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(54) Title: DEVICE AND METHOD FOR POSITIONING ELECTRONIC COMPONENTS IN A PROCESSING TOOL

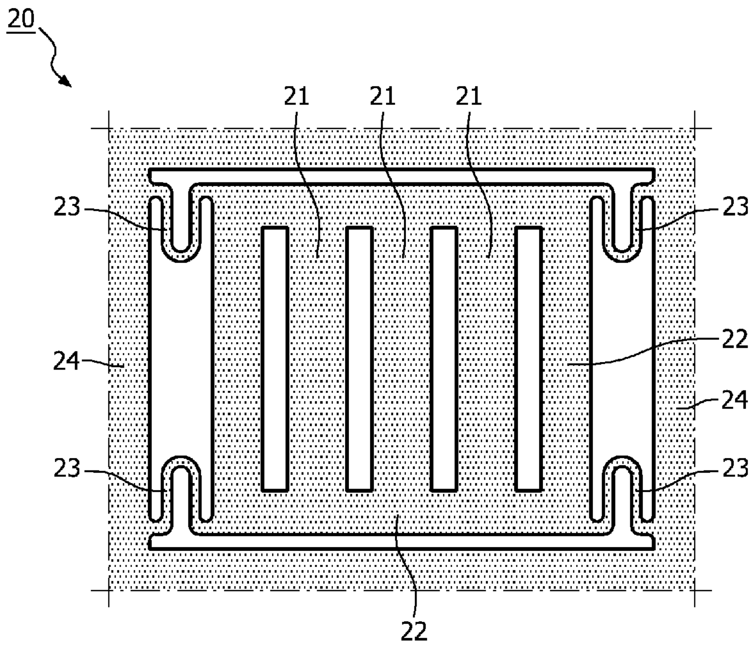

FIG. 3

(57) Abstract: The invention relates to a device for positioning linearly displaceable electronic components, comprising: a linear lower guide and a linear upper guide for the electronic components, wherein at least one of the guides forms part of a flat metal sheet such that the guide is resilient ly displaceable perpendicularly of the flat metal sheet. The invention also relates to a method for positioning linearly displaceable electronic components.

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Device and method for positioning electronic components in a processing tool

The present invention relates to a device and a method for positioning electronic components in a processing tool, wherein the components are linearly displaceable between an upper guide and a lower guide.

In the production and processing of electronic components there is a trend toward increasing miniaturization of the components for processing. These are usually also components of relatively high value, so that strict standards are set in respect of the handling of these electronic components. In the prior art processing of components use is usually made of a lower guide and an upper guide between which the electronic components are displaceable with little (for instance 0.05 - 0.2 mm) freedom of movement. During performing of a processing thereon, the electronic components are then engaged by clamping means such as for instance a clamping block. The drawback of this existing positioning method is that the costs are considerable and that, with increasing miniaturization of the electronic components, this also means that the components for positioning also have to become increasingly smaller, whereby they are also more vulnerable.

The present invention has for its object to provide an improved device and an improved method with which electronic components can be positioned in a processing tool in a reliable manner and at reduced cost compared to the prior art.

The present invention provides for this purpose a device for positioning linearly displaceable electronic components in a processing tool, comprising: a linear lower guide for guided support of the electronic components over a path; and a linear upper guide for guided limiting of the freedom of movement of the electronic components at a distance from the lower guide, wherein at least one of the guides forms part of a flat metal sheet, this sheet being provided with weakened portions such that the guide is resiliently displaceable at least 0.005 mm, preferably at least 0.01 mm, perpendicularly of the flat metal sheet relative to the sheet material surrounding the guide. The resiliently displaceable guide is preferably resiliently displaceable a maximum of 0.05 mm, or still more desirably a maximum of 0.0 3 mm, relative to the sheet material surrounding the guide. There is therefore a limited clearance of the electronic components between the upper and lower guide during displacement; this results in there being little chance of products for instance tilting during guiding. This is also the case for very small (discrete) electronic components (for instance the so-called miniature products with dimensions in the order of magnitude of 0.3 - 0.5 mm).

