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(54) **Extraction device for kitchen ventilation systems**

(57) An extraction device **(210,410)** for use in kitchen ventilation systems (200) is proposed. The extraction device **(210,410)** comprises a filter assembly **(235_j)** for filtering cooking fumes **(C_F)** from a kitchen environment **(K_{E2})**, the filter assembly **(235_j)** comprising filter units **(235_1,235_2,235_3,235_4)** each one having, at opposite faces thereof, an input section for receiving the cooking fumes **(C_F)** and an output section for providing discard air resulting from cooking fumes **(C_F)** filtering. The extraction device **(210,410)** further comprises a hollow case **(225)** for supporting the filter assembly **(235_j)**, the case **(225)** having on its top **(225_T)** an output opening **(125_{OUT})** for allowing exhaustion of the discard air. The case (225) has on its bottom **(225_T)** an input opening **(225_{IN})** for the passage of the cooking fumes **(C_F)** from below the extraction device. The filter units **(235_1,235_2,235_3,235_4)** are arranged in succession inside the case **(225)** and along a longitudinal direction **(Y)** of the case **(225),** the input and output sections of each filter unit **(235_1,235_2,235_3, 235_4)** facing said input **(225_{IN})** and output **(125_{OUT})** openings, respectively, thereby the cooking fumes **(C_F)** passing through said input opening **(225_{IN})** are intercepted and filtered by the filter units **(235_1,235_2,235_3,235_4)** and the corresponding discard air is exhausted through the output opening **(125_{OUT}).** d

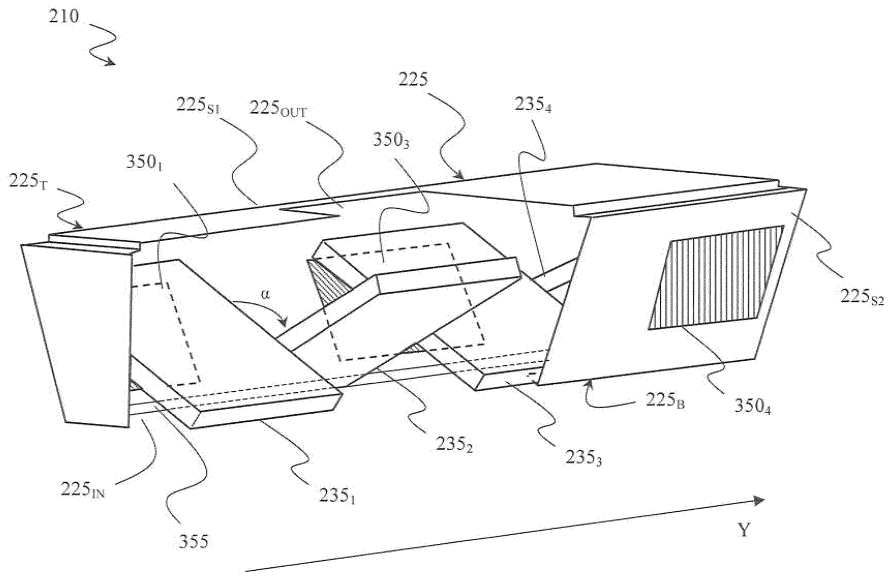

FIG.3

EP 2 840 322 A1

Description

Field of the invention

[0001] The present invention generally relates to kitchen ventilation systems (such as ventilation ceilings or range hoods) adapted to evacuate cooking fumes resulting from cooking processes. More particularly, the present invention relates to an improved extraction device for use in such ventilation systems.

Background of the invention

[0002] In most kitchen environments, *e.g.* professional kitchens in restaurants and other commercial buildings, ventilation systems are used for removal of cooking fumes - *i.e.* grease, smoke and/or odors laden air - unavoidably produced from cooking processes and combustion of cooking gas.

[0003] A widely practiced ventilation system (*e.g.*, ventilation ceiling or range hood) generally comprises an extraction device for extracting (and filtering) the cooking fumes from the kitchen environment, an exhaust duct system for exhausting air resulting from filtering of the extracted cooking fumes (hereinafter, discard air) outside the building, and one or more motorized blowers providing forced ventilation for promoting said extraction and exhaustion processes.

[0004] According to a typical implementation, the extraction device comprises a hollow case and a filter assembly comprising a number of - *e.g.*, labyrinth-type - filter units exposed from side surfaces of the case. In operation, the forced ventilation induced by blower causes the cooking fumes to pass through the filters units intercepting them, and the corresponding discard air within the case to be exhausted outside the building through the exhaust duct system.

[0005] As cooking fumes may have deleterious effects on health (as well as affect gas combustion of cooking ranges), cooking fumes extraction should be as fast as possible.

[0006] However, as the cooking fumes extraction decreases the amount of available air for personnel breathing and gas combustion, clean air should be continuously fed into the kitchen environment. This may be achieved by natural convection generated upon kitchen doors and/or windows opening, or by equipping the ventilation system with a compensation group for drawing ambient air from outside the kitchen environment (*e.g.*, from the external of the building or from adjacent rooms), and heating it up/cooling it down (according to the desired temperature) before feeding it into the kitchen environment.

Summary of the Invention

[0007] The Applicant has found that the known and practiced ventilation systems based on the above-described extraction device are not satisfactory for modem technological and costs requirements.

[0008] According to the Applicant, this is substantially due to extraction device inadequateness in terms of cooking fumes extraction flow rate - *i.e.,* the volume of extracted cooking fumes per unit time.

[0009] The extraction flow rate of such an extraction device is in direct relationship to the overall filtering surface (given by number of filter units and size thereof) available for intercepting and filtering the cooking fumes, and to the cooking fumes crossing speed (*i.e.,* the speed at which the cooking fumes are allowed to pass through the filter units). In other words, the extraction flow rate increases as filtering surface and/or crossing speed increases.

[0010] If, on the one hand, a low extraction flow rate may involve cooking fumes stagnation within the kitchen environment, on the other hand an excessively high extraction flow rate (such as for the known extraction devices) may involve excessive uptake of air from the kitchen environment (*i.e*., exhausted discard air to be compensated). In case of air compensation based on natural convection, this requires keeping the kitchen doors and/or windows wide opened for relatively long times (which is not a comfortable solution, especially in very hot or very cold climates), whereas in case of air compensation achieved by a dedicated compensation group of the ventilation system, this involves high costs (as an increased clean air demand implies more power consumption by the compensation group for drawing and treatment thereof).

