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(54) **Food baking oven with airflow control devices**

(57) Domestic use food baking oven to be embedded, of the type provided with a ventilation system for the thermal insulation of the baking chamber, with an airflow control device of the heat dispersion from the baking chamber, and with integrated ventilation system for the thermal insulation of the baking chamber, which oven, at the baking chamber access span, in an operative baking condition of said oven and with the baking chamber ac-

cess door in an open condition, has the forced airflow generated by the ventilation system for the thermal insulation of the baking chamber which is in a diverted condition at the baking chamber access span, wherein said airflow is diverted by means of a flow diverter, said flow diverter being of the type which can be shut down as soon as the access door of the oven, in a closed condition, is arranged in abutment with said flow diverter or with a part of it.

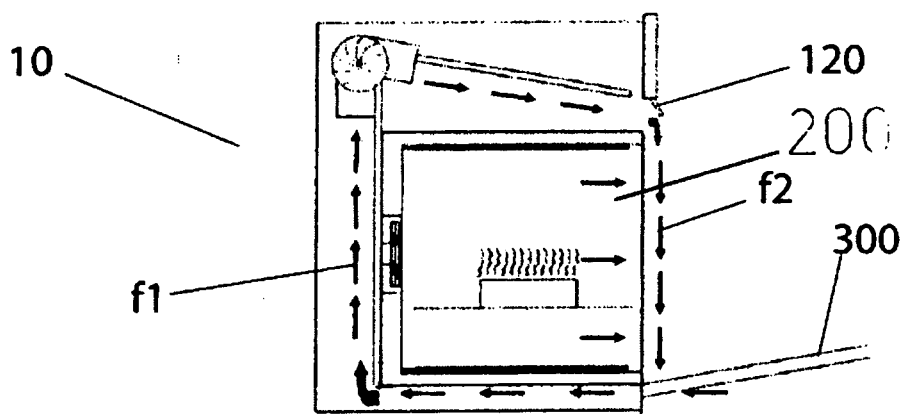


Fig. 2

Description

[0001] This invention relates to a food baking oven with an airflow thermal barrier device and baking system, particularly for embedded ovens and ovens for domestic use.

Domain

[0002] Freely installable domestic use kitchens and embedded ovens for domestic use too are known. Conventionally, they are devices which, in order to reduce the thermal flow exchanged between two different temperature environments, such as for example between the baking chamber of the oven and the external environment, are insulated with a thermal insulation, mostly made of glass wool, in correspondence of all the sides. In many other types of ovens and embedded kitchens an insulation air-casing is provided surrounding the baking chamber, which constitutes a cooling ventilation duct with an entry mouth obtained along the lower border of the access span of the baking chamber and a corresponding exit mouth obtained along the upper border of the same. Said air-casing is passed through by a one-way airflow also pushed by a fan, with the purpose to accelerate the cooling in such a way as to limit the heat dispersion and, improving at the same time the total performance of the baking chamber, for example as described in US3659578 (Davis et al.) and EP1028290 (Autin et al.) relative to ovens of the pyrolytic type.

[0003] Among the critical moments of any baking cycle, the opening phase of the door must be considered. It is an operation which occurs each time one needs to stir the food, to relocate the food, to perform an inspection, to sprinkle the food with liquids useful for the baking, these being sequences which are particularly recurrent, repeated during even short intervals and which are necessary for the user in order to obtain a good food baking quality. Therefore, the door opening operation itself is a circumstance which is common to all the types of ovens, included the ones intended for domestic use, being this a situation which however causes various problems. More in detail, contextually with the door opening operation, at the baking chamber, an immediate and progressive heat exit occurs which is proportional to the time the door itself remains in the open condition and to the room temperature. This phenomenon, mainly due to the re-establishment of the equilibrium of the two pressures, the one inside the baking chamber and the environment one, very often causes some known drawbacks, such as for example blasts, lengthening of the baking time, loss of the uniformity and of the coloring of the baking surface of the food and not least the increase in the power consumption due to the fact that once the door has been closed, the temperature set by the user should be reestablished again by the control and heating devices of the oven.

