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**Datasheet for the decision
of 16 June 2010**

Case Number: T 1467/08 - 3.3.06

Application Number: 97121495.2

Publication Number: 0848974

IPC: B01D 3/26

Language of the proceedings: EN

Title of invention:

Two-Phase downflow liquid distribution device

Patentee:

Haldor Topsoe A/S

Opponent:

UOP LLC

Headword:

Liquid distribution device/HALDOR TOPSOE

Relevant legal provisions:

EPC Art. 123(2), 54, 56

Relevant legal provisions (EPC 1973):

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Keyword:

"Added subject-matter (no): amended claim supported by the teaching of the figures of the application as filed read in combination with its description and its claims"

"Novelty (yes)"

"Inventive step (yes)"

Decisions cited:

T 0983/04, T 0397/89

Catchword:

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Case Number: T 1467/08 - 3.3.06

D E C I S I O N
of the Technical Board of Appeal 3.3.06
of 16 June 2010

Appellant:
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
30 May 2008 concerning maintenance of the
European patent No. 0848974 in amended form.

Composition of the Board:

Chairman: P.-P. Bracke
Members: L. Li Voti
U. Tronser

Summary of Facts and Submissions

- I. The present appeal is from the decision of the Opposition Division to maintain in amended form the European patent no. 848 974 concerning a two-phase downflow liquid distribution device.
- II. In its notice of opposition the Opponent sought revocation of the patent on the grounds of Article 100(a) EPC, because of lack of novelty and inventive step of the claimed subject-matter, and of Article 100(c) EPC and referred *inter alia* to the following document
- (3): US-A-3218249.
- III. The Opposition Division found in its decision *inter alia* that
- the claims according to the then pending auxiliary request complied with the requirements of Article 123(2) EPC;
 - moreover, the subject-matters of these claims were novel and involved an inventive step over the cited prior art.
- IV. An appeal was filed against this decision by the Opponent (Appellant). In its statement of the grounds of appeal the Appellant cited some additional documents, the teaching of which was indicated to be similar to that of document (3).

V. The independent claim 1 of the set of 4 claims submitted by the Respondent during oral proceedings as the sole request reads as follows:

"1. A liquid-vapour distribution device for use in two-phase concurrent downflow vessels which liquid-vapour distribution device comprises:

a level, horizontal tray fabricated and installed so as to be essentially leak free at the junctions of the tray and vessel wall;

said horizontal tray being perforated with holes of equal size; and

the holes being evenly spaced distributed over the surface of the horizontal tray, each perforation through the horizontal tray being fitted with a vapour lift tube, consisting of one or two elongated upflow legs and one elongated downflow leg creating one or two upflow zones, a transition zone and a downflow zone, each downflow leg having same geometric cross sectional shape as the holes and being attached to the horizontal tray by means to make a leak proof seal and the one or two upflow legs of the vapour lift tube have one or more vertical slots cut into its side;

characterised in that the one or two upflow legs of the vapour lift tube are fitted along the downflow leg so that each up flow leg is non-concentric with respect to the downflow leg, that the bottom of the upflow zone portion terminates above the level of the horizontal tray so that the liquid is not impeded from flowing into the lower portion of the upflow leg, that the vapour lift tube is an "M" or an inverted "U" shaped

device, and that the slot height will end at or below the elevation of the top of the downflow leg."

Dependent claims 2 to 4 relate to particular embodiments of the subject-matter of claim 1.