[0011] The Applicant has noticed that, typically, ventilation systems of the above-mentioned type are dimensioned to efficiently exhaust cooking fumes without stagnations, but uptake too much air from the kitchen environment (*i.e.*, they feature excessively high extraction flow rate). However, lowering the extraction flow rate by discretionally decreasing the overall filtering surface (*e.g.*, by replacing or covering one or more filter units with case portions or blind panels, respectively) and/or by reducing the crossing speed is not a practicable approach to solve this problem. Indeed, in both cases, the amount of cooking fumes directed towards the extraction device that would not be intercepted by the filter units and thus stagnate within the kitchen environment would drastically increase. In other words, the extraction device would feature a lower interception capacity of the cooking fumes, *i.e.* it would intercept a lower amount of all the cooking fumes directed towards, and hitting it. Indeed, considering as an example to replace half of the filter units by blind panels (so as to halve the overall filtering surface, thereby halving the extraction flow rate), the cooking fumes hitting such blind panels would not be intercepted any longer upon said hitting, neither most of them would be intercepted by the filter units adjacent the blind panels (*e.g.* due to unpredictable whirlwinds originating with other cooking fumes in the neighborhoods that would cause cooking fumes moving away from the extraction device),

which would result in a substantially halved interception capacity.

[0012] On the other hand, also decreasing the overall filtering surface while increasing the crossing speed - for partly balancing the reduced interception capacity - is not a viable solution. Indeed, this would make stronger and more unpredictable whirlwinds outside the extraction device, with resulting further negative effect on the interception capacity, and would cause intense whirlwinds inside the extraction device (*e.g.*, due to violent crashing between cooking fumes passing through filter units encased at opposite sides of the extraction device case), with resulting negative effect on extraction and exhaust processes.

[0013] The Applicant has therefore faced the problem of devising a satisfactory solution able to overcome the above-discussed drawbacks.

[0014] In particular, one or more aspects of the solution according to specific embodiments of the invention are set out in the independent claims, with advantageous features of the same solution that are indicated in the dependent claims (with any advantageous feature provided with reference to a specific aspect of the solution according to an embodiment of the invention that applies *mutatis mutandis* to any other aspect thereof).

[0015] An aspect of the solution according to one or more embodiments of the invention relates to an extraction device for use in kitchen ventilation systems. The extraction device comprises a filter assembly for filtering cooking fumes from a kitchen environment, the filter assembly comprising filter units each one having, at opposite faces thereof, an input section for receiving the cooking fumes and an output section for providing discard air resulting from cooking fumes filtering. The extraction device further comprises a hollow case for supporting the filter assembly, the case having on its top an output opening for allowing exhaustion of the discard air. The case has on its bottom an input opening for the passage of the cooking fumes from below the extraction device. The filter units are arranged in succession inside the case and along a longitudinal direction of the case, the input and output sections of each filter unit facing said input and output openings, respectively, thereby the cooking fumes passing through said input opening are intercepted and filtered by the filter units and the corresponding discard air is exhausted through the output opening.

[0016] According to an embodiment of the invention, each filter unit extends between a first side wall of the case and a second side wall of the case opposite said first side wall.

[0017] According to an embodiment of the invention, said filter units comprise at least one first filter unit arranged such that the input section thereof faces the first side wall of the case, and the output section thereof faces the second side wall of the case, and at least one second filter unit arranged such that the input section thereof faces the second side wall of the case, and the output section thereof faces the first side wall of the case.

[0018] According to an embodiment of the invention, the filter units are arranged in alternate succession of first filter units and second filter units, each first filter unit defining, in a view according to said longitudinal direction, a crossed arrangement with any previous and/or following second filter unit of the succession.

[0019] According to an embodiment of the invention, the side walls of the case comprise intake grids for allowing further passage of cooking fumes from laterally the extraction device.

[0020] According to an embodiment of the invention, said intake grids comprise at least one first intake grid provided at the first side wall of the case and facing a corresponding first filter unit, and at least one second intake grid provided at the second side wall of the case and facing a corresponding second filter unit.

[0021] According to an embodiment of the invention, each first intake grid and each second intake grid has an extent substantially defmed by the orthogonal projection of the corresponding first filter unit on the first side wall and of the corresponding second filter unit on the second side wall, respectively.

[0022] According to an embodiment of the invention, the case comprises on its bottom a peripheral gutter member for supporting the filter units and allowing collection of condensed grease resulting from cooking smokes filtering.

[0023] According to an embodiment of the invention, the extraction device further comprises baffle members arranged between adjacent filter units for deflecting scattered cooking fumes towards the input sections of adjacent filter units.

[0024] According to an embodiment of the invention, each baffle member comprises attachment flaps each one adapted to be fixed to a corresponding filter unit.

[0025] According to an embodiment of the invention, the filter units comprise labyrinth filters.

[0026] Another aspect of the solution according to one or more embodiments of the invention relates to a ventilation system for a professional kitchen. The ventilation system comprises said at least one extraction device for extracting cooking fumes from the kitchen environment, an exhaust duct system fluidly connected to the extraction device for exhausting the discard air outside the kitchen environment, and at least one motorized blower for providing forced ventilation thereby promoting said extraction and exhaustion processes.

[0027] According to an embodiment of the invention, the ventilation system comprises a ventilation ceiling or a range hood.

[0028] The extraction device of the present invention (and the corresponding ventilation system comprising such an extraction device) features an extraction flow rate high enough to avoid cooking fumes stagnation within the kitchen environment, but not so high to draw too much air from such environment (thus possibly avoiding the high costs of a compensation group). This has been achieved by using a reduced number of filter units ar-

ranged in a optimized way so as to achieve same, or higher, interception capacity, thus resulting in a cheaper extraction device.

[0029] From now on, the "extraction flow rate" will denote the volume of extracted cooking fumes per unit time, which is in direct relationship to the overall filtering surface available for intercepting and filtering the cooking fumes, and to the crossing speed.

[0030] Instead, the "interception capacity" will denote the capacity of the extraction device to intercept the cooking fumes directed towards and hitting it, for their extraction from the kitchen environment. As should be understood, the interception capacity depends on the overall filtering surface with respect to the overall outer surface of the extraction device that can be hit by the cooking fumes. In other words, the interception capacity provides an indication of how much of the overall outer surface of the extraction device the cooking fumes can virtually hit is occupied by filter units able to intercept (and filter) them.

