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Case Number: T 0565/12 - 3.2.06

Application Number: 03758659.1

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Language of the proceedings: EN

Title of invention:
SYSTEM AND PROCESS FOR MEASURING, COMPENSATING AND TESTING NUMERICALLY CONTROLLED MACHINE TOOL HEADS AND/OR TABLES

Patent Proprietor:
FIDIA S.p.A.

Opponents:
DR. JOHANNES HEIDENHAIN GmbH
Petec GmbH

Headword:

Relevant legal provisions:
EPC 1973 Art. 54, 56, 114(2)

Keyword:
Novelty - (yes)
Inventive step - (yes)

Decisions cited:
T 0410/96, T 0287/86

Catchword:

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Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 0565/12 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 8 January 2014

Appellant 1: (Patent Proprietor)	FIDIA S.p.A. Corso Lombardia, 11, Zona Industriale Pescarito 10099 San Mauro Torinese (Torino) (IT)
Representative:	Grünecker, Kinkeldey, Stockmair & Schwanhäusser Leopoldstrasse 4 80802 München (DE)
Appellant 2: (Opponent 1)	DR. JOHANNES HEIDENHAIN GmbH Dr.-Johannes-Heidenhain-Str. 5 D-83301 Traunreut (DE)
Representative:	Dr. Johannes Heidenhain GmbH Dr. Johannes-Heidenhain-Strasse 5 83301 Traunreut (DE)
Respondent: (Opponent 2)	Petec GmbH Riemenschneiderstrasse 6 63839 Kleinwallstadt (DE)
Representative:	Küchler, Stefan Patentanwalt Färberstrasse 20 90402 Nürnberg (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 27 December 2011 concerning maintenance of the European Patent No. 1549459 in amended form.**

Composition of the Board:

Chairman:	M. Harrison
Members:	M. Hannam
	R. Menapace

Summary of Facts and Submissions

I. An appeal was filed by the appellant/proprietor (hereinafter referred to simply as the proprietor) against the interlocutory decision of the opposition division concerning maintenance of the European patent No. 1 549 459 in amended form. The proprietor requested that the interlocutory decision be set aside and the patent be maintained as granted.

II. An appeal was also filed by the appellant/opponent I (hereinafter referred to simply as the opponent), requesting that the interlocutory decision of the opposition division be set aside and that the patent be revoked. With respect to the patent as granted, the opponent raised objections under Article 54 and Article 56 EPC in view of the following documents:

A1 DE-C2-199 44 429
A2 Proceedings of the 3rd euspen International Conference, 26th-30th May 2002, Volume 2 pages 629-632
A3 DE-A-195 01 094
A5 US--A-5 841 668

III. With its letter of response to the proprietor's appeal, the opponent filed the following document:

A12 Precision Engineering, Vol. 22, No. 1, January 1998, pages 10-18

It requested that A12 be admitted in view of it *prima facie* depriving the subject-matter of claim 1 of novelty.

IV. The Board issued a summons to oral proceedings including a communication containing its provisional

opinion, in which it indicated *inter alia* that A12 appeared to lack sufficient relevance to be admitted and that the subject-matter of claim 1 appeared to be both novel and to involve an inventive step over the cited state of the art, contrary to the arguments of the opponent.

V. Oral proceedings were held before the Board on 8 January 2014, at which the final request of the proprietor was that the decision under appeal be set aside and that the patent be maintained as granted. The opponent requested that the decision under appeal be set aside and that the European patent No. 1 549 459 be revoked.

VI. Claim 1 as granted (with features numbered by the Board for ease of reference) reads as follows:

1.0 "System for measuring, compensating and testing numerically controlled machine tool heads (1) and/or tables, characterised in that it comprises:

1.1 at least one support base (11) equipped with a plurality of distance sensors (14);

1.2 at least one device (16) of the gage tool type composed of an elongated cylinder (17), said cylinder (17) being equipped at one of its ends with connection means (18) for said heads (1) and being equipped at another opposite end with a ball (20), said ball (20) being placed next to said sensors (14) so that they are able, always and in any position, to measure a distance that separates them from said ball (20);

1.3 wherein said system is operatively coupled with processing means (30),

1.3.1 said processing means (30) being adapted, through a single measure obtained by said sensors

(14) about a distance that separates said sensors (14) from said ball (20), to detect the XYZ coordinates of a center of a tool in a position of interest,

1.3.2 said processing means (30) comprising means (31) for performing measure processes for errors that can be modeled,

1.3.3 means (32) for performing measure processes for errors that cannot be modeled and

1.3.4 means (33) for performing dynamic checks."

