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(54) Gas cooking appliance

(57) A gas cooking appliance (1) comprises a support frame (2), at least one burner (3) rigidly connected to said support frame, and a gas feeding circuit (4) to feed gas to the burner, wherein at least one of the following components of the gas cooking appliance is made of a thermosetting or thermoplastic material:

• at least one burner body, being part of said at least one burner;
• a spark plug body, being part of said at least one burner;
•at least one gas connection pipe, being part of said gas feeding circuit, to feed gas to said at least one burner;
• a gas rail, being part of said gas feeding circuit, connected to said at least one gas connection pipe;
•a connection member, being part of said gas feeding circuit, for connecting the gas rail to an external feeding pipe; and
• at least part of the support frame.

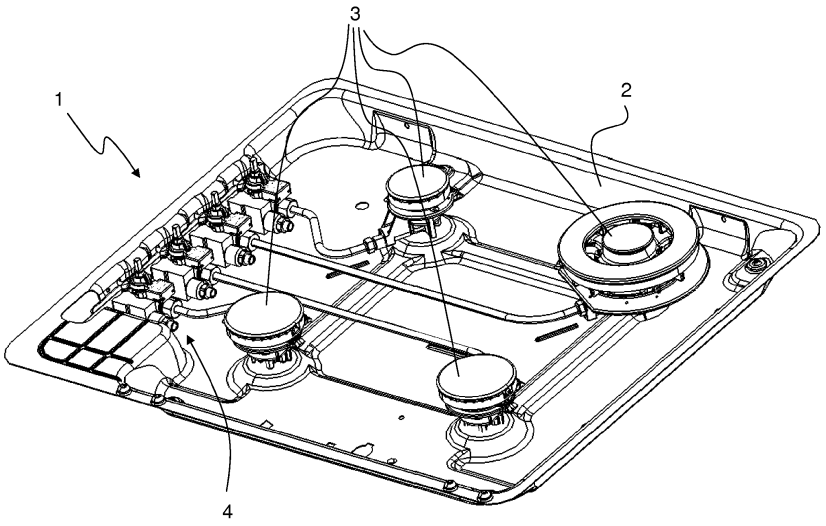

Fig. 1

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Description

[0001] The present invention relates to a gas cooking appliance, such as a gas cooktop (or cooking hob) or a free standing cooker.

[0002] Typically, a gas cooking appliance comprises one or more burners rigidly connected to a supporting and protective structure, and a gas feeding circuit to feed gas to the burner(s).

[0003] A cooktop, in particular, typically comprises a supporting plate or frame of rectangular shape and having a plurality of seats, a plurality of burners positioned in the seats and fixed to the supporting frame, and a gas feeding circuit, to feed combustion gas to the burners. These parts are typically assembled with each other so as to form a single rigid body.

[0004] In turn, each burner typically comprises a burner body fixed to the supporting frame, a burner crown held by the burner body and having circumferential openings for the exit of the air-gas combustion mixture, a cap closing the burner top, a gas injector to eject a gas flow into the burner body, a tubular element (typically integrated in the burner crown) for air/gas mixing by means of the Venturi effect, a thermocouple and a spark plug support (also usually integrated in the burner crown).

[0005] These burners may have different dimensions, as well as different size of the burner ports so as to achieve different velocity, pressure, inclination and distribution of the air-gas mixture. Moreover, it is possible to have more complex burner structures, with two or even three flame crowns.

[0006] The gas feeding circuit typically comprises a gas rail extending along one side of the supporting frame and designed to be connected to an external gas feeding pipe, a plurality of valves distributed along the gas rail in a number corresponding to the number of burners, a corresponding number of gas pipes connecting the gas rail to the burner via the valves, and a plurality of joints (typically "elbow", "push on" and "Boule and nut" connectors), to connect each other the external gas feeding pipe with the gas rail, the gas rail with the valves, the valves with the pipes, and the pipes with the burners.

[0007] Typically, the cooktop also comprises a top plate, which is positioned onto the supporting frame to define therebetween a space where the gas feeding circuit is arranged.

[0008] All these components are necessarily made of a heat-resistant material. In particular, the burners are typically made of die cast aluminium, which is safe, easy to cast and long lasting. The other above-mentioned parts of the appliance, like the connection pipes, the gas valves and the main rail, are usually made of aluminium, zinc plated, iron or brass.

[0009] The mass production of this kind of appliance has demonstrated the existence of some drawbacks, such as the high number of the constructional components, the time needed to assembly them, as well as the complexity of the die casting process to produce the burners and the resulting increase of the overall production costs, since the die casting tooling has a limited duration over time, and a high cost of energy consumed. Moreover, it has been observed that some parts of the appliance made of the above-mentioned materials may have a limited duration and may deteriorate due to corrosion or cleaning agents.

[0010] Some of these drawbacks have already been highlighted in the patent literature.

[0011] US2003000512 points out that a major drawback of typical burners made of a plurality of pieces assembled together is that they have a large number of constructional components, so that a significant amount of time is required to assemble the individual components as a single unit, and then to assemble the burners on the cooking hobs. The same difficulties exist when the burner must be assembled or disassembled for maintenance or routine cleaning purposes.

[0012] The same document highlights that the production of the individual components by means of die-casting processes is complex and increases the overall production costs, and that the material used, typically pressure-cast aluminium, has a limited duration and is subject to corrosion by the cleaning agents.

[0013] The document then suggests, in order to overcome these problems, to realize a gas burner for a cooking hob wherein a burner body, a flame-dividing element defining together with said burner body an air/gas mixing chamber, and a converging/diverging duct defining a Venturi tube located downstream of a gas injector, are part of a monolithic structure in the form of a pressed sheet-metal casing, in particular made of steel.

