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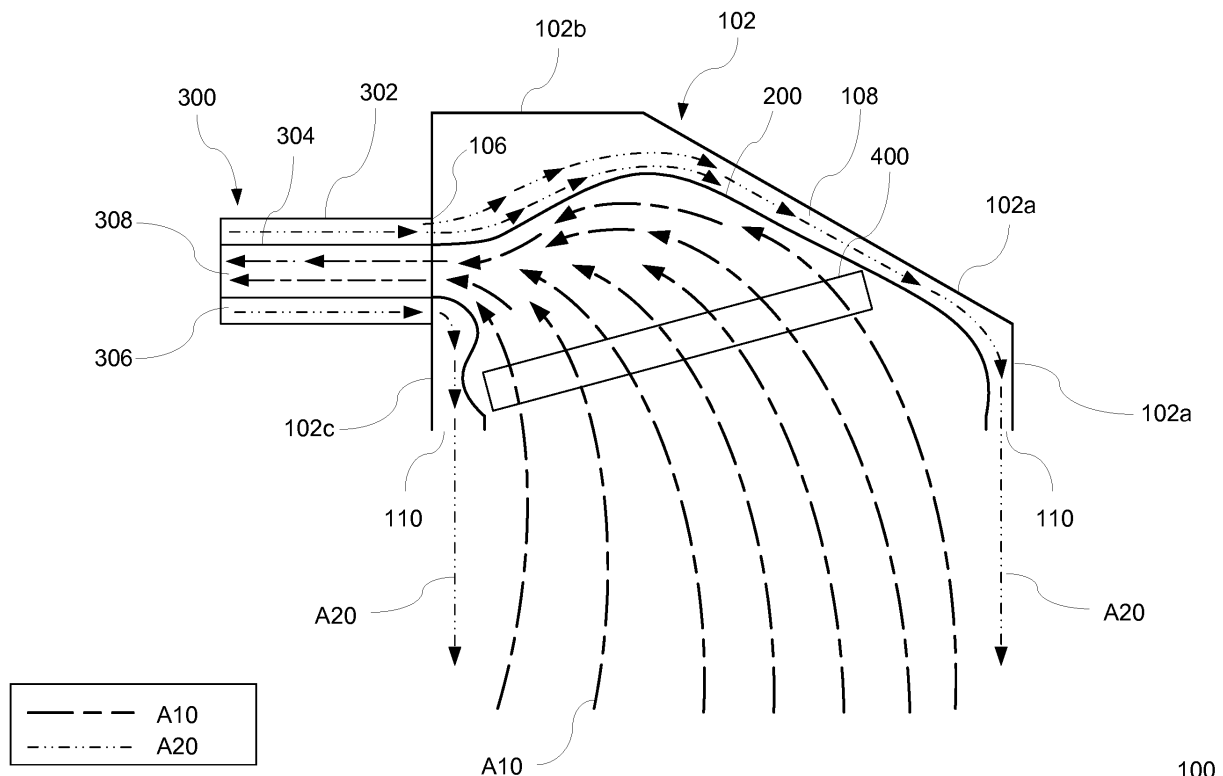
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KH MA MD TN(71) Applicant: **BSH Hausgeräte GmbH****81739 München (DE)**(72) Inventor: **Scott, Sean****Tulsa, 74112 (US)**(30) Priority: **12.12.2018 US 201816217429****(54) COOKTOP VENTILATION SYSTEM HAVING A COMPLEX CURVE INTERIOR FLOW SURFACE**

(57) A cooktop ventilation appliance or system provides ventilation of a domestic cooking appliance, and includes a complex curve interior flow surface in the housing, the complex curve interior flow surface partitioning the interior of the housing for separately conveying secondary air and exhaust air. A first side of the complex

curve interior flow surface configured to guide and smooth a flow of the secondary air from an opening for receiving secondary air into the interior of the housing to an opening for permitting the secondary air to exit the housing to form an air curtain that enhances a capture ability of the domestic ventilation appliance.

**FIG. 2B**100

Description

CROSS-REFERENCES TO RELATED APPLICATION

[0001] This application is related to Applicants' co-pending U.S. application, which is filed concurrently herewith, entitled "COOKTOP VENTILATION SYSTEM HAVING A DUAL DIRECTION FLOW BLOWER/FAN," Attorney Docket No. 2018P02094US, which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention is directed to a ventilation system for a domestic home appliance, and more particularly, to a domestic cooktop ventilation system providing an air curtain that enhances the capture ability of the ventilation device, the cooktop ventilation system having an airflow channel or cavity having a complex curve interior flow surface that guides and smooths air flow through the airflow channel or cavity.

BACKGROUND OF THE INVENTION

[0003] Some modern domestic kitchens include an appliance, such as a cooking range or cooktop, that has an electric or gas heat source such as an inductive, electric, or gas cooktop, a griddle, an internal heat source such as an oven or warming drawer, or other feature that requires ventilation. Various types of ventilation appliances have been provided for ventilating or filtering air in a kitchen, such as a traditional wall ventilation hood, a chimney ventilation hood, or an island ventilation hood.

SUMMARY OF THE INVENTION

[0004] The present invention is directed to a cooktop ventilation appliance, or system, that provides an air curtain that enhances the capture ability of the ventilation appliance or system, and includes an airflow channel or cavity having a complex curve interior flow surface that guides and smooths air flow through the airflow channel or cavity, thereby reducing cavitation in the airflow channel or cavity, and provides sound insulation and sound deadening, thereby reducing noise levels associated with the operation of the appliance or system.

[0005] The present invention recognizes that, among other factors, the size, shape, and distance of the opening of a housing of a ventilation appliance or system affects the ability of the ventilation appliance or system to capture exhaust air (e.g., hot air, flue gases, contaminated air, etc.) from an appliance that requires ventilation, such as a cooking range or cooktop that has an electric or gas heat source such as an inductive, electric, or gas cooktop, a griddle, an internal heat source such as an oven or warming drawer, or other feature that requires ventilation. To solve these and other problems, the present invention provides an air curtain flowing from the housing of a cook-

top ventilation appliance or system, such that the air curtain provides a virtual extension of the housing of the hood or ventilation capture system (e.g., away from the hood or ventilation capture system and toward or around the kitchen appliance needing ventilation), which enhances the capture ability of the ventilation appliance or system. The air curtain can be formed around a part of, or all of, a perimeter of a region where exhaust air is to be captured.

[0006] The air curtain can be formed by an airflow of secondary air, such as cool air, outside air, etc. (i.e., non-exhaust air), that is supplied to the ventilation appliance from either a specific blower, make-up blower, or other air flow source. In one example, the appliance can be configured to use, or supply, make-up air to form the air curtain, thereby supplying a quantity of make-up air into the kitchen environment to replace the exhaust air being drawn into and exhausted from the kitchen by the ventilation appliance while using the make-up air in a functional manner to provide a virtual extension to the end of the hood or ventilation capture system that will enhance capture ability of the ventilation device. Exemplary embodiments of the invention can be configured to be used with or without make-up air.

[0007] The air curtain can be directed through one or more air channels or cavities of a housing of the cooktop ventilation appliance or system towards the front, sides, rear, and/or perimeter of the housing from either a specific blower, make-up blower, or other air flow source and that flows from one or more openings, slots, or ports at the front, sides, rear, and/or perimeter of the housing. The air curtain will provide a virtual extension to the end of the hood or ventilation capture system that can enhance capture ability of the ventilation device, thereby improving the capture of, and increasing the efficiency of the capture of smoke, grease, air (aroma), flue gases, contaminated air, etc. from an appliance that requires ventilation, such as a cooking range or cooktop, that has an electric or gas heat source such as an inductive, electric, or gas cooktop, a griddle, an internal heat source such as an oven or warming drawer, or other feature that requires ventilation.

[0008] The present invention further recognizes that such an airflow being directed through one or more air channels or cavities of the housing of the cooktop ventilation appliance towards the front, sides, rear, and/or perimeter of the housing during operation of the ventilation appliance can result in increased levels of noise (e.g. flow induced noise). The interior of a ventilation appliance typically is very rough or irregular with many cavities that can capture and redirect the air flow as well as provide cavitation points for the air flow, each of which can cause noise. Some conventional solutions for addressing noise rely on insulation and damping materials. However, these conventional techniques do not address issues of flow induced noise concerns.

[0009] To solve these and other problems, the present invention provides a cooktop ventilation system with a

complex curve interior flow surface that can provide sound insulation and sound deadening, while at the same time directing, guiding, and/or smoothing out the air flow as it flows through the ventilation appliance towards the front, sides, rear, and/or perimeter of the housing and exits from one or more openings, slots, or ports at the front, sides, rear, and/or perimeter of the housing of the ventilation appliance, thereby reducing cavitation and noise levels, including flow induced noise, while also providing a compact arrangement.

[0010] The complex curve interior flow surface can be configured to form one or more channels or cavities in the interior of the housing of the ventilation appliance to direct or guide the airflow (e.g., either from a specific blower, make-up blower, or other air flow source) towards the front, sides, rear, and/or perimeter of the housing during operation of the ventilation appliance. The complex curve interior flow surface can cooperate with one or more interior surfaces or components of the housing of the ventilation appliance to form the one or more channels or cavities, or in other examples, one or more parts or portions of the complex curve interior flow surface can be configured to discretely form the one or more channels or cavities. The airflow can exit the housing at one or more openings, slots, or ports at the front, sides, rear, and/or perimeter of the housing.

[0011] In an example, the one or more channels or cavities formed by the complex curve interior flow surface can have a cross-section or profile similar to a syphon of a toilet bowl, thereby improving the flow efficiency of the airflow. However, the complex curve interior flow surface can have other cross-section or profile arrangements. For example, the complex curve interior flow surface can be configured to provide added space or clearance for other components of the ventilation appliance, such as for a filter system (e.g., one or more air filters and/or grease filters), a control system, one or more sensors, etc.

[0012] The complex curve interior flow surface can include, for example, one or more parts (e.g., one or more stamped plastic parts) that fit inside the interior of the housing of the ventilation appliance. The complex curve interior flow surface can be formed from a single part (e.g., a single stamped or molded part formed from high temperature plastic) or from a plurality of parts (e.g., a plurality of stamped or molded parts formed from high temperature plastic) that fit together or cooperate with one another to fit inside the interior of the housing of the ventilation appliance and provide sound insulation and sound deadening, while at the same time directing, guiding, and/or smoothing out the flow of the cool air, thereby reducing cavitation and noise levels, including flow induced noise across the interior of the housing of the ventilation appliance, while providing a compact system or arrangement. The complex curve interior flow surface can be formed from other materials, such as sheet metal, high temperature composite materials, or a combination of one or more high temperature materials configured to

fit inside the interior of the housing of the ventilation appliance.

