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**Datasheet for the decision
of 4 April 2022**

Case Number: T 1009/19 - 3.3.05

Application Number: 08853343.5

Publication Number: 2216108

IPC: C25D5/26, F16L9/16, B21C37/09

Language of the proceedings: EN

Title of invention:
MULTIPLEX-WOUND STEEL PIPE

Patent Proprietor:
Sanoh Kogyo Kabushiki Kaisha

Opponent:
TI Automotive (Heidelberg) GmbH

Headword:
Multiwall steel pipe/Sanoh Kogyo

Relevant legal provisions:
EPC Art. 100(a), 54, 56

Keyword:
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:



Beschwerdekammern

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Chambres de recours

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Case Number: T 1009/19 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 4 April 2022

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 7 February 2019
rejecting the opposition filed against European
patent No. 2216108 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman E. Bendl
Members: S. Besselmann
R. Winkelhofer

Summary of Facts and Submissions

- I. This appeal lies from the opposition division's decision to reject the opposition against European patent EP 2 216 108. The patent in suit concerns a multiplex-wound steel pipe.
- II. The claims of the patent as granted relate to a multiwall steel tube (claim 1), to a use of the multiwall steel tube (claim 2) and to a multiwall steel tube manufacturing method (claim 3), and read as follows:

"1. A multiwall steel tube formed by winding a steel sheet (10), said steel sheet (10) having opposite first and second surfaces respectively coated with copper films (11, 12) by plating, around a forming roll into a tube and bonding together the layers of the steel sheet (10) by brazing, wherein the copper film (11) coating the first surface has a thickness t_1 , the copper film (12) coating the second surface has a thickness t_2 greater than the thickness t_1 , and the steel sheet (10) is wound such that the first surface faces outside, wherein the ratio of the thickness t_1 to the thickness t_2 is in a range expressed by an inequality:

$$1/3 \leq t_1/t_2 \leq 2/3;$$

and wherein the thickness t_1 of the copper film (11) coating the first surface meets a condition expressed by:

$$0 < t_1 \leq 3 \mu\text{m};$$

and wherein the thickness t_2 of the copper film (12) coating the second surface meets a condition expressed by:

$$3 \mu\text{m} \leq t_2 \leq 6 \mu\text{m}."$$

"2. Use of the multiwall steel tube according to claim 1 as a brake tube having a pressure rating of 35 MPa or above for vehicles."

"3. A multiwall steel tube manufacturing method of manufacturing a multiwall steel tube formed by winding a steel sheet (10) having copper-plated surfaces around a forming roll into a tube and bonding together the layers of the steel sheet (10) by brazing, said method comprising the steps of:

preparing a steel sheet (10) having a first surface coated with a copper film (11) of a thickness t_1 and a second surface coated with a copper film (12) of a thickness t_2 greater than the thickness t_1 ;
winding the steel sheet (10) around a forming roll into a steel tube such that the first surface faces outside;
and bonding together the layers of the steel sheet (10) of the steel tube by brazing that heats the steel tube at a temperature not lower than the melting point of copper in a reducing atmosphere,
wherein the ratio of the thickness t_1 to the thickness t_2 is in a range expressed by an inequality:

$$1/3 \leq t_1/t_2 \leq 2/3;$$

and wherein the thickness t_1 of the copper film (11) coating the first surface meets a condition expressed by:

$$0 < t_1 \leq 3 \mu\text{m};$$

and wherein the thickness t_2 of the copper film (12) coating the second surface meets a condition expressed by:

$$3 \mu\text{m} \leq t_2 \leq 6 \mu\text{m}."$$

III. The documents referred to in the decision under appeal included:

- D1 EP 0 576 733 A1
- D2 EP 1 488 865 A1
- D3 JP 57-127575 A and translation into English
- D4 US 1 892 607 A
- D5 GB 352 323 A

IV. In particular, the opposition division found that the term "copper film" had to be interpreted as a film of commercially pure copper, excluding films of copper alloys (point 2.1 of the decision). As per this interpretation, the claimed subject-matter was held to be novel over D1-D3. Starting from D4 as the closest prior art, it also involved an inventive step.