Prior art

[0004] At the same time, airflow thermal barriers are known to control the microclimate inside rooms. Conventionally it is an airflow, confined as far as possible within certain spaces, which is generated by convenient fan means, and conveyed near the access opening to the environment in such a way as to result a sort of vertically oriented air curtain, mainly with a continuous flow but also temporized which, being thermostated, is originated interposed between two different areas, each of which with its own ambient temperature.

[0005] It is widely used in trade centers, at our latitudes as well, and it allows to limit the bilateral migration, through an opening, of the natural convective air motion due to the different temperature in charge of the two relative air masses. From a practical point of view, a slit is obtained in correspondence of the opening, along the lintel, developing for about the whole length, before or after a conventional door, through which an airflow exits oriented in such a way as to result substantially perpendicular to the floor, like a barrier. In this way, notwithstanding the frequent opening of the doors to allow the transit of people, e.g. in correspondence of the access to a department store, or means as at the entry of an industrial shed, the air, for example hot air, circulating inside the heated environment, does not exit through the opening, even if it is attracted by the external cold mass and vice-versa. Solutions of this type are well known in literature also in more than one configuration, and they find application in different sectors. For instance in US6234892 (Geyer et al.) a device is described for producing hot air barriers for door openings in the local transit of vehicles. It is a device for producing airflows in correspondence of door openings, to allow the passage of people where vehicles transit, having a unit for forming an airflow which forms a barrier against the cold air penetration into a space located adjacent to the door opening. The unit is structured in such a way as to be located at the lower end of the door and it is limited in height between a minimum of a third to a maximum of the half of the total height of the door opening in such a way as to prevent the penetration of the hot air only in the lower zone of the door opening.

[0006] In the field of ovens in general, in particular to perform the braise, US4898319 (Williams) is known. It is an oven comprising a device which generates an airflow or barrier involving the area of the door of the oven opening when the door is in an open condition. The barrier or air curtain consists of a fluid localized portion directed through the opening. The air barrier prevents the gas exit from inside the oven when the door of the oven is in an open condition, and furthermore it is used to relocate or to fill with the conditioned air the internal part of the oven when it exits from the oven itself. The barrier is generated through an opening and by means of load-bearing and generation means, located on the outside and adjacent to the opening or in the internal housing of the oven and

adjacent to the opening.

[0007] The solutions relative to the prior art are surely significant, in substance, if on the one hand they suggest the use of an air barrier, which encumbers the migration of the airflow, in correspondence of an opening dividing two rooms and which remains in a temporarily open condition, on the other hand it is also true that they are not solutions which are optimized for many other sectors. In this case, of particular relevance is the fact that so far said solutions have not been applied to food baking ovens, and consequently the problem relative to the heat exit, and therefore to the sudden lowering of the temperature in the baking chamber, due to the opening of the door/hatch in an operative condition of the oven, was noticeably an unsolved problem.

[0008] Moreover, it is interesting that the position of the channel or of the emission mouth of the air blast originated by corresponding generation means, is obtained, based on the prior art, on the outside or on the inside with respect to the wall delimiting the opening towards the heating chamber. The applications listed in the prior art refer to solutions which noticeably can find application only in specific intended uses which are not similar and appropriate for food baking ovens. In most of the cases, in fact, said applications could not find use in the latter equipments also because in any case they need the door occluding the access and in a condition which, when it is an operative condition, must remain as closed as possible and which does not need the use of the air barrier. The presence of the door or of the hatch, mainly in the cases in which it is hinged along the upper side of the access mouth to the baking chamber or along the lower side of the same, therefore constitutes an objective limit to the translation of said techniques in food ovens, substantially having a structural origin, the prior art being de facto inapplicable.

Prior art closest to the invention

[0009]

D1: JP91 19643 (Kurokawa)
D2: ITTV2005U000029 (Ferretti)
D3: US3659578 (Davis et al.)

[0010] In D1 a baking apparatus is described, intended to reduce the hot air consumption and the steam discharged out of the heating chamber, when the door is opened during the baking, by providing an air barrier which is formed at the opening surface of the door of the heating chamber for baking food. A door is provided at the front surface of a baking chamber in an oven. An air outlet port is provided at the upper border of the opening surface of the door so as to be extended horizontally along the whole border. The air is supplied to the air outlet port by a fan through a ventilation passage and a header so as to blow the air flow through the air outlet port. An air suction port is provided at the lower border of the door

opening surface so as to be extended along the whole length of said lower border. In this way the air located at the door opening surface is sucked into the air suction port by means of a suction device which disposes the discharged air into a collecting hood through a ventilation passage and a duct at the door opening surface where the air barrier is formed.