Brief Description of the Drawings

[0031] These and other features and advantages of the solution according to one or more embodiments of the invention will be best understood with reference to the following detailed description, given purely by way of a non-restrictive indication, to be read in conjunction with the accompanying drawings (wherein corresponding elements are denoted with equal or similar references, and their explanation is not repeated for the sake of exposition brevity). In this respect, it is expressly understood that the figures are not necessarily drawn to scale (with some details that may be exaggerated and/or simplified) and that, unless otherwise indicated, they are simply used to conceptually illustrate the described structures and procedures. In particular:

Figure 1 schematically shows a sectional view of a part of a kitchen environment known in the state of the art;

Figure 2 schematically shows a sectional view of a part of a kitchen environment provided with a kitchen ventilation system according to the principles of the present invention;

Figure 3 schematically shows a perspective view of an extraction device according to an embodiment of the present invention, and

Figures 4A and **4B** schematically show a perspective view of a part of an extraction device according to another embodiment of the present invention, and a close-up view thereof, respectively.

[0032] With reference to the drawings, **Figure 1** schematically shows a sectional view of a part of a kitchen environment $\mathbf{K_{E1}}$ (*e.g.*, a professional kitchen) known in the art.

[0033] As usual, the kitchen environment $\mathbf{K_{E1}}$ is provided with a ventilation system **100** for removing cooking fumes (*i.e.*, grease, smoke and/or odors laden air) $\mathbf{C_F}$ generated by one or more (*e.g.*, two in the example at issue) electric and/or gas cooking appliances **105** (*e.g.*, cooking range, oven and the like) during operation thereof.

[0034] The ventilation system **100** (i. e. a ventilation ceiling - as herein assumed and illustrated by way of example only - or a range hood) comprises one or more (two, in the illustrated example) extraction devices **110** (preferably arranged over one or more respective cooking appliances **105)** for extracting and filtering the cooking fumes $\mathbf{C_F}$, an exhaust duct system **115** for allowing discard air from (cooking fumes extraction and filtering by) each extraction device **110** to be exhausted outside the kitchen environment $\mathbf{K_{E1}}$, and one or more (three, in the illustrated example) motorized blowers **120** providing forced ventilation for promoting said extraction, filtering and exhaustion processes.

[0035] Each extraction device **110** comprises a hollow case **125,** preferably wedge-shaped and made of metal, whose top wall comprises an output opening $\mathbf{125_{OUT}}$ generally configured for allowing exhaustion of the discard air. In this respect, the exhaust duct system **115** comprises air exhausting pipes **128** to guide exhausted air to the outside of the kitchen environment $\mathbf{K_{E1}}$, and joint members **130** fitted each one within the output opening $\mathbf{125_{OUT}}$ of a corresponding extraction device **110** and fluidly connecting the extraction device **110** with the air exhausting pipes **128.** Thus, the case hollow of each extraction device **110** is fluidly connected with the outside of the kitchen environment $\mathbf{K_{E1}}$ through said output opening $\mathbf{125_{OUT}}$, the corresponding joint member **130** and the exhausting pipes 128.

[0036] A number *N* of filter units $\mathbf{135_i}$ (*i*=1,2, ...*N*, with *N*=8 in the example at issue - only the filter units $\mathbf{135_1}$ and $\mathbf{135_5}$ being visible in the figure) are arranged at, and exposed from, opposite side surfaces of the case **125 -** with input and output sections (*i.e.*, airflow input and output sides) of each filter unit $\mathbf{135_i}$ that are directed towards the kitchen environment $\mathbf{K_{E1}}$ and the corresponding case hollow, respectively. Thus, in operation, the forced ventilation induced by blowers **120** causes the cooking fumes $\mathbf{C_F}$ to pass through the filters units $\mathbf{135_i}$ where they are intercepted, and the corresponding discard air to be exhausted outside the kitchen environment $\mathbf{K_{E1}}$ through the exhaust duct system **115.** On each side of the case **125,** the filter units $\mathbf{135_i}$ are arranged side by side and on a same plane, so as to form two elongated filtering areas inclined one with respect to the other. The lower part of each filter unit is held by a common central supporting member.

[0037] The ventilation system **100** may also comprise a compensation group generally configured for compensating the discard air by clean air thereby ensuring optimal air conditions for personnel within the kitchen environment $\mathbf{K_{E1}}$ (as well as optimal gas combustion of gas cooking appliances, if provided). In this respect the com-

pensation group comprises a further duct system **115'** for drawing ambient air from outside the kitchen environment $\mathbf{K_{E1}}$ (*e.g.*, from the external of the building or from adjacent rooms), a heating/cooling device **140** for heating up/cooling down (according to the desired temperature) the external air and feeding a temperature-adjusted clean air $\mathbf{C_A}$ into the kitchen environment $\mathbf{K_{E1}}$, and a further motorized blower (or more thereof) **120'** for promoting such drawing, treatment and feeding operations.

[0038] As discussed in the introductory part of the present description, the extraction device **110** is implicitly inadequate to feature an extraction flow rate high enough to avoid cooking fumes stagnation within the kitchen environment $\mathbf{K_{E1}}$, but low enough to prevent excessive uptake of breathing air from the kitchen environment. In fact, the extraction flow rate increases as the overall filtering surface available for intercepting and filtering the cooking fumes $\mathbf{C_F}$ (in turn depending on number and size of filter units $\mathbf{135_i}$ of each extraction device **110),** and crossing speed (*i.e.,* the speed at which the cooking fumes $\mathbf{C_F}$ are allowed to pass through the filter units $\mathbf{135_i}$) increase. Assuming, as usual for today's standard extraction devices, a filter unit 0.4m x 0.35m sized (thus, an overall filtering surface equal to 8 x 0.4 x 0.35 m^2 for an extraction device **110** comprising eight filter units), and a crossing speed of 1 m/s, the extraction flow rate is of 4032 m^3/h.

[0039] However, the Applicant has verified that a suitable range of values of the extraction flow rate to avoid cooking fumes stagnation and to prevent excessive air uptake is between 2500 m^3/h and 3500 m^3/h, while guaranteeing an adequate crossing speed of the filter units (*i.e.*, equal to, or, preferably, higher than 1 m/s).

