



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.04.2013 Bulletin 2013/16

(51) Int Cl.:
D06F 58/22 (2006.01) D06F 58/20 (2006.01)

(21) Application number: **11184845.3**

(22) Date of filing: **12.10.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventors:
• **Noviello, Flavio**
33080 Porcia (PN) (IT)
• **Pillot, Sergio**
33080 Porcia (PN) (IT)

(71) Applicant: **Electrolux Home Products Corporation N.V.**
1130 Brussel (BE)

(74) Representative: **Nardoni, Andrea et al**
Electrolux Italia S.p.A.
Corso Lino Zanussi, 30
33080 Porcia (PN) (IT)

(54) **A laundry dryer with a heat pump system and filter**

(57) The present invention relates to a laundry dryer (10) with a heat pump system. The laundry dryer (10) includes a rotatable laundry drum (12). An access opening (14) is arranged in the front side of the laundry dryer (10). The access opening (14) allows an access to the interior of the laundry drum (12). The heat pump system includes an evaporator (18) and a condenser (20). The heat pump system includes an air stream circuit arranged in such a way to allow an air stream (16) to pass the laundry drum (12), the evaporator (18) and the condenser (20). At least one filter element (22, 24) is arranged upstream the evaporator (18). The at least one filter element is arranged at least partially in correspondence of and/or below the access opening, so that it is removable from the laundry dryer from the access opening; the evaporator is arranged at least partially in correspondence of and/or below the access opening, so that it is accessible from the access opening once the at least one filter element has been removed.

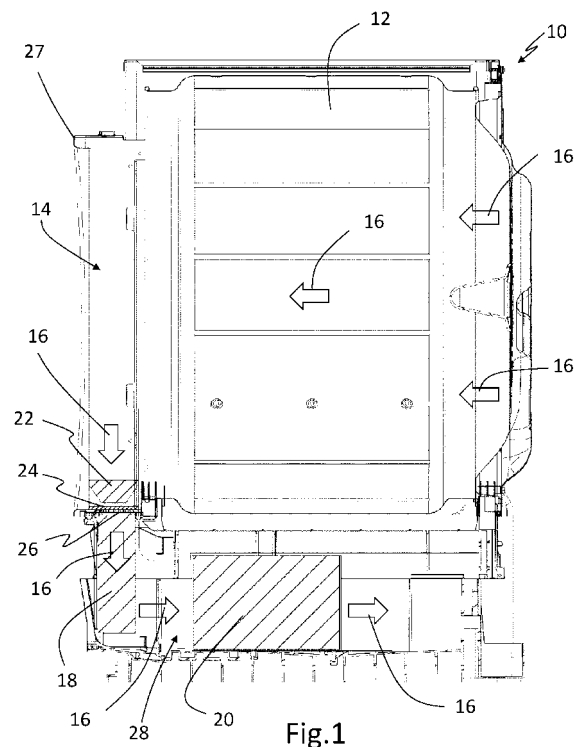


Fig.1

Description

[0001] The present invention relates to a laundry dryer with a heat pump system according to the preamble of claim 1.

[0002] The heat pump system of a laundry dryer includes an air stream circuit. The air stream flowing in said air stream circuit passes a laundry drum, an evaporator and a condenser. The evaporator and the condenser are heat exchangers. Further, one or more filter elements are arranged in the air stream circuit. Mostly, the filter elements are arranged upstream the evaporator.

[0003] The filter elements have to be periodically cleaned. Also the inlet side of the evaporator (i.e. the side from which the air stream enters the evaporator) has to be periodically cleaned, since the filter elements may be not totally perfect, and therefore lint or fluff coming from the laundry may escape from the filter element and may settle on the evaporator. However, the heat exchangers of the heat pump system, and in particular the evaporator, are usually arranged in the bottom of the laundry dryer, so that the cleaning of the evaporator requires a number of steps in order to obtain an access to the inlet sides of the latter.

[0004] EP 2 230 349 A1 discloses a laundry dryer with a heat pump system, wherein the evaporator is arranged in the bottom of the casing.

[0005] JP 2007-330568 A discloses a laundry dryer with a heat pump system, wherein a filter for the evaporator may be accessed from a frontal portion of the casing.

[0006] It is an object of the present invention to provide a laundry dryer with a heat pump system, which allows a simplified access to the inlet side of the evaporator.