“Resiliently displaceable” is here understood to mean a freedom of movement perpendicularly of the flat metal sheet which is such that during the quantified displacement, after the force with which the displacement is effected has been removed, the guide returns fully to the starting situation prior to the displacement. The freedom of movement of the electronic components between the guides can be influenced by varying the distance between the upper guide and the lower guide. An important advantage of the device according to the invention is now however that it also becomes possible to clamp the electronic components between the guides with little chance of damage. Displacement (linear guiding) of the electronic components between the guides can thus be obstructed or even prevented, as desired, such that the electronic components are clamped between the guides. This can for instance be advantageous for the purpose of performing processes on the electronic components or carrying out measurements.

An advantage of the resilient displaceability of at least one of the guides relative to the sheet material surrounding and bearing this guide is that, when the electronic components are clamped between the guides, limited variations in the dimensions of the electronic components can be compensated and/or, when contaminants are present between the electronic components and a guide, it is possible to prevent the electronic components or the guides being damaged. Other than in the prior art, where separate clamping means are usually provided in addition to the already present guides, this functionality is realized without separate clamping means with a separate and controllable suspension construction being required for this purpose. The desired functionality is thus realized according to the present invention in an efficient and effective manner. The resiliently displaceable guide, a thinned (resilient) coupling part and the surrounding sheet material forming the holder are manufactured integrally from the flat metal sheet.

A further advantage is that according to the present invention only a relatively small relative freedom of movement (between 0.005 and 0.05 mm) of the upper and lower guide is required. This becomes possible because the functions of guiding and clamping are assembled in a single component. Because separate components are not applied for these functions, it is not necessary to compensate for the (cumulative) tolerances of the different components. The thus obtained possibility of sufficing with a relatively small freedom of movement now once again makes possible the processing of relatively small electronic components.

At least one of the guides is preferably provided with at least one upright edge for positioning in lateral direction relative to the direction of linear displacement. The upper guide and/or lower guide is thus provided with an upright, preferably linear guide edge or a number of parallel linear guide edges, with which, in addition being bounded between the upper and lower guide, the electronic components are also bounded in a lateral direction relative to the linear guides. Lateral displacement of the electronic components, together with the vertical displacement ("vertical displacement" being understood to mean the displacement perpendicularly of the guides), is prevented with one and the same component.

In another advantageous embodiment variant a plurality of guides running parallel to each other are combined in a single flat metal sheet. Using this embodiment variant multiple rows of electronic components can be simultaneously positioned adjacently of each other. Particularly in the processing of smaller components (such as from so-called high-density frames and the miniature products also referred to in this text) multiple rows of electronic components are processed in parallel. By now arranging a plurality of guides in a single flat metal sheet the costs of guiding can be kept limited because the present invention makes a greater processing capacity (UPH) possible. The processing capacity of a device according to the invention can thus increase by as much as 50 to 100% relative to the comparable prior art devices.

For advancing of the electronic components it is desirable to provide the device with drive means such that the electronic components can be pushed forward or be carried/moved along between the upper guide and lower guide. This displacement is usually imparted to the products via a lead frame or carrier, but can also be realized by means of the products pushing each other forward. It is also desirable to be able to vary the distance between the holder of the upper guide and the holder of the lower guide. The device is desirably provided for this purpose with a closing mechanism with which this distance can be adjusted. Not only can the electronic components thus be given the necessary freedom, as desired, to be displaceable (slidable) between the upper guide and lower guide, but can also be clamped between the lower guide and the upper guide. It can also be advantageous for the upper guide and the lower guide to be movable so far apart (to open) that electronic components can be removed, for instance in the case of breakdown. In order to prevent the two holders being moved too close together, whereby undesirably great forces can occur, it is further desirable to limit the minimum mutual distance between the holders.

