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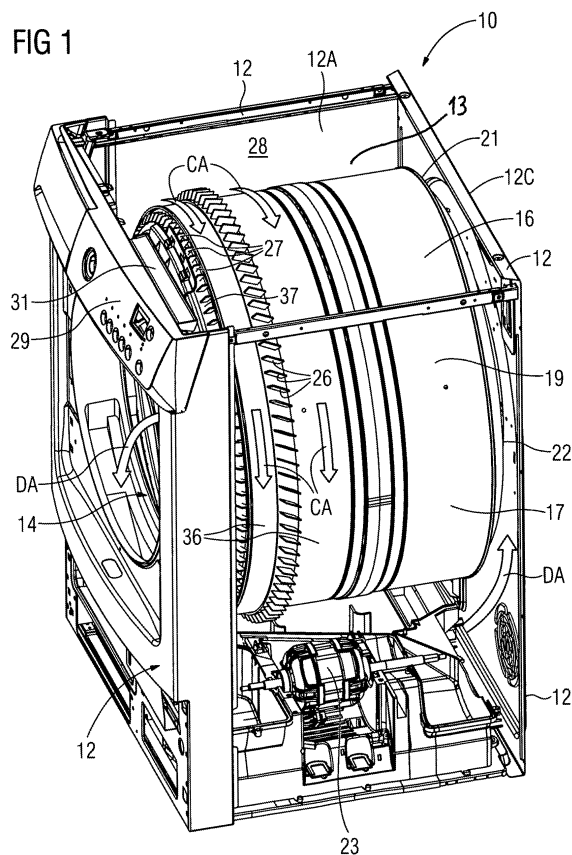
(72) Inventors:
• **Dal, Ben Diego**
33080 Zoppola (PN) (IT)
• **Castiglione, Massimo**
33080 Fiume Veneto (PN) (IT)

(71) Applicant: **Electrolux Home Products Corporation
N.V.**
1930 Zaventem (BE)

(74) Representative: **Schröder, Gernot H. et al**
Meissner, Bolte & Partner GbR
Bankgasse 3
90402 Nürnberg (DE)

(54) **Laundry dryer**

(57) The laundry dryer (10; 30) comprises a casing (12) and a rotatable or rotating drum (16) arranged in the interior space of said casing (12) the drum having a drum interior space for receiving or holding the laundry to be dried, the drum interior space being enclosed by a drum wall having a loading opening for loading and unloading the laundry and at least one drying air passing region with openings for passing drying air into the drum interior space or out of the drum interior space, wherein the rotatable or rotating drum (16) is provided with ventilation elements (26; 32) at the outside of the drum wall, the ventilation elements (26, 27, 32) being arranged in a continuous ventilation region of the drum wall spaced apart from each drying air passing region.



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Description

TECHNICAL FIELD

[0001] The present invention relates to a laundry dryer.

BACKGROUND TECHNOLOGY

[0002] Laundry dryers (or: tumble dryers, fabric dryer) are known in the current state of the art. They normally comprise an outer casing provided with a loading door, a rotating drum arranged in the interior space of said outer casing and receiving or holding the laundry to be dried, a drying air circuit adapted to cause heated drying air to be circulated through said rotating drum, heating means adapted to heat up the drying air, usually supplied by electrical or gas combustion energy, and a condenser adapted to remove moisture from the hot moisture-laden drying air exiting said rotating drum after having flown through the laundry contained therein. Moreover, blowing means are provided in order to circulate the drying air through the drum and the drying air circuit.

[0003] During the operation of such a laundry dryer, hot moisture-laden air leaving the rotating drum through openings in the drum is delivered into and through the condenser, where the air is cooled and the moisture is removed by means of a heat-exchange process. Thereupon, the air is transmitted to the heating means in order to heat it up again. Subsequently, the hot air is blown again through openings into the rotating drum, where it receives again moisture of the laundry received therein.

[0004] WO 89/09303 A1 describes a laundry dryer having a perforated rotating drum with perforation for entry of the drying air, wherein at the periphery of the drum next to the perforations fins are formed in order to increase the air flow from outside into the interior of the drum through the perforation. Therefore, a rotation of the drum by means of the fins induces an air flow through the drum from the outside into the drum through the perforation.

[0005] One drawback of such laundry dryers is, that the temperature of the interior space of the tumble dryer cabinet between the outer casing and the drum wall may become high. This requires, that components contained in this interior space of the laundry dryer, in particular electronic and electrical components, must be specified for high temperature levels. Normally this is accompanied by a cost increase for such components.

[0006] Starting from the aforementioned prior art it is an object of the present invention to at least partially eliminate or at least mitigate the aforementioned drawback caused by high temperatures in the prior art.

