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(54) HOUSEHOLD APPLIANCE FOR WASHING ARTICLES SUCH AS DISHES OR PIECES OF SILVERWARE

(57) The present invention relates to a household appliance (1) for washing articles such as dishes or pieces of silverware comprising a tub (2) adapted to receive articles to be washed and a sprayer (10) configured for dispensing a washing fluid in the tub (2). The household appliance (1) also comprises a heat pump configured for operating by means of a process fluid and comprising a compressor (13), an evaporator (14), a condenser (15), an expansion member (16). The heat pump has a circuit for the circulation of the process fluid fluid-dynamically connecting the compressor (13), the evaporator (14), the condenser (15) and the expansion member (16). The condenser (15) is at least partially extended in contact with the tub (2) and the compressor (13), the evaporator (14) and the expansion member (16) are arranged in a base (11) of the household appliance (1).

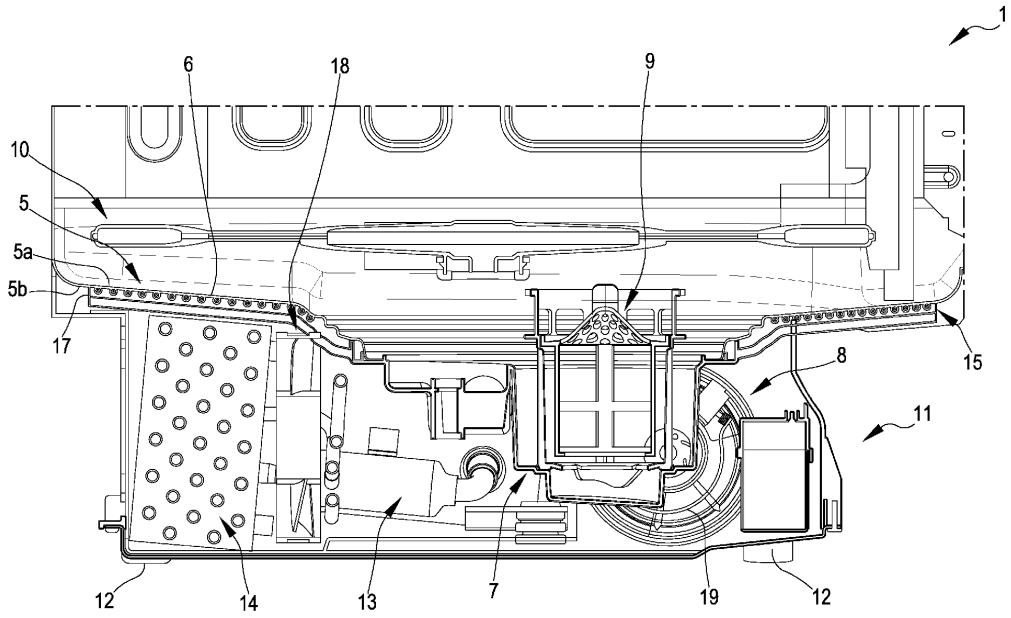

FIG.4

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Description

FIELD OF THE FINDING

[0001] The object of the present invention is a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump.

[0002] The invention also regards a method for engaging a condenser with a tub for a household appliance for washing articles such as dishes or pieces of silverware of heat pump type.

STATE OF THE ART

[0003] Household appliances are known for washing dishes of the type with heat pump, which usually have an energy consumption lower than the household appliances for washing dishes, which do not have a heat pump circuit. A known patent document relative to a household appliance for washing dishes of the type with heat pump is represented by the European patent application No. EP0862889A2. EP0862889A2 discloses a household appliance for washing dishes provided with a heat pump, whose circuit has an architecture which allows saving energy. Nevertheless, the architecture of the circuit of the heat pump proposed by EP0862889A2 does not allow ensuring an optimal heating of the washing fluid.

OBJECT OF THE INVENTION

[0004] Object of the present invention is therefore that of solving at least one of the drawbacks or limitations pursuant to the state of the art.

[0005] A first objective of the present invention is to improve the architecture of the heat pump circuit of a household appliance for washing articles such as dishes or pieces of silverware, of the type with heat pump.

[0006] Another object of the present invention is to provide a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump which ensures an optimal and efficient heating of the washing fluid.

[0007] An additional object of the present invention is to provide a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump which allows a quick heating of the washing fluid. Another object of the invention is to provide a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump which allows speeding up or minimizing the transients aimed to reach the operating conditions of the household appliance.

[0008] A further object of the present invention is to make a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump which is efficient and effective. In particular, one object of the invention is to provide a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump adapted to implement washing cycles in an efficient and effective manner, in particular under the profile of energy consumption of the household appliance.

[0009] An additional object of the present invention is to provide a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump of compact type.

[0010] A further object of the present invention is to provide a method for engaging a condenser with a tub for a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump which ensures an optimal heating of the washing fluid.

[0011] Another object of the present invention is to provide a method for engaging a condenser with a tub for a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump which allows assembling and making a household appliance in a quick, simple and effective manner.

[0012] An additional object of the invention is to illustrate a method for engaging a condenser to a tub for a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump which allows making a household appliance that is compact and with limited bulk.

[0013] The further objects indicated above with reference to the household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump are also applicable to the method for engaging a condenser with a tub for a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump.

[0014] These and still other objects, which will be clearer from the following description, are substantially reached by a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump, by a method for engaging a condenser with a tub for a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump and by a method for making a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump in accordance with one or more of the enclosed claims and, as an addition or alternative, with one or more of the following aspects.

SUMMARY

[0015] Aspects of the finding are described hereinbelow.

[0016] In a 1st aspect, a household appliance is provided for washing articles such as dishes or pieces of silverware comprising:

- a tub defining a washing chamber adapted to receive said articles,
- at least one sprayer configured for dispensing a washing fluid in the washing chamber,
- a heat pump configured for operating by means of a

process fluid and provided at least with:

- an evaporator at which the process fluid absorbs heat from a fluid, optionally from the washing fluid,
- a condenser at which the process fluid transfers heat to a fluid, optionally to the washing fluid,
- a circuit for the circulation of the process fluid fluid-dynamically connecting the condenser and the evaporator and configured for allowing the circulation of process fluid between the evaporator and the condenser,

in which the condenser is at least partially extended in contact with the tub.

[0017] In a 2nd aspect in accordance with the 1st aspect, the household appliance also comprises a support element engaged at a lower portion of the tub, the condenser being mounted on the support element or being embedded, for example by means of co-molding, in the support element.

[0018] In a 3rd aspect in accordance with the 1st or the 2nd aspect, the condenser is configured for transferring heat to at least one between:

- the washing fluid, the condenser being arranged along a washing circuit of the household appliance,
- a drying fluid adapted to dry articles such as dishes or pieces of silverware, previously washed, the condenser being arranged along a drying circuit of the household appliance.

[0019] In a 4th aspect in accordance with any one of the preceding aspects, the condenser being arranged both along the washing circuit and along the drying circuit and being configured for transferring heat, for example in different operating steps, to the washing fluid and to the drying fluid.

[0020] In a 5th aspect in accordance with any one of the preceding aspects, the evaporator is configured for absorbing heat from at least one between:

- the washing fluid, the evaporator being arranged along a washing circuit of the household appliance,
- a drying fluid adapted to dry articles, such as dishes or pieces of silverware, previously washed, the condenser being arranged along a drying circuit of the household appliance.

[0021] In a 6th aspect in accordance with any one of the preceding aspects, the evaporator is arranged both along the washing circuit and along the drying circuit and being configured for absorbing heat, for example in different operating steps, from the washing fluid and from the drying fluid.

[0022] In a 7th aspect in accordance with any one of the preceding aspects, the condenser is engaged with the tub at a lower portion of the tub.

[0023] In an 8th aspect in accordance with any one of the preceding aspects, the tub comprises a bottom provided with an internal surface facing the washing chamber and an external surface, the condenser facing the, or being extended in proximity to or at the, external surface of the bottom of the tub.

[0024] In a 9th aspect in accordance with any one of the preceding aspects, the household appliance comprises a washing fluid collection well in fluid communication with the tub, the washing fluid collection well being configured for collecting washing fluid so as to evacuate it from the washing chamber, the condenser being extended at least partially around the washing fluid collection well.

[0025] In a 10th aspect in accordance with the 9th aspect, the washing fluid collection well has an access mouth having a closed path profile and adapted to allow the access of the washing fluid from the washing chamber to the washing fluid collection well, the condenser being extended perimetrically with respect to the closed path profile of said access mouth.

[0026] In an 11th aspect in accordance with the 10th aspect, the closed path profile of the access mouth has a plurality of sides or sections transverse to each other, the condenser comprising a plurality of branches, at least one branch of said plurality of branches being arranged in proximity to each side or section of the closed path profile of the access mouth.

[0027] In a 12th aspect in accordance with any one of the preceding aspects, the tub comprises a bottom and a lateral wall transverse to the bottom, the bottom of the tub comprising a washing fluid downflow portion configured for facilitating the downflow of the washing fluid from the washing chamber to the washing fluid collection well, the washing fluid downflow portion being arranged between the lateral wall and the washing fluid collection well, the condenser being at least partially arranged or engaged at the washing fluid downflow portion.

[0028] In a 13th aspect in accordance with any one of the preceding aspects, the condenser comprises a plurality of branches arranged in parallel to each other, the branches of said plurality of branches having or being configured for having at least one from among the following: a same load loss, a same flow of process fluid, a same length, a same internal diameter, a same external diameter, a same shape, a same bulk.

[0029] In a 14th aspect in accordance with any one of the preceding aspects, the condenser has at least one end fluid-dynamically connected to the circuit for the circulation of the process fluid by means of a flexible connection element.

[0030] In a 15th aspect in accordance with any one of the preceding aspects, the heat pump also comprises:

- a compressor configured for moving the process fluid into the circuit for the circulation of the process fluid,

◦ at least one flexible connection element fluid-dynamically connecting the condenser and the compressor.

[0031] In a 16th aspect in accordance with the 15th aspect, the compressor is extended at a first section of the heat pump.

[0032] In a 17th aspect in accordance with any one of the preceding aspects, the heat pump also comprises:

- an expansion member, such as a coil or a thermal expansion valve, arranged between the condenser and the evaporator, the expansion member being extended optionally at a first section of the heat pump, the expansion member being configured for determining an expansion of the process fluid,
- optionally, a further flexible connection element fluid-dynamically connecting the compressor and the expansion member.

[0033] In an 18th aspect in accordance with any one of the preceding aspects, the condenser is at least partially extended at a heater greater than a height of the evaporator, the heights of the condenser and of the evaporator being defined with reference to an g of the household appliance intended to come into contact with an abutment surface for the household appliance or with reference to an abutment surface for the household appliance.

[0034] In a 19th aspect in accordance with any one of the preceding aspects, the household appliance also comprises a base arranged below with respect to the tub, the evaporator being arranged in the base.

[0035] In a 20th aspect in accordance with any one of the preceding aspects, the evaporator is defined in a first section of the heat pump extended at the base and the condenser is defined in a second section of the heat pump, the second section being defined above with respect to the first section.

[0036] In a 21st aspect in accordance with any one of the preceding aspects, the household appliance also comprises a heater, such as an electrical heating element, configured for heating the washing fluid.

[0037] In a 22nd aspect in accordance with any one of the preceding aspects, the household appliance comprises a washing circuit and a pump configured for moving the washing fluid along the washing circuit, the heater being arranged in proximity to the pump or being engaged with the pump or being wound around the pump.