VII. The proprietor's arguments may be summarised as follows:

The system of claim 1 was not simply adapted to measure errors, rather it was adapted to measure particular types or errors, namely those that could be modeled and those that could not be modeled. Features 1.3.2 and 1.3.3 thus defined two separately identifiable device features rather than a single feature achieving both functions. The 'means for' wording in features 1.3.2 and 1.3.3 was to be interpreted as 'means adapted for' in line with T 410/96.

A12 included a kinematic ball bar for measuring a displacement vector; these were only relative displacements such that no error model could be generated, rather only a kinematic model was possible. A12 is furthermore directed to contour measurement using a single ball bar which, in order to provide XYZ coordinate data, would require multiple measurements to be taken, and was thus to be seen as less relevant than prior art already on file.

Regarding novelty (Article 54 EPC) of the subject-matter of claim 1, A1 measured overall positioning

errors in conjunction with a kinematic model in contrast to the claimed error model. No dynamic checks were carried out in A1 and no explicit disclosure of the coordinates of the middle point of the ball was to be found.

Regarding the presence of an inventive step (Article 56 EPC) in the subject-matter of claim 1, A1 lacked features 1.3.2 - 1.3.4 of claim 1 for which an objective technical problem was to provide a system improved in terms of measuring and testing. The skilled person would not consider a combination with A5 since the use of a ball bar therein to measure relative displacements was incompatible with the distance sensor arrangement of A1. Furthermore the error models generated in A5 by the ball bar were incompatible with the data generated by the error sensors in A1. In addition to this fundamental incompatibility, A5 also failed to disclose a separate measure process for errors that cannot be measured, so that a combination of the documents could anyway not lead to the claimed subject-matter.

Regarding the combination of A2 or A3 with A5, both A2 and A3 presented a less suitable starting point since, in addition to features 1.3.2 - 1.3.4 being missing, the physical location of features 1.1 and 1.2 were interchanged when compared to A1 (i.e. the plurality of distance sensors in feature 1.1 were located on the support base whereas in A2 and A3 they were attached to the tool head; also the gage tool was attached to the tool head in feature 1.2 whereas in A2 and A3 the functionally equivalent part was attached to the support base.) The combination of A2 or A3, which utilised distance sensors, with A5, which used a ball bar for displacement measurement, was also not obvious

to the skilled person due to significant structural modification required in order to substitute the ball bar for the distance sensors.

VIII. The opponent's arguments may be summarised as follows:

A12 was submitted as soon as possible in the appeal proceedings and was *prima facie* highly relevant.

In claim 1 features 1.3.2 and 1.3.3 simply implied means 'suitable for' performing measure processes for errors that can be modeled and that cannot be modeled. Decision T287/86, concerned an arrangement analogous to that of the present case. The findings in T287/86 were to be followed such that the kind of error measured did not put any limitation on the physical means used to measure that error. Fig. 3 and the last paragraph on page 13 of A12 disclosed a classification of errors such that this document was highly relevant and anticipated the subject-matter of claim 1.

Claim 1 failed to include separate means for each error type. Thus a single means suitable for measuring general errors as found in A1 anticipated features 1.3.2 and 1.3.3 of claim 1. Its subject-matter was thus not novel (Article 54 EPC) over A1.

Regarding the presence of an inventive step, the type of error being measured did not put any further limitation on the claimed 'means for performing measure processes'. A5 disclosed appropriate means suitable for measuring each of the error types. A1 and A5 thus deprived the subject-matter of claim 1 of an inventive step. Similar considerations existed for the document combinations A2 and A5 as well as A3 and A5, whereby the interchanged location of features 1.1 and 1.2 in A2

and A3 did not provide the basis for an inventive step since it was the relative separation between the sensors and the reference ball which was of importance.

