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(54) **Laundry dryer**

(57) The present invention relates to a laundry dryer including:

- a casing; a basement (24) defining a basement plane (X,Y); a drum;
- a process air conduit (18) including a basement process air duct (28) having walls (28w) and including a basement process air outlet (19);
- a process air generator (30), being located within said process air conduit;
- a motor (50) having a shaft (51) defining a motor axis (M), which is passing through an aperture (26) provided in the basement process air duct and substantially at or in proximity of a center of said basement process air outlet;
- wherein a plane (PH) perpendicular to said basement

plane (X,Y) and sectioning said basement along said motor axis divides said basement process air duct in an outer (28outer) and in an inner portion (28inner);

- wherein a section by a plane (PZ) passing through said motor axis (M) and sectioning said basement process duct portion and said basement outlet in said outer portion defines a curve (C), a starting point (Pin) of said curve being located at said basement process air outlet and an end point (Pend) of said curve (C) being located at said aperture (26); and wherein in said section by said plane (PZ) passing through the motor axis, the distance (D1,..., Di,...,DN) between a point of said curve (C) and said motor axis (M) is a decreasing monotone function if the position of said point moves from said starting point (Pin) to said end point (Pend).

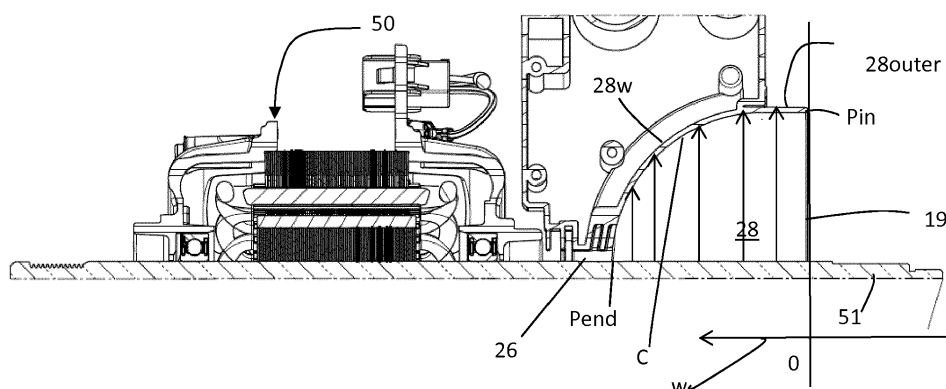


FIG. 11

DescriptionTechnical field

5 **[0001]** The present invention relates to a laundry dryer having an improved process air conduit.

Background of the invention

10 **[0002]** The heat pump technology in a laundry dryer is at present the most efficient way to dry clothes in terms of energy consumption. In a heat pump system of the laundry dryer an air stream flows in a closed air stream circuit, called process air circuit. Further, the heat pump system includes a closed refrigerant circuit. The air stream is moved by a (main) fan, passes through a laundry chamber, which is preferably formed as a rotatable laundry drum, and removes there water from wet clothes. Then, the air stream is cooled down and dehumidified in an evaporator, heated up in a condenser and re-inserted into the laundry drum again. The refrigerant is compressed by a compressor, condensed in
15 the condenser, expanded in an expansion device and then vaporized in the evaporator.

[0003] Thus, the condenser and the evaporator are components of the air stream circuit as well as of the refrigerant circuit. The condenser and the evaporator are heat exchangers between the air stream circuit and the refrigerant circuit.

[0004] Usually, the components of the heat pump system (as described above) are placed in a basement of the laundry dryer. The basement of a laundry dryer is part of a casing, which includes in addition to the basement also walls, substantially vertically supported from the basement, such as a front wall and a rear wall, and lateral walls. In the casing, a drum (where the laundry is introduced in order to dry the same) is rotatably supported. In particular, the compressor, the evaporator and the condenser are arranged in said basement below the laundry drum. A process air duct of the air stream circuit has to pass the basement of the dryer, bringing the humid air to the evaporator and reintroducing the dry air from the condenser into the drum. The process air duct in the basement can be formed by joining together two shells,
20 an upper shell portion and a lower shell portion, which together form the basement.

[0005] The shape of the process air duct within the basement plays an important role when it comes to the efficiency of the laundry dryer and the noise produced by the same.

[0006] Indeed, any sharp bend or corners which are present in the air stream circuit cause pressure drops and turbulences increasing the energy consumption and the noise. Indeed, a duct having for example sudden change in cross section is far away from the best aerodynamic shape, this latter being the shape reducing considerably air resistance during the flow.
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[0007] However, it is rather complex to modify the outline and shape of the process air duct where process air flows within the basement. The various component of the heat pump, with particular reference to the heat exchangers and the compressor, as well as the motor of the dryer, are rather "bulky", and repositioning of the same are limited due to the confined volume present in the basement of the dryer.
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[0008] The above applies also to laundry dryer without a heat pump system, but having an air-air type heat exchanger, wherein drying air is dehumidified by a cooling airflow passing through said heat exchanger.

[0009] It is known that prior art dryer includes a basement where a process air duct is formed. The process air within the basement process air duct is moved by the fan of the process air circuit. The process air exits the basement process air duct in order to be fed to the fan which blows the air to the drum. Between the outlet present in the basement and the air inlet of the fan, a flange is present, which restricts the dimension of the process air channel. Such flange or restriction causes turbulences and vortices in the process air flow, lowering the dryer efficiency as well as causing noise.
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[0010] It is an object of the present invention to provide a laundry dryer with a process air generator, wherein the flow of the process air is improved, with particular reference to the air stream flow between the basement of the laundry dryer and the air inlet of the fan.
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[0011] Applicant has realized via numerous experiments that the efficiency of the dryer and of the process air generator, e.g. a heat pump, system can be improved avoiding such a flange and therefore changing the outline of the basement process air duct and of the air inlet to the fan.

[0012] The absence of such a flange prevents the formation of "sharp corners" inside the basement process air duct, so that the pressure drops in the basement process air duct are reduced. The process air flow from the condenser to the basement outlet is optimized. The heat exchange between the refrigerant circuit and the air stream circuit is increased. The dimensions of the evaporator and condenser may be reduced.
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[0013] In addition, the energy consumption of the motors for the compressor and the fan is reduced. Further, the noise of the laundry dryer is reduced.

55 **[0014]** According to a first aspect, the invention relates to a laundry dryer including:

- a dryer casing having a front wall, a rear wall, lateral walls, and a basement defining a basement plane;
- a drum rotatably accommodated within said casing and accessible via a door connected to said front door;

- a process air conduit wherein drying process air is apt to flow, said process air conduit being connected to said drum so that said process air flows therethrough;
- a process air generator, apt to generate drying process air, said process air generator being located within said process air conduit;
- 5 - said process air conduit including a basement process air duct formed in said basement, said basement process air duct having walls and including a basement process air outlet where process air exits said basement,
- a motor having a shaft defining a motor axis, said motor axis passing through an aperture provided in the basement air duct and substantially at or in proximity of a center of said basement process air outlet;
- 10 - wherein a plane perpendicular to said basement plane and sectioning said basement along said motor axis divides said basement process air duct in an outer and in an inner portion, said outer portion being the portion not passing through a longitudinal centreline of the casing;
- wherein a section by a plane passing through said motor axis and sectioning said basement process duct portion and said basement outlet in said outer portion defines a curve, a starting point of said curve being located at said basement process air outlet and an end point of said curve being located at said aperture; and
- 15 - wherein in said section by said plane passing through the motor axis, the distance between a point of said curve and said motor axis is a decreasing monotone function if the position of said point moves from said starting point to said end point.

20 **[0015]** In the following, with the term "dryer" both drying machines which dry only as well as combined washer-dryers capable of performing washing and drying cycles are meant.

[0016] The dryer of the invention includes a drying chamber, such as a drum, in which the load, e.g. clothes or laundry, to be dried is placed.

25 **[0017]** The drum is part of an air process circuit, in particular a closed-loop circuit in case of a condensed dryer or an open circuit in case of a vented dryer, which in both cases includes an air conduit for channelling a stream of air to dry the load. The process air circuit is connected with its two opposite ends to the drum. More specifically, hot dry air is fed into the drying chamber, flowing over the laundry, and the resulting humid (and to a lower temperature cooled down) air exits the same. In case of a closed-loop drying air circuit, the humid air stream, rich in water vapor, is then fed into a humidity removal element, such as a heat exchanger. In a preferred embodiment of the invention, the humid air is fed to an evaporator of a heat pump system, where the moist process air is further cooled down and the humidity present therein condenses. The resulting cool dry air is then heated up before re-entering again in the drying chamber by means of a hot drying air generator, which can be for example a condenser of the heat pump system, and the whole loop is repeated till the end of the drying cycle. Alternatively or in addition, to remove humidity from humid air stream exiting the drum, an air-air type heat exchanger may be used. Such heat exchanger receives ambient air as cooling fluid to cool down and remove humidity from humid air stream passing therethrough. Furthermore, the hot drying air generator may comprise an electrical or gas powered heating device. In a vented dryer, ambient air is taken into the dryer via an inlet duct, such air is heated up by a hot drying air generator, such as condenser of the heat pump system and/or an electrical or gas powered heating device, before entering the drum. Heated air flowing through and on humid laundry contained in the drum, removes humidity from laundry. Humid air stream exiting the drum may be optionally dehumidified by an evaporator of a heat pump system, or an air-air type heat exchanger as explained above, before being exhausted outside the dryer.

40 **[0018]** The dryer furthermore includes a casing or bearing structure, comprising a basement, and preferably also a front wall, a rear wall and lateral walls. The front wall is advantageously provided with a through opening, at which a door is mounted to access the drum in order to store the laundry for drying purposes, or to remove the dry laundry at the end of the drying process. Preferably, a rim of the rear end of the drum abuts against the rear wall of the casing, and even more preferably a gasket is interposed therebetween; as well as a rim of the front end of the drum abuts against the front wall with also preferably a gasket therebetween.

45 **[0019]** Within the casing, the drum is rotatably mounted for rotating according to a horizontal or substantially horizontal or tilted rotational axis. Support element(s) for rotatably supporting the drum is/are provided for within the casing. The drum is rotated preferably by means of a motor which defines a motor axis, for example which corresponds to the axis of a motor shaft.

50 **[0020]** In an advantageous embodiment, said drum support element includes a drum shaft, said shaft passing through said rear or back wall of the drum, said shaft defining said axis of rotation of said drum. Alternatively or in addition, said drum support element includes a roller, the axis of the roller being substantially parallel to the axis of rotation of said drum.

55 **[0021]** The basement of the dryer of the invention includes a portion of the process air conduit. This portion of the process air conduit realized in the basement is called a basement process air duct. Within the basement process air duct or outside the same but still within the basement, the process air generator, e.g. both heat exchangers of the heat pump system are preferably located. Furthermore, the basement process air duct channels the process air exiting the process air generator such as the heat pump to an outlet of the basement. From the outlet of the basement, the process

air - dried by the process air generator - is fed, for example via an additional portion of the process air conduit realized preferably in the rear wall of the casing, to the drum so as to dry the laundry therein.

