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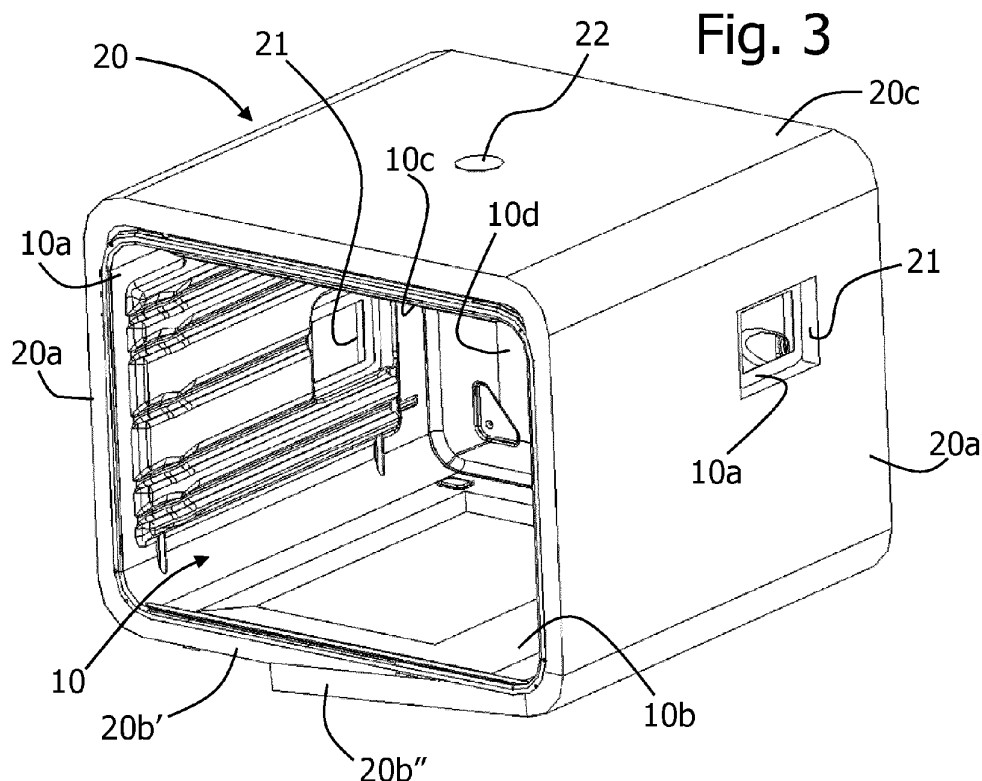
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(54) **Household oven for cooking food**

(57) An oven for cooking food has a load-bearing structure (2) with a door (9) and a muffle (10) that define a cooking chamber (11). The cooking chamber is accessible via the door (9) and is insulated via an insulation

that comprises at least one insulating body (20) having a flexible structure made of closed-cell polymeric material. Preferentially, the flexible structure of polymeric material is formed by or comprises polyimide.



Description

Field of the invention

[0001] The present invention relates to household appliances for the preparation of food and has been developed with particular reference to cooking ovens having a thermally insulated muffle.

Prior art

[0002] Household ovens for cooking food typically comprise a metal casing, with an enamelled muffle delimiting a cooking chamber, associated to which is a door. Ovens of the type referred to above are provided with elements for heating the food set in the cooking chamber, typically represented by metal electrical resistances or by gas burners. Given that the running temperatures can assume even high values (for example, between 250°C and 600°C approximately), these ovens must be provided with an adequate insulation, having the purpose of preventing dispersion of heat by the muffle, both in order to reduce consumption of the electrical household appliance during the cycles of operation and increase energy efficiency thereof and in order to enable the temperatures of the parts in contact with the surrounding kitchen furniture and the internal components sensitive to high temperatures (such as an electronic control card) to be kept under control.

[0003] The aforesaid thermal insulation traditionally comprises a flexible mantle having a fibrous structure with a base of refractory inorganic substances, such as glass fibres or mineral fibres or ceramic fibres, for instance, glass wool or rock wool. These fibres are aggregated using thermosetting resins or inorganic binders and in some cases via the mechanical process of needling. The fibrous structure is usually coated with a sheet of a heat-resistant material, typically aluminium foil.

