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Datasheet for the decision of 28 September 2007

Case Number: T 0622/03 - 3.3.06

Application Number: 98906000.9

Publication Number: 1015087

IPC: B01D 3/22

Language of the proceedings: EN

Title of invention:
Improved mass transfer device

Appellant:
Koch-Glitsch, LP

Headword:
Fixed valve/KOCH-GLITSCH

Relevant legal provisions:
EPC Art. 56, 123(2)

Keyword:
"Inventive step (main request): no - improved performance not due to the only distinguishing feature"
"Added subject-matter (first auxiliary request): yes"
"Inventive step (second auxiliary request): yes - improved performance linked to distinguishing features"

Decisions cited:
-

Catchword:
-

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Case Number: T 0622/03 - 3.3.06

D E C I S I O N
of the Technical Board of Appeal 3.3.06
of 28 September 2007

Appellant: Koch-Glitsch, LP
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 30 January 2003 refusing European application No. 98906000.9 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P.-P. Bracke
Members: L. Li Voti
J. Van Moer

Summary of Facts and Submissions

I. This appeal lies from the decision of the Examining Division to refuse European patent application no. 98 906 000.9, relating to a mass transfer tray.

II. In its decision, the Examining Division, referring to

document (2): US-A-3463464,

found *inter alia* that:

- the application as originally filed did not contain any support for a mass transfer tray according to claim 9 wherein the shape of a perforation had to be different from that of the cover member and the upstream support leg of the cover member was not at least 5% longer than the downstream support leg as required in the original claim 9; claim 9 thus did not comply with the requirements of Article 123(2) EPC;

- the invention described in document (2) dealt with the reduction of the weeping rate and with the provision of a fixed valve which was simple to manufacture and did not need to have parts separately manufactured;

- document (2) disclosed a mass transfer tray containing fixed valves having trapezoidal perforations and bridge members associated therewith struck upwardly from the tray plate and having the same size and shape as the perforations, the width of the upstream support leg of the bridge member being therefore the same as the maximum transverse width of the perforation;

- therefore, the subject-matter disclosed in document (2) differed from the subject-matter of claim 1 according to the present application insofar as the upstream support leg of the cover member was not at least 5% wider than the greatest width of the perforation transverse to the design flow direction; in fact, document (2) did not suggest to use fixed valves with an upstream support leg being wider than the greatest width of the perforation transverse to the design flow direction;

- however, it was known from document (2) that the weeping rate of the tray could be reduced and its efficiency increased by providing a deflector upstream of each perforation capable of shielding the perforations from the approaching liquid;

- therefore, if the skilled person would have been prepared to accept a more expensive construction of the fixed valve, it would have been obvious to him to depart from the teaching of document (2) and to select an alternative construction of the bridge member of the fixed valve in order to optimize the shielding of the perforation, for example, by providing a separately manufactured bridge member having an upstream supporting leg having a width much larger than the greatest width of the perforation transverse to the design flow direction;

- therefore, the claimed subject-matter did not involve an inventive step.

III. An appeal was filed against this decision by the Applicant (Appellant).

The Appellant submitted with the letter dated 17 April 2007 an amended set of 10 claims to be considered as main request and a first declaration by Mr. Nieuwoudt.
This declaration contained an experimental report wherein a mass transfer tray according to the present application (**PROVALVE** tray) was compared with one according to the teaching of document (2).

A further declaration by Mr. Nieuwoudt, containing further experimental evidence, was submitted with the letter of 28 August 2007.

During the oral proceedings held before the Board on 28 September 2007 the Appellant filed two new sets of amended claims to be considered as first and second auxiliary requests, respectively.

Claim 1 of the set of 10 claims according to the main request reads as follows:

"1. A mass transfer tray having a plurality of perforations therein and a design flow direction across the tray past the perforations and, spanning each perforation, a bridge member comprising first and second support legs connected by a solid cover member oriented in the design flow direction in the vicinity of the perforation and wide enough to completely cover the perforation, the legs of said bridge member being attached to the tray so as to span the perforation and anchor the bridge member in place, the first support

leg being a solid member located upstream of the perforation in the design flow direction and having a width that is at least 5% wider than the greatest width of the perforation transverse to the design flow direction and the second support leg being located downstream of the perforation."