In yet another embodiment variant the flat metal sheet with the resiliently displaceable guide is provided with continuous recesses adjoining the displaceable guide. In addition to providing the desired freedom of movement of the displaceable guide in this way, this also provides passage for tools with which the electronic components can be processed between the guide elements. Using the device the electronic components can thus be clamped between the upper guide and the lower guide such that they are fixed. They can then be processed in this fixed position. It is desirable for this purpose that the device is also provided with at least one tool for processing electronic components held between the guide elements. Examples of such tools are punches, bending tools and cutting tools. The resiliently displaceable guide can also be displaced with this tool. The (main) movement of the tool can for instance thus be used to also move the resiliently displaceable guide relative to the sheet material surrounding the guide. It is of course desirable here for the guide to be displaced (shortly) before the tool begins a processing. The tool can be provided for this purpose with a gripper which makes contact with the guide, for instance one or more resilient leading pins. The freedom of movement for clamping the electronic components between the guides can be reduced to for instance 0.005 - 0.05 mm. This is made possible because all reference surfaces can be incorporated in a single component and can therefore be very precisely defined relative to each other. This further contributes toward being able to handle and position very small components. An increasing problem in the prior art is that the space between products on a carrier from which they are being separated is so small that only extremely little space is still available for pressing elements and for the tools with which the electronic components can be processed. In the present invention the pressing function and the guiding function are combined in a single component, thereby resulting in a gain in space. The present invention thus makes it possible to design production means for processing carriers with ultra-high density. It is anticipated that it is precisely these carriers with ultra-high density which will be processed more in the future, since the semiconductor industry can hereby save raw material costs. Carriers usually consist for a major part of copper or an alloy in which copper, aluminium or another relatively costly material form part, the costs of which have considerably increased in recent years.

The present invention also provides a method for positioning linearly displaceable electronic components in a processing tool between a linear lower guide and a linear upper guide, comprising the processing steps of: A) placing the electronic components between the lower guide and the upper guide such that the freedom of movement thereof is obstructed, except in the direction of linear displacement; B) moving a holder of the upper guide and a holder of the lower guide closer to each other so that the distance between the holders is smaller than during processing step A); C) clamping the electronic components between the upper guide and the lower guide as a result of processing step B); wherein the guide, which is formed together with the associated holder from a flat metal sheet, is resiliently displaced during processing step C) through a distance of about 0.005 mm, preferably at least 0.01 mm, in a direction perpendicularly of the flat metal sheet of which the guide forms part. The guide is preferably displaced here a maximum of 0.03 mm. In the processing of larger products it is also possible to opt for a displacement of a maximum of 0.05 mm. For a summary of a number of important advantages of this method, reference is made to the above described advantages of the device according to the invention. Also described there is that it is advantageous for the electronic components clamped resiliently between the guides to be processed with a tool which has access to the electronic components through at least one recess in the flat metal sheet with the resiliently displaceable guide.

The invention will be further elucidated on the basis of the non-limitative exemplary embodiments shown in the following figures. Herein:

figure 1 shows a cross-section through a part of the device according to the present invention, figure 2 is a perspective view of a part of the device according to the present invention,

figure 3 is a top view of a part of an alternative embodiment variant of the device according to the present invention, and

figure 4A is a perspective view of a section through an upper guide with suspension such as forms part of an embodiment variant of a device according to the present invention, and

figures 4B and 4C are detail views of the upper guide shown in figure 4A.

Figure 1 shows a cross-section through a part of a device 1 according to the present invention. An electronic component 2 provided with leads 3 is enclosed between a lower guide 4 and an upper guide 5. Lower guide 4 is assembled with a carrier plate 6. Upper guide 5 forms part of a flat metal sheet 7 shown here with hatching. Electronic component 2 is linearly displaceable in a direction perpendicularly of the visible surface. Upper guide 5 is provided with a profiled surface comprising two upright edges 8, 9 whereby electronic component 2 is also positioned in lateral direction (relative to the direction of linear displacement).

Weakened portions 10 are arranged in the flat metal sheet 7 such that upper guide 5 is displaceable to a limited extent (0.005 - 0.05 mm) in a direction perpendicularly of the guide surface of upper guide 5 relative to sheet material 11 of the flat metal sheet 7 surrounding upper guide 5.

Figure 2 is a perspective view of the flat metal sheet 7 as forms part of device 1 shown in figure 1. Clearly visible is that sheet material 11 of the flat metal sheet 7 surrounding upper guide 5 is connected by means of a limited number of bridge pieces 12 to upper guide 5. The material of the flat metal sheet 7 originally enclosing bridge pieces 12 has been removed (for instance by machining and/or chemical treatment of the flat metal sheet 7). The coupling between the sheet material 11 of the flat metal sheet 7 surrounding upper guide 5 and the upper guide 5 is thus weakened such that, as a result of the material properties of the flat metal sheet 7, the desired resilient displaceability (of 0.005 to 0.05 mm) is obtained while an extremely precise relative orientation is nevertheless defined. An additional aspect is that bridge pieces 12 leave clear through-openings 13 in the flat metal sheet 7, whereby tools can gain access to electronic components 2, for instance for bending or cutting thereof.

