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Datasheet for the decision of 22 October 2013

Case Number: T 1704/10 - 3.2.07

Application Number: 01907469.9

Publication Number: 1263547

IPC: B24B 5/42, B24B 49/04, B24B 49/10

Language of the proceedings: EN

Title of invention:
Apparatus and method to measure the dimensional and form deviation of crankpins at the place of grinding

Patent Proprietor:
MARPOSS SOCIETA PER AZIONI

Opponent:
JENOPTIK Industrial Metrology Germany GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 54(3), 56, 123(2), 123(3)
EPC R. 80

Keyword:
"Amendments - occasioned by ground of opposition (yes)"
"Amendments - added subject-matter (no)"
"Amendments - broadening of claim (no)"
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 1704/10 - 3.2.07

D E C I S I O N
of the Technical Board of Appeal 3.2.07
of 22 October 2013

Appellant: (Patent Proprietor)	MARPOSS SOCIETA PER AZIONI Via Saliceto 13 I-40010 Bentivoglio (IT)
Appellant: (Opponent)	JENOPTIK Industrial Metrology Germany GmbH Alte Tuttlinger Strasse 20 D-78056 Villingen-Schwenningen (DE)
Representative:	Wagner, Carsten Wagner Dr. Herrguth Patentanwälte Burckhardtstrasse 1 D-30163 Hannover (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted 1 June 2010 concerning maintenance of European patent No. 1263547 in amended form.**

Composition of the Board:

Chairman: H. Meinders
Members: G. Patton
E. Kossonakou

Summary of Facts and Submissions

I. Appellant I (patent proprietor) lodged an appeal against the interlocutory decision of the Opposition Division maintaining European patent N° 1 263 547 in amended form.

Appellant II (opponent) likewise lodged an appeal against this interlocutory decision.

II. In the opposition proceedings, appellant I filed a main request and auxiliary requests 1 to 9. The Opposition Division held that the subject-matter of the main request did not fulfil the requirements of Article 54(1) EPC, the auxiliary request 1 not the requirements of Rule 80 EPC, the auxiliary requests 2-6 not the requirements of Article 123(3) EPC, the auxiliary requests 7-8 not the requirements of Article 123(2) EPC. The method claims according to the auxiliary request 9 (with only the method claims 12-17 of the patent as granted) was found to meet the requirements of the EPC.

III. With its statement of grounds of appeal appellant I requested the maintenance of the patent on the basis of a main request(=patent as granted) or of one of the first to sixth auxiliary requests.

In reply to the appeal of the opponent, appellant I filed an auxiliary request 7 consisting in the maintenance of the method claims as granted, i.e. as maintained by the opposition division, and auxiliary requests 8 and 9 with only further amended method claims.

IV. The Board provided its preliminary non-binding opinion annexed to the summons for oral proceedings that the claims of the requests of appellant I did not seem to fulfil the requirements of the EPC in view of Articles 54(1), 56, 123(2) and/or 123(3) EPC and/or Rule 80 EPC.

In reaction thereto, appellant I filed with letter of 1 August 2013 a new main and auxiliary requests 1 to 5 replacing all requests on file.

During the oral proceedings held on 22 October 2013, appellant I filed new first and second auxiliary requests. The new second auxiliary request was assessed for compliance with the requirements of Article 123(3), Rule 80 and Article 56 EPC, the latter in the light of documents D2 to D6, in particular the combined teachings of D2 and D6, and the general knowledge of the person skilled in the art. At the end of the discussion the original main request and the new first auxiliary request were withdrawn. The new second auxiliary request was declared to be the main request.

The present decision was announced at the end of the oral proceedings.

Since the present decision concerns the maintenance of the patent on the basis of appellant I's main request, the remaining auxiliary requests need no discussion.

V. Appellant I requests that the decision under appeal be set aside and the patent maintained in accordance with the main request filed as new second auxiliary request at the oral proceedings held on 22 October 2013.

VI. Appellant II requests that the decision under appeal be set aside and that the European patent No. 1 263 547 be revoked.

VII. Claim 1 of the main request reads as follows (in bold the amendments with respect to claim 1 of the patent as granted; emphasis added by the Board):

"Apparatus for the dimensional and form deviation checking of a crankpin (18) of a crankshaft (34), **the crankpin (18) defining a geometrical symmetry axis (C),** during orbital rotations about a main rotation axis (O) **parallel to and spaced apart (c) from the symmetry axis (C)** on a numerical control grinding machine where it is worked, the grinding machine having a grinding-wheel slide (1) carrying a grinding wheel (4) and a worktable (23) defining said main rotation axis (O), with
- a gauging head (39, 39') with a Vee-shaped reference device (20, 20') adapted to engage the crankpin (18) to be checked, a feeler (17) adapted to touch the surface of the crankpin (18) to be checked, and a transducer (41) adapted to provide signals indicative of the position of the feeler (17) with respect to the Vee-shaped reference device (20, 20'),
- a support device (5, 9, 12), with mutually movable coupling elements (9, 12), that movably supports the gauging head (39, 39'),
- a control device (28) to control automatic displacements of the gauging head (39, 39') from a rest position to a checking position, and vice-versa,
wherein in said checking condition of the head (39, 39'), the Vee-shaped reference device (20, 20') is adapted for maintaining contact with the crankpin (18)

