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(72) Inventors:
• **Viero, Massimo**
I-33080 Porcia (PN) (IT)
• **Contarini, Andrea**
I-33080 PORCIA (PN) (IT)

(71) Applicant: **Electrolux Appliances Aktiebolag**
105 45 Stockholm (SE)

(74) Representative: **Maccalli, Marco et al**
Maccalli & Pezzoli S.r.l.
Via Settembrini, 40
20124 Milano (IT)

(54) **Laundry appliance having overheating preventing system**

(57) The solution according to one or more embodiments of the invention relates to a laundry appliance (500) comprising a cabinet (505), a laundry chamber (105) enclosed within the cabinet (505) for containing laundry to be dried, and a worktop (505_T) atop the cabinet (505). The worktop (505_T) integrates a drying process

air circulation system (100-400) adapted to continuously circulate process air through the laundry chamber (105). The worktop (505_T) comprises an air duct (130-430) for allowing ambient air (A_{AIR}) to enter the process air circulation system (100-400) and to mix with the process air thereby avoiding overheating thereof.

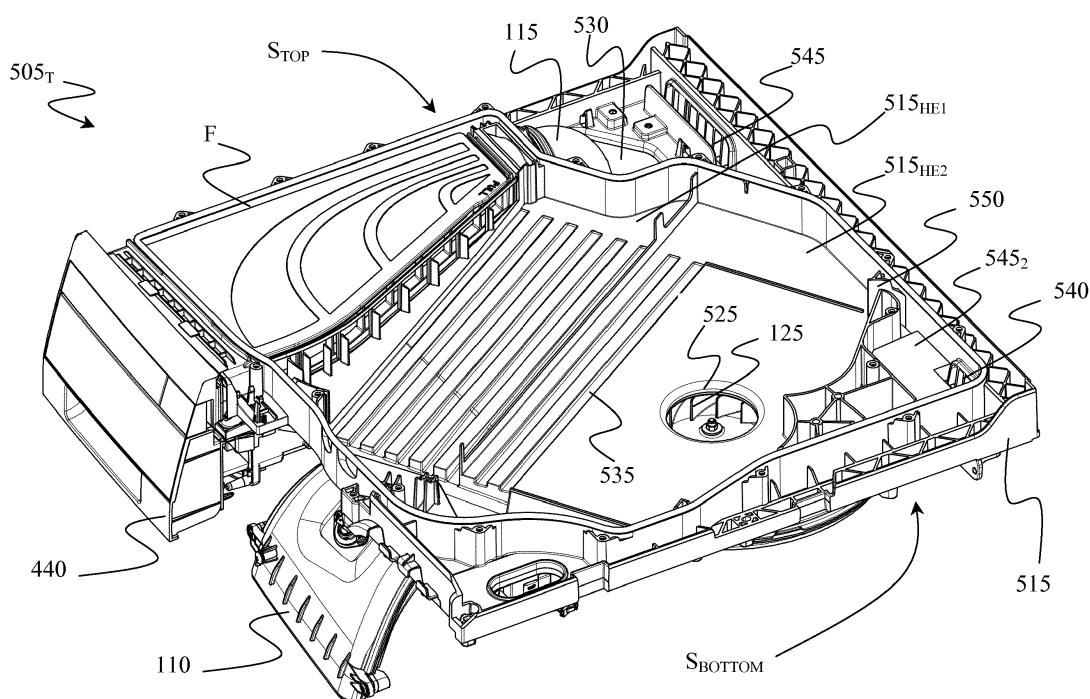


Figure 5C

Description

Field of the invention

[0001] The solution according to embodiments of the invention generally relates to household and/or professional laundry treating appliances configured for performing drying operations (e.g., laundry washing/drying appliances and laundry drying appliances, hereinafter both referred to as laundry appliances for the sake of conciseness). More particularly, such solution relates to laundry appliances provided with heat pump devices.

Background of the invention

[0002] Each household and/or professional laundry appliance (such as laundry washing/drying appliance, or washer/dryer, and laundry drying appliance, or dryer) generally comprises a laundry chamber configured for housing a laundry load (including articles such as clothes and other textiles) and for causing drying air circulating therethrough to remove moisture from the laundry load, e.g. shortly after cleaning/washing thereof.

[0003] In order to achieve that, a class of laundry appliances are provided with heat pump devices.

[0004] Broadly speaking, each heat pump device substantially makes use of a refrigerant circuit for effectively transferring thermal energy from a first side at a lower temperature (also referred to as cool side), to a second side at a higher temperature (also referred to as hot side). A common type of heat pump device exploits physical properties of a refrigerant fluid (or refrigerant), which is made to flow in the refrigerant circuit, and comprises a compressor, a pressure-lowering device (e.g., an expansion valve), and a heat exchanger assembly - i.e. a first heat exchanger (where the refrigerant absorbs heat) and a second heat exchanger (where the refrigerant releases heat).

[0005] During drying operation of a usual laundry appliance provided with heat pump device, the air leaving the laundry chamber with decreased temperature and increased humidity (or dump air) with respect to the incoming hot air (i.e., the drying air), is passed through the first heat exchanger, where it is further cooled down and dehydrated, and then through the second heat exchanger where, upon reheating, it forms the hot drying air, thereafter the drying air is fed again inside the laundry chamber for evaporating moisture from the laundry load.

Summary of the invention

[0006] The Applicant has found that the known and practiced solutions are not satisfactory for modern technological requirements.

[0007] Indeed, the Applicant has found that cooling capacity at cool side is not high enough to efficiently cool down the dump air, which results in overheating of the drying air at hot side. Thus, an undesired overheating of

the laundry appliance, and especially of electric/electro-mechanic/electronic components housed therein, is typically experienced, which sets reliability issues.

[0008] This also lowers attractiveness of laundry appliances based on heat pump devices over laundry appliances based on other de-moisturizing and heating solutions - e.g., those based on air-air heat exchanger/heating resistor assembly, where heating and cooling capacities balancing can be achieved by adjusting electric power provided to the heating resistor.

[0009] Many current solutions are provided with a motor-driven fan intended to promote forced ventilation of ambient air on the compressor thereby at least partly cooling it down. However, the Applicant has found that overheating of the other appliance components is not avoided (for example, electronic components, whose safe and optimal operation is guaranteed at relatively low operative temperatures).

[0010] The Applicant has found that such overheating issues get worse in more critical implementations where the heat exchanger assembly is arranged, together with other components, on a top of the laundry appliance (or worktop).

[0011] Such drawbacks are exacerbated in most of modern laundry dryers, wherein the increased size of the laundry chambers - intended to meet user requirements of high laundry-capacity for the same, or better, drying performance - involves more drying air to be used.

[0012] The Applicant has faced the problem of devising a satisfactory solution able to overcome the above-discussed drawbacks.

[0013] 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).

[0014] An aspect of the solution according to one or more embodiments of the invention relates to a laundry appliance comprising a cabinet, a laundry chamber enclosed within the cabinet for containing laundry to be dried, and a worktop atop the cabinet. The worktop integrates a drying process air circulation system adapted to continuously circulate process air through the laundry chamber. The worktop comprises an air duct for allowing ambient air to enter the process air circulation system and to mix with the process air thereby avoiding overheating thereof.

[0015] According to an embodiment of the invention, the laundry chamber comprises an opening for allowing an amount of process air within it to leave the air circulation system thereby substantially compensating the ambient air added thereto.

[0016] According to an embodiment of the invention, the worktop comprises a further air passage configured to allow un-channeled air within the cabinet to be vented

outside the appliance, at least a part of said amount of process air being vented un-channeled outside the appliance through said further air passage.

[0017] According to an embodiment of the invention, the laundry appliance is a washer/dryer operable in washing and/or drying operation modes and comprising a washing products dispensing arrangement fluidly connected to said opening for dispensing, when operated in washing mode, washing products to the laundry chamber. At least a part of said amount of process air is vented channeled outside the washer/dryer through said washing products dispensing arrangement.

[0018] According to an embodiment of the invention, the laundry appliance further comprises a washing products loading tray, arranged at a front of the worktop, for allowing loading of washing products, the washing products loading tray being fluidly connected to the washing products dispensing arrangement. At least part of said amount of process air is vented outside the appliance through interstices of said loading tray allowing opening/closing movements thereof.

[0019] According to an embodiment of the invention, the laundry appliance is a washer/dryer operable in washing and/or drying operation modes. The appliance further comprises an overflow-preventing system preventing liquids introduced within the laundry chamber from overflowing out of the washer/dryer. At least a part of said amount of process air flowing into said overflow-preventing system and hence venting inside the washer/dryer.

