



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.06.2022 Bulletin 2022/23

(51) International Patent Classification (IPC):
F24C 15/10 ^(2006.01) **H05B 6/12** ^(2006.01)
H05B 3/68 ^(2006.01)

(21) Application number: **20211478.1**

(52) Cooperative Patent Classification (CPC):
H05B 6/1209; F24C 15/104; H05B 3/68;
H05B 2206/022

(22) Date of filing: **03.12.2020**

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

- **REBELEIN, Elisabeth**
91541 Rothenburg (DE)
- **LEYH, Björn**
91541 Rothenburg ob der Tauber (DE)
- **BAYERLEIN, Stefan**
91541 Rothenburg ob der Tauber (DE)
- **KLEIN, Gerhard**
91541 Rothenburg ob der Tauber (DE)
- **HÄUTLE, Ulrich**
91541 Rothenburg ob der Tauber (DE)

(71) Applicant: **ELECTROLUX APPLIANCES**
AKTIEBOLAG
105 45 Stockholm (SE)

(74) Representative: **Electrolux Group Patents**
AB Electrolux
Group Patents
S:t Göransgatan 143
105 45 Stockholm (SE)

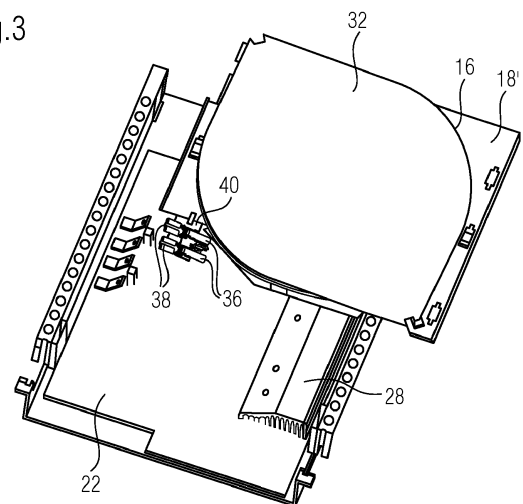
(72) Inventors:
• **NEUKAMM, Alwin**
91541 Rothenburg ob der Tauber (DE)

(54) **ELECTRICAL COMPONENT, HOUSEHOLD APPLIANCE AND METHOD FOR MANUFACTURING A HOUSEHOLD APPLIANCE**

(57) An electrical component (16, 64) for a household appliance (10) comprises at least one connection cable (36, 62), particularly a flexible connection cable, with a first end connected to the electrical component (16, 64) and a second end. The second end comprises at least one terminal (38) or conductor end (74). According to the invention, the second end and/or the at least one terminal (38) or conductor end (74) is retained by a retaining element (40, 68) in such a way that at least the at least one terminal (38) or conductor end (74) is accessible to a tool, in particular a production tool, or an instrument, in particular a measuring instrument.

Further disclosed is a household appliance (10) comprising or being configured to receive an electrical component (16, 64) and particularly a retaining element (40, 68), as well as a method for manufacturing a household appliance (10).

Fig.3



Description

[0001] The present invention relates to an electrical component for a household appliance, particularly a cooking appliance, more particularly a cooking hob, even more particularly an induction cooking hob, according to the preamble of claim 1. The present invention relates further to a household appliance according to claim 11. Finally, the present invention relates to a method for manufacturing a household appliance, particularly a cooking appliance, more particularly a cooking hob, even more particularly an induction cooking hob, according to claim 13.

[0002] Generally, household appliances are assembled from modular components, which may be individual parts, e.g. motors, heating elements, a mains terminal box, or the like, or systems or subsystems, which themselves may be an assembly of single parts, e.g. printed circuit boards like control units or user interfaces. A relevant number of said modular components is of electrical nature, which modular components have to be supplied with electrical energy and which are electrically connected with other electrical components for information and/or power transfer. In production facilities for household appliances, nowadays, there is already an advanced level of automation, which is reflected in an automated assembly of components, for example arrangeable in a housing of the household appliance. However, there are still manual assembly steps required for establishing electrical contacts, particularly by connecting plug contacts of wiring harnesses.

[0003] It is an object of the present invention to provide a household appliance and/or an electrical component for a household appliance, which is or are constructed in such a way that the level of automation in production facilities of household appliances can be further increased. It is a further object of the present invention to provide a method for assembling a household appliance, which supports an advanced level of automation during manufacturing a household appliance.

[0004] The object is achieved by an electrical component for a household appliance comprising at least one connection cable, which may be a flexible connection cable, with a first end connected to the electrical component and a second end. The second end comprises at least one terminal or conductor end. According to the present invention, the second end and/or the at least one terminal or conductor end is retained by a retaining element in such a way that at least the at least one terminal or conductor end is accessible to a tool, in particular a production tool, e. g. a handling element, a gripper or the like, or an instrument, in particular a measuring instrument.

[0005] The main purpose of the arrangement according to the present invention is to provide an access to the electrical connection or connections of an electrical component that has been just integrated in or mounted at a household appliance in a production line of said house-

hold appliance. The access shall be provided for executing an internal wiring in the interior of the household appliance or its external connection, which internal wiring or external connection shall preferably be carried out by an automated process, particularly by an assembly robot or a robot for any other kind of treatment.

[0006] The household appliance is particularly a cooking appliance and may be a cooking hob, in particular an electrically driven cooking hob. A specifically selected household appliance is an induction cooking hob.

[0007] The at least one connection cable may be one of a power cable, a sensor cable, a control cable and a shield cable. In case of a plurality of connection cables is included, a mixture of the afore-mentioned cable types may be implemented.

[0008] At least two connection cables may be included in the electrical component, which particularly comprise terminals or conductor ends collected in a multiple connector, e. g. a group connector. In this case, the multiple connector, particularly a housing of the multiple connector, may be accessible to the tool or instrument, e. g. for a simultaneous and/or joint handling of the at least two connection cables. Moreover, the group connector may be retained by the retaining element or the multiple connector, in particular a housing thereof, may even form at least partly or a part of the retaining element.

[0009] According to an embodiment, fixation means are arranged at the electrical component and/or the retaining element for its or their fixation to the household appliance. Said fixation means are arranged and/or designed in a way that the at least one terminal or conductor end is accessible to the tool or the instrument after the installation of the electrical component and/or the retaining element in the household appliance. The at least one terminal or conductor end may comprise a non-insulated section, which may provide access to the tool or the instrument. The non-insulated section is particularly interesting for establishing an electrical connection for either providing power supply or for measurement purposes.

[0010] The retaining element may form an auxiliary means for supporting a process step in a production line and it may be configured to be removed during a subsequent process step or even only prior to an installation of the household appliance at its installation location. In the latter case the retaining element may also form a transportation aid.

[0011] According to a first particularly preferred embodiment of the invention, the retaining element is connected to the electrical component. It may be connected to a housing or casing or frame part of the electrical component. Alternatively to said connection to the electrical component, the retaining element may be connected to a supporting element of the electrical component, which supporting element may be configured to be assembled in the household appliance during the same assembly process step as the electrical component. The retaining element is particularly made of a plastic material. Said connection may be executed in a rigid way. The retaining

element may permanently be connected to the electrical component. Preferably, the connection is present in an unmounted state of the electrical component, and the retaining element is no longer connected to the electrical component, when the household appliance is fully assembled. To this end, a step of removal of the retaining element may be implemented in the manufacturing process.

[0012] With the composition of a retaining element, which is connected, particularly rigidly connected, to the electrical component or to the supporting element of the electrical component, also a predetermined positioning of the retaining element in relation to the household appliance is provided after the implementation of the electrical component or of the supporting element of the electrical component at its predetermined position inside of or at the household appliance.

[0013] More specifically, the retaining element is connected in one piece with the electrical component or with the supporting element of the electrical component. It is preferably configured to be broken off the electrical component or its supporting element. Alternatively, the retaining element may be a separate unit, which is releasably attachable to the electrical component or to the supporting element of the electrical component. A releasable attachment may be provided by means of any kind of fixation means, for example formed as snapping or clipping means. Also a generally inseparable attachment of the retaining element at the electrical component or at its supporting element, however, with implementation of a predetermined breaking point or edge for an effortless break off of essential portions of the retaining element may be considerable.

[0014] The retaining element may comprise at least a first member and a second member. In particular, the first member is included in or attached at the electrical component, or at a housing part or carrier thereof, and the second member is included in or arranged at the at least one terminal or conductor end or specifically in or at the multiple connector. First and second members of the retaining element may be separable from each other, either by breaking in two or by releasing a releasable connection between them. Said releasable connection may be designed as a bayonet connection or a click connection.