[0038] In a 23rd aspect in accordance with any one of the preceding aspects, the pump is at least partially extended in the washing fluid collection well.

[0039] In a 24th aspect, a household appliance is provided for drying articles such as dishes or pieces of silverware comprising a tub defining a drying chamber adapted to receive said articles and a bottom, the bottom comprises:

- at least one first portion associated with at least one heating element and
- at least one second portion, for example defined in proximity to the first portion, associated with at least one cooling element.

[0040] In a 25th aspect in accordance with the 24th, the heating element comprises a condenser of a heat pump circuit. In a 26th aspect in accordance with the 24th or with the 25th aspect, the cooling element comprises an evaporator of a heat pump circuit.

[0041] In a 27th aspect in accordance with any one of the aspects from the 24th to the 26th, the household appliance is of the type with heat pump, the evaporator and the condenser being part of a same heat pump circuit of the household appliance.

[0042] In a 28th aspect in accordance with any one of the aspects from the 24th to the 27th, the household appliance is a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump in accordance with any one of the aspects from the 1 st to the 23rd and/or with the enclosed household appliance claims.

[0043] In a 29th aspect in accordance with any one of the aspects from the 24th to the 28th, the tub defines both the washing chamber and the drying chamber.

[0044] In a 30th aspect, a method is provided for engaging a condenser with a tub for a household appliance of the type with heat pump for washing articles such as dishes or pieces of silverware, the household appliance being optionally in accordance with any one of the aspects from the 1 st to the 29th and/or with any one of the enclosed household appliance claims, the method comprising at least the steps of:

- arranging a tub, optionally for a household appliance for washing dishes of the type with heat pump, the tub defining a washing chamber adapted to receive articles, such as dishes or pieces of silverware, to be washed,
- arranging a condenser,
- engaging the condenser at least partially in contact with the tub.

[0045] In a 31st aspect in accordance with the 30th aspect, arranging a condenser comprises:

- arranging a support element, optionally the support element being made of plastic material,
- mounting the condenser on the support element,
- engaging the support element with the tub, optionally the engagement of the support element with the tub being attained by means of threaded elements.

[0046] In a 32nd aspect in accordance with the 30th or with the 31st aspect, in which:

- arranging a condenser comprises arranging a con-

denser comprising a plurality of branches,

- arranging a support element comprises arranging a support element, optionally made of plastic material, having grooves at least partially counter-shaped with respect to a profile of the condenser and configured for housing respective branches of the condenser,
- mounting the condenser on the support element comprises positioning each branch of said plurality of branches at a respective groove of the support element.

[0047] In a 33rd aspect in accordance with any one of the aspects from the 30th to the 32nd, arranging a condenser comprises:

- arranging a support element, optionally the support element being an element made of tar sheet,
- embedding the condenser in the support element,
- engaging the support element with the tub.

[0048] In a 34th aspect in accordance with the 33rd aspect, embedding the condenser in the support element comprises co-molding the condenser and the support element.

[0049] In a 35th aspect in accordance with the 34th aspect:

- co-molding the condenser and the support element comprises co-molding the condenser on an element made of tar sheet,
- engaging the support element with the tub comprises engaging the element made of tar sheet with the tub, for example by means of gluing.

[0050] In a 36th aspect in accordance with any one of the aspects from the 30th to the 35th, engaging the condenser at least partially in contact with the tub comprises at least one from among the following steps:

- arranging the condenser along a washing circuit of the household appliance,
- arranging the condenser along a drying circuit of the household appliance,
- arranging the condenser along a washing circuit of the household appliance and along a drying circuit of the household appliance.

[0051] In a 37th aspect in accordance with any one of the aspects from the 30th to the 36th, engaging the condenser at least partially in contact with the tub comprises engaging the condenser with the tub at a lower portion of the tub.

[0052] In a 38th aspect in accordance with any one of the aspects from the 30th to the 37th, the tub comprises a bottom provided with an internal surface facing the washing chamber and an external surface, engaging the condenser at least partially in contact with the tub comprises arranging the condenser with respect to the bottom of the tub in a manner such that the condenser faces the, or is extended in proximity to or at the, external surface of the bottom of the tub.

[0053] In a 39th aspect in accordance with any one of the aspects from the 30th to the 38th, the method comprises the steps of:

- arranging a compressor, a pump and, optionally, an expansion member,
- arranging a base,
- arranging in the base the compressor and the pump and, optionally, the expansion member.

[0054] In a 40th aspect in accordance with any one of the aspects from the 30th to the 39th, arranging a tub comprises assembling the condenser at a base of the household appliance.

[0055] In a 41st aspect in accordance with the 40th aspect, assembling the condenser at a base of the household appliance also comprises connecting the condenser and the base by means of at least one flexible connection element.

[0056] In a 42nd aspect in accordance with the 41st aspect, connecting the condenser and the base by means of at least one flexible connection element comprises connecting, by means of a flexible connection element, the condenser and the compressor.

[0057] In a 43rd aspect in accordance with any one of the aspects from the 30th to the 42nd, arranging a tub comprises arranging a box-like body, optionally for a household appliance of the type with heat pump for washing articles such as dishes or pieces of silverware, within the box-like body a tub being housed defining a washing chamber and adapted to receive articles, such as dishes or pieces of silverware, to be washed.

[0058] In a 44th aspect in accordance with any one of the aspects from the 30th to the 43rd, the method comprises a step of arranging a heat pump configured for operating by means of a process fluid.

[0059] In a 45th aspect in accordance with the 44th aspect, arranging a heat pump comprises:

- arranging an evaporator,
- arranging a condenser,
- arranging a compressor,
- arranging an expansion member,
- fluid-dynamically connecting the evaporator, the condenser, the compressor and the expansion member along a circuit for the circulation of process fluid.

[0060] In a 46th aspect in accordance with any one of the aspects from the 30th to the 45th, the method comprises a step of arranging a box-like body.

[0061] In a 47th aspect in accordance with the 46th aspect, arranging a box-like body comprises arranging a heat pump configured for operating by means of a process fluid at least partially housed in the box-like body.

[0062] In a 48th aspect in accordance with the 46th or with the 47th aspect, arranging a box-like body comprises:

- arranging a box-like body defining a washing chamber adapted to receive articles, such as dishes or pieces of silverware, to be washed,
- arranging a tub,
- engaging the tub within the box-like body.

[0063] In a 49th aspect in accordance with the 48th aspect:

- arranging a tub comprises:
    - ◦ arranging a washing fluid collection well, and
    - ◦ placing in fluid communication the washing fluid collection well and the tub in a manner such that the washing fluid collection well can collect washing fluid so as to evacuate it from the washing chamber,
- engaging the condenser at least partially in contact with the tub comprises arranging the condenser at least partially around the washing fluid collection well.

[0064] In a 50th aspect in accordance with the 49th aspect:

- arranging a washing fluid collection well comprises arranging a washing fluid collection well having an access mouth having a closed path profile and adapted to allow the access of the washing fluid from the washing chamber to the washing fluid collection well,
- engaging the condenser at least partially in contact with the tub comprises arranging the condenser perimetrically with respect to the closed path profile of said access mouth.

[0065] In a 51st aspect in accordance with the 50th aspect, the closed path profile of the access mouth has a plurality of sides or sections transverse to each other, the condenser comprising a plurality of branches, the step of arranging the condenser perimetrically with respect to the closed path profile of said access mouth comprising a step of arranging at least one branch of said plurality of branches in proximity to each side or section of the closed path profile of the access mouth.

[0066] In a 52nd aspect in accordance with any one of the aspects from the 30th to the 51st, the tub comprises a bottom and a lateral wall transverse to the bottom, the bottom of the tub comprising a washing fluid downflow portion configured for facilitating the downflow of the washing fluid from the washing chamber to the washing fluid collection well, the washing fluid downflow portion being arranged between the lateral wall and the washing fluid collection well, the step of engaging the condenser at least partially in contact with the tub comprising engaging the condenser at the washing fluid downflow portion or at least partially arranging the condenser at the washing fluid downflow portion.

[0067] In a 53rd aspect in accordance with any one of the aspects from the 30th to the 52nd, the method comprises the following steps:

- arranging an evaporator,
- arranging the evaporator at a height lower than a height at which the condenser is arranged or arranging the condenser at a heater greater than a height at which is arranged the evaporator,

the heights of the evaporator and of the condenser being defined with reference to an abutment portion of a box-like body or of the household appliance intended to come into contact with an abutment surface of the box-like body or of the household appliance or with reference to an abutment surface of the box-like body or of the household appliance.

[0068] In a 54th aspect in accordance with the 53rd aspect, arranging the evaporator at a height lower than a height at which the condenser is arranged comprises arranging a base with which an evaporator is engaged and, optionally, engaging the base ad a lower portion of the box-like body in a manner such that the evaporator is extended at least partially below with respect to the tub.

[0069] In a 55th aspect in accordance with the 53rd or with the 54th aspect, the step of arranging the evaporator at a height lower than a height at which the condenser is arranged is subsequent to the step of engaging the condenser at least partially in contact with the tub.

[0070] In a 56th aspect in accordance with any one of the aspects from the 30th to the 55th, arranging the evaporator at a height lower than a height at which the condenser is arranged or arranging the condenser at a heater greater than a height at which is arranged the evaporator comprises at least one from between the following steps:

- arranging the evaporator in a base of the household appliance, for example at a first section of a heat pump,
- arranging the condenser at a second section of the heat pump.

[0071] In a 57th aspect in accordance with the 56th aspect, the step of arranging the evaporator in the base is subsequent to the step of arranging the condenser at a second section of the heat pump.

[0072] In a 58th aspect in accordance with any one of the aspects from the 53rd to the 57th, arranging an evaporator comprises:

- arranging an evaporator and a base and engaging the evaporator with the base or arranging a base with which an evaporator is engaged, optionally the

evaporator being housed in the base,

- engaging the base with a lower portion of the box-like body or at a space defined below the tub, optionally in a manner such to make a first section of a heat pump of the household appliance at least partially defined below with respect to a bottom of the tub, the heat pump being configured for operating by means of a process fluid.

[0073] In a 59th aspect in accordance with any one of the aspects from the 30th to the 58th, engaging the condenser at least partially in contact with the tub comprises positioning the condenser above with respect to a base, optionally in a manner such to make a second section of the heat pump of the household appliance at least partially defined above with respect to the bottom of the tub.

[0074] In a 60th aspect in accordance with any one of the aspects from the 30th to the 59th, the method also comprises a step of arranging a circuit for the circulation of the process fluid fluid-dynamically connecting the condenser and the evaporator.

[0075] In a 61st aspect in accordance with the 60th aspect, the circuit for the circulation of process fluid is configured for allowing the circulation of fluid between the first section and the second section.

[0076] In a 62nd aspect in accordance with any one of the aspects from the 30th to the 61st, the method comprises the steps of:

- arranging a base in which a compressor and an evaporator are housed, optionally in the base an expansion member also being housed,
- fluid-dynamically connecting the condenser to the compressor and/or to the evaporator by means of a flexible connection element.

[0077] In a 63rd aspect in accordance with any one of the aspects from the 30th to the 62nd, the method also comprises a step of engaging at least one flexible connection element with the condenser.

[0078] In a 64th aspect in accordance with any one of the aspects from the 30th to the 63rd, the method also comprises a step of fluid-dynamically closing a circuit for the circulation of the process fluid by means of at least one flexible connection element.

[0079] In a 65th aspect in accordance with the 64th aspect, the step of engaging said at least one flexible connection element with the condenser comprises the step of fluid-dynamically closing a circuit for the circulation of the process fluid by means of at least one flexible connection element.