Reasons for the Decision

1. A12

1.1 A12 was filed for the first time with the opponent's response to the proprietor's appeal, arguing that it deprived the subject-matter of claim 1 as granted of novelty (Article 54 EPC). The Board resolved to take this document into account in the understanding, however, that this did not result in the document automatically being admitted irrespective of its relevance. When considering the Rules of Procedure of the Boards of Appeal (RPBA), in particular Article 12(4) thereof, although the Board indeed has the discretionary power to hold inadmissible evidence (such as A12) which could have been presented in the first instance proceedings (a matter which was not disputed by the parties), it was not however necessary in the present case to establish whether A12 could have been filed in the first instance proceedings. Instead the Board took it into account and considered that it lacked sufficient relevance for it to be admitted into proceedings, since, as detailed below in points 1.2 - 1.6, A12 is not of such relevance that its admittance would prejudice the maintenance of the European patent. A12 was thus not admitted into the proceedings by the Board when exercising its discretion under Article 114(2) EPC 1973.

1.2 Regarding the relevance of the system described in A12 with respect to the novelty of the subject-matter of

claim 1, A12 lacks at least the following numbered features of claim 1:

Feature 1.1 Whilst including at least one support base (machine table; see page 13, left-hand column, lines 9-10), A12 discloses just a single distance sensor (see Fig.2 and page 14, first paragraph of 'Dynamic path measurements') in the form of a single laser ball bar (LBB) using sequential trilateration to achieve that which a plurality of distance sensors could in a single trilateration process.

Feature 1.2 The tool socket of A12 (see Fig.2) holds one of the balls of the LBB rather than the gage tool as claimed. As a result, the ball held by the tool socket is never placed 'next to' the sensors, as defined in claim 1, rather the ball represents an integral part of the single LBB sensor.

Feature 1.3.1 Since only a single LBB sensor is used in A12, the process of sequential trilateration requires three readings to be sequentially taken for each measured position of the ball in the tool socket, rather than the single measure claimed. Furthermore, A12 does not unambiguously disclose the XYZ coordinates of a center of a tool (in this case the ball held by the tool socket) being detected since the LBB simply measures relative displacements between the balls located at each of its ends, and this provides no indication of the absolute coordinates of the center of a tool in question. Whilst both Figs. 2 and 3 include the annotation 'XYZ in LBB coordinates', the fact that the LBB is able to provide only a measure of relative displacement results in A12 not unambiguously disclosing the detection of the XYZ coordinates of the tool center, as required by claim 1.

Feature 1.3.2 In A12, the measured tool positioning errors are used with a suitable kinematic model of the machine tool to evaluate its accuracy (see page 13, right-hand column, last paragraph). Thus, only a kinematic model is disclosed in A12 and, with no error model being produced, the claimed 'measure processes for errors that can be modeled' can also not be understood unambiguously to be present.

Feature 1.3.3 The error measurement carried out in A12 is of the total error in positioning of the tool socket, such a total error (implicitly) being a combination of the errors that can be modeled and the errors that cannot be modeled. A12 fails to explicitly or implicitly identify that an error can be so divided into those that can and those that cannot be modeled. It thus follows that, with no unambiguous recognition of errors that cannot be modeled, no unambiguous disclosure exists of the claimed 'means for performing measure processes for errors that cannot be modeled'.

1.3 Regarding the opponent's argument that features 1.3.2 and 1.3.3 simply implied means 'suitable for' performing measure processes for errors that can be modeled and that cannot be modeled, the Board finds otherwise. As regards claims of the 'means plus function' type in a data processing system, these must be interpreted as requiring means adapted to carry out the given function. Applying this interpretation to the present case indicates that the claimed 'means for performing measure processes...' must be interpreted as the means being adapted (for example, by appropriate programming) to perform the measure processes. Thus, prior art including means which are simply capable of performing such measure processes in that they can

(possibly with only minor adaptation or even by arranging a specific connection to be present) be put in the position of being able to perform the measure processes, rather than being specifically adapted to do so, do not anticipate the features 1.3.2 and 1.3.3 of claim 1. This interpretation of the claim is also in line with T 410/96 (see Reasons, items 5 and 6).

1.4 Regarding the opponent's argument that T 287/86 in fact disclosed the way of interpreting the feature 'means for performing measure processes...', the Board does not concur. T 287/86 (see page 6, section (d), second paragraph) concerns a device that needs to be suitable for an indicated purpose (a photoelectric densitometer system for scanning successive coloured areas). This contrasts with the present case in which a data processing means performs a specific function (performing measure processes of a specific type). It thus follows that the interpretation given above appropriate for a data processing system (and confirmed in T 410/96) presents the only appropriate way of interpreting the disputed features of claim 1.

