(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 108 452 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.10.2009 Bulletin 2009/42

(51) Int Cl.:
B01L 9/00 *(2006.01)*

(21) Application number: **08006714.3**

(22) Date of filing: **02.04.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

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(54) Adjustable chip holder

(57) An adjustable microchip holder for holding a microchip is provided having a plurality of interconnection points for connecting the connection points of a microchip with one or more external devices. The adjustable microchip holder can fit different sizes of microchips with varying positions of connection points.

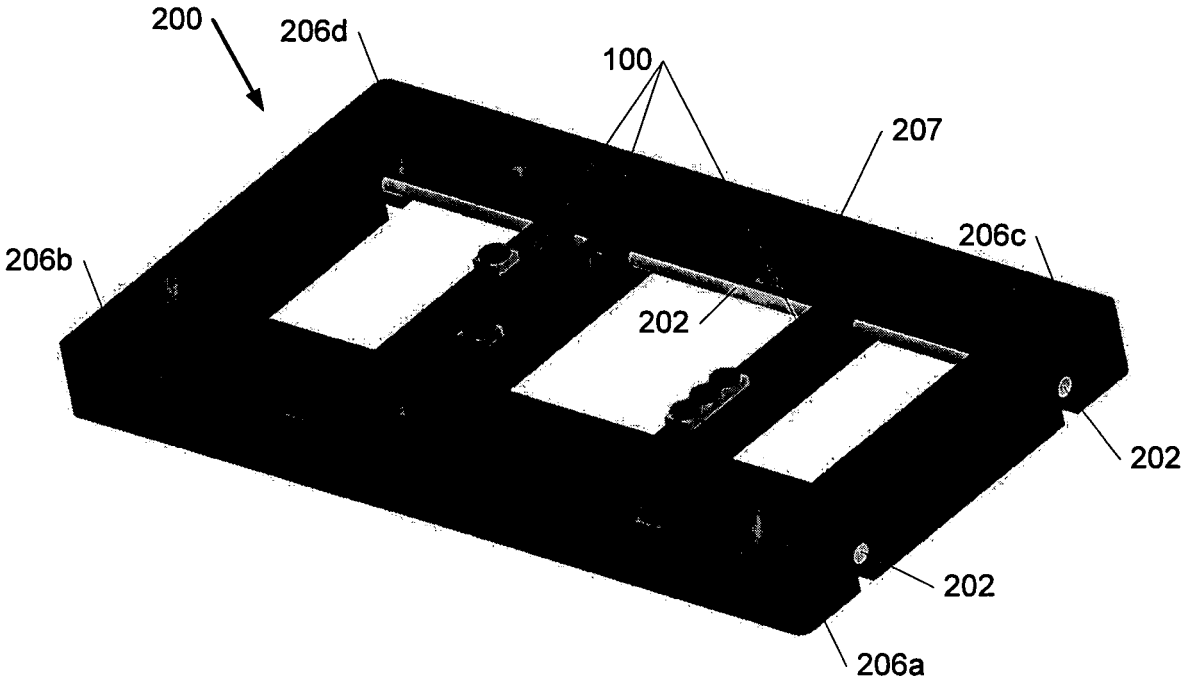

Fig. 2

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Description

FIELD OF THE INVENTION

[0001] This invention, in general, relates to the field of micro systems. In particular, the present invention provides an adjustable chip holder for microchips with varying positions of the connecting ports.

BACKGROUND OF THE INVENTION

[0002] Since the first integrated circuit was invented, miniaturization has become an important research topic in both electronic and non-electronic devices. In the late 1970s, miniaturization was extended to mechanical devices with electronics which is now known as microelectromechanical systems (MEMS). MEMS research has been largely encouraged by the first introduction of miniaturized total analysis systems, and MEMS systems are widely employed in areas from biomedical and drug delivery to space and fuel cell microfluidic systems. These systems have been reduced in size to micro scale for the realization of fully integrated micro systems such as lab-on-a-chip or a micro total analysis system. Major advantages of miniaturization are the drastic decrease in chemical reaction time and less consumption of expensive chemical reagents as well as enhancement of reliability. As fully integrated microfluidic systems are expensive to realize in a chip or analysis system, it is essential that the functionality is as desired. It is therefore required that the systems are thoroughly tested prior to the final miniaturization. Microfluidic systems are therefore well-suited in an experiential setting or in the context of research.

