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(54) **Title:** ECO CONTACTOR

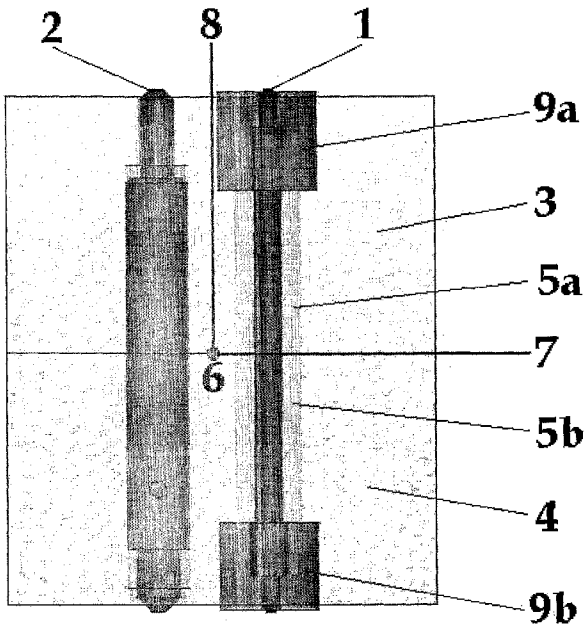

FIG. 2

(57) **Abstract:** The present invention relates to an improved a shielded contactor having an insulative material or proxy (9a, 9b) for making reliable electrical contact. Accordingly, the length of the assembled contactor is totally surrounded by conductive material, thereby providing shielding element. Resultantly, the present invention has the capability of eliminating impedance mismatch during the signal transmission.

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DESCRIPTION

TITLE OF INVENTION: ECO CONTACTOR

FIELD OF INVENTION

The present invention relates to a contactor to couple a device under test, and more particularly, a shielded contactor having an insulative material or more specifically relating to structures for making reliable electrical contact thereto.

BACKGROUND OF INVENTION

A wide variety of contactors currently is available for use such as the conventional plastic contactors and/or partially shielded contactors are amongst those widely used in the market.

Many of these shielding devices are constructed of relatively thin flexible sheets of metal and utilize spring contactors for making electrical contact at multiple locations to effect ground connections in various shielding arrangements.

Shielding is a founded on coaxial theory, wherein by shorting the housing to the ground pins, a virtual ground plane will be created around the signal pins to provide a good control over the impedance which is a major contributor in determining the performance of the contactor.

One commercially available contactor known as partially shielded contactors consist of three plates. The middle plate, made of conductive materials, are shorter to the ground pins thus creating a virtual ground plane that shields the signal pin at a constant impedance. The top plate

and bottom plate, made of engineered plastic materials, are to hold the pins in position and prevent them from shorting to ground. In order to obtain good control over the impedance of a partially shielded contactor would be to maximize the shielding percentage by reducing the plastic materials plates so as long as it does not compromise the mechanical structures of the contactor.

It would be highly desirable to have that can be aligned with contact pads if 100% shielding is achieved. Nevertheless, the limiting factor in the currently available contactors, one is not able to achieve 100% shielding factor as the thicknesses of the plastic plates are totally dependent on the mechanical limitation and requirements of the sockets.

It would also be desirable to have such a contactor which is less susceptible to damage. To achieve such a 100% Shielding Factor, the housing must be fully made from conductive metal.

In doing so, steps and measures are taken to prevent the signal pins from being shorted to housing as this may cause improper setup and faulty device.

Therefore it is an object of the present invention to provide an epoxy-sealed contactor in overcoming the aforesaid issues and to achieve a 100% shielding factor. Then, an insulative material inserted into the Contactor to prevent the Signal pins from being shorted to ground. By doing so, the mechanical limitations constricted to the partially shielded contactors are obliterated.

At the same time the nature of epoxy of molding itself to the shape of the containment and adhesive effect helps in providing a dependable contactor structure.