[0011] D2 discloses an improved pizza baking electrical oven, comprising an airflow thermal barrier for controlling the environment temperature in the baking chamber with, in correspondence of the front of the oven, a control board, which provides means for maintaining the preset temperature controlling the heat supply, the automatic and/or a traditional type programming of the oven ignition; said oven consisting of a parallelepiped metal covering structure, which integrates the plant design, and a baking chamber with relative heating means, said baking chamber having at least one surface coated with a refractory material, located in correspondence of the bed-plate, wherein said baking chamber is enlightened and it is provided with an access opening closed by a respective tiltable door hinged along the lower or along the upper side; in which means are provided to generate a thermal barrier consisting of an airflow which is channeled in correspondence of the access opening of the oven in such a way that the airflow is perpendicular to the profile delimiting the opening itself, and in which said airflow is generated only contextually to the opening of the door of the oven and in a substantially operative condition of the oven which requires the presence of a certain baking temperature inside the baking chamber.

[0012] D3 discloses a vent structure for venting an air space around the cavity of a self-cleaning food oven with the vent structure including a damper located at the airflow exit mouth along the upper border of the access span of the baking chamber of said oven.

[0013] It is therefore reasonable to consider as known:

- ☐ a baking oven for domestic use or to be embedded;
- ☐ a baking oven for domestic use or to be embedded provided with a cooling system of the baking chamber by means of ventilation through a duct surrounding the baking chamber;
- ☐ a thermal barrier consisting of a forced airflow which is generated by fan means and induced through a duct with at least one exit mouth, which thermal barrier precludes the heat exit from a heating chamber;
- ☐ a food baking oven provided with means intended to generate a thermal barrier consisting of an airflow, which airflow exits through some openings located in correspondence of the upper border of a baking chamber access span which is closed by a door through which one can access the baking chamber, wherein said thermal barrier is active with the door in an open position and in a baking operative condition of the food oven.

Brief description of the invention

[0014] Domestic use food baking oven to be embedded, of the type provided with a ventilation system for the thermal insulation of the baking chamber, with an airflow control device of the heat dispersion from the baking chamber, and with integrated ventilation system for the thermal insulation of the baking chamber, which oven, at the baking chamber access span, in an operative baking condition of said oven and with the baking chamber access door in an open condition, has the forced airflow generated by the ventilation system for the thermal insulation of the baking chamber which is in a diverted condition at the baking chamber access span, wherein said airflow is diverted by means of a flow diverter, said flow diverter being of the type which can be shut down as soon as the access door of the oven, in a closed condition, is arranged in abutment with said flow diverter or with a part of it.

Aims

[0015] In this way, by the considerable creative contribution the effect of which constitutes an immediate and non-negligible technical progress, different and important aims are achieved.

[0016] A first aim is to retain inside the oven the heat produced during the baking of the food, whenever the condition in which the user opens the oven door occurs, to stir, to inspect or to sprinkle cooking liquids, by means of the airflow barrier generated by the hot airflow produced by the insulation ventilation of the baking chamber.

[0017] A second aim is to eliminate, by means of the airflow barrier, the blasts, making the intervention of the user more comfortable, easier and safer.

[0018] A third aim is to reduce by means of the airflow barrier, the baking time in the usual baking cycle which considers the conventional periods with the door in an open/closed condition, due to the fact that the temperature detectable inside the baking chamber of the oven is not subject to relevant variations. In this way a greater rapidity is also allowed in restoring the steady state temperature originally set in the baking chamber, because the fluctuations of temperature in the baking chamber are minimum. Finally, also due to the fact that the changes of temperature in the baking chamber are minimum, an improvement of the food baking cycle is achieved, with an optimal coloring and uniformity of the food.

[0019] A fourth aim is to reduce, by means of the airflow barrier, power consumption because the temperature inside the oven baking chamber is less subject to significant changes and, as a result, less power is required to restore the original condition.