V. In their statement of grounds of appeal, the opponent (appellant) disagreed with the opposition division's interpretation of the term "copper film" and included the following annexes in their submissions:

- Annex 1 Brief description of a book
"Kupferschichten - Abscheidung, Eigenschaften, Anwendungen" by N. Kanani, first edition 2000, Leuze Verlag
- Annex 2 Machine translation of JP 2005-095976
- Annex 3 DE 600 38 061 T2 (German language publication belonging to the same patent family as JP 2005-095976)

The appellant asserted that the subject-matter of claims 1 and 3 lacked novelty in view of each of D1-D3, and lacked an inventive step starting from either D4 or D5. They argued that the subject-matter of claim 2 lacked an inventive step in view of any one of D1-D3. In later submissions (10 March 2022), they also relied on D3 as the closest prior art for the product and its manufacturing method, and cited D1 and D2 as

alternative starting points for assessing inventive step.

VI. The patent proprietor (respondent) defended the granted patent and filed two auxiliary requests with their reply to the appeal.

VII. The appellant's arguments, where relevant to the present decision, can be summarised as follows.

The term "copper film" was a generic term and included copper alloy films. The claim had to be given the broadest technically sensible meaning. The copper alloys used in D1-D3 were thus copper films within the meaning of the claim. Document D1 disclosed that the thickness corresponding to t_1 could be $1.5 \mu\text{m}$ and the thickness corresponding to t_2 could be $4 \mu\text{m}$, with both values being specifically mentioned. This resulted in a t_1/t_2 ratio within the claimed range. Similarly, it was possible to select thickness values within the teaching of D2, namely $1.5 \mu\text{m}$ on one side and $3 \mu\text{m}$ on the other side, which fulfilled the required ratio. The embodiment of D3 involved a t_1/t_2 ratio of 0.5, since the nickel-only layer had to be disregarded for the purpose of calculating the thickness ratio of the copper films.

Alternatively, even if the term "copper film" were to be construed more narrowly, the claimed subject-matter was obvious starting from D3 as the closest prior art. Replacing a copper alloy with copper did not lead to any technical effect. The objective technical problem was thus merely providing an alternative. Using a copper film as an alternative to copper was well known and did not involve an inventive step.

Starting from D4 as the closest prior art, the skilled person would have found the solution to the problem of improving the brazing quality and obtaining a high quality fillet in D1 or D3.

Document D5 in combination with any one of D1, D2 or D3 would also have rendered the subject-matter of claims 1 and 3 obvious.

On the basis of the broad interpretation of the term "copper film" as including copper alloys, D1 and D2 were also relevant to inventive step because it would have been obvious for the skilled person to provide suitable combinations of film thicknesses, resulting in a t_1/t_2 ratio within the claimed range.

VIII. The respondent's arguments, where relevant to the present decision, can be summarised as follows.

In the technical field of the patent and in the context of the patent's disclosure, the term "copper film" was to be understood as a film of commercially pure copper and not as a film of a copper alloy. Copper and copper alloys were not equivalent, requiring different brazing conditions and providing different properties, e.g. strengths.

D1 described the use of copper alloys and did not disclose copper films. It also failed to disclose a ratio of the thickness t_1 to the thickness t_2 in the claimed range, as illustrated in the figure provided (submission of 4 May 2021, page 9). Similar arguments applied in relation to D2. The disclosure of D3 also differed from the claimed tube because D3 stated that one surface of the steel was coated with nickel and the other surface with a copper alloy. The nickel layer

could not be disregarded, so the features relating to the thickness t_1 being greater than the thickness t_2 and to the t_1/t_2 ratio were not satisfied either.

D4 was the closest prior art. Starting from D4, it was an object of the patent to improve the strength and appearance of a multiwall tube formed by brazing a copper-coated steel sheet. D4 did not render the claimed subject-matter obvious either alone or in combination with any one of D1-D3. The inventive-step objections starting from D1-D3 as the closest prior art were late-filed and should be disregarded.

