



- (51) International Patent Classification:
D06F 58/22 (2006.01) *D06F 58/20* (2006.01)
D06F 58/28 (2006.01)
- (21) International Application Number:
PCT/TR2015/050213
- (22) International Filing Date:
30 November 2015 (30.11.2015)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
2014/16222 30 December 2014 (30.12.2014) TR
- (71) Applicant: ARÇELİK ANONİM ŞİRKETİ [TR/TR]; E5
Ankara Asfaltı Üzeri, 34950 Tuzla/İstanbul (TR).
- (72) Inventors: SIR, Gökhan; Arçelik Anonim Şirketi, Patent
Bölümü, E5 Ankara Asfaltı Üzeri, 34950 Tuzla/İstanbul
(TR). HARTOKA, Onur; Arçelik Anonim Şirketi, Patent
Bölümü, E5 Ankara Asfaltı Üzeri, 34950 Tuzla/İstanbul
(TR). TUTKAK, Erman; Arçelik Anonim Şirketi, Patent
Bölümü, E5 Ankara Asfaltı Üzeri, 34950 Tuzla/İstanbul
(TR). AVCI, Saban; Arçelik Anonim Şirketi, Patent
Bölümü, E5 Ankara Asfaltı Üzeri, 34950 Tuzla/İstanbul
(TR). PEHLIVAN, Ümit; Arçelik Anonim Şirketi, Patent
Bölümü, E5 Ankara Asfaltı Üzeri, 34950 Tuzla/İstanbul
(TR).

(74) Agent: ANKARA PATENT BUREAU LIMITED; Be-
stekar Sokak No:10, Kavaklıdere, 06680 Ankara (TR).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

[Continued on next page]

(54) Title: A HEAT PUMP LAUNDRY DRYER

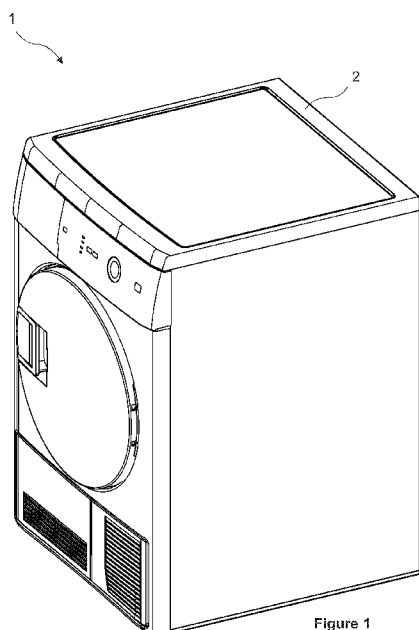


Figure 1

(57) Abstract: The present invention relates to a laundry dryer (1) compris-
ing a body (2), an air channel (3) that is disposed in the body (2), wherein the
process air (PA) that provides drying is circulated, a filter (4) that is disposed
on the air channel (3), whereon the lints that come off the laundry are collec-
ted, a washing means (5) that enables the filter (4) to be cleaned by washing,
at least one heat exchanger (6) that is situated on the air channel (3) and that
dehumidifies or heats the process air (PA), and a compressor (7) that pressur-
izes the refrigerant fluid and provides the circulation thereof through the heat
exchanger (6).



-
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

DESCRIPTION

A HEAT PUMP LAUNDRY DRYER

The present invention relates to a laundry dryer comprising a heat pump that dehumidifies and heats the process air.

5 In laundry dryers, the lints that come off the laundry in the drying process mix with the process air enabling the drying process and adhere on components like the heat exchanger, fan and decrease the drying efficiency. Lint filters are situated on the air channel for collecting the lints. In this situation, the lint filter is clogged in the course of time and the filter has to be cleaned. The lint filter that is not cleaned in time hinders the
10 flow of the process air and since the heated process air cannot pass over the laundry, it cannot be cooled and the temperature rises in the air channel. In this case, the overheated compressor changes into standby mode for protection. The compressor in the standby mode operates again after cooling down and the total duration of the drying process increases since the laundry cannot be dehumidified meanwhile. Embodiments
15 are known, wherein water is passed over the lint filter for cleaning during the drying process. However, in these embodiments, a water wall forms on the filter that hinders the flow of the process air while the filter is washed and washing the filter during the drying process cannot completely solve the above mentioned problem.