[0007] The object of the present invention is achieved by the laundry dryer according to claim 1.

[0008] According to the present invention at least one filter element is arranged at least partially in correspondence of and/or below an access opening present in the casing of the laundry dryer for allowing the access to the internal of the latter, so that the at least one filter element is removable from the laundry dryer from the access opening; moreover the evaporator of the heat pump system is arranged at least partially in correspondence of and/or below the access opening, so that it is accessible from the access opening once the at least one filter element has been removed.

[0009] The core of the present invention is the arrangement of the evaporator and the at least one filter element at least partially in correspondence of and/or below the access opening.

[0010] The geometric properties of the evaporator and the filter element are preferably adapted to a front wall of the laundry dryer.

[0011] The at least one filter element is removable preferably by an upward motion from the laundry dryer, so that the inlet side of the evaporator is accessible from the access opening. The filter element can be cleaned

outside the laundry dryer.

[0012] Preferably, the at least one filter element is removable from the laundry dryer via a lower side of the access opening. The access opening of the laundry dryer and its lower side are easily accessible by the user.

[0013] Preferably, the air stream passes the laundry drum from the rear side to the front side of said laundry drum. Preferably, the condenser is arranged in the bottom of the laundry dryer.

[0014] More preferably the air stream passes the bottom from the front side to the rear side of the laundry dryer.

[0015] Advantageously, the air stream enters the evaporator in a downward direction; preferably the air stream leaves the evaporator in an at least partially rearward direction. It may be that all of a part of the air stream leaves the evaporator in the downward direction. Then, the air stream may pass the condenser in a rearward direction.

[0016] At least one main filter element may be arranged between the access opening and the evaporator. Further, at least one additional filter element may be arranged between the main filter element and the evaporator.

[0017] Moreover, at least one protection grid may be arranged upstream (with respect to the direction of the air stream) the inlet side of the evaporator.

[0018] The novel and inventive features believed to be the characteristic of the present invention are set forth in the appended claims.

[0019] The invention will be described in further detail with reference to the drawings, in which

FIG 1 shows a schematic sectional side view of a laundry dryer with a heat pump system according to a preferred embodiment of the present invention,

FIG 2 shows a schematic perspective view of the laundry dryer with the heat pump system according to the preferred embodiment of the present invention, and

FIG 3 shows a detailed perspective view of an access opening of the laundry dryer with the heat pump system according to the preferred embodiment of the present invention.

[0020] FIG 1 illustrates a schematic sectional side view of a laundry dryer 10 with a heat pump system according to a preferred embodiment of the present invention.

[0021] The laundry dryer 10 includes a casing 27 (only partially represented in the enclosed drawings) containing a rotatable laundry drum 12 (in which the laundry can be loaded) and provided with an access opening 14 for accessing the internal of the drum 12; the access opening 14 may be closed by a door, not illustrated in the enclosed figures, preferably hinged to the casing 27. Advanta-

geously the laundry drum 12 is rotatable around a substantially horizontal axis. Said axis extends from the front side to the rear side of the laundry dryer 10. The access opening 14 is arranged at the front side of the laundry dryer 10.

[0022] The heat pump system includes an air stream circuit formed preferably as a closed loop. The air stream circuit comprises the laundry drum 12, an evaporator 18 and a condenser 20. The arrows 16 in FIG 1 schematically represent the air stream. The air stream 16 flows in the laundry drum 12 from the rear side to the front side of said laundry drum 12, removing moisture from the laundry (not illustrated), contained in said drum 12. Thus, the air stream 16 arrives at the access opening 14. Then, the air stream 16 flows from the access opening 14 downwards to a bottom of the laundry dryer 10, where a channel 28 is provided for the flowing of this air stream 16. Advantageously the condenser 20 is placed inside the channel 28. Inside the channel 28 in the bottom of the dryer, the air stream 16 flows, at least partially, rearwards (i.e. towards the rear of the dryer). At last, the air stream 16 flows upwards in the rear portion of the laundry dryer 10 into the rear side of the laundry drum 12 again.

[0023] Between the access opening 14 and the channel 28 provided in the bottom of the dryer, the air stream 16 advantageously passes a main filter element 22, preferably also an additional filter element 24, preferably also a protection grid 26, and the evaporator 18.

