United States Patent

Adams et al.

[15] **3,693,087**

[45] **Sept. 19, 1972**

[54] **DUAL ACTING PROBE WITH EXTRACTOR/GUIDE**

[72] Inventors: **Joseph E. Adams,** Millbrook; **Edmund J. Di Stefano; Arthur E. Enderley,** both of Poughkeepsie, all of N.Y.

[73] Assignee: **International Business Machines Corporation,** Armonk, N.Y.

[22] Filed: **Dec. 17, 1970**

[21] Appl. No.: **99,204**

[52] **U.S. Cl.**.....**324/158 P,** 324/72.5, 339/45 M

[51] **Int. Cl.**.....**G01r 1/06,** H01r 13/62

[58] **Field of Search**...324/158 P, 158 F, 158 R, 72.5, 324/149; 339/45 R, 45 T, 45 M, 108 TP, 65, 66 R, 66 M, 66 T

[56] **References Cited**

UNITED STATES PATENTS

2,445,608	7/1948	Detweiler	339/45 R
2,711,523	6/1955	Willis	324/72.5
3,277,422	10/1966	Shevlin	339/65
1,227,375	5/1917	Boirault	339/66 M
1,650,779	11/1927	Williams	324/72.5
2,769,155	10/1956	Wimble	339/32 R

Primary Examiner—Rudolph V. Rolinec
Assistant Examiner—Ernest F. Karlsen
Attorney—Hanifin & Jancin and D. R. McKechnie

[57] **ABSTRACT**

An electrical probe is designed to test printed circuit boards having contact elements and connectors mounted thereon. The probe has an insulating body carrying two parallel contact blades. A member of insulating material is slideably mounted on the blades and is connected to a plunger assembly. The plunger assembly is used to move the member between two positions. In one position, the ends of the blades are exposed for insertion into a connector for engagement with the contact elements therein. Upon movement of the member from this position, the member engages the connector assembly and facilitates extracting the blades from the assembly. In the other position, the member covers the ends of the blades and is shaped to guide the blades into engagement with the contact elements on the board.

