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(54) COOKING HOB WITH AT LEAST ONE HEATING POWER TRANSFERRING ELEMENT

(57) The present invention relates to a household cooking hob (10) comprising one or more heating power transferring elements (16), wherein:

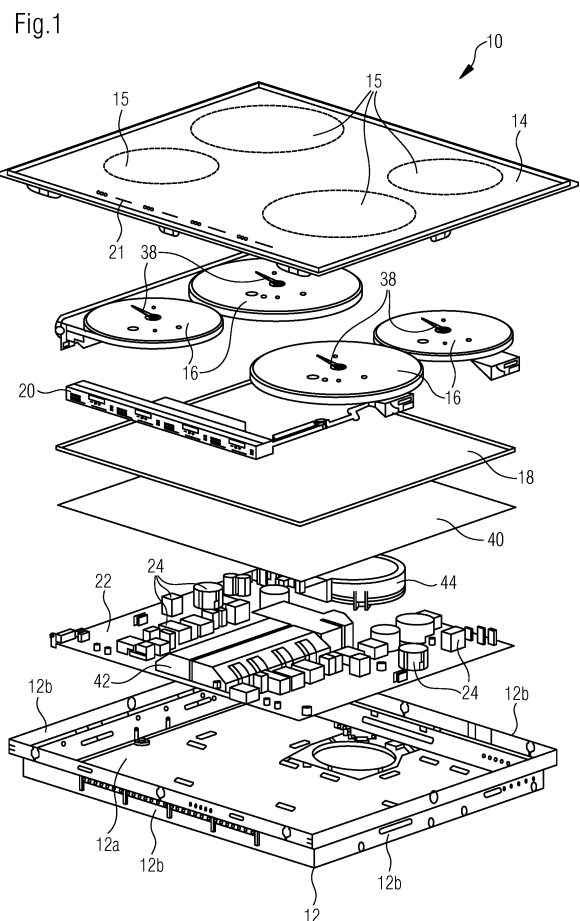
- the cooking hob (10) comprises at least one electric and/or electronic element (24),

- the at least one heating power transferring element (16) is arranged above and/or supported by at least one heating power transferring element carrier (18) or heating power transferring element support,

- at least a part of the at least one electric and/or electronic element (24) is arranged beneath the at least one heating power transferring element (16) and the at least one heating power transferring element carrier (18) or heating power transferring element support,

- the cooking hob (10) comprises at least one electric strength increasing material or element (40), and

- at least a part of the electric strength increasing material or element (40) is arranged between at least a part of the at least one heating power transferring element carrier (18) or heating power transferring element support on the one hand and the at least one electric and/or electronic element (24) on the other hand.



Description

[0001] The present invention relates to a household cooking hob with at least one heating power transferring element.

[0002] In the field of household cooking hobs there is a strong demand on installation of such hobs in workbenches having a small height. Accordingly, there is a strong demand to provide cooking hobs with a small height. Thereby, however, the distance between the mechanical, electric and/or electronic elements becomes very small. Said small distance requires a sufficient electric and thermal insulation which includes the need to meet respective clearance and creepage distances.

[0003] The document JP WO2016/139942 A1 discloses an induction cooking hob having two circular and one rectangular cooking zones with dedicated induction coils arranged beneath a top plate, the induction coils being supported by an aluminium shield plate. Isolation sheets for electrical isolation, each one made of a mica layer, are arranged between the top plate and the dedicated coil as well as between the coil and a dedicated coil ferrite which itself is arranged above the aluminium sheet plate.

[0004] It is an object of the present invention to provide a cooking hob with one or more heating power transferring elements, wherein components arranged very close to each other are sufficiently insulated.

[0005] These and other problems are solved by the cooking hob according to claim 1.

[0006] Preferred embodiments may be taken from the dependent claims, and, beyond that, from the following description, in particular comprising various embodiments as covered and described in the annexed claims.

[0007] According to the present invention, a household cooking hob comprising one or more heating power transferring elements, wherein the cooking hob comprises at least one electric and/or electronic element, wherein the at least one heating power transferring element is arranged above and/or supported by at least one heating power transferring element carrier or heating power transferring element support, wherein the at least one electric and/or electronic element is arranged beneath the at least one heating power transferring element, wherein the cooking hob comprises at least one electric strength increasing material or element, and wherein at least a part of the electric strength increasing material or element is arranged between at least a part of the at least one heating power transferring element carrier or heating power transferring element support on the one hand and the at least one electric and/or electronic element on the other hand. Said electric strength increasing material or element is suitable for avoiding short circuits or arcing.

[0008] The expression "electric strength increasing material or element" shall be understood as a substance or material or element which, when arranged between the at least one heating power transferring element and the at least one electric and/or electronic element, arranges for an electric strength which is higher than with-

out such substance, material or element, i.e. when only an air gap is in effect between said elements. With such increased electric strength arrangement either the safety with respect to arcing can be increased or air gaps or clearance distances can be reduced without reducing the safety level. Such household cooking hob according to the present invention may be advantageously provided with a reduced height compared to household cooking hobs of the prior art. Preferably, the household cooking hob of the present invention is a built-in appliance. Particularly, in such embodiment the reduced height is of particular advantage, as the height of a worktop plate may also advantageously be reduced. Moreover, the space below the cooking hob of the present invention is advantageously increased, which allows placement of drawers or the like in an easier way. Thereby, the advantage particularly may result from the electric strength increasing material or element arranged between heating power transferring elements and the at least one electric and/or electronic element. In particular, the electric strength increasing material or element may advantageously act as an electric insulator and/or thermal insulator. Preferably, the electric strength increasing material or element has a small thickness and allows for realizing a small height, particularly a small distance between the heating power transferring elements and the at least one electric and/or electronic element. With such a provision, a solution is found for avoiding short circuits or arcing, namely providing a material or an element which enables to reduce necessary clearance and creepage distances. Thus, the cooking hob advantageously may be realised with a small construction height.

[0009] By "clearance distance" shall be understood the shortest distance between two conductive components or parts and by "creepage distance" shall be understood the shortest distance between two conductive components or parts along the surface of a solid insulating material.

[0010] It is known in the art that such household cooking hobs usually are provided for conducting at least one cooking process comprising heating and/or cooling step, respectively. Such cooking process preferably at least comprises a heating step, e.g. frying, boiling, simmering or pouching of a foodstuff or a cooking liquid, respectively. For supporting the foodstuff or cookware item, it is particularly known to provide a cooking support, for example in the form of a cooking surface. Such cooking surface usually provides a support for the cookware items, for example, provided in the form of a plate element, particularly a glass or glass ceramic plate.

[0011] Preferably, the cooking hob comprises, preferably consists of, a cooking support and a lower casing. Thereby it is preferred that an open top side of the lower casing is covered by at least a part of the cooking support. The cooking support may be provided particularly as at least one panel, wherein preferably the panel is a glass ceramic panel. Preferably, at least one or more heating power transferring elements are arranged beneath the

panel. The lower casing may be manufactured from different material comprising plastics or metal, e.g. aluminium.

[0012] In particular, such casing may include a bottom wall and at least one sidewall. It is preferred that said casing is made of metal, e.g. aluminium or steel, and/or plastics, wherein preferably the casing made of metal is grounded.

[0013] Advantageously said lower casing may comprise at least one heating power energy unit, particularly arranged in a respective heating power energy unit housing, the heating power transferring elements, heating power transferring element carrier or heating power transferring element support. In other words, the lower casing and the cooking support may form a closed unit comprising all essential parts of the cooking hob. Thereby the lower casing may comprise fastening means for fastening and/or arranging the cooking hob on top of or in a cutout of a work plate.

