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(54) **Title:** CONNECTOR AND ELECTRONIC DEVICE EQUIPPED WITH SAID CONNECTOR AND LIGHTING DEVICE

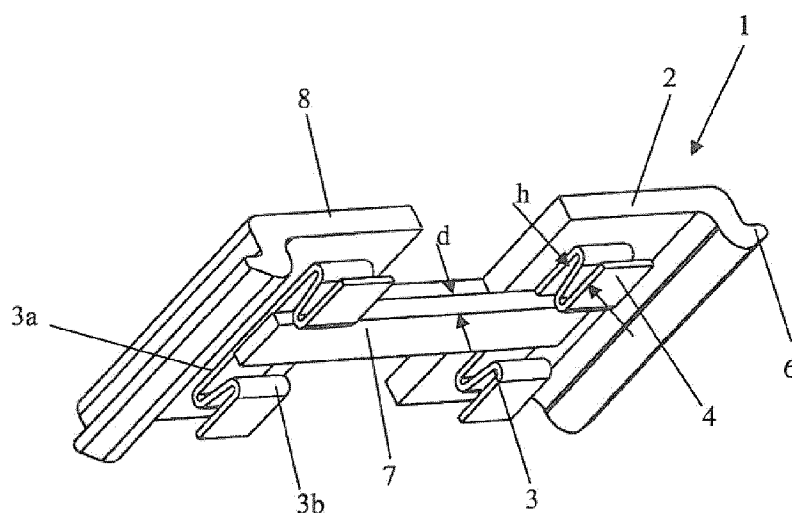


Figure 1

(57) **Abstract:** The present invention relates to a connector for a circuit board of an electronic device. The electronic device comprises at least two circuit boards to be connected, wherein a connector (1) comprises an electrical connection part (3) and a mechanical connection part (2) which at least presses electrically conductively the electrical connection part (3) against respective circuit boards (10), and the mechanical connection part (2) is provided with a flexible edge (6) which engages a stop edge (5) formed on the electronic device for providing a pressing force. In addition, the present invention also relates to an electronic device equipped with the connector and a lighting device. The connector according to the present invention may electrically connect two circuit boards without soldering and other accessories, ensuing easiness and convenience for assembling.

Description

Connector and electronic device equipped with said connector and lighting device

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Technical Field

The present invention relates to a connector and an electronic device equipped with said connector and a lighting device.

10 Background Art

Currently, a large number of electronic devices are applied in daily life. Due to the limitation of the manufacturing size of a circuit board, electrically conductive connectors are usually used to connect multiple smaller circuit boards into a circuit board larger in size. Especially in a linear luminaire such as a T8 LED tube, two or three linear circuit boards are generally needed. Because of the SMT technique limitation, the length of each circuit board can not be longer than 500mm. Therefore, electrical connectors between respective circuit boards or between metal core printed circuit boards are very important. In the prior art, it is a common practice to solder with wires or metal pins or use a SMT connector to connect the anode and cathode between two circuit boards needing to be connected for solving said problem. The commonness of these methods lies in that they are all realized by a complex, trivial soldering process. In terms of soldering with wires or metal pins, long time is needed for assembling and the cost is high; moreover, when the gap between the circuit boards is changed by stress, the connection member will be broken. As for a SMT connector,

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long-time stableness can not be ensured and it is difficult to perform SMT between separate circuit boards.

Summary of the invention

Hence, one object of the present invention lies in providing
5 a novel type of connector. By using the connector according to the present invention, two circuit boards may be electrically connected without soldering and other accessories, ensuring easiness and convenience for assembling.

The object of the present invention is realized by a connector
10 for a circuit board of an electronic device. The electronic device comprises at least two circuit boards to be connected, wherein the connector comprises an electrical connection part and a mechanical connection part which at least presses electrically conductively the electrical connection
15 part against respective circuit boards, and the mechanical connection part is provided with a flexible edge which engages a stop edge formed on the electronic device for providing a pressing force. Applying a pressing force to the flexible edge by means of a rigid stop edge can make the
20 whole connector press against the circuit board, thereby allowing the electrical connection part to be press electrically conductively against the predetermined positions of respective circuit boards, viz. anode and cathode to be connected. Therefore, the firm electrical connection between
25 two circuit boards can be realized simply without a soldering-like process or other accessories.