[0022] The motor axis exits the basement also through the outlet of the basement. The motor axis can be for example used additionally to drive a main fan of the process air conduit, apt to blow air from the basement back to the drum. The axis of the motor substantially passes through a center of the basement outlet, or in proximity of such a center. In order to exit the basement, the motor shaft has to pass through the process air duct in the basement, as better detailed below.

[0023] The basement process air duct may include one or more lateral walls depending on its geometry. If the geometry of the duct is substantially cylindrical or of a cylindroid, the basement process air duct includes a single lateral wall having circular or round or substantially circular or substantially roundish cross section, which may change in diameter depending on the position in which the cross section is taken. Alternatively, the basement process air duct may include parallel flat lateral wall, for example substantially perpendicular to the basement.

[0024] In a standard operative position, the basement of the dryer is positioned on a floor or other substrate on which the dryer performs its standard operations (e.g. drying and/or washing and/or spinning cycles). Such positioning defines a horizontal or at least substantially horizontal plane, which is called the basement plane (X, Y). Plane parallel to the basement plane are therefore substantially horizontal planes.

[0025] In this standard operative position, also other terms are well defined: "front" or "rear" or "back", "top" or "bottom", "upper" or "lower" are always referred to the normal standard configuration of a dryer with the basement positioned on a floor. The front wall of the dryer is defined by the wall in which the door from which the drum is accessed is positioned. Given the horizontal plane on which the laundry is located, "top" and "bottom" - as their normal common meaning - refer to the position of an object along a vertical axis.

[0026] Preferably, on the basement of the dryer the rear, the front, and the lateral walls of the casing of the dryer are mounted. Even more preferably, the casing includes further walls, for instance a top wall.

[0027] In a top view of the dryer, the basement can be considered as "divided" in two longitudinal halves by the axis of rotation of the drum (or the projection of said axis onto the basement plane). Whether the axis is horizontal (thus parallel to the basement plane (X,Y)) or tilted with respect to the latter, on a top view of the basement, the projection of the drum axis divides the basement in two halves, a first or left longitudinal half and a second or right longitudinal half. In other words, taking a plane which is perpendicular to the basement plane and which passes through the rotational axis of the drum, which generally coincides with the centerline of the basement, this plane virtually sections the basement in two longitudinal halves. This plane, called first plane, when sectioned by a plane parallel to the (X, Y) plane, defines a line of division of the basement in two in a top view.

[0028] The two halves do not need to be identical. In other words with a first and a second half, a "right" and a "left" portion of the basement with respect of the above mentioned plane (first plane) passing through the rotational axis of the drum and perpendicular to the basement plane are meant. The projection on the basement of such rotational axis can be thus shifted from the centerline of the basement. Preferably, the centerline and the projection of the rotational axis of the drum coincide.

[0029] The layout of the basement of the dryer of the invention is the following.

[0030] The process air generator, e.g. the heat exchangers of the heat pump, are located within the basement air conduit and extend for the majority of their volume within the first longitudinal half of the basement, e.g. they are substantially located for the majority of their volume to the left of the rotational axis of the drum. The heat exchangers can be completely contained within the first longitudinal half of the basement or part of their volume, the minority, can also extend within the second longitudinal half of the basement. Also, an exit of process air from the condenser, i.e. the surface of the condenser from which process air exits, is located within the first longitudinal half of the basement, at least for most of its area.

[0031] On the other end, the outlet of process air from the basement is located within the second longitudinal half of the basement, i.e. on the half of the basement right to the rotational axis of the drum. Preferably, the basement outlet is realized in the rear part of the basement, i.e. facing the rear wall of the cabinet. Thus, in order to channel the process air outside the basement, the basement duct extends from the exit of the condenser to the outlet of the basement starting from the first longitudinal half of the basement and reaching the second longitudinal half of the basement.

[0032] Preferably, the motor is located within the second longitudinal half of the basement. Due to the fact that the basement duct extends from the exit of the condenser to the outlet of the basement, in order for the motor to have a motor shaft exiting the basement through the outlet as well, the shaft has to form a hole or aperture in the wall(s) of the basement process air duct. This motor shaft preferably rotates also the fan, in particular the impeller of the same.

[0033] According to the invention, the basement process air duct is forming a "smooth" channel to channel process air from the basement to the impeller of the fan, as better detailed below. The presence of a smooth channel is particularly relevant in proximity of the outlet of the basement, where abrupt changes in the configuration of the basement process air duct would cause turbulences, vortexes and a sharp reduction in the efficiency of the dryer, as well as of the heat pump system.

[0034] A "smooth" channel means, in this contest that close to the basement process air outlet there are no "relevant"

obstacles for the process air flow, such as flanges that abruptly reduce the diameter of the process air duct in the direction of the process air flow from the process air generator towards the basement process air outlet.

[0035] In order to have a smooth flow of air from the basement to the outlet, the basement duct which terminates with the basement process air outlet has a specific shape according to the invention.

[0036] Considering now a plane which is perpendicular to the basement plane and which includes the motor axis, this plane divides the basement duct in two parts, which will be called in the following inner and outer portions. The outer portion is the part which is not including the centreline of the casing, while the inner part is the part that passes through the centerline of the casing.

[0037] This plane, in case the basement process air outlet is a circle, sections the outlet in two semi-circles and the basement duct in the inner portion, which extends from the second longitudinal half of the basement into the first longitudinal half, and in the outer portion which is confined within the second longitudinal half of the basement and is sandwiched between a lateral wall of the casing and the sectioning plane above described passing through the motor axis.

[0038] In the following, only the part of the basement duct within the outer portion is considered, and in particular its shape.

[0039] A further plane is considered, which passes through the motor axis. This plane does not have to have any specific angle with the basement plane, as long as it sections the outer portion of the basement duct. Substantially any plane passing through the motor axis is considered due to the fact that the outer portion spans an angle 180° around the motor axis. Each of these further planes sections the outer portion of the basement duct, defining a curve. In other words, a section along this plane passing through the motor axis sections the basement duct at the outer portion in such a way that the walls of the basement duct defines a curve in the section itself. This curve has the following shape.

[0040] One point of the curve belongs to the outlet of the basement. This is always true because the motor axis passes through the outlet and thus all planes passing through the motor axis also sections the outlet of the basement. This point at the outlet is one of the ends of the curve and it is called the starting point of the curve.

[0041] Further, the curve terminates with an end point. This endpoint is located at the aperture created by the motor shaft into the wall(s) of the basement duct. As mentioned above, the motor shaft has to pierce one of the basement duct walls in order to reach the outlet.

[0042] Each curve, limited by the end point and starting point, resembles substantially a polynomial curve.

[0043] For each point of the curve, a distance D from that point to the motor axis is defined. Thus calling w the ordinate or position of the point along the motor axis, where the "0" (zero) is positioned at the starting point of the curve at the outlet of the basement and the ordinate axis points towards the motor, the function $D(w)$ is according to the invention a monotone function and more preferably a decreasing monotone function.

[0044] That is to say that the closer the ordinate or position w of the point to the end point of the curve is taken, the smaller is the distance between the point of the curve at that ordinate w and the motor axis, while the closer to the starting point of the curve such ordinate is, the longer is the distance between the point of the curve having such ordinate w curve and the motor axis. This function of the distance of the position of a selected point of the curve from the motor axis versus the position or ordinate of such selected point of the curve at which the distance is calculated, as said, is decreasing monotone and therefore there are no changes in the way the function progresses; there is no possibility for the presence of a flange because this would cause an increase of the distance curve-axis of the motor after a decrease of the same, which is not according to the claimed shape of the process duct.

[0045] In this way, the process air duct, in particular in a portion of the process air duct close to the basement process air outlet, is "smooth" and does not include sudden variations in its diameter.

[0046] With the term "diameter", not only ducts or apertures having a circular cross section are meant. In case of non-circular sections, the term "diameter" defines the largest dimension of their respective cross section along a given plane (for example horizontal).

[0047] The process air substantially flows smoothly through the process air conduit without any sharp variation in the cross section dimensions in this part of the process air conduit.

[0048] Tests of the Applicant have shown that the dryer having such a construction of the basement duct yields a flow of process air considerably improved, increasing the overall efficiency of both the process air generator and of the fan which moves process air within the process air conduit.

[0049] According to this aspect, the invention may include, alternatively or in combination, any of the following characteristics.

[0050] Preferably, said laundry dryer includes a fan apt to circulate said process air into said process air conduit, said fan being located within said process air conduit and including an impeller having an air inlet section which is the inlet for the process air to said impeller and wherein a diameter of said basement process air outlet is smaller or substantially equal to a diameter of said inlet for the process air to the impeller.

[0051] The process air conduit advantageously includes a main fan having an impeller which sucks process air out of the basement to blow it towards the drum. The fan of the dryer is located inside an impeller housing. In the impeller housing, the impeller defines an inlet section, which is in other words the section at the inlet of process air to the impeller.

[0052] Advantageously, said diameter of said basement process air outlet is equal or substantially equal to a diameter of the air inlet section of said impeller. In this way, all the impeller is invested by process air and the efficiency of the fan is improved. No discontinuity is present in the process air conduit, but substantially a single smooth channel brings process air from the basement to the impeller of the fan.

[0053] Preferably, said impeller housing is in abutment to said basement of said laundry dryer.

[0054] Preferably, said basement process air duct is inserted for a predefined length in said impeller housing.

[0055] More preferably, said basement process air outlet is positioned substantially in front of said impeller.

[0056] The air flow coming from the process air generator is directly guided to the impeller, without any disturbing discontinuities in the air channel in front of the impeller of the fan, so as to maximize the efficiency of the dryer and minimize its energy consumption. In addition, the number of components is minimized, avoiding connecting channels between the various part of the dryer.

[0057] In a preferred embodiment, a family of planes passing through said motor axis and sectioning said basement process duct portion and said basement process air outlet in said outer portion forms a family of sections which define a family of curves, a starting point of each of these curves being located in said basement process air outlet and an end point of said curve being located at the aperture; and wherein in all said sections by said family of planes passing through the motor axis, the distance between a point of each of said curves and said motor axis is a decreasing monotone function if the position of said point moves from said starting point to said end point.

[0058] There is therefore not only a single curve which defines a monotone decreasing function of the distance between a point of the curve and motor axis as a function of the ordinate of the selected point along the same motor axis, but a plurality of such curves can be defined in the outer portion of the basement duct. This implies that the duct is "smooth" substantially in its entirety close to the basement process air outlet.

[0059] Advantageously, said casing includes a rear wall, and said back wall comprises said impeller housing.

[0060] In this way the number of components of the casing is reduced.

