



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.10.2016 Bulletin 2016/42

(51) Int Cl.:
D06F 58/24 ^(2006.01)

(21) Application number: **16169116.7**

(22) Date of filing: **20.12.2011**

(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

- **CESARONI, Andrea**
60035 Jesi (AN) (IT)
- **MARCHESI, Nicola**
60044 Fabriano (AN) (IT)
- **MANCINI, Mauro**
60044 Fabriano (AN) (IT)

(30) Priority: **22.12.2010 IT RN20100080**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
11810676.4 / 2 655 725

(74) Representative: **Guerci, Alessandro et al**
Whirlpool Europe S.r.l.
Patent Department
Viale G. Borghi 27
21025 Comerio (VA) (IT)

(71) Applicant: **Indesit Company S.p.A.**
60044 Fabriano (AN) (IT)

(72) Inventors:
• **PAOLINI, William**
63857 Amandola (FM) (IT)

Remarks:

This application was filed on 11-05-2016 as a divisional application to the application mentioned under INID code 62.

(54) **ELECTRICAL HOUSEHOLD APPLIANCE**

(57) The invention relates to an improved electrical household appliance for drying laundry, comprising:

- i) a drying compartment (2);
- ii) a line (3) for extracting a gaseous fluid from the drying compartment (2), the extraction line (3) comprising a condenser (4) which allows the condensation of at least a part of the vapour present in the gaseous fluid.

The condenser (4) comprises:

- a channel (41) for the passage of the gaseous fluid from the drying compartment (2);

- a channel (42) for the passage of a refrigerant fluid.

The condenser (4) comprises a condensing wall (40) which separates the channel (41) for the passage of the gaseous fluid from a first part of the channel (42) for the passage of the refrigerant fluid.

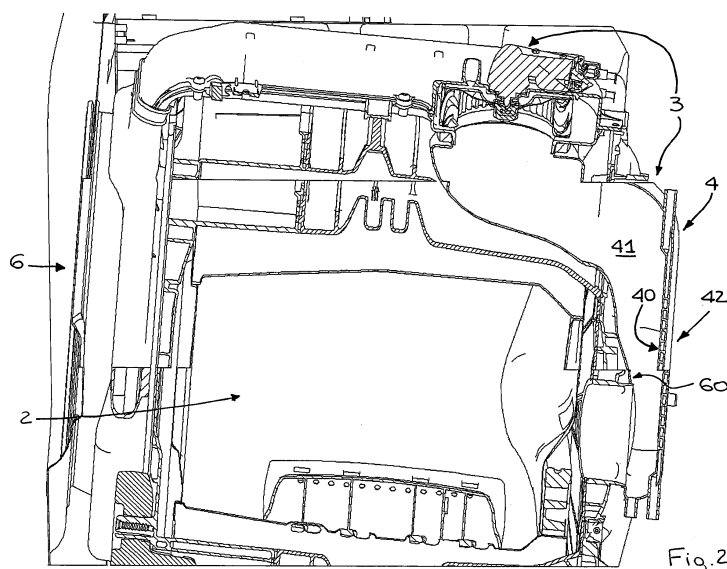


Fig. 2

Description

Technical Field

[0001] This invention relates to an electrical household appliance for drying laundry. The electrical household appliance might also be a washer-dryer where the drying action follows a washing action.

Background Art

[0002] Known in the prior art is an electrical household drying appliance which comprises a plastic duct extending between a laundry drying compartment and an impeller which extracts moist air from the compartment.

[0003] Along the inside surface of the duct there is a plurality of outlet nozzles for delivering cooling water from the water mains. The cooling water sprayed inside the duct condenses part of the moisture present in the air extracted from the drying compartment.

[0004] A drawback of a solution of this type is its low condensing efficiency.

[0005] Document EP 0 429 953 describes a laundry dryer with a condenser having a channel for the passage of hot air from the drying compartment and a channel for the passage of cooling air used as refrigerant fluid, these channels being separated by a condensing wall.

Disclosure of the Invention

[0006] In this context, the technical purpose which forms the basis of this invention is to propose an electrical household appliance that overcomes the above mentioned drawbacks of the prior art.

[0007] More specifically, the aim of this invention is to provide an electrical household appliance capable of improving the efficiency with which the moisture extracted from the washing compartment is condensed.

[0008] The technical purpose indicated and the aims specified are substantially achieved by an electrical household appliance comprising the technical features described in one or more of the appended claims.