According to one preferred embodiment of the present invention, the flexible edge is arranged along the connection direction of the circuit board. This means, the connection
30 part between the connector and the electronic device is also

arranged merely along the connection direction of the circuit board, which not only allows the stop edge to press firmly against the flexible edge but also unaffected spatially the circuit board and the electronic assembly mounted thereon.

5 According to one preferred embodiment of the present invention, the flexible edge is hook-shaped. The hook-shaped design enlarges the contact area between the flexible edge and the stop edge and has a location-limiting function to realize the firm engagement of the connector with the electronic de-
10 vice. Other suitable shapes of the flexible edge and the stop edge cooperating with the shape of the flexible edge may also be taken into consideration, of course.

According to one improved embodiment of the present invention, the electrical connection part comprises a central
15 horizontal part and curved parts at two ends bent into an S shape and distant from the horizontal part. The even surface of the horizontal part may completely press against the mechanical connection part, thereby allowing the stressed area of the electrical connection part to be as large as possible.
20 The curved parts are designed as an S shape for transferring pressure applied to the horizontal part by sufficiently using the deformation and the buffering characteristic of said structure, such that the bottom surfaces of the curved parts can press against the electrode of the circuit board to be
25 connected.

Preferably, at least the curved parts are made of elastic conductive materials. Particular preferably, said curved parts are either made of copper or made of a stainless steel material. Other elastic conductive materials may also be
30 used to manufacture said curved parts. The curved parts with the above characteristics are not only low in cost but also

have good electrical conduction performance, and can be flexibly deformed under pressure.

According to one improved embodiment of the present invention, the mechanical connection part comprises an upper portion and a lower portion which clamp the electrical connection part therebetween. Preferably, a fixing slot allowing the passage of the electrical connection part, for example, is formed between the upper portion and the lower portion or the electrical connection part may be embedded directly between the upper portion and the lower portion when using an injection moulding process, for example, to manufacture the mechanical connection part. In general, the position of the electrical connection part is fixed between the upper portion and the lower portion.

Preferably, the upper portion provides a pressing force towards the circuit board. Particularly preferably, the upper portion is designed as an H shape. The upper portion provides a pressing force towards the circuit board by the pressing of the electronic device and the connector. In order to unaffected the components on the circuit board, the upper portion can be designed as an H shape, thereby reducing the coverage area of the circuit board and ensuring that the flexible edge has as large an area as possible in contact with the stop edge.

Preferably, the thickness of the lower portion is smaller than or equal to the height of the curved parts which are in a maximum compression state. This means that, the lower portion will not press against the circuit board when the curved parts deform to the greatest extent, thereby preventing the occurrence of an open-circuit-like failure.

According to one design solution of the present invention, the upper portion and the lower portion are formed into one entirety. Preferably, the upper portion and the lower portion are made of plastic, which not only reduces the number of parts of and the inherent weight of the connector but also ensures the electrical insulation between the mechanical connection part and the circuit board.

Another object of the present invention lies in providing an electronic device comprising at least two circuit boards to be connected, wherein the connector as mentioned above is mounted in the electronic device. Said connector electrically connects advantageously the circuit boards of the electronic device without soldering, embodying the advantages of simple assembling and low cost.

Preferably, the stop edge is formed by one part of a heat sink mounted on the back surface of the circuit board. The stop edge is formed directly by part of the heat sink, which can reduce the number of parts and simplify the manufacturing and assembling steps.

Preferably, the heat sink comprises a first portion carrying the back surface of the circuit board and a second portion extending to one side of the front surface of the circuit board, the second portion being provided with the stop edge. The heat sink herein is preferably used as a base for receiving the circuit board therein, and the edge of the heat sink, viz. part of the lateral wall of the base constitutes a stop edge. In a preferred embodiment of the present invention, the stop edge is a bent stop part. Thus, in correspondence with the flexible edge of the connector designed as, e.g., a hook shape, the rigid bent stop part presses the flexible edge with a hook shape against the circuit board.