[0014] Thereby, preferably, a heating power transferring element may be arranged below a cooking support. Preferably, the one or more heating power transferring elements are arranged in an upper portion of the lower casing of the cooking hob. A heating power transferring element may be arranged and supported by one or more heating power transferring element carrier or heating power transferring element support, preferably the heating power transferring element being attached and/or arranged on said carrier or support. A housing comprising an energy power unit may be arranged below one or more heating power transferring element carrier or heating power transferring element supports. Thereby, preferably a heating power transferring element carrier or heating power transferring element support with the supported heating power transferring element may advantageously be arranged on top of and/or attached to such housing of an energy power unit.

[0015] For conducting the cooking process, particularly a heating step, a cooking appliance, particularly the lower casing thereof, comprises at least one heating power-transferring element. Said heating power-transferring element is provided for transferring heating power to the foodstuff or cooking liquid, preferably contained in a cookware item.

[0016] Preferably, the at least one heating power transferring element is an electric heating element, in particular an induction heating element, particularly induction coil, and/or radiant heating element. The heating power provided by a heating power transferring element may be preferably provided electrically. Preferably, the heating power may be provided by a heat-generating magnetic field, more particularly an induction field. Accordingly, the cooking hob of the present invention preferably is an induction hob.

[0017] Preferably, a heating power-transferring element in the form of an induction coil comprises a planar conductive winding wire, particularly a copper wire. Preferably, an induction coil comprises at least one magnetic

field supporting element, e.g. a ferrite element. Preferably, said at least one magnetic field supporting element, particularly at least one ferrite element, is arranged below the plane of the conductive winding wire. Said at least one magnetic field supporting element, particularly ferrite element, is advantageous in establishing and/or supporting the high frequent alternating magnetic field of the induction coil. Said magnetic field supporting element, particularly if arranged below the conductive winding wire, may be glued to or supported by ferrite support elements, e.g. snap fit connectors or the like.

[0018] Preferably, an induction coil comprises a shielding element, e.g. a mica sheet. The shielding element preferably is adapted to the form of the planar conductive winding wire or the form of at least two planar conductive winding wires of at least two adjacently arranged coils. The shielding element preferably is provided above the at least one magnetic field supporting element, particularly at least one ferrite element. The shielding element preferably in its main function is a support for the planar conductive wire windings of the coil. However, additionally the shielding element, particularly mica sheet, may also shield temperature radiated from the above, e.g. resulting from a heated up pot bottom.

[0019] In the cooking hob of the present invention the at least one heating power transferring element is preferably arranged and/or mounted on a heating power transferring element carrier or heating power transferring element support, particularly comprised in the lower casing. It is particularly preferred that a carrier made of aluminum sheet metal supports the heating power transferring element. Particularly, the cooking hob of the present invention may comprise heating power transferring element carrier or heating power transferring element support to support one heating power transferring element, however, it is also considered herein that one power transferring element carrier or heating power transferring element support is provided to support more than one heating power transferring element.

[0020] In a preferred embodiment of the present invention, two heating power-transferring elements are arranged on and supported by one common heating power transferring element carrier. Particularly at least two induction coils are arranged on and supported by one common induction coil carrier plate.

[0021] The heating power transferring element carrier or heating power transferring element support may be advantageously supported by or on a housing of the heating energy power unit.

[0022] Particularly, at least one of, preferably all of, the heating power transferring elements of an cooking hob of the invention, more particularly an induction coil of an induction hob, may be arranged below a cooking support, particularly a cooking surface in form of a plate element, and particularly within the lower casing, in order to provide the heat for a heating step to a heating zone of the cooking support and to the bottom side of a cookware item and foodstuff, respectively, when placed on said

heating zone.

[0023] A cooking support of a cooking hob of the invention, particularly of an induction hob of the invention, preferably comprises at least one heating zone. Such heating zone as referred to herein, preferably refers to a portion of the cooking support, particularly cooking surface, which is associated with one heating power transferring element, e.g. a radiant heating element or an induction coil, which is arranged at, preferably below, the cooking support, e.g. the glass ceramic plate. Particularly, in an embodiment according to which the cooking hob of the present invention is an induction hob, it is preferred that such heating zone refers to a portion of the cooking support, which is associated with at least one induction coil. Thereby, the heating power transferring elements associated with a heating zone are preferably configured such that the same heating power of the associated heating power transferring elements is transferred to the heating zone. Preferably, the heating zone thus refers to a portion of the cooking support to which the same heating power of the associated at least one heating power transferring element is transferred.

[0024] In addition, the cooking hob of the present invention, may particularly be configured such that in one operation mode one or more than one heating zones form one cooking zone and/or are combined to one cooking zone, respectively. A cooking zone may be particularly be provided as at least a portion of the cooking surface. Particularly, such cooking zone is associated with at least one heating zone. Additionally, or alternatively, a cooking zone may be associated with more than one heating zone. Particularly, a cooking zone may be associated with an even number, particularly two, four, six, eight or ten, more particularly two, heating zones. Alternatively, a cooking zone may be associated with an uneven number, particularly three, five, seven or nine, more particularly three, heating zones.

[0025] Preferably, the cooking hob of the present invention is configured such that a cooking zone comprises one or more than one heating zones, which can be driven with the same or different power, frequency or heating level.

[0026] In the present invention, it is preferred that in at least one operation mode of the cooking hob according to the present invention is configured such that a cooking zone comprises at least two, preferably two, heating zones, driven by the same power, frequency or heating level. Particularly, such cooking zone comprises or is associated with at least two, preferably two, heating power transferring elements.

[0027] Additionally or alternatively, the cooking hob of the present invention may be configured such that the number of heating zones associated with one cooking zone may vary and/or may be adjustable dependent on the needs of the cook and/or the size, form or kind of cookware placed on the cooking surface.

[0028] Particularly, a cooking hob according to the present invention, preferably an electric hob, such as an

induction hob, may comprise at least one heating power energy unit. A heating power energy unit as used herein, preferably provides energy to at least one of, preferable a number of, the heating power transferring elements such that the heating power transferring element is capable of transferring heating power for heating up the foodstuff or cooking liquid. A heating power energy unit of an induction hob, for example, may provide energy in the form of a high frequency alternating current to a heating power transferring element in the form of an induction coil, which transfers heating power in the form of a magnetic field to a suitable cookware item. For such purpose, a heating power energy unit may comprise at least one associated power circuit mounted and/or arranged on at least one printed circuit board. Preferably, a heating power energy unit is supported and arranged in a housing, preferably a plastic housing, preferably arrangeable in and adapted to the lower casing. This allows easy manufacturing and modularization.

[0029] Particularly, the housing may comprise supporting elements for supporting the heating power transferring element carrier or heating power transferring element support. Particularly, such supporting elements may comprise elastic means, e.g. springs or silicon elements, for elastically supporting the heating power transferring element carrier or heating power transferring element support, and particularly advantageous in pressing a heating power transferring element onto the bottom surface of the cooking support plate, which particularly is a glass ceramic plate.

[0030] Particularly, the heating power energy unit, and particularly the associated power circuit, may be configured to be connected to at least one, preferably two phases of a mains supply. A cooking hob according to the present invention thereby comprises at least one, preferably two or three heating power energy units, connected to one or two, preferably one phases of the mains supply each.

[0031] Preferably, a heating power energy unit may comprise at least one associated power circuit, particularly in the form of an at least one heating power generator, for generating heating power and supplying heating power transferring elements with heating power, particularly for providing heating power to the at least one heating zone. Thereby the power circuit particularly may be provided in the form of a half-bridge configuration or a quasi-resonant configuration.

