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Datasheet for the decision of 15 December 2022

Case Number: T 0061/20 - 3.2.03

Application Number: 13867229.0

Publication Number: 2939751

IPC: B21B45/02

Language of the proceedings: EN

Title of invention:
COOLING METHOD AND COOLING DEVICE FOR HOT-ROLLED STEEL STRIP

Patent Proprietor:
JFE Steel Corporation

Opponent:
SMS group GmbH

Headword:

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

Keyword:
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 0061/20 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 15 December 2022

Appellant: (Opponent)	SMS group GmbH Eduard-Schloemann-Strasse 4 40237 Düsseldorf (DE)
Representative:	Kross, Ulrich Hemmerich & Kollegen Patentanwälte Hammerstraße 2 57072 Siegen (DE)
Respondent: (Patent Proprietor)	JFE Steel Corporation 2-3, Uchisaiwaicho 2-chome Chiyoda-ku Tokyo 100-0011 (JP)
Representative:	Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 5 November 2019 rejecting the opposition filed against European patent No. 2939751 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	B. Miller
Members:	G. Patton
	D. Prietzel-Funk

Summary of Facts and Submissions

I. European patent No. 2 939 751 B1 ("the patent") relates to a cooling method and a cooling apparatus of a hot-rolled steel strip.

II. The opposition was against the patent as a whole and was based on the ground of lack of inventive step in accordance with Article 100(a) EPC.

The Opposition Division held that the subject-matter of claims 1 and 7 of the then main request ("patent as granted") involved an inventive step and, hence, rejected the opposition.

The opponent lodged an appeal against the Opposition Division's decision.

III. The Board provided its preliminary, non-binding opinion to the parties in a communication dated 21 January 2022 pursuant to Article 15(1) RPBA 2020 annexed to the summons to oral proceedings.

IV. At the end of the oral proceedings held on 15 December 2022, the opponent ("appellant") requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the appeal be dismissed or, subsidiarily, that the patent be maintained in amended form on the basis of the set of claims filed by letter dated 28 August 2018.

V. Claim 1 of the **main request** (patent as granted) reads as follows, with the feature lettering used by the parties:

a1) A method for cooling a hot-rolled steel strip (1), comprising:

b1) preparing a cooling apparatus including a plurality of cooling headers (6)

c1) having a plurality of spray nozzles (5)

d1) arranged in a width direction,

e1) the cooling headers (6) being arranged in a steel strip conveying direction,

f1) supply of cooling water being performed using two systems as one set in the cooling headers (6),

characterized in that

g1) valves (7) being attached to the two systems of supply pipes of cooling water so that spraying or stop of spraying of cooling water can be independently performed,

h1) spray nozzles (5) adjacent in the width direction being connected to supply pipes of different systems of the two systems of supply pipes,

i1) wherein when increasing cooling rate, cooling water is supplied to one set of cooling headers (6) from two systems of supply pipes

j1) and cooling water is sprayed from all of the spray nozzles (5) of the one set of cooling headers (6), and

k1) wherein when decreasing cooling rate, cooling water is supplied to one set of cooling headers (6) from one system of supply pipe and

l1) cooling water is sprayed from every other spray nozzle (5) attached to the one set of cooling headers (6) in the width direction.

Claim 7 of the **main request** (patent as granted) reads as follows, with the feature lettering used by the parties:

a7) A cooling apparatus including a plurality of cooling headers (6)

b7) having a plurality of spray nozzles (5)

c7) arranged in a width direction,

d7) the cooling headers (6) being arranged in a steel strip conveying direction,

e7) wherein supply of cooling water is performed using two systems as one set in the cooling headers (6),

characterized in that

f7) spray valves (7) are attached to the two systems of supply pipes of cooling water so that spraying or stop of spraying of cooling water can be independently performed,

g7) and spray nozzles (5) adjacent in the width direction have pipe systems

h7) connected to supply pipes of different systems of the two systems of supply pipes,

i7) and wherein the apparatus includes a control mechanism that makes it possible to, when increasing cooling rate, supply cooling water to one set of cooling headers (6) from two systems of supply pipes and spray cooling water from all of the spray nozzles (5) of the one set of cooling headers (6),

j7) and to, when decreasing cooling rate, supply cooling water to one set of cooling headers (6) from one system of supply pipe and spray cooling water from every other spray nozzle (5) attached to the one set of cooling headers (6) in the width direction.