Another object of the present invention lies in providing a lighting device, the lighting device comprises the electronic device mentioned above, wherein the circuit board is provided with a light emitting module. Such a lighting device in an elongated shape, for example, has at least two circuit boards adjacent to each other, such as common T8 LED tubes, etc.

It should be understood that the general descriptions above and detailed descriptions below are only illustrative for the purpose of further explaining the present invention required.

10 **Brief Description of the Drawings**

The drawings constitute a portion of the Description for further understanding of the present invention. These drawings illustrate the embodiments of the present invention and explain the principle of the present invention together with the Description. In the drawings the same part is represented by the same reference sign. In the drawings,

Fig. 1 is a 3D view of a connector according to the present invention;

Fig. 2 is a cross-sectional view of an electronic device according to the present invention; and

Fig. 3 is a magnified 3D view of a connector according to the present invention in an electronic device.

Detailed Description of the Embodiments

Fig. 1 is a 3D view of a connector according to the present invention. In this embodiment, a connector 1 comprises a mechanical connection part 2 and an electrical connection part 3 and the mechanical connection part 2 comprises an upper

portion 8 and a lower portion 7 which clamp the electrical connection part 3 therebetween. The upper portion 8 preferably has an H-shaped structure and can be designed as a rectangle or other suitable shapes according to actual application conditions.

For clarity, a description of Fig. 1 is made hereinafter in combination with Fig. 3. The main part of the connector 1 is the mechanical connection part 2. In an assembling state, a flexible edge 6 of the mechanical connection part 2 engages a stop edge 5 (see Fig. 3) formed on the electronic device to provide a pressing force for allowing the connector 1 fixed on the electronic device to be pressed electrically conductively against a circuit board 10. Before the assembling state, the height of the connector 1 is greater than the height thereof in an assembling state. Thus, the electrical connection between the circuit boards can be realized by a mechanical connection manner of pressing a connection member instead of a traditional soldering manner, thereby saving the assembling time and reducing the cost during production.

In order to realize good pressing effect, the outer edge of the mechanical connection part 2 constitutes the flexible edge 6, e.g., in the shape of hook. Said flexible edge 6 can ensure the connector 1 is pressed by the rigid stop edge 5 of the electronic device against the circuit board 10 and can provide a downward pressure perpendicular to the mechanical connection part 2. The flexible edge 6 on the outside of the mechanical connection part 2 may also be designed as other forms, for example, it is designed simply as a protrusion stopped by the stop edge 5 of the electronic device, etc. In order to unaffected the function or structure of the element on the circuit board 10 to be connected, such as the lamination effect of LED, the middle segment of the upper portion 8 can

be designed particularly as a strip shape. The upper portion 8 and the middle segment can be designed separately according to actual conditions, of course, so as to form an H-shaped combination structure of "upper portion-beam-upper portion" or other more preferred structures.

The lower portion 7 is connected on the bottom surface of the mechanical connection part 2, wherein the lower portion 7 is preferably designed as a beam shape for clamping the electronic connection part 3. The lower portion 7 and the upper portion 8 can be formed into one entirety made of a good non-rigid insulation material such as plastic and be mounted as a separate part at the lower part of the mechanical connection part. A slot is preset between the lower portion 7 and the bottom surface of the lower portion 8, which allows the position-limiting passage of the electrical connection portion 3. When manufacturing the mechanical connection part with an injection moulding process, the electrical connection part 3 may be embedded directly between the upper portion 8 and the lower portion 7.

Preferably, the electrical connection part 3 is made of a flexible conductive material, such as flexible copper or stainless steel, etc. and comprises a central horizontal part 3a and curved parts 3b at two ends bent into an S shape and distant from the horizontal part 3a. In order to obtain favorable stability, the elongated horizontal part 3a, in a preferable case, passes over the lower portion 7 as a symmetry axis in a direction perpendicular to the lower portion 7 and the top surface of the horizontal portion 3a presses against the bottom surface of the mechanical connection part 2. The S-shaped structure of the curved parts 3b may advantageously ensure the flexible deformation of the electrical connection part 3 under pressure. The curved parts 3b can be

designed to have one or more S-shaped curves depending upon the material of the electrical connection part 3. The curved parts 3b have even contact surfaces 4 preferably in parallel with the mechanical connection part 2. The contact surfaces 4 are located at two sides of the lower portion 7, respectively, for pressing tightly against electrodes 1e, 2e of two circuit boards to be connected under pressure, whereby a firm electrical connection with the circuit board 10 can be formed simply without the soldering process in the prior art.