[0003] One of the key elements of micro systems are microchips used e.g. for analyzing fluidic samples or process electronic data. These microchips are normally connected to external devices through chip holders. In general, microchips comprise connection points on one side of the chip. Such connection points can be fluidic, electrical or the like. In microfluidics, the chips are connected to the external devices by e.g. gluing tubes directly on the connection points of the chip. As this must be done with accuracy, this is a very time-consuming process. In electronics, the microchip wires are soldered on the ports. A more time-economic possibility is to make custom made holders for specific microchips. These microchip holders are provided with elements onto which the microchip is pressed to achieve a connection. The advantage is the reusability of the microchip holder so single-time used microchips can be used and that this setting can be standardized. Since microchips vary in e.g. size, number and position of connection points, individual microchip holders have a limited scope of use. Consequently, for each type of microchip a new holder must be fabricated which from the viewpoint of costs and usability is problematic.

OBJECT AND SUMMARY OF THE INVENTION

[0004] The objective of the present invention is to solve the above-mentioned problems.

[0005] In one embodiment the microchip holder for holding a microchip comprises at least one interconnection point for interconnecting at least one connection point on the microchip with at least one external device. The microchip holder further comprises means for adjusting the position of the interconnection point, enabling the interconnection points to be adjusted to fit the position of the connection points on the microchip. The microchip holder is advantageous as it provides a reliable connection between microchips and external devices in microfluidic, microelectrical and microoptical systems. The highly configurable microchip holder can be used many times as it can be (re)adjusted to fit any microchip varying in both size, position of connection points and purpose. Further, the microchip holder of the present invention eliminates the need for special skills and reduces the time needed to build micro systems. Consequently, the costs of configuring micro systems are reduced considerably. The microchip holder is therefore well suited in research and educational settings.

[0006] In another embodiment of the microchip holder the interconnection points are adjustable in a first direction using a rail system comprising at least one rail, the rail having at least one interconnection point adjustable in the direction of the rail. In a further embodiment the rail is adjustable in a second direction. In yet another embodiment the first direction and said second direction of the microchip holder corresponds to an x and a y axis in a two-dimensional co-ordinate system. The advantage of these embodiments is that they, taken alone or in combination, provide flexibility in terms of configuring the microchip holder to establish a connection between a microchip and external devices. It further enables the user to provide a precise positioning of the interconnection points corresponding to the connection points of the microchip.

[0007] In a further embodiment rail comprised in the microchip holder comprises an elongated hole and the interconnection point comprises a collet positioned in said hole adapted to be adjusted in the direction of said elongated hole. The adjustment mechanism is advantageous as it is very easy to operate.

[0008] In yet another embodiment the interconnection points comprised in the microchip holder are adapted to interconnect the connection point of the microchip and the external devices with a transport channel for enabling the transport of a fluid between the microchip and the external device. In another embodiment the interconnection point of the microchip holder comprises a sealing element for sealing the connection between the interconnection point and the connection point on the microchip. In a further embodiment the sealing element is an elastic pad. Apart from the advantages listed above, the advantage of these embodiments is that they, taken alone or

in combination, provide a sealed fluidic connection between a microfluidic chip and external devices.

[0009] In another embodiment the microchip further comprises a cover for pressing the microchip and thereby the connection point towards the interconnection points in the microchip holder. In yet another embodiment the microchip holder comprises a suction device for sucking the microchip and thereby the connection point towards the interconnection points in the microchip holder. The advantage of these embodiments is that they ensure a reliable connection between the microchip and the external devices.

[0010] In a further embodiment the microchip holder comprises a surface part for positioning the microchip, wherein the surface part comprises at least one interconnection point. Here the advantages are as listed above.

[0011] In another embodiment the microchip holder comprises a frame surrounding the microchip and corresponding to the dimensions of the microchip, wherein the frame comprises at least one interconnection point. This is an advantage when the microchip comprises connection points on the sides of the microchip, whereby the microchip holder can be configured to accommodate the characteristics of a greater variety of the position of the connection points of microchips. A further advantage is that the frame aligns and fixates the microchip in the microchip holder.