SUMMARY OF THE INVENTION

[0007] This object is solved by providing a laundry dryer having the features of claim 1 or by providing a method for cooling an interior space of a casing of a laundry dryer

according to claim 11 or by a laundry dryer or by a method having the features and characteristics as defined and recited by any of the claims appended hereto. Dependent claims refer to individual embodiments of the present invention.

[0008] The present invention provides a laundry (or: fabrics) dryer comprising a casing (or: housing, cabinet) and a rotatable or rotating laundry drum arranged (or: mounted) in the interior space of said casing. The drum has a drum interior space for receiving or holding the laundry to be dried. The drum interior space is enclosed (or: surrounded, delimited) by a drum wall having a loading opening for loading and unloading the laundry and at least one drying air passing region with opening(s), in particular perforations, for passing drying air into the drum interior space or out of the drum interior space, the direction of the drying air depending on the selected overall direction of the drying air stream through the drum interior space). Now, according to the invention, the rotatable or rotating drum is provided with ventilation elements (or: venting elements, forced-convection elements) at the outside of the drum wall (or in other words: at the side of the drum wall facing away from the drum interior space). These ventilation elements are arranged in a continuous ventilation region of the drum wall (or: a closed region of the drum wall, a region of the drum wall which has no openings or perforations) spaced apart (or: arranged at a distance) from each drying air passing region. Alternatively or in addition the ventilation elements are configured and/or arranged to generate, during rotation of the drum, a cooling air stream in an intermediate interior space of the interior space of the casing lying outside of the outside wall of the drum and/or being separated from the drum interior space by the drum wall

[0009] Thereby or in this manner the ventilation elements, during rotational operation of the drum, generate a cooling air stream (or: flow) in an interior space of the casing lying outside of the drum wall or in between the drum wall and the casing. The continuous or closed drum wall in the ventilation region in the vicinity of the ventilation elements serves as an air guiding wall preventing the ventilated air from entering or flowing into the drum interior.

[0010] The method for cooling an interior space of a casing of a laundry dryer according to the present invention comprises the steps of

- rotating a drum of the laundry dryer for receiving the laundry to be dried,
- generating a cooling air stream (or: flow) in the interior space of the casing lying outside of an outside wall of the drum (or: intermediate interior space) by means of ventilation elements provided at the outside wall of the drum and rotating with the drum.

[0011] The invention is based on the idea that in order to reduce the temperature inside the casing of the laundry dryer during its operation ventilation means or ventilation

are provided utilizing the rotation of the rotating drum for creating or generating a cooling air stream within the casing and outside of the drum. Accordingly, the temperature inside the laundry dryer can be lowered in such a manner, that components may be used, which need not to be specified for high levels of temperatures as requested in prior art technology.

[0012] Preferably, such electric and/or electronic components are arranged within the intermediate interior space and/or within a region adjacent or connected to the intermediate interior space, in particular at an operating panel.

[0013] In a preferred embodiment the ventilation elements, during rotation of the drum, generate a cooling air stream or flow in the interior space of the casing outside of the drum wall (or: intermediate interior space), the continuous drum wall in the ventilation region preventing the cooling air ventilated by the ventilation elements from entering the drum interior space and in particular serving as air guiding surface. The cooling air ventilation or stream generated by means of the ventilation elements rotating with the drum is preferably basically independent from the drying air circulation through the drum or constitutes a separate air convection system. In particular the cooling air stream does not or only to a negligible or minor part flow through the drum interior and thus does not influence the drying air stream.

[0014] Preferably the ventilation elements are formed by appendixes (or: protrusions, juts) arranged at the outside of the drum wall and protruding outwardly from the drum wall or protruding into the interior space of the casing lying outside of the drum wall (intermediate interior space). The appendixes are in particular formed as fins, flaps, blades, paddles, vanes or ribs. The appendixes can be formed integrally, i.e. in a single-piece construction, with the drum wall or the outer surface of the rotating drum or can be formed as separate elements mounted at the drum wall.

[0015] The laundry dryer may usually also comprises a drying air circuit adapted to cause heated drying air to be circulated through said rotating drum or its interior space and heating means adapted to heat up the drying air. Preferably also a condenser is comprised which is adapted to remove moisture from the hot moisture-laden drying air exiting said rotating drum after having flown through the laundry contained therein.

[0016] In a further embodiment the laundry dryer is provided with a loading door mounted at the casing for closing and opening the loading opening of the drum, wherein the loading door in particular serves as an air channel for the drying air flowing in or out of the drum interior space and in particular contains air passing openings towards the loading opening and preferably also a filter for filtering the drying air and/or wherein in particular the loading door is also part of the drying air circuit.

[0017] The drum or the drum wall may be made of plastics material. Furthermore, at least one drying air passing region and its opening or openings for passing drying air

are arranged in a rear drum wall or rear region of the drum wall. Also, an opening or several openings can be formed in a stationary rear bulkhead of the drum for passing drying air.

