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(71) Applicant: **Electrolux Home Products Corporation N.V.**
1130 Brussel (BE)

(72) Inventors:
• **Pillot, Sergio**
33080 Porcia (PN) (IT)
• **Santarossa, Marco**
33080 Porcia (PN) (IT)
• **Sartor, Luciano**
33080 Porcia (PN) (IT)

(74) Representative: **Nardoni, Andrea et al**
Electrolux Italia S.p.A.
Corso Lino Zanussi, 30
33080 Porcia (PN) (IT)

(54) Laundry treatment apparatus with heat exchanger cleaning

(57) The invention relates to a laundry treatment apparatus, in particular a dryer or a washing machine having a dryer function, comprising a control unit, a laundry treatment chamber (18) for treating laundry (19) using process air, a process air loop (20) for circulating the process air, a heat exchanger (10) arranged in the process air loop for cooling the process air, at least one liquid distributing element (42) arranged upstream the heat ex-

changer (10) and adapted to distribute liquid to the heat exchanger (10) for cleaning the heat exchanger, a pivot element having a pivot axis is pivotally supporting the at least one liquid distributing element (42), wherein the at least one liquid distributing element (42) is designed such that due to the rotating movement of the at least one liquid distributing element liquid is sprayed to the heat exchanger (10).

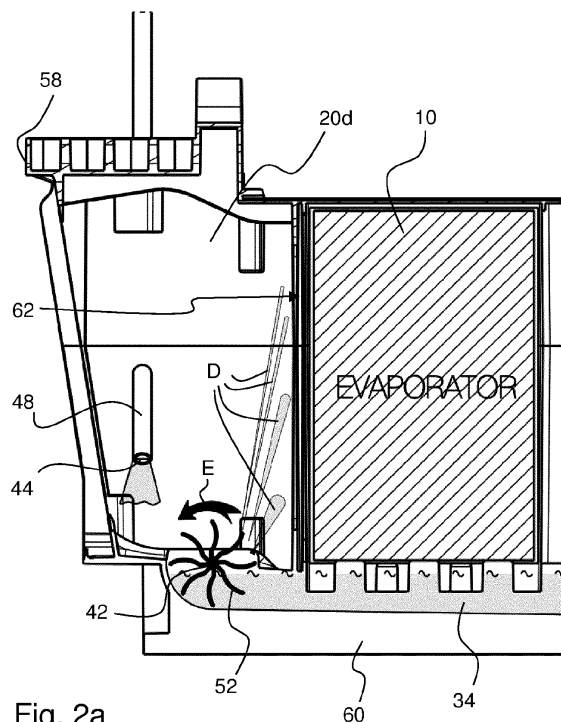


Fig. 2a

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Description

[0001] The invention relates to a laundry treatment apparatus, in particular a dryer or a washing machine having a dryer function, comprising a heat exchanger.

[0002] DE 196 00 489 A1 discloses a dryer having a heat exchanger. The heat exchanger is arranged in a process air channel of the dryer such that during a drying operation process air passes the heat exchanger vertically. Condensate generated on the heat exchanger surface flows vertically downwards and washes off fluff accumulated on the heat exchanger surface. To assist removing fluff from the heat exchanger a liquid sprayer is arranged upstream the heat exchanger which is adapted to spray collected condensate to the heat exchanger for rinsing the surface of the heat exchanger. A condensate collector chamber of the dryer comprises a water reservoir for feeding the liquid sprayer and for providing a sufficient amount of condensate at the beginning of a drying operation for cleaning the heat exchanger with the liquid sprayer.

[0003] US 2010/0192398 A1 discloses a dryer comprising a heat exchanger and an elongate injection nozzle element arranged above the heat exchanger. The injection nozzle is fed via a pipe and a valve with water which is sprayed to the heat exchanger for cleaning the heat exchanger. The injection nozzle element may be pivoted by means of a driving motor about its longitudinal axis within a predetermined angle, such that a water spray of the nozzle element is directed towards the heat exchanger or forms a water curtain in front of the heat exchanger. Alternatively the injection nozzle element is moved along its longitudinal axis to assist washing off fluff from the heat exchanger.

[0004] It is an object of the invention to provide a laundry treatment apparatus which keeps a heat exchanger of the apparatus free from fluff in an alternative and fail-safe way.

[0005] The invention is defined in claim 1. Particular embodiments are set out in the dependent claims.

[0006] According to claim 1 a laundry treatment apparatus, in particular a dryer or a washing machine having a dryer function, comprises a control unit to control the operation of the apparatus, a laundry treatment chamber for treating laundry using process air, a process air loop for circulating the process air and a heat exchanger arranged in the process air loop for cooling the process air. At least one liquid distributing element is arranged upstream the heat exchanger and is adapted to distribute liquid to the heat exchanger for cleaning the heat exchanger. For example the at least one distributing element is adapted to sprinkle, splash, cast or spray liquid to the heat exchanger for cleaning the heat exchanger. The at least one liquid distributing element is pivotally supported by a pivot element having a pivot axis, in particular each liquid distributing element is pivotally supported by a corresponding pivot element. The at least one liquid distributing element is designed such that due

to the rotating movement of the at least one liquid distributing element liquid is sprayed or distributed to the heat exchanger. In other words the pivoting or rotational movement of the at least one distributing element causes that liquid is distributed or conveyed towards the heat exchanger to clean the heat exchanger.

[0007] The above described cleaning devices for heat exchangers of the prior art need a pump to build up pressure in a liquid sprayer or nozzle to provide that liquid is sprayed towards the heat exchanger. I.e. the nozzles of the prior art are under pressure and are therefore worn down over time and get easily clogged with foreign particles, whereby the cleaning efficiency is reduced. In contrast to the prior art, the present invention provides an alternative solution for cleaning a heat exchanger by distributing liquid to the heat exchanger with a simple and fail-safe rotational movement of the distributing element itself.

[0008] Herein 'upstream' refers to a position in an air flow channel where an element A is upstream of an element B, if in the channel the element A is arranged such that the air flow reaches it first and then the element B.

[0009] Preferably the at least one liquid distributing element comprises at least one blade element or protruding element configured to convey liquid towards the heat exchanger by a rotating movement of the at least one liquid distributing element. For example the at least one protruding element comprises a bristle or a plurality of bristles, one or more paddles, one or more wings or a combination thereof, which accelerates or casts liquid towards the heat exchanger.

[0010] Preferred the at least one distributing element is supported by the pivot element such that the distributing element executes a rotational movement about the pivot axis, in particular at least one full rotation, to provide that liquid is distributed or sprinkled to the heat exchanger. For example the pivot element(s) comprise a pivot bearing like a ball bearing or a low-cost bush bearing or pin bearing made for example of plastic which allow a full rotation of the at least one distributing element, in particular a continuous rotation thereof.

[0011] Preferably the at least one liquid distributing element is at least partially arranged in or above a condensate collector chamber or tray below the heat exchanger for collecting condensate from the heat exchanger such that in operation the at least one liquid distributing element is at least temporarily immersed in condensate. E.g. when the at least one distributing element is rotated (e.g. a wing element or another blade or protruding element) plunges or dips into the collected condensate and picks up condensate and accelerates the condensate towards the heat exchanger. Further, the consumption of fresh water of the treatment apparatus is reduced as condensate is used for cleaning the heat exchanger.

[0012] In an embodiment the at least one liquid distributing element is arranged in or above the collector chamber or tray such that in operation the liquid distributing element is at least partially immersed in condensate. I.e.

as the distributing element is always at least partially immersed in condensate the distributing element immediately distributes liquid to the heat exchanger when it starts rotating or in each rotated position.

