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**Datasheet for the decision
of 17 June 2024**

Case Number: T 2542/22 - 3.3.05

Application Number: 07756077.9

Publication Number: 2056960

IPC: B01J19/00

Language of the proceedings: EN

Title of invention:

FLOW DISTRIBUTION CHANNELS TO CONTROL FLOW IN PROCESS CHANNELS

Applicant:

Velocys, Inc.

Headword:

Flow distribution channels/Velocys

Relevant legal provisions:

EPC Art. 56, 113, 116

RPBA 2020 Art. 12(2), 12(3), 12(6), 12(8), 15(3)

Keyword:

Oral proceedings - withdrawal of request for oral proceedings
Decision in writing - no need for further procedural steps -
fair trial - legal certainty in due time
Primary object of appeal proceedings to review decision -
appeal case directed to requests on which decision was based
(no)
Late-filed request - admitted (no)
Inventive step - auxiliary request (no)

Decisions cited:

J 0006/22, T 1974/16, T 0185/20, T 0990/21, T 1780/17

Catchword:



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Case Number: T 2542/22 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 17 June 2024

Appellant: Velocys, Inc.
(Applicant) 7950 Corporate Boulevard
Plain City, OH 43064 (US)

Representative: Brand Murray Fuller LLP
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London W1W 8EA (GB)

Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 25 May 2022
refusing European patent application No.
07756077.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair E. Bendl
Members: T. Burkhardt
R. Winkelhofer

Summary of Facts and Submissions

I. The applicant's (appellant's) appeal lies from the examining division's decision to refuse European patent application No. 07 756 077.9.

II. The following documents were among those discussed at the examination stage.

D1 WO 2005/044442 A1

D8 S. G. Kandlikar, "Fundamental issues related to flow boiling in minichannels and microchannels", *Experimental Thermal and Fluid Science*, 26, 2002, 389-407

III. The examining division concluded, *inter alia*, that the main request and auxiliary request 1 at the time did not meet the requirements of Article 56 EPC.

IV. At the appeal stage, the appellant additionally submitted the following documents.

D9 S. G. Kandlikar, "Heat Transfer Characteristics in Partial Boiling, Fully Developed Boiling, and Significant Void Flow Regions of Subcooled Flow Boiling", *Journal of Heat Transfer*, 120, 1998, 395-401

D10 J. G. Hawley et al., "Predicting boiling heat transfer using computational fluid dynamics", *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering*, 218, 2004, 509-20

V. With its statement of grounds of appeal, the appellant submitted a new main request, auxiliary requests 1 and 2 and a new auxiliary request 3 (with auxiliary requests 1 and 2 being identical respectively to the main request and auxiliary request 1 before the examining division).

VI. Claim 1 of the main request reads as follows (emphasis added by the board):

"1. A method of fluid processing, comprising:
 passing a process stream into a manifold;
 wherein the manifold is connected to at least a first flow distribution channel (FDC) and a second FDC;
 wherein each FDC comprises a series of turns, comprising at least four turns that are 90° or less, or comprising at least two turns that are greater than 90°; and
 wherein the first FDC channel connects the manifold to a first process channel;
 wherein the second FDC channel connects the manifold to a second process channel; and
 wherein the portion of the process stream that flows through the first FDC connects with only one process channel and does not connect with any other FDC so that all of the portion of the process stream that enters the first FDC flows into the first process channel; wherein the pressure drop through the FDCs is greater than the pressure drop through one process channel that is connected to the first FDC; and
 conducting a unit operation in the first and second process channels; and wherein the unit operation in the first process channel comprises partially boiling a liquid as it passes through the first process channel."

VII. In claim 1 of auxiliary request 1, the last feature of claim 1 of the main request has been replaced by (emphasis added by the board):

"...conducting a unit operation in the first and second process channels; and conducting a step of wherein the unit operation in the first process channel comprises partially boiling a liquid the process stream as it passes through the first process channel."