[0020] According to an embodiment of the invention, the overflow-preventing system is in fluid communication with said further air passage.

[0021] According to an embodiment of the invention, said washing products dispensing arrangement comprises a downwards protruding pipe portion configured to be filled, during drying operation mode, with a predefined amount of water, so that when said amount of process air is passed through the washing products dispensing arrangement, fluff is held in the water.

[0022] According to an embodiment of the invention, the worktop houses, along the process air circulation system, first and second heat exchangers of a heat pump device, said air duct allowing the ambient air to enter the process air circulation system through an input region thereof in correspondence of the second or the first heat exchanger.

[0023] According to an embodiment of the invention, the worktop houses, along the process air circulation system, first and second heat exchangers of a heat pump device, said air duct allowing the ambient air to enter the process air circulation system through an input region thereof between the first and second heat exchangers.

[0024] According to an embodiment of the invention, said air duct comprises an enlarged portion acting as a resonant cavity suppressing/dampening acoustic waves within it caused by ambient air flow.

[0025] According to an embodiment of the invention,

said air duct comprises first and second sound suppressing/dampening portions for suppressing/dampening acoustic waves caused by ambient air flow, the first and second suppressing/dampening portions being spaced apart from each other so as to define an air gap therebetween for ambient air flow.

[0026] According to an embodiment of the invention, said air duct comprises an air passage provided at a panel of said cabinet, said ambient air being admitted within the cabinet through said air passage and hence through said air duct.

[0027] According to an embodiment of the invention, said air passage extends between top and bottom surfaces of a worktop base, and at a rear portion thereof, the first and second sound suppressing/dampening portions being arranged on the top surface of the worktop base such that the ambient air, after entering said air passage, is channeled within said air gap.

[0028] According to an embodiment of the invention, the worktop base comprises a bottleneck portion fluidly connecting said air gap to the ambient air input region of the air circulation system, said bottleneck portion preventing the process air from diffusing to the surrounding environment through the air gap and the air passage.

[0029] Thanks to the proposed invention, overheating issues are substantially avoided, or at least drastically reduced. This increases laundry appliance reliability, and attractiveness of heat pump-based laundry appliances.

Brief description of the annexed drawings

[0030] These and other features and advantages of the present invention will be made apparent by the following description of some exemplary and non limitative embodiments thereof; for its better intelligibility, the following description should be read making reference to the attached drawings, wherein:

Figures 1-4 schematically show an air circulating system according to embodiments of the invention; **Figure 5A** shows a perspective and partly exploded front view of a laundry appliance according to an embodiment of the invention;

Figure 5B shows a perspective rear view of a part of the laundry appliance of **Figure 5A** according to an embodiment of the invention;

Figures 5C-5D show top and bottom perspective views with partly removed parts, respectively, of a worktop of the laundry appliance of **Figure 5A** according to an embodiment of the invention, and

Figures 5E-5F show a top view with partly removed parts of the worktop of **Figures 5C-5D**, and a close-up view thereof, respectively, according to an embodiment of the invention.

Detailed description of preferred embodiments of the invention

[0031] With reference to the drawings, **Figures 1-4** conceptually show an air circulating system **100-400** according to embodiments of the invention.

[0032] The air circulating system **100-400** is adapted to continuously, *i.e.* cyclically, circulate drying air through a laundry chamber **105** (*i.e.*, a tub and a rotating drum housed therein, not illustrated) containing a laundry load to be dried. Specifically, the air circulating system **100-400** comprises a delivery duct **110** fluidly connected to an input opening **IN₁₀₅** of the laundry chamber **105** for supplying it with drying air, and a return duct **115** fluidly connected to a main output opening **OUT₁₀₅** of the laundry chamber **105** for taking moisture-laden air deriving from drying process (dump air).

[0033] Between (and connecting) the delivery **110** and return **115** ducts, a main duct **120** is provided, which houses first **HE₁** and second **HE₂** heat exchangers (*e.g.*, evaporator and condenser members, respectively) of a heat pump device, as well as a motor-driven fan **125**, *e.g.* arranged downstream the second heat exchanger **HE₂**. As usual, under fan **125** action, the dump air leaving the laundry chamber **105** with decreased temperature and increased humidity with respect to the incoming hot drying air, is first passed (through the return duct **115**) through the first heat exchanger **HE₁**, where it is further cooled down and de-moisturized (heat pump cool side). The de-moisturized air is then passed through the second heat exchanger **HE₂** (heat pump hot side), where it is heated-up, thereafter the corresponding hot de-moisturized air, *i.e.* the drying air, is fed again (through the delivery duct **110**) into the laundry chamber **105**.

[0034] In order to compensate insufficient cooling capacity at cool side with respect to heating capacity at hot side, which could result in dangerous overheating (especially of electric/electro-mechanic/electronic components, not shown, arranged near or within the air circulation system **100-400**), a secondary air duct **130-430** is provided that fluidly connects the air circulation system **100-400** with the appliance surrounding environment - preferably, with the outside of a laundry appliance where the air circulation system **100-400** is intended to be used.

[0035] Therefore, by means of the secondary air duct **130-430**, relatively cool ambient air **A_{AIR}** is taken from the outside of the laundry appliance and supplied/channelled into the air circulation system **100-400**. The ambient air **A_{AIR}** entering the air circulation system **100-400** mixes with (thereby cooling down) the air circulating therewithin. This avoids overheating issues.

[0036] As illustrated, **Figures 1-3** embodiments differ from one another for the air circulation system **100-300** input region where the ambient air **A_{AIR}** is allowed to enter - *i.e.*, input region in correspondence of the second heat exchanger **HE₂**, input region between the first **HE₁** and second **HE₂** heat exchangers, or input region in correspondence of the first heat exchanger **HE₁**, respective-

ly. The secondary air ducts **130-330** have been illustrated as having same shapes and arrangements, but reciprocally different lengths (depending, in the example at issue, on the air circulation system **100-300** input regions which they are fluidly connected to), it being understood that shape, size and arrangement thereof, not limiting for the invention, may be chosen according to design options of the air circulation system **100-300** (as progressively detailed when introducing design issues thereof) and of the corresponding laundry appliance (as better detailed when discussing a practical implementation thereof). As far as **Figure 4** embodiment is concerned, the ambient air **A_{AIR}** is allowed to enter through the air circulation system **400** input region in correspondence of the second heat exchanger **HE₂** (as for **Figure 1** embodiment).

[0037] A secondary output opening **OUT_{105,S}** of the laundry chamber **105** is provided for allowing an amount of dump air within it to leave the air circulation system **100-400** (and to vent, at least in part, outside the laundry appliance), so as to substantially compensate/balance the ambient air **A_{AIR}** added therinto. In order to achieve compensation, the amounts of dump air allowed to leave the air circulation system **100-400** (hereinafter, compensation air **C_{AIR}**) and of ambient air **A_{AIR}** allowed to enter therinto should be made substantially equal (*e.g.*, by properly shaping and sizing the secondary air duct **130-430** and the secondary output opening **OUT_{105,S}** one another).

[0038] Venting of the compensation air **C_{AIR}** may take place by any suitable approach, not limiting for the invention. For example, the compensation air **C_{AIR}** may be vented un-channelled - as for cooling air typically used for cooling down heat pump compressor, not shown - and/or channelled.

[0039] **Figure 4** illustrates compensation air **C_{AIR}** venting by channeling, wherein a venting duct **435** is provided that fluidly connects the secondary output opening **OUT_{105,S}** of the laundry chamber **105** to the environment surrounding the laundry appliance.

[0040] The venting duct **435** may be a dedicated duct/path/channel, or it may advantageously comprise (as illustrated from **Figure 4** on) a washing products dispensing arrangement that, in a laundry appliance performing both washing and drying functions (hereinafter, washer/dryer), allows dispensing washing products from a washing products loading tray **440**. In other words, the same dispensing arrangement that, during a washing-mode operation of the washer/dryer, allows feeding the laundry chamber **105** with washing products, is also used, in the example at issue, for venting at least a part of compensation air **C_{AIR}** outside the washer/dryer during a drying-mode operation thereof.

[0041] Thus, venting of at least a part of compensation air **C_{AIR}** outside the washer/dryer can take place from the loading tray **440** (both when, in order to allow washing products loading, it is opened, and when it is closed, as better discussed in the following).

[0042] Ambient air **A_{AIR}** and compensation air **C_{AIR}**

flows may originate excessive sound/noise issues, thus sound/noise suppression/dampening may be required.