Brief Description of the Drawings

[0009] Further features and advantages of the invention are more apparent in the non-limiting description which follows of a preferred non-limiting embodiment of an electrical household appliance illustrated in the accompanying drawings, in which:

- Figure 1 is a perspective view of a component of an electrical household appliance in accordance with this invention;
- Figure 2 shows a cross section of Figure 1;
- Figure 3 shows a component of an electrical household appliance in accordance with this invention;
- Figure 4 shows a cross section through the plane A-

A of Figure 3;

- Figure 5 shows a cross section through the plane B-B of Figure 3;
- Figures 6 and 7 are perspective views of the component of Figure 3;
- Figure 8 shows a component alternative to that of Figure 3;
- Figure 9 shows a cross section through the plane A-A of Figure 8;
- Figure 10 shows a cross section through the plane B-B of Figure 8;
- Figures 11 and 12 are perspective views of the component of Figure 8;
- Figure 13 schematically shows a component alternative to those of Figures 3 and 8.

Detailed Description of the Preferred Embodiments of the Invention

[0010] In the accompanying drawings, the reference numeral 1 denotes an electrical household appliance for drying laundry. Typically, electrical household appliances capable of performing this function are known as dryers or washer-dryers (which wash and dry the laundry).

[0011] The electrical household appliance 1 comprises:

- i) a drying compartment 2;
- ii) a line 3 for extracting a gaseous fluid from the drying compartment 2.

[0012] Conveniently, the extraction line 3 is at least partly interposed between the drying compartment 2 and an impeller 5 which sucks the gaseous fluid (typically moist air) from the drying compartment 2. Downstream of the impeller 5, the gaseous fluid is advantageously heated by a heating element and channelled back into the drying compartment 2. Conveniently, the electrical household appliance 1 comprises a door 6 giving access to the drying compartment 2 and a wall 60 opposite the door 6, the door 6 and the wall 60 contributing to delimiting the drying compartment 2. The extraction line 3 extends from the wall 60 opposite the door 6.

[0013] The extraction line 3 comprises a condenser 4 which allows the condensation of at least a part of the vapour present in the gaseous fluid. Conveniently, the condenser 4 is connected directly to at least one of the walls delimiting the drying compartment 2 (typically the wall 60 opposite the door 6).

[0014] The condenser 4 comprises:

- a channel 41 for the passage of the gaseous fluid from the drying compartment 2;
- a channel 42 for the passage of a refrigerant fluid. Typically, the refrigerant fluid is liquid, in particular, water (preferably drawn from the water mains).

[0015] The condenser 4 comprises a condensing wall

40 which separates the channel 41 for the passage of the gaseous fluid from a first part of the channel 42 for the passage of the refrigerant fluid. The condensing wall 40 extends for a length greater than 5 centimetres along the line followed by the first part of the channel 42.

[0016] The condensing wall 40 shapes or contributes to shaping the channel 41 for the passage of the gaseous fluid and the first part of the channel 42 for the passage of the refrigerant fluid. Thus, the condensing wall 40 is in contact with the channel 41 for the passage of the gaseous fluid and the first part of the channel 42 for the passage of the refrigerant fluid. The condensing wall 40 usually has a thickness of less than 3 millimetres. It may be made of plastic material (as in the embodiment illustrated in Figure 8) or metal (as in the embodiment illustrated in Figure 3).

[0017] Conveniently, the first part of the channel 42 for the passage of the refrigerant fluid extends substantially alongside the channel 41 for the passage of the gaseous fluid. In the preferred embodiment, the refrigerant fluid in the first part of the channel 42 for the passage of the refrigerant fluid flows in the opposite direction to the gaseous fluid in the channel 41 for the passage of the gaseous fluid. Conveniently, the first part of the channel 42 for the passage of the refrigerant fluid has a winding shape. This considerably improves heat exchange with the gaseous fluid.

[0018] Conveniently, the condensing wall 40 extends substantially parallel to a plane. Preferably, the condensing wall 40 is planar.

[0019] In the embodiment of Figure 3 or 8, the first part of the channel 42 for the passage of the refrigerant fluid defines a zone which extends substantially parallel to a plane, this zone being for exchanging heat with the channel 41 for the passage of the gaseous fluid.

[0020] In the embodiment of Figure 3, the condenser 4 comprises two superposed metal sheets comprising a first portion where they are in contact and a second portion where they are apart so as to define, interposed between them, the first part of the channel 42 for the passage of the refrigerant fluid. The condensing wall 40 is integrated into the two superposed metal sheets. The metal sheets are irremovably connected to each other (by a process known as "roll-bonding"). They are preferably made of aluminium.

