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D E C I S I O N
of 9 January 2003

Case Number: T 1092/00 - 3.2.1

Application Number: 93116369.5

Publication Number: 0647486

IPC: B21B 13/02

Language of the proceedings: EN

Title of invention:
Rolling mill

Patentee:
MITSUBISHI JUKOGYO KABUSHIKI KAISHA

Opponent:
SMS Demag AG

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1092/00 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 9 January 2003

Appellant: (Opponent)
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Respondent: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 31 August 2000 rejecting the opposition filed against European patent No. 0 647 486 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: S. Crane
Members: J. Osborne
G. E. Weiss

Summary of Facts and Submissions

I. The appeal is directed against the decision of the Opposition Division to reject the opposition against European patent No. 0 647 486.

II. During oral proceedings held 9 January 2003 the appellant requested that the impugned decision be set aside and that the patent be revoked. The following evidence from the opposition procedure was referred to:

D2: JP-A-61-202704 (English language abstract)

D4: JP-A-31-38006 (English language abstract).

The respondent requested that the appeal be dismissed.

III. Claim 1 as granted reads:

"A rolling mill including a roll-crossing device for making respective axes of upper and lower work rolls (11) and upper and lower backup rolls (10) held in circumferential contact with said work rolls cross with each other within a plane in parallel to a rolled sheet surface;
characterized in that said upper and/or said lower backup roll (10) is/are constructed as a sleeve-roll type backup roll, in which the backup roll is divided into three or more rolls along its axial direction, said plurality of divided rolls (2, 3, 4) are rotatably mounted as held eccentric on one roll support shaft (1) whose rotary angle is adjustable, and said plurality of divided rolls (2, 3, 4) are all accommodated with one sleeve (6)."

IV. The arguments of the appellant can be summarised as follows:

A rolling mill according to the preamble of Claim 1 is known from D2 which teaches that the surface configuration of the sheet produced in a cross-roll mill may be controlled additionally by using sleeve-type back-up rolls and elastically deforming the surface thereof by applying hydraulic pressure within the sleeve. The problem solved by adding the features of the characterising portion of present Claim 1 is as defined in the patent specification, that is to achieve greater variation in the crown of the work rolls. D4 discloses the characterising features and shows that the elastic deformation may be achieved alternatively by mechanical means. It was therefore obvious for the skilled person to replace the hydraulic adjustment offered by D2 by the mechanical adjustment offered by D4. The combination does not result in any surprising effect.

V. The respondent replied essentially as follows:

It is accepted that D2 and D4 disclose the features of the preamble and characterising portions respectively. However, the hydraulic adjustment according to D2 only permits the achievement of a simple parabolic crown pattern and there is no suggestion to replace it with another arrangement. The adjustment achievable by the arrangement according to D4 is not equivalent to that achievable with D2 because it permits adjustment of the crown in additional positions along the roll. Also D4 relates to a mill having parallel rolls and contains no suggestion that the roll be used in a mill according to D2. There are many possibilities to vary the crown

pattern of the roll and the particular combination according to Claim 1 permits exact control when rolling large widths of low thickness sheet, resulting from a functional interaction of the parameters determining the crown pattern.

Reasons for the decision

1. The Board is in agreement with both parties that D2 discloses the features of the preamble of present Claim 1. However, the disclosure of D2 goes further in as far as each back-up roll is constructed as a sleeve-type roll mounted on a support shaft, the crown being adjustable by feeding hydraulic pressure to the central region of the sleeve, thereby causing it to elastically deform. D2 additionally discloses the application of bending forces to the ends of the work roll. As acknowledged by the respondent, the disclosed construction of the back-up roll of D2 permits the achievement of a generally V-shaped crown which together with the roll crossing and bending enables effective control over edge elongation of the sheet material.

1.1 The subject-matter of Claim 1 therefore differs from that of D2 by the following features:

- "the backup roll is divided into three or more rolls along its axial direction, said plurality of divided rolls are rotatably mounted as held eccentric on one roll support shaft whose rotary angle is adjustable, and said plurality of divided rolls are all accommodated with one sleeve."

In a back-up roll having these differentiating features the crown of the roll can be varied along the length occupied by the eccentric roll portions by changing both their relative rotational positions and the angular position of the support shaft on which they are mounted. Various crown patterns of the back-up roll are achievable, solving the problem of correcting a range of composite elongations of the sheet product.

2. D4 relates to a rolling mill having upper and lower work rolls and upper and lower back-up rolls, all arranged to be mutually parallel. The upper back-up roll A is illustrated as having an outer sleeve 3c supported by five roll portions 1a, 1b, 1c mounted on a support shaft in the axial direction of the roll. The lower back-up roll is similar. According to the text the support shaft of back-up roll A may be angularly adjusted to create a V-shaped or inverted V-shaped crown, whilst angular adjustment of the support shaft of back-up roll B may be used to achieve a W-shape and an inverted W-shape. As acknowledged by the respondent, this is a disclosure to the skilled person of back-up rolls having the differentiating features listed under 1.1 above. According to D4 the V- and inverted V-shaped crown patterns may be used to correct end and middle elongation of the product respectively whilst the W- and inverted W-shaped patterns may be used to correct middle/end elongation and quarter elongation respectively.

2.1 The skilled person beginning with a rolling mill according to D2 was already aware that end elongation of rolled sheet may be corrected by using an elastically deformable sleeve-type back-up roll when used together with roll crossing and bending. When

seeking the possibility to correct composite elongation the skilled person would have considered known ways of achieving this result. D4 teaches that crown patterns additional to the V-shape, which according to the teaching of D2 was effective against end elongation, may be used in correcting composite elongations of the rolled sheet and that these additional patterns are achievable using back-up rolls having the differentiating features listed under 1.1. Under these circumstances it was obvious for the skilled person to combine the teaching of D2 with that of D4 and thereby arrive at the subject-matter of Claim 1.

2.2 Figure 11 of the patent specification illustrates crown patterns achievable using a prior art sleeve roll having the features of the characterising portion of Claim 1 whilst Figure 3 illustrates a larger number of patterns which may be realised in a rolling mill "according to one preferred embodiment of the present invention". However, whereas Figure 11 illustrates the crown patterns achievable at eight different rotational positions of the support shaft using a single relative arrangement of the eccentric roll portions, Figure 3 illustrates patterns achievable at the same rotational positions when using five different relative eccentricity arrangements (Nos. 1, 2, 3, 5, 7) also in combination with changes in roll-portion diameters (Nos. 4, 6, 8, 9, 10). There is no evidence derivable from a comparison of these figures that the sleeve roll as defined in present Claim 1 and which is acknowledged in the patent specification as being known *per se* from the prior art produces any additional or surprising effect when it is used in a cross-roll mill which is not achievable by its known use in a parallel-roll mill. Indeed, there is no mention in relation to

Figure 3 of any non-parallel arrangement of the rolls which might have produced any different effect. Figure 7 of the patent specification, on the other hand, does relate to the effects of both crossing the rolls and changing the roll crown pattern. It illustrates with the area A B C D the calculated variation in sheet crown achievable by using a sleeve-type back-up roll in a parallel-roll mill and with the lines A-A', B-B' etc. the variation achievable when using a back-up roll of fixed crown pattern with up to 1.5° cross-angle. The variation achievable by using a combination of a sleeve-type back-up roll and up to 1.5° cross angle is represented by the area A' B B' D' C' C. It can be seen that the effects of the sleeve-type back-up roll and the cross-angle are purely additive.

3. The Board therefore concludes that the subject-matter of present Claim 1 does not involve an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

S. Fabiani S. Crane