[0013] Preferably the at least one liquid distributing element or the at least one protruding element has a width in pivot axis direction corresponding to or substantially corresponding to the width of the heat exchanger in pivot axis direction while flowing its way downward along all the heat exchanger (front) surface. Thus the liquid distributed towards the heat exchanger, e.g. in a splash, spray or sprinkle, covers the width of the heat exchanger for a thorough cleaning of the heat exchanger surface.

[0014] According to a preferred embodiment the heat exchanger is horizontally arranged in the process air channel, i.e. the process air passes the heat exchanger horizontally or substantially horizontally. Alternatively the heat exchanger is arranged vertically in the process air channel, i.e. the process air passes the heat exchanger vertically or substantially vertically.

[0015] Preferably, when the heat exchanger is arranged horizontally, the at least one distributing element is arranged upstream or in front of the heat exchanger such that the vertical cross section (vertical front) facing the process channel upstream the heat exchanger is cleaned by liquid distributed towards the heat exchanger by the distributing element. Preferably the above and below described distributing element(s) are configured to distribute liquid across the complete vertical front surface of the heat exchanger. Alternatively or additionally the liquid distributing element(s) are configured to distribute liquid to an upper portion of the front surface from where the liquid flows along the surface of the heat exchanger downwards and washes fluff from the heat exchanger surface. Thus less liquid is needed to clean the heat exchanger as gravitation assists to wash off fluff from the surface of the horizontally arranged heat exchanger.

[0016] In an embodiment, when the heat exchanger is arranged vertically, the at least one distributing element is arranged below the heat exchanger such that the horizontal cross section (horizontal front) facing the process air channel upstream the heat exchanger is cleaned by liquid distributed towards the heat exchanger by the at least one distributing element. For example several liquid distributing elements are arranged spaced apart from each other below the heat exchanger such that the liquid distributed by each distributing element covers a portion of the horizontal front, wherein the liquid distributed to the heat exchanger of all distributing elements together cover the complete horizontal front of the heat exchanger, such that the horizontal front is completely cleaned. Gravitation additionally assists the cleaning of the vertically arranged heat exchanger in that condensate which is generated on the heat exchanger surface flows downwards toward the collector chamber or tray such that fluff accumulated on the heat exchanger surface is washed off.

[0017] Preferably the at least one distributing element

comprises at least two blade elements, wherein the at least two blade elements are arranged along the pivot axis such that the combined width of the blade elements corresponds to or substantially corresponds to the width of the heat exchanger. Preferred the at least two blade elements are arranged with an angular offset to each other. I.e. when the at least one distributing element executes a rotational movement one protruding element after the other plunges into the condensate and distributes or accelerates liquid towards the heat exchanger. Thus the force or load acting on the at least one distributing element and on the pivot element or pivot axis is reduced or more evenly distributed during a rotational movement of the at least one distributing element.

[0018] Preferred the apparatus comprises a drive means configured to rotate the at least one distributing element about the pivot axis, wherein the control unit is adapted to control the drive means to rotationally accelerate the at least one distributing element such that a flush of liquid of the at least one distributing element covers a cross section of the heat exchanger perpendicular to the process air flow in a cleaning phase for cleaning the heat exchanger. E.g. due to the rotational acceleration a sudden gush or splash of liquid toward the heat exchanger is generated which washes off fluff from the heat exchanger surface which is more firmly attached to the heat exchanger surface.

[0019] To further assist a removal of fluff which clings persistently to the heat exchanger surface preferably the control unit is adapted to control the driving means to rotate the distributing element about the pivot axis intermittently in a cleaning phase for cleaning the heat exchanger, such that several splashes of liquid towards the heat exchanger are generated.

[0020] Preferably the control unit is adapted to control the drive means to continuously rotate the at least one distributing element such that a continuous liquid spray of the at least one distributing element covers a cross section of the heat exchanger perpendicular to the process air flow in a cleaning phase for cleaning the heat exchanger.

[0021] Alternatively or additionally the control unit is adapted to control the drive means to rotationally accelerate the at least one distributing element such that a liquid flow in the collector chamber or tray is generated which is directed towards a drain opening of the collector chamber or tray after a cleaning phase for cleaning the heat exchanger. Thus the at least one distributing element generates a flow of condensate which transports washed off fluff towards a drain outlet and provides that fluff does not accumulate in the collector chamber or tray. I.e. the at least one distributing element additionally keeps the collector chamber clean.

[0022] Each of the above described controlled operating modes or movements of the at least one distributing element may be used in a cleaning phase for the heat exchanger alone or in combination to provide that all fluff is removed from the heat exchanger surface and trans-

ported to the drain outlet.

[0023] According to a preferred embodiment the drive means is a liquid supply source providing a liquid jet configured to move the liquid distributing element rotationally. E.g. the liquid supply source is the nozzle or opening of a liquid supply pipe directed towards blade element(s) of the at least one distributing element, such that the water jet or spray out of the supply pipe actuates the at least one distributing element to rotate about its pivot axis. Alternatively or additionally the at least one distributing element is driven by a motor controlled by the control unit - e.g. as described above.

[0024] Preferably the apparatus comprises at least one baffle element configured to direct a liquid spray of at least one distributing element towards the heat exchanger, or each of a plurality of distributing elements comprises a baffle element for directing a liquid spray of each distributing element to the heat exchanger. I.e. the baffle element, like a vane or a panel, provides that liquid or condensate reaches or washes a desired portion of the heat exchanger.

[0025] Preferably the drive means is configured to rotate the at least one distributing element in a first rotating direction and in a second rotating direction reverse to the first direction. E.g. in dependency of the rotating direction of the at least one distributing element liquid is distributed or directed to a different portion of the heat exchanger front surface. Thus by rotating the distributing element (s) in both directions the distributing element(s) clean or wash a larger area of the heat exchanger surface.

[0026] In an embodiment the at least one baffle element is configured such that in dependency of the rotation direction of the at least one distributing element the liquid spray of the at least one distributing element is directed to different areas of the (vertical or horizontal) front or cross section of the heat exchanger. I.e. the at least one baffle element is configured such that a liquid spray is directed to a first section of the (horizontal or vertical) front or cross section of the heat exchanger when the at least one distributing element is rotated in the first rotating direction and the at least one baffle element is configured such that a liquid spray is directed to a second section of the (horizontal or vertical) front or cross section of the heat exchanger when the at least one distributing element is rotated in the second rotating direction. Alternatively more than one baffle element is provided for the at least one distributing element, for example a baffle element for each rotation direction.

[0027] According to a preferred embodiment the apparatus comprises an extractable condensate container which is connected to the collector chamber or tray by means of a drain pipe and a drain pump. The condensate container is normally used to store condensate that is to be removed by the user from time to time. Preferably the at least one distributing element is fluidly connected to the condensate container such that condensate collected in the container can be fed to the at least one distributing element during a heat exchanger cleaning phase. Pref-

erably a filter element is arranged in the fluid line connecting the collector chamber or tray to the condensate container or the filter element is arranged in the line from the condensate container towards the at least one distributing element. If only one liquid line (generally 'liquid line' can also be denoted 'pipe') is provided, a valve may be provided which switches a branch between the line to the container and selectively the two lines to the at least one distributing element and the collector chamber or tray. In an embodiment this or an additional valve is used to branch the liquid flow from the line coming from the collector chamber or tray selectively to the condensate container or the at least one distributing element.

[0028] The condensate container may be extractable e.g. like a drawer to be conveniently emptied after a drying operation of the apparatus. Preferably the extractable container is arranged at an upper portion of the apparatus easily and conveniently reachable for a user. Preferably the line to the condensate container comprises a filter unit arranged upstream the condensate container. Thus the condensate collected in the extractable container is filtered, i.e. it is particularly pure and ready to be used e.g. for steam ironing.