[0021] As shown by way of example in the embodiments illustrated, the condenser 4 comprises an outer delimiting surface 45. The first part of the channel 42 for the passage of the refrigerant fluid conveniently defines a gap 46 interposed between the channel 41 for the passage of the gaseous fluid and the outer delimiting surface 45 of the condenser 4. Conveniently, the first part of the channel 42 for the passage of the refrigerant fluid is interposed between the outer delimiting surface 45 and a duct which delimits the channel 41 for the passage of the gaseous fluid; thus, a duct delimiting the first part of the channel 42 does not extend into the channel 41 of the passage of the gaseous fluid.

[0022] In the embodiment of Figure 8, the gap 46 is delimited by:

- a shell 461 made as a single part and having an opening;
- a lid 462 which occludes the opening. Conveniently, the outer delimiting surface 45 is partly integrated into the lid 462.

[0023] The gap 46 comprises a plurality of partitions 463 which confer a winding shape on the first part of the channel 42 for the passage of the refrigerant fluid. The partitions 463 are at least partly built into the lid 462. More specifically, the partitions 463 extend from a base 465 of the lid 462 until coming into contact with a wall of the shell 461 opposite the base 465 of the lid 462. The partitions 463 are transversal (preferably at right angles) to the base 465 of the lid 462. That way, the shell 461 and the lid 462 define, in combination, the channel 42 for the passage of the refrigerant fluid. Advantageously, the partitions 463 are formed entirely on the lid 462. In an alternative embodiment, they might be aligned with partitions formed on the shell 461 to define, in combination, the winding channel 42 for the passage of the refrigerant fluid.

[0024] The utility of placing the partitions 463 on the lid is linked to the fact that simplifying the geometry of the shell 461 allows it to be made as a single part, preferably by blow moulding, without abandoning the advantages of a winding path in terms of heat exchange efficiency. Conveniently, the partitions 463 are formed (for example, by moulding) on the lid 462. This feature facilitates the process for manufacturing the condenser 4. Conveniently, the shell 461 delimits the channel 41 for the passage of the gaseous fluid.

[0025] In the preferred embodiment, the gap 46 only partly circumscribes the channel 41 for the passage of the gaseous fluid. An extension line followed by the channel 41 for the passage of the gaseous fluid is defined. Conveniently, the gap 46 (or the channel 42 for the passage of the refrigerant fluid) does not completely surround the extension line followed by the channel 41 for the passage of the gaseous fluid (the Applicant has found that this considerably simplifies construction but without reducing heat exchange efficiency).

[0026] Conveniently, the channel 41 comprises two main legs 71, 72 which are transversal to each other (for example, substantially at right angles). The channel 42 for the passage of the refrigerant fluid extends only along one of the two main legs.

[0027] Conveniently, the outer delimiting surface 45 comprises:

- a first and a second face 73, 74 opposite each other;
- two flanks 75, 76, also opposite each other, interposed between the first face and the second 73, 74.

[0028] Conveniently, the channel 42 for the passage

of the refrigerant fluid extends along the first face 73. The channel 42 for the passage of the refrigerant fluid does not, on the other hand, extend along the second face 74 and the two flanks 75, 76.

[0029] In the example embodiment shown in Figure 8, there is no interface which:

- is common to the channel 41 for the passage of the gaseous fluid and to the channel 42 for the passage of the refrigerant fluid;
- places the channel 41 for the passage of the gaseous fluid and the channel 42 for the passage of the refrigerant fluid in fluid communication inside the condenser 4.

[0030] Conveniently (in an embodiment not illustrated), there might be a conduit comprising a part which places the channel 42 for the passage of the refrigerant fluid and the channel 41 for the passage of the gaseous fluid in fluid communication, the part of the conduit being at least partly outside the condenser 4.

[0031] In the embodiment of Figure 13, alternatively to the embodiment of Figure 3 or Figure 8, the channel 42 for the passage of the refrigerant fluid comprises a tank 48 comprising an interfacing opening 481 which places it in fluid communication with the channel 41 for the passage of the gaseous fluid. In one particular (non-limiting) embodiment, the tank 48 is annular and surrounds the channel 41 for the passage of the gaseous fluid. The tank 48 comprises an outlet 482 for delivering the refrigerant fluid. Conveniently, the opening 481 of the tank defines a spillway through which the refrigerant fluid flows out of the channel for the passage of the gaseous fluid. In this case, the refrigerant fluid is then extracted by the same means as those used for extracting the condensate. Alternatively, the tank 48 may comprise a refrigerant fluid extraction outlet 483 separate from the opening 481.

