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D E C I S I O N
of 16 November 1993

Case Number: T 0857/91 - 3.2.3

Application Number: 84308707.3

Publication Number: 0148609

IPC: F28F 1/40, F28F 13/18

Language of the proceedings: EN

Title of invention:
Heat-transfer tubes with grooved inner surface

Patentee:
Hitachi cable, Ltd.

Opponents:
Outokumpu Oy
Pechiney, S.A.
Wieland-Werke AG

Headword:
-

Relevant legal norms:
EPC Art. 52, 54, 56

Keyword:
"Novelty and inventive step (no)"
"New definition of a known parameter"
"Disclaimer admitted (yes)"
"Late-submitted material admitted (no)"

Decisions cited:
T 0574/91, T 0004/80, T0433/86, T0105/87, T0170/87, T 0204/83, T 0056/87

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0857/91 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 16 November 1993

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 21 June 1991 with the written grounds sent on 5 September 1991 revoking European patent No. 0 148 609 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C.T. Wilson
Members: J. du Pouget de Nadaillac
J.-C. Saisset

Summary of Facts and Submissions

I. The appeal is directed against the decision dated 5 September 1991 of the Opposition Division of the EPO revoking the European patent No. 0 148 609, (granted on the basis of European patent application No. 84 308 707.3), on the grounds that the subject-matter of granted Claim 1 does not imply an inventive step with regard to the document hereinafter referenced (1) and that the independent claims of the auxiliary request contain subject-matter which extends beyond the content of the application as filed (Articles 52(1), 56 and 123(2) EPC).

The three oppositions were based on the following documents:

(1): "Performance Characteristics of MULTI-GROOVED TUBE for Air-conditioners" in the FURUKAWA Electric Review, Nov. 1981, No. 73, pages 205 to 210 (the English translation was published after the priority date 28 December 1983 of the contested patent, in the FURUKAWA Electric Review, Dec. 1984, pages 71 to 76)

(2): JP-U-55-180186

(3): US-A-4 480 684, published on 6 December 1984 and claiming the priority date 6 May 1979 of a Japanese application No. 54-65952

(4): Conference of Daikin of 9 April 1982, pages 1 to 11

(5): JP-A-62-25959, together with a French translation of the publication dated 5 June 1987 of the corresponding application before examination and mentioning a publication date of 7 July 1979 for the application after examination

(6): US-A-4 044 797

(7): A prior use (4 documents).

II. Claim 1 as granted reads as follows:

"A heat-transfer tube having spiral grooves on its inner surface, wherein the ratio of the depth of said grooves to the inside diameter of the tube is between 0.02 and 0.03, the helix angle of said grooves to an axis of the tube is between 7° and 30°, the ratio of the cross-sectional area of respective grooved section to said groove depth is between 0.15 and 0.40; and the apex angle in cross-section of a ridge located between said respective grooves is between 30° and 60° whereby the grooved inner surface is adapted to phase transition of fluid flowing inside the tube."

III. The Appellant (Patentee) lodged the appeal on 5 November 1991 and paid simultaneously the appeal fee. The Statement of Grounds was received on 14 January 1992.

The Respondents I to III (Opponents I to III) filed replies on 23, 8, and 30 May 1992, respectively.

IV. In response to a communication dated 13 September 1993 of the Board pursuant to Article 11(2) RPBA, the Appellant submitted on 28 October 1993 two full sets of claims, as Auxiliary Requests I and II, and new pages of the description.

V. Oral proceedings took place on 16 November 1993. During these proceedings, Respondent I submitted the abstract of Document (3). The Appellant also withdrew his first auxiliary request and requested to replace it with the above Auxiliary Request II as a single auxiliary request.

Claim 1 of this auxiliary request has the following wording:

"A heat-transfer tube having spiral grooves on its inner surface, wherein the ratio of the depth of said grooves to the inside diameter of the tube is between 0,02 and 0,03; the helix angle of said grooves to an axis of the tube is between 7° and 30°; the ratio of the cross-sectional area of respective grooved section to said groove depth is between 0,15 and 0,40; and the apex angle in cross-section of a ridge located between said respective grooves is between 30° and 60°, whereby the grooved inner surface is adapted to phase transition of fluid flowing inside the tube, with the exception of a heat-transfer tube in which the helix angle of said grooves to an axis of the tube is 10°, the ratio of the cross-sectional area of respective grooved section to said groove depth is 0,3 to 0,4, and the apex angle in cross-section of a ridge located between said respective grooves is 57°."

