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**Datasheet for the decision
of 22 February 2011**

Case Number: T 2018/07 - 3.4.02

Application Number: 03712319.7

Publication Number: 1446636

IPC: G01B21/04, G01B7/008,
G01B5/008, G01B11/00

Language of the proceedings: EN

Title of invention:
DYNAMIC ARTEFACT COMPARISON

Applicant:
Renishaw plc

Opponent:
Carl Zeiss Industrielle Messtechnik GmbH

Headword:

Relevant legal provisions:
EPC 1973 Art. 56, 84, 100(c)

Keyword:
Main Request, Claims 1 and 2 - Inventive Step (yes)
Main Request, Claims 1 and 2 - inadmissible amendment (no) -
Clarity (yes)

Decisions cited:

Catchword:



Case Number: T2018/07 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 22 February 2011

Appellant: Renishaw plc
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Wotton-Under-Edge
Gloucestershire GL12 8JR (GB)

Representative: Jackson, John Timothy
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Patent Department
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Respondent: Carl Zeiss Industrielle Messtechnik GmbH
(Opponent) Carl Zeiss Strasse 22
73447 Oberkochen (DE)

Decision under appeal: **Interlocutory decision of the Opposition**
Division of the European Patent Office posted
17.10.07 concerning maintenance of the European
Patent No 1446636 in amended form.

Composition of the Board:

Chairman: A. Klein
Members: M. Rayner
B. Müller

Summary of Facts and Submissions

I. The patent proprietor has appealed against the decision of the opposition division that, as amended during the opposition proceedings European Patent No. 1 446 636 (application number 03712319.7) meets the requirements of the Convention. The patent concerns inspecting a series of workpieces using a coordinate measuring apparatus. In the opposition and/or appeal proceedings, reference has been made to documents including the following:-

D1	EP-A-0 769 677
D2	US-A-4 991 304
D3	US-A-5 426 861.

II. In the decision under appeal, reasoning of the opposition division pertinent to the present appeal can be summarised as follows.

External calibration of a part for the purpose of arriving at more reliable results in terms of absolute values for this part is well-established in the art of measurement. Therefore, in the division's view, in improving accuracy of a coordinate measuring machine a skilled person would undertake the step of having an artefact (or first workpiece) calibrated externally on another machine, because it would be clear to him that he could then correct static error measurements on the coordinate measuring machine. Therefore, although document D2 teaches effecting slow measurements on the same coordinate measuring machine to achieve static error correction, instead of using an externally calibrated workpiece, effecting an external calibration is not considered to involve an inventive step.

The disclosure of document D1, as evidenced by the paragraph bridging columns 4 and 5, is that, despite external calibration, the coordinate measuring machine used requires or is expected to require static error correction (see penultimate paragraph on page 11 of the decision).

Document D3 does not make any mention of speed (see paragraph bridging pages 8 and 9 of the decision) and gives no teaching as to static or dynamic error correction in the shop machine described therein (see penultimate paragraph on page 11 of the decision).

With respect to the interpretation of the term "artefact", the "artefact" of claim 1 is considered anticipated by the "first workpiece" of D2; this conclusion being based e.g. on the patent in suit itself, which in the dependent claim 2 therein itself subsumes a workpiece to fall within the term artefact.

III. The appellant requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of claims 1-11 filed with the letter of 22 February 2011 as its main request, or alternatively, according to claims according to auxiliary requests filed with the letter of 22 February 2011.

(a) Amendments

Support for the amendments made to claims 1 and 2 is to be found in granted claims 2 and 3 and in the description, column 3, lines 49 to 52 and column 4, lines 39-41.

(c) Patentability

The objective technical problem compared with the disclosure of document D2 is the removal or reduction of static errors in addition to the dynamic errors. The invention claimed has the advantage that by calibrating the workpiece (or artefact which mimics the workpiece) on a separate coordinate measuring apparatus, the resulting error map or function includes corrections for both static and dynamic data to be generated in a single step. This method has the advantage that static error correction of the coordinate measuring machine on which the series of workpieces are measured is not required. There is no prompting in document D2 to suggest that the workpiece could be calibrated on a separate machine in order also to correct for static errors.

The claimed subject matter is therefore inventive over document D2 and, furthermore, inventive over document D2 in combination with either document D1 or D3.

