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**D E C I S I O N**  
**of 29 October 2003**

**Case Number:** T 0674/98 - 3.3.5

**Application Number:** 93919755.4

**Publication Number:** 0658128

**IPC:** B01F 3/04

**Language of the proceedings:** EN

**Title of invention:**

A method and device for reducing the pressure and the temperature of a steam in a steam conditioning valve

**Patentee:**

BTG KÄLLE INVENTING AB

**Opponent:**

WELLAND & TUXHORN Armaturen- und Maschinenfabrik GmbH & Co.KG

**Headword:**

Valve/BTG

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step: no"

**Decisions cited:**

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**Catchword:**

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Case Number: T 0674/98 - 3.3.5

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.5  
of 29 October 2003

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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 6 May 1998  
revoking European patent No. 0658128 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** R. K. Spangenberg  
**Members:** B. P. Czech  
J. H. Van Moer

## Summary of Facts and Submissions

I. The appeal is from the decision of the opposition division dated 6 May 1998 revoking the European patent No. 0 658 128.

II. The patent had been granted with four claims, which read as follows:

"1. Method of reducing the pressure and temperatures of steam in a steam conditioning valve (1), in which steam flow is regulated by a plug (5) perforated by a plurality of first holes (6), such that a greater or less number of holes (6) being uncovered or closed off in response to movement of the plug (5) along a seating (4) formed inside the valve (1), cooling water being simultaneously taken into the upper part (8) of the valve and regulated with the aid of a water seat (10) and a plurality of calibrated second holes (9) in a hollow valve spindle (7) passing through the plug (5), this regulation being proportional to that of the process steam, the cooling water then being taken through the hollow valve spindle (7) for spraying out and through a jet (12) in the centre of the departing steam flow, characterized in that for small opening amounts of the valve (1) process steam is taken directly to the vicinity of the outlet openings (16) of the jet (12) and the cooling water sprayed out therefrom, such as to break up this water by the process steam being caused to impinge on the sprayed-out water simultaneously as partial vapourisation of the water is achieved and process steam cooling is improved."

"2. Method as claimed in claim 1, characterized in that process steam is taken into an annular space (15) surrounding the jet (12) and is caused to flow from the outlet (19) of this space (15), said outlet being situated immediately above the outlet openings (16) of the cooling water, which is ejected substantially transverse the axial direction of the hollow valve spindle (7), whereby the process steam with its entire unreduced pressure cuts across the direction of the cooling water flow such as to break up the water."

"3. Apparatus for reducing steam pressure and temperature in a steam conditioning valve (1), including a plug (5) coacting with a seating arranged in a valve housing (2), the plug being perforated by a plurality of first holes (6) for regulating steam flow through the valve (1), a hollow valve spindle (7) passing through the plug and having at its upper portion (8) a plurality of calibrated second holes (9) for coaction with a water seat (10) for feeding cooling water into the hollow spindle (7) in proportion to regulation of the steam, said cooling water flowing through a jet (12) extending downwardly below the plug (5) to exit at the centre of the departing steam flow, characterized in that the plug (5) has in its central region(13) above the first holes (6) at least one row of third holes (14) adapted such that for small amounts of valve openings they lead process steam to at least one separate duct (15) taking the steam to the vicinity of outlet openings (16) for the cooling water in the jet (12)."

"4. Apparatus as claimed in claim 3, characterized in that the separate duct (15) is annular and delimited radially outwardly by a tubular jacket (17) concentric with the jet (12) and extending downwardly along the curved surface (18) of the jet such as to provide an annular outlet (19) above the outlet openings (16)."

III. In the contested decision, the opposition division came *inter alia* to the conclusion that the subject-matter of claim 3 was not based on an inventive step in view of a combination of the documents

D1: EP-A-0 134 454 and

D6: DE-U-88 16 986.

The opposition division held that starting from D1 as the closest prior art and confronted with the problem of unsatisfactory cooling at small valve openings, ie those under 15 to 20%, the skilled person would consider D6, which addresses this problem and proposes a solution for it, and would apply the teaching of D6 to thereby arrive at the claimed subject-matter without having to exercise any inventive step.

IV. With its notice of appeal the appellant (proprietor of the patent) filed an amended set of three claims. The new independent process and apparatus claims 1 and 2 were based on combinations of claims 1 and 2, and of claims 3 and 4 as granted, respectively. It submitted that the amended claims had been "restricted in view of the cited prior art", that they did "more exactly set forth the distinguishing features according to the

invention", and that their subject-matter was inventive in view of D1 and D6.