VIII. In claim 1 of auxiliary request 2, the first feature of claim 1 of auxiliary request 1 has been replaced by (emphasis added by the board):

"1. A method of manifolding heat transfer fluids to a unit operation fluid processing, comprising: ..."

IX. Compared with claim 1 of auxiliary request 1, all the instances of "process channel[s]" have been replaced by "process microchannel[s]" in claim 1 of auxiliary request 3.

X. The board summoned the appellant to oral proceedings.

XI. The appellant submitted that they would not attend the oral proceedings.

XII. The oral proceedings were cancelled.

XIII. The arguments put forward by the appellant during the appeal proceedings, where relevant to the present decision, are summarised as follows.

The main request corresponded to claims still on file.

The subject-matter of auxiliary requests 1 and 2 met the requirements of Article 56 EPC.

Auxiliary request 3 should be admitted as it was a "response to the inventive step objections accepted by the Examining Division during oral proceedings".

- XIV. The appellant requests that the decision under appeal be set aside and amended such that a patent be granted on the basis of the main request, or one of the three auxiliary requests, all submitted with the statement setting out the grounds of appeal.

Reasons for the Decision

1. Procedural matters

- 1.1 This decision is taken in writing in accordance with Articles 12(8) and 15(3) RPBA, with due respect for the appellant's rights pursuant to Articles 113 and 116 EPC.

In a case like the current one, legal certainty in due time, just as procedural economy, as an essential cornerstone of a fair trial, has to prevail over other considerations in the conduct of the appeal proceedings (see J 6/22, Reasons 52). No further procedural steps were required and were thus not to be taken (see T 1974/16, Reasons 1, 4.1, 4.6; cf. also T 185/20, Reasons 1; T 990/21, Reasons 1, 5.1, 5.3; T 1780/17, Reasons 2, 2.3, 4.).

After submitting the grounds of appeal, the appellant stated in reply to the summons to oral proceedings that they would not attend the oral proceedings.

The explicit declaration of the appellant's intention not to attend the scheduled oral proceedings amounts to a withdrawal of the request for oral proceedings, and the appellant is to be treated as relying only on their written case. In such a case, the oral proceedings can be cancelled and a decision issued in written proceedings (see Case Law of the Boards of Appeal, 10th edition, 2022, III.C.4.3.2).

- 1.2 It is also established case law of the boards of appeal that an appellant who submits amended claims shortly before the oral proceedings and subsequently does not attend these proceedings must expect a decision based on objections which might arise against such claims in their absence (Case law of the Boards of Appeal, 10th edition, 2022, V.A.5.5.4).

In the same vein, an appellant, having withdrawn their request for oral proceedings, must also expect

- a decision not to admit new claim requests into the appeal proceedings pursuant to Article 12(6) RPBA (cf. again T 1780/17, Reasons 2.3), and
- a decision that confirms the examining division's finding that claim requests did not meet the requirements of Article 56 EPC.

In this context, a duly summoned appellant who by their own volition does not attend the oral proceedings cannot be in a more advantageous position than they would have been, if they had attended. The voluntary absence of the appellant can therefore not be a reason

for the board not to raise issues it would have raised if the appellant had been present.

Main request

2. Admittance and consideration

In view of the primary object of the appeal proceedings of reviewing the decision under appeal in a judicial manner, an appellant's case must be directed to the requests on which the decision under appeal was based (Article 12(2) RPBA).

The current main request had already been filed at the examination stage but was superseded and replaced at the oral proceedings before the examining division (page 1 of the minutes, lines 9 to 12). It is hence not dealt with in the decision under appeal.

Contrary to the appellant's view, this request was thus no longer on file when the examining division took its decision.

The appellant has also failed to explain why they submitted this request again at the appeal stage.

In line with Article 12(6) RPBA 2020, this request consequently cannot be admitted into the appeal proceedings (see also Case Law of the Boards of Appeal, 10th edition, 2022, V.A.4.2.2 h)).