[0080] In a 66th aspect in accordance with any one of the aspects from the 30th to the 65th, the method comprises a step of arranging a compressor, optionally at the first section, the compressor being configured for moving the process fluid into the circuit for the circulation of the process fluid of the heat pump.

[0081] In a 67th aspect in accordance with the 66th aspect, the method comprises a step of fluid-dynamically connecting the condenser and the compressor by means of at least one flexible connection element.

[0082] In a 68th aspect in accordance with the 67th aspect, the step of fluid-dynamically closing a circuit for the circulation of the process fluid by means of at least one flexible connection element comprises the step of fluid-dynamically connecting the condenser and the compressor by means of said at least one flexible connection element.

[0083] In a 69th aspect in accordance with any one of the aspects from the 30th to the 68th, the method also comprises a step of loading process fluid in the compressor, the step of loading process fluid in the compressor being subsequent to the step of fluid-dynamically connecting the condenser and the compressor by means of said at least one flexible connection element.

[0084] In a 70th aspect in accordance with any one of the aspects from the 30th to the 69th, the method also comprises a step of arranging a heater, such as an electrical heating element, configured for heating the washing fluid.

[0085] In a 71st aspect in accordance with any one of the aspects from the 30th to the 70th, the method also comprises a step of arranging a pump configured for moving a washing fluid, the method comprising at least one from among the following steps:

- arranging the heater in proximity to the pump, or
- engaging the heater with the pump, or
- winding the heater around the pump.

[0086] In a 72nd aspect in accordance with any one of the aspects from the 30th to the 71st, the method is a method for making a household appliance for washing dishes of the type with heat pump.

[0087] In a 73rd aspect, a method is provided for making a household appliance of the type with heat pump for washing articles such as dishes or pieces of silverware, the household appliance being optionally in accordance with any one of the aspects from the 1 st to the 29th and/or with any one of the enclosed household appliance claims, the method comprising at least the steps of:

- arranging a heat pump configured for operating by means of a process fluid and provided with an evaporator, a condenser and a circuit for the circulation of the process fluid fluid-dynamically connecting the condenser and the evaporator,
- engaging the condenser with a tub of the household appliance in accordance with the method according to any one of the aspects from the 30th to the 72nd and/or with any one of the enclosed method claims,
- arranging a sprayer configured for dispensing a washing fluid in a washing chamber defined by the tub,
- arranging a pump configured for moving the washing fluid,

- placing in fluid communication the pump, the sprayer and the washing chamber in a manner such to define a washing circuit.

[0088] In a 74th aspect in accordance with the 72nd aspect, the method also comprises the following steps:

- arranging a box-like body,
- at least partially housing the tub in the box-like body,
- arranging a door,
- engaging the door with the box-like body at an access, for example a front access, to the tub in a manner such that the door can operate between:
    - a closed configuration in which it obstructs the access to the washing chamber and consequently prevents the accessibility to the washing chamber,
    - an open configuration in which it allows the access to the washing chamber and consequently allows the accessibility to the washing chamber.

[0089] In a 75th aspect in accordance with the 73rd or with the 74th aspect, the method also comprises the following steps:

- defining a washing fluid collection well,
- placing in fluid communication the washing fluid collection well and the tub in a manner such that the washing fluid collection well can collect washing fluid so as to evacuate it from the washing chamber.

[0090] In a 76th aspect in accordance with any one of the aspects from the 73rd to the 75th, placing in fluid communication the pump, the sprayer and the washing chamber in a manner such to define a washing circuit comprises placing in fluid communication the pump, the sprayer, the washing chamber and the washing fluid collection well in a manner such to define a washing circuit.

[0091] In a 77th aspect, a method is provided for making a household appliance for drying articles such as dishes or pieces of silverware, the household appliance being optionally in accordance with any one of the aspects from the 24th to the 29th and/or with any one of the enclosed household appliance claims, the method comprising the following steps:

- arranging a tub defining a drying chamber adapted to receive said articles and comprising a bottom,
- associating a heating element with a first portion of the bottom,
- associating a cooling element with a second portion of the bottom, for example defined in proximity to the first portion.

[0092] In a 78th aspect in accordance with the 77th aspect, associating a heating element with a first portion of the bottom comprises arranging a condenser at or in proximity to the first portion of the bottom or vice versa.

[0093] In a 79th aspect in accordance with the 78th aspect, arranging a condenser at or in proximity to the first portion of the bottom or vice versa comprises engaging the condenser with a tub according to the method in accordance with the method according to any one of the aspects from the 30th to the 72nd and/or with any one of the enclosed method claims, the step of engaging the condenser at least partially in contact with the tub providing for engaging the condenser at the first portion of the bottom of the tub.

[0094] In an 80th aspect in accordance with any one of the aspects from the 77th to the 79th, associating a cooling element with a second portion of the bottom comprises arranging an evaporator at or in proximity to the second first portion of the bottom or vice versa.

[0095] In an 81st aspect in accordance with any one of the aspects from the 77th to the 80th, the method is a method for making a household appliance for the washing and the drying of articles such as dishes or pieces of silverware.

[0096] In an 82nd aspect in accordance with any one of the aspects from the 1st to the 81st, the household appliance also comprises a base arranged below with respect to the tub and the heat pump also comprises a compressor configured for moving the process fluid into the circuit for the circulation of the process fluid and, optionally, an expansion member configured for determining an expansion of the process fluid, the compressor, the evaporator and, optionally, the expansion member being arranged in the base.

[0097] In an 83rd aspect in accordance with the 82nd aspect, the base is of pre-assembled type.

[0098] In an 84th aspect in accordance with any one of the aspects from the 1st to the 83rd, the washing circuit connects fluid-dynamically the pump, the sprayer and the tub.

[0099] In an 85th aspect in accordance with any one of the aspects from the 1st to the 84th, the pump is arranged between the evaporator and the compressor.

[0100] In an 86th aspect in accordance with any one of the aspects from the 1st to the 85th, the household appliance for washing articles such as dishes or pieces of silverware is a household appliance for the washing and the drying of articles such as dishes or pieces of silverware.

[0101] In an 87th aspect in accordance with any one of the aspects from the 1st to the 86th, the washing chamber is a washing chamber and/or drying adapted to receive articles, such as dishes or pieces of silverware, to be washed and/or dried.

[0102] In an 88th aspect in accordance with any one of the aspects from the 1st to the 87th, the household appliance for washing articles such as dishes or pieces of silverware is a dishwasher.

[0103] In an 89th aspect in accordance with any one of the aspects from the 1st to the 88th, the household

appliance comprises a box-like body housing the tub.

[0104] In a 90th aspect in accordance with any one of the aspects from the 1st to the 89th, the household appliance comprises at least one fan configured for heating the evaporator and/or for cooling compressor.

[0105] In a 91st aspect in accordance with the 90th aspect, said at least one fan is configured for heating the evaporator, at least in part using heat of the compressor.

[0106] In a 92nd aspect in accordance with any one of the aspects from the 1st to the 90, the household appliance also comprises at least one filter configured for filtering the washing fluid flowing out from the washing chamber. In a 93rd aspect in accordance with the 92nd aspect, said at least one filter is at least partially extended in the washing fluid collection well.

[0107] In a 94th aspect in accordance with any one of the aspects from the 1st to the 93rd, the bottom of the tub is configured for allowing the heat exchange between washing fluid and process fluid.

[0108] In a 95th aspect in accordance with any one of the aspects from the 1st to the 94th, the bottom of the tub is made of thermally conductive material.

[0109] In a 96th aspect in accordance with any one of the aspects from the 1st to the 94th, the tub is made of thermally conductive material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0110] Several embodiments and several aspects of the finding will be described hereinbelow with reference to the enclosed drawings, provided only as a non-limiting example, in which:

- figure 1 is a perspective view of a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump in accordance with one embodiment of the present invention,
- figure 2 is a cross section of the household appliance of figure 1,
- figure 3 is a bottom view of the household appliance of figure 1,
- figure 4 is a side cross section of a lower portion of the household appliance of figure 1.

DEFINITIONS AND CONVENTIONS

[0111] It is observed that in the present detailed description, corresponding parts illustrated in the various figures are indicated with the same reference numbers. The figures could illustrate the object of the invention by means of representations that are not in scale; therefore, parts and components illustrated in the figures relative to the object of the invention could exclusively regard schematic representations. In the context of the present description, the use of terms such as "upper", "above", "lower", "below", "lateral", "laterally", "horizontal", "horizontally", "vertical", "vertically", "frontal", "frontally", "rear", "on the rear part" and the like refer - except for specific different indications - to at least one spatial orientation that the object of the invention can normally take on in operating conditions or use conditions. On such matter, see the enclosed figures illustrating at least one possible spatial orientation of the object of the invention. Except for specific different indications, the use of terms "condition" or "configuration" can be used interchangeably in the context of the present document.

[0112] Hereinbelow, several definitions are reported which can be used for the purposes of better understanding the present invention:

- with the expression "washing circuit" it is intended a circuit along which a washing fluid can flow in order to carry out at least one washing cycle of the household appliance,
- with the expression "washing fluid" it is intended a fluid, for example a liquid, configured for washing articles, such as dishes or pieces of silverware; in particular, the washing fluid comprises water and at least one washing agent dissolved in the water,
- with the expression "drying circuit" it is intended a circuit along which a drying fluid can circulate in order to carry out at least one washing cycle of the household appliance,
- with the expression "drying fluid" it is intended a fluid, in particular air, configured for drying articles, such as dishes or pieces of silverware; the drying fluid is typically heated and, hitting articles such as dishes or pieces of silverware in the drying chamber, removes water in the form of steam from such articles,
- with the expression "heat pump" it is intended any one apparatus of the type with heat pump, i.e. an apparatus which exploits change of phase of a process fluid;
- with the expression "circuit for the circulation of the process fluid" it is intended the circuit of the heat pump along which a process fluid can circulate,
- with the expression "process fluid" it is intended the operating fluid of the heat pump.

DETAILED DESCRIPTION

Household appliance for washing articles such as dishes or pieces of silverware

[0113] Reference number 1 overall indicates a household appliance for washing articles such as dishes or pieces of silverware of the type with heat pump in accordance with the present invention. The household appliance 1 has a washing circuit along which a washing fluid can flow so as to wash the articles and, in addition or as an alternative, a rinsing fluid so as to rinse the articles. The washing fluid can be water, to which at least one additive or washing agent (detersive) can be added. The rinsing fluid can be water, to which at least one additive or rinsing agent (brightener) can be added. The household appliance 1 can optionally also have a drying

circuit along which a drying fluid can circulate, such as heated air, so as to dry the articles. The household appliance 1 can therefore be adapted to allow both the washing of articles such as dishes or pieces of silverware and the drying of such articles.

[0114] The household appliance 1 comprises a tub 2, which defines a washing chamber 2a sized for receiving articles to be washed. The tub 2 has a covering portion 3, a lateral wall 4 and a bottom 5. The tub 2 can be monolithic; in such embodiment, the covering portion 3, the lateral wall 4 and the bottom 5 are made of a single piece. As an alternative, the covering portion 3, the lateral wall 4 and the bottom 5 can be assembled together to form the tub 2. The tub 2 can be made of thermally conductive material. In particular, the tub 2 can be made by means of a suitably-shaped plate of thermally conductive material.

[0115] The covering portion 3 is extended at an upper portion of the tub 2 and delimits above the washing chamber 2a. In substance, the covering portion 3 substantially defines a ceiling of the tub 2.