SUMMARY OF THE INVENTION

With the foregoing background in mind, while it is an object of the invention to provide a reliable contact structure that can produce 100% shielding factor, the present invention also aims to eliminate impedance mismatch during the signal transmission.

The foregoing and other objects are achieved formed of a structure illustrated below. The present invention can be made up of six-part embodiment; In accordance with one embodiment of this invention, the present invention comprises at least a six piece construction. The contactor provides a first contact means (top probe pins), second contact means (bottom probe pins) which extend above and below the surface of the said first and second contact means respectively to make contact with the DUT; a top plate, bottom plate which are sealed with an insulative material including but not limited to epoxy. The plates serve as the housing for probe pins and are made from conductive materials.

The virtual ground planes created by shorting the housing to the ground pins will provide the shielding for Signal Pin and a good constant control of impedance along the signal path can be achieved. Internally in the contactor, an insulative material such as but not limited to epoxy, functions as a fixture to hold the signal pins as well as to prevent them from being shorted to the housing.

During signal transmissions, interferences from neighboring pins occurs resulting in a noisy and distorted transmited signals. These phenomena of signal interference from one pin to the adjacent pin are commonly known as crosstalk.

In the present invention, the signal pins are shielded 100%, thus offering the most desirable crosstalk performances as opposed to the conventional plastic and/or partially shielded contactors.

With good controls obtained on impedance through methods of shielding, the problem impedance mismatch along the transmission line is further reduced. Smaller mismatch provides good Return Loss.

The ratio of plastic materials existed in the conventional plastic and partially shielded contactors are much higher if compared to the present invention. The smaller the ratio the lesser the dielectric loss tangent which contributes to the performance of the contact insertion loss of the signal pins. Therefore, with the present invention, the losses that which are normally incurred during transmission in conventional plastic or partially shielded contactors are greatly reduced.

Loop inductance improves tremendously when 100% shielding factor are achieved. Shorter return path together with higher mutual inductance contributes to this significant improvement.

As such, the present invention attains several objects and advantages, some of which are summarized as providing improved shielding against electromagnetic and radio frequency interference in electronic devices reduced forces for attaining and maintaining effective shielding contact; attains full deflection of the contactors of shielding arrangements with reduced force and without deleterious permanent deformation.

Yet another objective of the present invention is to provide for long-term consistent and intimate shielding contact and resists permanent deformations which otherwise could defeat effective shielding contact.

It is the object of the present invention to assure highly localized contact between the contactors and surrounding structure for effective shielding contact.

It is also an object of the subject invention to provide a contactor which is shielded from electrical interference brought about by spurious electrical signals coming in from different sources.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows the cross section conventional 3-plate design for probe contactor.

FIG. 2 shows the front cross section view of the present invention

FIG. 3 shows the top view of the present invention

FIG. 4 shows the isometric view of the present invention

DESCRIPTION OF THE PREFERRED EMBODIMENT

While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides for inventive concepts capable of being embodied in a variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific manners in which to make and use the invention and are not to be interpreted as limiting the scope of the present invention.

In describing a preferred embodiment of the invention illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

With reference to its orientation in Figure 1, the conventional 3-plate design for probe contactor for semiconductor device testing usually consist of signal pins (1'), top plate (3') and the bottom plate (4'), which holds the signal pins (1') that is conducted together with layers of conductive material (9') with air gap (10'). This partially shielded conventional contactor consists of three plates. The conductive material (9') are shorted to the ground pins (not shown in the picture) thus creating a virtual ground plane that shields the signal pin (1') at a constant impedance. Surrounding the signal pin (1') is the air gap (10') which consists of no materials. This air gap (10') is not connected to the signal pin (1'). The top plate (3') and bottom plate (4') are made of engineered plastic materials, serve as the housing to hold the pins in position and prevent them from shorting to the ground. In order to gain a good control over the impedance of a partially shielded contactor, the shielding percentage will have to be maximized, by reducing the plastic materials plates on both the top side (3') and bottom side (4').