[0043] In order to achieve that, the secondary air duct **430** is preferably provided with an enlarged portion **445** that, upon proper sizing, acts as a resonant cavity suppressing/dampening acoustic waves within it at selected frequencies (and/or frequencies ranges). Additionally (as illustrated), or alternatively, first **445₁** and second **445₂** sound suppressing/dampening portions may be provided (e.g., made of aluminum foam or any other suitable sound absorbing or soundproof materials). The first **445₁** and second **445₂** suppressing/dampening portions are preferably spaced apart from each other so as to define an air gap therebetween for ambient air **A_{AIR}** flow (with such air gap that, in terms of air path, is part of the secondary air duct **430**), for example (as illustrated) arranged at top and bottom recessed walls, respectively, of the cavity **445**.

[0044] A washer/dryer **500** incorporating an air circulation system (e.g., the air circulation system **400**) is shown, according to an embodiment of the invention, in the perspective and partly exploded front view of **Figure 5A** (which will be discussed with joint reference to **Figure 4**). As above-mentioned, it is understood that the principles of the invention may be applied to any other laundry appliance generally configured for performing laundry drying operations, and that reference to a washer/dryer is made only as a preferred and complete embodiment. Hereinafter, references denoting components of the air circulation system **400** in their schematic representation of **Figure 4** will also denote the same components in their practical implementation in the washer/dryer **500**.

[0045] The washer/dryer **500** comprises a substantially parallelepiped-shaped cabinet **505**, having a front panel **505_F**, two side panels **505_S** (only one visible in the figure), and a bottom panel. The cabinet **505** encloses an inner compartment housing the laundry chamber **105** and accessible through an access door **510** (shown in closed configuration).

[0046] A top panel **505_T** closes the cabinet **505** from above, and defines a ready-to-mount worktop incorporating/housing the air circulation system. In this respect, reference will be also made to **Figure 5B**, showing a perspective rear view of a part of the washer/dryer **500**, to **Figures 5C-5D**, showing top and bottom perspective views with partly removed parts of the worktop **505_T**, and to **Figures 5E-5F**, showing a top view and a close-up view, respectively, of the worktop **505_T**.

[0047] The worktop **505_T** comprises, at a front thereof, the washing products loading tray **440** (shown in the closed configuration), and a removable filter unit **F**, preferably arranged on the washing products loading tray **440**. The filter unit **F** is configured to filter the dump air (from fluff and other residual laundry load fabrics) before being passed through the first **HE₁** and second **HE₂** heat exchangers.

[0048] The worktop **505_T** comprises a, e.g. a plastic, base element **515** shaped and sized so as to define a

number of housing sections adapted to house corresponding components of the air circulation system, and a cover assembly (globally denoted by number reference **520**) for top covering the base element **515** and delimiting air paths therebetween (as discussed below).

[0049] Preferably, the base element **515** comprises housing sections **515_F**, **515_{HE1}**, **515_{HE2}**, for housing the filter unit **F**, the first heat exchanger **HE₁**, and the second heat exchanger **HE₂**, respectively. As visible in the figures, such housing sections **515_F**, **515_{HE1}**, **515_{HE2}** take most of a worktop top surface **S_{TOP}**, exception made for (left and right) corner regions of the base element **515** (intended to other purposes, as discussed below). A first covering panel **520₁** of the cover assembly **520** (**Figure 5A**) covers the base element **515** with the exception of the left corner region thereof - the space between the base element **515** (i.e., the housing sections **515_{HE1}**, **515_{HE2}**) and the first covering panel **520₁** delimiting an air path that substantially identifies, together with filter unit **F** air path, the main duct **430**. A second covering panel **520₂** is instead provided on the first covering panel **520₁** for aesthetical issues.

[0050] The base element **515** comprises, e.g. at a substantially central part of the housing section **515_{HE2}**, a base opening **525**, which is fluidly connected to the fan **125** (e.g., rigidly fixed to the base element **515**, underneath it) and to the delivery duct **110** for allowing the drying air to be supplied into the laundry chamber **105**. Preferably, the base opening **525** opens down to a fan **125** input, whereas the delivery duct **110**, arranged underneath the base element **515** as well, has a first end connector (not visible) for connection with a fan **125** output, and a second end connector (for example, an elongated-shaped connector, as illustrated) for connection with an opening of a bellow (not shown) that, as usual in washer/dryers, seals gap between the drum and the access door **510**.

[0051] The base element **515** also comprises, e.g. at the left corner region thereof, a further base opening **530**, which allows connection of the return duct **115** (carrying the dump air within it) from the output opening **OUT₁₀₅** of the laundry chamber **105** to the filter unit **F**.

[0052] As better discussed in the following, the base opening **530** also allows passage of un-channeled air circulating within the washer/dryer **500** (outside the air circulating system).

[0053] During drying-mode operation of the washer/dryer **500**, the dump air leaving the laundry chamber **105** is first supplied (through the return duct **115**) through the filter unit **F**, and the filtered dump air output therefrom is then passed through the first heat exchanger **HE₁**, where it is de-moisturized (with the condensed moisture that is properly collected and drained by a slot grid **535** of the base element **515** on which the first heat exchanger **HE₁** rests). The de-moisturized air is then passed through the second heat exchanger **HE₂**, where it is heated-up, thereafter the drying air is supplied again (through the base opening **525**, the fan **125** and the delivery duct **110**)

into the laundry chamber **105** (*i.e.*, from a front thereof through the bellow opening).

[0054] The air duct **430** comprises an air passage **540** for allowing admission/access of ambient air **A_{AIR}** into the washer/dryer cabinet **505**. Such air passage **540** may be provided at any suitable panel **505_T**, **505_F**, **505_S** of the cabinet **505**, and at any proper position thereof.

[0055] Advantageously, as illustrated, such air passage **540** is provided at the worktop **505_T**, as the latter integrating the air circulation system within it (however, nothing prevents from providing the air passage **540** at the front **505_F** or side **505_S** panels, in which case joint members could be necessary for joining the air passage **540**, at the front **505_F** or side **505_S** panels, to the input region of the air circulation system **400**, at the worktop **505_T**).

[0056] More preferably, the air passage **540** is provided at the base element **515** of the worktop **505_T**. In the exemplary illustrated embodiment, the air passage **540** is configured as an air grid vertically extending (with respect to the floor where the washer/dryer **500** is intended to rest) between opposite top **S_{TOP}** and bottom **S_{BOTTOM}** surfaces of the base element **515** (however, any other configuration deemed suitable for the purpose can be conceived).

[0057] Preferably, as shown in **Figure 5B**, the air passage **540** is placed at a rear portion (*e.g.*, at the right corner) of the base element **515** that, upon worktop **505_T** mounting, protrudes with respect to washer/dryer **500** back. This generates a gap between the washer/dryer **500** back and a vertical wall (not shown) which the washer/dryer **500** is intended to lean against, which allows adequate ambient air **A_{AIR}** intake. **Figure 5B** also shows, at the left corner of the base element **515**, a further air passage **545**, similar to the air passage **540**, configured to allow un-channeled air within the cabinet **505** to be vented outside the washer/dryer **500** (as indicated by arrows exiting from the worktop **505_T** air passage **545**). Such un-channeled air may comprise (as in many washer/dryers) further ambient air intended to cool down the compressor heat pump, and/or (as discussed above for some contemplated embodiments of the invention) the compensation air **C_{AIR}**.

[0058] Air passage **540** arrangement should take into account air passage **545** arrangement. Preferably, as illustrated, the air passages **540** and **545** are arranged far enough to substantially avoid, or at least limit, that the air exiting the air passage **545** gets back into the air passage **540** thereby frustrating drying air cooling.

[0059] As visible in **Figures 5A** and **5C**, the first **445₁** and second **445₂** sound suppressing/dampening portions are arranged on the top surface **S_{TOP}** of the worktop base **515** such that the ambient air **A_{AIR}**, after entering the air passage **540**, are channeled within the air gap defined by them.

[0060] As best visible in **Figures 5E** and **5F**, the ambient air **A_{AIR}** is then channeled into a bottleneck portion **550** of the base element **515** fluidly connecting the air

gap to the housing section **515_{HE2}** (or to any other input region of the air circulation system **400**, as discussed above), thereafter mixing between ambient air **A_{AIR}** and drying air takes place. Thus, the air passage **540**, the air gap between the first **445₁** and second **445₂** sound absorbing portions and the bottleneck portion **550** act, as a whole, as the secondary air duct **430**.

[0061] Arrangement of the air passage **540**, as well as sizing and shaping of the air gap and of the bottleneck portion **550**, are adapted to meet specific design options. For example, a sufficiently narrow and curved bottleneck portion (as the illustrated bottleneck portion **550**), is able to prevent the drying air from spreading without control through the secondary air duct **430**.