[0116] The lateral wall 4 of the tub 2 is extended continuously with the covering portion 3. The lateral wall 4 is transverse to the covering portion 3 and constitutes a cover of the tub 2 adapted to laterally delimit the washing chamber 2a. The lateral wall 4 has an upper end with which the covering portion 3 is engaged and a lower end with which the bottom 5 is engaged. The lateral wall 4 has an access at which it is possible to access the washing chamber 2a. The lateral wall 4 can comprise a plurality of panels arranged transverse to each other. The lateral wall 4 can as an example comprise three panels 4a, 4b, 4c which are extended without interruption to form a substantially U-shaped or C-shaped profile; immediately consecutive panels 4a, 4b, 4c can be arranged orthogonally to each other. In the enclosed figures, a household appliance 1 is illustrated in which the panels 4a, 4c constitute flanks of the lateral wall 4 of the tub 2 and the panel 4b is interposed transverse to the flanks 4a, 4c to constitute a back of the lateral wall 4 delimiting the tub 2 on the rear part. In other words, the panel 4b is a rear panel of the tub 2. In further possible embodiments, the lateral wall 4 can comprise a number of panels different from three.

[0117] The bottom 5 of the tub 2 is extended continuously with the lower end of the lateral wall 4. The bottom 5 of the tub 2 is opposite the covering portion 3 and is arranged at a lower portion of the tub 2. The bottom 5 of the tub 2 delimits below the washing chamber 2a. The bottom 5 is provided with an internal surface 5a facing the washing chamber 2a and an external surface 5b; in operating conditions of the household appliance 1, the internal surface 5a of the bottom 5 comes into contact with the washing fluid. The bottom 5 has a washing fluid downflow portion 6 adapted to make the washing fluid flow out from the washing chamber 2a. The washing fluid downflow portion 6 can advantageously have a shape aimed to make the washing fluid flow out; for example, the washing fluid downflow portion 6 can have a downflow section which decreases when proceeding, along a vertical direction, from the lower end of the lateral wall 4 to a lower terminal end of the bottom 5. The downflow section can be defined as a useful passage section for the washing fluid at which the washing fluid can flow out. In accordance with one possible embodiment, the bottom 5 can have a substantially funnel-like shape. The bottom 5 of the tub 2 can be made of thermally conductive material.

[0118] The household appliance 1 also comprises a washing fluid collection well 7, which is in fluid communication with the tub 2. The washing fluid collection well 7 is configured for collecting washing fluid so as to evacuate it from the washing chamber 2a. For such purpose, the washing fluid collection well 7 can be arranged immediately after the washing fluid downflow portion 6 along an evacuation path of the washing fluid from the household appliance 1. The washing fluid collection well 7 has an access mouth 7a having a closed path profile, which has a plurality of sides or sections transverse to each other. The access mouth 7a is adapted to allow the access of the washing fluid from the washing chamber 2a to the washing fluid collection well 7. In the embodiment illustrated in the enclosed figures, the washing fluid collection well 7 is arranged on the bottom 5 of the tub 2 and the washing fluid downflow portion 6 is extended around the washing fluid collection well 7. The washing fluid collection well 7 can be a component separated from the bottom 5 of the tub 2 and can be engageable with the bottom 5 of the tub 2 or, as an alternative, it can be integral with the bottom 5 of the tub 2. The household appliance 1 also comprises a pump 8 configured for moving the washing fluid along the washing circuit. The pump 8 can be extended in proximity to the washing fluid collection well 7.

[0119] The household appliance 1 also comprises at least one filter 9 arranged along the washing circuit and configured for filtering the washing fluid, for example the washing fluid flowing out from the washing chamber 2a. In the embodiment pursuant to the enclosed figures, the filter 9 is extended mainly at the washing fluid collection well 7 and is configured for filtering the washing or rinsing fluid at the washing fluid collection well 7.

[0120] The household appliance 1 also comprises at least one sprayer 10 configured for dispensing the washing fluid in the washing chamber 2a. The sprayer is extended within the tub and has a plurality of nozzles configured for dispensing washing fluid in the washing chamber 2a. The sprayer 10 can be rotatably engaged with the tub 2 in a manner such to be able to rotate within the tub 2 in at least one operating condition of the household appliance 1. The sprayer 10 is configured for dispensing the washing fluid in the washing chamber 2a during its rotation. The sprayer 10 can be arranged at a lower portion or at an upper portion of the tub. In figure 4, a sprayer 10 is illustrated, extended at the lower portion of the tub 2 and facing bottom 5 of the tub 2. The household appli-

ance 1 can also have a second sprayer 10 extended at an upper portion of the tub 2 and a valve configured for conveying the washing fluid selectively towards the first sprayer or towards the second sprayer. Optionally, the valve can be configured for conveying the washing fluid simultaneous towards the first sprayer and towards the second sprayer. In one possible embodiment in which the household appliance 1 comprises a first sprayer extended at the lower portion of the tub 2 and a second sprayer extended at the upper portion of the tub 2, the household appliance 1 can optionally have a third sprayer arranged at an intermediate height and comprised between a height at which is extended the first sprayer and a height at which is extended the second sprayer. The first sprayer can face bottom 5 of the tub 2 and the second sprayer can face the covering portion 5 of the tub 2.

[0121] In the scope of the washing circuit, the sprayer 10 constitutes a terminal for dispensing washing fluid. In addition to the sprayer 10, also the pump 8, the washing chamber 2a, the washing fluid downflow portion 6, the washing fluid collection well 7 and the filter 9 are arranged along the washing circuit. The washing circuit receives washing fluid from a source of washing fluid and moves the washing fluid, by means of the pump 8, along the washing circuit. The source of washing fluid is usually outside the household appliance 1 and can be constituted by a water mains to which the household appliance 1 is fluid-dynamically connected, for example by means of a supply pipe. In a step for delivering washing fluid, the pump 8 moves the washing fluid towards the sprayer 10 or the sprayers 10, by means of which the washing fluid is dispensed in the washing chamber 2a. After having carried out a washing cycle or step, in a discharge step the washing fluid is conveyed from the washing fluid downflow portion 6 towards the washing fluid collection well 7, at which it is filtered by the filter 9. The washing fluid collection well 7 then conveys the washing fluid towards the outside of the household appliance 1, for example towards a discharge network to which the household appliance 1 is fluid-dynamically connected. The household appliance 1 can be fluid-dynamically connected to the discharge network by means of a discharge pipe engaged with the washing fluid collection well 7.

[0122] The household appliance 1 can optionally comprise at least one drawer configured for housing the articles. The drawer is configured for allowing a user to replace the articles in a step preceding a step of washing the articles; for such purpose, the drawer can have a plurality of housings for the articles. The drawer can have a reticular structure provided with a plurality of hollow passage sections adapted to allow the passage of washing fluid through the drawer. The drawer is movable, for example by means of suitable guides, between an operating position, in which it is extended within the tub 2 and a loading or discharge position, in which it is at least partially extended outside the tub 2. In operating conditions of the household appliance 1, the drawer is arranged within the tub 2. In order to pass from the operating position to the loading or discharge position, the drawer is extractable from the tub 2 and, in order to carry out the reverse operation, i.e. so as to pass from the loading or discharge position to the operating position, the drawer is insertable in the tub 2. The household appliance 1 can also have a first drawer arranged at a lower portion of the tub 2 and a second drawer arranged at an upper portion of the tub 2; the first drawer can face the first sprayer and the second drawer can face the second sprayer. In one possible embodiment, between the first drawer and the second drawer the household appliance 1 can provide for a third drawer, also extractable from the tub 2 and insertable in the tub 2 in a manner such to be able to operate between an operating position and a loading or discharge position. The third drawer can be arranged at an intermediate height and comprised between a height at which the first drawer is extended and a height at which the second drawer is extended. Each drawer can have different size, shape, geometric characteristics or volume in a manner such to be able to house one or more specific types of articles such as dishes or pieces of silverware.

[0123] The household appliance 1 can also comprise a door arranged with respect to the tub in a manner such to operate between a closed position which it obstructs the access to the washing chamber 2a and an open position in which it allows the access to the washing chamber 2a. The door has an internal surface which, in the closed position of the door, faces the washing chamber 2a and contributes, together with the lateral wall 4 of the tub 2, to laterally delimit the washing chamber 2a. In operating conditions of the household appliance 1, the door is in closed position and the internal surface comes in contact with the washing fluid.

[0124] The household appliance 1 also comprises a base 11 arranged below with respect to the tub 2. The base 11 has an internal volume at which, as will be detailed hereinbelow, a plurality of components of the household appliance 1 can be arranged, and in particular of the heat pump of the household appliance 1. As illustrated in figure 4, the washing fluid collection well 7 and the pump 8 can be extended at least partially at the base 11. The base 11 is typically made of molded plastic material and comprises a plurality of seats made integrally in such base 11 for housing functional components of the household appliance 1.

[0125] The household appliance 1 can also provide, optionally, a box-like body defining a housing volume within which the tub 2 is housed. Optionally, the door can be engaged with the box-like body in a manner such to be movable with respect to the box-like body between the open position and the closed position, and vice versa; as an example, the door can be hinged to the box-like body, for example at a lower portion of the box-like body, in a manner such to be able to rotate between the open position and the closed position, and vice versa.

[0126] The household appliance 1 also comprises at least one abutment portion 12 intended to come into con-

tact with an abutment surface for the household appliance 1, such as a floor, on which the household appliance 1 is intended to be installed. The abutment portion can comprise one or more abutment feet 12.

[0127] The household appliance 1 also comprises a heat pump. The heat pump comprises a compressor 13, an evaporator 14, a condenser 15 and an expansion member 16, which are arranged along a circuit for the circulation of the process fluid, which connects them fluid-dynamically. Hereinbelow, for description simplicity, reference will be made to the circuit for the circulation of the process fluid as circuit of the heat pump. The heat pump can have a first section, at which the compressor 13, the evaporator 14 and the expansion member 16 are extended, and a second section, at which the condenser 15 is extended. The first section is extended at a height lower than a height at which is extended the second section; in substance, the first section is extended mainly or completely below with respect to the second section. The heights of the first section and of the second section of the heat pump can be defined and calculated with reference to the abutment portion 12 of the household appliance 1 or with reference to the abutment surface for the household appliance 1.

[0128] The compressor 13 constitutes the drive member of the heat pump and is configured for moving the process fluid into the circuit of the heat pump. As illustrated in figure 4, the compressor 13 can be arranged substantially horizontally within the base 11.

[0129] The evaporator 14 can be arranged along the drying circuit in a manner such to absorb heat from the drying fluid in order to extract moisture from the air in the form of condensation. The household appliance 1 can provide for a tray for collecting condensation positioned below with respect to the evaporator 14, in which the drops of condensation can be accumulated, percolating via gravity from the evaporator 14. The evaporator 14 can be arranged along the drying circuit downstream of a drying chamber, which can for example be provided by the tub and can volumetrically coincide with the washing chamber 2a itself. The evaporator 14 can be of the type with finned pipe or of the type comprising a plurality of microchannels. As illustrated in figure 4, the evaporator 14 can be extended substantially vertically within the base 11.

[0130] The condenser 15 constitutes the section of the circuit of the heat pump at which the process fluid transfers heat to the washing fluid in a manner such to heat the washing fluid. The condenser 15 can be arranged along the washing circuit upstream of the washing chamber 2a. In one possible embodiment, the condenser 15 can also be arranged along the drying circuit in a manner such to transfer heat to the drying fluid. The condenser 15 can be arranged along the drying circuit upstream of a drying chamber, which can for example be provided by the tub 2 and can coincide volumetrically with the washing chamber 2a itself.

