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**Datasheet for the decision
of 28 September 2010**

Case Number: T 0907/08 - 3.4.02

Application Number: 95120185.4

Publication Number: 0718599

IPC: G01D 5/245

Language of the proceedings: EN

Title of invention:
Incremental encoder

Patentee:
Kabushiki Kaisha TOPCON

Opponent:
DR. JOHANNES HEIDENHAIN GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-



Case Number: T 0907/08 - 3.4.02

DECISION
of the Technical Board of Appeal 3.4.02
of 28 September 2010

Appellant:
(Patent Proprietor)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 22 February 2008
revoking European patent No. 0718599 pursuant
to Article 101(2) EPC.

Composition of the Board:

Chairman: A. G. Klein
Members: A. Maaswinkel
D. S. Rogers

Summary of Facts and Submissions

I. European patent No. 0 718 599 (based on application No. 95120185.4) was revoked by the decision of the opposition division dated 22 February 2008. In the division's opinion, the claims of the main, first auxiliary and second auxiliary requests did not involve an inventive step (Article 56 EPC), starting from the embodiments in document D3 (DE-C3-24 16 212) considered as closest prior art. Furthermore, the following documents were relied on by the parties in the proceedings:

D1: DE-A1-40 37 545

D2: WO-A1-92/04601

II. On 5 May 2008 the patent proprietor filed an appeal against this decision and paid the appeal fee on the same day. In the statement setting out the grounds of appeal received on 1 July 2008 the appellant requested that the decision of the opposition division be set aside and that the patent be maintained on the basis of the claim of the second auxiliary request submitted during the oral proceedings and filed as "New Claim 1" with this letter. Auxiliarily the appellant requested oral proceedings.

III. In its reply received on 19 December 2008 the opponent raised objections under Article 123(2) EPC and 56 EPC and requested that the appeal be dismissed.

IV. In a summons pursuant to Rule 115(1) EPC sent on 12 May 2010 the board invited the parties to oral proceedings.

- V. In a letter dated 30 August 2010 the appellant filed further observations.
- VI. Oral proceedings were held on 28 September 2010. During the oral proceedings the appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of claim 1 of "New Claim 1" filed with the appellant's letter dated 1 July 2008.
- VII. The respondent withdrew its former objection under Art. 123(2) EPC against the amended claim. Furthermore the respondent requested that the appeal be dismissed.
- VIII. The wording of claim 1 reads as follows:

" A rotary encoder comprising:

 a rotor (100) provided with a main scale (110) including graduation lines and with a plurality of indices (120) for detecting a reference point, said indices (120) being arranged at pitches of different numbers of the graduation lines, said pitches increasing in a specific direction;

 a stator (200) provided with a first subscale (210) and with a second subscale (220) for use in combination with said indices (120); and

 a detecting means (300) comprising a light source unit (311; 321), an optical system (312; 322) and a light receiving unit (313; 323), rotor (100) and said stator (200) being disposed between said light source unit (311; 321) and said light receiving unit (313; 323), wherein the detecting means (300) detects a specific index (I_1) and starts counting the graduation lines of the main scale (110) in a first up/down counter (605) until the detecting means (300) detects

the next index (I_2), a set reference point is determined by calculation on the basis of the counted number of graduation lines of the main scale (110), and then the angle between the reference point and the position of said next index (I_2) is determined,

wherein the angle between said next index (I_2) and an optional position is determined on the basis of the corresponding number graduation lines of the main scale (110) counted in a second up/down counter (608) which is started after the detecting means (300) has detected said next index, and the angle between the reference point and the optional position is determined by adding the angle between the reference point and the position of said next index (I_2) to the angle between said next index (I_2) and the optional position;

a controller (609) operationally connected with the first (605) and the second (608) up/down counter to enable starting said counters ".

IX. The arguments of the appellant may be summarised as follows.

Amendments

The features added to the claim as granted are clearly disclosed in the original application (first and second counters 510, 520; 605, 608; controller 400, 609) and limit the scope of the granted claim. In this respect particular attention is drawn to paragraphs [0028] and [0032] of the patent specification which state that counters 510 (in Fig. 3b) and 605 (Fig. 5) correspond to each other. Paragraph [0035] discusses in detail the provision of ON and OFF signals which are fed by the CPU to the counters together with the signals from the

index detection circuit 606. Thus, there is no issue under Article 123(2) or (3) EPC.

