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D E C I S I O N
of 5 September 1996

Case Number: T 0416/95 - 3.2.1

Application Number: 82109007.3

Publication Number: 0075943

IPC: B21B 37/00, B21B 1/18

Language of the proceedings: EN

Title of invention:
Control device for a continuous rolling machine

Patentee:
Mitsubishi Denki Kabushiki Kaisha

Opponent:
ASEA Aktiebolag

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-



Case Number: T 0416/95 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 5 September 1996

Appellant:
(Opponent)

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Respondent:
(Proprietor of the patent)

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Decision under appeal:

Interlocutory decision of the Opposition Division
of the European Patent Office posted 10 March
1995 concerning maintenance of European patent
No. 0 075 943 in amended form.

Composition of the Board:

Chairman: F. Pröls
Members: S. Crane
J.-C. Saisset

Summary of Facts and Submissions

- I. European patent No. 0 075 943 was granted on 7 January 1987 on the basis of European patent application No. 82 109 007.3.
- II. The patent was opposed by the present appellants on the basis that its subject-matter lacked novelty and/or inventive step with respect to US-A-4 141 071 (document D1).

In response to amendments made to the patent the appellants subsequently cited US-A-3 650 135 (document D2). The appellants also objected to the amended patent specification under the grounds of insufficiency of disclosure, lack of clarity of the claims and inadmissible extension of subject-matter.

- III. With its decision taken at oral proceedings on 9 February 1995 and issued in written form on 10 March 1995 the Opposition Division found that the subject-matter of claim 1 according to the main request then on file lacked novelty. The subject-matter of claim 1 according to the first auxiliary request submitted at the oral proceedings was however novel and involved an inventive step with respect to the state of the art. Furthermore, the claims of this request were clear, the claimed invention was sufficiently disclosed and there were no objections under Articles 123(2) or (3) EPC to the amended documents. The Opposition Division therefore held that the patent was to be maintained in amended form on the basis of the documents according to the first auxiliary request.

Claim 1 according to this request reads as follows:

"A continuous rolling machine of the type wherein a rolling material is passed through a plurality of horizontal and vertical mill stands, each of said mill stands having a rolling position and an exit, including a control arrangement comprising:

first rolling position control means (12, 14, 16) for controlling the rolling position of a first (4) of said plurality of mill stands in a first direction (Y) corresponding to a first dimension of the rolling material to a first rolling position value in accordance with a first rolling position control signal based on a detected rolling load at the first mill stand;

second rolling position control means (11, 13, 15) for controlling the rolling position of a second (3) of said plurality of mill stands immediately upstream of said first mill stand in a second direction (X) corresponding to a second dimension of the rolling material, substantially perpendicular to the first dimension to a second rolling position value, in accordance with a second rolling position control signal based on a detected rolling load at the second mill stand;

first detection means (6) for detecting in said first direction (Y) a first dimension of said rolling material at the exit of said first (4) mill stand and for generating a first detection signal (hi); and control signal means (17, 18, 19) having first means for generating a third rolling position control signal for said first mill stand (4) in response to said first detection signal, and second means for generating a fourth rolling position control signal for said second mill stand (3) in response to said first detection signal, wherein:

said control signal means is arranged to supply from said first means said third rolling position control signal for the first rolling position control means (12, 14, 16) to adjust the first rolling position value to control the material dimension (hi) in the first direction (Y) at the exit of said first mill stand (4); whereby in said control signal means said first means responsive to said first detection signal generates in operation said third rolling position control signal in accordance with a first coefficient (Kh) of change in the rolling position of said first mill stand with respect to change in said first dimension of said rolling material at the exit of said first mill stand; characterised in that

said second means includes means (19) responsive to said third rolling position control signal supplied to said first rolling position control means, to generate in operation said fourth rolling position control signal in accordance with a second coefficient (Kbi) of the change in rolling position of said first mill stand with respect to change in said second dimension of said rolling material at the exit of said first mill stand and also in accordance with a third coefficient (Kbi-1) of change in the rolling position of said second mill stand with respect to change of said second dimension of said rolling material at the exit of said first mill stand; and

said control signal means being arranged to supply from said second means, said fourth rolling position control signal to said second rolling position control means (11, 13, 15) to adjust the second rolling position value to compensate a change in the second dimension of the rolling material at the exit of said first mill stand (4) from the adjustment of said first mill stand."

Dependent claims 2 to 4 relate to preferred embodiments of the machine according to claim 1.

- IV. An appeal against this decision was filed on 10 May 1995 and the fee for appeal paid one day later. The statement of grounds of appeal was received on 11 July 1995. In this statement the appellants referred to two new prior art documents, US-A-3 222 900 (document D3) and US-A-3 212 310 (document D4).

