



- (51) International Patent Classification:
D06F 37/22 (2006.01)
- (21) International Application Number:
PCT/EP2015/054297
- (22) International Filing Date:
2 March 2015 (02.03.2015)
- (25) Filing Language: English
- (26) Publication Language: English
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34950 Istanbul (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,

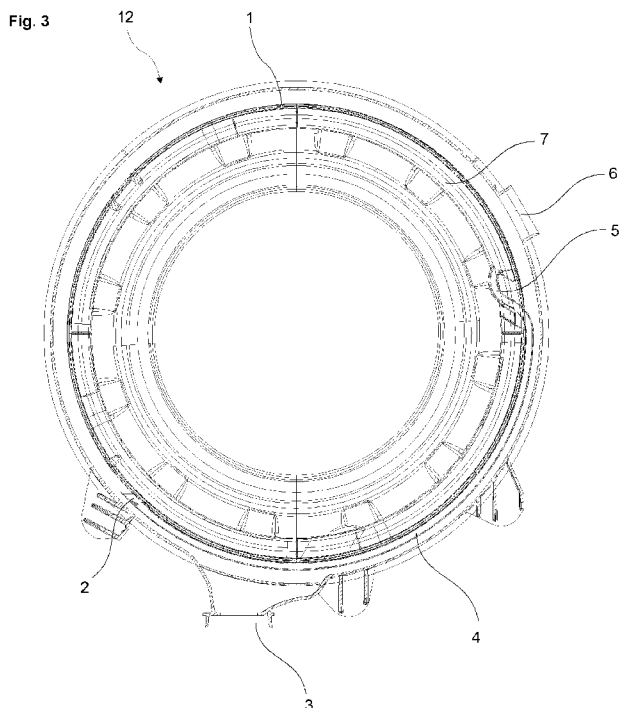
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DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
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PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, 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))

- (54) Title: A LAUNDRY MACHINE WITH AN IMPROVED FLUID DISTRIBUTION LOAD BALANCE SYSTEM



(57) Abstract: The present invention relates to a laundry machine wherein the unbalanced load within the drum (1) is balanced with a fluid distribution system. The present invention more particularly relates to a laundry machine comprising a rotary drum (1) in which cloth items are placed and accessible via a front door, a tub (12) in which the rotary drum (1) is rotatable and an electrical motor outside the tub (12) on the rear side of the drum (1), providing the rotary drum (1) to be driven.

Description**A LAUNDRY MACHINE WITH AN IMPROVED FLUID DISTRIBUTION LOAD
BALANCE SYSTEM**

- [0001] The present invention relates to a laundry machine wherein the unbalanced load within the drum is balanced with a fluid distribution system.
- [0002] In laundry machines, such as washing or washing/drying machines, the laundry is placed into a drum that rotates around a horizontal axis and the speed of rotation is changed in accordance with the respective laundry processing cycle inside the appliance.
- [0003] During the rotation of the drum, the laundry is typically not distributed evenly over the inner surfaces of the drum, causing vibrations due to non-uniform rotational movement thereof. It is to be noted that high speed rotation of the drum may damage motor bearing elements and other mechanical parts of the laundry machine which may in turn result in additional irregularities further contributing to unbalanced rotational movement.
- [0004] The primary cause of unbalanced rotational movement originates from the fact that the laundry in the drum during washing cycles tends to adhere to the inner surfaces of the drum in a peripherally non-homogenous manner so that unbalanced load distribution occurs. This unbalanced operation needs dynamic balancing since the locational source and amount of the laundry associated with the unbalanced operation is subject to dynamic change.
- [0005] To this end, active balancing systems find extensive use in the prior art applications, which, however, require complex electromechanical elements in the form of a plurality of flow control means enabling selective loading of water into a plurality of balancing reservoirs.
- [0006] The drum of the laundry machine is typically connected to the motor shaft on the rear side thereof where a number of bearings on the shaft effectuate connection of the drum with the motor. Typically, when the load inside the drum is unbalanced, the bearings are expected to compensate the resulting unbalanced operation and elliptical rotational trajectory to a

certain extent. The situation causing elliptical movement of the front side of the drum may deteriorate in response to an increased speed of rotation as well as relative to the amount of the unbalanced load.