[0061] Preferably, said drying air generator includes a heat pump system comprising a condenser and an evaporator, wherein said condenser and said evaporator are preferably located in said basement.

[0062] The heat pump technology allows achievements of increased efficiency in a dryer.

[0063] In a preferred embodiment, said basement includes an upper shell portion and a lower shell portion, said basement process air duct and basement process air outlet being formed by the connection between said upper shell portion and said lower shell portion.

[0064] The basement process air duct portion in the basement can be realized for example in an easy and reliable manner joining together two shell portions so as to form walls of the basement process air duct.

[0065] Advantageously, said basement is realized in plastic material, and said basement process air duct is realized integral to said basement.

[0066] It should also be observed that, in the present description and in the attached claims, the terms "plastic material" and the like, are used to indicate any plastic or synthetic material, or based on plastic or synthetic material, possibly added with fillers suitable to improve the functional and robustness characteristics thereof, such as minerals, textile synthetic fillers and so on and so forth.

[0067] The fact that the basement is realized in plastic allows a minimization of the number of elements included in the dryer of the invention. Indeed, with a single producing process, for example with the same molding process, the basement can be realized including a plurality of additional functional elements for the dryer that do not have to be realized separately and then assembled, such as the basement process air duct portion or others, for example the seats for the heat exchangers.

[0068] Preferably, said casing includes a rear wall and said impeller housing is fluidly connected to a portion of process air conduit located within said rear wall to channel process air to said drum.

[0069] The air blown by the fan is directed towards the drum. Preferably the number of components in the casing is reduced and thus the channel directing process air from the fan to the drum is realized in the rear wall of the dryer.

[0070] Preferably, said fan is located downstream of said process air generator in the direction of flow of said process air.

[0071] Advantageously, said basement defines a basement plane, in which a first longitudinal half of the basement and a second longitudinal half of the basement are identifiable by means of a first plane perpendicular to said basement plane and passing through a rotational axis of said drum; said basement process air outlet being located within said second longitudinal half of said basement and said first heat exchanger and said second heat exchanger are located for the majority of their respective volumes within said first longitudinal half of said basement.

[0072] In a top view of the dryer, as mentioned, the basement can be considered as "divided" in two halves by the axis of rotation of the drum. Whether the axis is horizontal (thus parallel to the basement plane of the dryer) or substantially horizontal or tilted with respect to the basement plane of the dryer, on a plan view of the basement the projection of the rotational axis of the drum divides the basement in two halves, a first or left longitudinal half and a second or right longitudinal half. In other words, taking another plane which is perpendicular to the basement plane and which passes through the rotational axis of the drum, this other plane virtually sections the basement also in two halves. This other

plane, when sectioned by a plane parallel to said basement plane defines a line of division of the basement in two.

[0073] The layout of the heat pump system located in the basement of the dryer of the invention is the following.

[0074] The first heat exchanger and the second heat exchanger are located within the basement in the process air conduit and extend for the majority of their respective volume within the first longitudinal half of the basement, e.g. they are substantially located for the majority of their respective volumes on the left of the rotational axis of the drum, i.e. within the first longitudinal half of the basement. The heat exchangers can be completely contained within the first longitudinal half of the basement or, alternatively, a part of their volume, the minority part, can also extend within the second longitudinal half of the basement. Also the exit of process air from the condenser is located within the first longitudinal half of the basement, at least for most of its area.

[0075] On the other end, the outlet of process air is located within the second longitudinal half of the basement, i.e. right of the rotational axis of the drum. Preferably, the outlet is realized in the rear of the basement, i.e. facing the rear wall of the casing. Thus, in order to channel the process air outside the basement, the basement process air duct portion extends from the exit of the condenser to the outlet of the basement starting from the first longitudinal half of the basement and reaching the second longitudinal half of the basement.

[0076] Preferably, said laundry dryer includes a motor, said motor being apt to rotate said fan and said drum.

[0077] In order to lower costs, a single motor is present, which drives both the fan and the drum of the laundry dryer. Preferably, both motor and fan shares the same shaft and are thus coaxial.

Brief description of the drawings

[0078] Further advantages of the present invention will be better understood with non-limiting reference to the appended drawings, where:

- Fig. 1 is a perspective view of a laundry dryer realized according to the present invention;
- Fig. 2 is a perspective view of the laundry dryer of Fig. 1 with an element of the casing removed for showing some internal components;
- Fig. 3 is a perspective view, in a disassembled configuration, of the basement of the dryer of Fig. 1 or Fig. 2;
- Fig. 4 is a perspective view of the basement of Fig. 3 with all elements contained therein removed;
- Figs. 5 is a top view of the basement of Fig. 3;
- Fig. 6 is a lateral view in section of a portion of the basement of Figs. 3-5;
- Figs. 7 is a perspective views in a disassembled configuration, of a portion of the laundry dryer of Figs. 1 and 2 including the basement of Figs. 3-5;
- Figs. 8a and 8b are two front views of a detail of two different embodiment of the dryer of the invention;
- Fig. 9 is a rear view of the basement of Figs. 3-5;
- Fig. 10 is a top view of the basement of Figs. 3-5 divided in two;
- Fig. 11 is section of the basement along line A-A of Fig. 9; and
- Fig. 12 is a section of the basement along line B-B of Fig. 9.

Detailed description of one or more embodiments of the invention

[0079] With initial reference to Figs. 1 and 2, a laundry dryer realized according to the present invention is globally indicated with 1.

[0080] Laundry dryer 1 comprises an outer box or casing 2, preferably but not necessarily parallelepiped-shaped, and a drying chamber, such as a drum 3, for example having the shape of a hollow cylinder, for housing the laundry and in general the clothes and garments to be dried. The drum 3 is preferably rotatably fixed to the casing 2, so that it can rotate around a preferably horizontal axis R (in alternative embodiments, rotation axis may be tilted). Access to the drum 3 is achieved for example via a door 4, preferably hinged to casing 2, which can open and close an opening 4a realized on the cabinet itself.

[0081] More in detail, casing 2 generally includes a front wall 20, a rear wall 21 and two lateral walls 25, all mounted on a basement 24. Preferably, the basement 24 is realized in plastic material. Preferably, basement 24 is molded via an injection molding process. Preferably, on the front wall 20, the door 4 is hinged so as to access the drum. The casing, with its walls 20, 21, 25, defines the volume of the laundry dryer 1. Advantageously, basement 24 includes an upper and a lower shell portion 24a, 24b (visible in Figures 3 and 4 detailed below).

[0082] The dryer 1, and in particular basement 24, defines an horizontal plane (X,Y) which is substantially the plane of the ground on which the dryer 1 is situated, thus it is considered to be substantially horizontal, and a vertical direction Z perpendicular to the plane (X,Y).

[0083] Laundry dryer 1 also preferably comprises an electrical motor assembly 50 for rotating, on command, revolving drum 3 along its axis inside cabinet 2. Motor 50 includes a shaft 51 which defines a motor axis of rotation M.

[0084] Further, laundry dryer 1 may include an electronic central control unit (not shown) which controls both the electrical motor assembly 50 and other components of the dryer 1 to perform, on command, one of the user-selectable drying cycles preferably stored in the same central control unit. The programs as well other parameters of the laundry dryer 1, or alarm and warning functions can be set and/or visualized in a control panel 11, preferably realized in a top portion of the dryer 1, such as above door 4.

[0085] With reference to Figure 2, the rotatable drum 3 includes a mantle, having preferably a substantially cylindrical, tubular body 3c, which is preferably made of metal material and is arranged inside the casing 2 and apt to rotate around the general rotational axis R which can be - as said - horizontal, i.e. parallel to the (X,Y) plane, or tilted with respect to the latter. The mantle 3c defines a first end 3a and a second end 3b and the drum 3 is so arranged that the first end 3a of the mantle 3c is faced to the laundry loading/unloading opening realized on the front wall 20 of the casing 2 and the door 4, while the second end 3b faces the rear wall 21.

[0086] Drum 3 may be an open drum, i.e. both ends 3a and 3b are opened, or it may include a back wall (not shown in the appended drawings) fixedly connected to the mantle and rotating with the latter.

[0087] In order to rotate, support elements for the rotation of the drum are provided as well in the laundry of the invention. Such support elements might include rollers at the front and/or at the back of the drum, as well as or alternatively a drum shaft connected to the rear end of the drum (shaft is not depicted in the appended drawings). In Fig. 2, for example, a roller 10 connected to the basement via a bracket 101a as well as a roller 10 connected to the rear wall 21 via a boss 101 is depicted. Any support element for the rotation of the drum around axis R is encompassed by the present invention.

[0088] Dryer 1 additionally includes a process air circuit which comprises the drum 3 and a process air conduit 18, depicted as a plurality of arrows showing the path flow of a process air stream through the dryer 1 (see Figures 3 and 4). In the basement 24, a portion of the process air conduit 18 is formed by the connection of the upper shell 24a and the lower shell 24b. Process air conduit 18 is preferably connected with its opposite ends to the two opposite sides of drum 3, i.e. first and second rear end 3a, 3b of mantle 3c. Process air circuit also includes a fan or blower 12 (shown in Figs. 3, 6, 7 and 8a-8b).

[0089] The dryer 1 of the invention additionally comprises a process air generator, in the depicted embodiment a heat pump system 30 including a first heat exchanger (called also condenser) 31 and a second heat exchanger (called also evaporator) 32 (see figure 3). Heat pump 30 also includes a refrigerant closed circuit (partly depicted) in which a refrigerant fluid flows, when the dryer 1 is in operation, cools off and may condense in correspondence of the condenser 31, releasing heat, and warms up, in correspondence of the second heat exchanger (evaporator) 32, absorbing heat. A compressor 33 receives refrigerant in a gaseous state from the evaporator 32 and supplies the condenser 31, thereby closing the refrigerant cycle. In the following the heat exchangers are named either condenser and evaporator or first and second heat exchanger, respectively. More in detail, the heat pump circuit connects via piping 35 (see Fig. 3) the second heat exchanger (evaporator) 32 via the compressor 33 to the condenser 31. The outlet of condenser 31 is connected to the inlet of the evaporator 32 via an expansion device (not visible), such as a choke, a valve or a capillary tube.

[0090] Preferably, in correspondence of evaporator 32, the laundry dryer 1 of the invention may include a condensed-water canister (also not visible) which collects the condensed water produced, when the dryer 1 is in operation, inside evaporator 32 by condensation of the surplus moisture in the process air stream arriving from the drying chamber (i.e. drum) 3. The canister is located at the bottom of the evaporator 32. Preferably, through a connecting pipe and a pump (not shown in the drawings), the collected water is sent in a reservoir located in correspondence of the highest portion of the dryer 1 so as to facilitate a comfortable manual discharge of the water by the user of the dryer 1.