VI. The Appellant's submissions were essentially as follows:

By claiming the ranges of four parameters, the present invention defines a tube lying within a well-defined field, which solves the specific problem mentioned in column 2 of the description of the contested patent. The most important feature is the ratio S/H, which achieves a surprising effect in combination with the other parameters: As shown in Figure 7 of the patent, when the claimed optimum cross-sectional area of the grooves is chosen, the flowing liquid uses the whole surface of the grooves and remains as thin as possible when flowing over the top of the ridges. It is the Appellant, who has for the first time realised the importance of this parameter S/H for the solution of the problem underlying the present invention.

Document (1) represents the closest prior art. However, for two main reasons, it is not possible to derive

technical information from Photo 1 of this document: First, it cannot be considered as being more than a diagrammatic or at least a crude photographic representation of tubes and, moreover, nothing indicates that the tubes of Photo 1 correspond to tubes having the values of Table 1. In the English version of this document, it is only stated that "the typical shapes of ...grooves", that is to say only examples, "are shown in Photo 1". The article "the" is further missing in the Japanese version, the only one published before the priority date of the contested patent. Thus, only certain examples of shapes are given in Photo 1, examples which could have been photographed from models and not from real tubes. Therefore, reliable information concerning numerical values cannot be taken from this photo. Moreover, contradictions appear between Photo 1 and Table 1, so that reasons exist to assume that the tubes according to Photo 1 do not correspond to the tubes defined in Table 1 in respect of their dimensions. A first contradiction appears with the ratio S/H, which has the value 0.33 when calculated by the Respondents on the basis of a high magnification of Photo 1, but a different value, namely 0.46 to 0.47, is obtained when only the dimensions given in Table 1 are used to calculate this ratio, as shown in the Statement of Grounds , pages 2 and 3. A second contradiction concerns the number of grooves: A calculation based on the fin top pitch measured on the enlarged photo results in a groove number of 60, whereas Table 1 mentions a number of grooves of 48 for the tube B.

Therefore, it is not justified to combine the values of Table 1 with data from Photo 1. Reference was made in this respect to the decisions T 204/83, OJ EPO 1985, 310 and T 56/87, OJ EPO 1990, 188 of the Boards of Appeal.

Since neither Table 1 nor Photo 1 of document (1) gives all the necessary information with respect to the four claimed ranges of parameters, a tube according to granted Claim 1 is not anticipated by the disclosure of this document.

Each of the three examples of tubes given in Document (2) shows only a few parameters of Claim 1, but not all the parameters in combination.

Documents (3) and (5) were published after the priority date claimed by the contested patent and, thus, do not form part of the prior art. The Japanese abstract of document (3) filed during the oral proceedings discloses geometrical figures which are not inside the claimed field and, further, it is not possible to determine whether this abstract was prepublished.

In Document (4), the information taken from Photo 2 is contradictory to what is said in Table 1. Thus, the reasons advanced to disregard document (1) apply also to this document. Moreover, it has not been proven that the content of this document, which has been published after the priority date of the present patent, corresponds to what has been told during the conference.

With respect to Document (5), its French translation indicates indeed a previous date of publication of the Japanese application, but the content of this Japanese document has not been submitted by the Respondents and the French translation is not certified. Thus, this document is doubtful and should not be considered. Moreover, the teaching of this prior art does not suggest the present invention, since the average widths W1 and W2 of respectively the grooves and ridges are not related to a cross-sectional area, but to a linear dimension. What is looked for in this prior art is the

condition W1 > W2, so that the significance of an average groove width alone is not recognised.

Document (6) teaches the use of multi-grooved tubes which have either triangular or U-shaped grooves and ridges, but a combination of the two shapes is not suggested. The width of the grooves is only considered in the case of U-shaped grooves and ridges, thus without an apex angle of the ridge. No hint is given to combine various parameters, which apply to a given shape, with parameters of other shapes.

It has not been proven that Document (7), namely the alleged prior use, pertains to the prior art.

