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**Datasheet for the decision
of 30 October 2008**

Case Number: T 1419/06 - 3.4.02

Application Number: 99935842.7

Publication Number: 1042645

IPC: G01B 21/20

Language of the proceedings: EN

Title of invention:

Finding shape deformations in objects with transformation parameters after registering

Patentee:

GENERAL ELECTRIC COMPANY

Opponent:

Carl Zeiss Industrielle Messtechnik GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 69, 123(2), 52(1), 54, 56

Keyword:

"Interpretation of claims"

Decisions cited:

G 0010/91, G 0011/91

Catchword:

Objection under Article 123(2) EPC against the claims of the patent as granted first raised during the appeal proceedings



Case Number: T 1419/06 - 3.4.02

DECISION
of the Technical Board of Appeal 3.4.02
of 30 October 2008

(Opponent) Carl Zeiss Industrielle Messtechnik GmbH
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Representative: Henckell, Carsten
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Respondent: GENERAL ELECTRIC COMPANY
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 22 August 2006
rejecting the opposition filed against European
patent No. 1042645 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: A. Klein
Members: F. Maaswinkel
C. Rennie-Smith

Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal, received on 13 September 2006, against the decision of the opposition division, dispatched on 11 August 2006, to reject the opposition against the European patent No. 1 042 645. The fee for the appeal was paid on 13 September 2006. The statement setting out the grounds of appeal was received on 15 December 2006.
- II. Opposition had been filed against the patent as a whole on the basis of Article 100(a) EPC on the ground that the subject-matter of the patent was not patentable within the terms of Articles 52 to 57 EPC because it lacked novelty and did not involve an inventive step. To support its objections the opponent referred inter alia to the following documents:
- (E1) VDI Berichte Nr. 1006, 1992, pages 23 - 38, K.-H. Breyer et al "Holometrische Koordinatenmeßtechnik - Neue Ansätze zur umfassenden Messung beliebiger Formelemente";
- (E3) Carl Zeiss Germany, "HOLOS-UX Messen und Digitalisieren von Freiformflächen", Company's Leaflet, 1993;
- (E7) IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 14, No. 2, February 1992, pages 239 - 256, P.J. Besl et al. "A Method for Registration of 3-D Shapes";
- (E8) JP-A-5 010 751.

Documents E1 and E3 had been filed with the notice of opposition. Documents E7 and E8 were filed with the

- grounds of appeal. Furthermore the appellant (opponent) filed an auxiliary request for oral proceedings.
- III. In a reply of 19 June 2007 the respondent requested that the appeal be dismissed and that the patent be maintained as granted and also filed an auxiliary request for oral proceedings. Furthermore in a subsequent letter of 31 August 2007 the respondent objected to the late-filed documents E7 and E8, submitting that these were not more relevant than the documents already on file and should therefore be disregarded.
- IV. In a further letter of 8 February 2008 the appellant for the first time in the opposition appeal proceedings raised an objection under Art. 123(2) EPC against the independent claims of the patent as granted and requested that the patent be revoked.
- V. In an official communication of 8 July 2008 oral proceedings were appointed to take place on 30 October 2008.
- VI. In a letter filed on 26 September 2008 the respondent objected to the newly filed ground of opposition as being inadmissible and submitted it should not be considered as a fresh ground for appeal. It submitted further arguments as to the substance of the independent claims and filed five sets of claims as auxiliary requests.
- VII. On 30 October 2008 oral proceedings were held.

- VIII. At the oral proceedings the appellant requested that the decision under appeal be set aside and that the patent be revoked.
- IX. The respondent requested that the patent be maintained as granted or alternatively that the decision under appeal be set aside and the patent be maintained on the basis of the claims of one of the auxiliary requests filed on 26 September 2008.
- X. The wording of independent claim 1 of the patent as granted (main request) reads as follows (*the numbering of features "a1)" to "f1)" is not part of the claims, but has been introduced for easier reference in the following Reasons*):
- "An apparatus (10) for finding shape deformations in objects comprising:
- a1) an imaging device (12) for obtaining a scanned image of said object;
 - b1) a memory (30) adapted to store a reference image of said object;
 - c1) an image register (24) coupled to said imaging device (12) and to said memory (30) to store patch information corresponding to said reference image (30) and said scanned image (22);
 - d1) a transformation estimator (26) coupled to said image register (24) to provide a transform for comparing said scanned image (22) to said reference image (30);
 - e1) a deformation estimator (28) coupled to said transformation estimator (26) and to said image register (24) to utilize said transform and said

patch information to determine shape deformations of said object (12); characterised by

- f1) said transformation estimator including a comparator arranged to compare a plurality of respective patches of selectable size and number from each of said reference image and said scanned image".