3 Claims, 6 Drawing Figures

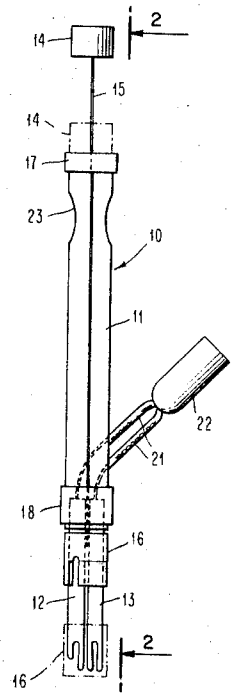


FIG. 1

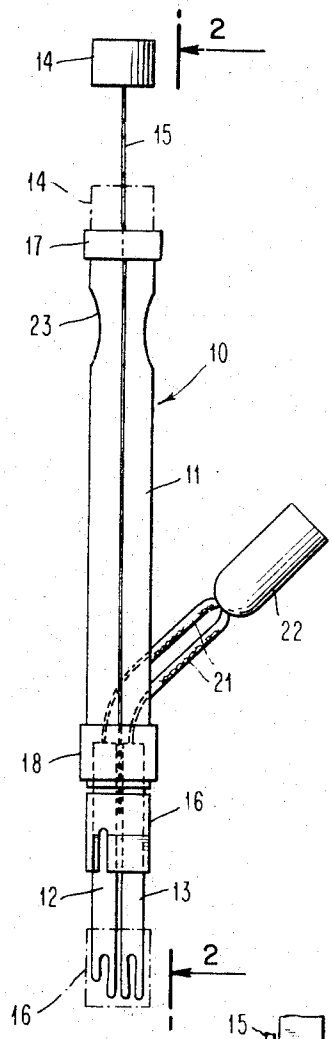


FIG. 2

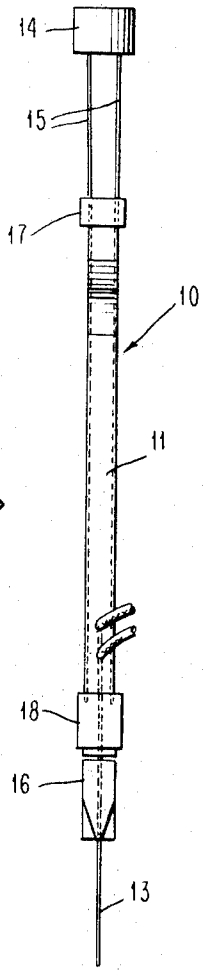
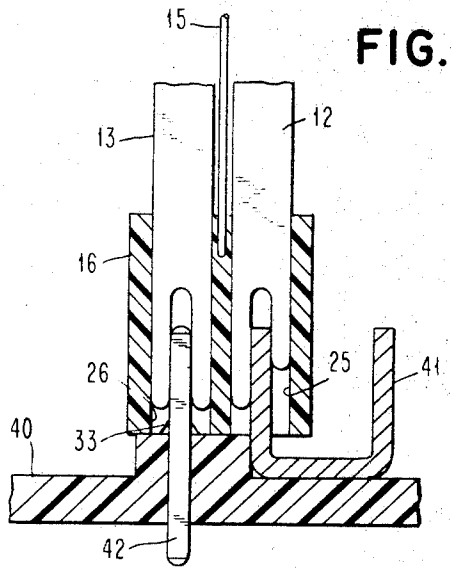


FIG. 5



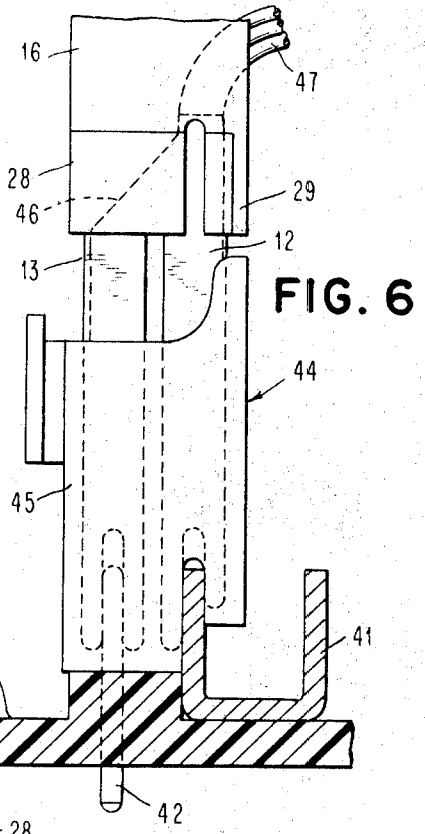
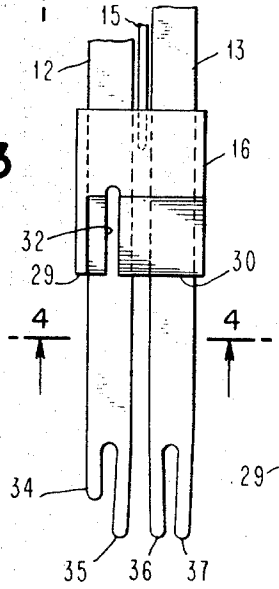


FIG. 6

FIG. 3



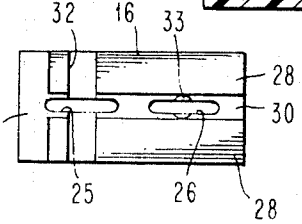


FIG. 4

INVENTORS
JOSEPH E. ADAMS
EDMUND J. DiSTEFANO
ARTHUR E. ENDERLEY
BY Douglas R. McTechnie
ATTORNEY

DUAL ACTING PROBE WITH EXTRACTOR/GUIDE

SUMMARY OF THE INVENTION

This invention relates to electrical probes for use in measuring and testing electronic devices having printed circuit boards provided with a multiplicity of contact elements and connectors. More specifically, it relates to probes provided with means for facilitating the engagement with and disengagement from the conductive elements to which it will be connected for probing purposes.