[0015] Alternatively, the retaining element may be connected both during and after the installation of the electrical component, i. e. the at least one terminal or conductor end is not released. Instead, the retaining element may be a flexible element or may comprise a flexible portion that is utilized for performing a connection movement.

[0016] A preferred embodiment of the present invention is characterized by a retaining element, which is designed for an automatic assembling process, particularly also including an automatic connecting process. By such specific design, the retaining element and/or the at least one terminal or conductor end is configured to be grabbed

by a tool, more specifically by an assembly tool, e. g. by a gripper, for its or their final placement, particularly for connecting the at least one terminal or conductor end to a related counterpart. In order to facilitate such automated handling process, a defined orientation in relation to the retaining element is advantageous. A preferred installation direction, particularly on an assembly line, is an at least approximate vertical direction, so that a respective vertical orientation of the at least one terminal or conductor end is favourable. Such favourable orientation also results in a simple handling for the connection process, because there is no need for any turning or rotating of the terminal or conductor end during the connection process.

[0017] Moreover, in order to ensure a secure automated handling process, e. g. by avoiding a destruction of any component, particularly of the at least one terminal or conductor end, or preventing any mismating, particular design elements or features as for example reinforcement means and/or defined reference positions may be envisaged.

[0018] One specific embodiment is characterized by an electrical component, which is a heating element of a cooking hob. In the case of an induction cooking hob, the electrical component is an induction coil. Then, the at least one connection cable is a power cable and/or a sensor cable. Said sensor cable may be adapted for the connection of a temperature sensor, which is particularly connected or connectable to an evaluation unit that is preferably included in a control electronics of the household appliance. The power cable is particularly connectable to a power board of the cooking hob.

[0019] The retaining element favourably comprises a mounting fixture for receiving and/or holding at least a portion of the connection cable. Said portion may be a section of the cable wire or at least a part of the terminal or conductor end, particularly a connector attached at the conductor end.

[0020] According to a second particularly preferred embodiment of the invention, the retaining element is a unit separate from the electrical component and it is configured to include the connection cable. The connection cable may be included or retained in a bundled and/or coiled way. More specifically, the electrical component is a mains terminal block and the connection cable is a mains power cable.

[0021] The retaining element is preferably a two-part plastic unit with a first part and a second part and the connection cable, in particular the bundle or the coil of the connection cable, is retained between the first part and the second part. At least one of the first and the second parts is preferably shaped as a four-armed starfish. If both the first and the second parts are shaped in said starfish design, these parts may be designed of comparable dimensions and/or they may be connectable with each other at the ends of their arms.

[0022] More specifically, the first part and the second part are formed in one piece and an integral hinge is

included for folding the first and second parts in a way that they are arranged in parallel to each other. Advantageously, the first and second parts are congruent with each other, what may be favourable in regards to their connection at the ends of their arms. Said hinge is preferably a film hinge in order to enable a facilitated folding. The hinge, particularly the film hinge, may be arranged at one connection point, i. e. at the end of one of the arms of the first part and of the second part. For establishing the connection of the first and the second part snapping means may be provided at at least one of the two parts.

[0023] Alternatively, the first part and the second part may be two individual units, which may be arranged next to each other in an assembled state, i.e. when they are fixed to the household appliance, particularly to a housing part of the household appliance. To this end, fixation means may be arranged at both the first part and at the second part, which fixation means interact with attachment means at the household appliance.

[0024] One preferred embodiment provides a middle section of the retaining element, which comprises a holding device for holding the at least one second end and/or the at least one terminal or conductor end. More specifically, the connection cable is not only equipped with a single second end. In fact, a plurality of second ends and/or terminals or conductor ends is included. In that case, the holding device is configured to hold a plurality of second ends and/or terminals or conductor ends in separated divisions or compartments. To this end, said middle section particularly offers sufficient space for an arrangement of said plurality of second end and/or of said terminals or conductor ends, preferably in a side-by-side or similar two-dimensional establishment.

[0025] The holding device may comprise an open access for enabling approach by the tool or instrument, in particular by a test equipment. The tool, preferably automated tool, may be configured to grab the at least one second end and/or the terminal or conductor end, for example for its connection to another electrical component or to a test equipment. An alternative and in many situations preferred solution is characterized by a holding device, which provides a test port for a test equipment, which directly contacts the second end or terminal or conductor end, more specifically at least two terminals or conductor ends, for testing purposes, in particular for end-of-line tests.

[0026] The object is also achieved by a household appliance, which comprises or is configured to receive an electrical component and particularly a retaining element according to anyone of the above-described embodiments. The household appliance is particularly a cooking appliance and may be a cooking hob, in particular an electrically driven cooking hob. A specifically selected household appliance is an induction cooking hob. The electrical component may be any kind of consumer load, which has to be connected to another electrical component of the household appliance by a connection cable, in particular a power cable and/or an information trans-

mission cable, particularly a sensor cable. In the case of a cooking hob, the electrical component is specifically a heating unit, which is supplied with electrical power using a power cable and which is preferably equipped with a temperature sensor that has to be connected to an evaluation unit via a sensor cable for sensor signal transmission.

[0027] All above described specific features of the electrical component and advantages earlier disclosed in relation to the electrical component are also valid for the household appliance.

[0028] The household appliance particularly comprises attachment elements, which interact with the fastening means of the electrical component. If the retaining element comprises own fastening means, specifically in the case of the retaining element being a separate unit that is not connected, e. g. mechanically and/or fixedly connected to the electrical component, said attachment means may also interact with these fastening means of the retaining element.

[0029] The object is also achieved by a method for manufacturing a household appliance, which comprises the steps

- b. installing an electrical component, which comprises at least one connection cable in the household appliance;
- c. approaching a second end and/or at least one terminal or conductor end of the at least one connection cable by a tool or an instrument, wherein the second end and/or at least one terminal or conductor end is retained by a retaining element,; and
- d. acting on the second end and/or the at least one terminal or conductor end by the tool or the instrument.

The steps b., c. and d. are consecutive steps, i. e. the step b. is the first one and the step d. is the final one of the manufacturing steps b. to d..

[0030] All above described specific features of the electrical component and/or of the household appliance and advantages earlier disclosed in relation to the electrical component and/or to the household appliance are correspondingly valid also for the method for manufacturing the household appliance.

[0031] The connection cable is particularly a flexible connection cable. It is preferred to use an automated assembling process for the installation of the electrical component.

[0032] At least step b., but preferably each of the assembly steps b., c. and d., may be performed during an automated assembling or treatment process, particularly by an assembling or treatment movement of an automated tool in a movement direction at least approximately orthogonally to a base area of the household appliance, e. g. of a housing or an installation casing thereof. Said at least approximately orthogonal movement direction may be a preferred direction for the assembling or treat-

ment movement, however, other movement direction may be envisaged as well. Any diagonal movement may be conceivable as well as any rotating movement of the electrical component and/or the at least one terminal or conductor end. The assembling or treatment tool is particularly an assembly or treatment robot.

[0033] The household appliance, to which the method applies or which is designed for the method to be applied on, is particularly a cooking appliance and may be a cooking hob, in particular an electrically driven cooking hob. A specifically selected appliance is an induction cooking hob. Further, the method may be applicable to a household appliance according to anyone of the afore-described embodiments.

[0034] A first particularly preferred embodiment of the method according to the invention provides that prior to step b. a step a. is performed, which includes a manufacturing process of the electrical component including the retaining element that is connected to the electrical component or to a supporting element of the electrical component. With the composition of a retaining element, which is connected, particularly rigidly connected, to the electrical component or to a supporting element of the electrical component, a fixed allocation between the retaining element and the electrical component is realized. As a consequence, a predetermined positioning of the electrical component inside of the household appliance is established, when the electrical component or its supporting element, has been installed at its predetermined installation position. In further accordance with this specific embodiment, the second end and/or the terminal or the conductor end is disconnected from the electrical component or from the supporting element of the electrical component during or after step d.. This act of disconnection is particularly performed by means of an automated manufacturing process.

[0035] Said disconnection may include either breaking off the retaining element from the electrical component, in particular from a housing or casing part or from a frame part thereof, or from the supporting element of the electrical component. Such a break off may be a simplified execution in the case of the retaining element being a plastic part. After said disconnection, notably by a break-off, a scrapping of the retaining element, which may simply be a mounting aid for an automated manufacturing process, may follow. Alternatively, the disconnection of the retaining element may be performed together with the disconnection of the flexible connection cable, particularly of its second end and/or of the at least one terminal or conductor end thereof, and at least parts of the retaining element may be left to the second end or to at least one terminal or conductor end.