[0013] The complex curve interior flow surface can be secured in the interior of the housing of the ventilation appliance by press fitting the part or parts into the interior of the housing or by securing the part or parts using securing means, such as one or more of fasteners, high temperature adhesive, high temperature tape, or the like (e.g., high temperature resistant securing means). The part or parts of the complex curve interior flow surface can be secured to and/or supported by one or more interior surfaces of the housing of the ventilation appliance, to one or more openings in the housing (e.g., an air supply opening or exhaust outlet), and/or to one or more ducts or blowers in or on the housing, among other things.

[0014] The complex curve interior flow surface can form a dividing wall or partition between a flow of the cool air used to form the air curtain and a flow of exhaust air captured by the ventilation appliance. In an example, one side of the complex curve interior flow surface guides the flow of the cool air used to form the air curtain from the air supply to the one or more openings, slots, or ports at the front, sides, rear, and/or perimeter of the housing, while another, opposite side of the complex curve interior flow surface guides the flow of the exhaust air captured by the ventilation appliance from the air capture region of the housing to one or more exhaust ducts or other elements for conveying the exhaust air from the kitchen, thereby providing dual functionality and facilitating a compact system and arrangement with improved flow efficiency. Each side of the complex curve interior flow surface can directly contact the respective air flow, or an intervening layer or component can be provided, such as an insulation layer, temperature resistant layer, etc., between the complex curve interior flow surface and one or more of the air flows. In an example, a direction of flow of the cool air on one side of the complex curve interior flow surface can be opposite to a direction of flow of the exhaust air on the other side of the complex curve interior flow surface.

[0015] In an example, the housing of the ventilation appliance can be coupled to a bi-directional air duct that both supplies the cool air to the interior of the housing and exhausts the exhaust air from the housing. In another example, the housing of the ventilation appliance can include a bi-directional air duct within the interior of the housing. An example of a bi-directional duct according to the invention can include a duct having an inner flow channel (e.g., for conveying exhaust air in a first direction) and an outer flow channel (e.g., for conveying cool air in a second direction that is opposite to the first direction). The bi-directional duct can be formed from concentric cylinders forming the flow paths. In other examples, the bi-directional duct can include square or rectangle shaped flow paths, with an interior flow path being nested within an exterior flow path, or with flow paths formed by individual ducts or a duct divided into flow paths arranged next to or adjacent to each other (e.g., side-by-side or

above and below each other). In other examples, the housing of the ventilation appliance can be coupled to or include one or more discrete air ducts supplying the cool air to the interior of the housing and/or one or more discrete air ducts exhausting the exhaust air from the housing.

[0016] The cool air can be supplied to the interior of the housing, either directly from a blower, a secondary blower or fan, or another source, or via a duct (e.g., bi-directional duct) coupled to a blower, a secondary blower or fan, or another source. The blower, a secondary blower or fan, or another source can be arranged, for example, in-line with the duct, in communication with the duct (e.g., either locally/adjacent to the duct or remote from the duct), or within the housing of the ventilation appliance or system.

[0017] Exemplary embodiments of the complex curve interior flow surface according to the invention can be provided in various types of ventilation appliances, such as a traditional wall hood, a chimney wall hood, or an island hood.

[0018] For purposes of this disclosure, the term exhaust air refers to, for example, one or more of hot air, flue gases, contaminated air, etc. from an appliance that requires ventilation, such as a cooking range or cooktop that has an electric or gas heat source such as an inductive, electric, or gas cooktop, a griddle, an internal heat source such as an oven or warming drawer, or other feature that requires ventilation. The term secondary air refers to non-exhaust air including, for example, one or more of cool air, outside air, make-up air, etc. that is supplied to the ventilation appliance, for example, from either a specific blower, make-up blower, or other air flow source.

[0019] An exemplary embodiment of the present invention addresses and solves the above-recognized problems and others by providing a domestic ventilation appliance for providing ventilation of a domestic cooking appliance, the domestic ventilation appliance and system comprising a housing having a first opening for capturing exhaust air from the domestic cooking appliance, a second opening for receiving secondary air into the interior of the housing, and a third opening for permitting the secondary air to exit the housing to form an air curtain that enhances a capture ability of the domestic ventilation appliance, and a complex curve interior flow surface in the housing, the complex curve interior flow surface partitioning the interior of the housing for separately conveying the secondary air and the exhaust air, a first side of the complex curve interior flow surface configured to guide and smooth a flow of the secondary air from the second opening to the third opening.

[0020] Another exemplary embodiment provides a domestic ventilation system for providing ventilation of a domestic cooking appliance, comprising a cooktop ventilation appliance including a housing and a complex curve interior flow surface in an interior of the housing, the complex curve interior flow surface partitioning the

interior of the housing for separately conveying secondary air and exhaust air through the housing, a first side of the complex curve interior flow surface configured to guide and smooth a flow of the secondary air from an opening in the housing for receiving secondary air into the interior of the housing to one or more outlets in the housing that allow the secondary air to exit the housing to form an air curtain that enhances a capture ability of the domestic ventilation appliance for providing ventilation of the domestic cooking appliance.

[0021] Other features and advantages of the present invention will become apparent to those skilled in the art upon review of the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other aspects and features of embodiments of the present invention will be better understood after a reading of the following detailed description, together with the attached drawings, wherein:

FIG. 1 is a schematic side view of a cooktop ventilation appliance or system according to an exemplary embodiment of the invention;

FIG. 2A is a cutaway view of the cooktop ventilation appliance or system according to the exemplary embodiment schematically illustrated in FIG. 1;

FIG. 2B is the cutaway view of the cooktop ventilation appliance or system illustrated in FIG. 1 showing air flow examples;

FIG. 3 is a schematic perspective view of a cooktop ventilation appliance or system according to an exemplary embodiment of the invention;

FIG. 4 is another schematic perspective view of a cooktop ventilation appliance or system according to an exemplary embodiment of the invention;

FIG. 5 is a cutaway view of the cooktop ventilation appliance or system according to the exemplary embodiment schematically illustrated in FIG. 3 with parts of the housing removed to show interior components;

FIG. 6 is another cutaway view of the cooktop ventilation appliance or system according to the exemplary embodiment schematically illustrated in FIG. 3 with parts removed to show interior components;

FIG. 7 is a schematic cross-sectional view of a duct of the cooktop ventilation appliance or system

- according to the exemplary embodiment;
- FIG. 8A is a perspective view of a complex curve interior flow surface according to the exemplary embodiment schematically illustrated in FIGS. 3-6;
- FIG. 8B is a schematic side view of the complex curve interior flow surface according to the exemplary embodiment schematically illustrated in FIG. 8A;
- FIG. 9 is a schematic side view of a complex curve interior flow surface according to other exemplary embodiments;
- FIG. 10 is a schematic cutaway view of the cooktop ventilation appliance or system according to other exemplary embodiments;
- FIG. 11 is a schematic cutaway view of the cooktop ventilation appliance or system according to other exemplary embodiments;
- FIG. 12 is a schematic cutaway view of the cooktop ventilation appliance or system according to other exemplary embodiments;
- FIG. 13 is a schematic side view of an airflow source and exhaust element of the cooktop ventilation appliance or system according to another exemplary embodiment; and
- FIG. 14 is a front perspective view of a domestic kitchen having a cooktop ventilation appliance or system showing air flow examples according to an exemplary embodiment of the invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS OF THE INVENTION

[0023] The present invention now is described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0024] FIGS. 1-14 schematically show examples of a cooktop ventilation appliance or system 100 having a housing 102 including a front wall 102a, a top wall 102b, a rear wall 102c, a first side wall 102d, and a second side wall 102e. A lower wall of the housing 102 can include a first opening 104 for drawing exhaust air A10 (e.g., hot air, flue gases, contaminated air, etc.) into the ventilation appliance 100 from a domestic home cooking appliance

that requires ventilation, or the walls 102a, 102c, 102d, and 102e of the housing 102 can define the first opening 104. The ventilation appliance 100 can be coupled to a duct 300, which can be coupled to one or more blowers or fans (e.g., schematically shown by 500 in FIG. 10 and 502 in FIG. 11) for generating movement of one or more air flows A10, A20 through the housing 102 of the ventilation appliance 100. In an example, the ventilation appliance 100 can be coupled directly to one or more blowers or fans, or in another example, one or more blowers or fans (e.g., schematically shown by 500 in FIG. 10) can be integrated into the housing 102 of the ventilation appliance 100.

[0025] With reference to FIGS. 1-7, the housing 102 can include one or more first openings 104 (e.g., air capture inlet) in the lower wall of the housing 102 for drawing exhaust air A10 into the housing 102, one or more second openings 106 for permitting secondary air A20 to enter the housing 102 and/or exhaust air A10 to exit from the housing 102, and one or more second openings 110 (e.g., outlet) for directing secondary air A20 out of the housing 102 to form an air curtain. The ventilation appliance 100 can include one or more air filters and/or grease filters 400 for filtering the exhaust air A10 as it flows through the ventilation appliance 100. In the examples, the secondary air A20 can be supplied to the housing 102, for example, by air flow path 306 through a bi-directional duct 300, and the exhaust air A10 can be exhausted from the housing 102, for example, by air flow path 308 through the bi-directional duct 300. The opening or outlet 110 can include one or more outlets (e.g., one or more slots, gaps, openings, elongated openings, etc.) formed in a surface of a lower wall of the housing 102. Additionally or alternatively, the one or more openings or outlets 110 can include one or more outlets (e.g., one or more slots, gaps, openings, elongated openings, etc.) extending along all or a part of a perimeter wall (e.g., 102a, 102c, 102d, 102e) of the housing. The one or more openings or outlets 110 can be configured to form an air curtain exiting from one or more of the front, sides, rear, and/or all or part of the perimeter of the housing 102 during operation of the ventilation appliance 100, as shown in FIG. 2B. The ventilation appliance 100 can include a complex curve interior flow surface 200 disposed within the housing 102 that guides the secondary air A20 through the housing 102 where the air A20 is directed from one or more second openings or outlets 110 to form an air curtain. The secondary air A20 generally is directed from the one or more second openings or outlets 110 in a direction that is opposite to a direction of flow of the exhaust air A10.