Claim 1 of the amended set of 10 claims according to the first auxiliary request differs from that according to the main request insofar as it requires that the second support leg has the same or a narrower width as the first support leg.

Claim 1 of the amended set of 9 claims according to the second auxiliary request reads as follows:

"1. A mass transfer tray having a plurality of perforations therein and a design flow direction across the tray past the perforations and, spanning each perforation, a bridge member comprising first and second support legs connected by a solid cover member oriented in the design flow direction in the vicinity of the perforation and wide enough to completely cover the perforation, the legs of said bridge member being attached to the tray so as to span the perforation and anchor the bridge member in place, the first support leg being a solid member located upstream of the perforation in the design flow direction and having a width that is at least 5% wider than the greatest width of the perforation transverse to the design flow direction and the second support leg being located downstream of the perforation, wherein the width of the second support leg is narrower than the width of the first support leg by at least 10% and in which the

cover member is at least 10% wider than the width of the associated perforation transverse to the design flow direction at the point directly below it."

Claims 2 to 9 of this request relate to particular embodiments of the subject-matter of claim 1.

IV. The Board, referring additionally to the following documents

(3): US-A-5360583 and
(4): US-A-5147584,

noted in writing that

- it was known from the documents (2) to (4) that the form and size of the perforations and of the bridge members of a mass transfer tray affected the liquid flow and the vapour-liquid interaction and that the liquid flow and the vapour-liquid interaction could be improved by selecting an upstream support leg wider than the downstream support leg;

- it was also known, e.g. from document (4), that valves and perforations of various size and shape could be prepared by punching or stamping a tray or, alternatively, by separately manufacturing a cover and support leg members and securing the leg members to the tray;

- it seemed that it would have been obvious to the skilled person to vary the shape and size of the perforation and of the bridge member in the attempt to optimize the performance of a mass transfer tray;

- the illustrative example on page 11 of the present application showed that a specific valve according to claim 1 had a different behaviour from one according to the teaching of document (2) but not a better efficiency;

- the experimental evidence contained in the Nieuwoudt's declaration submitted with letter of 17 April 2007 appeared to show that a mass transfer tray according to claim 1 having round perforations (**PROVALVE** tray) had a better overall performance than a tray having trapezoidal fixed valves according to the teaching of document (2); however, the size and shape of the perforations of the **PROVALVE** tray and of the trapezoidal valve tray tested as well as the size and shape of the bridge member associated therewith were different;

- therefore, it was not clear if the only distinctive feature of claim 1, i.e. an upstream leg member at least 5% wider than the greatest width of the perforation transverse to the design flow direction, provided any technical advantage over the prior art and it appeared questionable that the experimental evidence contained in the Nieuwoudt's declaration of 17 April 2007 could show the superiority over the prior art of any embodiments covered by the claimed subject-matter.

V. The Appellant submitted in writing and orally *inter alia* that

- document (2) solved the technical problem of reducing the weeping rate in mass transfer trays by using a trapezoidal perforation and an associated bridge member of similar shape struck upwards from the tray plate; however, such an economical construction of the fixed valve did not allow having an upstream supporting leg member wider than the greatest width of the perforation transverse to the design flow direction;

- document (3) taught how to improve the efficiency of the fixed valves disclosed in document (2) by maintaining the same shape and constructing characteristics but reducing *inter alia* the size and spacing of the perforations;

- document (4) disclosed mass transfer trays having round perforations containing movable or fixed valves having an upstream support leg extending across only 30% of the width of the round perforation;

- the selection of features of the claimed subject-matter brought about an overall improvement of the performance of a mass transfer tray over that disclosed in document (2) as shown in the Nieuwodt's declarations; moreover, the claimed mass transfer tray had a performance similar to that of a tray according to the teaching of document (3), which was also an improvement of that of document (2);

- the improvement obtained was confirmed by the commercial success of the **PROVALVE** tray tested in the Nieuwoudt's declarations;

- neither document (2) nor the other cited documents suggested the use of a fixed valve having the combination of features as claimed and that such a combination of feature could bring about further improvement; to the contrary, the skilled person would have been led by the teaching of the prior art to try fixed valves having narrower upstream support legs rather than wider ones;

- therefore, the claimed subject-matter involved an inventive step.