[0062] Moreover, air passage **540**, air gap and/or bottleneck portion **550** reciprocal arrangements, shaping and sizing could meet local pressures differences issues. For example, a pressure at the input region of the air circulation system **100** sufficiently lower than ambient pressure (outside the washer/dryer **500**, where the ambient air **A_{AIR}** is taken from) would allow ambient air **A_{AIR}** taking/drawing by pressure unbalance, without requiring any additional fans.

[0063] As discussed above, the drying air/ambient air **A_{AIR}** mixture is supplied to the laundry chamber **105**, thereafter at least a part thereof (compensation air **C_{AIR}**) is vented outside the washer/dryer **500** through the washing products dispensing arrangement **435** and the loading tray **440** connected thereto (as discussed herebelow).

[0064] Preferably, assuming a closed configuration of the loading tray during drying operation of the washer/dryer **500**, at least part of the compensation air **C_{AIR}** leaving the laundry chamber **105** and flowing, through the dispensing arrangement **435**, up to the loading tray **440** is vented through interstices of the loading tray **440** (not distinguishable) allowing opening/closing movements thereof.

[0065] Preferably, compensation air **C_{AIR}** venting is further achieved by means of an overflow-preventing system typically provided in washer/dryers for preventing liquids (*e.g.*, washing products and/or water) from overflowing out of the washer/dryer **500**, for example through the loading tray **440**, upon a fault occurrence (*e.g.*, water pump closure fail). The overflow-preventing system, *per se* well known in the art, comprises a draining channel **555** (part of which visible in **Figure 5D**), preferably arranged at a side of the loading tray **440** and at predefined height. When, as a result of a fault, the liquids, rising up within the laundry chamber **105**, reach the loading tray **440**, they reach a limit level (given by said predefined height), and the exceeding liquids are drained (through the draining channel **555**) to a proper liquid container (not shown) arranged within the washer/dryer **500**, where a liquid detection system (also not shown) is provided. Upon detection of a predefined liquids amount, the liquid detection system completely stops washer/dryer **500** operation, thereby preventing liquids from overflowing out of the washer/dryer **500** via the loading tray **440** and from

causing flooding of the user premises where the washer/dryer **500** is placed.

[0066] Thus, during normal operation of the washer/dryer **500** the compensation air **C_{AIR}** (or a part thereof) can flow through the overflow-preventing system, and vent inside the washer/dryer **500**. Advantageously, the overflow-preventing system is in fluid communication with the air passage **545**, such that, compensation air **C_{AIR}** (or a part thereof) which has been vented inside the washer/dryer **500**, can be exhausted outside the washer/dryer cabinet **505**.

[0067] The fluff-laden compensation air **C_{AIR}** leaving the laundry chamber **105** and flowing up the washing product dispensing arrangement **435** may cause fluff to accumulate within, thereby dirtying, the loading tray **440**. Such fluff may mix to washing products and negatively affect washing operation of the washer/dryer **500**.

[0068] In order to avoid such an event, or at least limit it, the washing products dispensing arrangement **435**, preferably in the form of a pipe, is preferably provided with a downwards protruding pipe portion **560** (**Figure 5D**) adapted to be at least partially filled, during drying operation mode, with a proper amount of water (a water well is thus formed along the compensation air **C_{AIR}** path). Upon compensation air **C_{AIR}** flowing into the dispensing arrangement **435**, fluff is held by the water well. Thus, the compensation air **C_{AIR}** is allowed to get out from the loading tray **440** free of fluff. Advantageously, during a same drying operation, several water well filling cycles (so as to compensate water evaporating over time due to compensation air **C_{AIR}** heat), and/or several water well discharge-and-filling cycles (so as to discharge hot water full of fluff and replace it with a fresh and clean water) may be provided.

[0069] 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 described in connection with any disclosed embodiment of the invention may be incorporated in any other embodiment as a matter of general design choice.

[0070] Moreover, analogous considerations apply if the laundry appliance has a different structure or comprises 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.

[0071] Although in the description the air passages have been described as provided at a rear portion of the laundry appliance, this should not be construed limitatively. By way of example only, it is possible to provide implementations wherein the air passages are provided at different cabinet sides, preferably opposite sides, thereof.

[0072] Finally, although in the present description explicit reference has been made to a laundry appliance whose moisture removal from the process air is carried out by means of a heat pump device, the principles of the present invention also apply to any other moisture condensing unit suitable for the purpose (e.g., an air-air heat exchanger).

Claims

1. Laundry appliance (**500**) comprising a cabinet (**505**), a laundry chamber (**105**) enclosed within the cabinet (**505**) for containing laundry to be dried, and a worktop (**505_T**) atop the cabinet (**505**), the worktop (**505_T**) integrating a drying process air circulation system (**100-400**) adapted to continuously circulate process air through the laundry chamber (**105**),
characterized in that
the worktop (**505_T**) comprises an air duct (**130-430**) for allowing ambient air (**A_{AIR}**) to enter the process air circulation system (**100-400**) and to mix with the process air thereby avoiding overheating thereof.
2. Laundry appliance (**500**) according to Claim 1, wherein the laundry chamber (**105**) comprises an opening (**OUT_{105,S}**) for allowing an amount of process air (**C_{AIR}**) within it to leave the air circulation system (**100-400**) thereby substantially compensating the ambient air (**A_{AIR}**) added thereto.
3. Laundry appliance (**500**) according to Claim 2, wherein the worktop (**505_T**) comprises a further air passage (**545**) configured to allow un-channeled air within the cabinet (**505**) to be vented outside the appliance, at least a part of said amount of process air (**C_{AIR}**) being vented un-channeled outside the appliance through said further air passage (**545**).
4. Laundry appliance (**500**) according to Claim 2 or 3, wherein the laundry appliance is a washer/dryer (**500**) operable in washing and/or drying operation modes, the washer/dryer (**500**) comprising a wash-

- ing products dispensing arrangement (435) fluidly connected to said opening (OUT_{105,S}) for dispensing, when operated in washing mode, washing products to the laundry chamber (105), at least a part of said amount of process air (C_{AIR}) being vented channeled outside the washer/dryer (500) through said washing products dispensing arrangement (435).
5. Laundry appliance (500) according to Claim 4, further comprising a washing products loading tray (440), arranged at a front of the worktop (505_T), for allowing loading of washing products, the washing products loading tray (440) being fluidly connected to the washing products dispensing arrangement (435), wherein at least part of said amount of process air (C_{AIR}) is vented outside the appliance through interstices of said loading tray (440) allowing opening/closing movements thereof.
 6. Laundry appliance (500) according to any Claim 2 to 5, wherein the laundry appliance is a washer/dryer (500) operable in washing and/or drying operation modes, the appliance (500) further comprising an overflow-preventing system (555) preventing liquids introduced within the laundry chamber (105) from overflowing out of the washer/dryer (500), at least a part of said amount of process air (C_{AIR}) flowing into said overflow-preventing system (555) and hence venting inside the washer/dryer (500).
 7. Laundry appliance (500) according to Claims 6 when depending from Claim 3, wherein the overflow-preventing system (555) is in fluid communication with said further air passage (545).
 8. Laundry appliance (500) according to any Claim from 4 to 7, wherein said washing products dispensing arrangement (435) comprises a downwards protruding pipe portion (560) configured to be filled, during drying operation mode, with a predefined amount of water, so that when said amount of process air (C_{AIR}) is passed through the washing products dispensing arrangement (435), fluff is held in the water.
 9. Laundry appliance (500) according to any of the preceding Claims, wherein the worktop (505_T) houses, along the process air circulation system (100;400), first (HE₁) and second (HE₂) heat exchangers of a heat pump device, said air duct (130;430) allowing the ambient air (A_{AIR}) to enter the process air circulation system (100;400) through an input region thereof in correspondence of the second or the first heat exchanger (HE₂,HE₁).
 10. Laundry appliance (500) according to any Claim from 1 to 8, wherein the worktop (505_T) houses, along the process air circulation system (200), first (HE₁) and second (HE₂) heat exchangers of a heat pump device, said air duct (230) allowing the ambient air (A_{AIR}) to enter the process air circulation system (200) through an input region thereof between the first (HE₁) and second (HE₂) heat exchangers.
 11. Laundry appliance (500) according to any of the preceding Claims, wherein said air duct (430) comprises an enlarged portion (445) acting as a resonant cavity suppressing/dampening acoustic waves within it caused by ambient air (A_{AIR}) flow.
 12. Laundry appliance (500) according to any of the preceding Claims, wherein said air duct (430) comprises first (445₁) and second (445₂) sound suppressing/dampening portions for suppressing/dampening acoustic waves caused by ambient air (A_{AIR}) flow, the first (445₁) and second (445₂) suppressing/dampening portions being spaced apart from each other so as to define an air gap therebetween for ambient air (A_{AIR}) flow.
 13. Laundry appliance (500) according to any of the preceding Claims, wherein said air duct (430) comprises an air passage (540) provided at a panel (505_T,505_F,505_S) of said cabinet (505), said ambient air (A_{AIR}) being admitted within the cabinet (505) through said air passage (540) and hence through said air duct (430).
 14. Laundry appliance (500) according to Claim 13 when depending from Claim 12, wherein said air passage (540) extends between top (S_{TOP}) and bottom (S_{BOTTOM}) surfaces of a worktop base (515), and at a rear portion thereof, the first (445₁) and second (445₂) sound suppressing/dampening portions being arranged on the top surface (S_{TOP}) of the worktop base (515) such that the ambient air (A_{AIR}), after entering said air passage (540), is channeled within said air gap.
 15. Laundry appliance (500) according to Claim 14 when depending from Claim 9 or 10, wherein the worktop base (515) comprises a bottleneck portion (550) fluidly connecting said air gap to the ambient air input region of the air circulation system (100-400), said bottleneck portion (550) preventing the process air from diffusing to the surrounding environment through the air gap and the air passage (540).