[0032] In an embodiment not illustrated, the condensing wall 40 might coincide with a wall which delimits a tubular duct for the passage of the refrigerant fluid and extending inside a duct which externally delimits the channel 41 for the passage of the gaseous fluid.

[0033] In the preferred embodiment, the electrical household appliance 1 is a washer-dryer where the drying compartment 2 coincides with a washing compartment 2.

[0034] In the washing compartment 2, therefore, the electrical household appliance 1 performs both a washing treatment and a drying treatment. Typically, the washing compartment 2 houses a rotating drum. The washer-dryer comprises washing liquid drainage means (for example a drain pump and pipe) which are, advantageously:

- in fluid communication with the channel 42 for the passage of the refrigerant fluid;
- located downstream of the channel 42 for the passage of the refrigerant fluid relative to the direction

of refrigerant fluid outflow.

[0035] This allows the refrigerant fluid (typically liquid) to be extracted by way of the drainage means, which are also used to extract the washing liquid.

[0036] The electrical household appliance 1, in the embodiment of Figure 8, comprises a condensate outlet channel 47 outside the channel 41 for the passage of the gaseous fluid. The outlet channel 47 places the channel 41 for the passage of the gaseous fluid in fluid communication with the washing compartment 2. This allows also the condensate which forms in the condenser 4 to be extracted by way of the drainage means used to extract the washing liquid or the refrigerant fluid.

[0037] The refrigerant fluid, however, might not be in fluid communication with the washing compartment 2. In that case, it is extracted by way of dedicated drainage means (pump, ducting, etc.).

[0038] The invention as described herein brings numerous advantages.

[0039] In particular, it improves condensation of the moist air extracted from the drying compartment.

[0040] It shall be understood that the invention described above may be modified and adapted in several ways without departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by other technically equivalent elements. In practice, all the materials used, as well as the dimensions, may vary according to requirements.

Claims

1. An electrical household appliance for drying laundry comprising:

- i) a drying compartment (2);
- ii) a line (3) for extracting a gaseous fluid from the drying compartment (2), the extraction line (3) comprising a condenser (4) which allows the condensation of at least a part of the vapour present in the gaseous fluid, the condenser (4) comprising:

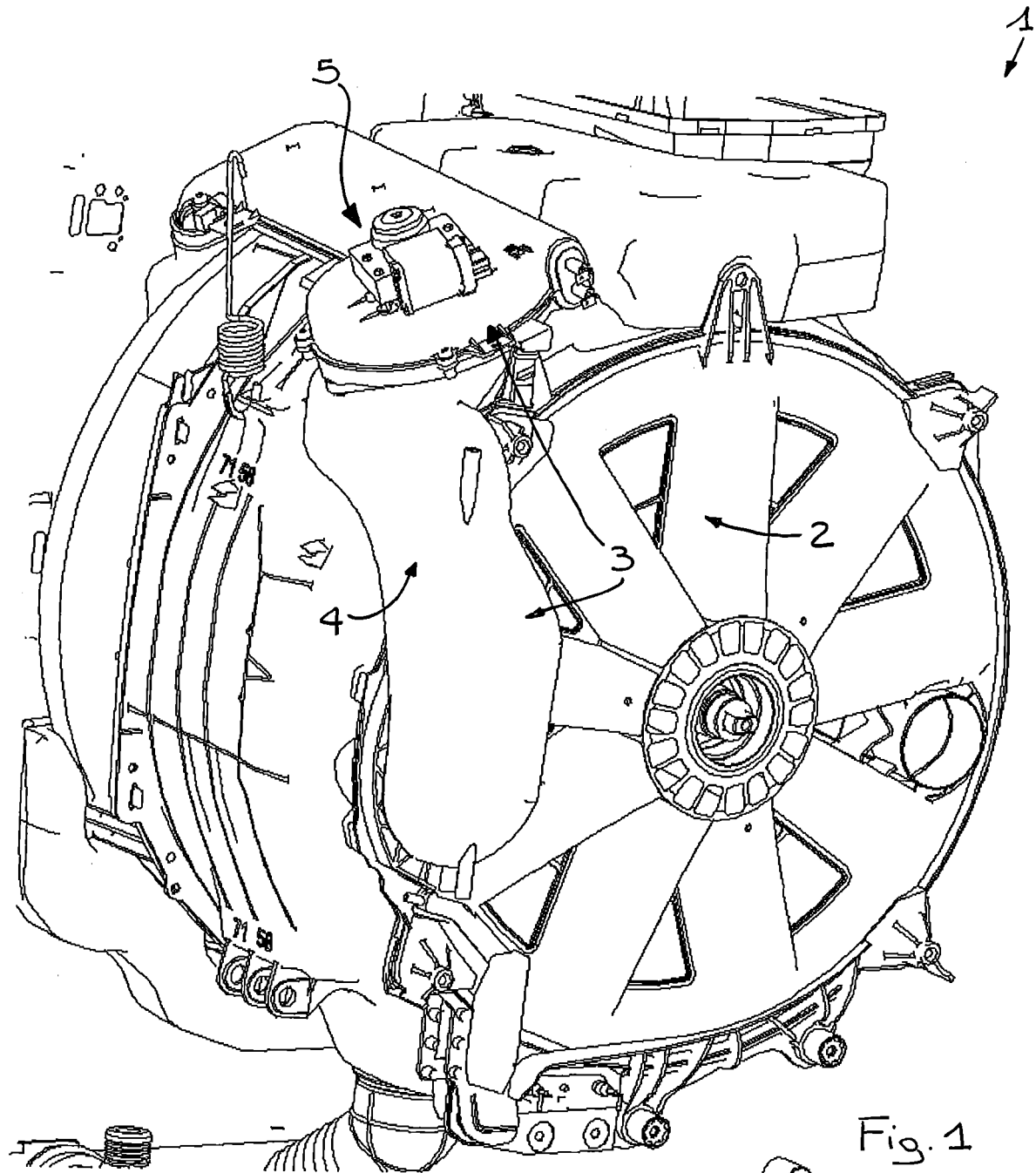
- a channel (41) for the passage of the gaseous fluid from the drying compartment (2);
- a channel (42) for the passage of a refrigerant fluid and
- a condensing wall (40) which separates the channel (41) for the passage of the gaseous fluid from a first part of the channel (42) for the passage of the refrigerant fluid,