to be checked substantially owing to the forces of gravity,

- a guide device **(21)** for guiding the arrangement of the Vee-shaped reference device (20, 20') on the crankpin (18) in the course of the orbital rotations of the latter, **wherein the guide device (21) serves to guide the Vee-shaped reference device (20, 20') to engage the crankpin (18) and maintain contact with the crankpin (18) while the Vee-shaped reference device (20, 20') moves away from the crankpin (18),** and
- processing and display devices (22, 33) connected to the gauging head (39, 39') adapted to receive and process said signals provided by the transducer (41),

characterized in that the processing and display devices (22, 33) are adapted to perform processing of said signals (rg(θ)) provided by the transducer (41) to obtain values (r(φ)) indicative of the profile of the crankpin (18) to be checked, said processing (66-72) being adapted to compensate the values of the signals (rg(θ)) provided by the transducer (41) for alterations caused by the movements of the coupling elements (9,12) and the gauging head (39, 39') during the orbital rotations of the crankpin (18) in the checking condition, and by the contact (A, B) between the Vee-shaped reference device (20, 20') and the surface of the crankpin (18) to be checked."

Claim 11 of the main request reads as follows (corresponds to claim 12 of the patent as granted):

"Method for checking a pin (18) defining a geometrical symmetry axis (C), the pin orbitally moving about a main rotation axis (0) parallel to and spaced apart (c)

from the symmetry axis (C), in a numerical control grinding machine including a grinding-wheel slide (1) carrying a grinding-wheel (4) and a worktable (23) defining said main rotation axis (O), by means of a checking apparatus including a support device (5, 9, 12), a gauging head (39, 39') movably connected to the grinding machine through the support device, and processing and display devices (22, 33) connected to the gauging head, the gauging head including a Vee-shaped reference device (20, 20') adapted to cooperate with the pin (18)to be checked, a movable feeler (17) adapted to touch the surface of the pin to be checked and to move along a translation direction, and a transducer (41) adapted to provide the processing and display devices with signals indicative of the position of the feeler with respect to the Vee-shaped reference device,

characterized in that the method, for checking form deviation of said pin (18), includes the following steps:

- detecting angular positions (θ) of the pin (18) about the main rotation axis (O) and providing relevant signals,
- detecting and storing (65) a sequence of rough values (rg(θ)) corresponding to the signals provided by the transducer at predetermined angular positions (θ) of the pin (18), and
- processing (66-72) said sequence of rough values (rg(θ)) to obtain profile values (r(φ)) indicative of the deviations of the radial dimensions of the pin (18) at corresponding sections of the surface of the pin angularly spaced out around the symmetry axis (C), by compensating components affecting the rough values (rg(θ)) due to the contact (A, B) between the Vee-

shaped reference device (20, 20') and the pin surface, and to variations in the angular arrangement of the Vee-shaped reference device in the course of orbital rotations of the pin about said main rotation axis (O), the processing step including
- performing the harmonic analysis (69) of a sequence of values (rf(φ)) relevant to the radial dimensions of the pin at said sections of the surface of the pin angularly spaced out around the symmetry axis (C), and calculating the values of the amplitudes (C_i) and phases (Φ_i) of the harmonics,
- correcting (72) the values of said amplitudes (C_i) and phases (Φ_i) on the basis of compensation coefficients (K_i, σ_i) relevant to angles (2α, α1+α2) defined by the sides of the Vee-shaped reference device (20, 20') and the translation direction of the feeler, and
- obtaining (72) said profile values (r(φ)) by means of the harmonics with the corrected values of amplitude and phase."

VIII. The following documents of the opposition proceedings are of relevance for the present decision:

D1 EP-A-1 063 052, published on 27 December 2000, i.e. between the priority date and the filing date of the contested patent.

D2 EP-B-0 859 689

D3 Jörg Seewig, "Automatisierte Dreipunktmessung zur Rundheitsbestimmung an Kolbenbolzen", Studienarbeit, Universität Hannover, Fachbereich Elektrotechnik, December 1992, 137 pages

D4 US-A-5 077 908

D5 EP-A-0 068 082

D6 R. Thalmann and J. Spiller, "Rundheitsmessung mit Nanometer-Genauigkeit", Ofmet*Info* 1/2, pages 1-4, 1994

D7* "inform - Messverfahren für gleichzeitige Erfassung von Durchmesser und Formfehler von Kolbenbolzen; MARPOSS kontrolliert das Werkstück", date unknown

*not admitted in the opposition proceedings

IX. Appellant I argued in substance essentially as follows:

Admission of document D7 in the proceedings

Document D7 should not be admitted in the proceedings since it is not clear whether it has been made available to the public without confidentiality restrictions nor whether that was before the priority date of the contested patent.

Amendments (Articles 123(2), (3) and Rule 80 EPC)

A disclosure of two distinct guide devices cannot be found in the application as originally filed. On the contrary, it is clear from the use of the same reference sign (21) that one and the same guiding means is meant for guiding the arrangement of the Vee-shaped reference device on the crankpin in the course of the orbital rotations of the latter, wherein the guide device serves to guide the Vee-shaped reference device to engage the crankpin and maintain contact with the crankpin while the Vee-shaped reference device moves away from the crankpin. Hence, the requirements of Article 123(2) EPC are fulfilled.