[0020] In conclusion, these aims and advantages have the value to obtain a food baking oven for domestic use or to be embedded with a good technological content.

[0021] These and other advantages will appear from the following detailed description of a preferred solution

with the aid of the enclosed schematic drawings whose execution details are not to be considered limitative but only and exclusively illustrative.

Content of the drawings

[0022]

□ Figure 1 is a view of the original path of the airflow of the cooling ventilation system for the thermal insulation of the baking chamber;

□ Figure 2 is a view of the path of the airflow of the cooling ventilation system for the thermal insulation of the baking chamber in a deviated condition of the flow to obtain the thermal barrier function;

□ Figure 3 is a view of the position of the flow diverter with the baking chamber access door in an open condition;

□ Figure 4 is a detailed view of the position of the flow diverter with the baking chamber access door in a condition close to the closed condition;

□ Figure 5 is a view of the position of the flow diverter with the baking chamber access door in a closed condition;

□ Figure 6 is a view of the position of the flow diverter only in a closed condition;

□ Figure 7 is a view of the position of the flow diverter only in an open condition;

□ Figure 8 is an exploded view of the flow diverter only.

Practical embodiment of the invention

[0023] The present innovation refers to a food baking oven (10) of the type to be embedded or for domestic use, with an airflow control device (100) of the heat dispersion from the baking chamber (20) through the access span (200) and with integrated ventilation system for the thermal insulation by means of a thermal barrier of the access span (Figs. 1 and 2). In particular, the oven (10) includes a baking chamber (20) surrounded by a frame (11) to which one can frontally access through the access span (200) which is closable by means of a door (300) of the type which is hinged to the frame (11) of the oven (10). The door (300) closing the access span (200) of the baking chamber (20) can be of the type hinged along the lower border (12) of the frame (11) of the oven (10), as represented in Figure 3, or as in other solutions not shown, along the upper border (13) of the frame (11) of the oven (10), or moreover with an arrangement of the hinges allowing a folding opening of the door (30) such as for example along the vertical border of the frame (11) of the oven (10), or sideways with respect to the access span (200).

[0024] The oven (10) is of the type provided with a cooling ventilation system for the thermal insulation of the baking chamber (20) by generating an airflow (f1) licking the external surface of the baking chamber (20)

along a path which is defined inside the frame (11) of the oven. Therefore, said cooling ventilation system consists of at least one environment air input vent (30) obtained in correspondence of the lower border (12) of the frame (11) of the oven (10) on the front side, followed by a duct (40) externally surrounding the baking chamber (20). Along the duct (40) a tangential fan (50) is present which pushes the cold air sucked through the environment air input vent (30) towards a hot air exit vent (60) which is located near the access span (200), along the upper border of the frame (11) of the oven (10) at the side of the access span (200) and which in this case is located on the front.

[0025] At the air exit vent (60) through which the cooling ventilation airflow (f1) flows outside the oven (10) for the thermal insulation of the baking chamber (20), the airflow (f2) control device (100) is present which controls the heat dispersion from the baking chamber (20) (Figs. 2, 3, 4 and 5). More in detail, along the upper and horizontal profile (61) of the air exit vent (60) the control device (100) is joined, which essentially consists of an anchor plate (101) fixed by means of screws to said upper and horizontal profile (61) of the exit vent (60). The anchor plate (101) at the upper face (101a) is provided with supports (102, 103, 104) each of which consisting of two spaced symmetrical and parallel walls (110, 111) and facing one another, each of which having a central hole (112), in such a way as to interpose a rotational shaft (113) engaged inside said holes (112). The purpose of each rotational shaft (113) is to allow to support in a hinged way the flow diverter (120). Even in more detail, said flow diverter (120), consists of a rectilinear wing shaped like a deflector, obtained from a plastic material, which in correspondence of the greater side (121) is provided with three overhanging hooks (122, 123, 124) with a semicircular section, each of which is engaged to the corresponding rotational shaft (113) of each support (102, 103, 104). In this way the flow diverter (120) is dynamic, being able to rotate with respect to the anchor plate (101) which is static, because it is fixed at the air exit vent (60) through which the cooling ventilation airflow (f1) for the thermal insulation of the baking chamber (20) flows outside the oven (10). The flow diverter (120) is elastically hinged with respect to the anchor plate (101) due to the fact that spiral springs (130) are provided, at least one for each support (102, 103, 104). Each spiral spring (130) is joined to the relative rotational shaft (113) and with a first end (131) presses the flow diverter (120) while the second end (132) is located at the anchor plate (101) between the latter and the upper and horizontal profile (61) of the exit vent (60).