- [0007] The present invention overcomes this unbalanced operation regime by means of a passive balancing system adapted to be integrated onto the outer surface of the drum. Therefore, the problem of unbalanced load which becomes a more prominent issue during higher speeds is solved without making use of electromechanical elements and active control and sensing mechanisms that would highly affect long-term operability of the laundry machine without requiring repair and/or maintenance. Additionally, such active mechanisms substantially add to the overall cost of the laundry machine.
- [0008] To this end, the present invention is devised under the recognition that an improved load balancing system by which the laundry machine is protected from possible damages due to the unbalanced load in the drum in a cost-efficient and space-saving manner remains a need.
- [0009] Among others, a prior art patent publication relevant to the technical field of the present invention can be referred to as US6066522, disclosing a washing machine, wherein a number of compensating containers at the same shape, uniformly distributed over the periphery of the drum are filled with water before the centrifugal drying operation and are provided with valves for releasing the water from the proper containers during the centrifuging operation, thus leaving only those containers filled or particularly filled due to their content of water counteracting the drum unbalance.
- [0010] The present invention, on the other hand, proposes a laundry machine, such as a washing or washing/drying machine, comprising an improved load balance mechanism wherein the required fluid amount is automatically receivable into balancing reservoirs without involving any active components such as valves operable to compensate the unbalanced load during the laundry treatment operation. The balancing fluid containers are placed such that they do not interfere with the inner capacity of the drum, i.e. they do not occupy space so as to diminish the

drum's volume, as provided by the characterizing features defined in Claim 1 and subsequent claims.

- [0011] Primary object of the present invention is to provide a laundry machine passive load balancing system for the drum thereof, featuring an improved balancing reservoir distribution system involving no expansive dynamical parts/components.
- [0012] The present invention proposes a laundry machine comprising a rotary drum with at least one balancing channel extending around the drum as a longitudinal tubular channel. At least one balancing channel collects water by means of a balance channel inlet from a water collecting area. The water collecting area is formed as a tub water reservoir to which a balance channel inlet can reach to pick water during rotation of the drum only if unbalanced rotational movement occurs.
- [0013] A balancing channel leads to a larger balancing water reservoir also extending around the lateral surface of the drum, the two bodies forming successive longitudinal portions proximate the front side of the drum. The length of the balancing channel is determined in the manner to radially extend along 60 to 120 degrees around the drum. Preferably the drum is provided with three to five outer surface balancing channels. It is yet possible to incorporate more in the form of radially disposed balancing channels being evenly distributed around the drum to obtain a more localized balancing effect.
- [0014] Each balancing channel opens to a successive balancing water reservoir in the form of a larger closed-end arc-shaped container around the lateral surface of the drum. A reservoir is radially 180 degrees apart from a respective balance channel inlet. Water stored in the balancing water reservoir is prevented from flowing back to the respective balancing channel by means of a channel ending neck in between the reservoir and the balancing channel.
- [0015] Accompanying drawings are given solely for the purpose of exemplifying a laundry machine drum load balancing system whose advantages over prior art were outlined above and will be explained in brief hereinafter.
- [0016] The drawings are not meant to delimit the scope of protection as identified

in the claims nor should they be referred to alone in an effort to interpret the scope identified in the claims without recourse to the technical disclosure in the description of the present invention.

- [0017] Fig. 1 demonstrates a front side view of a laundry machine's drum according to the present invention.
- [0018] Fig. 2 demonstrates a cross-sectional view as taken along line B-B in Fig. 1 according to the present invention.
- [0019] Fig. 3 demonstrates a cross-sectional view as taken along line C-C in Fig. 2 according to the present invention.
- [0020] Fig. 4 demonstrates a cross-sectional view as taken along line A-A in Fig. 1 according to the present invention.
- [0021] The following numerals are referred to in the detailed description of the present invention:
1. Drum
 2. Balance channel inlet
 3. Tub discharge opening
 4. Balancing channel
 5. Channel ending neck
 6. Water inlet opening
 7. Balancing water reservoir
 8. Tub water reservoir
 9. Water discharge opening
 10. Lateral drum sheet
 11. Water collecting area
 12. Tub
 13. Drum front sheet
 14. Water picking hole
 15. Water picking hole group
- [0022] The present invention provides a water based load balance system to ensure balanced rotation of a drum (1) in a laundry machine, such as a washing or washing/drying machine, thereby addressing problems associated with vibrations and elliptical rotational operation of the drum (1). The elliptical movement typically occurs depending on the severity of

the unbalanced load and speed of the drum (1).