[0012] I yet another embodiment of the present invention the microchip holder comprises means for adjusting the size of the frame enabling the holder to fit the dimension of different microchips. This is advantageous as the microchip holder can accommodate a great variety of dimensions of the microchips.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In the following, preferred embodiments of the invention will be described referring to the figures, where

figure 1 illustrates a rail system comprised in an adjustable chip holder for holding a microchip in accordance with one embodiment of the present invention;

figure 2 illustrates a microchip holder according to the present invention;

figure 3 illustrates an exploded perspective of a microchip holder system according to the present invention;

figure 4 illustrates a perspective view of a chip holder comprising interconnection elements for connecting to a microchip with connection points on the side of the microchip.

DESCRIPTION OF EMBODIMENTS

[0014] Figure 1 illustrates a rail system 100 comprised in an adjustable chip holder for holding a microchip in accordance with one embodiment of the present invention. The rail system 100 comprises an elongated hole 104 comprising a collet 102 arranged in the hole 104 for adjusting the position of the collet 102 in the direction of the elongated hole 104. An interconnection element 103 is comprised by the collet 102 and is, as stated, free to move in the elongated hole 104. The interconnection element 103 enables a connection to the connecting points of a microchip. The rail system 100 further comprises two side holes 105a, 105b to position the rail 101 in a second direction in the adjustable chip holder (not shown). Further, the rail movement in this second direction enables a movement of the interconnecting element 103 to a specific position required by the connection points of the microchip. Thus, the rail 101 can be aligned in directions corresponding to an x-axis and a y-axis.

[0015] The interconnection element 103 can further be connected to external devices, through e.g. a wire or tube, to connect the microchip to these external devices (not shown). In microfluidic systems the interconnection elements 103 can be made of e.g. a flexible and/or elastomeric and/or polymeric material, enabling a sealed connection to the connection points of a microfluidic chip. The connection elements 103 can have different shapes such as circular or elliptical. In microelectrical systems the interconnection elements 103 could be an interface for establishing an electrical connection to a microelectrical chip. In microoptical systems the interconnection elements 103 could be an interface for establishing an optical connection to a microoptical chip.

[0016] Figure 2 illustrates a perspective view of an adjustable microchip holder 200 according to the present invention. The microchip holder 200 comprises a number of rail systems 100 as described in figure 1. The chip holder 200 enables a connection between a microchip and external devices such as sensors, actuators, fluid pipes or control devices, etc. The microchip holder 200 comprises a frame 207, wherein two rods 202 are arranged parallel to each other in opposite sides of the frame 207. The rods 202 extend through the two sides holes 105a and 105b of the rail system 100. Each rail system 100 can be moved along the longitudinal axis of the two rods 202. The collet 102 and the comprised interconnection element 103 can, as described in figure 1, be moved in a direction along the elongated hole 104, whereby the interconnection element 103 can be moved in a two-dimensional plane given by the rail system 100 and the rods 202. In this way the microchip holder 200 can be adapted to the characteristics of a microchip, i.e. the interconnection elements 103 can be adjusted to the position of the connection points of a microchip, whereby a connection between the microchip and external devices can be obtained. The microchip (not shown) is placed on the surface part constituted by the plane of the intercon-

nection elements 103. Thereby the microchip can rest on the interconnection elements 103 and be supported by the sides of the hole (not indicated) in the top of the frame 207. After use the microchip holder 200 can simply be (re)adjusted to fit another microchip with different positions of the connection points. In an alternative embodiment the rail system 100 could be guided in or by other rail(s) or rods placed at e.g. the top, side or bottom of the microchip holder 200, or alternatively a combination of these embodiments. In another embodiment the hole (not indicated) in the top of the frame 207 of the microchip holder 200, wherein the microchip is placed, can be adjusted to fit different sizes of microchips.

[0017] Figure 3 illustrates an exploded perspective of a microchip holder system 300, where a microchip 301 is inserted into the chip holder 200 and pressed against the surface part constituted by the connection elements 103 with a cover 302, whereby a connection between the microchip and external devices is obtained. The microchip holder 200 can be adjusted to the individual characteristics of a microchip as described in figure 2. In this embodiment the position of the cover is fixed by the male/female connection between the protrusions 206a-d of the holder 201 and the holes or indentations 306a-d of the cover 302. The cover 302 can further be fixed to the frame 201 using screws, threaded bolts in combination with nuts or durable and/or replaceable snap functions. In an alternative embodiment, the microchip 301 can also be pressed against the chip holder 200 by other means, such as e.g. a suction device.