[0040] Decreasing the overall filtering surface or decreasing the crossing speed are not practicable solutions for lowering the extraction flow rate, as causing a reduced interception capacity of the cooking fumes. Instead, decreasing the overall filtering surface while slightly increasing the crossing speed - for partly balancing the reduced interception capacity - may cause whirlwinds within the case **125** (and hence inefficiencies of the extraction device **110).**

[0041] With reference to **Figure 2,** it is schematically shown a sectional view of a part of a kitchen environment $\mathbf{K_{E2}}$ provided with a ventilation system **200** according to the principles of the present invention. The ventilation system **200** differs from the ventilation system **100** for the provision of improved extraction devices **210.** In this regard, for the sake of conciseness and clarity, such figure will be discussed together with **Figure 3,** the latter schematically showing a perspective view with partly removed parts of one of such extraction devices **210** according to an embodiment of the present invention.

[0042] As visible in the figures, each extraction device **210** comprises a case **225** whose top $\mathbf{225_T}$ has, similarly to the system of **Figure 1,** an output opening $\mathbf{225_{OUT}}$ for exhaustion of the discard air, and whose bottom $\mathbf{225_B}$ (opposite the top $\mathbf{225_T}$ and directed, in use, towards the floor of the kitchen environment $\mathbf{K_{E2}}$) has an input opening $\mathbf{225_{IN}}$ for passage (interception) of the cooking fumes $\mathbf{C_F}$.

[0043] The top $\mathbf{225_T}$ preferably comprises a horizontal wall having, for example in its center, said output opening $\mathbf{125_{OUT}}$. The bottom $\mathbf{225_B}$ may either comprise a bottom wall having said input opening $\mathbf{225_{IN}}$, or may be completely opened, *i.e.* having no bottom wall and an input opening $\mathbf{225_{IN}}$ substantially occupying all (or almost all) the bottom surface of the case **225,** as in the example herein illustrated. Moreover, each extraction device **210** comprises a number *M* of filter units $\mathbf{235_j}$ (*j*=1,2, ... *M*), preferably panel filters of a labyrinth-type, which are encased within the case **225,** and are arranged in succession within it (along a longitudinal direction **Y** parallel to a plane of the bottom wall) such that the input and output sections of each filter unit $\mathbf{235_j}$ face the input opening $\mathbf{225_{IN}}$ and the joint member **130,** respectively. With respect to the filter architecture of **Figure 1,** where the filter units were arranged parallel to each other along the two sides of the case so as to form two lines of filter units, the filter units $\mathbf{235_j}$ are here arranged along only one line, where they are positioned with different inclination.

[0044] The extraction device **210** features a lower extraction flow rate than the extraction device **110** for the same, or similar, interception capacity. In fact, most of the cooking fumes coming from the cooking appliance **105** are substantially vertically attracted towards the input opening $\mathbf{225_{IN}}$, and hence they are intercepted and pass through the filter units $\mathbf{235_j}$ "covering" it. In other words, provision of the input opening $\mathbf{225_{IN}}$ extending along all the longitudinal length of the extraction device **210** where most of the cooking fumes tend to be attracted, and the use of a lower number of filter units $\mathbf{235_j}$ smartly arranged such as to "cover" the whole input opening $\mathbf{225_{IN}}$ allow optimizing extraction flow rate without penalizing the interception capacity.

[0045] The longitudinal extent of the input opening $\mathbf{225_{IN}}$ is related to the number *M* of filter units $\mathbf{235_j}$ and their size. In the preferred illustrated embodiment (see **Figure 3),** a number *M* of filter units $\mathbf{235_j}$ strictly necessary to "cover" the whole input opening $\mathbf{225_{IN}}$ is provided - thus allowing the cooking fumes $\mathbf{C_F}$ passing through the input opening $\mathbf{225_{IN}}$ to be completely intercepted by the filter units $\mathbf{235_j}$. However, by virtue of the disclosed arrangement, the number *M* of filter units $\mathbf{235_j}$ of the proposed extraction device **210** will always be lower than the number *N* of filter units $\mathbf{135_i}$ of a conventional extraction device **110** having same or similar interception capacity.

[0046] In the example at issue, wherein the input opening $\mathbf{225_{IN}}$ extends along substantially all the bottom $\mathbf{225_T}$ of the case **225,** four filter units $\mathbf{235_j}$ are requested for each extraction device **210** (hence, *M*=4, as visible in **Figure 3).**

[0047] Back to the numerical example of above, the overall filtering surface for each extraction device **210** is equal to 4 x 0.4 x 0.35 m^2. Moreover, being the filter units

235_j interposed between the input opening 225_{IN} and the joint member **130** side by side along the longitudinal direction **Y,** the privileged cooking fumes uptake direction is vertical, so that whirlwinds within the case **225** affecting the known extraction device (and caused by violent crashing between cooking fumes passing through filter units at opposite sides of the case) are substantially avoided. Thus, a slightly higher value for the crossing speed may also be set (*e.g.*, 1.5 m/s) without negatively affecting interception and extraction processes. Hence, the extraction device **210** will have an extraction flow rate of about 3024 m^3/h - *i.e.,* (4 x 0.4 x 0.35) m^2 x 1.5 m/s x 3600 s/h - which is an optimal trade-off between exhausted air and bearable costs for managing the necessary clean air.

[0048] Preferably, the case **225** comprises a first and a second side wall 225_{S1}, 225_{S2} facing each other. Advantageously, the side walls 225_{S1} and 225_{S2} converge towards each other in their lower part, so that the width of the upper part of case **225** is greater that the width of its lower part. Moreover, the side walls 225_{S1} and 225_{S2} are preferably concave.

[0049] In the embodiment of **Figure 3,** each filter unit 235_j extends between the side walls 225_{S1},225_{S2}, but with alternate slanting. In particular, when looking the case **225** along **Y** direction (as in **Figure 2),** each filter unit 235_j defines a crossed (or "X") arrangement, *e.g.* with a same cross angle α (see **Figure 3),** with any previous filter unit 235_{j-1} and/or any following filter unit 235_{j+1} of the succession. In such arrangement, the input section of the filter units 235_1,235_3 faces partly the input opening 225_{IN} and partly the side wall 225_{S1}, whereas the output section of the filter units 235_2,235_4 faces partly the input opening 225_{IN} and partly the side wall 225_{S2}.