- [0023] The present invention proposes a laundry machine with an improved load balance system for the drum (1) located inside the laundry machine and which is effective in carrying out processing cycles such as washing, drying/spin drying. The drum (1) of the laundry machine is connected to an electrical motor on the rear side by means of at least two bearings on the motor shaft, connecting the drum (1) to the electrical motor.
- [0024] In the load balance system in accordance with the present invention, water coming through an external water line is taken into the tub (12) by a water inlet opening (6). The received water is transferred to a tub water reservoir (8) in the form of a separate water collection body located outside the drum (1) on the lower part of the tub (12).
- [0025] The water received in the tub (12) flowing into the tub water reservoir (8) fills the same so that a water collecting area (11) is created on the lower part of the tub (12). When the rotational movement of the drum (1) begins and the rotational speed and the amount of the unbalanced laundry so effects, the front side of the drum (1) takes a slightly elliptical trajectory rather than a regular rotation around the rotational axis, which then in turn allows a balance channel inlet (2) to communicate with the water collecting area (11) and pick water from the tub water reservoir (8) during rotation of the drum (1).
- [0026] Water entering through the balance channel inlet (2) reaches a balancing channel (4), the latter in the form of a conduit extending around the lateral surface of the drum (1) proximate the front side thereof. The balancing channel (4) is an arc-shaped ring segment extending preferably in the range of 60 to 120 degrees around the drum (1). Therefore, preferably a plurality of consecutive balancing channels (4) is provided in a radially evenly distributed manner. Each balancing channel (4) communicates with the water collected in the tub water reservoir (8) through a respective balance channel inlet (2).
- [0027] In accordance with the present invention, each balancing channel (4) opens to a balancing water reservoir (7) also in the form of a closed-end arc-shaped ring segment extending around the lateral surface of the drum

(1). The middle point of a balancing water reservoir (7) associated with a balancing channel (4) is radially 180 degrees apart from the respective balance channel inlet (2). This advantageously provides that the water received into the balancing channel (4) by the balance channel inlet (2) is directly conveyed into the associated 180-degrees apart balancing water reservoir (7) by the centrifugal forces during rotational movement of the drum (1), thereby generating an instantaneous balancing effect to compensate the local unbalance only in the required amount as the amount of water taken into the system is also determined by the amount of unbalance according to the deviation of the drum (1) from its regular rotational trajectory around its constant axis of rotation.

[0028] Balance channel inlets (2) are designed as water picking holes (14) or alternatively as a water picking hole group (15) opening to a single balancing water reservoir (7). This provides a greater water volume to be received into the balancing system due to the increased number of individual balancing channels (4) as well as a dynamically responsive balancing effect due to the smaller diameter of the balancing channels (4) directly conveying water into the balancing water reservoirs (7).

[0029] The balancing channels (4) as well as the balancing water reservoirs (7) are preferably disposed on the lateral drum sheet (10) proximate the drum front sheet (13) so as to provide a sufficiently strong balancing effect on the outermost side of the drum (1) subject to greater unbalancing forces. Further, the balancing channels (4) as well as the balancing water reservoirs (7) preferably extend to coincide with a surface plane perpendicular to the longitudinal rotational axis of the drum (1).

[0030] Therefore, the elliptical trajectory as a result of the unbalanced operation of the drum (1) causes water to enter into the water picking holes (14) to be stored in the balancing water reservoirs (7). When the water inside a balancing channel (4) flows through a channel ending neck (5) at the end of the balancing channel (4), the S-formed structure of the channel ending neck (5) substantially prevents reverse flow of the liquid from the balancing water reservoir (7) in the direction of the balancing channels (4), thereby enabling the balancing water reservoir (7) to store the received water as

long as the centrifugal forces during the rotation keep the water therein.

- [0031] Once the centrifugal forces are no longer sufficiently efficient, water within the balancing water reservoirs (7) naturally escapes through water discharge openings (9) on the radially inner side of the balancing water reservoirs (7) so as to return back to the tub water reservoir (8).
- [0032] Water discharged from the balancing water reservoirs (7) will also be discharged through a tub discharge opening (3) after the laundry processing operation is terminated.
- [0033] In a nutshell, the present invention proposes a laundry machine comprising a rotary drum (1) in which cloth items are placed and accessible via a front door, a tub (12) in which the rotary drum (1) is rotatable and an electrical motor outside the tub (12) on the rear side of the drum (1), providing the rotary drum (1) to be driven.
- [0034] According to one embodiment of the present invention, at least one balancing channel (4) is provided in the form of an arc-shaped ring segment peripherally extending around the drum (1), at least one balancing channel (4) comprising a balance channel inlet (2) communicating with a water collecting area (11) so as to pick water from a tub water reservoir (8) during rotation of the drum (1) in response to unbalanced rotational movement of the same.
- [0035] According to a further embodiment of the present invention, the balance channel inlet (2) displaces in response to unbalanced rotational movement of the drum (1) so as to take a rotational trajectory farther to the central longitudinal axis of the drum (1) to communicate with the water collected in the tub water reservoir (8).
- [0036] According to a further embodiment of the present invention, the balancing channel (4) extends around the lateral surface of the drum (1) proximate the front side thereof.
- [0037] According to a further embodiment of the present invention, the balancing channel (4) peripherally extends around the lateral surface of the drum (1) radially in the range of 60 to 120 degrees.
- [0038] According to a further embodiment of the present invention, a plurality of consecutive balancing channels (4) is provided around the lateral surface

of the drum (1) in a radially evenly distributed manner.