The wording of the independent claims of the auxiliary request is irrelevant to the present decision.

VI. The following document considered in the opposition proceedings is relevant to the present decision:

D7: EP 1 900 449 B1

VII. As far as relevant to the present decision, the appellant essentially argued as follows.

Document D7, which dealt with cooling a hot steel strip like the patent, was considered to represent the closest prior art for claim 1. In view of the distinguishing features h1) and l1) of claim 1 over the

disclosure of D7, the problem to be solved could be formulated as to regulate the cooling rate in accordance with the properties of the steel strip to be achieved.

The skilled person facing this problem had the choice between arranging the nozzles alternatively in the width direction or in the longitudinal direction. Since they had to choose among two possibilities lying within their common general knowledge and expertise, inventive step could not be acknowledged for the claimed subject-matter.

D7 disclosed various alternative ways for cooling. Furthermore, D7 suggested that the nozzles be individually controlled and supplied with coolant. D7, claim 16 disclosed means for controlling and regulating the descaling not limited to acting in the conveying direction.

D7 (paragraphs [0005] and [0007]) aimed at providing more flexibility and taught that each nozzle could be activated individually. Hence, the apparatus of D7 could be used in the same manner as in Figures 4(b) or 5(b) of the patent. Faced with the above-mentioned problem, the skilled person would immediately think of using the apparatus of D7 like in Figure 5(b) of the patent and thus arrive at the claimed subject-matter in an obvious manner. The term "adjacent" used in feature h1) did not exclude a small offset in the conveying direction, like in D7, Figure 2, between the nozzles (2) of the cooling header (4) and the nozzles (3) of the cooling header (6).

Consequently, the method of claim 1 was obvious in view of D7 alone or in combination with the skilled person's

common general knowledge. The same applied to the apparatus claim 7.

VIII. As far as relevant to the present decision, the respondent essentially argued as follows.

Document D7 taken as the closest prior art did not disclose features h1) and l1) of method claim 1.

D7 concerned a descaling plant and, hence, could not lead the skilled person towards the claimed solution aiming at solving the problem of cooling hot-rolled steel strip.

In addition, D7 did not disclose or suggest the claimed solution, in particular the configuration of feature h1), which did not belong to the skilled person's common general knowledge either.

Inventive step of the subject-matter of method claim 1 should therefore be acknowledged. The same applied to the apparatus claim 7.

Reasons for the Decision

1. Main request

The appellant contests that the subject-matter of claims 1 and 7 involves an inventive step in view of the disclosure of D7, possibly taking into consideration the skilled person's common general knowledge.

1.1 Disclosure of D7

D7 discloses a method for descaling a steel strip ("Stahl", "Band" 6, see paragraphs [0011] and [0042]; Figure 2), suitable for cooling (see paragraph [0027], lines 49-50; paragraph [0029], line 11; paragraph [0031], line 47), comprising (see paragraphs [0042] to [0047] and Figure 2):

- preparing a cooling apparatus including a plurality of cooling headers ("Düsenreihen"; "Versorgungskanäle" 4, 5) having a plurality of spray nozzles ("Düsen" 2, 3) arranged in a width direction (paragraph [0044]), the cooling headers (4, 5) being arranged in a steel strip conveying direction (paragraph [0032]; "Laufrichtung", "Förderrichtung" R; Figure 2)

- supply of water ("Entzunderungsfluid", "Wasser") suitable for cooling being performed using two systems as one set ("Spritzbalken" 1) in the cooling headers (4, 5)

- valves ("Ventile" 12, 13) being attached to the two systems of supply pipes of cooling water so that spraying or stop of spraying of cooling water can be independently performed (column 8, lines 1-3, 11-16, 22-29; "Mittel" 8; Figures 3a, 3b, 4a and 4b)

- spray nozzles (2, 3) adjacent in the steel strip conveying direction (R) being connected to supply pipes of different systems of the two systems of supply pipes

- wherein when increasing cooling rate, cooling water is supplied to one set (1) of cooling headers (4, 5) from two systems of supply pipes and cooling water is sprayed from all of the spray nozzles (2, 3) of the one

set (1) of cooling headers (4, 5) (Figures 3b and 4b), and

- wherein when decreasing cooling rate, cooling water is supplied to one set (1) of cooling headers (4, 5) from one system of supply pipe and cooling water is sprayed from every other spray nozzle (2, 3) attached to the one set (1) of cooling headers (4, 5) in the steel strip conveying direction (R) (Figures 3a and 4a)