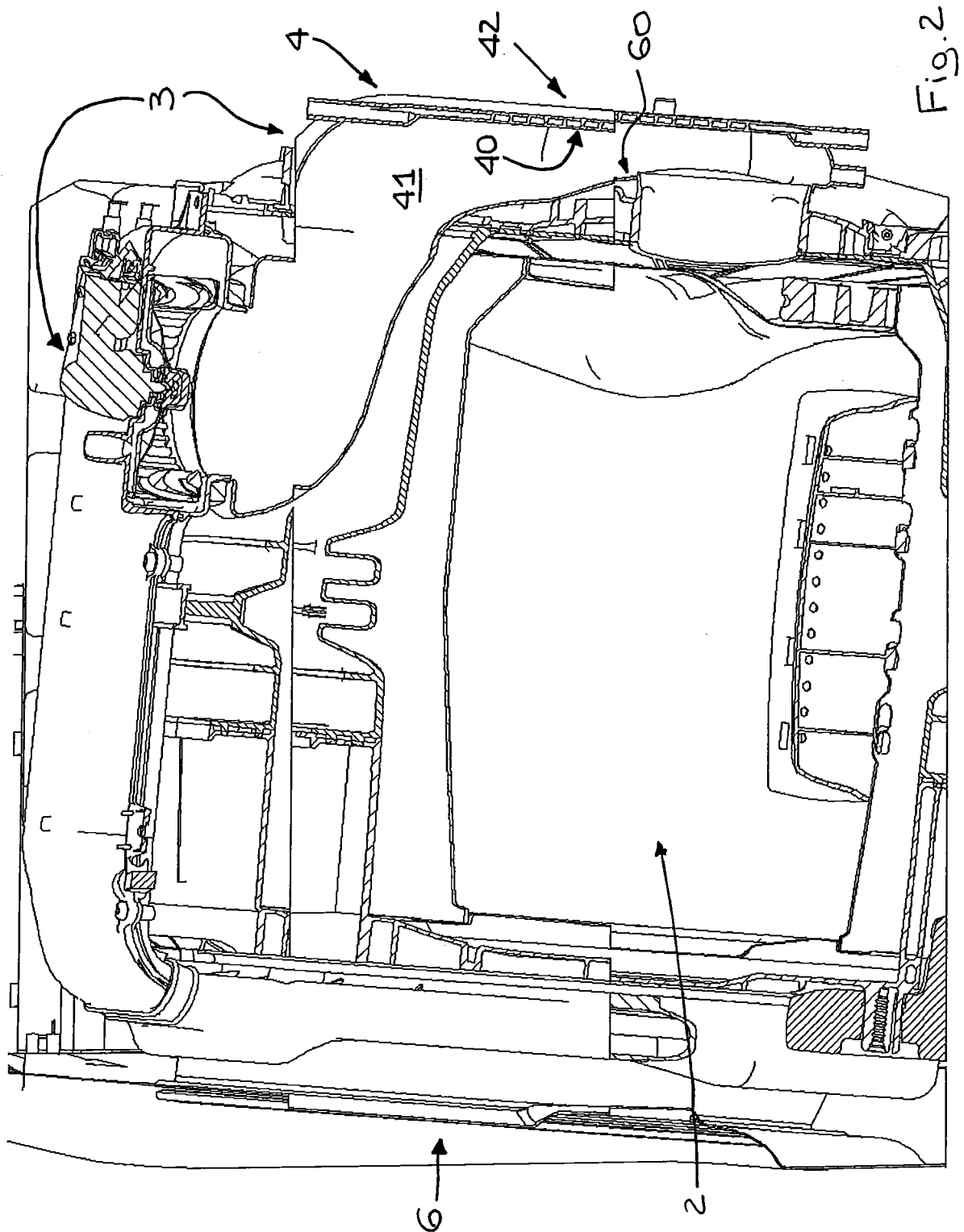
characterized in that

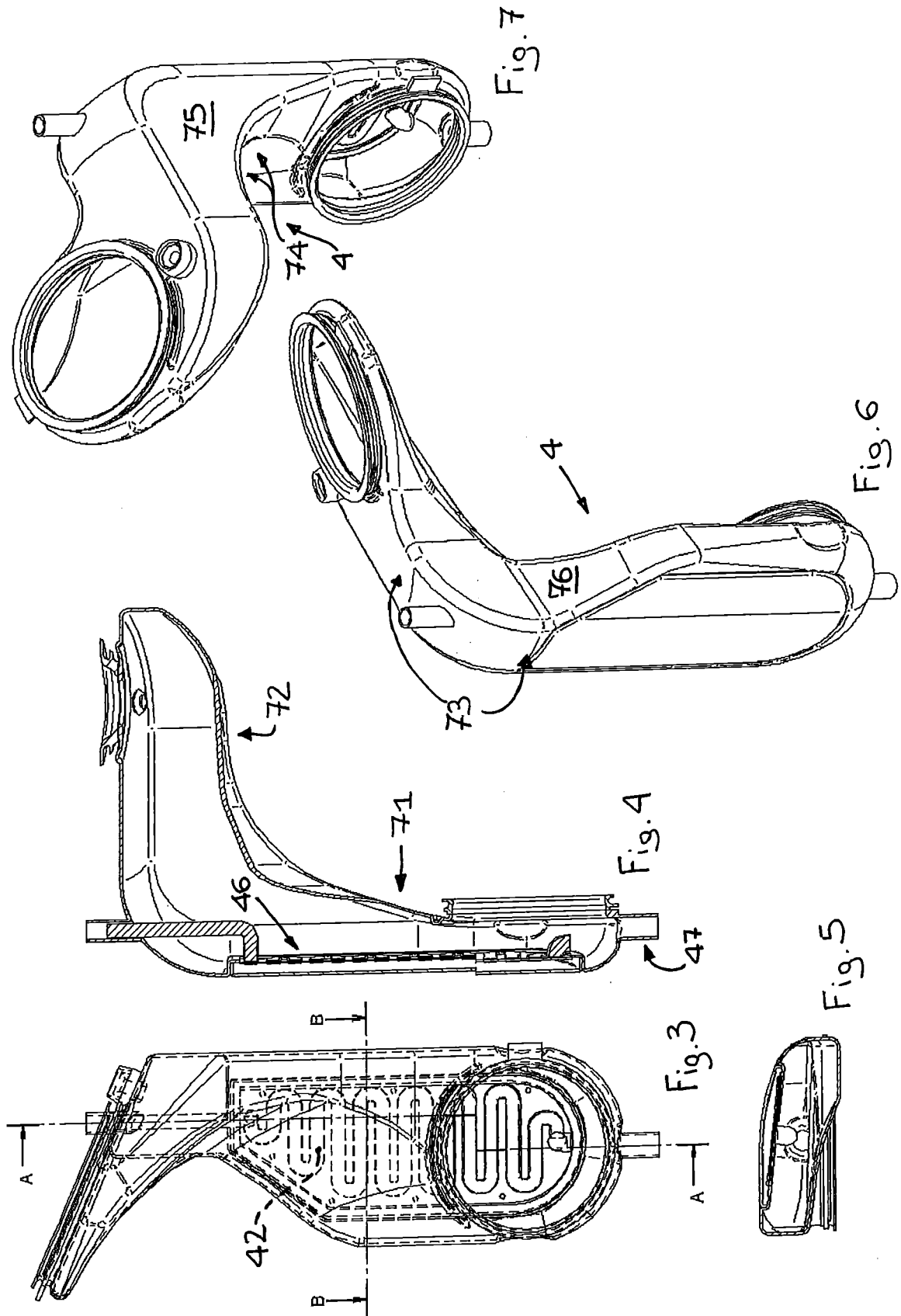
A) the electrical household appliance is a washer-dryer where the drying compartment (2) is also a washing compartment, the washer-dryer

