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File Number: T 245/88 - 3.2.1
Application No.: 82 100 879.4
Publication No.: 0 057 928
Title of invention: Atmospheric vaporizer

Classification: F17C 9/02, F28F 1/14

D E C I S I O N
of 12 March 1991

Proprietor of the patent: Union Carbide Corporation
Opponent: Linde AG

Headword:

EPC Art. 54, 56

Keyword: "Inventive step (yes)"
"Prior use and the availability to the public of equipment on the
fenced-off ground of a firm"

Headnote



Case Number : T 245/88 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 12 March 1991

Appellant : Union Carbide Corporation
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Decision under appeal : Decision of Opposition Division of the European
Patent Office dated 18 March 1988 revoking
European patent No. 0 057 928 pursuant to Article
102(1) EPC.

Composition of the Board :

Chairman : F. Gumbel
Members : F.J. Pröls
W. Moser

Summary of Facts and Submissions

I. European patent No. 57 928 was granted on 27 March 1985 on the basis of European patent application No. 82 100 879.4, filed on 8 February 1982.

II. The patent was opposed by the Respondent, who requested that the patent be revoked in its entirety. The opposition was based on:

D1: JP-A-48-32064 (cited as JP-Y-73 032 064 in the European Search Report)

and six prior uses:

- V1: Vaporizer type LD 12F4s (drawing 11-05650)
- V2: Vaporizer type LM 24F2 (drawing 11-03297)
- V3: Vaporizer type LM 72F4 (drawing 00-03491)
- V4: Vaporizer type LH 6F-F28 (drawing 11-05542)
- V5: Vaporizer type LM 36F4 (drawing 00-03636)
- V6: Vaporizer type LH 48F2 (drawing 00-03277)

each prior use being supported by filed evidence such as accounts, dispatch notes, packing lists and workshop drawings.

After expiry of the nine-month opposition period a further prior use

V7: Vaporizer based on a statutory declaration (=E1), dated 9 February 1987

was put forward.

III. The Opposition Division revoked the patent on 18 March 1988 for lack of inventive step of its subject-matter,

particularly in view of the prior art given by the vaporizer type LM24-F2 (prior use V2).

IV. The Appellants appealed against this decision on 17 May 1988, paying the appeal fee on the same day. The statement of grounds was submitted on 18 July 1988.

V. Following a communication of the Board accompanying the summons to oral proceedings and setting out the points to be considered in the oral proceedings subsidiarily requested by the Appellants and the Respondents, the Respondents filed a complementary statutory declaration dated 19 December 1990 (=E2) to support the prior use V7 and advanced a further prior use

V8: Vaporizer based on a statutory declaration (=E3), dated 5 February 1991, an account list and a workshop drawing,

and the Appellants filed amended Claims 1 to 12, received on 19 February 1991.

Independent Claim 1 of the valid claims now on file reads as follows:

"An apparatus for continuously vaporizing a cryogenic liquid by employing heat absorbed from the ambient air comprising at least three substantially vertical positioned passes (10, 51 to 58, 61 to 64, 71 to 74, 82, 84, 86, 88) which are piped together, each pass being comprised of a center tube (11, 21, 31, 41) provided with a plurality of fins (12, 22, 32, 42) substantially equally spaced around said tube, each fin having a radial length of at least 1.5 times the outside diameter of said tube and extending longitudinally along substantially the entire length of said tube, wherein the ratio of the

distance between the tips of the most adjacent fins of adjacent passes to radial fin length is above 1.3, characterized in that each center tube (11, 21, 31, 41) has an outside diameter of from 1.27 to 3.81 cm and is provided with 3 to 8 fins, each fin (12, 22, 32, 42) has a radial length of about 3.5 times the outside diameter of said tube, each pass has a length of from 1.52 to 6.08 m and a vertical distance from the ground or other support platform to the bottom edge of the fins from 0.3 to 1.2 m, and the ratio of the distance between the tips of the most adjacent fins of adjacent passes to radial fin length is from 2 to 5."