Fig. 2 is a cross-sectional view of an electronic device according to the present invention, wherein the circuit board 10 to be connected is arranged on the base 9. When a light emitting module is provided on the base 9 such as a heat sink of the electronic device and on the circuit board 10, the electronic device can be shown as a lighting device according to the present invention.

From the figure, it can be seen that, the heat sink 9 comprises a first portion 9a carrying the back surface of the circuit board 10 and a second portion 9b extending to one side of the front surface of the circuit board 10, the second portion 9b, viz. the lateral wall, being provided with the stop edge 5. The two outer edges of the mechanical connection part 2 are designed as the hook-shaped flexible edges 6 cooperating with inward convex angles of the second portion 9b of the heat sink 9 which are curved toward the center of the circuit board, viz. the stop edges 5. When the connector 1 is inserted into the heat sink 9, the cooperation of the stop edge 5 with the flexible edge 6 in shape can lock fixedly the connector 1 into the heat sink 9 and generates a pressure applied towards the circuit board 10 in a direction perpendicular to the mechanical connection part 2. In order to ensure that the contact surface 4 completely presses

against the electrodes 1e, 2e of the circuit board 10 under pressure, the thickness d of the lower portion 7 shall not be greater than the height h of the curves parts 3b in a maximum compression state. From said cross-sectional view, it can be
5 seen that, no additional parts such as bolts or a flux are needed for the whole electronic device to achieve the effects of assembling simply and conveniently, thereby facilitating disassembling or adjusting.

Fig. 3 is a magnified 3D view of a connector 1 according to
10 the present invention in an electronic device. The cooperation of the flexible edge 6 with the stop edge 5 in shape as shown at the upper right side of the view generates a downward perpendicular pressure F. Transferred by the mechanical connection part 2, the pressure is applied to each of the
15 curved parts 3b located at two sides of the lower portion 7. By means of the flexible deformation of the curves parts 3b, the bottom surface 4 is made to firmly press against the electrode e1 of the circuit board and the bottom surface 4 at the other side of the lower portion 7 is made to press
20 against the electrode e1 of the other circuit board, thereby forming a reliable electrical connection between the two circuit boards 10 sequentially placed and ensuring a position-fixing mechanical connection between the two circuit boards 10.

25 The above is merely preferred embodiments of the present invention but not to limit the present invention. For the person skilled in the art, the present invention may have various alterations and changes. Any alterations, equivalent substitutions, improvements, within the spirit and principle of
30 the present invention, should be covered in the protection scope of the present invention.

List of reference signs

	1	connector
	2	mechanical connection part
	3a	electrical connection part
5	3b	curved part
	4	contact surface
	5	stop edge
	6	flexible edge
	7	upper portion
10	8	lower portion
	9	heat sink/base
	9a	a first portion
	9b	second portion
	10	circuit board
15	1e, 2e	electrode

Patent claims

1. A connector for a circuit board of an electrical device, the electronic device comprising at least two circuit boards (10) to be connected, characterized in that, the connector (1) comprises an electrical connection part (3) and a mechanical connection part (2) which at least presses electrically conductively the electrical connection part (3) against respective circuit boards (10), and the mechanical connection part (2) is provided with a flexible edge (6) which engages a stop edge (5) formed on the electronic device for providing a pressing force.
2. The connector according to Claim 1, characterized in that, the flexible edge (6) is arranged along the connection direction of the circuit board (10).
3. The connector according to Claim 1, characterized in that, the flexible edge (6) is hook-shaped.
4. The connector according to any one of Claims 1 to 3, characterized in that, the electrical connection part (3) comprises a central horizontal part (3a) and curved parts (3b) at two ends bent into an S shape and distant from the horizontal part (3a).
5. The connector according to Claim 4, characterized in that, at least the curved parts (3b) are made of elastic conductive materials.
6. The connector according to Claim 5, characterized in that, at least the curved parts (3b) are made of copper.
7. The connector according to any one of Claims 1 to 3,

characterized in that, the mechanical connection part (2) comprises an upper portion (8) and a lower portion (7) which clamp the electrical connection part (3) therebetween.

