

Arrangement for passing a first liquid close to a second
liquid without intermixing

5 This invention relates to an arrangement for permitting a first liquid
to flow close to a second liquid, but without being mixed therewith, in
order, for example, to recover freshwater by distillation of sea water
or to transfer heat from a relatively hot liquid to a relatively cold
liquid. The arrangement is of a kind which comprises a first number of
10 plates intended for the first liquid, and a second number of plates
intended for the second liquid, which are located between, but separat-
ed from plates in the first number of plates. All plates are well
separated from each other by means of special separating pieces located
between each two of said plates.

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It is previously known to recover freshwater from sea water by low-
temperature distillation, see e.g. SE-PS 387 927, in which an arrange-
ment is disclosed which comprises a plurality of plane-parallel plates,
on every first one of which relatively cold freshwater flows and on
20 every second one of which relatively warm, solar-heated sea water flows.

It is necessary that the plates with sea water and, respectively, fresh-
water flow thereon are separated from each other, in order to prevent
intermixing of the two flows. The said patent specification describes
distance members, which consist of grooves turned upside down, and it
25 also describes special means for distributing the liquids to the
different plates and corresponding collecting means.

The object of the present invention is to provide devices of the afore-
mentioned kind but so modified that a higher efficiency may be
achievable through a simplified and more compact construction.

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According to the present invention there is provided an
arrangement for permitting a first liquid to flow close to
a second liquid, but without being intermixed therewith,
comprising first and second pluralities of plates intended
35 for the first and second liquids respectively, the plates

of the two series being mutually intercalated, all plates being separated from the adjacent plate(s) by separating pieces located between them, and wherein each separating piece comprises three parallel plate-form elements and a frame which extends around them, said three elements being:

5 (a) an outer porous and hydrophobic plastic diaphragm with a void radius such that liquid water cannot pass through the plastic diaphragm at the hydrostatic pressures prevailing in the arrangement, while passage of water vapour is possible; (b) an intermediate distance network of plastic; and (c) an outer plastic foil; said frame being provided in an upper region with inflow holes for air, and in a lower region with outflow holes for water.

An embodiment of the invention will now be described in greater detail with reference to the accompanying drawings, in which

- Fig. 1 schematically shows the location of plates and separating pieces relative to each other and supply and discharge means,
- Fig. 2 is a sectional lateral view of a separating piece,
- Fig. 3 is a front view of a portion of a distance network comprised

20 in a separating piece, and

- Figs. 4, 5, 6 are front views of the frame configuration of a separating piece, of a plate of a first group of plates and of a plate of a second group of plates.

25 The arrangement according to Fig. 1 comprises a plurality of plates prior to their mechanical assembly to one unit. An outer plate 10 includes a first supply means 101, a second supply means 103, a first discharge means 104 and a second discharge means 102. A second outer plate 14 includes corresponding supply means 141, 143 and discharge means 144, 142.

30 Between the said outer plates a first plurality of plates 11, a second plurality of plates 12 and separating pieces 13 are located. The drawing shows only one plate 11, one plate 12 and one separating piece 13, but in reality there are a great number of plates 11, which by means of separating pieces 13 are spaced from an equal number of tightly abutting

35 plates 12.

As appears from Fig. 2, a separating piece 13 comprises a frame 130 about plate-shaped mutually plane-parallel partial pieces, viz. an outer

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porous hydrophobic (water repellant) plastic diaphragm 21, an intermediate distance network 22 of plastic and an outer thin plastic foil 23. The frame 130 includes in its upper portion inlet holes 1301 for air and in its lower portion outlet holes 1302 for water.

5 The plastic diaphragm 21 consists of a porous material with a void radius of within the range 2 to 5 μ m.

The distance network 22 comprises vertical strips 222, see also Fig. 3, and perpendicularly thereto slightly downward directed cross-strips 221. The network has a thickness of about 1 to 2 mm, and the extension of the
10 cross-strips 221 perpendicularly to their vertical strips 222 is about 0,5 to 1 mm.

The ratio of the distance between the cross-strips 221 and the distance between the vertical strips 222 preferably is chosen to be about 20, for example the cross-strip distance = 50 mm, and the vertical strip distance
15 = 2 to 4mm.

The plastic foil 23 consists of polyethylene and has a thickness of about 0,1 mm.

As appears from Fig. 4, the frame 130 for a separating piece 13 is provided with four through holes 131, 132, 133, 134. These holes have no connection to
20 the space defined by the frame and intended for the partial pieces 21, 22, 23.