The present invention was specifically designed for use in probing an electronic device having a printed circuit board provided with a plurality of parallel ground rails and a multiplicity of square upstanding contact pins arranged in rows extending parallel to the rails. Various types of connectors and cable assemblies are used to interconnect the terminal pins and rails. One type of connector has a housing enclosing a pair of tuning fork contact elements, one of which is engagable with the ground rail and the other which is engagable with an adjacent pin. The upper ends of the contact elements are interconnected by a resistor to form what is known as a terminator. The terminator can be connected to an additional cable or not. A second type of connector, known as a "single" cable connector, includes the same type of contact elements and housing but the upper ends of the contact elements are connected to a cable whose other end may be connected to a similar connector located elsewhere on the printed circuit board. A third type of connector is known as a "double". Again, it involves the same housing. However, instead of merely housing a single pair of contact elements connected to one end of a cable, it has two pairs of such contact elements connected to two pairs of cables.

In the testing and probing of such an arrangement, it is necessary at times not only to make a probing engagement with any one of the three different types of connectors described above, but is also necessary at times to be able to directly probe the ground rail and adjacent pin when there is no connector mounted on it. In view of these specific probing requirements of such an arrangement then, it is the principal object of this invention to provide a single probe that is versatile and can be used to probe several different types of contact elements for the purpose of allowing the device associated therewith to be measured or tested.

Other objects of the invention are to provide a probe which aids in making electrical contact with the elements being probed, which can be readily connected to and disconnected from the elements being probed, and which is cheap and easy to use.

Briefly stated, the manner in which these and other objects are obtained is to provide a probe having an insulating body. Two parallel contact arms or blades are mounted on the body. A sliding guide/extractor element of insulating material is mounted on the blades and is moveable therealong by means of a plunger. The guide is moveable between two extreme positions. In one position, the guide covers the ends of the contact arms and serves to guide the arms onto a ground rail and associated pin by simply pushing the probe thereon. In the other extreme position, the element exposes the ends of the blades so that the ends can be inserted into a connector for engagement with contact elements therein. When it is desired to remove the probe, the plunger is pushed causing the extractor element to hold the connector while the blades are withdrawn therefrom.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

FIG. 1 is a front elevational view of a probe embodying the invention.

FIG. 2 is a side elevational view, with parts removed, looking along lines 2—2 of FIG. 1.

FIG. 3 is an enlarged side elevational view of a part of the probe shown in FIG. 1.

FIG. 4 is a bottom view of the element of the probe looking along lines 4—4 of FIG. 3.

FIG. 5 is an enlarged elevational view partly in section illustrating how the probe blades co-act with one type of an electrical device being probed.

FIG. 6 is an enlarged elevational view illustrating how the probe blades co-act with another type of electrical element being probed.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings and more specifically to FIGS. 1 and 2, a probe 10 has an elongated, manually grippable insulating body 11. The upper ends of a pair of parallel conductive contact blades or arms 12 and 13 are embedded in the lower end of body 11. A plunger 14 is located above the upper end of body 11 and is connected to a pair of rods 15. These rods pass through grooves that lie flush with the faces of body 11. Rods 15 are connected at their lower ends to an insulating element 16. Two bands 17 and 18 circle the ends of body 11 and hold the rods 15 within the slots for sliding movement therein. Plunger 14 and element 16 are moveable between the two extreme positions shown in FIG. 1 in full and dotted lines, respectively.

The upper ends of arms 12 and 13 are soldered or otherwise connected to a pair of insulated wires 21 whose other ends are connected to a standard connector 22. This allows probe 10 to be connected to the instruments used to test or measure the device being probed.