[0039] According to a further embodiment of the present invention, each balancing channel (4) opens to a balancing water reservoir (7) in the form of a closed-end arc-shaped ring segment extending around the lateral surface of the drum (1).

[0040] According to a further embodiment of the present invention, the middle point of a balancing water reservoir (7) associated with a balancing channel (4) is radially 180 degrees apart from the respective balance channel inlet (2).

[0041] According to a further embodiment of the present invention, the balance channel inlets (2) are formed as a plurality of water picking holes (14) opening to a single balancing water reservoir (7).

[0042] According to a further embodiment of the present invention, the balancing channels (4) and the balancing water reservoirs (7) are disposed proximate the outermost front side of the drum (1), on a lateral drum sheet (10) or a drum front sheet (13).

[0043] According to a further embodiment of the present invention, the balancing channels (4) and the balancing water reservoirs (7) extend to coincide with a surface plane perpendicular to the longitudinal rotational axis of the drum (1), thereby providing a more enhanced balancing effect symmetrically around the longitudinal axis of the drum (1).

[0044] According to a further embodiment of the present invention, a balancing channel (4) and an associated balancing water reservoir (7) are separated by a channel ending neck (5) in the form of an S-shaped structure preventing reverse flow of the liquid in the balancing water reservoir (7) in the direction of the balancing channel (4).

[0045] According to a further embodiment of the present invention, water discharge openings (9) are provided on the radially inner side of the balancing water reservoirs (7) whereby water in the balancing water reservoirs (7) returns back to the tub water reservoir (8) when the centrifugal forces are no longer efficient.

[0046] According to a further embodiment of the present invention, the tub water reservoir (8) is a separate water collection body located outside the drum

(1) on the lower front part of the tub (12).

[0047] According to a further embodiment of the present invention, the balance channel inlets (2) are provided with a gradually narrowing opening with a shoulder portion, the shoulder portion preventing reverse flow of the received water out from the balancing channels (4).

[0048] The present invention therefore proposes a load balance system for a laundry machine, the load balance system being placed on the outer surface of the drum (1) in the form of a plurality of outer circuit conduits providing a passive regulation system involving no additional active components such as valves acting as additional flow control components to balance the load inside the drum (1). Furthermore, a space-saving structure is proposed such that the internal volume of the drum (1) is not occupied by the components of the load balance system according to the invention.

[0049] The balancing channels (4) are specially developed to maintain the liquid inside once it enters to the channel. The water flowing into the balancing water reservoirs (7) creates an opposite unbalance around the lateral drum sheet (10), thus balancing the elliptical trajectory of the drum (1). The elliptical trajectory around the front side of the drum (1) turns into a regular form in the form of a rotational movement around a substantially constant rotational axis.

[0050] During the rotation of the drum with the unbalanced load, the necessary water is provided from the tub water reservoir (8) through the balancing channels (4). Therefore, it is of utmost importance that the water level in the tub water reservoir (8) is always at the same level to ensure the continuity of the dynamic balancing operation.

Claims

1. A laundry machine comprising a rotary drum (1) in which cloth items are placed and accessible via a front door, a tub (12) in which the rotary drum (1) is rotatable and an electrical motor outside the tub (12) on the rear side of the drum (1), providing the rotary drum (1) to be driven, **characterized in that** at least one balancing channel (4) is provided in the form of an arc-shaped ring segment peripherally extending around the drum (1), the balancing channel (4) comprising a balance channel inlet (2) communicating with a water collecting area (11) so as to pick water from a tub water reservoir (8) during rotation of the drum (1) in response to unbalanced rotational movement of the same.
2. A laundry machine as in Claim 1, **characterized in that** the balance channel inlet (2) displaces in response to unbalanced rotational movement of the drum (1) so as to take a rotational trajectory farther to the central longitudinal axis of the drum (1) to communicate with the water collected in the tub water reservoir (8).
3. A laundry machine as in Claim 1 or 2, **characterized in that** the balancing channel (4) extends around the lateral surface of the drum (1) proximate the front side thereof.
4. A laundry machine as in Claim 3, **characterized in that** the balancing channel (4) peripherally extends around the lateral surface of the drum (1) radially in the range of 60 to 120 degrees.
5. A laundry machine as in Claim 4, **characterized in that** a plurality of consecutive balancing channels (4) is provided around the lateral surface of the drum (1) in a radially evenly distributed manner.
6. A laundry machine as in Claim 5, **characterized in that** each balancing channel (4) opens to a balancing water reservoir (7) in the form of a closed-end arc-shaped ring segment extending around the lateral surface of the drum (1).
7. A laundry machine as in Claim 6, **characterized in that** the middle point of a balancing water reservoir (7) associated with a balancing channel (4) is radially 180 degrees apart from the respective balance channel inlet (2).
8. A laundry machine as in any one of the preceding claims, **characterized in that** the balance channel inlets (2) are formed as a plurality of water picking holes (14) opening to a single balancing water reservoir (7).