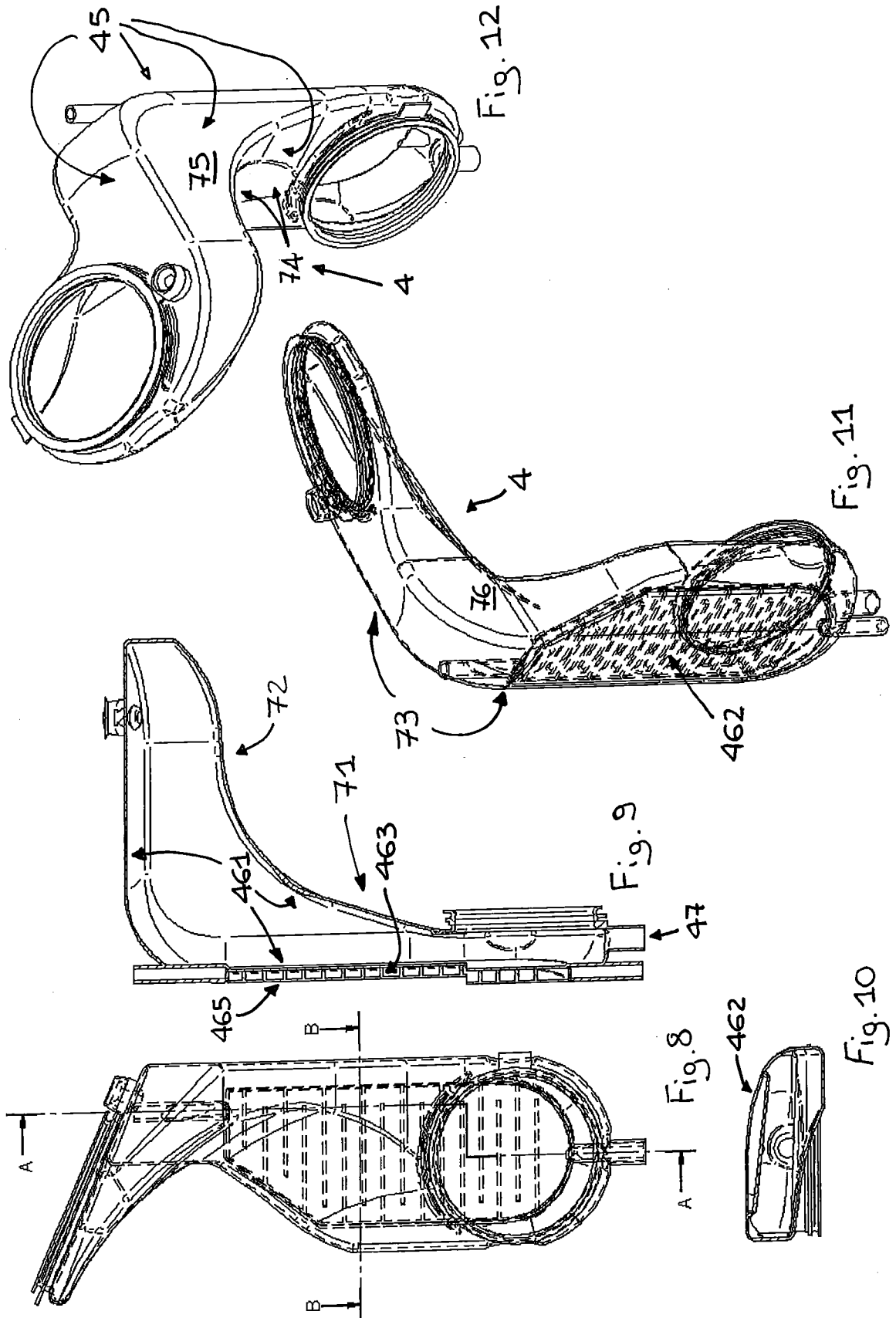
- comprising means for draining out the washing liquid, which are in fluid communication with the channel (42) for the passage of the refrigerant fluid and which are located downstream of the channel (42) for the passage of the refrigerant fluid relative to the direction of refrigerant fluid outflow
and/or **in that**
B) the first part of the channel (42) for the passage of the refrigerant fluid has a winding shape and/or **in that**
C) the channel (42) for the passage of the refrigerant fluid comprises a tank (48) comprising an interfacing opening (481) which places it in fluid communication with the channel (41) for the passage of the gaseous fluid.
2. The electrical household appliance according to claim 1, **characterized in that** the first part of the channel (42) for the passage of the refrigerant fluid extends substantially alongside a part of the channel (41) for the passage of the gaseous fluid.
 3. The electrical household appliance according to any of the preceding claims, **characterized in that** the condensing wall (40) extends substantially parallel to a plane.
 4. The electrical household appliance according to any of the preceding claims **characterized in that** the condenser (4) comprises two superposed metal sheets comprising a first portion where they are in contact and a second portion where they are apart so as to define, interposed between them, the first part of the channel (42) for the passage of the refrigerant fluid.
 5. The electrical household appliance according to any of the preceding claims, **characterized in that** the condenser (4) comprises an outer delimiting surface (45), the first part of the channel (42) for the passage of the refrigerant fluid defining a gap (46) interposed between the channel (41) for the passage of the gaseous fluid and the outer delimiting surface (45) of the condenser (4).
 6. The electrical household appliance according to claim 5, **characterized in that** the gap (46) is delimited by:
 - a shell (461) made as a single part and having an opening;
 - a lid (462) which occludes the opening;