5 8. The connector according to Claim 7, characterized in that, the electrical connection part (3) is molded by an injection moulding process to be integrated between the upper portion (8) and the lower portion (7).

10 9. The connector according to Claim 7, characterized in that, the upper portion (8) provides a pressing force towards the circuit board (10).

10. The connector according to Claim 9, characterized in
15 that, the upper portion (8) is designed as an H shape.

11. The connector according to Claim 7, characterized in that, the thickness (d) of the lower portion (7) is smaller than or equal to the height (h) of the curved parts (3b)
20 which are in a maximum compression state.

12. The connector according to Claim 7, characterized in that, the upper portion (8) and the lower portion (7) are formed into one entirety.

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13. The connector according to Claim 7, characterized in that, the upper portion (8) and the lower portion (7) are made of plastic.

30 14. An electronic device comprising at least two circuit boards (10) to be connected, characterized in that, at least one connector (1) according to Claims 1 to 12 is mounted in the electronic device.

15. The electronic device according to Claim 14, characterized in that, the stop edge (5) is formed by one part of a heat sink (9) mounted on the back surface of the circuit board (10).

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16. The electronic device according to Claim 15, characterized in that, the heat sink (9) comprises a first portion (9a) carrying the back surface of the circuit board (10) and a second portion (9b) extending to one side of the front surface of the circuit board (10), the second portion (9b) being provided with the stop edge (5).

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17. The electronic device according to Claim 16, characterized in that, the stop edge (5) is a bent stop part.

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18. A lighting device, characterized by, comprising the electronic device according to Claims 14 to 17, wherein the circuit board (10) is provided with a light emitting module.

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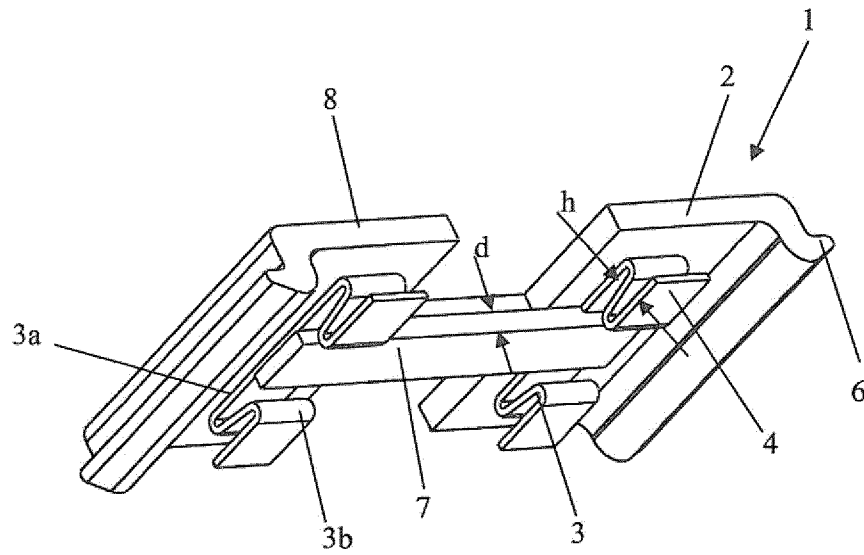