- V. The respondent (opponent) contested the patentability of the claimed subject-matter despite the amendments.
- VI. In a first communication dated 13 August 2002, the board *inter alia* raised objections against the proposed amendments under Articles 84 and 123(2)(3) EPC. Moreover, pointing out specific passages in document

D2: US-A-5 005 605,

the board indicated that this document could also be considered to represent the closest prior art, and that the method and apparatus disclosed therein appeared to correspond to the prior art acknowledged in the application as filed.

- VII. With its reply dated 12 December 2002, the appellant filed another set of claims, consisting of an amended independent method claim 1 and an amended independent apparatus claim 2, the latter now comprising the additional feature "below 15-20%" for defining the "small opening amounts of the valve".

The appellant acknowledged that the feature "whereby the process stream with its entire unreduced pressure cuts across..." was not entirely clear. Referring to the passage in column 2, lines 53 to 54 of the patent, it submitted that due to the short distance the exiting steam had to run before breaking up the ejected cooling water, its pressure drop was very low.

VIII. In its second communication dated 15 July 2003, the board *inter alia* raised objections under Articles 123(2) and 84 EPC against the new apparatus claim.

Indicating specific passages of D2, the board pointed out that the valves and methods disclosed therein could be considered to represent the closest prior art according to the pre-characterising parts of both the independent method and apparatus claims on file. The board also analysed and discussed the additional features now comprised in said claims and came to the provisional conclusion that a combination of D2 with D6 could be considered to lead to the claimed subject-matter in an obvious manner.

The appellant was invited to amend the claims and both parties were given a further opportunity to present their arguments concerning inventive step.

IX. In its letter dated 11 September 2003, the respondent expressly agreed with the provisional opinion of the board.

X. With its reply dated 11 September 2003, the appellant submitted a single further amended apparatus claim to replace the claims on file. The present decision is based on this new claim, which differs from claim 3 as granted in that its characterising part reads as follows (amendments appearing in **bold**):

"characterized in that the plug (5) has in its central region (13) above the first holes (6) at least one row of third holes (14) adapted such that for small amounts of valve openings, **below 15-20%**, they lead process

steam to a separate duct (15) taking the steam to the vicinity of outlet openings (16) for the cooling water in the jet (12), **said duct (15) is annular and delimited radially outwardly by a tubular jacket (17) concentric with the jet (12) and extending downwardly along the curved surface (18) of the jet (12) such as to provide an annular outlet (19) for the steam above the outlet openings (16) for the cooling water, said openings (16) are directed 90° to the longitudinal direction of the jet (12), whereby the process steam with its entire unreduced pressure cuts transversely across the direction of the cooling water flow in order to provide an effective breakdown into droplets as well as an earlier vaporization of the cooling water and improvement of steam cooling."**

The appellant submitted that "the apparatus according to the invention has such a structure and function which during small openings of the valve is leading steam to and passed (sic) the cooling water jet, hence is improving cooling due to the steam breaking up the cooling water jets into very small droplets and this also results in that the water is more easily vaporized while cooling is made more effective". According to the embodiment shown in Figures 1 to 3, "the openings 16 of the cooling water are directed 90° to the longitudinal direction of the jet, which is an important feature in receiving a fine distribution of water during the cooling of the process stream". The essential features of the preferred embodiment according to Figures 1 to 3 were stated in the new claim. "Since the new claim has been further restricted and more exactly is setting forth the distinguishing features according to the invention", the combination of D2 with D6 could "no



longer be considered to lead to the claimed subject-matter in an obvious manner".

XI. With its letter dated 26 September 2003, the respondent requested a decision according to the current state of the file.

XII. The appellant requested that the patent be maintained on the basis of claim 1 as filed with its telefax dated 11 September 2003.

The respondent requested that the appeal be dismissed.

## **Reasons for the Decision**

### **1. *Amendments***

The board is satisfied that the features incorporated into the characterising part of the independent apparatus claim during the appeal proceedings find sufficient basis in the patent as granted and in the application as filed. This was not disputed by the respondent. Concerning the feature "below 15-20%" see column 1, lines 52 to 53 (page 2, lines 15 to 16 as originally filed). Concerning the features "said duct (15) is annular ... above the outlet openings (16) for the cooling water" see claim 4 as granted (claim 4 as originally filed). Concerning the features "said openings (16) are directed 90° to the longitudinal direction of the jet (12)" see column 3, lines 7 to 9 (page 4, lines 13 to 15 as originally filed). Concerning the features "whereby the process stream with its entire unreduced pressure cuts transversely

across the direction of the cooling water flow" see the last sentence of claim 2 as granted (and of claim 2 as filed). Concerning the features "in order to provide ... improvement of steam cooling" see the sentence bridging columns 3 and 4 (page 5, lines 29 to 34 as filed).