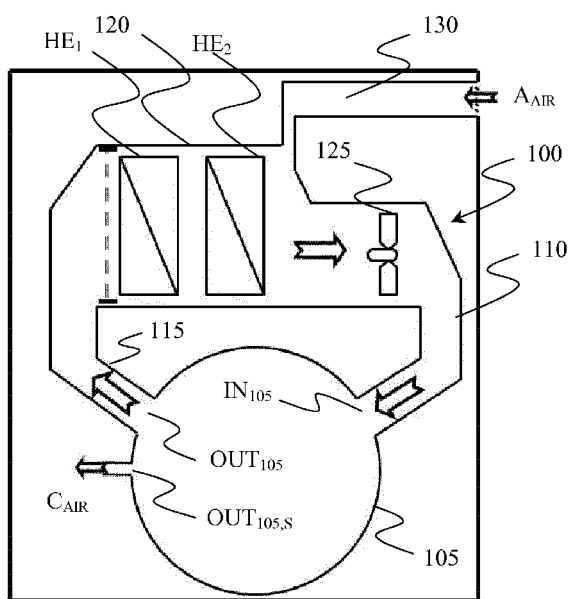


Figure 1

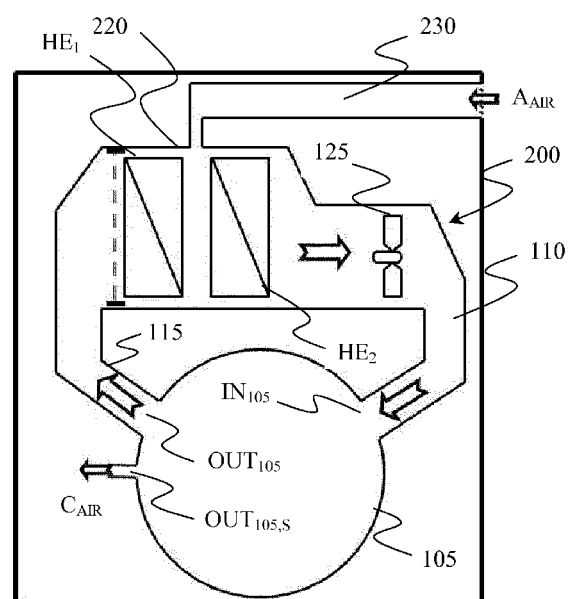


Figure 2

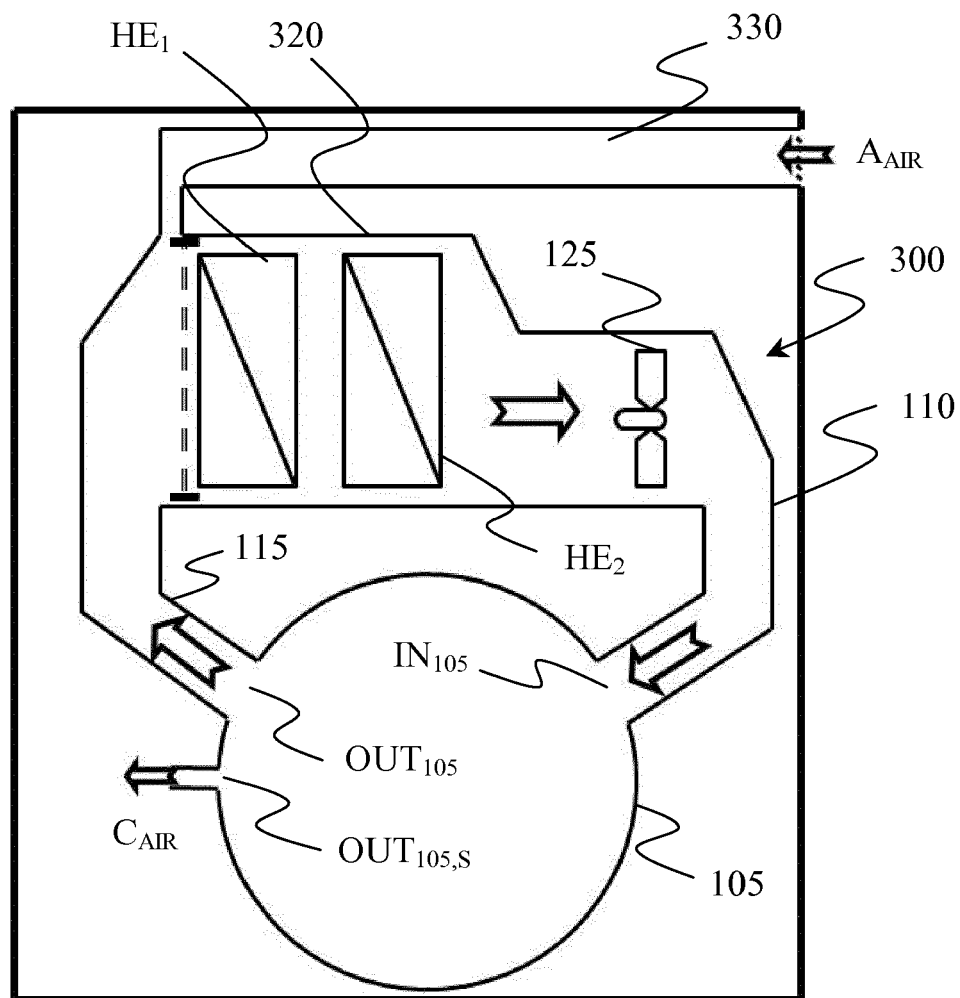


Figure 3

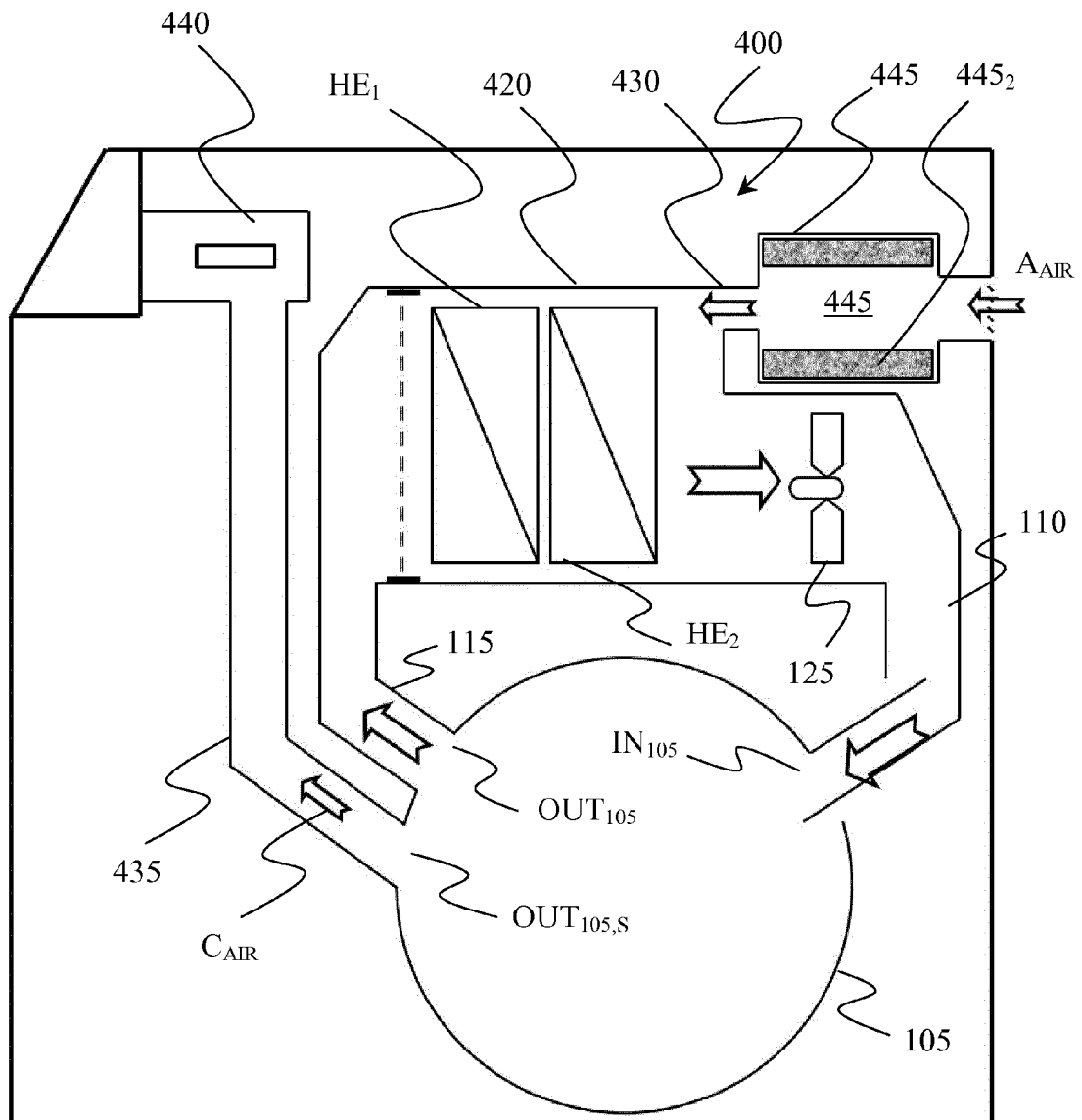


Figure 4

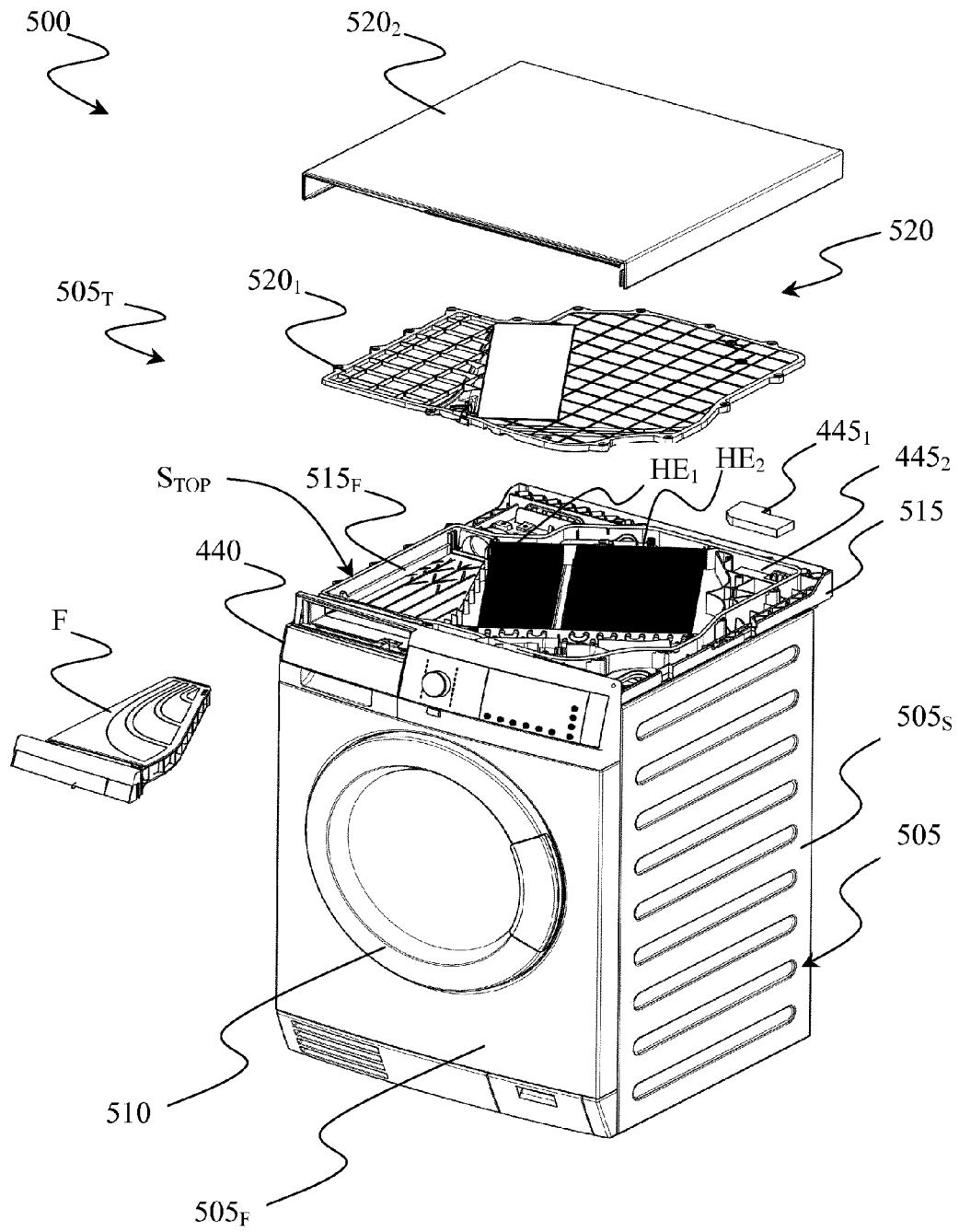


Figure 5A

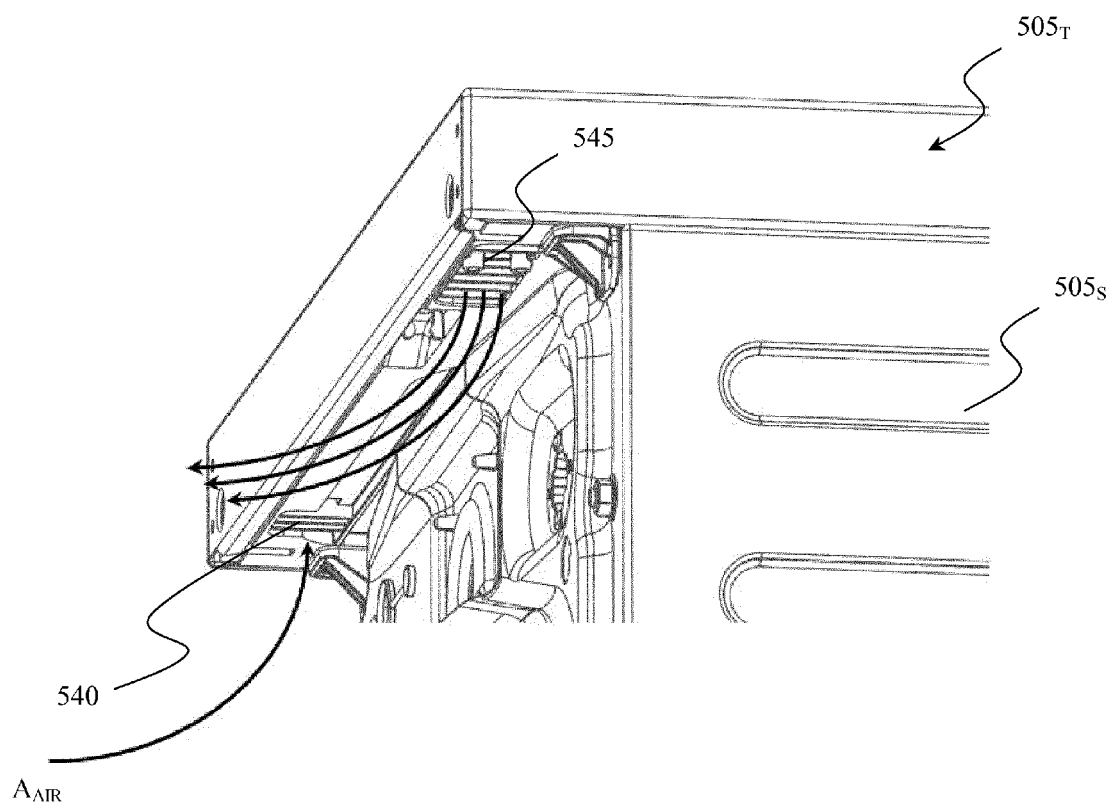


Figure 5B

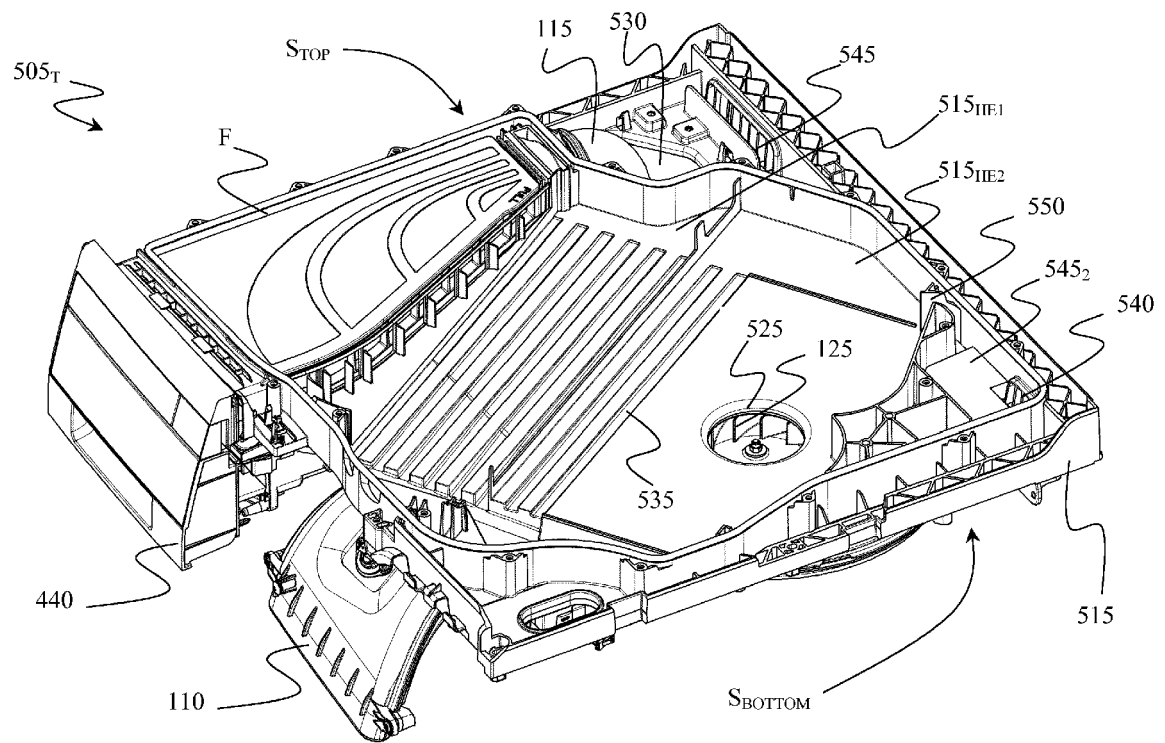


Figure 5C

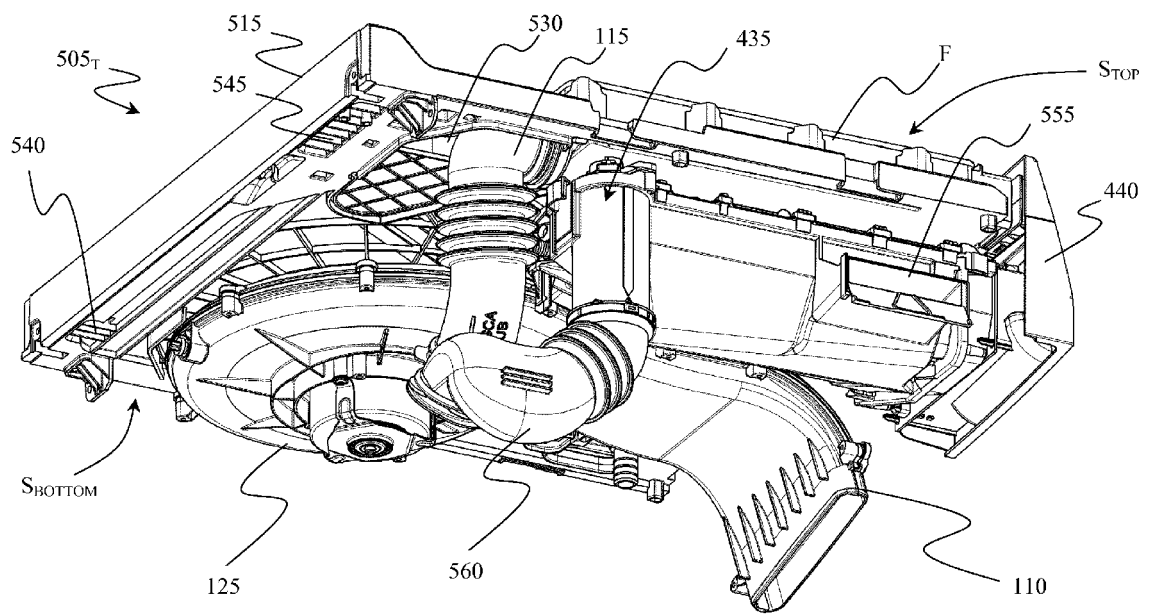


Figure 5D

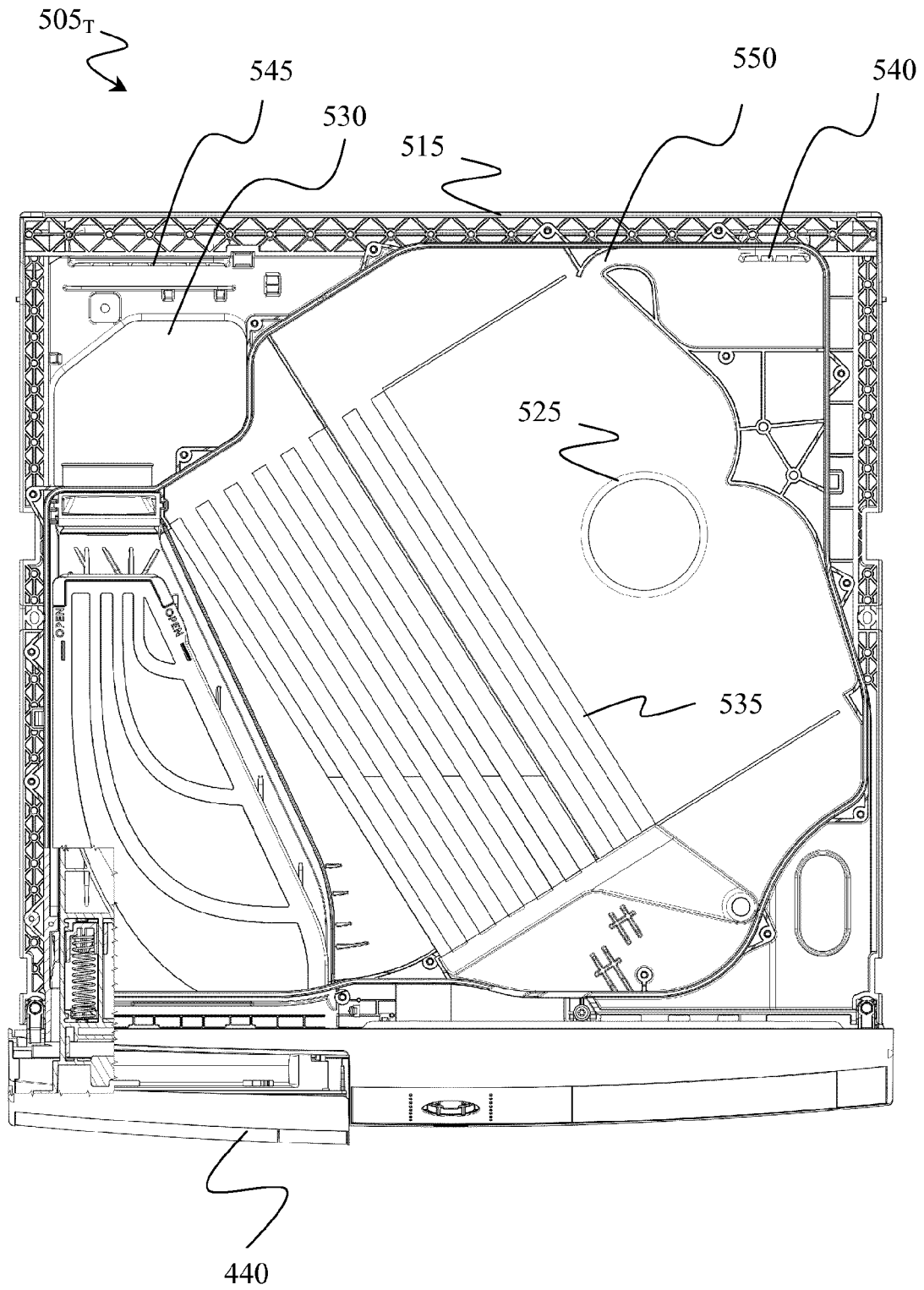


Figure 5E

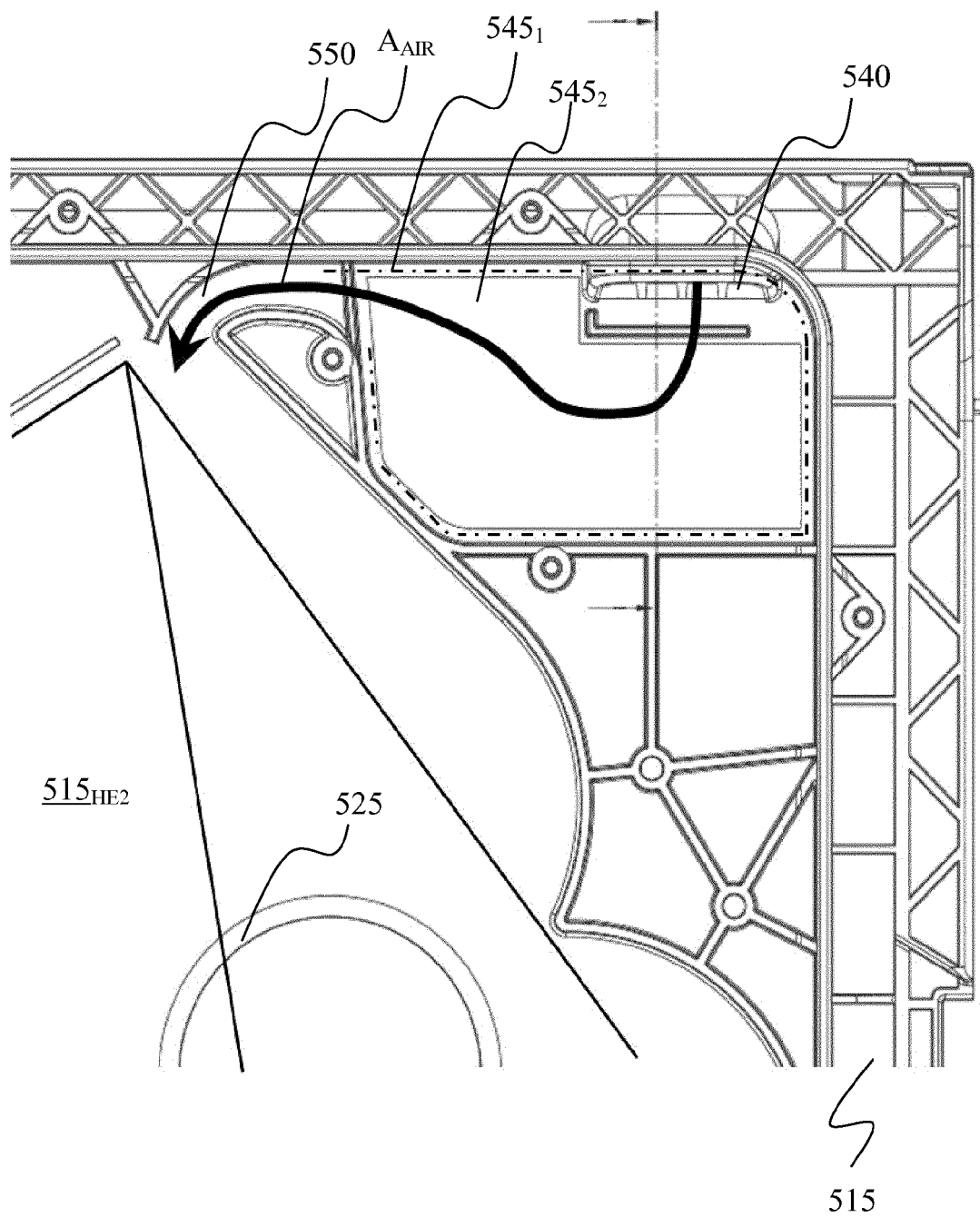


Figure 5F



EUROPEAN SEARCH REPORT

Application Number
EP 13 18 2331

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 467 188 A1 (BOSCH SIEMENS HAUSGERAETE [DE]; KULMBACHER KLIMAGERAETE [DE] BSH BOSCH) 22 January 1992 (1992-01-22) * column 1, line 42 - column 5, line 32; figure 1 *	1-15	INV. D06F58/20 D06F58/02
X	DE 44 09 607 A1 (MIELE & CIE [DE]) 27 October 1994 (1994-10-27) * column 1, line 21 - column 3, line 35; figure 4 *	1-15	