1.5 Concerning the opponent's further argument that the kind of error measured cannot define the physical means used to measure that error, the claimed means are 'adapted for performing measure processes' for each of the error types. Therefore it is to be understood that the means are limited to means having some particular, albeit undefined, features associated with them which makes them suited for performing the measure processes necessary for errors that either can or cannot be modeled. This might for example be software which is specific to a certain type of error. From this it follows that features 1.3.2 and 1.3.3 of claim 1 define

distinct and functionally separate means.

1.6 Regarding the opponent's argument that A12 disclosed a classification of the measured errors, this cannot be inferred from Fig. 3 in combination with the last paragraph of page 13. Fig. 3 simply shows an example of simultaneous triangulation, which itself was never used in the experiments described in A12 (see page 14, left hand column, last paragraph), rather sequential triangulation having been utilised. Fig. 3 provides no indication of how the data provided by the LBBs are processed, let alone that a classification of any errors measured occurs. Equally, in the last paragraph of page 13, a kinematic model is discussed into which the positioning errors collected by the LBB can be used. However, this is described as enabling a correction of the commanded position of the machine tool rather than any classification of the measured errors into those that can be modeled and those that cannot be modeled; a functionally separate means for each of these errors cannot therefore be inferred.

1.7 Thus, A12 does not *prima facie* present, at least for the claims as granted, prior art which would be highly likely to prejudice maintenance of the patent. A12 was thus not admitted into the proceedings by the Board when exercising its discretion according to Article 114(2) EPC 1973.

2. Novelty (Article 54 EPC 1973)

2.1 The subject-matter of claim 1 is found to be novel over the cited art.

2.1.1 A1, the sole document in the proceedings apart from A12 cited to support the opponent's objection of lack of

novelty of the subject-matter of claim 1, discloses (using the wording of claim 1 and references from A1 in parentheses):
a system for measuring, compensating and testing numerically controlled machine tool heads (see [0001]), comprising:
at least one support base (73) equipped with a plurality of distance sensors (80);
at least one device of the gage tool type (1) composed of an elongated cylinder (25), said cylinder being equipped at one of its ends with connection means for said heads (col.6, lines 14-17) and being equipped at another opposite end with a ball (9), said ball being placed next to said sensors (80) so that they are able (via measuring probes 29,30,83), always and in any position, to measure a distance that separates them from said ball (9);
wherein said system is operatively coupled with processing means (see col. 10, lines 25-45),
said processing means being adapted, through a single measure obtained by said sensors about a distance that separates said sensors from said ball (see col. 10, lines 16-25), to detect the XYZ coordinates (col. 10, lines 25-31) of a center of a tool (17 in Figs. 1,3 and 6; col. 9, line 67 - col. 10, line 15) in a position of interest (this position defined as the offset from a nominal cartesian zero point selected by the user).

The subject-matter of claim 1 thus differs from A1 through the following features:
1.3.2 said processing means comprising means for performing measure processes for errors that can be modeled,
1.3.3 means for performing measure processes for errors that cannot be modeled and

1.3.4 means for performing dynamic checks.

The system according to A1 enables the parameters for a CNC machine to be calibrated. The head of the machine holding the ball (9) is driven to a reference point at which a measurement using the measuring probes is performed. The probes provide readings identifying the error in the form of a displacement vector for the actual position of the ball relative to the desired position of the ball (see paragraphs [0056] - [0057]). Since a single reference point is, or multiple single reference points are, approached in A1, either a single displacement vector valid for all positions of the machine head is established or multiple displacement vectors are defined producing a displacement vector map valid for a multitude of discrete positions within the machine head's range of movement. Either way, no modeling of the displacement vector is disclosed, nor is the determining of parameters disclosed for use in a suitable model that would enable feature 1.3.2 to be seen as disclosed in A1.

No distinction is made in A1 between errors that can be modeled and errors that cannot be modeled. Whilst the displacement vector measured corresponds to an overall error at a particular reference point, comprising a combination of the error that can and the error that cannot be modeled, there is, as shown above, no means disclosed in A1 for determining errors that can be modeled, let alone means for determining errors that cannot be modeled. Feature 1.3.3 is thus not known from A1.

