brent A. Holcombe, et al., "Alignment/Retention Device for Connector-Less Probe", U.S. Appl. No. 10/644,365, filed Aug. 20, 2003.

Brock J. LaMeres, et al., "Backside Attach Probe, Components thereof, and Methods for Making and Using Same", U.S. Appl. No. 10/902,405, filed Jul. 28, 2004.

Brock J. LaMeres, et al., "Probes with Perpendicularly Disposed Spring Pins, and Methods of Making and Using Same", U.S. Appl. No. 10/781,086, filed Feb. 17, 2004.

Brock J. LaMeres, et al., "Probe Retention Kit, and System and Method for Probing a Pattern of Points on a Printed Circuit Board", U.S. Appl. No. 10/918,236 (17 pages of specification including claims and abstract, and five (5) sheets of formal drawings (Figs. 1-10), Filed Aug. 13, 2004.

\* cited by examiner

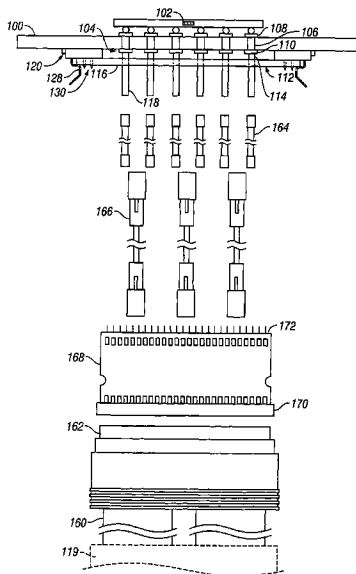
*Primary Examiner*—Ha Tran Nguyen

*Assistant Examiner*—Emily Y Chan

(57) **ABSTRACT**

An apparatus, method, and kit for probing a pattern of points on a first printed circuit board are disclosed. In one exemplary embodiment, the apparatus includes a probe having i) a plurality of compression interconnects to probe the pattern of points on the first printed circuit board, and ii) a plurality of fixed pins that are electrically coupled to the compression interconnects. The fixed pins extend from the probe opposite the compression interconnects. The apparatus further includes a flexible wire interconnect having first and second sets of electrically coupled connectors, the first set of which is coupled to the fixed pins of the probe. A second printed circuit board has at least one first connector that is electrically coupled to at least one second connector. The at least one first connector is coupled to the second set of connectors of the flexible wire interconnect, and the at least one second connector is configured to couple to a test instrument.