[0036] Generally, the retaining element could stay with the electrical component, however, in case of the electrical component being a heating element and the retaining element being a plastic part, the afore-described disconnection may be advantageous or even necessary, specifically if the plastic material of the retaining element

is not heat-resistant.

[0037] A particular embodiment of the method according to the invention provides that step d. is performed onto at least a first and a second single wire, particularly onto a plurality of single wires, of the connection cable. Further, the connections of the single wires may be performed jointly by way of a group connection. According to an alternative solution, the connections are performed by individual handling of the single wires in consecutive connecting steps.

[0038] According to a second particularly preferred embodiment of the method according to the invention, the manufacturing process comprises an end-of-line test for at least one capability test performed onto the household appliance. This specific test includes test contacts of a test equipment to act on the second end and/or the at least one terminal or conductor end. Said test contacts are automatically connected to or automatically contact the second end and/or the at least one terminal or conductor end for an electrical connection and/or supply of the household appliance. Preferably, the test contacts are put into contact with the terminals of a main power cord.

[0039] After connection of or after contacting the test contacts, an automated test procedure is particularly executed and after completion of the test procedure the test contacts may be automatically disconnected from the second end and/or the at least one terminal or conductor end.

[0040] The described end-of-line test, which is preferably of a fully automated nature, may be a final manufacturing process and it may be followed by a packaging of the household appliance for its shipment. This packaging, and optionally a loading for the shipment, is preferably also a fully automated process.

[0041] Novel and inventive features of the present invention are set forth in the appended claims.

[0042] The present invention will be described in further detail with reference to the drawing, in which

- Fig. 1 illustrates the general structure of an induction cooking hob in an exploded perspective view;
- Fig. 2 is a perspective top view of an assembled induction cooking hob designed similar to Fig. 1 including component groups, according to a first example of the invention;
- Fig. 3 is a schematic perspective view of one power board of the induction cooking hob according to Fig. 2 with a first indication coil unit prior to its assembly;
- Fig. 4 illustrates the induction coil unit according to Fig. 3 in an isolated illustration;
- Fig. 5 is a detailed view of a handover unit with prepositioned induction coil terminals according

to detail V of Fig. 4;

Fig. 6 is an isolated illustration of the handover unit according to Fig. 5;

Fig. 7a shows the induction cooking hob according to Fig. 4 with separated and fragmented handover unit;

Fig. 7b shows the induction cooking hob according to Fig. 7a with an alternative terminal design;

Fig. 8 is a schematic perspective view of an induction cooking hob partly assembled with components indicated in Fig. 1, according to a second example of the invention;

Fig. 9 is a perspective view of the bottom side of the induction cooking hob according to Fig. 8 illustrating a mains cable connection unit including a cable holder;

Fig. 10 is a perspective detail view of the mains cable connection unit according to Fig. 9;

Fig. 11 is a perspective view of the mains cable connection unit of Fig. 10 with a section of the cable holder broken away; and

Fig. 12 is an isolated illustration of the cable holder according to Fig. 9 with unconnected parts.

[0043] Fig. 1 illustrates an exploded perspective view of the general structure of a cooking hob 10.

[0044] 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.

[0045] 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.

[0046] A carrier 18 supports the heating element 16. Said carrier 18 is arranged beneath the heating elements 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, in that having dimensions close to the dimensions of the glass panel 14. Alternatively, four carriers 18 may be provided, each carrier 18 supporting merely one dedicated heating element 16.

[0047] The cooking hob 10 further comprises a user interface 20 for enabling user inputs including also a control panel for controlling the cooking hob functions. The user interface 20 includes touch sensors and display means corresponding with a user interface zone 21 arranged at the front edge of the glass panel 14.

[0048] 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, 26 is attached on the printed circuit board 22. The printed circuit board 22 including the electric and/or electronic elements 24, 26 forms a power board of the cooking hob 10. Power electronic elements 26 for supplying the heating elements 16 with electrical power are attached to a cooling channel 28, which extends horizontally through the cooking hob 10. An air stream driven by at least one fan 30 passes the cooling channel 28 and cools down the power electronic elements 26.

[0049] In this example, the cooking hob 10 is an induction cooking hob, wherein the heating element 16 is a heating coil unit 16 comprising an induction coil and the carrier 18 is a coil carrier.

[0050] Fig. 2 illustrates schematically an assembled induction cooking hob 10 designed similar to Fig. 1 but showing a different model of the induction cooking hob 10. The assembly of Fig. 2 mainly differs from the solution of Fig. 1 in that the single power board 22 of Fig. 1, which is configured to supply all four cooking zones 15, is split into two power boards 22, each one thereof supplying two cooking zones 15 arranged one behind the other. According to further differences to Fig. 1, the heating coil units 16 arranged above the power boards 22 are covered with approximately oval insulation layers 32, and they are individually supported by four smaller coil carriers 18', rather than the full-surface solution of the coil carrier 18 of Fig. 1. Moreover, the user interface 20 is also shown without any details, but it extends only over the half width of the front edge of the cooking hob 10 and it is indicated as being arranged in a user interface carrier 34 that is supported against the bottom wall 12a of the casing 12.

[0051] A skilled person readily understands from the illustrations according to Figs. 1 and 2 that the induction cooking hob is assembled in layers, i. e. one component or module arranged above another one, starting with a bottom part, which in the present case is the casing 12, followed by the assembly of the power boards 22. The heating elements 16, i. e. the induction coil units, including their coil carriers 18' and insulation layers 32 arranged beneath and above, respectively, are positioned on top of the power boards 22. Fig. 3 illustrates the moment of assembling the first one of the induction coil units 16. Said induction coil unit 16 is supplied with electrical energy by means of a two-core power cable, which is indicated in Fig. 3 merely by the end sections of the two cores 36 and a blade terminal 38 attached to each one of said end sections. The other ends of the core (not shown) are

connected to the ends of the coil winding for the power supply of the coil winding.

[0052] In order to avoid that the two cores 36 with their blade terminal 38 loosely hang around during the assembly of the induction coil unit resulting in a disordered arrangement after the assembly, the blade terminals 38 are fixedly attached to the induction coil unit 16, in particular, as in the present case, to the coil carrier 18' supporting the induction coil. The induction coil and the coil carrier 18', together forming the induction coil unit 16, are jointly assembled in the cooking hob casing 12, i.e. during the same assembly step, so that during and after said assembly a fixed assignment of the blade terminals 38 to the induction coil is established. As a result, as soon as the induction coil unit 16 is fixedly arranged in the casing 12, a fixed positioning of the blade terminals 38 inside of the casing 12 at a predetermined location is arranged, so that a disordered arrangement is avoided. With said predetermined location of the blade terminals 38, an automated handling thereof, i. e. an automated establishment of an electrical connection to the assigned power board 22 is possible, which may be executed by an assembly robot picking up the blade terminals 38 for performing an automated connection to respective flat male plugs, notably arranged on a related one of the power boards 22. Said picking up and connecting to the flat male terminals is performed after the heating coil unit 16 has been positioned in the casing 12.

[0053] Fig. 4 is an illustration of the induction coil unit 16 in an isolated view and Fig. 5 shows an enlarged view of detail V of Fig. 4, which detail provides more details about the fixation of the blade terminals 38 to the coil carrier 18'. Said fixation is performed by means of a small support plate 40, which is releasably attached to the coil carrier 18' by two abutment pins 42 abutting on the bottom side of the coil carrier 18' and a snap-in hook 44 engaging a through-hole of the coil carrier 18' from a top side of the coil carrier 18'. That way, the abutment pins 42 and the snap-in hook 44 enclose an edge zone of the coil carrier 18' in a sandwich-like arrangement.

[0054] The afore-described fixation elements, i. e. the abutment pins 42 and the snap-in hook 44, are illustrated more clearly in Fig. 6, which is an isolated presentation of the small support plate 40 together with the supported blade terminals 38. For holding the blade terminals 38, the support plate 40 includes fixing pins 46, which laterally enclose a section of a blade terminal 38, thus retaining this blade terminals 38 on the support plate 40. In the enlarged presentations of Figs. 5 and 6 also a plug 48 for the connection of a temperature sensor 50 (see Figs. 1 and 2) is visible, whereas a related connection cable is not illustrated but will be readily implied by a skilled person.

[0055] Fig. 7a presents the arrangement of Fig. 4 with isolated components, i. e. the cores 36 with their blade terminals 38, the plug 48 and the support plate 40 are illustrated isolated from each other and from the induction coil with its coil carrier 18' and its insulation layer 32. This

isolated presentation of components also offer the view to a retaining clip 52 arranged at an edge of the support plate 40 for holding the plug 48.

[0056] The induction coil unit 16 arrangement of Fig. 7b is the same as that one of Fig. 7a. The only difference is the provision of alternative connection means, namely eyelet connectors 38' rather than blade terminals.