[0026] In the examples shown in FIGS. 1-7, the complex curve interior flow surface 200 forms a dividing wall or partition between a flow of the secondary air A20 (e.g., make-up air, cool air, etc.) used to form the air curtain and a flow of the exhaust air A10 captured by the ventilation appliance 100. In the examples, one side of the complex curve interior flow surface 200 guides the flow of the secondary air A20 from the flow path 306 of the

bi-directional duct 300 to the one or more openings, slots, or ports 110 at the front, sides, rear, and/or perimeter of the housing 102 to form an air curtain, while another, opposite side of the complex curve interior flow surface 200 guides the flow of the exhaust air A10 captured by the ventilation appliance 100 from the air capture region (opening 104) of the housing 102 to the flow path 308 of the bi-directional duct 300 for conveying the exhaust air A10 from the kitchen. In the example shown in FIG. 2B, a direction of flow of the secondary air A20 on one side of the complex curve interior flow surface 200 is opposite to a direction of flow of the exhaust air A10 on the other side of the complex curve interior flow surface 200. In the examples, the complex curve interior flow surface 200 cooperates with the housing 102 to form a flow path 108 that smoothly and efficiently guides the flow of the secondary air A20 from the flow path 306 of the bi-directional duct 300 to the one or more openings, slots, or ports 110 at the front, sides, rear, and/or perimeter of the housing 102.

[0027] As shown in FIGS. 1-7, an example of a duct 300 (e.g., bi-directional duct) can include an outer wall 302 and an inner wall 304, which define a first flow path 308 through the duct 300 for conveying exhaust air A10 that is drawn into the housing 102, and a second flow path 306 through the duct 300 for conveying secondary air A20 (e.g., make-up air) that is supplied by a blower, a secondary blower or fan, or another source, into the housing 102 and conveyed by the flow path (e.g., channel or cavity 108) to an outlet 110 for forming an air curtain exiting or extending from the housing 102. The outer wall 302 and inner wall 304 are shown in the example as being concentric or nested cylinders forming the flow paths, thereby providing a compact and efficient means for conveying the air A20 into the housing and the exhaust air A10 out of the housing. The arrangement of the duct 300 is not limited to any particular arrangement. In other examples, the outer wall 302 and an inner wall 304 can have other shapes, such as a square shape or rectangular shape nested within each other. In other examples, the flow paths 306 and 308 can be formed by individual ducts arranged next to each other or a duct divided into flow paths arranged next to each other. As shown in the example illustrated in FIG. 6, the outer wall 302 can be coupled to the opening 106 of the wall 102c of the housing 102 such that both flow paths 306 and 308 are in communication with the interior of the housing 102 through the same opening 106.

[0028] FIGS. 8A and 8B illustrate an example of a complex curve interior flow surface 200 including a body 202 defining a cavity (e.g., a hollow body or shell) having lower perimeter edges 204, 206, 208, and 210. In the example, the complex curve interior flow surface 200 includes an opening 212 configured to be coupled to the inner wall 304 of the duct 300 for directing or guiding exhaust air A10 from the cavity within the body 202 into the flow path 308 of the duct 300. At the same time, the secondary air A20 can flow from the flow path 306 of the duct 300,

which is defined by the outer wall 302 and the inner wall 304, through the opening 106 in the wall 102c of the housing 102 over the exterior of the complex curve interior flow surface 200.

[0029] With reference again to FIGS. 2A, 2B, 8A, and 8B, the body 202 of the complex curve interior flow surface 200 can include a plurality of sections (e.g., a first section 202a, a second section 202b, and a third section 202c) configured to direct or guide the secondary air A20 (e.g., cool air, make-up air, etc.) over the outer surface of the body 202 to the second opening (outlet) 110, where the air A20 exits from the housing 102 to form an air curtain. In the example, the first section 202a directs, guides, or changes a direction of the air A20, which is supplied by a blower, a secondary blower or fan, or another source through the flow path 306 of the duct 300 into the channel or cavity 108 in the interior of the housing 102. In this example, the air A20 is directed or guided by the first section 202a from an initial (i.e., first) flow direction extending, in this example, in a generally horizontal direction as it exits the flow path 306 of the duct 300 to a second flow direction extending at an upward angle with respect to the initial direction. The complex curve interior flow surface 200 includes a second section 202b that directs, guides, or changes a direction of the air A20 from the second flow direction to a third flow direction that is different from the second flow path and that extends at an angle that is, in this example, closer to the horizontal direction than the second flow direction. The complex curve interior flow surface 200 includes a third section 202c that directs, guides, or changes a direction of the air A20 from the third flow direction to a fourth flow direction that is different from the third flow direction and that extends at an angle toward the one or more openings or outlets 110. The air A20 can exit from the one or more openings or outlets 110 in a direction of the fourth flow direction, or the air A20 can be directed in another angle (e.g., a vertical downward direction, an angled downward direction, etc.).

[0030] The sections (e.g., 202a, 202b, 202c) of the complex curve interior flow surface 200 can be planar sections, curved sections, or a combination thereof to smooth and guide the flow of the air A20. The sections (e.g., 202, 204, 206) of the complex curve interior flow surface 200 can be configured to form one or more channels or cavities 108 in the interior of the housing 102 to direct or guide the airflow A20 towards the front, sides, rear, and/or perimeter of the housing 102 during operation of the ventilation appliance 100. The one or more channels or cavities 108 formed by, for example, the sections 202a, 202b, and 202c of the complex curve interior flow surface 200 can have a cross-section or profile similar to a syphon of a toilet bowl, which can increase the flow efficiency of the air A20 over the body 202. The airflow A20 can exit the housing 102 at one or more openings, slots, or ports 110 at the front, sides, rear, and/or perimeter of the housing 102.

[0031] In the example shown in FIGS. 8A and 8B, the

complex curve interior flow surface 200 includes similar sections (e.g., sections 202d, 202e, 202f) that direct, guide, and smooth portions of the air A20 from the initial (i.e., first) flow direction, as it exits the flow path 306 of the duct 300, to other regions within the interior of the housing 102, such as along the rear and/or sides of the complex curve interior flow surface 200 and correspondingly to the one or more openings or outlets 110 along the perimeter of walls 102c, 102d, 102e. In this example, one or more of the channels or cavities 108 formed by the similar sections (e.g., sections 202d, 202e, 202f) of the complex curve interior flow surface 200 have a cross-section or profile similar to a syphon of a toilet bowl, which can increase the flow efficiency of the air A20 over the body 202. However, the complex curve interior flow surface 200 can have other cross-section or profile arrangements, or different cross-sections or profiles for guiding the air A20 to different openings, slots, or ports 110 at the front, sides, rear, and/or perimeter of the housing 102. For example, the complex curve interior flow surface 200 can be configured to provide added space or clearance for other components of the ventilation appliance, such as for a filter system (e.g., one or more air filters and/or grease filters), a control system, one or more sensors, etc.

[0032] As shown in the example illustrated in FIGS. 8A and 8B, the interior surface of the body 202 of the complex curve interior flow surface 200 (i.e., the surface facing the interior cavity) can assist with directing or guiding the exhaust air A10 from the capture opening 104 of the housing 102 to the opening 212 of the complex curve interior flow surface 200, which is coupled to the inner wall 304 of the duct 300, such that the exhaust air A10 flows through the opening 106 of the wall 102c of the housing 102 into the flow path 308 of the duct 300 (e.g., bi-directional duct), thereby increasing a flow efficiency of the exhaust air A10 through the housing 102.

[0033] For simplicity, FIG. 2B generally shows the air flow A20 and A10 using dashed lines. One of ordinary skill will recognize that, in operation, one or more sections or portions of the complex curve interior flow surface 200 can direct, guide, or change a direction of the air flow A20 and/or A10 within the flow cavities or channels, and at different locations along the flow path within the flow cavities or channels, such that the air flow A20 and/or A10 flows adjacent to or along the surfaces of the complex curve interior flow surface 200 (e.g., in a path corresponding, at least in part, to a shape of one or more surfaces of the complex curve interior flow surface 200).

[0034] The complex curve interior flow surface 200 can be configured to fit inside the interior of the housing 102 of the ventilation appliance 100. The complex curve interior flow surface 200 can be formed from a single part (e.g., a single stamped high temperature plastic part) or from a plurality of parts (e.g., a plurality of stamped high temperature plastic parts, each forming one or more of portions or sections) that fit together or cooperate with one another to form the complex curve interior flow sur-

face 200. The complex curve interior flow surface 200 can be formed from any suitable material, such as stamped or injection molded plastic (e.g., high temperature plastic), sheet metal, composite materials, or a combination of one or more materials (e.g., high temperature materials) configured to fit inside the interior of the housing 102 of the ventilation appliance 100. The complex curve interior flow surface 200 can be secured in the interior of the housing 102 in any suitable manner, such as by press fitting the part or parts into the interior of the housing 102 or by securing the part or parts of the complex curve interior flow surface 200 using one or more securing means, such as one or more of fasteners, high temperature adhesive, high temperature tape, or the like (e.g., high temperature resistant securing means). The part or parts of the complex curve interior flow surface 200 can be secured to and/or supported by one or more interior surfaces of the housing 102 of the ventilation appliance 100, to one or more openings 106 in the housing 102 (e.g., an air supply opening or exhaust outlet), and/or to one or more ducts 300 or blowers in or on the housing, among other things.

[0035] With reference to FIGS. 9-12, the complex curve interior flow surface 200 can have other profiles that are configured to direct or guide the airflow A20 towards the front, sides, rear, and/or perimeter of the housing 102 during operation of the ventilation appliance 100.

[0036] FIG. 9 illustrates an example in which the body 202 of the complex curve interior flow surface 200 can include a more uniform curved surface extending from the opening 212 to the edges 204, 206, 208, and 210.

[0037] FIG. 10 illustrates an example of a ventilation appliance 100 in which the complex curve interior flow surface 200 is configured to provide clearance or space within the housing 102 for a duct (e.g., bi-directional duct) and/or a blower, which are schematically illustrated by 500. Additionally or alternatively, the complex curve interior flow surface 200 can be configured to provide clearance or space within the housing 102 for a control system and/or one or more sensors, which are schematically illustrated by 600. For example, one or more features of the complex curve interior flow surface 200 providing clearance or space within the housing 102 for a duct (schematically illustrated by 500), a blower (schematically illustrated by 500), a control system (schematically illustrated by 600), and/or one or more sensors (schematically illustrated by 600) can be combined with the examples shown in the other examples described herein. The housing 102 of the ventilation appliance 100 can include one or more deflectors, louvers, or the like (e.g., 114) arranged at or near the one or more openings or outlets 110, for directing the air flow A20 from the outlet(s) 110 in one or more directions to form an air curtain at a predetermined angle. The housing 102 of the ventilation appliance 100 can include a lower surface 112 having one or more slots, openings, exit ports, vents, louvers, or the like (e.g., 110).

[0038] FIG. 11 illustrates examples of various alternate

arrangements of the ventilation appliance 100. As shown in the example in FIG. 11, the air A20 can be supplied by a blower, a secondary blower or fan, or another source (schematically illustrated by 502) through the flow path 306 defined by the duct 300 into the channel or cavity 108 of the housing 102.