[0004] The above fibrous materials are safe as long as they remain confined (for example, coated with other elements) but, in the case of exposure to air, in the surrounding environment there may be dispersed extremely fine particles of the materials. More in particular, the structure of the insulation has the tendency, when handled, to release particles having characteristic dimensions even smaller than 15 µm, which may be dangerous for health. Inhalation of these particles can cause irritation of the airways, disturbance to eyesight in the case of contact with the eyes, abrasions, and irritation of the skin. There hence arises the need in factories for the staff to work using protections for the airways and the eyes during assembly of the components, with all that this entails in terms of quality, costs, and efficiency.

[0005] The flexible mantle, which has a thickness of approximately 20-30 mm, is wrapped around the side, upper and lower walls of the muffle so as to surround it on four sides, and is held in position around the muffle itself via heat-resistant tapes, typically adhesive alumin-

ium tapes. Possibly, a further flexible mantle of the same type, but of smaller dimensions, can be associated with the rear wall of the muffle, for insulating the latter.

[0006] There have also been proposed insulating arrangements obtained by means of mantles in a single body or made up of a number of rigid panels arranged so as to gird the muffle of the oven. The production of these mantles and their installation on the muffle are generally complicated and costly. These panels frequently entail in any case the use of chemical binders, such as bituminous binders, which are potentially harmful for health or difficult to dispose of at the end of the useful service life of the oven.

Summary and aim of the invention

[0007] The main object of the present invention is basically to solve the above drawbacks. In this context, the main aim of the present invention is to provide an oven for cooking food having a muffle insulated via a thermal insulation that can be obtained at low costs, can be assembled in an easy and safe way, and is designed to reduce any risk of dispersion of heat. Another aim of the invention is to provide an insulation of the above sort that will not be harmful for people and for the environment.

[0008] One or more of the above aims are achieved, according to the present invention, by an oven for cooking food having the characteristics indicated in the annexed claims, which form an integral part of the technical teaching provided herein in relation to the invention.

Brief description of the drawings

[0009] Further objects, characteristics, and advantages of the invention will emerge from the ensuing description and from the attached drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a perspective view of a household cooking oven according to the invention;
- Figure 2 is a perspective cross sectional view of the oven of Figure 1;
- Figure 3 is a front perspective view of just the muffle of the oven of Figure 1, with a corresponding thermal insulation; and
- Figure 4 is a perspective cross-sectional view of the muffle of Figure 3.

Description of preferred embodiments of the invention

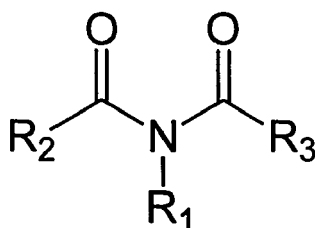
[0010] In Figures 1 and 2, designated as a whole by 1 is a household cooking oven according to the invention. The oven 1 is of the built-in type and has a load-bearing structure or casing, designated by 2, comprising a front frame 3, positioned in the upper part of which are some control means 3a, to provide a control panel of the oven. The casing further comprises a plurality of walls, namely, a lower wall 4, two side walls 5, and an upper wall 6,

there being associated to the latter a bulkhead 7, provided with a channelling for discharge of fumes and/or cooling of a door, of a conception in itself known, with a corresponding tangential fan 8. Hinged to the front part of the casing 2, in particular to a respective lower edge, is a door 9, having at least one frame 9a for a window 9b formed by two or more parallel glass panes.

[0011] Housed within the casing 2 is a muffle 10. The muffle 10 has a rigid metal body, having two side walls 10a, a lower wall 10b, an upper wall 10c and a rear wall 10d. The muffle 10 delimits a chamber for cooking food (not illustrated), which can be opened and closed at the front by means of the door 9. As may be seen in Figure 2, mounted within the muffle 8 are heating elements, here comprising an upper electrical resistance or grill 13. In the embodiment exemplified in the figures the oven 1 is a ventilated oven. At the rear wall 10d of the muffle 8, shaped according to techniques in themselves known, there are hence mounted a fan 14 and an annular resistance 15 of a traditional type, and the wall itself is provided with suitable passages for air.