[0050] As discussed below, the "X" arrangement of the filter units 235_j is aimed at further improving interception capacity and providing simplified condensed grease collection.

[0051] In this respect, as visible in **Figure 3,** the side walls 225_{S1},225_{S2} of the case **225** comprise intake grids 350_k (k=1,2, ...P, with P=4 in the example at issue) for passage of further cooking smokes C_F (*e.g.*, those being not intercepted by the input opening 225_{IN}).

[0052] The number P and size of intake grids 350_k are not limiting features for the present invention. However in the preferred illustrated embodiment, the number P of intake grids 350_k is equal to the number M of filter units 235_j - with each intake grid 350_k that is functionally associated with a corresponding filter unit 235_j.

[0053] For example, two intake grids 350_k (*e.g.*, the intake grids 350_1,350_3) are provided at the first side wall 225_{S1} and face the (input sections of) filter units 235_1,235_3, respectively, and two further intake grids 350_k (e.g., the intake grids 350_2,350_4, only the second being shown) are provided at the second side wall 225_{S2} and face the (input sections of) filter units 235_2,235_4, respectively. Preferably, as can be appreciated in **Figure 3,** the intake grids 350_1,350_3 and the intake grids 350_2,350_4 have an extent substantially defined by the orthogonal projection of the filter units 235_1,235_3 on the first side wall 225_{S1} and of the filter units 235_2,235_4 on the second side wall 225_{S2}, respectively. In this way, the cooking fumes C_F entering the intake grids 350_1-350_4 are intercepted by the input section of the filter units 235_1-235_4, respectively, and the corresponding discard air is exhausted through the exhaust duct system **115** as above.

[0054] The provision of the intake grids 350_k, and particularly their association and functional cooperation with the filter units 235_j, effectively provides a complete interception of the cooking fumes C_F.

[0055] As visible in **Figure 3,** the bottom 225_B of the case **225** also comprises a peripheral gutter member **355** for bottom supporting the filter units 235_j and draining the condensed grease dripping down by gravity from each filter unit 235_j towards a proper tank (not illustrated).

[0056] Thus, the cross angle α should be chosen by taking into account both cooking fumes interception and condensed grease collection issues. In this respect, the cross angle α is preferably between 20 and 90 degrees, more preferably between 40 and 80 degrees and even more preferably between 50 and 70 degrees (for example, 60 degrees, as illustrated in the figures).

[0057] With reference to **Figures 4A** and **4B,** it is schematically shown a perspective view of a part of an extraction device **410** according to another embodiment of the present invention, and a close-up view thereof, respectively. The extraction device **410** is substantially analogous to the extraction device **210,** but differs from the latter for the provision of baffle members **455** arranged between adjacent filter units 235_j.

[0058] The baffle members **455** are substantially planar members arranged vertically and perpendicular to **Y** direction between two consecutive filter units 235_j to form lateral barriers for deflecting scattered cooking fumes C_F towards (the input sections of) adjacent filter units (235_1,235_2,235_3,235_4). The baffle members **455** therefore define longitudinal dividers to divide the hollow case **225** into longitudinal sections (or compartments), each section comprising a corresponding filter unit 235_j. The baffle members **455** prevent cooking fumes C_F from being directly exhausted through the exhaust duct system **115** without being filtered. In particular, the baffle members **455** prevent cooking fumes C_F from entering one section of the hollow case **225** through the input opening 225_{IN} or through the corresponding intake grid 350_k before being filtered by the filter unit 235_j of that section, and allow the cooking fumes C_F to be laterally moved to the (adjacent) filter unit 235_j of the adjacent section.

[0059] As visible in the figure, each baffle member **455** comprises attachment flaps **460** adapted to be fixed to the filter units 235_j for providing mechanical stability.

[0060] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many logical and/or physical modifications and alterations. More specifically, although the present invention has been described with a certain

degree of particularity with reference to preferred embodiments thereof, it should be understood that various omissions, substitutions and changes in the form and details as well as other embodiments are possible. In particular, different embodiments of the invention may even be practiced without the specific details (such as the numeric examples) set forth in the preceding description for providing a more thorough understanding thereof; on the contrary, well known features may have been omitted or simplified in order not to obscure the description with unnecessary particulars. Moreover, it is expressly intended that specific elements and/or method steps described in connection with any disclosed embodiment of the invention may be incorporated in any other embodiment as a matter of general design choice.

[0061] For example, analogous considerations apply if the extraction device has a different structure or includes equivalent components, or it has other operating features. In any case, any component thereof may be separated into several elements, or two or more components may be combined into a single element; in addition, each component may be replicated for supporting the execution of the corresponding operations in parallel. It should also be noted that any interaction between different components generally does not need to be continuous (unless otherwise indicated), and it may be both direct and indirect through one or more intermediaries.

[0062] The number of the filter units herein disclosed should not be construed limitatively, and may be chosen according to the longitudinal (or transversal) extent of the input opening which the bottom wall of the case is provided with. Analogously, without affecting the principles of the present invention, the number, shape and arrangement of the intake grids may be any, *e.g.* also independent from the number and shape of the filter units.

[0063] As should be readily understood, the filter units may be arranged within the case in any other suitable way.

[0064] In another embodiment of the present invention, also not shown, the filter units with same orientation are all adjacent to each other. In this way, each group of filter units with same orientation still define the "X" arrangement with any previous and/or following group of filter units with different orientation in the succession.

[0065] In a further embodiment of the present invention, also not shown, each filter unit has a different orientation with respect to any previous and/or following filter unit of the succession (*i.e.*, each pair of adjacent filter units has a respective cross angle).

[0066] Although in the present description explicit reference has been made to a compensated ventilation ceiling, the principles of the present invention apply to any other ventilation ceiling (*e.g.*, of the non-compensated type).

[0067] Moreover, the same considerations equivalently apply to a compensated and/or non-compensated range hood, particularly of the type employed in professional kitchen environments. In this respect, the extraction device of above may be associated with a - *e.g.*, metal - known skirt or capture panel. Advantageously, the range hood thus obtained comprises a single, compact and versatile extracting "core" - *i.e.,* the extraction device itself; conversely, in the known range hood solutions number, shape and arrangement of the components (*e.g.*, filter units) are specifically designed for allowing cooperation with the particular panel shape.