[0039] FIG. 12 shows an example of a ventilation appliance 100 that is coupled to an air duct 310 supplying the secondary air A20 (cool air) to the interior of the housing 102 and an air duct 312 exhausting the exhaust air A10 from the housing 102. In this example, the complex curve interior flow surface 200 divides or partitions all or a portion of an upper region of the interior of the housing 102 from a lower region of the interior of the housing 102. The complex curve interior flow surface 200 directs, guides, and smooths the airflow of secondary air A10 conveyed by the duct 310 from a specific blower, make-up blower, or other air flow source 502 into the interior of the housing 102 along a flow path towards the front perimeter edge 206 (e.g., towards the front perimeter edge 206 only) of the complex curve interior flow surface 200 during operation of the ventilation appliance 100. The complex curve interior flow surface 200, in this example, cooperates with one or more interior surfaces or components of the housing 102 of the ventilation appliance to form a channel or cavity 108. The airflow A20 can exit the housing 102 at one or more openings, slots, or ports 110 at the front perimeter of the housing 102. In this example, the channel or cavity 108 formed by the complex curve interior flow surface 200 has a cross-section or profile similar to a syphon of a toilet bowl, thereby increasing flow efficiency of the airflow A20. The complex curve interior flow surface 200 is configured to provide added space or clearance for other components of the ventilation appliance, such as for a filter system 400 (e.g., one or more air filters and/or grease filters). In other examples, the complex curve interior flow surface 200 can be configured to provide added space or clearance for other components of the ventilation appliance, such as an internally mounted blower, a control system, one or more sensors, etc. (e.g., 500 and 600 in FIG. 10). The opposite side of the complex curve interior flow surface 200 (i.e., the surface facing the capture opening 104) can assist with directing or guiding the exhaust air A10 from the capture opening 104 of the housing 102 to the air duct 312, thereby increasing a flow efficiency of the exhaust air A10 through the housing 102.

[0040] FIG. 13 shows an example of another source, such as a cap system 504 (e.g., bi-directional cap system), for supplying the air A20. In this example, the walls 302 and 304 of the bi-directional duct 300 pass through an exterior wall 800, which separates an inside of a home from the outside of the home. The inner wall 304 can extend farther than the outer wall 302. The example includes a cap 504 at an end of the inner wall 304. The cap 506 is configured to permit the exhaust air A10 to exit the flow path 308 defined by the inner wall 304 of the duct 300 and be exhausted to the outside environment

of the home. In this example, the outer wall 302 is configured to permit outside air A20 to be drawn into the flow path 306 defined between the outer wall 302 and the inner wall 304 of the duct 300 and conveyed to the interior of the housing 102 of the ventilation appliance 100 (i.e., the kitchen ventilation appliance or hood). The cap system 504 (e.g., bi-directional cap system) includes a deflector or divider 508 extending outward (e.g., radially outward) from the inner wall 304. The deflector or divider 508 can guide the outside air A20 to be drawn into the flow path 306 and/or guide the exhaust air A10 exiting the flow path 308 to the outside environment.

[0041] FIG. 14 illustrates an example of a ventilation appliance or system 100 shown in a kitchen and arranged above a domestic home cooking appliance, such as a cooking range 10 having a gas cooktop and an internal heat source such as an oven, at least one of which requires ventilation. The ventilation appliance or system 100 can be mounted, for example, on a wall 12 of the kitchen with adjacent cabinetry 14 abutting the ventilation appliance 100. The cooking range 10 can be disposed adjacent to floor cabinets 16 and counters 18. An exemplary embodiment of a cooktop ventilation appliance or system 100 (e.g., as illustrated in the examples in Figures 1-13) can provide an air curtain A20 that enhances the capture ability of the ventilation appliance or system 100, and includes an airflow channel or cavity 108 having a complex curve interior flow surface 200 that directs, guides, and/or smooths air flow A20 through the airflow channel or cavity 108, thereby reducing cavitation in the airflow channel or cavity 108, improving flow efficiency of both the secondary airflow and the exhaust air flow, and providing sound insulation and sound deadening, thereby reducing noise levels associated with the operation of the appliance or system 100 while improving operation and efficiency of the ventilation appliance and providing a compact arrangement.

[0042] The example features and arrangements are not limited to any particular embodiment and can be included alone or in combination with each other, or alone or in combination with one or more of the other example features described and illustrated herein.

[0043] With reference again to the examples illustrated in FIGS. 1-14, an exemplary embodiment of the invention is directed to a domestic ventilation appliance (e.g., 100) for providing ventilation of a domestic cooking appliance (e.g., 10), comprising a housing (e.g., 102) having a first opening (e.g., 104) for capturing exhaust air (e.g., A10) from the domestic cooking appliance (e.g., 10), a second opening (e.g., 106) for receiving secondary air (e.g., A20) into the interior of the housing (e.g., 102), and a third opening (e.g., 110) for permitting the secondary air (e.g., A20) to exit the housing (e.g., 102) to form an air curtain that enhances a capture ability of the domestic ventilation appliance (e.g., 100); and a complex curve interior flow surface (e.g., 200) in the housing (e.g., 102), the complex curve interior flow surface (e.g., 200) partitioning the interior of the housing (e.g., 102) for separately conveying

the secondary air (e.g., A20) and the exhaust air (e.g., A10), a first side of the complex curve interior flow surface (e.g., 200) configured to guide and smooth a flow of the secondary air (e.g., A20) from the second opening (e.g., 106) to the third opening (e.g., 110).

[0044] With reference again to the examples illustrated in FIGS. 1-14, an exemplary embodiment of the invention is directed to a domestic ventilation system for providing ventilation of a domestic cooking appliance (e.g., 10), comprising a cooktop ventilation appliance (e.g., 100) including a housing (e.g., 102) and a complex curve interior flow surface (e.g., 200) in an interior of the housing (e.g., 102), the complex curve interior flow surface (e.g., 200) partitioning the interior of the housing (e.g., 102) for separately conveying secondary air (e.g., A20) and exhaust air (e.g., A10) through the housing (e.g., 102), a first side of the complex curve interior flow surface (e.g., 200) configured to guide and smooth a flow of the secondary air (e.g., A20), which is received into the interior of the housing (e.g., 102) from an opening (e.g., 106) in the housing (e.g., 102), through the housing (e.g., 102) to one or more outlets (e.g., 110) in the housing (e.g., 102) that allow the secondary air (e.g., A20) to exit the housing (e.g., 102) to form an air curtain that enhances a capture ability of the domestic ventilation appliance (e.g., 100) for providing ventilation of the domestic cooking appliance (e.g., 10).

[0045] In the description of embodiments disclosed herein, any reference to direction or orientation is merely intended for convenience of description and is not intended in any way to limit the scope of the present invention. Relative terms such as "lower," "upper," "horizontal," "vertical," "above," "below," "up," "down," "top" and "bottom" as well as derivative thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description only and do not require that the apparatus be constructed or operated in a particular orientation. Terms such as "attached," "connected," "coupled," "interconnected," and similar refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise.

[0046] The present invention has been described herein in terms of several preferred embodiments. However, modifications and additions to these embodiments will become apparent to those of ordinary skill in the art upon a reading of the foregoing description. It is intended that all such modifications and additions comprise a part of the present invention to the extent that they fall within the scope of the several claims appended hereto.

Claims

1. A domestic ventilation appliance for providing ventilation of a domestic cooking appliance, comprising:

a housing having a first opening for capturing exhaust air from the domestic cooking appliance, a second opening for receiving secondary air into the interior of the housing, and a third opening for permitting the secondary air to exit the housing to form an air curtain that enhances a capture ability of the domestic ventilation appliance; and

a complex curve interior flow surface in the housing, the complex curve interior flow surface partitioning the interior of the housing for separately conveying the secondary air and the exhaust air, a first side of the complex curve interior flow surface configured to guide and smooth a flow of the secondary air from the second opening to the third opening.

2. The domestic ventilation appliance of claim 1, wherein the second opening of the housing is configured to both receive the secondary air into the interior of the housing and to exhaust the exhaust air from the interior of the housing.

3. The domestic ventilation appliance of claim 2, wherein a second side of the complex curve interior flow surface, which is opposite to the first side of the complex curve interior flow surface, is configured to guide and smooth a flow of the exhaust air from the first opening of the housing to the second opening of the housing.

4. The domestic ventilation appliance of claim 2, further comprising:
a bi-directional duct coupled to the second opening of the housing, the bi-direction duct configured to convey the secondary air in a first direction through the second opening of the housing into the interior of the housing and to convey the exhaust air in a second direction, which is opposite to the first direction, from the interior of the housing through the second opening of the housing.

5. The domestic ventilation appliance of claim 4, wherein the bi-directional duct includes:

an outer wall; and
an inner wall nested within the outer wall, the outer wall and the inner wall defining a first flow path configured to convey the secondary air through the bi-directional duct in the first direction, and the inner wall defining a second flow path configured to convey the exhaust air through the bi-directional duct in the second di-

rection.

6. The domestic ventilation appliance of claim 5, wherein the outer wall and the inner wall are concentric cylindrical walls.
7. The domestic ventilation appliance of claim 5, wherein the outer wall of the bi-directional duct is coupled to a perimeter of the second opening of the housing.
8. The domestic ventilation appliance of claim 5, wherein the complex curve interior flow surface includes a body having an opening, wherein a perimeter of the opening of the body is coupled to the inner wall of the bi-directional duct and configured to convey the exhaust air in the second direction through the opening in the body of the complex curve interior flow surface into the second flow path of the bi-directional duct.
9. The domestic ventilation appliance of claim 8, wherein the outer wall of the bi-directional duct is configured to convey the secondary air in the first direction through the second opening of the housing and onto the first side of the complex curve interior flow surface to guide and smooth the flow of the secondary air from the second opening to the third opening.
10. The domestic ventilation appliance of claim 1, wherein the complex curve interior flow surface includes a body having an opening configured to permit the exhaust air to pass through the body.
11. The domestic ventilation appliance of claim 1, wherein the first side of the complex curve interior flow surface includes a plurality of sections configured to guide and smooth the flow of the secondary air from the second opening to the third opening, the plurality of sections including at least a first section that directs the flow of the secondary air from the second opening in a first direction, a second section that directs the flow of the secondary air in a second direction that is different from the first direction, and a third section that directs the flow of the secondary air in a third direction that is different from the second direction and extends toward the third opening.
12. The domestic ventilation appliance of claim 1, wherein a shape of the complex curve interior flow surface is configured to guide and smooth the flow of the secondary air from the second opening to the third opening while providing clearance for at least one component disposed within the interior of the housing.
13. The domestic ventilation appliance of claim 12, wherein the at least one component includes at least one of an air filter, a grease filter, a blower, a control

system, or a sensor.