[0057] A second example for an electrical component comprising a flexible connection cable with terminals for an electrical connection, wherein the terminals are retained by a retaining element according to the present invention is illustrated in Figs. 8 to 12.

[0058] Fig. 8 schematically illustrates lower sections of the induction cooking hob 10 similar to the embodiment of Fig. 2. Like Fig. 2, Fig. 8 includes two power boards 22 in a side-by-side arrangement within a casing 12. Due to the fact that the induction cooking hob 10 according to Fig. 8 illustrates an assembly state prior to that one of the induction cooking hob 10 according to Fig. 2, the view on the power boards 22 arranged inside the casing 12 is provided. Further, also a power supply box 54 is visible, which is arranged in a gap 56 between the two power boards 22. The two power boards 22 are supplied with electrical power by connecting them with the power supply box 54 via individual electrical connections for phase, neutral and protective conductors formed as brackets 58, which are kept very short, what is favourable in particular with regard to electromagnetic compatibility. The power supply box 54 is arranged in a cutout of the bottom wall 12a of the casing 12 and opened to the bottom side of the bottom wall 12a, while the brackets 58 provide connection facility by downwards directed connectors, formed as flat male plugs, which penetrate an overhead ground area 60 of the power supply box 54.

[0059] The electrical connection of a mains power cable 62 is provided from the bottom side of the bottom wall 12a, as can be seen in Fig. 9. A direct connection is provided by a connection plate 64, which comprises blade terminals (not shown), which are arranged at the connection plate 64 in an inwardly looking manner, i. e. with blade terminals being directed towards the interior of the power supply box 54, and which are connected with the wires of the mains power cable 62. After fitting the connection plate and the power supply box 54 together, the blade terminals fit into and are connected with the flat male plugs provided by the brackets 58. That way, the mains power cable 62 is finally electrically connected to the cooking hob 10. For an undetachable fixation of the mains power cable 62, the connection plate 64 further includes a strain relief clamp 66.

[0060] In order to avoid that the mains power cable 62 is hanging loose from the cooking hob 10 after its connection by fitting the connection plate 64 and the power supply box 54 together, a cable wrapping retainer 68 is provided for holding the mains power cable 62 in place in a coiled arrangement. Said cable wrapping retainer 68 is a plastic element formed as a two-part unit. A lower part 68a of the cable wrapping retainer 68 abuts the bot-

tom side of the bottom wall 12a and is fixed to said bottom wall 12a by means of latching hooks (not illustrated in detail). An upper part 68b of the cable wrapping retainer 68 is put on the lower part 68a leaving a space between lower 68a and upper 68b parts. The coiled mains power cable 62 is clamped between the lower 68a and the upper 68b parts inside of the space, in that being fixed to the bottom wall 12a in its coiled arrangement without a possibility to slip. Also the upper part 68b comprises fixation means for its fixation to either the bottom wall 12a or to the lower upper part 68a. With that kind of mains power cable fixation, the finally assembled cooking hob 19 is in a state to be packaged for shipment (as illustrated with Fig. 9).

[0061] Fig. 10 is an individual presentation of the coiled mains power cable 62 retained in the cable wrapping retainer 68 and connected to the connection plate 64. Pre-assembled in this way, this arrangement may be delivered to the assembly line of the cooking hob 10, particularly provided by a supplier. As can be seen from Figs. 9 to 12, the cable wrapping retainer 68 is a unit shaped like a starfish with four arms 70. The afore-mentioned fixation means for the lower 68a and upper 68b parts, particularly the latching hooks, are arranged at the ends of the arms 70.

[0062] Besides its function as a retaining means for the mains power cable 62, the cable wrapping retainer 68 is also used as an auxiliary equipment for testing activities at the assembly line. As can be seen in Fig. 11, which illustrates the arrangement of Fig. 10, however, with one half of the upper part 68a being broken away, the lower part 68a includes separation compartments 72 for an isolated arrangement and fixation of the wire ends 74. Said separation may serve protection purposes. However, the major purpose of the separated wire ends 74 is to provide a contacting, preferably an automated contacting, of the mains power cable 62 during an end-of-line test without any need of grabbing said mains power cable 62 and manually connecting it to the testing unit at the end of the assembly line for testing the functionality and safety of the finally assembled cooking hob 10. To this end, the wire ends 74 are contactable by test contacts of a test equipment from above in a direction orthogonally to the bottom wall 12a. As particularly visible in Fig. 11, the wire ends 74 are accessible by the test contacts via connection ducts 76 arranged in the upper part 68b, with each one of the connection ducts 76 being allocated to one of the separation compartments 72 housing one of the wire ends 74.

[0063] It shall be noted that the cable wrapping retainer 68, which is illustrated in Fig. 12 individually and with separated lower 68a and upper 68b parts, is only in use until the cooking hob 10 is going to be finally installed in a user's kitchen. The installation technician has to release the mains power cable 62 from the cable wrapping retainer 68 prior to performing the electrical connection to the domestic electricity connection. However, the system is configured in a way that the release of the mains

power cable 62 is only possible after a detachment of the cable wrapping retainer 68, which may be disposed thereafter.

[0064] Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying drawing, it is to be understood that the present invention is not limited to that precise embodiment, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

15 List of reference numerals

[0065]

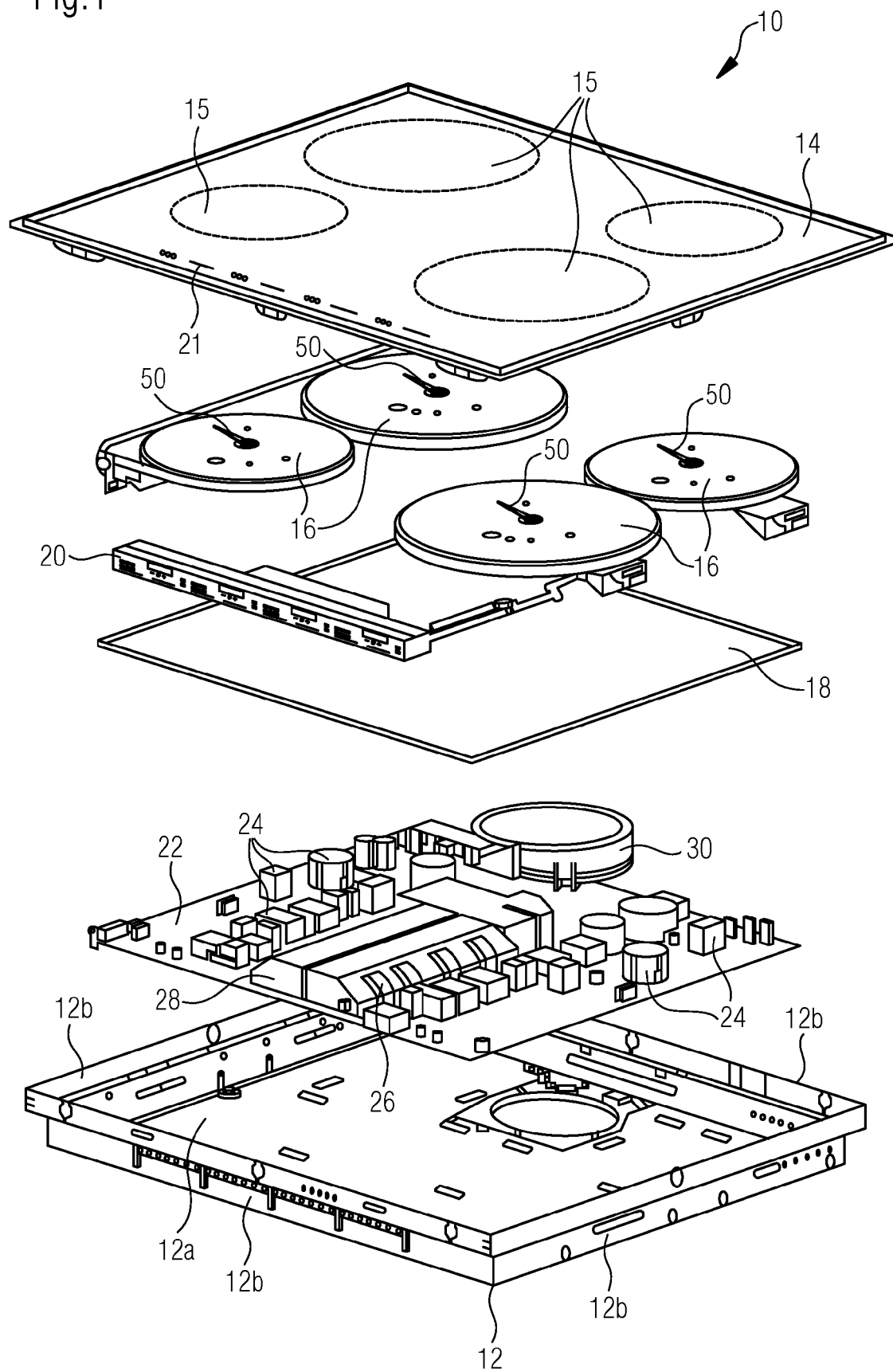
10	cooking hob
12	casing
12a	bottom wall
12b	side walls
14	glass panel
15	cooking zones
16	heating coil units
18, 18'	coil carriers
20	user interface
21	user interface zone
22	power board
24, 26	electric / electronic elements
28	cooling channel
30	fan
32	insulation layer
34	user interface carrier
36	cores
38	blade terminal
38'	eyelet connector
40	support plate
42	abutment pin
44	snap-in hook
46	fixing pins
48	plug
50	temperature sensor
52	retaining clip
54	power supply box
56	gap
58	bracket
60	ground area
62	mains power cable
64	connection plate
66	strain relief clamp
68	cable wrapping retainer
68a	upper part
68b	lower part
70	arms
72	compartments
74	wire ends
76	connection ducts