[0091] The condenser 31 and the evaporator 32 of the heat pump 30 are located in correspondence of the process air conduit 18 formed in the basement 24 (see Figure 3).

[0092] In case of a condense-type dryer - as depicted in the appended figures - where the air process circuit is a closed loop circuit, the condenser 31 is located downstream of the evaporator 32. The air exiting the drum 3 enters the conduit 18 and reaches the evaporator 32 which cools down and dehumidifies the process air. The dry cool process air continues to flow through the conduit 18 till it enters the condenser 31, where it is warmed up by the heat pump 30 before re-entering the drum 3.

[0093] It is to be understood that in the dryer 1 of the invention, an air heater, such as an electrical heater, can also be present, in addition to the heat pump 30. In this case, heat pump 30 and heater can also work together to speed up the heating process (and thus reducing the drying cycle time). In the latter case, preferably condenser 31 of heat pump 30 is located upstream the heater. Appropriate measures should be provided to avoid the electric heater to fuse plastic components of the dryer 1.

[0094] Further, with now reference to Figures 4 and 5, in the basement, the process air conduit 18 includes a duct formed by the upper and the lower shells 24a, 24b, having an inlet 19in from which process air is received from the drum 3 and an outlet 19 to channel process air out of the basement 24. Between inlet 19in and outlet 19, the duct is formed, preferably as two single pieces joined together and belonging to the upper and lower shell 24a, 24b, and including a first and a second portion 28 and 29. In the first portion 29 of this duct, seats 29s are formed for locating the first and

the second heat exchangers 31, 32. Preferably, first and second heat exchanger 31, 32 are placed one after the other, the first heat exchanger 31 being downstream in the direction of flow of the process air the second heat exchanger 32. Further, the second portion 28 channels the process air exiting from the first heat exchanger 31 towards the basement outlet 19.

[0095] The second portion 28 thus starts at the location of an exit 28in of the first heat exchanger 31, considered as the location of a plane sectioning the duct portion 28 and substantially in contact with a surface of the first heat exchanger 31 from which process air exits.

[0096] Preferably, the exit 28in may be defined on a plane perpendicular to the basement plane (X,Y), e.g. on a vertical plane.

[0097] Furthermore, preferably also the outlet 19, defined as the area at which the air exits the basement, defines in turn a plane substantially perpendicular to the basement plane, e.g. a vertical plane.

[0098] Considering now a first plane P1 perpendicular to the basement plane (X,Y) and embedding the rotational axis R of the drum 3, this first plane P1 divides the basement 24 in two halves, called, with now reference to Figures 4 and 5, basement first or right half 24 first half and basement second or left half 24 second half. These two halves 24 first half and 24 second half need not to be identical in dimension (i.e. they are not mathematical halves), however in the present depicted embodiment P1 also embeds a first - longitudinal - centerline H1 of the basement. Furthermore, still in the depicted embodiment, P1 is a vertical plane.

[0099] On the first half of the basement, 24 first half, the portion 29 of the duct is positioned, where also the first and the second heat exchanger 31, 32 of heat pump 30 are located. The heat exchanger can be completely contained within the first half of the basement 24 first half or they can also extend beyond the limit defined by the first plane P1. If a portion of the first and/or second heat exchanger 31, 32 is also located within the second half of the basement 24 second half, this portion is the minority of the whole volume occupied by the first and/or second heat exchanger 31, 32.

[0100] On the second half of the basement 24 second half, preferably the compressor 33 is located. More preferably, also the motor 50 is located in this second half. Furthermore, as mentioned, main fan 12 is part of the process air conduit 18 and it is placed substantially in front of in proximity of the basement outlet 19 so that it blows the air exiting the basement 24 towards drum 3. The outlet and the main fan are thus located in the basement second half 24 second half (although fan 12 does not properly belong to the basement, it belongs to that part of the casing which is divided by plane P1 where the second half of the basement is contained).

[0101] Preferably, motor 50 including shaft 51 defining motor axis M has the motor axis substantially parallel to the first plane P1 (see Figure 5).

[0102] Preferably, motor shaft 51 of motor 50 drives both the drum 3 and the fan 12 into rotation, i.e. preferably, motor shaft 51 is also the shaft of fan 12, which is located in proximity of outlet 19, preferably facing the latter. In particular, fan 12 includes an impeller 12a whose blades are rotated by the rotation of shaft 51. In order to rotate both the drum and the impeller 12a, the shaft 51 exits the basement 24 at least for a portion through outlet 19.

- Fan 12 blows the process air exiting the basement 24 through outlet 19 into the drum 3, preferably through a passage, not shown, part of the process air circuit 18, formed within the rear wall 21.

[0103] Advantageously, the motor shaft 51 is substantially perpendicular to the surface defined by outlet 19 and it passes through its center. Alternatively, the motor shaft 51 and the surface defined by outlet 19 can be slightly inclined and/or the shaft passes in proximity of the center of outlet 19. The center is defined as the intersection of two axis of the outlet surface. In order to exit through the outlet 19, the shaft 51 has to create a through hole or aperture 26 in the walls 28w of the duct 28, as better visible in Fig. 6.

[0104] Again with reference to Figs. 4 and 5, considering now a second plane P2, perpendicular to P1 and to the basement plane (X,Y) and passing through a second centerline H2 of the basement 24, perpendicular to the first centerline H1, the basement 24 is divided, by a combination of the first and the second plane P1, P2, in four quarters Q1 - Q4. The quarters are numbered in a clockwise manner, the first quarter Q1 being the rearmost quarter of the first half of the basement 24 (e.g. the quarter facing the rear wall 21), the second quarter Q2 being the rearmost quarter of the second half of the basement 24, the third quarter Q3 the foremost quarter (e.g. the quarter facing the front wall 20) of the second half of the basement and the last fourth quarter Q4 the foremost quarter of the first half of the basement 24.

[0105] It can be therefore seen that the heat exchangers 31, 32 and the duct portion 29 are substantially contained for the majority of their volume within the fourth quarter Q4, the second heat exchanger closer to the front wall 20 than the first heat exchanger 31; preferably compressor 33 is contained within the third quarter Q3, and the outlet 19 of basement 19 is located in the second quarter Q2, preferably facing rear wall 21 of casing 2.

[0106] Motor 50 is preferably contained within the second quarter Q2 as well and its shaft 51 which extends in such a way that it sticks out from the outlet 19, i.e. it exits the basement 24 with one of its ends through the basement outlet 19.

[0107] The duct portion 28 extends from the air exit of the compressor, 28in, which is located within the first quarter Q1 preferably close to the boundary with the fourth quarter Q4, i.e. close to centerline H2, to the outlet 19 of the basement,

located in the second quarter Q4.

[0108] Preferably, but not necessarily, the planes containing the exit 28in and the outlet 19 are substantially parallel to each other and even more preferably they are both parallel to P2.

[0109] The duct portion 28 therefore has to comprise at least one curve or bend in order to extend from the first to the second quarter. Furthermore, duct portion 28 includes walls 28w which form and delimit the duct portion itself. The configuration of walls 28w can change also along the extension of the duct, for example close to the outlet 19, the section of the duct portion 28 becomes substantially circular and thus walls 28w delimiting the duct 28 forms in section a circumference. However in other parts of the duct, the walls can have a different geometry, for example having flat portions. Any embodiment of the geometrical configuration of walls 28w is encompassed in the present invention.

[0110] Preferably, walls 28w includes a first and second lateral walls 28w1 and 28w2, which are each separated in half and each of the halves is integrally formed with the upper or lower shell 24a, 24b. That is to say, the upper shell 24a includes a part of first lateral wall 28w1 and a part of second lateral wall 28w2, both parts integrally formed with the upper shell 24a, while the lower shell 24b includes the remaining part of first lateral wall 28w1 and remaining part of second lateral wall 28w2, both remaining parts integrally formed with the lower shell 24b.

[0111] Referring now to Figs. 6 and 7, in the depicted laundry dryer 1, the rear wall 21 of the cabinet 2 forms a rear bulkhead 60 which faces the rear end 3b of the drum 3, and it is advantageously realized as a single, unitary, piece. Preferably, the rear wall 21 of the cabinet 2 includes also a fan housing 150, covered by a cover 61 which is attached, in a detachable manner, to the rear bulkhead 60. Thus a fan aperture 61a is formed in the bulkhead 60 which is closed by the cover 61, fan aperture used to access the fan 12, and in particular the impeller 12a of the same. The aperture 61a is located substantially below the location of the drum 3 and faces the interior of the casing 2, in this example, the basement 24 and more preferably an outlet 19 of the air from the basement 24.

Furthermore, as illustrated in the above example, the whole fan housing 150 is realized within the rear wall 21 and it is composed by a first cup-shaped portion 142 (which belongs to the rear bulkhead 60) and the cover 61.

The first cup-shaped face 142 is provided with a through opening 151in, in the example shown circular, for housing the relevant shaft 51 of the impeller 12a. Of course, the impeller 12a is housed in the housing 150. The same opening 151in is also used for the inlet air to the fan 12. Therefore, in the process air conduit 18, air exits the basement from outlet 19, where it has been heated and/or dried by the drying air generator - heat pump 30 -, and enters into the fan housing 150. From the fan housing 150, which is a closed element being the fan aperture 61a closed by cover 61, a conduit portion formed by the rear bulkhead 60 and the cover 61 channels air into the drum 3.

[0112] Shaft 51 thus exits the basement via the outlet 19. The arrangement of impeller 12a and outlet 19 is as follows. Preferably impeller is located in front of outlet 19. More preferably, outlet and impeller are concentric, i.e. they have the same center which preferably also coincides with the axis of the motor M. This situation is clearly depicted in Figs. 6 and 8a-8b.

[0113] The diameter Dia1 of the outlet 19 can be equal or smaller than the diameter Dia2 of the inlet of process air to the impeller 12a. The inlet of process air to the impeller in this embodiment coincides to the inlet 150in of fan housing 150. In general, the inlet of air in the impeller has a diameter Dia2 which coincides with the internal diameter of the impeller's blades.

[0114] In case the outlet 19 and/or the inlet 150in is/are not circular, the diameter is considered as the biggest dimension of the outlet/inlet along a horizontal plane.

[0115] In Figs. 8a and 8b the two different embodiments are shown: in Fig. 8a, the diameter Dia1 of the outlet 19 is smaller than the diameter Dia2 of the air inlet of impeller 12a. In Fig. 8b the two diameters Dia1 and Dia2 of the outlet 19 and inlet of impeller 12a preferably coincide. In this way, the impeller 12a is used in the most efficient way and all process air coming from the basement 24 impinges on the impeller inlet section.

[0116] Furthermore, in order to better channel process air to the impeller 12a, a portion of the duct 28 is inserted in the fan housing 150, in other words, as shown in Fig. 6, the outlet 19 of the basement is located within the fan housing 150.

[0117] Still with reference to Fig. 6, a small channel 14 can be realized within the fan housing 150 to introduce air from the inlet 150in to the blades of the impeller 12a.

