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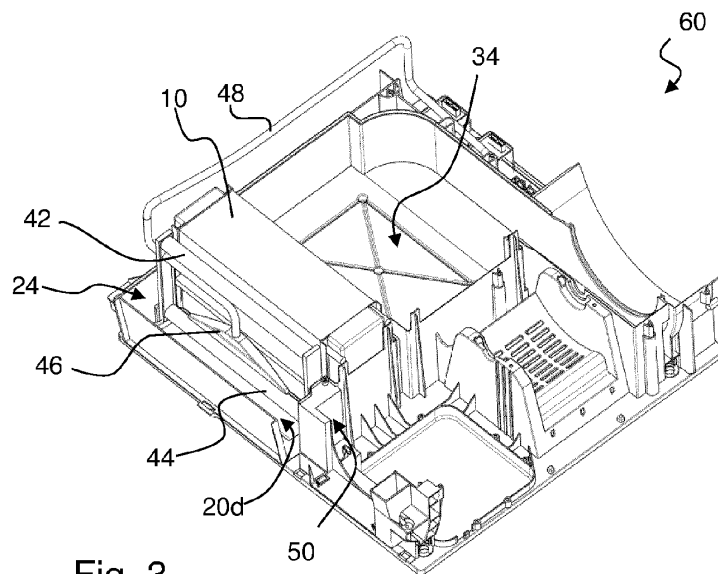
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(54) **Laundry treatment apparatus**

(57) The invention relates to a laundry treatment apparatus, in particular dryer or washing machine having a dryer function, comprising a control unit, a laundry treatment chamber for treating laundry using process air, a process air loop for circulating the process air, a heat exchanger (10) arranged in the process air loop for cooling the process air, a belt member arranged in the process air loop upstream the heat exchanger (10), at least two belt support elements (42, 44) mounted in the process air loop each having a rotation axis parallel to the

other and spaced apart from the other, wherein the at least two belt support elements (42, 44) are configured to support the belt member such that the belt member spans at least a portion of a cross-section of the process air loop, and a drive means (50) configured to drive at least one of the belt support elements (44) to rotate about its rotation axis such that the supported belt member is moved at least between the at least two belt support elements (42, 44), wherein the belt member comprises at least one cleaning element configured to mechanically clean the heat exchanger (10).



**Fig. 3**

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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]** In laundry treatment apparatuses fluff or lint is generated in a drying process and accumulates in process air channels of the apparatus. To remove fluff from the process air fluff or lint filters are used.

**[0003]** EP 1 050 619 B 1 discloses a fluff filter device for a laundry dryer which is arranged in a process air channel of the dryer. The filter device comprises a belt member supported by two rollers such that the belt member spans across a cross-section of the process air channel, wherein the belt member can be moved by a rotational movement of the rollers. A portion of the belt member comprises a filter element for collecting fluff from the process air flowing through the belt member. After a drying phase the filter element is cleaned by rotating the rollers such that the belt member with the filter element is guided towards a stripper which wipes the collected fluff from the filter element. The stripped fluff has to be removed separately by the user from time to time. In case not all fluff is filtered from the process air with the filter element, fluff still accumulates 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.

**[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 is provided, in particular a dryer or a washing machine having a dryer function. The apparatus is for example a condenser dryer or a heat pump dryer. The apparatus comprises a control unit for controlling a drying operation or washing 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. A belt member is arranged in the process air loop upstream the heat exchanger, preferably the heat exchanger is a or is working as evaporator and/or heater for the refrigerant. At least two belt support elements are configured to support the belt member such that the belt member spans at least a portion of a cross-section of a process air channel in which the process air is circulated. The at least two support elements are mounted in the process air channel, wherein each support element has a rotation axis parallel to the other and is spaced apart from the other. The belt support elements are formed for example as cylindrical shafts or rollers. A drive means is provided and is adapted to drive at least one of the belt support elements to rotate about its rotation axis such that the supported belt member is moved at least between the at least two belt support elements.

**[0007]** The belt member comprises at least one cleaning element configured to mechanically clean the heat exchanger. In other words the at least one cleaning ele-

ment is adapted to mechanically remove foreign matter like fluff or lint (in the following: fluff) from the heat exchanger which accumulates on the heat exchanger during a drying process of the apparatus. Thus it is ensured that even fluff and lint which is attached or accumulated on a surface of the heat exchanger - i.e. which cannot be filtered out of the process air flow any more - is removed from the heat exchanger such that the efficiency of the heat exchanger is maintained and the process air flow is not blocked.

**[0008]** Preferably the at least one cleaning element is configured to contact the heat exchanger at least temporarily such that a surface (e.g. heat exchanging surfaces) of the heat exchanger is swept or wiped by the at least one cleaning element when the belt member executes the movement. E.g. when the driving means drives at least one of the support elements, the at least one cleaning element wipes along a surface of the heat exchanger whereby fluff accumulated on a surface of the heat exchanger is removed from the heat exchanger.

**[0009]** In an embodiment the movement of the cleaning element is controlled by the control unit such that at least the complete length or width of a front surface of the heat exchanger facing or crossing the process air channel is wiped in one movement. Preferably the at least two support elements span the belt member across the air channel such that the belt member and the surface crossed or stripped by the cleaning element during movement covers the complete front surface of the heat exchanger. Preferably the heat exchanger front surface is efficiently cleaned in one movement (e.g. in one turn or one half-turn) of the at least one cleaning element or belt member. The front surface of the heat exchanger is the side face of the heat exchanger which is passed by the process air flow first and which is perpendicular or essentially perpendicular to the process air flow direction.

**[0010]** The movement direction of the belt member in front of the heat exchanger surface may be vertically (top/down and/or down/top) or horizontally (left/right and/or right/left) in case the process air flow is in a horizontal direction through the heat exchanger. In case of a vertical process air flow through the heat exchanger, the belt movement direction at the front surface of the heat exchanger may also be from rear to back and/or from back to rear (movement direction with respect to the body of the apparatus in an operation orientation of the apparatus - front surface of the heat exchanger is with respect to the process air inlet area to the heat exchanger).

