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**Datasheet for the decision
of 10 November 2015**

Case Number: T 2464/12 - 3.2.03

Application Number: 03777358.7

Publication Number: 1593441

IPC: B21B19/04, B21B25/00

Language of the proceedings: EN

Title of invention:
SEAMLESS METAL TUBE PRODUCING METHOD

Patent Proprietor:
Nippon Steel & Sumitomo Metal Corporation

Opponent:
V & M Deutschland GmbH

Headword:

Relevant legal provisions:
EPC Art. 87(1), 87(4), 54(2), 56

Keyword:
Priority - first application (yes),
Novelty (yes)
Inventive step (yes)

Decisions cited:

Catchword:



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Case Number: T 2464/12 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 10 November 2015

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
28 September 2012 concerning maintenance of the
European Patent No. 1593441 in amended form.**

Composition of the Board:

Chairman G. Ashley
Members: C. Donnelly
E. Kossonakou

Summary of Facts and Submissions

- I. The appeal lies from the intermediate decision of the opposition division that European patent no. 1 593 441 could be maintained in amended form on the basis of the main request filed with letter of 9 June 2010.
- II. The opponent (hereinafter: "the appellant") lodged an appeal against this decision in due form and time.
- III. The patent proprietor (hereinafter: "the respondent") replied by letter of 30 May 2013, filing sets of claims according to a main and three auxiliary requests.
- IV. The appellant relied *inter alia* on the following state of the art to support its case against the respondent's main request:

D2: Hensel A., et al., "Technologie des Metalformung, Eisen- und Nichteisenwerkstoffe", Deutsche Verlag für Grundstoffindustrie, 1. Edition, Leipzig 1990, pages 510 to 513;

D4: JP 03204106;

D8: JP-2002-360563 filing date of 12 December 2002
(priority document of the contested patent);

D9: JP-2001-178660 filing date of 13 June 2001;

D10: English translation of D9

D11: English translation of D8.

The appellant also cited:

D2*: Hensel A., et al, "Technologie des Metalformung, Eisen- und Nichteisenwerkstoffe", Deutsche Verlag für Grundstoffindustrie, 1. Edition, Leipzig 1990, pages 638, 639, 666, 678, 679;

but did not rely on it in detail to support its case.

V. The board informed the parties of its provisional opinion in a communication dated 28 September 2015, pursuant to Articles 15(1) and 17(2) RPBA. In particular, it indicated that D8 appeared to be the "first application" in the sense of Article 87(4) EPC and therefore the date to be considered for the purposes of determining prior art under Article 54(2) EPC was 12 December 2002.

VI. Oral proceedings before the board were held on 10 November 2015. At the end of the debate the parties confirmed the following requests:

The appellant requested that the decision under appeal be set aside and that the European patent No. 1593441 be revoked. Also, that the respondent's request for remittal not be allowed.

The respondent requested that the patent be maintained in amended form according to the main request or one of the first to third auxiliary requests, all requests filed with the reply to the grounds of appeal dated 30 May 2013. Further, that the case be remitted to the opposition division if the main request were to be found unallowable on the basis of arguments derived from D9. Finally, that D2* not be part of the proceedings.

VII. Independent claim 1 of the main request reads:

"A making method for a seamless metallic tube (7) of piercing rolling a solid round billet (4) of an outer diameter BD (mm) with a tilting roll type piercing rolling mill by use of a plug (5) having:

a nose rolling portion comprising a cylindrical portion with an axial length of L2 (mm) whose outer diameter d (mm) is equalized in the axial direction or whose outer diameter d is increased toward the rear end of the cylindrical portion in the axial direction while having a half angle in the cone angle of 2° or less, and a nose spherical portion having a curvature radius of r (mm) and an axial length of L1 (mm),

a working portion of an axial length of L3 (mm), continued to said nose rolling portion and formed by an arc rotating surface of a curvature radius of R (mm) so that the outer diameter is increased toward the axial rear end of the working portion, and

a tapered cylindrical reeling portion of an axial length of L4 (mm), continued to said working portion and formed by a cone angle of 2θ ($^\circ$), so that the outer diameter is increased toward the maximum outer diameter D (mm) on the axial rear end of the reeling portion,

characterised in that

said tilting roll type piercing rolling mill is an intersection type, tilting roll type piercing rolling mill in which a shape of the main roll is a cone type, the distance between an axial center of the roll and a pass line is small on an inlet side and the distance between an axial center of the roll and a pass line is large on an outlet side, is used, and in that

tensile strength of at least said nose rolling portion at 1100°C is 50 MPa or more, and in that

the relationships between the outer diameter d , the curvature radius R , and the axial lengths $L1$, $L2$ and $L3$ of said plug and the outer diameter BD of said solid billet satisfy all of the following expressions (2) to (4).