It is furthermore noted that the driving of the ball to the reference point is controlled manually (see paragraph [0004] describing the prior art, yet also

applicable to the invention in A1) and A1 also provides no detail of an automatic process for measuring or storing the measured values relating to the position of the machine head. It thus follows that the feature 'processing means comprising means for performing measure processes' in 1.3.2 and 1.3.3 can also not be regarded as known from A1.

Regarding feature 1.3.4, no dynamic behaviour of the machine tool is discussed. In fact, since single reference points are approached and solely at these reference points measurements are taken, no dynamic checks of the machine can be recognised in A1.

2.1.2 Regarding the opponent's argument that features 1.3.2 and 1.3.3 of claim 1 were anticipated simply by a processing means suitable for performing measure processes, the Board refers to the arguments in points 1.3 to 1.5 above. The features 1.3.2 and 1.3.3 are to be interpreted such that the means are adapted to perform measure processes and not such that means are present which, if adapted, would then be able to perform the measure processes. Such a functionality is not to be found in the processing means of A1.

2.1.3 It thus follows that the subject-matter of claim 1 is novel (Article 54 EPC 1973) over A1. Absent any further arguments regarding novelty as concerns claim 1, its subject-matter is found to be novel over the cited prior art (Article 54 EPC 1973).

2.2 No objections were raised by the opponent regarding the novelty of the subject-matter of independent claim 6. The Board also sees no reason to find that novelty is lacking.

3. Inventive step (Article 56 EPC 1973)

3.1 The subject-matter of claim 1 is found to involve an inventive step in view of the cited state of the art and considering the arguments presented by the opponent.

3.2 A1 and A5

3.2.1 A1, as found in point 2.1.1 above, fails to disclose features 1.3.2, 1.3.3 and 1.3.4 of claim 1. Starting from A1 and based on these features, an appropriate objective technical problem can be seen as being how to provide a system improved in terms of measuring and testing. However the skilled person would not consider A5 as providing the solution to this problem, since the teaching therein is not compatible with the device for determining correction parameters in A1.

A5 discloses a method of assessing errors in a machine tool utilising a kinematic ball bar as the data gathering device. Such an arrangement is shown in Fig. 2 of A5 with a machine tool spindle holding a first end (ball 18), a stationary mount holding the second end (ball 12) of the kinematic ball bar (col. 3, lines 45-64). The kinematic ball bar provides data of positioning errors of the centre point of the ball 18 (which correspond to positioning errors of the machine tool head) in the direction of the axial extension of the kinematic ball bar. These errors are then used to generate error models for the machine tool (see col. 4, lines 34-37). The generation of various error models, specifically relating to the disclosed error measurement using a kinematic ball bar, is provided in col. 4, line 41 to col. 8, line 16.

From the above analysis it is clear that the error models generated in A5 have, as the specific error data input, that data provided by a kinematic ball bar. A more general application of the error models in A5 to error data provided by other error sensors is not to be found. This is a very real restriction on the applicability of the disclosed error models in A5 to the data generated by the error sensors of A1 which, for each reference position of the machine tool head, provide a displacement vector in three-dimensional space for the measured positioning error. The displacement vector for each reference position generated by the error sensors of A1 would thus not be suitable input data for the error models of A5, these being specifically geared to data from a kinematic ball bar.

It is furthermore evident from the very different raw data generated by the kinematic ball bar in A5 and the error sensors in A1 that the skilled person would not be in a position to utilise the data provided in A1 in the error models disclosed in A5. The displacement vector of the measured error generated in A1 has an offset calculable in the X, Y and Z directions (see A1, col. 10, lines 21-29) which, however, is in a completely different format to that error generated by the kinematic ball bar of A5, which is a linear offset in the specific axial direction of the ball bar.

The skilled person would thus be faced with significant interpretation of the error data output from A1 before it would be compatible for input to the error models disclosed in A5, such that a combination of the two documents in order to arrive at the subject-matter of claim 1 cannot be regarded as obvious.