The function of the guide device of claim 1 of the patent as granted is broadly defined and, hence, the added function narrows down the scope of protection of claim 1 of the patent as granted, fulfilling the requirements of Article 123(3) EPC.

As the amendments to claim 1 were performed for overcoming an objection of lack of novelty of the claimed subject-matter vis-à-vis D1 (see point 3.3 below), they do not contravene Rule 80 EPC.

Novelty and inventive step (Articles 54(1), 56 EPC)

Document D2, which is regarded as the closest prior art for claim 1, does not disclose to compensate the measured data:

- for alterations caused by the movements of the coupling elements and the gauging head during orbital rotations of the crankpin in the checking condition; and
- for alterations caused by the contact between the Vee-shaped reference device and the surface of the crankpin to be checked.

In documents D3-D6 the checked object rotates about its own axis during the checking operation so that the first compensation cannot be disclosed. For this reason already the skilled person would not think of combining the teaching of any of the documents D3, D4, D5 or D6 with the apparatus of D2.

Furthermore, none of the documents D3, D5 or D6 is concerned with a Vee-shaped measurement device so that the second compensation cannot have been disclosed

either. D4, which discloses a Vee-shaped reference device, remains silent on the compensations.

As a result, even if the skilled person would think of combining the teaching of any of the documents D3, D4, D5 or D6 with the apparatus of D2, he would not arrive at the claimed subject-matter. The subject-matter of claim 1 involves therefore an inventive step.

The subject-matter of claim 11 is novel over D1 since said document, as far as supported in this respect by its earliest claimed priority (prio1), does not disclose any compensation of the measured data.

The same arguments for supporting inventive step of the subject-matter of claim 1 apply for claim 11.

X. Appellant II argued in substance essentially as follows:

Amendments (Articles 123(2), (3) and Rule 80 EPC)

In the application for the contested patent as originally filed apparently two distinct guide devices are disclosed with two distinct functions. A unique guide device as now in claim 1 for performing both functions is therefore not disclosed, which is contrary to Article 123(2) EPC.

By adding a new function to the guide device of claim 1 of the patent as granted, the claimed apparatus comprising such a new guide device extends the scope of protection beyond that of claim 1 of the patent as granted, contravening Article 123(3) EPC.

Novelty and inventive step (Articles 54(1), 56 EPC)

The subject-matter of claim 1 is novel, however, not inventive. Document D2, which is regarded as the closest prior art for claim 1, does not disclose to compensate the measured data:

- for alterations caused by the movements of the coupling elements and the gauging head during orbital rotations of the crankpin in the checking condition; and
- for alterations caused by the contact of between the Vee-shaped reference device and the surface of the crankpin to be checked.

The effect of these features is that a more precise roundness checking can be performed.

The skilled person faced with the problem of precise roundness checking of a pin of a crankshaft would mandatorily include the first compensation.

With respect to the second compensation, the skilled person would immediately think of applying a harmonic analysis (Fourier transform) to the measured data since this belongs to the common general knowledge of the skilled person as shown by D3, D4, D5 or D6. The contested patent itself discloses that performing a harmonic analysis amounts automatically to realise the second compensation. Therefore, the skilled person applying the harmonic analysis as taught in D3, D4, D5 or D6 would automatically perform the second compensation.

In particular D6 discloses that it is natural to apply a harmonic analysis when measuring roundness, i.e. a cyclic function, and both D5 and D6 disclose the use of a Fourier analysis in order to take into account the errors of the measuring system. When applying the teaching of D5 or D6, the skilled person would also use his common general knowledge in order to adapt and apply the corrective measures as explained in D5 or D6 for a single-point contact device to the three-point contact device of D2.

Consequently, the skilled person starting from D2 would arrive at the claimed subject-matter in an obvious manner by using his common general knowledge and applying the teaching of any of the documents D3, D4, D5 or D6.

The subject-matter of method claim 11 is anticipated by D1. Due to the similitude in the construction of the known and the claimed apparatus, both apparatuses will face the same partial problems of:

- correcting the angle in the raw data; and
- computing and excluding the artefacts resulting from the support device.

Since D1 solves the problems the same way as in claim 11, i.e. through a Fourier analysis (harmonic analysis), the features related to the data processing are also inevitably disclosed.

A similar objection of lack of inventive step as that against claim 1 is raised against method claim 11.

Reasons for the Decision

1. *Admission in the proceedings of document D7*

D7 was not admitted in the opposition proceedings because it was considered late filed (after expiry of the opposition period) and could not be regarded as belonging to the prior art since it does not bear any publication date (point 5 of the impugned decision; points 2, 3 and 10 of the minutes).

Appellant II filed a declaration at the very end of the oral proceedings before the opposition division (annexed to the minutes) in which Mr August Binninger, an employee of appellant II, attests that he received D7 from Mr Jakob Wagner, a former colleague, on 30 March 1991. However, as argued by appellant I, it is not clear how and when Mr Wagner happened to be in possession of D7, which is a document of appellant I. This attestation of Mr Binninger cannot therefore prove that D7 had been made available to the public without confidentiality restrictions before the priority date of the contested patent.