IX. The appellant requests that the decision under appeal be set aside and the patent be revoked.

The respondent requests that the appeal be dismissed or, alternatively, that the patent be maintained as amended on the basis of one of auxiliary requests 1 and 2 filed with the reply to the appeal.

Reasons for the Decision

1. Interpretation of the term "copper film"
 - 1.1 It was disputed whether the term "copper film" in the claims at issue encompassed copper alloys.
 - 1.2 The terms used in patent documents should normally be given their usual meaning in the relevant art. The standard meaning of the term "copper" is the metal copper, not an alloy thereof. Even if one looked at the description there is no convincing evidence that a different meaning was intended in the patent in suit, or that the term "copper film" in the claims at issue

referred to films comprising copper as a (principal) constituent among other possible constituents; the patent in suit does not mention any other such constituents.

1.3 The patent not only uses the compound term "copper film", but mentions copper independently when stating the object of the invention. Namely, the specific wording "providing a proper amount of copper necessary for brazing" and "avoiding the solidification of copper" (paragraph [0012]) is used, and similar wording is used in relation to the effect of the invention (paragraph [0015]). This wording supports the understanding that what is meant is the metal copper, not a copper alloy.

1.4 This understanding is also in line with the fact that the melting point of copper is mentioned in the context of the heating step, in conjunction with the indication that "the plated copper films 11 and 12 melt" (paragraphs [0026] and [0027]); claim 3 likewise mentions "the melting point of copper".

In the context in hand, it would be illogical to define the heating temperature range in terms of specifically the melting point of copper if the intention was to melt alloys with a higher or lower melting point.

1.5 The appellant, by contrast, is of the opinion that the term "copper film" generally has to be construed as a generic term including copper alloy films. According to the appellant, it was usual to define the brazing temperature in relation to the melting point of copper even if a copper alloy was used, as could be taken from D3, D4 and D5.

However, these documents do not support any such conclusion. D3 discloses a multilayer structure (with one layer being made of copper) and aims at melting the copper layer without melting the nickel layer (claim 4; paragraph bridging pages 13-14 of D3). D4 describes heating the copper to a temperature close to its melting point (page 3, lines 17-22). This passage cannot be regarded as a disclosure of specifically heating a copper alloy to the melting point of copper. While D4 teaches that other binding metals which can be used are copper alloys (page 1, lines 39-44), it also teaches that the temperature is to be varied when using other metals (paragraph bridging pages 3-4; paragraph bridging the two columns on page 4). According to D5, copper coating processes are carried out at temperatures above 1 981°F, the melting point of copper (page 2, lines 54-59). D5 indicates that the term "copper" is intended to cover commercially pure copper or alloys of copper (sentence bridging the two columns on page 2), but also specifies that the Monel alloy melts at roughly 2 480°F. D5 suggests neither that the term "copper" conventionally also covers copper alloys nor that using the melting point of copper also applies to copper alloys.

By contrast, D1, which relates specifically to using copper alloys with a low melting temperature, exemplifies a copper-tin alloy having 13-15% tin which can be brazed at about 800°C (page 2, lines 51-58).

- 1.6 The appellant additionally cited "*Anlage 1*" (a book "*Kupferschichten - Abscheidung, Eigenschaften, Anwendungen*") to support their interpretation.

However, the mere fact that this book includes a chapter "*Eigenschaften von Kupfer und -legierungen*"

(translation by the board: "properties of copper and copper alloys") does not prove that the ordinary meaning of the term "copper film" includes copper alloy films. Since copper films and copper alloy films are related, it is not surprising that a book with the title "*Kupferschichten*" ("copper layers") also deals with copper alloy films. As set out by the respondent, a book title usually has to be concise, not revealing too much about the book's content.

- 1.7 Reference was also made to paragraph [0007] of the impugned patent as an indication of a broader meaning of the term "copper film". This paragraph references JP 2005-095976 as disclosing a multilayer steel tube formed by processing a steel sheet having one surface coated with a plated copper film.

However, the use of the term "copper film" in relation to this reference does not introduce any ambiguity since this referenced document discloses a steel sheet plated with copper as a preferred embodiment (paragraph [0006] of annex 2; claim 1 of annex 3).