[0032] It will be immediately understood that the heating power energy unit may thus comprise one heating power generator for providing heating power to more than one heating zone, each associated with at least one heating power transferring element. Furthermore, the heating power energy unit may comprise one heating power generator comprising a single or pair of high frequency switching elements.

[0033] In particular, the high frequency switching element is provided in the form of a semiconductor-switching element, particularly an IGBT element.

[0034] In case the heating power energy unit may comprise one heating power generator comprising a single high frequency switching element, the single switching element preferably forms part of associated power circuit, provided in the form of a or a part of a Quasi Resonant circuit.

[0035] In case that the heating power energy unit may comprise one heating generator comprises a pair of high frequency switching elements, said pair of high frequency switching elements preferably forms part of an associated power circuit, provided in the form of a or a part of a half-bridge circuit.

[0036] A person skilled in the art will immediately understand that the heat, generated by and/or radiated from particularly the heating power transferring elements, the heating power energy unit and/or the cookware item, particularly the bottom thereof, may have also disadvantageous effects, particularly regarding safety and proper functioning. Particularly, the heating power energy unit, more particularly power circuits comprising switching elements, may generate a significant amount of heat being disadvantageous for the safety and proper functioning of the cooking hob. For this reason, the cooking hob comprises at least one cooling means. Particularly, said cooling means is adapted for cooling down the electric and/or electronic elements. Particularly, the heating power energy unit may comprise such cooling means. Such cooling means may comprise at least one of a fan, a cooling channel, a cooling body, preferably from a metal, particularly aluminium, cooling air-guiding means, cooling air deflection means and the like. Particularly, the cooking hob of the present invention may comprise such cooling means for cooling at least one heating power generator or a part thereof, particularly to at least one single or pair of high frequency switching elements. More particularly, such cooling means may comprise a cooling body, preferably arranged in the air path of a cooling fan, and thermally connected to at least one heating power generator or a part thereof, particularly to at least one single or pair of high frequency switching elements. Thereby it is preferred that the cooling means comprises at least one fan for generating an air stream through the cooling channel and/or alongside the cooling body. Preferably, the cooling channel and/or cooling body extend horizontally through the cooking hob. For example, the cooling channel and/or cooling body extend over a substantial part of the horizontal width of the cooking hob.

[0037] The cooking hob according to the present invention preferably further comprises a control unit. Such control unit is preferably operatively connected with the heating power energy unit to control at least one operational parameter of the cooking hob, particularly an operational parameter of the heating power energy unit. Furthermore, the control unit comprises a user interface at least for receiving a command input of a user. This advantageously allows the user to control at least one operational parameter of the cooking hob, particularly an operational parameter of the heating power energy unit.

Moreover, the control unit, and particularly a user interface if present, may be operatively connected to other appliances or interfaces, e.g. a suction hood, a voice control device, a server, a remote interface, a cloud-computing source or the like.

[0038] Accordingly, the household cooking hob according to the present invention comprises at least one electric and/or electronic element. Particularly, said at least one electric and/or electronic element comprises a heating power energy unit and/or control unit or parts thereof.

[0039] Particularly, the at least one electric and/or electronic element of the household cooking hob of the present invention may be part of an at least one heating energy power unit, preferably mounted and/or arranged on a power board and/or a power generating circuit mounted on a printed circuit board (PCB).

[0040] Such at least one electric and/or electronic element may be, for example, selected from the group comprising a heating power generator, filter coils, EMC filters, rectifier, switching elements, like IGBTs, relays, or the like.

[0041] In connection therewith a person skilled in the art will immediately acknowledge that a certain security clearance and/or creepage distance between electric and/or electronic elements on the one hand and the heating power transferring element carrier or heating power transferring element support with mounted heating power transferring elements on the other hand, particularly a certain security clearance and/or creepage distance between heating power energy units particularly comprising at least one associated power circuit mounted and/or arranged on at least one printed circuit board, on the one hand and an aluminum coil carrier carrying or supporting copper winding induction coil on the other hand is crucial for the security and proper functioning of the cooking hob. Thereby said certain security clearance and/or creepage distance at least partially determines the minimum height of cooking hobs, particularly induction hobs, in the prior art. The present inventors have surprisingly found that said clearance and/or creepage distance between electric and/or electronic elements on the one hand and the heating power transferring element carrier or heating power transferring element support with mounted heating power transferring elements on the other hand, particularly a clearance and/or creepage distance between heating power energy units, particularly comprising at least one associated power circuit mounted and/or arranged on at least one printed circuit board, on the one hand and an aluminum coil carrier carrying or supporting copper winding induction coil on the other hand, can be advantageously reduced by the inventive arrangement of at least a part of an electric strength increasing material or element between the one or more heating power transferring elements on the one hand and the at least one electric and/or electronic element on the other hand. This also advantageously allows for providing a cooking hob, particularly an induction hob, having

a reduced clearance and/or creepage distance and reduced overall height.

[0042] Thereby, the electric strength increasing material or element is provided and arranged such that short cuts or short circuits, respectively, and arcing between current-carrying parts, particularly the at least one electric and/or electronic elements, more particularly the or parts of the heating power energy unit, on the one hand and the heating power transferring element carrier or heating power transferring element support, particularly aluminum coil carrier, on the other hand are advantageously avoided. In other words, the provided electric strength increasing material or element advantageously compensates for the reduced clearance and/or creepage distance.

[0043] The present inventors have surprisingly found that the height of a household cooking hob can be advantageously reduced, if the cooking hob comprises at least one electric strength increasing material or element, wherein at least a part of said electric strength increasing material or element is arranged between one or more heating power transferring elements of the cooking hob on the one hand and at least one electric and/or electronic element, particularly at least one electric and/or electronic element of the power energy unit, on the other hand.

[0044] It is particularly preferred to select the material of said electric strength increasing material from materials capable of compensating the reduced airway or clearance distance and/or creepage distance. Furthermore it is preferred that the at least one electric strength increasing material or element is made of at least one electric insulating material. Particularly, said electric strength increasing material or element has a coefficient of resistivity of about at least $1 \cdot 10^6 \Omega \cdot m$, preferably at least $1 \cdot 10^9 \Omega \cdot m$, more preferably at least $1 \cdot 10^{12} \Omega \cdot m$, and most preferably at least $1 \cdot 10^{14} \Omega \cdot m$.

[0045] Resistivity as used herein preferably refers to the resistivity between the one or more heating power transferring elements on the one hand and the at least one electric and/or electronic element on the other hand. The higher the resistivity, the more the distance between the one or more heating power transferring elements on the one hand and the at least one electric and/or electronic element on the other hand can be advantageously decreased.

[0046] Preferably, the material of said electric strength increasing material or element additionally or alternatively is an EMC shielding and/or heat insulating material.

[0047] The present inventors have also surprisingly found that the electric strength increasing material or element according to the present invention may advantageously improve EMV shielding. Preferably, the electric strength increasing material or element is thus manufactured from a material having non- or low inductive properties. Such material advantageously reduces the probability of self-induction and own magnetic disturbances and field, respectively.

[0048] The present inventors have furthermore found

that the electric strength increasing material or element according to the present invention may advantageously improve heat shielding, particularly between the one or more heating power transferring elements on the one hand and the at least one electric and/or electronic element on the other hand. Preferably, the electric strength increasing material or element is thus manufactured from a material having heat-insulating properties.

[0049] In particular, the at least one electric strength increasing material or element is made of at least one heat insulating material, wherein preferably said electric strength increasing material or element has a thermal conductivity of at least $0.01 \text{ W/(m} \cdot \text{K)}$, preferably at least $0.25 \text{ W/(m} \cdot \text{K)}$, more preferably at least $0.3 \text{ W/(m} \cdot \text{K)}$. The term "thermal conductivity" as used herein preferably refers to the thermal conductivity between the one or more heating power transferring elements on the one hand and the at least one electric and/or electronic element on the other hand.