[0014] However, such solution, although being relatively safe and cheap, can be used only in limited circumstances because of the material used. In particular, it can be implemented only in very simple types of gas burner, which perform the minimum and essential functions of any gas burner. In addition, the problem of assembling the burner with a plurality of other parts still exists.

[0015] Another solution for making the production process of a cooking hob easier and cheaper is suggested by EP0615096A1, which describes a cooking plateau for a gas device made of a heat-resistant material, such as glass, plastic, aluminium, or ultra-deep drawn steel. The cooking plateau integrates burner housings, pan supports, and hinge points, so as to have a single plate-shaped part suitable to achieve different functions.

[0016] However, this solution offers only a limited advantage, as it concerns only the plateau, while all the other parts are still made according to known techniques, with the same materials and design. Therefore the overall production

process is still subject to the above-mentioned drawbacks.

[0017] It would therefore be desirable, and it is actually a main purpose of the present invention, to provide a gas cooking appliance that can be manufactured and assembled/disassembled in an easier and less expensive way than the cooking appliances of the prior art.

[0018] The Applicant has found that by making one or more parts of a gas cooking appliance of a thermosetting or thermoplastic material by an injection moulding process it is possible to reduce the production costs, since the cost per single piece is lower and it is possible to integrate some of these parts in a single piece by the same moulding process. Moreover, by integrating some parts together in a single piece the overall production process can be sensibly simplified and the final gas cooking appliance can be easier to assemble/disassemble.

[0019] A thermosetting material (or thermo-set) is a polymer material for which it is not possible to define a melting point, and a progressive increase a temperature would not result in its melting but instead in its burn. In particular, the material is a resin consisting of at least two monomers bound together to form a polymer through branching (cross-linking process) under the action of a catalyst activated by a temperature increase.

[0020] Differently, for a thermoplastic material there is no cross-linking process, and the polymeric chains overlap one onto the other without a precise order (or with a predetermined orientation in the case of semi-crystalline structures) and without chemical constraints, so that in this case a melting point can be defined.

[0021] In particular, according to the present invention, at least the following parts can be advantageously made of a thermosetting or thermoplastic material:

- the supporting frame or part thereof;
- the burner bodies;
- the gas rail;
- the spark plug body (insulation body);
- the connection elements that connects the rail to an external feeding pipe for receiving gas; and
- the connection pipes feeding the gas from the rail to the burner.

[0022] Moreover, two or more of these parts can be integrated in a single piece of thermosetting or thermoplastic material by a single injection moulding process. Possibly, all these parts may be realized as a single piece.

[0023] In a first aspect thereof, the present invention thus relates to a gas cooking appliance, comprising a support frame, at least one burner rigidly connected to the support frame, and a gas feeding circuit to feed gas to the burner, wherein at least one of the following components is made of a thermosetting or thermoplastic material:

- at least one burner body, being part of the at least one burner;
- a spark plug body, connected to the at least one burner;
- at least one gas connection pipe, being part of the gas feeding circuit, to feed gas to the at least one burner;
- a gas rail, being part of the gas feeding circuit, connected to the support frame;
- a connection member, being part of the gas feeding circuit, for connecting the gas rail to an external feeding pipe; and
- at least part of the support frame.

[0024] Preferably, at least two of said components are made as a single piece of thermosetting or thermoplastic material.

[0025] The single piece may include at least part of the support frame.

[0026] In addition or in alternative, the single piece may include the at least one burner body. Preferably, the at least one burner body includes supports for a thermocouple and a spark plug.

[0027] In addition or in alternative, the single piece may include the gas rail.

[0028] In addition or in alternative, the single piece may include the at least one gas connection pipe.

[0029] In addition or in alternative, the single piece may include the connection member.

[0030] In one possible embodiment, the gas cooking appliance comprises a plurality of burner bodies and a plurality of gas connection pipes, each connection pipe being designed to feed gas from the gas rail to a corresponding burner body, and the single piece includes all the burner bodies and all the connection pipes.

[0031] The single piece may also include also a plurality of joints connecting with each other different parts of the single piece.

[0032] In one possible embodiment, the support frame comprises a horizontal plate having at least one seat for hosting said at least one burner and this plate is made of thermosetting or thermoplastic material.

[0033] In another possible embodiment, the support frame may comprise at least one crossbar holding said at least one burner and this crossbar is made of thermosetting or thermoplastic material.

[0034] The support frame may also comprise, on each side of the appliance, two vertical bars (one on the front side and one on the back side of the appliance) and two horizontal bars (one on the top side and one on the bottom side of

the appliance) and, in one possible embodiment, these vertical bars and/or these horizontal bars are made of thermosetting or thermoplastic material.

[0035] The gas cooking appliance may advantageously comprise a plurality of burners, each burner including a burner body, and all the burner bodies may be made of thermosetting or thermoplastic material.

[0036] The gas feeding circuit may comprise a plurality of gas connection pipes to feed gas to said burners, and all the gas connection pipes may be made of thermosetting or thermoplastic material.

[0037] In a further aspect thereof, the present invention relates to a process for producing a gas cooking appliance comprising at least the following components:

- a support frame;
- at least one burner body;
- a gas rail;
- a spark plug body;
- a connection member suitable to connect the rail to an external feeding pipe to receive a gas; and
- at least a connection pipe suitable to feed the gas from the rail to the burner body;

the process comprising the step of moulding with a thermosetting or thermoplastic material at least one of said components and then assembling together said components.

[0038] The step of moulding preferably comprises moulding together with a thermosetting or thermoplastic material at least two of said components so as to form a single piece.

[0039] The same considerations made above, regarding the parts that can be made of thermosetting or thermoplastic material and can be made as a single piece, are still valid for the production process.