[0026] Operatively, (Figs. 2, 4 and 5), the oven (10) in a conventional condition corresponding to the baking of the food contained in the baking chamber (20), has a ventilation airflow (f1) for the thermal insulation, which is sucked through the environment air input vent (30) and runs along the peripheral duct (40) with respect to said baking chamber (20), to be sent towards the air exit vent

(60) by means of the tangential fan (50). With the door (300) in an open condition (Figures 2 and 3) the flow diverter (120) is directed towards the bottom in such a way as to intercept the flow (f1) and deviate the airflow (f1) generating an airflow (f2) acting as an air blade barrier parallel to the access span (200) in such a way as to involve at least all the width of said access span (200). In this condition the flow diverter (120) is maintained in an open position due to the tension applied by the springs (130) pushing downwards and in a predetermined position said flow diverter (120). Vice-versa, by closing the door (300) occluding the access span (200) of the baking chamber (20) of the oven (10), the tooth (301) along the upper border of the door (300) goes in abutment with the outwardly directed surface of the flow diverter (120), in such a way as to counteract the elastic effect of the springs (130) (v. Fig. 4). By further pushing the door (300) until reaching its closed condition (Fig. 5), the flow diverter (120) is caused to rotate towards the baking chamber (20) and therefore to remain in an upwardly rotated position until the door (300) is opened again. In this case, when one opens the door (300) again, the progressive contextual elastic release of the flow diverter (120) occurs in the condition shown in Figures 2 and 3.

Reference

[0027]

(10) oven
 (100) airflow control device
 (20) baking chamber
 (200) access span
 (11) frame
 (300) door
 (12) lower border of the frame (11)
 (13) upper border of the frame (11)
 (f1) ventilation airflow
 (30) environment air input vent
 (40) duct
 (50) tangential fan
 (60) hot air exit vent
 (f2) airflow thermal barrier
 (101) anchor plate
 (61) horizontal and upper profile of the air exit vent (60)
 (101a) upper face
 (102, 103, 104) supports
 (110, 111) symmetrical and parallel walls
 (112) central hole
 (113) rotational shaft
 (120) flow diverter
 (121) greater side
 (122, 123, 124) overhanging hooks
 (130) spiral springs
 (131) first end
 (132) second end
 (301) tooth of the door (300)

Claims

1. Food baking oven, with airflow control device of the heat dispersion from the baking chamber through the access span, and with integrated ventilation system for the thermal insulation with thermal barrier of the access span, comprising:

- a baking chamber (20) defined by a frame (11) of the oven (10) which is frontally accessible through the access span (200) which is closable by means of a door (300);
- a cooling ventilation system for thermal insulation of the baking chamber (20) with the airflow (f1) licking the external surface of the baking chamber (20) and consisting of at least one environment air input vent (30) obtained in correspondence of the lower border (12) of the frame (11) followed by a duct (40) with a tangential fan (50) which pushes the sucked cold air towards at least one hot air exit vent (60) which is located near the access span (200);

characterised in that in correspondence of the hot air exit vent (60) an airflow (f2) control device (100) is present controlling the heat dispersion from the baking chamber (20) through the access span (200), wherein said control device (100) includes a flow diverter (120).

2. Food baking oven, with airflow control device of the heat dispersion from the baking chamber through the access span, according to claim 1, **characterised in that** the flow diverter (120) of the control device (100) is elastically yielding.
3. Food baking oven, with airflow control device of the heat dispersion from the baking chamber through the access span, according to claim 1 and 2, **characterised in that** the control device (100) includes an anchor plate (101) joined in correspondence of the exit vent (60), said anchor plate (101) being provided along the face (101a) with supports (102, 103, 104) each of which consisting of symmetrical and parallel walls (110, 111) spaced from and facing each other, in such a way as to interpose a rotational shaft (113), a flow diverter (120) being hinged to each of them.
4. Food baking oven, with airflow control device of the heat dispersion from the baking chamber through the access span, according to the previous claims **characterised in that** the flow diverter (120) consists of a rectilinear wing shaped like a deflector, which, in correspondence of the side (121), has overhanging hooks (122, 123, 124), each of which is engaged to the corresponding rotational shaft (113) of each support (102, 103, 104), said flow diverter (120)

being of the dynamic type with respect to the static anchor plate (101).