**[0011]** Generally the belt member and cleaning element may be designed that no fluff filter is required in the process air channel of the apparatus or such that no fine fluff filter is provided, for example only one fluff filter is provided in the process air channel between the laundry treatment chamber and upstream to the heat exchanger and/or belt member.

**[0012]** Preferably the at least one cleaning element extends or essentially extends across the width or height (of the front surface) of the heat exchanger. Alternatively

a plurality of cleaning elements is configured such that they extend in combination across or essentially across the width of the heat exchanger. E.g. the cleaning elements together span the whole exchanger surface at least in one turn (partial-turn) or cycle (partial-cycle) of the belt member. Thus by the movement of the cleaning element along the width or height of the front surface of the heat exchanger the complete front surface is cleaned in the one movement.

**[0013]** Preferably a plurality of cleaning elements are arranged in a line, parallel to each other or overlapping each other on the belt member perpendicular or substantially perpendicular to the movement direction of the belt member. For example each of the cleaning elements has a width (perpendicular to the movement direction of the belt member) corresponding to or substantially corresponding to the surface length of the heat exchanger (the surface length of the heat exchanger is defined as the dimension of the front surface of the heat exchanger perpendicular to the movement direction of the belt member - e.g. the width or height of the heat exchanger). Alternatively the width of each of the cleaning elements is shorter than the surface dimension of the heat exchanger. For example the cleaning elements are arranged staggered with respect to each other over the width of the belt member such that all the cleaning elements in combination cover the complete surface length of the heat exchanger. The starting resistance when driving the belt member is reduced when for example only one (short) cleaning element starts to wipe or sweep along the front surface of the heat exchanger at a predefined belt position.

**[0014]** Preferred a plurality of cleaning elements are arranged diagonally on the belt member with respect to the movement direction of the belt member or are distributed over the belt member such that during the movement of the belt member the cleaning elements together sweep over the complete or essentially the complete front surface of the heat exchanger. By arranging the cleaning elements diagonally over the belt member the starting resistance when driving the belt member is reduced as the cleaning elements gradually starts wiping the heat exchanger. In other words it is prevented that the complete length of a cleaning element starts wiping the heat exchanger at once.

**[0015]** According to a preferred embodiment the heat exchanger comprises a plurality of cooling fins aligned parallel to the movement direction of the belt member. In particular the front edges of the fins at the process air entrance face of the heat exchanger and/or one direction of the plate surfaces of the fins run parallel to the movement direction. Preferably at least one cleaning element is provided for each cooling fin such that an outward facing edge of each cooling fin is swept or wiped by the corresponding cleaning element. Thereby it is ensured that each fin is thoroughly cleaned from fluff.

**[0016]** Preferably each of the cleaning elements can be formed such that each cooling fin is also wiped on its

side surfaces (at least close to the front side of the heat exchanger) to make sure that all fluff is wiped or swept from the heat exchanger. For example each of the cleaning elements has a counter profile matching a corresponding cooling fin or the cleaning elements are flexible, e.g. a brush, such that they reach the side surfaces of the fins.

**[0017]** According to a preferred embodiment a nozzle element is provided which is connected to a liquid supply source. Preferably the nozzle element is arranged in a volume surrounded or enclosed or defined by the belt member such that liquid can be sprayed in at least one liquid spray towards the belt member. In other words liquid is sprayed through the belt member from an inwards facing surface of the belt member to an outwards facing surface such that the belt member - and the at least one cleaning element - is thoroughly flushed with liquid, whereby fluff and foreign matter collected by the at least one cleaning element is rinsed or removed from the cleaning element. Alternatively the nozzle element is arranged adjacent to the outer side of the belt member and the at least one spray ejected from the nozzle element is directed towards a position where the cleaning element passes by during movement of the belt member.

**[0018]** Preferably the nozzle element comprises a plurality of outlet openings arranged parallel or substantially parallel to a rotation axis of a belt support element, i.e. perpendicular or substantially perpendicular to the movement direction of the belt member. Alternatively or additionally the nozzle element comprises an elongate outlet opening arranged parallel or substantially parallel to a rotation axis of a belt support element. Preferred the nozzle element opening is configured or the plurality of openings are configured to provide a liquid spray covering or substantially covering the width of the belt support in rotation axis direction. Thus when moving the belt member beneath the liquid spray the complete or substantially the complete belt member is washed, flushed or cleaned by the liquid spray.

**[0019]** In an embodiment the nozzle element and/or the spray direction of the nozzle element is directed vertically or substantially vertically downwards. Thereby gravity assists washing off fluff from the at least one cleaning element. In particular a liquid collector for collecting liquid and washed off fluff can be arranged below the belt member. Preferably the nozzle element or the spray direction of the nozzle element is directed towards a belt support element. Thereby the belt support element is washed or cleaned additionally to the belt member and the at least one cleaning element. I.e. it is ensured that the rotatable belt support element, e.g. a roller, is always free from fluff such that the support element runs smoothly and clogging of the rotatable element with fluff is prevented.

**[0020]** Preferably the control unit is adapted to control the drive means such that the at least one cleaning element moves from a bottom portion of the heat exchanger to an upper portion thereof. For example the at least one

cleaning element comprises a brush or sponge which is adapted to hold or absorb the collected fluff in the upward movement until the fluff is washed off the brush/ sponge with a liquid spray. Alternatively or additionally the control unit is adapted to control the drive means such that the least one cleaning element moves from an upper portion of the heat exchanger to a lower portion thereof. I.e. gravity assists wiping off the fluff, for example when the at least one cleaning element comprises a rubber lip the fluff is efficiently wiped off the heat exchanger in the downward movement. In an embodiment the control unit is adapted to control movement of the belt member in a reversing (e.g. up/down or left/right) manner via the drive means.

**[0021]** According to a preferred embodiment the belt member is configured to provide no or substantially no or a low flow resistance for the process air flow (e.g. low as compared to a fluff filter spanning the complete cross section of the process air channel). Thus, in operation of the apparatus, the process air passes the belt member without significant flow losses. The fluff passing the belt member accumulates on a surface of the heat exchanger from where the fluff is removed by means of the at least one cleaning element as described above.