[0012] The muffle 10 is thermally insulated via an insulating mantle, designated as a whole by 20 in Figures 2-4. According to the main aspect of the invention, the insulating mantle 20 comprises at least one insulating body with a polymeric base, resistant to high temperature, having a flexible and compressible structure constituted by a closed-cell foam. In practice, the insulation provided according to the invention substantially presents as a sheet of highly flexible and compressible foam rubber, and is thus easily adaptable to the conformation of the muffle, as well as easily workable in order to bestow thereon the desired shape and profiles, without any risk of diffusion of potentially harmful particles.

[0013] The polymeric material is preferentially a plastic or thermosetting polymeric material. In a preferred embodiment, the material used is a closed-cell polyimide foam. Polyimide is a material having a chemical structure formed by a polymer of imide. The structure of the functional group of the imide molecule is the following:



[0014] The advantages of the flexible polymeric insulation provided according to the invention are multiple.

[0015] In the first place, since the polymeric insulation is not fibrous, it can be handled without the need for particular protections and this leads to advantages from the standpoint of safety of the staff, of quality of the assembled product, of process costs, and of efficiency of production.

[0016] In the second place, the weight of the polymeric-foam insulation is extremely low, if compared to that of traditional fibrous insulating mantles: indicatively, materials of the type provided according to the invention have a weight per unit mass in the order of 6-8 kg/m³ instead of the approximately 30 kg/m³ of traditional glass wool. This constitutes, of course, a further advantage also in view of the ease of handling of the insulating material.

[0017] In the third place, the polymeric insulation is distinguished by a high resistance to heat, has excellent characteristics of thermal insulation and of resistance to ageing, and is subject to minimal dimensional shrinkage. An insulating mantle with a polyimide base is perfectly able to withstand continuously temperatures of up to 300°C. In any case, given that, in the use envisaged according to the invention, the insulating material is exposed to high temperatures only on one of its two major faces, this face can be exposed also to temperatures far higher than 300°C. For instance, from practical tests conducted, it has emerged that the exposure of a mantle of a thickness comprised between 20 and 30 mm (like the traditional insulation using glass wool) does not undergo particular degradation when applied to any muffle wall exposed to approximately 400°C for a prolonged time. The only appreciable change regards the fact that the surface of the closed-cell structure to the wall of the muffle hardens slightly. Obviously, the thickness of the mantle used may also be greater than 30 mm, in the case where the aim is to increase thermal insulation further.

[0018] Polyimide, on the other hand, is not subject to significant modifications of its functional characteristics even in the case of exposure to temperatures higher than the ones indicated. In these cases, polyimide tends to carbonize, but without this causing substantial modifications of its structure and loss of its capacity of thermal insulation.

[0019] Application of the insulation is simple and fast and can be obtained with modalities similar to those that use traditional fibrous mantles. The high flexibility and resilience of the polymeric mantle, in addition to enabling a precise adaptation thereof to the profile of the muffle, enables easy workability thereof, for example via dinking. The material may also be cut precisely into the desired shapes and thicknesses, using electronically controlled equipment, unlike the case of traditional fibrous mantles.

[0020] In a preferred embodiment, the outer face of the polymeric insulating mantle is coated with a surface layer, preferably of metal material, very preferably an aluminium foil.

[0021] In the embodiment exemplified in the figures, the insulating mantle 20 comprises a body shaped like a plate bent so as to gird the muffle 10. With particular reference to Figures 3 and 4, designated by 20a and 20c are the lateral and upper portions of the mantle 20, set up against the side walls 10a and upper wall 10c of the muffle. Designated instead by 20b' and 20b" are two lower end portions of the mantle, designed to be set up against the lower wall 10b of the muffle, adjacent to one

another or else partially overlapping. This is allowed, as has been said, by the flexibility and resilience of the material in question. It is preferable for the ends of the lower end portions 20b' and 20b" to be adjacent to one another so as to prevent thermal bridges or air gaps between the muffle 10 and the insulating mantle 20.