VI. The Appellant submitted in writing and orally *inter alia* the following:

- the wording of claim 1 requires that

(A): the holes perforating the horizontal tray are "evenly spaced distributed over the surface of the tray",

(B): the upflow and downflow legs are "elongated" and

(C): "the one or two upflow legs of the vapour lift tube are fitted along the downflow leg so that each up flow leg is non-concentric with respect to the downflow leg";

- the technical features (A) to (C) are either not disclosed in the application as filed or inadmissible generalisations of the original disclosure; therefore, as similarly found in decisions T 397/89 and T 983/04, the claimed subject-matter contravenes the requirements of Article 123(2) EPC;

- document (3) discloses a liquid-vapour distribution device containing a bubble cap tray wherein the cap of each bubble cap is centred concentrically on a downcomer; however, it is

explicitly mentioned in this document that in operation the centre of the caps could occasionally not coincide with the centre of the downcomer, in which case the upflow and downflow legs would be non-concentric; moreover, this document discloses also that the bubble cap can have a cap and a downcomer of different geometrical shapes and overlapping dimensions, including a bubble cap having a cap of rectangular cross-section and a cylindrical downcomer of such dimensions to correspond with the embodiments represented in figures 4 or 5 of the patent in suit; the subject-matter of claim 1 thus lacks novelty;

- furthermore, none of the alleged technical advantages indicated in the patent in suit have been convincingly achieved by means of the claimed subject-matter;

- therefore, it would have been obvious for the skilled person, in the light of the overall teaching of document (3), to try a bubble cap tray using bubble caps having such an arrangement of the caps and downcomers to correspond with the embodiments of figures 4 or 5 of the patent in suit as alternative to the concentric bubble caps described in the examples of this document.

VII. The Respondent (Patent Proprietor) submitted in writing and orally *inter alia* that

- it would have been clear to the skilled reader that the specific teaching of the figures was

generally applicable to the invention; therefore, the wording of claim 1 was directly and unambiguously derivable from the figures of the application as filed read in combination with its description and its claims;

- document (3) disclosed bubble caps having a cap centred concentrically on a downcomer and forming an annular upflow zone between the outer wall of the downcomer and the inner wall of the cap, which upflow zone surrounded the downcomer; therefore, it did not disclose a device having one or two upflow legs fitted along the downflow leg so that each upflow leg is non-concentric with respect to the downflow leg as required in claim 1; moreover, there was not a specific disclosure in this document of a combination of cap and downcomer that would result in an embodiment corresponding with any of figures 4 or 5 of the patent in suit; therefore, the claimed subject-matter was novel over document (3);

- moreover, in the light of the teaching of document (3) which was clearly directed to the use of bubble caps having a cap centred concentrically on a downcomer and forming an annular upflow zone between the outer wall of the downcomer and the inner wall of the cap, it would not have been obvious for the skilled person to envisage as an alternative other configurations of cap and downcomer not having such a concentric arrangement and such an annular upflow zone;

- therefore, the claimed subject-matter involved also an inventive step over the cited prior art.
- VIII. The Appellant requests that the decision under appeal be set aside and that the patent be revoked.
- IX. The Respondent requests that the patent be maintained on the basis of the claims according to the request submitted during oral proceedings.

Reasons for the Decision

1. *Article 123(2) EPC*

- 1.1 The Appellant submitted that the following features (A) to (C) of claim 1:

(A): the holes perforating the horizontal tray are "evenly spaced distributed over the surface of the tray",

(B): the upflow and downflow legs are "elongated" and

(C): "the one or two upflow legs of the vapour lift tube are fitted along the downflow leg so that each up flow leg is non-concentric with respect to the downflow leg",

would contravene the requirements of Article 123(2) EPC.

No objections were raised against the other features of the claim.

It is the established case law of the Boards of Appeal of the EPO that the relevant question to be decided in assessing whether an amendment adds subject-matter extending beyond the content of the application as filed is whether such an amendment was directly and unambiguously derivable from the whole content of the application as filed including description, claims and drawings (see Case Law of the Boards of Appeal of the EPO, 5th edition, 2006, III.A.2, A.2.1 and A.1.1, first paragraph).

It thus should be evaluated if the features (A) to (C) and their combination with the other features of the claim are directly and unambiguously derivable from the application as filed.