The Board is of the opinion that the opposition division applied its discretion correctly in not admitting D7 in the proceedings. Since no further information on this document has been filed, it is not admitted in the appeal proceedings either and therefore also not considered in the following.

The above, which corresponds to the preliminary opinion of the Board provided in the annex to the summons for oral proceedings, was not contested by appellant II.

2. *Contents of D1 to be considered*

Document D1, which is a European patent application, was published on 27 December 2000, i.e. between the priority and filing dates of the contested patent. The subject-matter of claim 1 of appellant I's main request is unambiguously and directly derivable from claims 1, 6 and 7 and page 6, lines 17-22 of the priority document and the subject-matter of its claim 11 is unambiguously and directly derivable from claims 9 and 10 of the priority document. Therefore, the effective date of claims 1 and 11 is the priority date of 6 March 2000 so that D1 is a document to be considered for novelty only according to Article 54(3) EPC for these claims, however depending on the validity of its own priority since its own filing date (23 June 2000) is after the effective date of the patent in suit.

D1 claims the priorities of 25 June 1999 (prio1) and 12 June 2000 (prio2). Since the effective date of the contested patent is 6 March 2000, only the subject-matter of D1 also present in prio1, i.e. prior to the effective date of the contested patent, can be used for the above mentioned assessment of novelty of claims 1 and 11. Subject-matter of D1 only present in prio2, which is later than the effective date of the contested patent, must be disregarded.

At least the following passages of D1: [0029]-[0058], figures 1-4, 5a, 5b, and 14-16, some of which are cited below, are present in prio1 ([0016]-[0039], figures 1-8).

The above, which corresponds to the preliminary opinion of the Board provided in the annex to the summons for oral proceedings, was not contested by the appellants.

3. Apparatus claim 1

3.1 For the purpose of analysis, the Board will use the following feature designation for claim 1:

A1 Apparatus for the dimensional and form deviation checking of a crankpin (18) of a crankshaft (34), the crankpin (18) defining a geometrical symmetry axis (C), during orbital rotations about a main rotation axis (O) parallel to and spaced apart (c) from the symmetry axis (C) on a numerical control grinding machine where it is worked, the grinding machine having a grinding-wheel slide (1) carrying a grinding-wheel (4) and a worktable (23) defining said main axis (O) with

A2 - a gauging head (39, 39')

A2.1 with a Vee-shaped reference device (20, 20') adapted to engage the crankpin (18) to be checked,

A2.2 a feeler (17) adapted to touch the surface of the crankpin (18) to be checked, and

A2.3 a transducer (41) adapted to provide signals indicative of the position of the feeler (17) with respect to the Vee-shaped reference device (20, 20'),

A3 - a support device (5, 9, 12), with mutually movable coupling elements (9, 12), that movably supports the gauging head (39, 39'),

A4 - a control device (28) to control automatic displacements of the gauging head (39, 39') from a rest position to a checking position, and vice

versa, wherein in said checking condition of the head (39, 39'), the Vee-shaped reference device (20, 20') is adapted for maintaining contact with the crankpin (18) to be checked substantially owing to the forces of gravity,

A5 - a guide device (21) for guiding the arrangement of the Vee-shaped reference device (20, 20') on the crankpin (18) in the course of the orbital rotations of the latter, wherein the guide device (21) serves to guide the Vee-shaped reference device (20, 20’) to engage the crankpin (18) and maintain contact with the crankpin (18) while the Vee-shaped reference device (20, 20’) moves away from the crankpin (18), and

A6 - processing and display devices (22, 23) connected to the gauging head (39, 39') adapted to receive and process said signals provided by the transducer (41),

characterized in that

A6.1 the processing and display devices (22, 23) are adapted to perform processing of said signals (rg(θ)) provided by the transducer (41) to obtain values (r(φ)) indicative of the profile of the crankpin (18) to be checked,

A6.2 said processing (66-72) being adapted to compensate the values of the signals (rg(θ)) provided by the transducer (41) for alterations caused by the movements of the coupling elements (9, 12) and the gauging head (39, 39') during the orbital rotations of the crankpin (18) in the checking condition, and by the contact (A, B) between the Vee-shaped reference device (20, 20')

and the surface of the crankpin (18) to be checked.

3.2 Amendments (Articles 123(2), (3) EPC and Rule 80 EPC)

3.2.1 Appellant II argues that in the application for the contested patent as originally filed two distinct guide devices are disclosed:

- a first one for guiding the arrangement of the Vee-shaped reference device (20, 20') on the crankpin (18) in the course of the orbital rotations of the latter (**functional feature a)**) (claim 6 of the A-publication); and
- a second one for guiding the Vee-shaped reference device (20, 20’) to engage the crankpin (18) and maintain contact with the crankpin (18) while the Vee-shaped reference device (20, 20’) moves away from the crankpin (18) (**functional feature b)**) (page 4, lines 1-5 of the A-publication).

For appellant II, a unique guide device as now claimed for performing both functions is neither explicitly nor implicitly originally disclosed (Article 123(2) EPC). It also refers to the impugned decision, point 12, to argue that appellant I itself sees two distinct guide devices in the application as originally filed.