[0131] In order to optimize the transmission of heat to the washing fluid, in accordance with the invention, the condenser 15 is at least partially extended in contact with the tub 2. The arrangement of the condenser in contact with the tub 2 advantageously allows ensuring an efficient heat exchange between washing fluid and process fluid, which actually occurs at the tub 2. In addition, the arrangement of the condenser 15 at least partially in contact with the tub 2 allows maximizing the transmission of heat to the washing fluid.

[0132] The condenser 15 is extended at a lower portion of the tub 2; for such purpose, in the embodiment pursuant to the enclosed figures, the condenser 15 is engaged with the bottom 5 of the tub 2. The engagement of the condenser 15 with the bottom 5 of the tub 2 advantageously allows optimizing the architecture of the circuit of the heat pump. The engagement of the condenser 15 with the bottom 5 of the tub 2 also allows optimally managing its bulk and consequently attaining a compact household appliance 1. The condenser 15 can be engaged with the bottom 5 of the tub 2 at the washing fluid downflow portion 6. By providing for such arrangement, the condenser 15 is allowed to follow a profile of the bottom 5 of the tub 2 defined at the washing fluid downflow portion 6 and therefore contributes to compacting the architecture of the circuit of the heat pump and, consequently, allows attaining a compact household appliance 1. The condenser 15 is engaged with the bottom 5 of the tub 2 in a manner such to not come into contact with the washing fluid; for such purpose, the condenser 15 can be engaged at or in proximity to the external surface 5b of the bottom 5 of the tub 2.

[0133] The condenser 15 comprises a plurality of branches, which define a profile of the condenser 15. Upstream and downstream of the branches of the condenser 5, for practical installation grounds, the household appliance 1 can provide for respective manifolds joining end sections of the branches. The succession of the branches substantially defines an overall length of the condenser 15. In the embodiment pursuant to the enclosed figures, the condenser 15 comprises a plurality of branches arranged in parallel to each other. The condenser 15 can for example have five branches arranged in parallel to each other; each branch can be extended along a coil path. As an example, the coil path of each of the five branches can have a same length equal to 3 m or 4 m, and consequently the condenser 15 can have an overall length of 15 m or 20 m. It remains intended that in possible alternative embodiments, the number of branches of the condenser 15 can be different from five and, in addition or as an alternative, the length of the branches can vary. In addition, in possible variants the branches can be arranged in series with each other or in an arrangement having both branches in parallel to each other and branches in series with each other.

[0134] The branches of the condenser 15 have an analogous load loss with respect to each other in a manner such that the process fluid is distributed as uniformly as possible between the branches of the condenser 15.

In addition, the branches of the condenser 15 can have a same length, a same internal diameter and, in addition or as an alternative, a same external diameter. The internal and external diameter of the branches can be of the order of magnitude of mm. As an example, the internal diameter of the branches can be comprised between 2 mm and 3 mm and the external diameter of the branches can be comprised between 3 mm and 4 mm. Each branch of the condenser 15 can optionally have rectilinear sections and curvilinear and can comprise one or more pipes.

[0135] Each branch of the condenser 15 is engaged at a respective portion of the bottom 5 of the tub 2 and can be fluid-dynamically conceived and shaped so as to optimize the heat exchange between process fluid and washing fluid. Providing for branches optimized for a respective portion of the tub 2 can advantageously allow managing the arrangement of the branches based on the specific heat exchange requirements of the household appliance, which can be local, i.e. defined at a specific portion of the tub, or overall; the latter can be for example a function of the volume of the washing chamber 2a or of the maximum load capacity of articles of the household appliance 1.

[0136] The condenser 15 is extended perimetrically around the closed path profile of the access mouth 7a of the washing fluid collection well 7. Each branch of the condenser 15 can be arranged in proximity to each side or section of the closed path profile of the access mouth 7a.

[0137] The condenser 15 is made of thermally conductive material, such as copper. Not coming into direct contact with the washing fluid, the condenser 15 has the advantage of allowing a decidedly greater array of choices (with respect to the prior art) regarding the constituent of the condenser 15 itself.

[0138] The condenser 15 can be engaged with the tub 2 by means of a support element 17. The support element 17 is configured for housing and supporting the condenser 15. The support element 17 is engaged at the lower portion of the tub 2. In the embodiment pursuant to the enclosed figures, the support element 17 is engaged with the bottom 5 of the tub 2 at the external surface 5b of the bottom 5. In such a manner, the support element 17 advantageously allows the arrangement of the condenser 15 in a manner such that this faces the tub 2 and is extended at least partially in contact with the tub 2.

[0139] In a first embodiment of the invention, the support element 17 has grooves at least partially countershaped with respect to the profile of the condenser 15; the grooves are configured for housing respective branches of the condenser 15. In such embodiment, the support element 17 can be advantageously made of plastic material. Providing for the plastic material for the support element can for example allow molding the support element 17 in a shape that provides for the grooves.

[0140] In a second embodiment of the invention, alternative to the first embodiment, the condenser 15 can be embedded in the support element 17, for example via co-molding of the condenser 15 in the support element 17. In such embodiment, the support element can be an element made of tar sheet 17.

[0141] Hereinbelow, the technical characteristics of the household appliance 1 are described, which can be common to both embodiments.

[0142] The condenser 15 is arranged at the second section of the heat pump, while the compressor 13, the evaporator 14 and, optionally, the expansion member 16 are arranged at the first section of the heat pump. The first section of the heat pump can be defined or positioned mainly in the base 11. Optionally, the first section of the heat pump can be defined or positioned completely in the internal volume of the base 11. Providing that the first section and the relative components of the heat pump, i.e. the compressor 13, the evaporator 14 and, optionally, the expansion member 16 are arranged mainly or completely in the base 11 makes possible the arranging of a pre-assembled base 11 provided with compressor 13, evaporator 14 and, optionally, expansion member 16, at which therefore most of the heat pump circuit is extended; such base 11 can therefore be assembled with the tub 2 so as to make the household appliance 1. Upon assembly of the base 11 to the tub 2, the closure of the circuit of the heat pump is provided, which is obtained by fluid-dynamically connecting the condenser 15 to the compressor 13 and to the evaporator 14, possibly with the interposition of the expansion member 16.

[0143] As an example, the expansion member 16 can be a coil or a thermal expansion valve. Downstream of the expansion member 16, the process fluid can advance along the circuit of the heat pump in the direction of the evaporator 14.

[0144] The household appliance 1 also comprises at least one flexible connection element, which defines a section of the circuit of the heat pump. The flexible connection element is configured for placing in fluid communication the condenser 15 and the compressor 13; for example, the flexible connection element can be used for making the closure operation of the circuit of the heat pump that was previously introduced. By placing in fluid communication the compressor 13 and the condenser 15, the flexible connection element allows fluid-dynamically connecting one end of the first section with the respective end of the second section. Providing for a flexible connection element is particularly advantageous since it allows considerably simplifying the assembly of the condenser 15 in the circuit of the heat pump. Providing for a flexible connection element is also advantageous since its flexibility allows the arrangement thereof in multiple operating configurations, being adapted to the geometry of the components of the household appliance 1. The flexible connection element can also be elastically deformable; the elastic deformability determines the flexibility thereof. The flexible connection element can be a flexible pipe which can be made, for example, made of plastic material.

[0145] The household appliance 1 can comprise a first

flexible connection element and a second flexible connection element defining a respective section of the circuit of the heat pump. The first flexible connection element is configured for placing in fluid communication the condenser 15 and the compressor 13 in accordance with that described above and therefore defines the section of the circuit of the heat pump arranged between the condenser 15 and the compressor 13, while the second flexible connection element can be configured for placing in fluid communication the compressor 13 and the expansion member 16 and therefore defines the section of the circuit of the heat pump arranged between the compressor and the expansion member.

[0146] The household appliance 1 can also comprise a fan 18 configured for drawing air from outside the household appliance 1, in particular for heating the evaporator 14 and, in addition or as an alternative, for cooling the compressor 13. As an example, the fan 18 can be configured for heating the evaporator 14, at least in part using heat coming from the compressor 13, for example heat dissipated by the compressor 13.

[0147] The household appliance 1 can also comprise a heater 19 configured for heating the washing fluid. Providing for the heater 19 can be particularly advantageous since this allows assisting the condenser 15 of the household appliance 1 in order to heat the washing fluid; in such a manner, the household appliance 1 provided with heater 19 and with heat pump is advantageously capable of speeding up or minimizing the transients aimed to reach the operations conditions of the household appliance 1. The heater 19 can be arranged in proximity to the pump 8 or it can be wound around the pump 8. The heater 19 can be, as an example, an electrical heating element. The household appliance 1 can also comprise a control unit configured for managing, driving or supervising at least one operating cycle or a plurality of operating cycles of the household appliance 1. The operating cycles can for example be washing or rinsing cycles and, in addition or as an alternative, drying cycles.

[0148] In use conditions of the household appliance 1 in drying, the household appliance 1 can provide for at least one zone at lower temperature (cold zone, i.e. zone with temperature lower than a warm zone) and at least one zone at higher temperature (warm zone, i.e. zona with temperature higher than the cold zone); such zone can be defined at the bottom 5 of the tub 2. Providing for at least one cold zone and at least one hot zone allows removing the moisture of the articles in the form of condensation. Preferably, each zone can comprise a respective portion of the bottom 5 of the tub 2. The cold zones can be attained by arranging a respective portion of the bottom 5 in proximity to or at the evaporator 14, which which allows lowering the temperature of such zone (cooling of the zone in order to define cold zone); in such a manner, the cold zones allow the condensation of the moisture. In an alternative embodiment, at least one cooling element can be provided that is an alternative with respect to the evaporator 14. Optionally, in addition or as an alternative with respect to the cold zone defined at the bottom 5 of the tub 2, a further cold zone can be defined at the rear panel 4b of the lateral wall 4 of the tub 2; in proximity to the rear panel 4b, a cooling element can be positioned that is configured for cooling at least one portion of the rear panel 4b in a manner such to define the further cold zone. The warm zones allow heating the drying fluid and therefore drying the articles arranged in the drying chamber 2a. At least one hot zone can be defined at the bottom 5 of the tub 2 due to the heating action carried out by the condenser 15 at the bottom 5. In an alternative embodiment, can be provided at least one alternative or additional heating element with respect to the condenser 15.

[0149] The household appliance can also comprise a mechanism for the automatic opening of the door, which is configured for opening the door when it is situated in the closed position. Providing for a mechanism for the automatic opening of the door allows evacuating the moisture of the articles in an automatic manner. The automatic opening of the door can be controlled by the control unit, for example as a function of the quantity of articles present in the drying chamber 2a or of the moisture present in the drying chamber 2a or of the type of drying cycle implemented by the household appliance 1.

[0150] Optionally, the household appliance can provide for a system for recirculating the drying fluid communicating with opposite portions of the tub 2, such as a lower portion defined in proximity to the bottom 5 and an upper portion defined in proximity to the covering portion 3, and configured for recirculating the drying fluid between such portions. The recirculation system can be configured for recirculating drying fluid between the lower portion and the upper portion in a specific direction (from the lower portion to the upper portion or from the upper portion to the lower portion) or in both directions. The recirculation system can provide for at least one fan configured for moving the drying fluid along a recirculation path of the recirculation system.