14. A domestic ventilation system for providing ventilation of a domestic cooking appliance, comprising:
a cooktop ventilation appliance including a housing and a complex curve interior flow surface in an interior of the housing, the complex curve interior flow surface partitioning the interior of the housing for separately conveying secondary air and exhaust air through the housing, a first side of the complex curve interior flow surface configured to guide and smooth a flow of the secondary air, which is received into the interior of the housing from an opening in the housing, through the housing to one or more outlets in the housing that allow the secondary air to exit the housing to form an air curtain that enhances a capture ability of the domestic ventilation appliance for providing ventilation of the domestic cooking appliance.
15. The system of claim 14, further comprising:
a bi-directional duct coupled to the opening of the housing, the bi-direction duct configured to convey the secondary air in a first direction through the opening of the housing into the interior of the housing on the first side of the complex curve interior flow surface and to convey the exhaust air in a second direction from the interior of the housing on a second side of the complex curve interior flow surface through the opening of the housing, the second direction being opposite to the first direction.
16. The system of claim 15, wherein the bi-directional duct includes:
an outer wall; and
an inner wall nested within the outer wall, the outer wall and the inner wall defining a first flow path configured to convey the secondary air through the bi-directional duct in the first direction, and the inner wall defining a second flow path configured to convey the exhaust air through the bi-directional duct in the second direction.
17. The system of claim 15, further comprising:
a blower coupled to the bi-directional duct for supplying the secondary air in the first direction through the opening of the housing into the interior of the housing.
18. The system of claim 15, further comprising:
a blower for supplying the secondary air in the first direction through the opening of the housing into the interior of the housing.

19. The system of claim 18, wherein the blower is disposed in the interior of the housing.

20. The system of claim 15, further comprising:
a secondary air source coupled to the bi-directional duct for supplying the secondary air in the first direction through the opening of the housing into the interior of the housing.

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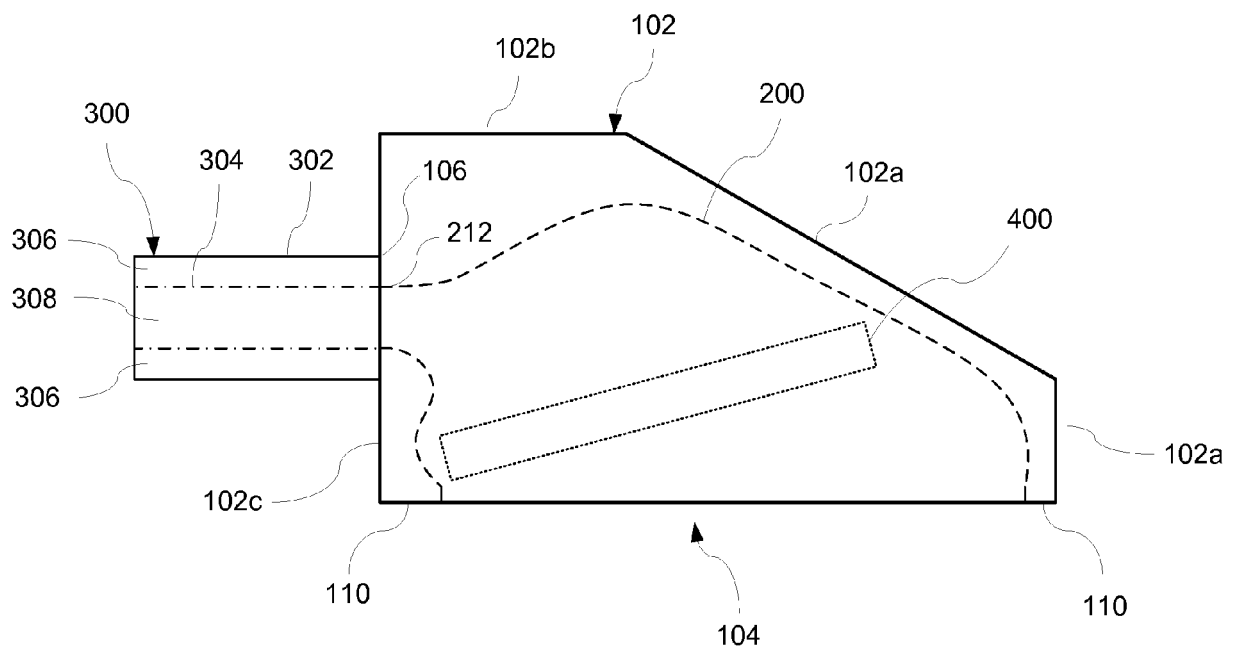
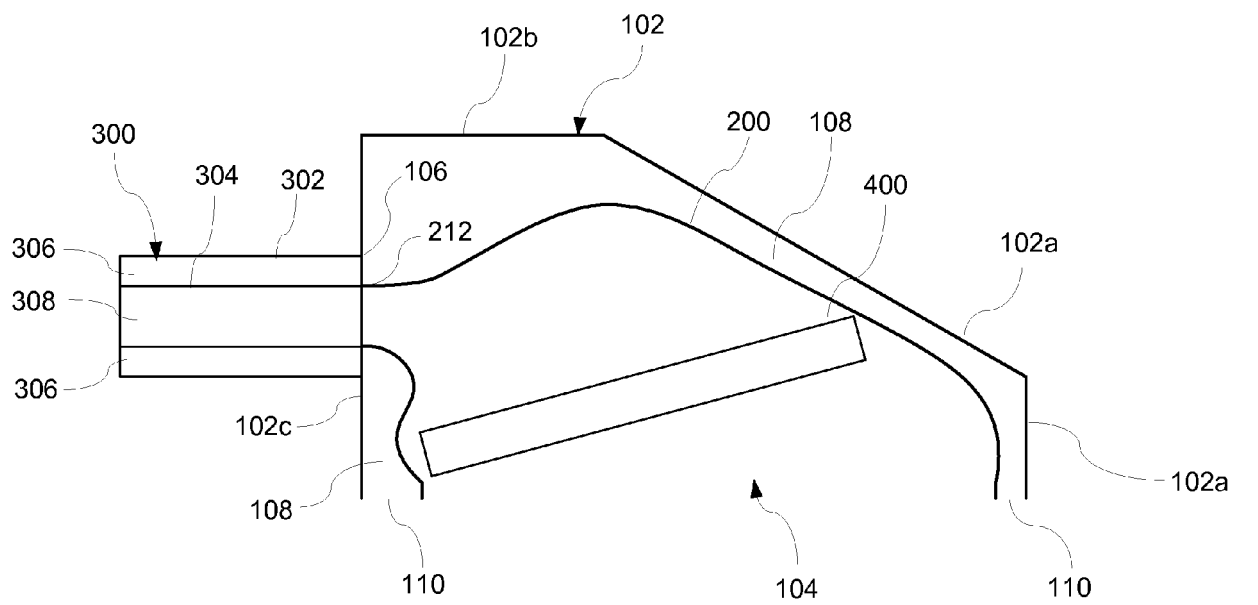