X	US 2012/030960 A1 (RYOO BYEONGJO [KR] ET AL) 9 February 2012 (2012-02-09) * paragraph [0104] - paragraph [0136]; figures 12-14 *	1-15	
A	EP 2 385 163 A1 (ELECTROLUX HOME PROD CORP [BE]) 9 November 2011 (2011-11-09) * paragraph [0028] - paragraph [0057]; figures 1-9 *	1-15	
A	DE 44 36 673 A1 (BOSCH SIEMENS HAUSGERAETE [DE] BSH BOSCH SIEMENS HAUSGERAETE [DE]) 18 April 1996 (1996-04-18) * column 1, line 37 - column 6, line 64; figures 1-6 *	4-8	TECHNICAL FIELDS SEARCHED (IPC) D06F
A	EP 0 552 843 A1 (CANDY SPA [IT]) 28 July 1993 (1993-07-28) * column 2, line 34 - line 52; figure 3 *	7	
A	EP 2 386 674 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 16 November 2011 (2011-11-16) * paragraph [0033] - paragraph [0073]; figures 1-7 *	8	
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The present search report has been drawn up for all claims			

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EPO FORM 1503 03.82 (P04C01)

Place of search

Munich

Date of completion of the search

13 February 2014

Examiner

Engelhardt, Helmut

CATEGORY OF CITED DOCUMENTS

