

(19)



(11)

EP 2 628 846 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
14.11.2018 Bulletin 2018/46

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

(21) Application number: **12156207.8**

(22) Date of filing: **20.02.2012**

(54) **Laundry treatment apparatus with heat exchanger cleaning**

Wäschebehandlungsvorrichtung mit Wärmetauscherreinigung

Appareil de traitement du linge avec nettoyage d'échangeur de chaleur

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

- **Santarossa, Marco**
33080 Porcia (PN) (IT)
- **Sartor, Luciano**
33080 Porcia (PN) (IT)

(43) Date of publication of application:
21.08.2013 Bulletin 2013/34

(74) Representative: **Electrolux Group Patents**
AB Electrolux
Group Patents
105 45 Stockholm (SE)

(73) Proprietor: **Electrolux Home Products**
Corporation N.V.
1130 Brussels (BE)

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(72) Inventors:
• **Pillot, Sergio**
33080 Porcia (PN) (IT)

EP 2 628 846 B1

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Description

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

[0002] 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 element comprises a plurality of injection holes along its longitudinal axis. The nozzle element is fed with fresh water from a feed pipe, which is connected to the nozzle element via a flexible pipe. According to an embodiment the nozzle element is pivotable about its longitudinal axis within a predetermined angle by means of a driving motor, such that a water spray of the nozzle element is directed towards the heat exchanger for washing off fluff, or such that it forms a water curtain in front of the heat exchanger to collect fluff from the process air before it accumulates on the heat exchanger surface. Alternatively the injection nozzle element is moved along its longitudinal axis by means of a driving motor to assist washing off fluff from the heat exchanger.

[0003] DE 10 2008 032800 A1 discloses a device for cleaning a heat exchanger of a dryer. A flushing nozzle is supported on a threaded spindle coupled to a driving motor. By means of the motor the spindle is rotated, such that the nozzle is moved along the heat exchanger for cleaning the heat exchanger surface.

[0004] It is an object of the invention to provide a cost-efficient 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, in particular a dryer or a washing machine having a dryer function, comprises a control unit to control operation of the apparatus (e.g. a drying operation), 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 nozzle element is provided which is adapted to spray liquid to the heat exchanger in at least one liquid spray for cleaning the heat exchanger. The nozzle element is connected to a liquid supply source and comprises at least one outlet opening, wherein each outlet provides a liquid spray in operation, i.e. in a cleaning phase for the heat exchanger. A liquid supply source is for example a pump or a valve connected to the nozzle element. A flexible coupling element is arranged between the nozzle element and the liquid supply source, i.e. the coupling element fluidly connects the nozzle element to the liquid supply source. The coupling element is for example a flexible pipe, a flexible hose or a flexible bellows. A pivot element having a pivot axis pivotally supports the nozzle element, such that at least one liquid spray can sweep over the heat exchanger, i.e. a surface of the heat exchanger is washed or cleaned with at least one liquid spray that is scanned through an angular range.

[0007] The arrangement of the pivot axis and the flexible coupling element with respect to the nozzle element is configured such that the angular orientation of the nozzle element is varied in dependency of the liquid pressure or the liquid flow. For example the flexible coupling element forms an actuating means actuated by the liquid pressure or liquid flowing through the coupling element. In this alternative additionally or alternatively the nozzle element is pivoted in dependency of the liquid flow through and/or pressure in the nozzle element. For example the liquid is deflected in the nozzle element and the deflection of the liquid flow causes a momentum to an inner wall of the nozzle element. This momentum in connection with a nozzle element arrangement where the momentum acts at a position and direction that provides a lever torque momentum on the nozzle element with respect to the pivot axis of the nozzle element results in a torque or swing movement during liquid pressure and/or liquid flow rate change through the nozzle element. This torque is preferably combined with a torque actuation provided by a movement (torque movement and/or contraction or expansion) of the flexible element. I.e. both torques have the same rotational sense during flow rate and/or pressure changes.

[0008] Additionally or alternatively the arrangement of the pivot axis and the outflow or liquid spray direction of the at least one outlet opening with respect to the nozzle element is configured such that the angular orientation of the nozzle element is varied in dependency of the liquid pressure or liquid flow out of the outlet. For example the liquid flow out of the outlet provides a torque and/or thrust force changing the angular orientation of the nozzle element. In other words the liquid flow or pressure of the liquid fed to the nozzle element actuates a pivot or swing or sweep movement of the nozzle element which in turn provides that the liquid spray out of the outlet(s) sweeps over the heat exchanger and washes off fluff which has been accumulated or collected thereon.

[0009] In contrast to the dryer of US 2010/0192398 A1, the apparatus according to the present invention does not necessarily need a driving motor to actuate the nozzle element, i.e. to provide that the nozzle element executes a pivot or rotational movement. Thus a cost-efficient treatment apparatus is provided in which no driving motor and corresponding control equipment is required to actuate the nozzle element.

[0010] Preferably the nozzle element section between the pivot axis and the connection to the flexible element forms a lever element that is actuated by the liquid pressure. For example the flexible element is adapted to expand or to contract in dependency of the liquid pressure inside the flexible element and actuates thereby the lever element which in turn provides that the nozzle element rotates or pivots about the pivot axis. Alternatively or additionally the flexible element is adapted to expand or contract its length in reaction to a pivot movement of the flexible element, wherein the

pivot movement is caused by a pressure and/or liquid flow rate change in the nozzle element causing a momentum due to a deflection at an internal surface of the nozzle element (in combination with a lever arrangement of the deflection site displaced from the pivot axis such that the deflection momentum results in an internal torque force of the nozzle element- see also detail above).

[0011] In an embodiment a contraction or expansion direction of the flexible element is inclined or perpendicular to the lever axis, such that a contraction or expansion of the flexible element effectively actuates the lever element, i.e. provides a rotational movement of the nozzle element about the pivot axis.

[0012] Preferably the nozzle element section between the pivot axis and the at least one outlet opening forms an alternative or additional lever element that is actuated by the liquid flow out of the outlet. For example the repulsion or thrust force of the liquid flow or liquid jet out of the at least one outlet opening generates a torque which acts on the nozzle element or the additional lever element such that the nozzle element executes a pivot movement or is deflected from an idle position. The lever element is the 'additional' lever element, if the other lever element is the one between the pivot axis and the connection point of the flexible element at the nozzle element, if the flexible element acts as actuating element actuating versus the other lever element. The idle or initial position is the position of the nozzle element when no liquid is supplied to the nozzle element. Repulsion or thrust force is direct proportional to the mass flow rate and the exhaust velocity, such that the degree of deflection of the nozzle element is adjustable by controlling the flow rate or pressure of the liquid fed to the nozzle element. I.e. the higher the flow rate or pressure the larger the deflection angle of the nozzle element or vice versa the lower the flow rate or pressure the smaller the deflection angle.

[0013] The outlet opening or the spray direction of the at least one outlet opening may be inclined or perpendicular to the additional lever axis, such that the repulsion or thrust force generates a torque which effectively actuates the additional lever, i.e. which provides an angular deflection of the nozzle element.

[0014] Preferably the pivot element is arranged downstream the flexible coupling element, wherein the nozzle element is free to rotate around or about the pivot axis. For example the pivot element is stationary and the nozzle element rotates around the pivot axis or alternatively the nozzle element and the pivot element are connected to each other or are made in one-piece, wherein both rotate about the pivot axis. Preferred the flow of the liquid through the flexible coupling element and the (pivoted) nozzle element or the pressure of the liquid flowing through the flexible coupling element and the (pivoted) nozzle element is adapted to drive the nozzle element into rotation such that at least one liquid spray sweeps over the heat exchanger.

[0015] In an embodiment the flexible element or the liquid supply source is connected to a central portion of the nozzle element with respect to the pivot axis. I.e. a central liquid supply to the nozzle element is provided whereby liquid pressure is evenly distributed across the nozzle element which results in a steady or uniform liquid spray towards the heat exchanger.

[0016] Preferably the flexible element is configured to provide an elastic restoring force after a deflection of the nozzle element. E.g. starting from an initial or idle position of the nozzle element (i.e. no liquid supply to the nozzle element) liquid is supplied to the nozzle element such that it is rotated about the pivot axis as described above. Due to the rotation or angular deflection of the nozzle element the flexible element, which is attached to the nozzle element, is stretched, torsionally and/or elastically deformed. Thus after the supply of liquid to the nozzle element the flexible element provides a restoring force which moves the nozzle element back to its initial or idle position. Preferably the flexible element is an elastically flexible element and provides a self-restoring force that restores the original force-free arrangement and shape of the flexible element after expansion, torsion and/or deformation during a phase where an internal (liquid) or external (lever) force is applied. Alternatively or additionally the arrangement of the nozzle element and the pivot axis is configured such that after an angular deflection of the nozzle element from the initial position, the initial position is restored by gravitational force acting on the nozzle element.

[0017] Preferably the flexible element and therefore the liquid supply source is axially connected to the nozzle element with respect to the pivot axis. Thereby a space-saving design is provided. When the nozzle element is deflected or rotated, the flexible element is (elastically and/or torsionally) twisted and provides a restoring force after the supply of liquid is stopped as described above.

[0018] The heat exchanger may have a larger width than the nozzle element with respect to the pivot axis and the nozzle element are adapted to provide a fan-out spray jet. In other words a compact and space-saving nozzle element construction is provided.

[0019] In an embodiment the pivot element comprises a pivot bearing at each end portion of the nozzle element with respect to the pivot axis. I.e. the nozzle element is axially supported at two points, e.g. by means of roller bearings or robust bush bearings, which provides a durable and long-lived support of the nozzle element.

[0020] In an embodiment the arrangement is configured such that a displacement angle between an initial position of the nozzle element or initial direction of the nozzle outlet (i.e. no liquid supply) and the outflow direction of the outlet during liquid supply increases when liquid pressure in the flexible element increases or when the length of the flexible element increases. For example a displacement angle between an initial vertical direction and the outflow direction of the nozzle outlet increases when liquid pressure in the flexible element increases or when the length of the flexible

element increases. The heat exchanger may be arranged horizontally in the process air channel, i.e. the process air passes the heat exchanger horizontally or substantially horizontally, such that a vertical cross-section or front surface of the heat exchanger faces the process air channel or the process air flow in horizontal direction.

[0021] The fluff or lint that has not be filtered upstream the heat exchanger (e.g. by an optional fluff filter between storing compartment and heat exchanger) accumulates over the front or process air inlet area of the heat exchanger. For cleaning or washing the vertical cross-section of the heat exchanger the arrangement is configured such that the outflow direction or a liquid spray from the nozzle element pivots from a vertical or substantially vertical orientation to a maximum deflection angle inclined towards the heat exchanger when liquid pressure in the flexible element increases or when the length of the flexible element increases. I.e. the liquid spray from the nozzle element sweeps along the heat exchanger upwards from a bottom portion to an upper portion thereof and washes off fluff attached or accumulated on the heat exchanger surface. For example the flexible element is configured such that the maximum deflection angle of a liquid spray of the nozzle element is between 5° to 45°, between 10° to 35°, or at most 20° to the vertical.

[0022] According to an alternative embodiment the nozzle element is configured such that in an initial position of the nozzle element the at least one outlet opening or the spray direction of the at least one outlet opening is inclined towards the heat exchanger. E.g. the arrangement of the pivot axis and the outflow direction of the at least one outlet opening with respect to the nozzle element is configured such that the nozzle element is adapted to pivot between the initial position and a vertical or substantially vertical direction of the outlet opening. For example in case of a horizontally arranged heat exchanger as described above, the outflow direction or liquid spray direction is directed in the initial or idle position to an upper portion or upper edge of the heat exchanger. When liquid is supplied to the nozzle element, the nozzle element swings out and the spray is deflected vertically downwards from the initially inclined position which effectively washes off fluff from the heat exchanger surface. E.g. the initial position of the outlet opening of the nozzle element is inclined toward the heat exchanger with respect to the vertical between 20° to 50°, between 25° to 45°, or at most 35°.

[0023] Preferably the supply source is a supply pump and the control unit is adapted to vary the pumping speed of the liquid supply pump, whereby the liquid pressure is varied. The varied pressure actuates the nozzle element, i.e. provides that e.g. the flexible element expands or contracts or that the repulsion or thrust force of the liquid jet and/or the flow in the nozzle element increases or decreases as described above. Alternatively or additionally the pump is intermittently operated, i.e. switched on and off several times. When a pump is started it needs some time to build-up liquid pressure or flow, i.e. the liquid pressure or flow gradually rises at the nozzle element which in turn provides an actuation or rotation of the nozzle element as described above. Thus when the drain or supply pump is switched on and off several times the at least one liquid spray sweeps over the heat exchanger surface several times. For example the supply pump is operated for or is (repeatedly) switched on for at least 30 seconds, for at least 50 seconds, preferred for at least one minute. Preferably the control unit is adapted to vary the liquid flow rate or pumping speed of the liquid supply pump such that a liquid spray sweeps over the heat exchanger at least once in a cleaning phase.

[0024] According to an alternative embodiment the liquid supply source is a valve connected to tap water and the control unit is adapted to open and close the valve. When the valve is opened it takes some time to build-up pressure in at the nozzle element such that the nozzle element is actuated or rotated as described above. For example the valve is opened and closed several times during a cleaning phase for cleaning the heat exchanger, e.g. is (repeatedly) opened for at least 30 seconds, for at least 50 seconds, for at least one minute before it is closed.