Inventive step

The opposition division based its decision to revoke the patent mainly on document D3. Applicant agrees that this document can be considered as closest art from which to assess novelty and inventive step of the amended claim. As stated by the opposition division, document D3 neither discloses two separate up/down counters nor a controller operationally connected to these counters. Novelty of the amended claim is therefore established. In particular, this document does not disclose or render obvious a rotary encoder with the combination of features as claimed:

- A main scale with indices whose distance increases in a specific direction;
- a first up/down counter for counting graduation lines between a first and a second index;
- a second up/down counter for counting graduation lines between the second index and an optional position of the main scale;
- a controller operationally connected with the counters.

Starting from document D3, the problem solved by the present invention can be defined as follows:

Since D3 is designed such that the counter (16) always indicates the absolute position of the main scale (i.e. position of last detected marker plus offset from this marker), the electronic circuits in Figs. 2 and 3 have to be fast enough to access the table (24) and to load the counter with the read out value (the absolute position of the detected marker) before the next signal

from a graduation line arrives in the counter (16) (cf. col. 9, lines 56 to 62). In high precision encoders with very dense graduation lines (and/or fast movements), the available time is short and puts tight design requirements on the electronic circuit as a whole (or, if it represents a possible implementation, on the performance of a microprocessor in case of a program implemented equivalent). Furthermore, the display of absolute positions in the counter (16) both for forward and backward movements requires an increased complexity of the entries in the table (24) and the circuit itself (cf. col. 10, lines 37 et seq.). Compared to D3, the patent-in-suit has therefore the object to provide a fast, yet simple, low cost and flexible electronic set-up for counting and evaluating the impulses generated by the graduation lines to provide absolute positions of the main scale, see also paragraph [0043] which states that the encoder can be operated "sharply". The invention solves this object by decoupling the counting as such from the evaluation/calculation of the position; for this purpose individual counters are provided for the graduation lines encountered between adjacent indices on the one hand, and the graduation lines counted after passing the second index on the other hand. Only these two counters have to meet the tight time constraints of being able to count the high frequency signals of dense graduation lines (and/or fast movements of the encoder), whereas the calculation of the absolute positions is subject to less time critical parameters and can easily be performed by a conventional controller or CPU. By arranging adjacent indices with continuously increasing mutual distances, the determination of the position of the current index is

simpler and operates in the same way irrespective of the direction of movement of the main scale. The increasing pitches of the indices allow furthermore a simple calculation (e.g. by multiplication) of the position of the reference point without the need for a complex look-up table as in D3. The use of two separate counters in combination with a controller for evaluating the signals as defined in the claim therefore provides a synergistic effect, which had been denied by the opposition division. Because of the synergy achieved by the counters and the controller, an analysis of the invention involving dissecting the features of the patent in suit into separate problems as done by the opposition division is inappropriate. The disclosure of D3 points the expert away from the solution proposed by the patent-in-suit in that it recommends overcoming the need for very fast circuits by implementing special blocking circuits for signals (cf. col. 9, line 51). Therefore, starting from D3, the expert would not have thought of providing two independent counters for the time critical parts of the signal flow and using the controller for the remaining tasks. Nor would the expert think of using a memory element in D3 for storing the contents of the single counter (16) after the second marker is detected. In view of the required fast operation, the expert would also not consider replacing the special "very fast" circuits of D3 by a program for the CPU which would hardly be able to meet the timing requirements.

The encoder disclosed in document D2 also follows the principle of document D3 in that the signals are processed in a processor to immediately output the absolute position values. As disclosed on page 7, lines

10 to 17, this sets high requirements on the speed of the processor. Therefore D2 does not suggest the principle followed in the present invention, that is to use two counters which count relative values which are only subsequently evaluated in the processor to provide the position between the reference point and the optional position.