VII. The arguments of the Respondents can be summarised as follows:

Column 2 of the first page of Document (1), in its English version, clearly indicates that a link exists between the Photo 1 and Table 1 of this document. The pitch for calculating the number n of grooves must be taken at the base of the ridges and not at their tips, as it has been made by the Appellant. Moreover, he has assimilated the ridges shown in Photo 1 to triangles in his calculation of S/H, ignoring thereby the rounded parts of these ridges, which reduce significantly the cross-sectional area of the grooves. No contradictions in reality appear, when Photo 1 and Table 1 are compared, so that they can be combined. One inventor of the contested patent confirmed this fact by combining them. Since the tube B of Photo 1 shows parameters which fall inside the claimed ranges, the subject-matter of the granted Claim 1 is not novel. Documents (3), (4) and (6) also disclose ranges of values or examples of tubes, which destroy the novelty of the subject-matter of

Claim 1 of the main request. Document (3), further, anticipates Claim 1 of the auxiliary request.

The use of a disclaimer, which excludes from the claimed invention a tube falling in the middle of the claimed ranges, is not sufficient to support the presence of an inventive step. The parameter S/H per se has not been disclosed, but, since it corresponds to the average groove width in most cases, it is nothing more than a new formulation of a known parameter. Either Document (2), which emphasises the importance of the ratio W/p, W being the width at the bottom of a groove and p the pitch, or Document (5) with its condition W1 > W2 discloses directly or indirectly this parameter. Figure 10 of document (6), also, shows the influence of the width of the grooves for the heat transfer, whereas the relationship between the apex angle and the heat transfer is shown in Figure 9, so that a consideration of both parameters, width of the groove and apex angle, is suggested to improve the heat transfer rate. It is also pointed out that in Claim 1 of each request of the Appellant, no information is given about the shape or width of the ridges. The subject-matter of each Claim 1 cannot, therefore, imply an inventive step.

VIII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained as granted or in accordance with the second auxiliary request filed with the letter dated 25 October 1993.

The Respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural Matters*

During the oral proceedings, the Appellant has raised an objection to Documents (3), (4), and (5), arguing for the first time that it has not been proven that any one of these documents constitutes prior art according to Article 54(2) EPC, so that oral proceedings should be postponed and the proceedings continued in writing if the Board considers taking any of these documents into account.

In particular, he has objected in respect of Document (5) that the French translation was not certified and, moreover, that it relates to the Japanese application after examination, which was published after the priority date of the patent in suit. Only the corresponding application before examination was published before this date. Thus, document (5) as submitted should not be considered, since it is not prior art under Article 54(2) EPC. Relating to the certification of the translation, the Board would point out that this objection was raised by the Appellant at the very last stage of the procedure, namely during the oral proceedings, although all the time before, namely during more than four years, the Appellant has himself considered and discussed the content of this document, giving consequently the impression that he treats it as a valid prior art. Moreover, according to international patent law, it is only possible to restrict the content of an application, and not to extend it, since no subject-matter can be added to the content of the application as filed. Thus, all information which is found in the application after examination, in the absence of any substantial evidence being put forward by the Appellant, can be assumed to have been present in the application before examination. For this reason, the Board has no reason not to consider the French

translation of the Japanese document as being part of the prior art. The Board would also point out in this respect that according to established Board of Appeal case law, (see for example paragraph 2 of T 574/91 of 3 August 1993, not published), it is incumbent on the parties to make clear as early as possible that indeed objections are raised on matters of fact. A failure to do so may, as in the present case, result in the objection being disregarded.

Main Request

3. *Novelty of the subject-matter of Claim 1*

From Document (1), heat-transfer tubes adapted to phase-transition of fluid flowing inside the tube and having on their inner surfaces spiral grooves are known. These inner-surface-grooved tubes show higher transfer performances than the conventional smooth tubes.

3.1 On the first page of Document (1), a photo, hereinafter referenced as Photo 1, shows three transverse cross sections of sectors of tubes, referenced respectively Types A, B and C, each type having grooves with a particular shape. The second type, namely Type B, is more particularly considered in the present case and shows ridges, which are almost triangular, separated by almost trapezoidal grooves, the junctions between ridges and grooves as well as the tips of the ridges being rounded. Table 1, which is just under this photo, gives the outer diameter (Do), the bottom thickness (t), the groove depth (H), the number of grooves (n) and the helix angle (β) of each type of tube. For the Type B, the values are respectively:

Do = 9.52 mm ; t = 0.35 mm ; H = 0.20 ; n = 48 ; β = 10°

Having Do, t and H, the inner diameter (Di) of Type B can be found:

Di = Do - 2(t + H) = 8.42 mm,
so that the ratio H/Di = 0.0237.