9. A laundry machine as in Claim 6 or 7, **characterized in that** the balancing channels (4) and the balancing water reservoirs (7) are disposed proximate the outermost front side of the drum (1), on a lateral drum sheet (10) or a drum front sheet (13).
10. A laundry machine as in Claim 9, **characterized in that** the balancing channels (4) and the balancing water reservoirs (7) extend to coincide with a surface plane perpendicular to the longitudinal rotational axis of the drum (1).
11. A laundry machine as in Claim 10, **characterized in that** a balancing channel (4) and an associated balancing water reservoir (7) are separated by a channel ending neck (5) in the form of an S-shaped structure preventing reverse flow of the liquid in the balancing water reservoir (7) in the direction of the balancing channel (4).
12. A laundry machine as in Claim 11, **characterized in that** water discharge openings (9) are provided on the radially inner side of the balancing water reservoirs (7) whereby water in the balancing water reservoirs (7) returns back to the tub water reservoir (8) when the centrifugal forces are no longer efficient.
13. A laundry machine as in any one of the preceding claims, **characterized in that** the tub water reservoir (8) is a separate water collection body located outside the drum (1) on the lower front part of the tub (12).
14. A laundry machine as in any one of the preceding claims, **characterized in that** the balance channel inlets (2) are provided with a gradually narrowing opening with a shoulder portion, the shoulder portion preventing reverse flow of the received water out from the balancing channels (4).
15. A drum (1) for a laundry machine as in Claim 1.