1.2 Distinguishing features

In view of the above, the only distinguishing features of claim 1 over the disclosure of D7 are:

h1) spray nozzles adjacent in the width direction being connected to supply pipes of different systems of the two systems of supply pipes

l1) cooling water is sprayed from every other spray nozzle attached to the one set of cooling headers in the width direction

1.3 Technical effect(s) - problem(s) to be solved

The Board shares the respondent's view that by connecting spray nozzles adjacent in the width direction to different systems of supply pipes, the distribution of cooling water can be controlled in the width direction of the steel strip. This enables regulating the temperature distribution in the width direction during the cooling process.

However, an improvement of the temperature distribution in the width direction cannot be acknowledged on the basis of the distinguishing features. As apparent from

the comparative example in Table 2 of the patent comprising this distinguishing features and based on the one-system manner of spraying shown in Figure 8, a large temperature deviation in the width direction is obtained (see paragraph [0058] of the patent).

As far as an improvement of the temperature in the conveying direction is concerned, the Board does not share the respondent's view either. The respondent argues that the use of a plurality of cooling headers arranged in the strip conveying direction further allows controlling the distribution of cooling water in the conveying direction. D7, however, also comprises a plurality of cooling headers (4, 5). "A plurality of conveying headers" is therefore not a distinguishing feature over the disclosure of D7 such that an additional technical effect over D7 cannot be alleged on its basis.

The alleged effect appears in fact to be linked to the provision of at least two sets of cooling headers (6), i.e. at least four cooling headers (6), as shown for instance in Figures 5 and 9(a) of the patent referred to by the respondent (see also paragraph [0029] and [0051]). This feature, a plurality of sets, each set comprising two systems of cooling headers (two sets possibly acting as a pair as shown in Figure 11; claim 2), is not present in claim 1 (see also paragraph [0024] and Figure 3 of the patent).

Hence, the Board does not agree with the respondent that the problem to be solved is to provide a uniform distribution of the cooling water in the width direction as well as in the conveying direction.

In view of the above and taking into consideration the appellant's arguments based on paragraphs [0002], [0003], [0004] and [0006] of the patent, the Board holds the view that the distinguishing features enable regulating the cooling rate in accordance with the properties of the steel strip to be achieved (see also paragraphs [0001], [0015], [0017], [0018] and [0054] of the patent).

The objective technical problem can therefore be seen as to modify the method of D7 to regulate the cooling rate in accordance with the properties of the steel strip to be achieved.

1.4 Inventiveness

1.4.1 The appellant argued that the skilled person facing the above-mentioned problem had the choice of arranging the nozzles alternatively in the width direction or in the longitudinal direction. Choosing one of these two alternatives was not inventive as the skilled person had to choose among two possibilities lying within their common general knowledge and expertise. D7 also taught many alternative ways of cooling due to the flexibility in being able to use the cooling headers and the nozzles individually (see paragraphs [0028], [0032], [0033] and [0034]).

Still according to the appellant, D7, paragraph [0002] aimed at achieving a good surface quality which, like in the patent (paragraphs [0029] and [0031]), also required achieving a uniform cooling effect over the entire width of the steel strip as well as in the conveying direction.

D7 referred several times to "nozzles or rows of nozzles", suggesting that the nozzles according to D7 were switched individually or together. Thus, D7 disclosed various alternative ways of cooling and for the nozzles to be controlled and supplied with coolant.

Claim 16 of D7 addressed a method according to which the descaling result was determined at a point downstream of the spray bar (1) in the conveying direction (R) of the strip (6) to be descaled, and the application of descaling fluid to the at least two cooling headers (4, 5) was controlled or regulated as a function of this measurement result. This form of control was not limited to acting in the conveying direction because the nozzles could also be arranged individually, as described several times in the description of D7.