VI. The Appellant requests that the decision under appeal be set aside and that a patent be granted on the basis of the main request filed with letter of 17 April 2007 or, in the alternative, on the basis of the first or second auxiliary requests submitted at the oral proceedings.

Reasons for the Decision

1. Main Request

1.1 Inventive step

1.1.1 The present invention relates to cross-flow fractionation trays having fixed valves (page 1, lines 13 to 15 and page 2, lines 2 to 3).

According to the description the invention provides a way of making mass transfer trays having fixed valves in which the shapes of the perforations and of the respective covers can be both manipulated and independently optimized to increase efficiency for any specific application (see page 3, line 28 to page 4, line 4).

Document (2) represents a suitable starting point for the assessment of inventive step as found in the decision under appeal (point 2.1 of the reasons for the decision) and agreed by the Appellant during oral proceedings.

Document (2) discloses a mass transfer tray having trapezoidal perforations longitudinally tapered from a maximum transverse dimension at its upstream end to a minimum transverse dimension at its downstream end and an associated fluid deflector member overlying each of the perforations, such a fluid deflector member being struck upwardly from the tray plate and corresponding in shape and alignment to the underlying perforation (see column 2, lines 29 to 46 and figures 3 and 4).

The subject-matter of claim 1 differs from that disclosed in document (2) only insofar as the upstream leg member is at least 5% wider than the greatest width of the perforation transverse to the design flow direction.

1.1.2 The Appellant defined during oral proceedings the technical problem underlying the present invention in the light of the teaching of document (2) as the

provision of a mass transfer tray having a better overall efficiency than that of document (2).

As indicated by the Board in writing (see point IV above), and not contested by the Appellant, the illustrative example of the present application does not show that a specific tray according to claim 1 has a better overall performance than one according to the teaching of document (2).

The experimental evidence contained in the Nieuwoudt's declarations submitted with letters of 17 April 2007 and 28 August 2007, respectively, shows convincingly, in the Board's view, that a mass transfer tray according to present claim 1 having round perforations, a cover member at least 10% wider than the width of the associated perforation transverse to the design flow direction at the point directly below it and a downstream support leg having a narrower width than the upstream support leg (**PROVALVE** tray) has a better overall performance than a tray having trapezoidal fixed valves according to the teaching of document (2) which valves, because of their construction, have a cover member of the same size as the perforation and an upstream support leg so wide as the maximum transverse width of the perforation.

However, the wording of claim 1 according to the main request encompasses fixed valves wherein the only distinctive technical feature over the prior art is that the upstream leg member is at least 5% wider than the width of the perforation, the cover member being substantially similar and not necessarily wider than the perforation at a point below it.

Therefore, the experimental evidence contained in the Nieuwoudt's declarations, relating to a **PROVALVE** tray differing from one according to the teaching of document (2) by two distinguishing features, the wider upstream support leg and the wider cover member, cannot show that the only distinctive feature of present claim 1, i.e. the presence of an upstream leg member at least 5% wider than the greatest width of the perforation transverse to the design flow direction, provides a technical advantage over the prior art. Moreover, the declaration of 17 April 2007 makes clear that the better performance of the PROVALVE tray might instead be due to the use of a cover member wider than the perforation (see page 7, lines 6 to 12), i.e. a feature not contained in claim 1 according to the main request.

1.1.3 The Board concludes that it has not been convincingly shown that all the embodiments encompassed by the wording of claim 1 solve the alleged technical problem underlying the invention of providing a mass transfer tray having a better overall efficiency than that of document (2).

Consequently, the technical problem underlying the invention can only be defined as the provision of an alternative mass transfer tray having fixed valves wherein the shapes of the perforations and of the respective covers can be both manipulated and independently optimized to increase efficiency for any specific application.

The Board has no doubt that the claimed subject-matter has solved this technical problem.

1.1.4 As noted by the Board in writing (see point IV above) and not contested by the Appellant, it was known from the prior art that the form and size of the perforations and of the bridge members of a mass transfer tray affect the liquid flow and the vapour-liquid interaction (see document (2), column 2, line 41 to 70; column 3, lines 55 to 62 and column 4, lines 12 to 62; document (3), column 3, lines 27 to 43 and document (4), column 4, lines 10 to 25 and 38 to 49; and column 9, line 57 to column 10, line 28).