The Board furthermore holds that the skilled person would not consider it obvious to replace the three error sensors of A1 with a kinematic ball bar. The three error sensors provide data enabling a displacement vector for a point of interest (such as the machine tool head) to be calculated i.e. an offset or error in three dimensions. This can be achieved through a simultaneous, single measurement by all three sensors. Conversely, a kinematic ball bar, in order to provide comparable three dimensional data, would require a separate measurement to be taken from each of three, individual locations of the ball bar relative to the point of interest. As such, this complication alone would dissuade the skilled person from substituting the kinematic ball bar for the three error sensors.

3.2.2 Regarding the opponent's assertion that dynamic checks are carried out and means for measuring both errors that can and those that cannot be modeled are provided in A5, the Board holds that this overlooks the fundamental incompatibility of A1 and A5. Even if the alleged features are present in A5, a combination of the modeling means relating specifically to the modeling of data produced from a kinematic ball bar would not be considered by the skilled person to be of any use in modifying the system known from A1 in order to solve the objective technical problem and reach the subject-matter of claim 1.

3.2.3 For these reasons and absent any further arguments of the opponent regarding the combination of A1 and A5, the subject-matter of claim 1 is found to involve an inventive step (Article 56 EPC 1973) over this document combination.

3.3 A2 and A5

3.3.1 A2 discloses a device which measures errors in the three dimensional positioning of a machine tool relative to a reference ball. This is achieved through a spherical ball which is positioned on a machine tool table and an arrangement of three, orthogonally positioned sensing styli carried by the machine tool head (see pages 629 - 631). The sensing styli are brought into contact with the reference ball whereupon the XYZ coordinates of the centre of the ball is calculated. This can be repeated for a number of known positions of the reference ball thus providing an error measurement for the machine tool head in each of the known positions of the reference ball.

Compared to the subject-matter of claim 1, A2 discloses an interchanged location of the gage tool (equivalent to the reference ball) and the distance sensors; in claim 1 the gage tool is held by the machine tool head (feature 1.2) whereas in A2 the reference ball is located on the machine tool table; also in claim 1 the sensors are located on a support base (feature 1.1) while in A2 these are carried by the machine tool head. A2 is furthermore silent regarding an error model and measure processes for errors that can be modeled (feature 1.3.2), as it is regarding the measurement of errors that cannot be modeled (Feature 1.3.3). Dynamic checks (feature 1.3.4) are also not disclosed in A2, the error measurement solely occurring in discrete positions of the reference ball.

It thus follows that A2 represents a less promising starting point than A1 for arriving at the subject-matter of claim 1 since, in addition to features 1.3.2 - 1.3.4, also features 1.1 and 1.2 are not known from

A2. Nevertheless, the argument of the opponent regarding the reversal of features 1.1 and 1.2 lacking particular significance can be followed, since it is the relative position of the sensors and the reference ball which is important for identifying a positional error, the measured positional error being the same irrespective of whether the sensor arrangement or the reference ball is attached to the machine tool head.

The objective technical problem to be addressed based on the distinguishing features 1.3.2 - 1.3.4 may thus be formulated as 'how to provide a system improved in terms of measuring and testing.

As already explained in point 3.2.1 above, A5 discloses a method of measuring errors using a kinematic ball bar, the error model thereby generated having, as a specific input, the data provided by a ball bar. In a manner analogous to that for A1 and A5, the combination of A2 and A5 also fails to deprive the subject-matter of claim 1 of an inventive step due to the significant differences between the kinematic ball bar error measurement and that of the styli from A2. Replacing the styli with a kinematic ball bar represents a significant structural modification of the system known from A2, not least since not only all three styli would need to be replaced by the ball bar, but also the reference ball itself would be replaced by one of the balls of the kinematic ball bar. Furthermore, the data produced by such a modified system would also need to be significantly modified due to the ball bar simply providing an error measurement along its axis rather than an XYZ coordinate error measurement. It thus follows that modifying the system known from A2 with the kinematic ball bar known from A5 in order to arrive at the subject-matter of claim 1, particularly the

means for performing measure processes for errors that can be modeled of claim 1, would not be possible for the skilled person without exercising an inventive step (Article 56 EPC 1973).

3.3.2 The argument of the opponent on this point fails to question this finding, it being restricted to the opinion that the means for performing measure processes for errors that can and cannot be modeled are anticipated by any processing means. This has been shown not to be the case in points 1.3 to 1.5 above, due to the 'means for..' expression in claim 1 being interpreted as 'means adapted for..'.