[0022] In the example represented, the lateral portions of the mantle 20 have through openings 21, defined in areas in which the side walls 10a of the muffle 10 are provided with through openings, for example openings for positioning a lamp for lighting and a temperature sensor. In the case illustrated in Figure 2, the upper wall 10c of the muffle 10 is provided with a duct 10e for discharge of the cooking fumes/vapours, in communication with an intake duct provided with the tangential fan 8. For this reason, conveniently made in the upper portion 20c of the mantle 20 is a through hole 22, which is to be located in a position corresponding to the aforesaid passage 10e (not represented for greater clarity in Figures 3-4). It will be appreciated - as already explained - that the openings 21 and the hole 22 can be obtained in an extremely simple way, for example via punching.

[0023] The polymeric mantle 20 can be held in the correct position, around the muffle 10, using means similar to those currently used in combination with fibrous insulating mantles. For this purpose, there may advantageously be used adhesive aluminium tapes (not represented), or similar materials designed to withstand high temperatures, or else fasteners or metal wires, according to techniques in themselves known.

[0024] Also the rear wall 10d of the muffle 10 may be conveniently thermally insulated using a plate-like body made of closed-cell-foam polymeric material. A body of this sort, here not represented, will be provided with a central through opening, in a position corresponding to the area where the fan 14 is installed. Alternatively, for insulation of the rear wall 10d of the muffle 10 there may be used two distinct plate-like insulating bodies, for example an upper one and a lower one, which leave free an intermediate space in the area where the fan 14 is installed.

[0025] It goes without saying that in the case of static ovens, i.e., without a rear fan, the wall 10d of the muffle 10 may be insulated via a plate-like body without the aforesaid central opening.

[0026] Once again with reference to the solution illustrated in Figure 2, defined in the side walls 10a of the muffle 10 are slide guides, one of which designated by 12, for internal supports of the cooking chamber, such as for example grills or dripping pans. These guides 12 are obtained substantially by deep drawing and extend in the direction of the depth of the muffle 10, giving rise on the inside and on the outside of the walls 10a to an alternation of projecting parts and parts that are plane and/or recessed. By exploiting the flexibility of the mantle 20, this can be slightly compressed on the side walls 10a of the muffle, in such a way that its portions penetrate into the aforesaid deep-drawn portions.

[0027] Previously, reference has been made to an embodiment in which the lateral insulation of the muffle 10 (i.e., of its walls 10a, 10b, and 10c) is obtained by means of a single plate-like body. It is on the other hand clear that, in possible variant embodiments, the insulating mantle may be formed by a plurality of plate-like insulating bodies, each of which is directly set up against a respective wall of the muffle 10, or again with two plate-like bodies bent substantially to form an "L", in such a way that the first portion of each body covers a respective side wall 10a and the second portion of each body the lower wall 10b, and, respectively, the upper wall 10c, of the muffle. Another possibility is to envisage two plate-like bodies bent substantially to form a "C", which cover entirely a wall of the muffle and partially two other walls of the muffle, orthogonal to the first. Another possibility still is to envisage a substantially U-shaped body, designed to be fitted on the muffle so as to cover three orthogonal walls (for example, the side walls 10a and the upper wall 10c), and a second plate-like body designed to be set up against the other wall (for example, the lower wall 10b). Also in the variants that have just been referred to, the contiguous edges of the various plate-like bodies may overlap to guarantee continuity of the thermal insulation.

[0028] One or more plates of the closed-cell polymeric material may be conveniently used also for thermal insulation of the door 9, in the regions alongside the glass window, once again exploiting the easy workability of the material in question, or for thermal insulation of the area behind the control panel 3.