Appellant I contests this view and considers that such a disclosure cannot be found in the application as originally filed as a whole (see also point 9.1.2 of the impugned decision, page 4, first paragraph; and the minutes of the oral proceedings before the opposition division, page 2, first paragraph). The Board shares appellant I's view as put forward during the oral

proceedings before the Board that the application as originally filed does not describe two distinct guide devices. On the contrary, it is clear from the use of the same reference sign (21) on page 4, lines 1-5 and claim 6 of the A-publication, as also shown in figure 1, that the same guide device is meant for performing the two functions (functional features a) and b)), contrary to the finding of the opposition division. This view is further supported by the passage at the end of the A-publication, page 13, lines 8-11, referring to "**the** guide device (21)", i.e. to only one (singular) and the same device with reference sign (21).

Hence, the requirements of Article 123(2) EPC are fulfilled.

3.2.2 Appellant II further considers that the amendments to claim 1 contravene Articles 123(3) EPC.

It argues that adding a new function (functional feature b)) to the guide device of claim 1 of the patent as granted amounts to replacing the earlier claimed guide device by a new one with a combined function. As a consequence, the claimed apparatus comprising the new guide device extends the scope of protection beyond that of claim 1 of the patent as granted, contravening Article 123(3) EPC.

Contrary to this argument and the interpretation of the opposition division, the Board is of the opinion that the guide device of claim 1 of the patent as granted is more broadly defined than just keeping the reference device **in contact with** the rotating crankpin

(point 9.1.2 of the impugned decision, first paragraph). There is indeed no mention of "in contact with" in said claim. The function (functional feature a)) of the guide device of the apparatus of claim 1 of the patent as granted is broad as it serves to **guide** in the broadest possible interpretation of this expression the reference device on the crankpin while it orbitally rotates.

Consequently, the broad functional feature a) encompasses unambiguously the functional feature b), i.e. also engaging, so that the latter feature can only further define the guide device and narrow down the scope of protection of claim 1 of the patent as granted.

This view is further supported by paragraph [0053] of the contested patent in which it is clear that (only) one and the same guide device (21) touches the crankpin (18) surface, i.e. also maintains contact according to functional feature b) (see point 3.2.1 above).

As a result, the requirements of Article 123(3) EPC are fulfilled.

3.2.3 Rule 80 EPC

As the amendments to claim 1, in particular the addition of functional feature b) and reference sign (21) to the guide device in feature A5, were performed to overcome an objection of lack of novelty of the claimed subject-matter vis-à-vis D1 (see point 3.3 below), the amendments do not contravene

Rule 80 EPC. This was not contested by appellant II during the oral proceedings before the Board.

3.2.4 No objection was raised by appellant II against the other amendments to claim 1.

3.3 Novelty (Articles 54(1) and 54(3) EPC)

Appellant II conceded during the oral proceedings before the Board that the subject-matter of claim 1 is now novel over the cited prior art D1 (Articles 54(1) and 54(3) EPC). Since there is no guide device according to feature A5 in D1, its previous objection of lack of novelty based on D1 against claim 1 of the patent as granted submitted in the written procedure does not hold any more (impugned decision, point 9.1).

3.4 Inventive step (Article 56 EPC)

3.4.1 During the oral proceedings before the Board, appellant II raised a lack of inventive step objection against claim 1 starting from D2 combined with the common general knowledge of the skilled person and the teaching of one of the documents D3, D4, D5 or D6 (Article 56 EPC).

D1 being a document according to Article 54(3) EPC, cannot be considered for inventive step.

3.4.2 The Board agrees with both appellants that D2 is the closest prior art for the claimed subject-matter as it is in the same technical field of apparatuses for checking a pin of a crankshaft with a Vee-shaped reference device while it orbitally rotates.

3.4.3 D2 ([0016]-[0028]; figures) discloses an apparatus for measuring the diameter of a crankpin (18) of a crankshaft (34) during orbital rotations about a main rotation axis (8) on a numerical control grinding machine where it is worked, the grinding machine having a grinding-wheel slide (1) carrying a grinding-wheel (4) and a worktable (23) defining said main axis (8) with

- a gauging head with a Vee-shaped reference device (20) adapted to engage the crankpin (18) to be checked, a feeler (17) adapted to touch the surface of the crankpin (18) to be checked, and a transducer (41) adapted to provide signals indicative of the position of the feeler (17) with respect to the Vee-shaped reference device (20),
- a support device (5, 9, 12), with mutually movable coupling elements (9, 12), that movably supports the gauging head,
- a control device (28) to control automatic displacements of the gauging head from a rest position to a checking position, and vice versa,
- a guide device (21) for guiding the arrangement of the Vee-shaped reference device (20) on the crankpin (18) in the course of the orbital rotations of the latter, and
- processing and display devices connected to the gauging head adapted to receive and process said signal provided by the transducer (41) (figures).

As put forward by appellant I in its written submission of 1 August 2013, point 3.2, pages 5-6, document D2 aiming essentially at measuring the diameter of a crankpin also suggests that the disclosed apparatus can be modified for the dimensional and form deviation

checking of a crankpin (18) of a crankshaft (34) ([0040]).