EXEMPLARY EMBODIMENTS

[0018] The detailed configuration, features and advantages of the present invention will become apparent in the course of the following description in particular with reference to the accompanying drawings.

FIG 1 is a perspective view showing a laundry dryer according to a first embodiment of the present invention, where a part of the outer casing is removed for better illustration;

FIG 2 is another perspective view of the laundry dryer shown in FIG 1, where a part of the outer casing is removed for better illustration;

FIG 3 is yet another perspective view of the laundry dryer shown in FIG 1 and 2, where a part of the outer casing is removed for better illustration;

FIG 4 is a perspective view showing a laundry dryer according to a second embodiment of the present invention.

[0019] Below, two embodiments of the present will be described with reference to the figures. In the figures, like parts or portions are denoted by like reference numerals, and redundant descriptions will be omitted.

[0020] FIG 1 to 3 are perspective views of a laundry dryer 10 according to a first embodiment of the present invention. The laundry dryer 10 comprises an outer casing 12 (partly not illustrated in order to show the inside of the laundry dryer 10) having two side walls 12A and 12B, a rear wall 12C, a bottom structure 12D and a front part 12E. All these walls and parts 12A to 12E jointly enclose a casing interior space 13 within the casing 12. The front part 12E is provided with a loading door 14 and an operating panel 29.

[0021] A rotating drum 16 is rotatably or rotatingly mounted at the casing 12 within the casing interior space 13. The rotating drum 16 has a drum interior space 15 to put in laundry to be dried and a drum wall 17 enclosing the drum interior space 15. In the rear region the drum 16, preferably with the edge of the drum wall 17, rotates slidingly in or on a stationary rear bulkhead 22. In the drum wall 17 in the front region a loading opening 25 is also provided for putting in or out the laundry. The intermediate interior space of the whole casing interior space 13 which is arranged between the drum wall 17 on one side and the casing 12 and its walls and parts 12A to 12E on the other side is designated with 28.

[0022] The laundry dryer 10 is further provided with a drying air circuit for circulating a flow of heated drying air

DA indicated by arrows through the drum interior space 15 of the rotating drum 16, heating means (not shown) for heating up said drying air DA, a condenser 18, which removes moisture from the hot moisture-laden drying air DA exiting the rotating drum 16 after having flown through the laundry contained therein, and blowing means in order to circulate the drying air DA through the rotating drum 16 and the drying air circuit.

[0023] During the operation of the laundry dryer 10, the drying air DA is circulated through the drying air circuit by the blowing means. Accordingly, the drying air DA, which was heated by the heating means, enters the drum interior space 15 of the rotating drum 16 through openings 20 formed in the stationary rear bulkhead 22 of the drum 16 and then through the rear region of the drum wall 21, which is open to the back, in one embodiment or through openings or perforations in a rear wall of the drum in another embodiment.

[0024] Within the drum interior 16, which is rotated by a motor 23, the heated drying air DA receives moisture from the laundry contained therein. Thereafter, the hot moisture-laden drying air DA leaves the rotating drum 16 through its loading opening 25 and the front bulkhead 24, passes through a lint-filter (not shown) in the loading door 14 and enters the condenser 18. Within the condenser 18, the hot moisture-laden drying air undergoes a heat-exchange process, in which heat is exchanged with a means lying at a lower temperature (for example an air heat exchanger or an evaporator of a heat pump system), to the purpose of removing from the air the moisture it took away from the laundry in the drum 16. Subsequently, the drying air DA, which was cooled down and dehydrated within the condenser 18, is heated up again passing through the heating means, whereupon it anew enters the drum 16 through the openings 20 and the rear region of the drum wall 17.

[0025] Within the intermediate interior space 28 and the casing interior space 13 or in regions of the laundry dryer adjacent to these spaces 28 or 13 electric and/or electronic components 31 are arranged. For instance electric and electronic components 31 can be positioned behind the operating panel 29, including e.g. an electronic main board as well as relays for controlling of the motor and the heater.

[0026] At least some, usually basically all, of these electric and/or electronic components 31 are sensitive for high temperatures. As the components 31 include electrically conductive materials which are usually also good thermal conductors heat transfer rate is high.

[0027] According to the present invention, an air ventilation of the intermediate interior space 28 is provided for cooling and keeping the temperatures at the electric and/or electronic components 31 low or below a certain threshold.

[0028] To this purpose, a plurality of ventilation elements 26 arranged in a ring configuration in a first ventilation region 36 and a plurality of further ventilation elements 27 arranged in another ring configuration in a

second ventilation region 37 are provided at the outer surface of the drum wall 17 of the drum 16 in such a manner, that they protrude outwards from the outer periphery of the drum 16.

[0029] In the embodiment shown the ventilation elements 26 and 27 are arranged at the side wall 19 or shell of the drum wall 17 in the front region although ventilation elements could also be provided at the rear region of the drum wall 21 and/or in the central region of the side wall 19 of the drum wall 17.