Auxiliary request 1

Auxiliary request 1 corresponds to the main request dealt with in the decision under appeal.

For the reasons set out below, the examining division's conclusion that the subject-matter of claim 1 lacks inventive step is correct (Article 56 EPC).

3. Claim interpretation

3.1 In the appellant's view, "vaporisation" and "partial boiling" designated different phenomena and involved different conditions.

Moreover, the feature "partially boiling" in claim 1 required a stable co-existence between the liquid and the vapour phase and that liquid remained at the end of the process channel. The temperature during partial boiling was below that of thermodynamic equilibrium and there was no net production of vapour.

The appellant further argued that the expression "partial boiling" referred to the specific region between the "onset of nucleate boiling" and "fully developed boiling" as explained in D8, D9 and D10.

3.2 These arguments are not convincing.

In the present context, vaporisation inevitably occurs when liquid boils. This takes place within the bulk of a liquid phase at locations where the temperature corresponds to boiling point (e.g. water boiling in a kettle). For these reasons, the examining division is correct in concluding that, in the case in hand, boiling and vaporisation relate to the same phenomenon.

This phenomenon has to be distinguished from evaporation, which occurs at the gas-liquid interface even at temperatures below boiling point (e.g. when a glass of water is left at room temperature or when laundry dries at room temperature).

Furthermore, the expression "partially boiling" in claim 1 has to be construed broadly. Claim 1 mentions neither microchannels, nor a subcooled liquid flow at the channel inlet, nor "nucleate boiling" nor a region of "fully developed boiling". The whole application is silent on "nucleate boiling" and "fully developed boiling".

There is thus no reason to restrict the meaning of the expression "partially boiling" in claim 1 to the specific situations described in:

- **D8** (flow boiling in mini- or microchannels), or
- **D9** (heat transfer model for subcooled flow boiling in a heated channel) and **D10** (heat transfer models applied to cooling galleries of internal combustion engines), the admittance of these documents notwithstanding. It is also noted that D9 and D10 are scientific papers and not text books representing common general knowledge.

In their preliminary opinion accompanying the summons to oral proceedings, the examining division had already indicated that the expression "partially boiling" in claim 1 was closely related to vaporisation and had to be construed in a broad manner.

Thus, the expression "partially boiling" covers any situation where liquid is boiling in a certain region

of the process channel. The board hence agrees with the examining division that claim 1 does not require that:

- the liquid has to be "partially boiling" through the entire length of the first process channel
- liquid has still to be present at the end of the first process channel
- there is heat exchange between the process channels
- there is stable co-existence of the liquid and the gaseous phase
- the operating conditions have to be "stable" (temperature, pressure)
- transient states are excluded
- there is no net production of vapour

Examples of what the skilled person would understand in the present context as "partially boiling" liquids in the first process channel within the meaning of claim 1 are:

- a liquid, which starts boiling somewhere downstream in the channel
- a liquid at a given distance from the channel inlet that is boiling in an outer region of the channel whereas it is still entirely liquid in the inner region

4. Inventive step

4.1 The invention relates to flow control in microchannel devices (page 1, line 14).

4.2 The examining division considered **D1** to be the closest prior art and this has not been disputed.

Since D1 also relates to microchannel devices (abstract, page 2, lines 1 to 2; page 13, lines 11 to

16; page 21, lines 1 to 14; page 40, lines 4 to 7; page 49, line 22 to page 50, line 24; figures 25 to 27) and has several features in common with claim 1, there is no reason to deviate from this correct finding (Article 15(8) RPBA 2020).

The appellant has not disputed the examining division's finding that D1 *individually* discloses the features:

- the pressure drop through the flow distribution channels is greater than the pressure drop through the process channels (on page 40, lines 4 to 7)
- application for the vaporisation of a liquid (e.g. page 13, line 13; page 23, line 13; page 25, line 1)

By contrast, the appellant disputes that D1 discloses the *combination* of these features.