[0050] In a further preferred embodiment the at least one electric strength increasing material or element has a dielectric strength of more than 8 kV/mm , preferably more than 12 kV/mm , more preferably more than 14 kV/mm , most preferably more than 17 kV/mm .

[0051] In a further preferred embodiment the at least one electric strength increasing material or element has a heat resistance of about at least 100°C , preferably at least 200°C , more preferably at least 300°C , most preferably at least 400°C .

[0052] A specific embodiment of the invention provides for an electric strength increasing material or element which has an HF dampening characteristic or is equipped with a material or layer with an HF dampening characteristic. This may be useful for reducing electromagnetic pollution. The material or layer may consist of or comprise a soft iron material.

[0053] Particularly, the material of said electric strength increasing material or element may advantageously be selected from mineral, preferably crystalline material, metal or plastic, wherein a mineral, particularly a crystalline mineral, is preferred. In a particularly preferred embodiment, the at least one electric strength increasing material or element is comprising and/or consisting of mica. Another preferred embodiment is characterised by an electric strength increasing material or element comprising and/or consisting of aramid (aromatic polyamide) fibres which are a class of heat-resistant and strong synthetic fibres.

[0054] The present inventors have furthermore found that providing the electric strength increasing material or element in a planar shape is advantageous. Particularly, the height of the cooking hob can be advantageously reduced, however, in addition a planar shape may have further advantageous properties regarding cooling and/or cooling air path improvement. Particularly the circulation of cooling air may be advantageously improved and may particularly prevent cooling air escaping from the area above the at least one electric and/or electronic

element towards the heating power transferring elements.

[0055] Preferably the at least one electric strength increasing material or element has a planar shape. Particularly, the at least one electric strength increasing material or element is provided as a layer, particularly a mica layer. Preferably, the electric strength increasing material or element having a planar shape and/or provided as a layer extends over a horizontal plane.

[0056] Preferably the thickness of said planar shaped electric strength increasing material or element and/or said electric strength increasing material or element provided as a layer is at least 0.29 mm, more preferably at least 0.25 mm, still more preferably at least 0.20 mm, still more preferably at least 0.10 mm, still more preferably at least 0.05 mm, most preferably at least 0.01 mm. The higher the thickness of the electric strength increasing material or element, the better will be the advantageous shielding and insulating properties.

[0057] Additionally or alternatively, the thickness of said planar shaped electric strength increasing material or element and/or said electric strength increasing material or element provided as a layer preferably is at most 5.0 mm, more preferably at most 4.0 mm, still more preferably at most 3.0 mm, still more preferably at most 2.0 mm, more preferably at most 0.7 mm, most preferably at most 0.35 mm.

[0058] The lower the thickness, the more the height of the hob can be advantageously reduced and the less material for the electric strength increasing material or element has advantageously to be used.

[0059] Preferably, the thickness of said planar shaped electric strength increasing material or element and/or said electric strength increasing material or element provided as a layer is between at least 0.29 mm and at most 5.0 mm, between at least 0.29 mm and at most 4.0 mm, between at least 0.29 mm and at most 3.0 mm, between at least 0.29 mm and at most 2.0 mm, between at least 0.29 mm and at most 1.0 mm, between at least 0.29 mm and at most 0.5 mm, more preferably between at least 0.25 mm and at most 5.0 mm, between at least 0.25 mm and at most 4.0 mm, between at least 0.25 mm and at most 3.0 mm, between at least 0.25 mm and at most 2.0 mm, between at least 0.25 mm and at most 1.0 mm, between at least 0.25 mm and at most 0.5 mm, still more preferably between at least 0.20 mm and at most 5.0 mm, between at least 0.20 mm and at most 4.0 mm, between at least 0.20 mm and at most 3.0 mm, between at least 0.20 mm and at most 2.0 mm, between at least 0.20 mm and at most 1.0 mm, between at least 0.20 mm and at most 0.5 mm, still more preferably between at least 0.10 mm and at most 5.0 mm, between at least 0.10 mm and at most 4.0 mm, between at least 0.10 mm and at most 3.0 mm, between at least 0.10 mm and at most 2.0 mm, between at least 0.10 mm and at most 1.0 mm, between at least 0.1 mm and at most 0.5 mm, still more preferably between at least 0.05 mm and at most 5.0 mm, between at least 0.05 mm and at most 4.0 mm,

between at least 0.05 mm and at most 3.0 mm, between at least 0.05 mm and at most 2.0 mm, between at least 0.05 mm and at most 1.0 mm, between at least 0.05 mm and at most 0.5 mm, and between at least 0.01 mm and at most 5.0 mm, between at least 0.01 mm at most 4.0 mm, between at least 0.01 mm and at most 3.0 mm, between at least 0.01 mm and at most 2.0 mm, between at least 0.01 mm and at most 1.0 mm, between at least 0.01 mm and at most 0.5 mm.

[0060] A specifically preferred embodiment provides for an electric strength increasing element which is attached to the heating power transferring element carrier or heating power transferring element support, preferably to a lower surface or lower side thereof. This attaching may be a manufacturing process step which is executed prior to the assembling of the cooking hob. In case of the electric strength increasing element being a separate layer or sheet, this process step may be a simple joining, it is preferred, however, to fix the electric strength increasing element, e.g. by gluing, to a surface of the heating power transferring element support or heating power transferring element carrier, in particular to a lower surface thereof. The electric strength increasing element or material may also be a material which is applied to, preferably by means of coating, a surface, e.g. the lower surface, of the heating power transferring element carrier or heating power transferring element support.

[0061] The heating power transferring element carrier or heating power transferring element support may comprise cut-outs or apertures, e.g. for feeding cables, in particular sensor cables, therethrough. Also the electric strength increasing material or element may comprise at least one cut-out or aperture which corresponds to the at least one cut-out or aperture arranged in the heating power transferring element carrier or heating power transferring element support. In order to avoid certain edge effects, i. e. arcing or creepage effects, at the area of uncoated metal surfaces, the cut-out or aperture of the electric strength increasing material or element is preferably smaller than the cut-out or aperture of the heating power transferring element carrier or heating power transferring element support, in that covering the metallic surface of the carrier or support.

[0062] Preferably, the at least one electric strength increasing element is fixed to or glued to the heating power transferring element carrier (18) or heating power transferring element support. Alternatively, the heating power transferring element carrier (18) or heating power transferring element support may be coated with the electric strength increasing material. An inner edge or a bent up inner ring zone of the cut-out or aperture of the heating power transferring element carrier (18) or heating power transferring element support is advantageously covered by an inner ring zone bordering the cut-out or aperture of the electric strength increasing element. This is favourable in the case of a coated electric strength increasing element.

[0063] The present inventors have found that it is of

particular advantage regarding improved EMV shielding or insulation, if the electric strength increasing material or element is arranged above electric and/or electronic elements having relatively high EMV emission. Such electric and/or electronic elements having relatively high EMV emission are preferably selected from the group comprising filter coils, chokes, copper-wrapped parts, capacitors and power electronics. It is thus preferred that the electric strength increasing material or element is arranged such that it substantially covers the lower casing, and particularly that it substantially covers at least one heating power energy unit. The electric strength increasing material or element may, however, be provided as a single piece part, or alternatively as a multi-piece part.

[0064] It is thereby particularly preferred, if the cooking hob of the present invention comprises at least one electric strength increasing material or element per heating zone, particularly more creepage distance reducing elements than heating zones. Preferably, the cooking hob comprises an electric strength increasing material or element advantageously arranged below one heating zone. It is also particularly preferred, if the cooking hob of the present invention comprises at least one electric strength increasing material or element per heating power transferring element.