[0030] The ventilation elements 26 and 27 may be formed integrally with the drum wall 17 or, alternatively, be fixed as separate elements to the periphery of the drum 16 at the drum wall 17.

[0031] The ventilation elements 26 and 27 are formed as fins or blades or ribs or similar shapes suitable for air convection or blowing and protrude outwardly in the radial direction or tilted or curved in a direction forming an angle with the radial direction. The ventilation elements 26 and the ventilation elements 27 respectively are arranged one behind the other along the circumference of the drum wall 17 in the rotating direction about the rotational axis of the drum 16.

[0032] When the drum 16 is rotated by means of the motor 23, the ventilation elements 26 and 27 swirl or force the air surrounding the outer periphery of the drum 16 in order to create an airflow of cooling air CA within the intermediate interior space 28 in particular in the front region, which leads to a reduction of the temperature within the outer casing 12 of the laundry dryer.

[0033] In each ventilation region 36 and 37 the drum wall 17 or 19 is completely closed or formed as a continuous wall or surface so that the ventilated cooling air CA does not enter the drum interior space 15 but flows only through the intermediate interior space 28 within the casing 12. Due to this cooling by the cooling air flow CA a lower temperature is achieved and electronic or electric components, which are contained inside the casing 12, in particular the components 31 in the front, need not to be specified for high levels of temperature. Accordingly, the costs for such components may be lowered.

[0034] The ventilation of the cooling air CA and cooling is achieved by the rotation of the drum itself thereby rotating also the ventilation elements 26 and 27 without the necessity to provide additional drives and motors for the cooling ventilation.

[0035] FIG 4 illustrates a second embodiment of a laundry dryer 30 according to the present invention. The configuration of the laundry dryer 30 is almost the same as the one of the laundry dryer 10 according to the first embodiment of the present invention explained above. However, here, ventilation elements 32 are formed on the outer surface of the drum 16 in such a manner, that they extend almost over the whole width of the drum 16 or, in other words, extend over the whole axial length of the side wall 19 as seen parallel to the rotational axis of the drum 16. Accordingly, the ventilation function created by these ventilation elements 32 is more effective or cov-

ers more space compared with the one realized by the ventilation elements 26 and 27 of the first embodiment.

[0036] Although only two exemplary embodiments of the present invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible with respect to the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention.

LIST OF REFERENCE SIGNS

[0037]

10	laundry dryer
12	casing
12A	side wall
12B	side wall
12C	rear wall
12D	bottom structure
12E	front part
13	casing interior space
14	loading door
15	drum interior space
16	rotating drum
17	drum wall
18	condenser
19	drum side wall
20	openings
21	drum rear wall
22	rear bulkhead
23	motor
24	front bulkhead
25	loading opening
26, 27	ventilation elements
28	intermediate interior space
29	operating panel
30	laundry dryer
31	electric and/or electronic components
32	ventilation elements
36, 37	ventilation region
DA	drying air
CA	cooling air

Claims

1. A laundry dryer (10; 30) comprising
a casing (12) and
a rotatable or rotating drum (16) arranged in an interior space of said casing (12) the drum having a drum interior space for receiving the laundry to be dried,
the drum interior space being enclosed by a drum wall (17) having a loading opening for loading and unloading the laundry and
at least one drying air passing region with at least

one opening for passing drying air into the drum interior space or out of the drum interior space, wherein the drum (16) is provided with ventilation elements (26; 32) at the outside of the drum wall (17, 19),

the ventilation elements being configured to generate, during rotation of the drum, a cooling air stream (CA) in an intermediate interior space (28) of the interior space of the casing lying outside of the outside wall of the drum and/or being separated from the drum interior space by the drum wall (17, 19) and/or the ventilation elements (26, 27, 32) being arranged in a continuous ventilation region (36, 37) of the drum wall spaced apart from each drying air passing region.

2. A laundry dryer (10; 30) according to claim 1, wherein the ventilation elements (26, 27, 32) are configured to generate, during rotation of the drum, a cooling air stream (CA) in the intermediate interior space (28) of the casing outside of the drum wall, the continuous drum wall in the ventilation region preventing the cooling air (CA) ventilated by the ventilation elements from entering the drum interior space.

3. A laundry dryer (10; 30) according to claim 1 or claim 2, wherein the ventilation elements are formed by appendixes (26, 27, 32) arranged at the outside of the drum wall (16) and protruding outwardly from the drum wall or protruding into the interior space of the casing lying outside of the drum wall.

4. A laundry dryer (10; 30) according to claim 3, wherein said appendixes are formed as fins, flaps, blades, paddles, vanes or ribs.

5. A laundry dryer (10; 30) according to claim 3 or claim 4, wherein the appendixes (26; 32) are formed integrally with the outer surface of the drum wall (16) of the drum (16) or are formed as separate elements mounted at the drum wall (17).