Claims

1. A household oven for cooking food (1) having a load-bearing structure (2), with a door and a muffle (10) that define a cooking chamber (11), and means for heating the cooking chamber selected between electrical resistive elements and gas burners, wherein the cooking chamber is insulated via an insulating mantle that comprises at least one insulating body (20), **characterized in that** the at least one insulating body (20) comprises a flexible structure made of closed-cell polymeric material.
2. The oven according to Claim 1, wherein the flexible structure of polymeric material is formed by or comprises polyimide.
3. The oven according to Claim 1 or Claim 2, wherein the at least one insulating body (20) includes a coating layer on a face of the flexible structure that is opposite to the muffle (10).
4. The oven according to Claim 3, wherein the coating layer comprises a metal foil, in particular an aluminium or aluminium-based foil.

5. The oven according to any one of the preceding claims, wherein the at least one insulating body (20) is substantially plate-shaped.
6. The oven according to any one of the preceding claims, wherein the insulating mantle comprises at least one insulating body (20) bent so as to gird the muffle (10) on at least two orthogonal walls thereof. 5
7. The oven according to Claim 6, wherein the at least one insulating body (20) is bent so as to gird the muffle (10) along its side walls (10a), lower wall (10b) and upper wall (10c). 10
8. The oven according to Claim 1, wherein the at least one insulating body (20) is held in position on the outside of the muffle (10) via one or more from among adhesive tapes, metal fasteners, and metal wires. 15
9. The oven according to any one of the preceding claims, wherein the insulating mantle comprises at least one said insulating body that is set up against a rear wall (10d) of the muffle (10). 20
10. The oven according to Claim 9, wherein said insulating body has a central through opening. 25