FIG. 1



100

FIG. 2A

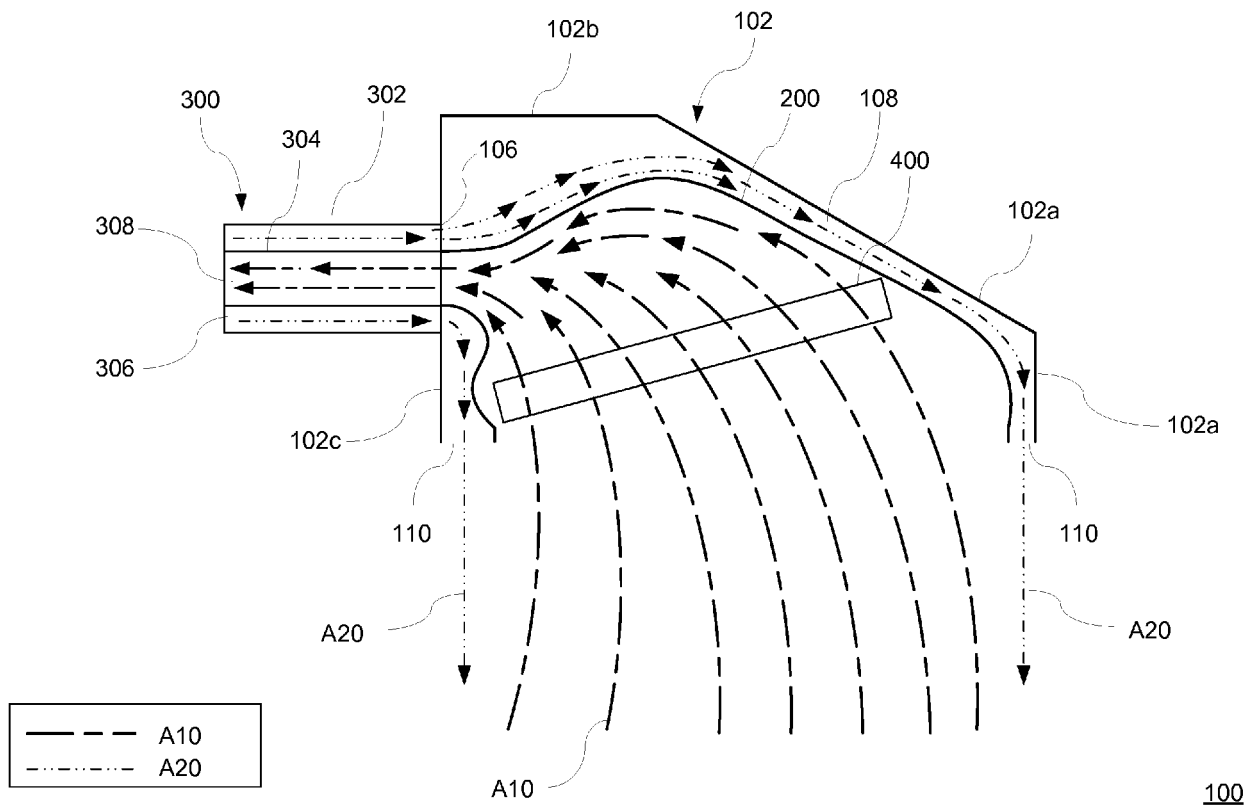


FIG. 2B

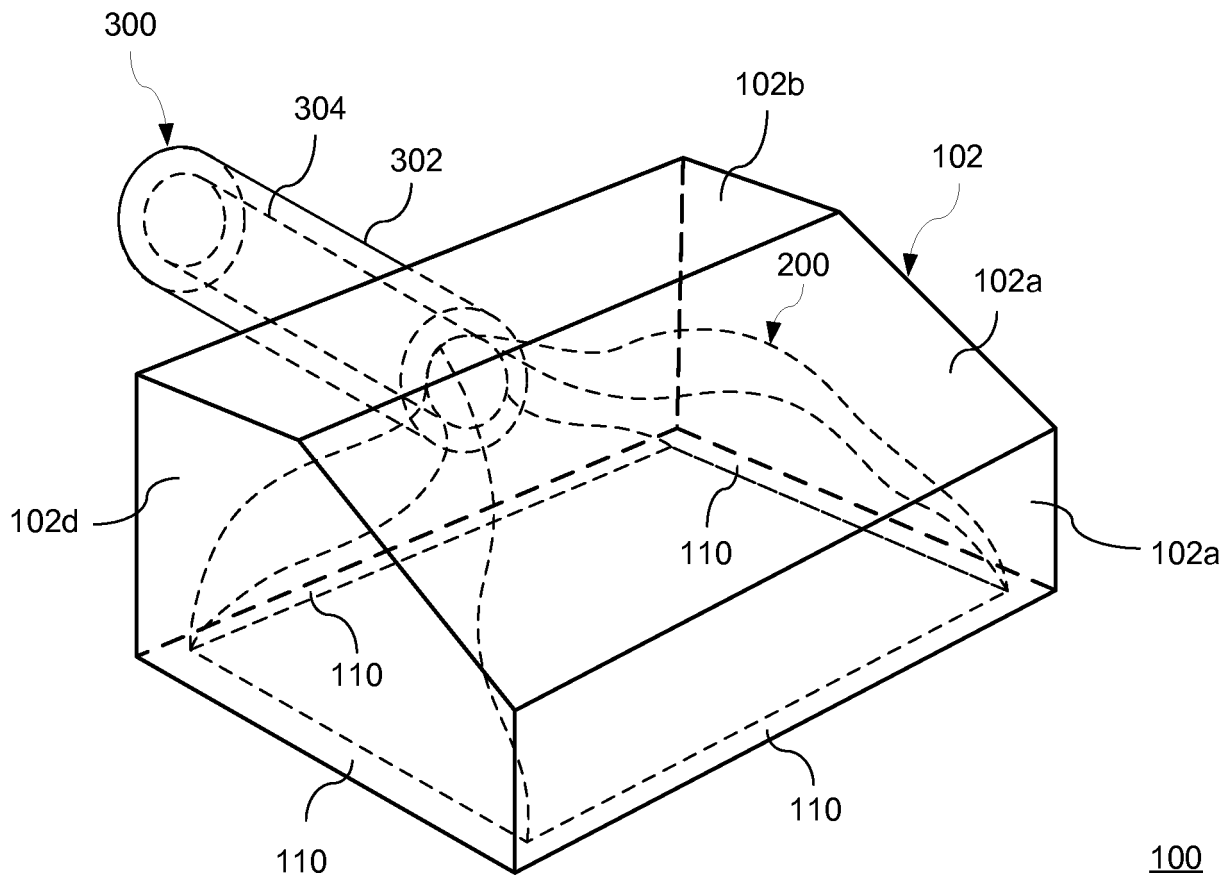


FIG. 3

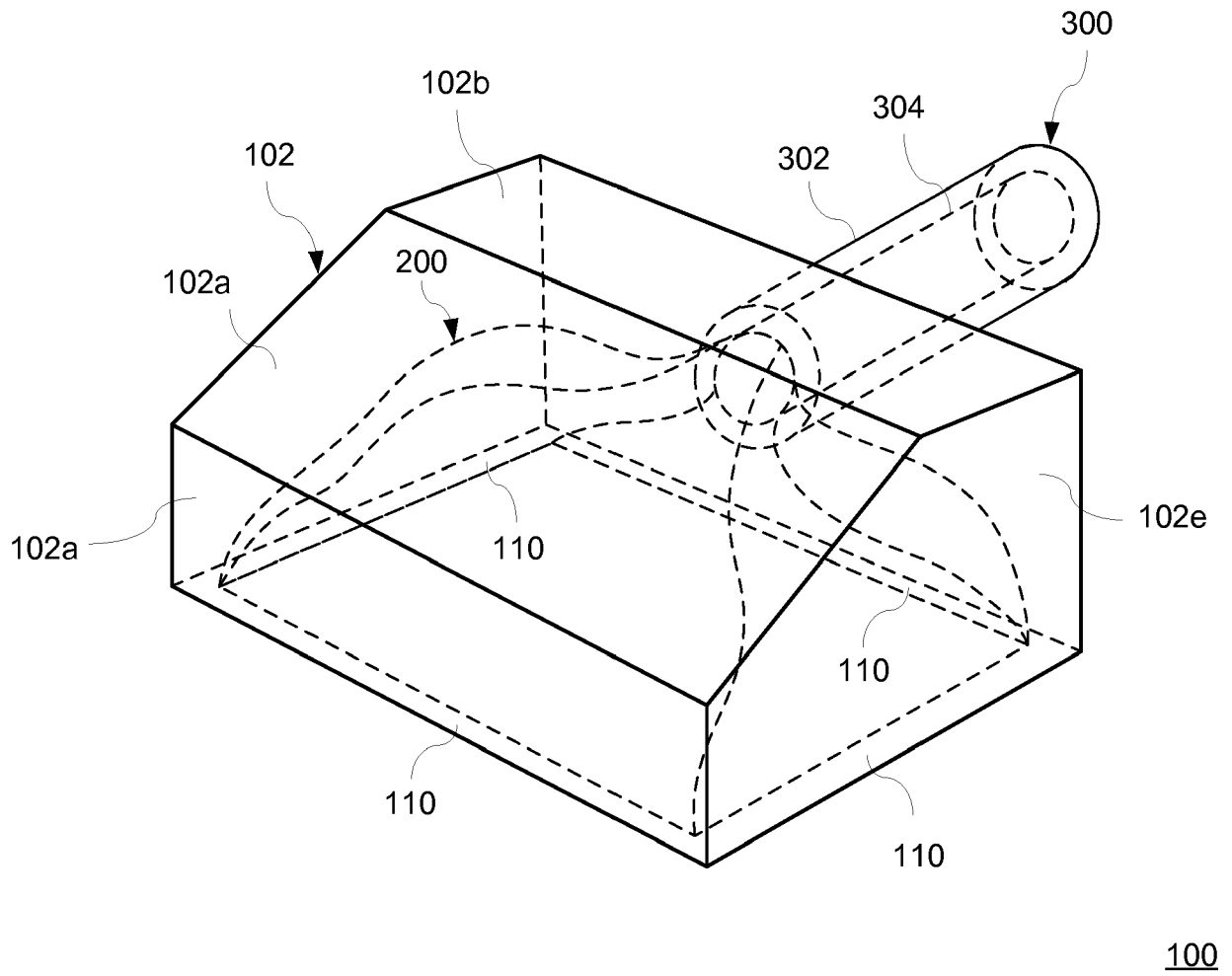


FIG. 4

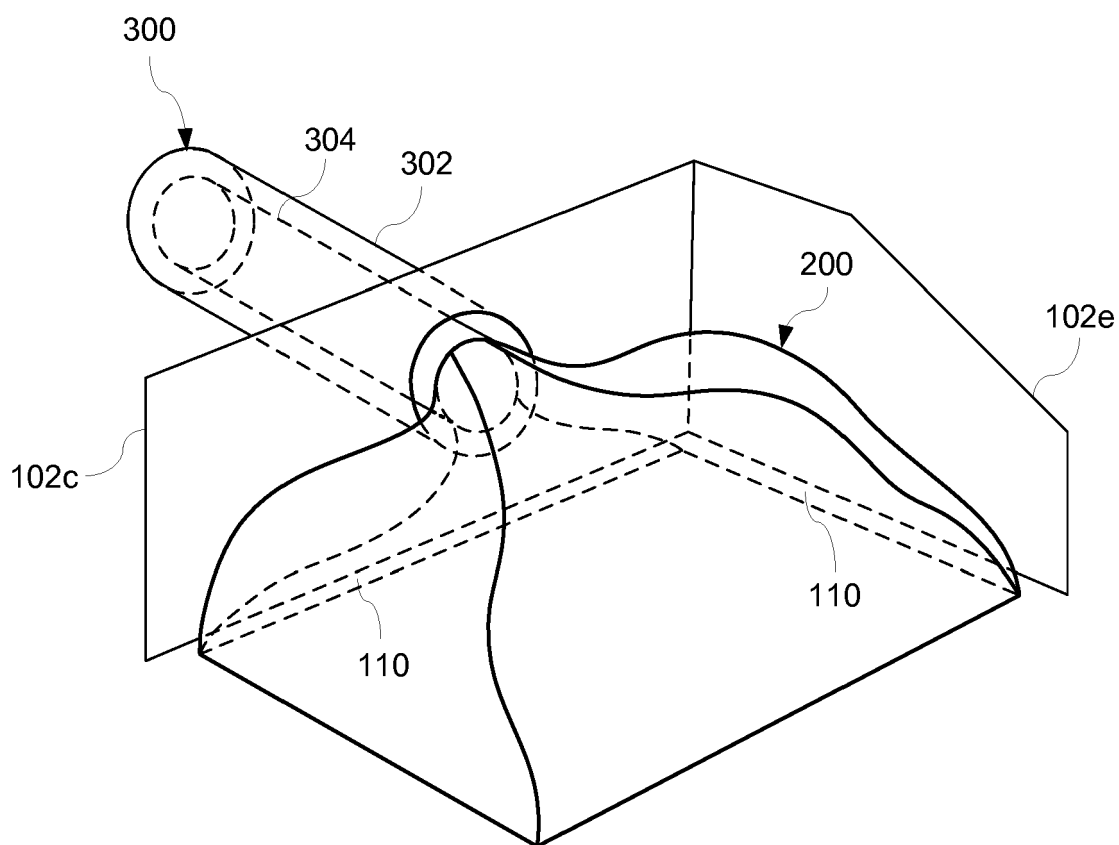


FIG. 5

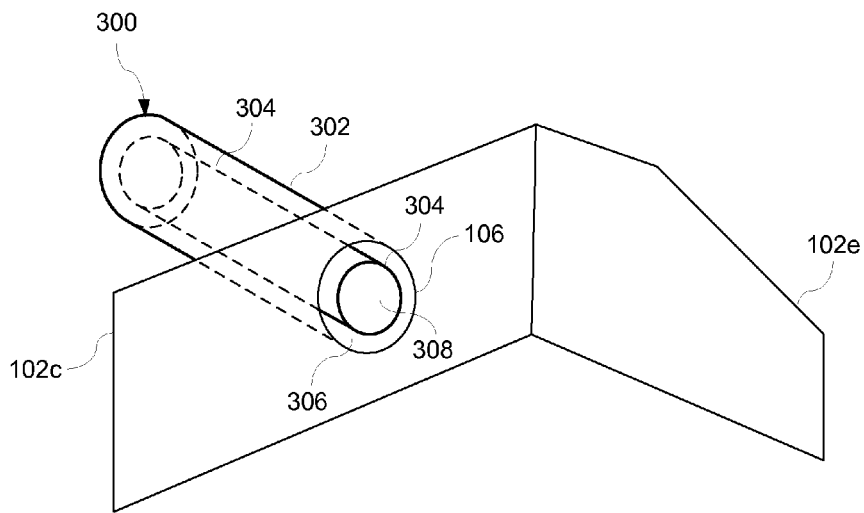