6. A laundry dryer (10; 30) according to any of the preceding claims, wherein the drum (16) or the drum wall is made of plastics material and/or wherein the at least one drying air passing region and its at least one opening for passing drying air into the drum interior space or out of the drum interior space are arranged in a rear drum wall or rear region of the drum wall and/or wherein at least one opening (20) is formed in a stationary rear bulkhead (22) of the drum (16) for passing drying air.

7. A laundry dryer (10; 30) according to any of the preceding claims, wherein within the intermediate interior space (28) and/or within a region adjacent or connected to the intermediate interior space (28) electric and/or electronic components (31) are ar-

ranged, in particular at an operating panel (29).

8. A laundry dryer (10; 30) according to any of the preceding claims, comprising a drying air circuit adapted to cause heated drying air (DA) to be circulated through said rotating drum (16) and heating means adapted to heat up the drying air. 5

9. A laundry dryer (10; 30) according to claim 8 further comprising a condenser (18) adapted to remove moisture from the hot moisture-laden drying air exiting said rotating drum (16) after having flown through the laundry contained therein. 10

10. A laundry dryer (10; 30) according to any of the preceding claims, further provided with a loading door (14) mounted at the casing for closing and opening the loading opening of the drum, wherein the loading door serves as an air channel for the drying air flowing in or out of the drum interior space and/or contains air passing openings towards the loading opening and/or contains a filter for filtering the drying air and/or wherein the loading door is part of the drying air circuit. 15
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11. A method for cooling at least a part of an interior space of a casing of a laundry dryer comprising the steps of 25
 rotating a drum of the laundry dryer for receiving the laundry to be dried, 30
 generating a cooling air stream in an intermediate interior space (28), which is a part of the interior space (13) of the casing lying outside of an outside wall of the drum, by means of ventilation elements (26, 27, 32) being provided at the outside wall of the drum and rotating with the drum. 35

12. The method according to claim 11, wherein a stream of drying air is forced through the drum interior space for drying the laundry said stream of drying air being distinct and separated and/or flowing independently from the cooling air stream and/or not being influenced by the cooling air stream. 40
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FIG 1