The objects and advantages, as well as further objects and advantages, are attained by the present invention which may be described briefly as an improvement in a shielding contactor device in which in the present embodiment as illustrated in Figure 2. Figure 2 shows the front view (refer to the X-axis (6) of the design, where Z-axis (8) is at the top and Y-axis (7) is on the right). This said invention consists of a top plate (3) with internal air gap (5a) and bottom plate (4) with internal air gap (5b), where top plate (3) and bottom plate (4) are having a conductive material

including, but not limited to aluminum or a plastic material that is coated with metallic material such as gold, copper or the like materials.

In Figure 2, there is illustrated a contactor having plates (3, 4) which serves as the housing for the signal pin (1) wherein said plates are constructed of a conductive material which extends in a longitudinal direction and has a lateral width between laterally opposite said plates (3, 4) respectively. The conductive material may include aluminum or a plastic material that is coated with metallic material such as gold, copper or the like materials. Accordingly, the length of the assembled contactor is totally surrounded by conductive material, thereby providing shielding element. The virtual ground planes created by shorting the housing to provide the shielding for signal pin (1); can eventually be used as other signal pin to achieve good constant control of impedance along the signal paths.

In a preferred embodiment of the subject contactor for forming a plurality of electrical connections between an IC package and a printed circuit board for instance, the said contactor includes a non-conductive substrate or an insulative material preferably epoxy but not limited to epoxy. According to the present invention, a plurality of insulative material (9a, 9b) extending between the top and bottom surfaces thereof, is disposed having the capability to prevent the signal pin (1) from being shorted to the housing, top plate (3) and bottom plate (4). The other function of the epoxy (9a, 9b) is used as a fixture to hold the signal pins (1) together with the top plate (3) and bottom plate (4).

Figure 3 shows the top view of the present invention (refer to the Z-axis (8) of the design, where X-axis (6) is at the bottom and Y-axis (7) is on the right). Insulative materials (9a) formed within the top probe pin (1) is used in order to solve certain mechanical issues that surfaces in the

partially shielded conventional contactors. The said insulative materials (9a) which are inserted into a contactor, constructed on conductive materials hold the pins (1) in position.

Since the housing, which is the top plate (3) and bottom plate (4), is shorted to ground, the signal pin (1) needs such materials (9a, 9b) in order to prevent them from being shorted to ground. Accordingly, such configurations will provide a 100% shielding factor. Based on coaxial concept, such a percentage would provide the most effective and desirable RF performances of a contactor. The internal air gap (5a) exists at the signal pin (1) to further help improve the insertion loss performance. Air, having the lowest dielectric loss tangent value, thus improves the losses incurred during insertion and signal transmissions.

Figure 4 illustrates the isometric view of the present invention (where the Z-axis (8), X-axis (6), and Y-axis (7) are shown). This clearly shows that the position of the insulative materials (9a, 9b) holding the signal pin (1) between the air gap (5a, 5b), together with the housing; top plate and bottom plate (3, 4).

Figure 4 also shows the position of the signal pin (1) being isolated from the ground pin (2) in order to archive the 100% shielding element, since the ground plane is no longer limited with the top plate and bottom plate (3, 4) of the plastic and partially shielded conventional contactors shown in Figure 1 (prior art).

It is to be understood that the above detailed description of preferred embodiments of the invention is provided by way of example only. Various details of design, construction and procedure may be modified without departing from the true spirit and scope of the invention, as set forth in the appended claims.

Claims

1. A contactor comprises three plates consist of signal pins (1'), top plate (3'), bottom plate (4'), which extends in a longitudinal direction and has a lateral width between laterally opposite said plates (3', 4') respectively; middle plate (9') characterized in that that the said contactor having an improved shielding element comprises of a conductive material.