2. *Construction of claim 1*

- 2.1 Some of the incorporated features (last sentence of present claim 1) concern the process to be carried out with the claimed apparatus and are partly worded as relative quantitative indications describing the results to be achieved upon the use of the apparatus rather than structural apparatus features. See in particular the expressions "entire unreduced pressure", "effective breakdown into droplets", "earlier vaporisation" and "improvement of steam cooling".

The feature "the process stream with its entire unreduced pressure" is not expressly mentioned in the description. However, for the purpose of the present decision, the board can accept the appellant's interpretation that this feature is implied by the arrangement of the steam and cooling water outlet openings in close proximity.

- 2.2 From the claim itself as well as from the description of the patent (column 3, line 53 to column 4, line 4) it can be gathered that the "effective breakdown into droplets", the "earlier vaporization of the cooling water" and the "improvement of steam cooling" are consequences of the immediate transverse impingement of the steam and the cooling water. The comparisons inherent to these expressions appear to be based upon

the allegedly unsatisfactory mixing and cooling obtained at low valve opening degrees in prior art steam conditioning valves such as the ones referred to in column 1, lines 18 to 53.

2.3 In the board's view, the said additional features merely describe the effects achieved upon the use of the valve as a consequence of the constructional and functional features as recited in the claim. The appellant did not submit that further limitations, in terms of constructional or functional features, are implied by the said expressions. The board thus holds that the claim encompasses any valve wherein at low opening degrees steam and cooling water are made to transversely impinge on each other immediately after leaving their respective ducts via outlets situated close to each other.

3. Since novelty of the claimed apparatus was not disputed, the main issue in the present case is inventive step.

3.1 All the features of the present claim, except for the merely descriptive ones addressed under 2.3 above, have been expressly discussed in the board's communications. Hence, the board is satisfied that despite the submission of an amended claim the appellant has had sufficient opportunity to present its comments in respect of the questions at issue.

4. *Closest prior art*

4.1 As already pointed out in the board's previous communications, document D2 discloses a steam conditioning valve for simultaneously reducing the

pressure and temperature of steam by mixing it with cooling water. See column 1, lines 13 to 16, lines 25 to 27 and lines 39 to 59, and in particular Figures 1, 5 and 11. The valve comprises a plug **26** co-acting with a seat **22** and being perforated by a plurality of first holes through which the steam flows from the inlet. The cooling water is supplied in an amount proportional to the amount of steam to be treated, ie to the valve opening degree, by means of a plurality of second holes **44** in the upper part **40** of a hollow spindle **31**. The hollow spindle terminates in a jet extending through and past the plug. The end of the jet comprises water outlets for feeding the water into the departing steam flow. See column 3, line 16 to column 4, line 44 and Figures 1 to 5. Moreover, as repeatedly pointed out by the respondent, a certain amount of steam is always carried to the proximity of the cooling water outlets of the jet by means of a separate annular duct or "small passage" **25** terminating above the cooling water outlets of the jet, thereby creating a suction effect on the injected cooling water, see Figures 1 and 2 and column 4, lines 18 to 20.

- 4.2 The preferred steam conditioning valves as shown in the figures of D2 are apparently more similar to the ones shown in Figure 1 of the contested patent than the ones according to D1 (see Figure 1). The appellant has not commented on the disclosure of D2. It has not contested that the valves of D2 have all the features recited in the pre-characterising part of present claim 1 and match the acknowledgment of the prior art in the application as filed, see page 1, line 19 to page 2, line 16. Taking further into account that D2 addresses the concept of leading steam to the proximity of the

water outlets by specific means (passage 25), the board therefore considers the disclosure of document D2 to represent a more appropriate closest prior art than D1.

5. *Technical problem*

In view of the passage in column 1, lines 49 to 58 of D2, and in the absence of any comments of the appellant concerning this document, it is not clear whether the specific valve design shown in D2 would actually lead to unsatisfactory cooling of the steam at low opening degrees of the valve. However, assuming in the appellant's favour that it would, the technical problem to be solved by the claimed invention can in any case be seen in the provision of a different steam conditioning valve of the type wherein the cooling water feed is regulated proportionally to the steam feed, which provides for a fully satisfactory steam cooling even at small valve opening degrees, ie those below 15 to 20%, see the contested patent, column 1, lines 50 to 57.