[0065] Moreover, it is further preferred that at least one electric strength increasing material or element is arranged such that a cooling means and/or the heating power energy unit may comprise one heating power generator comprising a single or pair of high frequency switching elements is substantially covered by said at least one electric strength increasing material or element.

[0066] Preferably, the one or more heating power transferring elements are supported by one or more heating power transferring element carrier or heating power transferring element support, wherein preferably at least a part of the electric strength increasing material or element is arranged between said one or more heating power transferring element carrier or heating power transferring element support on the one hand and the at least one electric and/or electronic element on the other hand.

[0067] In particular, at least one electric strength increasing material or element is arranged between the heating power transferring element and/or its heating power transferring element carrier or heating power transferring element support on the one hand and the cooling channel and/or the cooling body on the other hand.

[0068] At least a portion of the at least one electric strength increasing material or element may have a profile different to a planar or horizontally extended structure. Rather, the at least one electric strength increasing material or element may have a profile which is at least partially adapted to the surface profile of the at least one electric and/or electronic element. More specifically, the profile of the at least one electric strength increasing material or element is adapted to the surface profile of a group of electric and/or electronic elements, in particular

of a printed circuit board (PCB) assembly which is arranged beneath the heating power transferring element and its support or carrier. Such PCB assembly may belong to a power electronics of the cooking hob. In a particularly specific embodiment is the distance between the at least one electric strength increasing element and the top sides of the electric and/or electronic elements constant or at least approximately constant.

[0069] According to a special embodiment of the present invention, the at least one electric strength increasing material or element is a multilayer film including at least one electric strength increasing material or element, preferably at least one mica layer, and at least one conductive layer, preferably at least one aluminium layer. Particularly by this way, the conductive layer with a small thickness may be provided.

[0070] For example, the at least one conductive layer is grounded.

[0071] Further, at least one conductive layer may be connected to the printed circuit board.

[0072] Moreover, at least one conductive layer is connected to a predefined electric potential. Preferably, the conductive layer is connected to the ground, either directly or via an electric or electronic circuit. The conductive layer connected to the ground can absorb electromagnetic disturbances from induction coils.

[0073] For example, the conductive layer provides an electric strength increasing material or element between the heating power transferring element on the one hand and the electric and/or electronic elements on the other hand.

[0074] Novel and inventive features of the present invention are set forth in the appended claims.

[0075] The present invention will be described in further detail with reference to the drawing, in which

FIG 1 illustrates an exploded perspective view of an induction cooking hob comprising four circular cooking zones;

FIG 2 illustrates an exploded perspective view of a heating coil unit of the induction cooking hob according to FIG 1; and

FIG 3 illustrates a schematic partial sectional side view of the heating coil unit of FIG 2.

[0076] An induction cooking hob, as shown in FIG 1, comprises

FIG 1 illustrates an exploded perspective view of an induction cooking hob 10 according to a preferred embodiment of the present invention.

[0077] The cooking hob 10 comprises a casing 12 and a panel 14. The casing 12 includes a bottom wall 12a, four sidewalls 12b and an open top side. Preferably, the casing 12 is made of metal, e.g. steel. Alternatively, the casing 12 may be made of plastics. The panel 14 covers the top side of the casing 12. For example, the panel 14

is a glass ceramic panel.

[0078] The cooking hob 10 comprises four circular cooking zones 15, two thereof with a smaller diameter, while the diameter of the other two cooking zones 15 are larger. The contours of the cooking zones are indicated by respective circles on the top surface of the glass panel 14. Each cooking zone 15 receives its heating power from a heating element 16 arranged beneath the panel 14.

[0079] A carrier 18 supports the heating element 16. Said carrier 18 is arranged beneath the heating element 16. The carrier 18 is a metallic plate, preferably made of an aluminium material, and may be of an extension adapted to carry all four heating elements 16 (as illustrated in FIG 1), in that having dimensions close to the dimensions of the glass panel 14. Alternatively, four carriers 18 are provided, each carrier 18 supporting merely one dedicated heating element 16 (as illustrated in FIG 2).

[0080] The cooking hob 10 further comprises a control panel 20 for controlling the cooking hob functions. The control panel 20 includes touch sensors and display means corresponding with a user interface zone 21 arranged at the front edge of the glass panel 14.

[0081] Preferably, the heating element 16 is an electric heating element. At least one printed circuit board 22 is arranged above the bottom wall 12a of the casing 12. A plurality of electric and/or electronic elements 24 is attached on the printed circuit board 22. The printed circuit board 22 and the electric and/or electronic elements 24 form the circuit of the cooking hob 10.

[0082] In this example, the cooking hob 10 is an induction cooking hob, wherein the heating element 16 is a heating coil unit comprising an induction coil 26 and the carrier 18 is a coil carrier.

[0083] According to FIG 2 which in particular shows an exploded perspective view of the heating coil unit 16 of the induction cooking hob 10 including the dedicated carrier 18, the heating coil unit 16 comprises in addition to the induction coil 26 eight iron cores or ferrite 28 which are radially arranged between the carrier 18 and the induction coil 26 for empowering the magnetic field. A first discoid mica layer 30 is arranged between the iron cores or ferrite 28 acting as a spacer between the induction coil 26 and the eight iron cores or ferrite 28. This first mica layer works also as a support means for the induction coil 26 which does not influence or affect the high-frequency magnetic field and which is not acting as an electric isolator. FIG 2 also shows a second mica layer 32 (not shown in FIG 1) arranged directly beneath the panel 14, but above the heating coil unit 16, in that separating the heating coil unit from the glass panel 14. The second mica layer 32 provides for electrical isolation of conducting parts of the heating element 16 towards panel 14. In case of the panel 14 being a glass ceramic panel, the isolating effect of such material is more and more decreasing when heated up to a temperature of more than about 400 centigrades. Then the second mica layer 32

takes more and more over the electrical isolation, and fully taking over when the glass ceramic temperature is exceeding 700 centigrades. In addition, the second mica layer 32 may work as an additional safety element against electric shocks in case of damages to the panel 14.

[0084] The second mica layer 32 is partly of a square base, but with two diagonally arranged edges made round and following the circular shape of the induction coil 26 in these edges. Further, the heating coil unit 16 is equipped with a temperature sensor 36 for sensing the temperature of the cooking zone 15 in order to provide a user of the cooking hob 10 with a residual heat information. The temperature sensor 36 is inserted bottom-up into an aperture building a center zone of the induction coil 26 and is touching a sensor needle 38 arranged above the induction coil 26, said sensor needle 38 passing the cooking zone temperature on to the sensor 36. In order to separate the sensor needle 38 thermally and electrically from the induction coil 26, a discoid isolation layer 34 is interposed between these two components 26, 38. Congruent with the center zone of the induction coil 26, the isolation layer also comprises a center zone 52 which also receives the temperature sensor 36 in order to enable the sensor 36 to get into contact with the sensor needle 38. Finally, also the first mica layer 30 and the carrier 18 are provided with congruent apertures 46, 48 allowing a sensor cable 50 to pass therethrough for being connected to the control panel 20 (not shown).

[0085] As can be seen in FIGs 1 and 3, a third mica layer 40 is arranged between the heating coil unit 16 and the electric and/or electronic elements 24, more specifically between carrier 18 and the electric and/or electronic elements 24. The third mica layer 40 extends substantially in a horizontal plane. The third mica layer 40 may either cover the whole cross-section of the casing 12 (as shown in FIG 1) or only a part of the casing 12. Further, two or more third mica layers 40 may be arranged between the carrier 18 and the electric and/or electronic elements 24, wherein each of said third mica layers 40 covers a part of said electric and/or electronic elements 24. The third mica layer 40 provides an electric and/or thermal insulation between the carrier 18 and the electric and/or electronic elements 24. Preferably, the third mica layer 40 is glued to the bottom side of the carrier 18.