[0024] The following description refs to an embodiment in which the laundry dryer 10 comprises, in addition to the main filter element 22 and the evaporator 18, also the additional filter element 24 and the protection grid 26; however it is clear that also an embodiment in which the additional filter element 24 and the protection grid 26 are not provided is comprised in the invention.

[0025] Advantageously, the air stream 16 passes the main filter element 22, the additional filter element 24 and the protection grid 26 (if provided) in a vertical direction. Advantageously a bigger part of the air stream 16 changes its direction inside the evaporator 18 from vertical to horizontal. A smaller part of the air stream 16 leaves the evaporator 18 in the vertical direction. Alternatively, the air stream 16 changes its direction below the evaporator 18 from vertical to horizontal. The air stream 16 passes the condenser 20 in the bottom of the laundry dryer 10. Advantageously, the main filter element 22, the additional filter element 24 (if provided), the protection grid 26 (if provided) and the evaporator 18 are arranged on top of each other in the lower front portion of the laundry dryer 10. Further, the main filter element 22, the additional filter element 24 (if provided), the protection grid 26 (if provided) are advantageously arranged at least partially in correspondence of a bottom region of the access opening 14, and they extends below the latter, inside the casing 27. Advantageously the evaporator 18 is arranged below the access opening 14.

[0026] The geometric properties of the main filter element 22, the additional filter element 24 (if provided), the

protection grid 26 (if provided) and the evaporator 18 are adapted to a front wall of the laundry dryer 10 below the access opening 14. Thus, the main filter element 22, the additional filter element 24 (if provided) and the protection grid 26 (if provided) can be easily removed from access opening 14 of the laundry dryer 10 by an upward motion. The main filter element 22, the additional filter element 24 (if provided) and the protection grid 26 (if provided) can be cleaned outside the laundry dryer 10. Further, the absence of the main filter element 22, the additional filter element 24 (if provided) and the protection grid 26 (if provided) allows an access to the inlet side of the evaporator 18, so that the latter may be cleaned directly from the access opening 14, for example by using a vacuum cleaner.

[0027] FIG 2 illustrates a schematic perspective view of the laundry dryer 10 with the heat pump system according to the preferred embodiment of the present invention.

[0028] FIG 2 clarifies the arrangement of the evaporator 18 below the access opening 14 of the laundry dryer 10. In FIG 2 the main filter element 22, the additional filter element 24 and the protection grid 26 have been removed advantageously by an upward motion. This allows the access to the inlet side of the evaporator 18 from the access opening 14. The total inlet side of the evaporator 18 can be easily cleaned.

[0029] FIG 3 illustrates a detailed perspective view of the access opening 14 of the laundry dryer 10 with the heat pump system according to the preferred embodiment of the present invention. FIG 3 clarifies that substantially the total inlet side of the evaporator 18 is accessible, when a door (not illustrated) of the access opening 14 has been opened.

[0030] The laundry dryer 10 according to the present invention requires no additional door to the filter elements 22 and 24, the protection grid 26 and the evaporator 18. This reduces the complexity of the laundry dryer 10. The inlet side of the evaporator 18 can be easily directly cleaned for example by a vacuum cleaner, so as to obtain an effective cleaning.

[0031] There is more space in the air stream circuit downstream the condenser 20 improving the flow of the air stream. This allows for example the arrangement of air deflectors in the air stream circuit in order to optimize the flow of the air stream. The efficiency of water condensation is improved, so that possible leakages from a door plinth in the case of a bad seal are eliminated or at least reduced.

Claims

1. A laundry dryer (10) with a heat pump system, wherein:
 - the laundry dryer (10) includes a rotatable laundry drum (12),

- an access opening (14) is arranged in the front side of the laundry dryer (10),
- the access opening (14) allows an access to the interior of the laundry drum (12),
- the heat pump system includes an evaporator (18) and a condenser (20)
- the heat pump system includes an air stream circuit arranged in such a way to allow an air stream (16) to pass the laundry drum (12), the evaporator (18) and the condenser (20), and
- at least one filter element (22, 24) is arranged upstream the evaporator (18),

characterized in that

the at least one filter element (22, 24) is arranged at least partially in correspondence of and/or below the access opening (14), so that it is removable from the laundry dryer (10) from said access opening (14),

and in that

the evaporator (18) is arranged at least partially in correspondence of and/or below the access opening (14), so that it is accessible from the access opening (14) once said at least one filter element (22, 24) has been removed.