Therefore, a tube according to Type B of Document (1) has already two parameters, namely the ratio H/Di and the helix angle, inside the corresponding ranges of Claim 1 of the contested patent. Two parameters are missing, which could be deduced from Photo 1.

3.2 However, according to the Appellant, a photo is nothing more than a schematic representation, so that no dimension can be taken from it. This view cannot be followed by the Board:

A schematic representation is made by a draughtsman, who can have a wide range of aims when drafting an object. For example, he can confine his drawing either to the essential features, the general design of the object, or to the geometrical dimensions as is the case, for example, in Figure 1 of Document (1); He can also only represent the principle of the object. Hence, a schematic representation is not always to be considered as an exact representation of an object, unless other information offers a basis for this assumption. A photo, by comparison, is an independent reproduction of an object and, thus, has normally to be regarded as an exact representation of the object. Indeed, in particular cases, for example with artistic photos, the representation can be influenced by the user of the camera, but, as far as a technical teaching is concerned, it is to be expected that an exact representation is looked for, especially when a photo is used in preference to a drawing. In the present case, this conclusion is all the more probable, since the

information which is sought, namely the apex angle and the cross-sectional area of the grooves, requires a transverse cross section of the tubes, as is given by Photo 1, at the bottom of which it is expressly indicated that transverse cross sections are shown and not only shapes.

3.3 Moreover, contrary to the opinion of the Appellant, indications are given in Document (1) that the data of Table 1 concern the tubes shown in Photo 1. As already seen above, this photo shows three tubes referenced Types A to C, and Table 1 contains three lines of dimensions, one for each expressly referenced type. Moreover, on the first page of Document (1), it is indicated:

"The Multi-Grooved tubes are the tubular products with a number of fine spiral grooves on their inner surface, the typical shapes of which are shown in Photo 1. Also, the specification for their dimensions are shown in Table 1 and ...".

Thus, in addition to the link made by the same mentioned references A to C of the tube types, another clear link between Table 1 and Photo 1 is given by this passage. It would not be substantially modified when the article "the" applied to the typical shapes is omitted, as was alleged by the Appellant in the oral proceedings to be the case in the original Japanese document.

3.4 The contradictions put forward by the Appellant are not demonstrated and, therefore, values of the tube disclosed by Document (1) can be obtained by combining information from Table 1 and Photo 1 of this document:

(a) Concerning the ratio S/H :

In his calculations, the Appellant has used a formula, which shows that he has assimilated the ridges shown in Photo 1 to triangles having the apex angle and the height mentioned in Table 1. By doing so, he has neglected the rounded parts of the ridges, so that the corresponding triangles are well inside the cross-sectional areas of the ridges and do not follow the boundaries lines of the ridges. The cross-sectional area S of the grooves is thereby artificially and significantly increased. The planimeter method followed by Respondent III for measuring this area on the enlarged photo is more convincing and gives an S/H value of 0.33 mm, which approaches the value 0.34 obtained by Respondent II, who has measured the average width W of a groove on the photo, (This width corresponds to the ratio S/H in a trapezium and the grooves of the photo show trapezoidal shapes with opposite rounded parts at the angles, which counterbalance each other). These values are further not far from the value 0.377 mm calculated by one inventor of the present invention, who has combined, without raising any objection, values of Table 1 with the width of the groove bottom measured on Photo 1, as can be seen in a declaration of this inventor made during the USA procedure and filed by the Appellant in the opposition procedure. These values are well inside the claimed range of the ratio S/H, so that they would remain within this range, even if a margin of error for the measurements is admitted.