[0068] According to an embodiment (not illustrated) of compensated range hood, the panel may be provided with one or more baffles for deflecting the clean air being fed by the compensation group away from the range hood. In the meanwhile, air depressions naturally generating upon impact of the clean air on the baffles allows deflecting of scattered cooking fumes towards the extraction device.

Claims

1. Extraction device **(210,410)** for use in kitchen ventilation systems **(200),** the extraction device **(210,410)** comprising:

   a filter assembly **(235_j)** for filtering cooking fumes **(C_F)** from a kitchen environment **(K_{E2}),** the filter assembly **(235_j)** comprising filter units **(235_1,235_2,235_3,235_4)** each one having, at opposite faces thereof, an input section for receiving the cooking fumes **(C_F)** and an output section for providing discard air resulting from cooking fumes **(C_F)** filtering, and
   a hollow case **(225)** for supporting the filter assembly **(235_j),** the case **(225)** having on its top **(225_T)** an output opening **(125_{OUT})** for allowing exhaustion of the discard air,
   characterized in that
   the case **(225)** has on its bottom **(225_T)** an input opening **(225_{IN})** for the passage of the cooking fumes **(C_F)** from below the extraction device, and **in that**
   the filter units **(235_1,235_2,235_3,235_4)** are arranged in succession inside the case **(225)** and along a longitudinal direction **(Y)** of the case **(225),** the input and output sections of each filter unit **(235_1,235_2,235_3,235_4)** facing said input **(225_{IN})** and output **(125_{OUT})** openings, respectively, thereby the cooking fumes **(C_F)** passing through said input opening **(225_{IN})** are intercepted and filtered by the filter units **(235_1,235_2,235_3,235_4)** and the corresponding discard air is exhausted through the output opening **(125_{OUT}).**

2. Extraction device **(210,410)** according to Claim 1, wherein each filter unit **(235_1,235_2,235_3,235_4)** extends between a first side wall **(225_{S1})** of the case **(225_{IN})** and a second side wall **(225_{S1})** of the case

(225_{IN}) opposite said first side wall **(225_{S1}).**

3. Extraction device **(210,410)** according to Claim 2, wherein said filter units **(235_1,235_2,235_3,235_4)** comprise:

at least one first filter unit **(235_1,235_3)** arranged such that the input section thereof faces the first side wall **(225_{S1})** of the case **(225),** and the output section thereof faces the second side wall **(225_{S2})** of the case **(225),** and
at least one second filter unit **(235_2,235_4)** arranged such that the input section thereof faces the second side wall **(225_{S2})** of the case **(225),** and the output section thereof faces the first side wall **(225_{S1})** of the case **(225).**

4. Extraction device **(210,410)** according to Claim 2 or 3, wherein the filter units **(235_1,235_2,235_3,235_4)** are arranged in alternate succession of first filter units **(235_1,235_3)** and second filter units **(235_2,235_4),** each first filter unit **(235_1,235_3)** defming, in a view according to said longitudinal direction **(Y),** a crossed arrangement with any previous and/or following second filter unit **(235_2,235_4)** of the succession.

5. Extraction device **(210,410)** according to any one of Claims from 2 to 3, wherein the side walls **(225_{S1},225_{S2})** of the case **(225)** comprise intake grids **(350_k)** for allowing further passage of cooking fumes **(C_F)** from laterally the extraction device **(210,410).**

6. Extraction device **(210,410)** according to Claim 5, wherein said intake grids **(350_k)** comprise:

at least one first intake grid **(350_1,350_3)** provided at the first side wall **(225_{S1})** of the case **(225)** and facing a corresponding first filter unit **(235_1,235_3),** and
at least one second intake grid **(350_2,350_4)** provided at the second side wall **(225_{S2})** of the case **(225)** and facing a corresponding second filter unit **(235_2,235_4).**

7. Extraction device **(210,410)** according to Claim 6, wherein each first intake grid **(350_1,350_3)** and each second intake grid **(350_2,350_4)** has an extent substantially defined by the orthogonal projection of the corresponding first filter unit **(235_1,235_3)** on the first side wall **(225_{S1})** and of the corresponding second filter unit **(235_2,235_4)** on the second side wall **(225_{S2}),** respectively.

8. Extraction device **(210,410)** according to any of the preceding Claims, wherein the case **(225)** comprises on its bottom **(225_B)** a peripheral gutter member **(355)** for supporting the filter units **(235_1,235_2,235_3,235_4)** and allowing collection of condensed grease resulting from cooking smokes **(C_F)** filtering.

9. Extraction device **(210,410)** according to any of the preceding Claims, further comprising baffle members **(455)** arranged between adjacent filter units **(235_1,235_2,235_3,235_4)** for deflecting scattered cooking fumes **(C_F)** towards the input sections of adjacent filter units **(235_1,235_2,235_3,235_4).**

10. Extraction device **(210,410)** according to Claim 9, wherein each baffle member **(455)** comprises attachment flaps **(460)** each one adapted to be fixed to a corresponding filter unit **(235_1,235_2,235_3,235_4).**

11. Extraction device **(210,410)** according to any of the preceding Claims, wherein the filter units **(235_1,235_2,235_3,235_4)** comprise labyrinth filters.

12. Ventilation system **(200)** for a professional kitchen comprising:

at least one extraction device **(210,410)** according to any of the preceding Claims for extracting cooking fumes **(C_F)** from the kitchen environment **(K_{E2}),**
an exhaust duct system **(115)** fluidly connected to the extraction device **(210,410)** for exhausting the discard air outside the kitchen environment **(K_{E2}),** and
at least one motorized blower **(120,120')** for providing forced ventilation thereby promoting said extraction and exhaustion processes.

13. Ventilation system **(200)** according to Claim 12, wherein the ventilation system **(200)** comprises a ventilation ceiling or a range hood.