Fig. 5 shows a plate 11 comprised in said first plurality of plates. Said plate consists of a frame 110 with four through holes 111, 112, 113 and 114 in the periphery of the frame.

25 Two of said holes, viz. the holes 111 and 114, have connection to a depression (recess) 115 extending over a large part of the plate, while the remaining holes 112, 113 have no such connection.

Fig. 6 shows a plate 12 comprised in said second plurality of plates. This plate consists of a frame 120 with four through holes 121, 122, 123, 124 in
30 the periphery of the frame.

The holes 122 and 123 have connection to a depression in the plate, while the holes 121 and 124 have no such connection.

The plates 11 and 12 are identical relative to each other, but so turned in relation one to the other that holes 122, 123 with connection to the



depression of the plate in plate 12 correspond to holes 112,113 without connection to the depression of the plate in plate 11. As a direct consequence, the holes 111,114 in the plate 11 correspond to the holes 121 and 124 in the plate 12.

- 5 The separating pieces 13 prevent direct intermixing of, for example, relatively warm sea water with relatively cold freshwater at the production of freshwater by distillation of the sea water.

The porous hydrophobic plastic diaphragm 21 is located between a plate 11 for the warm sea water and the distance network 22 and has the object to 10 permit the passage of water vapour.

The distance network 22 has the object to provide an air gap between the diaphragm 21 and the plastic foil 23.

The plastic foil 23 has the object to act as condensation surface.

Due to the fact that the plastic diaphragm 21 and the plastic foil 23 15 include the distance network 22 (i.e. an air gap), a detached condensation chamber is formed where the water vapour is condensed out which has no contact with the warm water side nor with the cold water side. This implies in principle that both the warm water side and the cold water side can be charged with sea water. Owing to the design of the 20 separating piece, there is no risk that the plastic diaphragm is depleted of air and entirely or partially filled with liquid. The plastic foil 23 shall be so thin that the condensation heat easily can be conducted away by the cold liquid. A uniform water contact against the foil is obtained when the foil is dull finished.

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CLAIMS:

1. An arrangement for permitting a first liquid to flow close to a second liquid, but without being inter-
5 mixed therewith, comprising first and second pluralities of plates intended for the first and second liquids respectively, the plates of the two series being mutually intercalated, all plates being separated from the adjacent plate(s) by separating pieces located
10 between them, and wherein each separating piece comprises three parallel plate-form elements and a frame which extends around them, said three elements being:
(a) an outer porous and hydrophobic plastic diaphragm with a void radius such that liquid water cannot pass
15 through the plastic diaphragm at the hydrostatic pressures prevailing in the arrangement, while passage of water vapour is possible; (b) an intermediate distance network of plastic; and (c) an outer plastic foil; said frame being provided in an upper region with
20 inflow holes for air, and in a lower region with outflow holes for water.

2. An arrangement as defined in claim 1, wherein the porous plastic diaphragm has voids with radii within the
25 range 2 to 5 μm ; the distance network has a thickness of 1 to 2 mm and consists of vertical strips and cross-strips perpendicular thereto, the cross-strips being slightly downwardly directed and projecting 0.5 to 1 mm perpendicularly to the vertical strips; and the plastic
30 foil has a thickness of 0.1 mm and consists of polyethylene.

3. An arrangement as defined in claim 1, or claim 2 wherein the plates of said first and second pluralities
35 each comprise a frame with four through holes in its periphery, two of which holes communicate with a



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depression extending over a large part of the plate,
while the two remaining holes do not; the plates in the
second plurality being oriented so that the communicating
holes thereof are in register with non-communicating
5 holes in the first plurality of plates, and vice versa;
and wherein the frames of the separating pieces are
provided with four through holes which correspond to
the holes in said two pluralities of plates; and wherein,
10 in use, the two pluralities of plates with intermediate
separating pieces are mechanically held together
to form a liquid-tight unit, there being first
inflow means and first outflow means for a first liquid
communicating with respective ones of said communicating
15 holes in the first plurality of plates; and second
inflow means and second outflow means for a second
liquid communicating with respective ones of said
communicating holes in the second plurality of plates.

4. An arrangement for permitting a first liquid to
20 flow close to a second liquid without intermixing
substantially as herein described with reference to and
as illustrated in the accompanying drawings.

5. Apparatus for water distillation comprising an
25 arrangement according to any preceding claim.

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