2. ECO contactor wherein said non conductive material includes a plurality of insulative material (9a, 9b) extending between the top and bottom surfaces.

3. ECO contactor as claimed in Claim 2 wherein said insulative material may include but not limited to epoxy (9a, 9b).

4. ECO contactor as claimed in Claim 3 wherein said insulative material (9a, 9b) are housed in the top plate (3) and bottom plate (4) which extends in a longitudinal direction and has a lateral width between laterally opposite said plates (3,4) respectively.

5. ECO contactor as claimed in Claim 4 wherein said top plate and bottom plate (3,4) are constructed of a conductive material (9) which may include aluminum or a plastic material that is coated with metallic material including but not limited to gold or copper.

6. ECO contactor as claimed in Claim 4 wherein said insulative materials or epoxy (9a, 9b) having the flexibility of being moulded into the shapes of the container having adhesive effect.

7. ECO contactor further comprises top plate (3) having an internal air gap (5a) and bottom plate (4) having an internal air gap (5b).

8. A contactor according to Claims 7 wherein said contactor may use a single or double ended probe pin.

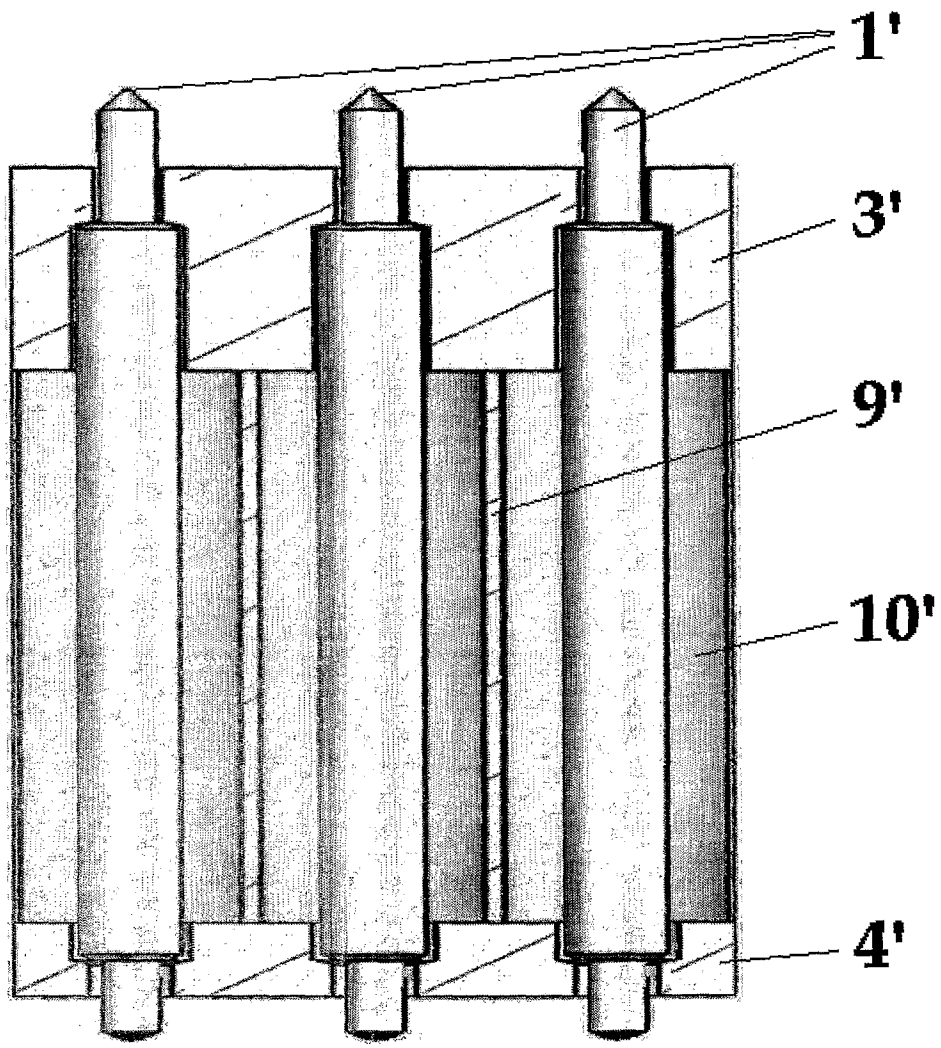

FIG. 1

(Prior Art)