[0118] Considering now the front view of the basement 24 Fig. 9, a plane perpendicular to the basement plane (X,Y) and passing through the motor axis M is visualized and named PH. This plane divides the basement process air duct 28 in two parts called 28inner and 28outer. Being the outlet 19 part of the duct 28, PH also divides the outlet 19 in two, in case of a circular outlet 19 the two parts are two halves of a circumference. In Fig. 10, a top view of the basement 24 is shown divided in the upper and lower shells 24a, 24b. In this top view, the motor axis M and the plane PH coincide. The outer portion 28outer of the duct 28 sectioned by the plane PH is the portion of duct 28 that in this figure starts at motor axis M and extends towards the bottom of the Figure 10, while the inner part 28inner is the portion of duct 28 that starts at the motor axis and extends towards the top of the Figure 10. Regardless of the orientation of the drawing, the inner portion 28inner is the portion of duct that passes through the centreline H1 (see Fig. 4) of the basement 24, while the outer portion 28outer does not. The outer portion 28outer is located only within the basement first half 24 first half, while the inner portion 28inner extends through the first and the second half of the basement. Furthermore, the outer

portion 28_{outer} only includes a part of the inner curve 28a, while the inner portion 28_{inner} includes the outer curve 28a and possibly also part of the inner curve 28b.

[0119] In the front view of Fig. 9, the outer portion 28_{outer} is substantially half of a cylindroid-shaped mantel which terminates with a bottom end.

[0120] With still reference to Fig. 9, a further plane is considered, PZ, again passing through the motor axis M, but at any angle with the basement plane (X,Y). This plane PZ, two of which are shown in Fig. 9, sections the outer portion 28_{outer} of the duct 28. Each section of the outer portion 28_{outer} defines a curve C, which is the configuration of the sectioned walls 28w in the sectioned plane. A section along a first plane PZ of line A-A of Fig. 9 and a section along a second plane PZ of line B-B of Fig. 9 are depicted in Figs. 11 and 12, respectively. Further, also Fig. 10 is such a section along a plane PZ, in this case with a plane PZ passing through the motor axis M and parallel to the basement plane (X,Y).

[0121] As better visible in the enlarged details of Figs. 11 and 12, the curve C of each section along a plane PZ has a starting point Pin which is positioned on the outlet 19 of the basement 24. Further, each curve C (one curve formed by each section) has an end point Pend, located in proximity of the motor axis M, at aperture 26 formed by the motor shaft 51 on the walls 28w of the outer portion 28_{outer} of duct 28.

[0122] The curve C of each section is delimited thus by these two points Pin and Pend and it extends for a given length along the motor axis M. For each selected point of the curve C in a section, a distance between the selected point and the motor axis M is defined. These distances D1....Di....DN for different points 1....i....N having a different location along the motor axis M are depicted with a plurality of arrows in Figs. 11 and 12.

[0123] The shape of the outer portion 28_{outer} of the duct 18 is according to the invention as follows. The distance between the starting point Pin and the motor axis is the longest distance among all distances D1....Di....DN. The distance between the motor axis M and the end point Pend is the shortest distance among all distances D1....Di....DN. The distance between a point of the curve having ordinate w, where w is a point on the motor axis M and the 0 is located at the starting point Pin, the direction of the ordinate axis w being towards the end point Pend, is a monotone function of the ordinate w of the point and in particular a decreasing monotone function:

Distance of a point of the curve C having ordinate w and the motor axis as a function of the ordinate w of the point = $D(w)$ = decreasing monotone function, where $Pin(=0) \leq w \leq Pend$.

[0124] Preferably, this is valid for all planes PZ sectioning the outer portion 28_{outer} defining a C curve, not only for a single plane PZ. In each curve C obtained by the section with a plane PZ, the distance between a point in the curve and the motor axis is a decreasing function when the point considered has a position which moves its ordinate starting from the outlet 19 and going towards the motor engine 50.

[0125] A smooth duct 28 is so realized, which gently channels air towards the outlet t19.

Claims

1. A laundry dryer (1) including:

- a dryer casing (2) having a front wall (20), a rear wall (21), lateral walls (25), and a basement (24) defining a basement plane (X,Y);
- a drum (3) rotatably accommodated within said casing (2) and accessible via a door connected to said front door (4);
- a process air conduit (18) wherein drying process air is apt to flow, said process air conduit (18) being connected to said drum (3) so that said process air flows therethrough;
- a process air generator (30), apt to generate drying process air, said process air generator (30) being located within said process air conduit (18);
- said process air conduit (18) including a basement process air duct (28) formed in said basement (24), said basement process air duct (28) having walls (28w) and including a basement process air outlet (19) where process air exits said basement (24),
- a motor (50) having a shaft (51) defining a motor axis (M), said motor axis passing through an aperture (26) provided in the basement process air duct (28) and substantially at or in proximity of a center of said basement process air outlet (19);
- wherein a plane (PH) perpendicular to said basement plane (X, Y) and sectioning said basement (24) along said motor axis (M) divides said basement process air duct (28) in an outer (28_{outer}) and in an inner portion (28_{inner}), said outer portion (28_{outer}) being the portion closer to a lateral wall (25) of the casing (2);
- wherein a section by a plane (PZ) passing through said motor axis (M) and sectioning said basement process

duct portion (28) and said basement outlet (19) in said outer portion (28_{outer}) defines a curve (C), a starting point (Pin) of said curve (C) being located at said basement process air outlet (19) and an end point (Pend) of said curve (C) being located at said aperture (26); and

- wherein in said section by said plane (PZ) passing through the motor axis, the distance (D1,..., Di,...,DN) between a point of said curve (C) and said motor axis (M) is a decreasing monotone function if the position of said point moves from said starting point (Pin) to said end point (Pend).

2. The laundry dryer according to claim 1, including a fan (12) apt to circulate said process air into said process air conduit (18), said fan (12) being located within said process air conduit (18) and including an impeller (12a) having an air inlet section (150_{in}) which is the inlet for the process air to said impeller (12a) and wherein a diameter (Dia1) of said basement process air outlet (19) is smaller or substantially equal to a diameter (Dia2) of said inlet (150_{in}) for the process air to the impeller (12a).
3. The laundry dryer according to claim 1 or 2, wherein said casing includes an impeller housing (150) in which an air channel (14) to channel said process air to said impeller (12a) is defined, said air channel (14) having as inlet an air inlet section (150_{in}) which is the inlet for the process air to said impeller (12a).
4. The laundry dryer according to claim 3, wherein said impeller housing (150) is in abutment to said basement (24) of said laundry dryer (1).
5. The laundry dryer (1) according to any of the preceding claims, wherein a family of planes (PZ) passing through said motor axis (M) and sectioning said basement process duct portion (28) and said basement process air outlet (19) in said outer portion (28_{outer}) forms a family of sections which define a family of curves (C), a starting point (Pin) of each of these curves being located in said basement process air outlet (19) and an end point (Pend) of said curve (C) being located at the aperture (26); and wherein in all said sections by said family of planes passing through the motor axis, the distance (D1,..., Di,...,DN) between a point of each of said curves (C) and said motor axis (M) is a decreasing monotone function if the position of said point moves from said starting point (Pin) to said end point (Pend).
6. The laundry dryer (1) according to any of the preceding claims when dependent on claim 2, wherein said basement process air duct (28) is inserted for a predefined length in said impeller housing (150).
7. A laundry dryer according to claim 6, wherein said basement process air outlet (19) is positioned substantially in front of said impeller (12a).
8. A laundry dryer (1) according to any of the preceding claims when dependent on claim 2, wherein said casing (2) includes a rear wall (21) and said rear wall (21) of the casing (2) comprises said impeller housing (150).
9. A laundry dryer (1) according to any of the preceding claims, wherein said process air generator (30) includes a heat pump system comprising a condenser (31) and an evaporator (32), said condenser (31) and said evaporator (32) being located in said basement (24).
10. The laundry dryer (1) according to any of the preceding claims, wherein said basement (24) includes an upper shell portion (24a) and a lower shell portion (24b), said basement process air duct (28) and said basement process air outlet (19) being formed by the connection between said upper shell portion (24a) and said lower shell portion (24a).
11. The laundry dryer (1) according to any of the preceding claims, wherein said basement (24) is realized in plastic material and said basement air duct (28) is realized integral to said basement (24).
12. The laundry dryer (1) according to any of the preceding claims when dependent on claim 2, wherein said casing (2) includes said rear wall (21) and said impeller housing (150) is fluidly connected to a portion of said process air conduit (18) located within said rear wall (21) of the casing (2) to channel process air to said drum (3).
13. The laundry dryer (1) according to any of the preceding claims, wherein said fan (12) is located downstream of said process air generator (30) in the direction of flow of said process air.
14. The laundry dryer (1) according to any of the preceding claims when dependent to claim 4, wherein said basement process air duct (28) includes a duct portion which connects an exit of said process air generator (30) to said

basement process air outlet (19) and wherein the diameter (D1) of said basement process air outlet (19) is the smallest dimension of said basement process air duct (28).

- 5 **15.** The laundry dryer (1) according to any of the preceding claims when dependent on claim 9, wherein said basement (24) defines a basement plane (X,Y) and in said basement (24) a first longitudinal half (24 first half) of the basement (24) and a second longitudinal half (24 second half) of the basement (24) are identifiable by means of a first plane (P1) perpendicular to said basement plane (X,Y) and passing through a rotational axis (R) of said drum (3); said basement process air outlet (19) being located within said second longitudinal half (24 second half) of said basement (24) and said first heat exchanger (31) and said second heat exchanger (32) are located for the majority of their
10 respective volumes within said first longitudinal half (24 first half) of said basement (24).