[0025] Preferably a condensate collector for collecting condensate from the heat exchanger is connected to the nozzle element such that the nozzle element is supplied with condensate. I.e. no fresh or tap water is needed to clean or wash the heat exchanger whereby the water consumption of the treatment apparatus is reduced or is independent of tap water.

[0026] In an embodiment the apparatus comprises an extractable condensate container which is connected to the condensate collector and to the nozzle element by means of a valve. E.g. depending on the requirements liquid may be supplied to the nozzle element directly from the condensate collector or tray below the heat exchanger or from the extractable container. For example at the beginning of a drying operation when no condensate or not sufficient condensate is collected in the condensate collector, liquid is supplied to the nozzle element from the extractable condensate container.

[0027] Preferably the control unit is adapted to control the liquid supply pump to pump condensate from the condensate collector to the extractable condensate container such that a minimum amount of condensate is provided or retained in the condensate collector for at least one cleaning phase of the heat exchanger. For example at least about 2 liters of condensate is provided or maintained in the condensate collector or tray.

[0028] The condensate collector may comprise at least two communicating compartments, wherein a first compartment is connected to the liquid supply source and a second compartment is connected to the extractable drawer, wherein a condensate pump is adapted to pump condensate from the second compartment to the extractable condensate container. The communicating compartments are configured such that a minimum amount of condensate is provided in the first compartment for at least one cleaning phase of the heat exchanger. For example an overflow wall is provided between the two compartments which has an appropriate height to provide that the minimum amount of condensate is retained in the collector.

[0029] Preferably a filter element or unit is arranged upstream the nozzle element or downstream the heat exchanger. I.e. washed off fluff is filtered from the liquid or condensate which is supplied to the nozzle element. According to a preferred embodiment the filter element is extractable such that the filter element can be cleaned by a user after each or after several drying operations of the treatment apparatus. In contrast to prior art dryers which filter fluff from the process air by arranging an air filter element directly upstream or in close proximity to the heat exchanger, the present invention can provide (additional) filtering of the deposited fluff from the collected condensate. In other words no (additional) air filter element is arranged in the process air channel directly upstream or in close proximity to the heat exchanger. Thus according to this embodiment the position of the filter element is independent from the position of the heat exchanger. In particular the extractable filter element is arranged at an upper portion of the treatment apparatus which is conveniently accessible for a user. Further as fluff is removed or washed off with liquid or condensate provides that also very small fluff particles like dust is collected and removed from the process air loop. In particular the filtered out material is damp or wet and can therefore be safely removed from the filter element without generating dust.

[0030] The nozzle element may comprise a housing arranged above or essentially above a housing of the heat exchanger, wherein the heat exchanger housing comprises an aperture for the outlet opening or for the at least one liquid spray of the nozzle element. E.g. only a small aperture or opening is provided between the nozzle element housing and the heat exchanger housing. For example the at least the outlet opening of the nozzle element is arranged upstream the heat exchanger with respect to the process air flow. In particular the nozzle element does not extend into the process air channel, such that the process air flow is not or substantially not disturbed.

[0031] According to a preferred embodiment the nozzle element and the heat exchanger are arranged within a common housing. E.g. the housing for the nozzle element and the heat exchanger is formed in one piece facilitating the assembly of the apparatus and providing an airtight connection. Alternatively a housing of the nozzle element is separately attached to a heat exchanger housing.

[0032] Preferably the liquid supply source is connected to the nozzle element via a liquid supply pipe which is at least partially formed integrally with the housing of the heat exchanger. Thus the assembly of the treatment apparatus is facilitated and the assembly time reduced.

[0033] In an embodiment the pivot axis of the nozzle element is perpendicular to or essentially perpendicular to a longitudinal axis of the heat exchanger. For example when a horizontal heat exchanger is provided, i.e. the process air passes the heat exchanger substantially horizontal as described above, the pivot axis is e.g. also horizontal but in a right angle to the horizontal axis of the heat exchanger. Thus a liquid spray of the nozzle element (having an elongate nozzle opening or a plurality of nozzle openings along the pivot axis) covers the (horizontal) width or cross-section of the heat exchanger.

[0034] Preferably a basement or base section of the treatment apparatus comprises an upper shell and a lower shell to form a portion of the drying circuit or the process air channel where the heat exchanger is arranged. I.e. only two parts have to be assembled to provide a base section or a housing for the heat exchanger which facilitates the assembly of the apparatus and reduces the assembly time.

[0035] In an embodiment 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. Thus the energy efficiency of the apparatus is increased. Preferably the drain pump is arranged in the basement.

[0036] Preferably the lower shell forms the condensate collector or tray where a supply pump for supplying liquid or condensate to the nozzle element is arranged.

[0037] In an embodiment the upper shell comprises the aperture for the outlet opening or for the at least one liquid spray nozzle element as described above. I.e. the nozzle element and the pivot element are separated or are essentially separated from the process air channel and therefore protected from e.g. fluff. E.g. a housing for the nozzle element is separately attached to the upper shell or at least a portion of the housing for the nozzle element is formed integrally with the upper shell (e.g. side walls), wherein a separate cover provides an airtight seal for the nozzle element in its housing.

[0038] Preferably the pivot element is coupled to the upper shell. For example the pivot element like a pivot bearing or pivot support is formed in one piece with the upper shell, whereby the assembly of the apparatus is facilitated in that the nozzle element simply has to be inserted in or engaged with the pivot element.

[0039] The upper shell may comprise a housing for the pivot element and the nozzle element, such that the nozzle element is arranged inside the drying circuit portion formed by the upper and lower shell. Preferably the upper shell and the housing for the pivot element and the nozzle element are made in a single-piece construction.

[0040] Preferred the housing covers the aperture for the nozzle element or liquid spray. Preferably the upper shell and the housing forms a substantially air-tight chamber to prevent or reduce leakage of drying air from the drying circuit

[0041] Preferably a heat pump system is provided for the treatment apparatus as described above. The heat pump system includes a compressor, a first heat exchanger as described above, an expansion means and a second heat exchanger, wherein the first heat exchanger is adapted to cool down the drying air and heat up the refrigerant flowing through the heat pump system, the second heat exchanger is adapted to heat up the drying air and cool down the refrigerant and the nozzle element is adapted to spray liquid to at least one between the first and second heat exchanger.

[0042] 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 perspective side view of a treatment apparatus,
- Fig. 3 a top view on a basement of the treatment apparatus of Fig. 2 according to a first embodiment,
- Fig. 4 a perspective partial sectional view of the basement of Fig. 3,
- Fig. 5 an exploded view of the basement of Fig. 3,
- Fig. 6 a sectional side view of a detail of the basement of Fig. 3,
- Fig. 7a-d sectional side views of the detail of the basement of Fig. 3 in different stages of a cleaning phase for cleaning a heat exchanger of the apparatus,
- Fig. 8 a perspective top view of a basement according to a second embodiment,
- Fig. 9 a sectional side view of a detail of the basement of Fig. 8,
- Fig. 10 a sectional side view of a detail of the basement of Fig. 8,
- Fig. 11 a sectional side view of a detail of the basement of Fig. 8 showing different operating positions in a cleaning phase for cleaning a heat exchanger, and
- Fig. 12 a sectional side view of a detail of the basement of Fig. 8.

[0043] 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 which 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.

[0044] 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 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 formed at the first heat exchanger 10 is collected and guided via a condensate channel to the condensate collector 30.

[0045] The 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 from where it can be comfortably withdrawn and emptied by a user.

[0046] It is a problem in dryers 2 having heat exchangers 10, 12 that fluff or lint which is generated during a drying process accumulates on the surface, in particular at the front surface and neighboring surfaces, of the heat exchanger 10 where the process air passed through. Lint accumulated on the heat exchanger 10 reduces the efficiency of the heat exchanger 10 and constricts the flow of process air A.

[0047] To remove or wash off accumulated fluff from the surface of the first heat exchanger 10 a cleaning device 41 is provided close to the heat exchanger 10. The condensate collector 30 is connected via the drain pipe 46, the drain

pump 36, the valve 38 and a feed pipe 48 to the cleaning device 41, wherein the drain pump 36 and the valve 38 are controlled by a control unit of the apparatus 2. Alternatively a circulation pump 37 (Fig. 2) is provided to pump condensate from the collector 30 to the cleaning device 41 - i.e. the circulation pump 37 is provided additionally to the drain pump 36.

[0048] Fig. 2 shows a perspective side view of a treatment apparatus 2, which is in this embodiment a heat pump tumble dryer. The basement or base section 5 of the dryer 2 is formed by an upper shell 58 and a lower shell 60, which contains or houses amongst others the heat exchangers 10, 12 and the pumps 36, 37. In particular the upper and lower shell 58, 60 provide an air-tight process air channel 20 which is easy and fast to assemble as the basement housing or shell is formed by only two elements 58, 60. A housing 62 for the cleaning device 41 is formed in one piece with the upper shell 58.

[0049] Fig. 3 shows a top view of the basement or base section 5 of the treatment apparatus of Fig. 2 and Fig. 4 shows a perspective partial section view of the base section 5 with a cleaning device 41 according to a first embodiment. Process air enters the base section 5 via the front channel 20d and passes the horizontally arranged heat exchanger 10, i.e. the process air passes the heat exchanger 10 horizontally or substantially horizontally. Fluff generated during a drying process accumulates mainly on a front surface 54 or vertical cross section of the heat exchanger 10 which is passed by process air first.

[0050] The housing 62 of the cleaning device 41 is arranged on top of the upper shell 58. The cleaning device 41 comprises a nozzle element 42 which is pivotally supported in the housing 62 by means of a pivot bearing 56 having a pivot axis D as shown in the exploded view of the base section 5 in Fig. 5. A flexible element 52 in particular a bellows is arranged between the nozzle element 42 and the feed pipe 48. The elongate nozzle element 42 comprises an elongate nozzle outlet 44 or a plurality of nozzle outlets or openings parallel to the pivot axis D which provide a liquid spray to the heat exchanger 10 to clean the front face 54 or vertical cross section thereof. The nozzle element 42 is fed via the feed pipe 48 with condensate from the condensate collector 30 or tray which is formed by the lower shell 60 below the heat exchanger 10. The feed pipe 48 may be formed integrally or in one-piece with the upper shell 58 or may be a separate element as shown in Fig. 5.

[0051] Fig. 6 shows in a sectional side view along the line A-A of Fig. 3 a superimposition of different operating positions of the cleaning device 41 during a cleaning phase for cleaning the heat exchanger 10. In an initial or idle position E of the nozzle element 42, no liquid or condensate is fed to the nozzle element 42, the nozzle outlet 44 is directed to an upper portion or upper edge of the heat exchanger 42 or front face 54. The arrangement of the pivot axis D and the flexible coupling element 52 with respect to the nozzle element 42 is configured such that the angular orientation of the nozzle element 42 is varied in dependency of the liquid pressure or the liquid flow due to a momentum created by a liquid deflection in the nozzle element and/or a change of the dimension and/or form of the flexible element in response to flow rate and/or pressure change.

[0052] Additionally or alternatively the arrangement of the pivot axis D and the outflow or liquid spray direction of the at least one outlet opening 44 with respect to the nozzle element 42 is configured such that the angular orientation of the nozzle element 42 is varied in dependency of the liquid pressure or liquid flow out of the outlet by the repulsion of the sprayed liquid. Thus when liquid is fed to the nozzle element 42 via feed pipe 48 as indicated by arrow F, the nozzle element 42 is deflected from its initial or idle position E such that the liquid jet or spray out of the nozzle opening(s) 44 sweeps over the heat exchanger front face 54 from top to bottom. Thereby fluff is washed off the surface of the heat exchanger 10 towards the condensate collector 30 or tray below the heat exchanger 10.

[0053] It has been found that the source of the generated torque is on the one hand the bellows 52 which expands or lengthens with increasing liquid flow or pressure such that a force acts on a lever element formed by the section of the nozzle element 42 between the pivot axis D and the bellows 52. On the other hand the ejected liquid spray(s) out of the nozzle outlet(s) 44 generate a repulsion force which acts on an additional lever element formed by the section of the nozzle element 42 between the pivot axis D and the nozzle outlet(s) 44. Repulsion force is directly proportional to the liquid or mass flow rate and the exhaust velocity, thus the higher the flow rate or the exhaust velocity the larger the deflection angle. I.e. the deflection angle is dependent on the liquid pressure or liquid flow.

[0054] Summarizing the deflection angle of the nozzle element 42 and therefore the liquid spray(s) is controllable by controlling the liquid pressure or flow to and through the nozzle element. For example by controlling the pumping rate of a pump which pumps liquid to the nozzle element 42, i.e. the drain pump 36 or the circulation pump 37. The corresponding pump may be switched on and off several times, i.e. is operated intermittently, to provide a rising and falling of liquid pressure in the feed pipe 48, bellows 52 and nozzle element 42. Alternatively the feed pipe 48 and therefore the nozzle element 42 is connected via the valve 38 e.g. to the extractable container 40 at the upper portion of the treatment apparatus 2 or to tap water (e.g. in case the apparatus is a washing machine). I.e. when the valve 38 is opened the liquid pressure in the bellows 52 and nozzle element 42 rises, whereby the nozzle element 42 is deflected.