The board agrees. The vaporisation of a fluid along a channel as in D1 implies a liquid state at the beginning of the channel and a vapour state at the end. The vaporisation inevitably takes place over some length of the channel. For the reasons set out above under point 3.2, such a situation anticipates the feature "partially boiling a liquid as it passes through the first process channel" of claim 1.

- 4.3 According to the application, the problem to be solved is the provision of a method of fluid processing with improved fluid distribution even in the event of pressure drop variations caused by "unit operations" arranged in the process channels (page 2, lines 9 to 25).

- 4.4 It is suggested to solve the problem posed by means of the method of claim 1 characterised by the *combination* of:
- the pressure drop through the flow distribution channels being greater than the pressure drop through the process channels
 - application for the partial boiling/vaporisation of a liquid

4.5 Since D1 already discloses uniform fluid distribution (page 13, lines 21 to 23; page 32, lines 28 to 35), there is no evidence on file of improved fluid distribution when compared with the device of D1. There is no basis for assuming such improved fluid distribution either.

The problem to be solved can therefore only be use of the method of D1 for an alternative application.

4.6 However, D1 discloses application for the vaporisation of a liquid (e.g. page 13, line 13; page 23, line 13; page 25, line 1).

As explained above (see points 3.2 and 4.2), this vaporisation mentioned in D1 anticipates the feature "partially boiling a liquid as it passes through the first process channel" of claim 1.

4.7 The appellant alleges that the skilled person, when starting from D1, would not necessarily maintain the higher pressure drop through the flow distribution channel than through the process channel when considering a vaporisation/partial-boiling application.

However, the pressure-drop considerations in said passage on page 40, lines 4 to 7 of D1 are of a general

nature and aim at good fluid distribution. No reason can be seen why the skilled person would deviate from this teaching.

Hence, the examining division was correct that the subject-matter of claim 1 does not involve an inventive step (Article 56 EPC).

Auxiliary request 2

Auxiliary request 2 corresponds to auxiliary request 1 dealt with in the decision under appeal.

5. Inventive step

The examining division was also correct in finding that the new feature "manifolding heat transfer fluids to a unit operation" cannot render the subject-matter of claim 1 inventive (Article 56 EPC).

In fact, any liquid that is vaporised in a heated channel, as disclosed in D1, has to transfer heat (e.g. from the outer region in the channel to the inner region) and can therefore be considered to be a "heat transfer fluid" within the meaning of claim 1.

Furthermore, vaporisation is a "unit operation" (also within the meaning of the application, see for instance page 12, line 9).

Auxiliary request 3

6. Admittance and consideration

In claim 1, the "process channels" are further limited to "process *microchannels*".

The appellant must set out their whole case in the statement of grounds (Article 12(3) RPBA). This includes the relevant issues to be taken into account for the discretionary decision if new requests filed on appeal are considered (Article 12(4) RPBA). Thus, the board shall be in a position to take an immediate decision also as to the consideration of the new requests, based on the complete case as set out in the statement of grounds.

The appellant merely argued that this claim request should be admitted as it was a response to "inventive step objections accepted by the examining division during oral proceedings". The appellant provided no further arguments with regard to the consideration of auxiliary request 3.

However, novelty or inventive step objections in view of D1 were present throughout the entire examination proceedings, from the first communication to the preliminary opinion accompanying the summons to oral proceedings.

In addition, the role of the nature of the channels was discussed in the preliminary opinion accompanying the summons to oral proceedings (e.g. at the end of the paragraph bridging pages 3 and 4).

It is therefore not comprehensible why the appellant did not submit auxiliary request 3 before, at the latest at the oral proceedings at the examination stage.

Moreover, since D1 also deals with microchannels (e.g. the abstract), there is no *prima facie* reason why the new feature would render the subject-matter of claim 1 inventive.

This request cannot therefore be admitted
(Article 12(6) RPBA 2020)

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chair:



C. Vodz

E. Bendl

Decision electronically authenticated