3.4.4 Consequently, only features **A6.1** and **A6.2** of the characterising portion of claim 1 are regarded as distinguishing features over D2. This was admitted by appellant II during the oral proceedings before the Board. D2 is indeed silent on the data storing and/or processing method.

3.4.5 These distinguishing features have the synergetic technical effect of enabling the performance of precise roundness checking of the pin of a crankshaft while orbitally rotating (see contested patent, [0034]-[0035]; [0049]; [0052]).

3.4.6 As put forward by both appellants during the oral proceedings before the Board, the problem to be solved is therefore seen as how to modify the apparatus of D2 for performing more precise roundness checking of a pin of a crankshaft while orbitally rotating.

3.4.7 The Board concurs with appellant I's view that none of the cited documents discloses the compensations c1 and c2 of feature **A6.2** of claim 1:

c1: for alterations caused by the movements of the coupling elements and the gauging head during orbital rotations of the crankpin in the checking condition (called **"precession"** error; [0028]-[0032]); and

c2: for alterations caused by the contact of between the V-shaped reference device and the surface of

the crankpin to be checked (called **"inter-modulation"** error; [0033]-[0035]).

Indeed, contrary to D2 and the claimed apparatus, none of the documents D3-D6 is concerned with the measurement of a pin while orbitally rotating. In said documents the checked object rotates about its own symmetry axis during the checking operation.
A compensation c1 is therefore not disclosed, nor even suggested. For this reason already the skilled person would not think of combining the teaching of any of the documents D3, D4, D5 or D6 with the apparatus of D2.

Furthermore, as argued by appellant I, none of the documents D3, D5 or D6 is concerned with a Vee-shaped measurement device so that a compensation of the type c2 is not disclosed, neither explicitly nor implicitly. Even D4, which discloses a Vee-shape reference device and the use of a harmonic analysis (Fourier transform) for obtaining the roundness profile of the checked object, remains silent on compensations c1 and c2.

As a result, the Board agrees with appellant I that the skilled person would not think of combining the teaching of any of the documents D3, D4, D5 or D6 with the apparatus of D2. Should he nevertheless do so, he would not arrive at the claimed subject-matter since the compensations c1 and c2 (feature A6.2) are not disclosed therein.

An inventive step for the subject-matter of claim 1 is therefore to be acknowledged (Article 56 EPC).

3.4.8 Appellant II considers that the skilled person reading D2 and having in mind the problem of checking the roundness of the pin would immediately and inevitably think of linking the measured data to their respective location on the circumference of the checked object, performing mandatorily therewith compensation c1.

With respect to compensation c2, the skilled person would also immediately think of applying a harmonic analysis (Fourier transform) to the measured data since this belongs to the common general knowledge of the skilled person as illustrated for instance by any of the documents D3, D4, D5 or D6 (D3, pages 2, 5, 22; D4, column 2, line 66 to column 3, line 20 and abstract; D5, page 5, line 3 to page 9, line 8; claims 1-2, 6; figures 1-3, 7; D6, page 1, bottom of right-hand column).

Since, as explicitly mentioned in the contested patent itself, [0035], performing a harmonic analysis amounts to automatically compensate for the negative effects of inter-modulations of the form deviation errors of the crankpin, the skilled person applying the harmonic analysis as taught in D3, D4, D5 or D6 would then automatically perform compensation c2.

Appellant II cites in particular D6 which aims at measuring roundness and discloses that the raw data (f(φ)) of a single-point contact measuring device should be corrected using a Fourier analysis in order to take into account the errors of the measuring system ("Spindelfehler", g(φ)). The values h(φ) ("Komponentenfehler") represent the roundness of the workpiece portion to be checked, i.e. the corrected

profile values (pages 1-2, "Drehschritt-Fehlertrennverfahren"). It is explicitly taught in D6, page 1, bottom of right-hand column, that it is natural to apply a harmonic analysis when measuring roundness, i.e. a cyclic function. Therefore, the skilled person would certainly think of using the teaching of D6 and apply the harmonic analysis to the roundness measuring device of D2. When applying the teaching of D6, the skilled person faced with the above objective technical problem would also use his common general knowledge in order to adapt and apply the corrective measures explained on page 2 of D6 for a single-point contact measuring device, i.e. correcting the raw data by the errors of the measuring device using a harmonic analysis, to the three-point contact device of D2.

The same applies to D5 which discloses the use of a Fourier analysis for a single-point contact measuring device in order to take into account the errors of the measuring system such as the eccentricity e and angle α and obtain the actual roundness of the workpiece to be checked: $F(\varphi)$ and correct the raw data: $M(\psi)$ (page 5, line 3 to page 9, line 8; claims 1-2, 6; figures 1-3, 7).

Consequently, according to appellant II, the skilled person starting from D2 and faced with the problem mentioned under point 3.4.6 above would arrive at the claimed subject-matter in an obvious manner by using his common general knowledge and applying the teaching of any of the documents D3, D4, D5 or D6.

3.4.9 The Board concurs with appellant I's view that performing a harmonic analysis (Fourier transform) is

known as such, but is just a mathematical tool. None of the cited documents discloses both compensations c1 and c2 as claimed so that, even if the skilled person would use his knowledge of such a tool and think of combining the teaching of any of the documents D3, D4, D5 or D6 with the apparatus of D2, he would not arrive at the claimed subject-matter.