[0086] The first, second and third mica layers 30, 32, 40 are dielectric layers. Mica is a group of sheet silicate minerals having a substantially perfect basal cleavage. Said substantially perfect basal cleavage is obtained by hexagonal or pseudo-hexagonal sheet-like arrangement of the atoms. The mica layers 30, 32, 40 provide the electric and/or thermal insulation with a small layer thickness. The thin mica layers 30, 32, 40 allow a small height of the cooking hob 10.

[0087] A typical thickness of a mica layer is between 0.1 mm and 0.5 mm, in particular 0.3 mm. The dielectric strength of a mica layer is bigger than 18 kV/mm. Further, a mica layer has a heat resistance of about 400°C. For example, the thermal conductivity of a mica layer is about

0.3 W/(m*K).

[0088] Further, the third mica layer 40 may be arranged between the heating coil unit 16 and/or its carrier 18 on the one hand and a cooling means 42 of the cooking hob 10 on the other hand. Preferably, said cooling means or cooling channel or cooling body 42 extends horizontally through the cooking hob 10. An air stream driven by at least one fan 44 passes the cooling channel 42 and/or cooling means and/or cooling body and cools down the electric and/or electronic elements 24.

[0089] Moreover, the third mica layer 40 may be a multilayer film including one or more mica layers and at least one conductive layer. For example, the conductive layer is connected to the grounded casing 12. The conductive layer connected to the ground can absorb electromagnetic disturbances from induction coils. Further, the conductive layer may be connected to another appropriate potential of the circuit of the cooking hob 10.

[0090] For example, the conductive layer provides an electric strength increasing material or element between the heating element 16 and the electric and/or electronic elements 24. In particular, high frequency currents pass the induction coil 16, which may disturb the electric and/or electronic elements 24 and electric and/or electronic circuits.

[0091] The specific embodiment according to FIGs 1 to 3 is provided with a third mica layer 40 having a thickness of 0.33 mm. According to the material characteristics of mica, its dielectric strength is at least 15 kV/mm. Following the above-mentioned specific thickness, the third mica layer 40 allows protection against 5 kV arcing. Consequently, the selected third mica layer 40 provides a sufficient protection meeting also the requirements of standard specifications requiring electric shielding or protection against 2.5 kV arcing only.

[0092] The inventive cooking hob 10 with the mica layer 40 allows a small distance between the heating element 16 and the electric and/or electronic elements 24, so that the cooking hob 10 may be realised with the small construction height. Further, the mica layer 40 provides the electric and/or thermal insulation between the carrier 18 and the electric and/or electronic elements 24. Moreover, the mica layer 40 with the integrated conductive layer allows the electric strength increasing material or element between the heating element 16 and the electric and/or electronic elements 24.

[0093] The embodiments in the figures may relate to preferred embodiments, while all elements and features described in connection with embodiments may be used, as far as appropriate, in combination with any other embodiment and feature as discussed herein, in particular related to any other embodiment discussed further above.

[0094] The features of the present invention disclosed in the specification, the claims, examples and/or the figures may both separately and in any combination thereof be material for realizing the invention in various forms thereof.

List of reference numerals

[0095]

5	10	cooking hob
	12	casing
	12a	bottom wall
	12b	side walls
	14	panel
10	15	cooking zone
	16	heating element
	18	carrier of the heating element
	20	control panel
	21	user interface zone
15	22	printed circuit board
	24	electric and electronic elements
	26	induction coil
	28	ferrite
	30	first mica layer
20	32	second mica layer
	34	isolation layer
	36	temperature sensor
	38	sensor needle
	40	third mica layer
25	42	cooling means / cooling channel / cooling body
	44	fan
	46	mica layer aperture
	48	carrier aperture
	50	sensor cable
30	52	isolation layer center zone

Claims

- 35 1. A household cooking hob (10) comprising at least one heating power transferring elements (16), wherein:
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- the cooking hob (10) comprises at least one electric and/or electronic element (24),
 - the at least one heating power transferring element (16) is arranged above and/or supported by at least one heating power transferring element carrier (18) or heating power transferring element support,
 - the at least one electric and/or electronic element (24) is arranged beneath the at least one heating power transferring element (16) and the at least one heating power transferring element carrier (18) or heating power transferring element support,
 - the cooking hob (10) comprises at least one electric strength increasing material or element (40), and
 - at least a part of the electric strength increasing material or element (40) is arranged between at least a part of the at least one heating power transferring element carrier (18) or heating power
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er transferring element support on the one hand and the at least one electric and/or electronic element (24) on the other hand.

2. The cooking hob according to claim 1,
characterised in that
the at least one electric strength increasing material or element (40) is made of at least one electric insulating material, preferably having a coefficient of resistivity of about at least $1 \cdot 10^8 \Omega \cdot m$, preferably at least $1 \cdot 10^9 \Omega \cdot m$, more preferably at least $1 \cdot 10^{10} \Omega \cdot m$, and most preferably at least $1 \cdot 10^{12} \Omega \cdot m$. 5
3. The cooking hob according to any one of the preceding claims,
characterised in that
the at least one electric strength increasing material or element (40) has a planar shape, having preferably a thickness between 0.01 mm and 5.0 mm, more preferably between 0.05 mm and 4.0 mm, more preferably between 0.1 mm and 3.0 mm, more preferably between 0.2 mm and 2.0 mm, more preferably between 0.25 mm and 1.0 mm, more preferably between 0.29 mm and 0.5 mm, most preferably a thickness of about 0.33 mm. 10 15
4. The cooking hob according to any one of the preceding claims,
characterised in that
the at least one electric strength increasing material or element (40) has a dielectric strength more than 10 kV/mm, preferably more than 50 kV/mm, more preferably more than 100 kV/mm, most preferably more than 150 kV/mm. 20 25
5. The cooking hob according to any one of the preceding claims,
characterised in that
the at least one electric strength increasing material or element (40) has a heat resistance of about at least $100^\circ C$, preferably at least $200^\circ C$, more preferably at least $300^\circ C$, most preferably at least $400^\circ C$. 30 35
6. The cooking hob according to any one of the preceding claims,
characterised in that
the at least one electric strength increasing material or element (40) has a high frequency dampening characteristic or is equipped with a material or layer with a high frequency dampening characteristic, the material or layer in particular consisting of or comprising a soft iron material and/or the material or layer in particular being effective within the range between 9 kHz and 150 kHz, more preferably within the range between 18 kHz and 100 kHz. 40 45 50
7. The cooking hob according to any one of the preceding claims, 55

characterised in that

the at least one electric strength increasing material or element is a mica layer (40) or sheet or an aramid fiber or aramid polymer layer or sheet, wherein preferably the layer (40) or sheet or at least a part thereof extends over a horizontal plane.