6. *Obviousness of the solution*

6.1 D6 discloses a steam conditioning valve wherein steam is cooled by mixing it with an appropriate amount of water, see page 1, the first paragraph and the figure. More particularly, the cooling water is fed to the valve via a hollow spindle **1** and is mixed with the steam entering via the plurality of perforations **3** and **4** comprised in a plug **2** co-acting with a seat **6**. The board shares the view of the opposition division that D6 also addresses the problem of providing a steam conditioning valve leading to satisfactory steam

- cooling at low valve opening degrees of less than 15%, see page 1, second and third paragraphs, and page 2, lines 11 to 13.
- 6.2 As a solution to this problem D6 discloses the provision of perforations and conduits **4** and **5** which lead the incoming steam, separately from the main steam flow path via perforations **3**, to the immediate vicinity of the cooling water outlet openings **9** at low opening degrees of the valve. See page 2, lines 1 to 4, page 3, fourth paragraph, page 4, lines 3 to 6 and the last paragraph, and the figure. The suggested arrangement provides for a particularly intimate mixing of the steam and the cooling water at such low valve opening degrees, see page 2, lines 4 to 8.
- 6.3 In the contested decision, the opposition division took the view that the relative arrangement of steam and water outlets at low valve opening degrees as shown in the figure of D6 leads to an impingement of the steam and cooling water streams on each other. Due to the intersection of the two streams at an angle of about 90°, a breaking-up and vaporisation of the water stream and a satisfactory mixing and cooling of the steam will necessarily be obtained. In the course of the appeal proceedings, the appellant has not commented on the disclosure of D6 at all. In the absence of any counter-arguments from the appellant the board, as indicated in its second communication, sees no reason for deviating from the view of the opposition division.
- 6.4 The board also shares the view of the opposition division that the skilled person, starting from known steam conditioning valves such as the ones disclosed in

D1, and confronted with the stated technical problem would consider the teaching of D6, which relates to a similar type of steam conditioning valve, and apply it to the known valves, thereby arriving at a valve as disclosed in claim 1 as granted. Moreover, in the absence of any counter-argument from the appellant, the board maintains its view as expressed in its communications that the skilled person would, for the same reasons, and without any inventive skills being involved, also consider the application of the teaching of D6 to valves such as shown in D2 in order to solve the stated technical problem.

- 6.5 As already pointed out in the board's second communication, those additional specific structural features of present claim 1 which were not present in the independent apparatus claim 3 as granted are also disclosed in or at least suggested by D6.
- 6.5.1 D6 clearly addresses valve opening degrees of below 15%, see page 2, lines 11 to 13.
- 6.5.2 D6 discloses a plurality of steam ducts **5** arranged circumferentially around, ie in an annular fashion, and extending along the lowermost part of the water-feeding hollow spindle **1**, ie the jet, their outlets **10** forming an annular steam outlet. The ducts **5** are delimited radially outwardly by a solid wall portion that can be considered as a jacket. It can be gathered from the figure of D6 that outlet openings **10** for the steam are arranged very near to and slightly above the cooling water outlets.

6.5.3 According to the figure of D6, the cooling water exits the jet at an angle of 90° with the longitudinal direction thereof. Without giving any further explanations, the appellant has argued that this feature was important for receiving a fine distribution of the water during the cooling of the steam. According to the contested patent, the purpose of this arrangement of the water outlets, within the context of the preferred embodiment shown in the figures, is to achieve the crossing of the steam and water streams, see column 3, lines 9 to 12. Although according to the figure of D6 the cooling water exits the jet at an angle of roughly 45° with the longitudinal axis thereof, an intersection of the steam and water streams at an angle of roughly 90° is achieved by a corresponding arrangement of the steam outlets. Hence, the board maintains its earlier opinion, that no particular effect can be attributed to the feature in question. The board holds that, depending on the direction of the exiting steam, the choice of an appropriate water exit angle, with the proviso that the steam and water streams intersect each other, is merely a matter of engineering routine.

6.5.4 Considering the relative arrangement of the steam and cooling water outlets, the board maintains its view that the features "whereby the process steam with its entire unreduced pressure cuts transversely across the direction of the cooling water flow", which describe the effects obtained, are disclosed in D6, the effects necessarily obtained being "an effective breakdown into droplets as well as an earlier vaporization of the cooling water and improvement of steam cooling", in



accordance with the construction of claim 1 as set out under point 2.4 above.

6.6 In the absence of any counter arguments of the appellant, the board is not convinced that the further restricting amendments carried out in the apparatus claim during the appeal proceedings are suitable for establishing the presence of an inventive step. The application of the teaching of D6 to a valve as disclosed in D2, together with the provision of slight modifications which are easily available to the skilled person and have no demonstrated impact on the functioning of the valve and the effects to be obtained, would lead to a valve falling within the terms of claim 1 in an obvious manner.

6.7 Consequently, the subject-matter of claim 1 is found not to be based on an inventive step.

## **Order**

### **For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

U. Bultmann

R. Spangenberg