- 1.2 Feature (A). Claim 1 of the application as filed requires that the holes perforating the horizontal tray are "distributed on an optimized pattern over the surface of the horizontal tray" instead of being "evenly spaced distributed over the surface of the horizontal tray" as required in claim 1 of the sole request.

However, the description of the application as filed discloses that the horizontal tray is perforated by evenly spaced holes across its surface (page 2, line 32; reference being made to the published version of the application as filed) and that an optimized pattern requires, in addition to the already mentioned even spacing between all perforations, also an even ratio, i.e. a constant ratio, of perforation hole area to horizontal tray area across the entire horizontal tray (page 2, lines 34 to 36).

According to the wording of claim 1 of the sole request the holes have to be evenly distributed, thus providing a constant spacing between all perforations; moreover, since according to the claim the evenly distributed holes are of equal size (see point V above: lines 7 and 8 of claim 1), the ratio of the perforation hole area to horizontal tray area must necessarily be constant throughout the entire horizontal tray.

Therefore, the wording of claim 1 of the sole request corresponds to the optimized pattern disclosed in the application as filed.

The Board concludes that the wording of the amended claim 1 with regard to feature (A) does not contravene the requirements of Article 123(2) EPC.

- 1.3 Feature (B). The Board remarks that the application as filed does not use in its claims the wordings "upflow leg" or "downflow leg" but the wordings "upflow/transition tube portion" and "downflow tube portion", wherein said tube portions are specified to be a tube or channel, i.e. a tubular passage (see claim 2, lines 2 to 3 and claim 4, lines 1 to 2).

On the other hand, the description teaches that figures 1 and 4 represent the design concepts of the vapour lift tubes of the invention, which are either an inverted "U" or an "M" shaped device, and uses with reference to these figures the term "leg" instead of the wording "tube portion" (see page 2, line 50 and page 3, lines 10 to 11). Therefore, the skilled reader would derive directly and unambiguously that the term

"leg" has in the application as filed the same meaning as "tube portion" and that the "upflow" and "downflow" legs represent a tube or channel wherein the fluid flows upwards and downwards, respectively.

As correctly indicated by the Appellant the application as filed does not use the term "elongated" with respect to the upflow and downflow legs. However, since figures 1 and 4 represent the design concepts of the vapour lift tubes of the invention, the skilled person would consider the teaching of these figures to be generally applicable to all the embodiments of the invention.

In the Board's view, it is directly derivable from figures 1 and 4 that the upflow and downflow legs must be higher than wider, i.e. that they must be elongated. In fact, even if specific dimensions cannot be derived from the drawings, figures 1 and 4, by representing the general constructional aspects of the vapour lift tubes of the invention, show also the generic shape of an inverted "U" or "M" device of the invention. Therefore, they show also any relationship of the different parts of the device which can be appreciated by the skilled person without need of a precise dimensional figure. Such a generic, higher than wider, shape of the legs of figures 1 and 4 is found also in the other figures of the invention representing similar vapour lift tubes.

Moreover, the Board finds that the word "elongated" referred to a leg being a tube or a channel designated as being an "upflow leg" or "downflow leg", i.e. a leg wherein a fluid flows upwards or downwards, can only concern the relative dimension of the leg in the upward

or downward direction of the fluid flow with respect to its dimension across this flow, i.e. it can only concern its height with respect to its width, since the consideration of any other possible directional axis has in the present case no technical meaning. The Appellant also did not submit any evidence that the skilled person could understand the wording "elongated leg" in a different way.

Therefore, the Board concludes that feature (B) is also directly and unambiguously derivable from the application as filed.

- 1.4 Feature (C). The Board remarks that claim 4 of the application as filed, dependent on claim 2, already mentioned hereinabove, requires that the upflow tube or channel of an inverted "U" or "M" shaped vapour lift tube produces an upflow zone which is adjacent to the downflow tube. This is confirmed by the passage of the description relating to figure 1, which as explained above, represents the general concept of the vapour lift tube design, according to which the vapour and liquid mix in the shorter leg (upflow leg) with the vapour lifting the liquid to flow up and over **the connecting wall** between the shorter and longer legs (upflow and downflow legs) (page 3, lines 2 to 4). Figure 4 represents the equivalent embodiment relating to the "M" shaped device (see page 3, lines 9 to 11).

