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(71) Applicant: **Candy S.p.A.**
20900 Monza (MB) (IT)

(72) Inventor: **FUMAGALLI, Aldo**
20900 Monza MB (IT)

(74) Representative: **Perani & Partners S.p.A.**
Piazza Armando Diaz, 7
20123 Milano (IT)

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(54) **A CONDENSATION TYPE LAUNDRY DRYER MACHINE**

(57) The present invention relates to a condensation type laundry dryer machine (2) comprising a drum (1) in which the laundry to be dried is placed, a bottom wall (8), a first conduit (3) for conveying a flow of hot air toward said laundry (4) contained in the drum (1), a heater (4) for heating said air flow, a first motorized generator (5) for generating said air flow, a second conduit (6) for collecting the flow of moist air from the drum (1) and convey it toward a condenser (7), a first filter (25) placed in said conduit (6) upstream from said condenser (7) for filtering said moist air from the drum (1). The machine is characterized in that said condenser (7) is a heat exchanger made of a metal material, and is located in a housing (12) formed in the lower portion of the laundry dryer machine, said condenser (7) being inclined at an angle (α) relative to the plane defined by the bottom wall (9) of the machine (2) and comprising connector means for mechanically connecting said heat exchanger (7) to said housing (12).

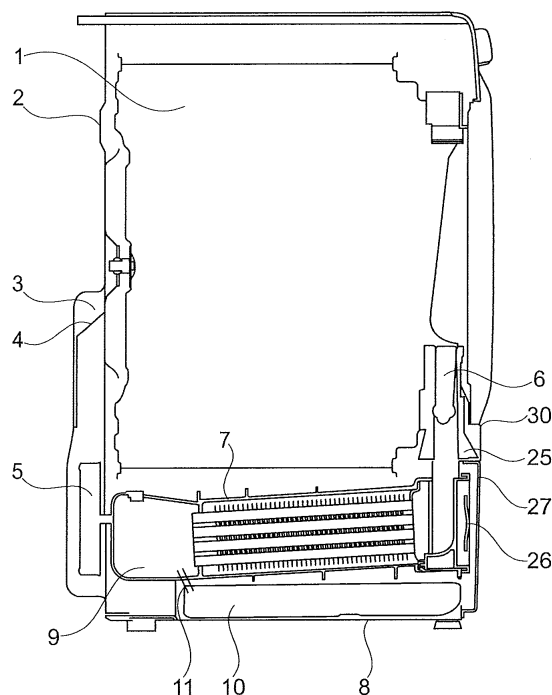


Fig. 1

Description

Technical field

[0001] The present invention relates to a condensation type laundry dryer machine as defined in the preamble of claim 1.

[0002] Particularly, but without limitation, the condensation type laundry dryer machine comprises a rotating drum in which the laundry to be dried is placed, a bottom wall, a vertical wall, a first conduit for conveying a hot air flow toward said laundry contained in the compartment, a heater for heating said air flow, a first motorized generator for generating said air flow, a second conduit for collecting the flow of moist air from the laundry compartment and conveying it toward a condenser, air and water outlets, for discharging air and water resulting from the moisture condensed by said condenser, a second motorized generator for generating a cooling air flow and conveying it toward said condenser.

Background of the invention

[0003] In the prior art, the conduit of the aforementioned condensation type laundry dryer machines, i.e. the conduit that collects the moist flow from the compartment in which the laundry to be dried is placed, contains a filter that can be removed from the conduit for cleaning purposes, to prevent any lint and fluff from the laundry, carried by the moist air flow, from being dragged into the pipes of the condenser thereby causing obstructions and resulting in a degradation of the energy efficiency of the machine.

[0004] In the prior art, the condenser is also designed to be removed from the machine, also for cleaning purposes, and particularly to remove fluff and lint that might have reached it.