Figure 3 shows a top view of a part of an alternative embodiment variant of a flat metal sheet 20 for applying in a device according to the present invention. Flat metal sheet 20 is provided with three guide parts 21 extending parallel to each other. Three rows of electronic components 2 can thus be guided parallel to each other. Guide parts 21 are held rigidly in a frame 22, this frame 22 being connected with narrowed coupling strips 23 to a part 24 of flat metal sheet 20 surrounding guide parts 21. It is once again noted for the sake of clarity that all said components: guide parts 21, frame 22, narrowed coupling strips 23 and the part 24 surrounding guide parts 21, all form an integral part of flat metal sheet 20.

Figure 4A shows a perspective view of an upper guide 30 provided with a flat metal sheet 31 consisting of a frame 32 which is connected via coupling parts 33 to guide parts 34. Through displacement of a guide plate 35 the contact parts 36 exert a force such that guide parts 34 are pressed downward relative to frame 32 of metal sheet 31. The relative freedom of movement of guide parts 34 relative to frame 32 is made possible by the (limited) flexibility of coupling parts 33. Left clear between the guide parts are spaces through which cutting tools 37 can be displaced downward (for a clearer view hereof see also figures 4B and 4C). As also shown in figure 4B, cutting tools 37 are embedded in a tool block 38 rigidly connected to a tool plate 39. By now displacing guide plate 35 and tool plate 39 in vertical direction an electronic component for processing - not shown in this figure - can first be clamped with one of the guide parts 34 and subsequently processed by one of the cutting tools 37. After the processing the cutting tools 37 and guide parts 34 are moved upward again such that the processed electronic component can be discharged. Figure 4C shows a guide part 34 in more detail, and cutting tools 37 (also referred to as punches) on either side of guide part 34 are moved downward such that they are situated in an active position.

Claims

1. Device for positioning linearly displaceable electronic components in a processing tool, comprising:
- a linear lower guide for guided support of the electronic components over a path; and
- a linear upper guide for guided limiting of the freedom of movement of the electronic components at a distance from the lower guide,

wherein at least one of the guides forms part of a flat metal sheet, this sheet being provided with weakened portions such that the guide is resiliently displaceable at least 0.005 mm, preferably at least 0.01 mm, perpendicularly of the flat metal sheet relative to the sheet material surrounding the guide.

2. Device as claimed in claim 1, **characterized in that** the resiliently displaceable guide is resiliently displaceable a maximum of 0.05 mm, preferably a maximum of 0.0 3 mm, relative to the sheet material surrounding the guide.

3. Device as claimed in claim 1 or 2, **characterized in that** at least one of the guides is provided with at least one upright edge for positioning in lateral direction relative to the direction of linear displacement.

4. Device as claimed in any of the foregoing claims, **characterized in that** a plurality of guides running parallel to each other are assembled in a single flat metal sheet.

5. Device as claimed in any of the foregoing claims, **characterized in that** the device is provided with drive means for advancing electronic components between an upper guide and a lower guide.

6. Device as claimed in any of the foregoing claims, **characterized in that** the device is provided with a closing mechanism with which the distance between the lower guide and the upper guide can be adjusted.

7. Device as claimed in any of the foregoing claims, **characterized in that** the flat metal sheet with the resiliently displaceable guide is provided with continuous recesses adjoining the displaceable guide.

8. Device as claimed in claim 7, **characterized in that** the device is also provided with at least one tool for processing electronic components held between the guide elements.

9. Method for positioning linearly displaceable electronic components in a processing tool between a linear lower guide and a linear upper guide, comprising the processing steps of:
A) placing the electronic components between the lower guide and upper guide such that the freedom of movement thereof is obstructed, except in the direction of linear displacement;
B) moving a holder of the upper guide and a holder of the lower guide closer to each other so that the distance between the holders is smaller than during processing step A);
C) clamping the electronic components between the upper guide and the lower guide as a result of processing step B);
wherein the guide, which is formed together with the associated holder from a flat metal sheet, is resiliently displaced during processing step C) through a distance of at least 0.005 mm, preferably at least 0.01 mm, in a direction perpendicularly of the flat metal sheet of which the guide forms part.