$$0.06 \leq d/BD \leq 0.12 \quad \dots (4)$$

$$0.020 \leq (d/2BD)/(R/L3) \leq 0.046 \quad \dots (2)$$

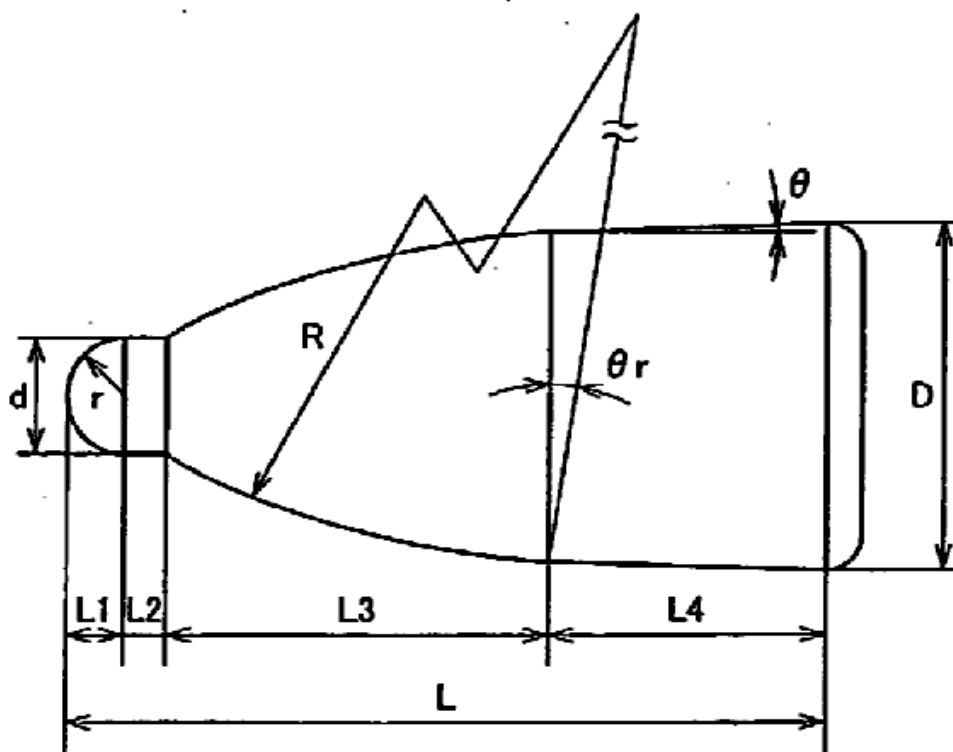
$$0.5d \leq L1 + L2 \leq 3d \quad \dots (3)$$

Claim 3 of the main request reads:

"A making method for a seamless metallic tube according to claims 1 or 2 wherein a scale thickness of a base material forming said working portion and said reeling portion are 200 μ m to 1000 μ m".

VIII. The geometry of the plug under consideration shown in figure 3 of the patent is reproduced here to facilitate understanding of the relevant dimensions under discussion.

FIG. 3



IX. The arguments of the parties relevant to the decision can be summarised as follows:

a) *Priority*

(i) *Appellant's case*

The priority date of the patent is not valid since the subject-matter of independent claim 1 is disclosed in D9 which has a filing date of 13 June 2001 i.e. 18 months minus 1 day prior to the filing date of D8. Therefore D9, and not D8, is the first application referred to in Article 87(1) EPC.