[0029] In an embodiment a liquid pump is provided for conveying liquid from the collector chamber or tray towards the at least one distributing element. The liquid pump may also be used for pumping condensate to the condensate container (see above). Additionally or Alternatively a filter unit for filtering the liquid is arranged upstream the at least one distributing element or the liquid pump. This filter unit may be the filter unit arranged in the drain line to the condensate collector. Preferably the filter unit, more preferably a filter in the filter unit, is configured to be removable such that the filter unit or filter element can be removed from the treatment apparatus to be cleaned. In case a condensate container is provided (see above) a valve may be provided that switches the liquid flow from the condensate collector chamber or tray selectively to be supplied to the condensate container or the at least one distributing element. In further embodiment this valve is the one that guides the flow coming from the condensate container to the at least one distributing element. Preferably switching of the valve and/or of the operation of the pump is made under the control of a control unit.

[0030] Preferably the liquid supply line or pipe from the condensate collector chamber or tray comprises the pump and/or the filter unit. When providing both, preferably the filter unit is arranged upstream the pump. Preferably the outlet of the liquid line or pipe at the side of the at least one distributing element comprises a pipe outlet opening or nozzle for supplying the conveyed liquid towards the at least one distributing element. The nozzle or outlet may also first spray the liquid against the heat exchanger from where it is flowing to the at least one distributing element so that it can be repeatedly sprayed to the heat exchanger.

[0031] According to a preferred embodiment the filter

unit is configured to be extractable, i.e. the filter unit can be extracted from the laundry machine to be cleaned. Thus the position of the filter unit collecting the fluff from the apparatus is independent from the position of the heat exchanger. I.e. the filter unit may be placed in any convenient position easily reachable by a user for extracting and cleaning. Preferred the filter unit is positioned in an upper portion of the apparatus which is conveniently accessible for a user.

[0032] Preferably the apparatus comprises a feed pipe connecting the filter unit to the condensate collector chamber or tray, i.e. filtered condensate is fed to the collector chamber for cleaning the heat exchanger such that the consumption of fresh water is reduced. Alternatively or additionally the feed pipe connects the condensate container to the condensate collector chamber or tray such that condensate from the condensate container can be fed to the collector chamber or tray for example at the beginning of a drying operation when no or not enough liquid is collected in the collector chamber or tray. Thus filtered condensate may be provided directly from the collector chamber or is first collected in the extractable container and then fed to the collector chamber for cleaning the heat exchanger.

[0033] Preferred a valve is arranged between the feed pipe and the filter element, wherein the control unit is adapted to control the valve and the drain pump such that a minimum amount of filtered condensate is provided in the condensate collector chamber or tray for cleaning the heat exchanger in a cleaning phase with the distributing element(s). E.g. a minimum amount of liquid provides that the distributing element(s) are at least partially immersed in liquid such that each pivot or rotational movement of the distributing element(s) transports a sufficient amount of liquid to the heat exchanger for cleaning the heat exchanger. E.g. the apparatus comprises a liquid level sensor arranged in the collector chamber or tray to detect the liquid level therein, such that the control unit controls the valve and drain pump to maintain the minimum liquid level. For example a liquid level in the collector chamber or tray at least in the area of or in proximity to the distributing element(s) is between 10 mm to 30 mm, preferably about 20 mm.

[0034] According to a preferred embodiment an outlet of the feed pipe for feeding liquid to the condensate collector chamber or tray is directed towards the heat exchanger such that liquid flowing out of the outlet cleans the heat exchanger. I.e. in addition to the above described cleaning of the heat exchanger by means of the distributing element(s) a direct cleaning of the heat exchanger is possible. The liquid may be fed to the heat exchanger by means of a pump. Alternatively liquid is fed to the heat exchanger by opening a valve connecting the feed pipe to the collection container at an upper portion of the apparatus, such that filtered water is fed to the heat exchanger arranged in a lower portion of the apparatus, i.e. by means of gravity. In particular the condensate which is fed directly towards the heat exchanger

flows down the heat exchanger surface into the collector chamber or tray from where it can be distributed by the distributing element(s) as described above. According to an alternative embodiment liquid may be fed to the heat exchanger or to the condensate collector via a valve connected to tap water and controlled by the control unit.

[0035] Preferably a basement of the treatment apparatus comprises an upper shell and a lower shell to form a portion of the drying circuit where the heat exchanger is arranged. Thus only two elements form the basement or base section or base unit of the treatment apparatus which facilitates the assembly and reduces the assembly time of the apparatus.

[0036] Preferred the pivot element of each distributing element is coupled to the lower shell. For example the pivot element(s) are fixed or attached to the lower shell in a separate assembly step or the pivot element(s) and lower shell are formed in one piece such that the assembly time is reduced.

[0037] According to a preferred embodiment the treatment apparatus is provided with a heat pump system including a compressor, a first heat exchanger, expansion means and a second heat exchanger, wherein the first heat exchanger is adapted to cool down the process air and heat up a refrigerant flowing through the heat pump system, and the second heat exchanger is adapted to heat up the drying air and cool down the refrigerant. In this embodiment the liquid distributing element is adapted to spray liquid to at least one of the first and the second heat exchanger.

[0038] Reference is made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying figures, which show:

- 35 Fig. 1 a schematic view of a laundry treatment apparatus,
- Fig. 2 a sectional side view of a basement of a laundry treatment apparatus according to a first embodiment,
- 40 Fig. 2a a detail of Fig. 2,
- Fig. 3 a top view of the laundry treatment apparatus of Fig. 2,
- 45 Fig. 4 a side view of the laundry treatment apparatus of Fig. 2,
- 50 Fig. 5 a rear view of the laundry treatment apparatus of Fig. 2, and
- Fig. 6 a sectional side view of a laundry treatment apparatus according to a second embodiment.
- 55

[0039] Fig. 1 shows a schematically depicted laundry treatment apparatus 2 which in this embodiment is a heat

pump tumble dryer. The tumble dryer 2 comprises a heat pump system 4, including a closed refrigerant loop 6. Loop 6 has in the following order of refrigerant flow B: a first heat exchanger 10 acting as evaporator for evaporating the refrigerant and cooling process air, a compressor 14, a second heat exchanger 12 acting as condenser for cooling the refrigerant and heating the process air, and an expansion device 16 from where the refrigerant is returned to the first heat exchanger 10. Together with the refrigerant pipes connecting the components of the heat pump system 4 in series, the heat pump system forms the refrigerant loop 6 through which the refrigerant is circulated by the compressor 14 as indicated by arrow B.

[0040] The process air flow within the treatment apparatus 2 is guided through a compartment 18 of the home appliance 2, i.e. through a compartment 18 for receiving articles to be treated, e.g. a drum 18. The articles to be treated are textiles, laundry 19, clothes, shoes or the like. The process air flow is indicated by arrows A in Fig. 1 and is driven by a process air blower 8. The process air channel 20 guides the process air flow A outside the drum 18 and includes different sections, including the section forming the battery channel 20a in which the first and second heat exchangers 10, 12 are arranged. The process air exiting the second heat exchanger 12 flows into a rear channel 20b in which the process air blower 8 is arranged. The air conveyed by blower 8 is guided upward in a rising channel 20c to the backside of the drum 18. The air exiting the drum 18 through the drum outlet (which is the loading opening of the drum) is filtered by a fluff filter 22 arranged close to the drum outlet in or at the channel 20. The fluff filter 22 is arranged in a front channel 20d forming another section of channel 20 which is arranged behind and adjacent the front cover of the dryer 2. Condensate formed at the first heat exchanger 10 is collected and guided to a condensate collector 30.

[0041] The condensate collector 30 is connected via a drain pipe 46, a filter element 24, a drain pump 36, a valve 38 and a drawer pipe 50 to an extractable condensate drawer 40. I.e. the collected condensate can be pumped from the collector 30 to the drawer 40 which is arranged at an upper portion of the apparatus 2 from where it can be comfortably withdrawn and emptied by a user.