Claims

1. An electrical component (16, 64) for a household appliance (10), particularly for a cooking appliance, more particularly for a cooking hob, even more particularly for an induction cooking hob, the electrical component (16, 64) comprising at least one connection cable (36, 62), particularly a flexible connection cable, with a first end connected to the electrical component (16, 64) and a second end, which second end comprises at least one terminal (38) or conductor end (72),
characterized in that
the second end and/or the at least one terminal (38) or conductor end (74) is retained by a retaining element (40, 68) in such a way that at least the at least one terminal (38) or conductor end (74) is accessible to a tool, in particular a production tool, specifically a handling element, e. g. a gripper, or an instrument, in particular a measuring instrument.
2. The electrical component (16, 64) according to claim 1,
characterized in that
fixation means are arranged at the electrical component (16, 64) and/or the retaining element (40, 68) for its or their fixation to the household appliance (10), which fixation means are arranged and/or designed in a way that the at least one terminal (38) or conductor end (74), in particular a non-insulated section thereof, is accessible to the tool or the instrument after the installation of the electrical component (16, 64) and/or the retaining element (40, 68) in or at the household appliance (10).
3. The electrical component (16, 64) according to claim 1 or 2,
characterized in that
the retaining element (40, 68) forms an auxiliary means for supporting a process step in a production line and is configured to be removed during a subsequent process step or prior to an installation of the household appliance (10) at its installation location.
4. The electrical component (16, 64) according to anyone of the preceding claims,
characterized in that
the retaining element (40), particularly a plastic retaining element, is connected, preferably rigidly connected, to the electrical component (16), particularly to a housing or frame part thereof, or to a supporting element (18') of the electrical component (16), which supporting element (18') is preferably configured to be assembled during the same assembly process step as the electrical component (16).
5. The electrical component (16, 64) according to claim 4,
characterized in that
the retaining element (40)
- is connected in one piece with the electrical component or the supporting element, preferably configured to be broken off the electrical component or the supporting element, or
- is a separate unit, which is releasably attachable to the electrical component (16) or the supporting element (18').
6. The electrical component (16, 64) according to anyone of the preceding claims,
characterized in that
the electrical component (16) is a heating element of a cooking hob (10), in particular an induction coil for an induction cooking hob, and the at least one connection cable (36) is a power cable and/or a sensor cable, particularly for the connection of a temperature sensor (50).
7. The electrical component (16, 64) according to anyone of the preceding claims,
characterized by
at least two connection cables comprising terminals (38) or conductor ends (72), which are collected or combined in a multiple connector, particularly a group connector, wherein particularly
- the multiple connector is retained by the retaining element (40), or
- the retaining element (40) forms at least one part of the retaining element (40) and/or a connector housing.
8. The electrical component (16, 64) according to anyone of the claims 1 to 3,
characterized in that
the retaining element (68) is a unit separate from the electrical component (64) and configured to include the connection cable (62), particularly in a bundled and/or coiled way, wherein the electrical component (64) is particularly a mains terminal block, or a part of the mains terminal block, and the connection cable (62) is particularly a mains power cable.
9. The electrical component (16, 64) according to claim 8,
characterized in that
the retaining element (68) is a two-part plastic unit with a first part (68a) and a second part (68b) and the connection cable (62), particularly the bundled or coiled connection cable, is retained between the first part (68a) and the second part (68b), the first part (68a) and the second part (68b) preferably being shaped as four-armed starfishes and being connectable with each other at the ends of their arms (70).

10. The electrical component according to claim 8 or 9,
characterized in that
a middle section of the retaining element (68) comprises a holding device (72) for holding the at least one second end and/or the at least one terminal or conductor end (74), particularly for holding a plurality of second ends and/or terminals or conductor ends (74) in separated divisions.
11. The electrical component according to claim 10,
characterized in that
the holding device (72) comprises an open access (76) for enabling approach by the tool or instrument, in particular by a test equipment.
12. A household appliance (10), particularly a cooking appliance, more particularly a cooking hob, even more particularly an induction cooking hob, comprising or being configured to receive an electrical component (16, 64) and particularly a retaining element (40, 68) according to anyone of the preceding claims.
13. The household appliance (10) according to claim 12,
characterized by
attachment elements interacting with the fastening means of the electrical component (16, 64) and particularly of the retaining element (40, 68).
14. A method for manufacturing a household appliance (10), particularly a cooking appliance, more particularly a cooking hob, even more particularly an induction cooking hob, the method comprising the consecutive steps
- b. installing an electrical component (16, 64), which comprises at least one connection cable (36, 62), particularly a flexible connection cable, in the household appliance (10), preferably during an automated assembling process;
 - c. approaching a second end and/or at least one terminal (38) or conductor end (74) of the at least one connection cable (36, 62), which second end and/or at least one terminal (38) or conductor end (74) is retained by a retaining element (40, 68), by a tool or an instrument; and
 - d. acting on the second end and/or the at least one terminal (38) or conductor end (74) by the tool or the instrument.
15. The method according to claim 14,
characterized in that
prior to step b. a step a. is performed, which includes a manufacturing process of the electrical component (16) including the retaining element (40), which is rigidly connected to the electrical component or to a supporting element (18') of the electrical component (16),
and in that
- the second end and/or the terminal (38) or the conductor end (74) is disconnected, particularly by means of an automated manufacturing or treatment process, from the electrical component or from the supporting element (18') of the electrical component (16) during or after step d..
16. The method according to claim 14 or 15,
characterized in that
step d. is performed onto at least a first and a second single wire, particularly onto a plurality of single wires, of the connection cable (36), and the connections of the single wires
- are performed either jointly by way of a group connection; or
 - are performed by individual handling of the single wires in consecutive connecting steps.
17. The method according to claim 14,
characterized in that
the manufacturing process comprises an end-of-line test for at least one capability test performed onto the household appliance (10), wherein test contacts of a test equipment act on the second end and/or the at least one terminal or conductor end (74), preferably on the terminals of a main power cord (62), by an automated connection or contacting for an electrical connection and/or supply of the household appliance (10).
18. The method according to claim 17,
characterized in that
after connection of or contacting the test contacts, an automated test procedure is executed and after completion of the test procedure the test contacts are automatically disconnected from the second end and/or the at least one terminal or conductor end (74).

