US 20040207417A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2004/0207417 A1

Barr (43) Pub. Date: Oct. 21, 2004

(54) ELECTRONIC PROBE WITH POSITIONABLE TIP

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(21) Appl. No.: 10/417,848

(22) Filed: Apr. 16, 2003

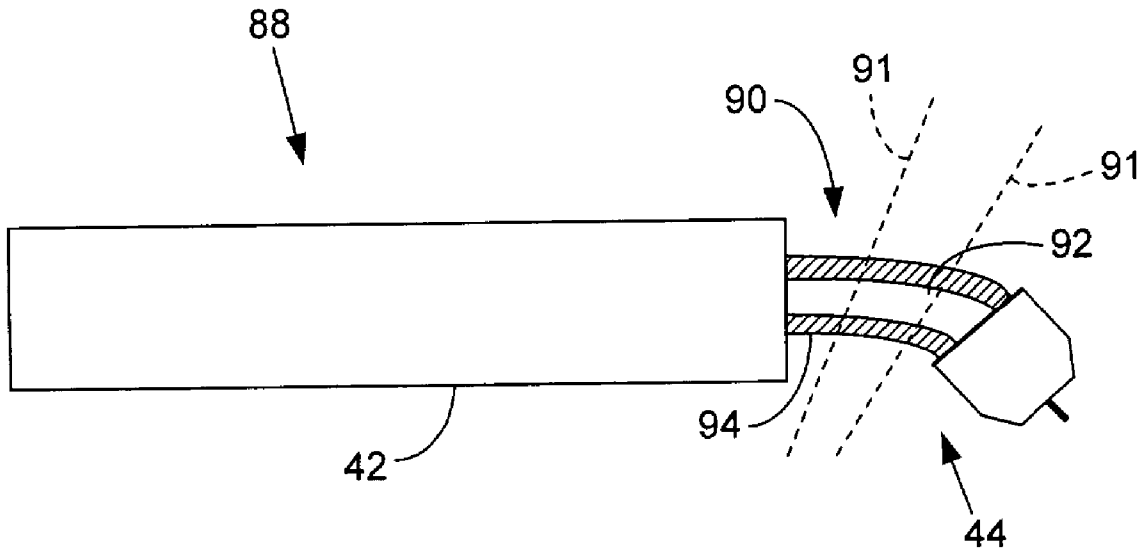
Publication Classification

(51) Int. Cl.[7] G01R 31/02

(52) U.S. Cl. 324/754

(57) ABSTRACT

An electronic probe includes a body and a tip positionable relative to the body. With such a positionable tip, a technician can more easily probe a region of a circuit board that is otherwise difficult to access with a conventional probe, and can do so without using an extension wire. Furthermore, the tip may be removable and include a point for contacting a signal node and a coupling element that couples the point to the body and that allows the point to assume multiple positions relative to the body.