The rotary encoder in accordance with the amended claim is therefore based on an inventive step.

X. The arguments of the respondent may be summarised as follows.

According to the appellant the subject-matter of the claim differs from prior art encoders in four aspects, involving the pitches increasing in a specific direction, two counters, and a controller connected to the counters. These differences, however, do not imply an inventive activity for the following reasons.

The use of reference indices having an increasing pitch in a specific direction is well known in encoders of the type having a main scale and a reference scale as illustrated in documents D1 and D2: both documents acknowledge document D3 in their introductory part, therefore a combination of the teachings of these documents is obvious to the skilled person.

The use of two counters has been motivated in that these would apparently allow a higher speed of the data processing system. However, the patent in suit does not disclose any details about the speed of the respective components, therefore the objective problem over the

prior art cannot be defined as "increasing the speed of the encoder system". Rather, the underlying problem is the provision of an alternative solution.

As to the further differences over the prior art it is noted that the proprietor incorrectly refers to the controller as a "CPU". Rather, a "controller" as defined in the claim may consist of discrete components with restricted functionality and high processing speed, for instance, the circuitry in the embodiments of document D3. Also document D2 clearly discloses the use of a processor for processing the data, see page 7, line 13. Therefore a "controller" is known from the prior art. In any case, the only task specified in the claim for the controller is to "enable" starting the counters, which is merely purposive and does not restrict the controller.

Furthermore, considering the counting of the graduation lines, both documents D2 and D3, as well as the patent in suit, rely on the same principle of distance encoded reference indices: such indices, having differing distances between two subsequent indices on one scale, enable the determination of a reference position by counting the graduation lines of a parallel incremental scale and subsequently, starting from the reference position, the determination of an absolute position by further counting of graduation lines. Document D3 discloses two embodiments involving one counter. A further example involving two parallel scales is disclosed in document D2. Although the latter document does not explicitly disclose the electronic circuit for the counting and data processing it appears obvious that the data collection of the two parallel scales

involving two respective signals can be carried out by using two counters.

This shows that the solution defined in claim 1 of the patent in suit follows the same principle as the prior art and involves a further alternative to the known solutions of the prior art. Such an alternative merely defining the use of two counters instead of one counter does not involve an inventive step.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments*
 - 2.1 Present claim 1 was originally filed at the oral proceedings before the opposition division who did not raise an objection on formal grounds (Art. 84 EPC or Art. 123(2) or (3) EPC). During the oral proceedings before the board, the respondent declared that he no longer maintained the objection against this claim under Article 123(2) EPC.
 - 2.2 The board is satisfied that the amendments in the claim are fairly supported by passages indicated by the appellant. Therefore the amendments are not objectionable.

3. *Patentability*

3.1 *Novelty*

The novelty of the subject-matter of the claim was not disputed between the parties. The board also has no objection in this regard.

3.2 *Inventive step*

3.2.1 In the decision under appeal document D3 was considered to disclose the closest prior art, which view was shared by the parties. The board concurs with the position of the opposition division and of the parties that document D3 discloses a rotary encoder of the generic type of the encoder defined in claim 1, and that the subject-matter of the claim differs from the encoder in this document in the features:

- i) The pitches between the indices on the main scale increase in a specific direction;
- ii) A first up/down counter for counting graduation lines of the main scale between a first and a second index;
- iii) A second up/down counter for counting graduation lines between the second index and an optional position of the main scale; and
- iv) A controller operationally connected with the counters which is arranged to enable starting the counters.

3.2.2 With respect to the definition of the objective problem underlying the difference between the subject-matter of claim 1 and the prior art device the board concurs with the respondent that the objective problem could be seen

in providing an alternative rotary encoder device to the encoder known from document D3.

3.2.3 Considering the features i) - iv) defining the differences over the prior art device in document D3 the board agrees with the respondent in the assessment of feature i) that this feature is known from the prior art (document D2). The appellant's argument that this feature adds to the speed of the device because it would allow the calculation of the position of the reference point without the need for a complex look-up table as in D3 was addressed by the respondent at the oral proceedings who, referring to col. 7, line 1 of the patent specification, explained that also the patent included both possibilities (...to calculate or call") and that in any case accessing a look-up table was faster than carrying out a calculation. For this reason the board considers feature i) to include an alternative known in the art which does not interact with the further features ii) - iv) and therefore does not provide a synergistic contribution.