**[0022]** Preferred at least a portion of the belt element comprises a filter net such that lint is filtered from the process air upstream the heat exchanger. Alternatively at least a portion of the belt element is formed as a filter net. I.e. the filter net is configured to filter fluff from the process air, while the at least one cleaning element ensures that fluff which might pass the filter net is removed from the heat exchanger as described above. It is particularly advantageous that the at least one water spray from the nozzle element also cleans the filter net, i.e. it is not necessary to clean the filter net manually by a user.

**[0023]** Preferably the control unit is adapted to control the liquid supply source for controllably supplying liquid to the nozzle element. Preferably in a cleaning phase for cleaning the cleaning element and the belt member, liquid is continuously supplied to the nozzle element. I.e. a continuous liquid spray is provided which thoroughly flushes the belt member, cleaning element(s) and optionally the filter net such as to remove any collected fluff.

**[0024]** Preferably the control unit is adapted to control the or a liquid source to supply liquid intermittently to the nozzle element in a cleaning phase for cleaning the cleaning element. In other words the liquid supply source is switched on and off several times such that the flow rate of the liquid is varied which assists washing off fluff.

**[0025]** One or more cleaning phases may be executed during and/or after a drying operation of the apparatus, wherein in one cleaning phase the front surface of the heat exchanger is wiped at least once and the at least one cleaning element, belt member/ filter net is flushed at least once with liquid from the nozzle element.

**[0026]** Preferably a cleaning space is provided at a position along the belt member for receiving deposits (e.g. fluff) from the at least one cleaning element. Preferably

the transfer of the deposit from the at least one cleaning element to the cleaning space is assisted by at least one liquid spray from a nozzle element that washes deposits from the at least one cleaning element to the cleaning space. The cleaning space may be provided at any position along the movement path of the belt member (i.e. of the at least one cleaning element). For example it may be provided at a top turning position of the belt member. Preferably the cleaning space is provided at a lower region of the belt member, more preferably it is provided below the belt member. Preferably the cleaning space between the belt member and the closest wall opposite to the belt member across the cleaning space has a gap width that corresponds to the maximum extension or is less than the maximum extension of the brush element perpendicular to the belt member. This dimensioning assists in stripping off of the fluff from the brush element. Preferably the cleaning space positioned along the belt member is in fluid communication with a condensate collector chamber for collecting condensate from the heat exchanger. Preferably the cleaning space is part of or communicates with a condensate collecting chamber, e.g. via a condensate collection tray that extends below the belt member. The cleaning space or the collecting chamber (which for example extends below the belt member) provides that fluff which has been washed from the belt member and cleaning element(s) is not caught again in the belt member or cleaning element(s) but has sufficient space to be collected and to be flushed away from the belt member, e.g. towards a drain outlet of the condensate collector chamber or collection tray.

**[0027]** In an embodiment the liquid supply source comprises a drain pump in fluid communication with a condensate collector chamber for collecting condensate from the heat exchanger and/or wherein the liquid supply source comprises a valve connected to tap water. The control unit preferably is adapted to control the drain pump and/or is adapted to control the valve to supply water to the nozzle element during a cleaning phase of the belt member and cleaning element(s).

**[0028]** According to a preferred embodiment the apparatus comprises an extractable condensate container which is in fluid connection to the condensate collector. Preferably the condensate collector is selectively connected to the nozzle element and to the extractable condensate container by means of a fluid connection switching valve. For example the control unit is adapted to control the drain pump and/or switching valve such that excess condensate from the condensate collector below the heat exchanger is conveyed to the extractable condensate container. Alternatively or additionally the control unit is configured to control the drain pump and/or switching valve such that a predetermined amount of liquid or condensate is maintained in the condensate collector, i.e. a minimum amount of liquid is maintained for at least one cleaning phase for the heat exchanger, i.e. for cleaning the belt member and cleaning element(s).

**[0029]** Preferably a or the liquid supply source, in par-

ticalular a liquid supply conduit thereof comprises a fluff filter element to filter the liquid supplied upstream the nozzle element, such that liquid supplied to the belt member and cleaning element(s) is free or substantially free from fluff.

**[0030]** In an embodiment a basement of the apparatus comprises an upper shell and a lower shell to form a portion of the drying circuit where the heat exchanger is arranged and wherein the upper and the lower shell form a substantially air-tight chamber to prevent or reduce leakage of drying air or process air from the process air loop. Preferably the heat exchanger and the belt member with the at least one cleaning element are arranged between the lower and the upper shells. Additionally or alternatively the drive means for the belt member and/or the drain pump are arranged in the basement, preferably between the upper and lower shells. Preferably a drive motor for driving the belt member is arranged in a chamber formed by the upper and lower shells that is essentially or completely separated and/or sealed to the process air channel section where the belt member and the heat exchanger are arranged.

**[0031]** Reference is made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying figures, which show:

- Fig. 1 a schematic view of a laundry treatment apparatus,
- Fig. 2 a top view of a laundry dryer base unit housing a heat exchanger,
- Fig. 3 a perspective view on a bottom shell of the base unit of Fig. 2,
- Fig. 4a-c sectional side views of the base unit of Fig. 2 with a cleaning element on a belt member in different positions during a cleaning cycle for the heat exchanger,
- Fig. 5 a sectional front view of the base unit of Fig. 2 with the belt member, and
- Fig. 6 a sectional front view of the base unit of Fig. 2 showing a belt member according to an alternative embodiment.

**[0032]** Fig. 1 schematically depicts a 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. The refrigerant loop 6 comprises in the order of the refrigerant flow B: a first heat exchanger 10 acting as evaporator for evaporating the refrigerant and cooling the 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. To-

gether with the refrigerant pipes connecting the components of the heat pump system 4 in series, the heat pump system 4 forms a refrigerant loop 6 through which the refrigerant is circulated by the compressor 14 as indicated by arrow B.

**[0033]** 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. The condensate is collected and guided via a condensate sump 34 (Fig. 4a) to the condensate collector 30 thus collecting the condensate formed at the first heat exchanger 10.

**[0034]** Condensed water from the first heat exchanger 10 is collected in a condensate collector 30 below the first heat exchanger 10. The collector 30 is connected via a drain pump 36 and a valve 38 to an extractable condensate drawer 40, such that collected condensate can be pumped from the collector 30 to the drawer 40 which is arranged at an upper portion of the apparatus from where it can be comfortably withdrawn and emptied by a user.