Method for making the household appliance

[0151] Also forming the object of the present invention is a method for making the household appliance which provides for engaging a condenser 15 with a tub 2 for a household appliance 1. The method can be aimed to attain of a household appliance 1 for washing articles such as dishes or pieces of silverware in accordance with the above-reported description, in accordance with any one of the enclosed claims and, as an addition or as an alternative, in accordance with any one of the preceding aspects. The components which will be described hereinbelow can be of the type described above with reference to the household appliance 1.

[0152] The method provides for arranging a tub 2 and a condenser 15. The tub 2 and the condenser 15 can be in accordance with that stated above.

[0153] The step of arranging the condenser 15 can pro-

vide for arranging a condenser 15 in engagement with a support element 17.

[0154] In accordance with a first embodiment of the method, the arranging of the condenser 15 in engagement with the support element 17 can provide for arranging a support element 17, for example made of plastic material, and mounting the condenser 15 on the support element. The arranged support element 17 can be provided with a plurality of grooves at least partially countershaped with respect to the profile of the condenser 15 and configured for housing respective branches of the condenser 15. The step of mounting the condenser 15 on the support element 17 can provide for positioning each branch of the condenser 15 at a respective groove of the support element 17. The first embodiment then provides for engaging the support element 17 with the tub 2; a possible mode of engaging the support element 17 with the tub 2 provides for the use of threaded elements or fitting elements. In possible variants, engagement elements can be provided that are alternative with respect to the threaded elements and with respect to the fitting elements.

[0155] In accordance with a second embodiment of the method, the arranging of the condenser 15 in engagement with the support element 17 can provide for arranging a support element 17, for example an element made of tar sheet, and for embedding the condenser 15 in the support element 17. The step which provides for embedding the condenser 15 in the support element 17 can be made via co-molding of the support element 14 and of the condenser 17. If the support element is an element made of tar sheet 17, the step of co-molding provides for co-molding the condenser 15 on the element made of tar sheet 17. The second embodiment then provides for engaging the support element 17, in which the condenser 15 is embedded, with the tub 2; one possible mode for engaging the support element 17 with the tub 2 provides for gluing the support element 17 with the tub, in particular causing the melting of the portion of the element made of tar sheet in contact with an external surface 5b of the bottom 5 of the tub 2.

[0156] In both embodiments, the step of engaging the support element 17 with the tub 2 is attained in a manner such to engage the condenser 15 at least partially in contact with the tub 2.

[0157] Hereinbelow, further steps of the method are described, which can be common to both embodiments.

[0158] The step of engaging the support element 17 with the tub 2 provides for engaging the support element 17 with the bottom 5 of the tub 2. The support element 17 can be for example engaged at the external surface 5b of the bottom 5 of the tub 2.

[0159] The engagement of the support element 17 with respect to the tub 5 allows arranging the condenser 15 at least partially in contact with the tub 5 and defines the second section of the heat pump.

[0160] The engagement of the support element 17 with respect to the tub 5 can be made in a manner such to arrange the condenser 15 with respect to the tub 2 in accordance with that previously described with reference to the household appliance 1; for example, the condenser 15 can be arranged at least partially around the washing fluid collection well 7.

[0161] The method also provides for arranging a base 11, typically made via molding of plastic material, within which the compressor 13, the evaporator 14 and, optionally, the expansion member 16 are housed. The step of arranging the base 11 can provide for arranging a pre-assembled base 11 in which the compressor 13, the evaporator 14 and, optionally, the expansion member 16 are already mainly or completely arranged in the internal volume of the base 11 and define the first section of the heat pump. Arranging a pre-assembled base 11 is particularly advantageous since it allows assembling the household appliance 1 in a quick and effective manner. As an alternative, the step of arranging the base 11 can provide for arranging a base 11 and for arranging, mainly or completely, the compressor 13, the evaporator 14 and, optionally, the expansion member 16 in the internal volume of the base 11 in a manner such to define the first section of the heat pump.

[0162] The method can also provide for fluid-dynamically closing the circuit of the heat pump by means of at least one flexible connection element. The step which provides for fluid-dynamically closing the circuit of the heat pump provides for placing in fluid communication the compressor 13 and the condenser 15 by means of a flexible connection element; such step then provides for placing in fluid communication the first section of the circuit of the heat pump with the second section of the circuit of the heat pump. The flexible connection element can be of the type previously described with reference to the household appliance 1.

[0163] The method can also provide for fluid-dynamically closing the circuit of the heat pump fluid-dynamically connecting the compressor 13 and the condenser 15 by means of a first flexible connection element and fluid-dynamically connecting the compressor 13 and the expansion member by means of a second flexible connection element. Such steps can be successive to the arranging of the base 11; as an alternative, the step which provides for fluid-dynamically connecting the compressor 13 and the condenser 15 by means of the first flexible connection element can be successive to the step of arranging the base 11, while the step of fluid-dynamically connecting the compressor 13 and the expansion member 16 by means of the second flexible connection element can be made in the scope of arranging the pre-assembled base 11.

[0164] The method can comprise a step of loading process fluid in the compressor 13; such step can follow the step of connection between condenser 15 and compressor 13. The loading of the process fluid can make use of a suitable loading pipe provided in the compressor 13.

[0165] The method can also provide for arranging a

pump 8 configured for moving the washing fluid along the washing circuit of the household appliance 1.

[0166] The method can also provide for arranging a heater 19 configured for heating the washing fluid. Optionally, the method can provide for arranging the heater 19 in proximity to the pump 8 or winding the heater 19 around the pump 8.

Method for operating the household appliance

[0167] The household appliance 1 is configured for operating in accordance at least with an operating method, which can be defined with reference to at least one operating cycle for washing or rinsing the household appliance 1. The washing or rinsing cycle of the household appliance 1 can be managed, controlled or supervised in each step thereof by the control unit of the household appliance 1. Hereinbelow, as an example, a washing or rinsing cycle of the household appliance 1 is described. At the start of the cycle, it is provided to load water from a source of washing fluid of the above-described type. The loading of the water can be managed by means of one or more solenoid valves. The household appliance 1 provides for adding an additive or a washing or rinsing agent to the water in order to form, based on the type of additive or agent added, the washing fluid (water with addition of detersive) or rinsing fluid (water with addition of brightener). The loaded water is heated and conveyed from the pump 8 to at least one sprayer 10 or to a plurality of sprayers 10; the feeding of water to the sprayers 10 can be managed in accordance with that described above, for example by means of the control unit of the household appliance 1. The washing or rinsing fluid is then dispensed in the washing chamber 2a by means of the sprayer 10 or the sprayers 10. Subsequently, after having suitably washed the articles present in the washing chamber 2a, the water flows out, by means of the washing fluid downflow portion 6 defined on the bottom 5 of the tub 2, into the washing fluid collection well 7, where it is filtered by the filter 9 and collected herein. The washing or rinsing fluid can then be discharged from the washing fluid collection well 7, for example by means of a dedicated pump.

[0168] The water is heated by means of the heating element 19 and by means of the heat pump. The cycle provides for activating the heat pump which, by means of the process fluid and in accordance with that described above, allows the heating of the condenser 15. In the time interval that runs between the activation of the heat pump and the attainment of a desired condition of the household appliance 1, the water is heated both by means of the heating element 19 and by means of the condenser 15. The desired condition can be for example reached when the water, or the condenser 15, reaches a desired temperature. The desired condition can be an operating condition of the condenser 15 or of the heat pump or, more generally, of the household appliance 1. As a function of the type of operating cycle of the household appliance 1 or of the type of additive or agent added to the water, the desired temperature can vary. Upon reaching the desired condition, the heating element 19 is deactivated and the heating of the water exclusively continues by means of the condenser 15. In addition, if the operating cycle is an ecological cycle (cycle with energy savings), this can provide for not activating the heating element 19 and can therefore provide for heating the water exclusively by means of the condenser 15.

[0169] The method for operating the household appliance 1 can be also be defined with reference to at least one operating cycle for drying the household appliance 1. The drying cycle of the household appliance 1 can be managed, controlled or supervised in each step thereof by the control unit of the household appliance 1. Hereinbelow, as an example, a cycle for drying the household appliance 1 is described. The cycle provides for drying the articles present in the drying chamber 2a by means of air (drying fluid).

[0170] The air allows, by acting on the articles, the removal of moisture from the articles themselves and the consequent drying of the same; such removal can be carried out via removal of the moisture in the form of condensation and/or via evacuation of the moisture outside the household appliance 1.

[0171] The moisture can be for example removed in the form of condensation, advantageously providing for, in use conditions of the household appliance 1 in drying and in accordance with that described above, at least one cold zone and at least one hot zone; such zones are preferably defined at the bottom 5 of the tub 2. The evaporator 14 allows lowering the temperature of at least one zone of the bottom 5 (cooling of the zone in order to define cold zone) and; in such a manner, the cold zone allows the condensation of the moisture. The warm zones instead allow triggering convective motion of the air in the drying chamber 2a, and heating the air; the convective motion is exploited so as to increase the temperature of the articles and hence cause the evaporation of the water present on the surface thereof. Providing for an alternation between at least one hot zone and at least one cold zone advantageously optimally triggering convective motion of the air in the drying chamber 2a and simultaneously removing, in an efficient manner, moisture from the air. In order to render the heat exchange within the drying chamber 2a more efficient, the air can be made to recirculate by means of the recirculation system, for example by means of a fan, between opposite portions of the tub 2.

[0172] In addition or as an alternative with respect to the removal of the moisture in the form of condensation, the household appliance 1 can provide for evacuating the moisture. The moisture can be evacuated by opening, upon command of the control unit, the door by means of the mechanism for automatically opening the door. Opening the door, the air exits outward from the drying chamber 2a and is introduced into the environment outside the household appliance 1; in such a manner, the steam present in the air exits outward from the tub 2 and

decreases the moisture in the drying chamber 2a. The air can be moved out of the drying chamber 2a by means of a fan. The fan can allow the recirculation, with a suitable command imparted by the control unit, of the air along the recirculation path of the recirculation system.

ADVANTAGES OF THE FINDING

[0173] The present invention allows obtaining a household appliance 1 for washing articles such as dishes or pieces of silverware of the type with heat pump capable of optimizing the heat exchange between the condenser 15 and the washing fluid; such advantage is attained by means of the arrangement of the condenser 15 with respect to the above-described tub 2 and pursuant to the following claims. The arrangement of the condenser 15 with respect to the tub 2 in accordance with the invention also allows optimizing the architecture of the heat pump of the household appliance 1. In addition to that stated above, the arrangement of the condenser 15 with respect to the tub 2 pursuant to the invention allows arranging the condenser 15 both along the washing circuit of the household appliance 1, so as to heat the washing fluid, and along the drying circuit of the household appliance 1, so as to heat the drying fluid. The arrangement of the condenser 15 with respect to the tub 2 in accordance with the invention also allows making a household appliance 1 that is compact and with limited bulk.

[0174] In addition, by engaging the condenser 15 with the bottom 5 of the tub 2, the household appliance 1 in accordance with the invention allows maximizing the heat exchange surface at which the condenser 15 transmits heat to the washing fluid.