3.4 A2 and skilled person

3.4.1 As identified in point 3.3.1, A2 lacks features 1.1, 1.2 and features 1.3.2 - 1.3.4. Whilst the skilled person would recognise the interchanged location of features 1.1 and 1.2 to be obvious due to solely the relative position of the sensors and reference ball being of importance, the further lacking features are not to be regarded as obvious. The skilled person is provided with no hint from his general knowledge guiding him to the solution to the objective problem presented in claim 1, nor did the opponent provide any arguments suggesting this to be the case.

The subject-matter of claim 1 thus involves an inventive step (Article 56 EPC 1973) in view of A2 in combination with the general knowledge of the skilled person.

3.5 A3 and A5

3.5.1 A3 discloses an apparatus for the calibration of moving devices such as robots. A reference ball is provided for measurement and distance sensors are mounted to the robot arm. In order to calibrate the robot arm's position the stationary reference ball is approached from various directions and the XYZ coordinates of various points of the ball's surface are registered (col. 3, lines 22-64; Fig. 2). A model for the robot itself is generated and adapted according to the parameters received from the calibration in order to achieve agreement between the measured and actual position.

Compared to claim 1, the location of the reference ball and distance sensors are reversed in A3 (features 1.1 and 1.2). Furthermore a model of the robot is generated rather than an error model, such that the means for performing measure processes both for errors that can be modeled and for errors that cannot be modeled (features 1.3.2 and 1.3.3) are missing in A3. The means for performing dynamic checks (feature 1.3.4) are also lacking in A3, the calibration occurring simply in stationary positions of the reference ball and thus of the robot arm.

As identified in point 3.3.1, it is the relative positions of the reference ball and distance sensors that are of importance for carrying out the calibration process in A3, such that the reversal of features 1.1 and 1.2 in A3 when compared to claim 1 is of no importance regarding the presence of an inventive step.

The subject-matter of claim 1 further differs from A3 through the features 1.3.2 - 1.3.4 for which the

objective technical problem, as is the case for the foregoing inventive step attacks, is how to provide a system improved in terms of measuring and testing.

As already shown in the findings concerning A1 in combination with A5 and A2 in combination with A5 above, A5 discloses a method of measuring errors using a kinematic ball bar, the error model thereby generated being specific to the data provided by a ball bar. The combination of A3 and A5 thus also fails to deprive the subject-matter of claim 1 of an inventive step due to the significant differences between the kinematic ball bar error measurement and that of the distance sensors from A3. Replacing the sensors with a kinematic ball bar represents a significant structural modification of the system known from A3. Furthermore, the data produced by such a modified system would also be significantly modified due to the ball bar simply providing an error measurement along its axis rather than an XYZ coordinate error measurement. It thus follows that modifying the system known from A3 with the kinematic ball bar known from A5 in order to arrive at the subject-matter of claim 1 would not be possible in an obvious manner without exercising an inventive step (Article 56 EPC 1973).

3.5.2 The opponent's argument regarding the type of error being measured not characterising the claimed 'means for performing measure processes' cannot be accepted due to the interpretation of this feature as 'means adapted to perform measure processes' and thus a required adaptation, for example through programming, to the function which the means must be capable of performing (see point 1.3 - 1.5). This is not present in A3.

3.6 A3 and skilled person

3.7 As identified in point 3.5.1, A3 lacks features 1.1, 1.2 and features 1.3.2 - 1.3.4. Whilst the skilled person would recognise that the reversal of features 1.1 and 1.2 may be of an obvious nature due to solely the relative position of the sensors and reference ball being of importance, the further lacking features are not to be regarded as obvious. The skilled person is provided with no hint from his general knowledge guiding him to the solution to the objective problem presented in claim 1, nor did the opponent provide any arguments suggesting this to be the case.

The subject-matter of claim 1 thus involves an inventive step (Article 56 EPC 1973) in view of A3 in combination with the general knowledge of the skilled person.

3.8 No objections were raised by the appellant/opponent regarding the subject-matter of claim 6 involving an inventive step. The Board also sees no reason to find differently in this respect.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is maintained as granted.

The Registrar: The Chairman:

M. H. A. Patin M. Harrison

Decision electronically authenticated