Therefore, the application as filed discloses that the upflow leg, i.e. the tube or channel producing the upflow zone, is adjacent to the downflow leg. This means that, as shown in figures 1 and 4, it must be in contact over its whole length with the downflow leg and

it must form a common wall along the contact surface. This fact is correctly expressed in feature (C) by requiring that each upflow leg is fitted along the downflow leg.

Feature (C) further requires that each upflow leg is non-concentric with respect to the downflow leg.

The word "non-concentric" can be found in the application as filed only with regard to the embodiment of figure 3 consisting of a downflow tube fitted along the inside wall of a wider upflow tube, the two tubes not having the same central axis in the direction of the fluid flow, i.e. not being concentric.

Even though all other embodiments of the invention specifically disclosed in the figures do not relate exclusively to cylindrical tubes, it is directly derivable from these figures that the upflow legs have a different central axis in the direction of the fluid flow than the downflow legs and that therefore they are non-concentric too.

The Board cannot accept in this respect the Appellant's argument that there are other axes which could be considered and that therefore the invention would cover embodiments not disclosed in the application as filed.

In fact, the only axis of these legs which the skilled person could reasonably consider in reading the application as filed is, as explained in point 1.3 above, the axis in the upward or downward direction of the fluid flow, i.e. that passing through the centre of the cross-section of each leg.

Moreover, the Board remarks that the "M" shaped device, having two distinct upflow legs fitted along the downflow leg cannot have concentric legs. As to the "U" shaped device, such a device also cannot have concentric legs since the upflow leg can be fitted either along the outside wall of the downflow leg, in which case the centres of the relative cross-sections will be far apart, or along the wall of a narrower downflow leg contained within the upflow leg in which case it is also not possible to have concentric legs.

The Board concludes that, in fact, the partial feature "non-concentric" of feature (C) results automatically from the other technical features of the claim.

Therefore, also feature (C) is directly and unambiguously derivable from the application as filed.

- 1.5 The Board remarks further that the decisions T 397/89 and T 983/04 cited by the Appellant are in line with the established jurisprudence of the Boards of Appeal of the EPO and confirm that the amendments to a claim must be directly and unambiguously derivable from the application as filed (see T 983/04, point 3.4 and 3.7 of the reasons) and, in particular, that a generalisation of a teaching disclosed in the application as filed must be supported by the application as read by the skilled person (see T 397/89, point 2.4 of the reasons).
Moreover, decision T 397/89 confirms that figures may also be considered to contain a general teaching for specific technical features (see point 4.2 of the reasons).

Therefore, these decisions do not contradict the Board's finding that the amendments discussed hereinbefore, based at least in part on the figures of the application as filed, can be generalised to all the embodiments of the invention under the circumstances of the present case.

- 1.6 The Board remarks that the Appellant did not contest that the other features of claim 1 as well as the subject-matters of claims 2 to 4 are supported by the application as filed.

The Board remarks also that claims 1 to 4 correspond to claims 1 to 4 of the set of claims already found by the Opposition Division to comply with the requirements of Article 123(2) EPC.

The Board thus is convinced that all claims comply with the requirements of Article 123(2) EPC.

2. *Novelty*

- 2.1 Claim 1 relates to a liquid-vapour distribution device for use in two-phase concurrent downflow vessels comprising a perforated horizontal tray, each perforation being fitted with a vapour lift tube, wherein each elongated upflow leg of the vapour lift tube is fitted along the elongated downflow leg (see point V above). This means, as already explained above, that the tube or channel, i.e. tubular passage, forming the upflow zone must be in contact over its whole length with the downflow leg and form a common wall along the contact surface.