The appellant specifically cited paragraph [0002] of this referenced document. However, this paragraph does not relate to any embodiment of JP 2005-095976 but references yet another document.

- 1.8 The appellant also held that alloying elements could be present in a steel, meaning that they could also be present in copper. This analogy is not convincing since copper is a chemical element while steel is not.
- 1.9 The appellant argued that the teaching of the patent also functioned for copper alloy films, while the respondent held that the problem - and in particular

the claimed solution - was tailored to copper films. In any case, the appellant's argument would not, as such, imply that copper alloy films are included in the scope of the claim for the purpose of assessing novelty and inventive step.

1.10 In conclusion, the term "copper film", in the context of the claims at issue, does not encompass copper alloy films.

2. Novelty

2.1 The appellant was of the opinion that the subject-matter of claims 1 and 3 lacked novelty in view of each of D1-D3.

2.2 D1 does not disclose a copper film within the narrow meaning set out above (point 1.10), considering that a copper alloy is used (see page 3, lines 12-17 and the claims of D1).

The subject-matter of claim 1 also differs from D1 in that the ratio of the thickness t_1 to the thickness t_2 has to be within the claimed range. Selections within the ranges known from D1, i.e. within the ranges corresponding to t_1 (0.5 to 1.5 μm) and t_2 (4 to 6 μm), are necessary to arrive at a ratio within the scope of the claim. This was visualised by the figure provided by the respondent to illustrate the ranges disclosed in D1 and the claimed thickness values (submission of 4 May 2021, page 9).

The disclosure of D1 does not point to combining specifically the highest possible value corresponding to t_1 (i.e. 1.5 μm) with the lowest possible value

corresponding to t_2 (i.e. $4\ \mu\text{m}$), this combination thus not being specifically disclosed in D1. The only specific ratio directly derivable from D1 is for $t_1 = 1\ \mu\text{m}$ and $t_2 = 4\ \mu\text{m}$, namely $t_1/t_2 = 0.25\ \mu\text{m}$ - outside the claimed range.

2.3 D2 does not disclose a copper film within the narrow meaning set out above (point 1.10) either. Moreover, the subject-matter of claim 1 differs from D2 on account of the t_1/t_2 thickness ratio. According to D2, the copper-tin alloy layer preferably has a thickness of $3\text{-}5\ \mu\text{m}$ on one side and $0.5\text{-}1.5\ \mu\text{m}$ on the other side (paragraph [0019]). Thus, selections would again be necessary to arrive at the claimed thickness ratio, selecting not only the individual thickness values but also the side of the strip to which the relevant thickness is applied.

2.4 D3 discloses a double-wall tube, the steel sheet from which it is formed being coated with two layers, namely a $2\ \mu\text{m}$ nickel layer and a $3\ \mu\text{m}$ copper layer, and the other side being plated with a $4.5\ \mu\text{m}$ copper-nickel alloy layer (84% copper, 16% nickel; Table 3). To obtain the two-layer plating on the one side, the nickel layer is plated on the steel surface and the copper layer is plated on the nickel layer (Embodiment 2).

The steel sheet does not have both surfaces coated with copper films, the copper-nickel alloy layer not being a copper film as per the interpretation given above (point 1.10).

2.5 The same considerations apply to claim 3.

- 2.6 In conclusion, the requirement of novelty is fulfilled (Article 54 EPC).
3. Inventive step
- 3.1 The appellant chose to start in particular from D3 as the closest prior art. Regardless of whether this objection is to be considered, it is in any case not convincing.
- 3.2 The impugned patent relates to a multiwall steel tube for use in brake piping in an automobile and in hydraulic systems of industrial machinery, formed from a steel sheet having both surfaces coated with copper films (paragraphs [0001] and [0003]).
- 3.3 D3 describes a double-wall tube for use in automotive brake lines and thus relates to a similar purpose.
- 3.4 The patent in suit addresses the technical problem of forming a satisfactory fillet to improve the appearance of the tube and form a brazed part having high strength (paragraph [0015]).
- 3.5 As the solution, the multiwall steel tube according to claim 1 is proposed in which both surfaces of the steel sheet from which it is formed are coated with copper films.
- 3.6 The appellant was of the opinion that replacing the copper-nickel alloy in D3 with copper did not achieve a technical effect, so the objective technical problem was merely providing an alternative.