**[0035]** It is a problem in dryers 2 having heat exchangers 10, 12 that fluff or lint which is generated during a drying process accumulates in particular on the surface of the heat exchanger 10 which the process air passes first. I.e. due to lint accumulated on the heat exchanger 10 on the one hand the efficiency of the heat exchanger is reduced and on the other hand the flow of process air is constricted. To remove lint from the first heat exchanger 10 a mechanical cleaning device 24 is arranged upstream the first heat exchanger 10 with respect to the process air flow. The cleaning device 24 as described in the following and comprising the belt member 52, 52' and at least one cleaning element 54 is intended to replace the fluff fine filter that is normally used in a dryer in a flow position between fluff coarse filter 22 and entrance to the first heat exchanger 10. However the cleaning device may also be used to replace all fluff filters (i.e. also fluff filter 22).

**[0036]** Fig. 2 shows a top view of a base unit 5 of the

dryer 2 of Fig. 1. The main components of the heat pump system 4 are arranged in the base unit 5 or basement of the dryer 2. Among others the battery channel 20a, the heat exchangers 10, 12, the motor for driving the drum 18 and the drain pump 36. The base unit 5 comprises an upper shell 58 and a lower shell 60 (Fig. 3) which are joint together to form a substantially airtight process air channel section providing a chamber for the heat exchangers 10, 12 and adapted to prevent or reduce leakage of drying air. The upper and lower shells 58, 60 form a basement of the dryer that encloses and/or supports the components of the dryer. In the embodiment the cleaning device 24 is arranged between the lower and the upper shells 58, 60.

**[0037]** Fig. 3 shows a perspective view of the lower shell 60 of the base unit 5 of Fig. 2. Only the first heat exchanger 10 and the mechanical cleaning device 24 are depicted being placed in the lower shell 60. The mechanical cleaning device 24 upstream the heat exchanger 10 comprises an upper roller 42 and a lower roller 44 which support a belt member 52 (Figs. 4a-c) such that the belt member 52 spans the cross section of the process air channel 20d upstream the heat exchanger 10. The belt member 52 comprises a brush element 54 (Figs. 4a-c) which can be formed integrally with the belt member 52, i.e. in one-piece, or which is fixable to the belt member 52. The lower roller 44 is driven by a motor 50 to rotate about its rotation axis, wherein the roller 44 in turn drives the belt member 52 and the brush element 54. Due to the movement of the belt member 52 the brush element 54 moves along a front surface of the heat exchanger 10, such that lint and fluff is mechanically wiped off the front surface and the heat exchanger 10 is cleaned.

**[0038]** A nozzle element 46 is arranged in the inner volume or space defined by the belt member 52 and the rollers 42, 44. The nozzle element 46 is connected to a liquid feed conduit 48 which is in turn connected to the condensate collector 30 or condensate sump 34. I.e. the nozzle element 46 is fed with condensate generated by the first heat exchanger 10. By supplying condensate to the nozzle element 46 a liquid spray is generated which cleans the belt member 52 and the brush element 54 from lint and fluff accumulated thereon.

**[0039]** As shown in Fig. 1 the nozzle element 46 is connected via a valve 38 and the drain pump 36 to the condensate collector 30. According to requirements the control unit is configured to control the valve 38 and the drain pump 36 such that condensate is pumped to the nozzle element 46 in a cleaning phase or is pumped to the condensate drawer 40 when excess condensate has to be removed from the condensate collector 30.

**[0040]** Figs. 4a-c show sectional side views of the base unit 5 of Fig. 2 along the line A-A in several stages of a cleaning phase. As shown in Fig. 4a the nozzle element 46 has a nozzle opening 47 directed downwards towards the lower roller 44. In Fig. 4a the brush element 54 faces away from the heat exchanger 10. By driving the roller motor 50 the lower roller 44 starts rotating about its ro-

tation axis (in this embodiment roller 44 rotates in counterclockwise direction when looking to the shown cross-section), whereby the belt member 52 and the brush element 54 move downwards towards the lower deflection roller 44. While the belt member 52 moves downwards the nozzle element 46 can be fed with liquid to provide a liquid spray towards the belt member 52 and lower roller 44, respectively, such that lint collected by the brush element 54 in a former cleaning phase is washed off. A cleaning gap 56 is provided below the belt member 52 to prevent that the washed off lint below the belt member 52 blocks the belt member 52 or is recollected by the brush element 54 before the lint is flushed away with the liquid from the nozzle element 46. I.e. sufficient space is provided for washed off lint below the belt member 52 before it is flushed with the liquid from the nozzle element 46 towards the condensate sump 34. In this embodiment the cleaning space 56 is provided by a space between the lower region of the belt member 52 and a bottom section of a condensate collecting chamber or tray 34 which extends below the belt member 52. Preferably the space 56 between the belt member 52 and the closest wall opposite to the belt member across the space 56 has a gap width that is less than the maximum extension of the brush element 56 perpendicular to the belt member. This dimensioning assists in stripping off of the fluff from the brush element.

**[0041]** In an embodiment the cleaning gap 56 or a cleaning space may be provided at any other position along the surroundings of the belt member 52 at a convenient position where the brush element 54 is passing during movement of the belt member and the fluff carried along with the brush element 54 can be deposited by transfer or removal from the brush element. For example the cleaning space may be provided at the top of the cleaning device 24.

**[0042]** In the embodiment the components of the cleaning device 24, namely the belt member 52, the brush element 54, the rollers 42, 44, and the nozzle element 46 are provided in the front channel section 20d, i.e. are arranged between the upper and lower shells 58, 60. Preferably the motor 50 is also provided in a space between the upper and lower shells, preferably in a chamber formed by the shells which is separated from the channel section 20d and connected thereto by a drive shaft or drive belt passage (not shown).

**[0043]** As shown in Fig. 4b the brush element 54 is sweeping or wiping the front surface of the first heat exchanger 10 from bottom to top and collects lint and fluff accumulated on the heat exchanger surface. Fig. 4c shows the brush element 54 almost at the top or upper end of the front surface, i.e. the front surface of the heat exchanger 10 is now free from fluff and lint. The brush element 54 holds the collected fluff in its bristles until the brush element 54 is moved past the liquid spray of the nozzle element 46 by the moving belt member 52 where the fluff is washed out of the brush element 54.