[0042] In dryers 2 fluff or lint is generated during a drying process in compartment 18 and conveyed by the process air through front channel 20d towards the heat exchangers 10, 12. Particularly if no fluff filter is provided the fluff accumulates on the front surface of the heat exchanger 10 and the complete fluff removal has to be provided there. Even if a fluff filter is provided in the flow path from the compartment 18 to the heat exchanger 10 (compare filter 22), some portion of the fine fluff is not completely filtered and - after passing the filter - deposits on the front surface of heat exchanger 10. The fluff or lint accumulated on the heat exchanger 10 reduces the efficiency of the heat exchanger 10 and constricts the flow

of process air A.

[0043] Fig. 2 shows a sectional side view of the base section 5 of the laundry treatment apparatus 2 according to a first embodiment and Fig. 2a a detail of Fig. 2. The heat exchangers 10, 12 are arranged horizontally in the base section 5, such that the process air passes the heat exchangers 10, 12 horizontally or substantially horizontally.

[0044] A liquid distributing element 42, in this embodiment a water mill, is arranged upstream the first heat exchanger 10 such that the water mill 42 is partially immersed in condensate collected in the condensate collector 30 or sump 34 of the base section 5. As shown in Fig. 2a, a rotation E of the water mill 43 accelerates the condensate D from the sump 34 towards the front surface 62 or vertical cross section of the first heat exchanger 10, such that the heat exchanger front 62 is cleaned from fluff attached or accumulated thereto.

[0045] The water mill 42 comprises a plurality of wings 52 (only one wing 52 labeled for clarity) each designed to provide a liquid flush, gush or sprinkle towards the heat exchangers vertical cross section 62 when the water mill 42 is rotated. In particular each wing 52 may be designed to distribute liquid or condensate towards the heat exchanger 10. In the embodiment of the depicted water mill design, each of the wings extends over the front width extension of the heat exchanger 10 such that the complete heat exchanger cross section perpendicular to the process air flow direction is cleaned. Further the wings are arranged around the pivot or center axis of the mill 42 at equiangular radial directions. Alternatively the wings 52 are designed such that each wing 52 distributes condensate D to a different section of the front surface of the heat exchanger 10. For example the wings 52 extend only a portion of the axial extension of the mill and preferably the axial extension overlaps in a way that the total axial extension of the mill is occupied by at least one of the blades. So the blade elements 52 in combination distribute liquid to the complete front surface 62 of the heat exchanger 10 such that fluff is washed off the complete vertical cross section of the heat exchanger 10.

[0046] According to another alternative solution the wings 52 are designed such that liquid is distributed towards an upper section of the heat exchanger 10 front surface 62, wherein the distributed liquid flows down the heat exchanger surface 62 and washes the heat exchanger 10 thereby.

[0047] Further in a (slow mode) rotational movement E of the water mill 42 provides a flow of condensate in the condensate collector 30 or tray below the heat exchanger 10 which transports washed off fluff towards a drain outlet of the sump 34.

[0048] A feed pipe 48 having a nozzle opening 44 opens out into the base section 5 or the sump 34 to supply liquid to the condensate collector 30 for cleaning the heat exchanger 10. The control unit of the apparatus 2 controls the supply of liquid to the condensate collector 30 such that at all times during a drying operation of the apparatus

2 a minimum amount of liquid is provided in the condensate collector 30 to allow a cleaning of the heat exchanger 10 with the water mill 42 as described above. For example the liquid level in the sump 34 is between 15 mm to 30 mm, preferably at least 25 mm, which provides that the water mill 42 transports or distributes sufficient liquid to clean the heat exchanger as described above and such that the washed off fluff in the sump is conveyed or flushed towards the drain outlet.

[0049] The liquid fed to the condensate collector 30 via the feed pipe 48 is collected condensate from the condensate collector 30 which has been filtered by the filter element 24. Fig. 3 shows a top view of the laundry treatment apparatus 2 of Fig. 2. The filter element 24 is arranged at an upper portion of the treatment apparatus 2 which is easily accessible for a user. The filter element 24 is extractable such that it may be cleaned after each or a couple of drying operations of the apparatus 2. In a drying operation condensate F is pumped by means of the drain pump 36 via a drain pipe 46 out of the condensate collector 30 or sump 34 towards the filter element 24. From the filter element 24 the filtered condensate G is pumped via pipe 50 and through an inlet 56 into the extractable condensate container 40 or it is pumped back to the condensate collector 30 or sump 34 via the feed pipe 48. The control unit controls the valve 38 and the drain pump 36 such that depending on the demand the flow of filtered condensate G is directed either to the container 40 or to the condensate collector 30 of the apparatus. For example the valve 38 is incorporated into the filter element 24.

[0050] Fig. 4 shows a side view of the laundry treatment apparatus of Fig. 2 and depicts the user-friendly design of the apparatus 2. The extractable condensate container 40 as well as the filter element 24 are arranged at an upper portion of the apparatus 2 easily accessible for a user such that the filter element 24 and the container 40 to be cleaned or emptied, respectively, are conveniently extractable by means of the handles 54, 54'.

[0051] The base section 5 of the apparatus 2 comprises an upper shell 58 and a lower shell 60 which provide a substantially air-tight process air channel 20. The assembly of the apparatus 2 and in particular of the base section 5 is facilitated as only two parts form the shell of the base section 5.

[0052] Fig. 5 shows a partial sectional rear view of the laundry treatment apparatus 2 of Fig. 2. The arrangement of the feed pipe 48 at the apparatus 2 and the feed opening 44 is depicted wherein the heat exchangers 10, 12 and the cleaning device are not depicted. The opening 44 opens into the battery channel 20a and is directed downwards towards the condensate collector 30.

[0053] Fig. 6 shows a sectional side view of a laundry treatment apparatus 2' according to a second embodiment. Unless otherwise mentioned, elements as well as operation modes of the cleaning device of the second embodiment correspond to the elements and operation modes of the cleaning device of the above described

embodiment. Like reference numerals are used for like elements.

[0054] In contrast to the above described embodiment the second embodiment comprises vertically arranged heat exchangers 10', 12', i.e. process air passes the heat exchangers 10', 12' vertically or substantially vertically. The heat exchangers 10', 12' are arranged in a battery channel 20a' of a base section 5' comprising an upper and a lower shell 58', 60' as described above.

[0055] Three water mills 42a-c are arranged below the first heat exchanger 10' to provide a cleaning of a horizontal front surface 62' or horizontal cross section of the heat exchanger 10' by distributing liquid from the sump 34 to the surface of the heat exchanger 10' as described above. In contrast to the first embodiment the liquid is distributed to a horizontal cross section 62' of the heat exchanger 10' instead to a vertical cross section. In particular each of the water mills 42 a-c is configured to distribute liquid to a particular or predetermined section of the heat exchanger 10' such that in combination the water mills 42a-c cover the complete horizontal cross-section 62' of the heat exchanger 10'.

[0056] As described above a slow mode of rotation E of the water mills 42a-c assists the flow of condensate and washed off fluff towards the drain outlet of the condensate collector 30 or sump 34.

[0057] An additional self-cleaning effect is provided by the vertical arrangement of the heat exchangers 10', 12'. The first heat exchanger 10' cools the warm and damp process air whereby water condensates on the heat exchanger 10' surface. Due to gravity the generated condensate flows down the heat exchanger 10' and washes off fluff thereby (indicated in Fig. 6 by small droplets).

