(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 955 264 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.12.2015 Bulletin 2015/51

(51) Int Cl.:
D06F 58/02 *(2006.01)* ***D06F 58/24*** *(2006.01)*
D06F 25/00 *(2006.01)*

(21) Application number: **15169519.4**

(22) Date of filing: **28.05.2015**

(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
Designated Validation States:
MA

(30) Priority: **10.06.2014 CN 201410256573**

(71) Applicant: **BSH Hausgeräte GmbH**
81739 München (DE)

(72) Inventors:
- **Lu, Fei**
  Nanjing city
  Jiangsu 210000 (CN)
- **Pang, Wenfeng**
  Jiangsu 210046 (CN)
- **Wang, Yongjia**
  Jiangsu 210000 (CN)
- **Ziegler, Jörg**
  81739 München (DE)

(54) CLOTHES DRYER

(57) Disclosed is a clothes dryer 1, comprising a barrel 6 forming a drying space so as to make clothes dried therein, and a condensing channel 7 formed on the barrel and having a common wall 61 with the barrel 6. The condensing channel 7 has a first pathway 16 and a second pathway 17 not in communication with each other, wherein the first pathway 16 is in communication with a space in the barrel 6, and a cooling medium 15 can pass through the second pathway 17. As the cooling medium 15 passes through the second pathway 17 not in communication with the first pathway 16, the cooling medium 15 in the second pathway 17 can be selected freely, which may be air, a liquid or other coolant. Moreover, as the second pathway 17 is not in communication with the first pathway 16, the cooling medium 15 in the second pathway 17 may not carry clothes fluff or other contaminants existing in the first pathway 16and thus can be recycled.

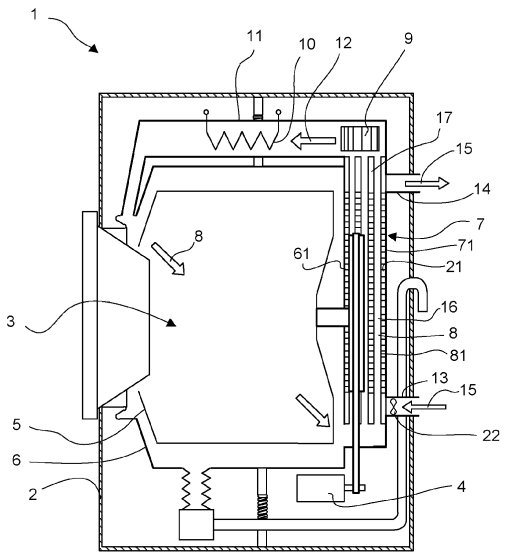

FIG. 1

EP 2 955 264 A1

Description

[0001] The present invention relates to a clothes dryer, and in particular to a condensing device of a clothes dryer.

[0002] A clothes dryer generally has a cabinet and a barrel located in the cabinet to accommodate dried clothes, and also has a condensing system connected with the barrel. It can be known according to experiments that, when the volume of the barrel that accommodates the clothes is greater, wrinkle of the dried clothes are fewer, and at the same time, the drying capacity is apparently larger. Thus, obtaining an in-barrel space as large as possible in a limited cabinet space becomes an inevitable objective of technological development in the field of clothes dryers.

[0003] German Patent Application DE 1 808 534 A1 discloses a clothes dryer that combines a condensing device with an outer barrel. The condensing device and the outer barrel are combined into one piece, they are more structurally compact, thereby saving the space, and therefore, compared with a structure where they are separated, the clothes dryer can have a larger barrel space. However, as the clothes dryer uses a traditional water-cooling manner for condensation, water should be supplied for the condensing device for a long time from an intake pipe extending into a condensing channel during the whole drying period to cool humid-hot process air, and a large amount of water needs to be consumed during the period, which is unfavorable for the environment. Moreover, as the cooling water will carry fluff in the process air, it is more difficult to recycle the water.

[0004] One objective of the present invention is to provide a water-saving, compact and high-drying-efficiency clothes dryer.

[0005] With respect to the objective, the technical solution adopted in the present invention is a clothes dryer as defined in the independent claim attached. Improved embodiments of the invention are defined in dependent claims, the subsequent description and the attached drawing.