2. The laundry dryer according to claim 1,

characterized in that

the at least one filter element (22, 24) is removable from the laundry dryer (10) via a lower side of the access opening (14).

3. The laundry dryer according to any one of the preceding claims,

characterized in that

the air stream (16) passes the laundry drum (12) from the rear side to the front side of said laundry drum (12).

4. The laundry dryer according to any one of the preceding claims,

characterized in that

said condenser (20) is arranged in the bottom of said laundry dryer.

5. The laundry dryer according to any one of the preceding claims,

characterized in that said air stream (16) passes the bottom of the laundry dryer (10) from the front side to the rear side of the laundry dryer (10).

6. The laundry dryer according to any one of the preceding claims,

characterized in that

the air stream (16) enters the evaporator (18) in a downward direction.

7. The laundry dryer according to any one of the preceding claims,

characterized in that

the air stream (16) leaves the evaporator (18) in an at least partially rearward direction.

8. The laundry dryer according to any one of claims 1 to 6,

characterized in that all of a part of the air stream leaves the evaporator (18) in a downward direction.

9. The laundry dryer according to any one of the preceding claims,

characterized in that

the air stream (16) passes the condenser (20) in a rearward direction (10).

10. The laundry dryer according to any one of the preceding claims,

characterized in that

at least one main filter element (22) is arranged between the access opening (14) and the evaporator (18).

11. The laundry dryer according to claim 10,

characterized in that

at least one additional filter element (24) is arranged between the main filter element (22) and the evaporator (18).

12. The laundry dryer according to any one of the preceding claims,

characterized in that

at least one protection grid (26) is arranged upstream the inlet side of the evaporator (18).