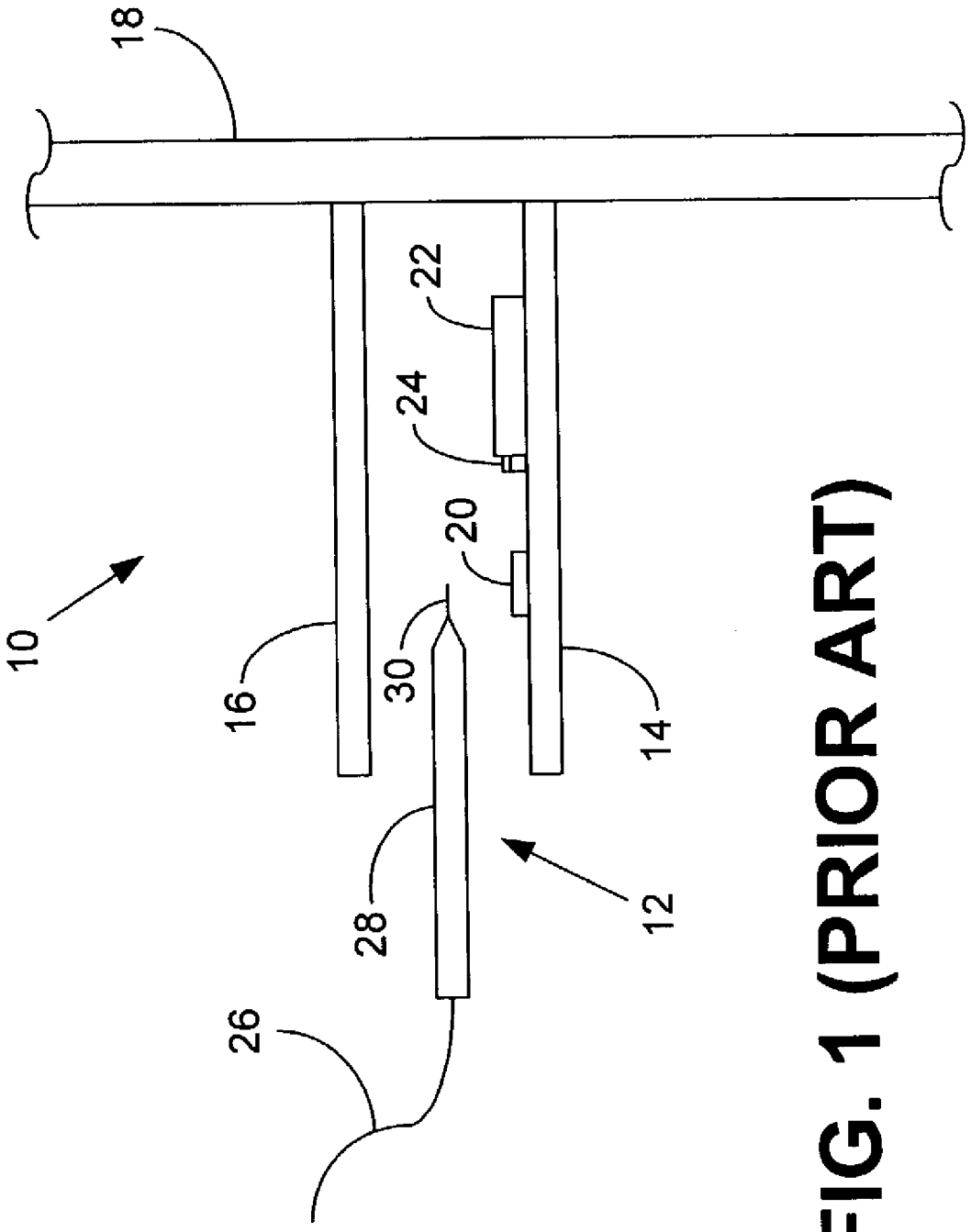


FIG. 1 (PRIOR ART)