[0005] In order to remove the condenser and, of course, sealingly reintroduce it in a proper position into the conduits, according to the prior art, the condenser removal technology provides sealing devices, as well as coupling and release mechanisms for fixation thereof, and doors for opening and closing its housing it in the machine.

[0006] For these purposes, in the prior art, the heads of the tube bundle and the plate pack that form the heat-exchanging circuits of the condenser, are typically formed by plastic molding, which affords the seals and the retaining hooks required for positioning and removal of the condenser to be easily and properly introduced into these heads.

[0007] Namely, the heads that complete the structure of the condenser, still in the prior art, are joined to the plate pack and the tube bundle by gluing, and glues, as well as the plastic materials that are used to form the heads, impart poor dimensional resistance at the required operating temperatures of the condensation type laundry dryer machine, thereby affecting proper position-

ing of the condenser, especially after repeated removal and reintroduction steps.

[0008] This leads to a number of drawbacks, affecting functional reliability of this technical solution for removing the condenser, due to its poor dimensional stability and inconvenience for the user.

[0009] For instance, EP219578 discloses laundry washing machine with a removable condenser as described above.

SUMMARY OF THE INVENTION

[0010] Therefore, the object of the present invention is to obviate the aforementioned drawbacks by providing a technical solution that can provide the laundry dryer machine as described hereinbefore with a hermetically sealed circuit of the heat exchanger.

[0011] The aforementioned technical purpose and object are substantially fulfilled by a condensation type laundry dryer machine that has the technical features as disclosed in one or more of the accompanying claims.

Advantages

[0012] The present invention can afford a cost reduction as compared with the fabrication of the heat exchangers that are currently used in condensation type laundry dryer machines.

[0013] The present invention can also provide condensation type laundry dryer machines that impart dimensional stability to the condenser even at relatively high operating temperatures and is easy to use by the user.

LIST OF DRAWINGS

[0014] Further features and advantages of the present invention will result more clearly from the illustrative, non-limiting description of a preferred, non-exclusive embodiment of a condensation type laundry dryer machine, as shown in the accompanying drawings, in which:

- Figure 1 diagrammatically shows a vertical section of a condensation type laundry dryer machine according to the present invention;
- Figure 2 shows a cross-sectional view of Figure 1 and particularly the portion of the conduit that conveys hot moist air from the laundry compartment to the condenser, the latter being shown in a longitudinal sectional view;
- Figure 3 shows a perspective view of the condenser of the apparatus of the invention.

DETAILED DESCRIPTION

[0015] Even when this is not expressly stated, the individual features as described with reference to the particular embodiments shall be intended as auxiliary to and/or interchangeable with other features described

with reference to other exemplary embodiments.

[0016] Reference will be made hereinafter to a condensation type laundry dryer machine 2, i.e. a laundry dryer machine that can heat the air required to dry clothes or laundry, using an electrical resistor, to introduce hot air into the drum.

[0017] Therefore, the disclosure does not address a laundry dryer machine of the heat-pump type.

[0018] Referring to the afore-mentioned figures and particularly to Figure 1, it will be appreciated that the condensation type laundry dryer machine 1 comprises a drum 1 (or drying compartment) in which the wet clothes to be dried is placed, and a first conduit 3 for conveying a hot air flow toward the laundry.

[0019] For this purposes, the machine 2 comprises a heater 4, e.g. a resistor, for heating said air flow, a first generator, e.g. a motorized fan 5, for generating said air flow, a second conduit 6 for collecting the moist air flow from the laundry compartment 1 and conveying it toward a condenser 7 which is located at the bottom 8 of the machine 2, as described in greater detail with reference to Figures 2 and 3.

[0020] Still referring to Figure 1, it will be appreciated that the laundry-dryer machine 2 comprises a second generator, not shown, for generating a cooling air flow and conveying it through an appropriate conduit, e.g. made of plastic, to said heat exchanger-based condenser 7.