10. Method as claimed in claim 9, **characterized in that** the guide is resiliently displaced a maximum of 0.05 mm, preferably a maximum of 0.03 mm, in a direction perpendicularly of the flat metal sheet of which the guide forms part for the purpose of positioning the electronic components.

11. Method as claimed in claim 9 or 10, **characterized in that** the electronic components clamped resiliently between the guides are processed with a tool which has access to the electronic components through at least one recess in the flat metal sheet with the resiliently displaceable guide.

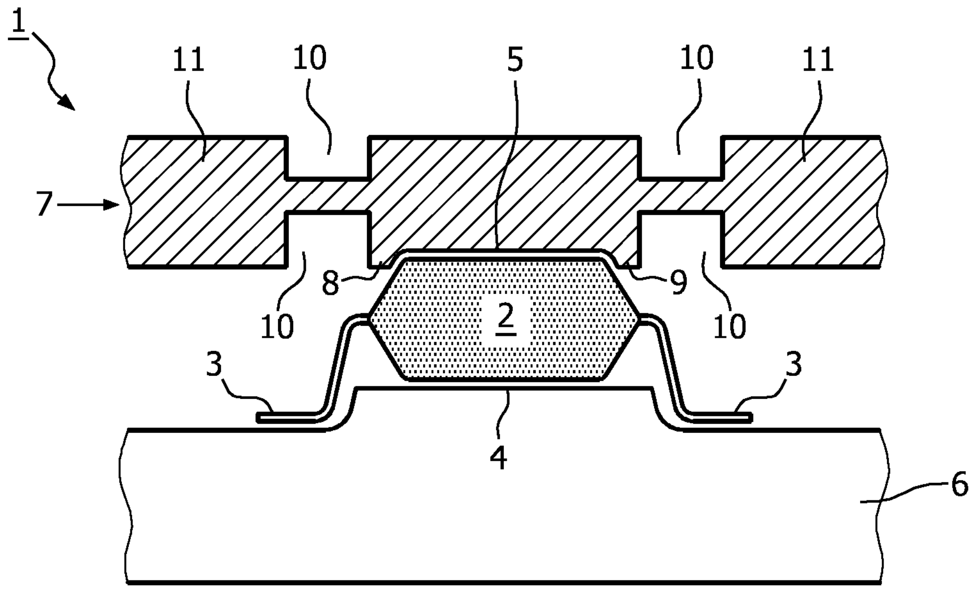
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FIG. 1

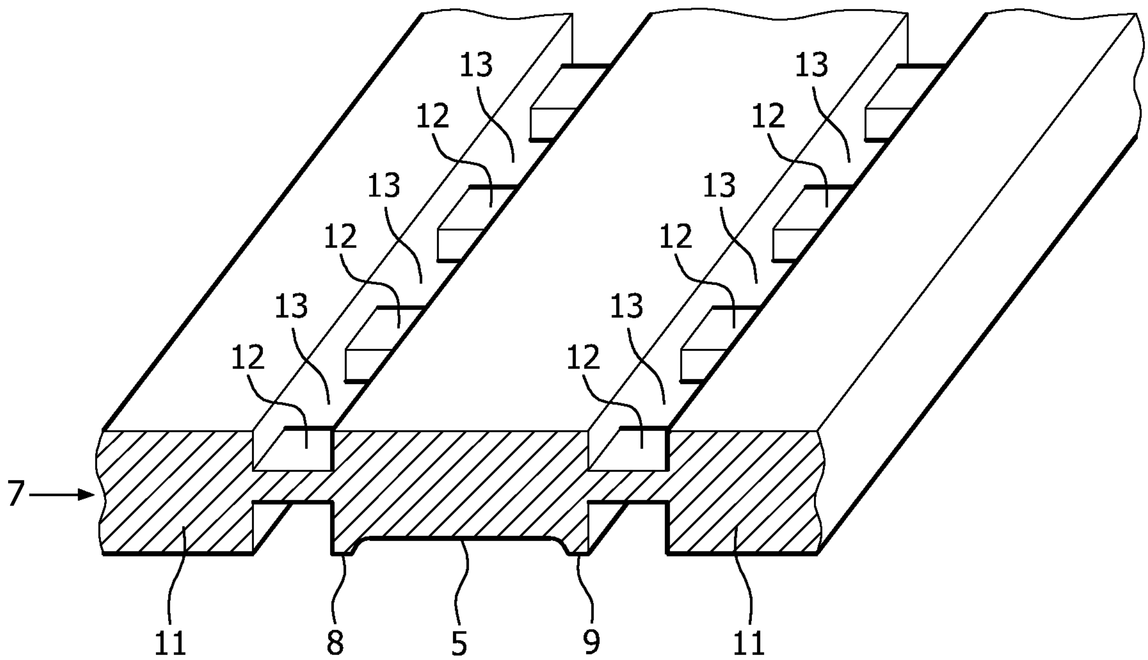
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FIG. 2