Therefore, it would have been obvious for the skilled person to try various combinations of form and shape of the elements of a fixed valve in the attempt of optimizing the performance of a mass transfer tray.

Moreover, it was also known that valves and perforations of various size and shape can be prepared by punching or stamping a tray or, alternatively, by separately manufacturing a cover and support leg members and securing the leg members to the tray, (see document (4), column 4, lines 38 to 66; column 9, lines 18 to 24; column 10, lines 27 to 28 and lines 60 to 67; figures 5 to 7).

Therefore, it would have been obvious to the skilled person to depart from the teaching of document (2) and to try alternative constructions of the bridge member of the fixed valve in order to optimize the shielding of the perforation, for example, by providing a separately manufactured bridge member having an

upstream supporting leg having a width much larger than the greatest width of the perforation transverse to the design flow direction.

The Board finds also that the teaching of document (4), relating to the use of movable or fixed valves with narrower upstream support legs in combination with round perforations (column 4, lines 13 to 21), would not have led the skilled person, starting from the teaching of document (2), away from trying wider upstream support legs, since document (4) related only to mass transfer trays having round, oval or triangular perforations (column 4, lines 14 and 44 to 46) and did not deal with the technical problems arising from the use of trapezoidal perforations as in document (2).

On the contrary, the skilled person, knowing that, for example, the weeping rate of a mass transfer tray according to document (2) could be reduced by using an upstream support leg of adequate width (column 4, lines 45 to 56), would have also tried similar fixed valves having their part separately manufactured and wider upstream support legs in the attempt of optimizing the performance of such a tray.

The Board concludes that the subject-matter of claim 1 according to the main request lacks an inventive step.

The main request has thus to be dismissed.

2. First Auxiliary Request

2.1 Article 123(2) EPC

The amended set of 10 claims according to the first auxiliary request differs from that according to the main request insofar as claim 1 requires that the second support leg has the same or a narrower width as the first support leg.

The documents of the application as originally filed disclose only that the overall width of the second leg is preferably at least 10% narrower than that of the first leg (page 4, lines 26 to 29) and that the width of the second leg can be reduced till it is narrower than the widest dimension of the perforation at right angles to the flow direction (page 5, lines 4 to 7).

Therefore, they do not contain any support for a width of the second support leg being narrower than that of the first support leg but still wider than the widest dimension of the perforation, as encompassed by the wording of claim 1 according to the first auxiliary request.

Therefore, claim 1 according to the first auxiliary request contravenes the requirements of Article 123(2) EPC.

3. *Second Auxiliary Request*

3.1 Article 123(2) EPC

3.1.1 The amended set of 9 claims according to the second auxiliary request differs from that according to the main request insofar as claim 1 requires that

- the width of the second support leg is narrower than the width of the first support leg by at least 10% and
- it incorporates the subject-matter of claim 10 according to the main request, i.e. that the cover member is at least 10% wider than the width of the associated perforation transverse to the design flow direction at the point directly below it.

3.1.2 The Board is satisfied that the wording of all claims according to the second auxiliary request is supported by the original documents of the application and thus complies with the requirements of Article 123(2) EPC.

3.1.3 In particular, the wording of claim 1 is supported by claim 1 as originally filed read in combination with page 1, line 26 to page 2, line 3; page 4, lines 10 to 31 and page 5, lines 10 to 12 and 30 to 33, of the description.

In fact, the requirement that the cover member is at least 10% wider than the width of the associated perforation transverse to the design flow direction at the point directly below it is supported by the passage on page 5, lines 30 to 33 of the original description reading "It is preferred that the cover member, at all

points, be at least 10% wider than the width of the perforation at the point directly below it". Therefore, even though claim 1 does not include the wording "at all points", this feature is implicitly included in the requirement that the cover member is at least 10% wider than the width of the associated perforation at the point directly below it.

Moreover, the requirement that the width of the second support leg is narrower than the width of the first support leg by at least 10% is supported by the passage on page 4, lines 26 to 29, of the original description.