[0055] Fig. 7a-d show sectional side views of the base section 5 of Fig. 3 in different stages of a cleaning phase for cleaning the heat exchanger 10, wherein in the sequence from Fig. 7a to Fig. 7d the liquid pressure or flow F to the nozzle element 42 rises. Fig. 7a shows the nozzle element 42 in its initial position E as described above. Fig. 7b shows the nozzle element 42 shortly after the start of liquid supply via the feed pipe 48, when the liquid flow rate or the liquid

pressure starts to rise. It has been found that the depicted position of the pivot axis D with respect to the bellows 52 and with respect to the outflow direction of the nozzle outlet 44 results in a torque acting on the nozzle element 42 when liquid is supplied or pumped to the nozzle element 42. In other words the nozzle element 42 is deflected and swings about the pivot axis D as shown in the sequence of Figs. 7a-d - thereby washing the heat exchanger 10 from top to bottom. The pivot angle is at its maximum in Fig. 7d. With water pressure reduction the nozzle element 42 returns towards its idle or rest position E.

[0056] Fig. 8 shows a perspective view of a basement 5' according to a second embodiment. Unless otherwise mentioned elements of the second embodiment and their corresponding functioning correspond to the elements of the above described embodiment, wherein like or similar elements are marked with like or similar reference numerals.

[0057] The base section 5' comprises an upper shell 58' and a lower shell 60', wherein a housing 62' for a nozzle element 42' is formed at least partially in one piece with the upper shell 58'. As shown in the sectional side view of Fig. 9, the housing 62' for the nozzle element 42' comprises a first lug 64a on the outside to connect the feed pipe 48 thereto and a second lug 64b on the inside to connect a bellows 52' thereto. I.e. the assembly of the cleaning device or apparatus is facilitated as the bellows 52' is simply mounted or slipped onto the inner lug 64b. Between the housing 62' for the nozzle element 42' and the heat exchanger 10 only a small aperture 34 (Fig. 11) is provided for injecting a liquid spray from the nozzle element 42' towards the heat exchanger 10. In other words the size of the aperture 34 is adapted to let pass only or essentially only the liquid spray of the nozzle element 42'. The nozzle element 42' does not or substantially not protrude into the process air channel 20 or is essentially separated from the process air flow A or channel 20. Thus the process air flow A through the process air channel 20 is not disturbed by the nozzle element 42' or cleaning device 41, and the nozzle element 42', the bellows 52' and the pivot bearings 56 are protected from fluff.

[0058] Fig. 10 shows a sectional side view of the basement of Fig. 8 with the nozzle element 42' in an initial or idle position E', i.e. no liquid supply to the nozzle element 42'. In this embodiment the position of the pivot axis D' (Fig. 11) is shifted towards the nozzle outlet 44'. In the initial position E' the outlet or outflow direction of the nozzle outlet 44' is directed vertically or substantially vertically downwards as indicated by the dash-dotted line in Fig. 11.

[0059] Like in the above described embodiment the nozzle element 42' is deflected from its initial position E' in dependency of the liquid pressure or flow to the nozzle element 42'. In contrast to above embodiment a torque acting on the lever element formed by the section of the nozzle element 42' between the pivot axis D' and the bellows 52' provides that the nozzle element 42' rotates such that the outflow direction of the outlet(s) 44' is deflected towards the heat exchanger 10. This torque is provided by the momentum transferred from the liquid onto the inner surface of the nozzle element at the liquid deflection surface and/or a length expansion of the flexible element 52' due to the internal liquid pressure during liquid spraying. To some degree the additional lever element formed by the section of the nozzle element 42' between the pivot axis D' and the nozzle outlet(s) 44' provides additional repulsion and thus torque by the ejected liquid. Taking the effects together, a torque is generated which rotate the nozzle element 42' towards the heat exchanger 10. The deflection angle increases with respect to the vertical with increasing liquid pressure or flow. In other words the liquid spray(s) from the nozzle outlet(s) 44' sweeps over the heat exchanger front surface 54 from bottom to top (inclined inward position of the spray) when the liquid pressure or flow rises in a cleaning phase for cleaning the heat exchanger 10.

[0060] Fig. 12 shows a sectional side view of the basement 5' of Fig. 8. One of two pivot bearings 56' and bearing supports 57 for the nozzle element 42' are depicted. The bearing supports 57 are formed in one piece with the housing 62' or the upper shell 58'. Thus the nozzle element 42' is supported on two opposing ends with respect to the pivot axis D' which provides a robust and failsafe rotatable connection to the basement 5'.

Reference Numeral List

2	tumble dryer	40	condensate container
4	heat pump system	41	cleaning device
5	base section	42, 42'	nozzle element
6	refrigerant loop	44, 44'	nozzle outlet
8	blower	46	drain pipe
10	first heat exchanger	48	feed pipe
12	second heat exchanger	50	drawer pipe
14	compressor	52, 52'	bellows
16	expansion device	54	front surface
18	drum	56, 56'	pivot bearing
19	laundry	57	bearing support
20	process air channel	58, 58'	upper shell
20a	battery channel	60, 60'	lower shell
20b	rear channel	62, 62'	nozzle element housing

(continued)

	20c	rising channel	64a-b	lug
	20d	front channel		
5	22	filter element	A	process air flow
	24	condensed water filter	B	refrigerant flow
	30	condensate collector	D, D'	pivot axis
	34	aperture	E, E'	idle position of nozzle
10	36	drain pump		element
	37	circulation pump	F	condensate flow
	38	valve		

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, 20a, 20b, 20c, 20d) for circulating the process air, a heat exchanger (10) arranged in the process air loop (20, 20a, 20b, 20c, 20d) for cooling the process air, a nozzle element (42, 42') comprising at least one outlet (44, 44') each for providing a liquid spray in operation, wherein the nozzle element (42, 42') is connected to a liquid supply source and is adapted to spray liquid to the heat exchanger (10) by the at least one liquid spray for cleaning the heat exchanger (10), a flexible coupling element (52, 52') arranged between the nozzle element (42, 42') and the liquid supply source, and
a pivot element (56, 56') having a pivot axis (D, D') for pivotally supporting the nozzle element (42, 42') such that at least one liquid spray can sweep over the heat exchanger(10),
characterized in that
the arrangement of the pivot axis (D, D') and the flexible coupling element (52, 52') with respect to the nozzle element (42, 42') is configured such that the angular orientation of the nozzle element (42, 42') is varied in dependency of the liquid pressure or the liquid flow due to a momentum created by a liquid deflection in the nozzle element (42, 42') and/or a change of the dimension of the flexible coupling element (52, 52') and/or a change of the form of the flexible coupling element (52, 52') in response to flow rate change and/or pressure change, and/or the arrangement of the pivot axis (D, D') and the outflow or liquid spray direction of the at least outlet (44, 44') with respect to the nozzle element (42, 42') is configured such that the angular orientation of the nozzle element (42, 42') is varied in dependency of the liquid pressure or liquid flow out of the outlet (44, 44') by the repulsion of the sprayed liquid.
2. Laundry treatment apparatus according to claim 1, wherein the nozzle element section between the pivot axis (D, D') and the connection to the flexible coupling element (52, 52') forms a lever element that is configured to be actuated by the liquid pressure.
3. Laundry treatment apparatus according to claim 1 or 2, wherein the nozzle element section between the pivot axis (D, D') and the at least one outlet opening (44, 44') forms a lever element or an additional lever element that is actuated by the liquid flow out of the outlet (44, 44').
4. Laundry treatment apparatus according to claim 1, 2 or 3, wherein the pivot element is arranged downstream the flexible coupling element (52, 52') and the nozzle element (42, 42') is free to rotate around the pivot axis (D, D'), and wherein the flow of liquid through the flexible coupling element (52, 52') and the nozzle element (42, 42') or the pressure of the liquid flowing through the the flexible coupling element (52, 52') and the nozzle element (42, 42') is adapted to drive the nozzle element (42, 42') to pivot such that at least one liquid spray sweeps over the heat exchanger (10).
5. Laundry treatment apparatus according any of the previous claims, wherein the flexible coupling element (52, 52') is configured to provide an elastic restoring force after a deflection of the nozzle element (42, 42').
6. Laundry treatment apparatus according any of the previous claims, wherein the pivot element (56, 56') comprises a pivot bearing at each end portion or at opposite portions of the nozzle element (42, 42') with respect to the pivot axis (D, D').

7. Laundry treatment apparatus according any of the previous claims, wherein the arrangement is configured such that a displacement angle of the outflow direction of the nozzle outlet (44, 44') with respect to a rest or idle orientation of the nozzle outlet (44, 44') increases when liquid pressure in the flexible coupling element (52, 52') increases or when the length or twist of the flexible coupling element (52, 52') increases.
8. Laundry treatment apparatus according any of the previous claims, wherein the arrangement is configured such that a liquid spray from the nozzle element (42, 42') pivots from a vertical or substantially vertical orientation (E') to a maximum deflection angle inclined towards the heat exchanger (10) when liquid pressure in the flexible coupling element (52, 52') increases or when the length or twist of the flexible coupling element (52, 52') increases.
9. Laundry treatment apparatus according any of the previous claims, wherein the arrangement or the flexible coupling element (52, 52') is configured such that the maximum deflection angle of a liquid spray of the nozzle element (42, 42') is between 5° to 45°, between 10° to 35°, or at most 20° to the vertical.
10. Laundry treatment apparatus according any of claims 1 to 7, wherein the nozzle element (42, 42') is configured such that in an initial position (E) of the nozzle element (42, 42') the at least one outlet opening or the spray direction of the at least one outlet opening (44, 44') is inclined towards the heat exchanger (10).
11. Laundry treatment apparatus according any of the previous claims, wherein the supply source is a supply pump (36, 37) and the control unit is adapted to vary the pumping speed of the liquid supply pump (36, 37) or is adapted to temporarily switch the liquid supply pump (36, 37) on, or wherein the supply source is a valve connected to tap water and the control unit is adapted to open and close the valve.
12. Laundry treatment apparatus according to claim 11, wherein the control unit is adapted to vary the liquid flow rate or pumping speed of the liquid supply pump (36, 37) such that a liquid spray sweeps over the heat exchanger (10) at least once in a cleaning phase.
13. Laundry treatment apparatus according to claim 11 or 12, wherein the control unit is adapted to operate the liquid supply pump (36, 37) intermittently in a cleaning phase.
14. Laundry treatment apparatus according any of the previous claims, comprising a condensate collector (30) for collecting condensate from the heat exchanger (10), wherein the condensate collector (30) is connected to the nozzle element (42, 42') such that the nozzle element (42, 42') is supplied with condensate.
15. Laundry treatment apparatus according any of the previous claims, wherein the nozzle element (42, 42') comprises a housing (62, 62') arranged above or essentially above a housing of the heat exchanger (10), and wherein the heat exchanger housing (62, 62') comprises an aperture (34) for the outlet opening (44, 44') or for the at least one liquid spray of the nozzle element (42, 42').
16. Laundry treatment apparatus according any of the previous claims, wherein a basement (5, 5') of the apparatus comprises an upper shell (58, 58') and a lower shell (60, 60') to form a portion of the drying circuit where the heat exchanger (10) is arranged.
17. Laundry treatment apparatus according to claim 16, wherein the lower shell (60, 60') forms the condensate collector (30) where the supply pump (36, 37) is arranged.
18. Laundry treatment apparatus according to claim 16 or 17, wherein the upper shell (58, 58') comprises the aperture (34) for the outlet opening (44, 44') or for the at least one liquid spray of the nozzle element (42, 42').

Patentansprüche

1. Wäschebehandlungsvorrichtung, insbesondere Trockner oder Waschmaschine mit einer Trocknerfunktion, umfassend
eine Steuereinheit,
eine Wäschebehandlungskammer (18) zur Behandlung von Wäsche (19) unter Verwendung von Prozessluft,
eine Prozessluftschleife (20, 20a, 20b, 20c, 20d) zur Zirkulation der Prozessluft,
einen Wärmetauscher (10), der zum Kühlen der Prozessluft in der Prozessluftschleife (20, 20a, 20b, 20c, 20d)

angeordnet ist,

ein Düsenelement (42, 42'), das mindestens einen Auslass (44, 44') jeweils zur Bereitstellung eines Flüssigkeits-sprühers im Betrieb umfasst, wobei das Düsenelement (42, 42') mit einer Flüssigkeitsversorgungsquelle verbunden ist und angepasst ist, Flüssigkeit über das mindestens einen Flüssigkeitssprüher zum Reinigen des Wärmetauschers (10) in den Wärmetauscher (10) zu sprühen,

ein flexibles Verbindungselement (52, 52'), das zwischen dem Düsenelement (42, 42') und der Flüssigkeitsversorgungsquelle angeordnet ist, und

ein Schwenkelement (56, 56'), das eine Schwenkachse (D, D') aufweist, um schwenkend das Düsenelement (42, 42') zu tragen, sodass mindestens einen Flüssigkeitssprüher über den Wärmetauscher (10) schwenken kann,

dadurch gekennzeichnet, dass

die Anordnung der Schwenkachse (D, D') und das flexible Verbindungselement (52, 52') bezüglich des Düsenelements (42, 42') so konfiguriert sind, dass die Winkelausrichtung des Düsenelements (42, 42') abhängig von dem Flüssigkeitsdruck oder Flüssigkeitsstrom aufgrund eines Moments schwankt, das durch eine Flüssigkeitsableitung in dem Düsenelement (42, 42')

und/oder eine Änderung der Abmessungen des flexiblen Verbindungselements (52, 52')

und/oder eine Änderung der Form des flexiblen Verbindungselements (52, 52') in Reaktion auf die Änderung des Durchflusses und/oder eine Druckänderung erzeugt wird und/oder die Anordnung der Schwenkachse (D, D') und des Auslasses oder der Flüssigkeitssprührichtung des mindestens einen Auslasses (44, 44') bezüglich des Düsenelements (42, 42') so konfiguriert ist, dass die Winkelausrichtung des Düsenelements (42, 42') abhängig von dem Flüssigkeitsdruck oder Flüssigkeitsstrom aus dem Auslass (44, 44') durch Abstoßung der gesprühten Flüssigkeiten verändert wird.