The upper end of body 11 is notched at 23 so that probe 10 can be manually grasped, in a manner similar to that of a hyperdermic needle, by engaging body 11 between the index and middle fingers in the notched areas while allowing the thumb to rest on plunger 14. This facilitates the extracting movement described below. The length of body 11 is preferably sufficient to allow the upper end of probe 10 to project above any maize of wires and cables that might exist in the device being probed.

As best seen in FIGS. 3 and 4, element 16 is generally in the form of a rectangular block having two slots 25 and 26 extending therethrough for receiving contact arms 13 and 12, respectively. Slots 25 and 26 are dimensioned to allow element 16 to freely slide along arms 12 and 13. The lower faces of element 16 are bevelled or tapered at 28, almost all the way across element 16 so as to leave at one edge thereof a flange 29. The lower edge of element 16 has a flat face 30 which in conjunction with flange 29 provides a T-shaped

lower face or end. An upwardly extending groove **32** is cut into the lower end of element **16** for the purpose of guiding contact arm **12** onto a ground rail in a manner more fully pointed out below. A chamfer **33** surrounds the lower middle end of groove **26** and opens through face **30** for the purpose of guiding contact arm **13** onto a contact pin in a manner more fully described below.

Referring now to FIG. **3**, the lower ends of arms **12** and **13** are bifurcated to provide tines **34–37**. Tines **34** and **35** are bent inwardly slightly towards each other as are tines **36** and **37**, the purpose of this shape being to develop a high contact pressure when arms **12** and **13** are engaged with the element being probed. Tine **34** is shorter than the remaining tines so that as the probe is engaged with a ground rail and contact pin, the points in time at which the maximum forces are applied for separating tines **36** and **37** and **34** and **35** do not coincide. This minimizes the maximum force necessary to engage the probe. The arms **12** and **13** are long enough so that when element **16** is in the upper position, the free ends of arms **12** and **13** can be inserted into a connector, such as illustrated with reference to FIG. **6**, without being interferred with by element **16**.

As indicated previously, the probe was designed for use with a specific type of printed circuit board and connector. Examples of the circuit boards and connector assemblies are shown in applications Ser. No. 47,073, filed June 17, 1970 by E. J. DiStefano et al. for "Connector Assembly With Tine Skewing Housing", and application Ser. No. 858,476, filed Sept. 16, 1969, by E. J. DiStefano et al. for "Electrical Connector". Both applications are assigned to the assignee of the present application. Reference may be had thereto for a more detailed description of the environment for which the present invention was designed. While it is to be understood that the printed circuit board assemblies for which the invention was designed may have several ground rails and a multiplicity of rows of pins and connectors mounted thereon, for the purpose of illustrating the invention, the printed circuit board assembly is shown simply as having a single ground rail **41** of upstanding U-shaped cross section and a single contact pin **42** both of which are mounted on a printed circuit board **40**. The pin projects upwardly and extends parallel to the adjacent flange of the ground rail **41**. The spacing between the center lines of contact arms **12** and **13** is the same as the spacing between pin **42** and such adjacent flange of ground rail **41**.

In the operation of probe **10**, when it is desired to probe a ground rail **41** and contact pin **42**, in a situation where there is no connector mounted thereon, the operation proceeds as follows. First, plunger **14** is depressed until it abuts the upper end of body **11**. This action moves element **16** to its lowest position. In such a position, the lower edge of element **16** projects downwardly beyond the lower edges of contact arms **12** and **13** so as to bring into play the guiding action of chamfer **33** and slot **32**. With element **16** in this lower position, the probe **10** is then manually grasped while maintaining the plunger in its lowest position and brought into alignment above the pin and ground rail. The probe is then pushed downwardly until it is fully seated. As element **16** initially contacts pin **42**, chamfer **33** receives the upper end of pin **42** and guides it between tines **36** and **37**. This motion spreads tines **36** and **37** apart to develop a high electrical contact pressure. As further downward movement proceeds, tine **34** makes an initial compact with ground rail **31** and it is spread apart to develop the desired high electrical contact pressure between tines **34** and **35** and element **41**. With the probe in this position, the various electrical tests and measurements may be taken. To remove probe **10**, it is simply pulled upwardly.