It should be noted that both D8 and D9 belong to Sumitomo Metal Industries Limited and that one of the

inventors is common to both applications. As regards content, not only are figures 1 to 9 and 11 of the patent identical to those of D9, but also formulas (1), (2) and (3), as well as the results shown in tables 1 to 3, are the same as those of the patent. The majority of the description of the patent is also identical to that of D9.

Furthermore, the subject-matter of claim 1 of the main request only differs from a combination of claims 1 and 2 of D9 in that it comprises:

- an additional criterion specifying that the tensile strength of the nose rolling portion at 1100deg.C is set over 50MPa; and in that:
- formula (1) is replaced by formula (4).

The tensile strength of the nose rolling portion is implicitly disclosed in the description of D9 which describes a composition of a billet made from 18%Cr-8%Ni-1%Nb austenitic stainless steel (see paragraph [0040] of D10 - the translation of D9). This material has a tensile strength of over 50Mpa at 1100°C. A person skilled in the art knows that at least the nose rolling portion of a piercer plug must always be of a hardness greater than that of the billet. Hence, the hardness of the nose rolling portion is implicitly greater than 50Mpa at 1100°C. Paragraph [0077] of the patent refers to 0.5%Cr-1.5%Mo-3%W which has a tensile strength of 55Mpa, as the plug material. Thus, it is certain that the nose rolling portion has a tensile strength greater than 50MPa.

With reference to the English translation, it is accepted that D9 refers to the term d/D throughout the description, for example see the translation D10 at page 3, line 30, page 9, line 22 and page 14, lines 1 and 15,

whereas in D8 the term d/BD is used. However, table 1, on page 18 of D10, contains values for d/BD , but not for d/D . The skilled person would immediately see that this was an error and should be corrected by replacing d/D with d/BD throughout the description. The fact that the error should be corrected in this way rather than correcting d/BD in table 1 to read d/D is borne out by the fact that the values given for d/BD in table 1 do not correspond to the values which would be obtained using the values for d and D given in the table.

Since the claimed priority is not valid, D9 must be considered to be prior art under Article 54(2) EPC.

Furthermore, the priority is not valid for claim 3 of the main request since there is no mention of scale thickness in either D8 or D9.

(ii) Respondent's case

Claim 1 of the main request enjoys the right to priority D8, since D9 relates to a ratio d/D in its equation (1) and not to a ratio d/BD as required by the corresponding equation (4) of claim 1. The term "BD" is the outer diameter of the solid billet prior to piercing rolling, whereas D is the maximum outer diameter of the tapered cylindrical shape of the plug itself. None of the examples given in D9 has parameters which all fall within the scope of equations (4), (2) and (3) of claim 1.

The skilled person would not recognise that the reference to d/BD in table 1 of D9 was indicative of an error in equation (1) throughout the description of D9 which should be corrected by replacing d/D with d/BD

since the error might simply lie in that the column for d/D had been missed out of table 1 owing to a word processing error.

Further, it is technically incorrect to assert that the skilled person knows that at least the nose rolling portion of a piercer plug shall always be of a hardness greater than that of the billet, such that it is implicitly greater than 50MPa at 1100°C in D9. This is borne out by the fact that examples 1 and 2 of the contested patent disclose materials where this is not the case.

Example 1 of the present invention shows a test result of piercing rolling of a billet made of 18%Cr-8%Ni-1%Nb stainless steel using a plug made of 0.5%Cr-1.5%Mo-3.0%W steel (see paragraphs [0077] and [0080] of the patent). The tensile strength of the 18%Cr-8%Ni-1%Nb stainless steel billet is about 100Mpa at 1100°C, which is greater than the tensile strength of the plug.

Example 2 of the patent shows test results of piercing rolling of a billet made of 18%Cr-8%Ni-1%Nb stainless steel using plugs which have a tensile strength of 50Mpa or more (see Table 5 (1) to (3) of the patent). The tensile strength of these plugs at 1100°C is also less than that of 18%Cr-8%Ni-1%Nb stainless steel.

It is possible to use a plug with a lower tensile strength than that of the billet since, prior to piercing, the temperature of the billet is about 1250°C (see paragraph [0080] of the patent), whereas the temperature of the plug is at about room temperature. Therefore, at the start of piercing, owing to its lower temperature, the strength of the plug is much greater than that of the billet. During the piercing operation

the temperature of the plug rises whereas, owing to its greater mass, the temperature of the billet remains essentially constant. However, the temperature of the plug never reaches that of the billet and therefore it is entirely possible that the strength of the plug at any given temperature (for example 1100°C as in claim 1) is lower than that of the billet, as in examples 1 and 2 of the patent, and piercing is still possible.