5. Food baking oven, with airflow control device of the heat dispersion from the baking chamber through the access span, according to the previous claims **characterised in that** the flow diverter (120) is elastically hinged with respect to the anchor plate (101), due to the provision of springs (130), at least one spring being provided for each support (102, 103, 104).
6. Food baking oven, with airflow control device of the heat dispersion from the baking chamber through the access span, according to the previous claims **characterised in that** each spiral spring (130) is joined to the respective rotational shaft (113) and with a first end (131) it acts on the flow diverter (120) while the second end (132) is located in correspondence of the anchor plate (101).
7. Integrated ventilation system for the thermal insulation with thermal barrier of the access span for food baking ovens, with an airflow (f2) control device (100) controlling the heat dispersion from the baking chamber (200), according to at least one of the previous claims; in which the oven (10) in a conventional condition of the food contained in the baking chamber (20), presents a ventilation airflow (f1) for the thermal insulation, which is sucked through the environment air input vent (30), it flows along the duct (40) which is peripheral with respect to said baking chamber (20), and it is sent by means of the tangential fan (50) towards the air exit vent (60); **characterised in that**, when the door (300) is in an open condition, the flow diverter (120) is directed towards the bottom in such a way as to intercept the flow (f1) and deviate the airflow (f1) generating an airflow (f2) acting as an air blade barrier parallel to the access span (200) in such a way as to involve at least all the wideness of said access span (200).
8. Integrated ventilation system, according to claim 7 **characterised in that** closing the door (300) occluding the access span (200) of the baking chamber (20) of the oven (10), the tooth (301) along the top edge of the door (300) goes in abutment with the outwardly directed surface of the flow diverter (120), in such a way as to counteract the elastic effect of the springs (130), and in which further pushing the door (300) until reaching its closed condition, the flow diverter (120) is caused to rotate towards the baking chamber (20) and therefore to remain in an upwardly rotated position until the door (300) is opened again, due to the fact that, when one opens the door (300) again, the progressive contextual elastic release of the flow diverter (120) occurs.

9. Integrated ventilation system according to claims 7 and 8, **characterised in that** the flow diverter (120), in an open door (300) condition, is maintained in an open position due to the tension applied by the springs (130) pushing downwards and in a predetermined position. , 5

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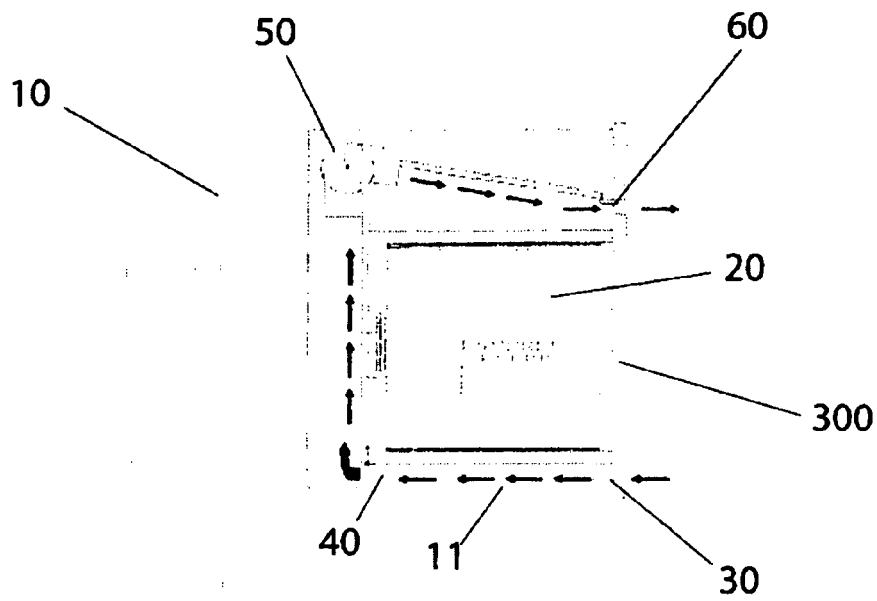