3.1.4 The wordings of claims 2 to 8 are supported by claims 2 to 8 as originally filed.

3.1.5 Claim 9 relates to a mass transfer tray according to claim 1 wherein the cover member has a shape that is different from the shape of the associated perforation.

The Examining Division found that the application as originally filed did not contain any support for a mass transfer tray in which the shape of the cover member was different from that of the perforation associated to it and the upstream support leg of the bridge member was **not** at least 5% longer than the downstream support leg as required in the original claim 9.

However, even though original claim 9 related to an embodiment according to which the shape of the cover member was different from that of the perforation associated to it **and** the upstream support leg of the bridge member was at least 5% longer than the downstream support leg, the description of the

application as originally filed does not report or require this combination. In fact, the description discloses only that the shape of the cover members and of the perforations can be independently manipulated and optimized as desired (see page 3, lines 28 to 32; page 4, lines 2 to 4) and, in a separate passage, that it is often preferred that the upstream support leg of the bridge member is selected to be at least 5% longer than the downstream support leg (see page 6, lines 20 to 22).

Therefore, the description does not contain any indication that the latter feature should be selected only in the case that the perforations and the cover members have a different shape.

Therefore, the Board concludes that the wording of claim 9 according to the main request is also supported by the documents of the application as originally filed.

3.2 Novelty

The Board is satisfied that the claimed subject-matter is novel over the cited prior art.

3.3 Inventive step

3.3.1 The Board notes that the subject-matter of claim 1 according to the second auxiliary request differs from that of document (2) not only insofar as the width of the upstream support leg is at least 5% wider than the greatest width of the perforation transverse to the design flow direction, but also insofar as the cover member is at least 10% wider than the width of the

associated perforation transverse to the design flow direction at the point directly below it.

The Board notes also that the **PROVALVE** tray tested in the Nieuwoudt's declarations corresponds to the subject-matter of claim 1 and differs from a tray according to the teaching of document (2) by the two distinguishing features mentioned above.

Therefore, the Board has no doubt that it has been convincingly shown in the Nieuwoudt's declarations that a tray according to claim 1 of the second auxiliary request has a better overall performance than one according to the teaching of document (2) and that the improved performance is due to the combination of such distinguishing features (see point 1.2.2 above).

Moreover, as submitted during oral proceedings, the **PROVALVE** tray has a performance at least equal to that of a tray according to the teaching of document (3), which was already an improvement of the trays of document (2).

The Board has also no reason to doubt that a similar performance would be obtained by using a tray having different perforations or different cover members than the **PROVALVE** tray tested, provided that it complies with the requirements of claim 1.

3.3.2 Therefore, the Board is satisfied that the technical problem underlying the present invention defined by the Appellant during oral proceedings, i.e. the provision of a mass transfer tray having a better overall efficiency than that of document (2) (see point 1.2.2

above) has been convincingly solved by means of a tray having the combination of features of claim 1.

3.3.3 The Board notes that document (3) teaches only that the performance of a tray according to document (2) can be improved by selecting specific dimensions for the perforations and the fixed valve without modifying the width of the upstream support leg and of the cover member with regard to the perforation, i.e. without suggesting using an upstream support leg and a cover which are wider than the perforation (see document (3) column 3, lines 27 to 43).

Moreover, document (4) suggests only to use narrower upstream support legs in combination with perforations having a shape different from that used according to the teaching of document (2) (see column 4, lines 13 to 21).

Therefore, even though it was known that a modification of the form and shapes of perforations and cover and leg members would affect the performance of a tray (see point 1.2.3 above) and it had to be regarded obvious for the skilled person to construct a fixed valve from separately constructed parts (see also point 1.2.3 above), the Board finds that it was not expectable in the light of the teaching of the prior art that the overall performance of a tray according to the teaching of document (2) could be improved at such an extent to reach at least the performance of one according to the teaching of document (3), by using the combination of features of claim 1 according to the second auxiliary request.

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

The remaining claims also involve an inventive step for the same reasons.

Order

For these reasons it is decided that:

The decision under appeal is set aside.

The case is remitted to the first instance with the order to grant a patent on the basis of the second auxiliary request submitted during oral proceedings, a description to be adapted and figures 1 to 4 as filed.

The Registrar: The Chairman:

G. Rauh P.-P. Bracke