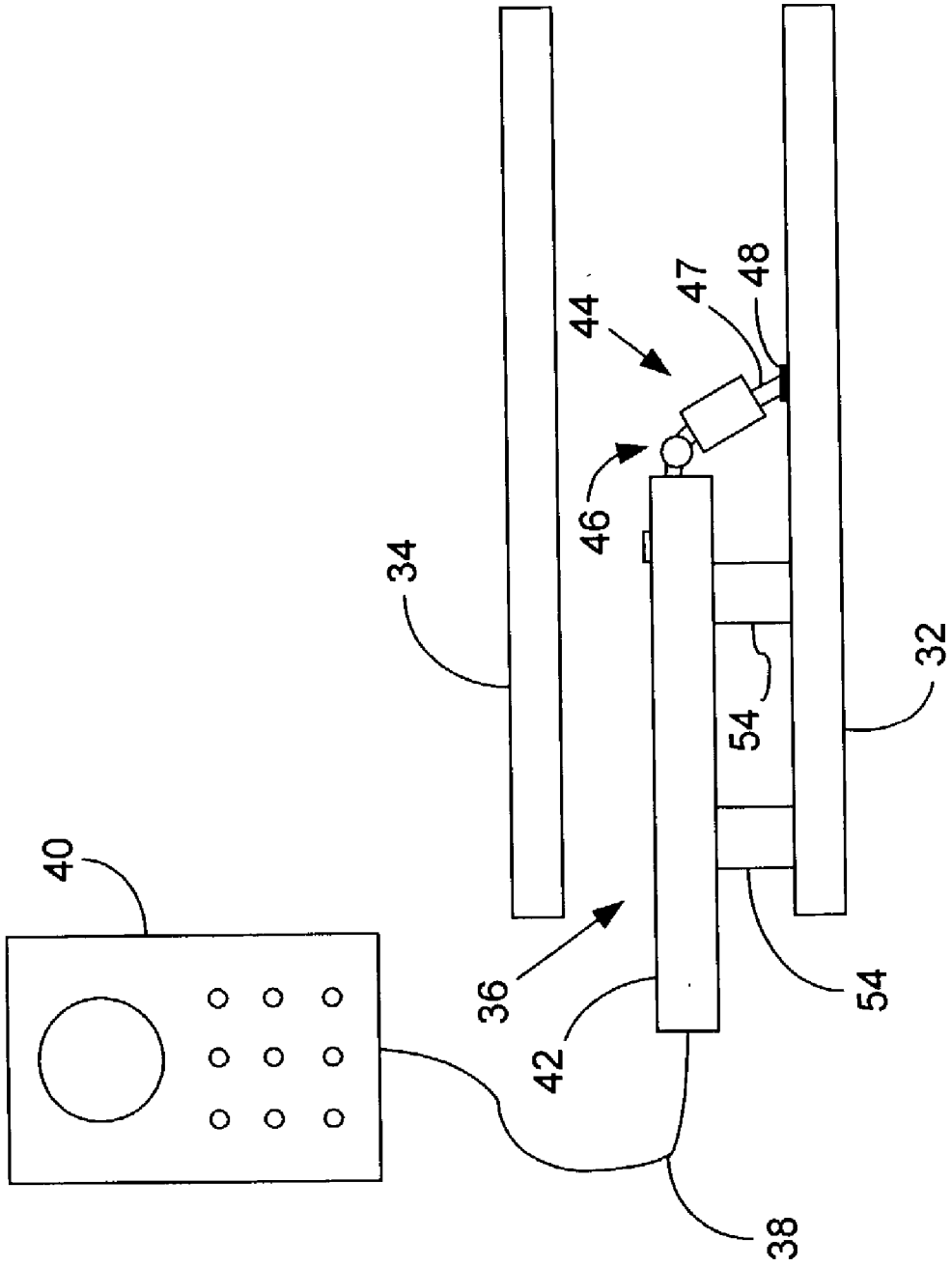


FIG. 2

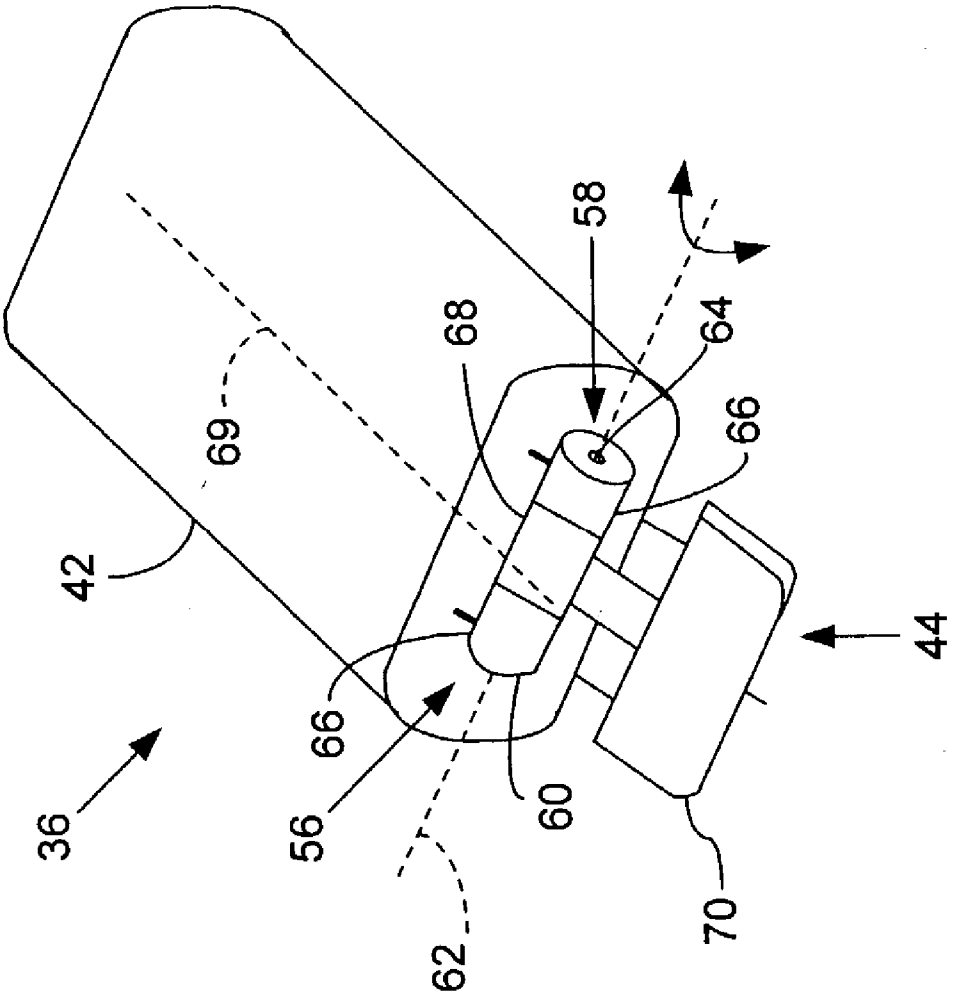


FIG. 3

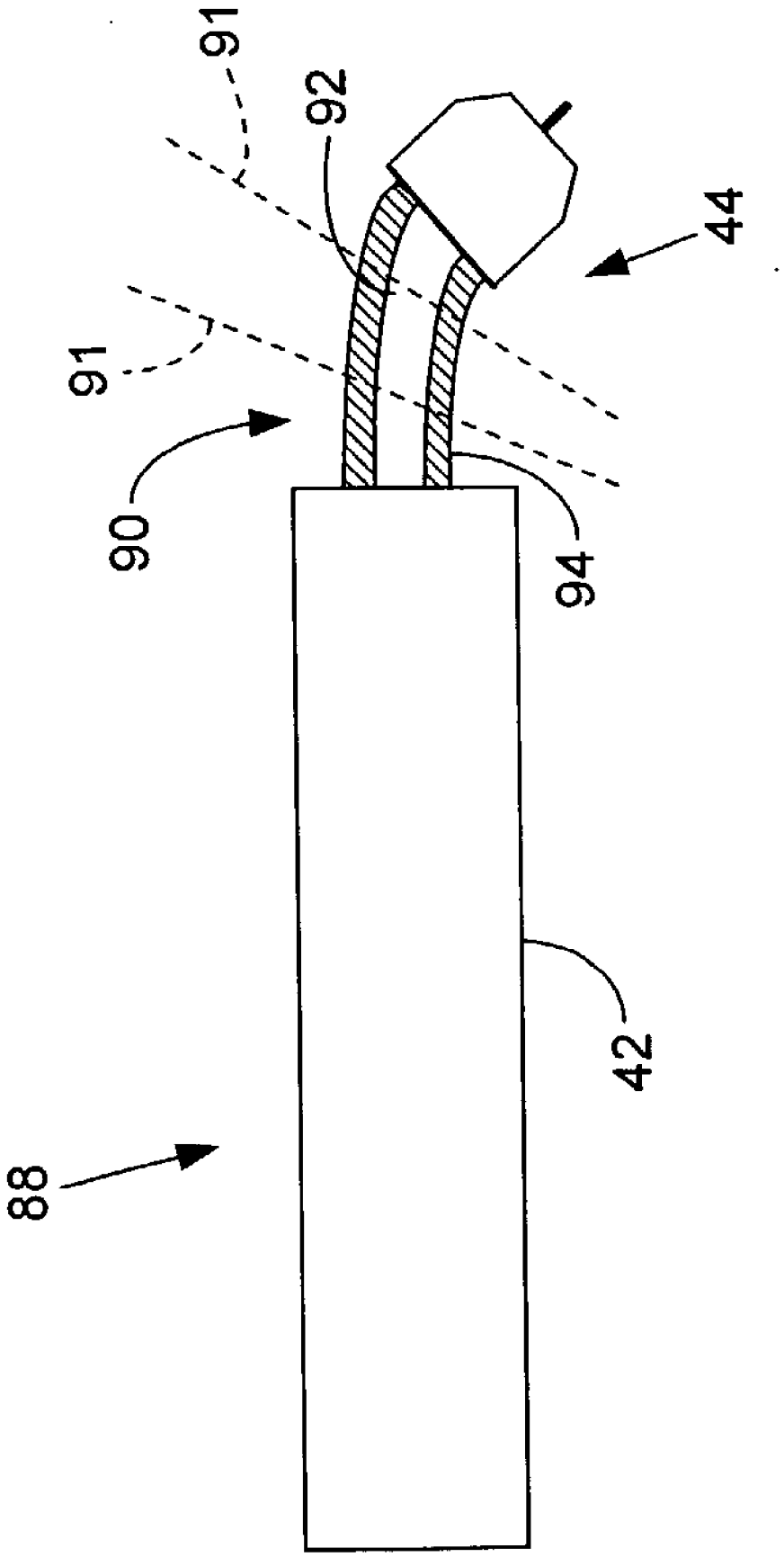


FIG. 4

ELECTRONIC PROBE WITH POSITIONABLE TIP

BACKGROUND OF THE INVENTION

[0001] Many electronic devices, such as computers and stereos, include a main circuit board, or motherboard, that contains the device's basic circuitry and/or components for operating the device. For example, a main circuit board may include a microprocessor for executing instructions, memory for storing data, and an expansion slot for adding more components or circuitry to the main board. In addition, many electronic devices include a secondary circuit board, or daughterboard, that may be mounted to the expansion slot of the main circuit board and that contains additional circuitry and/or components for operating the device. For example, a daughterboard may include memory for storing data, and a microprocessor for executing instructions to operate a portion of the device such as a modem incorporated in a computer or an equalizer incorporated in a stereo.

[0002] When such devices malfunction or when the design or manufacture of such devices is not complete, a technician typically tests/diagnosis the device by probing the circuits and/or components of the main and/or secondary circuit boards with a probe coupled to a measuring device such as an oscilloscope.