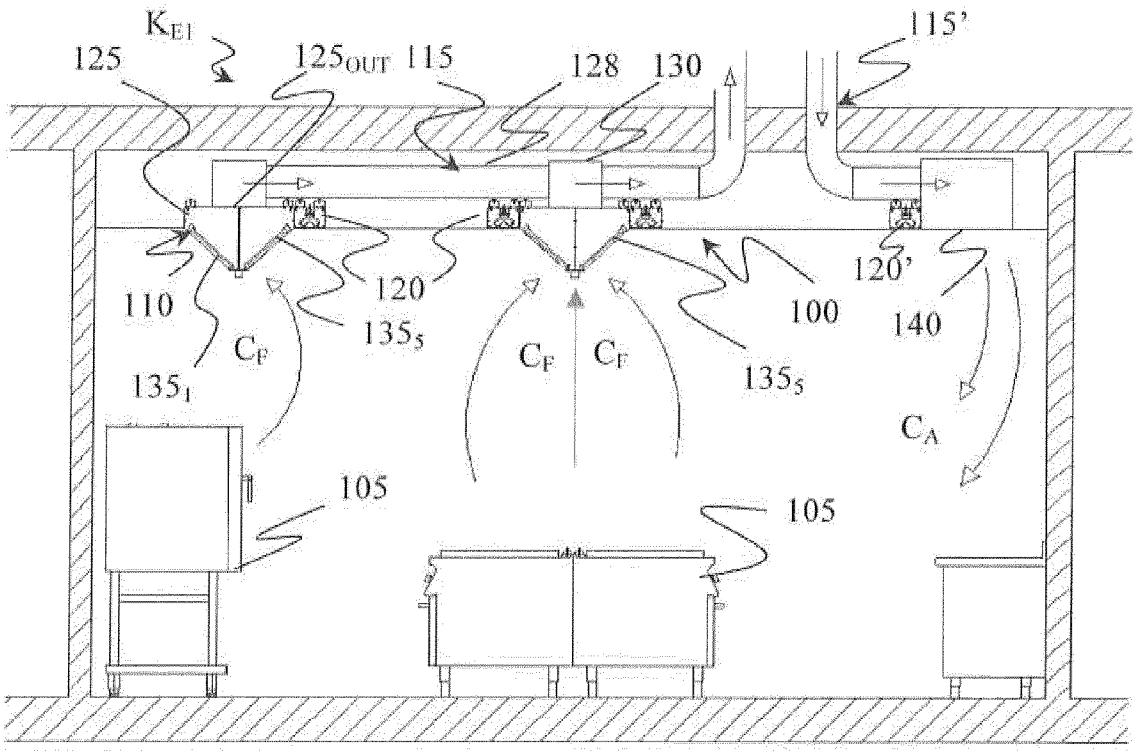
K_{E1}
125
125_{OUT}
115
128
130
115'
110
120
135_5
C_F
135_1
C_F
C_F
135_5
100
120'
140
C_A
105
105

FIG.1

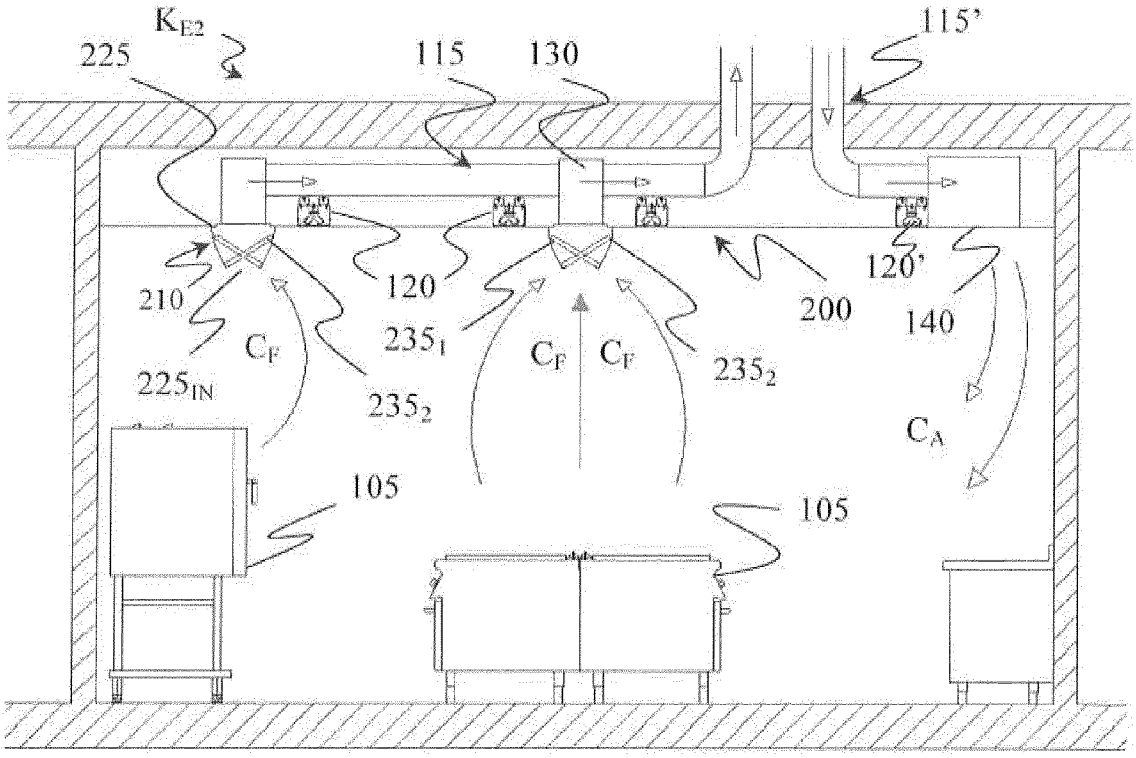
K_{E2}
225
115
130
115'
210
C_F
225_{IN}
120
235_1
235_2
C_F
C_F
200
120'
140
235_2
C_A
105
105