[0058] Reference Numeral List

2, 2'	tumble dryer
4	heat pump system
5, 5'	base section
6	refrigerant loop
8	blower
10, 10'	first heat exchanger
12, 12'	second heat exchanger
14	compressor
16	expansion device
18	drum
19	laundry
20	process air channel

20a, 20a'	battery channel		Claims
20b	rear channel		1. Laundry treatment apparatus, in particular dryer or washing machine having a dryer function, comprising
20c	rising channel	5	a control unit,
20d, 20d'	front channel		a laundry treatment chamber (18) for treating laundry (19) using process air,
22	filter element		a process air loop (20) for circulating the process air,
24	condensed water filter	10	a heat exchanger (10, 10') arranged in the process air loop for cooling the process air,
30	condensate collector		at least one liquid distributing element (42, 42a-c) arranged upstream the heat exchanger (10, 10') and adapted to distribute liquid to the heat exchanger (10, 10') for cleaning the heat exchanger,
34	condensate sump	15	characterized by
36	drain pump		a pivot element having a pivot axis for pivotally supporting the at least one liquid distributing element (42, 42a-c), wherein the at least one liquid distributing element (42, 42a-c) is designed such that due to the rotating movement of the at least one liquid distributing element liquid is sprayed to the heat exchanger (10, 10').
38	valve	20	
40	condensate container		
42, 42a-c	water mill		
44	nozzle opening	25	2. Laundry treatment apparatus according to claim 1, wherein the at least one liquid distributing element (42, 42a-c) comprises at least one blade element (52) or protruding element configured to convey liquid towards the heat exchanger (10, 10') by a rotating movement of the at least one liquid distributing element.
46	drain pipe		
48	feed pipe	30	
50	drawer pipe		
52	wing		3. Laundry treatment apparatus according to claim 1 or 2, wherein the at least one liquid distributing element (42, 42a-c) is at least partially arranged in a condensate collector chamber or tray (30, 34) below or in front of the heat exchanger (10, 10') for collecting condensate from the heat exchanger (10, 10') such that in operation the at least one liquid distributing element is at least temporarily immersed in condensate.
54, 54'	handle	35	
56	inlet		
58, 58'	upper shell	40	
60, 60'	lower shell		
62, 62'	front surface		4. Laundry treatment apparatus according to claim 1, 2 or 3, wherein the at least one liquid distributing element (42, 42a-c) is arranged in the collector chamber or tray (30, 34) such that in operation the liquid distributing element is at least partially immersed in condensate.
A	process air flow	45	
B	refrigerant flow		
D	liquid flow	50	5. Laundry treatment apparatus according to any of the previous claims, wherein the at least one liquid distributing element (30, 34) or the at least one protruding element has a width in pivot axis direction corresponding to or substantially corresponding to the width of the heat exchanger (10, 10') in pivot axis direction.
E	rotation direction		
F	unfiltered condensate flow		
G	filtered condensate flow	55	
			6. Laundry treatment apparatus according to any of the

previous claims, comprising at least two blade elements (52) arranged along the pivot axis such that the combined width of the blade elements corresponds to or substantially corresponds to the width of the heat exchanger (10, 10').

7. Laundry treatment apparatus according to any of the previous claims, comprising a drive means configured to rotate the at least one distributing element (42, 42a-c) about the pivot axis, wherein the control unit is adapted to control the drive means to rotationally accelerate the at least one distributing element (42, 42a-c) such that a flush of liquid of the at least one distributing element covers a cross section of the heat exchanger (10, 10') perpendicular to the process air flow in a cleaning phase for cleaning the heat exchanger, or wherein the control unit is adapted to control the drive means to continuously rotate the at least one distributing element (42, 42a-c) such that a continuous liquid spray of the at least one distributing element (42, 42a-c) covers a cross section of the heat exchanger (10, 10') perpendicular to the process air flow in a cleaning phase for cleaning the heat exchanger, or wherein the control unit is adapted to control the drive means to rotationally accelerate the at least one distributing element (42, 42a-c) such that a liquid flow in the collector chamber or tray (30, 34) is directed towards a drain opening of the collector chamber or tray (30, 34) after a cleaning phase for cleaning the heat exchanger (10, 10').
8. Laundry treatment apparatus according to any of the previous claims, wherein the control unit is adapted to control the driving means to rotate the at least one distributing element (42, 42a-c) about the pivot axis intermittently in a cleaning phase for cleaning the heat exchanger.
9. Laundry treatment apparatus according to any of the previous claims, comprising at least one baffle element configured to direct a liquid spray of at least one distributing element (42, 42a-c) towards the heat exchanger, or wherein each of a plurality of distributing elements (42, 42a-c) comprises a baffle element for directing a liquid spray of each distributing element to the heat exchanger.
10. Laundry treatment apparatus according to any of the previous claims, wherein the drive means is configured to rotate the at least one distributing element (42, 42a-c) in a first rotating direction (E) and in a second rotating direction reverse to the first rotation direction (E).
11. Laundry treatment apparatus according to any of the previous claims, wherein a or the at least one baffle

element is configured such that in dependency of the rotational direction of the at least one distributing element (42, 42a-c) liquid is directed to different areas of the cross section of the heat exchanger (10, 10').

12. Laundry treatment apparatus according to any of the previous claims, comprising a liquid pump (36) adapted to convey liquid from a or the collector chamber or tray (30, 34) towards the at least one distributing element (42, 42a-c), wherein a filter unit (24) for filtering the liquid is arranged upstream the at least one distributing element or the liquid pump (36).
13. Laundry treatment apparatus according to claim 12, wherein the filter unit (24) or a filter element of the filter unit is configured to be removable such that the filter unit (24) or filter element can be removed from the treatment apparatus to be cleaned.
14. Laundry treatment apparatus according to claim 12 or 13, comprising a pipe (46) connecting the filter unit (24) or the liquid pump (36) to the condensate collector chamber or tray (30, 34), or a feed pipe (48) fluidly connecting the filter unit (24) or the liquid pump (36) to a pipe outlet opening or nozzle (44) for supplying the conveyed liquid towards the at least one distributing element (42, 42a-c).
15. Laundry treatment apparatus according to any of the previous claims, comprising a liquid level sensor to detect the liquid level in the or a condensate collector chamber or tray (30, 34), wherein a or the control unit is adapted to control a valve (38) or a drain pump (36) such that at least a minimum level of liquid is provided in the collector chamber or tray (30, 34) during a cleaning phase for cleaning the heat exchanger.