The appellant request that the contested decision be set aside and the patent revoked in its entirety.

- V. Oral proceedings before the Board were held on 5 September 1996.

At the oral proceedings the respondents (proprietors of the patent) presented as their main request that the appeal be dismissed and the patent maintained as approved by the Opposition Division. They also submitted new sets of claims corresponding to a first and second auxiliary request for maintenance of the patent in amended form.

- VI. The main arguments presented by the appellant can be summarised as follows:

In its decision the Opposition Division had correctly established that according to the state of the art disclosed in document D2 the rolling position of the "second" (i.e. upstream) mill stand was adjusted in a way to compensate for the adjustment of the rolling position of the "first" (i.e. downstream) mill stand. Thus, the only difference between the subject-matter of claim 1 according to the main request and this state of the art was the way in which the rolling position control signal for making the appropriate adjustment of the upstream mill stand was derived. In this respect

claim 1 required that this (i.e. "fourth") rolling position control signal for the upstream stand be derived from the corresponding (i.e. the "third") signal for the downstream stand, whereas according to document D2 the two signals were derived separately from the measured dimensions of the rolling material as it left the downstream mill stand.

It was however already known from document D1 that the rolling position control signal supplied to the upstream mill stand should be compensated in dependence on the corresponding signal calculated for the downstream mill stand. The application of this principle to the system disclosed in document D2 could not therefore involve an inventive step.

In any case, the derivation of one control signal from another was a principle ("master and slave") which was well known in the control art. An example was to be found in document D3 which related to the speed control for a group of rolling mill stands. A similar example was disclosed in document D4. It was obvious that the application of this principle to the rolling machine of document D2 would avoid any problems of drift or the like associated with the generation of the third rolling position control signal for the downstream stand, this being the only remaining technical problem which, on an objective basis, the subject-matter of claim 1 could be seen to solve in relation to the closest state of the art. In this respect, it had to be noted that this remaining technical problem was not one which was identified in the application as originally filed and its solution was not claimed. Thus it was apparent that the present claims related to an invention which was different to that originally claimed and searched, so that the present claims were unallowable having regard to Rule 86(4) EPC.

VII. In reply the respondents argued substantially as follows:

In the rolling machine according to document D2 the third and fourth rolling position control signals for the downstream and upstream rolling mill stands respectively were calculated separately and independently of each other. There was no suggestion anywhere in this prior art document that the upstream mill stand was adjusted to compensate for the adjustment of the downstream mill stand. The claimed invention achieved this objective in a simple and accurate manner by deriving the control signal for the upstream mill stand directly from the control signal for the downstream mill stand. There was nothing in the state of the art which could suggest this. Contrary to what was asserted by the appellants, document D1 did not disclose compensation of this kind, whereas documents D3 and D4 had nothing whatsoever to do with the claimed invention.

Reasons for the Decision

1. The appeal complies with the formal requirements of Articles 106 to 108 and Rules 1(1) and 64 EPC. It is therefore admissible.
2. *The claimed invention*

The contested patent relates in general to a rolling machine in which the material being rolled passes through a plurality of horizontal and vertical mill stands, arranged alternately in sequence, in order to form a product having a desired, for example round, profile.

Despite the length and relative complexity of claim 1 of the main request the basic idea behind the claimed invention can be expressed in simple terms. The reduction of thickness of material obtained in the roll gap of any particular mill stand is accompanied inevitably by an increase in the width of the material in the direction along the axis of the roll gap. This phenomenon is known as "spread". The amount of spread is dependent on a number of factors, the most important of which is the amount of thickness reduction of the material at the mill stand. Thus, if the roll gap of this mill stand is controlled automatically in dependence on the detected thickness of the material at the exit of the mill stand there will be concomitant and unwanted variation in the width of the material owing to change in the amount of spread. The claimed invention proposes substantially to eliminate this variation by adjusting the roll gap of the upstream mill stand. Since this roll gap determines the width of the material being fed into the roll gap of the downstream mill stand it is possible in this way to compensate for the variations in the amount of spread occurring at the latter. It is true that the adjustment of the upstream mill will in turn lead to a different degree of spread there with the result that the thickness of the material entering the roll gap of the downstream mill stand will be changed. The effect of this on the final dimensions of the product leaving the downstream mill stand is however small, and can be neglected. In order to correlate the adjustments of the roll gap at the downstream and upstream mill stands the appropriate control signal for the latter is directly derived from the corresponding control signal for the former by the application of a suitable coefficient.