FIG. 6

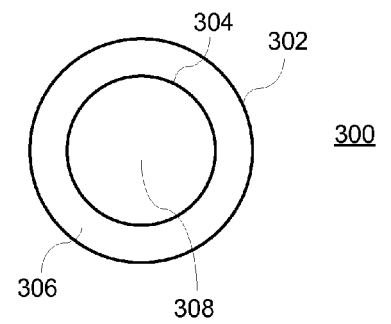


FIG. 7

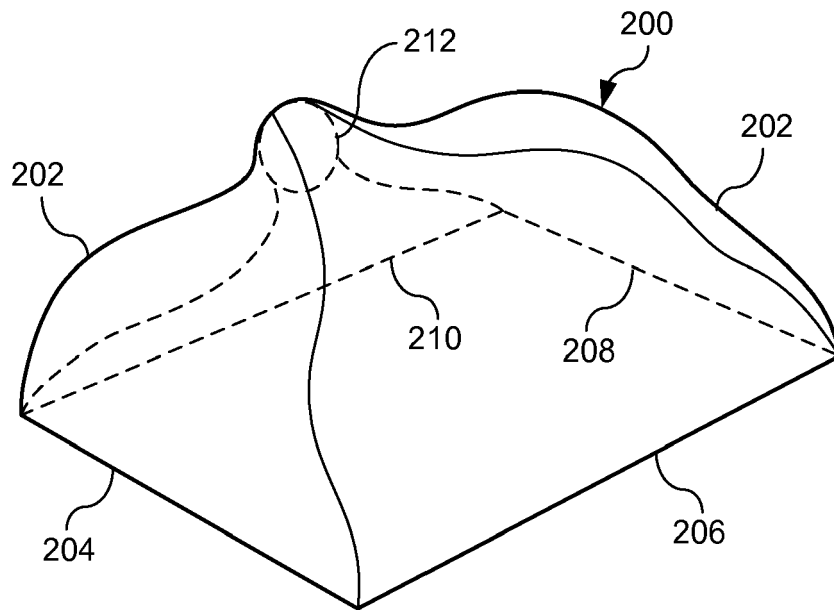


FIG. 8A

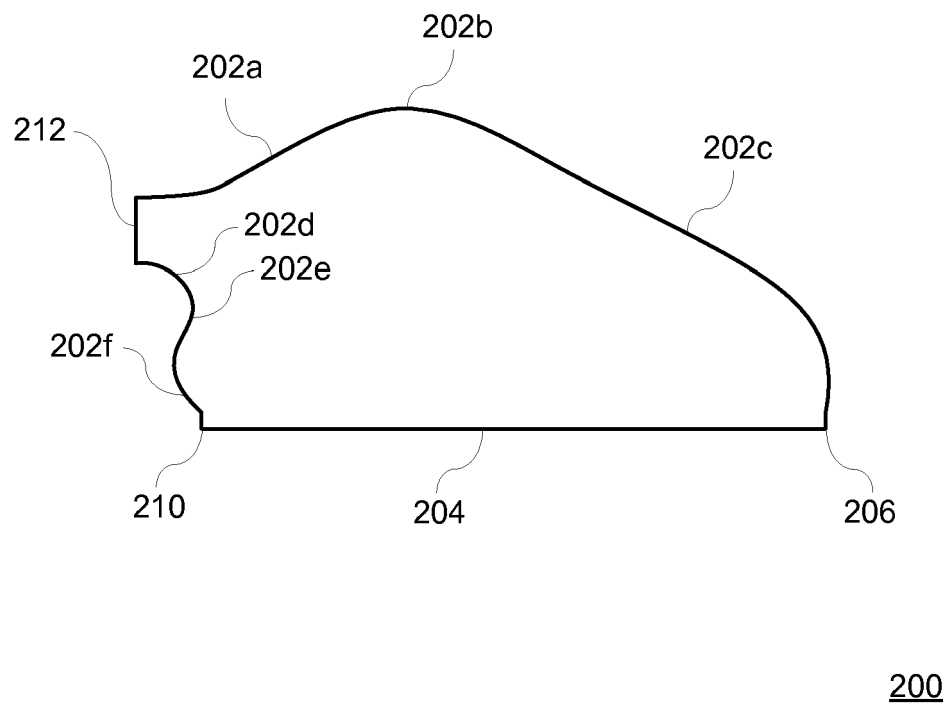


FIG. 8B

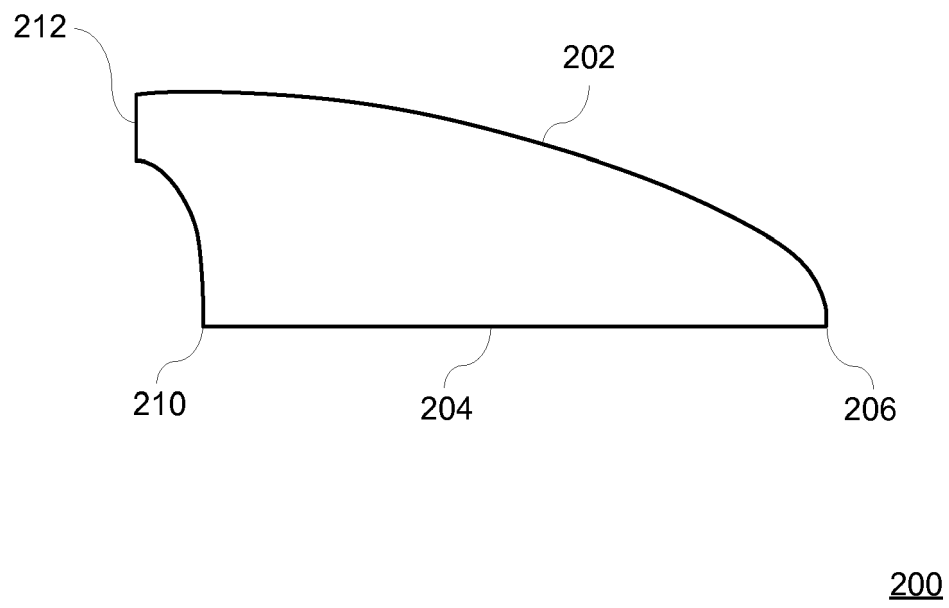
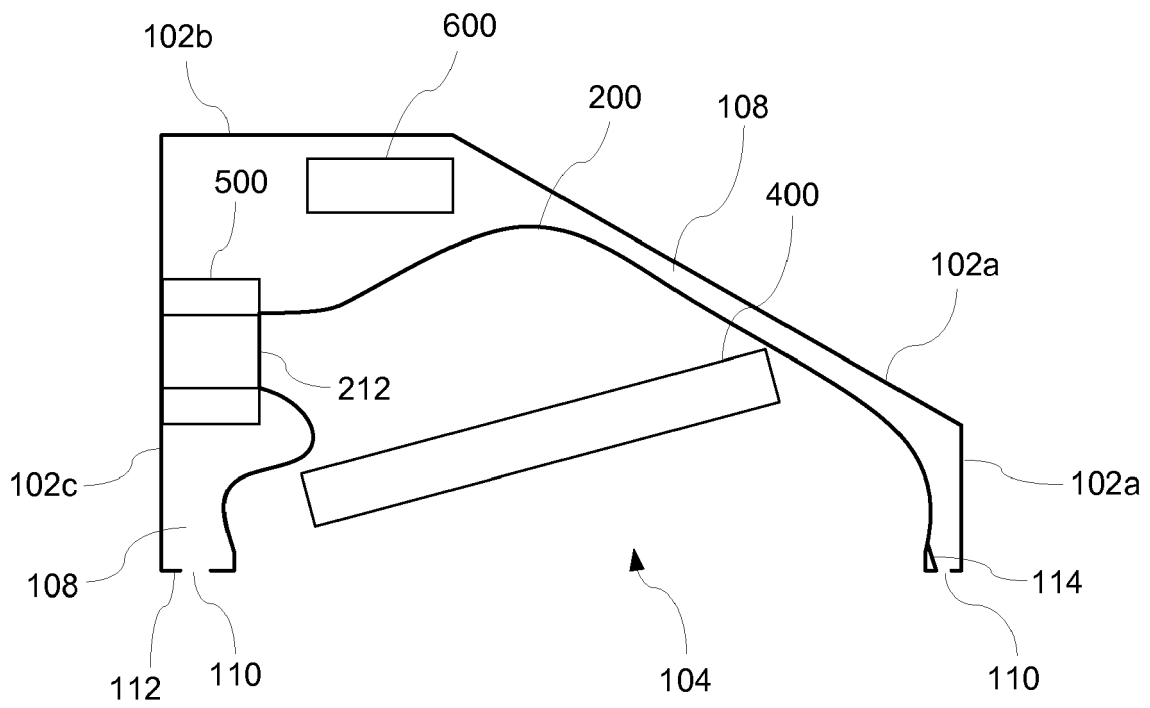