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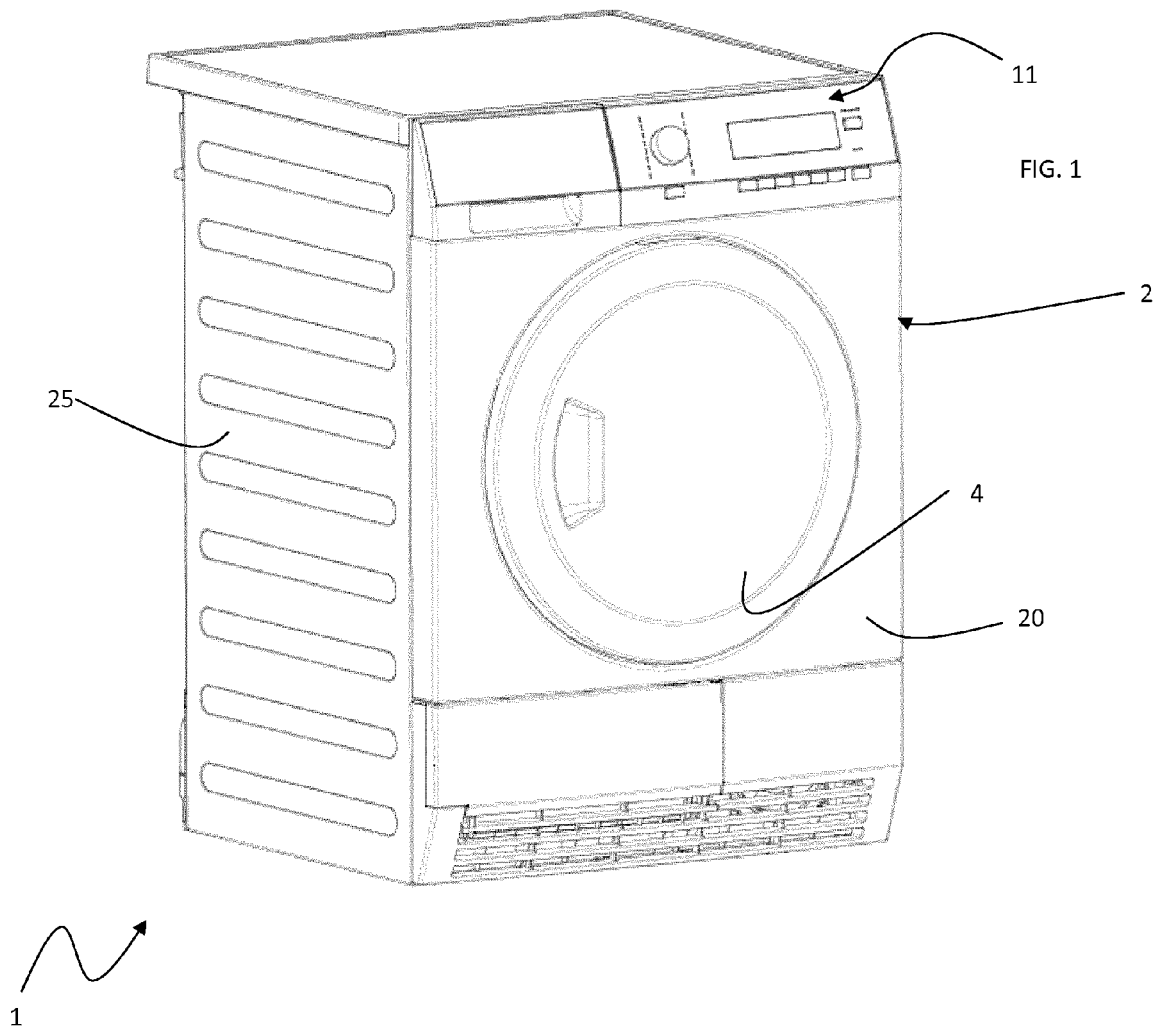
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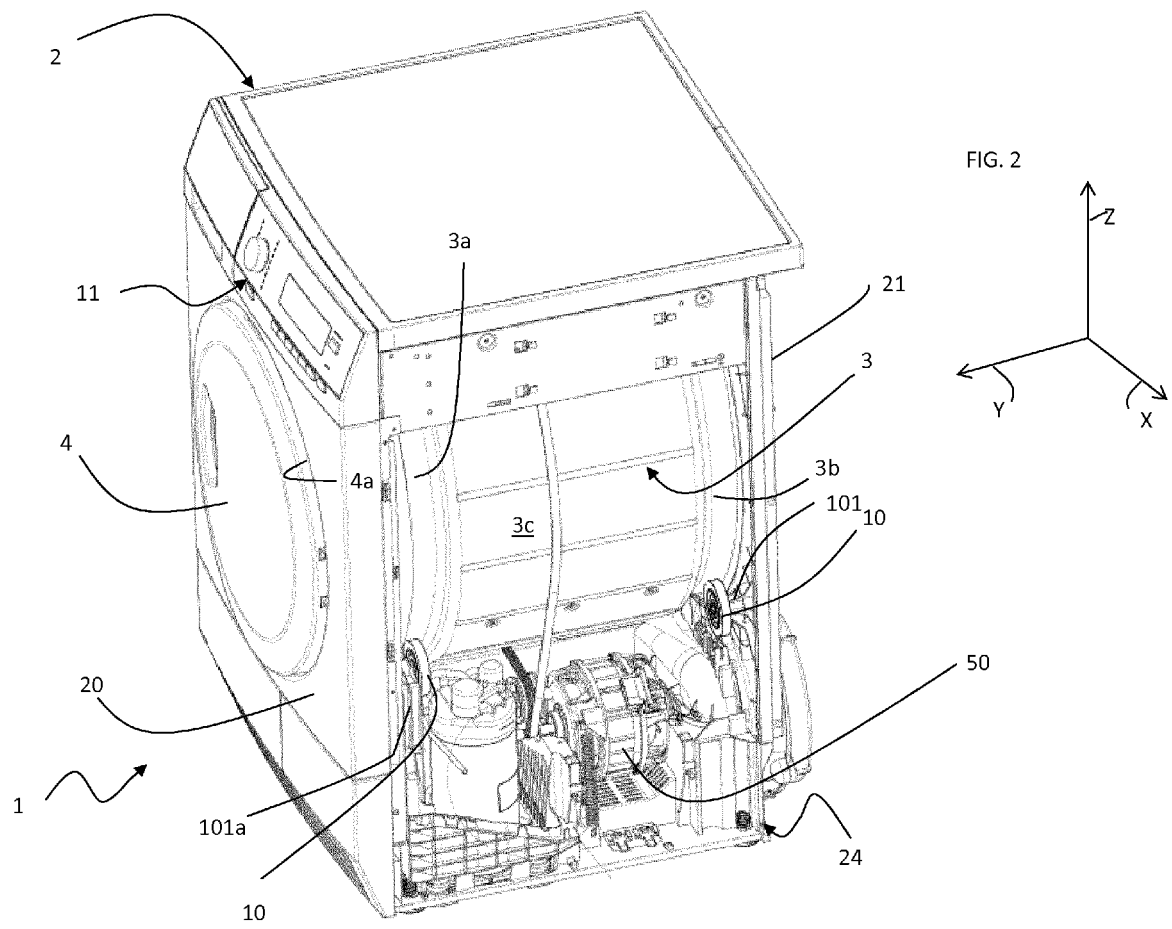
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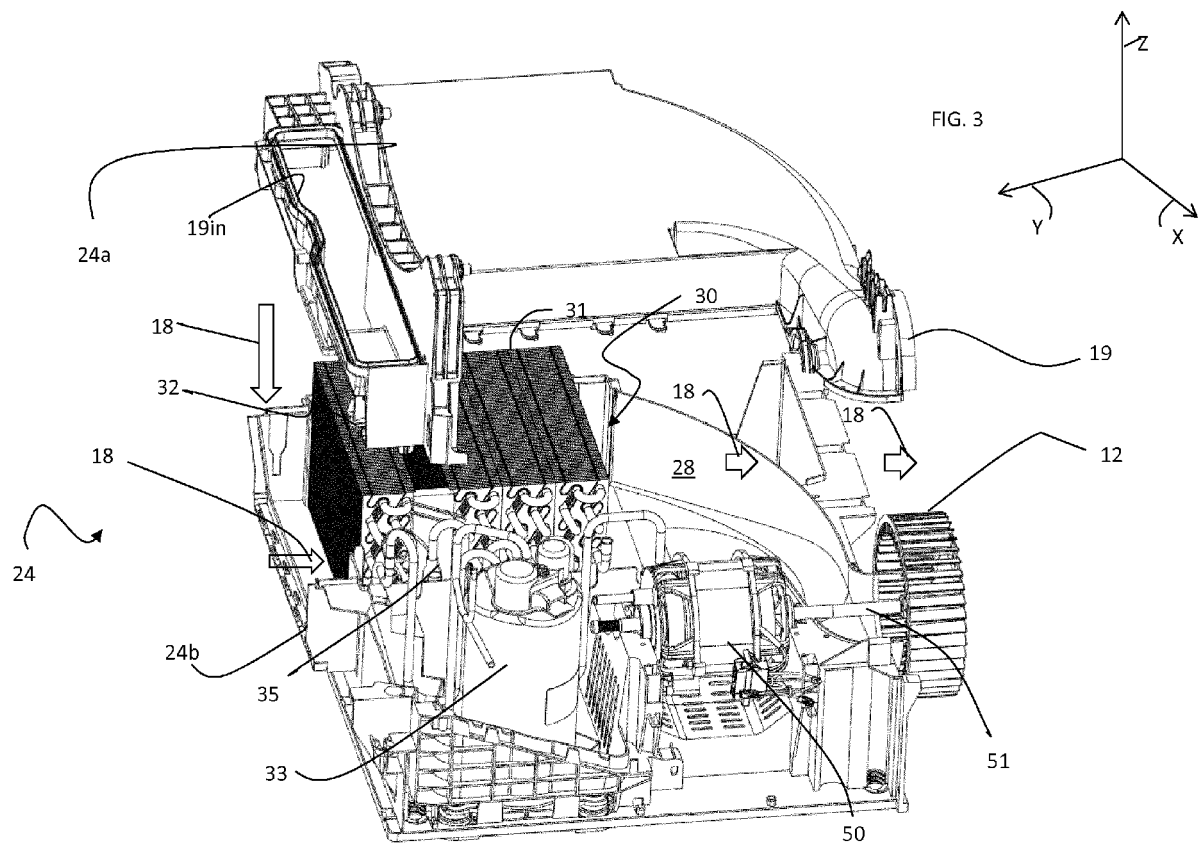