3. *The amended documents*

In essence, claim 1 according to the main request differs from granted claim 1 in the following respects:

- (a) The claim is now directed to a "continuous rolling machine", rather than a "control arrangement for a continuous rolling machine".
- (b) It is specified that the "first" (i.e. downstream) and "second" (i.e. upstream) mill stands are provided with respective primary rigidity control means for controlling the rolling position.
- (c) It is specified how the "fourth" rolling position control signal is derived from the "third" rolling position control signal.

Amendment (a) is self-explanatory. The basis for amendment (b) is to be found in particular at page 4, lines 7 to 14 of the original application (column 3, lines 8 to 15 of the patent specification. Amendment (c) finds its basis in particular at page 7, line 22 to page 9, line 9 of the original application (column 5, lines 1 to 54 of the patent specification).

In the course of the opposition proceedings the appellants objected under Articles 83, 84 and 123(2) EPC to the terms of present claim 1. The three objections were closely related and derived from the same source, which was that the claim did not specify that the dimension of the rolling material detected at the exit of the downstream mill stand was compared with a reference value. In the contested decision the Opposition Division dealt comprehensively with these objections and point out, *inter alia*, that it was the purpose of the description and not the claim to provide

sufficient disclosure of the invention, that it was not necessary for a claim to state features which were conventional in the art and that the comparison of the detected dimension with a reference value was not something which had been portrayed in the original disclosure as being an essential feature of the invention. In their statement of grounds of appeal the appellants did not come back to these objections. Instead, they raised the matter under another head, namely that in the absence of a comparison with a reference value the claimed machine would not work and was therefore not susceptible of industrial application (Article 57 EPC).

In an annex to the summons to oral proceedings dated 14 June 1996 the Board expressed its doubts as to whether the raising of an objection under Article 57 EPC was admissible at this stage in the proceedings but in any case expressed its view, with reference to the "Guidelines for Examination" CII 4.11 and C IV 4.1, that the objection was inappropriate in the circumstances. The Board further indicated that the real objection of the appellants appeared to be one of lack of clarity of the claims or possibly insufficiency of disclosure and that these matters had been adequately dealt with in the contested decision. Since the appellants did not take up these issues at the subsequent oral proceedings the Board sees no need here to reiterate the detailed observations of the Opposition Division in those respects and for the reasons stated in the contested decision comes to the conclusion that present claim 1 meets the requirements of Articles 84 and 123(2) EPC and that the claimed invention is sufficiently disclosed.

In the course of the appeal proceedings the appellants introduced yet another objection to present claim 1 based on their assertion that no significance was

attached in the original disclosure to the particular compensation technique now featuring in the claim, with the result that the claim related to a different invention originally claimed and searched and consequently should not be allowed pursuant to Rule 86(4) EPC. In this respect the Board points out in the first place that Rule 86(4) EPC is concerned with amendments made to the application during pre-grant examination proceedings and so is not applicable to opposition proceedings. For completeness it is however also noted that the derivation of the compensation signal as set out in original claim 5, particularly when this claim is read in the light of the relevant part of the description, is equivalent in many respects to what is now stated in claim 1.

It is also apparent from what is said above that present claim 1 includes all the features of granted claim 1 so that it also meets the requirement of Article 123(3) EPC.

Present dependent claims 2 to 4 have been derived, after suitable adaptation to the terms of claim 1, from granted dependent claims 4 to 6, which were substantially equivalent to dependent claims 4 to 6 as originally filed.

The amendments made to the description concern solely references to the most relevant state of the art.

4. *State of the art*

4.1 Document D2 represents the closest state of the art and forms the basis for the preamble of present claim 1. It is concerned, as is the claimed invention, with the dimensional control of the product of a rolling machine wherein the material to be rolled is passed through adjacent mill stands of which the roll gaps are

arranged orthogonally with respect to each other. After a detailed theoretical introduction, equations are derived which relate the necessary adjustments of the rolling position of upstream and downstream mill stands to the deviations in thickness and width of the product leaving the downstream mill stand. With reference to Figures 1 to 3 it is then explained how these equations are applied to derive adjustment signals for the dynamic control of the settings of the upstream and downstream mill stand are held substantially constant. In each case the respective signal is related to the sum of the determined deviations in thickness and width of the product, with each of these deviations being multiplied by appropriate coefficients, which are different for the upstream and downstream mill stands.

4.2 Document D1 is also concerned with a rolling mill set up in which alternate mill stands have roll gaps which are arranged orthogonally with respect to each other. In particular, it is directed to an arrangement with hollow rolls for rolling round bar stock and measurement and control means for adjusting the rolling position of the penultimate and final mill stands in order to give a product with a minimum deviation in maximum diameters. In columns 47 and 48 it is explained how the initially calculated adjustment for the penultimate mill stand is adapted on the basis of that calculated for the final mill stand.