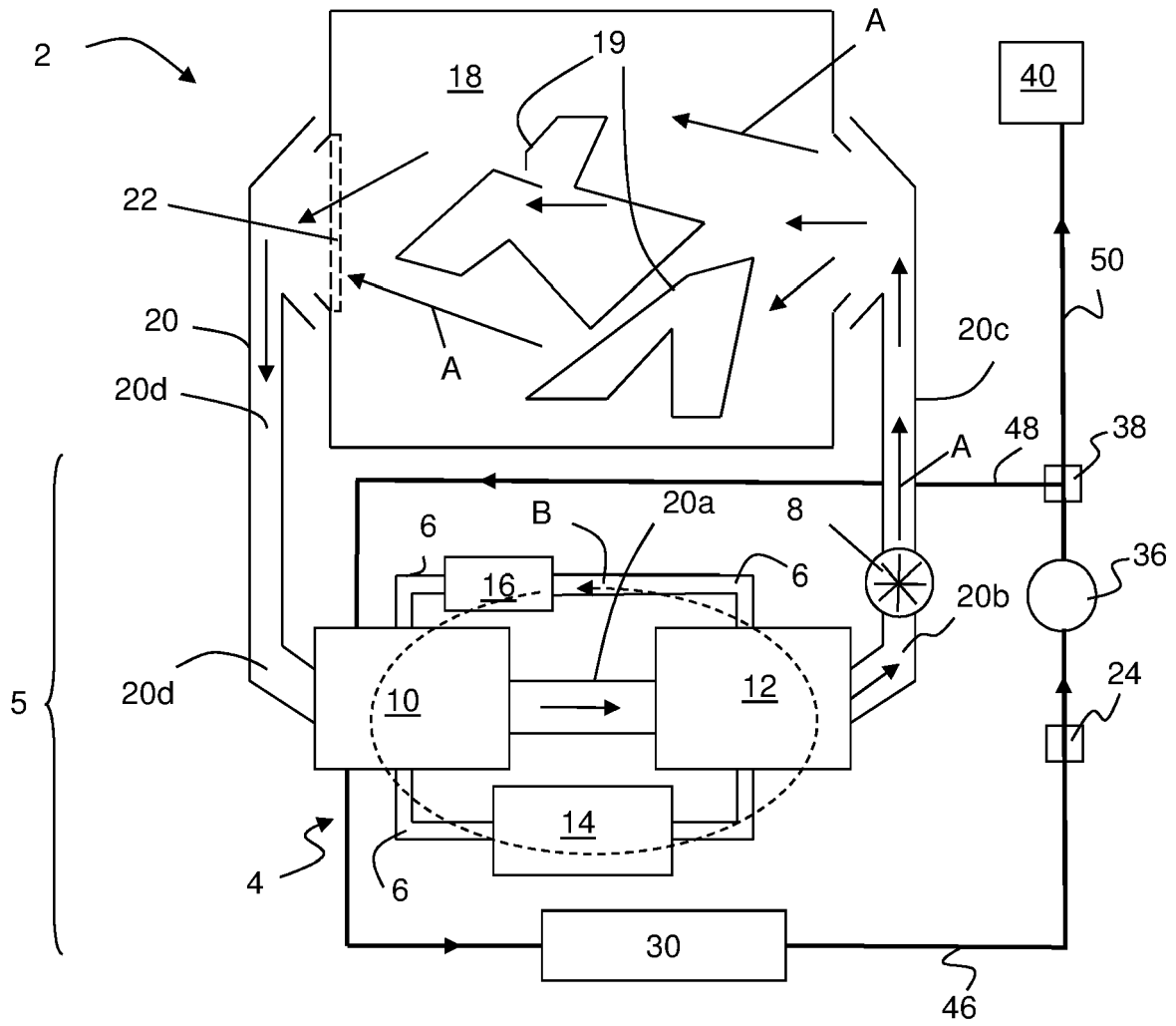


Fig. 1

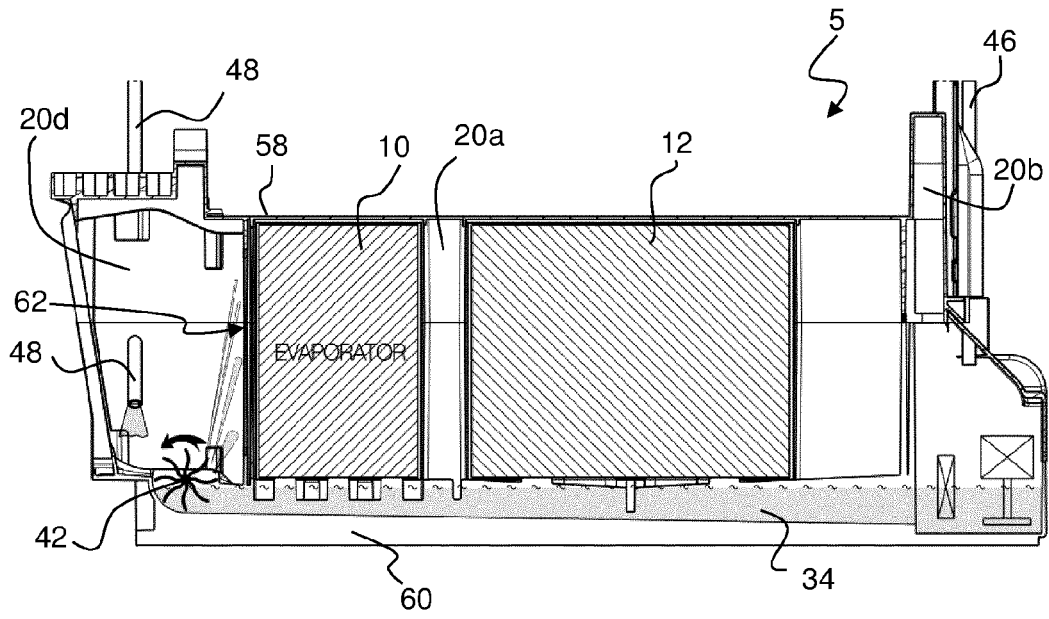


Fig. 2