VI. In the oral proceedings held on 12 March 1991 both parties defended their cases essentially by completing their arguments put forward in written form, whereby, in essence, the prior uses V2 and V7 were dealt with in detail. The Board did not consider the alleged prior uses according to V7 and V8 as late filed, since they have been filed in response to a substantial amendment of the contested set of claims and, if acknowledged as state of the art, they would be more relevant than the other prior art.

VII. The Appellants requested that the decision under appeal be set aside and that the patent be maintained on the basis of Claims 1 to 12 filed on 19 February 1991, the description submitted at the oral proceedings and the drawings as granted.

Their arguments in support of this request can be summarised as follows:

Contrary to the alleged prior uses V2, V3, V5 and V6, which are acknowledged as prior art in the present description (see the vaporizers A to D in the table on

page 2a), the availability to the public of the vaporizers according to V7 and V8 is specifically contested. The statutory declarations E1 to E3 do not prove the free accessibility to the public of the vaporizers V7 and V8 located on the property of a shipyard at a distance of about 5 m from a fence. Further, the relationship between the signatory of the statutory declarations and the shipyard was not clear from the declarations E1 to E3. Additionally, said signatory obtained permission to measure the vaporizers for the first time only at least 6 years after the priority date of the contested patent, and it was not sure whether he would have obtained this permission six years earlier. Furthermore, a visitor from an outside firm or an employee of a sub-contracting firm would in general not be allowed to measure installations within non-public properties, unless they were sworn to secrecy. As concerns the visibility of the vaporizers from outside the fence it was argued that there was no evidence for the unimpeded accessibility to the ground beyond the fence next to the vaporizers.

It would also be doubtful whether a person skilled in the art could estimate the relevant dimensions of the vaporizers from outside the fence. As concerns the teaching of present Claim 1, none of the established or alleged prior art solutions gave any hint to the expert to provide a ratio of radial fin length to tube outside diameter of about 3.5 which was far outside of the previously used range and was, amongst further parameters, the basis for the curves of Fig. 9 of the contested patent. This feature, now present in Claim 1, had been disclosed in original Claim 9 and in the description as filed on page 5, line 20. Vaporizer V4 was the only one amongst the allegedly prior used vaporizers which appears to provide a ratio of radial fin length to tube outside diameter being next to the claimed range. The ratio measured from the workshop drawing 11-05542 of V4 was

about 4. This vaporizer, however, proposed a spacing ratio of about 0.55 contrary to the invention which claimed a spacing ratio from 2 to 5. Lastly, the documents "Chemical Engineers' Handbook", 4th edition, J.H. Perry, R.H. Perry et al, pages 10-24, 10-25 (D2), US-A-2 322 341 (D3) and FR-A-1 239 402 (D4) would lead a skilled person to a solution different from that claimed by the patent.

VIII. In support of their request that the appeal be dismissed the Respondents (Opponents) put forward the following arguments:

The views of the Appellants on the detailed questions of availability of the vaporizers according to the prior use V7 or V8 could have been easily refuted if the Appellants had advanced their considerations in due time so that further evidence could have been filed before the oral proceedings. As a preventive measure further evidence was expressly offered if the Board should disregard the prior uses V7 and V8 for the reasons mentioned by the Appellants for the first time during oral proceedings. As to the relationship between the signatory of the statutory declarations and the shipyard it was stated that, for a certain time, said signatory was an employee of the firm Tekoma B.V. before joining the firm Cryonorm, both firms being sub-contractors of the shipyard, the firm Cryonorm having installed the vaporizer V8. It would appear extremely unlikely that these vaporizers could have been replaced or considerably modified before the inspection effectuated by the signatory of the statutory declarations, which took place for the first time about 6 years after the priority date of the contested patent. The area of the shipyard was considered to be in general accessible to specialist circles. As compared with the acknowledged prior art vaporizer V2 the claimed vaporizer differed only by two values: the spacing ratio and the

radial fin length ratio. If frost and ice build-up on the fins was observed in practice, it would be obvious for a person skilled in the art to increase the distance between the fin tips for the reasons set out in the impugned decision of the Opposition Division. Furthermore, the now claimed value, according to which the radial fin length is about 3.5 times the tube diameter, was not originally disclosed as being essential for the invention. Moreover, this value was in principle already known from the prior used vaporizer V4 which shows a value of 4 in this respect. The arguments of the Appellants put forward in conjunction with the prior art documents D2 to L4, which deal with heat transmission and exchanger units transferring heat to the ambient air, were not convincing, since these documents did not treat the problem of frost and ice build-up as was essential in the present case.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rules 1(1) and 64 EPC; it is admissible.
2. **Formal allowability of the amendments**
 - 2.1 Current Claim 1 comprises the features of Claim 1 as filed wherein the value or values claimed for
 - (a) the ratio of the distance between the tips of the most adjacent fins of adjacent passes to radial fin length (=spacing ratio) and
 - (b) the ratio of the radial fin length to the outside diameter of the tube (further designated as "radial fin length ratio")

have been limited from the original ranges of "1 to 5" (for the ratio (a)) and "1.5 to 7" (for the ratio (b)) to the range "2 to 5 (for the ratio (a)) and the single value "about 3.5" (for the ratio (b)). The originally used term "ground clearance" has been replaced by the terms "vertical distance from the ground or other support platform to the bottom edge of the fins" as defined in the original description page 7, lines 27 to 29.

It is apparent that the originally defined ranges have been restricted to a narrower range or to a single value. The relevant values are to be found in the original disclosure (see original Claim 2 for the value 2 forming now the lower limit of the range for ratio (a) and original Claim 9 directed to a value of "about 3.5" for ratio (b)). Moreover, the results achieved by a vaporizer working within the now claimed limits are particularly discussed in the description as filed with reference to Figure 9. The value "about 3.5" (for the ratio (b)) is the basis for the graph in Figure 9, see page 12, first paragraph and page 14, last paragraph of the original description.

Dependent Claims 2 to 12 derive from Claims 1 to 8 and 10 to 13 as filed respectively.

As compared with Claim 1 as granted present Claim 1 is clearly restricted in its scope regarding ratios (a) and (b). There is, therefore, no objection to the current claims under Article 123(2) and (3) EPC.

- 2.2 The amendments made to the description in comparison with that originally filed consist essentially in an evaluation of the most relevant state of the art and an adaptation to the terms of the new claims.

2.3 In conclusion, the Board has no formal objections to the documents forming the basis of the Appellants' request.

3. State of the art

3.1 Current Claim 1 is delimited over the vaporizer according to the prior use V2 which is acknowledged as prior art vaporizer A in the present description together with the further prior use vaporizers V3, V5 and V6 identified as known vaporizers B, C and D respectively.

The vaporizer V2 represents the nearest prior art amongst all vaporizers mentioned in the appeal procedure except those (V7 and V8) defined in the statutory declarations E1 to E3. These alleged prior use vaporizers V7 and V8 provide a spacing ratio of 3.5 and 2.12 respectively, which ratios be within the claimed spacing ratio range of 2 to 5.

3.2 However, in the Board's view, the alleged prior uses V7 and V8 have not beyond any doubt been made available to the public before the priority date of the contested patent.

The area inside the fence of a shipyard or a factory is certainly a non-public property. The submissions in the statutory declarations and the further evidence forwarded by the Respondents in the oral proceedings have not fully convinced the Board that, before the priority date of the contested patent (10 February 1981), it was possible for members of the public to gain knowledge of these vaporizers and that there was no bar of confidentiality restricting the use or dissemination of such knowledge. Indeed the signatory of the statutory declarations E1 to E3 may have got permission from the owner of the shipyard in 1987 to gain knowledge of the

vaporizers including taking measurements of them and to freely use this knowledge. However, this event took place about six years after the priority date. The declaration in point 4 of E2 that, even before the priority date, every specialist being professionally engaged periodically or temporarily within the area of the shipyard would have got this unrestricted permission must be considered as a mere speculation, since it appears to be virtually impossible to establish with reasonable accuracy what confidentiality requirements had to be satisfied in this respect six years ago. The statutory declaration does not offer any further explanation thereabout.

Furthermore, it cannot be established beyond any doubt that the vaporizers which had been installed at the shipyard since 1975 and 1971 respectively, had not been exchanged or modified in the time between 1981 and 1987.

As concerns the opportunity to view these vaporizers from outside the fence of the shipyard area, the Board is also not convinced that a person skilled in the art, without the knowledge of the subject-matter claimed in the contested patent, would have recognised the teaching thereof and the problem to be solved thereby. Even if the spacing ratio had in fact been 3.5 and thus the claimed relative fin tip distance had been more than twice greater than that known e.g. from the prior art according to V2 (spacing ratio=1.38), it is questionable whether a skilled person not aware of the present invention would have taken notice of the claimed spacing ratio amongst a great number of dimensions and dimension ratios which can be derived from a multi-tube vaporizer. The fin tip distance can further only be evaluated if the spectator looks exactly in the direction of the gaps between the tubes which are arranged in several rows one behind the other. In an arrangement wherein the tube rows are staggered as shown

in Fig. 6 of the patent in suit, it would appear to be very difficult to correctly estimate the spacing ratio if the vaporizer is regarded from a distance of about 5 meters.

- 3.3 Thus, the Board is not satisfied that in these circumstances a person skilled in the art was in a position to recognise clearly and unambiguously from the vaporizers V7 and V8 the essential features claimed in the patent in suit, even if, at the priority date, these vaporizers comprised a spacing ratio of 3.5 or 2.12, respectively. However, there appears to be no need for a further discussion of this issue and for a definite decision as to whether or not the prior uses V7 and V8 belong to the state of the art because even in the case of a positive answer to this question the patentability of the subject-matter of Claim 1 must be acknowledged as will be shown in the following paragraphs.

4. **Novelty**

The Board notes that the established prior art cited during the opposition proceedings does not disclose a vaporizer having all the features as defined in Claim 1. The vaporizers according to V7 and V8 do not comprise the feature concerning the radial fin length ratio of 3.5. Since novelty has never been disputed, there is no need for further detailed substantiation of this matter.

5. **Inventive step**

- 5.1 The object to be achieved by the subject-matter of the patent in suit consists in providing an atmospheric vaporizer for cryogenic liquids that is suitable for continuous operation while substantially avoiding the

drastic reduction in operating efficiency characteristic of prior art atmospheric vaporizers.

This object is set out on page 3, last paragraph of the present description and has been transferred unchanged from the original description.

With continuously working prior art atmospheric vaporizers the aforementioned drastic reduction in the operating efficiency results from the frost build-up on the tube fins caused by the moisture in the air which condenses and freezes on the surfaces of the vaporizer.

It is to be noted that none of the prior art documents taken into consideration mentions the problem of frost build-up on the vaporizer.

The Board sees no reason to doubt the fact that present Claim 1 provides a solution to this problem and to query the accuracy of the diagram depicted in Fig. 9 which represents the functional relation between spacing ratio and flow rate measured with a vaporizer having the claimed radial fin length ratio and showing further relevant dimensions lying within the claimed ranges.

- 5.2 The prior art vaporizers V2, V3, V5 and V6 have dimensions lying within the claimed ranges except that the values of
- (a) the spacing ratio (tip distance of the adjacent fins of adjacent passes to radial fin length) and
 - (b) the radial fin length ratio (radial fin length to centre tube outside diameter)

are between 1.3 and 1.4 (spacing ratio (a)) and between 1.6 and 1.8 ("fin length ratio" (b)) contrary to the claimed vaporizer claiming a spacing ratio (a) between 2 and 5 and a fin length ratio (b) of about 3.5.

The claimed vaporizer provides an increased radial fin length, which is defined by the tube diameter multiplied by the claimed increased fin length ratio (b), and an extremely great fin tip distance which is defined by the increased radial fin length multiplied by the claimed high spacing ratio (a). Thus, the claimed increase of the fin length ratio (b) changing the average prior art value of 1,6 (V2) to the claimed value of about 3.5 not only doubles the fin length but automatically also doubles the fin tip distance which is increased still further by the additionally claimed increase of the spacing ratio. Hence, there is a combinatorial link between the increase of both values in the sense of a cumulative effect leading to an extremely great fin tip distance as compared with any of the vaporizers under discussion. If, for example, the known spacing ratio of about 1.4 (V2) is e.g. doubled on its part to a value of 2.8 being within the claimed ratio 2 to 5, then this would lead to a fin tip distance which is four times greater than the known tip distance. The only vaporizer amongst all acknowledged or alleged prior uses (including also V1, V4, V7 and V8) which provides an increased radial fin length ratio (b) is that of the alleged prior use V4. The radial fin length as measured and reckoned from the drawing 11-05542 of V4 has a value of about 4 (i.e. about 2 to 2.5 times greater than the corresponding values of V1 to V3, V5 to V8 and D1) and is higher than the claimed value of about 3.5. However, contrary to all other vaporizers advanced in this procedure, the spacing ratio derived from the drawing of V4 has been decreased to a value of about 0.55. This value must be multiplied by the factor 2 to 2.5 to reach the

common values of V1 to V3 and V5 to V8. This means that in V4 the fin tip distance is in essence the same as with the other prior use vaporizers.

5.3 Therefore, the vaporizer (V4) which at first sight could give rise to the use of a high radial fin length ratio as claimed, does not direct the skilled person to the overall teaching of cumulating the effects of high ratios (a) and (b) according to Claim 1 of the contested patent, but rather leads in the opposite direction. Therefore, even in the case of acknowledging the vaporizers V7 and V8 (with their increased spacing ratios 3,5 and 2,12 leading to an increased fin tip distance) as prior uses, the Board is convinced that a skilled person would not derive any suggestions as to apply such a spacing ratio with a vaporizer according to V4 which already has an increased fin tip distance as a result of an increased fin length ratio.

5.4 Summarising, the Board is of the opinion that even though one may take the view that the use of an increased spacing ratio is either suggested by V7 or V8 or considered as obvious for the reasons set out on pages 5 and 6 of the contested decision of the Opposition Division, a simultaneous and cumulative use of such a spacing ratio together with the increase of the radial fin length ratio up to 3.5 as claimed in present amended Claim 1 would involve an inventive step, since this would necessarily lead to an extremely great fin tip distance which would be against any teaching in the prior art including V7 and V8.

5.5 The Board, therefore, comes to the conclusion that the subject-matter of valid Claim 1 cannot be derived in an obvious manner from the state of the art and has

accordingly to be seen as involving an inventive step,
Articles 52(1) and 56 EPC.

This claim, together with its dependent Claims 2 to 12 and
the revised description, can, therefore, form the basis
for maintaining the contested patent in amended form.

Order

For these reasons, it is decided that:

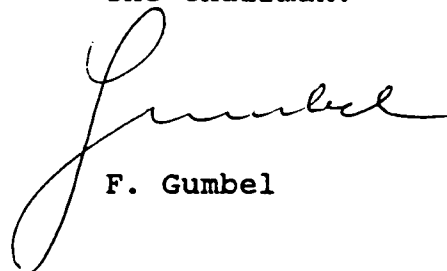
1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order
to maintain the patent on the basis of Claims 1 to 12,
received on 19 February 1991, and the description as
submitted at the oral proceedings together with Figures 1
to 9 as granted.

The Registrar:



S. Fabiani

The Chairman:



F. Gumbel