Fig. 1

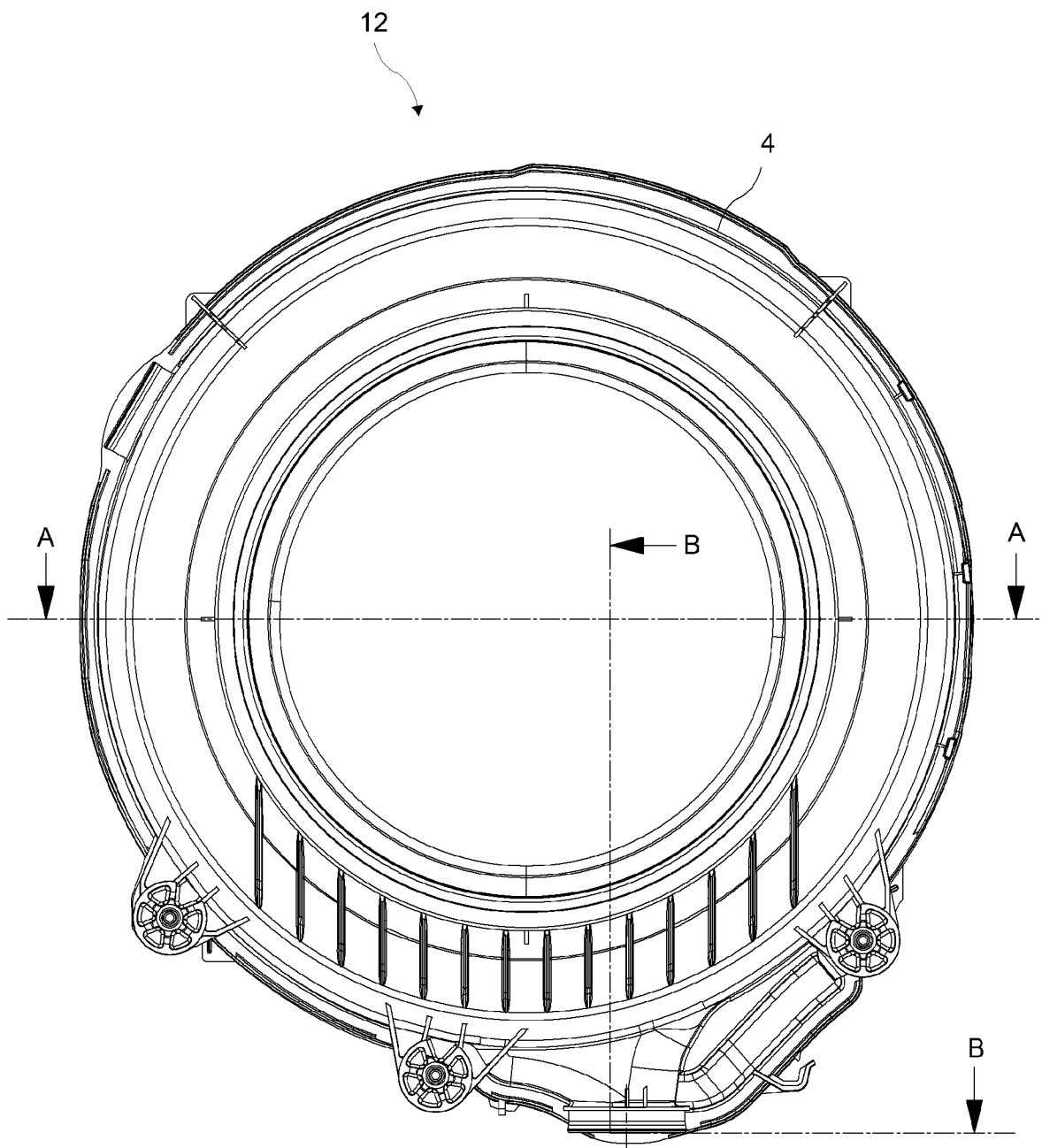


Fig. 2

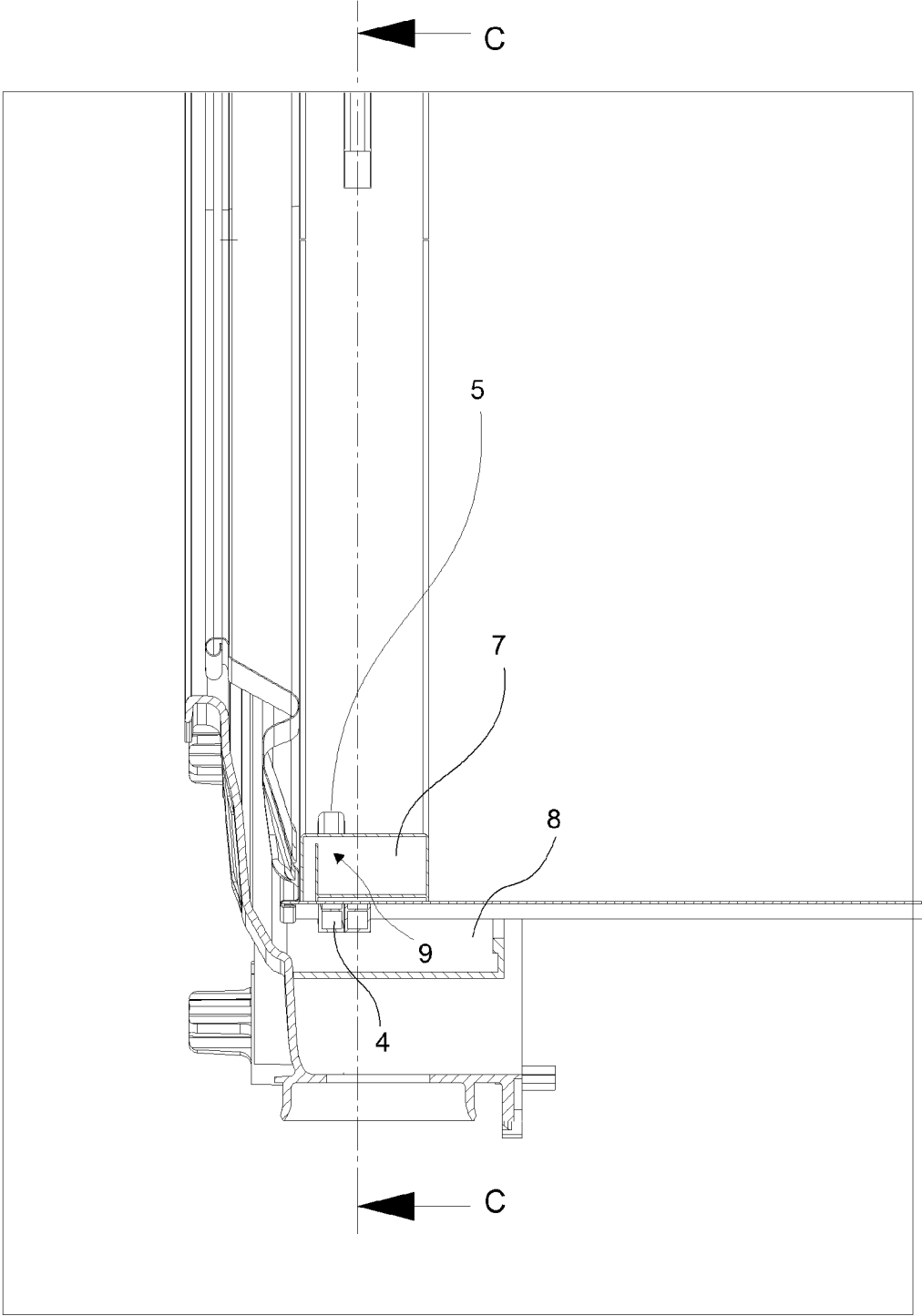