IV. The respondent (=opponent) requests that the appeal be dismissed. Arguments including the following were advanced by the respondent.

(a) Amendments

The amended claims involve a method according to which static errors are reduced, which is not supported by the documents as filed, e.g. the disclosure corresponding to paragraphs [0025], [0026] and claims 7 of the published specification.

(b) Clarity

It is not clear how and how far static errors are reduced.

(c) Patentability

As set out by the opposition division, external calibration of a part for the purpose of arriving at more reliable results in terms of absolute values was well established in the art of measurement. In doing this, not only dynamic, but also static errors are corrected. The skilled person thus obviously reached the subject matter of the claims of the main request starting from document D2 using standard knowledge in the field as evidenced by document D1 or D3. Claim 2 differs from claim 1 in reciting "an artefact having features, the size and location of which match the features of the workpieces" instead of a "workpiece in the series of workpieces". If, as the opposition division correctly pointed out, under "artefact" a workpiece is subsumed, this is certainly so for "an artefact having features, the size and location of which match the features of the workpiece".

V. Both the appellant and the respondent requested oral proceedings on an auxiliary basis, which consequent to these requests, were appointed by the board.

VI. During the oral proceedings, the appellant argued as follows.

(a) Amendments

Machines are calibrated by the manufacturer and are usually recalibrated periodically to avoid them becoming less and less accurate in use. "No

requirement" as referred to in paragraph [0025] of the patent in dispute simply refers to this recalibration.

(b) Clarity

So far as clarity is concerned in relation to reduction, a numerical limit would of course be more precise but the numerical extent is not necessary for clarity because a yes or no to reduction is itself clear.

(c) Patentability

It is common general knowledge that a coordinate measuring machine is statically calibrated, usually by laser interference or ring gauges.

Document D3 is not doing this and is not common general knowledge nor used in practice. The teaching of document D3 assumes both machines concerned have regular calibration, a time consuming operation taking some five days to complete. Why should one turn to document D3, as it is about thermal errors, not static errors.

Document D1 is simply irrelevant.

VII. During the oral proceedings, the respondent argued as follows.

(a) Amendments

In the patent in dispute, particularly paragraph [0026] of the patent in dispute, "removing or reducing" as recited in feature (e) of claim 1 of the main request, is not defined or quantified, so the question arises as

to what exactly is meant in concrete terms. According to paragraph [0025], there is no requirement for correction of static errors. Moreover, it is also taught that use of a calibrated master or artefact results in there being no requirement for the coordinate measuring machine to be corrected for geometric (static) errors. This has the advantage of speeding up the process and reducing calibration costs as the coordinate measuring machine will no longer require regular calibration. The respondent therefore concludes that there is a disclosure of removing static errors, but only in common with dynamic errors, there being no differentiation, as all errors are corrected. Thus, reducing static errors is not disclosed in the documents as filed.

(b) Clarity

Moreover, the term "reducing static errors" is not clear because it is not clear what error is really corrected because the difference is completely fluid as dynamic errors always occur on movement.

(c) Patentability

Neither claim 1 nor claim 2 can be considered directed to subject matter involving an inventive step in view of the disclosures of document D1 with either document D1 or D3.

Document D2 discloses a slow and then fast measurement as in the claimed subject matter. The difference in the subject matter claimed lies in the words "not using" in feature (a).

The effect is making the calibration as exact as possible, which, as the opposition division pointed out, is not inventive.

VIII. The independent claims according to the main request of the appellant are worded as follows. For the reasons set out in Section 7 of the Reasons for the Decision below, the wording of the independent claims of the other requests is not given.

Main Request

"1. A method of inspecting a series of substantially identical workpieces using a coordinate measuring apparatus, in which a workpiece-sensing probe is moved into a position-sensing relationship with each workpiece and a position reading taken, the method comprising the following steps in any suitable order;

(a) calibrating a workpiece in the series of workpieces not using said coordinate measuring apparatus;

(b) measuring said workpiece with the coordinate measuring apparatus at a desired speed, the desired speed being used to measure subsequent parts;

(c) generating an error map or error function corresponding to the difference between the calibration of said workpiece and the measurement of said workpiece;

(d) measuring subsequent workpieces with the coordinate measuring apparatus at said desired speed; and

(e) correcting the measurements of the subsequent workpieces using the error map or error function and thereby removing or reducing both dynamic and static errors.