The Board further agrees with the impugned decision, point 13.2, and the appellant I's arguments that the measurement device of D6 does not provide that the axis of the workpiece portion to be checked is orbitally rotating as in claim 1 since it is fixed. This also applies to document D5 which is concerned with checking an object which ideally rotates about its own axis. Eccentric "e" is in fact an error aiming at being as small as possible and has nothing to do with the eccentricity (c) of a pin of a crankshaft as claimed (page 4, line 15 to page 5, line 25; figures 1-3; claim 1).

4. Method claim 11

4.1 For the purpose of analysis, the Board will use the following feature designation for claim 11:

M1 Method for checking a pin (18) defining a geometrical symmetry axis (C), the pin orbitally moving about a main rotation axis (O) parallel to and spaced apart (c) from the symmetry axis (C), in a numerical control grinding machine including a grinding-wheel slide (1) carrying a grinding-wheel (4) and a worktable (23) defining said main rotation axis (O), by means of a checking

apparatus including a support device (5, 9, 12), a gauging head (39,39') movably connected to the grinding machine through the support device, and processing and display devices (22,33) connected to the gauging head, the gauging head including a Vee-shaped reference device (20,20') adapted to cooperate with the pin (18) to be checked, a movable feeler (17) adapted to touch the surface of the pin to be checked and to move along a translation direction, and a transducer (41) adapted to provide the processing and display devices with signals indicative of the position of the feeler with respect to the Vee-shaped reference device,

characterized in that the method, for checking form deviation of said pin (18), includes the following steps:

M2 - detecting angular positions (θ) of the pin (18) about the main rotation axis (O) and providing relevant signals,

M3 - detecting and storing (65) a sequence of rough values (rg(θ)) corresponding to the signals provided by the transducer at predetermined angular positions (θ) of the pin (18), and

M4 - processing (66-72) said sequence of rough values (rg(θ)) to obtain profile values (r(φ)) indicative of the deviations of the radial dimensions of the pin (18) at corresponding sections of the surface of the pin angularly spaced out around the symmetry axis (C), by compensating components affecting the rough values (rg(θ)) due to the contact (A, B) between

the Vee-shaped reference device (20, 20') and the pin surface, and to variations in the angular arrangement of the Vee-shaped reference device in the course of orbital rotations of the pin about said main rotation axis (0),

M5 the processing step including
- performing the harmonic analysis (69) of a sequence of values (rf(φ)) relevant to the radial dimensions of the pin at said sections of the surface of the pin angularly spaced out around the symmetry axis (C), and calculating the values of the amplitudes (C_i) and phases (Φ_i) of the harmonics,

M6 - correcting (72) the values of said amplitudes (C_i) and phases (Φ_i) on the basis of compensation coefficients (K_i, σ_i) relevant to angles (2α, α1+α2) defined by the sides of the Vee-shaped reference device (20, 20') and the translation direction of the feeler, and

M7 - obtaining (72) said profile values (r(φ)) by means of the harmonics with the corrected values of amplitude and phase.

4.2 Novelty (Articles 54(1), (3) EPC)

With its statement of the grounds of appeal, appellant II raised a lack of novelty objection against claim 11 (=claim 12 of the patent as granted) vis-à-vis D1 (Article 54(3) EPC)

4.2.1 D1 ([0029]-[0058]; figures 1-4, 5a, 5b, 14-16) itself discloses a method for checking a pin (K) defining a geometrical symmetry axis (O), the pin orbitally moving about a main rotation axis (C) parallel to and spaced

apart from the symmetry axis (O), in a numerical control grinding machine (10, 100) including a grinding-wheel slide carrying a grinding-wheel (7) and a worktable (9) defining said main rotation axis (C), by means of a checking apparatus including a support device, a gauging head (25) movably connected to the grinding machine through the support device (1, 21), and processing and display devices (conversion board 18; 19; PC) connected to the gauging head, the gauging head including a Vee-shaped reference device (25) adapted to cooperate with the pin (K) to be checked, a movable feeler (27) adapted to touch the surface of the pin to be checked and to move along a translation direction, and a transducer (27) via the wire (8) adapted to provide the processing and display devices with signals indicative of the position of the feeler with respect to the Vee-shaped reference device (see in particular, figures 1-2, 4).

The method of D1 includes the following steps:

- detecting angular positions (ψ in the figures; φ in the description) of the pin (K) about the main rotation axis (C) and providing relevant signals,
- detecting and storing a sequence of rough values corresponding to the signals provided by the transducer at predetermined angular positions (ψ; φ) of the pin (K), and
- processing said sequence of rough values y(φ) (corresponding to the values rg(θ) in claim 1) to obtain profile values r(θ) (corresponding to the values r(φ) in claim 1) indicative of the deviations of the radial dimensions of the pin (K) at corresponding sections of the surface of the

pin angularly spaced out around the symmetry axis (O) ([0033], [0034] and [0045]-[0047]).