Therefore, D9 does not directly and unambiguously disclose that the nose rolling portion of the plug has a tensile strength of 50Mpa or more at 1100°C.

Also, there is no disclosure in D9 of the range of inequality (4) specified in claim 1.

Consequently, claim 1 of the main request is entitled to the claimed priority, such that D9 can no longer be cited as prior art against it.

As regards claim 3, it is accepted that D8 does not explicitly disclose any figures for the range of scale thickness. However, paragraph [0057], page 21 of the English translation D11 of the priority document, specifies a "thick scale formed on a base material". It would be implicit to the person skilled in the art, that a "thick" scale in the present context lies in the range specified in the patent.

b) Novelty, Inventive step

(i) Appellant's case

Claim 1 lacks novelty in view of D9.

Claim 1 lacks an inventive step in view of D2 and the general knowledge of the person skilled in the art. D2 describes a plug structure having the dimensions as specified in figure 11.3 and a billet having the dimensions disclosed in table 11.7b.. It is obvious to pierce this billet with the plug of figure 11.3, which results in the claimed method.

As shown in the table below it can be seen from the values given in D2 that inequalities (2), (3) and (4) are satisfied.

	d	BD	R	L1+ L2	L3	Eq (4) $0.06 \leq d/BD \leq 0.12$	Eq (2) $0.020 \leq (d/2BD) ((R/L3) \leq 0.046$	Eq (3) $0.5d \leq L1 + L2 \leq 3d$
Minima	22	203	380	20	170	0.1083 Ok	0.0242 Ok	ok
Maxima	35	240	400	30	190	0.1458 Ok	0.0346 Ok	ok

The first paragraph of item 11.4.1.4 on page 510 of D2 suggests the use of double cone type rolls, as required by claim 1. According to table 11.8 on page 511 of D2, the tensile strength of the nose rolling portion is implicitly over 50Mpa at 1100⁰C.

Claim 3

Claim 3 also lacks an inventive step in view of a combination of D9 with D4. The person skilled in the art of piercing rolling solid billet in order to obtain metallic tube is well aware that the plug is subject to

deterioration after several uses. In view of this, in order to improve the repeatability of the process without having to change the plug after each use, it is common practice to try and improve the durability of the plug.

It is self evident that durability will be increased by using higher strength materials for the nose portion of the plug. Thus, the selection of a material with a UTS of 50Mpa or more at 1100⁰C is obvious.

The skilled person wishing to improve the durability of the plug known from D9 would also consult D4. This document teaches that durability can be improved by placing a covering layer around the plug which has a thickness between 30 and 300µm.

The problem of improving the durability of the plug is distinct from the second partial problem of improving the piercing characteristics of the plug, notably to ensure complete engagement and reduce shearing. The skilled person wishing to improve the engagement and shearing properties would see it as an obvious measure to adjust the d/BD ratio and would inevitably arrive at values falling within the ranges claimed.

(ii) Respondent's case.

Since claim 1 of the main request is entitled to the claimed priority date, D9 is not citable against it. Thus, the subject-matter of claim 1 is new.

The billet dimension BD is not disclosed in D2 in conjunction with the plug of figure 11.13. From the equation for l_3 in figure 11.13 of D2, it is possible to calculate an allowable wall thickness s . This calculation shows that s is equal to 66.83mm. This thickness is much greater than the values of 37mm and 29.5mm given in table 11.7b) of D2. Also, most of the inner diameters of table 11.7b) fall outside of the allowable range of inner diameter $D_D = 160-180\text{mm}$ given in figure 11.13 of D2, even if a maximum value for k of 14mm is assumed. Hence, the values for BD in table 11.7b) cannot be taken to be relevant for the plug of figure 11.13 of D2. Consequently, the equations (4) and (2) of claim 1 are not disclosed in D2.

Additionally, figure 11.13 is not linked to cone type rolls.