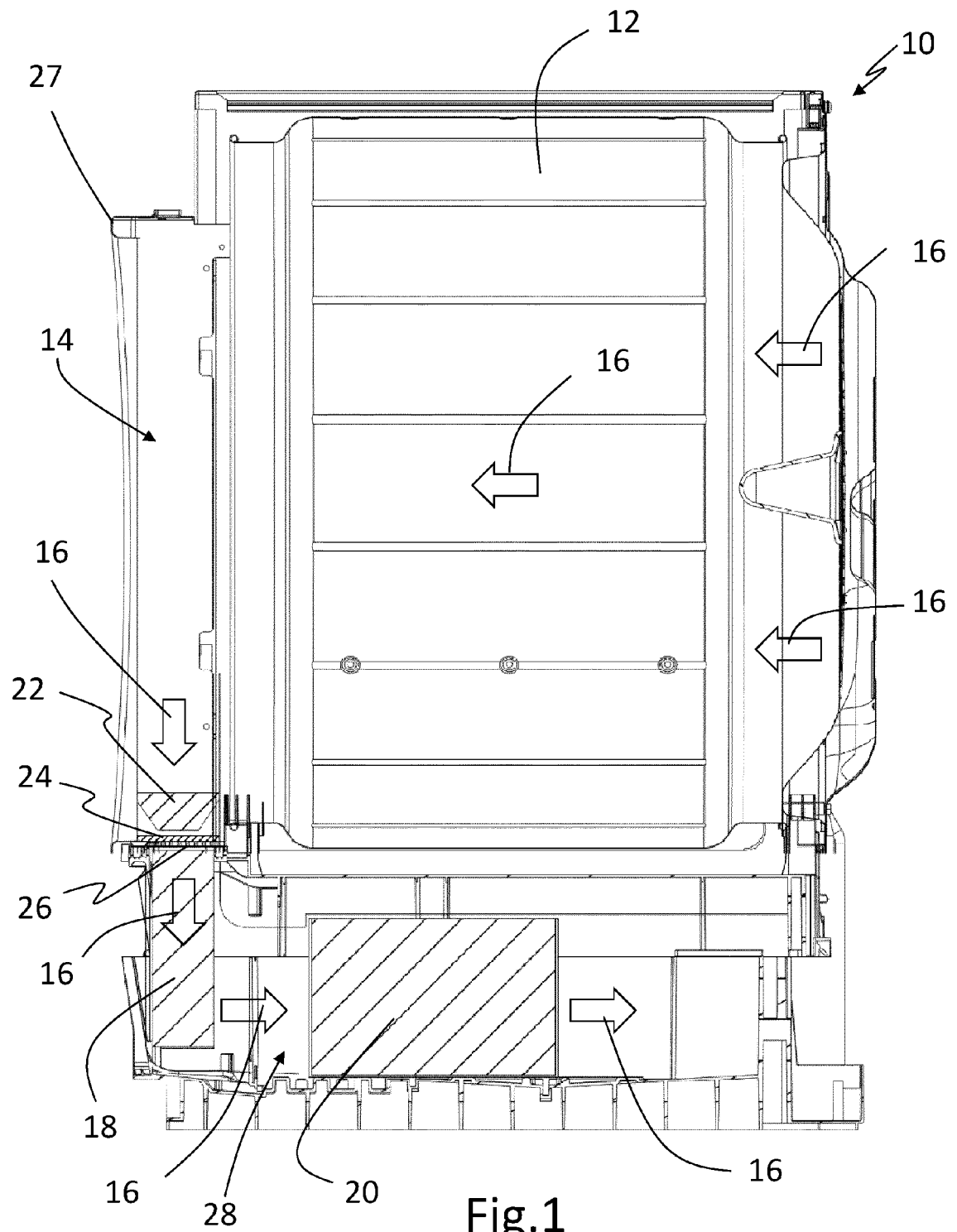
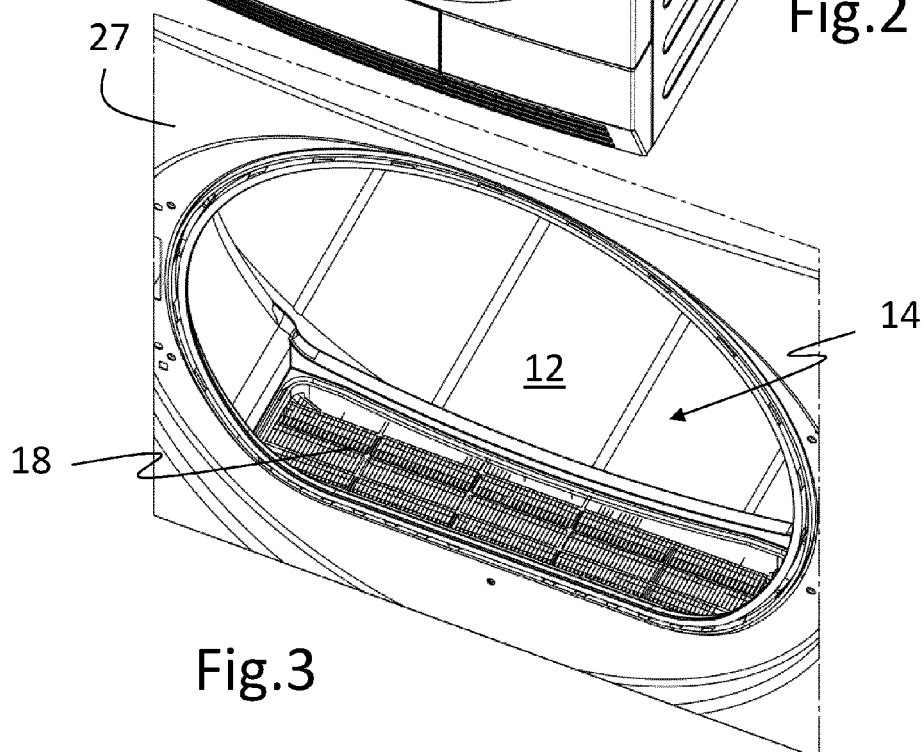
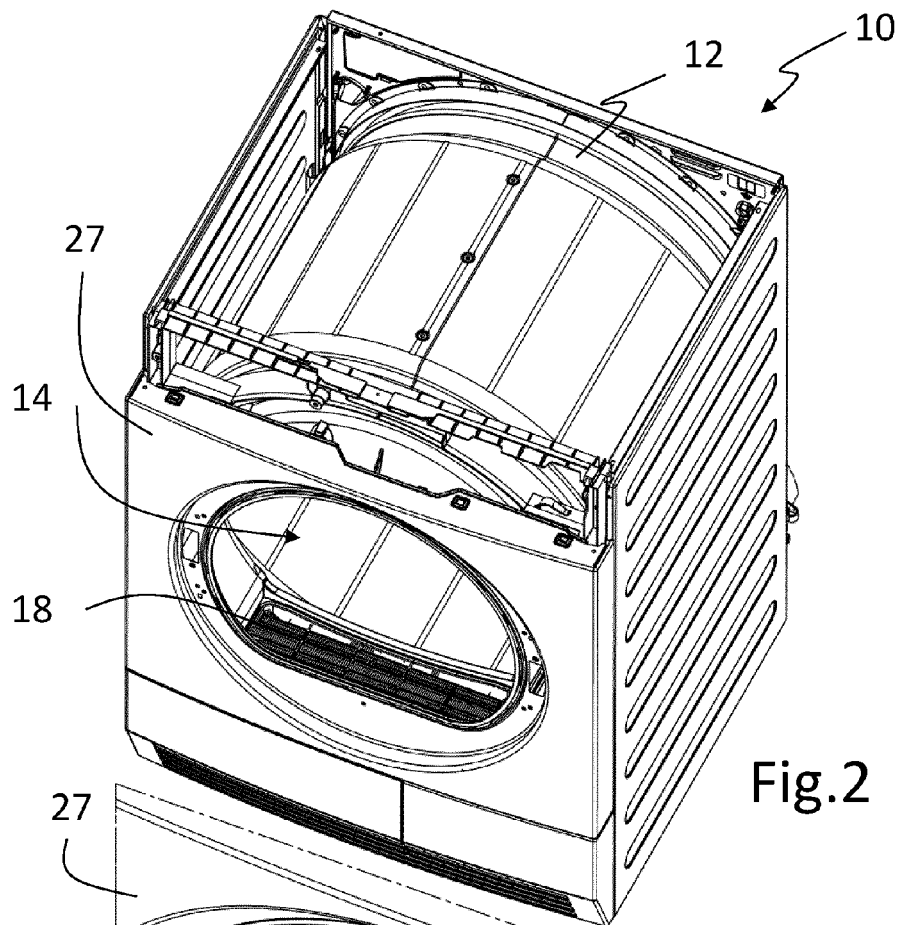