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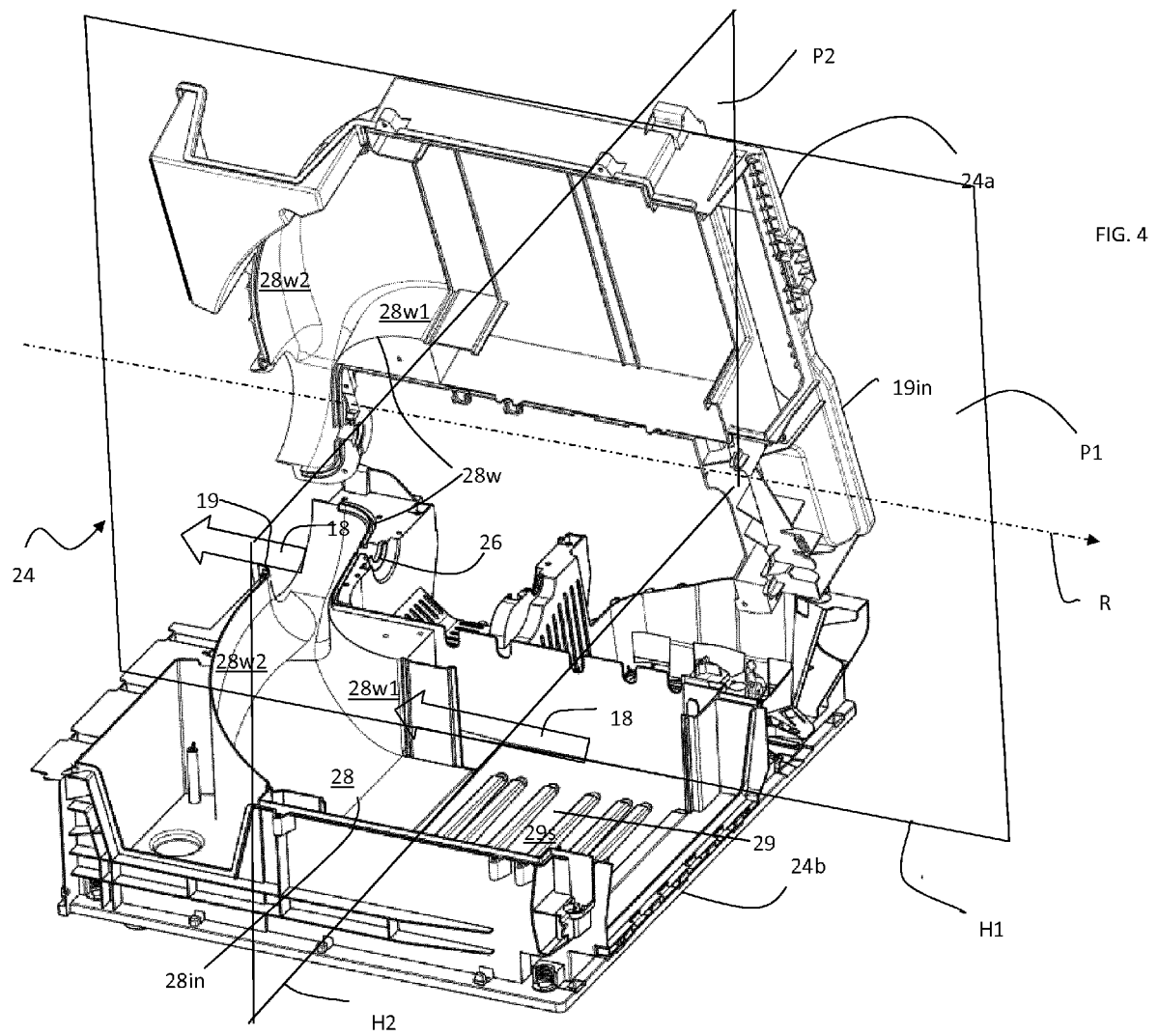
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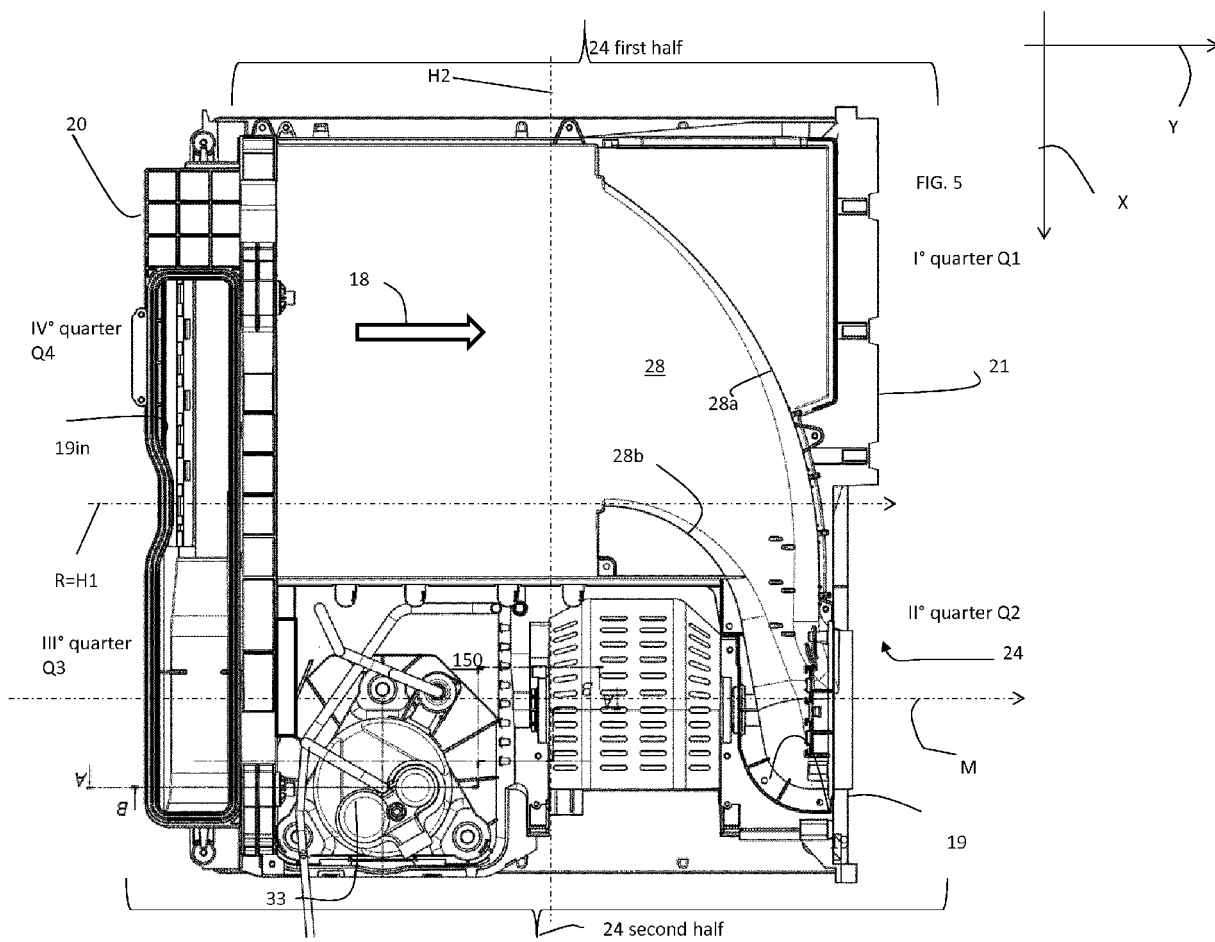
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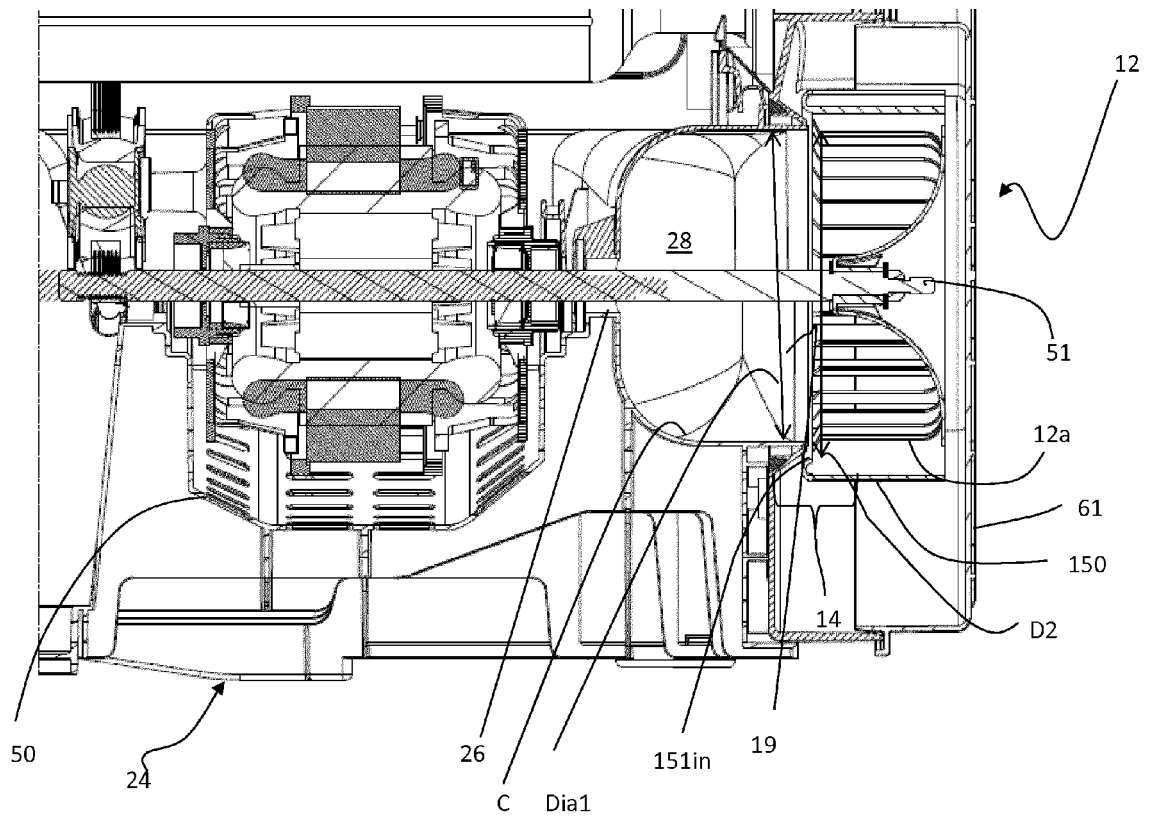