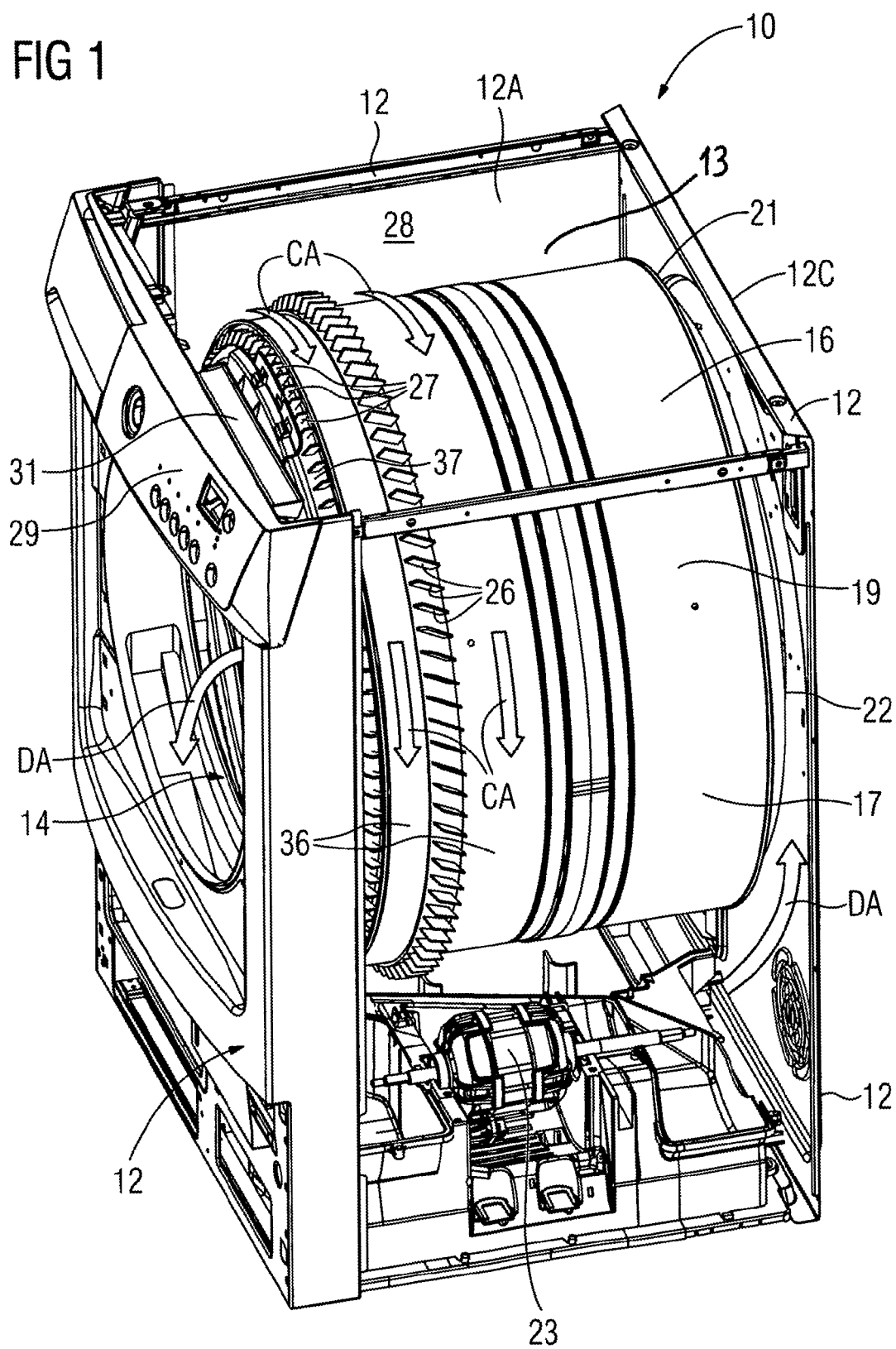


FIG 2

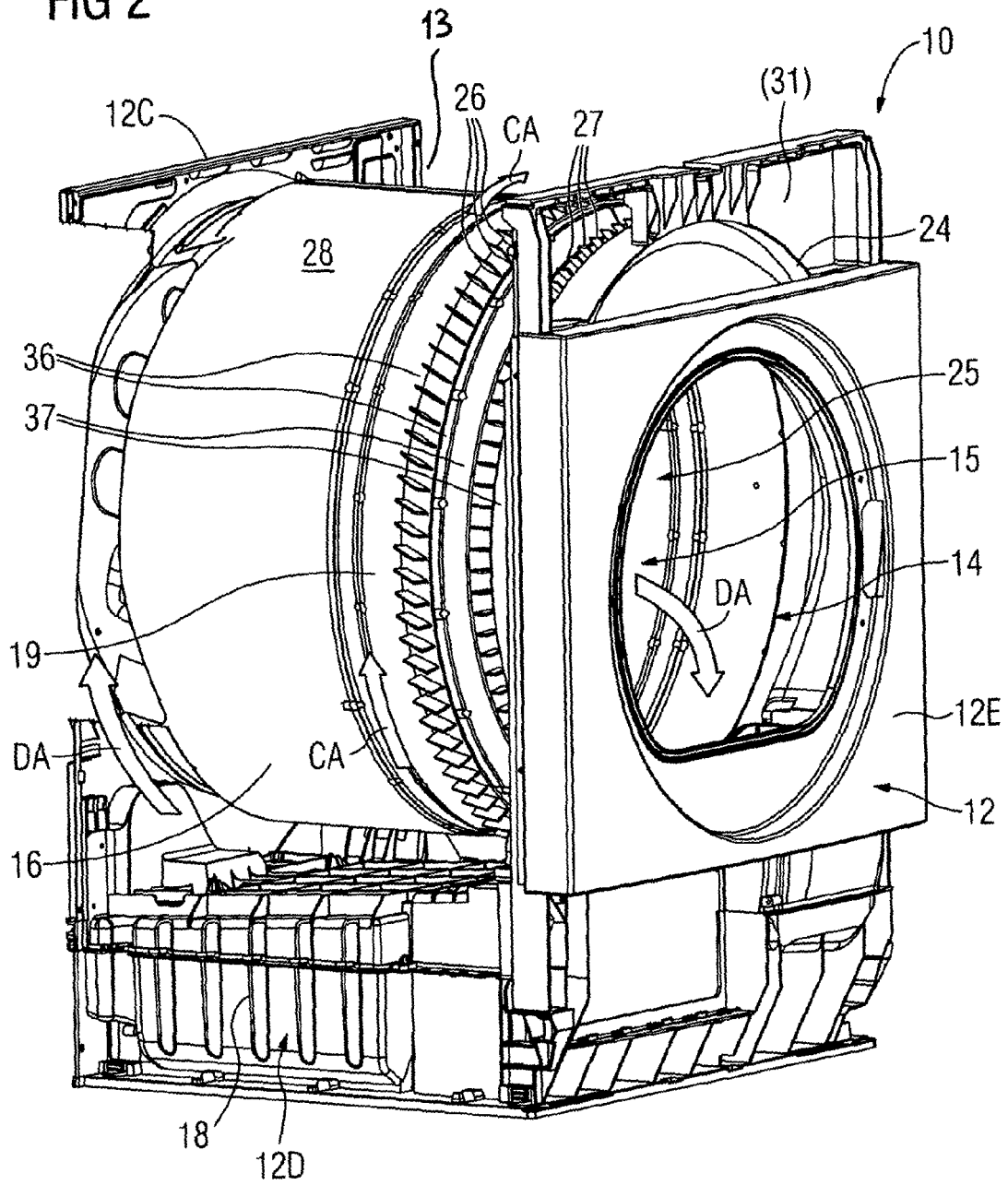