2. A method of inspecting a series of substantially identical workpieces using a coordinate measuring apparatus, in which a workpiece-sensing probe is moved into a position-sensing relationship with each workpiece and a position reading taken, the method comprising the following steps in any suitable order;

(a) calibrating an artefact having features, the size and location of which match the features of the workpiece, not using said coordinate measuring apparatus;

(b) measuring said artefact with the coordinate measuring apparatus at a desired speed, the desired speed being used to measure subsequent parts;

(c) generating an error map or error function corresponding to the difference between the calibration of said artefact and the measurement of said artefact;

(d) measuring subsequent workpieces with the coordinate measuring apparatus at said desired speed; and

(e) correcting the measurements of the subsequent workpieces using the error map or error function and thereby removing or reducing both dynamic and static errors."

IX. At the end of the oral proceedings, the board gave its decision

Reasons for the Decision

1. The appeal is admissible.

2. Amendments

Support for the wording of the amendments to the claims is given by the references provided by the appellant.

The respondent did not object to the wording as such but saw rather an addition in substance, in that there was no disclosure of correction of static error in the documents as filed, but only correction of both static and dynamic errors. The respondent, however, explained that both static and dynamic errors are always present. In the board's view, correction results from the error map which was generated by measurement difference between the workpiece calibration and desired speed measurement on the coordinate measurement machine so that both dynamic and static errors are corrected. This tallies both with the claimed wording and the explanation of the respondent. Therefore only an artificial reading of the claim can lead to the conclusion that "just" static errors are corrected. The submissions of the respondent did not therefore persuade the board that an inadmissible amendment had been made.

3. Clarity

It is not necessary to quantify the allocation of static as opposed to dynamic error for clarity of the claimed wording as the skilled person, like the respondent, knows these errors are present and mapped, whether or not relatively quantified. Accordingly, the board was not convinced by the submission of the opponent that the claims as amended lack clarity.

4. Prior Art - Key Features

4.1 Document D1

Already present static errors such as guide deviation or feeler bending are active to compensate, while the coordinate measuring machine measures differing

diameter circular or segmental calibration lines of exactly defined form at differing speed. Deviation values from these can be determined and stored as correction values. Ring gauges or a special calibration block with bores of differing diameter in one or all three dimensions can be used in this process. After the correction values are determined, real workpieces can be measured with a low error. The user is informed that correction values are available when the measurement task includes a circular, cylindrical or round geometry.

4.2 Document D2

A method of inspecting a series of identical workpieces in succession is provided. All the required points on a first workpiece are measured slowly and stored. All these measurements on the first workpiece are then repeated at a fast speed. When both measurements have been taken for each point on the first workpiece, the differences between the two values for each point are calculated and stored. The result is a stored error value for each measured point, which not only takes account of the slower speed but also takes account of the faster speed. These error values effectively form a map of the systematic errors encountered during a probing cycle at the faster speed. The next workpiece is set up and measurements are taken only at the fast speed. These fast measurements are repeatable even though they are inaccurate. Accordingly, each of the fast measurements is adjusted by adding the corresponding difference value to compensate for the errors induced by the fast measurement.

4.3 Document D3

Rather than trying to overcome environmental problems by modifying a coordinate measuring machine or controlling the environment, a reference part of substantially the same size and shape as an eventual production part is inspected in the laboratory so that its dimensions are known as precisely as is possible. This reference part is then taken to another measuring machine on the shop floor where there is a less controlled environment to which the reference part and the production parts are exposed. The reference part is inspected by the shop floor machine and a production part is inspected by the shop floor machine. The measurement data is processed to determine, with accuracy comparable to laboratory accuracy via deviation values, how close the dimensions of the production part are to the specified dimensions.

5. Patentability

5.1 The teaching of document D2 has been considered to represent the closest prior art by the parties and the board can concur with this approach because of the reference to a series of identical workpieces. Feature (a) of claim 1 can be considered novel over the disclosure of document D2 because, unlike the teaching of document D2, the workpiece is calibrated not using the coordinate measuring apparatus. Moreover, since the error map or function in feature (c) is produced using a difference to the calibrated workpiece, this map or function must be different to any derived according to the teaching of document D2 using the same machine. The objective technical problem addressed is improving efficiency in removal or reduction of errors.