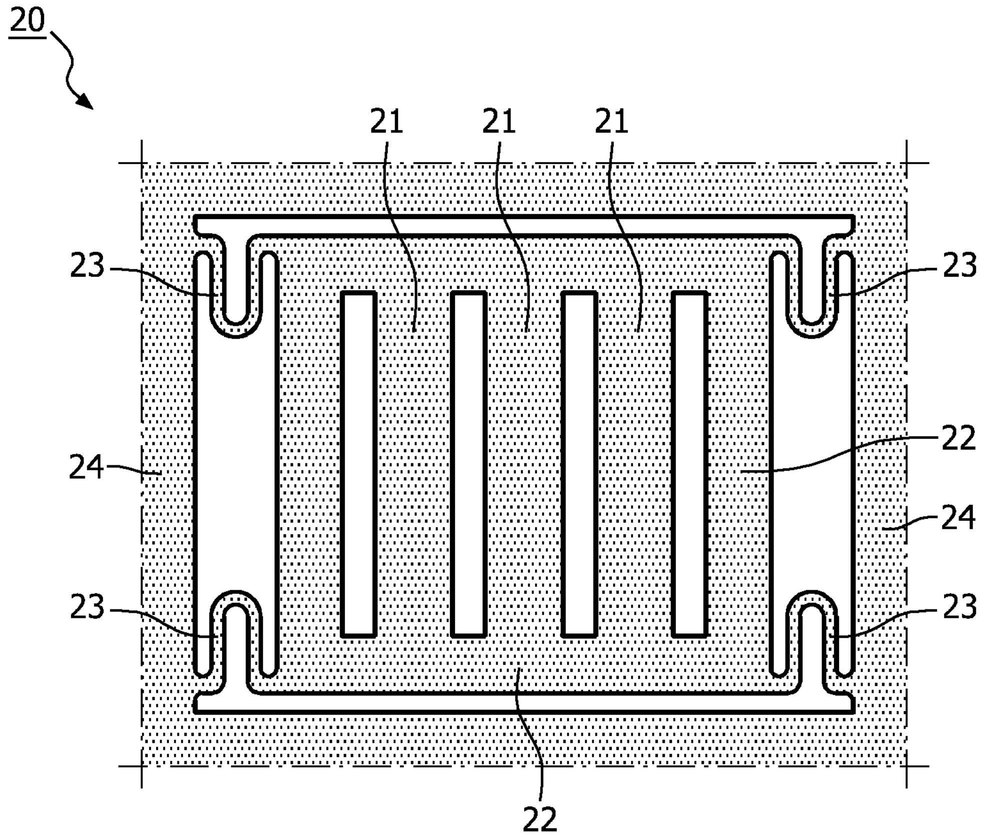

FIG. 3

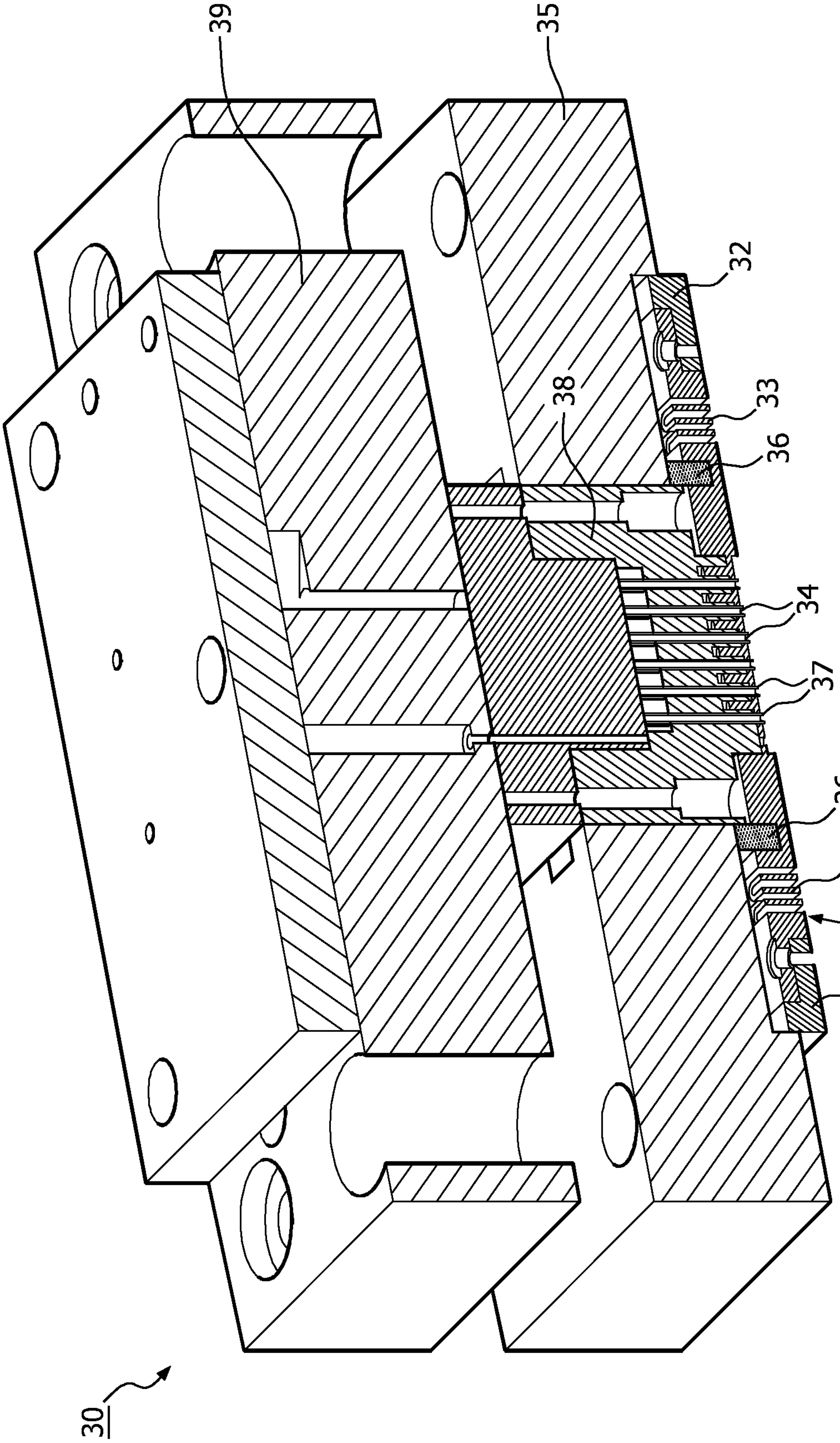

FIG. 4A

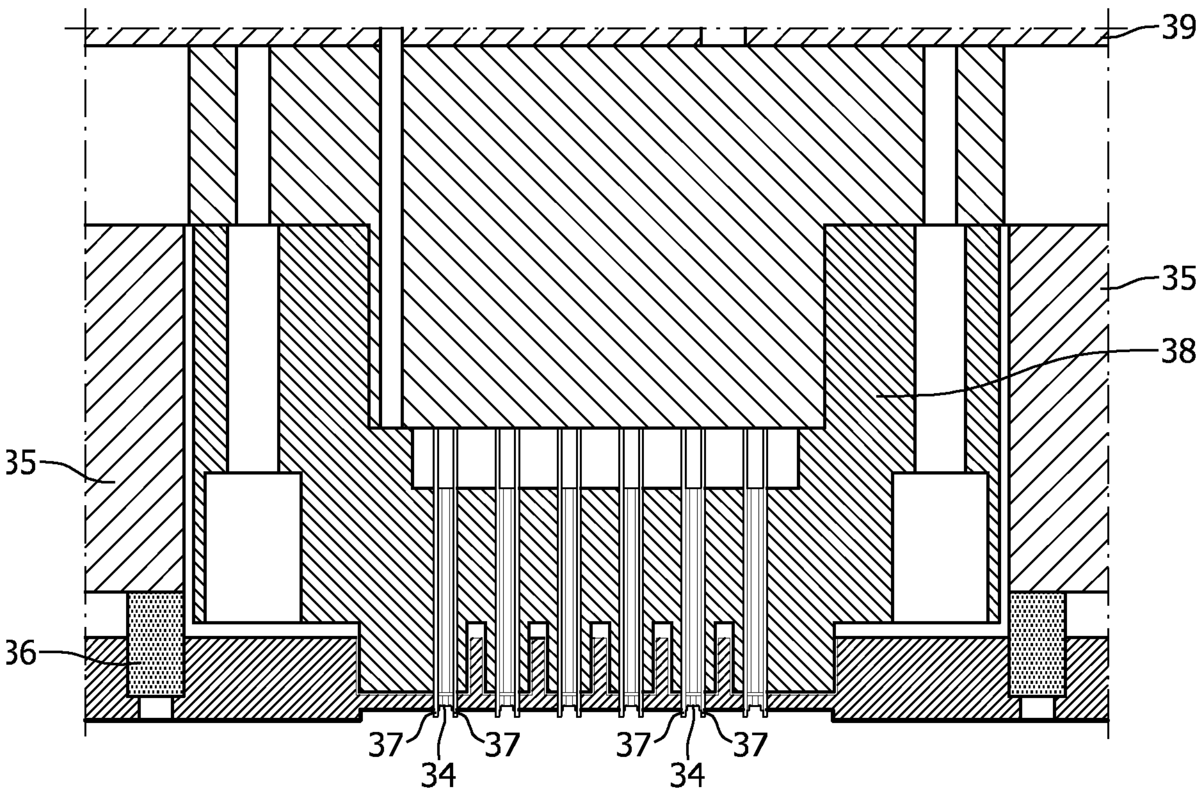

FIG. 4B

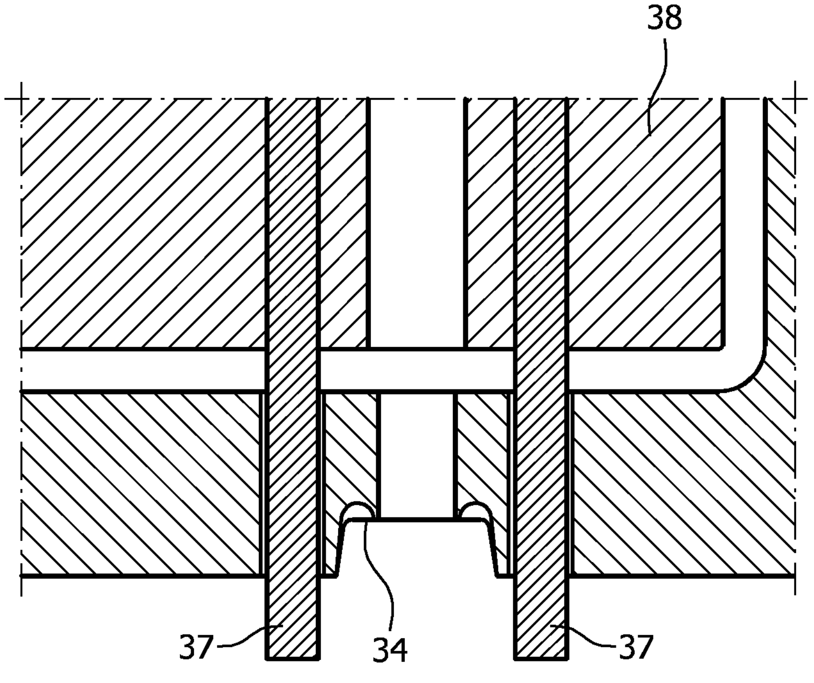

FIG. 4C

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2009/050585

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05K13/00

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)
H05K H01L

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 practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 078 186 A (TOGASHI MINORU [JP] ET AL) 7 January 1992 (1992-01-07) abstract; figures	1,9
A	US 5 979 510 A (HAMILTON ERNEST J [US]) 9 November 1999 (1999-11-09) abstract; figures	1,9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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

"P" document published prior to the international filing date but later than the priority date claimed

"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.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 December 2009	28/12/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Rieutort, Alain

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2009/050585

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5078186	A	07-01-1992	NONE	
US 5979510	A	09-11-1999	NONE	