2.2 To the contrary, document (3) discloses a similar device wherein the tray perforations are fitted with a so-called bubble cap, which consists of a downcomer (downflow leg) and a cap positioned on the downcomer to form an annular upflow zone between the internal wall of the cap and the outer wall of the downcomer, which upflow zone surrounds the downcomer (see figures 2, 13 as well as claim 8). Such a circular annular upflow zone not having a tubular form cannot be considered, in the Board's view, as an upflow tube or channel in contact over its whole length with the downflow leg and forming a common wall along the contact surface. Therefore, it cannot represent the upflow leg of the patent in suit.

As a consequence, even if the cap of the bubble caps can be occasionally not positioned concentrically in operation as mentioned in document (3) (column 10, lines 17 to 21), the embodiments disclosed in document (3) which always comprise such an annular upflow zone cannot destroy the novelty of the subject-matter of claim 1.

2.3 The conclusion drawn in point 2.2. above applies also to the embodiments of document (3) wherein some lugs or other means are used to keep the cap in its concentric position since these means do not form distinct tubes or channels in contact over their whole length with the downflow leg but are instead contained themselves within the annular upflow zone mentioned above (figure 13; column 6, lines 73 to 75).

For similar reasons the other documents cited in writing by the Appellant, which documents were considered to be similar to the disclosure of document (3) (see point IV above) and were no longer discussed during oral proceedings, cannot destroy the novelty of claim 1.

- 2.4 The Appellant submitted during oral proceedings that according to the teaching of document (3) the downcomer and the cap of the bubble cap devices could have different geometrical shapes and would include a cap having a rectangular cross-section and a circular downcomer. Moreover, they could have such dimensions to embrace embodiments not having any space left between two sides of the cap inner wall and the downcomer wall, in which case the upflow zone would be present as two distinct upflow legs formed between the other two sides of the cap inner wall and the downcomer wall. Such an embodiment would correspond to any of figures 4 or 5 of the patent in suit in which there are two upflow legs adjacent to the downflow leg.

The Board remarks that document (3) does not contain any explicit teaching of such a combination of a cap having a rectangular cross-section with a circular downcomer; moreover, the dimensions given for the cap in document (3) regard only circular caps but not caps of different geometrical shape (see column 6, lines 24 to 27 and column 8, lines 43 to 51).

Therefore, document (3) does not disclose directly and unambiguously an embodiment as submitted by the Appellant.

2.5 The Board concludes that the subject-matter of claim 1 is novel over the cited prior art.

3. *Inventive step*

3.1 The present invention concerns a liquid distribution tray device that improves liquid distribution over the cross sectional area of a vessel following the tray. The device also intimately contacts the liquid and vapour phases to achieve thermal and compositional equilibrium (see paragraph 1 of the patent in suit).

One example of a liquid distribution device of the prior art is represented by the so-called bubble cap tray. This device uses a number of bubble caps laid out on a regular pitched pattern on a horizontal tray. The bubble cap is a cap centred concentrically on a standpipe and having its sides slotted for vapour flow. Liquid flows under the cap and, together with the vapour, flows upward in the annular area and then down through the centre of the standpipe (paragraphs 5 and 6).

According to the description the technical problem underlying the invention is considered to be the provision of an alternative device capable of providing a better distribution of liquids than a bubble cap tray and which could be made easier and would cost less (see paragraph 21).

During oral proceedings the Respondent submitted also that such a device would offer more process flexibility as suggested in paragraph 17 of the patent in suit.

3.2 As accepted by all parties, document (3), relating to the use of a bubble cap tray of the type indicated in the discussion of the prior art in the description for the same purpose as the present invention, represents the most suitable starting point for the evaluation of inventive step.

The Board thus has no reason not to take document (3) as the most reasonable starting point for the evaluation of inventive step.