FIG 3

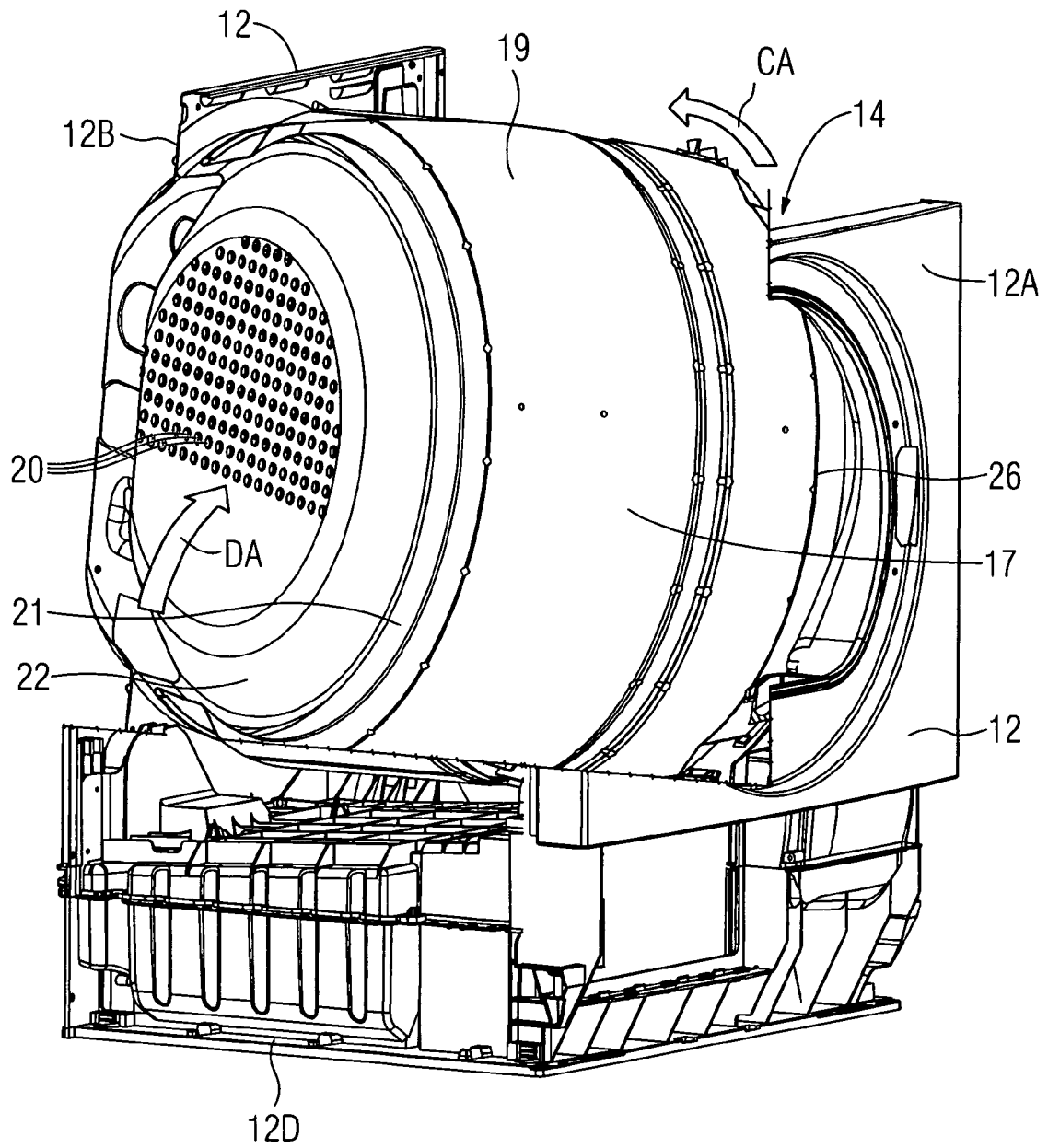
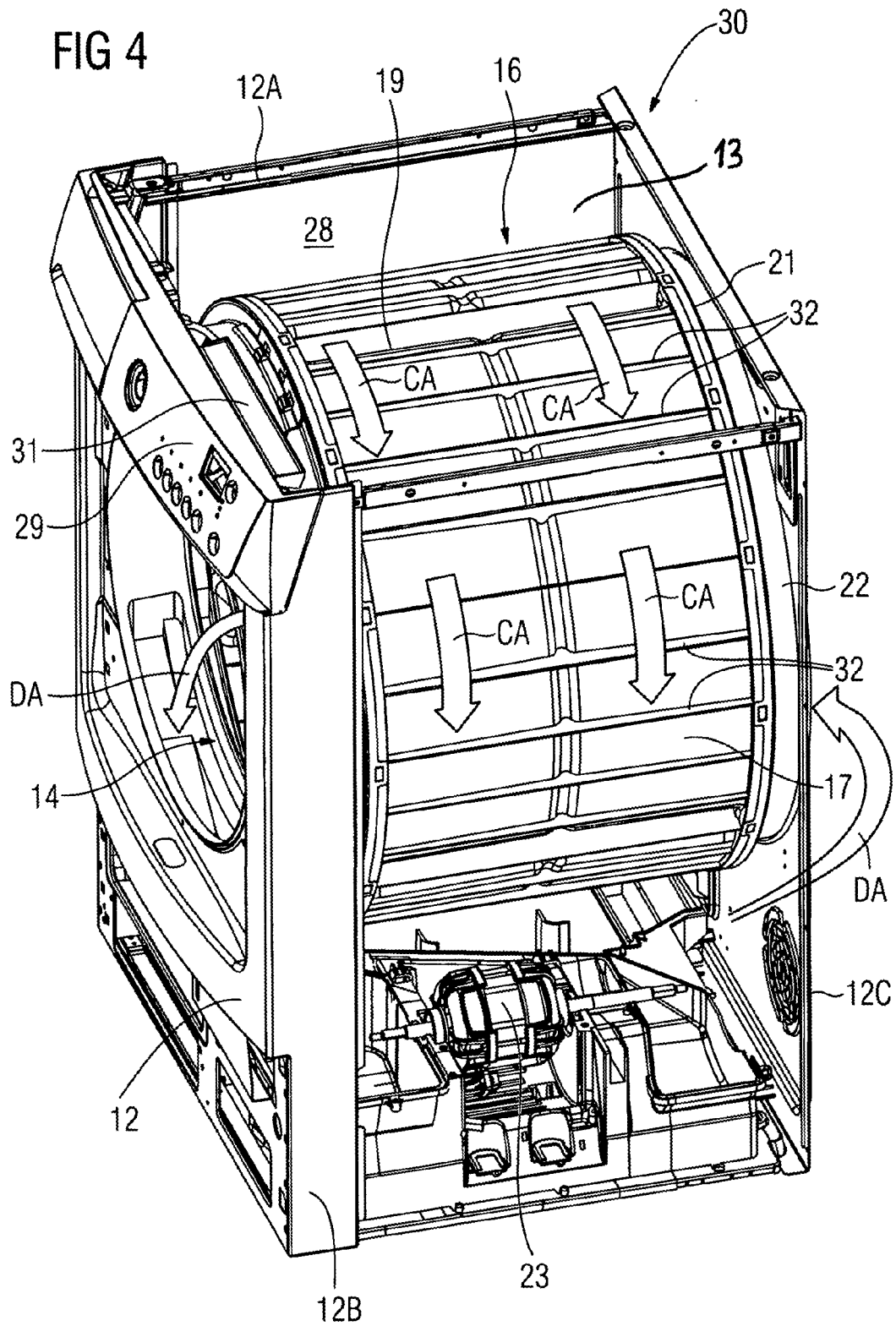