Fig. 3

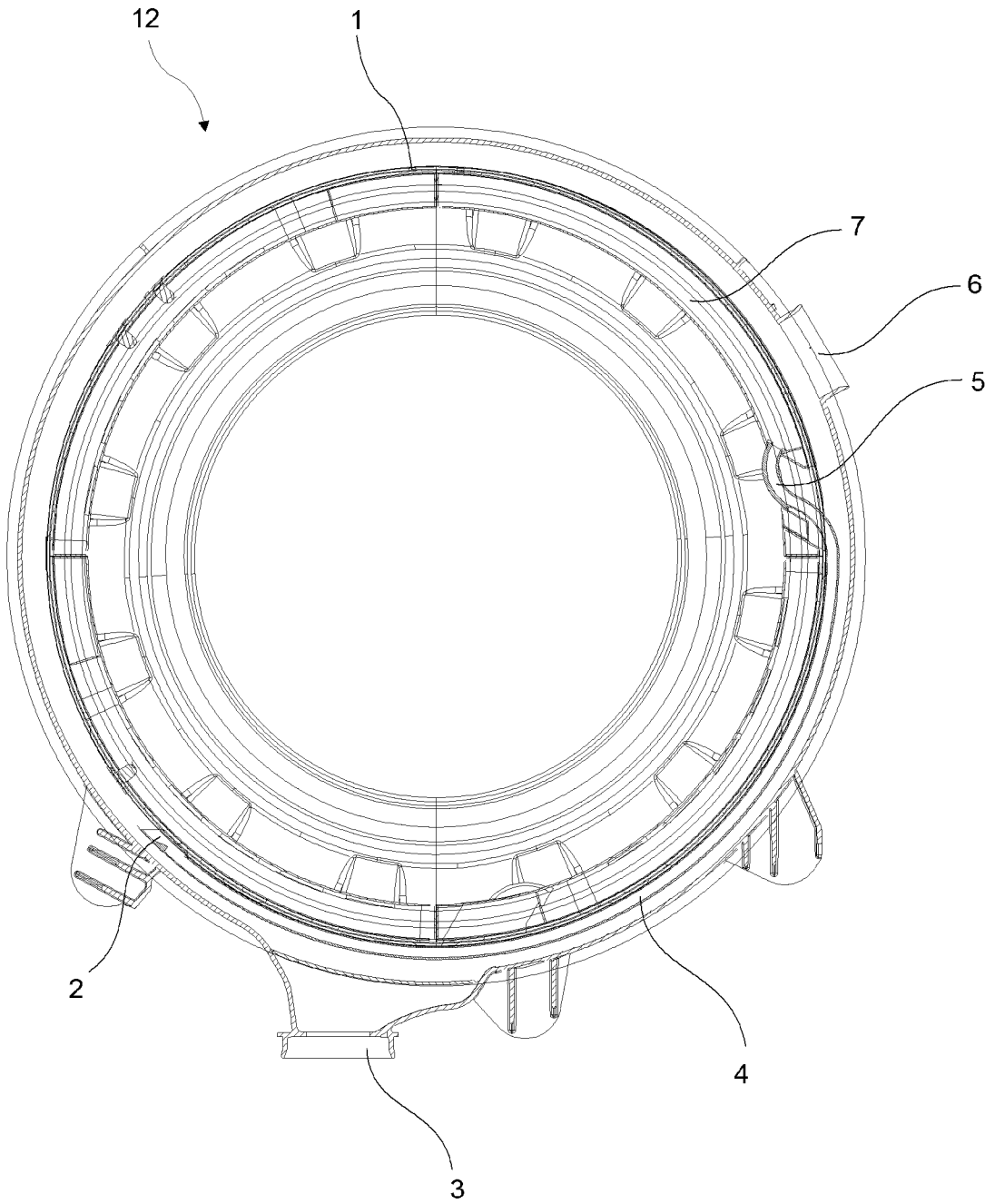
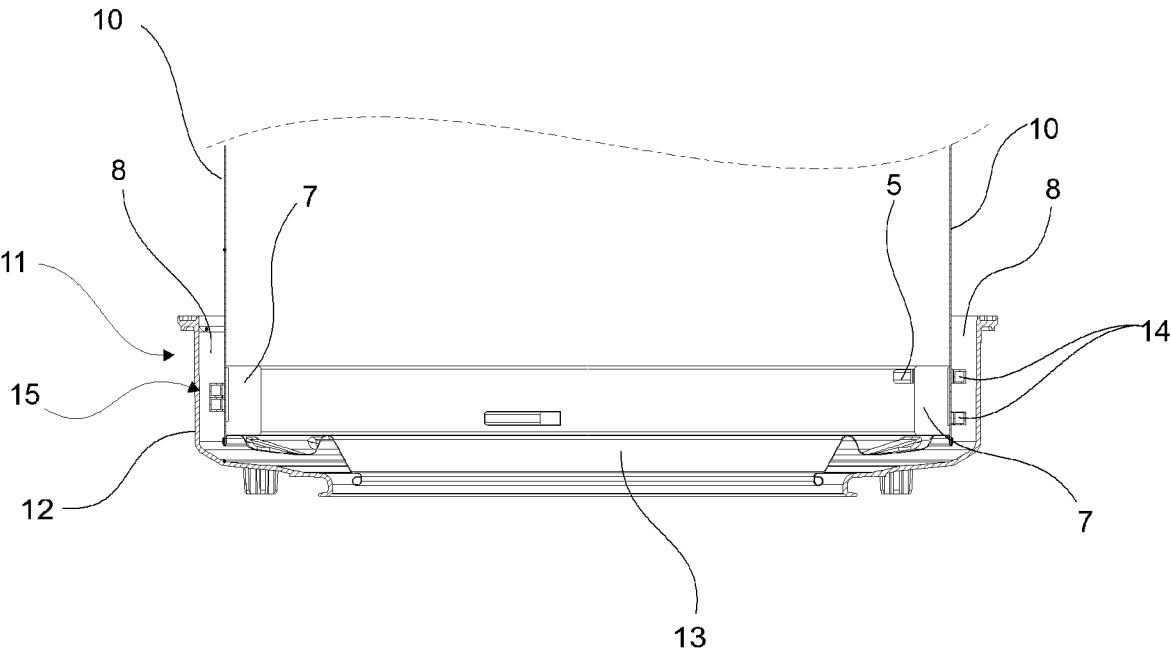