2. Wäschebehandlungsvorrichtung nach Anspruch 1, wobei der Düsenelementabschnitt zwischen der Schwenkachse (D, D') und der Verbindung mit dem flexiblen Verbindungselement (52, 52') ein Hebeelement bildet, das konfiguriert ist, durch den Flüssigkeitsdruck betätigt zu werden.

3. Wäschebehandlungsvorrichtung nach Anspruch 1 oder 2, wobei der Düsenelementabschnitt zwischen der Schwenkachse (D, D') und der mindestens einen Auslassöffnung (44, 44') ein Hebeelement bildet, das durch den Flüssigkeitsfluss aus dem Auslass (44, 44') betätigt wird.

4. Wäschebehandlungsvorrichtung nach Anspruch 1, 2 oder 3, wobei das Schwenkelement hinter dem flexiblen Verbindungselement (52, 52') angeordnet ist und sich das Düsenelement (42, 42') frei um die Schwenkachse (D, D') drehen kann, und

wobei der Fluss der Flüssigkeit durch das flexible Verbindungselement (52, 52') und das Düsenelement (42, 42') oder der Druck der Flüssigkeit, die durch das flexible Verbindungselement (52, 52') und das Düsenelement (42, 42') fließt, angepasst ist, das Düsenelement (42, 42') schwenkend zu betätigen, sodass mindestens ein Flüssigkeitssprüher über den Wärmetauscher (10) schwenkt.

5. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei das flexible Verbindungselement (52, 52') konfiguriert ist, eine elastische Wiederherstellungskraft nach einer Ablenkung des Düsenelements (42, 42') bereitzustellen.

6. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei das Schwenkelement (56, 56') an jedem Endabschnitt oder an bezüglich der Schwenkachse gegenüberliegenden Abschnitten des Düsenelements (42, 42') (D, D') ein Schwenklager umfasst.

7. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei die Anordnung so konfiguriert ist, dass ein Verschiebungswinkel der Ausströmrichtung des Düsenauslasses (44, 44') bezüglich einer Ruhe- oder Leerlaufausrichtung des Düsenauslasses (44, 44') ansteigt, wenn der Flüssigkeitsdruck in dem flexiblen Verbindungselement (52, 52') ansteigt oder wenn die Länge oder Drehung des flexiblen Verbindungselements (52, 52') ansteigt.

8. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei die Anordnung so konfiguriert ist, dass ein Flüssigkeitssprüher aus dem Düsenelement (42, 42') von einer vertikalen oder im Wesentlichen vertikalen Ausrichtung (E') auf einen maximalen Ablenkungswinkel schwenkt, der zu dem Wärmetauscher (10) hin geneigt ist, wenn der Flüssigkeitsdruck in dem flexiblen Verbindungselement (52, 52') ansteigt oder wenn die Länge oder Drehung des flexiblen Verbindungselements (52, 52') ansteigt.

9. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei die Anordnung oder das flexible Verbindungselement (52, 52') so konfiguriert sind, dass der maximale Ablenkungswinkel eines Flüssigkeitssprühers des Düsenelements (42, 42') zwischen 5° und 45°, zwischen 10° und 35° oder maximal bei 20° gegen die Vertikale liegt.
10. Wäschebehandlungsvorrichtung nach einem der Ansprüche 1 bis 7, wobei das Düsenelement (42, 42') so konfiguriert ist, dass die mindestens eine Auslassöffnung oder die Sprührichtung der mindestens einen Auslassöffnung (44, 44') in einer Anfangsposition (E) des Düsenelements (42, 42') in Richtung des Wärmetauschers (10) geneigt ist.
11. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei die Versorgungsquelle eine Versorgungspumpe (36, 37) ist und die Steuereinheit angepasst ist, die Pumpgeschwindigkeit der Flüssigkeitsversorgungspumpe (36, 37) zu verändern, oder angepasst ist, die Flüssigkeitsversorgungspumpe (36, 37) temporär einzuschalten, oder wobei die Versorgungsquelle ein Ventil ist, das mit Leitungswasser verbunden ist, und die Steuereinheit angepasst ist, das Ventil zu öffnen und zu schließen.
12. Wäschebehandlungsvorrichtung nach Anspruch 11, wobei die Steuereinheit angepasst ist, den Flüssigkeitsdurchfluss oder die Pumpgeschwindigkeit der Flüssigkeitsversorgungspumpe (36, 37) so zu verändern, dass ein Flüssigkeitssprüher mindestens einmal pro Reinigungsphase über den Wärmetauscher (10) schwenkt.
13. Wäschebehandlungsvorrichtung nach Anspruch 11 oder 12, wobei die Einheit angepasst ist, die Flüssigkeitsversorgungspumpe (36, 37) in einer Reinigungsphase periodisch zu bedienen.
14. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, umfassend einen Kondensatsammler (30) zum Sammeln von Kondensat aus dem Wärmetauscher (10), wobei der Kondensatsammler (30) mit dem Düsenelement (42, 42') verbunden ist, sodass das Düsenelement (42, 42') mit Kondensat versorgt wird.
15. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei das Düsenelement (42, 42') ein Gehäuse (62, 62') umfasst, das über oder im Wesentlichen über einem Gehäuse des Wärmetauschers (10) angeordnet ist, und wobei das Wärmetauschergehäuse (62, 62') eine Öffnung (34) für die Auslassöffnung (44, 44') oder für den mindestens einen Flüssigkeitssprüher des Düsenelements (42, 42') umfasst.
16. Wäschebehandlungsvorrichtung nach einem der vorhergehenden Ansprüche, wobei ein Bodenteil (5, 5') der Vorrichtung eine Schale (58, 58') und eine untere Schale (60, 60') umfasst, um einen Abschnitt des Trockenkreislaufes zu bilden, wo der Wärmetauscher (10) angeordnet ist.
17. Wäschebehandlungsvorrichtung nach Anspruch 16, wobei die untere Schale (60, 60') den Kondensatsammler (30) bildet, wo die Versorgungspumpe (36, 37) angeordnet ist.
18. Wäschebehandlungsvorrichtung nach Anspruch 16 oder 17, wobei die obere Schale (58, 58') die Öffnung (34) für die Auslassöffnung (44, 44') oder für den mindestens einen Flüssigkeitssprüher des Düsenelements (42, 42') umfasst.

Revendications

1. Appareil de traitement de linge, en particulier sèche-linge ou lave-linge possédant une fonction de sèche-linge, comprenant :
 - une unité de commande,
 - une chambre de traitement de linge (18) servant au traitement du linge (19) au moyen d'air de traitement,
 - une boucle d'air de traitement (20, 20a, 20b, 20c, 20d) servant à la mise en circulation de l'air de traitement,
 - un échangeur thermique (10) disposé dans la boucle d'air de traitement (20, 20a, 20b, 20c, 20d), servant au refroidissement de l'air de traitement, un élément formant buse (42, 42') comprenant au moins une sortie (44, 44') servant à la production d'un jet pulvérisé de liquide lors du fonctionnement, l'élément formant buse (42, 42') étant raccordé à une source d'alimentation en liquide et étant conçu pour pulvériser du liquide sur l'échangeur

thermique (10) par le biais du ou des jets pulvérisés de liquide afin de nettoyer l'échangeur thermique (10),
un élément d'accouplement souple (52, 52') disposé entre l'élément formant buse (42, 42') et la source d'alimentation en liquide, et
un élément formant pivot (56, 56') comportant un axe de pivot (D, D') servant au support, de manière pivotante,
de l'élément formant buse (42, 42') de telle sorte qu'au moins un jet pulvérisé de liquide puisse balayer l'échangeur thermique (10),

caractérisé en ce que

la disposition de l'axe de pivot (D, D') et de l'élément d'accouplement souple (52, 52') par rapport à l'élément formant buse (42, 42') est configurée de telle sorte que l'orientation angulaire de l'élément formant buse (42, 42') soit variée en fonction de la pression du liquide ou du débit du liquide du fait d'une impulsion créée par une déviation du liquide dans l'élément formant buse (42, 42') et/ou un changement dimensionnel de l'élément d'accouplement souple (52, 52') et/ou un changement de forme de l'élément d'accouplement souple (52, 52') en réaction à un changement de débit et/ou un changement de pression, et/ou

la disposition de l'axe de pivot (D, D') et la direction de l'écoulement sortant ou du jet pulvérisé de liquide de la ou des sorties (44, 44') par rapport à l'élément formant buse (42, 42') est configurée de telle sorte que l'orientation angulaire de l'élément formant buse (42, 42') soit variée en fonction de la pression du liquide ou du débit du liquide au niveau de la sortie (44, 44') par le refoulement du liquide pulvérisé.

2. Appareil de traitement de linge selon la revendication 1, dans lequel la section de l'élément formant buse entre l'axe de pivot (D, D') et le raccordement à l'élément d'accouplement souple (52, 52') définit un élément formant levier qui est configuré pour être actionné par la pression du liquide.
3. Appareil de traitement de linge selon la revendication 1 ou 2, dans lequel la section de l'élément formant buse entre l'axe de pivot (D, D') et l'ouverture ou les ouvertures de sortie (44, 44') définit un élément formant levier ou un élément formant levier supplémentaire qui est actionné par le débit du liquide au niveau de la sortie (44, 44').
4. Appareil de traitement de linge selon la revendication 1, 2 ou 3, dans lequel l'élément formant pivot est disposé en aval de l'élément d'accouplement souple (52, 52') et l'élément formant buse (42, 42') est libre de tourner autour de l'axe de pivot (D, D'), et dans lequel le débit du liquide à travers l'élément d'accouplement souple (52, 52') et l'élément formant buse (42, 42') ou la pression du liquide s'écoulant à travers l'élément d'accouplement souple (52, 52') et l'élément formant buse (42, 42') est apte à entraîner l'élément formant buse (42, 42') à pivoter de telle sorte qu'au moins un jet pulvérisé de liquide balaye l'échangeur thermique (10).
5. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel l'élément d'accouplement souple (52, 52') est configuré pour produire une force de rappel élastique après une déviation de l'élément formant buse (42, 42').
6. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel l'élément formant pivot (56, 56') comprend un palier de pivot au niveau de chaque partie d'extrémité ou au niveau de parties opposées de l'élément formant buse (42, 42') par rapport à l'axe de pivot (D, D').
7. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel la disposition est configurée de telle sorte qu'un angle de décalage de la direction de l'écoulement sortant de la sortie de buse (44, 44') par rapport à une orientation de repos ou inactive de la sortie de buse (44, 44') augmente lorsque la pression du liquide dans l'élément d'accouplement souple (52, 52') augmente ou lorsque la longueur ou la déformation de l'élément d'accouplement souple (52, 52') augmente.
8. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel la disposition est configurée de telle sorte qu'un jet pulvérisé de liquide à partir de l'élément formant buse (42, 42') pivote d'une orientation verticale ou essentiellement verticale (E') à un angle de déviation maximal correspondant à une inclinaison en direction de l'échangeur thermique (10) lorsque la pression du liquide dans l'élément d'accouplement souple (52, 52') augmente ou lorsque la longueur ou la déformation de l'élément d'accouplement souple (52, 52') augmente.
9. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel la disposition ou l'élément d'accouplement souple (52, 52') est configuré(e) de telle sorte que l'angle de déviation maximal d'un jet pulvérisé de liquide de l'élément formant buse (42, 42') soit compris entre 5° et 45°, entre 10° et 35°, ou soit d'au plus 20° par rapport à la verticale.

10. Appareil de traitement de linge selon l'une quelconque des revendications 1 à 7, dans lequel l'élément formant buse (42, 42') est configuré de telle sorte que, dans une position initiale (E) de l'élément formant buse (42, 42'), l'ouverture ou les ouvertures de sortie ou la direction de pulvérisation de l'ouverture ou des ouvertures de sortie (44, 44') soit inclinée (s) en direction de l'échangeur thermique (10).

5

11. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel la source d'alimentation est une pompe d'alimentation (36, 37) et l'unité de commande est conçue pour varier la vitesse de pompage de la pompe d'alimentation en liquide (36, 37) ou est conçue pour mettre temporairement la pompe d'alimentation en liquide (36, 37) en marche, ou

10 dans lequel la source d'alimentation est une vanne raccordée à l'eau du robinet et l'unité de commande est conçue pour ouvrir et fermer la vanne.

10

12. Appareil de traitement de linge selon la revendication 11, dans lequel l'unité de commande est conçue pour varier le débit du liquide ou la vitesse de pompage de la pompe d'alimentation en liquide (36, 37) de telle sorte qu'un jet pulvérisé de liquide balaye l'échangeur thermique (10) au moins une fois au cours d'une phase de nettoyage.