Figure 1

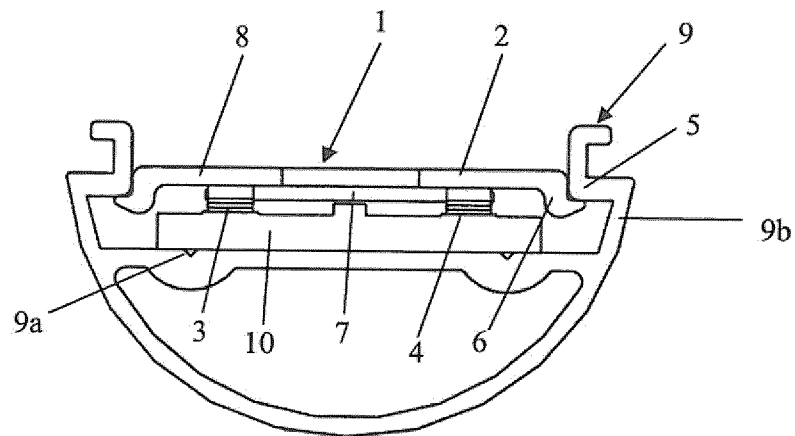
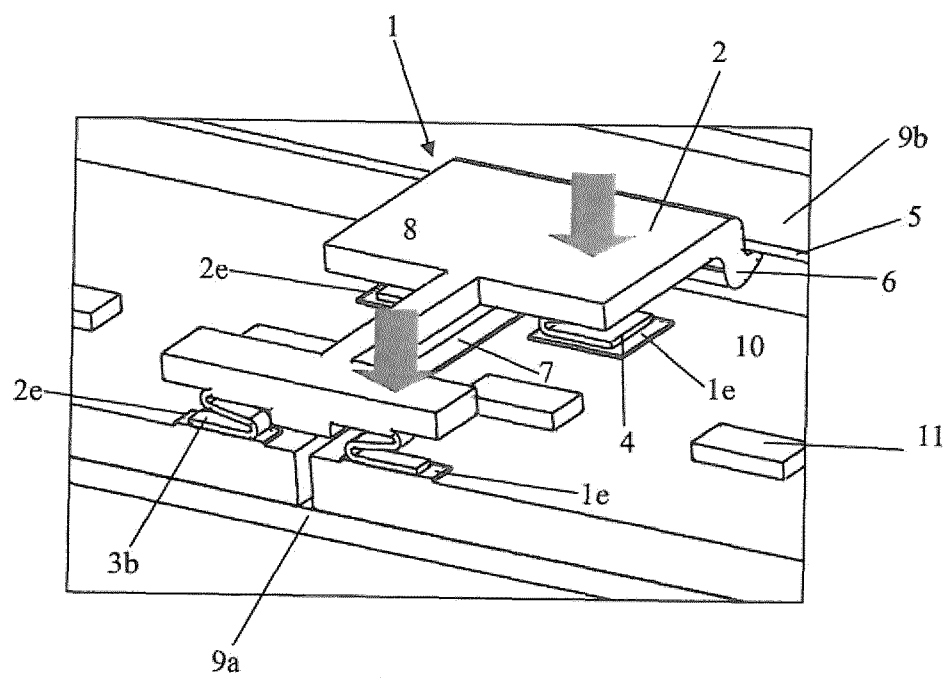


Figure 2

**Figure 3**

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/064007

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R12/73 H05K3/36 H01R13/627
ADD.

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)
H01R H05K

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 1 622 362 A1 (RESEARCH IN MOTION LTD [CA]) 1 February 2006 (2006-02-01)	1-17
Y	paragraph [0020] - paragraph [0038]; figures 2,3,4,5	18
X	US 2011/151701 A1 (NGO HUNG VIET [US]) 23 June 2011 (2011-06-23)	1-17
Y	paragraph [0018] - paragraph [0021]; figures 2,3,4 paragraph [0029] - paragraph [0029] paragraph [0034] - paragraph [0034]	18
X	US 4 938 701 A (HEBERLING JAMES R [US]) 3 July 1990 (1990-07-03)	1-17
Y	column 3, line 28 - column 4, line 9; figure 1	18
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Further documents are listed in the continuation of Box C.



See patent family annex.

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19/11/2012

Name and mailing address of the ISA/

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Bouhana, Emmanuel

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/064007

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/142205 A1 (BISHOP PETER [GB])	18
A	10 June 2010 (2010-06-10) claim 1; figure 3 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/064007

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