Fig.1



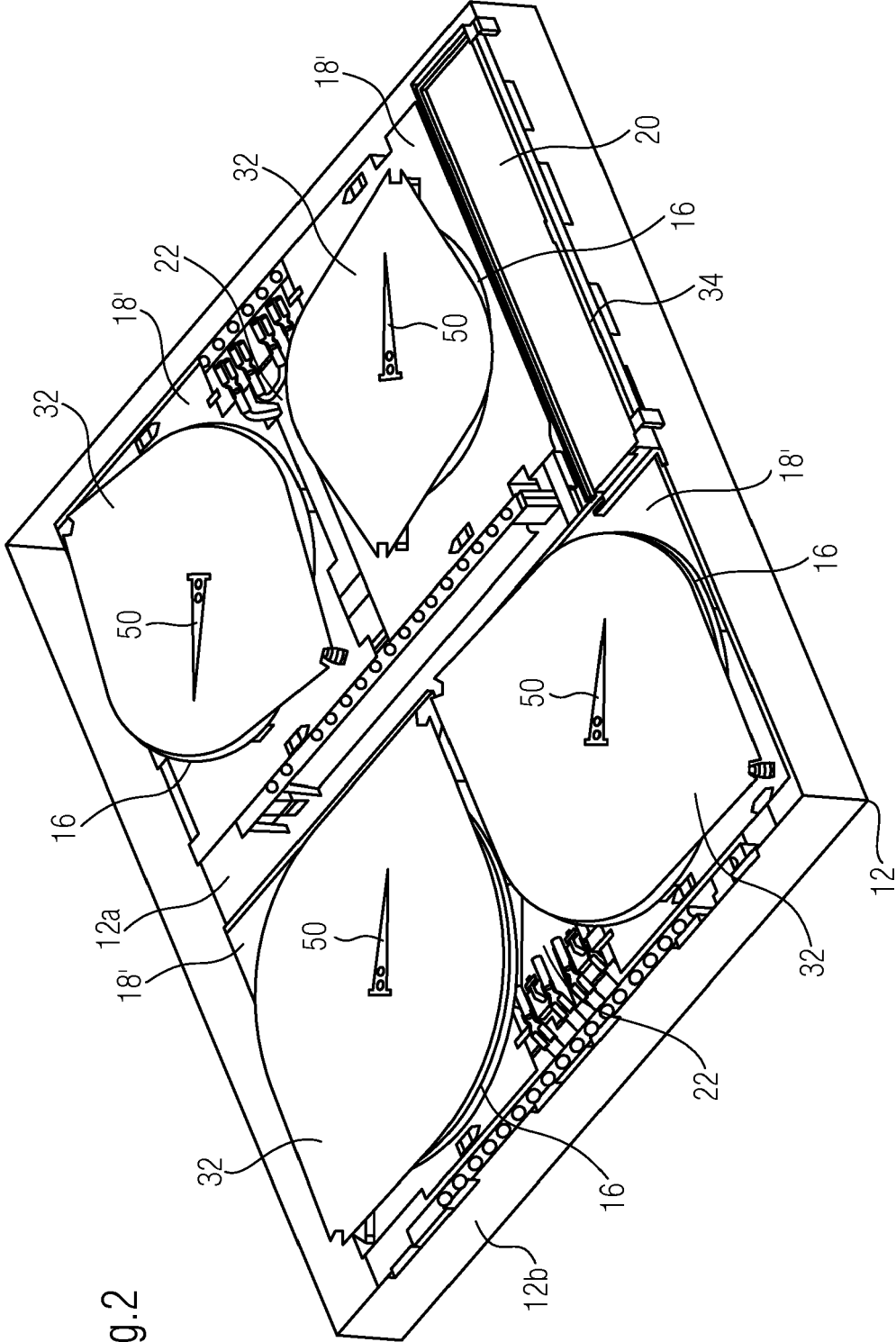


Fig. 2

Fig.3

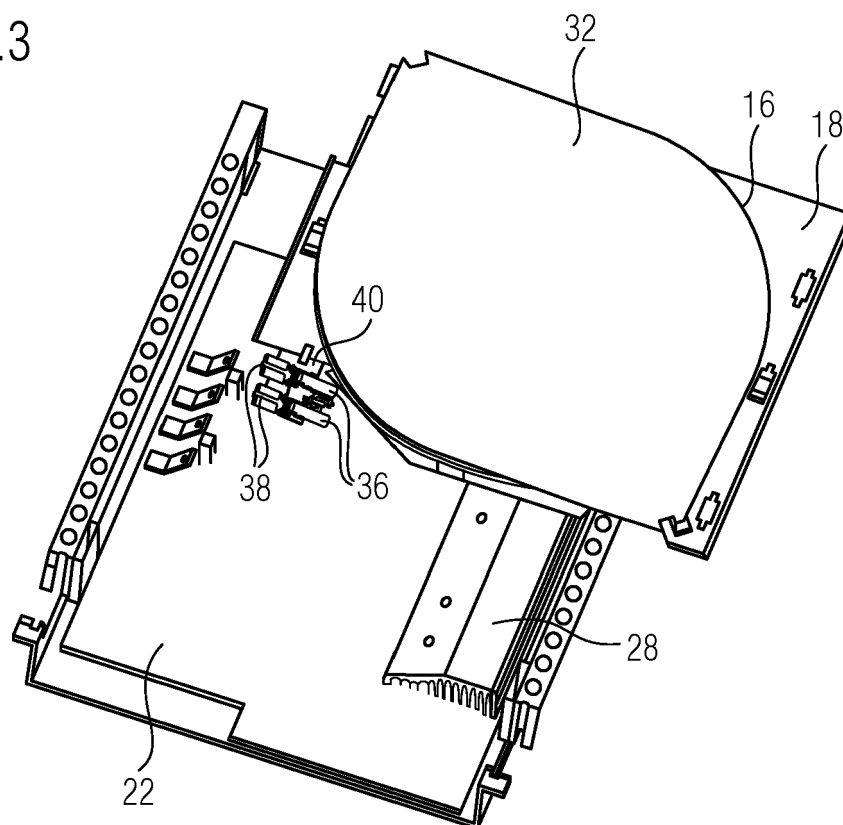


Fig.4

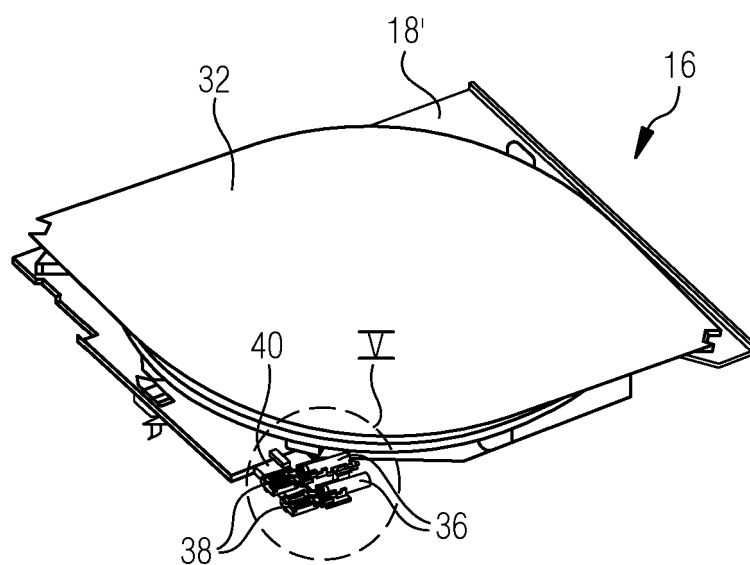


Fig.5

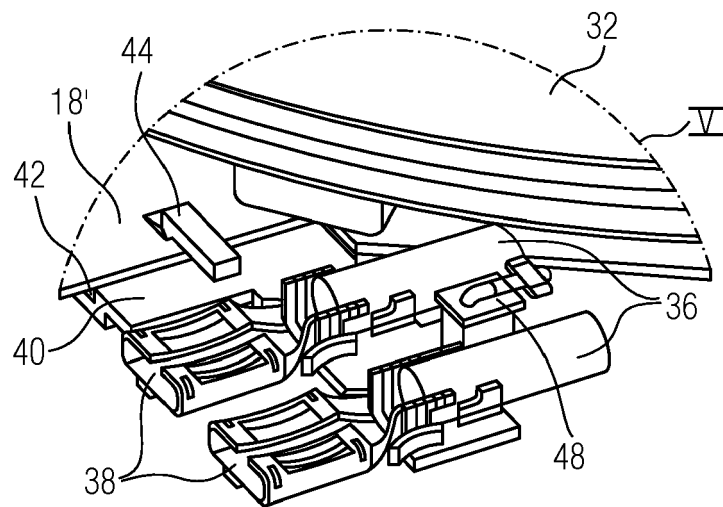


Fig.6

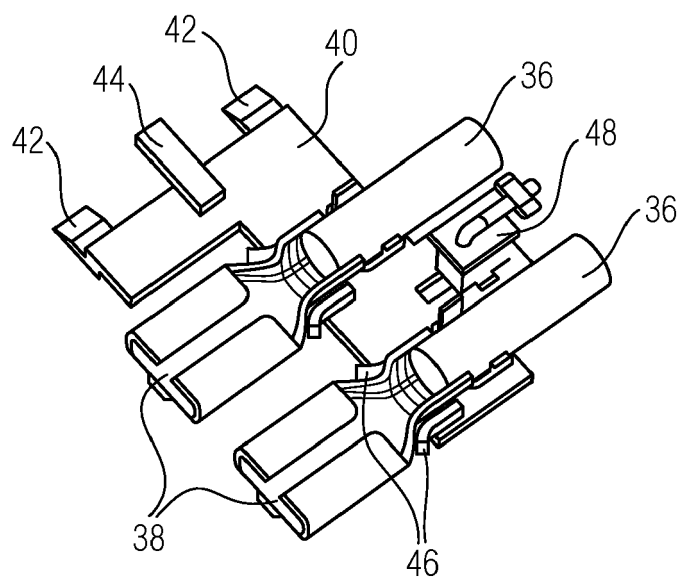


Fig.7a

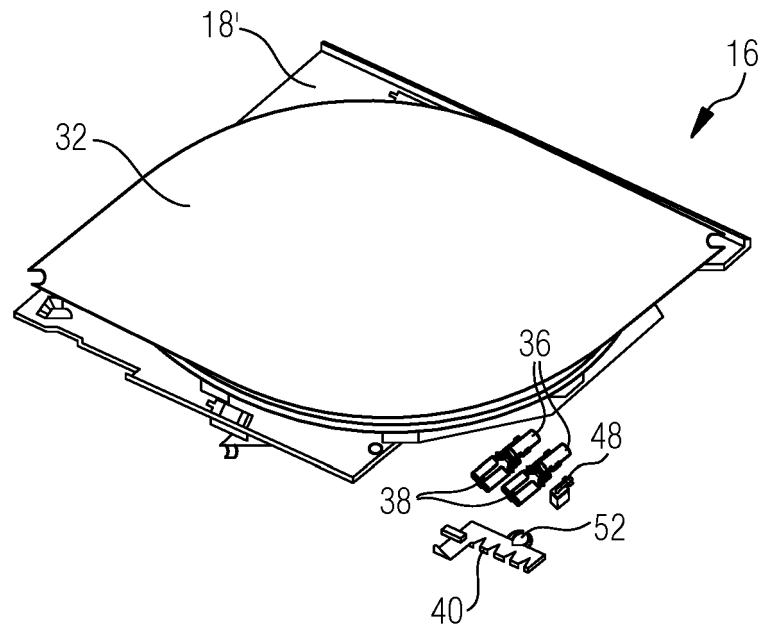


Fig.7b

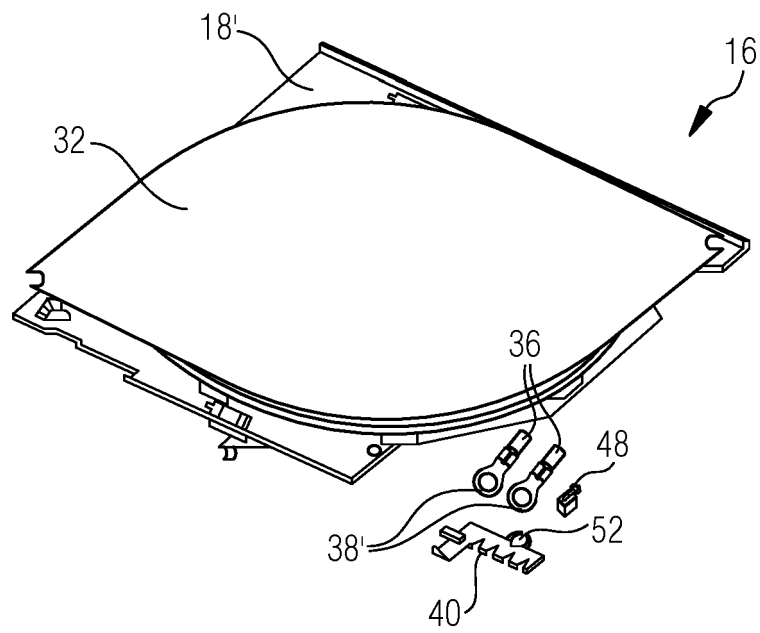


Fig.8

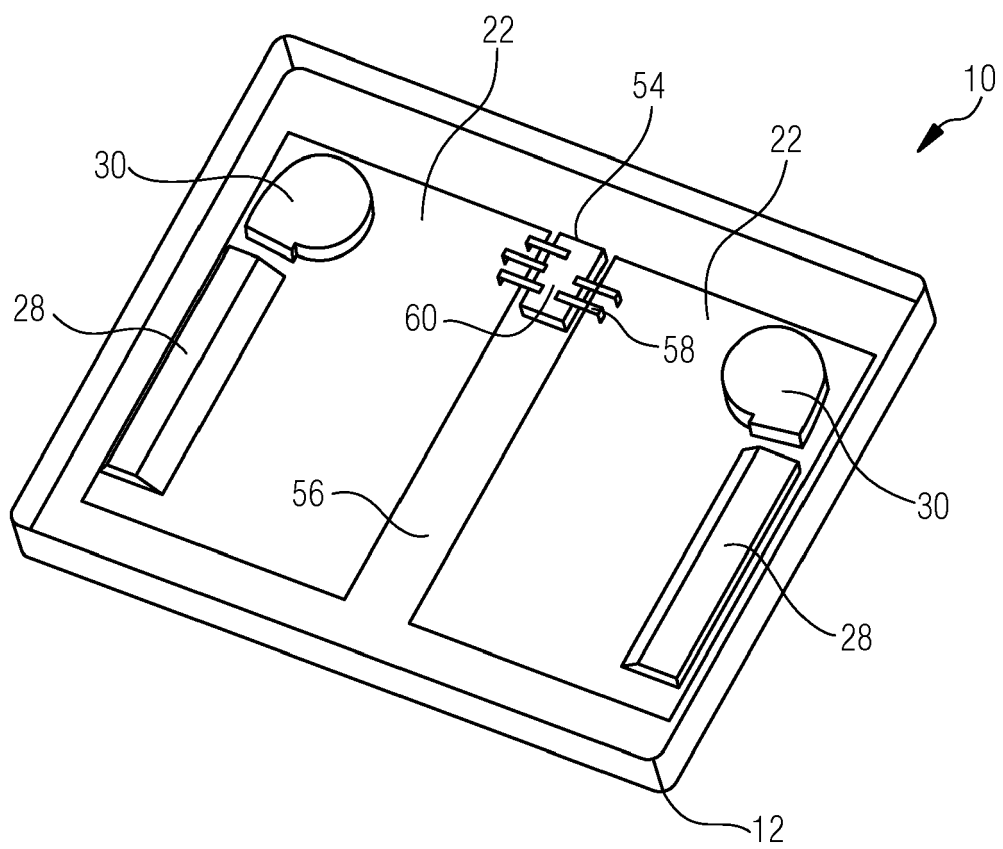


Fig.9

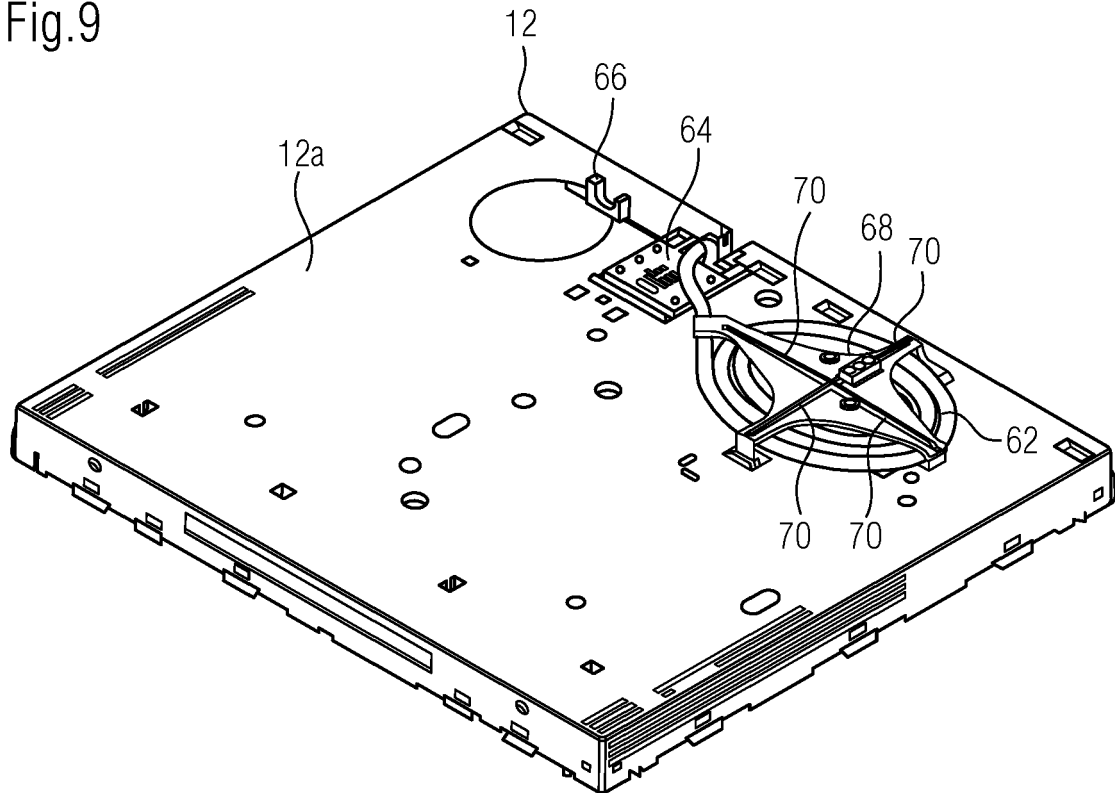


Fig.10

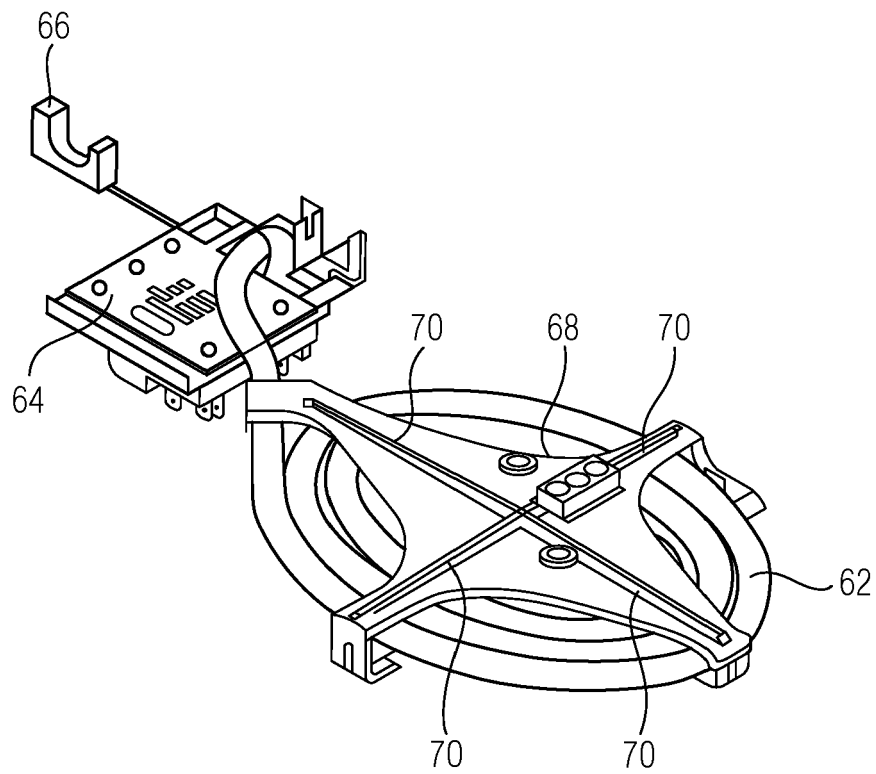


Fig.11

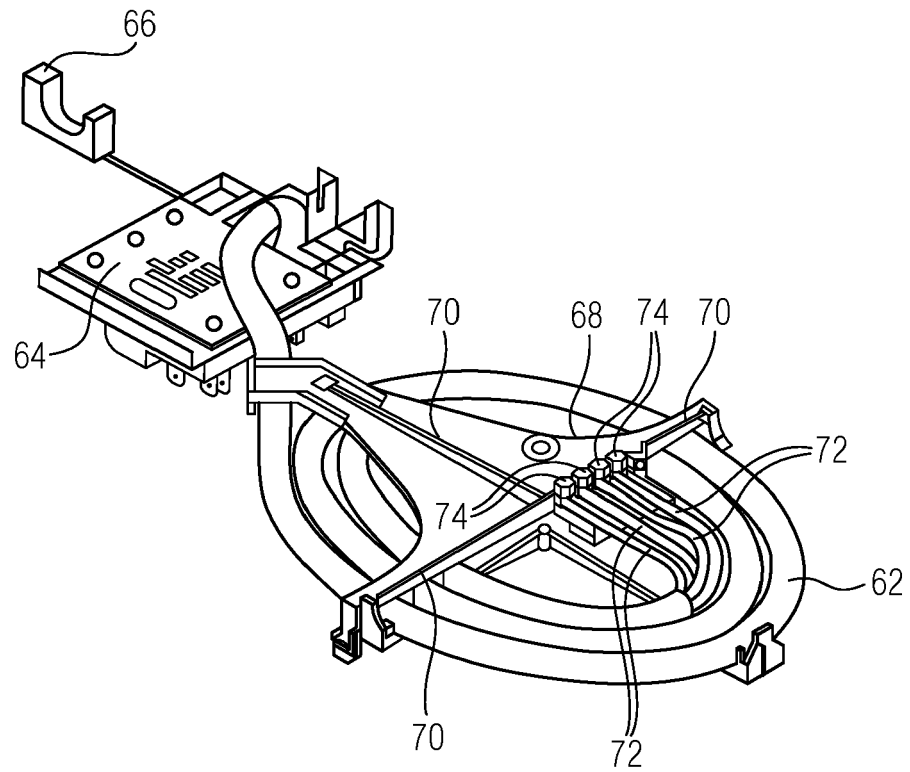
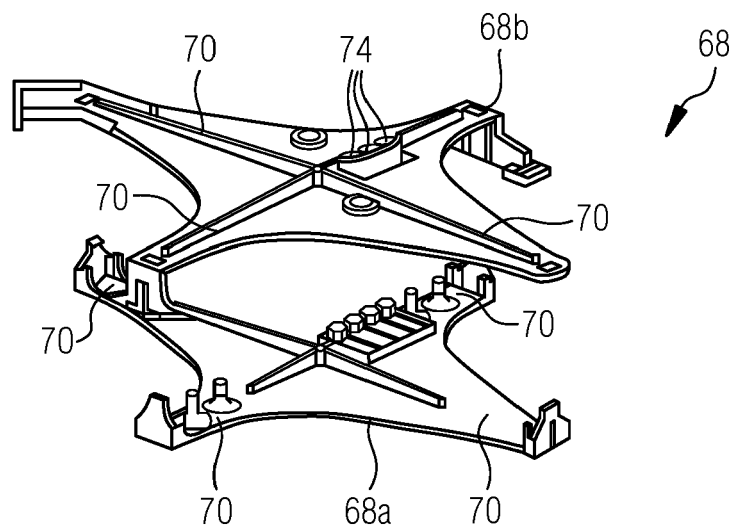


Fig.12





EUROPEAN SEARCH REPORT

Application Number
EP 20 21 1478

5

10

15

20

25

30

35

40

45

50

55

