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D E C I S I O N
of 22 January 2004

Case Number: T 0291/02 - 3.2.1

Application Number: 95302263.9

Publication Number: 0679453

IPC: B21C 47/14

Language of the proceedings: EN

Title of invention:
High speed laying head

Patentee:
MORGAN CONSTRUCTION COMPANY

Opponent:
SMS Demag AG

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (no) -main request"
"Inventive step (yes) - auxiliary request"

Decisions cited:
T 0204/83

Catchword:
-

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Case Number: T 0291/02 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 22 January 2004

Appellant: (Opponent)	SMS Demag AG Eduard-Schloemann-Str. 4 D-40237 Düsseldorf (DE)
Representative:	Valentin, Ekkehard, Dipl.-Ing. Patentanwälte Hemmerich, Valentin, Gihske Grosse Hammerstrasse 2 D-57072 Siegen (DE)
Respondent: (Proprietor of the patent)	MORGAN CONSTRUCTION COMPANY 15 Belmont Street Worcester Massachusetts 01605 (US)
Representative:	Specht, Peter, Dipl.-Phys. Loesenbeck, Stracke, Specht, Dantz Patentanwälte Jöllenbeckerstrasse 164 D-33613 Bielefeld (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted 28 January 2002 concerning maintenance of European patent No. 0679453 in amended form.**

Composition of the Board:

Chairman: S. Crane
Members: J. Osborne
A. Pignatelli

Summary of Facts and Submissions

I. The opponent's appeal is directed against the decision posted 28 January 2002 in which the Opposition Division found that, account being taken of the amendments made by the patent proprietor during the opposition proceedings, the European patent no. 0 679 453 and the invention to which it relates meet the requirements of the EPC.

II. The following documentation played a role during the appeal procedure:

D1: G. Rudloff, "Geschwindigkeits-Weltrekord beim Drahtwalzen-Windungsleger mit Spezial-Zylinderrollenlager ausgerüstet", Wälzlagertechnik FAG Kugelfischer Georg Schäfer KGaA, 1984-2, 22, 23

D2: Schloemann drawing 357 568

D4: SMS drawing 7595050.

III. At oral proceedings on 22 January 2004 the appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked. The respondent (patent proprietor) requested that the patent be maintained in the form approved by the Opposition Division (main request) or in the alternative that the patent be maintained on the basis of claims 1 and 2 according to the auxiliary request submitted during the oral proceedings.

IV. Claim 1 according to the respondent's main request (after correction of "overhand" to read "overhang") reads:

"A laying head for a rolling mill which is adapted for receiving a single strand product in the form of a rod or the like moving axially and for forming said product into a continuous series of rings, said laying head comprising:
a quill (14) having a longitudinal axis (X);
first and second bearing assemblies (16,18) encircling and supporting said quill for rotation about said axis, said first and second bearing assemblies being located respectively in first and second mutually spaced reference planes (P_1, P_2) perpendicular to said axis;
means (20,22) for rotating said quill about said axis; and
a laying pipe (24) carried by said quill for rotation therewith about said axis, said laying pipe having an entry section (24_a) lying on said axis between said first and second bearing assemblies and into which said product is directed, and having a curved intermediate section (24_b) leading from said entry section across said second reference plane to terminate at a delivery end (24_c) from which said product emerges as said continuous series of rings, said delivery end (24_c) being spaced radially from said axis (X) to define a circular path of travel, and being spaced from said second plane by an overhang distance (A) which is less than the diameter (F) of said circular path of travel and wherein said second bearing assembly has a D_mN number above 1,000,000."

Note: D_m represents the mean value in millimetres of the inner and outer diameters of the second bearing and N represents the rotational speed of the laying pipe in rpm.

Claim 1 according to the auxiliary request reads:

"A laying head for a rolling mill which is adapted for receiving a single strand product in the form of a rod or the like moving axially and for forming said product into a continuous series of rings, said laying head comprising:
a quill (14) having a longitudinal axis (X);
first and second bearing assemblies (16,18) encircling and supporting said quill for rotation about said axis, said first and second bearing assemblies being located respectively in first and second mutually spaced reference planes (P_1 ,P_2) perpendicular to said axis;
means (20,22) for rotating said quill about said axis; and
a laying pipe (24) carried by said quill for rotation therewith about said axis, said laying pipe having an entry section (24_a) lying on said axis between said first and second bearing assemblies and into which said product is directed, and having a curved intermediate section (24_b) leading from said entry section across said second reference plane to terminate at a delivery end (24_c) from which said product emerges as said continuous series of rings, said delivery end (24_c) being spaced radially from said axis (X) to define a circular path of travel, and being spaced from said second plane by an overhang distance (A) which is between 0.77 and 0.83 of the diameter of said circular

path of travel, wherein said second bearing assembly has a D_mN number above 1,000,000."