**13 Claims, 5 Drawing Sheets**



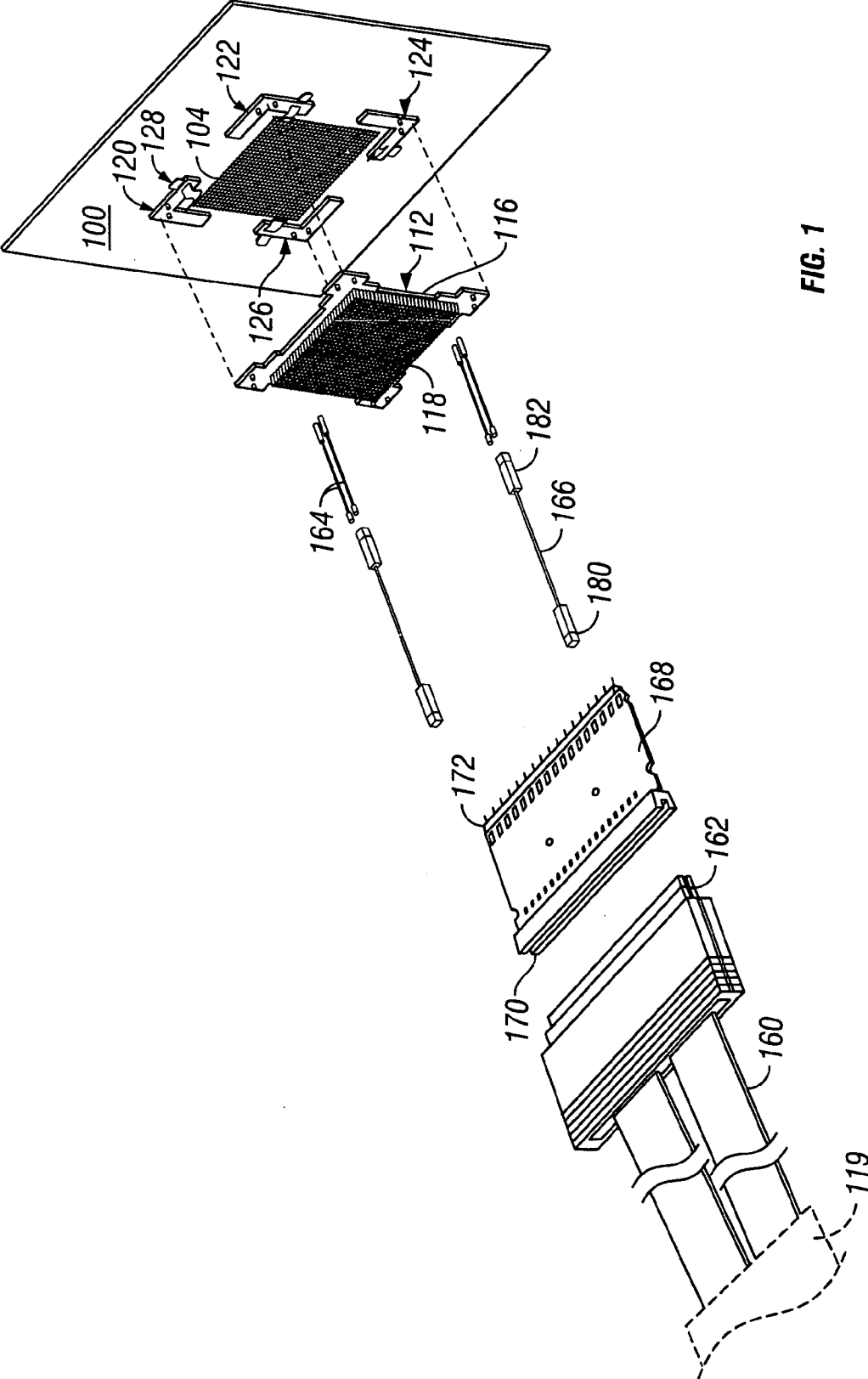