3.7 In the appellant's favour, it is assumed that the objective technical problem is merely providing an alternative.

3.8 What remains to be assessed is if the proposed solution would have been obvious to the skilled person.

D3 teaches away from replacing the nickel-copper alloy film in the embodiment of Table 3 with a copper film. The principal teaching of D3 is to use a multilayer structure involving a copper alloy film (point 2.4 above; claim 4 of D3) instead of a conventional tube having both surfaces coated with copper films (Table 3). According to D3, using copper films on both surfaces is not desirable because it runs the risk of corrosion (page 4, last paragraph) and is also associated with liquid metal embrittlement (paragraph bridging pages 5 and 6).

The only disclosure in D3 that could be relevant to configurations in which copper films are coated on both surfaces is the conventional example (Table 3). In this conventional example, the copper films have identical thicknesses. The skilled person would thus be led back to what is the starting point of D3 and also the starting point described in the patent in suit (paragraph [0004]).

The patent in suit, however, takes a different direction, namely changing the configuration (thicknesses and thickness ratio) of the copper films.

D3 is not concerned with optimising the configuration of copper films, and there is no teaching concerning the thickness ratio of copper films; what may be taken from D3 is at most that the total coating thicknesses

on both surfaces are preferably the same (Tables 2 and 3).

3.9 In conclusion, starting from D3 the skilled person would not have arrived at a multiwall steel tube as specified in claim 1.

3.10 The other documents cited during the proceedings as being relevant to inventive step do not lead to a different conclusion, irrespective of whether the objections starting from D1 and D2 are to be considered.

3.10.1 D4 as the closest prior art

D4 discloses a multiwall steel tube formed from a steel sheet having copper films on both surfaces, and thus reflects the prior art described as the starting point for the claimed invention in the patent in suit (paragraph [0004]).

The problem addressed in the patent in suit is set out above (point 3.4).

As the solution to this technical problem, the claimed multiwall steel tube is proposed, in which the thickness t_1 , the thickness t_2 and their ratio lie within the specified ranges.

The examples provided in the patent in suit show an effect of the claimed values of the thicknesses t_1 and t_2 on the quality of the fillet (Table 1). The problem posed has been solved.

The board does not agree that any one of D1-D3 would lead the skilled person to the claimed solution. D1

does not disclose or point to the claimed ratio of t_1/t_2 (see point 2.2 above). D2 is similar to D1 (point 2.3). Even if the skilled person were to combine the teachings of D4 and D1 (or D2), they would not necessarily arrive at the claimed multiwall tube. D3 contains no relevant teaching, for the reasons indicated, and in particular is not concerned with the thickness ratio of copper films (point 3.8 above).

3.10.2 D5 as the closest prior art

D5 is less relevant. It describes a multiwall tube formed by brazing a copper-plated steel sheet coated with an additional solder material. D5 does not provide any values for the thickness of the copper layer, so at least the considerations set out in relation to D4 apply (point 3.10.1).

3.10.3 D1 or D2 as the closest prior art

The objections starting from D1 or D2 as the closest prior art were based on the term "copper film" being construed as including copper alloys. As outlined above (point 1.10), the board does not concur with this interpretation. Furthermore, the skilled person would not have been led to using copper films because using copper alloy films is an essential feature in D1 and D2.

3.11 For these reasons, the subject-matter of claim 1 involves an inventive step (Article 56 EPC).

3.12 Claim 2 relates to a use of the multiwall steel tube according to claim 1, so it too involves an inventive step, for the same reasons.

3.13 Claim 3 relates to a multiwall steel tube manufacturing method. It includes the features of claim 1 and thus also involves an inventive step, for the same reasons.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

E. Bendl

Decision electronically authenticated