4.3 Document D3 relates to controlling roll speeds in a rolling mill in which the material is passed through a sequence of mill stands. The purpose of the control is to held the tension in the material between successive mill stands to a low level. One of the mill stands is designated as a base and is supplied with a reference speed signal set by a potentiometer. The respective

reference speed signals for the other mill stands are derived from that for the base mill stand in accordance with pre-set coefficients. A similar roll speed control system is disclosed in document D4.

5. *Novelty and inventive step*

The respondents maintain that document D2, which they recognise as representing the closest state of the art, does not teach the compensation of the varying amount of spread at the downstream mill stand by adjusting the rolling position of the upstream mill stand. The appellants on the other hand, while conceding that document D2 does not explicitly mention "compensation" as such, argue that the teachings of the document must inevitably lead to the necessary compensation since otherwise the object of dynamically controlling the two mill stands to obtain a product with constant dimensions could not in fact be achieved. Accordingly, the coefficients contained in the equations which are used to calculate the respective adjustment signals for the two mill stands must inherently reflect the compensation that is needed. They also argue that the Opposition Division came to the same conclusion when rejecting the main request dealt with in the decision under appeal.

On this question the Board shares the view of the appellants. It is apparent that the adjustment signal supplied to the upstream mill stand in the state of the art must take account of adjustment of the downstream stand if the stated object is to be achieved in practice. However, this is not decisive. The distinction between the subject-matter of present claim 1 and the state of the art according to document D2 does not hinge on a mere form of words, i.e. whether there is "compensation" or not, but on the way the signal, i.e. "the fourth rolling position control

signal" of effecting the compensation is derived. Claim 1 requires that this signal be directly derived from the adjustment signal for the downstream mill stand, i.e. "the third rolling position control signal" in accordance with appropriate coefficients. It is not in dispute that the adjustment signal for the upstream mill stand in document D2 is not derived in this way and instead is generated independently of the adjustment signal for the downstream mill stand. It follows therefore that the two-part form of present claim 1 is correct and that the subject-matter of the claim is distinguished by the features set out in its characterising clause from the state of the art known in document D2.

The way the "fourth rolling position control signal" is generated as set out in present claim 1 has the advantage that it directly correlates it to the signal actually serving to control the downstream mill stand thus, as is noted in the decision under appeal, eliminating errors inherently associated with the generation of that latter signal in dependence on the measured dimension of the product as it leaves the downstream mill. The argument of the appellants that the way of proceeding disclosed in document D2 provides superior overall dimensional control since deviations in both width and thickness of the product are used to generate the adjustment signal for both upstream and downstream mill stands is true only to the extent that it can be assumed that the errors mentioned above do not occur in the parallel control paths. In the light of this it is necessary to investigate whether there is anything in the cited state of the art which would have led the skilled person to discard the parallel control set-up disclosed in document D2 and adopt that claimed.

In this respect the appellants have relied in particular on document D1. In claim 3 of this document

reference is made to computing a roll gap adjustment for the penultimate stand "utilizing...the roll gap adjustment computed for the last stand". On the face of it that statement would indeed appear to be teaching what is required by present claim 1. Reference to the relevant parts of the description in columns 47 to 50 of document D2 show, however, that this is not the case. From these it can be seen that the adjustment applied to the upstream mill stand is only dependent on the adjustment to the downstream mill stand to the extent that if the latter is outside certain limits then the former is recalculated. This is clearly different from what is defined in present claim 1 and cannot lead the skilled person to the claimed subject-matter.

The appellants have also argued, with reference to documents D3 and D4 as examples, that the generation of one control signal from another control signal is a well known principle ("master and slave") in the control art. They maintain that where the value of a secondary control signal should always bear a fixed relationship to the value of a primary control signal and these are to be varied simultaneously it is clearly advantageous to derive the former from the latter rather than independently. This principle can be seen in application in the roll speed controls of documents D3 and D4. However, the control situation envisaged in these documents is not clearly comparable with the more complex one of the claimed invention where the purpose of varying the secondary control setting is to compensate in advance for unwanted effects associated with varying the primary control setting. Accordingly, the Board is not convinced that the distinction between the subject-matter of claim 1 and the state of the art known from document D2 follows routine considerations commonplace in the control art.

The Board thus comes to the conclusion that the subject-matter of claim 1 according to the main request cannot be derived in an obvious manner from the state of the art and therefore involves an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:


The appeal is dismissed.

The Registrar:


S. Fabiani

The Chairman:


F. Pröls


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