[0018] Figure 4 illustrates a perspective view of a chip holder 200 comprising a frame 207 and interconnection elements 103 for connecting to a microchip with connection points on the side of the microchip (not shown). The frame 207 comprises a rail 104 in which the interconnection elements 103 are arranged. The interconnection elements 103 are comprised by a collet (not indicated) resembling the collet 102 disclosed in figure 2. The interconnection elements 103 can be moved along the rail 104 and thereby placed in a position corresponding to the connection points of a microchip (not shown).

[0019] The frame 207 further comprises an opening (not indicated) along the inner side of the frame 207 facing the center of the chip holder 200 and is embodied in connection to the rail 104. By sliding the microchip (not shown) into this opening, the microchip is aligned and fixed in the holder 200. A connection between the microchip and external devices can hereby be obtained. After use, the microchip can simply be removed by pulling it out of the openings of the frame 207. The chip holder 200 could also comprise interconnection elements 103 in the bottom of the frame 207 as e.g. disclosed in figure 2. This would enable a connection between external devices and a microchip comprising connecting points at the bottom and side of the microchip.

[0020] While this invention has been described in detail with reference to certain preferred embodiments, it should be appreciated that the present invention is not limited to those precise embodiments. Rather, in view of the present disclosure, which describes the current best mode for practicing the invention, many modifications and variations would present themselves to those skilled in the art without departing from the scope and spirit of this invention, which is limited only by the appended claims.

REFERENCES

[0021]

100	rail system
101	rail
102	collet
103	interconnection element
104	elongated hole
105a,b	side hole
200	microchip holder
202	rod
206a-d	protrusions or hole
207	frame
300	microchip holder system
301	microchip
302	cover
306a-d	hole, indentation

Claims

1. A microchip holder for holding a microchip, said microchip holder comprises at least one interconnection point for interconnecting at least one connection point on said microchip with at least one external device, said microchip holder further comprises means for adjusting the position of said interconnection point, enabling said interconnection points to be adjusted to fit the position of said connection points on said microchip.

2. A microchip holder according to claim 1, wherein said interconnection point is adjustable in a first direction using a rail system comprising at least one rail, said rail having at least one interconnection point adjustable in the direction of said rail.

3. A microchip holder according to claim 2, wherein said rail is adjustable in a second direction.

4. A microchip holder according to any of claims 1-3, wherein said first direction and said second direction correspond to an x and a y axis in a two-dimensional co-ordinate system.

5. A microchip holder according to any of claims 1-4, wherein said rail comprises an elongated hole and said interconnection point comprises a collet positioned in said hole adapted to be adjusted in the di-

rection of said elongated hole.

6. A microchip holder according to any of claims 1-4, wherein interconnection points are adapted to interconnect said connection point of said microchip and said external devices with a transport channel for enabling the transport of a fluid between said microchip and said external device.

7. A microchip holder according to claim 6, wherein said interconnection point comprises a sealing element for sealing the connection between the interconnection point and the connection point on said microchip.

8. A microchip holder according to claim 7, wherein said sealing element is an elastic pad.

9. A microchip holder according to any of claims 1-8, further comprising a cover for pressing the microchip and thereby said connection point towards the interconnection points in said holder.

10. A microchip holder according to any of claims 1-9, wherein the holder comprises a suction device for sucking the microchip and thereby said connection point towards the interconnection points in said holder.

11. A microchip holder according to any of claims 1-10, wherein said holder comprises a surface part for positioning said microchip, wherein said surface part comprises at least one interconnection point.

12. A microchip holder according to any of claims 1-11, wherein said holder comprises a frame surrounding said microchip and corresponding to the dimensions of said microchip, wherein said frame comprises at least one interconnection point.

13. A microchip holder according to claim 12, wherein said holder comprises means for adjusting the size of the frame enabling the holder to fit the dimension of different microchips.