(b) Concerning the number of grooves n:

Photo 1 shows a very partial cross-sectional view of the tubes and only five grooves are shown for the Type B tube, so that it is not easy to determine exactly the exact number of grooves, which concerns the whole tube, and not only a particular part of the tube, for example a groove, as was the case for the measurements above. Moreover, an examination of the calculations made by the Appellant for this purpose shows that these are based on doubtful values. On the magnified Photo 1 filed by Respondent III with his grounds of opposition and used by the Appellant, the ridge top pitch, when measured, is 23 mm or more. Another measurement made by the Board on the whole photo, that is to say between the five grooves, gives a length between 117 and 118 mm, which divided by five, gives a pitch between 23.4 and 23.6 mm, confirming thereby that the (magnified) ridge top pitch is between 23 and 23.6 mm, and not 22 mm as used by the Appellant. A reduction coefficient V has also to be applied to obtain the real values from measurements on the magnified photo. It has been calculated by Respondent III from measurements of the groove height and, then, used by the Appellant, but the obtained value is not accurate enough and should be near 0.022 and not 0.02. Measuring, for example, the bottom wall thickness, the limits of which, contrary to those of the groove height, are clear on Photo 1, a reduction coefficient V = 0.35 mm/16 mm = 0.0219 is obtained. Then, applying with these two more accurate values the calculations of the Appellant, a groove number n between 51 and 52 is obtained, not far from the value 48 of Table 1. Hence, no contradiction appears.

3.5 The apex angle (α) of the ridges measured from Photo 1, Type B, lies between 51° and 54°, thus inside the range of contested Claim 1. The Appellant has not contested this measurement *per se*.

Thus, the following values are obtained for the tube, Type B, shown in Document (1):

H/Di = 0.0237 ; α = 51°to 54°; β = 10°; S/H = 0.33.

Since such a tube falls within the field defined by Claim 1, it anticipates the subject-matter of this Claim, which is, therefore, not new (Articles 52 and 54 EPC). For this reason, the main request cannot be allowed.

Auxiliary request

4. Claim 1 of this request amends Claim 1 as granted by excluding tubes corresponding to tube B disclosed in Document (1) from the scope of the claim. The subject-matter of this disclaimer was not disclosed in the application of the contested patent, as filed. However, since it is known from a relevant state of the art, namely Document (1), at the date of filing of the present patent, it may, according to the jurisprudence of the Boards of Appeal, be excluded without objection under Article 123(2) EPC, see in this respect the decisions T 04/80 (OJ 82, 149) and T 433/86 and T 105/87 (not published).

5. *Novelty*

With this disclaimer, the subject-matter of Claim 1 is new with respect to Document (1). The Respondents have, however, objected novelty of this subject-matter in the

light of other documents, such as documents (3), (4) and (6).

However, there is no need to consider this objection , since Claim 1 cannot be allowed for lack of inventive step in the light of Document (1), as set out below.

6. *Inventive step*

Whilst according to established Board of Appeal case law, e.g. as expressed in the above cited decisions, it is permissible to exclude a special state of the art from the claimed invention by means of a disclaimer in order to establish novelty, it has also been established that such a disclaimer cannot make an obvious teaching inventive, see T 170/87 (OJ 89, 441). In other words, it must be examined whether the disclaimed subject-matter constituted an "accidental disclosure". However, an "accidental disclosure" means that the disclosure is directed to a different purpose, solves a different problem, and has no bearing on the problem and solution addressed by the invention. This is clearly not the case here.

6.1 It has been admitted by all the parties that the closest prior art is represented by Document (1). In its English translation, page 72, last paragraph of the right-hand column, the heat transfer rate is stated to be improved "by the effect of enlarged inner surface area due to the grooves processed inside and that of the grooves themselves (effect of promoting the generation of turbulent flow, capillary phenomenon etc.) superposed on it". The person skilled in the art, thus, receives a hint that by improving the total inner surface area of the tube and more particularly the surface area of the grooves good results for the heat transfer are possible.

6.2 The tubes used for the tests in Document (1) have an outer diameter of 9.52 mm and groove depths of 0.20 mm or 0.15 mm. All the documents cited in the procedures show that these dimensions are those, which are the most common. Considering the first range of values of the contested Claim 1, namely the range of ratio H/Di, a graph Di = f (H) shows that the condition $0.02 < H/Di < 0.03$ implies, in fact, a groove depth H between 0.16 mm and 0.27 mm for tubes having the most usual outer diameters, namely those between 9 and 10.2 mm. With tubes having larger diameters, that is to say up to 12 mm, the graph shows that a depth of not more than approximately 0.35 mm fulfils the condition. Since it is well known in the technical field that, with too large groove depths, namely those above 0.4 mm, the pressure drop of the fluid flowing inside the tube is increased and adversely affects the heat transfer rate, the use of depths fulfilling the first condition of Claim 1 is therefore quite usual.