Claim 2 according to the auxiliary request corresponds to claim 4 as granted and relates to a preferred embodiment of the laying head according to claim 1.

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

The subject-matter of claim 1 of the main request lacks novelty with respect to the disclosure of D1. The article relates to development of a laying head having the particularity of a large diameter second bearing comprising cylindrical rollers and which was capable of handling a particularly high throughput of rod material. The laying head is described with reference to a drawing "figure 2" which is stated to be based on a drawing by "SMS", has all of the characteristics of a technical drawing and clearly is not a schematic drawing within the meaning of T 204/83 (OJ EPO 1985, 310). The diameters of the first and second bearings and of the path of travel of the delivery end are quoted in the text. The skilled person, in this case the rolling mill design engineer, would recognise that those dimensions are reproduced in the figure according to a consistent scale of 1:14 and that the drawing therefore is an accurate scale representation of the laying head. Subsequent measurement of the dimensions on the drawing of the spacing of the circular path of travel of the delivery end from the plane of the second bearing and of its diameter would result in a ratio of these (hereafter "A/F") of about 0.85, i.e. the former is less than the latter, as defined in claim 1. As

regards the feature that the value of $D_mN>1,000,000$, although the quoted speed of 2,200 rpm with a D_m value of 450 mm results in D_mN of only 990,000, it is stated that in testing the laying head ran at a speed 18% higher, corresponding to D_mN of 1,168,200 which satisfies the requirement in claim 1 that $D_mN>1,000,000$. This article is a disclosure in itself and it is not relevant whether the drawing accurately represents the laying head which was used.

Whilst the subject-matter of claim 1 according to the auxiliary request is novel with respect to D1 and D2, it lacks an inventive step. The skilled person is aware that the problem of increasing the stiffness of the rotating portion of the laying head can be solved by reducing the ratio A/F. The ratio A/F based on measurements taken from D1 is 0.85 and it is a simple step for the skilled person to arrive at the value of 0.83 contained in claim 1.

VI. The respondent rebutted the arguments of the appellant essentially as follows:

The laying head which is referred to in the text of D1 is that shown in D4 and has a ratio A/F>1. The drawing in figure 2 of D1 was intended merely to draw attention to the application of a bearing in a laying head. It has a simpler view of the laying pipe and is not an accurate representation of the laying head itself. The skilled person moreover would be aware that the drawing of figure 2 of D1 was not an accurate copy of the correct drawing because a correct representation of the complex run of the laying pipe, such as D1 figure 2 attempts to show, would not have been possible at that

time i.e. without the benefit of CAD. Indeed, the skilled person would understand that companies do not permit the publication of scale drawings and so would not attempt to derive information from it. As regards the value of D_mN, the maximum rolling speed referred to as a world record was 114 m/s, corresponding to a value of $D_mN<1,000,000$. It is derivable from the wording of D1 that the speed of 135 m/s was not achieved during a rolling operation.

Claim 1 according to the auxiliary request defines a combination of a particular range of the ratio A/F with a value of D_mN. When starting from the laying head shown in D2 the invention solves the problem of increasing the stiffness of the rotating parts in order to permit higher rotational speeds. A larger bearing permits the laying pipe to deviate from the rotational axis at a point closer to the second bearing and so allows a shorter overhang and as a result a reduction in the ratio A/F. The linear speed of the bearing rollers increases with the diameter of the bearing and the skilled person, when increasing the size of the bearing, would attempt to reduce, not increase the value of D_mN. Even if D1 were considered to disclose a value of the ratio A/F<1 this is not a teaching either of the presently claimed range or of the combination of this range with a value of $D_mN>1,000,000$.

Reasons for the Decision

Novelty of the main request

1. It is not disputed by the respondent that all features of claim 1 with the exception of the features relating to the ratio A/F and the value of $D_mN>1,000,000$ are disclosed in D1. The Board therefore needs to concern itself only with these contentious features.