With respect to claim 3, D9 does not disclose the feature of the tensile strength of the nose portion being at least 50Mpa or more at 1100°C , or inequality 2 or 4, or a spherical nose portion. Further, all the examples given in D9 fall outside the scope of claim 3. In examples A to G the d/BD ratios are too high to meet the requirements of inequality 4, examples E, F, G and H fail to meet the requirements of inequality 2, examples A and F do not fulfil the requirements of inequality 3.

Also, it would not be obvious for the skilled person to modify the plug dimensions starting out from any of the examples given in D9 to those defined in claim 1. Essentially, a reduction in the d/BD ratio makes the plug more pointed which, together with the specification to increase the UTS of the nose portion, overcomes the problem of incomplete engagement (see paragraph [0058] and table 3 of D9) and shearing.

Hence, taking the scale thickness value from D4 and applying it to the plug known from D9 does not result in the subject-matter of claim 3 anyway.

Reasons for the Decision

1. Main request, claim 1,

1.1 Priority

1.1.1 The claimed priority is valid for claim 1, since D9 relates to a ratio d/D in equation (1) and not to a ratio d/BD as required by the corresponding equation (4) of claim 1. The term "BD" is the outer diameter of the solid billet prior to piercing rolling whereas D is the maximum outer diameter of the tapered cylindrical plug shape (see D10 (translation of D9) page 9, lines 11 to 15).

1.1.2 The board does not consider that the term " d/BD " used in Table 1 on page 18 of D9 would prompt the skilled person immediately to realise that the reference to the relationship " d/D " throughout the description of D9 (see D10: page 3, line 30, page 9, line 22, page 14, lines 1 and 15) is (i) an obvious error, and (ii) that it should be corrected by replacing " D " with " BD ".

1.1.3 Firstly, it is not obvious that there is an error, since the values given in table 1 for d/BD do not correspond to the ratios d/D which would be obtained by using the values given for " d " and " D " in the table, and

furthermore the ratio d/BD forms part of the expression $(d/2BD)/(R/L3)$ in the next column. Thus, the skilled person would most likely assume that the values in the table are correct for the ratio d/BD and are for use in working out the expression $(d/2BD)/(R/L3)$. Similarly, it would be reasonable for the skilled person to conclude that it is sufficient to provide the values of "d" and "D" in the table since it is easy to insert these values directly into the relevant relationships. Secondly, even if the skilled person decided that values for the ratio d/D should have been given in table 1, it is probable, as the respondent argues, that he would just conclude that the column giving the values "d/D" had been left out by error or even deliberately for reasons of formatting. In conclusion, although the skilled person might find the presentation of values in table 1 of D9 slightly unconventional and/or incomplete, he would not conclude that there was any error in the application documents.

1.1.4 Thus, D8 is the "first application" and the date that should be considered for the purposes of Art. 54(2) EPC is 12 December 2002.

1.2 *Novelty*

1.2.1 Since D9 does not constitute prior art under Article 54(2) EPC, it cannot be used to attack novelty of claim 1.

1.3 *Inventive step*

1.3.1 The appellant argues that the subject-matter of claim 1 is not inventive in view of D2 in combination with the skilled person's general knowledge.

- 1.3.2 However, in the board's opinion, the dimensions given for the billet diameter BD ("Vorblockdurchmesser") in table 11.7b) of D2 do not apply to the plug shown in figure 11.13 of D2, since the dimensions for the wall thickness s do not tally. As shown by the respondent, using the equation for l_3 given in figure 11.13 to calculate an allowable wall thickness s gives a value of 66.83mm, which is much greater than the values for s of 37mm and 29.5mm given in table 11.7b).
- 1.3.3 Also, most of the inner diameters of table 11.7b) fall outside of the allowable range of inner diameter $D_D = 160-180\text{mm}$ given in figure 11.13 of D2, even if a maximum value for k (the stretching factor) of 14mm is assumed. Hence, the values for BD in table 11.7b) cannot be taken to be relevant for the plug of figure 11.13 of D2. Consequently, the equations (4) and (2) of claim 1 are not disclosed in D2.
- 1.3.4 In conclusion, the skilled person would see that the values given in table 11.7b) of D2 do not apply to the plug shown in figure 11.13 of D2, nor is there any suggestion to this effect. Thus, it is not possible for the skilled person to arrive at the subject-matter of claim 1 on the basis of the teachings of D2 in combination with general knowledge. The subject-matter of claim 1 therefore meets the requirements of Article 56 EPC.