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13. Appareil de traitement de linge selon la revendication 11 ou 12, dans lequel l'unité de commande est conçue pour actionner la pompe d'alimentation en liquide (36, 37) de manière intermittente au cours d'une phase de nettoyage.

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14. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, comprenant un collecteur de condensat (30) servant à la collecte de condensat à partir de l'échangeur thermique (10), dans lequel le collecteur de condensat (30) est raccordé à l'élément formant buse (42, 42') de telle sorte que l'élément formant buse (42, 42') soit alimenté avec le condensat.

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15. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel l'élément formant buse (42, 42') comprend un logement (62, 62') disposé au-dessus ou essentiellement au-dessus d'un logement de l'échangeur thermique (10), et dans lequel le logement (62, 62') de l'échangeur thermique comprend un orifice (34) pour l'ouverture de sortie (44, 44') ou pour le ou les jets pulvérisés de liquide de l'élément formant buse (42, 42').

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16. Appareil de traitement de linge selon l'une quelconque des revendications précédentes, dans lequel une base (5, 5') de l'appareil comprend une coque supérieure (58, 58') et une coque inférieure (60, 60') destinées à former une partie du circuit de séchage dans laquelle est disposé l'échangeur thermique (10).

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17. Appareil de traitement de linge selon la revendication 16, dans lequel la coque inférieure (60, 60') forme le collecteur de condensat (30) dans lequel est disposée la pompe d'alimentation (36, 37) .

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18. Appareil de traitement de linge selon la revendication 16 ou 17, dans lequel la coque supérieure (58, 58') comprend l'orifice (34) pour l'ouverture de sortie (44, 44') ou pour le ou les jets pulvérisés de liquide de l'élément formant buse (42, 42').

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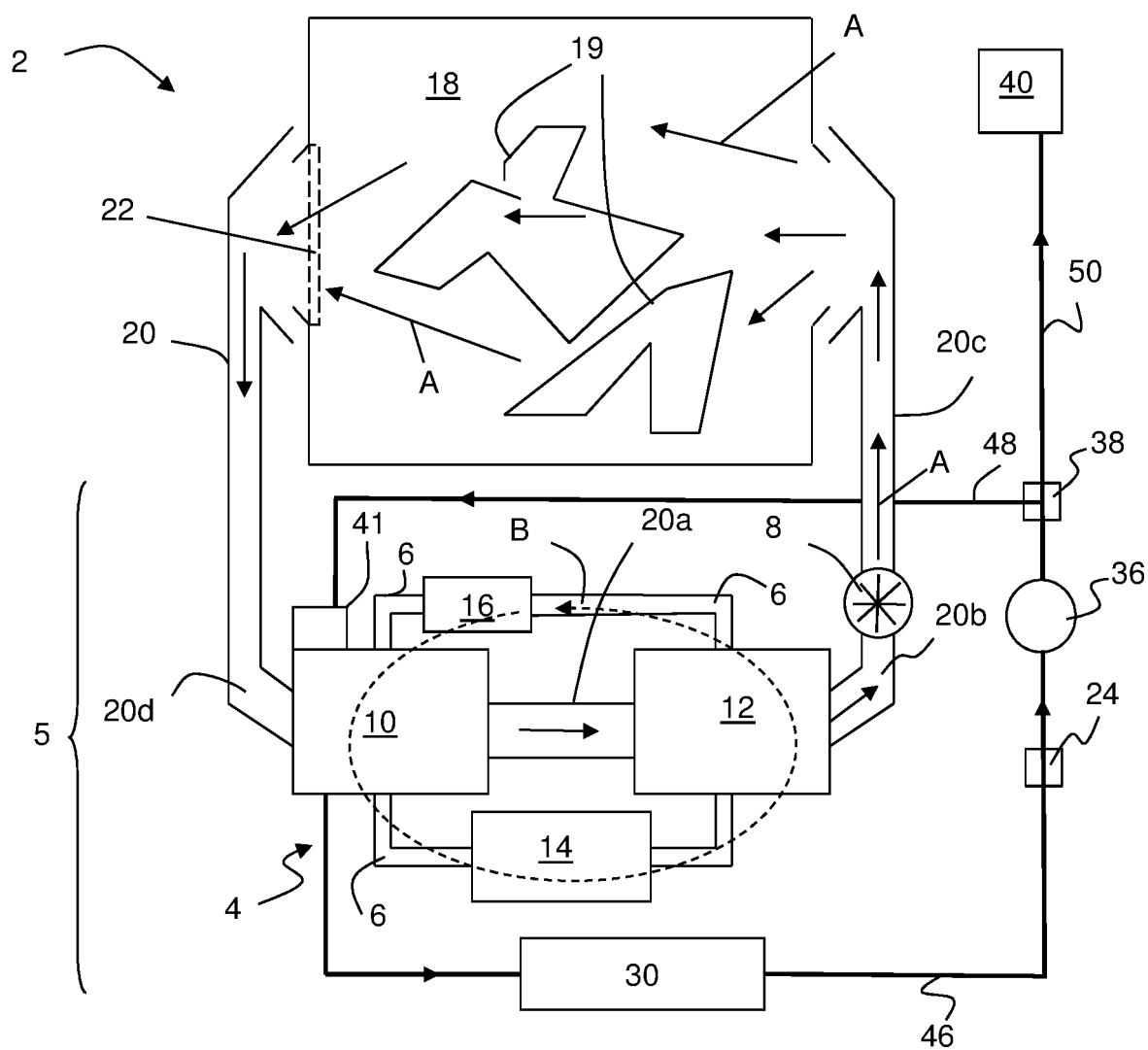
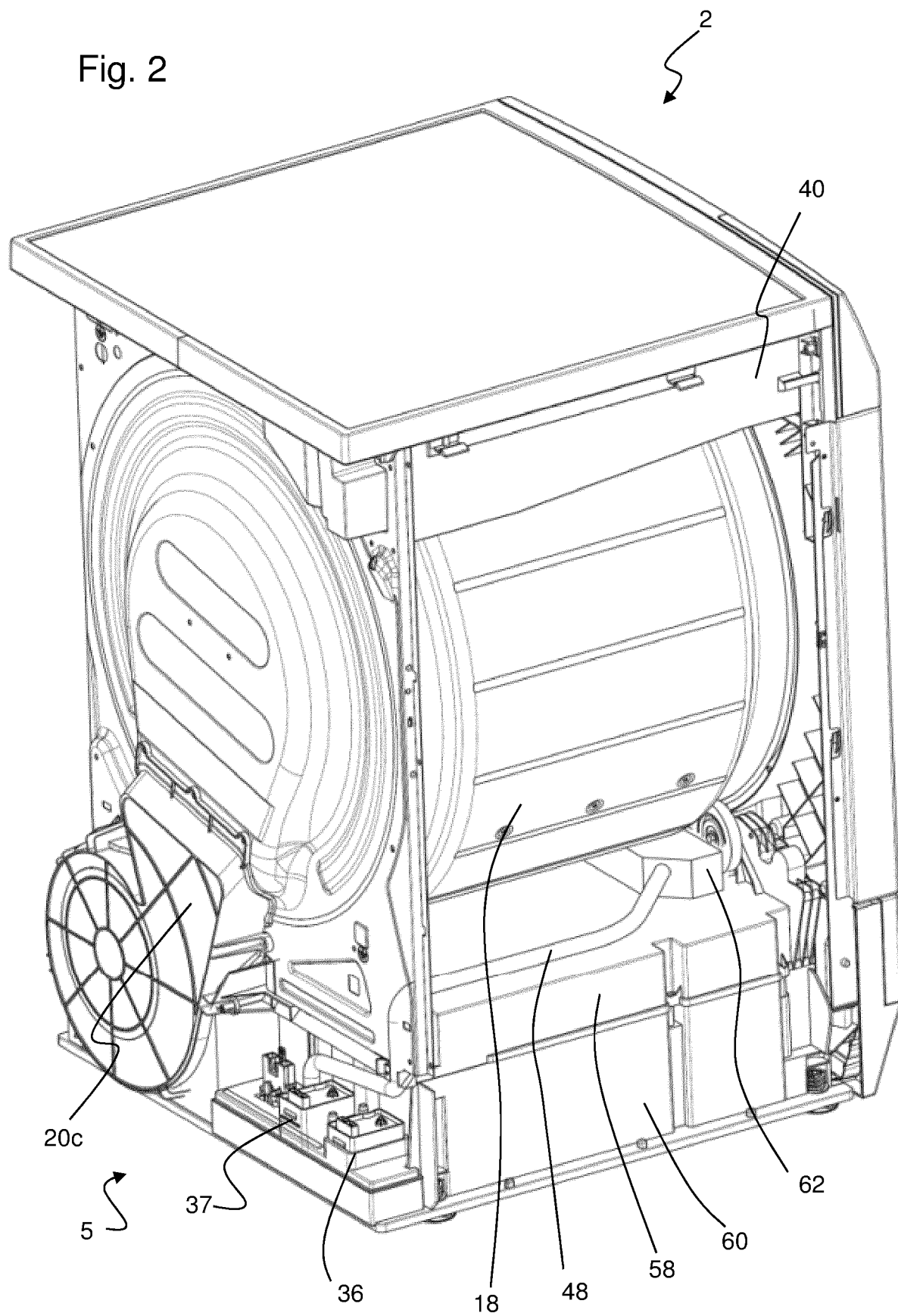


Fig. 1

Fig. 2



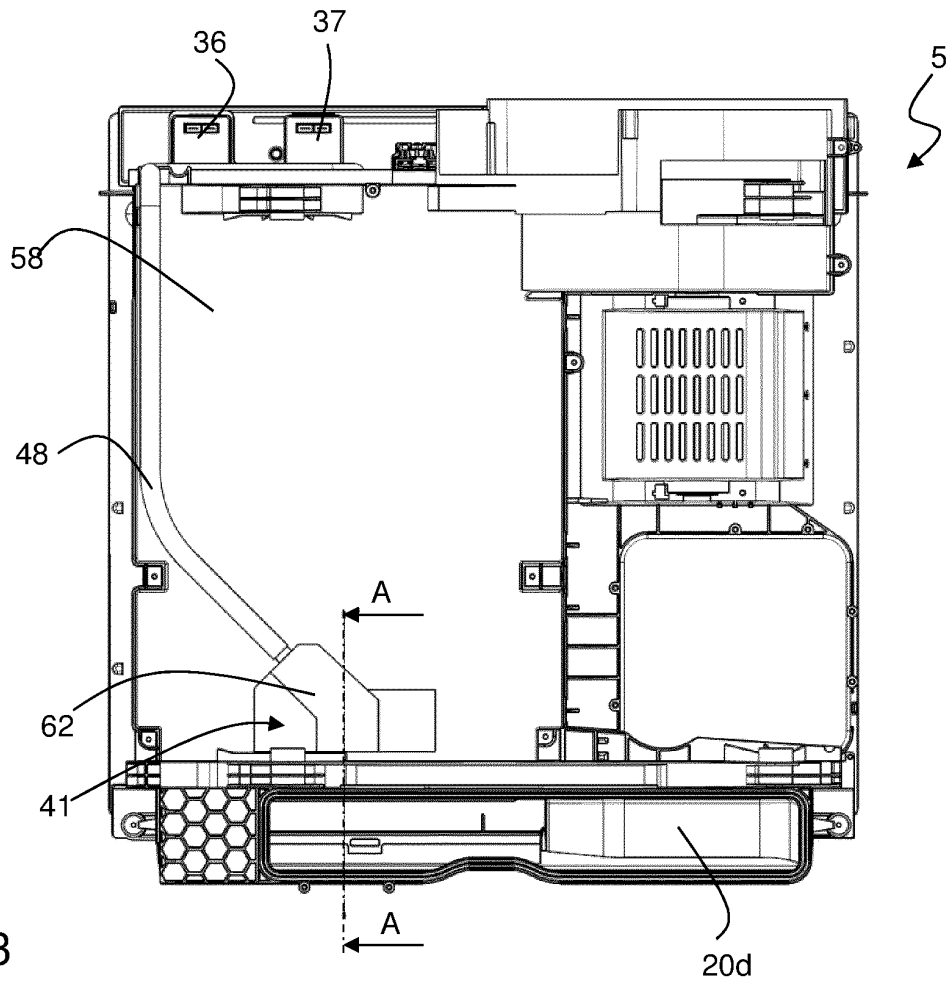


Fig. 3

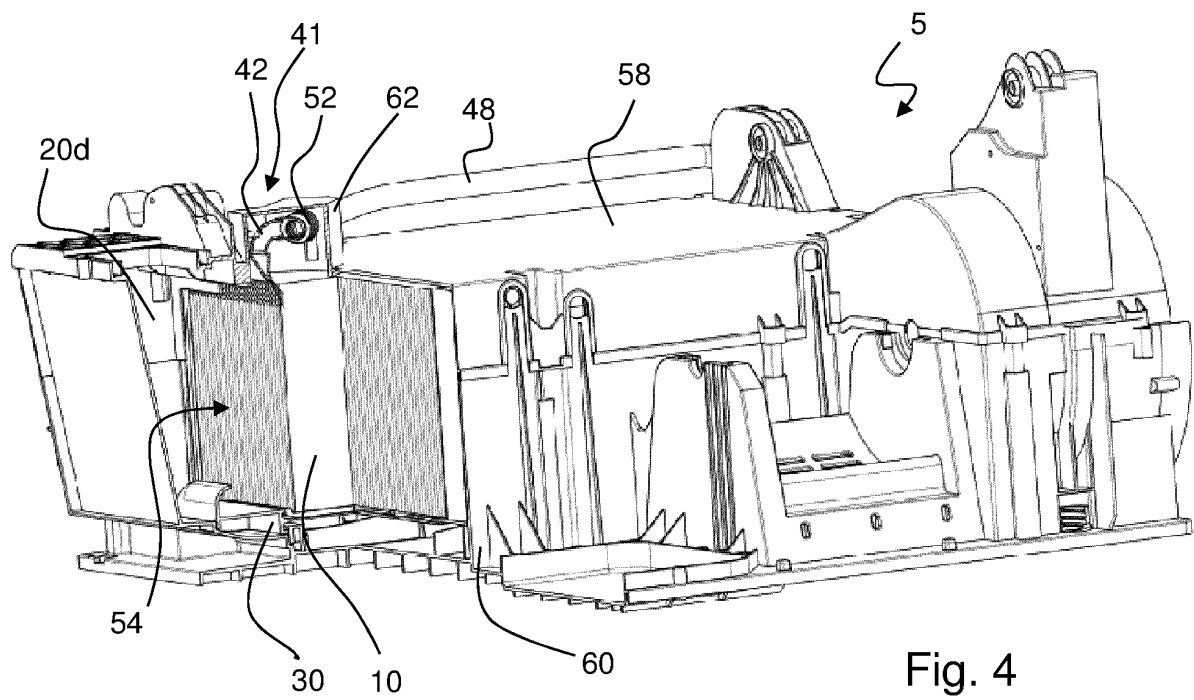


Fig. 4

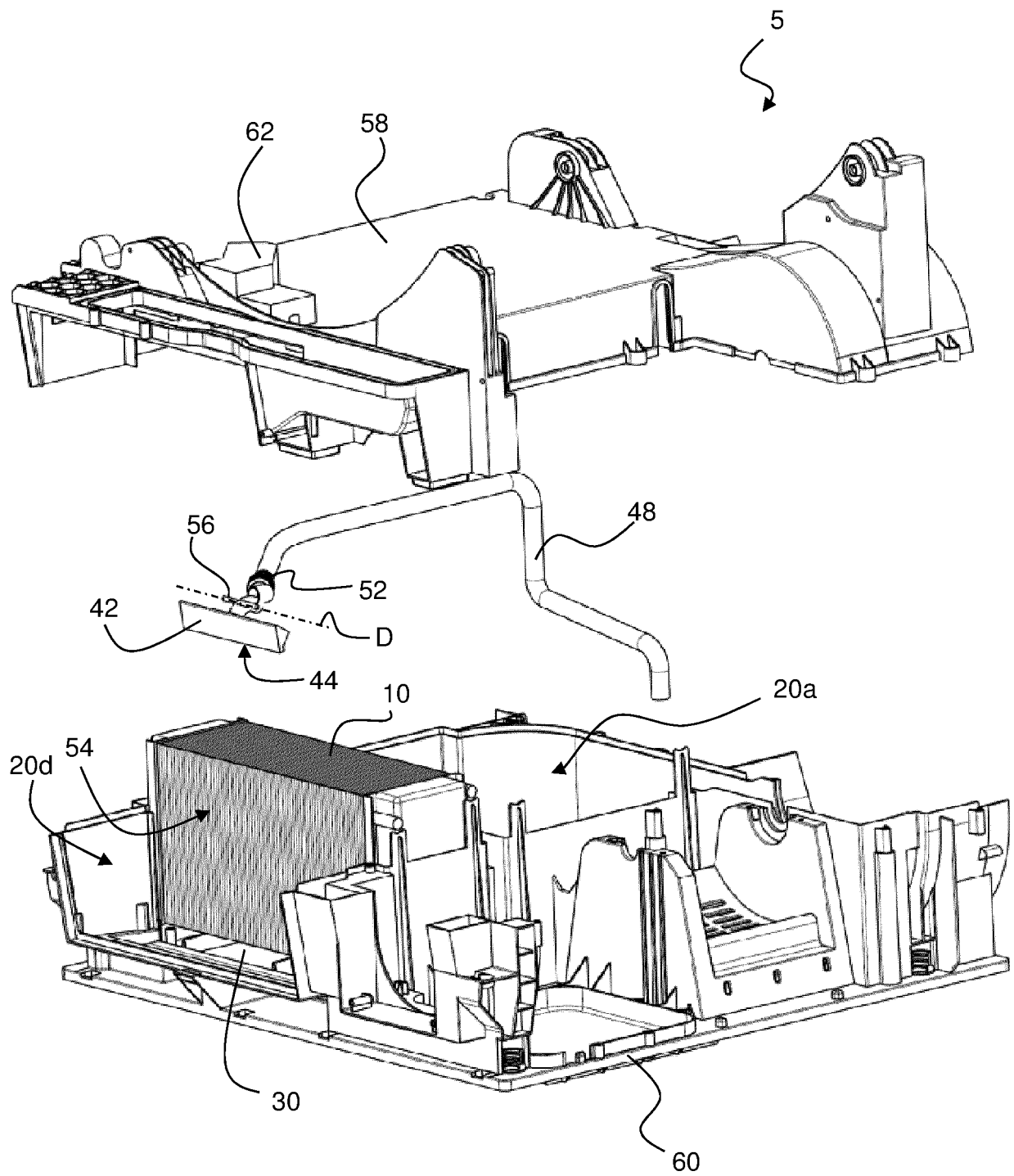


Fig. 5

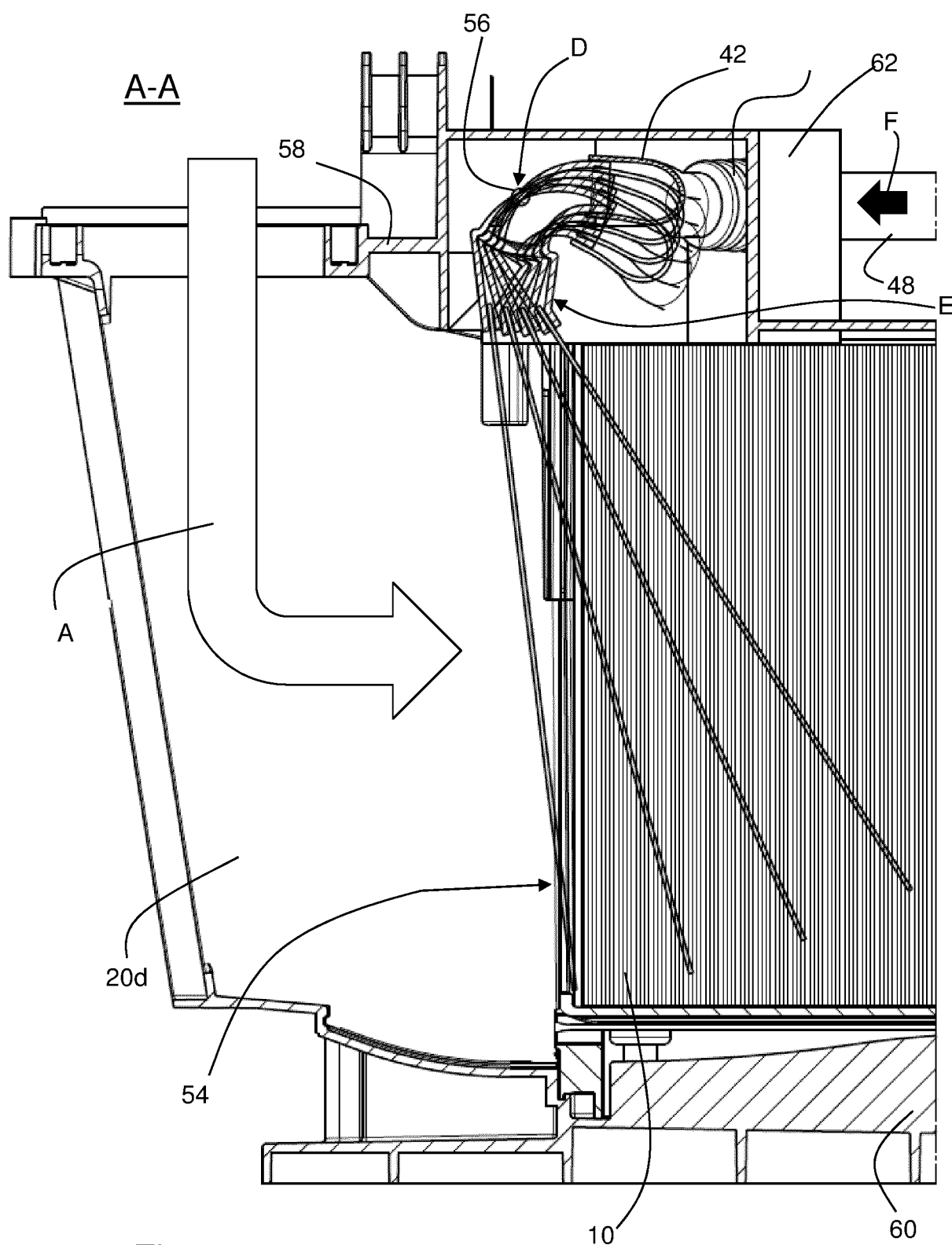
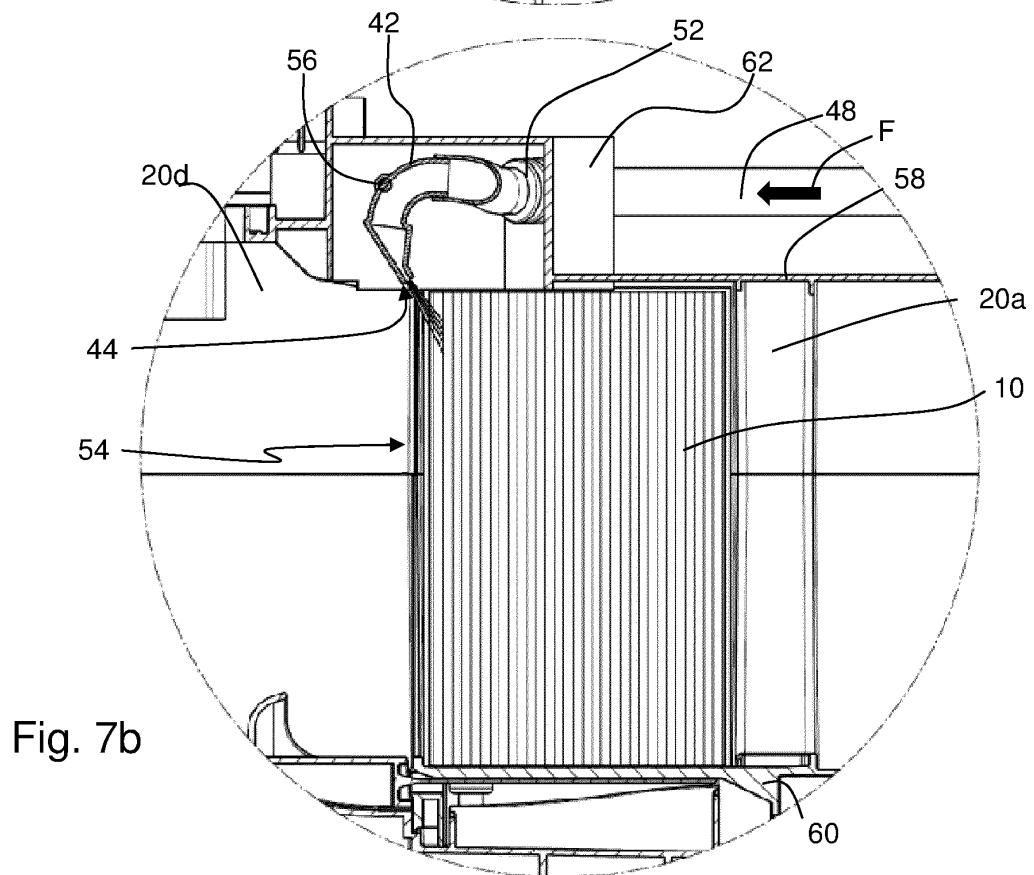
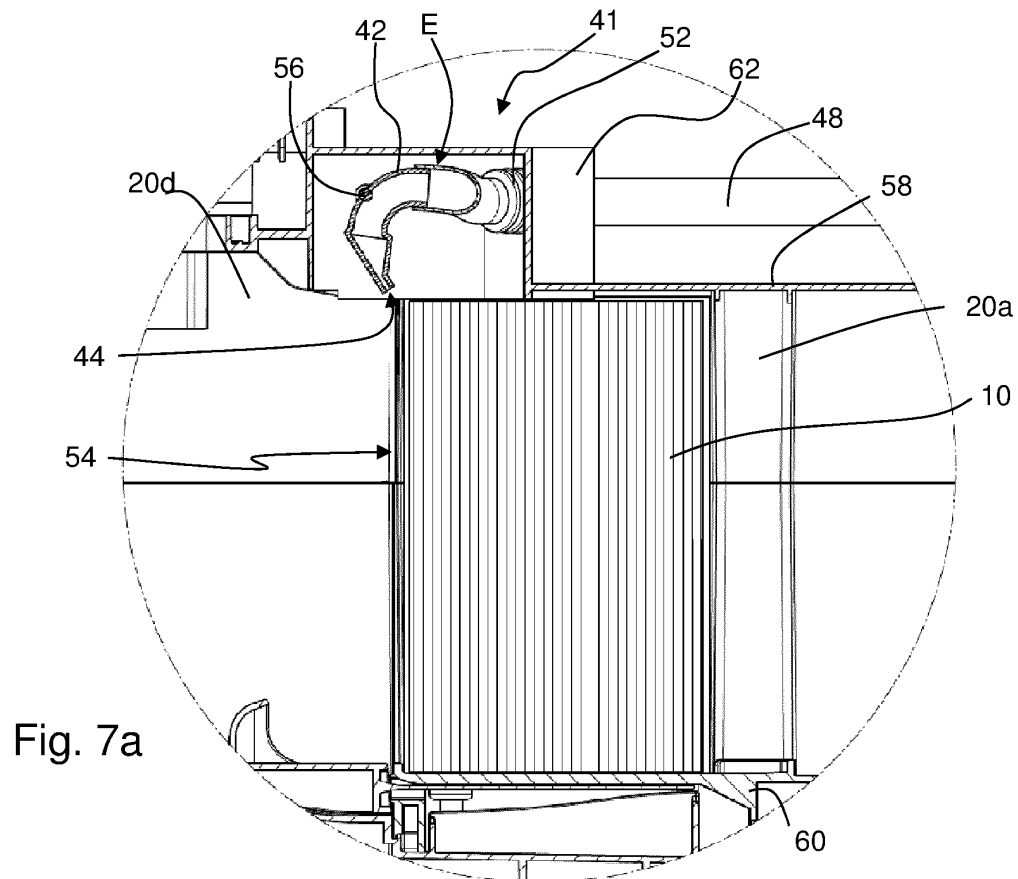
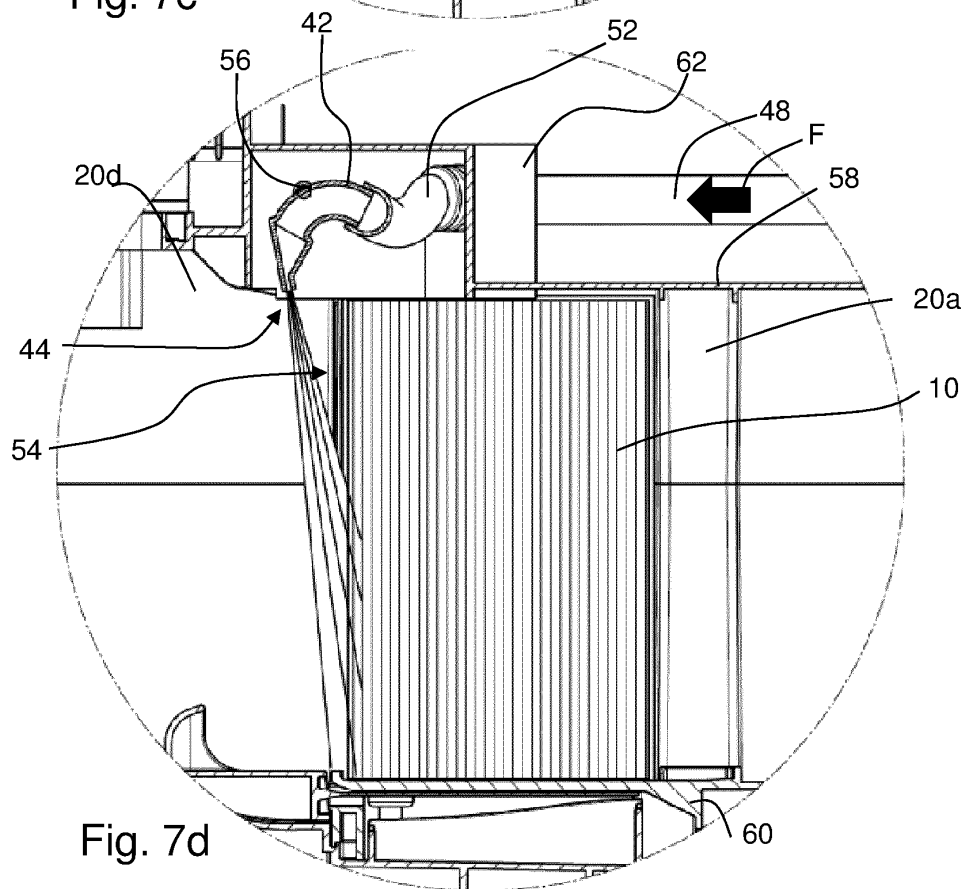
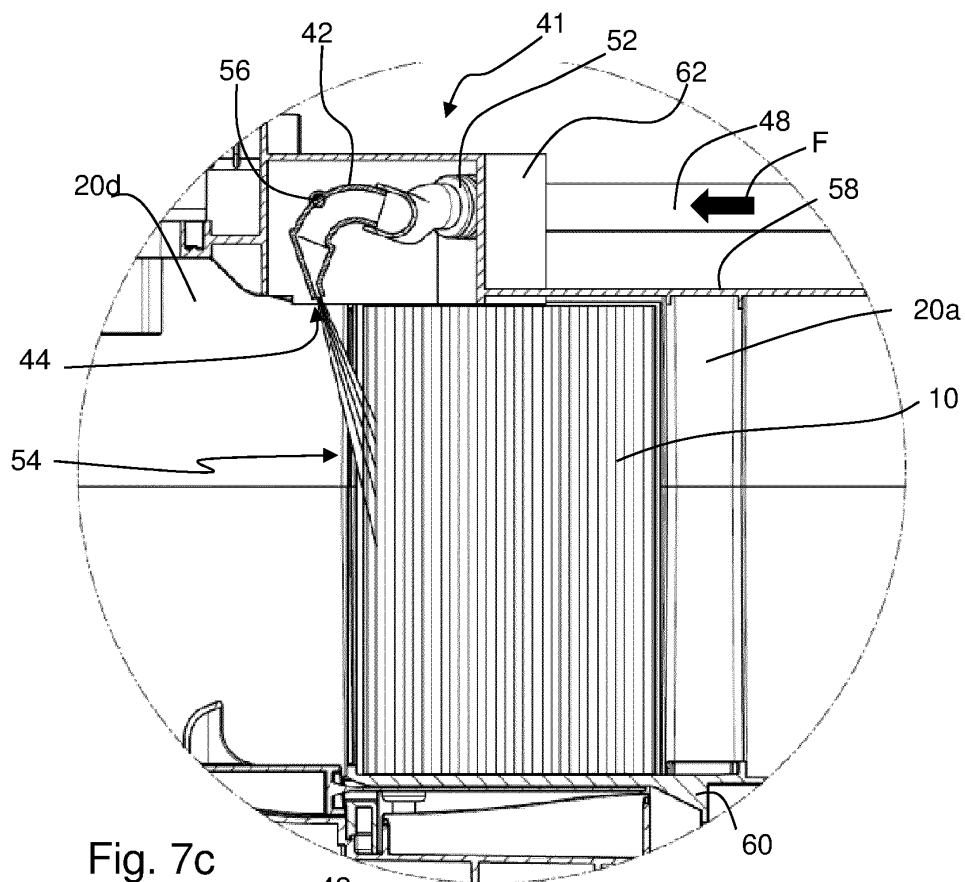


Fig. 6





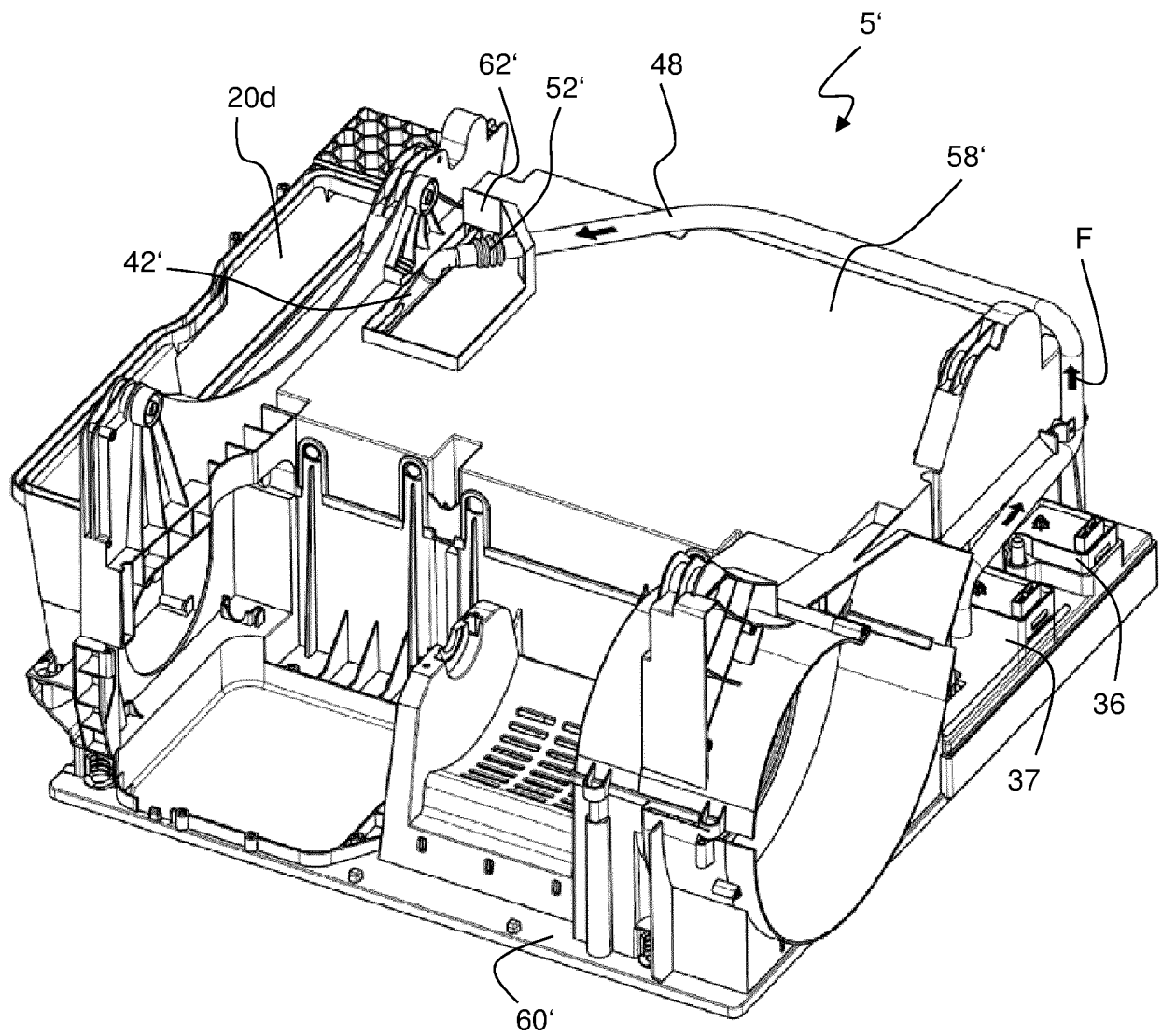


Fig. 8

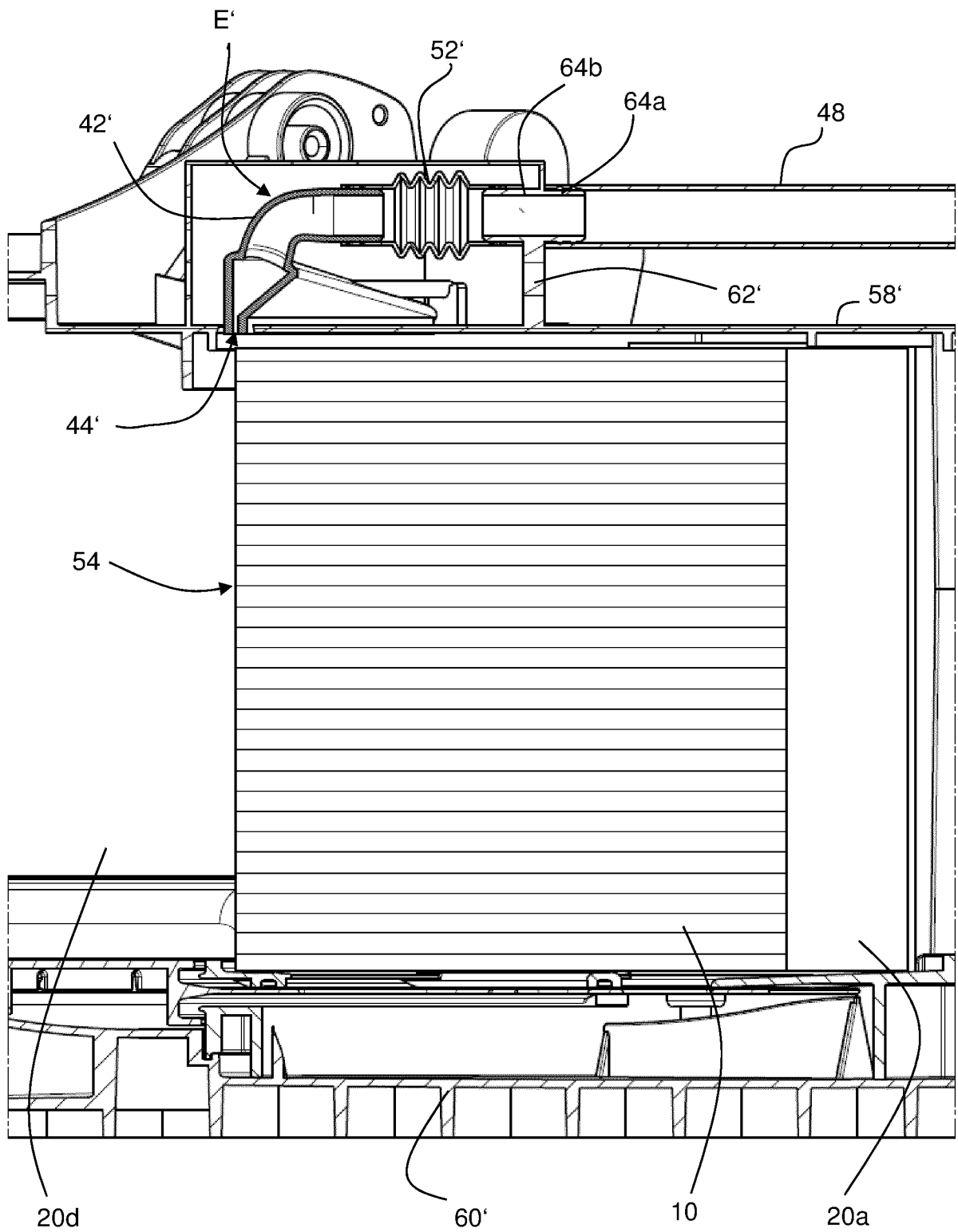


Fig. 9

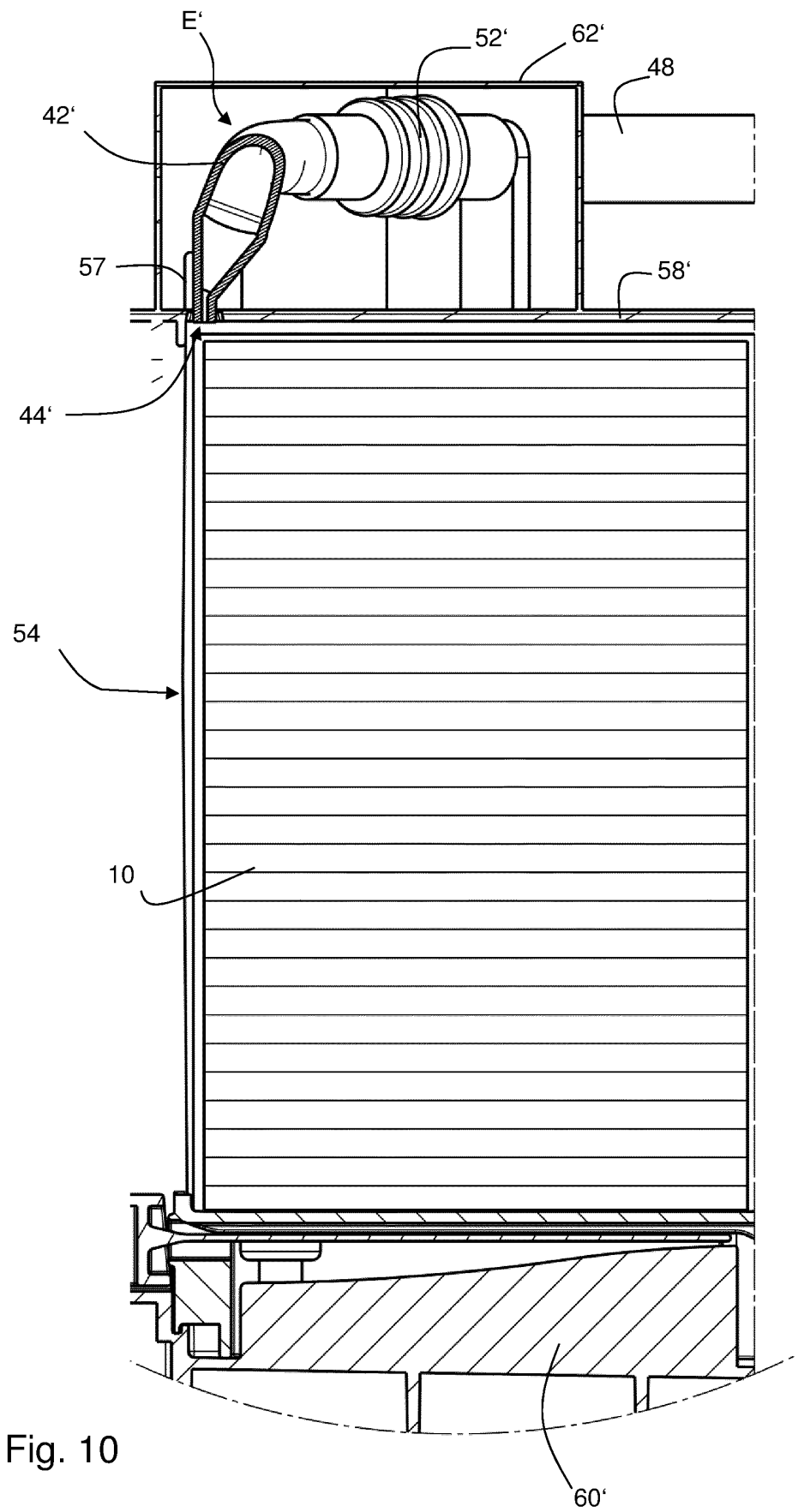


Fig. 10

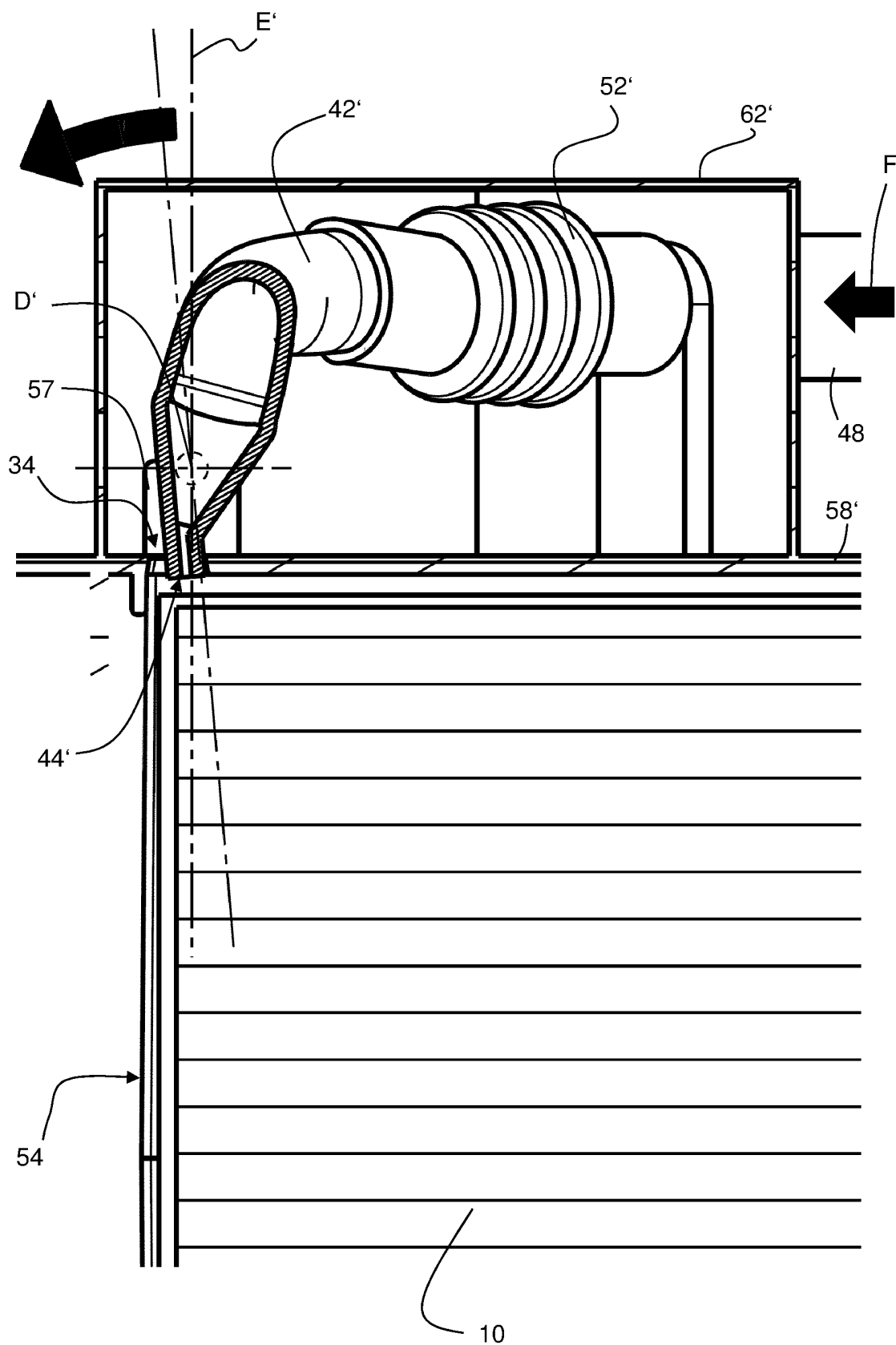
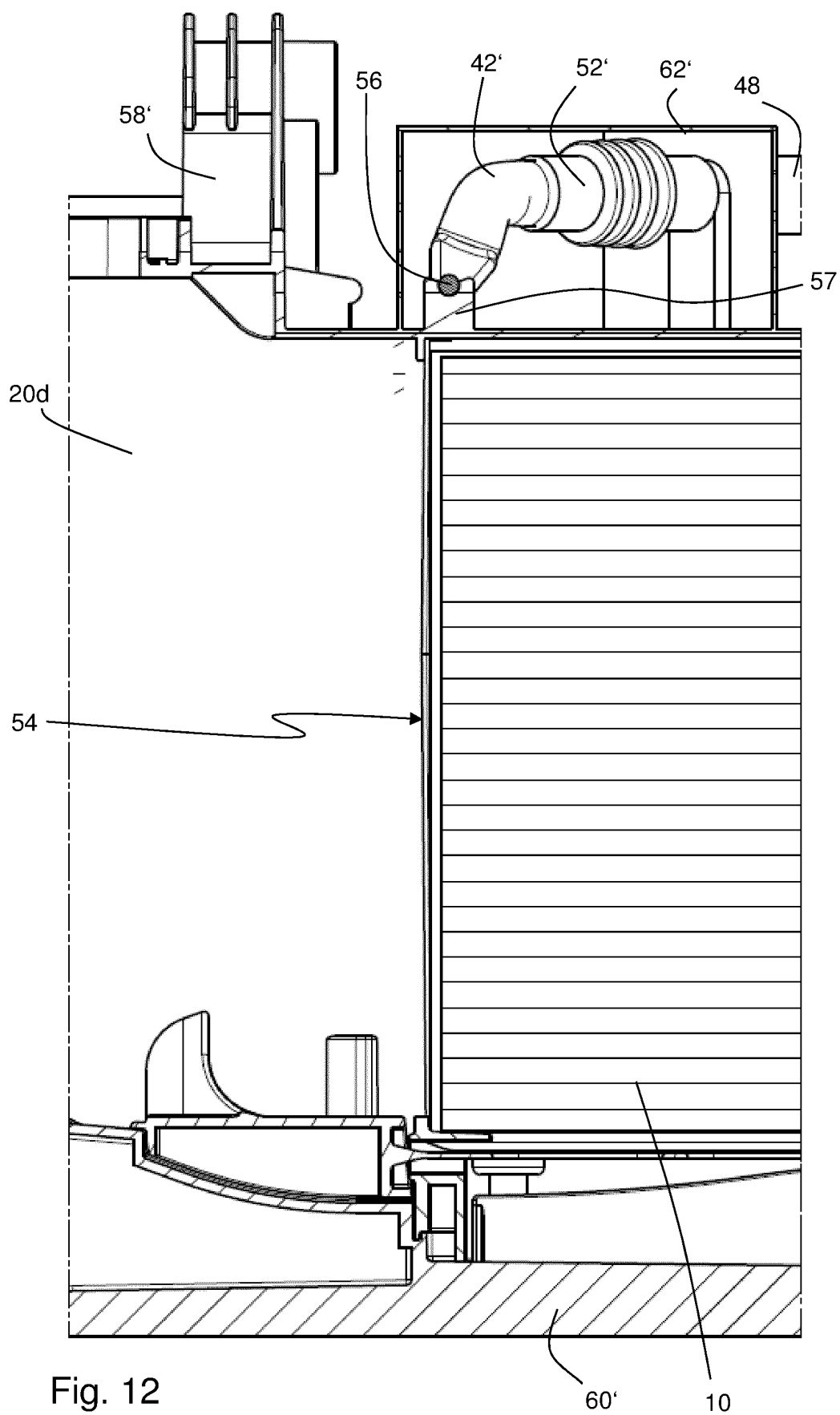


Fig. 11



REFERENCES CITED IN THE DESCRIPTION

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