At the oral proceedings before the Board, the appellant further argued that D7, paragraphs [0005] and [0007] aimed at providing more flexibility compared to the apparatuses of its own prior art. Hence, it was clear that in the apparatus of D7, each nozzle could be activated individually. As a consequence, the apparatus of D7 could also be used in the same manner as disclosed in Figures 4(b) or 5(b) of the patent. Faced with the above-mentioned problem, the skilled person would immediately think of using the apparatus of D7 like in Figure 5(b) of the patent. For achieving this operating manner, they would, for instance, spray cooling water from every other spray nozzle (2) in the width direction of the cooling header (4) and, at the same time, spray cooling water from every other spray nozzle (3) in the width direction of the cooling header (5), spraying with the nozzles (2, 3), facing each other or not, to achieve the desired patten. In this

configuration, cooling water would be sprayed from every other spray nozzle (2, 3) attached to the one set of cooling headers (4, 5) in the width direction in accordance with feature l1). For the appellant, the term "adjacent" used in feature h1) encompassed a broad meaning such that a small offset in the conveying direction was not excluded, like in D7, Figure 2, between the nozzles (2) of the cooling header (4) and the nozzles (3) of the cooling header (5).

As a result, the appellant considered that the skilled person was prompted towards the claimed solution, such that they would arrive at the subject-matter of claim 1 in an obvious manner in view of D7 alone or in combination with their common general knowledge. The same applied to claim 7.

1.4.2 The Board does not share the appellant's view for the following reasons.

Document D7 is suitable for achieving some cooling of the steel strip (see paragraphs [0027], [0029] and [0031]). However, D7 concerns a descaling plant (see claim 1) and the problems of operating a descaling plant, in particular, its spray bars, and improving the flexibility in the descaling of the steel strips in a rolling mill (see paragraph [0011]). Hence, D7 does not deal with cooling a hot-rolled steel strip. Therefore, the Board is not convinced that D7 represents suitable closest prior art for a cooling method and a cooling apparatus of a hot-rolled steel strip such that the skilled person would envisage modifying the disclosed method and apparatus of D7 in view of solving problems linked to cooling. For this reason alone, inventive step can be acknowledged for the claimed subject-matter.

In any case, D7 does not disclose or suggest the specific configuration of connecting spray nozzles arranged adjacently in the width direction to different systems of supply channels (feature h1)) to enable operating the apparatus in accordance with feature l1).

To the contrary, D7 discloses that all the spray nozzles arranged adjacently in the width direction are connected to the same supply channel (see, for instance, paragraphs [0032] and [0044]). Claim 16 of D7 is also consistent with this disclosure.

The Board is also not convinced that the term "adjacent" in feature h1) would encompass an offset between nozzles in the conveying direction which could be present in the apparatus of D7. It is clear that the term "adjacent" does not exclude small offsets in the conveying direction resulting from some deviation in their positioning during installation. However, the skilled person looking at the apparatus of D7 would not derive that a spray nozzle (2) of the cooling header (4) would be "adjacent in the width direction" to a spray nozzle (3) of the cooling header (5). The skilled person would immediately and unambiguously derive that a nozzle (2) is adjacent in the width direction to the next nozzle (2) of the same cooling header (4) and by the same token that a nozzle (3) is adjacent in the width direction to the next nozzle (3) of the same cooling header (5). In fact, as apparent from Figures 2 to 6 of D7, which are cross-sections of the apparatus in the conveying direction, the nozzles (2) are unambiguously aligned with the nozzles (3) in the conveying direction so that they cannot be considered to be adjacent to each other in the width direction. Hence, the term "adjacent" of feature h1) does not

encompass the offset of the apparatus of D7 between spray nozzles (2) of cooling header (4) and spray nozzles (3) of cooling header (5).

Finally, the reference made by the appellant to the skilled person's common general knowledge on the choice between two alternatives, i.e. arranging the nozzles alternatively in the width direction or in the longitudinal direction, is a mere allegation without any evidence. Even if the skilled person taking into account the alleged flexibility had the idea of arranging and activating the spray nozzles alternatively in the width direction in the apparatus of D7, they would still not arrive at the claimed solution of having the spray nozzles adjacent in the width direction being connected to supply pipes of different systems of the two systems of supply pipes (feature h1)). Claim 16 of D7 referred to by the appellant does not change this fact.

Therefore, in the absence of any disclosure or suggestion towards the distinguishing features, the skilled person starting from D7 and faced with the above-mentioned objective technical problem would not arrive at the subject-matter of claim 1 in an obvious manner.

Undisputed by the appellant, the above reasoning applies *mutatis mutandis* to claim 7 which comprises features g7), h7) and j7) corresponding to distinguishing features h1) and l1) of claim 1 over D7 (see point 1.2 above).

2. Auxiliary request

In view of the above, the auxiliary request does not need to be considered.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Spira B. Miller

Decision electronically authenticated