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& : member of the same patent family, corresponding document



EUROPEAN SEARCH REPORT

Application Number
EP 13 18 2331

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP 2007 313063 A (MATSUSHITA ELECTRIC IND CO LTD) 6 December 2007 (2007-12-06) * paragraph [0026] - paragraph [0028]; figures 3,4 *	11-14	
A	US 2011/041260 A1 (BALINSKI BARBARA A [US] ET AL) 24 February 2011 (2011-02-24) * paragraph [0009] - paragraph [0068]; figures 1,2 *	4-8	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 February 2014	Examiner Engelhardt, Helmut
CATEGORY OF CITED DOCUMENTS			
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ON EUROPEAN PATENT APPLICATION NO.**

EP 13 18 2331

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The members are as contained in the European Patent Office EDP file on
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13-02-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0467188 A1	22-01-1992	DE 4023000 A1 EP 0467188 A1 ES 2158839 T3	23-01-1992 22-01-1992 16-09-2001
DE 4409607 A1	27-10-1994	NONE	
US 2012030960 A1	09-02-2012	US 2012030960 A1 WO 2012020943 A2	09-02-2012 16-02-2012
EP 2385163 A1	09-11-2011	BR PI1102068 A2 EP 2385163 A1 US 2011265523 A1	30-10-2012 09-11-2011 03-11-2011
DE 4436673 A1	18-04-1996	AT 407264 B CN 1133369 A CZ 9502660 A3 DE 4436673 A1 FR 2725735 A1 GB 2291891 A HK 177096 A IN 187989 A1 KR 100409241 B1 PL 310876 A1 RU 2144104 C1 TR 960250 A2 US 5588313 A	26-02-2001 16-10-1996 17-04-1996 18-04-1996 19-04-1996 07-02-1996 27-09-1996 03-08-2002 09-03-2004 15-04-1996 10-01-2000 21-06-1996 31-12-1996
EP 0552843 A1	28-07-1993	DE 69302026 D1 DE 69302026 T2 EP 0552843 A1 IT 1260443 B	09-05-1996 24-10-1996 28-07-1993 09-04-1996
EP 2386674 A2	16-11-2011	CN 102242481 A EP 2386674 A2 KR 20110124505 A US 2011277513 A1	16-11-2011 16-11-2011 17-11-2011 17-11-2011
JP 2007313063 A	06-12-2007	NONE	
US 2011041260 A1	24-02-2011	DE 102010017103 A1 US 2011041260 A1	24-02-2011 24-02-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82