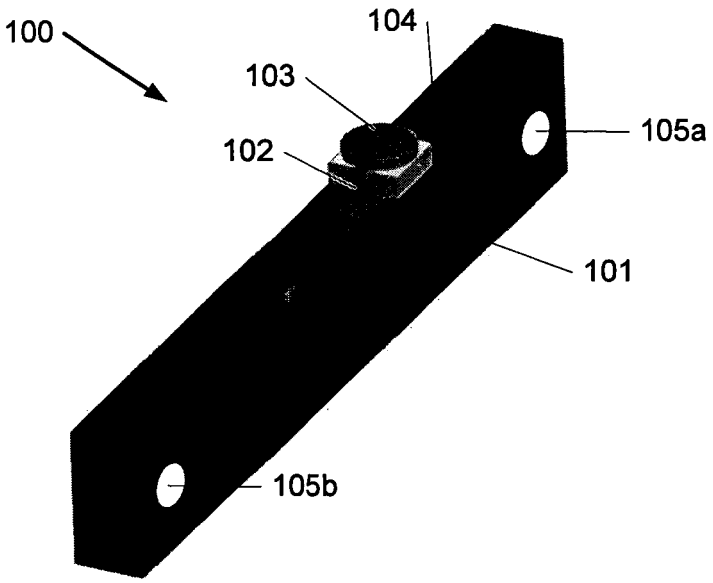
100
104
103
102
105a
101
105b

Fig. 1

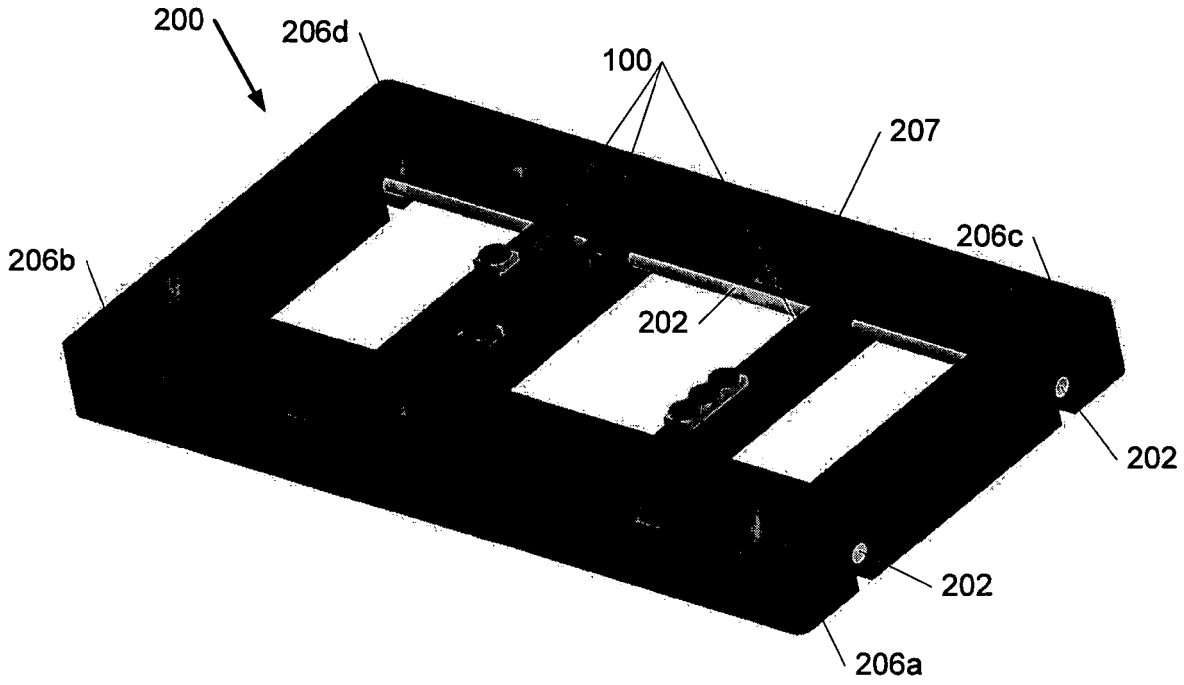
200
206d
100
207
206c
206b
202
202
202
206a