[0040] Further features and advantages of the present invention will be more evident from the following description of some embodiments, given only by non-limiting examples of the invention, with reference to the figures wherein:

- Figure 1 is a perspective view of part of a cooking hob (or cooktop) according to the present invention;
- Figure 2 is a top view of the same part of the cooking hob of Figure 1;
- Figure 3 is an exploded view of a burner that is part of the cooking hob of Figure 1;
- Figure 4 is a perspective view of the cooking hob of Figure 1, in which also a top plate (or plateau) is shown;
- Figure 5 shows an elbow connection to connect part of the cooking hob of the present invention with an external feeding pipe; and
- Figure 6 is a perspective view of a free standing cooker a cooking system according to the present invention.

[0041] Figures 1 and 2 show part of a gas cooking hob 1 according to a first embodiment the present invention.

[0042] The hob 1 comprises a lower supporting frame (or plate) 2, a plurality of burners 3 and a gas feeding circuit 4.

[0043] The supporting plate 2 is a cup-shaped planar rectangular body, laying horizontally, designed to support a plurality of other components described below.

[0044] The burners 3 are positioned in predetermined points of the frame 2. In the present embodiment there are four burners 3 positioned according to the vertices of a square or a rectangle.

[0045] As shown in Figure 3, each burner 3 comprises:

- a burner body 5, which is held by the supporting frame 2, in particular fixed to the frame 2;
- a burner crown 6, held by the burner body 5 and having a plurality of radiant openings on its circumference for the exit of air-gas combustion mixture;
- a cap 7, to close the burner top;
- a Venturi-type central vertical tubular element (not shown) for air/gas mixing, which in the present embodiment is integral with the burner crown 6, but in a different embodiment could be also a separate piece;
- a gas injector 14 to eject a gas flow into the Venturi-type element, and which can be integrated in the burner body;
- a thermocouple 16, and related support 17 (integral with the burner body 5 in the present embodiment); and
- a spark plug 15, and related support 18 (integral with the burner body 5 in the present embodiment).

[0046] With reference again to Figures 1, 2 and also to Figure 5, the gas feeding circuit 4 comprises:

- a gas rail 8 extending along one side of the frame 2 and suitable to be connected to an external gas feeding pipe (not shown) to receive the combustion gas;
- a connection member 19 (see Figure 5), preferably of a "elbow" type, to connect the gas rail 8 with the external gas feeding pipe;
- a plurality of valves 9 arranged along the gas rail 8, in a number corresponding to the number of burners 3 (four in

the present embodiment), to regulate the gas flow;

- a corresponding number of gas connection pipes 10, each connecting a valve 9 to a burner 3 to feed it with the gas; and
- a plurality of joints 11, to connect each other the gas rail 8 with the valves 9, the valves with the pipes 10, and the pipes 10 with the burners 3.

[0047] As shown in Figure 4, the hob 1 also comprises a top plate (or work plate) 12, which is arranged onto the lower supporting plate 2 to define there between a space where the gas feeding circuit is arranged. The top plate 12 has a plurality of holes where the burners 3 can extend through. The hob 1 further comprises a plurality of knobs 13 (only one of which is represented in Figure 4) connected to the valves 9.

[0048] According to the present invention, some of the above-described components are realized in a thermosetting or thermoplastic material and are preferably made integral with each other in one piece by means of a moulding process. In particular, it is possible to realize different embodiments, where the following parts can be selectively made of a thermosetting or thermoplastic material by an injection moulding process:

- the supporting frame 2;
- the burner bodies 5, possibly including the supports 17 and 18 for the thermocouple 16 and the spark plug 15, respectively;
- the body of the spark plug 15 (insulation body);
- the gas rail 8;
- the elbow connection 19; and
- the gas connection pipes 10 or part thereof.

[0049] Regarding the burner crowns 6 of Figure 3, the Applicant has noticed that the high temperature to which it is subjected does not allow to use the thermosetting and thermoplastic materials known today.

[0050] Regarding the thermocouple 16, this part cannot be made of thermosetting and thermoplastic material because of the presence of electrical components.

[0051] Regarding the valves 9, the complexity of this component does not render it particularly suitable for a realization in thermoplastic or thermosetting material.

[0052] According to the present invention, it is also particularly advantageous to integrate in a single piece two or more of the above parts, by means of a single moulding process. By way of non-limitative examples, the following parts could be made integral with each other: the supporting frame 2 and the burner bodies 5, the supporting frame 2 and the gas rail 8, the supporting frame 2 and the connection pipes 10 or part thereof, the gas rail 8 and the elbow connection 19, each burner body with at least a part of the connection pipe 10.

[0053] It is also possible to make more complex combinations of the above components, and possibly also to make a single piece including all the above components.

[0054] The parts that are not made in one piece can be assembled with the other parts according to traditional fixing techniques. Moreover, the parts that are not made in one piece can be made of thermosetting or thermoplastic material as well, by means of a separate moulding process, and then assembled with the others by means of traditional fixing techniques.

[0055] The Applicant has found that the thermosetting and thermoplastic materials defined by the following ranges of parameters are particularly suitable for the scope of the present invention.