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/054297

A. CLASSIFICATION OF SUBJECT MATTER
INV. D06F37/22
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)

EPO-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.
X	DE 21 05 507 A1 (POENSGEN GMBH GEB) 10 August 1972 (1972-08-10)	1-3,15
A	pages 9,10,13; figure 1	4-14
A	GB 874 922 A (BBC BROWN BOVERI & CIE) 16 August 1961 (1961-08-16)	1-15
	page 1, line 75 - page 2, line 6; figure 5 page 2, lines 3-127	
A	US 5 709 109 A (CHO SUNG WON [KR]) 20 January 1998 (1998-01-20)	1-15
	column 3, line 16 - column 4, line 5; figures	
A	EP 2 730 691 A1 (WHIRLPOOL CO [US]) 14 May 2014 (2014-05-14)	1-15
	paragraphs [0007], [0010]; figures 3,4,6	
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

1 June 2015

Date of mailing of the international search report

09/06/2015

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Stroppa, Giovanni

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/054297

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/144879 A1 (VERMA VISHAL [US]) 14 June 2012 (2012-06-14) paragraph [0002]; figures -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2015/054297

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2105507	A1	10-08-1972	NONE
GB 874922	A	16-08-1961	NONE
US 5709109	A	20-01-1998	JP 2755567 B2 20-05-1998 JP H08215473 A 27-08-1996 US 5709109 A 20-01-1998
EP 2730691	A1	14-05-2014	NONE
US 2012144879	A1	14-06-2012	DE 102011054269 A1 14-06-2012 US 2012144879 A1 14-06-2012