8. The cooking hob according to any one of the preceding claims,
characterised in that
the at least one electric strength increasing material or element (40) is attached to the heating power transferring element carrier (18) or heating power transferring element support, in particular to the lower surface or lower side thereof. 10
9. The cooking hob according to any one of the preceding claims,
characterised in that
the at least one electric strength increasing material or element (40) is a separate layer or sheet attached to, in particular fixed to or glued to, a surface of the heating power transferring element carrier (18) or heating power transferring element support, in particular to the lower surface thereof, or is a material applied to, preferably by means of coating, a surface of the heating power transferring element carrier (18) or heating power transferring element support, in particular applied to the lower surface thereof. 20 25
10. The cooking hob according to any one of the preceding claims,
characterised in that
at least one cut-out or aperture (46) is arranged in the at least one electric strength increasing material or element (40) which corresponds to a cut-out or aperture (48) arranged in the heating power transferring element carrier (18) or heating power transferring element support, wherein preferably the cut-out or aperture (46) of the electric strength increasing material or element is smaller than the cut-out or aperture (48) of the heating power transferring element carrier (18) or heating power transferring element support. 30 35 40
11. The cooking hob according to claim 10,
characterised in that
the at least one electric strength increasing element (40) is fixed to or glued to the heating power transferring element carrier (18) or heating power transferring element support or the heating power transferring element carrier (18) or heating power transferring element support is coated with the electric strength increasing material, wherein an inner edge or a bent up inner ring zone of the cut-out or aperture (48) of the heating power transferring element carrier (18) or heating power transferring element support is covered by an inner ring zone bordering the cut- 45 50 55

out or aperture (46) of the electric strength increasing element (40).

12. The cooking hob according to any one of the preceding claims, 5
characterised in that
 the profile of the at least one electric strength increasing material or element (40) is at least partially adapted to the surface profile of the at least one electric and/or electronic element (24) or of a group of 10
 electric and/or electronic elements (24), in particular of a printed circuit board (22) particularly belonging to a power electronics of the cooking hob (10), wherein preferably the distance between the at least 15
 one electric strength increasing element (40) and the top sides of the electric and/or electronic elements (24) is at least approximately constant.
13. The cooking hob according to any one of the preceding claims, 20
characterised in that
 at least one electric strength increasing material or element (40) is a multilayer film including one conductive layer or sheet, wherein preferably the at least 25
 one conductive layer is grounded.
14. The cooking hob according to claim 13,
characterised in that
 at least one conductive layer or sheet is connected to the printed circuit board (22), wherein preferably 30
 at least one conductive layer or sheet is connected to a predefined electric potential.
15. The cooking hob according to claim 13 or 14, 35
characterised in that
 the conductive layer or sheet provides an electric and/or electromagnetic shielding between the heating power transferring element (16) on the one hand and the electric and/or electronic elements (24) on 40
 the other hand.