2. *Main request, dependent claim 3*

2.1 *Priority*

- 2.1.1 As regards dependent claim 3, the appellant is correct in arguing that the feature defining the scale thickness of a base material forming said working portion and said

reeling portion as lying in a range of 200µm to 1000µm, as specified in claim 3, appeared for the first time in the patent application filed on 8 December 2003. There is no mention of such a specific range of scale thickness in D8, nor is it implicit, since a simple reference to a "thick" scale is not a sufficient indication.

2.1.2 Thus, the claimed priority date is not valid for the subject-matter of claim 3.

2.2 *Inventive step*

2.2.1 Since the priority is not valid, D9 constitutes prior art under Article 54(2) EPC and can be taken into consideration when assessing inventive step under Article 56 EPC.

2.2.2 The parties agree that D9 does not explicitly disclose the feature of the tensile strength of the nose portion being at least 50Mpa or more at 1100⁰C. The board also considers that there is no implicit disclosure of this feature in D9 since the respondent has provided a plausible explanation (see section VII above) that the nose rolling portion of a piercer plug need not always be of a hardness greater than that of the billet.

2.2.3 Thus, the subject-matter of claim 3 differs from all the examples disclosed in D9 at least in that:

(i) - the tensile strength of at least the nose rolling portion at 1100⁰C is 50 MPa or more;

(ii) - a scale thickness of a base material forming said working portion and said reeling portion is 200µm to 1000µm.

- 2.2.4 As has been shown above when determining the validity of the priority, D9 refers to a range of the ratio d/D instead of a ratio of d/BD in equation (1) (corresponding to equation (4) of claim 1). However, table 1 of D9, which is essentially identical to table 1 of the patent, discloses values for d/BD in examples A to H ranging from 0.10 to 0.36. The value of 0.10 of example H is therefore the only one falling within the range of equation (1) of claim 3. However, example H fails to satisfy the requirements of equation (2) $0.020 \leq (d/2BD)/(R/L3) \leq 0.046$, since it has a value for $(d/2BD)/(R/L3)$ of 0.012.
- 2.2.5 In summary, all the examples given in table 1 of D9 fall outside the scope of claim 3. In examples A to G the d/BD ratios are too high to meet the requirements of equation (4), examples E, F, G and H, fail to meet the requirements of equation (2) and examples A and F do not fulfil the requirements of equation (3).
- 2.2.6 The board agrees with the respondent that a reduction in the ratio d/BD indicates a more pointed plug, since the dimension BD is fixed. There is also a certain synergy between such a geometry and the specification to increase the UTS of the nose portion and provide a protective scale coating (see paragraph [0073] of the patent) since, if the nose diameter is reduced, its heat capacity is diminished (see paragraph [0065] of the patent) and it will be subject to relatively greater stresses. Therefore, the board does not accept that the distinguishing features can be dealt with by considering

a series of partial problems as the appellant has suggested.

- 2.2.7 In view of this the board considers the problem to be solved as that specified in the patent at paragraph [0018] of minimising incomplete engagement whilst maintaining the service life of the plug at high temperatures (see also page 8, lines 16 to 17 and paragraph [0068]).
- 2.2.8 Faced with this problem it would not be obvious for the skilled person to modify the plug dimensions starting out from any of the examples given in D9 to those defined in claim 3 and implement the additional measures of providing a protective scale and increased strength of the nose portion without the benefit of hindsight.
- 2.2.9 In conclusion, the subject-matter of claim 3 meets the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent as amended in the following version:

- claims 1 to 4 according to the main request filed with the letter of 30 May 2013;
- description pages 3 to 10 and 12 in accordance with the main request filed with the letter of 30 May 2013 and pages 2, 11, 13 to 16 and 17, lines 1 to 8 of the patent specification;
- figures 1 to 11 of the patent specification.

The Registrar:

The Chairman:



C. Spira

G. Ashley

Decision electronically authenticated