1.1 D1 is an article in a technical journal produced by a bearing manufacturer which describes developments in laying heads in order to cope with increasing rolling speeds and in particular with a laying head which had been delivered to a company Arbed Saarstahl GmbH. A laying head serves to form hot rolled rod into helical ring formations for deposit on a cooling conveyor which is then able to run at speeds lower than that at which the rod is delivered to the laying head. D1 explains that in such a laying head it is desirable that the circular path of travel of the delivery end be as large as possible and that in the particular case, with specific reference to a drawing figure 2, the diameter was about 1m. It further explains that the quill must be supported close to the delivery end of the laying pipe. As a result, two design parameters for the "second bearing" (cf. claim 1), namely a relatively large internal diameter of 400 mm and a rotational speed of 2,200 rpm were pre-determined. The article continues by explaining that such a speed would not be possible when using a conventional roller bearing having the 400 mm internal diameter but that this problem was solved by a bearing specially designed for high speed use.

1.1.1 The article quotes the inner and outer diameters of both the first and second bearings, 400 mm, 500 mm, 200 mm and 310 mm respectively. A comparison of these dimensions with the respective illustrations in the figure results in a consistent scale factor of about 1:14. The illustrated radius of the delivery end measures 39 mm which, when multiplied by the same factor of 14 results in a delivery end path diameter of 1.09 m which is in agreement with the text. Moreover, it is stated in the text that with the help of the laying head a rolling speed of 114 m/s was achieved. A laying head having a delivery end path of 1m diameter rotating at 2200 rpm corresponds to a linear rod delivery speed of 114 m/s. It follows that there is consistent agreement between dimensions stated in the text and the illustration of parts having those dimensions in the drawing. Moreover, the drawing is of a standard typical of that which the skilled person would expect in scale technical drawings; it includes, for example, features such as cross-hatching, centre-lines and indications of welds. It is clear that the drawing is not a full assembly drawing; for instance, centre-lines through flanges are indicated but corresponding fasteners are not. However, there is no indication for the skilled person that the detail which is shown is not a faithful, albeit simplified copy of the corresponding parts of the drawing on which it is based. Even the laying pipe is illustrated as having a relatively complex, compound curve which, whilst it differs from the simpler view of the corresponding pipe shown in D4, resembles somewhat more closely that illustrated in D2.

1.1.2 The Board is not convinced by the respondent's argument that the skilled person would recognise the drawing of D1 figure 2 as not being a scale representation of the laying head referred to in the text. Even if it were normal that important dimensions would not be reproduced to scale when a technical drawing is published, in the case of D1 all dimensions which are disclosed in the text are represented in the drawing of figure 2 according to a consistent scale factor. It is the Board's view that, in the absence of any indication to the contrary the skilled person would conclude that all dimensions were accurately represented. Furthermore, the Board cannot accept the respondent's argument that a view of the compound curve of the laying pipe as shown in D1 figure 2 would not have been possible in the early 1980s, before the advent of CAD, particularly in view of the existence of a compound curve in D2, albeit in a different view, dated eight years earlier.

1.1.3 On the basis of the foregoing the Board considers that the skilled person would have understood the drawing of figure 2 of D1 to be a scale representation of the laying head to which the text in the article refers. Moreover, the Board is of the view that the statement in D1 that the need to support the quill as close as possible to the delivery end, resulting in the need for the larger bearing, together with the statement regarding the desirability of a large diameter of the delivery path, is an encouragement to the person skilled in rolling mill design to investigate the dimensions actually used and so derive these by measuring the drawing.

1.1.4 Measurement in D1 of the spacing of the delivery end from the rotational axis (A/2) and of the overhang distance (F) and division of the latter dimension by twice the former dimension results in a value of A/F of 0.85. In view of the inherent inaccuracy of this method, this is not considered as a disclosure of the value of 0.85 itself. Nevertheless, this value is sufficiently far removed from the value of 1 that it is a clear disclosure of A/F<1.

This finding is consistent with that of decision T 204/83 (*supra*) in which it was stated that "dimensions obtained merely by measuring a diagrammatic representation in a document do not form part of the disclosure", because the drawing in D1 figure 2 is not a mere diagrammatic representation but is drafted to a standard typical of an engineering drawing.