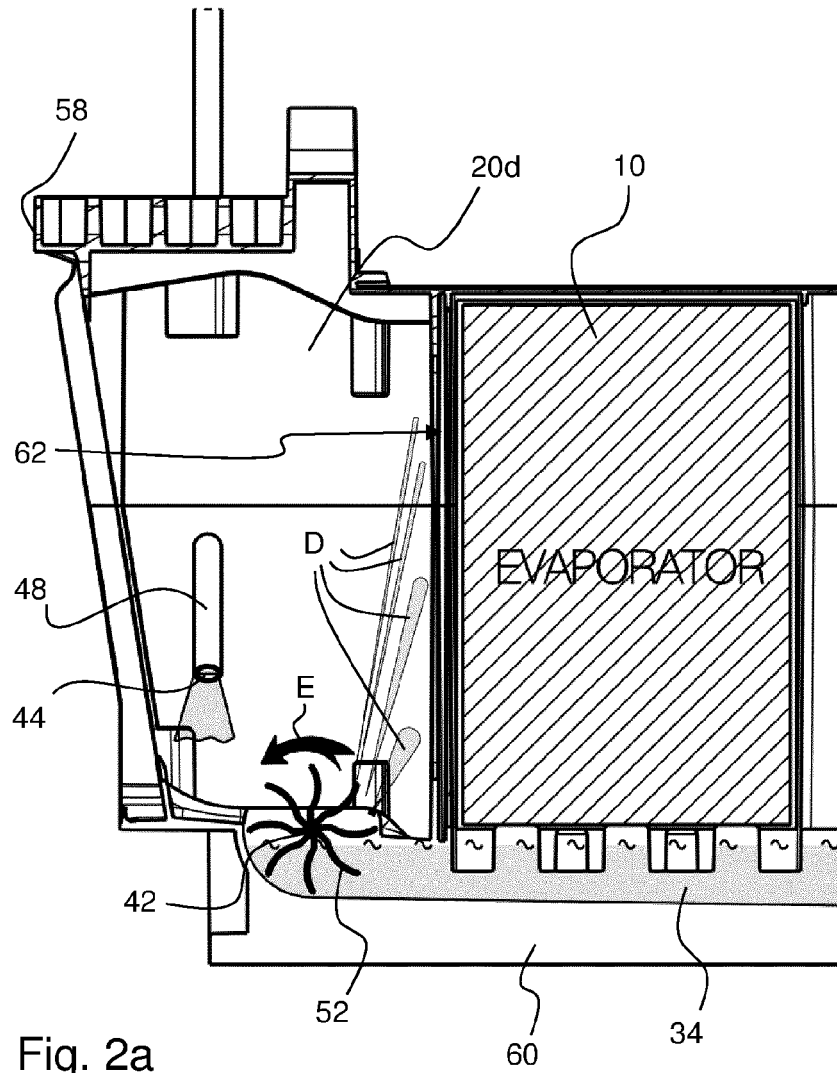


Fig. 2a

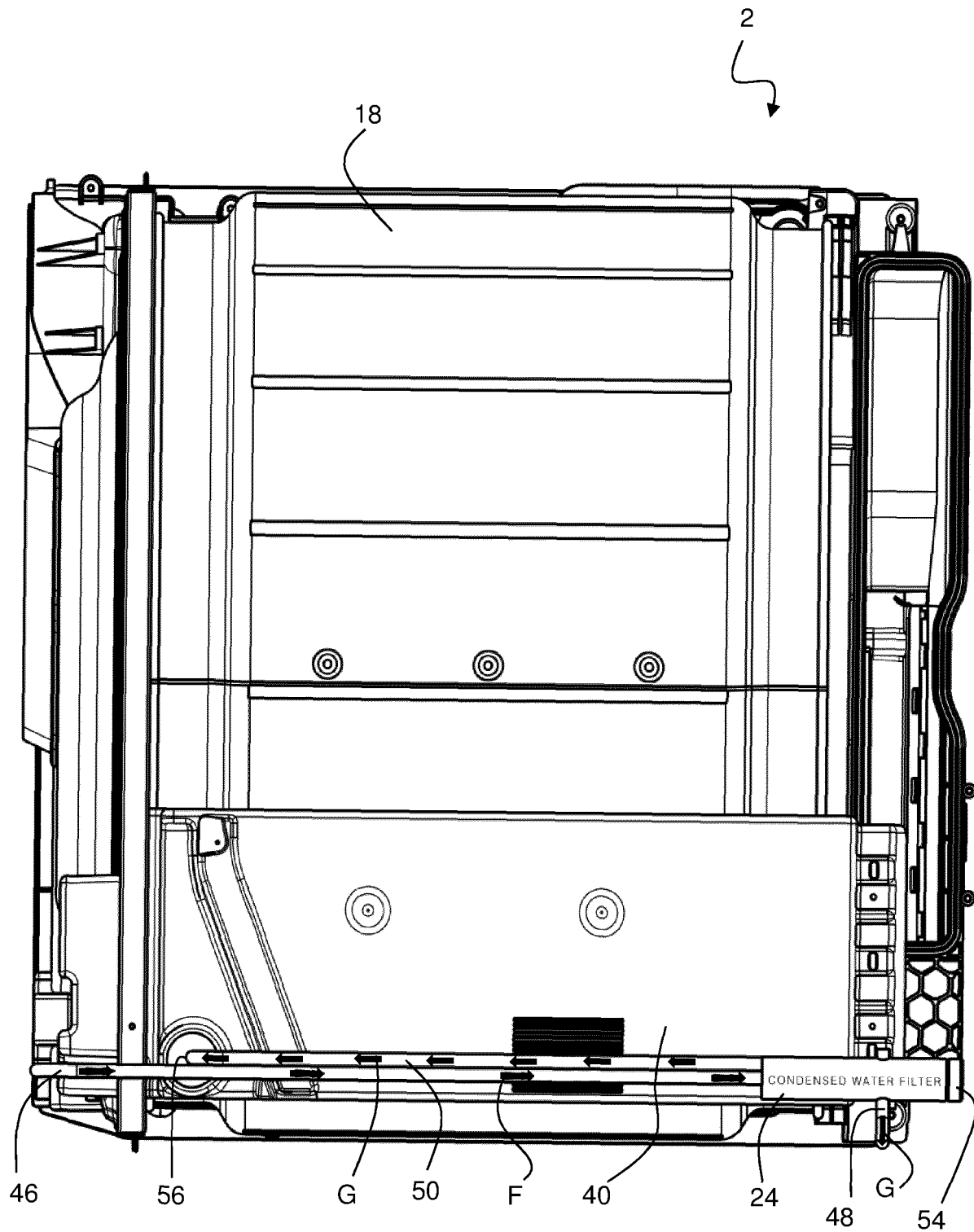
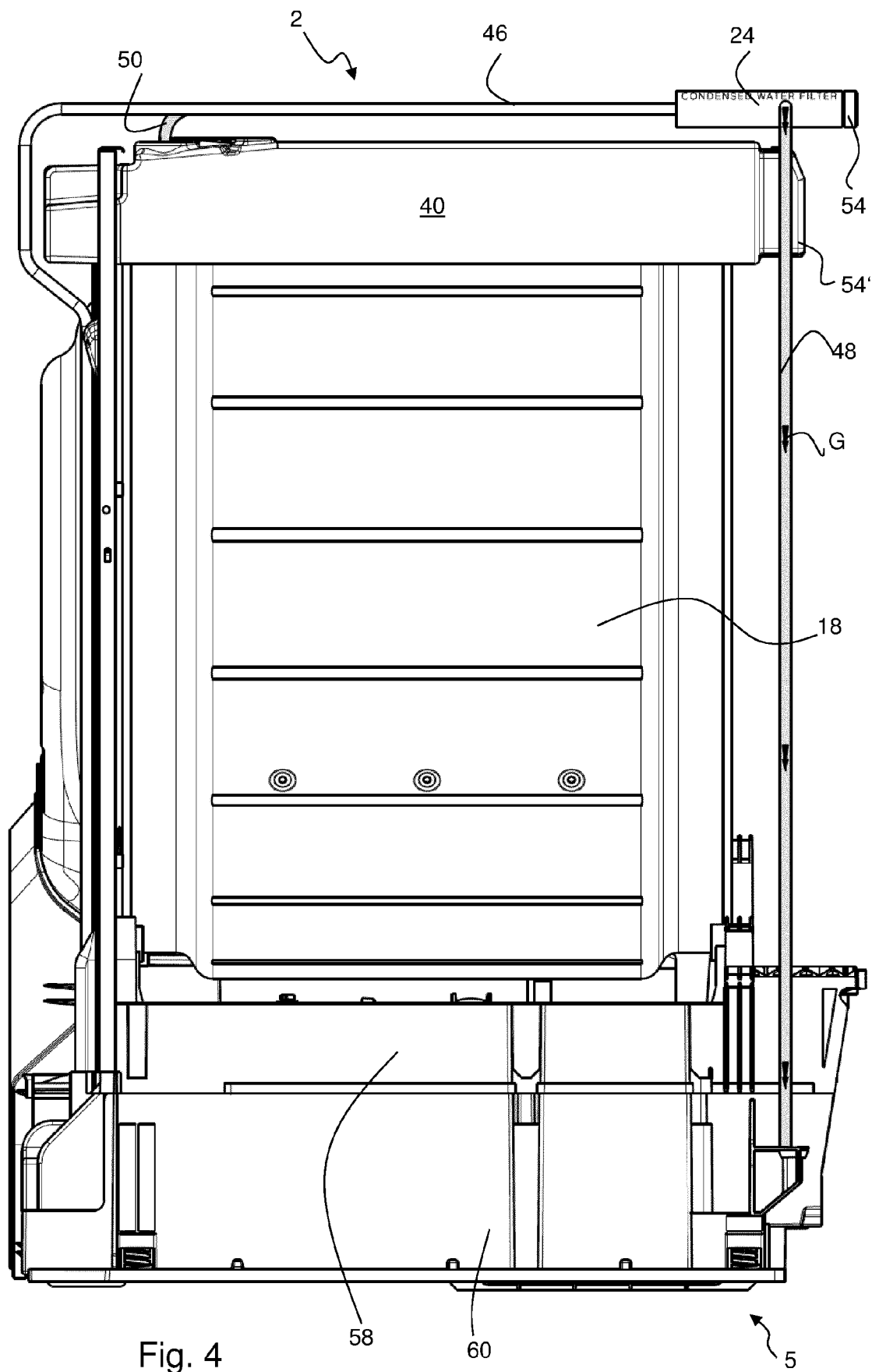