Fig. 1

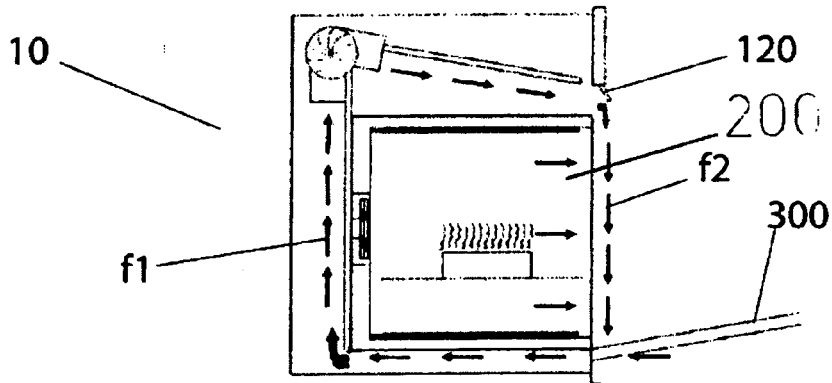


Fig. 2

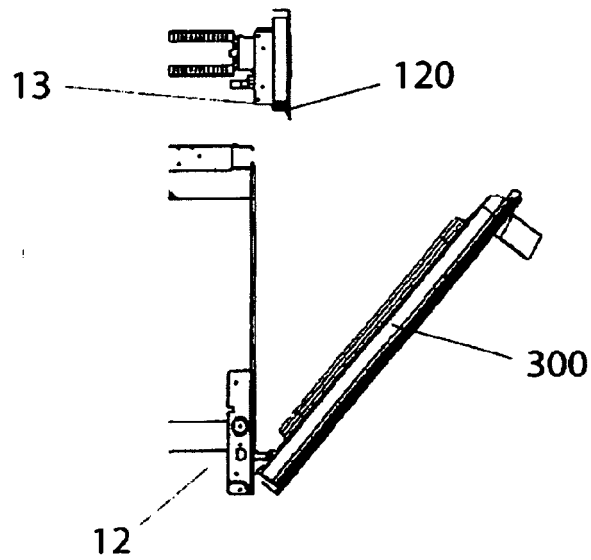


Fig. 3

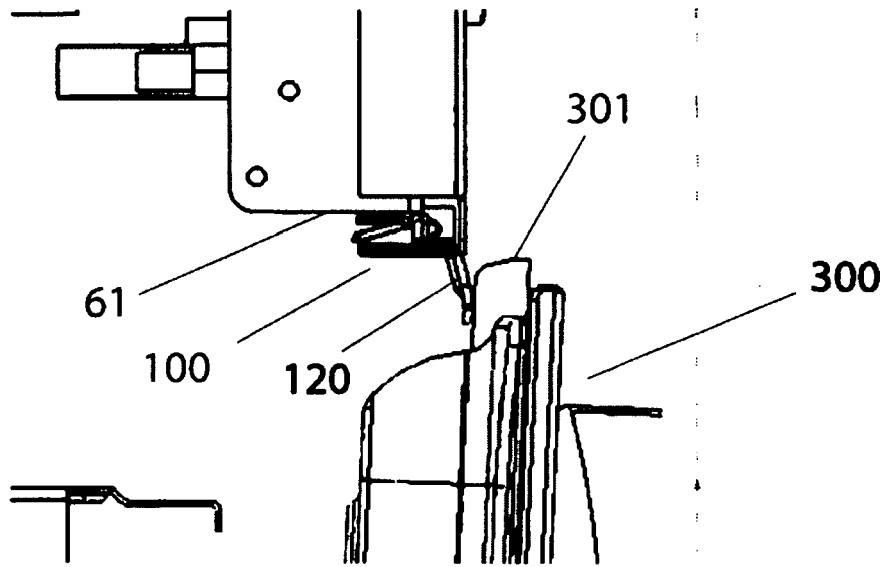


Fig. 4

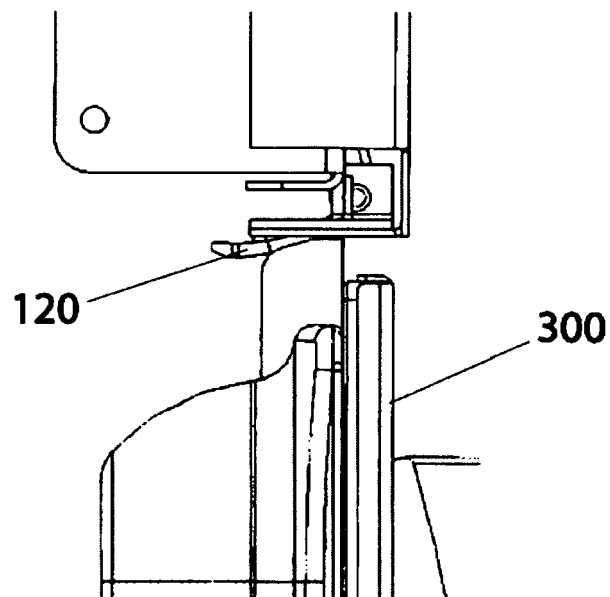


Fig. 5

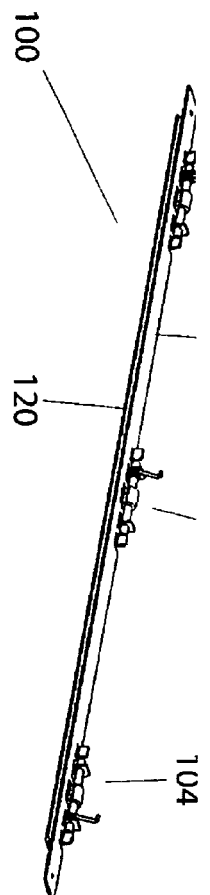


Fig. 6

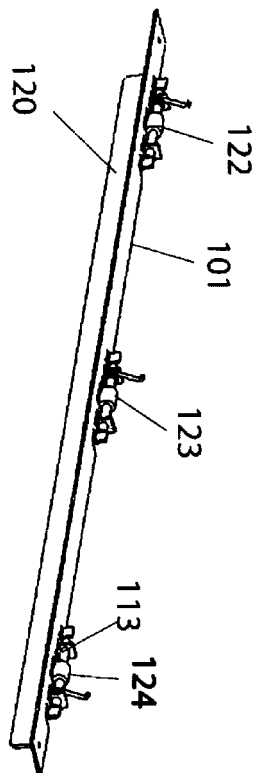
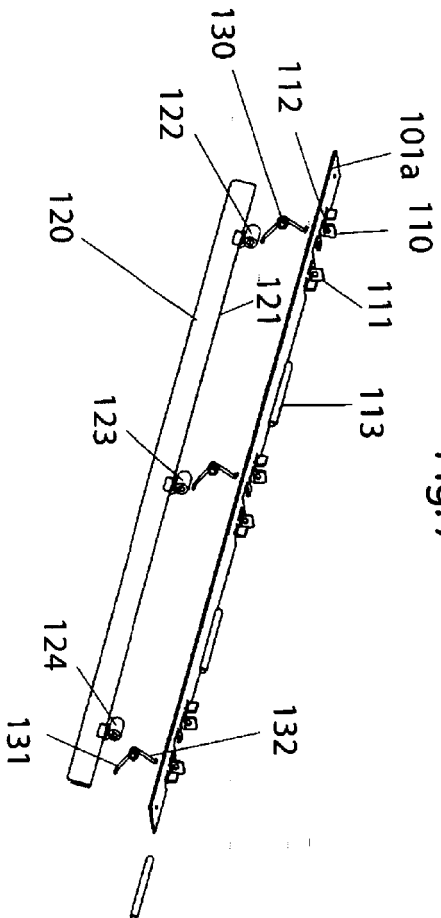


Fig. 7





EUROPEAN SEARCH REPORT

Application Number
EP 09 01 1711

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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 13 November 2009	Examiner Moreno Rey, Marcos
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			

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EPO FORM 1503 03.82 (P04C01)

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

EP 09 01 1711

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