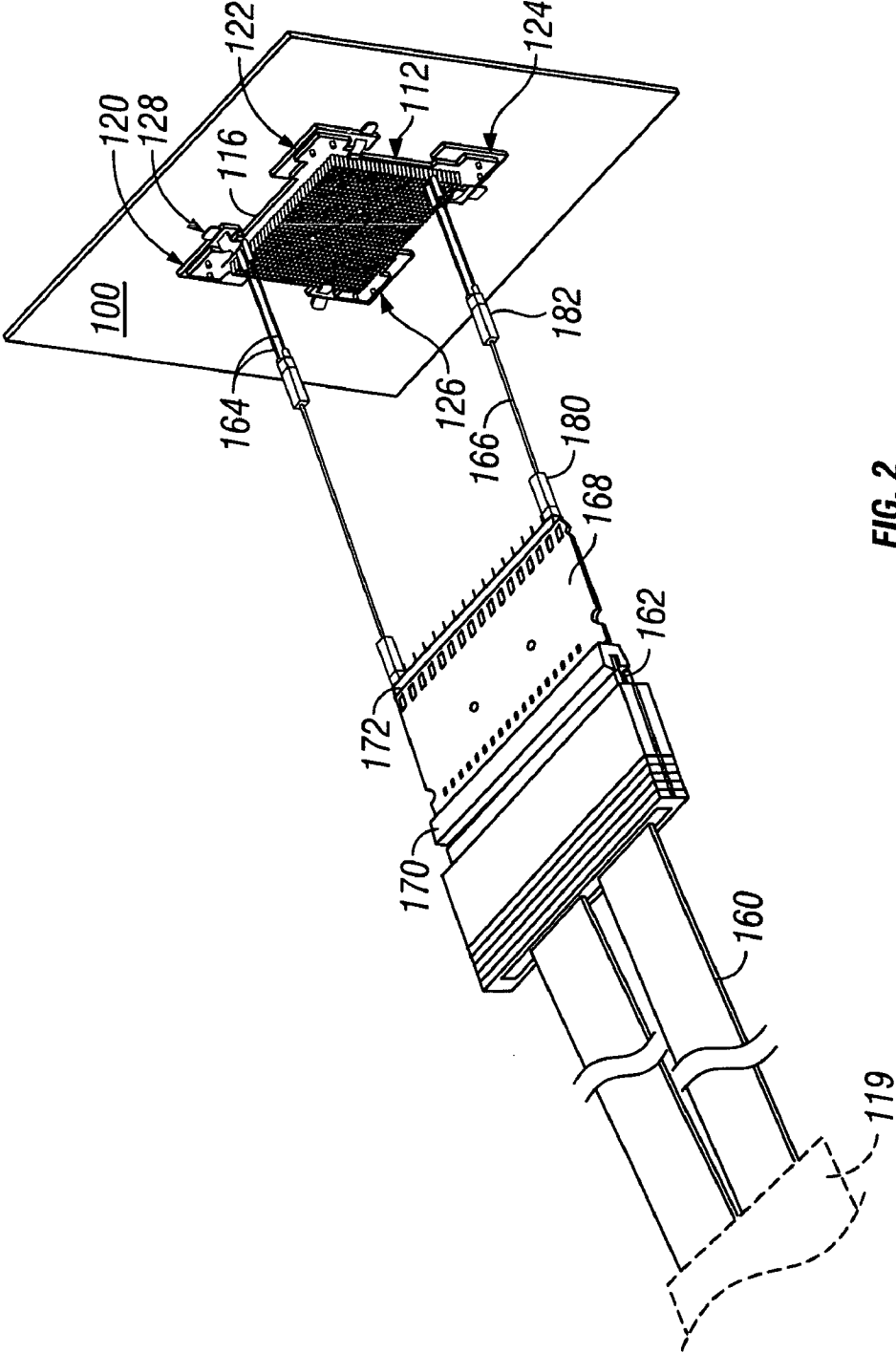