FIG. **6** is used to illustrate how probe **10** co-acts with another structure which is to be probed. A connector assembly **44**, of a type similar to that disclosed in the aforementioned applications, includes an insulating housing **45**. A contact assembly **46** includes two tuning fork connectors (not shown) engaged respectively with contact pin **42** and ground rail **41**. The upper end of contact assembly **46** is connected to a tri-wire flat cable **47**. The housing **45** has sufficient room therein to allow the insertion of arms **12** and **13** in such a manner that these arms engage the contact elements of contact assembly **46** and also contact pin **42** and rail **41**. The operation of probing this device follows. First, plunger **14** is raised to its uppermost position which position is defined by the upper edge of element **16** engaging the lower end of body **11**. This exposes the lower free ends of contact arms **12** and **13**. Next, the probe **10** is aligned over connector assembly **44** so that contact arm **13** will be aligned over pin **42**. Then, body **11** of probe **10** is pushed downwardly causing the contact arms **12** and **13** to enter assembly **44** and make electrical contact with both pin **42**, rail **41** and the contact elements of contact assembly **46**. To remove probe **10** from this position, body **11** is grasped between the fingers and plunger **14** is pushed downwardly to eventually extract arms **12** and **13** from assembly **44**. As element **16** moves downwardly, the bevelled surface **28** brushes or cams past the upper edge of contact assembly **46** and cable **47** so as to bring the lower edge of flange **29** into engagement with the upper underlying edge of housing **45**. At this point, the downward movement of element **16** stops but the continued exertion of force between the fingers now causes body **11** to move upwardly to thereby extract arms **12** and **13**. Thus, the extraction is accomplished without exerting any upward force on connector assembly **44** which would tend to disconnect it from contact pin **42** and rail **41**.

While the probe **10** has been illustrated for use with only one type of connector assembly **44**, which is known as a "single" because of the fact that it has only a single cable **47** and single contact assembly **46** associated therewith, the probe is also useful for probing connector assemblies known as doubles and terminators. In a double, there are two cables **47** and associated contact assemblies **46** housed in a single housing **45**. In this case, there is insufficient room in the housing **45** for the probe to make contact with pin **42** and rail **41**. But the probe is used by weding arms **12** and **13** between the upper edges of the contact elements between the adjacent contact assemblies **46**. For a terminator, which has a resistor across the upper ends of the contact elements of assembly **46**, the arms **12** and **13** are wedged between the resistor and the contact elements. Element **16** is used in the manner previously described to extract arms **12** and **13** from the wedging positions in both double and terminator connectors.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. For use in testing a circuit board assembly having a conductive rail and at least one upstanding contact pin spaced from said rail, a probe comprising:

body of insulating material;

a pair of parallel conductive contact blades fixedly mounted on said body and extending beyond one end and being adapted to be conductively engaged with said pin and said rail;

an insulating member surrounding and slideably mounted on the extending portion of said contact blades for movement between a first position exposing the end portions of said blades whereby said blades are adapted to be inserted into said circuit board assembly and a second position covering the ends of said blades, said member being shaped so as to guide said contact blades into contact with said pin and said rail when said member is in said second position;

and means for moving said member between said positions whereby said member is adapted to engage said circuit board assembly for extracting said contact blades therefrom; and means for connecting said blades to a testing circuit connector.

2. A probe in accordance with claim 1, wherein said moving means comprises:

a plunger connected to said body and to said insulating member, said body and plunger being so sized and shaped as to be manually grasped between the fingers for effecting relative movement between said insulating member and plunger and said body.

3. A probe in accordance with claim 1, wherein:

said member is shaped so as to project beyond the ends of said contact blades and is adapted to engage said pin and said rail for guiding said blades into engagement therewith.

* * * * *