the gap (46) comprising a plurality of partitions (463) which confer a winding shape on the first part of the channel (42) for the passage of the refrigerant fluid, the partitions (463) being at least partly built into the lid (462).
 7. The electrical household appliance according to claim 5 or 6, **characterized in that** gap (46) only partly circumscribes the channel (41) for the passage of the gaseous fluid.
 8. The electrical household appliance according to any of the preceding claims, **characterized in that** there is no interface which:
 - is common to the channel (41) for the passage of the gaseous fluid and to the channel (42) for the passage of the refrigerant fluid;
 - places the channel (41) for the passage of the gaseous fluid and the channel (42) for the passage of the refrigerant fluid in fluid communication inside the condenser (4).
 9. The electrical household appliance according to claim 1, **characterized in that** it comprises a condensate outlet channel (47) outside the channel (41) for the passage of the gaseous fluid and which places the channel (41) for the passage of the gaseous fluid in fluid communication with the washing compartment.









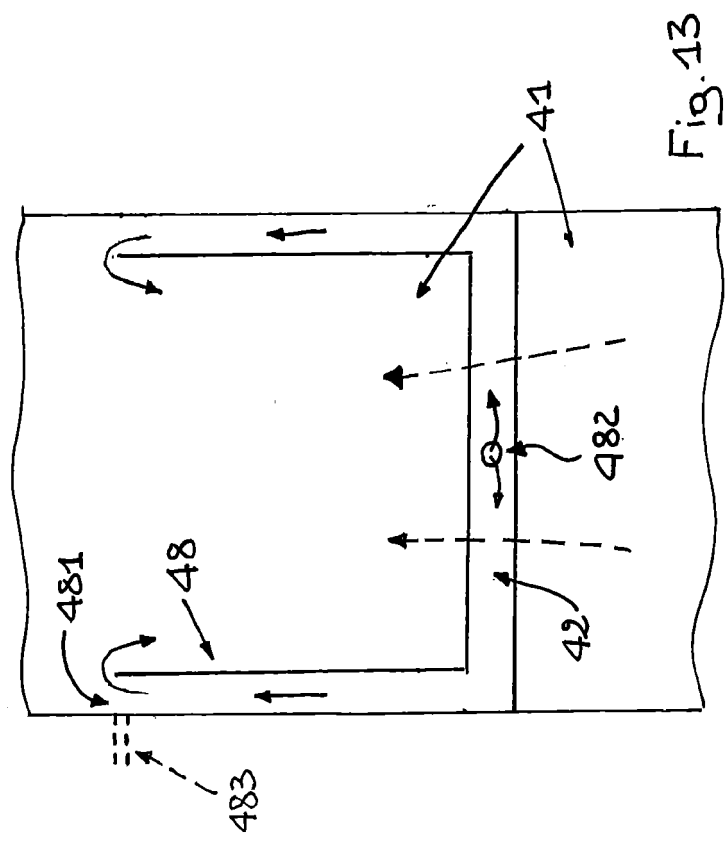


Fig. 13

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 0429953 A [0005]