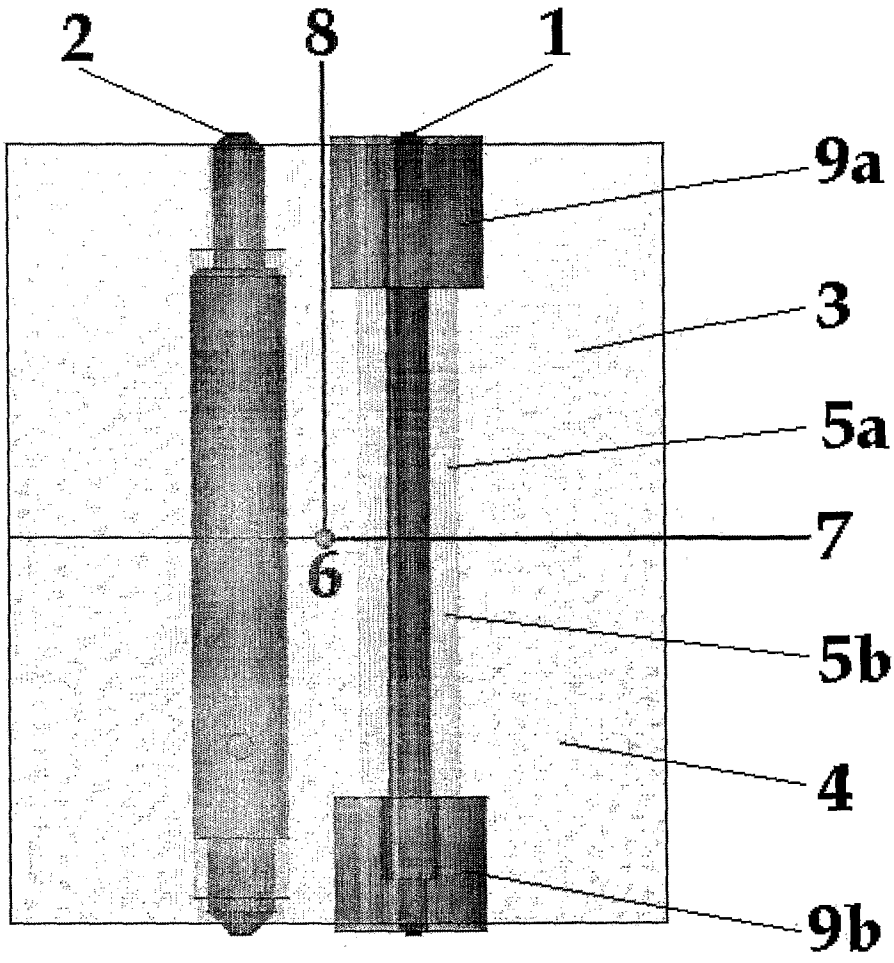

FIG. 2

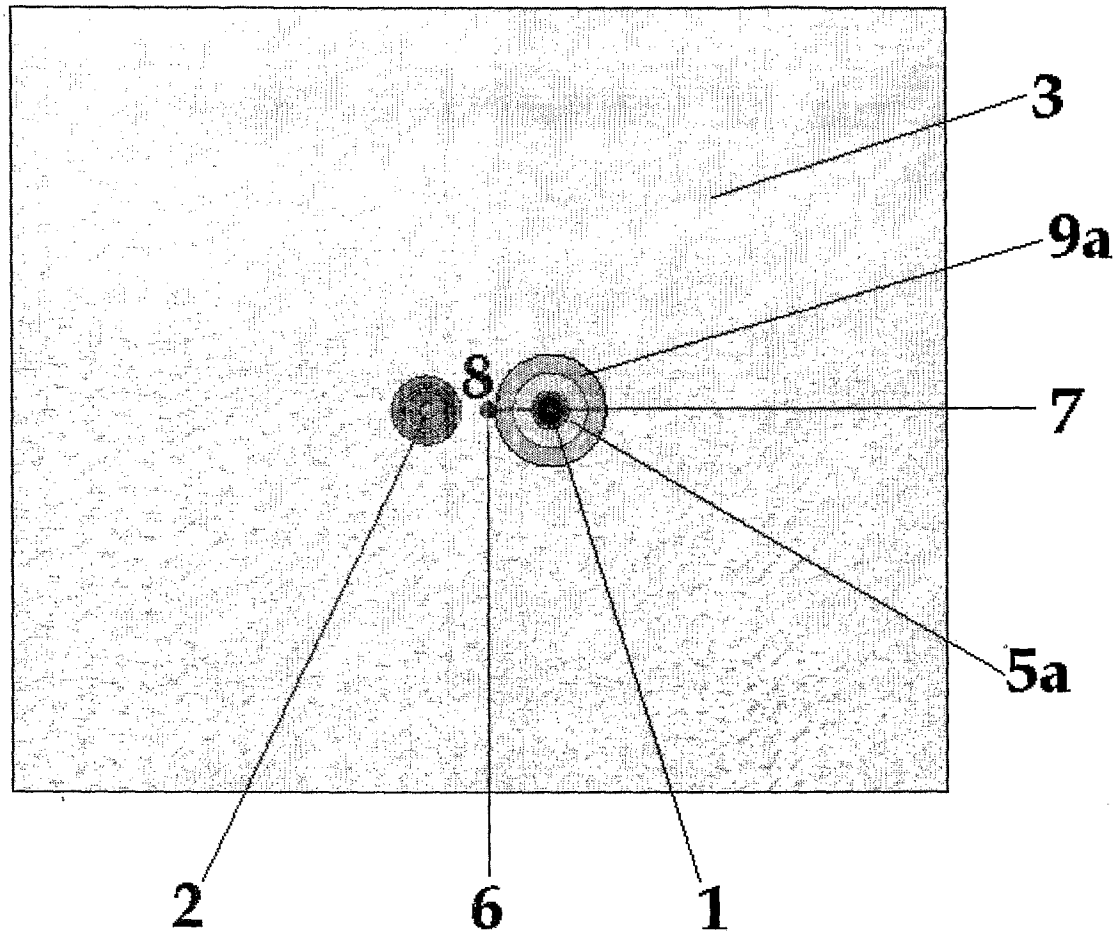

FIG. 3

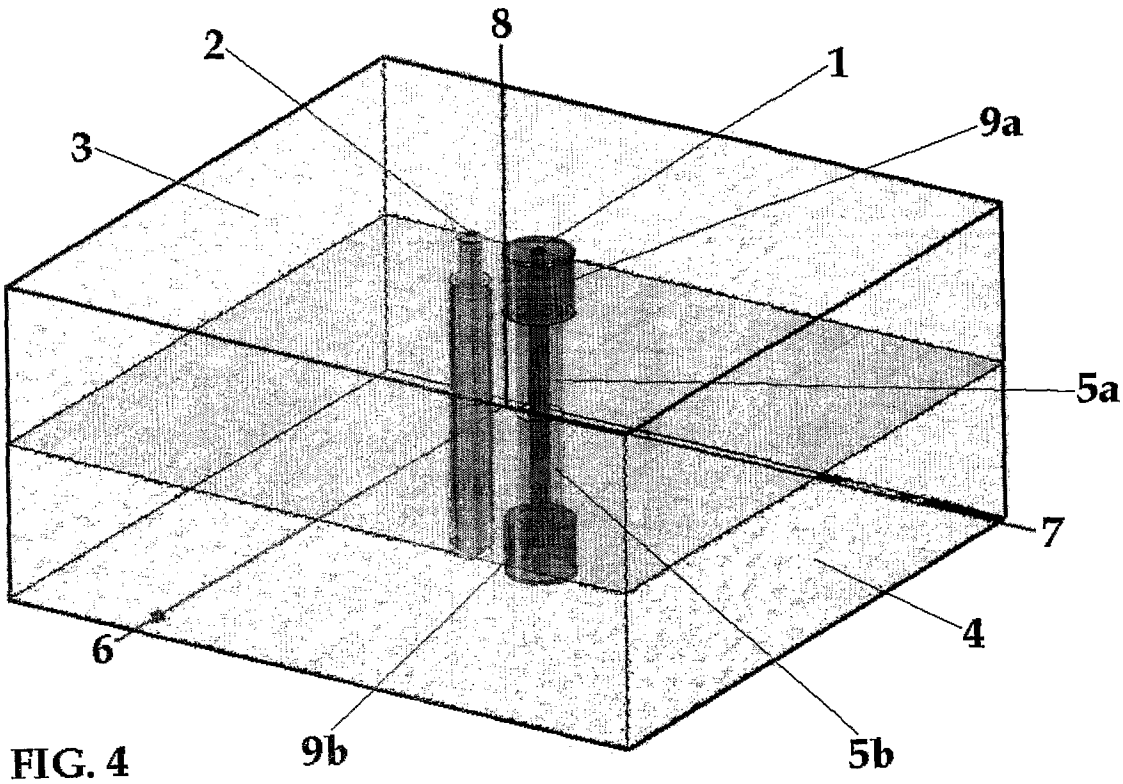

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

G01R 1/06 (2006.01) ***G01R 31/02*** (2006.01) ***H01R 12/00*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC, ESPACE: {(CONTACTOR?); (PIN? OR PROBE? OR PLATE?) ; SHIELD ;(INSULAT+ OR DIELECTRIC+ OR NON_CONDUCT+ (GAP? OR CAVITY OR RECESS OR HOLE); AIR)}

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2004/0043653 A1 (Feldman) 4 March 2004 [see Abstract, para 0020 – 0023 & figure 1]	**1- 6** **7, 8**
X	GB 1416950 A (Ronald Boyle) 10 December 1975 [see Abstract, see page 2 lines 20 – 50, page 5 lines 1- 8]	**1- 6**