6.3 The values of the helix angles of the grooves to an axis of the tube, which are given in Document (1), are 25° and 10°, covering thus a wide part of the claimed range of 7° to 30° of the granted patent.

6.4 The Appellant has emphasised the importance of the ratio S/H for solving the problem underlying the present invention, namely to provide an inner surface grooved tube having a higher heat-transfer rate. For the present invention, the concept of using the cross-sectional area of the grooves by means of the ratio S/H is essential. However, the Appellant has simultaneously recognised that for simple and symmetric configurations the value of this ratio is identical with the average groove width W1. When the grooves are either triangular or trapezoidal, a calculation based on the surface formula of these geometrical shapes shows that, effectively, the

ratio S/H = W1. Since these shapes are the most commonly used, an almost general identity between the parameters S/H and W1 is consequently to be assumed.

6.5 The consideration of this parameter W1 for the same purpose, namely to improve the heat transfer rate, is however not new:

6.5.1 Document (5), for example, considers this parameter: It teaches to improve the heat transfer rate of a tube by providing its inner surface with trapezoidal ridges and grooves, because with such a shape the cross-sectional area of the grooves, and thus the total inner surface of the tube is increased. The depth of the grooves has to be in the range between 0.2 and 0.5 mm to avoid a pressure loss of the flowing fluid and a pitch of the grooves and ridges between 0.3 and 1.5 mm is said to contribute to a good capillary effect. This pitch corresponds to W1 + W2, W1 and W2 being respectively the average widths of grooves and ridges, measured at H/2. Figure 5 of this prior art shows that the best heat transfer is obtained when the ratio W1/W2 is near the value 2 and this good result is attributed - see page 7 - to the fact that the quantity of liquid taken by the grooves increases with the average width of the grooves. This document, further, recommends the use of spiral shapes of grooves and ridges, since the flowing fluid receives thereby a rotating force along the wall pipe, improving further the heat transfer rate. A helix angle of 10° is mentioned, which is inside the range given in Claim 1 of the contested patent.

6.5.2 Starting from the multi-grooved tubes known from Document (1), the person skilled in the art receives, therefore, from document (5) a clear teaching to consider the average width of the grooves as an essential parameter. It is equivalent to the

cross-sectional area of the groove, and, when this width is increased within certain limits, the heat transfer is improved. Moreover, document (5) teaches that this parameter has to be considered together with other parameters such as the groove depth, the helix angle and the groove pitch, all parameters which are mentioned in Document (1), the groove pitch being equivalent to the number of grooves. The values or ranges given in Document (5) for these parameters are within or overlap the ranges of the same or equivalent parameters of the contested Claim 1 (see Point 3.2).

6.6 The sole parameter, which is not mentioned in Document (5), is the apex angle of the ridges. However, it has been seen that the tube B shown in Document (1) has an apex angle, which lies within the corresponding range of Claim 1 of the contested patent. Moreover, because of the methods which are used to manufacture these grooved tubes, - methods in which a smooth tube is passed over a grooving plug and metal balls are rotated around the exterior surface of the tube, applying pressure thereto - too narrow apex angles cannot be obtained without difficulties, whereas, on the other hand, too large apex angles reduce the cross-sectional area of the grooves and, thus, the heat transfer rate. Most of the documents cited in the procedure show that the claimed apex angle range from 30° to 60° comprises the most usual apex angles. Document (6), further, gives the general teaching that the sharper the apex angle is, the higher the heat transfer rate obtained.

6.7 For all these reasons, the use of the parameter S/H in combination with the claimed ranges of the ratio H/Di, the helix angle and the apex angle for defining a grooved heat transfer tube does not imply an inventive step. With the most common shapes of grooves, this

parameter S/H is nothing more than a new definition of the known parameter W1.

The subject-matter of Claim 1 represents the normal considerations of the person skilled in the art, starting from the pipe according to Document (1) and varying the standard parameters to establish the limits in which he can work.

It follows, consequently, that the subject-matter of Claim 1 of the auxiliary request does not imply an inventive step and is therefore not allowable under Articles 52 and 56 EPC.

Order

For these reasons, it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

N. Maslin C.T. Wilson