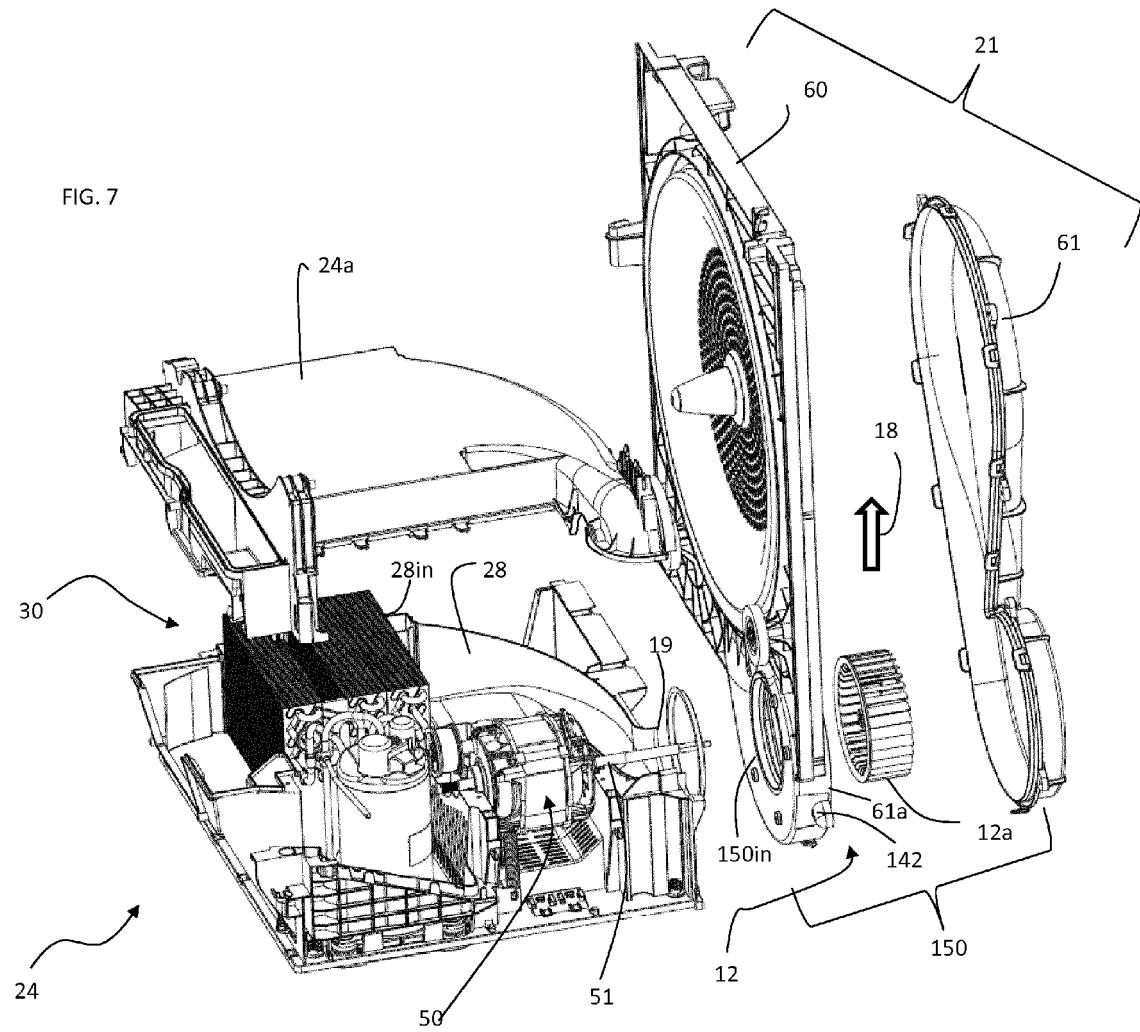


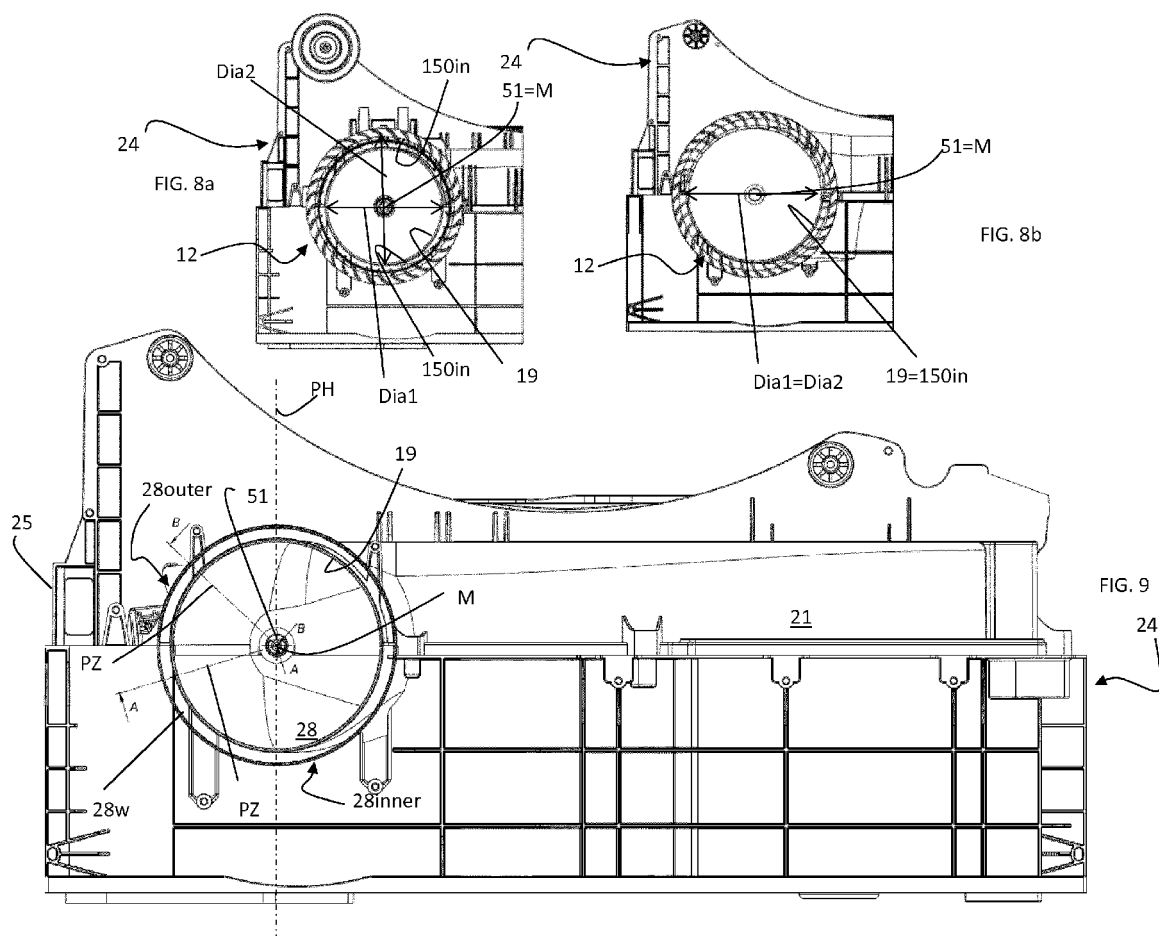


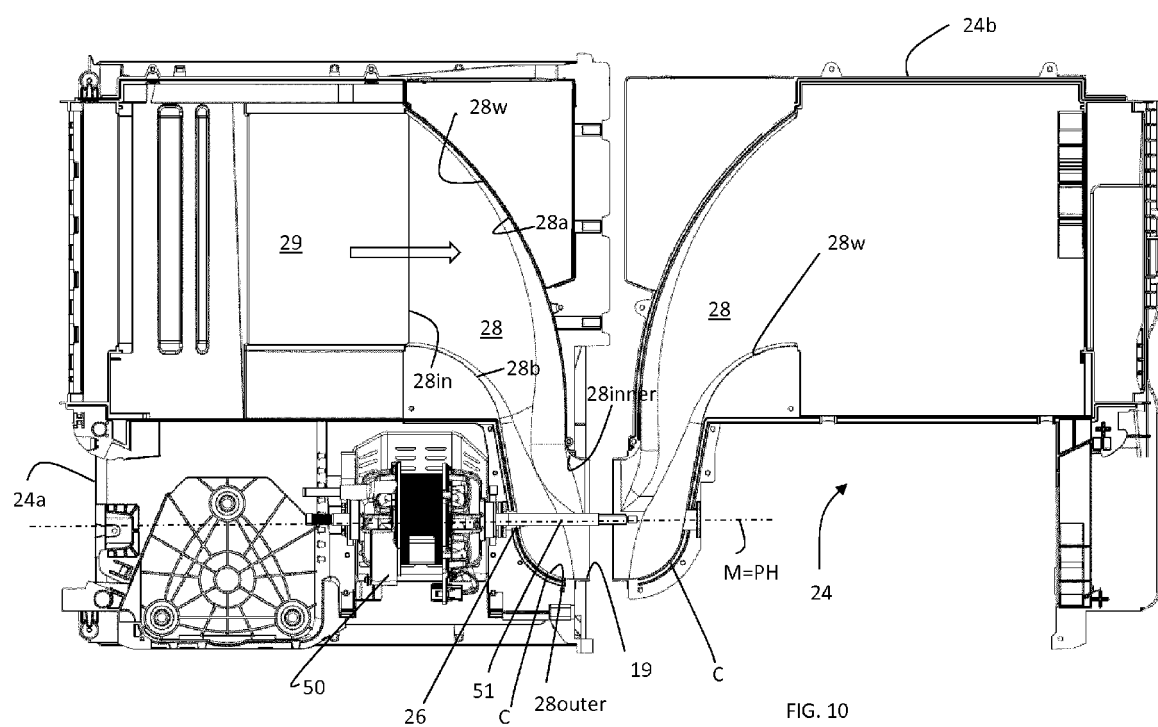












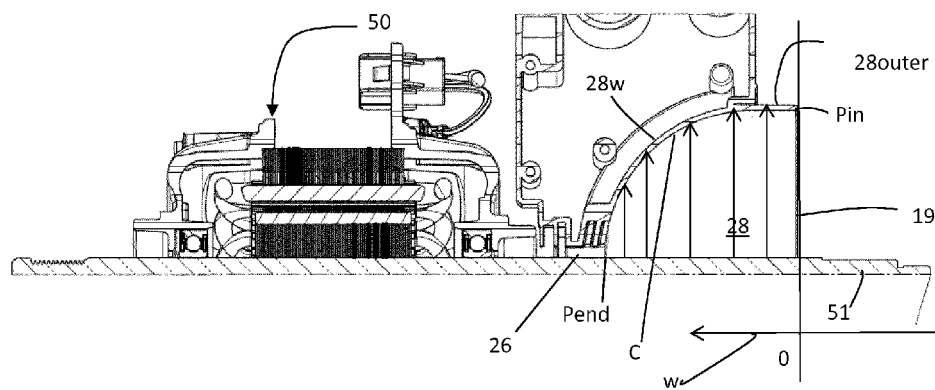


FIG. 11

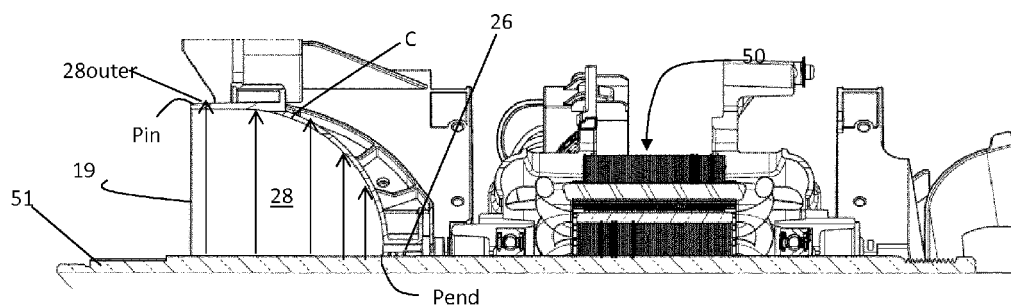


FIG. 12



EUROPEAN SEARCH REPORT

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Place of search Munich		Date of completion of the search 25 February 2015	Examiner Bermejo Pasetti, M
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