FIG.2

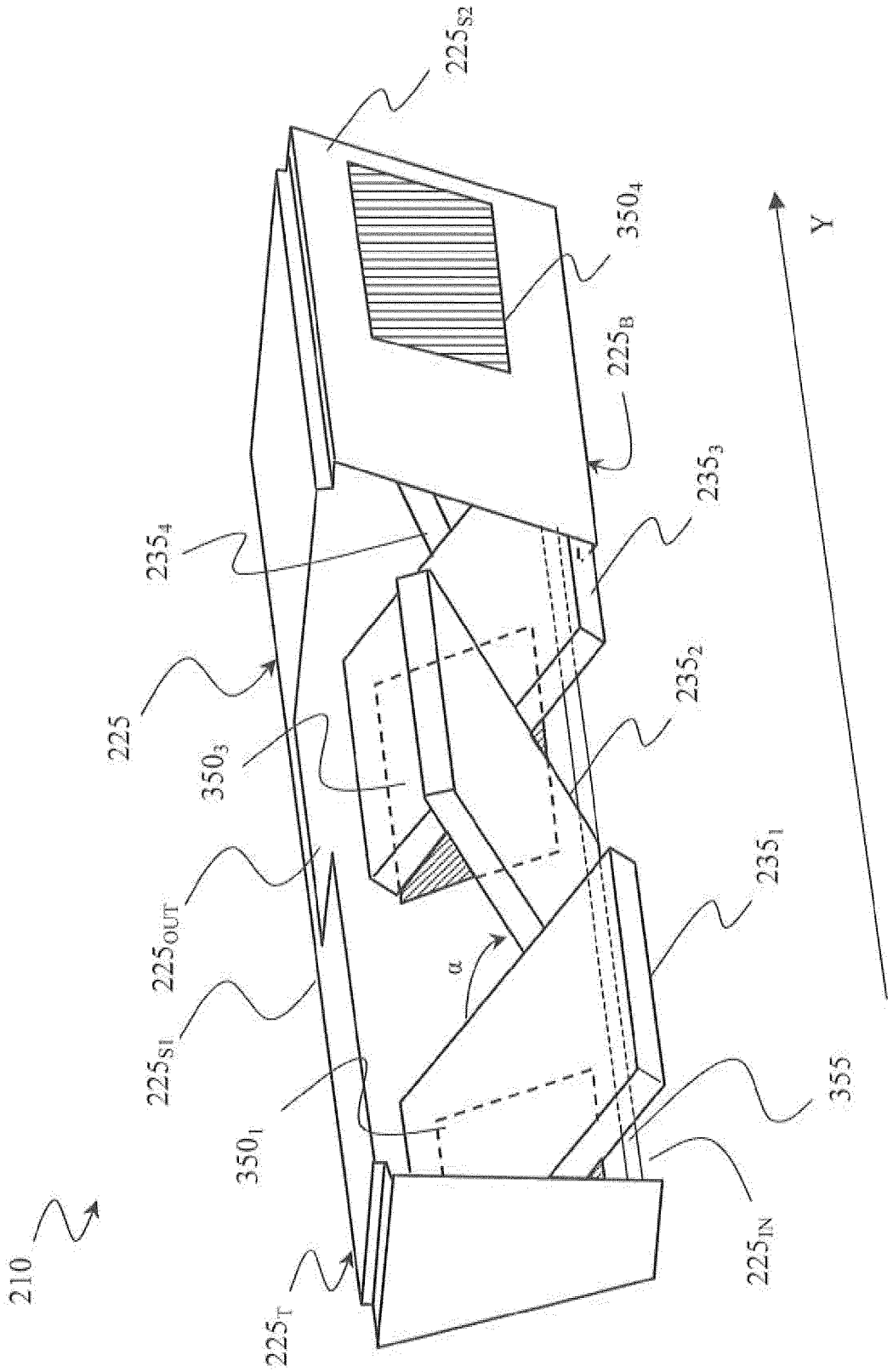
210
225
225S2
225B
225T
225IN
225OUT
225S1
350I
350₃
350₄
235₁
235₂
235₃
235₄
355
α
Y

FIG.3

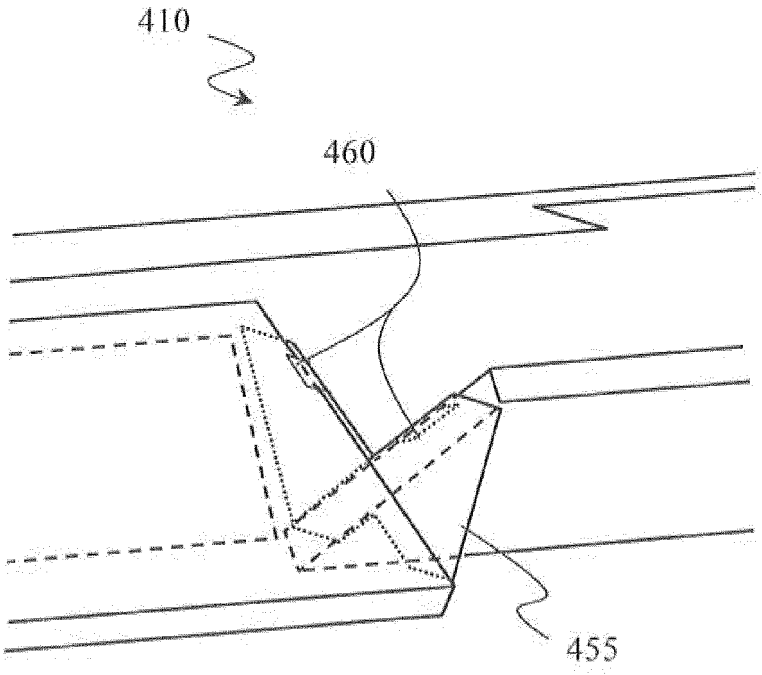

FIG.4A

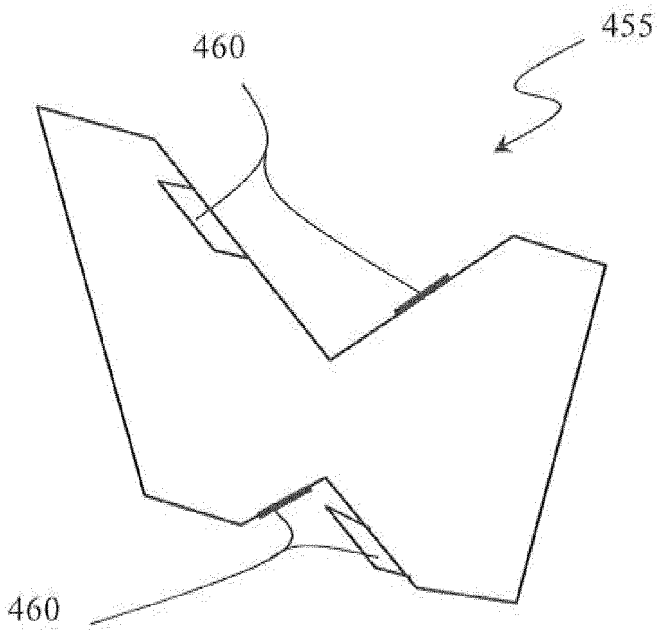

FIG.4B

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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 1355

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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	20 February 2014	Makúch, Milan

CATEGORY OF CITED DOCUMENTS

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Application Number
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