[0175] In addition to that stated above, the invention allows making different paths or profiles of the condenser 15, which can be conceived, optimized and subsequently arranged on the external surface 5b of the bottom 5 of the tub 2 in accordance with specific characteristics of the tub 2 with which the condenser 15 is intended to be coupled, such as the volume of the tub 2, or in accordance with specific characteristics of the household appliance 1, such as the load capacity of the household appliance 1. The different paths or profiles of the condenser 15 can for example vary by dimensions, volume, further geometric characteristics, number of branches, arrangement of the branches and, with reference to the single branches, they can for example vary by load loss, flow of process fluid, length, internal diameter, external diameter, shape or bulk. The invention also allows, due to the positioning of the condenser 15 in contact with the tub 2, arranging branches on specific portions of the tub 2, such branches specially conceived and sized, for example from the fluid-dynamic standpoint; the arrangement of the branches on specific portions of the tub 2 advantageously allows locally maximizing the heat exchange capacity, i.e. at each of said portions. Consequently, the invention allows maximizing the overall heat exchange capacity between condenser 15 and washing fluid.

[0176] The household appliance 1 in accordance with the invention is also particularly efficient and effective from the standpoint of energy consumption, which is reduced without however negatively affecting the performances of the household appliance 1.

[0177] The invention also provides a household appliance 1 capable of speeding up or minimizing the transients aimed for reaching the operating conditions of the household appliance 1.

[0178] The invention also provides a method which allows engaging a condenser 15 with a tub 2 for a household appliance 1 for washing articles such as dishes or pieces of silverware of the type with heat pump in a simple and effective manner.

[0179] The further advantages indicated above with reference to the household appliance 1 for washing articles such as dishes or pieces of silverware of the type with heat pump are also applicable to the method for engaging a condenser 15 with a tub 2 for a household appliance 1 for washing articles such as dishes or pieces of silverware of the type with heat pump.

[0180] In particular, the method allows engaging the condenser 15 with the tub 2 in a manner such to form a circuit of the heat pump with optimized architecture.

[0181] In addition, the arrangement of the condenser 15 in contact with the tub 2 allows optimizing the transmission of heat from the process fluid to the washing fluid.

[0182] The method also allows attaining a household appliance 1 that is compact and with limited bulk.

[0183] The invention also allows providing a household appliance 1 in a particular high-performing energy class, for example A++or higher.

Claims

1. Household appliance (1) for washing articles such as dishes or pieces of silverware comprising:

    - a tub (2) defining a washing chamber (2a) adapted to receive said articles,
    - at least one sprayer (10) configured for dispensing a washing fluid in the washing chamber (2a),
    - a heat pump configured for operating by means of a process fluid and provided at least with:

        ◦ an evaporator (14) at which the process fluid absorbs heat from a fluid, optionally from the washing fluid,
        ◦ a condenser (15) at which the process fluid transfers heat to a fluid, optionally to the washing fluid,
        ◦ a circuit for the circulation of the process fluid fluid-dynamically connecting the condenser (15) and the evaporator (14) and configured for allowing the circulation of process fluid between the evaporator (14)

and the condenser (15),

wherein the condenser (15) is at least partially extended in contact with the tub (2).

2. Household appliance according to claim 1, also comprising a support element (17) engaged at a lower portion of the tub (2), the condenser (15) being mounted on the support element (17) or being embedded, for example by means of co-molding, in the support element (17).

3. Household appliance according to claim 1 or 2, wherein the condenser (15) is engaged with the tub (2) at a lower portion of the tub (2), the tub (2) comprising a bottom (5) provided with an internal surface (5a) facing the washing chamber (2a) and an external surface (5b), the condenser (15) facing, or being extended in proximity to or at, the external surface (5b) of the bottom (5) of the tub (2).

4. Household appliance according to any one of the preceding claims, also comprising a washing fluid collection well (7) in fluid communication with the tub (2), the washing fluid collection well (7) being configured for collecting washing fluid so as to evacuate it from the washing chamber (2a), the condenser (15) being at least partially extended around the washing fluid collection well (7),
optionally wherein the washing fluid collection well (7) has an access mouth (7a) having a closed path profile and adapted to allow the access of the washing fluid from the washing chamber (2a) to the washing fluid collection well (7), the condenser (15) being extended perimetrically with respect to the closed path profile of said access mouth (7a),
optionally wherein the bottom (5) of the tub (2) comprises a washing fluid downflow portion (6) configured for facilitating the downflow of the washing fluid from the washing chamber (2a) to the washing fluid collection well (7), the washing fluid downflow portion (6) being arranged between the lateral wall (4, 4a, 4b, 4c) and the washing fluid collection well (7), the condenser (15) being at least partially arranged or engaged at the washing fluid downflow portion (6).

5. Household appliance according to any one of the preceding claims, wherein the condenser (15) has at least one end fluid-dynamically connected to the circuit for the circulation of the process fluid by means of a flexible connection element.

6. Household appliance according to any one of the preceding claims, also comprising a base (11) arranged below the tub (2), wherein the heat pump also comprises a compressor (13) configured for moving the process fluid into the circuit for the circulation of the process fluid, the compressor (13) and the evaporator (14) being arranged in the base (11).

7. Household appliance (1) for washing articles such as dishes or pieces of silverware, optionally according to any one of the preceding claims, wherein the household appliance (1) is also configured for drying articles such as dishes or pieces of silverware and comprises a tub (2) defining a drying chamber (2a) adapted to receive said articles and comprising a bottom (5), the bottom (5) comprising:

- at least one first portion associated with at least one heating element (15), optionally the heating element comprising a condenser (15) of a heat pump circuit, and
- at least one second portion, for example defined in proximity to the first portion, associated with at least one cooling element (14), optionally the cooling element comprising an evaporator (14) of a heat pump circuit,

especially wherein the evaporator (14) and the condenser are part of a same heat pump circuit of the household appliance (1).

8. Method for engaging a condenser (15) to a tub (2) for a household appliance (1) of the type with heat pump for washing articles such as dishes or pieces of silverware, the household appliance (1) being optionally in accordance with any one of the preceding claims, the method comprising at least the steps of:

- arranging a tub (2) defining a washing chamber (2a) adapted to receive articles to be washed such as dishes or pieces of silverware,
- arranging a condenser (15),
- at least partially engaging the condenser (15) in contact with the tub (2).

9. Method according to claim 8, wherein arranging a condenser (15) comprises:

- arranging a support element (17), optionally the support element (17) being made of plastic material,
- mounting the condenser (15) on the support element (17),
- engaging the support element (17) with the tub (2),

optionally wherein:

- arranging a condenser (15) comprises arranging a condenser (15) comprising a plurality of branches,
- arranging a support element (17) comprises arranging a support element (17), optionally made of plastic material, having grooves at least

partially counter-shaped with respect to a profile of the condenser (15) and configured for housing respective branches of the condenser (15),
- mounting the condenser (15) on the support element (17) comprises positioning each branch of said plurality of branches at a respective groove of the support element (17).

or wherein arranging a condenser (15) comprises:

- arranging a support element (17), optionally the support element (17) being an element made of tar sheet,
- embedding the condenser (15) in the support element (17),
- engaging the support element (17) with the tub (2),

optionally wherein:

- embedding the condenser (15) in the support element (17) comprises co-molding the condenser (15) and the support element (17),
- co-molding the condenser (15) and the support element (17) comprises co-molding the condenser (15) on a tar sheet element (17),
- engaging the support element (17) with the tub (2) comprises engaging the tar sheet element (17) with the tub (2), for example by means of gluing.

10. Method according to claim 8 or 9, wherein the method comprising the following steps:

- arranging a base (11) in which a compressor (13) and an evaporator (14) are housed,
- fluid-dynamically connecting the condenser (15) to the compressor (13) and/or to the evaporator (14) by means of at least one flexible connection element.