3.3 The Board remarks that the subject-matter of claim 1 does not contain as a technical feature any specific dimensions for the claimed device; therefore, it cannot be concluded that the vapour lift tube of the invention is necessarily smaller than a conventional bubble cap and that more of them can be positioned on a tray than the known bubble caps with a consequent better liquid distribution as suggested in the description of the patent in suit (page 3, lines 34 to 38).

Moreover, the tests present in the patent in suit, which were implemented during examination with the dimensions of the tested device of the invention, cannot prove this effect as the dimensions of the downflow leg and of the upflow zone as well as those of the slots present in the upflow zone of the comparative bubble cap of example III of document (3) are very much different from those of the device of the invention.

Therefore, it cannot be established if any of the distinguishing technical features is responsible for the improvement shown in these tests and it cannot be concluded that all the dimensionless embodiments of the

invention can provide such an advantage over the embodiment of example III of document (3).

As regards the alleged advantage that the inventive device would be easier to construct, for example, because it is not necessary to provide a concentric cap and means for securing the cap in a concentric position, the Board remarks that at least some of the embodiments of the invention also require a careful selection of the dimensions in order to reach a non-concentric arrangement of the upflow and downflow legs which have to be in contact along one surface like, for example, in the case of the embodiments of figures 3 or 5 of the patent in suit, which arrangements cannot be considered to be easier to achieve than that of a bubble cap wherein the cap is simply centrally positioned on the top of the downcomer. Therefore, it cannot be concluded that all the embodiments covered by claim 1 can be easier constructed than the bubble caps of document (3).

Moreover, because of the absence of specific dimensions in the claim, it cannot be concluded that any embodiment of the invention would cost less than a conventional bubble cap.

As regards process flexibility, it cannot be disputed that the teaching of document (3) includes devices having different geometrical shapes (column 8, lines 48 to 51). Therefore, it also offers similar process flexibility as the devices of the present invention.

Since the alleged technical problem underlying the invention has not been convincingly solved by the claimed subject-matter, the technical problem

underlying the invention can only be defined as the provision of an alternative two-phase downflow liquid distribution device.

The Board has no doubt that this technical problem has been successfully solved by means of the subject-matter of claim 1.

- 3.4 As explained above, document (3) relates explicitly only to concentric bubble caps which have an annular upflow zone between the cap inner wall and the downcomer outer wall, which upflow zone surrounds the downcomer, these devices differing from the subject-matter of claim 1 insofar as they have not one or two upflow legs being tubes or channels fitted along the downflow leg (see figures 1, 2, 4 and 13; claims 8, 11 and 13; column 1, lines 24 to 44; column 3, lines 17 to 19; column 5, lines 57 to 59; column 8, lines 66 to 69; column 10, lines 17 to 28).

Document (3) does not contain any suggestion for the skilled person to prepare a device having upflow legs fitted along the downflow leg instead of such an annular upflow zone.

Moreover, even though the dimensions given for the circular caps and for a cylindrical downcomer overlap (column 6, lines 24 to 27 and column 8, lines 43 to 47), it would have been clear to the skilled person that the diameter of the circular cap must be necessarily larger than the diameter of the downcomer in order to permit the overflow of the liquid from the upflow zone into the downcomer.

Finally, document (3) does not contain any suggestion to apply the dimensions concerning the diameter of a circular cap to caps of other geometrical shape. Furthermore, it is the Board's view that the skilled person, by selecting the dimensions for caps of different geometrical shape, would try as alternative a device having dimensions permitting to obtain an upflow zone similar to that of the concentric bubble caps with circular caps, i.e. having only one annular upflow zone surrounding the downcomer, which embodiment is not covered by the subject-matter of claim 1 of the patent in suit wherein the upflow legs must be tubes or channels fitted along the downflow leg.

Therefore, the skilled person would not have found any suggestion in document (3) to prepare as alternative a device as claimed in the patent in suit.

The Board concludes that the subject-matter of claim 1 involves an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is maintained on the basis of the claims according to the request submitted during oral proceedings.

The Registrar:

The Chairman:

G. Rauh

P.-P. Bracke