1.2 The laying head according to D1 contributed to a "world record" performance of a rolling mill in achieving a rolling speed of 114 m/s. With the indicated delivery path diameter of 1m this corresponds to the rotational speed (N) of the quill of 2200 rpm which is stated in D1. Since the dimensions of the second bearing result in a value of D_m of 450 mm, the corresponding value of D_mN is 990,000. However, it is further indicated in D1 that the bearing was capable of running at speeds higher than the 2,200 rpm and that in testing 135 m/s had been achieved. In the Board's view this is a clear statement that the laying head was run at a D_mN value of $\left(\frac{135}{114}\right)$ x 990,000, namely 1,168,200. Even if the value of 1.09 m for the delivery path end diameter, as derived from measuring figure 2 of D1, were taken as the basis

for the calculation of D_mN, it is apparent that the resulting value would still lie significantly above 1,000,000. The respondent argues that this running speed of the laying head was not actually associated with the passage of rolled rod therethrough. If that were the case it would be difficult to understand why the speed is referred to in metres per second, which can only sensibly refer to the movement of the rod, and not simply rotation of the laying pipe. In any case it is not important in the view of the Board whether this performance of the laying head was associated with an actual rolling operation as the subject-matter of claim 1 is merely a laying head.

2. On the basis of the foregoing the Board concludes that the subject-matter of claim 1 is known from D1 and therefore lacks novelty (Article 54 EPC).

Inventive step of the auxiliary request

3. It is not disputed that the subject-matter of claim 1 according to the auxiliary request is novel with respect to both D1 and D2. Moreover, during appeal the respondent has not challenged the matter of prior public disclosure in respect of D2. The Board therefore need consider only the question of inventive step with respect to these two documents.

4. The parameters which directly influence the speed at which rod material can pass through a laying head are the diameter of the delivery path and the speed of rotation of the quill. According to the patent specification the speed of rotation is limited by the critical resonance speed of the quill which in part

depends on the overhang. Since the laying pipe cannot deviate significantly from the axial direction before it has passed through the second bearing, reducing the overhang requires an increase in the size of the second bearing. Reducing the overhang also reduces the ratio between this and the diameter of the path of the delivery end whereby the stiffness of the laying head is increased, permitting higher rotational speeds. The increases in both bearing diameter and rotational speed combine to increase the value of D_mN.

4.1 It is explained in D1 that it is desirable that the diameter of the path of travel of the delivery end of the laying pipe, i.e. dimension F, be large in order to minimise the bending of the rod and in order to enable a sufficiently low speed of the conveyor. Moreover, D1 refers to the necessity to support the quill as closely as possible to the delivery end, i.e. to minimise overhang. Although, as discussed above, D1 does indeed disclose to the person skilled in the art a laying head where the A/F ratio is significantly less than 1, it makes no reference to the reduction of the A/F ratio to below any particular value as being an important design consideration for achieving the required high laying speeds. Furthermore, despite the fact that D1 discloses that a laying head had been run under test conditions resulting in a value of $D_mN>1,000,000$, it is clear that, even with the size of the second bearing and therefore the value of D_m taught by D1, the laying head was intended to run only at a value of D_mN of 990,000. Although D1 does mention parameters which directly influence the speed at which the laying head can operate, it relates to the application of a particular bearing which was specially adapted for the purpose and

the skilled person beginning with D1 therefore would not be encouraged by D1 to further increase the size of the bearing.

In summary it can therefore be seen that D1 contains nothing which encourages the person skilled in the art to combine a lowered value of the ratio A/F of between 0.77 and 0.83 with a value of D_mN of above 1,000,000.

4.2 The prior used laying head according to the drawing D2, which dates from 1976, has an A/F ratio of 0.86. The mean diameter D_m of the second bearing is of the order of 280 mm. There are indications that the normal running speed of the laying head is of the order of 1000 rpm, which would correspond to a laying speed of around 50 to 60 m/s, the conventional value for rolling mills of the relevant time period. As a consequence a D_mN value of around 300,000 can be assumed.

A comparison between the laying heads of D1 and D2 demonstrates that in the intervening years there had been an increase in bearing diameter to give greater stiffness at higher rotational speeds, although the claimed threshold of 1,000,000 for D_mN had not been breached for normal continuous operation. However, no trend to a lower A/F ratio is discernible, the corresponding ratios in the laying heads of D1 and D2 being essentially identical. Indeed, the fact that, as derivable from D4, the laying head actually installed at Arbed Saarstahl had an A/F ratio of 1.02 would appear to lead support to the contention of the respondent that in the context of constructions actually deployed the trend had been in the other direction.

Accordingly, the same positive conclusion with respect to the inventive step of the subject-matter of claim 1 of the auxiliary request is reached if the laying head of D2 is taken as the starting point for evaluation.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:

   – claims 1 and 2 according to the auxiliary request submitted at the oral proceedings;

   – description and drawings as granted.

The Registrar: The Chairman:

S. Fabiani S. Crane