Fig. 3



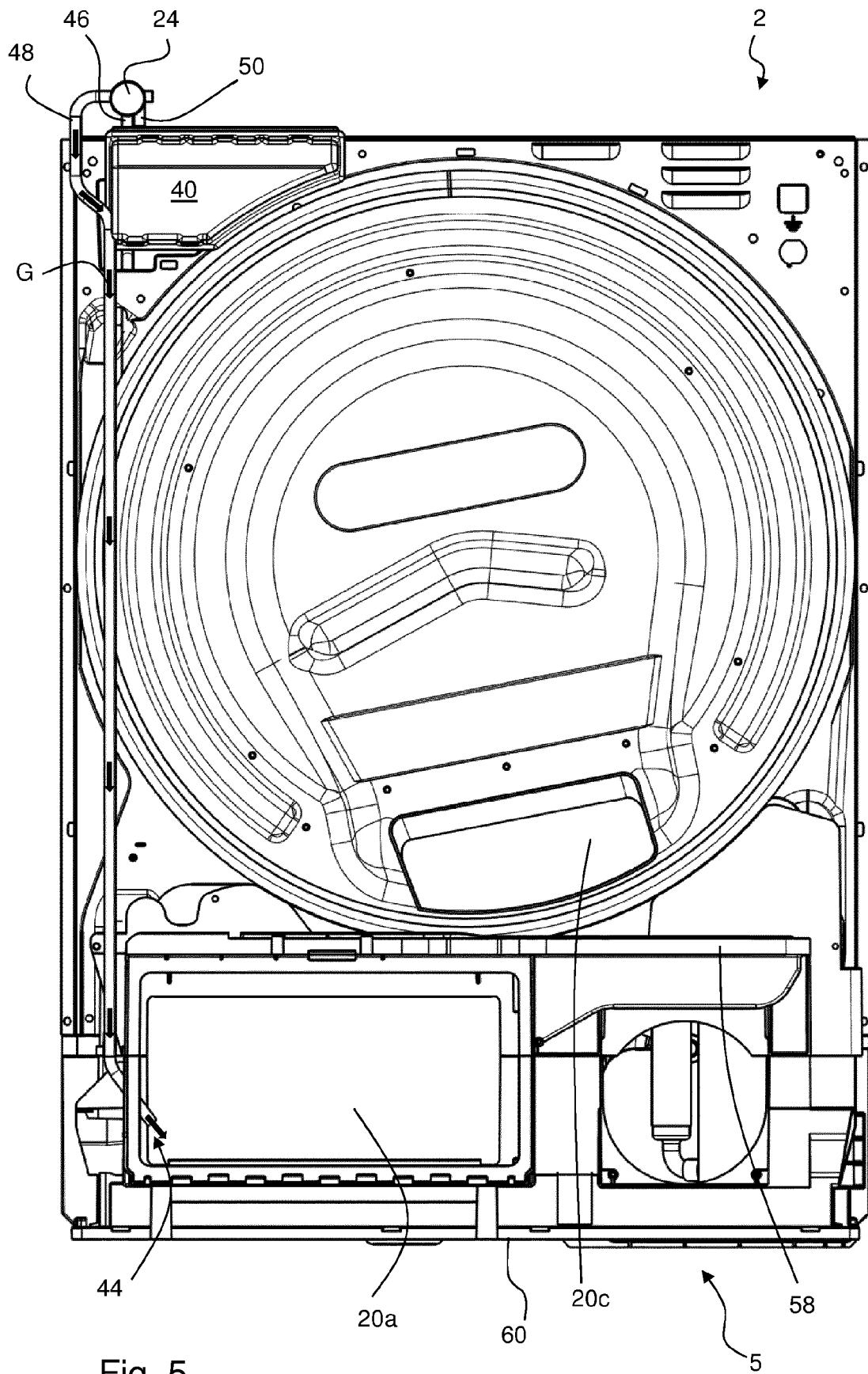


Fig. 5

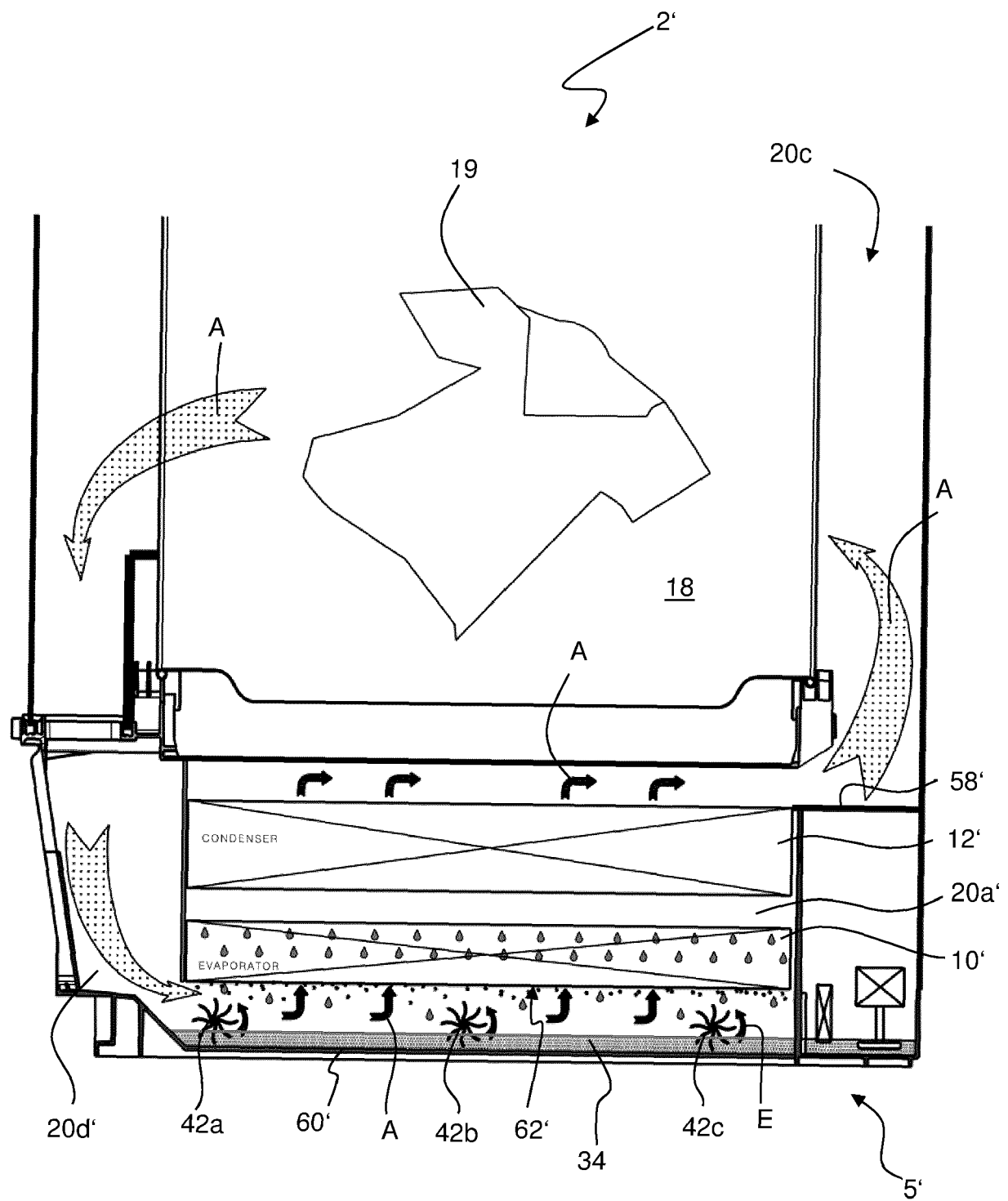


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 6254

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 196 00 489 A1 (MIELE & CIE [DE]) 18 July 1996 (1996-07-18) * the whole document *	1-15	INV. D06F58/22 D06F58/20 D06F58/24
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
Place of search		Date of completion of the search	Examiner
Munich		23 July 2012	Spitzer, Bettina
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EPO FORM 1503 03.82 (P04C01)

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23-07-2012

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REFERENCES CITED IN THE DESCRIPTION

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