Fig. 2

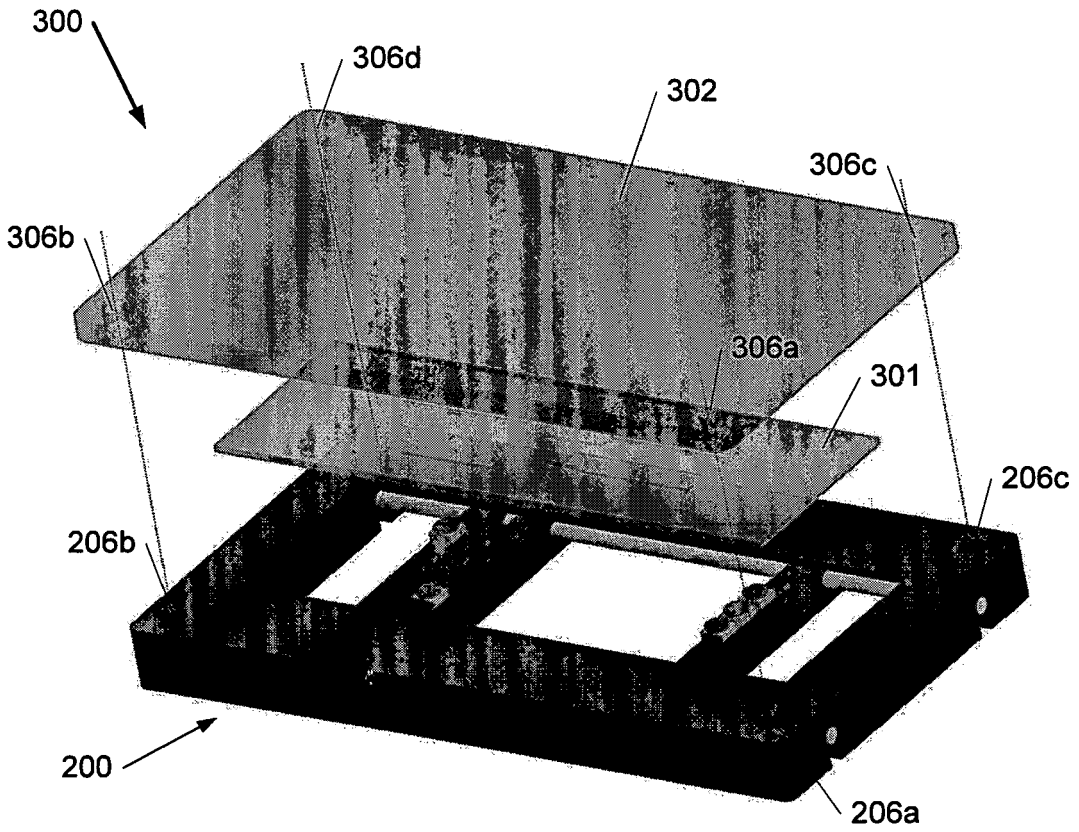
300
306d
302
306c
306b
306a
301
206c
206b
200
206a

Fig. 3

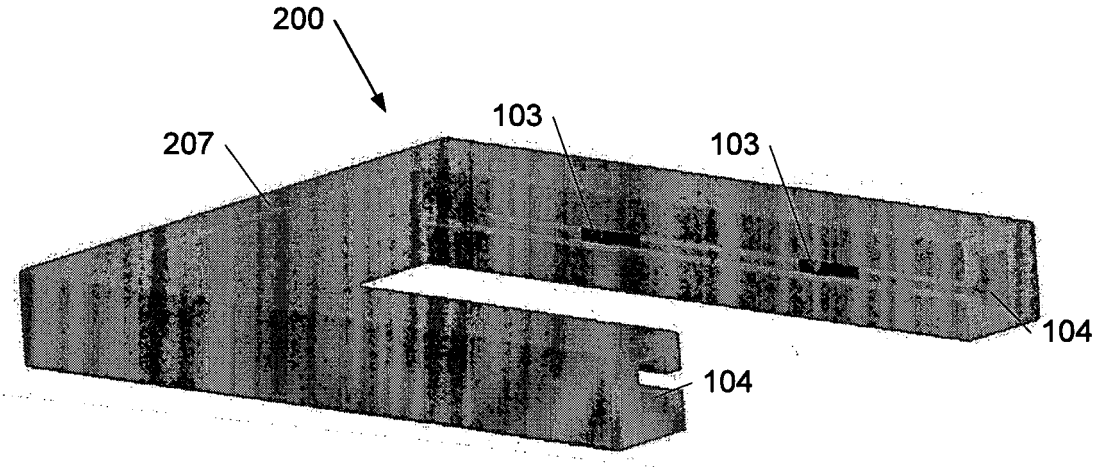
200
103
207
103
104
104

Fig. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 00 6714

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B01L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 August 2008	Skowronski, Maik

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