In the state of the art International Patent Application No. WO2014102073, a laundry
20 dryer is disclosed, that comprises a variable speed compressor.

In the state of the art International Patent Application No. WO2014102073, a laundry dryer is disclosed, that comprises a compressor, the operating speed of which is changed depending on the temperature.

The aim of the present invention is the realization of a laundry dryer, the drying
25 effectiveness of which is increased.

The laundry dryer realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a control unit that regulates the operational speed of the compressor performing the refrigerant cycle depending on the operation of a washing means that provides the spraying of water onto

the lint filter during the drying process and that decreases the operational speed of the compressor while the washing means operates. The control unit determines the operational speed of the compressor depending on the operation duration of the washing means so that the compressor does not change into standby mode by overheating and
5 when the washing means operates, decreases the operational speed of the compressor. Thus, the compressor is enabled to continue operating without being affected by the water wall formed on the filter while the filter is being washed.

In an embodiment of the present invention, the control unit decreases the operational speed of the compressor just before the washing means sprays water onto the lint filter
10 and operates the compressor in low speed during the operation duration of the washing means. By operating the compressor at lower speeds, when the process air flow rate decreases while the filter is being washed, the compressor is aimed to continue operating without being affected from this situation.

In another embodiment of the present invention, the control unit increases the
15 operational speed of the compressor just after the washing means completes water spraying operation onto the lint filter. By means of this embodiment, the operational speed of the compressor is increased after the water wall on the filter is drained so that the drying duration is not prolonged and the laundry is enabled to be dried faster.

In another embodiment of the present invention, the washing means sprays water onto
20 the lint filter at predetermined intervals during the drying process and the control unit decreases the operational speed of the compressor step by step between two operational stages of the washing means. During the drying process, lints continuously accumulates on the filter. The lints accumulated on the filter affects the flow rate of the process air. When the filter is clean and the flow rate is high, the process air flow rate decreases as
25 lints accumulate on the filter. The control unit operates the compressor in line with the flow rate of the process air by gradually decreasing the operational speed of the compressor between two operational stages of the washing means. Thus, the compressor is prevented from overheating.

In another embodiment of the present invention, just after the washing means completes
30 the operation of sprays water onto the lint filter, the control unit changes the operational

speed of the compressor to the previous operational speed, that is before the washing means sprays water onto the lint filter. By means of this embodiment, the compressor is operated at low speed only when the washing means operates, at other times is operated at high speed and provides the completion of the drying process in a time as short as possible.

In another embodiment of the present invention, the laundry dryer comprises a fan that provides the cooling of the compressor by blowing air thereon and the control unit operates the fan while the washing means sprays water onto the lint filter. The compressor is enabled to be cooled by the fan, thus prevented from changing into the standby mode by overheating. In a version of this embodiment, the control unit increases the operational speed of the fan when the washing means is operated and provides the realization of a more effective cooling.

By means of the present invention, accumulation of lint in the air channel is prevented and the compressor is enabled to operate incessantly during the drying process without changing into the standby mode such that the duration of the drying process is not prolonged. Thus, the drying duration is optimized and the drying efficiency is increased.

The laundry dryer realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 – is the perspective view of a laundry dryer.

Figure 2 – is the sideways schematic view of a laundry dryer.

The elements illustrated in the figures are numbered as follows:

1. Laundry dryer
2. Body
3. Air channel
4. Filter
5. Washing means
6. Heat exchanger
7. Compressor

8. Control unit

9. Fan

The laundry dryer (1) comprises a body (2), an air channel (3) that is disposed in the body (2), wherein the process air (PA) that provides drying is circulated, a filter (4) that
5 is disposed on the air channel (3), whereon the lints that come off the laundry are collected, a washing means (5) that enables the filter (4) to be cleaned by washing, at least one heat exchanger (6) that is situated on the air channel (3) and that dehumidifies or heats the process air (PA), and a compressor (7) that pressurizes the refrigerant fluid and provides the circulation thereof through the heat exchanger (6).

10 In the laundry dryer (1), the lints that come off the laundry are collected on the filter (4). The washing means (5) enables the filter (4) to be cleansed of the lints accumulated thereon by preferably spraying pressurized water onto the filter (4) at certain intervals during the drying process. The compressor (7) pressurizes and delivers the refrigerant fluid to the heat exchanger (6) and the refrigerant fluid that passes through the heat
15 exchanger (6) returns to the compressor (7) by completing its cycle and this cycle is repeated during the drying process.

The laundry dryer (1) of the present invention comprises a control unit (8) that controls the operation of the washing means (5) and enables the rotation speed of the compressor (7) to be decreased while the washing means (5) is operated. The control unit (8)
20 controls when and how long the washing means (5) is operated during the drying process. The control unit (8) decreases the rotation speed of the compressor (7) depending on the operation state of the washing means (5) and prevents the compressor (7) from stopping due to the water wall formed on the filter (7).

In an embodiment of the present invention, the control unit (8) provides that the rotation
25 speed of the compressor (7) is decreased a certain time period predetermined by the producer before the washing means (5) is operated and that the compressor (7) is continued to be operated at low rotation speed during the operation of the washing means (5). By means of this embodiment, the compressor (7) is enabled to operate at low rotation speed while the washing means (5) operates and is prevented from being

affected from increasing temperature when the water wall is formed on the filter (4) and the flow of process air (PA) is paused or the flow rate is decreased.

In another embodiment of the present invention, the control unit (8) changes the rotation speed of the compressor (7) to minimum before the washing means (5) is operated. By means of this embodiment, the compressor (7) is enabled to continue operating without being affected by the above mentioned problems, in other words, without changing to the standby mode by overheating.

In another embodiment of the present invention, the control unit (8) increases the rotation speed of the compressor (7) after the washing means (5) is operated and the filter (4) washing operation is completed, that is after the washing means (5) is deactivated. By means of this embodiment, the compressor (7) is enabled to be operated at high rotation speed so that the drying process is completed in as a time period as short as possible. The rotation speed of the compressor (7) is increased when the filter (4) is cleaned by the washing means (5) and the process air (PA) flow returns to normal.

In another embodiment of the present invention, the control unit (8) changes the rotation speed of the compressor (7) to maximum after the washing means (5) is operated and the filter (4) washing operation is completed, that is after the washing means (5) is deactivated. Thus, when the filter (4) is cleaned and the process air (PA) is enabled to flow at high rate, the compressor (7) is operated at maximum rotation speed and the duration of the drying process is shortened.

In another embodiment of the present invention, the control unit (8) decreases the rotation speed of the compressor (7) gradually between two operation stages of the washing means (5). The producer determines the operation frequency of the washing means (5), that is in what time duration the filter (4) becomes clogged so as to affect the drying process, as a result of experiments conducted and saves the operation frequency of the washing means (5) depending on the weight and type of the laundry loaded in the memory of the control unit (8). The filter (4) is clogged increasingly between two operational stages of the washing means (5) and this situation affects the flow rate of the process air (PA). The control unit (8) prevents overheating of the compressor (7) by gradually decreasing the operation speed of the compressor (7) proportionally to the

decrease in the flow rate of the process air (PA) between two operational stages of the washing means (5).

In another embodiment of the present invention, after the washing means (5) is deactivated, the control unit (8) changes the rotation speed of the compressor (7) to its
5 previous rotation speed before the washing means (5) was operated. In this embodiment, the compressor (7) is changed to its previous rotation speed when the process air (PA) flow rate changes to normal so that the total drying duration is not prolonged.

In another embodiment of the present invention, the laundry dryer (1) comprises a fan (9) which provides the cooling of the compressor (7) and the control unit (8) operates
10 the fan (9) while the washing means (5) is operated. By means of this embodiment, the compressor (7) is prevented from being affected from the increasing temperature while the washing means (5) operates.

In another embodiment of the present invention, the control unit (8) enables the rotation speed of the fan (9) to be increased while the washing means (5) is operated. Thus, the
15 compressor (7) is enabled to be cooled more effectively.

In the laundry dryer (1) of the present invention, the compressor (7) is enabled to operate during the drying process such that dehumidifying of the laundry is not hindered by determining the rotation speed of the compressor (7) in accommodation with the washing means (5). By means of the present invention, the drying process duration is
20 optimized.

CLAIMS

- 1- A laundry dryer (1) comprising a body (2), an air channel (3) that is disposed in the body (2), wherein the process air (PA) that provides drying is circulated, a filter (4) that is disposed on the air channel (3), whereon the lints that come off the laundry
5 are collected, a washing means (5) that enables the filter (4) to be cleaned by washing, at least one heat exchanger (6) that is situated on the air channel (3) and that dehumidifies or heats the process air (PA), and a compressor (7) that pressurizes the refrigerant fluid and provides the circulation thereof through the heat exchanger (6), **characterized by** a control unit (8) that enables the rotation speed of the
10 compressor (7) to be decreased while the washing means (5) is operated.
- 2- A laundry dryer (1) as in Claim 1, **characterized by** the control unit (8) that enables the rotation speed of the compressor (7) to be decreased a certain time period before the washing means (5) is operated and the compressor (7) to continue operating at low rotation speed during the operation of the washing means (5).
- 15 3- A laundry dryer (1) as in any one of the above claims, **characterized by** the control unit (8) that increases the rotation speed of the compressor (7) after the washing means (5) is operated and the filter (4) washing operation is completed.
- 4- A laundry dryer (1) as in any one of the above claims, **characterized by** the control unit (8) that gradually decreases the rotation speed of the compressor (7) between
20 two operational stages of the washing means (5).
- 5- A laundry dryer (1) as in any one of the above claims, **characterized by** the control unit (8) that changes the rotational speed of the compressor (7) to the previous rotational speed before the washing means (5) was operated after the washing means (5) is deactivated.
- 25 6- A laundry dryer (1) as in any one of the above claims, **characterized by** a fan (9) which provides the cooling of the compressor (7) and the control unit (8) that operates the fan (9) while the washing means (5) is operated.
- 7- A laundry dryer as in Claim 6, **characterized by** the control unit (8) that enables the rotation speed of the fan (9) to be increased while the washing means (5) is operated.

Figure 1

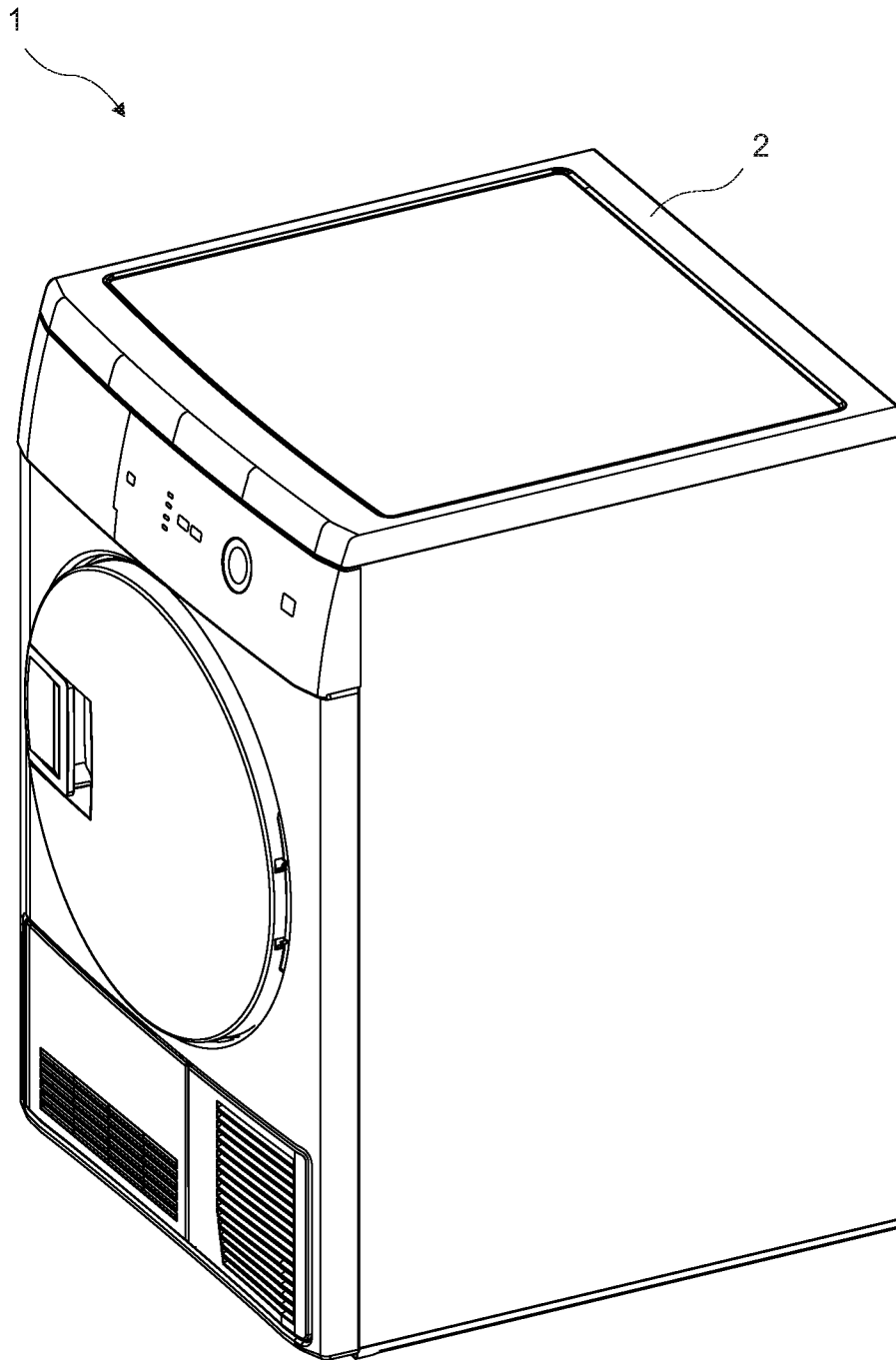
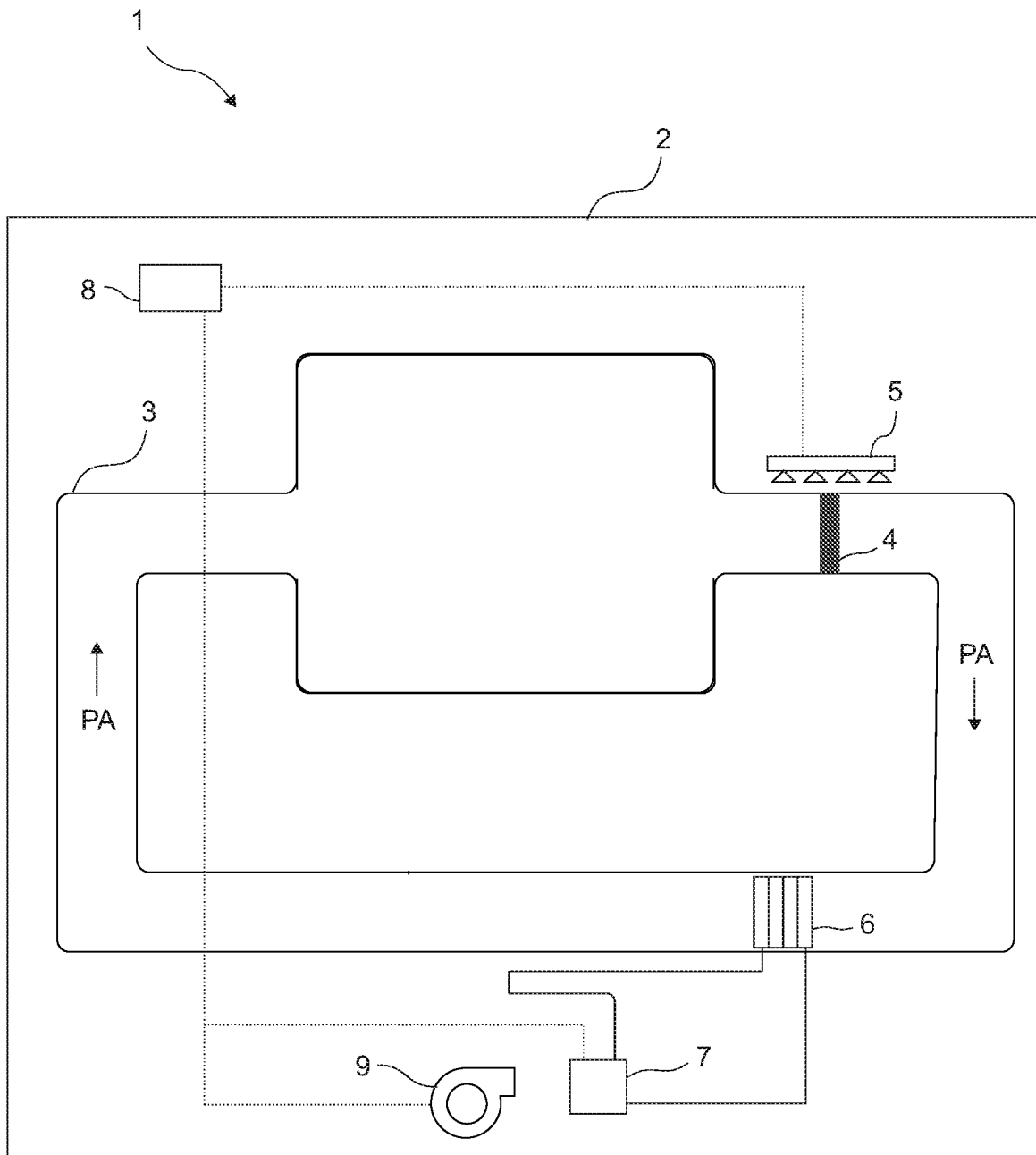


Figure 2



INTERNATIONAL SEARCH REPORT

International application No

PCT/TR2015/050213

A. CLASSIFICATION OF SUBJECT MATTER

INV. D06F58/22 D06F58/28 D06F58/20
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 2 455 526 A1 (BSH BOSCH SIEMENS HAUSGERAETE [DE]) 23 May 2012 (2012-05-23) paragraphs [0015], [0041], [0043], [0044]; figures 2,3,4 -----	1-7
Y	US 2013/340797 A1 (BOEMMELS RALF [DE] ET AL) 26 December 2013 (2013-12-26) paragraph [0021]; figure 1 -----	1-7
Y	JP 2013 202159 A (PANASONIC CORP) 7 October 2013 (2013-10-07) figure 1 -----	1-7
A	EP 2 789 728 A1 (ELECTROLUX APPLIANCES AB [SE]) 15 October 2014 (2014-10-15) paragraph [0006] ----- -/--	1,6



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

3 May 2016

Date of mailing of the international search report

11/05/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Kising, Axel

INTERNATIONAL SEARCH REPORT

International application No

PCT/TR2015/050213

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013 081638 A (PANASONIC CORP) 9 May 2013 (2013-05-09) abstract; figures 1,4 -----	1,4
A	WO 2009/015919 A1 (IMAT S P A [IT]; DRIUSSI DIEGO [IT]) 5 February 2009 (2009-02-05) abstract; figure 1 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/TR2015/050213

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 2455526	A1	23-05-2012	CN 103221604 A	24-07-2013
			EP 2455526 A1	23-05-2012
			EP 2640885 A1	25-09-2013
			WO 2012065916 A1	24-05-2012

US 2013340797	A1	26-12-2013	US 2013340797 A1	26-12-2013
			WO 2014001950 A1	03-01-2014

JP 2013202159	A	07-10-2013	NONE	

EP 2789728	A1	15-10-2014	AU 2014253302 A1	22-10-2015
			CN 105102710 A	25-11-2015
			EP 2789728 A1	15-10-2014
			US 2016040349 A1	11-02-2016
			WO 2014166848 A1	16-10-2014

JP 2013081638	A	09-05-2013	NONE	

WO 2009015919	A1	05-02-2009	AT 504688 T	15-04-2011
			EP 2171151 A1	07-04-2010
			WO 2009015919 A1	05-02-2009