**[0044]** The above described cleaning phase can be

executed several times to provide that the heat exchanger 10 is completely or almost completely free from fluff, for example at the end of a drying phase of the apparatus 2 and additionally or alternatively during a drying phase of the apparatus 2.

**[0045]** To provide that the washed off fluff is flushed towards the condensate collector 30 or sump 34 the nozzle element 46 can be supplied with liquid after a cleaning phase or between cleaning phases, optionally without moving the belt member 52. The fluff collected by the brush element 54 from the front surface of the first heat exchanger 10 is washed by the spray or sprays from the nozzle element 46 towards the cleaning space 56 and from there towards the condensate collector 30 along sump 34.

**[0046]** In other embodiments of belt movement cycles the belt member may be moved in the other direction such that the brush element 54 cleans the front surface of the evaporator from top to bottom. By this preferred rotation direction of the belt member 52 the fluff collected at the heat exchanger 10 is transported the shortest way to the cleaning space 56 where it can be washed away from the brush element 54. Alternatively the roller rotation movement can be controlled such that the brush element 54 first moves upward at the front side of the evaporator and then downward after reaching the top region of the evaporator - i.e. without full-rotation of the belt member. Preferably the cleaning cycle(s) start after the drying process is already in progress for a while and enough condensate has collected from laundry drying. Preferably at least one cleaning cycle is executed after finishing the drying process such that the final fluff is removed.

**[0047]** Further an additional lint filter (not depicted) can be arranged in the condensate collector or between the condensate collector 30 and the nozzle element 46 such that the washed off fluff is removed from the collected condensate before it is fed to the nozzle element 46.

**[0048]** Fig. 5 depicts a cross-sectional side front of the base unit 5 of Fig. 2 along the line B-B with a belt member 52 according to a first embodiment. The belt member 52 has a net-like structure and provides almost no flow resistance for the process air flow, i.e. the belt member 52 is configured such that the process air as well as the fluff transported therein can freely pass the belt member 52. The brush element 54 may be co-injected to the belt member 52 or may be a bi-mold with the belt member to provide a reliable and long-lived connection between the elements.

**[0049]** Fig. 6 depicts a cross-sectional front view of the base unit 5 of Fig. 2 along the line B-B with a belt member 52' according to an alternative embodiment. Apart from the belt member 52' all other elements of the apparatus correspond to the above described. The belt member 52' has a filter net structure, i.e. it forms a filter element to filter fluff from the process air flow before it accumulates on the surface of the heat exchanger 10. The belt member 52' can be cleaned in a cleaning phase as described above by a liquid spray of the nozzle element 46.

## Reference Numeral List

### [0050]

|    |     |                                   |
|----|-----|-----------------------------------|
| 5  | 2   | tumble dryer                      |
|    | 4   | heat pump system                  |
|    | 5   | base section                      |
| 10 | 6   | refrigerant loop                  |
|    | 8   | blower                            |
| 15 | 10  | first heat exchanger (evaporator) |
|    | 12  | second heat exchanger (condenser) |
|    | 14  | compressor                        |
| 20 | 16  | expansion device                  |
|    | 18  | drum (laundry compartment)        |
| 25 | 19  | laundry                           |
|    | 20  | process air channel               |
|    | 20a | battery channel                   |
| 30 | 20b | rear channel                      |
|    | 20c | rising channel                    |
| 35 | 20d | front channel                     |
|    | 22  | fluff filter                      |
|    | 24  | mechanical cleaning device        |
| 40 | 30  | condensate collector              |
|    | 34  | condensate sump                   |
| 45 | 36  | drain pump                        |
|    | 38  | valve                             |
|    | 40  | condensate drawer                 |
| 50 | 42  | upper roller                      |
|    | 44  | lower roller                      |
| 55 | 46  | nozzle element                    |
|    | 47  | nozzle opening                    |

48 liquid feed conduit  
 50 roller motor  
 52, 52' belt member  
 54 brush element  
 56 brush cleaning gap  
 58 upper shell  
 60 lower shell  
 A process air flow  
 B refrigerant flow

### Claims

1. Laundry treatment apparatus, in particular dryer or 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 (20) for cooling the process air,  
 a belt member (52, 52') arranged in the process air loop (20) upstream the heat exchanger (10),  
 at least two belt support elements (42, 44) mounted in the process air loop (20) each having a rotation axis parallel to the other and spaced apart from the other, wherein the at least two belt support elements (42, 44) are configured to support the belt member (52, 52') such that the belt member (52, 52') spans at least a portion of a cross-section of the process air loop (20), and  
 a drive means (50) configured to drive at least one of the belt support elements (44) to rotate about its rotation axis such that the supported belt member is moved at least between the at least two belt support elements (42, 44),  
**characterized in that**  
 the belt member (52, 52') comprises at least one cleaning element (54) configured to mechanically clean the heat exchanger (10).
2. Apparatus according to claim 1, wherein the at least one cleaning element (54) is configured to contact the heat exchanger (10) at least temporarily such that a surface of the heat exchanger (10) is swept or wiped by the at least one cleaning element (54) when the belt member (52, 52') executes the movement.
3. Apparatus according to claim 1 or 2, wherein the at

least one cleaning element (54) extends or essentially extends across the width of the heat exchanger (10), or wherein a plurality of cleaning elements are configured such that they extend in combination across or essentially across the width of the heat exchanger (10).