[0006] According to the invention, therefore, there is provided a clothes dryer, including a barrel forming a drying space so as to make clothes dried therein, and a condensing channel formed on the barrel and having a common wall with the barrel, wherein the condensing channel has a first pathway and a second pathway not in communication with each other, where the first pathway is in communication with a space in the barrel, and a cooling medium can pass through the second pathway.

[0007] The term "clothes dryer" may refer to various machines having a clothes drying function, for example, the clothes dryer may be a machine purely drying clothes or a machine having both clothes washing and clothes drying functions.

[0008] It is well-known that the clothes dryer generally includes a rotatable inner barrel directly containing clothes and an outer barrel installed outside the inner barrel, and the barrel refers to the outer barrel.

[0009] The barrel and the condensing channel are partitioned through the common wall. The common wall may be a part of the whole barrel, or may be an independent member connected to the barrel.

[0010] That the first pathway and the second pathway are not in communication with each other may be understood as that they are partitioned spatially.

[0011] The first pathway is in communication with a space in the barrel, and thus humid-hot process air from the barrel carrying a large amount of moisture can pass through the first pathway to exchange heat with the cooling medium in the second pathway. The moisture in the process air cooled is re-condensed and separated from the air.

[0012] Compared with the prior art, as the cooling medium passes through the second pathway not in communication with the first pathway, the cooling medium in the second pathway can be selected freely, which may be air, a liquid or other coolant. Moreover, as the second pathway is not in communication with the first pathway, the cooling medium in the second pathway may not carry clothes fluff or other contaminants existing in the first pathway and thus can be recycled; alternatively, if water is used as the cooling medium, the water can be stored and then directly taken as washing or rinsing water. Thus, the present invention achieves the technical effect of saving water, and has a compact structure.

[0013] As one preferred improved solution, the first pathway and the second pathway are disposed adjacent to each other, and are partitioned through a partition wall which transfers heat.

[0014] As one possible improved solution of the present invention, the first pathway and the second pathway have substantially the same extending direction. In more detail, at least one part of the second pathway extends along with the first pathway. Through such a structure, the first pathway and the second pathway have a longer heat exchange path, the heat exchange is more thorough, and thus the heat exchange efficiency is higher.

[0015] More preferably, the second pathway is disposed around the first pathway.

[0016] As a further improvement to the present invention, the cooling medium is air. That the air is used as the cooling medium is more economic and environmentally friendly.

[0017] As a further improvement to the present invention, two ends of the second pathway are respectively connected with an inlet pathway and an outlet pathway, and a first fan that causes ambient air to enter into the second pathway from the inlet pathway to participate in heat exchange and to be exhausted from the outlet pathway is disposed in the inlet pathway or the outlet pathway.

[0018] As a further improvement to the present invention, the first pathway is in communication with a heating pathway provided with a heating device, and the process air can circulate in the barrel, the first pathway and the

heating pathway under the action of a second fan.

[0019] As a further improvement to the present invention, the second pathway is provided with a heat exchange member, and the heat exchange member is in heat-conductive contact with a wall of the first pathway. More possibly, the heat exchange member is a solid member. More suitably, the heat exchange member is made of a metal material. Herein, the heat exchange member mainly plays a role of transferring heat. Heat from the process air in the barrel is conducted to the wall of the first pathway. The heat is then transferred to the heat exchange member through the wall of the first pathway. The heat exchange member transfers the heat to the cooling medium in the second pathway finally. The heat exchange member participates in the heat exchange, the heat exchange area increases, and thus heat exchange efficiency can be significantly improved.

[0020] As a further improvement to the present invention, the heat exchange member is a metallic fin. The metallic fin has higher thermal conductivity, and the heat exchange area is greater.

[0021] As a further improvement to the present invention, the condensing channel is formed by a part of a barrel wall and a lid installed to the part of the barrel wall. Such a structure makes assembly in the production process relatively simple, and has lower requirements for the injection molding process of the barrel per se.

[0022] As a further improvement to the present invention, the condensing channel is formed on a rear-end wall of the barrel. That the condensing channel is formed on a rear-end wall of the barrel has the advantage of using the position of a stiffener on the rear-end wall of the barrel, and thus the thickness of the clothes dryer may not be additionally increased basically. As another feasible implementation, the condensing channel may also be formed on a sidewall of the barrel, so as to have a freer position and space, and a longer and wider heat exchange path can be designed.

[0023] The present invention may further be implemented as follows: the first pathway is formed in at least one pipeline in the condensing channel, and the second pathway is formed in a space between the lid and the barrel wall excepting the pipeline. Such design causes the process air passing through the first pathway to be surrounded by the cooling medium in the second pathway in the condensing channel, at the same time, the cooling medium is further in contact with the common wall of the condensing channel and the barrel and can further cool the air in the barrel, and thus such a structure feature has better condensing effects, so as to improve the drying efficiency. This is a better implementation, but the present invention does not exclude the implementation that the second pathway is formed in at least one pipeline in the condensing channel, and the first pathway is formed in a space between the lid and the barrel wall excepting the pipeline. The implementation also has the technical effects of being compact and saving water resources.

[0024] As a further improvement to the present invention, the second pathway and the space in the barrel are partitioned through the common wall, and the common wall is thermal conductive. In this way, the cooling medium in the second pathway can exchange heat with the process air in the barrel through the common wall, to condense moisture in the process air. As the common wall also participates in the heat exchange, the heat exchange area further increases, and the drying efficiency can be improved.

[0025] As a further improvement to the present invention, the second pathway includes a first part extending along with the pipeline and a second part individually extending along a circumferential direction of the barrel wall. Limited by positions of a fan, a heater and the like, the path forming the pipeline of the first pathway is often restricted. For example, the fan, the heater and the like are generally located at the top of the barrel, and thus the pipeline is generally designed as extending from the position of an air outlet at the bottom of the barrel to the position of the fan at the top of the barrel along one side in a circumferential direction. In this way, the other side is not utilized. Through the technical solution, the second part of the second pathway can extend to the other side, and the cooling medium in the second pathway exchanges heat with the humid-hot process air in the barrel through the barrel wall, so as to further enhance the heat exchange efficiency.

[0026] As a further improvement to the present invention, the second pathway extends along a circumferential edge of the rear-end wall of the barrel, and an extending range thereof exceeds half of the circumference of the rear-end wall of the barrel. Half of the circumference can be interpreted as that the extending range of the second pathway exceeds 180 degrees centered on a rotation shaft of the barrel. Generally, when the second pathway has a greater extending range, the efficiency of heat exchange that the second pathway conducts with the air in the barrel through the barrel wall is higher, and the drying efficiency is higher.

[0027] The improved and preferred embodiments of the present invention are further described below with reference to the figures of the accompanying drawing. The present disclosure will become more fully understood from the detailed description given hereinbelow for illustration only and thus not limitative of the total disclosure herein. In the drawing:

FIG. 1 is a schematic view of a clothes dryer;

FIG. 2 is a planar view of an outer barrel and accessories thereof looked from back to front;

FIG. 3 is a sectional view a rear barrel of the outer barrel in FIG. 2 along an A-A direction; and

FIG. 4 is an exploded view of a rear barrel of a washing barrel and a condensing channel formed in com-

bination therewith, wherein the metallic fins in FIG. 1 and FIG. 3 are not shown.

[0028] As shown in FIG. 1, a clothes dryer 1 has a laundry processing barrel assembly 3 located in a cabinet 2, which includes an inner barrel 5 that can rotate under the driving of a motor 4 and an outer barrel 6 sheathed outside the inner barrel 5. A condensing channel 7 is formed on a rear-end wall 61 of the outer barrel 6. The condensing channel 7 and the outer barrel 6 share the rear-end wall 61, that is, the rear-end wall 61 of the outer barrel constitutes a part of a wall 71 of the condensing channel 7. The condensing channel 7 contains a plurality of pipelines 8 extending in parallel which are in communication with a space inside the outer barrel 6. The other end of each one of the pipelines 8 is connected with a hot air pipeline 11 provided with a process fan 9 and an air heater 10. The downstream of the hot air pipeline 11 is further connected with the outer barrel 6. Thus, a process air circulation path is formed in the outer barrel 6, the pipeline 8 and the hot air channel 11. Under the action of the process fan 9, the process air 12 enters into the outer barrel 6 after being heated by the air heater 10, and then enters into the inner barrel 5 in communication with the space of the outer barrel 6 to exchange heat with wet clothes, to take away moisture in the clothes. The humid-hot process air 12 carrying the moisture enters into the pipelines 8 in the condensing channel 7, and therein, the moisture in the process air 12 is condensed, and is separated from the process air 12 for treatment. Afterwards, the process air 12 relatively dry re-enters into the hot air channel 11, and proceeds to next circulation after being heated by the air heater 10.

[0029] The condensing channel 7, except the pipelines 8 for allowing the process air 12 to pass through therein, further has some spaces. The remaining spaces are connected with an inlet pathway 13 and an outlet pathway 14. The inlet pathway 13 is provided with a cooling fan 22, to cause cooling air 15 with a relatively low temperature in a surrounding environment to enter into a space of the condensing channel 7 surrounding the pipeline 8 from the inlet pathway 13 and to be exhausted out of the clothes dryer 1 from the outlet pathway 14. Thus, a first pathway 16 passing through the process air 12 and located in the pipeline 8 and a second pathway 17 located between the wall 71 of the condensing channel 7 and the pipeline 8 and allowing the cooling air 15 to pass through are formed in the condensing channel 7. The first pathway 16 is in an environment surrounded by the second pathway 17. Then, the process air 12 passing through the first pathway 16 exchanges heat with the cooling air 15 in the second pathway 17 through a wall 81 of the pipeline 8, to cause the moisture in the process air 12 to be condensed.

[0030] The structures of the outer barrel 6 and the condensing channel 7 can be understood in more detail from FIG. 2 to FIG. 4.

[0031] As shown in FIG. 2 to FIG. 4, the condensing channel 7 is formed on a rear-end wall 61 of the outer barrel 6, and is formed by a part of the rear-end wall 61 of the outer barrel 6 and a lid 18 installed to the part. The pipelines 8 that allow the process air 12 to pass through are located in the condensing channel 7, and are connected between an air inlet 19 and the process fan 9.

[0032] The condensing channel 7 covered by the lid 18 circumferentially extends along an edge of the rear-end wall 61 of the outer barrel, and an extending range thereof exceeds half of the circumference of the rear-end wall 61 of the barrel and approximates three fourths of the circumference. That is, the extending range of the condensing channel 7 exceeds 180 degrees centered on a rotation shaft 20 of the barrel, and approximates 270 degrees. As the path of the second pathway 17 is near the extending space of the whole condensing channel 7, the second pathway 17 circumferentially extends along an edge of the rear-end wall 61 of the outer barrel, and an extending range thereof exceeds half of the circumference of the rear-end wall 61 of the barrel and approximates three fourths of the circumference. The second pathway 17 includes a first part 171 extending along with the pipelines 8 and a second part 172 individually extending along a circumferential direction of the wall 61 of the outer barrel. The rear-end wall 61 of the outer barrel has thermal conductivity. Then, the cooling air 15 in the second pathway 17, in addition to exchanging heat with the process air 12 in the first pathway 16, can further exchange heat with the process air 12 in the outer barrel 6 through the rear-end wall 61, to enhance the heat exchange efficiency. The longer extending path of the second pathway 17 also makes its heat exchange function better played.

[0033] Further, the second pathway 17 is provided with a metallic fin 21, which is in heat-conductive contact with a wall 81 of the first pathway 16. Then, Heat from the process air 12 in the outer barrel 6 is conducted to the wall 81 of the first pathway. The heat is then transferred to the metallic fin 21 through the wall 82 of the first pathway. The metallic fin 21 transfers the heat to the cooling air 15 in the second pathway 17 finally. The metallic fin 21 may also be replaced with other suitable heat exchange members.

[0034] Various specific implementations described above and illustrated in the figures are merely used for describing improved features of the present invention, but are not all of the present invention. Any form of variations made to the present invention by those of ordinary skill in the art within the basic technical thought of the present invention should fall within the protection scope of the present invention.

Claims

1. A clothes dryer (1), comprising a barrel (6) forming a drying space so as to make clothes dried therein, and a condensing channel (7) formed on the barrel

and having a common wall (61) with the barrel (6), **characterized in that** the condensing channel (7) has a first pathway (16) and a second pathway (17) not in communication with each other, wherein the first pathway (16) is in communication with a space in the barrel (6), and a cooling medium (15) can pass through the second pathway (17).

2. The clothes dryer (1) according to claim 1, **characterized in that** the first pathway (16) and the second pathway (17) are disposed adjacent to each other, and are partitioned through a partition wall (81) which transfers heat.

3. The clothes dryer (1) according to claim 2, **characterized in that** the first pathway (16) and the second pathway (17) have substantially the same extending direction.

4. The clothes dryer (1) according to one of claims 2 and 3, **characterized in that** the second pathway (17) is disposed around the first pathway (16).

5. The clothes dryer (1) according to one of the preceding claims, **characterized in that** the cooling medium (15) is air.

6. The clothes dryer (1) according to claim 5, **characterized in that** two ends of the second pathway (17) are respectively connected with an inlet pathway (13) and an outlet pathway (14), and a first fan (22) that causes ambient air to enter into the second pathway (17) from the inlet pathway (13) to participate in heat exchange and to be exhausted from the outlet pathway (14) is disposed in the inlet pathway (13) or the outlet pathway (14).

7. The clothes dryer (1) according to one of the preceding claims, **characterized in that** the first pathway (16) is in communication with a heating pathway (11) provided with a heating device (10), and process air (12) can circulate in the barrel (6), the first pathway (16) and the heating pathway (11) under the action of a second fan (9).

8. The clothes dryer (1) according to one of the preceding claims, **characterized in that** the second pathway (17) is provided with a heat exchange member (21), and the heat exchange member (21) is in heat-conductive contact with a wall (81) of the first pathway (16).

9. The clothes dryer (1) according to claim 8, **characterized in that** the heat exchange member (21) is a metallic fin.

10. The clothes dryer (1) according to one of the preceding claims, **characterized in that** the condensing channel (7) is formed by a part (61) of a barrel wall and a lid (18) installed to the part of the barrel wall.

11. The clothes dryer (1) according to claim 10, **characterized in that** the condensing channel (7) is formed on a rear-end wall (61) of the barrel (6).

12. The clothes dryer (1) according to one of claims 10 and 11, **characterized in that** the first pathway (16) is formed in at least one pipeline (8) in the condensing channel (7), and the second pathway (17) is formed in a space between the lid (18) and the barrel wall (61) excepting the pipeline (8).

13. The clothes dryer (1) according to claim 12, **characterized in that** the second pathway (17) and the space in the barrel (6) are partitioned through the common wall (61), and the common wall (61) is thermally conductive.

14. The clothes dryer (1) according to claim 13, **characterized in that** the second pathway (17) comprises a first part (171) extending along with the pipeline (8) and a second part (172) individually extending along a circumferential direction of the barrel wall (61).

15. The clothes dryer (1) according to claim 14, **characterized in that** the second pathway (17) extends along a circumferential edge of the rear-end wall (61) of the barrel, and an extending range thereof exceeds half of the circumference of the rear-end wall (61) of the barrel.

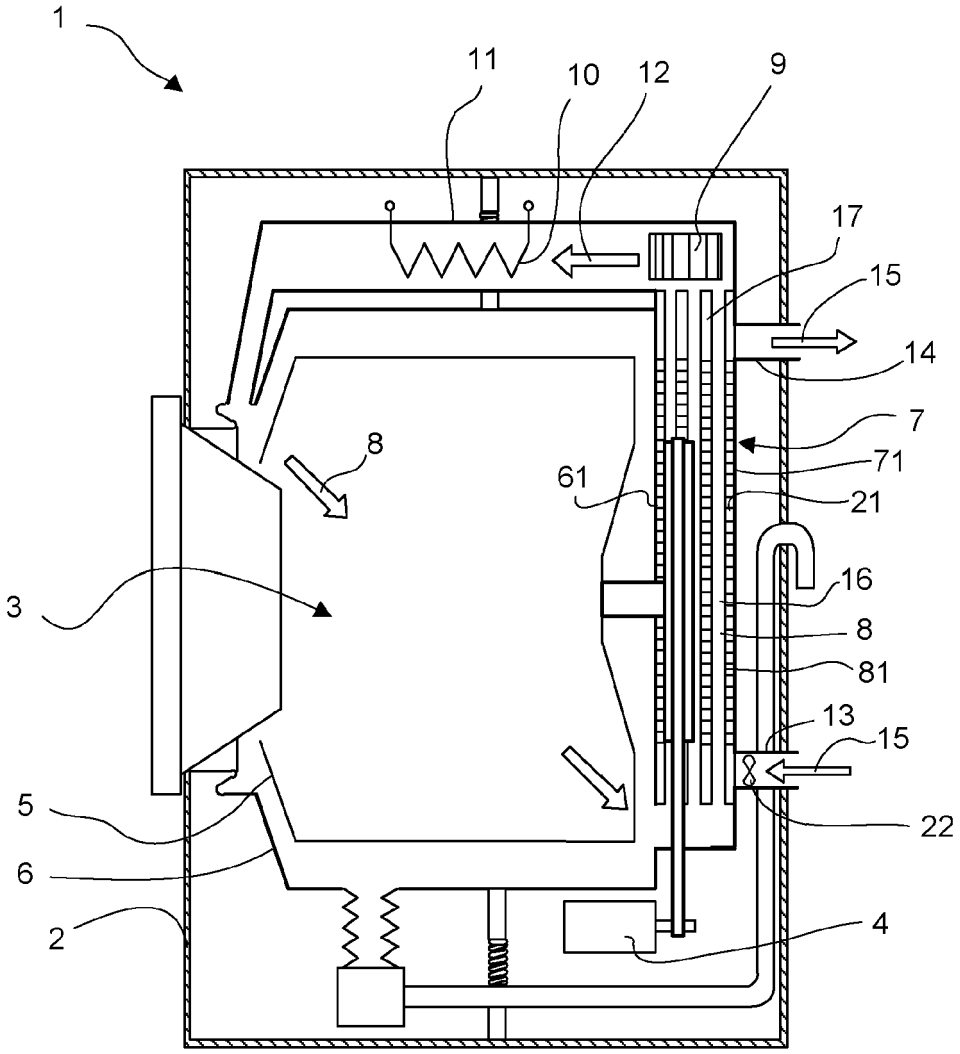

FIG. 1

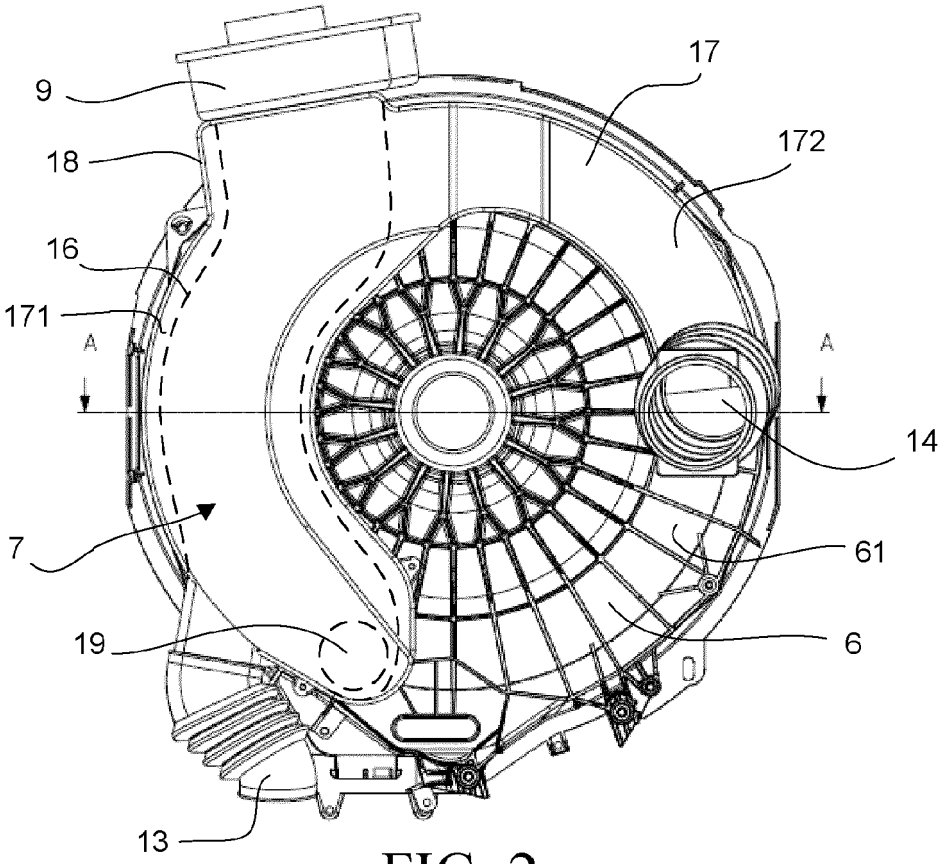

FIG. 2

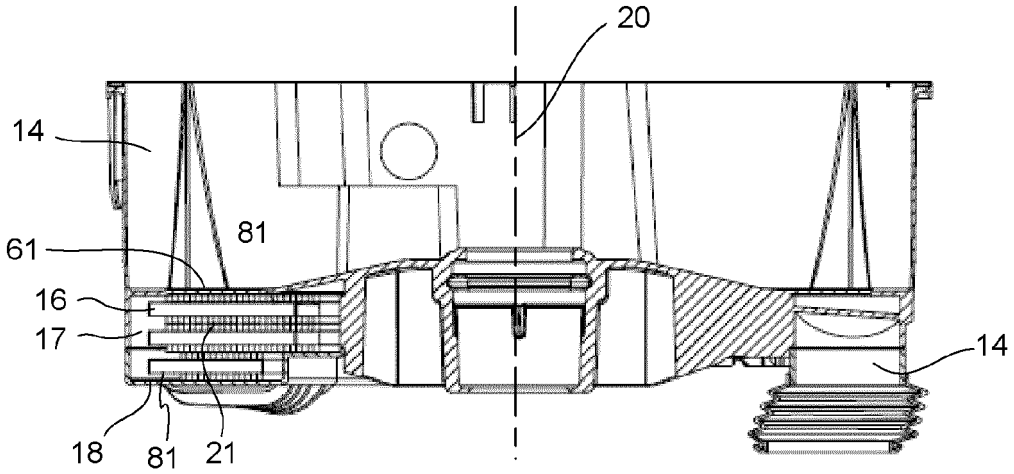

FIG. 3

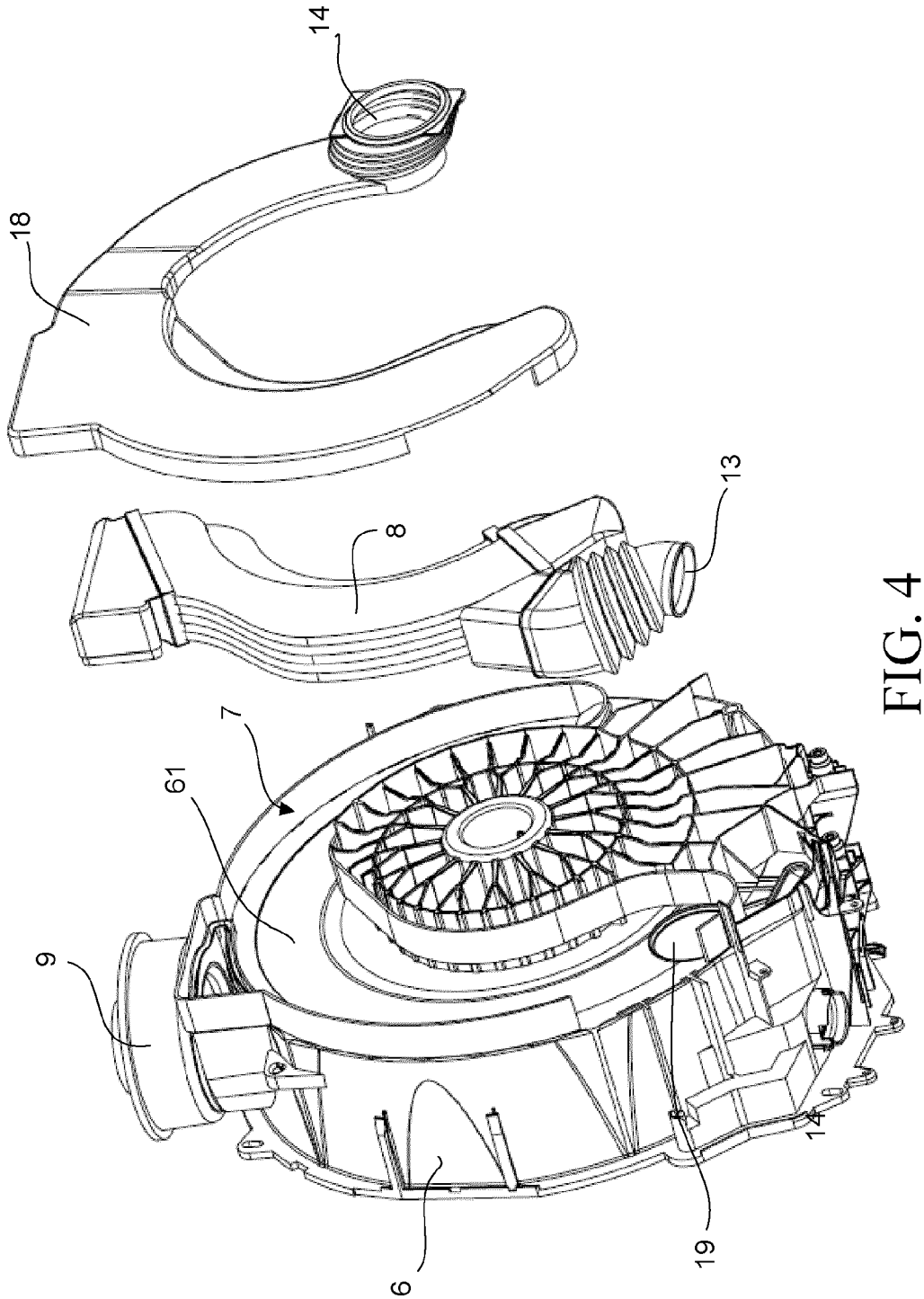

FIG. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 16 9519

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 A	EP 2 019 160 A1 (CANDY SPA [IT]) 28 January 2009 (2009-01-28) * paragraphs [0013], [0014], [0017], [0026] - [0029]; figures 1, 3, 4 *	1-3,7, 10,11 4-6,8,9, 12-15	INV. D06F58/02 D06F58/24 D06F25/00
X A	JP 2007 135728 A (HITACHI APPLIANCES INC) 7 June 2007 (2007-06-07) * paragraphs [0088], [0091] - [0093]; figures 6a, 6b *	1-3,7, 10,11 4-6,8,9, 12-15	
A	US 2 752 694 A (MCCORMICK FRANCIS H) 3 July 1956 (1956-07-03) * column 3, lines 61-75; figures 2, 6 * * column 4, line 64 - column 5, line 4 * * column 5, lines 61-70 *	4-6,8,12	
A,D	DE 18 08 534 A1 (SIEMENS ELEKTROGENAETE GMBH) 11 June 1970 (1970-06-11) * page 5, lines 9-27; figures 1,3,5,7 *	15	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 August 2015	Kirner, Katharina

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 15 16 9519

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.

19-08-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2019160 A1	28-01-2009	NONE	
JP 2007135728 A	07-06-2007	CN 1966806 A	23-05-2007
		JP 2007135728 A	07-06-2007
US 2752694 A	03-07-1956	NONE	
DE 1808534 A1	11-06-1970	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

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

- DE 1808534 A1 **[0003]**