Fig.1





EUROPEAN SEARCH REPORT

Application Number
EP 11 18 4845

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 100 02 742 C1 (WHIRLPOOL CO [US]) 28 June 2001 (2001-06-28) * the whole document *	1-12	INV. D06F58/22 D06F58/20
Y	GB 2 261 060 A (WHIRLPOOL EUROP [NL]) 5 May 1993 (1993-05-05) * the whole document *	1-12	
A	DE 197 05 616 A1 (MIELE & CIE [DE]) 20 August 1998 (1998-08-20) * the whole document *	1-12	
A	DE 44 22 191 A1 (MIELE & CIE [DE]) 19 January 1995 (1995-01-19) * the whole document *	1-12	
A	DE 10 2007 049959 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 23 April 2009 (2009-04-23) * the whole document *	1-12	
A	DE 10 2008 017093 A1 (MIELE & CIE [DE]) 15 October 2009 (2009-10-15) * the whole document *	1-12	TECHNICAL FIELDS SEARCHED (IPC)
A	DE 197 56 708 A1 (MIELE & CIE [DE]) 1 July 1999 (1999-07-01) * the whole document *	1-12	D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 April 2012	Examiner Prosig, Christina
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	

 2
EPO FORM 1503 03.82 (P04C01)

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

EP 11 18 4845

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-04-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10002742	C1	28-06-2001	NONE
GB 2261060	A	05-05-1993	DE 4135845 A1 06-05-1993 GB 2261060 A 05-05-1993
DE 19705616	A1	20-08-1998	NONE
DE 4422191	A1	19-01-1995	NONE
DE 102007049959	A1	23-04-2009	DE 102007049959 A1 23-04-2009 EP 2050862 A1 22-04-2009 US 2009100697 A1 23-04-2009
DE 102008017093	A1	15-10-2009	DE 102008017093 A1 15-10-2009 EP 2107156 A1 07-10-2009
DE 19756708	A1	01-07-1999	NONE

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2230349 A1 [0004]
- JP 2007330568 A [0005]