4. Apparatus according to claim 1, 2 or 3, wherein a plurality of cleaning elements are arranged in a line, parallel to or overlapping each other on the belt member perpendicular or substantially perpendicular to the movement direction of the belt member.
5. Apparatus according to any of the previous claims, wherein a plurality of cleaning elements are arranged diagonal or are distributed over the belt member (52, 52') such that during the movement of the belt member (52, 52') the cleaning elements together sweep over the complete or essentially the complete front surface of the heat exchanger (10).
6. Apparatus according to any of the previous claims, wherein the at least one cleaning element (54) is selected from a brush element, an elastic lip element and a sponge element.
7. Apparatus according to any of the previous claims, wherein a nozzle element (46) connected to a liquid supply source (30, 48) is arranged in a space between or defined by the belt member (52, 52') such that liquid can be sprayed in at least one liquid spray towards the belt member (52, 52').
8. Apparatus according to claim 7, wherein the nozzle element (46) comprises a plurality of outlet openings arranged parallel or substantially parallel to a rotation axis of a belt support element (42, 44), or wherein the nozzle element (46) comprises an elongate outlet opening arranged parallel or substantially parallel to a rotation axis of a belt support element (42, 44).
9. Apparatus according to claim 7 or 8, wherein the nozzle element (46) or the spray direction of the nozzle element is directed vertically or substantially vertically downwards.
10. Apparatus according to claim 7, 8 or 9, wherein the nozzle element (46) or the spray direction of the nozzle element is additionally or mainly directed towards a belt support element (42, 44).
11. Apparatus according to any of the previous claims, wherein the belt member (52) is configured to provide no or substantially no flow resistance for the process air flow.
12. Apparatus according to any of the previous claims, wherein the heat exchanger (10) comprises a plu-

ality of cooling fins having a portion aligned parallel to the movement direction of the belt member (52, 52'), wherein at least one cleaning element is provided for each cooling fin such that an outward facing edge of each cooling fin is swept or wiped by the corresponding cleaning element. 5

13. Apparatus according to any of the previous claims, wherein a cleaning space (56) adapted to receive deposits removed by the at least one cleaning element (54) from the heat exchanger (10) is provided at a position along and adjacent the belt member (52, 52'), or 10  
wherein a cleaning space (56) is provided below the belt member (52, 52') in fluid communication with a condensate collector chamber (30, 34) for collecting condensate from the heat exchanger (10). 15
14. Apparatus according to any of the previous claims, wherein the liquid supply source (30, 48) comprises a conduit (48), a condensate collector chamber (30, 34) and a drain pump (36) in fluid communication with the condensate collector chamber (30, 34) or a valve connected to tap water. 20  
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15. Apparatus according to any of the previous claims, comprising an extractable condensate container (40) is in fluid connection to the condensate collector (30, 34), wherein a valve (38) is provided to selectively provide the fluid connection from the condensate collector chamber (30, 34) to a or the nozzle element (46) and to the extractable condensate container (40). 30  
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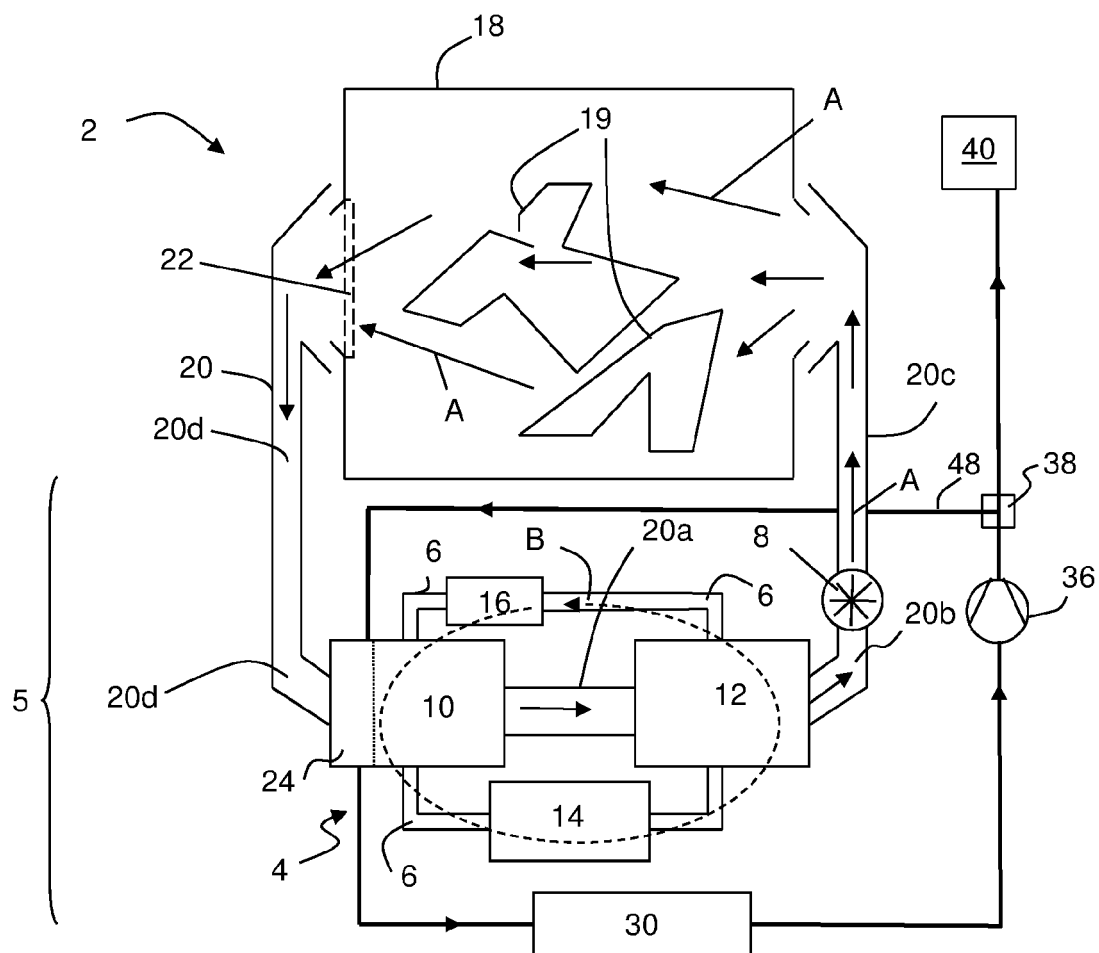