FIG. 1



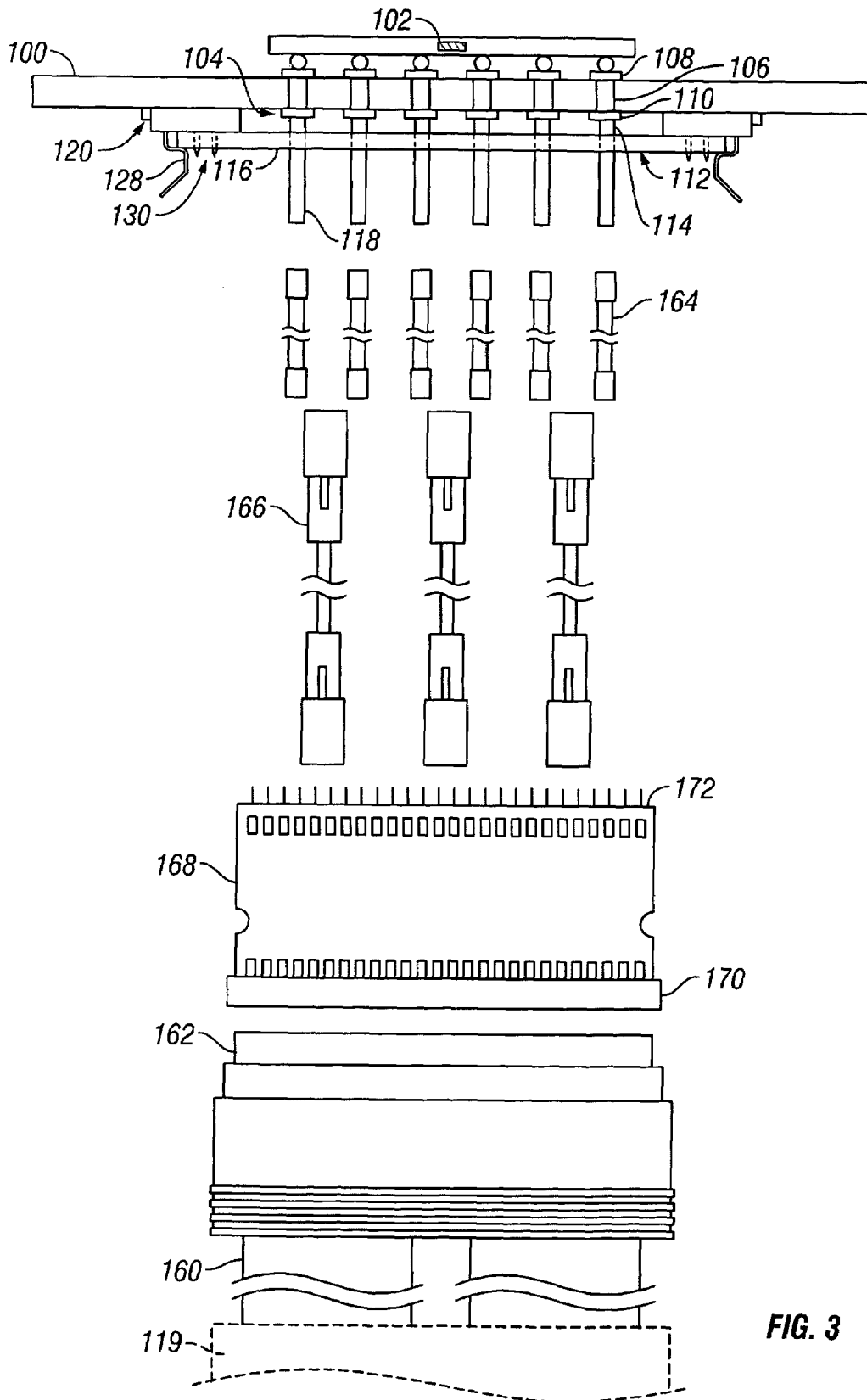


FIG. 3

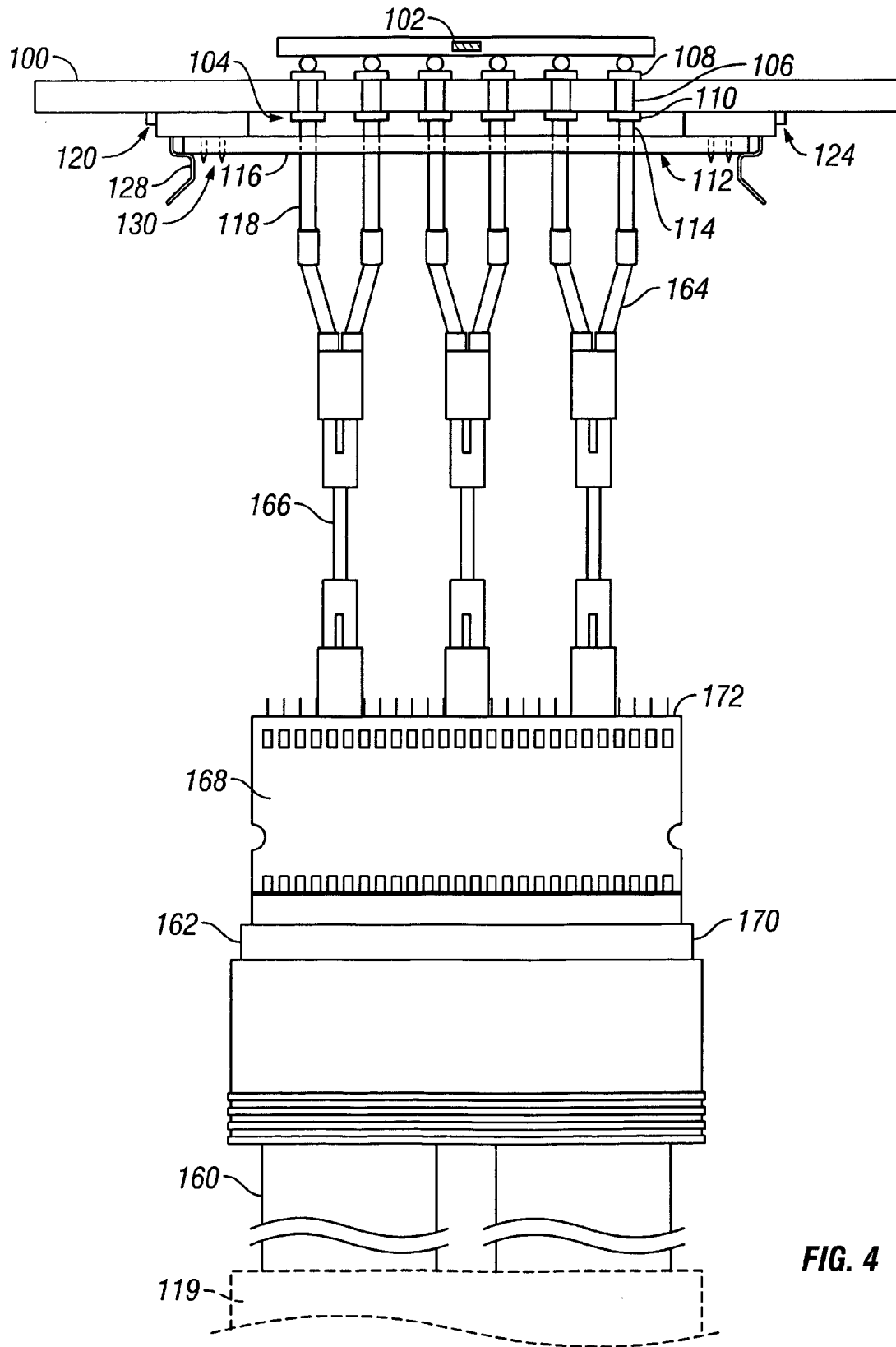


FIG. 4

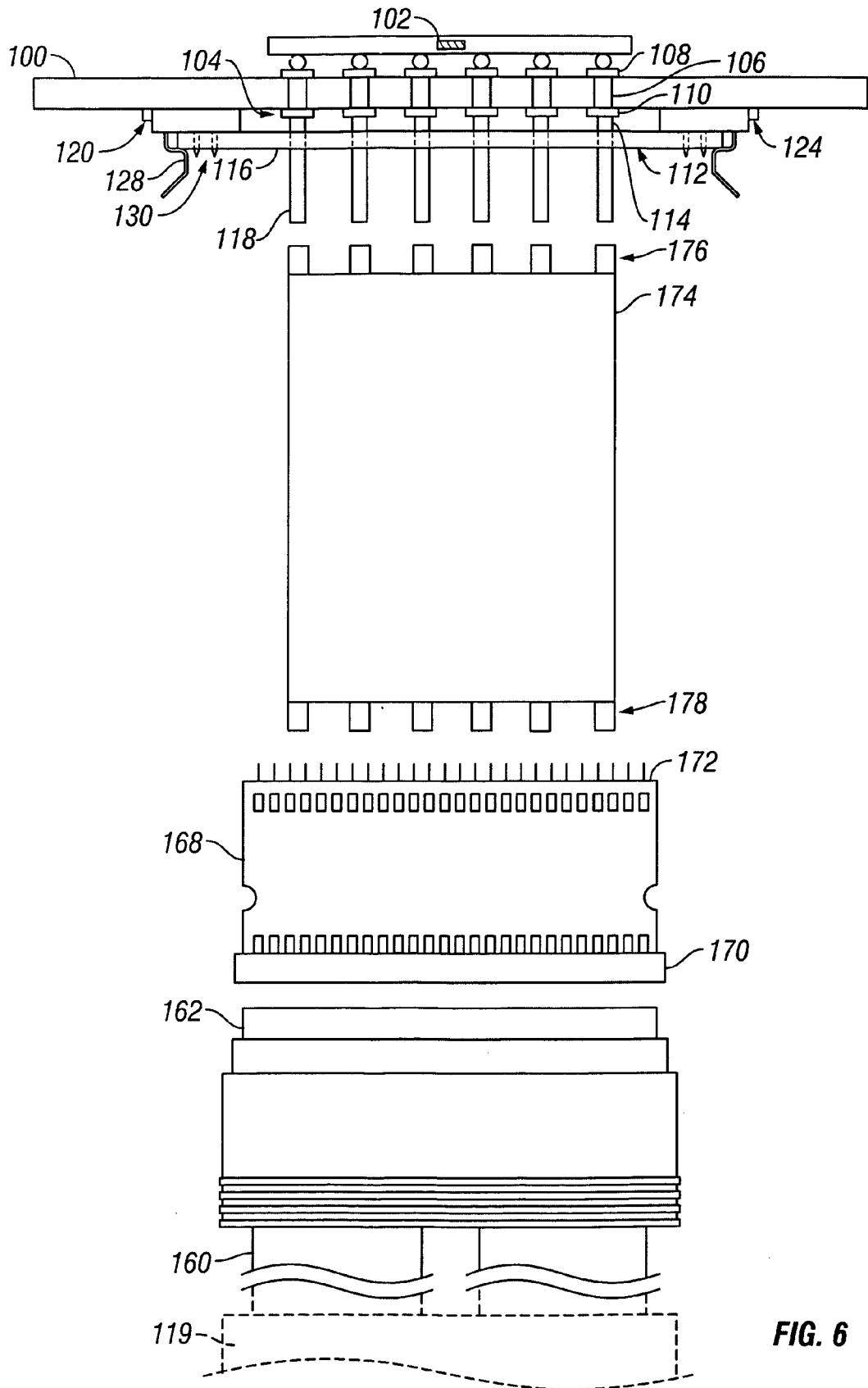


FIG. 6

1

## APPARATUS, METHOD, AND KIT FOR PROBING A PATTERN OF POINTS ON A PRINTED CIRCUIT BOARD

### BACKGROUND

Connector-less probing has emerged as an attractive form of probing for logic analyzers and other test equipment. In connector-less probing, a customer may design their printed circuit board (PCB) to incorporate a "landing pattern" of test points. The customer then attaches a connector-less probe to their test equipment, and mounts the connector-less probe to their PCB so that a plurality of spring-pins on the probe engage the plurality of test points in their PCB's landing pattern.

One embodiment of a connector-less probe is disclosed in the United States patent application of Brent A. Holcombe, et al. entitled "Connector-Less Probe" (Ser. No. 10/373,820, filed Feb. 25, 2003). An alignment/retention device for mounting a connector-less probe to a PCB is disclosed in the United States patent application of Brent A. Holcombe, et al. entitled "Alignment/Retention Device For Connector-Less Probe" (Ser. No. 10/644,365, filed Aug. 20, 2003).

Connector-less probes for probing a plurality of breakout vias on the backside of a printed circuit board to which a grid array package is attached are disclosed in the United States Patent Application of Brock J. LaMeres, et al. entitled "Backside Attach Probe, Components Thereof, and Methods for Making and Using Same" (Attorney Docket Number 10030947-1, filed on the same date as this application). This application is related to another United States Patent Application of Brock J. LaMeres et. al., filed on the same date as this application, and entitled, "Probe Retention Kit, System, and Method for Probing A Pattern of Points on a Printed Circuit Board."

Agilent Technologies, Inc. (headquartered in Palo Alto, Calif.) markets a number of connector-less probing solutions under the name "Soft Touch".