[0003] Unfortunately, probing a circuit board can be difficult with many probes. Manufacturers frequently mount circuit boards close together and/or close to the housing of the device to reduce the overall size of the device. This reduces the space between the circuit boards and/or circuit board and housing in which a technician can maneuver a probe. Consequently, some regions of a circuit board may be difficult or impossible for a technician to probe.

[0004] For example, **FIG. 1** is a view of an electronic system **10** and a conventional high-frequency-signal probe **12** that a technician may use to probe the system **10**. The system **10** includes two secondary circuit boards **14** and **16** mounted to a main circuit board **18**. The secondary board **14** includes a probe pad **20**, and a component **22** having a terminal **24**. The probe **12** is connected to a cable **26** that couples the probe to an oscilloscope (not shown), and includes a body **28** and a tip **30** for probing the pad **20** and terminal **24**.

[0005] To probe the secondary circuit board **14**, a technician tries to contact the pad **20** or terminal **24** with the probe tip **30**. To do this, the technician attempts to angle the probe **12** such that the tip **30** contacts the pad **20** or terminal **24**. But if the boards **14** and **16** are too close together, or if the probe body **28** is too wide, then the technician may be unable to angle the probe **12** to the degree necessary for the tip **30** to contact the pad **20** or terminal **24**.

[0006] One solution to this problem is to solder an extension wire (not shown) between the pad **20** or terminal **24** and the tip **30**. Although such an extension wire allows a technician to more easily access the board **14**, the extension wire may present other problems. For example, the extension wire may add inductance to the measurement path, and thus, may corrupt the accuracy of the measurement, particularly where the probed signal has a high frequency.

[0007] Another solution is to remove the board **16** so as to allow easier access to the board **14**. But this solution may be unavailable if the board **16** is needed for the proper operation of the circuits on the board **14**, or if the probe **12** cannot be properly angled even with the board **16** removed.