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	EP 1 954 097 A1 (EGO ELEKTRO GERAETEBAU GMBH [DE]) 6 August 2008 (2008-08-06) * paragraphs [0020] - [0024]; figures 1,2 *	1-18	INV. F24C15/10 H05B6/12 H05B3/68
X	DE 26 51 848 A1 (EGO ELEKTRO BLANC & FISCHER) 18 May 1978 (1978-05-18) * claim 1; figures 1-3 *	1-14	
X	EP 0 224 098 A1 (EGO ELEKTRO BLANC & FISCHER [DE]) 3 June 1987 (1987-06-03) * the whole document *	1-18	
			TECHNICAL FIELDS SEARCHED (IPC)
			F24C H05B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 May 2021	Examiner Meyers, Jerry
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			

 1
EPO FORM 1503 03.82 (P04C01)

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

EP 20 21 1478

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-05-2021

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1954097	A1	06-08-2008	AT 507702 T	15-05-2011
			CN 101252796 A	27-08-2008
			DE 102007006280 A1	07-08-2008
			EP 1954097 A1	06-08-2008
			ES 2364439 T3	02-09-2011
			JP 5475952 B2	16-04-2014
			JP 2008192611 A	21-08-2008
			US 2008179316 A1	31-07-2008

DE 2651848	A1	18-05-1978	AU 512394 B2	09-10-1980
			DE 2651848 A1	18-05-1978
			ES 463798 A1	16-06-1978
			FI 773011 A	14-05-1978
			FR 2371118 A1	09-06-1978
			IT 1087254 B	04-06-1985
			YU 222177 A	31-05-1982
			ZA 776185 B	28-06-1978

EP 0224098	A1	03-06-1987	AT 54530 T	15-07-1990
			AU 622715 B2	16-04-1992
			AU 6514186 A	21-05-1987
			DE 3540816 A1	21-05-1987
			EP 0224098 A1	03-06-1987
			ES 2016243 B3	01-11-1990
			JP S62123684 A	04-06-1987
			US 4818846 A	04-04-1989
			YU 193086 A	30-04-1988
			ZA 868608 B	24-06-1987