3.2.4 Features ii) - iv), however, cannot be considered separately because, as illustrated in Figure 5 and disclosed in paragraphs [0034] and [0035] of the patent specification, the first up-down counter (605) and the second up-down counter (608) cooperate with the CPU (609) in order to count the graduation lines of the main scale between a first and second index (counter 605); subsequently to count the graduation lines between the second index and an optional position (counter 608); wherein the counters are enabled (and disabled) by the CPU 609. As is illustrated in Figure 4, step S9, determining the difference between the counts

- of both counters is carried out in the CPU in a separate, subsequent step and does not impede the counters, see also paragraph [0030].
- 3.2.5 It is therefore to be examined whether the skilled person, seeking to provide an alternative to the encoder in D3, would have arrived at the type of encoder defined in claim 1 and including the first and second counters and the controller of features ii) - iv).
- 3.2.6 In the opinion of the board such a modification of the encoder of D3 does not appear obvious, because, apart from the differences in the above features ii) - iv) it is to be noted that the design principle of that encoder and its output are rather different from the encoder of the patent in suit: in particular the aim of the encoder in D3 is to offer instantaneously at its output the absolute position of the main scale, see for instance col. 4, line 66 to col. 5, line 18. In order to realise this the device, for instance the dedicated circuitry in Figure 2, must be fast, see col. 9, lines 56 to 62.
- 3.2.7 On the other hand the encoder of the patent in suit determines a distance between two reference index marks (with the first counter); determines the distance from the second index mark up to any optional position (with the second counter); and subsequently evaluates the respective counts in a controller/CPU for obtaining a position with respect to a reference point, for instance by equating the distance between the first and second index marks with a difference to a reference position.

- 3.2.8 Therefore, both because of the objective pursued in document D3 (instantaneous indication of the absolute position) in contrast to the patent in suit and the detailed circuitry needed for obtaining that solution (Figures 2 and 3 of D3) there does not appear a clear incentive for the skilled person to modify the apparatus of D3 in the way as defined in claim 1, because this would imply giving up the objective of the instantaneous absolute position at its output and, moreover, a complete re-design of the apparatus.
- 3.2.9 At the oral proceedings the respondent also made reference to document D2, which, although not providing any instrumental details, already included a controller that might be realised with two counters because two signals from each of the two scales were detected.
- 3.2.10 However, document D2 follows a similar objective as document D3 in that it also aims at displaying the encoder's absolute position instantaneously, to which aim it even includes an additional shift in the position value for correction of the calculation time. It is also noted that although the encoder in the patent in suit includes two scales, a main scale with incremental gradation lines and a second, index scale, it is not correct that the first up-down counter would count the information of the first (main) scale and the second up-down counter the information of the second (index) scale: rather, as illustrated in Figure 5, both counters count the graduation lines of the main scale, the markings of the index scale being used for starting the counters by respectively switching the AND-gates together with the control signals by the CPU. In the

opinion of the board this clearly illustrates the synergistic effect defined in features ii) - iv) in point 3.2.1 supra.

- 3.2.11 Neither document D3, nor D2 discloses or suggests a modification of the devices disclosed in these documents in the way defined in claim 1. Therefore the subject-matter of this claim includes an inventive step.

4. At the oral proceedings the description of the patent specification was adapted to the new claim.

5. Accordingly, taking into consideration the amendments made to the patent, the requirements of the Convention are met. The patent as so amended can therefore be maintained (Article 101(3)(a) EPC).

Order

For these reasons it is decided that:

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

Description:

Pages 2, 4, 5, 6 of the patent specification, page 3 received during the oral proceedings of 28 September 2010.

Claims:

Claim 1 of "New Claim 1" filed with letter dated 1 July 2008.

Drawings:

Figures 1 - 8 of the patent specification.

The Registrar:

The Chairman:

M. Kiehl

A. G. Klein