FIG. 9



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FIG. 10

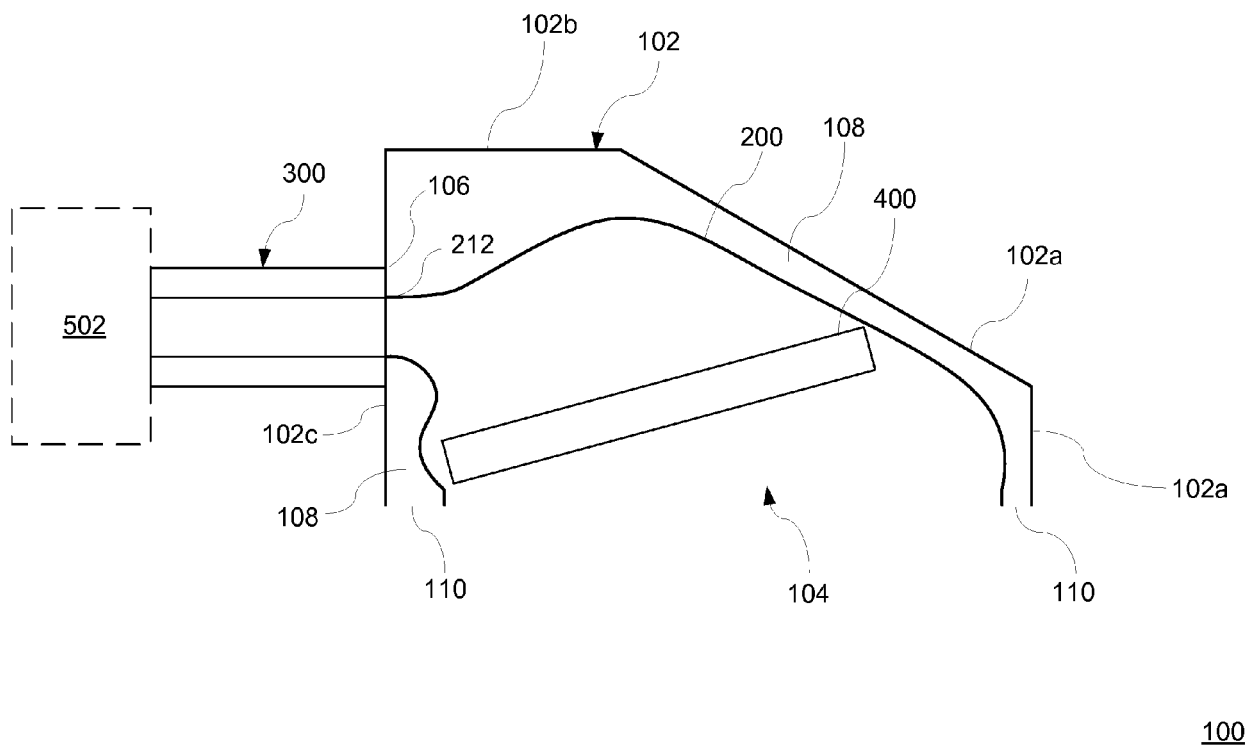


FIG. 11

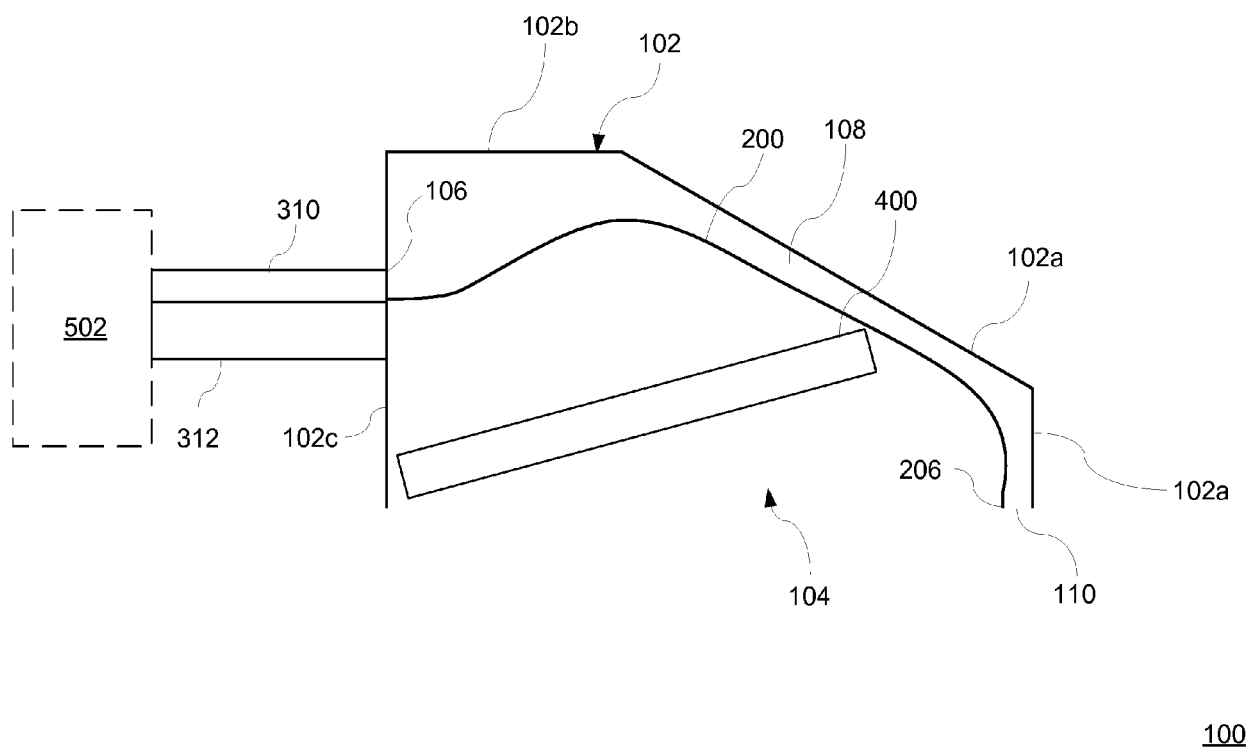


FIG. 12

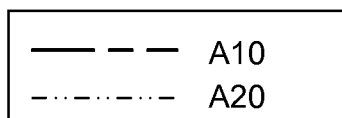
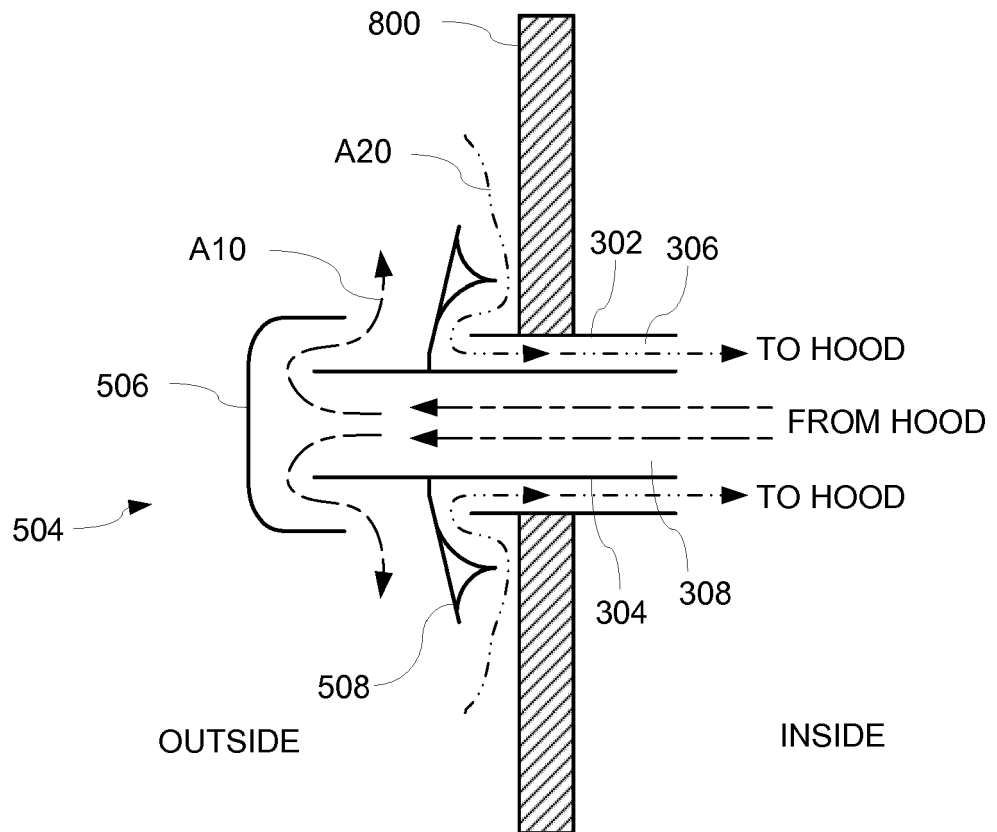


FIG. 13

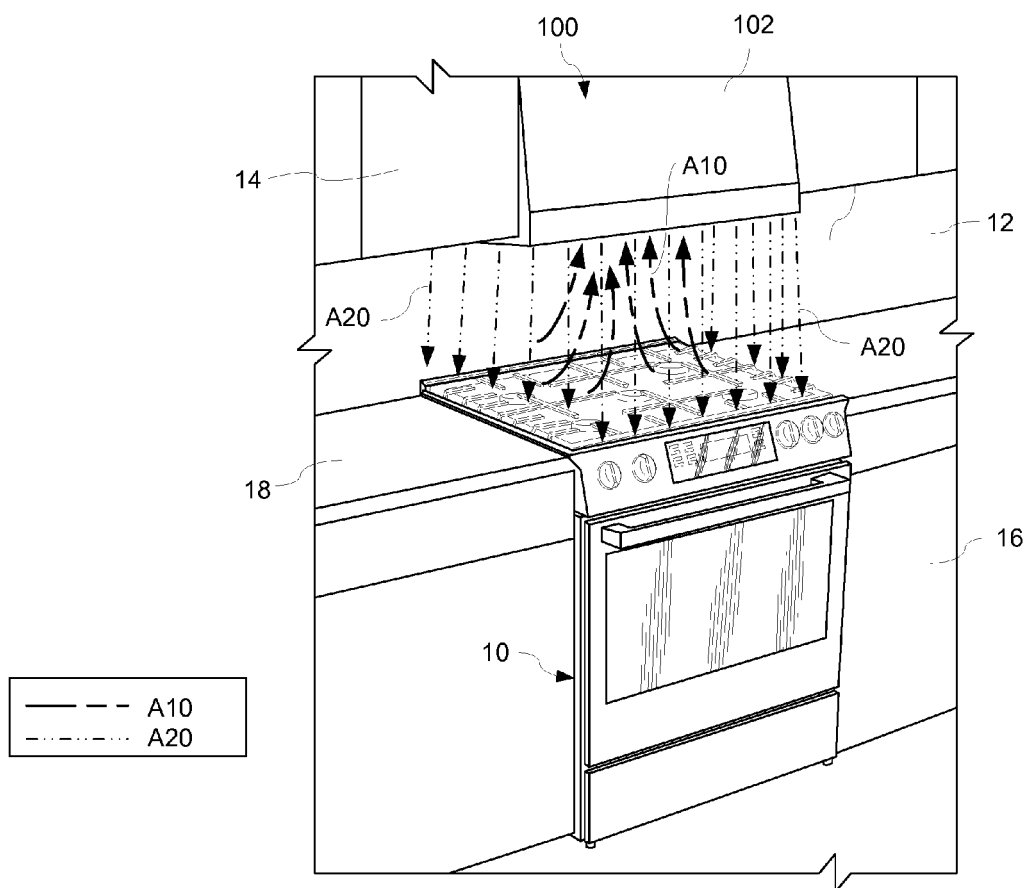


FIG. 14



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Application Number
EP 19 21 1844

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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 8 May 2020	Examiner Verdoodt, Luk
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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The members are as contained in the European Patent Office EDP file on
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