5.2 It is immaterial how much error in the error map or function is static as opposed to dynamic, the fact is

that the "same" speed means the dynamic error conforms to the map for all workpieces and the static error also conforms because the machine is the same for the subsequent workpieces. Therefore, generation of the error map or function consequent to use of the external machine is all that is necessary in order to deal with all the errors. The objective technical problem is solved in this way.

5.3 The arguments of the parties permit the conclusion that the machine disclosed in document D2 will likely be regularly calibrated in service and this also chimes with the view of the opposition division about use of an external machine. However this is part of the maintenance process, it is not involved in creating the error map for the workpieces. All that the teaching of document D2 itself provides is a slow measurement of the workpiece followed by a fast measurement on the same machine, which means that only dynamic errors are dealt with in its error map or function, whether or not an external calibration was made and even if the workpiece was used for such external calibration. In other words, the fast measurements are mapped to have the accuracy of slow measurements. This is to be contrasted with the patent in dispute, where the "same" speed measurements are mapped to have the accuracy of the external machine as there is no slow measurement on the same machine. Only with hindsight can the possibility of dispensing with the slow scanning and using an external machine be envisaged.

5.4 Of course the respondent is correct to say that the fast speed measurements made following the teaching of document D2 contain dynamic and static errors, but the latter are not mitigated by the error map or function used so this situation does not detract from the

difference in error map as set out in the preceding paragraph. The board had therefore to conclude that no effective challenge to inventive step based solely on document D2 has been made.

5.5 Document D1 does not help the respondent's case because of employment of ring gauges or a special calibration block, items rather different to one of a series of substantially identical workpieces or an artefact having features of size and location matching the features of the workpiece. The teaching of document D1 is really about calibrating vis-à-vis the entire machine for multiple speeds and curves rather than use with a workpiece series at the same speed. This applies also to the static calibration using the already present static errors, which again chimes with the well established external calibrations as referred to by the opposition division and respondent or recalibration in use as referred to by the appellant. It is thus not likely that the skilled person trying to improve measurement efficiency of a workpiece series compared with the teaching of document D2 would have turned to this document. Even were this step to be taken, the most that could result is a refinement of the measurements made to be closer to the rings as measured with the same machine, the workpiece or artefact would still not be calibrated "not using the said" coordinate measuring apparatus. Accordingly, inventive step is not challenged by the submissions of the respondent.

5.6 Document D3 is mainly concerned with environmental factors, e.g. temperature, affecting measurements made by the shop machine compared with the laboratory machine. These are not really static errors of the machine and dynamic errors are not mentioned at all. Therefore the skilled person would not have turned to

this document and even had this been done would only have tried to address environmental issues, thus having no teaching towards the novel features of claim 1. Accordingly, inventive step is not challenged by the submissions of the respondent.

6. Independent Claims 1 and 2

As pointed out by the respondent, claim 2 differs from claim 1 in reciting "an artefact having features, the size and location of which match the features of the workpieces" instead of a "workpiece in the series of workpieces". The submissions of the respondent concerning amendments and clarity do not bear on this difference. So far as inventive step is concerned, the considerations advanced above apply to both the workpiece and the artefact so that inventive step of the subject matter of claims involving either one, i.e. claim 1 or claim 2, is not called into question by the respondent's submissions.

7. Auxiliary Requests

Since the case of the appellant succeeded on the basis of its main request, it is necessary neither to give the wording of the claims according to the auxiliary request, nor to consider them further in the reasons for the present decision.

8. The case of the appellant thus succeeded and that of the respondent failed.

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 as amended in the following version:

Description

Columns 1 and 2 received during the oral proceedings of 22 February 2011,
Columns 3 and 4 filed during the oral proceedings on 19 September 2007 and attached to the interlocutory decision of 17 October 2007,
Column 5 of the patent specification.

Claims

No. 1-10 filed of the main request filed with the letter of 20 January 2011

Drawings

Figures 1 and 2 of the patent specification

The Registrar:

The Chairman:

M. Kiehl

A. Klein