### SUMMARY

In one embodiment, apparatus for probing a pattern of points on a first printed circuit board comprises a probe, a flexible wire interconnect, and a second printed circuit board. The probe has i) a plurality of compression interconnects to probe the pattern of points on the first printed circuit board, and ii) a plurality of fixed pins that are electrically coupled to the compression interconnects. The fixed pins extend from the probe opposite the compression interconnects. The flexible wire interconnect has first and second sets of electrically coupled connectors, the first set of which is coupled to the fixed pins of the probe. The second printed circuit board has at least one first connector that is electrically coupled to at least one second connector, with the at least one first connector being coupled to the second set of connectors of the flexible wire interconnect, and the at least one second connector being configured to couple to a test instrument.

In another embodiment, a method for probing a pattern of points on a first printed circuit board comprises electrically coupling a plurality of compression interconnects, held by a probe, to the pattern of points. A plurality of damped wire accessories are electrically coupled to a plurality of fixed pins of the probe (the fixed pins being coupled to the compression interconnects). A plurality of flying lead cables are electrically coupled to the plurality of damped wire accessories, with each flying lead cable being coupled to at

2

least two of the damped wire accessories. The plurality of flying lead cables are electrically coupled to a second printed circuit board. The second printed circuit board is electrically coupled to a test instrument.

In yet another embodiment, a kit for probing a pattern of points on a first printed circuit board comprises a probe, a plurality of damped wire accessories, and a plurality of flying lead cables. The probe has i) a plurality of compression interconnects to probe the pattern of points on the first printed circuit board, and ii) a plurality of fixed pins that are electrically coupled to the compression interconnects. The fixed pins extend from the probe opposite the compression interconnects. Each of the plurality of damped wire accessories has first and second electrically coupled connectors, the first of which is configured to couple to one of the fixed pins of the probe. Each of the plurality of flying lead cables has first and second electrically coupled connectors, the first of which is configured to couple to at least two of the second connectors of the damped wire accessories. The second printed circuit board has at least one first connector that is electrically coupled to at least one second connector, with the at least one first connector being configured to couple to the second connectors of the flying lead cables, and the at least one second connector being configured to couple to a test instrument.

Other embodiments of the invention are also disclosed.

### BRIEF DESCRIPTION OF THE DRAWINGS

Illustrative and presently preferred embodiments of the invention are illustrated in the drawings, in which:

FIGS. 1 & 2 illustrate the assembly of an exemplary system for probing a pattern of points on a PCB;

FIGS. 3 & 4 illustrate the assembly of the system shown in FIGS. 1 & 2, but from an elevation perspective;

FIG. 5 illustrates an exemplary method for probing a pattern of points on a PCB; and

FIG. 6 illustrates an elevation of a second exemplary apparatus for probing a pattern of points on a PCB.

### DESCRIPTION OF THE INVENTION

After loading a printed circuit board (PCB **100**) with a number of components **102**, the loaded board must be tested. At times, an engineer may conduct tests by probing a pattern of points **104** on the PCB **100**.

An exemplary pattern of points **104** is variously shown in each of FIGS. 1-4. As shown in FIGS. 3 & 4, the pattern of points **104** may be positioned on a PCB **100** opposite the side to which a component **102** such as an integrated circuit (IC) is attached. Alternately, the pattern of points **104** could be 1) positioned on the same side of the PCB **100** as the component **102**, or 2) coupled to other and/or different components.

By way of example, the pattern of points **104** shown in FIGS. 3 & 4 is coupled to the IC **102** by means of breakout vias (e.g., **106**) in the PCB **100**. For purposes of illustration, each of the breakout vias **106** is shown to be bounded above and below by a somewhat thick pad (e.g., **108**, **110**). Typically, however, these pads **108**, **110** will be very thin.

One way to probe a pattern of points **104** on a PCB **100** is via a probe **112** having a plurality of compression interconnects (e.g., **114**) therein. As shown in FIG. 1-4, such a probe **112** may generally comprise a substrate **116** formed of an insulating material (e.g., plastic or FR4). The probe's compression interconnects **114** may then be molded, press fitted, snapped, clipped, screwed, soldered or otherwise