[0021] The condensation water that comes out of the condenser 7 is conveyed toward a collection chamber 9, which is in fluid communication with a tank 10 by means of a connecting valve 11, for the discharge of water that has been formed in the condenser 7.

[0022] The dehumidified air that comes out of the condenser 7 may be conveyed out of the machine 2 through an opening (not shown), e.g. formed on the bottom 8 of the machine.

[0023] According to the invention, the condenser 8 is of the heat exchanger-based type.

[0024] According to a peculiar aspect, this heat exchanger 7 is made of a metal material.

[0025] Furthermore, according to another aspect of the present invention, the heat exchanger 7 cannot be removed from the machine 2 by the user unless for scheduled maintenance by skilled personnel.

[0026] For this purpose, particularly referring to Figure 2, a housing 12 is provided at the bottom 8 of the machine 2. The condenser 7 is mechanically connected in this housing 12 using connection means that lock the front frame of the condenser 8 to the abutment of the conduit 7.

[0027] These connection means are of removable type, to ensure the aforementioned scheduled maintenance to be performed by the skilled personnel.

[0028] For example, the connection means are embodied by screws or bolts or similar elements.

[0029] The housing 12 comprises an inlet opening 13 having a peripheral abutment.

[0030] Such housing 12 has an outlet opening for the

flow of air or condensation water, as explained in greater detail hereinafter, which is referenced 14 and has in turn a peripheral abutment 15.

[0031] Referring now to Figures 2-3, the heat exchanger-based structure of the condenser 7 comprises a tube bundle, e.g. composed of thirty-two sections of aluminum tubes, referenced 18, which have an outside diameter "D", for instance, of 16.00 mm and an inside diameter "d", for instance, of 14.00 mm, and have each a length "L", for instance, of 175.00 mm.

[0032] The tube sections 18 are supported at their ends by the opposite heads 19 and 20, which are preferably embodied by plates, also preferably made of aluminum, and have holes in which said tube sections are mechanically fastened by expanding operations.

[0033] Cooling fins 14 are mounted and mechanically fixed to the tube bundle as mentioned above, have each a thickness "s" of 0.15 mm, are also made of aluminum, and form a pack of forty-two fins.

[0034] The first head 19 of the condenser, which faces the conduit 6 that conveys the hot and moist air flow from the drum 1, when it is within the housing 12, has a recess 21 within its contour 22. The latter is engaged against the peripheral abutment of the housing 12, when the condenser 8 is properly positioned therein.

[0035] Likewise, the head 20 of the condenser 7 comprises a contour 23 which is designed to engage at its front against the peripheral abutment 15 of the opening 14 of the housing 12.

[0036] The laundry dryer machine 2 comprises a first filter 25 which is configured to filter any lint and fluff from the laundry, which are carried by the moist air flow, i.e. to prevent them from entering the pipes of the condenser thereby causing obstructions and leading to degradation of the energy efficiency of the machine.

[0037] The laundry-dryer machine 2 comprises an additional filter 24. Such additional filter 24 is placed in the conduit 7 downstream from the filter 25 and in contact with the heat exchanger 7, preferably with its head 19.

[0038] In one aspect, the recess 21 receives a filter holder 26 which is designed to receive the additional filter 24, such recess 21 being accessible through an openable door 27, which is introduced into an opening 29 of the vertical wall 30 of the machine 2.

[0039] In one aspect, the additional filter 23, which is housed in the recess 21 formed in the head 19 of the condenser 7, may be removed by the user for cleaning, once the door 27 has been opened, which makes it easily accessible through the connection area 28.

[0040] This filter 24 is added to the filter 25, also removable for cleaning, which, in the prior art, is placed in the conduit 7 immediately downstream from the compartment 1 in which the laundry is treated, and is designed to retain most of the lint that comes from the aforementioned compartment with the hot and moist air.

[0041] The door 27 engages in the opening 29, with a seal interposed therebetween.

[0042] The wall of the door 27 has a preferably curved

shape and forms, in front of the opening 13 of the housing 12, a connection area 28 between the hot and moist air conduit 6 and the opening 13.

[0043] The position of the condenser 7 relative to the bottom 8 of the machine is preferably inclined at an angle of inclination α to facilitate the outflow of condensation water by gravity toward the collection and discharge points 16.

[0044] Such angle α ranges from 2° to 6° and is preferably 3°, relative to the bottom wall 8 which extends in a direction of extension that is substantially parallel to the plane on which the laundry dryer machine 2 stands.

[0045] In one aspect, the condenser 7 in the laundry-dryer machine 2 assumes a condition in which it cannot be removed by the user for frequent cleaning operations, as the latter only mainly consist in cleaning the additional removable filter 24 which is placed immediately in front of the inlet opening of the condenser 7 and is placed within a simple recess, and whose repositioning does not require alignment of conduit openings, introduction of seals and actuation of connecting members, which would be indispensable in case of removal of the condenser.

[0046] Furthermore, the omission of plastic materials in the condenser heads affords an improved behavior thereof at the operating temperatures of the machine, and hence also improved safety margins.

[0047] Those skilled in the art will obviously appreciate that a number of changes and variants may be made to the arrangements as described hereinbefore to meet incidental and specific needs. All of these variants and changes fall within the scope of the invention, as defined in the following claims.

Claims

1. A condensation type laundry dryer machine (2) comprising a drum (1) in which the laundry to be dried is placed, a bottom wall (9), a first conduit (3) for conveying a flow of hot air toward said laundry (4) contained in the drum (1), a heater (4) for heating said air flow, a first motorized generator (5) for generating said air flow, a second conduit (6) for collecting the flow of moist air from the drum (1) and convey it toward a condenser (7), a first filter (25) placed in said second conduit (6) upstream from said condenser (7) for filtering the flint and fluff that are carried by the flow of said moist air that comes from the drum (1), wherein said condenser (7) is a heat exchanger made of a metal material, and is located in a housing (12) formed in the lower portion of the laundry dryer machine, said condenser (7) being inclined at an angle (α) relative to the plane defined by the bottom wall (9) of the machine (2), connection means for mechanically connecting said heat exchanger (7) to said housing (12), said condenser (7) comprising a tube bundle (18)

and cooling fins (16) mounted to said tube bundle (18), a first head (19) connected to said tube bundle (18) and facing said second conduit (6) and a second head (20) opposite to the first head (19),

characterized in that the end portions of the tube sections that form said tube bundle (18) are connected to said heads (19, 20) by an expanding step.

2. A condensation type laundry dryer machine (2) as claimed in claim 1, comprising a second filter (24) located in said second conduit (6) downstream from said first filter (25), said second filter (24) being placed in contact with said heat exchanger (7).
3. A condensation type laundry dryer machine (2) as claimed in claim 2, wherein said second filter (24) is placed against said first head (19) of said heat exchanger (7).
4. A condensation type laundry dryer machine (2) as claimed in claim 3, wherein said first head (19) of said heat exchanger (7) has a recess (21) and said second filter (24) is placed within said recess (21).
5. A condensation type laundry dryer machine (2) as claimed in claim 3 or 4, wherein said first head (19) of said heat exchanger (7) has a contour (22) that engages against a peripheral abutment of the housing (12) when the condenser (7) is properly positioned in it.
6. A condensation type laundry dryer machine (2) as claimed in claim 3, wherein said second head (20) of the condenser (7) has a contour (23) that is designed for front engagement against a peripheral abutment (15) of the opening of the housing (12).
7. A condensation type laundry dryer machine (2) as claimed in claim 2, comprising a vertical wall (30) having an opening (29) with a door (27) for removal and introduction of said second filter (24).
8. A condensation type laundry dryer machine (2) as claimed in claim 7, wherein said door (27) of the opening (29) for removal and introduction of said additional filter (24) has an arched shape which forms a connection area (28) between the conduit (6) for hot moist air and the opening (13) of the housing (12), in front of said opening (13) of the housing (12) of said condenser (7).
9. A condensation type laundry dryer machine (2) as claimed in one or more of the preceding claims 3 to 8, wherein said first and second heads (19, 20) of said heat exchange condenser (7) consist of aluminum plates.