Thermosetting materials

[0056]

Material Parameter	Range of values
Tensile Strength	70-130 Mpa
Linear Dilation Coefficient	10.10^{-6} — 30.10^{-6} mm °C
Flammability	V0 Class
Water absorption	≤ 0,5%
HDT (heat deflection temperature)	≥ 220 °C
Upper Limit Temperature Index	≥ 120 °C

Moulding Process Parameter	Range of values
Injection Temperature	Equal to mould temperature
Mould temperature	130-160 °C
Injection time (*)	Equal to stay time in the mould
Stay Time in the Mould	30-40 s/mm
Cooling Time	no cooling time
Compression Pressure	40-110 BAR
Notes: - (*) The injection time can be defined as the polimerization time	

Thermoplastic Materials

[0057]

Material Parameter	Range of values
Tensile Strength	150-250 MPa
Linear Dilation Coefficient	$12x10^{-6}$ —19x 10^{-6} mm °C
Flammability	V0 Class
Water absorption	< 0,2 %
HDT (heat deflection temperature)	220 - 280 °C
Upper Limit Temperature Index	>150 °C

Moulding Process Parameter	Range of values
Injection Temperature	>250 °C
Mould temperature	>100 °C
Injection time (*)	<4 s
Stay Time in the Mould (**)	about 40 s for material thickness ≥ 3mm or about 10 s for each mm of material thickness
Cooling Time	about 10 s for each mm of material thickness
Injection Pressare	800—1500 Bar
Notes: - (*) The injection time can be defined as the polymerization time - (**) Stay Time = Cooling Time + Injection Time + Machine Movement Time	

[0058] Figure 6 shows another type of appliance, in particular a free standing cooker 101, realized according to the present invention. The free standing cooker 101 comprises a support frame 102, a plurality of burners 103 rigidly connected, directly or indirectly, to the support frame 102, and a gas feeding circuit 104.

[0059] The burners 103 can be made as previously described with reference to Figure 3.

[0060] The support frame 102 comprises an assembly of elongated structural elements placed vertically or horizontally along the perimeter of the appliance so as to form the skeleton thereof, to which the externals panels, such as the side panels 151 of Figure 6, and the various internal parts, are connected.

[0061] In particular, the supporting frame 102 could comprise, on each side of the appliance, two vertical bars 141 (one on the front and one on the back of the appliance) and two horizontal bars 142 (one on the top and one on the bottom of the appliance), forming respective rectangular bodies.

[0062] In the embodiment of Figure 6, the support frame 102 also comprises two crossbars 144 extending parallel to

each other between the two horizontal bars 142 so as to define supporting elements for the burners 103. In particular, the burners 103 are rigidly connected to the crossbars 144.

[0063] Some of the bars 141, 142 and 144, or all of them, may be made of thermosetting and thermoplastic material. For example, in one possible embodiment all the mentioned bars can be made of thermosetting and thermoplastic material, and in another possible embodiment only the crossbars 144 is made of thermosetting and thermoplastic material while the bars 141 and 142 are made of another material, preferably metal.

[0064] The cooker 101 also comprises a top plate, not represented in Figure 6, having substantially the same shape and function of the top plate 12 of the hob 1 previously described.

[0065] In a further possible embodiment, the two crossbars 144 may be missing, and the burners 103 may be directly held by the top plate. In this embodiment, it is possible to make of thermosetting and thermoplastic material all the bars 141 and 142, or possibly only some of them. In this case the burners 103 are rigidly connected to the support frame 102, formed by the bars 141 and 142, through (i.e. by means of) the top plate.

[0066] The gas feeding circuit 104 comprises connection pipes 110, one for each burner, a rail 108 similar to the one of the hob 1, and a connection member (not shown) to connect the gas rail with the external gas feeding pipe.

[0067] As in the case of the cooktop previously described, at least one, but preferably more than one, of these components is realized in a thermosetting or thermoplastic material. If two or more components are made of thermosetting or thermoplastic material, these components can be possibly made integral with each other in one piece by means of a moulding process. In particular, it is possible to make of a thermosetting or thermoplastic material one or more of the following components:

- the supporting frame 102 or part thereof;
- the burner bodies 5, possibly including the supports for the thermocouple and the spark plug, respectively;
- the body 15 of the spark plug (insulation body);
- the gas rail 108;
- the connection member19; and
- the connection pipes 110 or part thereof.

[0068] It is clear that the embodiments and the materials previously described are just illustrative examples and that numerous variants can be made without departing from the scope of the present invention.

[0069] For example, the burners could be made according to different designs known in the art, such as with more than one flame crowns and a more complex structure. There can be also more than one injector. For the purposes of the present invention, the injectors could be also considered as part of the gas feeding circuit and be integrated with the connecting pipes. Moreover, the connector 19 can be of a different type than an elbow connector.

[0070] The present invention offers several advantages over the prior art.

[0071] First, the production cost, and therefore the final cost of the appliance, is reduced, since it is possible to produce some parts of the apparatus by a simple and cheap moulding process, and the number of parts to be assembled can be reduced. The thermoplastic component(s) made by the moulding process can be easily and quickly assembled with the other parts, and this advantage provides benefit in both the production process and possible maintenance/repair process, where the apparatus must be disassembled and then assembled again.

[0072] It is also possible to have a wide variety of cheap coloured parts, by using particular additives in the moulding composition, thus improving the aesthetic of the apparatus.

[0073] As concern the manufacturing process, no particular details have been provided, as the injection moulding and the assembling techniques previously mentioned are well known in the art.

Claims

1. A gas cooking appliance (1; 101), comprising a support frame (2; 102), at least one burner (3; 103) rigidly connected to said support frame, and a gas feeding circuit (4; 104) to feed gas to said burner, **characterized in that** at least one of the following components of the gas cooking appliance is made of a thermosetting or thermoplastic material:

    • at least one burner body (5), being part of said at least one burner;
    • a spark plug body (15), connected to said at least one burner;
    • at least one gas connection pipe (10; 110), being part of said gas feeding circuit, to feed gas to said at least one burner;
    • a gas rail (8; 108), being part of said gas feeding circuit, connected to said support frame;
    • a connection member (19), being part of said gas feeding circuit, for connecting the gas rail to an external feeding pipe; and

- at least part of the support frame (2; 102).

2. The gas cooking appliance of claim 1, wherein at least two of said components are made as a single piece of thermosetting or thermoplastic material.