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Fig.1

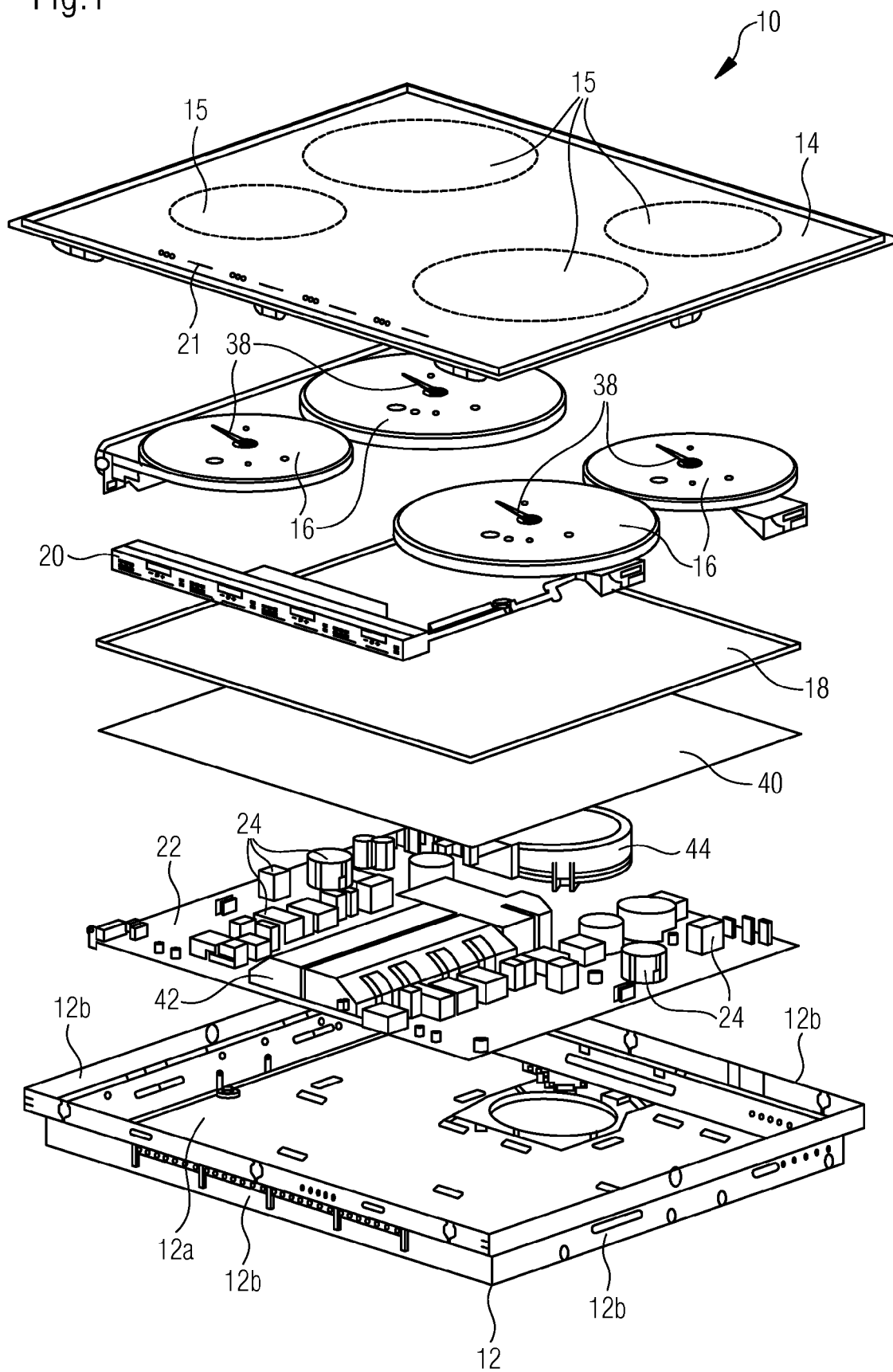


Fig.2

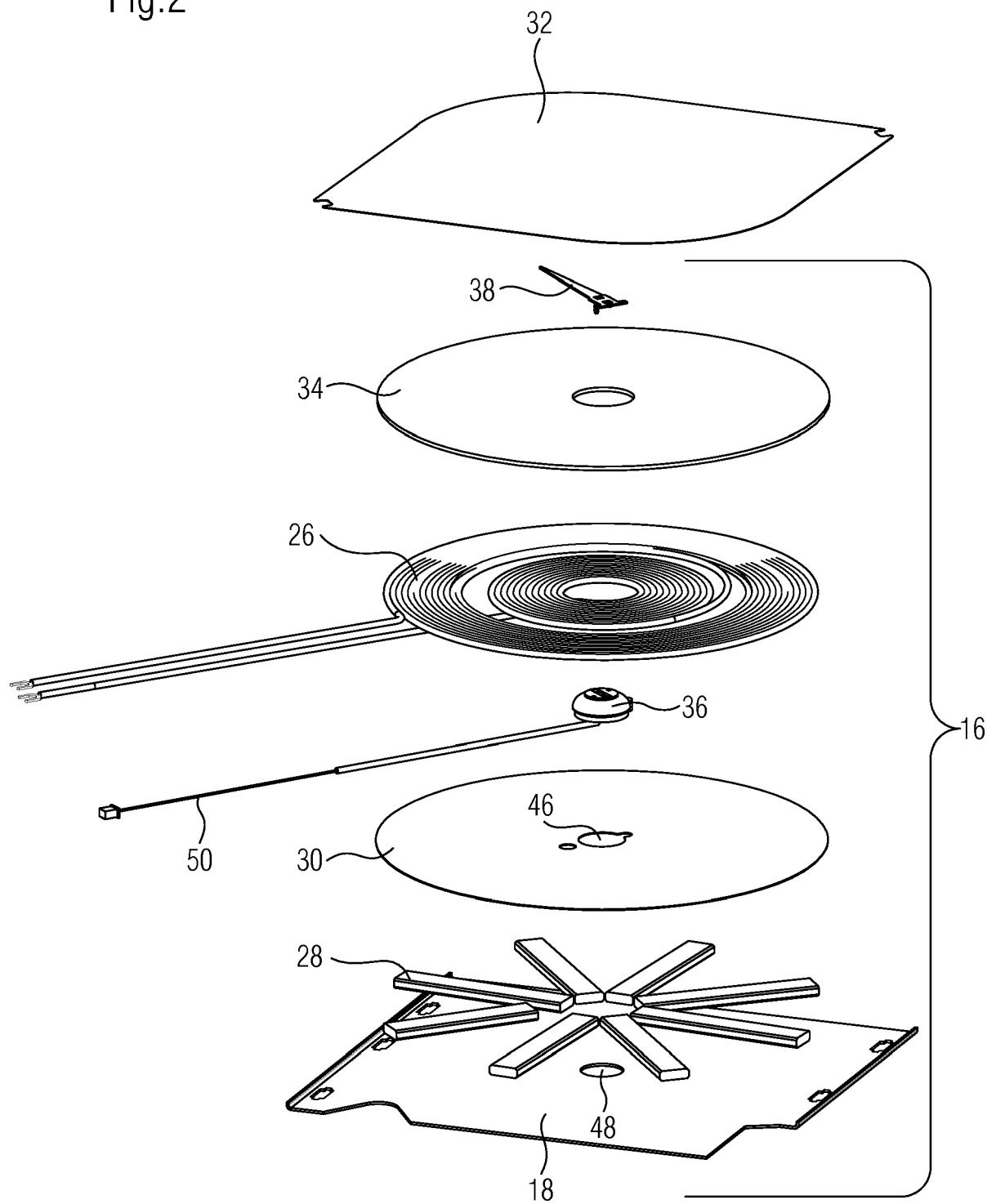
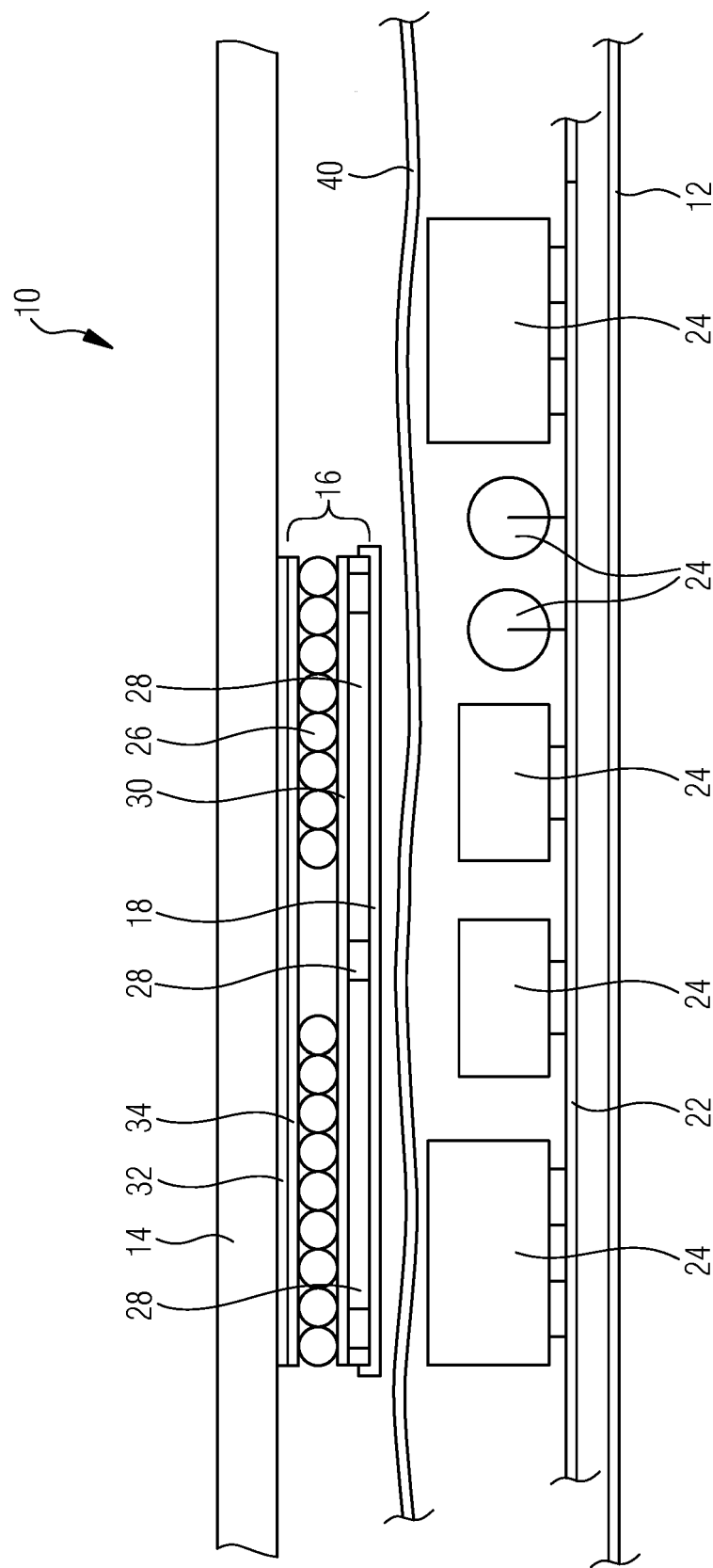


Fig.3





EUROPEAN SEARCH REPORT

Application Number
EP 18 18 6828

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2013/118026 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]; BEIFUSS WOLFGANG [DE]; HAS UWE [DE] 15 August 2013 (2013-08-15) * page 16, lines 11-15; figures 1,3 * -----	1-15	INV. F24C7/08 H05B6/12 F24C7/06
X	US 2016/113070 A1 (SUZUKI HIDEKAZU [JP] ET AL) 21 April 2016 (2016-04-21) * paragraph [0096]; figure 6 * -----	1	
A,P	EP 3 267 766 A1 (PANASONIC IP MAN CO LTD [JP]) 10 January 2018 (2018-01-10) * figures 2,3 * -----	1-15	
A	US 2010/237064 A1 (LIU HSI-AN [TW] ET AL) 23 September 2010 (2010-09-23) * figure 1 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			H05B F24C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 November 2018	Examiner Adant, Vincent
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 18 6828

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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08-11-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013118026 A1	15-08-2013	DE 112013000918 A5	23-10-2014
		ES 2423381 A2	19-09-2013
		WO 2013118026 A1	15-08-2013
US 2016113070 A1	21-04-2016	CN 105409326 A	16-03-2016
		EP 3038432 A1	29-06-2016
		ES 2654058 T3	12-02-2018
		JP 6323691 B2	16-05-2018
		JP W02015025523 A1	02-03-2017
		US 2016113070 A1	21-04-2016
		WO 2015025523 A1	26-02-2015
EP 3267766 A1	10-01-2018	EP 3267766 A1	10-01-2018
		JP W02016139942 A1	14-12-2017
		WO 2016139942 A1	09-09-2016
US 2010237064 A1	23-09-2010	TW 201036493 A	01-10-2010
		US 2010237064 A1	23-09-2010

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2016139942 A1 [0003]