SUMMARY OF THE INVENTION

[0008] In one aspect of the invention, a signal probe includes a body and a tip positionable relative to the body. With such a positionable tip, a technician can more easily probe a region of a circuit board that is otherwise difficult to access with a conventional probe, and can do so without using an extension wire. Furthermore, the tip may be removable and include a point for contacting a signal node and a coupling element that couples the point to the body and that allows the point to assume multiple positions relative to the body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** illustrates the difficulty of probing one of two circuit boards mounted close together with a conventional signal probe.

[0010] **FIG. 2** is a view of a probe having a positionable tip according to an embodiment of the invention.

[0011] **FIG. 3** is a perspective view of the probe in **FIG. 2** according to an embodiment of the invention.

[0012] **FIG. 4** is a perspective view of a signal probe according to another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] The following discussion is presented to enable one skilled in the art to make and use the invention. Various modifications to the disclosed embodiments will be readily apparent to those skilled in the art, and the generic principles herein may be applied to other embodiments and applications without departing from the spirit and scope of the present invention as defined by the appended claims. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

[0014] **FIG. 2** is a view of two circuit boards **32** and **34** incorporated in an electronic device (not shown for clarity), and a signal probe **36** having a positionable tip **44** according to an embodiment of the invention. A cable **38** couples the probe **36** to an oscilliscope **40**, which receives and displays the probed signal. The probe **36** may be an active probe, such as a high frequency probe that includes circuitry (not shown) within the probe body **42**, or may be a passive probe. The tip **44** includes a coupling element **46** (discussed in greater detail in conjunction with **FIGS. 3 and 4**) that couples the tip **44** to the body **42** and allows the tip **44** to be positioned relative to the body **42**. The tip **44** also includes a conductive point **47** for contacting the pad **48**. With a positionable tip, the probe **36** may be used to probe a pad **48** of the circuit board **32** that would be difficult to access with a conventional probe. Thus, a technician may probe the pad **48** without an extension wire (not shown) and without removing the board **34**. Furthermore, the tip **44**, or portions thereof, may be removable and replaceable.

[0015] Still referring to **FIG. 2**, the tip **44** may include a locking element (not shown in **FIG. 2** but discussed in greater detail in conjunction with **FIG. 3**) for retaining the

tip **44** at one or more positions where the tip **44** is angled relative to the body **42**. For example, the locking element may retain the tip **44** at three different angular positions. The first position may be where the tip **44** and body **42** are aligned, that is, form a 180° angle. The second position may be where the tip **44** and body **42** form a 135° angle. And the third position may be where the tip **44** and body **42** form a 90° angle. Alternatively, the locking element **46** may retain the tip **44** at more or fewer than three angular positions relative to the body **42**.

[**0016**] Still referring to **FIG. 2**, supports **54** may be used to support the probe **36**. By pivoting the tip **44**, the supports **54** can hold the probe **42** substantially parallel to the board **32** while the tip contacts the probe pad **48**. In this position, the supports **54** can securely support the probe **36** above other components (not shown) on the circuit board **32** so that a technician does not have to support the probe with his/her hand.

[**0017**] **FIG. 3** is a perspective view of the probe **36** in **FIG. 2** according to an embodiment of the invention. The tip **44** includes a coupling element **56** that couples the tip **44** to the body **42** and allows the tip **44** to be positioned relative to the body **42**, and a locking element **58** for retaining the tip **44** at one or more positions relative to the body **42**.

[**0018**] In one embodiment, the coupling element **56** includes a hinge **60** that allows the tip **44** to pivot about the hinge axis **62**, and the locking element **58** includes a screw **64** for frictionally retaining the tip **44**. The hinge **60** is a conventional hinge that includes a first section **66** fastened to the body **42** and a second section **68** fastened to a head **70** of the tip **44**. The first section **66** is rotatably coupled to the second section **68** to allow the tip **44** to pivot about the hinge axis **62** when a technician wishes to position the tip **44** relative to the body **42**. The screw **64** includes a contact surface (not shown) that may be forced against the second section **68** of the hinge **60** to retain the tip **44** at a desired position relative to the body **42**. To move the screw **64** toward and away from the second section **68**, the screw **64** includes a thread (not shown) that slidingly contacts a corresponding thread (not shown) in the first section **66**.