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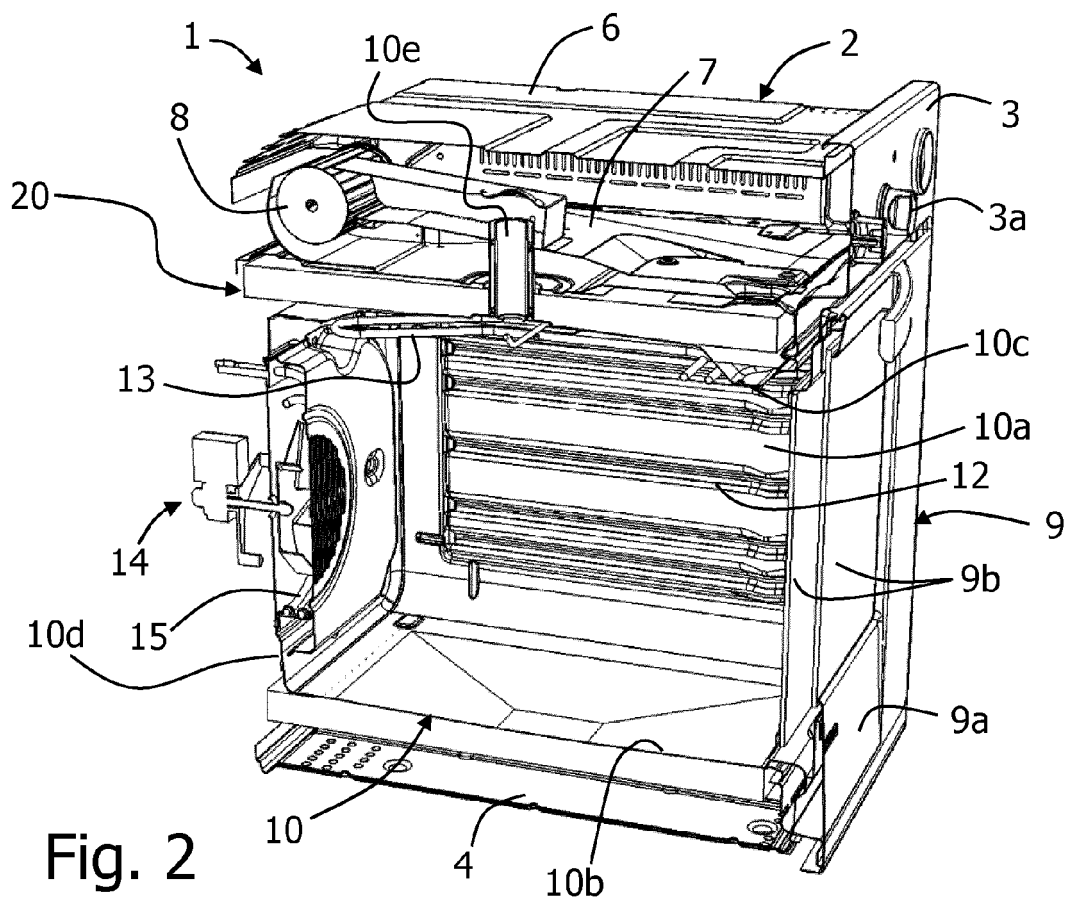
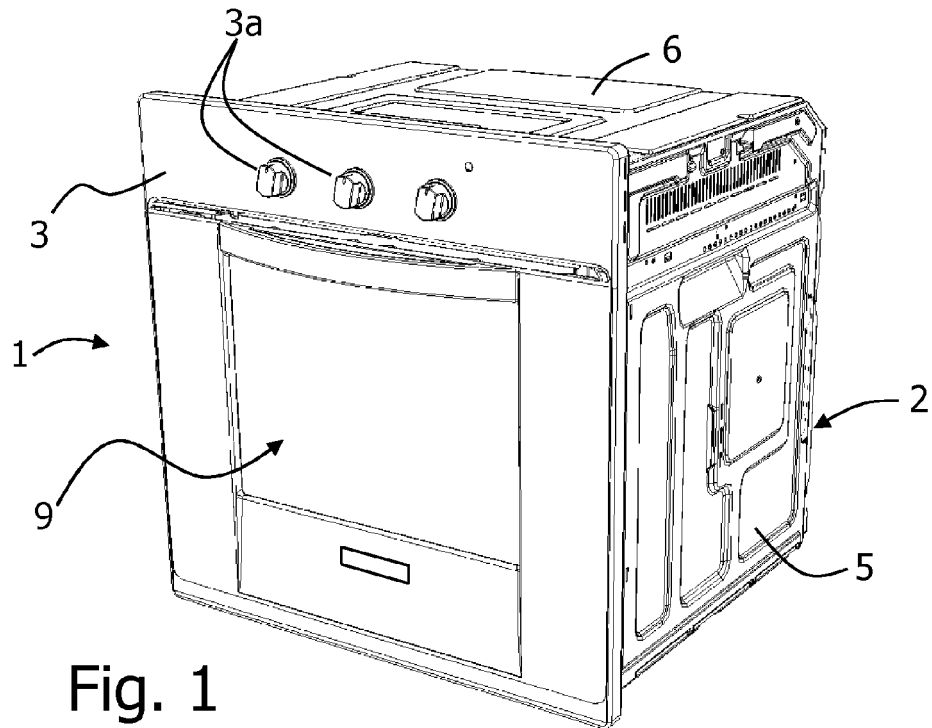
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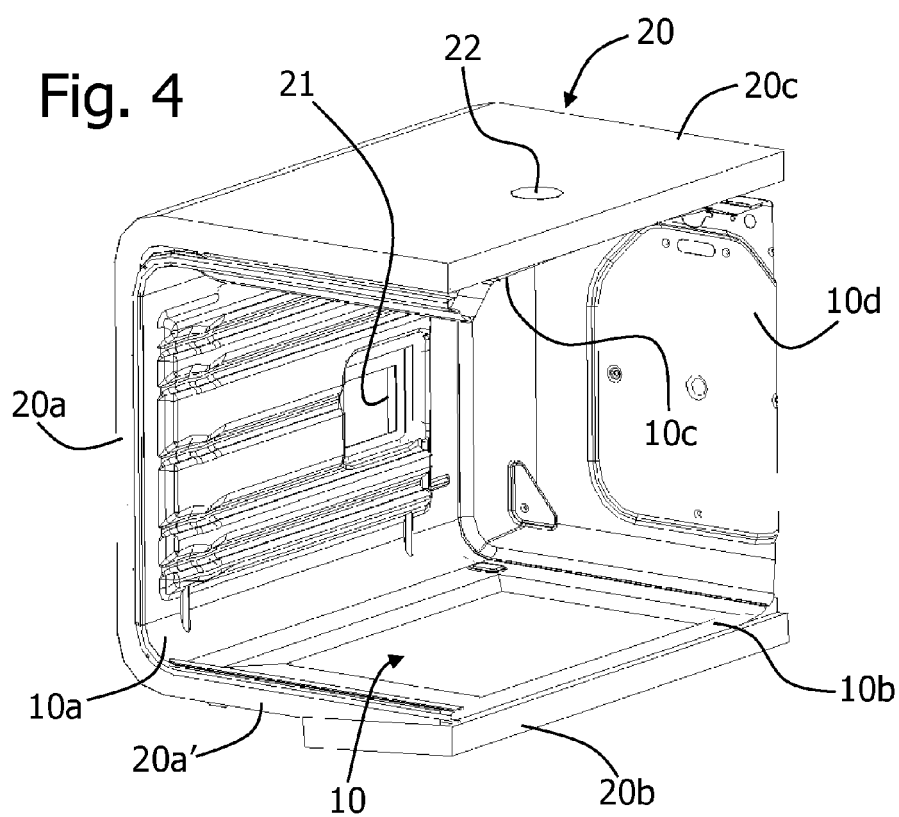
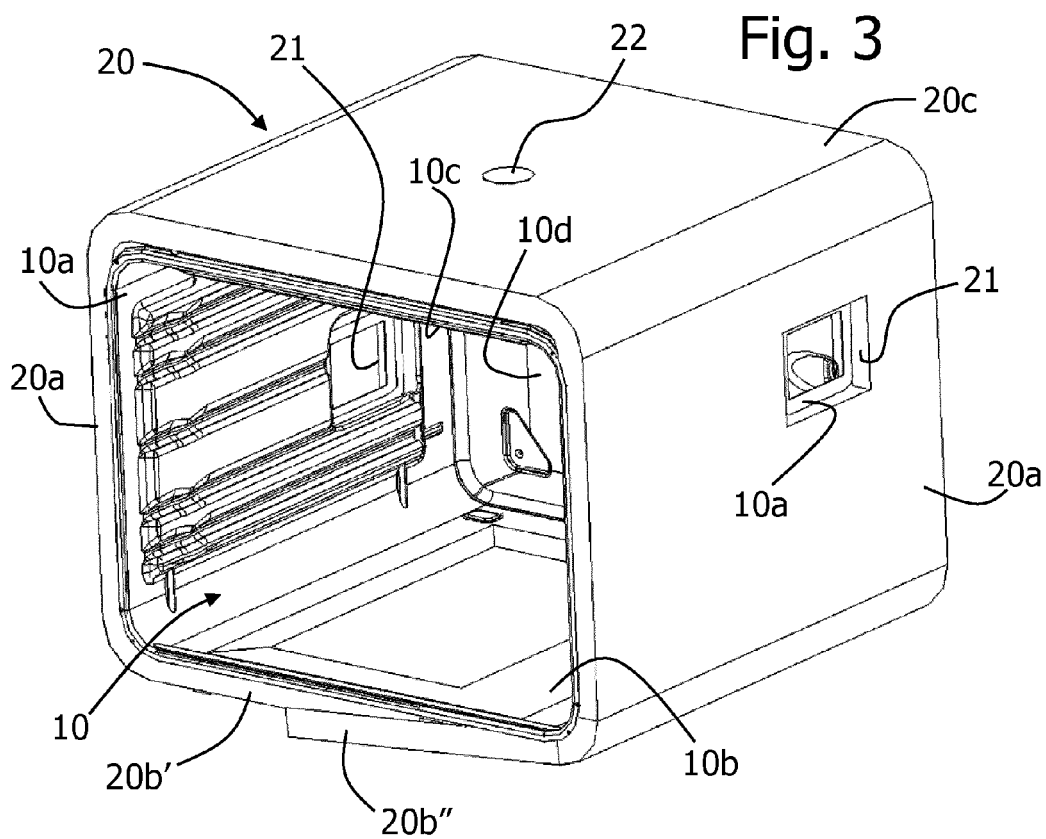
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Application Number
EP 13 18 4416

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 January 2014	Examiner Verdoodt, Luk
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