FIG 4





EUROPEAN SEARCH REPORT

Application Number
EP 08 01 0696

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	GB 2 063 441 A (HOOVER LTD) 3 June 1981 (1981-06-03) * page 2, line 103 - page 3, line 6; figure 1 *	1,11	INV. D06F58/02 D06F58/04
A	EP 1 584 733 A (LG ELECTRONICS INC [KR]) 12 October 2005 (2005-10-12) * paragraph [0037] - paragraph [0038]; figures 1,3,4 *	1,11	
A	GB 787 942 A (FRANZ PLUEMER) 18 December 1957 (1957-12-18) * page 1, line 39 - page 1, line 85 * * page 2, line 72 - line 58; figures 1-4 *	1,11	
A	US 3 651 580 A (MEYER ANFRIED) 28 March 1972 (1972-03-28) * column 2, line 45 - column 3, line 7; figures 1-3 *	1,11	
D,A	WO 89/09303 A (LENZ HANS [AU]) 5 October 1989 (1989-10-05) * page 7, line 10 - page 8, line 25; figures 2,3 *	1,11	TECHNICAL FIELDS SEARCHED (IPC) D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 November 2008	Examiner Fachin, Fabiano
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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

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The members are as contained in the European Patent Office EDP file on
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04-11-2008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 2063441	A	03-06-1981	NONE	
EP 1584733	A	12-10-2005	NONE	
GB 787942	A	18-12-1957	NONE	
US 3651580	A	28-03-1972	DE 1804153 A1	30-04-1970
WO 8909303	A	05-10-1989	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 8909303 A1 [0004]