Y	US 2007/0004238 A1 (Breinlinger et al) 4 January 2007 [see Abstract, para 0008 & para 0037]	**7, 8**

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

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"O" document referring to an oral disclosure, use, exhibition or other means

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search	Date of mailing of the international search report
01 April 2009	14 APR 2009
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **RIJU JACOB** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2220

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MY2008/000179

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5945836 A (Sayre et al) 31 August 1999. [Whole document]	**1 – 8**
A	US 2001/0011897 A1 (Hamel et al) 9 August 2001. [Whole document]	**1 – 8**
A	US 6911833 B2 (Tan et al) 28 June 2005. [Whole document]	**1 - 8**

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/MY2008/000179

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2004043653	AU	2003247852	EP	1546740	US	6902416
		WO	2004021019				
GB	1416950	DE	2364786	DE	2525166	FR	2211651
		FR	2275781	GB	1459700	JP	49091582
		JP	51006678	US	3806801	US	3911361
US	2007004238	CN	101288206	EP	1900065	KR	20080034886
		WO	2007005920				
US	5945836	EP	0840131	EP	1512977	EP	1512978
		EP	1512979	EP	1512980	JP	10186005
		US	6225817	US	6407565	US	6414502
		US	6469531				
US	2001011897	US	6404211				
US	6911833	US	7034555	US	2003111264	US	2005046432

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX