(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 October 2006 (05.10.2006)

PCT

(10) International Publication Number
WO 2006/104443 A1

(51) International Patent Classification:
F28D 9/00 (2006.01) *B01D 1/22* (2006.01)

(21) International Application Number:
PCT/SE2006/000351

(22) International Filing Date: 21 March 2006 (21.03.2006)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
0500728-1 1 April 2005 (01.04.2005) SE
0500978-2 29 April 2005 (29.04.2005) SE

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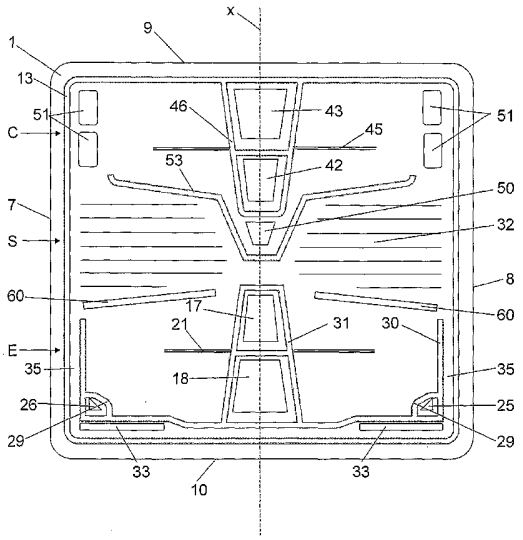
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A PLATE HEAT EXCHANGER



(57) Abstract: The invention refers to a plate heat exchanger for treatment of a medium. The plate heat exchanger comprises a number of compression-moulded heat exchanger plates (1), which are piled beside each other in a plate package (2) and which form first plate interspaces (5) for the medium and second plate interspaces (6). The first plate interspaces and the second plate interspaces are provided in an alternating order in the plate package. The plate package (2) encloses an evaporation section, a separation section and a condensation section. The evaporation section is arranged to permit evaporation of at least a part of the medium flowing through the first plate interspaces. The separation section is arranged to separate non-evaporated liquid from the evaporated part of the medium. The condensation section is arranged to condense the evaporated part flowing through the first plate interspaces.

WO 2006/104443 A1

Titel: A plate heat exchanger

THE BACKGROUND OF THE INVENTION AND PRIOR ART

The present invention refers generally to a plate heat exchanger for distillation of a medium. Especially, it is referred to desalination of salt-containing water, such as seawater. More specifically, the present invention refers to a plate heat exchanger for treatment of a medium, comprising a number of compression-moulded heat exchanger plates, which are successively provided in a plate package and which form first plate interspaces for the medium and second plate interspaces, wherein the first plate interspaces and the second plate interspaces are provided in an alternating order in the plate package.

Equipment for desalination of seawater, where one or several plate packages of heat exchanger plates form the main components in the process, is manufactured since many years. SE-B-464 938 discloses such a desalination plant comprising a plate package provided in a cylindrical container. The heat exchanger plates have no ports for steam, but instead the space outside the heat exchanger plates is used as one or several flow paths for the steam, depending on the kind of process. The container is a substantially cylindrical pressure vessel. In a large plant including several plate packages, these may be located in the longitudinal direction of the cylinder. To a certain extent, the container is limiting for the size of the plant, if not several containers are allowed to be included in the plant.

At least for smaller or medium sized plants, the cost for the container is a large part of the total cost for the plant. The manufac-

turing and mounting of the container are both complex and time consuming. In addition, maintenance of the plant and cleaning of the heat exchanger plates are difficult, for instance since the plate package and the heat exchanger plates only are accessible after opening of the container.

SUMMARY OF THE INVENTION

The object of the invention is to provide an improved plate heat exchanger for distillation of a medium and especially for desalination of salt-containing water. A further object of the invention is to provide such a plate heat exchanger which is efficient and which can be manufactured in an easy and inexpensive manner. A further object is to provide such a plate heat exchanger which permits an easy maintenance.

This object is achieved by the plate heat exchanger initially defined, which is characterized in that the plate package encloses an evaporation section, a separation section and a condensation section, wherein the evaporation section is arranged to permit evaporation of at least a part of the medium flowing through the first plate interspaces, the separation section is arranged to separate non-evaporated liquid from the evaporated part of the medium, the condensation section is arranged to condense the evaporated part flowing through the first plate interspaces, and the evaporation section, the separation section and the condensation section are provided in such a way that said evaporation, said separation and said condensation are permitted in each of the first plate interspaces.

Such a plate heat exchanger thus offers a possibility to perform the whole desired treatment of the medium, for instance desalination of seawater, in the plate package. The plate heat exchanger therefore does not need any container in which the plate package is enclosed. Consequently, a plate heat exchanger is achieved, which is efficient and which can be manu-

factured in an easy and inexpensive manner. Furthermore, maintenance and cleaning of the plate package and the individual heat exchanger plates are facilitated.

According to a preferred embodiment of the invention, a centre axis extends substantially centrally between two side edges of each heat exchanger plate and substantially vertically when the plate package is disposed in a normal position of use. The centre axis may advantageously extend substantially centrally through the evaporation section, the separation section and the condensation section, wherein the evaporation section is located at the lowermost position and the condensation section at the uppermost position in the normal position of use.

According to a further embodiment of the invention, substantially each of the second plate interspaces of the evaporation section forms a heating space, which is closed relatively to the first plate interspaces and relatively to the separation section and the condensation section and arranged to permit through-flowing of a heating medium for heat transfer to the medium flowing in the first plate interspaces of the evaporation section for providing the evaporation. The evaporation section may then be closed by means of a gasket which extends around the evaporation space.

According to a further embodiment of the invention, the evaporation section comprises at least one inlet for the medium, wherein the inlet is formed by an inlet port in substantially each heat exchanger plate in the plate package, which inlet ports form a port channel which is closed relatively to the second plate interspaces and communicates with the first plate interspaces. Advantageously, the port channel of the inlet may be closed relatively to the second plate interspaces by means of an inlet gasket, which extends around the inlet port in each of the second plate interspaces. Furthermore, the port channel of the inlet may communicate with the first plate interspaces via at least a rela-

tively small hole, which is provided between the inlet port and the inlet gasket and extends through every second heat exchanger plate in the plate package from the second plate interspaces to the first plate interspaces. By means of such a relatively small hole, a relatively large pressure drop is achieved, which enables a proper distribution of the medium entering the first plate interspaces in the evaporation section, and in such a way an efficient heating and evaporation of the medium is achieved. The port channel of the inlet may then be closed relatively to the first plate interspaces by means of a further gasket which extends around the inlet port between the hole and the inlet port in each of the first plate interspaces.

According to a further embodiment of the invention, a delimiting gasket is provided in the first plate interspaces and arranged to delimit the evaporation space of the evaporation section and to permit transport of the medium to the separation section.

According to a further embodiment of the invention, each heat exchanger plate comprises at least one communication port, which permits that the medium partly flows from the first interspaces in the evaporation section to the second plate interspaces in the separation section. Furthermore, the separation section may then be arranged to permit flowing of the medium through the first plate interspaces and the second plate interspaces. The first and second plate interspaces thus communicate with each other in the separation section and both these plate interspaces may be used for the flowing of the medium. Consequently the flow velocity is reduced and an efficient catching of liquid droplets may be achieved. Advantageously, the heat exchanger plates in the separation section may be corrugated in such a way that they permit catching of liquid from the medium flowing through the first plate interspaces and the second plate interspaces.

According to a further embodiment of the invention, the separation section is arranged to convey the caught liquid to a liquid outlet for discharge of the caught liquid. Advantageously, the gasket of the evaporation section, which adjoins the separation section, is provided in such a way that the caught liquid flows along the gasket towards the liquid outlet. The gasket of the evaporation section, which adjoins the separation section, may then slope downwardly and outwardly from the centre axis towards the side edges. Furthermore, the delimiting gasket and the gasket of the evaporation section may advantageously together define a lateral passage between these gaskets and the respective side edge, wherein these lateral passages comprise both first and second plate interspaces and are arranged to convey the caught liquid further to the liquid outlet.

According to a further embodiment of the invention, substantially each of the second plate interspaces of the condensation section forms a cooling space which is closed relatively to the first plate interspaces and relatively to the separation section and the evaporation section, and is arranged to permit through-flowing of a cooling medium for heat transfer from the medium flowing in the first plate interspaces of the condensation section for providing the condensation. Furthermore, the condensation section comprises at least a medium outlet, wherein the medium outlet is formed by an outlet port in substantially each heat exchanger plate in the plate package, which outlet ports form one of a port channel which extends through substantially the whole plate package.

According to a further embodiment of the invention, substantially each heat exchanger plate in the separation section comprises at least a collection port, which forms a collection channel which extends through substantially the whole plate package and is arranged to convey the medium to the first plate interspaces of the condensation section. Advantageously, substantially each heat exchanger plate in the separation section may comprise at

least two collection ports, which form a respective such collection channel, wherein such a collection port is provided in the proximity of each side edge on each heat exchanger plate.

According to a further embodiment of the invention, a guide gasket is provided in each of the first plate interspaces and arranged to delimit the separation section from the condensation section. Advantageously, the guide gasket slopes downwardly towards the port channel of the medium outlet and is arranged to convey the medium condensed in the condensation section to the medium outlet. Furthermore, the medium outlet may be provided in a central position, wherein the guide gasket slopes downwardly to the port channel of the medium outlet from two positions which are located in the proximity of a respective one of said collection ports.

According to a further embodiment of the invention, the plate heat exchanger is designed to convey the medium through the second plate interspaces of the condensation section before the medium is conveyed into the first plate interspaces of the evaporation section, wherein the medium forms the cooling medium.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is now to be explained more closely by means of a description of various embodiments and with reference to the drawings attached hereto.

Fig. 1 discloses a side view of a plate heat exchanger according to an embodiment of the invention.

Fig. 2 discloses a plan view of a heat exchanger plate having gaskets in a first plate interspace.

Fig. 3 discloses a plan view of a heat exchanger plate having gaskets in a second plate interspace.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS OF THE INVENTION

Fig. 1 discloses a plate heat exchanger for treatment of a medium. In the following description an application with respect to desalination of seawater is described. However, it is to be noted that the invention is not limited to this application but may also refer to any other treatment, for instance distillation of a liquid.

The plate heat exchanger comprises a large number of compression-moulded heat exchanger plates 1, which are provided in parallel to each other and successively in such a way that they form a plate package 2. The plate package 2 is provided between a frame plate 3 and a pressure plate 4. Between the heat exchanger plates 1, first plate interspaces 5 and second plate interspaces 6 are formed. The first plate interspaces 5 and the second plate interspaces 6 are provided in an alternating order in the plate package 2 in such a way that substantially each first plate interspace 5 is surrounded by two second plate interspaces 6, and substantially each second plate interspace 6 is surrounded by two first plate interspaces 5. Different sections in the plate package 2 are delimited from each other by means of gaskets in each plate interspace 5, 6, which is to be explained more closely below.

Each heat exchanger plate has two opposite substantially parallel side edges 7, 8, an upper edge 9 and a lower edge 10. A centre axis x extends substantially centrally between the two side edges 7 and 8, and substantially vertically when the plate package 2 is located in a normal position of use.

The plate package 2, i.e. the heat exchanger plates 1 and the gaskets provided therebetween, is kept together by means of schematically indicated tie bolts 11 in a manner known per se.

An embodiment of the plate heat exchanger is now to be explained more closely with reference to Figs. 2 and 3, which disclose a respective heat exchanger plate 1. Fig. 2 discloses one side of a heat exchanger plate 1, which faces one of the first plate interspaces 5 substantially arranged to form a passage for the medium to be treated; in this case seawater to be desalinated. Fig. 3 discloses a side of a heat exchanger plate 1, which faces one of the second plate interspaces 6.

The plate package 2 encloses an evaporation section E, a separation section S and a condensation section C. The evaporation section E is arranged to permit evaporation of at least a part of the medium flowing through the first plate interspaces 5. The separation section S is arranged to separate non-evaporated liquid from the evaporated part of the medium. The condensation section C is arranged to condense the evaporated part flowing through the first plate interspaces 5. The centre axis x extends substantially centrally through the evaporation section E, the separation section S and the condensation section C. As can be seen in Figs. 2 and 3, the evaporation section E is located at a lowermost position, the condensation section C at an uppermost position and the separation section S between the evaporation section E and the condensation section C when the plate heat exchanger is in the normal position of use.

In each of the first plate interspaces 5 and the second plate interspaces 6, there is a main gasket 13 extending around the evaporation section E, the separation section S and the condensation section C in the proximity of the edges 7, 8, 9 and 10.

Substantially each of the second plate interspaces 6 of the evaporation section E forms a heating space 15, which is closed relatively to the first plate interspaces 5 and relatively to the separation section S and the condensation section C by means of a gasket 16, which extends around the heating space 15. The heating space 15 is arranged to permit through-flowing of a

heating medium for heat transfer to the medium flowing in the first plate interspaces 5 of the evaporation section E for providing the evaporation. Each heat exchanger plate 1 comprises an inlet port 17 and outlet port 18, which are located in the heating space 15 inside the gasket 16 and form an inlet port channel and an outlet port channel, respectively, for the heating medium. The inlet port channel and the outlet port channel are connected to an external inlet conduit 19 and an external outlet conduit 20, respectively, for the heating medium, see Fig. 1. Between the inlet port 17 and the outlet port 18, each heat exchanger plate 1 has a corrugation 21, which is turned inwardly into the heating space 15 and forms a barrier guiding the heating medium upwardly towards the side edges 7, 8 from the inlet port 17 in such a way that the surface of the whole heating space 15 may be utilized.

The evaporation section E comprises at least one inlet for the medium. In the embodiment disclosed, the evaporation E comprises two inlets, which are formed by two inlet ports 25 in each heat exchanger plate 1 in the plate package 2. The inlet ports 25 form a respective port channel, which is closed relatively to the second plate interspaces 6 and communicate with the first plate interspaces 5. The port channels of the inlet are closed relatively to the second plate interspaces 6 by means of a respective inlet gasket 26, which extends around the respective inlet port 25 in each of the second plate interspaces 6 and which is a part of the gasket 16. The port channels of the inlet are connected to a respective inlet conduit 27, see Fig. 1. The port channels of the inlet communicate with the first plate interspaces 5 via a respective relatively small hole 28, which is disclosed in Fig. 3 and provided between the respective inlet port 26 and the respective inlet gasket 26. The holes 28 extend through every second heat exchanger plate 1 in the plate package from the second plate interspaces 6 to the first plate interspaces 5. The port channels of the inlet are also closed relatively to the first plate interspaces 5 by means of a further gas-

ket 29, which extends around the respective inlet port 25 between the respective hole 28 and the respective inlet port 25 in each of the first plate interspaces 5.

A delimiting gasket 30 is provided in each of the first plate interspaces 5 and arranged to delimit the evaporation space for the medium in the evaporation section E and to convey the medium to the separation section S. The delimiting gasket 30 thus extends partly around the evaporation space in the first plate interspaces 5 at a small distance from the surrounding main gasket 13. The delimiting gasket 30 also comprises a gasket portion 31, which extends around each of the inlet port 17 and the outlet port 18 in order to seal these against each other and against the evaporation space in the first plate interspaces 5.

The delimiting gasket 30 is open along its upper end so that the evaporated medium may flow upwardly in the separation section S. Furthermore, each heat exchanger plate 1 has at least one or two, as in the example disclosed, communication ports 60. The communication ports 60 are provided in a lower part of the separation section S immediately above the gasket 16. The communication ports 60 are arranged to permit that a part of the evaporated medium flows from the first plate interspaces 5 into the second plate interspaces 6, wherein the separation section S is arranged to permit flowing of the medium through both first plate interspaces 5 and the second plate interspaces 6. The heat exchanger plates 1 is in the separation section S corrugated with a corrugation 32 of ridges and valleys in such a way that they permit catching of a liquid from the medium flowing through the first plate interspaces 5 and the second plate interspaces 6. The corrugation 32, i.e. the ridges and valleys of the corrugation, extends in the embodiment disclosed transversally to the centre axis x, preferably substantially perpendicularly to the centre axis x.

The separation section S is also arranged to convey the caught liquid to the two liquid outlets 33 for discharge of the caught liquid. The gasket 16 mentioned above of the evaporation section E in the first plate interspaces 5 adjoins the separation section S and is provided in such way that the liquid, which is caught in the separation section S, flows along the gasket 16 towards the liquid outlets 33. In the embodiment disclosed, these gaskets 16 slope downwardly and outwardly from the centre axis x towards the side edges 7 and 8. The delimiting gasket 30 and the gasket 16 are provided and located in such a way that they together define a lateral passage 35 between these gaskets 30, 16 and the respective side edge 7 and 8, and more specifically between these gaskets 30, 16 and the main gasket 13. These lateral passages 35 thus extend through both the first plate interspaces 5 and the second plate interspaces 6. The lateral passages 35 are arranged to convey the caught liquid further from the separation section S proper to the liquid outlets 33, which are located beneath the heating area 15 and the evaporation section E. As can be seen in Figs. 2 and 3, the liquid outlets are located above the lower edge 10 and the lower part of the main gasket 13 and beneath a lower part of the delimiting gasket 30 and the gasket 16.

Substantially each of the second plate interspaces 6 of the condensation section C forms a cooling space 40, which is closed relatively to the first plate interspaces 5 and relatively to the separation section S and the evaporation section E by means of a gasket 41, which extends around the cooling space 40. The cooling space 40 is arranged to permit through-flowing of a cooling medium for heat transfer from the medium flowing in the first plate interspaces 5 of the condensation section C for providing the condensation. Each heat exchanger plate 1 comprise an inlet port 42 and an outlet port 43, which are located in the cooling space 40 inside the gasket 41 and form an inlet port channel and an outlet port channel, respectively, for the cooling medium. The inlet port channel and the outlet port channel are connected to an external inlet conduit 44 and an external outlet conduit 45,

respectively, for cooling, see Fig. 1. Between the inlet port 42 and the outlet port 43, each heat exchanger plate 1 has a corrugation 45 which is turned inwardly into the cooling space 40 and forms a barrier guiding the cooling medium outwardly towards the side edges 7, 8 from the inlet port 42 in such a way that the whole surface of the cooling space 40 may be utilized for the condensation of the medium.

The main gasket 13 in the first plate interspaces 5 also comprises a gasket portion 46, which extends around each of the inlet port 42 and the outlet port 43 for sealing these against each other and against the condensation space in the first plate interspaces 5.

The condensation section C comprises at least one medium outlet, which is formed by an outlet port 50 in substantially each heat exchanger plate 1 in the plate package 2. The outlet ports 50 form one of a port channel extending through substantially the whole plate package 2 and are connected to a discharge channel 55 for discharging the condensed medium, i.e. in the example disclosed, the desalinated seawater is discharged as fresh water. Furthermore, substantially each heat exchanger plate 1 comprises in an upper part of the separation section S two collection ports 51 in the proximity of each side edge 7, 8. These collection ports 51 form four collection channels, which extend through substantially the whole plate package 2 and are arranged to convey the medium from the second plate interspaces 6 of the separation section S into the first plate interspaces 5 of the condensation section C.

The outlet port 50 is closed relatively to the second plate interspaces 6 by means of an outlet gasket 52 in each of the second plate interspaces 6. Each such outlet gasket 52 extends around the outlet port 50 in the respective second plate interspace 6. The outlet gasket 52 coincides partly with the gasket 41 of the cooling space 40.

A guide gasket 53 is provided in each of the first plate interspaces 5 and arranged to delimit the separation section S from the condensation section C. The guide gasket 53 slopes downwardly towards the outlet port 50 and the port channel of the medium outlet and is arranged to convey the medium condensed in the condensation section C to the medium outlet. The medium outlet is provided in a central position, wherein the guide gasket 53 slopes downwardly towards the outlet port 50 from two positions, which are located in the proximity of the collection ports 51 at each side edge 7, 8. As can be seen in Fig. 2, the guide gasket 53 extends beneath the outlet port 50. The guide gasket 53 also has the function to guide the medium in the separation section S outwardly towards the collection ports 51.

As can be seen in Fig. 1, the plate heat exchanger is designed to convey the medium, i.e. the seawater, through the second plate interspaces 6 of the condensation section C before the medium is conveyed into the first plate interspaces 5 of the evaporation section E in such a way that the medium forms the cooling medium in the condensation section C, i.e. the outlet conduit 45 from the cooling space 40 is connected to the two inlet conduits 27.

The invention is not limited to the embodiments disclosed but may be varied and modified within the scope of the following claims.

It is to be noted for instance that the different sections can be located in another manner in the plate package than the one disclosed. The evaporation section may for instance be located in the proximity of a lower corner of the plate package, the separation section in the upper part of the plate package and the condensation section in the other lower corner of the plate package. It is also to be noted that all heat exchanger plates 1 are substantially identical except for the relatively small holes

28, which merely are made in every second heat exchanger plate 1. In connection with the mounting of the plate package 2, every second plate is turned around the centre axis x in a manner known per se.

Claims

1. A plate heat exchanger for treatment of a medium, comprising a number of compression-moulded heat exchanger plates (1), which are successively provided in a plate package (2) and which form first plate interspaces (5) for the medium and second plate interspaces (6), wherein the first plate interspaces (5) and the second plate interspaces (6) are provided in an alternating order in the plate package (2),
characterized in that the plate package (2) encloses an evaporation section, a separation section and a condensation section, wherein
the evaporation section is arranged to permit evaporation of at least a part of the medium flowing through the first plate interspaces,
the separation section is arranged to separate non-evaporated liquid from the evaporated part of the medium,
the condensation section is arranged to condense the evaporated part flowing through the first plate interspaces, and
the evaporation section, the separation section and the condensation section are provided in such a way that said evaporation, said separation and said condensation are permitted in each of the first interspaces.

2. A plate heat exchanger according to claim 1, characterized in that a centre axis (x) extends substantially centrally between two side edges (7) of each heat exchanger plate (1) and substantially vertically when the plate package (2) is disposed in a normal position of use.

3. A plate heat exchanger according to claim 2, characterized in that the centre axis (x) extends substantially centrally through the evaporation section (E), the separation section (S) and the condensation section (C), wherein the evaporation section (E) is located at the lowermost position and the condensation section (C) at the uppermost position in the normal position of use.

4. A plate heat exchanger according to any one of the preceding claims, characterized in that substantially each of the second plate interspaces (6) of the evaporation section (E) forms a heating space (15), which is closed relatively to the first plate interspaces (5) and relatively to the separation section (S) and the condensation section (C) and arranged to permit through-flowing of a heating medium for heat transfer to the medium flowing in the first plate interspaces (6) of the evaporation section (E) for providing the evaporation.

5. A plate heat exchanger according to claim 4, characterized in that the heating space (15) is closed by means of a gasket (16) which extends around the evaporation space (15).

6. A plate heat exchanger according to any one of claims 4 and 5, characterized in that the evaporation section (E) comprises at least one inlet for the medium, wherein the inlet is formed by an inlet port (25) in substantially each heat exchanger plate (1) in the plate package (2), which inlet ports (25) form a port channel which is closed relatively to the second plate interspaces (6) and communicates with the first plate interspaces (5).

7. A plate heat exchanger according to claim 6, characterized in that the port channel of the inlet is closed relatively to the second plate interspaces (6) by means of an inlet gasket (26), which extends around the inlet port (25) in each of the second plate interspaces (6).

8. A plate heat exchanger according claims 6 and 7, characterized in that the port channel of the inlet communicates with the first plate interspaces (5) via at least a relatively small hole (28), which is provided between the inlet port (25) and the inlet gasket (26) and extends through every second heat exchanger

plate (1) in the plate package (2) from the second plate interspaces (6) to the first plate interspaces (5).

9. A plate heat exchanger according to claim 8, characterized in that the port channel of the inlet is closed relatively to the first plate interspaces (5) by means of a further gasket which extends around the inlet port (25) between the hole (28) and the inlet port (25) in each of the first plate interspaces (5).

10. A plate heat exchanger according to any one of the preceding claims, characterized in that a delimiting gasket (30) is provided in the first plate interspaces (5) and arranged to delimit the evaporation space of the medium in the first evaporation section (E) and to permit transport of the medium to the separation section (S).

11. A plate heat exchanger according to any one of the preceding claims, characterized in that each heat exchanger plate (1) comprises at least one communication port (60), which permits that the medium partly flows from the first plate interspaces (5) in the evaporation section (E) to the second plate interspaces (6) in the separation section (S).

12. A plate heat exchanger according to any one of the preceding claims, characterized in that the separation section (S) is arranged to permit flowing of the medium through the first plate interspaces (5) and the second plate interspaces (6).

13. A plate heat exchanger according to claim 12, characterized in that the heat exchanger plates (1) in the separation section (S) are corrugated in such a way that they permit catching of liquid from the medium flowing through the first plate interspaces (5) and the second plate interspaces (6).

14. A plate heat exchanger according to claim 13, characterized in that the separation section (S) is arranged to convey the

caught liquid to a liquid outlet (33) for discharge of the caught liquid.

15. A plate heat exchanger according to claims 5 and 14, characterized in that the gasket (16) of the evaporation section (E) which adjoins the separation section (S), is provided in such a way that the caught liquid flows along the gasket (16) towards the liquid outlet (33).

16. A plate heat exchanger according to claims 3 and 15, characterized in that the gasket (16) of the evaporation section (E) which adjoins the separation section (S), slopes downwardly and outwardly from the centre axis (x) towards the side edges (7, 8).

17. A plate heat exchanger according claims 2, 5 and 16, characterized in that the delimiting gasket (30) and the gasket (16) of the evaporation section (E) together define a lateral passage (35) between these gaskets and the respective side edge (7, 8), wherein these lateral passages (35) comprise both the first and second plate interspaces (5, 6) and are arranged to convey the caught liquid further to the liquid outlet (33).

18. A plate heat exchanger according to any one of the preceding claims, characterized in that substantially each of the second plate interspaces (6) of the condensation section (C) forms a cooling space (40) which is closed relatively to the first plate interspaces (5) and relatively to the separation section (S) and the evaporation section (E), and is arranged to permit through-flowing of a cooling medium for heat transfer from the medium flowing in the first plate interspaces (5) of the condensation section (C) for providing the condensation.

19. A plate heat exchanger according to claim 18, characterized in that the condensation section (C) comprises at least a medium outlet, wherein the medium outlet is formed by an outlet

port (50) in substantially each heat exchanger plate (1) in the plate package (2), which outlet ports (50) form one of a port channel which extends through substantially the whole plate package (2).

20. A plate heat exchanger according to any one of claims 18 and 19, characterized in that substantially each heat exchanger plate (1) in the separation section (S) comprises at least a collection port (51), which forms a collection channel which extends through substantially the whole plate package (2) and is arranged to convey the medium to the first plate interspaces (5) of the condensation section (C).

21. A plate heat exchanger according to claims 2 and 20, characterized in that substantially each heat exchanger plate (1) in the separation section (S) comprises at least two collection ports (51), which form a respective such collection channel, wherein such a collection port (51) is provided in the proximity of each side edge (7, 8) on each heat exchanger plate (1).

22. A plate heat exchanger according to any one of claims 18 to 21, characterized in that a guide gasket (53) is provided in each of the first plate interspaces (5) and arranged to delimit the separation section (S) from the condensation section (C).

23. A plate heat exchanger according to claims 19 and 22, characterized in that the guide gasket (53) slopes downwardly towards the port channel of the medium outlet and is arranged to convey the medium condensed in the condensation section (C) to the medium outlet.

24. A plate heat exchanger according to claims 21 and 23, characterized in that the medium outlet is provided in a central position, wherein the guide gasket (53) slopes downwardly to the port channel of the medium outlet from two positions which

are located in the proximity of a respective one of said collection ports (51).

25. A plate heat exchanger according to any one of claims 18 to 24, characterized in that the plate heat exchanger is designed to convey the medium through the second plate interspaces (6) of the condensation section (C) before the medium is conveyed into the first plate interspaces (5) of the evaporation section (E), wherein the medium forms the cooling medium.

Fig 1

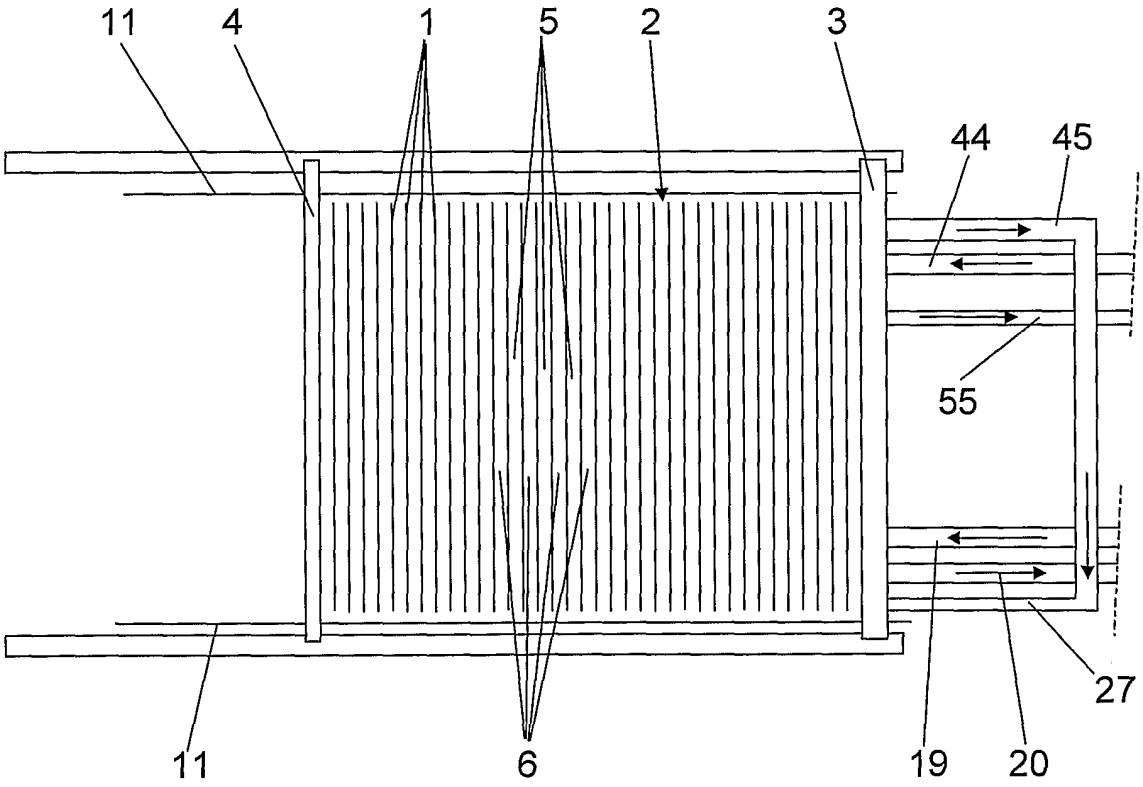
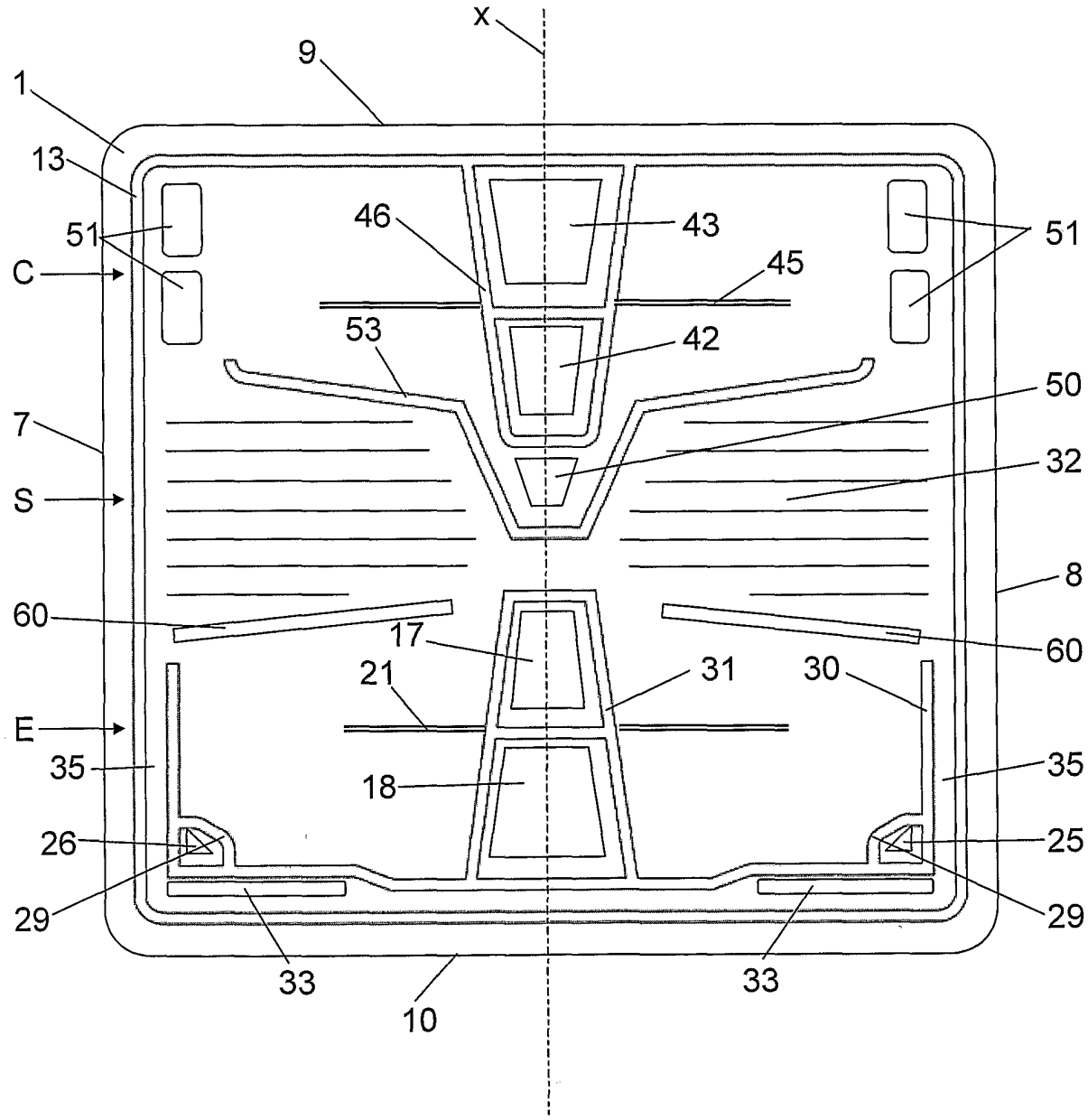


Fig 2


x
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1
13
51
C
46
43
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51
53
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S
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E
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18
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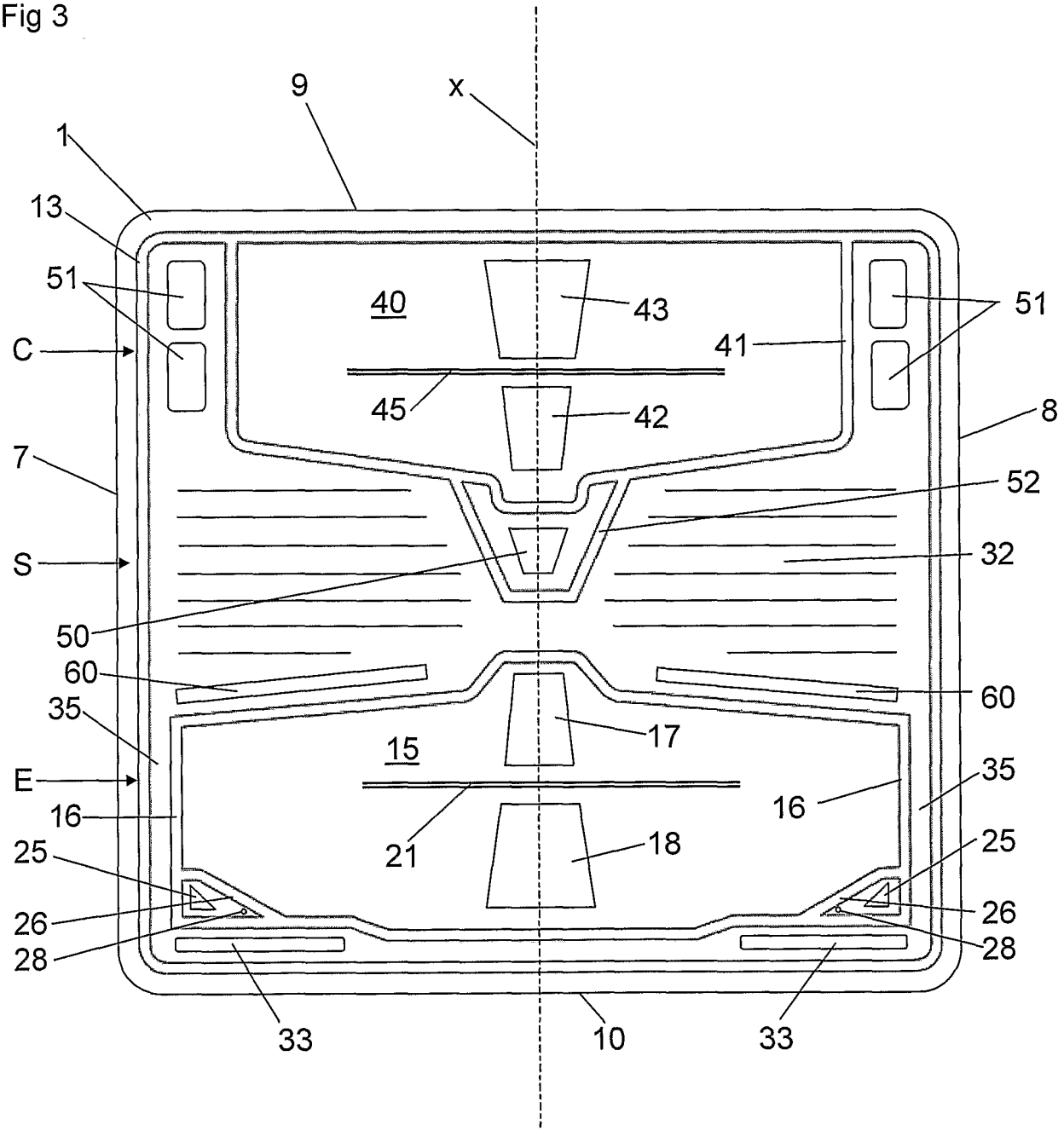
10

Fig 3


9
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2006/000351

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F28D, F28F, B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004070302 A1 (ADVANCED FLOW TECHNOLOGY INC.), 19 August 2004 (19.08.2004), whole document ---	1-25
A	US 3150028 A (F.J. WENNERBERG), 22 Sept 1964 (22.09.1964), column 1, penultimate paragraph ---	1-25
A	US 6536511 B1 (M. NILSSON ET AL), 25 March 2003 (25.03.2003), column 3, line 11 - line 13 ---	1-25
A	EP 1085286 A1 (EBARA CORPORATION), 21 March 2001 (21.03.2001), figure 6 ---	1-25

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 June 2006	26 -06- 2006
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Annette Riedel / JA A Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2006/000351

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5333683 A (P. ARRIULOU ET AL), 2 August 1994 (02.08.1994), column 1, line 61 - line 62	1-25
A	GB 2132327 A (APV COMPANY LIMITED), 4 July 1984 (04.07.1984), page 1, line 86 - line 116	1-25
A	US 4763488 A (A.M. JOHNSTON), 16 August 1988 (16.08.1988), column 2, line 14 - line 19	1-25

International patent classification (IPC)

F28D 9/00 (2006.01)
B01D 1/22 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

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