4.2.2 However, it is not mentioned in the earliest priority of D1 (prio1) that this processing includes "compensating components affecting the rough values due to the contact between the Vee-shaped reference device and the pin surface, and to variations in the angular arrangement of the Vee-shaped reference device in the course of orbital rotations of the pin about said main rotation axis".

The "compensation" of the raw data, i.e. the phase angle errors, as put forward by the appellant II (reference is made to [0069] and [0085] of D1), **is not present in prio1**.

Therefore, the Board considers that feature **M4** is not disclosed in prio1 of D1 and therefore does not form part of the disclosure of D1 that can be held against the patent in suit pursuant to Article 54(3) EPC.

4.2.3 The processing step of D1 ([0045]-[0047]) includes a harmonic analysis of a sequence of values $y(\theta)$ (corresponding to the values $rf(\varphi)$ in claim 1), which is relevant to the radial dimensions of the pin at said sections of the surface of the pin angularly spaced out around the symmetry axis (O).

Contrary to appellant I's view, the Board is of the opinion that it is inherent to the harmonic analysis that the values of the amplitudes (C_i) and phases (Φ_i) of the harmonics will be calculated so that feature **M5**

is regarded as being present in D1. It is also disclosed by prio1 of D1.

4.2.4 Appellant II considers that due to the similitude in the construction of the known and claimed apparatuses, both apparatuses will face the same partial problems of:

- correcting the angle in the raw data; and
- computing and excluding the artefacts resulting from the support device.

Since D1 solves the problems the same way as in claim 11, i.e. through a Fourier-analysis (harmonic analysis), features **M5 to M7** would also inevitably be disclosed (equations in [0010] and [0011]; [0046] and [0047]).

The Board cannot share appellant II's view. Although a harmonic analysis is indeed performed in D1, the raw data are not corrected by values relevant to the Vee-shaped reference guide (contested patent, [0037]-[0039]). The correction of the phase angle performed in D1, [0069] and [0085] does not correspond to the claimed corrections of phase and amplitude according to harmonics. The subject-matter of claim 11 is therefore already novel over D1 by features **M6 and M7**.

4.2.5 Since features M6 and M7 are not disclosed in D1 and the content of D1 which benefits from the priority date prio1 of D1 does not include feature M4, the subject-matter of claim 11 is novel over D1 (Articles 54(1) and 54 (3) EPC) (corresponds to point 9.2 of the impugned decision).

The above corresponds to the preliminary opinion of the Board provided in the annex to the summons for oral

proceedings. It was not further contested by appellant II.

4.3 Inventive step

4.3.1 Appellant II raises a lack of inventive step objection against claim 11 starting from D2 combined with the common general knowledge of the skilled person and the teaching of any of the documents D3, D4, D5 or D6 (Article 56 EPC).

4.3.2 D2 ([0016]-[0028]; figures), which is considered as the closest prior art by both parties for the same reasons as those given for claim 1 under point 3.4.2 above, discloses a method for checking a pin (18) defining a geometrical symmetry axis, the pin orbitally moving about a main rotation axis (8) parallel to and spaced apart from the said geometrical symmetry axis, in a numerical control grinding machine including a grinding-wheel slide (1) carrying a grinding-wheel (4) and a worktable (23) defining said main rotation axis (8), by means of a checking apparatus including a support device, a gauging head (20) movably connected to the grinding machine through the support device (5, 9, 12), and processing and display devices connected to the gauging head, the gauging head including a Vee-shaped reference device (20) adapted to cooperate with the pin (18) to be checked, a movable feeler (17) adapted to touch the surface of the pin to be checked and to move along a translation direction, and a transducer (41, 42) adapted to provide the processing and display devices with signals indicative of the position of the feeler with respect to the Vee-shaped reference device.

The method of D2 is silent about data measuring and processing (features **M2-M7**) (point 13.2 of the impugned decision).

4.3.3 With respect to features **M2** and **M3**, the Board follows appellant I's view that they are not implicitly disclosed in D2. Indeed, contrary to appellant II's position, the steps of detecting the angular positions of the pin about the main axis and detecting and storing the signals as a function of the said angular positions are **not** compulsory in the method of D2 for achieving its aim of checking the diameter of crankpins ([0001], [0007]). As argued by appellant I, for the purpose of only **checking a diameter** as in D2 in order to enable a decision on subsequent processing, which is different from a roundness analysis as in the claimed method, the skilled person is aware that either storing the minimum measured diameter or computing an average of the measured diameters are plausible alternative methods for data storing and/or processing. The data in the method of D2 need therefore not be linked with an angular position on the pin.

4.3.4 Appellant II has not contested that feature **M4** is a distinguishing feature over D2. Since features **M2-M4** of claim 11 encompass feature **A6.2** of claim 1, the entire reasoning about inventive step applicable to claim 1 under point 3.4 above also applies to claim 11 with the same positive conclusion on inventive step (Article 56 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: page 2 and pages 4 to 9 of the patent specification and
     page 3 as filed with letter of 1 August 2013 to the then first auxiliary request,
   - claims: 1 to 16 according to the main request filed as new second auxiliary request at the oral proceedings held on 22 October 2013,
   - drawings: figures 1 to 7 of the patent specification.

The Registrar: The Chairman:

G. Nachtigall H. Meinders