Fig. 1

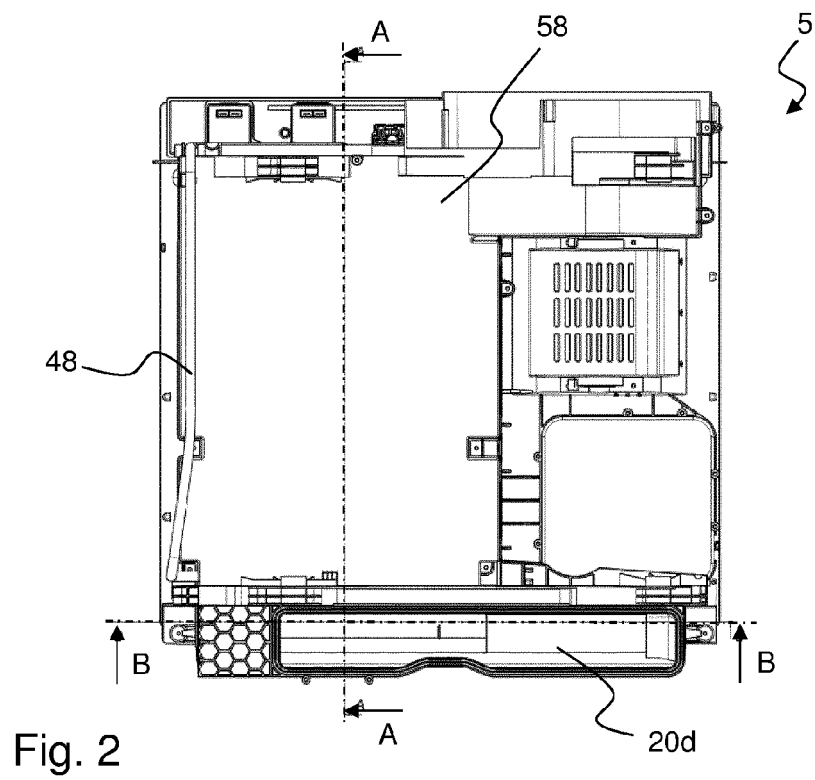


Fig. 2

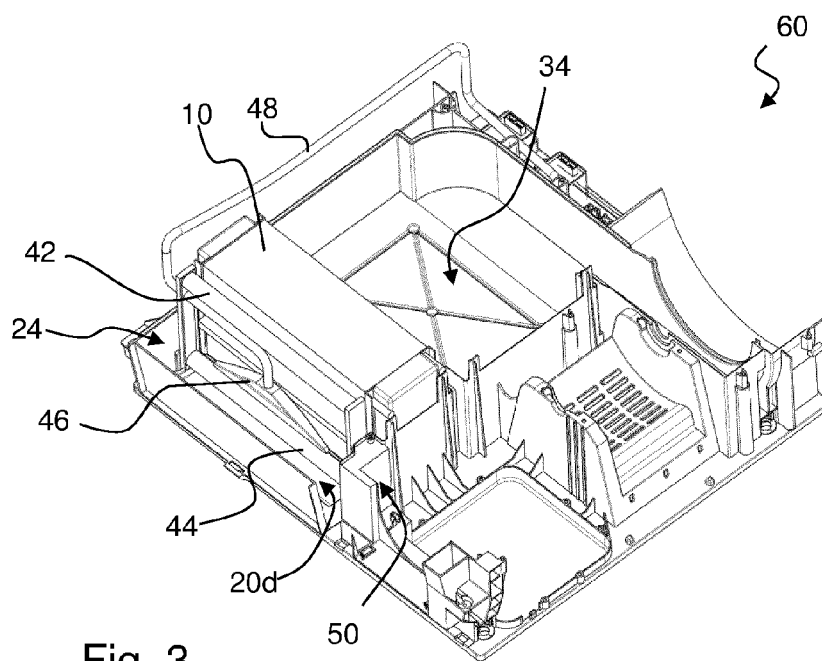


Fig. 3

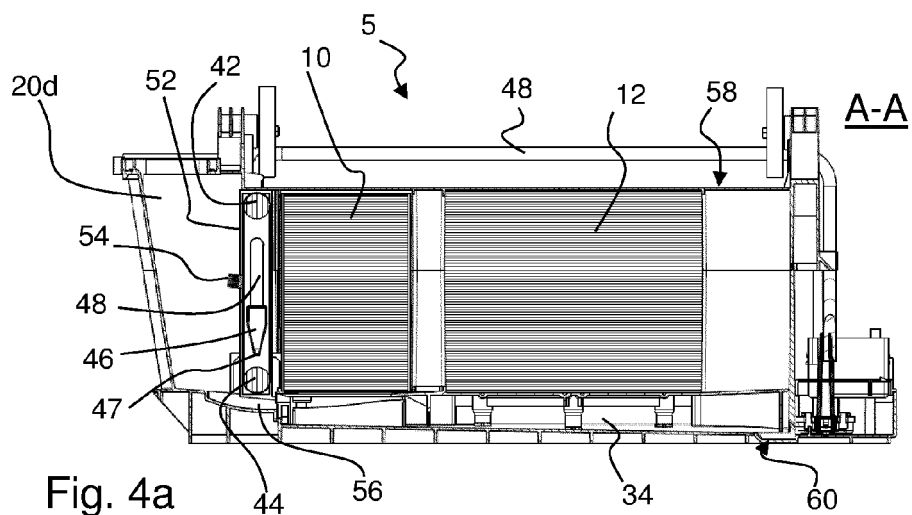


Fig. 4a

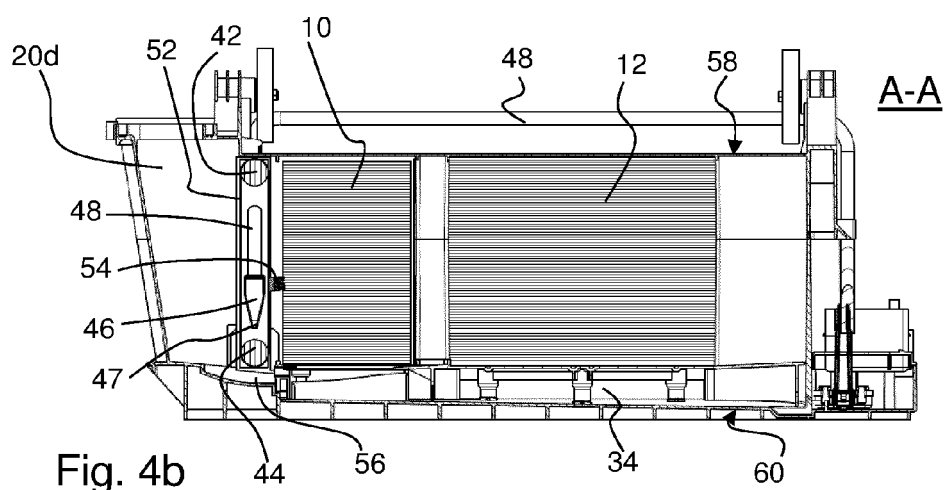


Fig. 4b

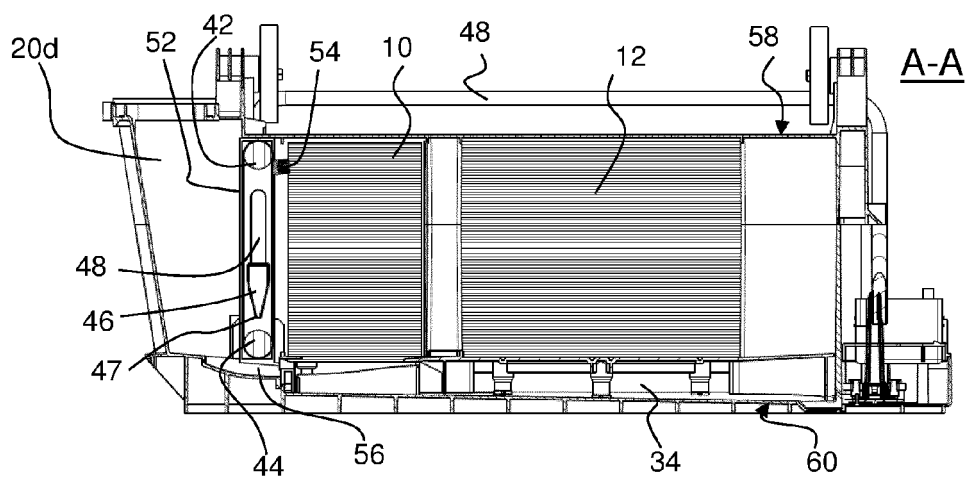


Fig. 4c

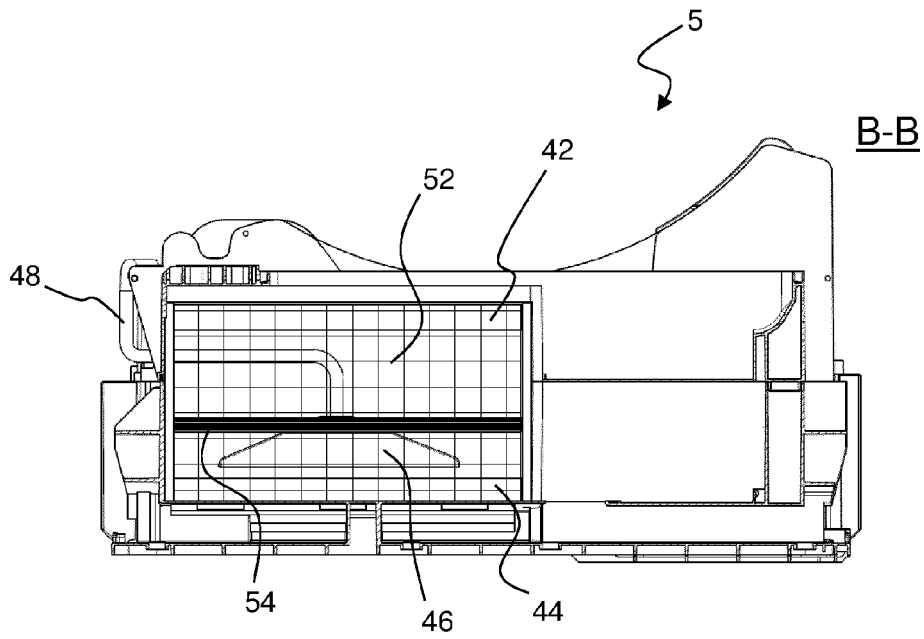


Fig. 5

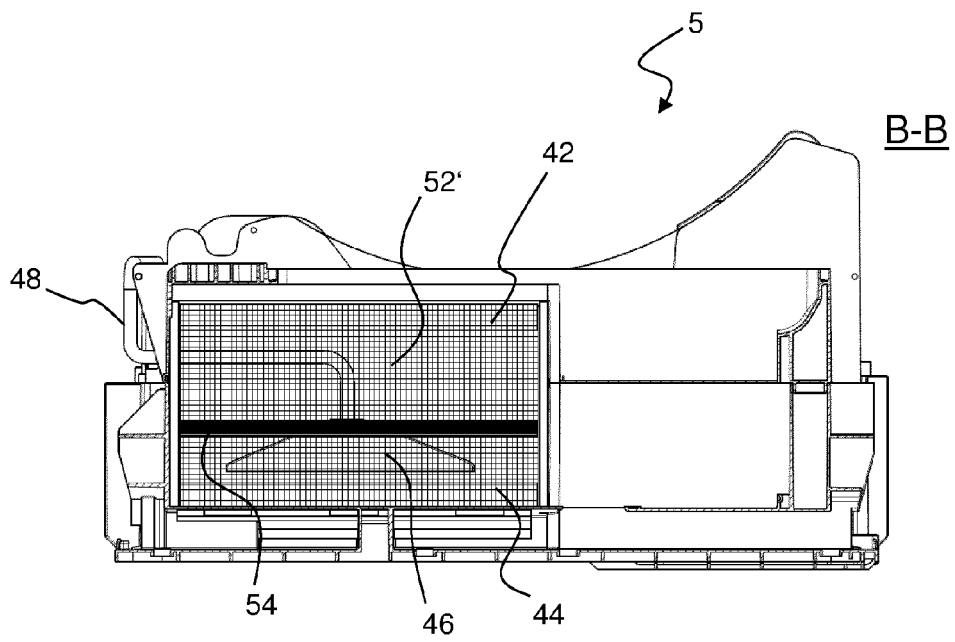


Fig. 6



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Application Number  
EP 12 15 2570

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| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                         | Date of completion of the search | Examiner                                |
| Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                         | 12 July 2012                     | Westermayer, Wilhelm                    |
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The members are as contained in the European Patent Office EDP file on  
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12-07-2012

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