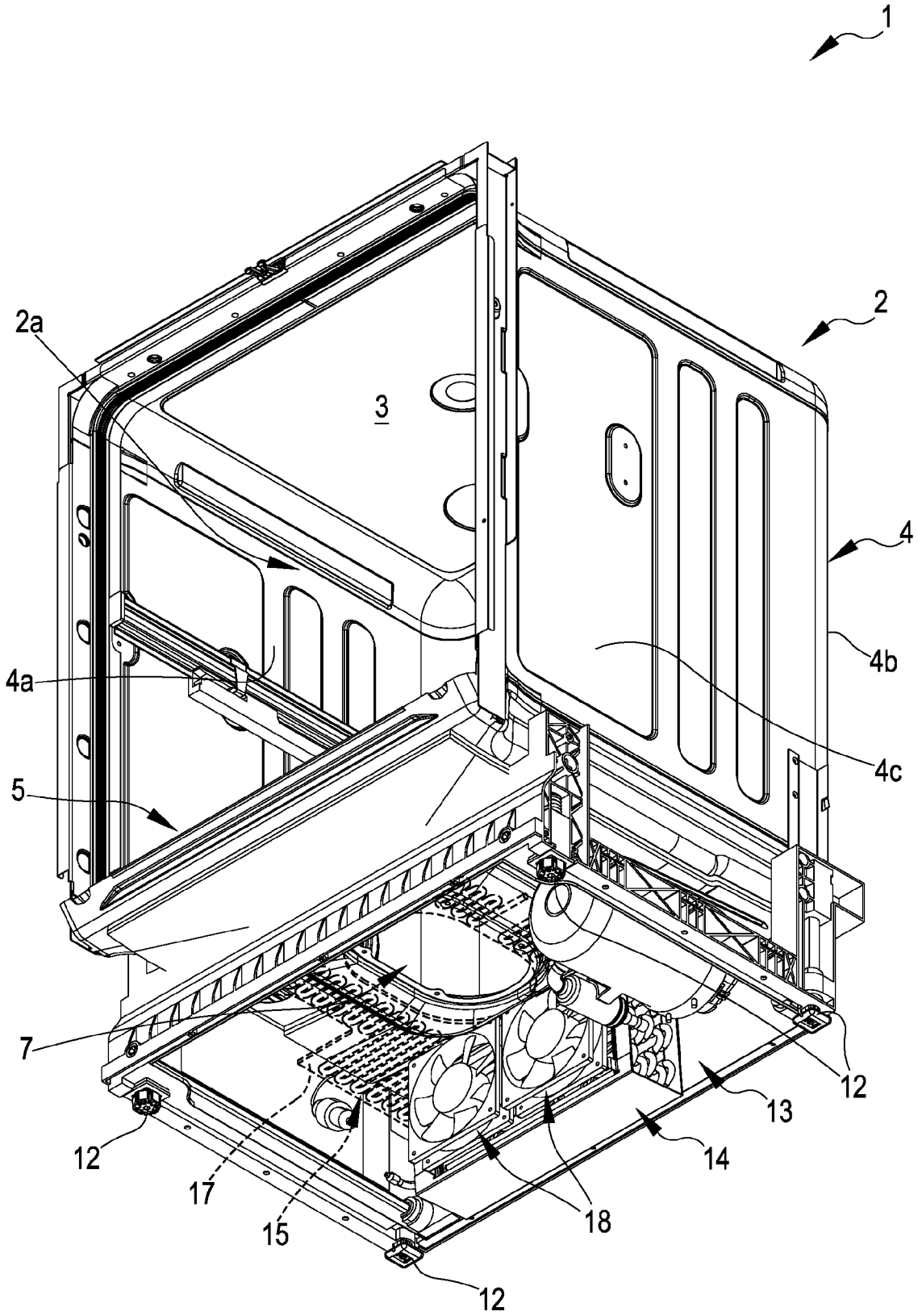

FIG.1

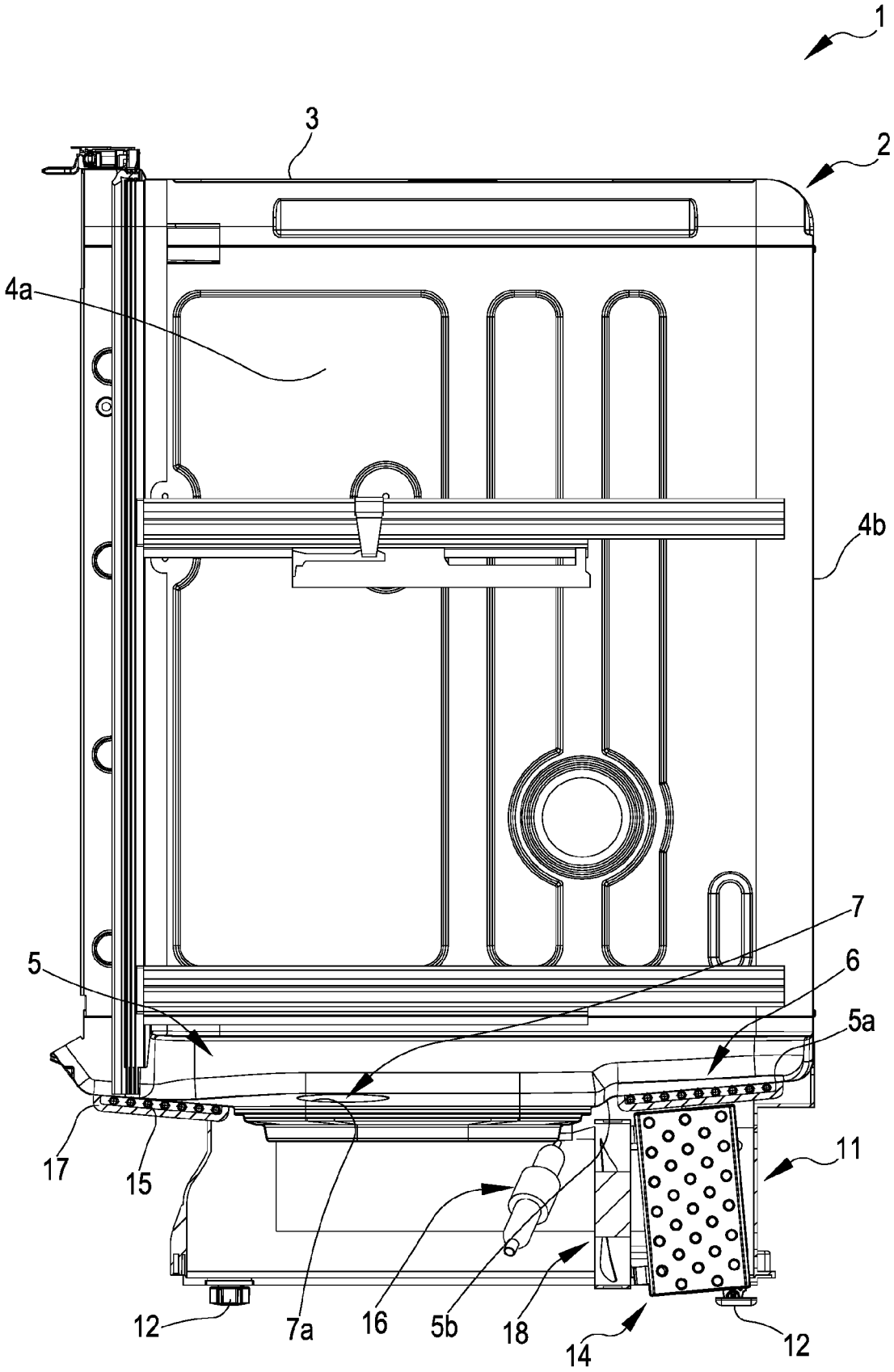

FIG.2

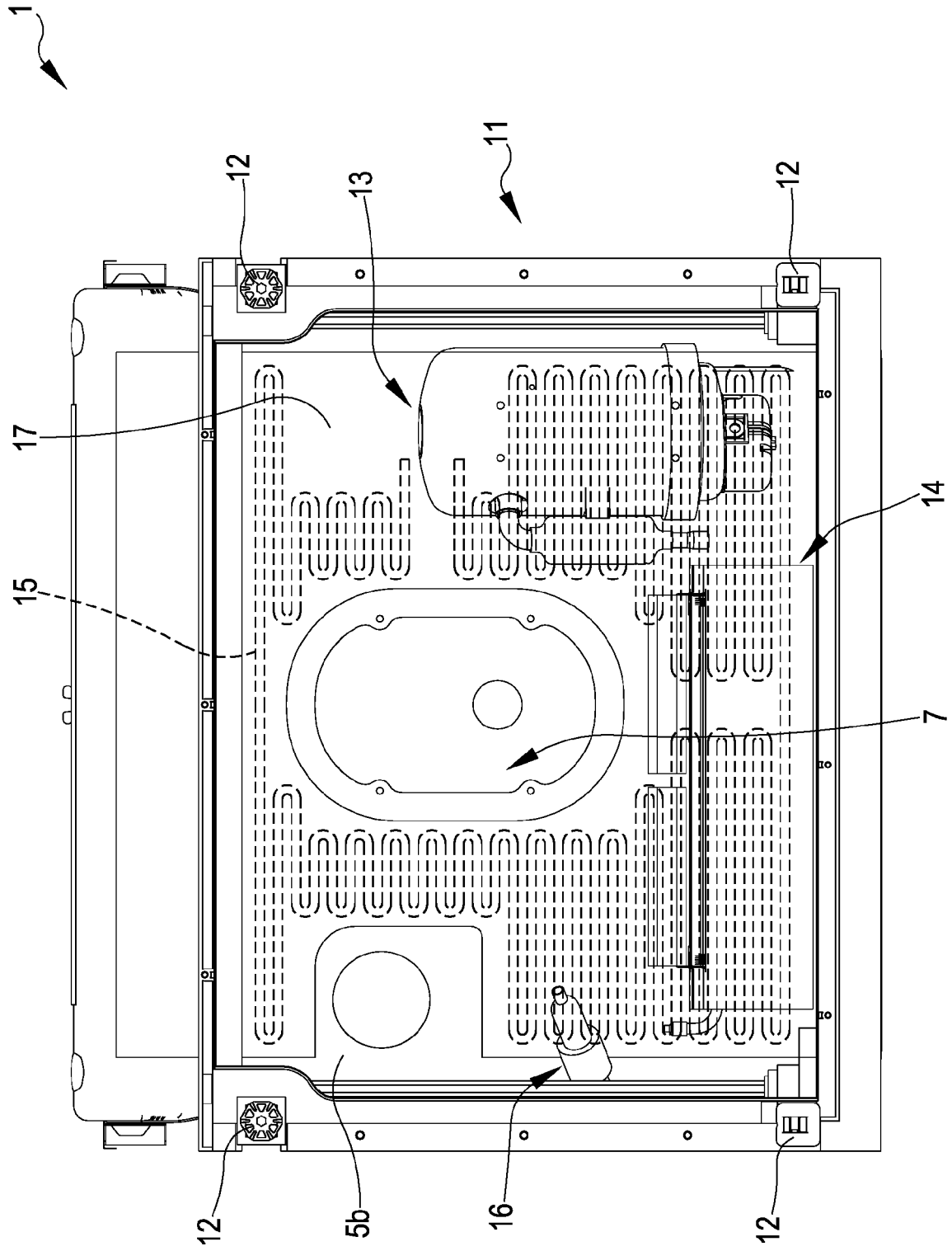

FIG.3

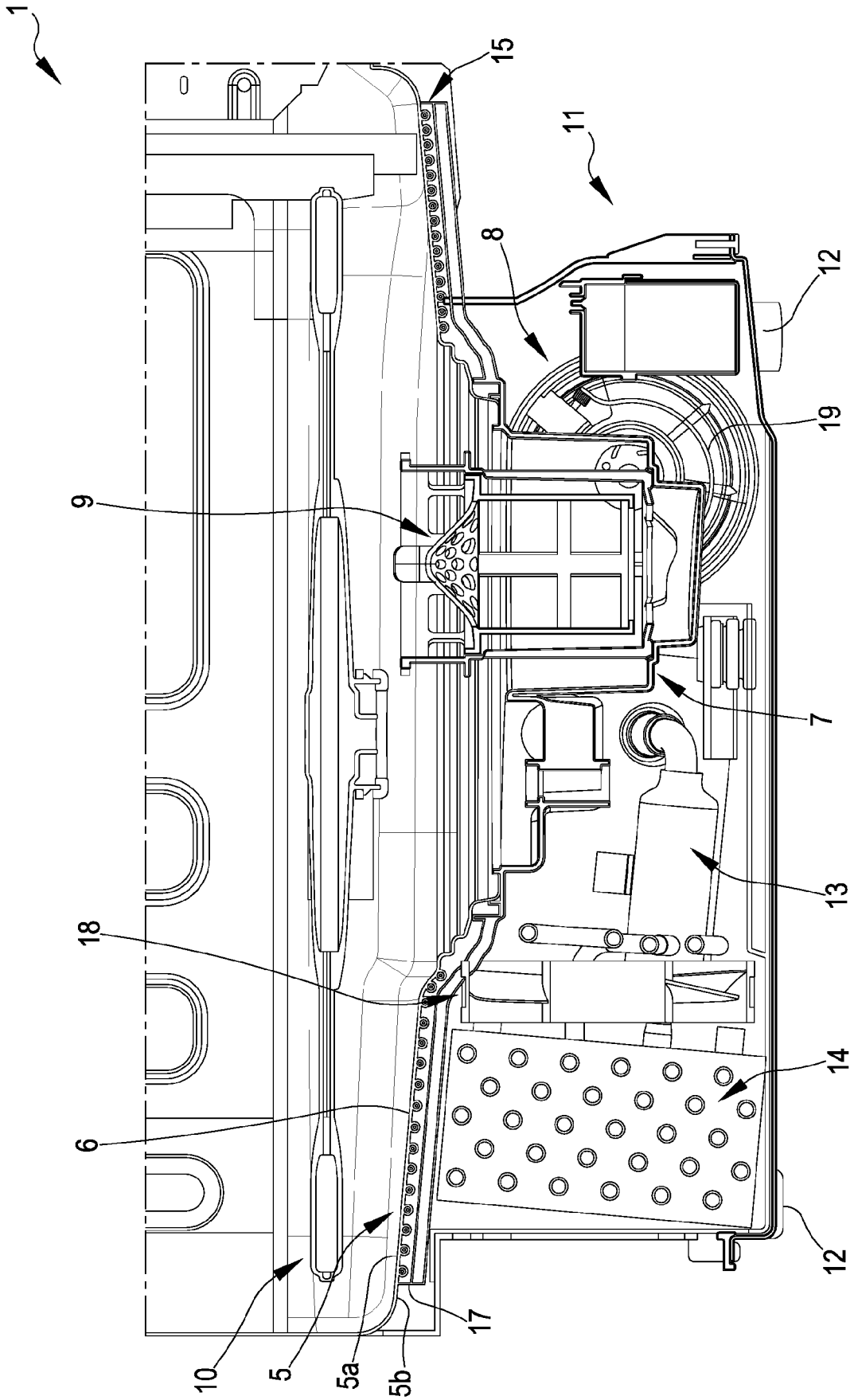

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 2657

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	WO 2017/195057 A1 (BSH HAUSGERÄTE GMBH [DE]) 16 November 2017 (2017-11-16)	1-4,6-9	INV. A47L15/42
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A	US 2017/028447 A1 (CAGNASSO ANDREA [IT] ET AL) 2 February 2017 (2017-02-02) * paragraph [0021] - paragraph [0049] *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 August 2020	Jezierski, Krzysztof

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 18 2657

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05-08-2020

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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