[**0019**] In other embodiments, the tip **44** may include a coupling element that allows the tip **44** to rotate about more than one axis. For example, in addition to allowing the tip **44** to pivot about the pivot axis **62**, the coupling element **56** may allow the tip **44** to rotate about a longitudinal axis **69** of the body **42** that is perpendicular to the pivot axis **62**, and to be locked in a particular position. In addition, the tip **44** may include other locking elements such as a conventional ratchet and pawl that allows the tip **44** to pivot in one direction but prevents the tip **44** from pivoting in an opposite direction unless the pawl is moved away from the ratchet.

[**0020**] **FIG. 4** is a perspective view of a probe **88** according to another embodiment of the invention. The probe **88** includes a coupling element **90** made of conventional material that plastically deforms when bent, i.e., retains its new shape. Thus, the tip **44** may be positioned about multiple and/or different axes **91** and may be retained in a position by the material's non-elasticity.

[**0021**] In one embodiment, the coupling element **90** includes a metal conductor **92** that electrically couples the body **42** to the tip **44** and a rubber sheath **94** made of conventional rubber for protecting and insulating the conductor **92**. The conductor **92** may be made from any desired metal such as copper that is capable of bending. The coupling element **90** may be permanently attached to the tip **44** and the body **42** or releasably fastened to the tip **44** and/or the body **42**. When releasably fastened to the tip **44** and/or body **42**, the tip **44** may be replaced as desired. Furthermore, the coupling element **90** may include a cover (not shown) of conductive material such as copper mesh to shield the conductor **92** from signal noise. The cover may be located on the outside surface of the rubber sheath **94** and may be plastically and/or elastically deformable.

[**0022**] In other embodiments, the coupling element **90** may be made of conventional material that elastically deforms when bent. Thus, the tip **44** may bend about multiple axes **91**. But because the material elastically deforms, the tip **44** typically is retained in a particular angular position relative to the body **42** by a technician or an external support pressing the tip **44** against the probed point such as the probe pad **48** of **FIG. 2**. Thus, in this embodiment the coupling element **98** does not retain the tip **44** in the angular position once this pressure is removed.

What is claimed is:

1. A signal-probe tip, comprising:

a conductive point operable to contact a signal node; and

a coupling element operable to couple the point to a probe body and to allow the point to assume multiple positions relative to the body.

2. The tip of claim 1 wherein the tip is releasably fastened to the body.

3. The tip of claim 1 wherein the tip is pivotable relative to the body.

4. The tip of claim 1 wherein the coupling element comprises a locking element operable to retain the tip at at least one position.

5. The tip of claim 1 wherein the coupling element comprises a hinge.

6. The tip of claim 1 wherein the coupling element comprises a hinge operable to pivot the tip about a pivot axis.

7. The tip of claim 1 wherein, after the coupling element is bent, the coupling element retains its new shape.

8. The tip of claim 1 wherein, the coupling element comprises a material operable to allow the tip to bend relative to the body by plastically deforming.

9. The tip of claim 1 wherein, after the coupling element is bent, the coupling element does not retain its new shape.

10. The tip of claim 1 wherein, the coupling element comprises a material operable to allow the tip to bend relative to the body by elastically deforming.

11. A signal probe comprising:

a body; and

a signal-probe tip that includes:

a conductive point operable to contact a signal node; and

a coupling element operable to couple the point to the body and to allow the point to assume multiple positions relative to the body.

12. The probe of claim 11 wherein the probe comprises a passive probe.

13. The probe of claim 11 wherein the probe comprises an active probe.

14. A method comprising:

positioning a tip of a probe relative to a body of the probe; and

contacting a signal source with the tip.

15. The method of claim 14 wherein positioning a tip includes bending the tip.

16. The method of claim 14 wherein positioning the tip includes pivoting a hinge.

17. The method of claim 14 further comprising retaining the tip in a position relative to the body by exerting pressure against the tip.

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