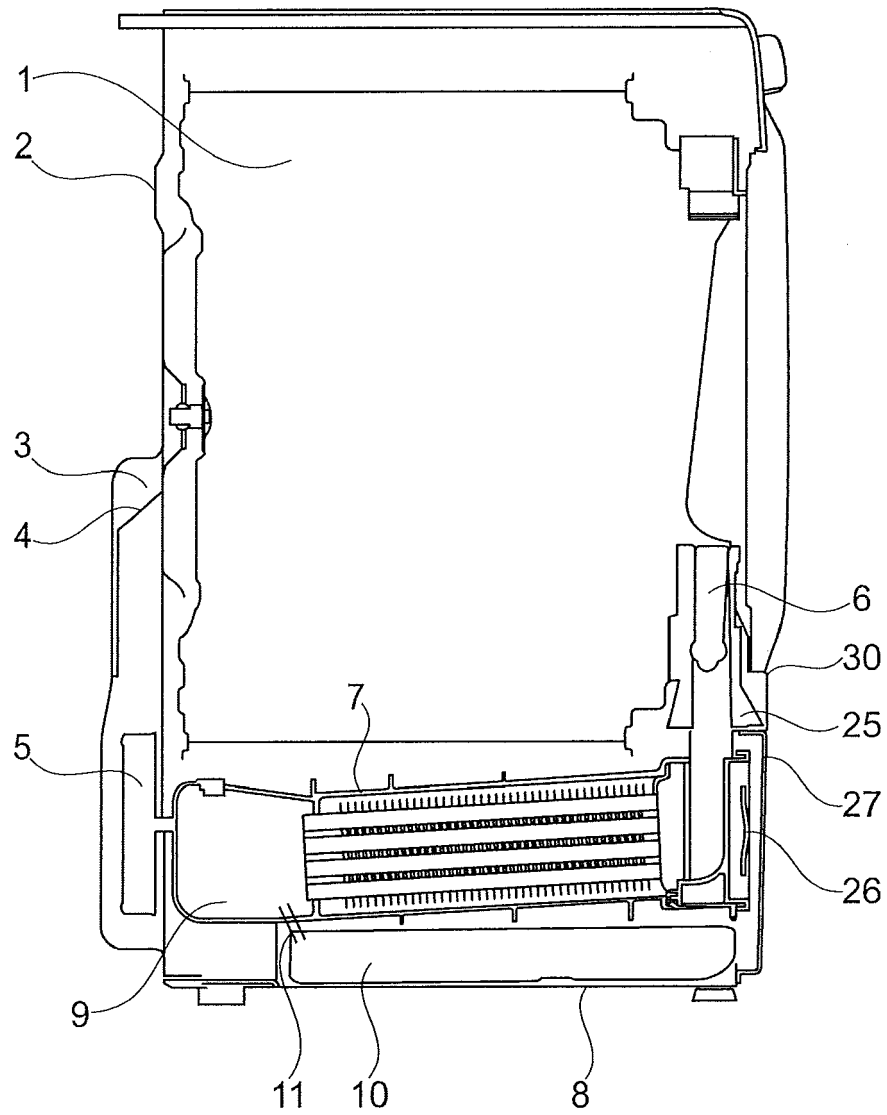


Fig. 1

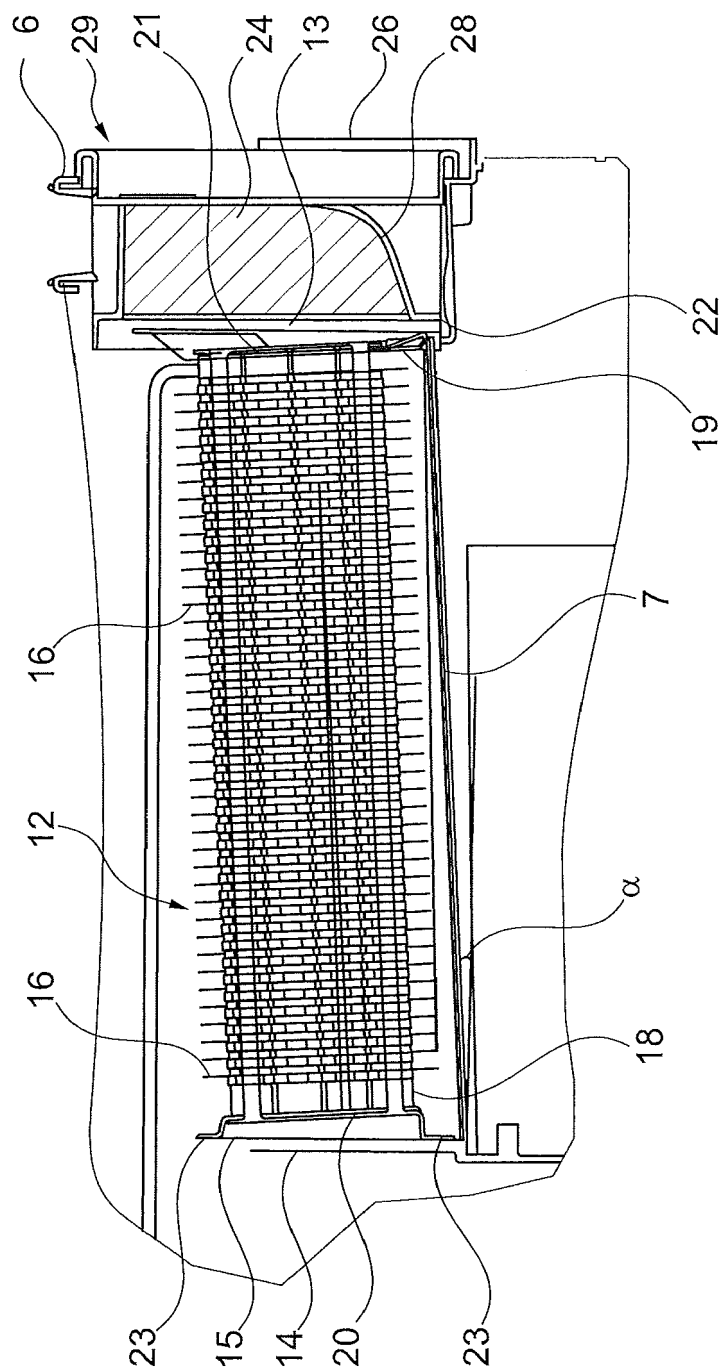


Fig. 2

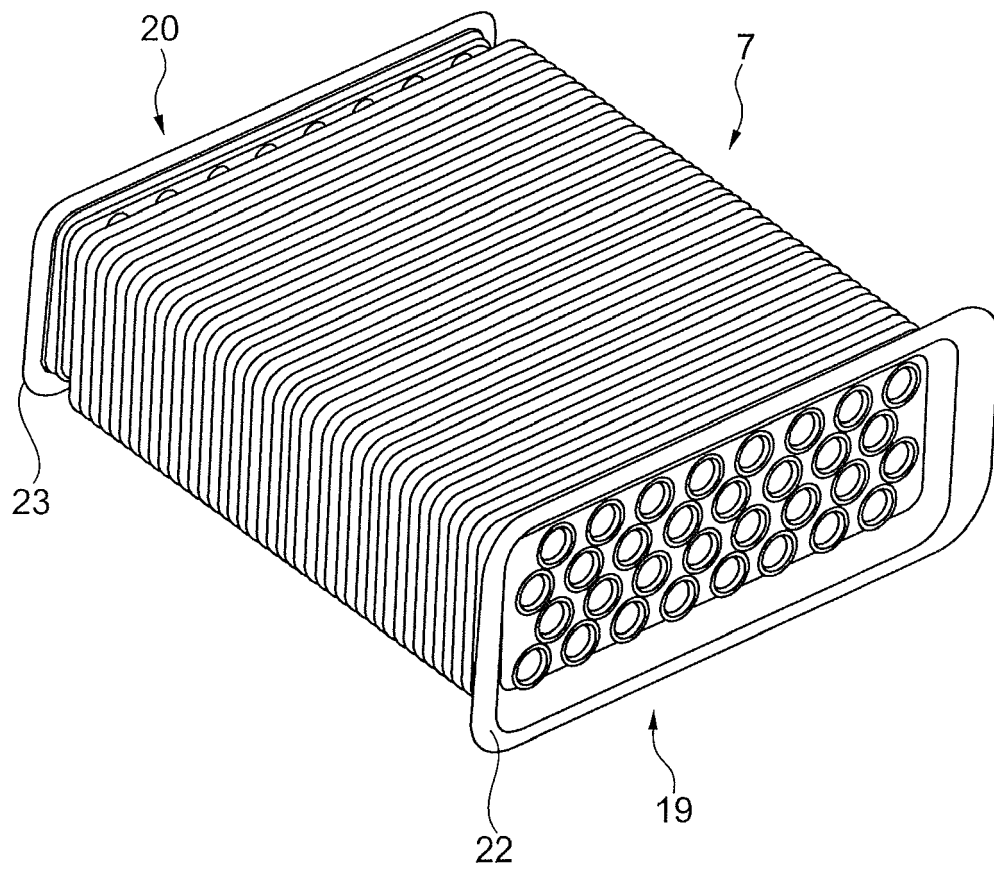


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 18 15 6757

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 196 578 A1 (ELECTROLUX HOME PROD CORP [BE]) 16 June 2010 (2010-06-16)	1-5,7-9	INV. D06F58/24
Y	* paragraph [0015] - paragraph [0017] *	1	
A	* paragraph [0040] - paragraph [0057] *	6	ADD. D06F58/22
	* figures 1-12 *		

X	EP 2 366 828 A1 (CANDY SPA [IT]) 21 September 2011 (2011-09-21)	1-3	
A	* paragraph [0018] - paragraph [0033] *	4-9	
	* figures 1-4 *		

Y	EP 3 124 681 A1 (LG ELECTRONICS INC [KR]) 1 February 2017 (2017-02-01)	1	
A	* paragraph [0035] - paragraph [0046] *	3-6	
	* paragraph [0056] - paragraph [0063] *		
	* paragraph [0084] - paragraph [0094] *		
	* figures 6, 7 *		

A	EP 2 980 306 A1 (INDESIT CO SPA [IT]) 3 February 2016 (2016-02-03)	2,3	
	* paragraph [0025] - paragraph [0034] *		
	* figures 1-6 *		

The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 August 2018	Examiner Bermejo, Marco
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

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

EP 18 15 6757

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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09-08-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2196578 A1	16-06-2010	AT 525514 T EP 2196578 A1 ES 2375458 T3	15-10-2011 16-06-2010 01-03-2012
EP 2366828 A1	21-09-2011	NONE	
EP 3124681 A1	01-02-2017	CN 106400424 A EP 3124681 A1 KR 20170014587 A US 2017030007 A1 WO 2017018862 A1	15-02-2017 01-02-2017 08-02-2017 02-02-2017 02-02-2017
EP 2980306 A1	03-02-2016	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 219578 A [0009]