3. The gas cooking appliance of claim 2, wherein said single piece includes at least part of the support frame.

4. The gas cooking appliance of claim 2 or 3, wherein said single piece includes the at least one burner body.

5. The gas cooking appliance of anyone of claims 2-4, wherein said single piece includes the gas rail.

6. The gas cooking appliance of anyone of claims 2-5, wherein said single piece includes the at least one gas connection pipe.

7. The gas cooking appliance of anyone of claims 2-6, wherein said single piece includes the connection member.

8. The gas cooking appliance of anyone of the claims 2-7, wherein it comprises a plurality of burner bodies (5) and a plurality of gas connection pipes (10), each connection pipe being designed to feed gas from the gas rail to a corresponding burner body, and wherein said single piece includes all the burner bodies and all the connection pipes.

9. The gas cooking appliance of anyone of the preceding claims, wherein said single piece includes also a plurality of joints (11) connecting each other different parts of said single piece.

10. The gas cooking appliance of anyone of the preceding claims, wherein the support frame comprises a horizontal plate (2) having at least one seat for hosting said at least one burner and wherein the plate is made of thermosetting or thermoplastic material.

11. The gas cooking appliance of anyone of the preceding claims, wherein it comprises a plurality of burners, each burner including a burner body (5), and wherein all the burner bodies are made of thermosetting or thermoplastic material.

12. The gas cooking appliance of anyone of the preceding claims, wherein the gas feeding circuit comprises a plurality of gas connection pipes (10; 110) to feed gas to said burners, and wherein all of the gas connection pipes (10; 110) are made of thermosetting or thermoplastic material.

13. The gas cooking appliance of anyone of the preceding claims, wherein the support frame comprises at least one crossbar (144) holding said at least one burner and wherein the crossbar is made of thermosetting or thermoplastic material.

14. A process for producing a gas cooking appliance (1; 101) comprising at least the following components:

- a support frame (2; 102);
- at least one burner body (5);
- a gas rail (8; 108);
- a spark plug body (15);
- a connection member (19) suitable to connect the rail to an external feeding pipe to receive a gas; and
- at least a connection pipe (10; 110) suitable to feed the gas from the rail to the burner body;

the process comprising the step of moulding with a thermosetting or thermoplastic material at least one of said components and then assembling together said components.

15. The process of claim 14, wherein the step of moulding comprises moulding together with a thermosetting or thermoplastic material at least two of said components so as to form a single piece.

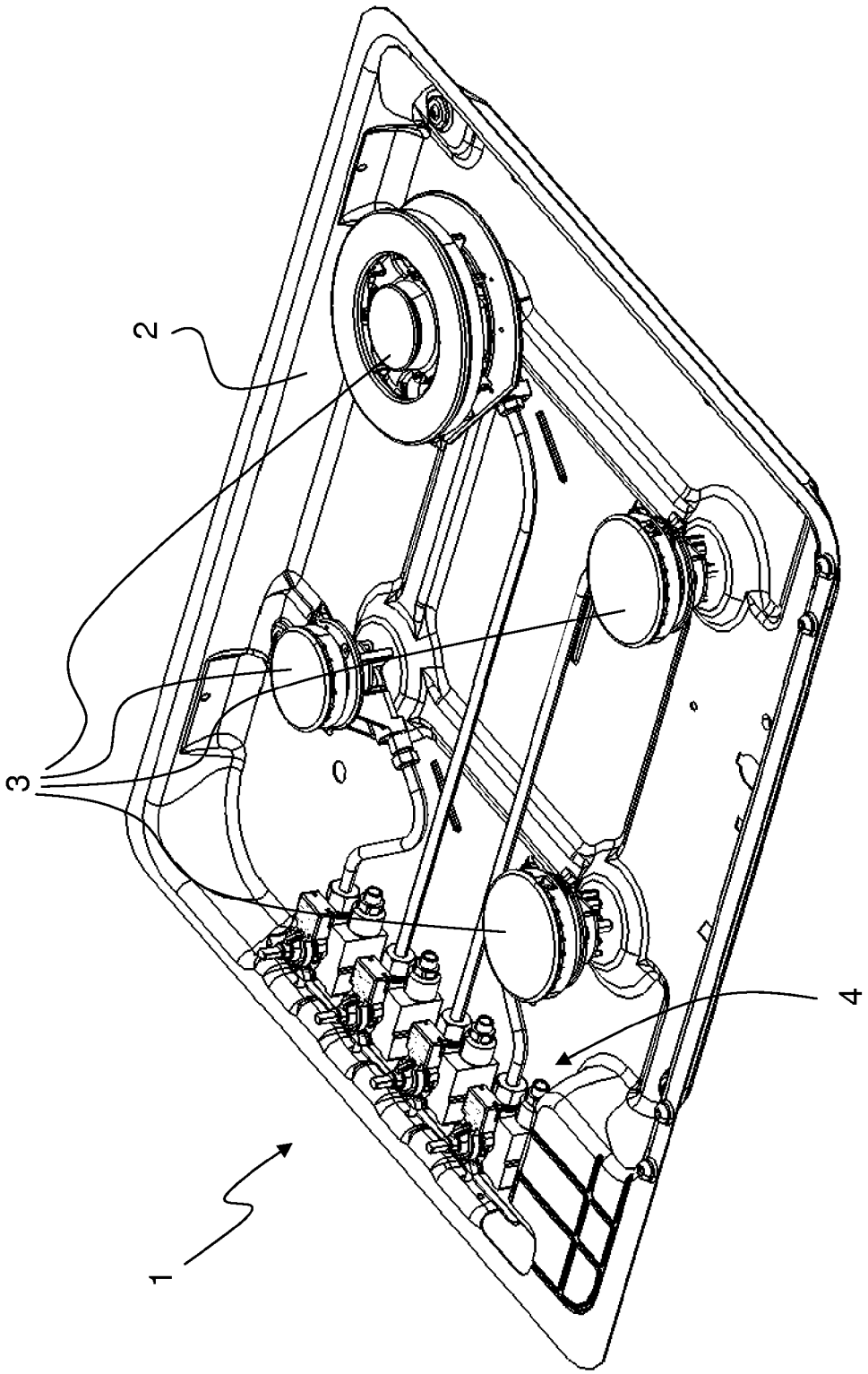

Fig. 1

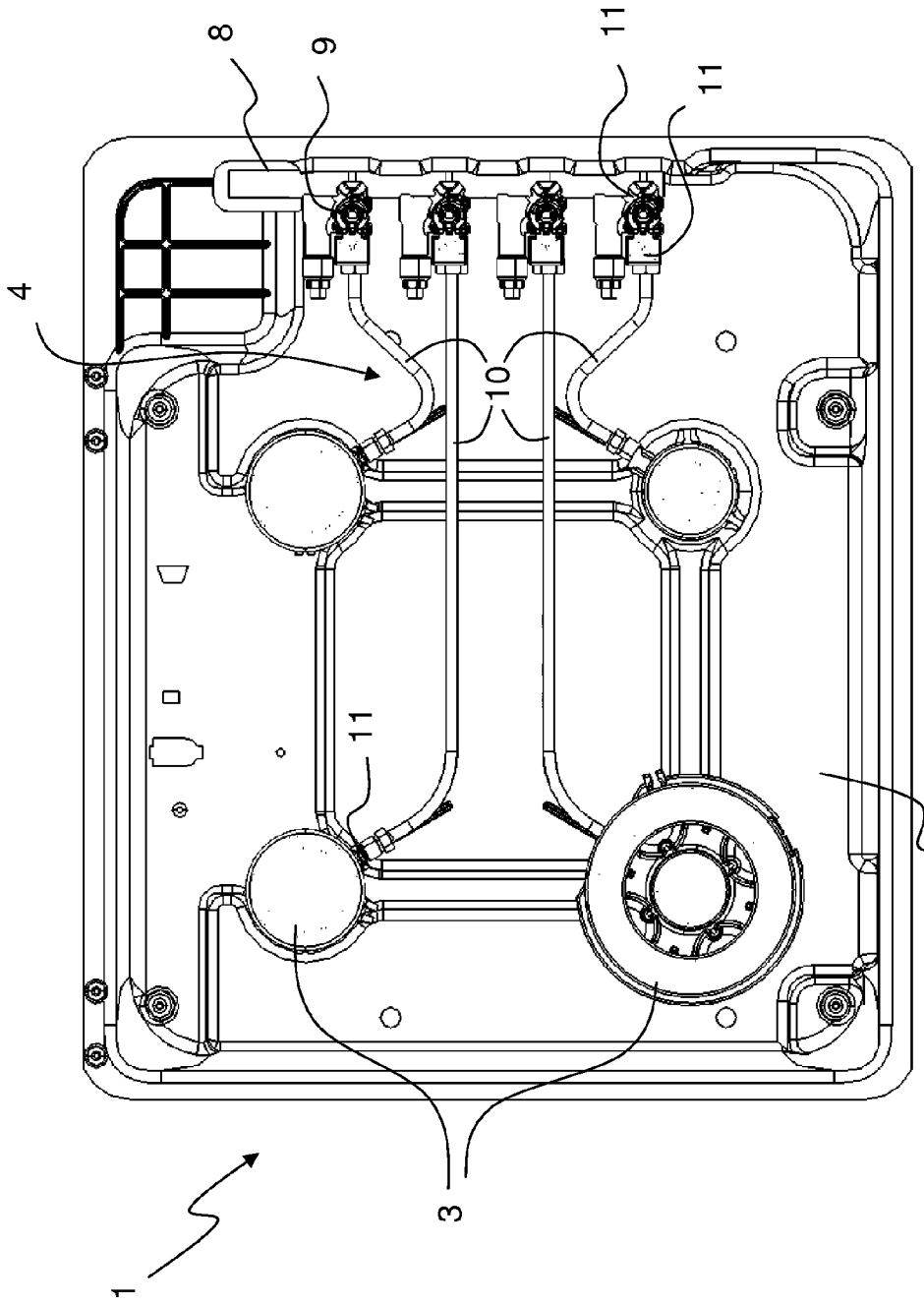

Fig. 2

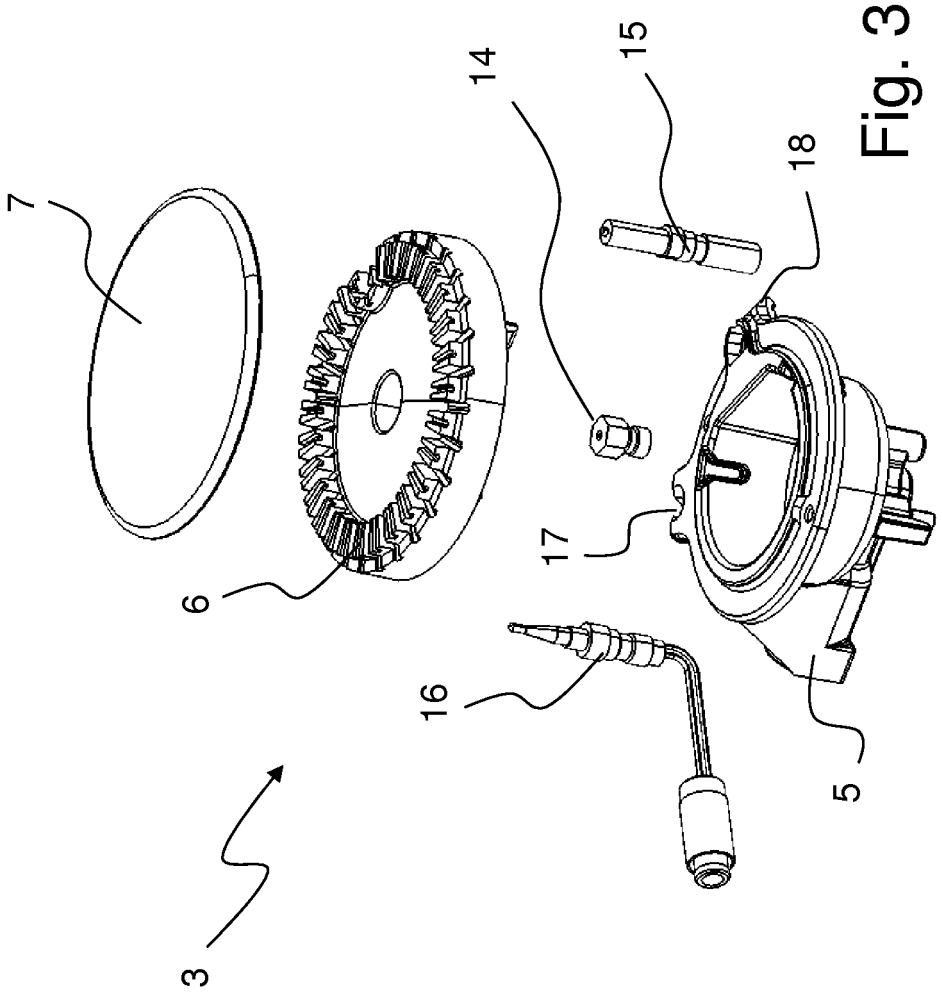

Fig. 3

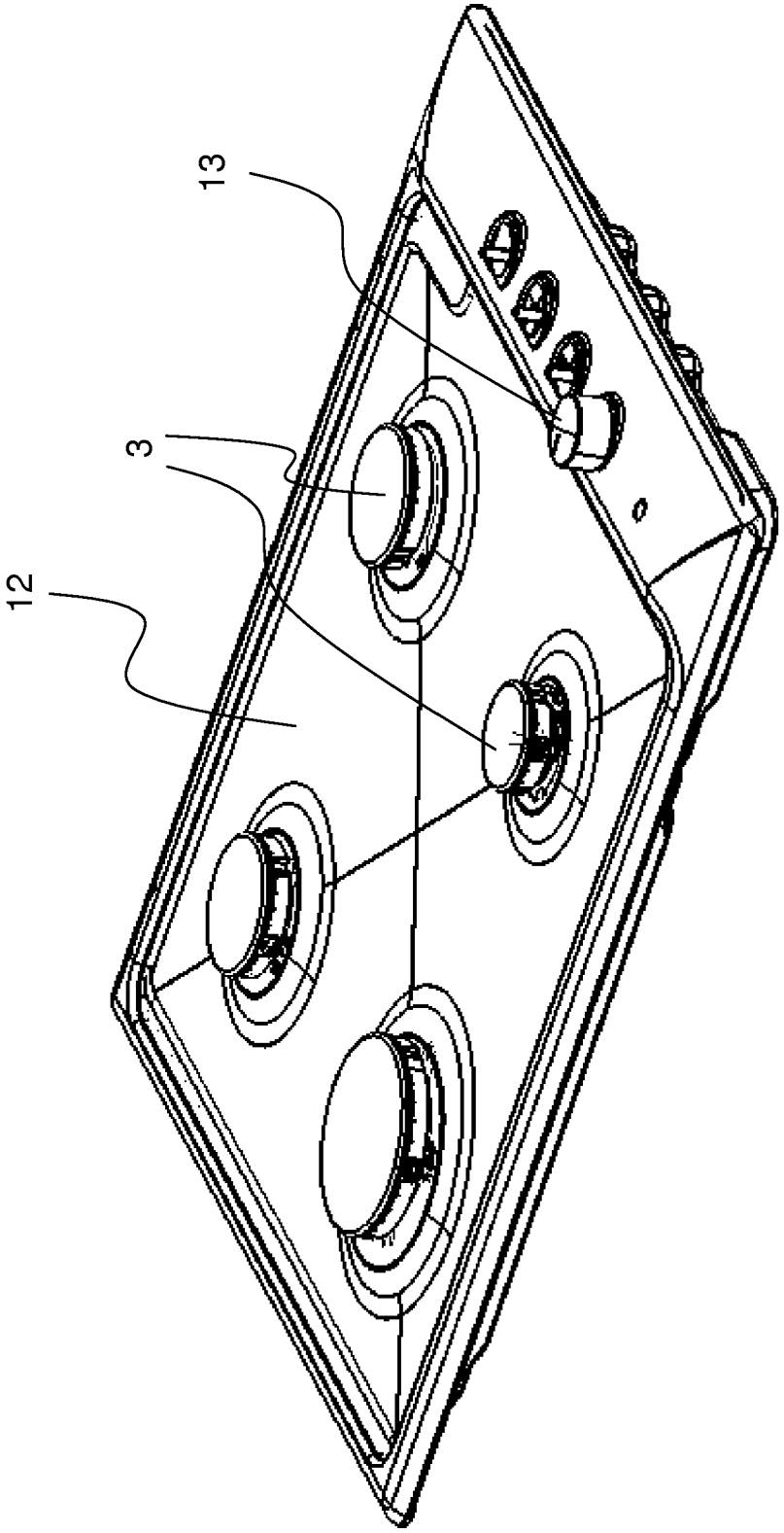

Fig. 4

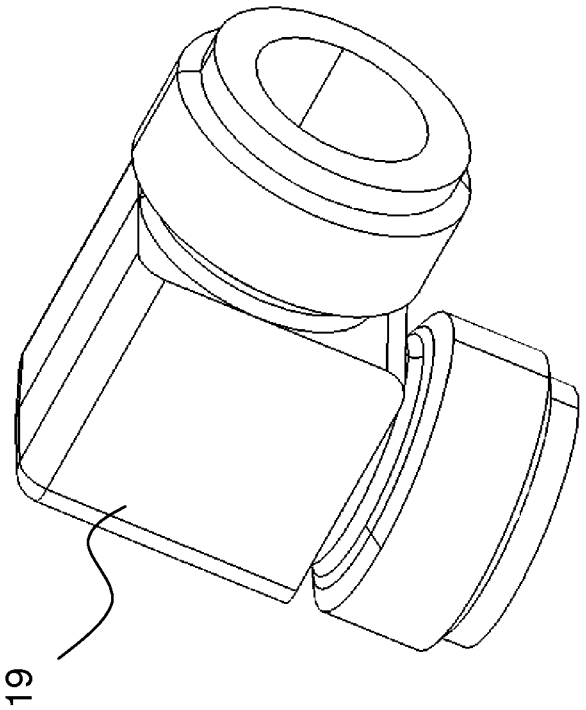

Fig. 5

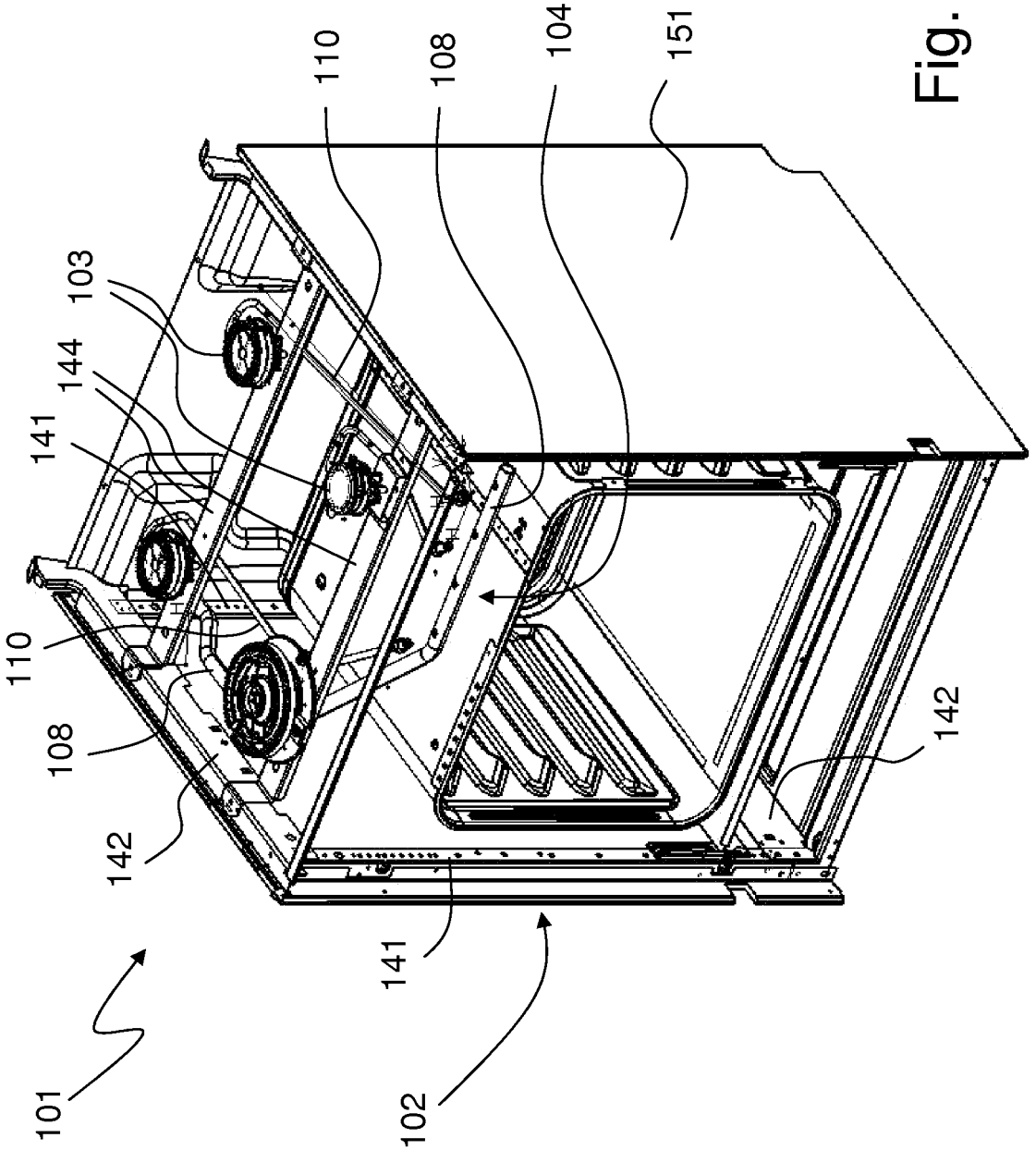

Fig. 6

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 6864

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 Y	GB 2 266 140 A (ZANUSSI ELETTRODOMESTICI [IT]) 20 October 1993 (1993-10-20) * claim 4; figure 1 * -----	1-12,14, 15 13	INV. F24C3/00 F24C15/10
Y	US 6 492 623 B1 (VILATO PABLO [FR] ET AL) 10 December 2002 (2002-12-10) * column 6, line 34 * -----	13	
Y	FR 2 788 334 A1 (SCHOTT GLAS [DE]) 13 July 2000 (2000-07-13) * claims 1,10 * -----	13	

TECHNICAL FIELDS SEARCHED (IPC)

F24C
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 October 2010	Adant, Vincent

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