The wording of independent claim 7 according to this request reads as follows:

"A method of finding shape deformations in objects comprising:
obtaining a scanned image of said object;
storing a reference image of said object in a memory;
storing patch information corresponding to said reference image and said scanned image (22) in an image register (24) coupled to an imaging device (12) and to said memory;
providing a transform for comparing said scanned image (22) to said reference image by means of a transformation estimator (26) coupled to said image register (24); and
utilizing said transform and said patch information to determine shape deformations of said object (12) by means of a deformation estimator (28) coupled to said transformation estimator (26) and to said image register (24);
characterised in that
said step of providing a transform comprises comparing a plurality of respective patches of selectable size and number from each of said reference image and said scanned image".

The wording of independent claim 20 of this request reads as follows:

"A storage medium encoded with machine-readable computer program code for performing the method of claim 7".

Claims 2 to 6 and claims 8 to 19 are dependent claims.

The claims of the auxiliary requests are not relevant for the purpose of this decision.

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

During the examination proceedings independent claims 1 and 7 have been amended to include the feature "said transformation estimator including a comparator arranged to compare a plurality of respective patches of selectable size and number from each of said reference image and said scanned image". However, nowhere in the original patent application documents is there a disclosure of a feature "comparator to compare ...patches ...from each of said reference image and said scanned image". In particular there is no explanation whatsoever what should be understood by the expression "...to compare...patches from each of said reference image and said scanned image". In the decision under appeal it had been argued that the subject-matter of the independent claims was novel by virtue of this feature f1). However, since this feature had not been disclosed in the original patent application and, furthermore, is obscure, feature f1)

includes an inadmissible extension of subject-matter under Article 123(2) EPC. The patent should therefore be revoked.

The reason for submitting documents E7 and E8 with the grounds of appeal was motivated by the sudden change in the position of the opposition division during the oral proceedings compared to its prior assessment in the preliminary opinion of 19 January 2006, in which documents E1 to E3 had been considered to anticipate the subject-matter of the independent claims. This change of position appears to be related to the fact that the patent proprietor has attributed to some features in claims 1 and 7 a meaning which differs from the meaning which these features have if the patent specification is read in an objective way. In this respect Article 69, paragraph 1, second phrase EPC clearly specifies that for the interpretation of the claims the description and drawings shall be used to interpret the claims. In particular the feature "patch" has, according to paragraph [0012] of the patent specification, a very broad meaning of "...a grid on the reference plane which grid encompasses at least a portion of the surface of the imaged object". Also the expression "patch information" in feature c1) of claim 1 is vague and includes, according to paragraph [0028] of the patent specification, merely some indefinite kind of information on the subdivision of the "reference image" and the "scanned image". Furthermore, the patent proprietor has alleged, as is also suggested by the wording of claim 1, that for the alignment process no measurement data points and reference image points would be needed because patches would be compared. This allegation is in complete

contradiction to the disclosure of the patent in suit. For instance, paragraph [0037] of the specification discloses that "...In one embodiment of the invention, robust registration of the data points using low curvature patches is performed by a Robust-Closest Patch algorithm (RCP) that accurately registers the data points to the CAD model, using all points on all visible and stable surfaces of the part". Therefore single data points are registered to the CAD model. Also the second algorithm described in this paragraph is based on minimising the distance between two points: "...In one embodiment of the invention, registration using RCP is driven by low curvature patches computed from the model off-line. The RCP algorithm uses an approximate normal distance between a patch and a surface..." As clearly follows from paragraphs [0044] to [0049] and corresponding Figures 3 and 4, the aforesaid distance ("approximate normal distance") is determined by a point p on a model patch and a point q of the measured image data, wherein the resulting distances are minimised according to equation (1) of the patent specification, i.e. the Gauss-criterion, which minimises the sum of the squared distances. See also paragraph [0055] according to which "since the local patch P' has no detectable boundaries or landmarks" point(s) p' cannot be determined. Instead points q_i are determined by dropping a perpendicular \vec{n} from the model patch to the data point cloud. Therefore, in fact, these points q_i are the "patches" representing the scanned image data. In its decision the opposition division unexpectedly interpreted claim 1 in a completely different way than in its earlier communication, as a result of which the

opponent/appellant was forced to refer to the new documents E7 and E8 in arguing its case.

With respect to the issue of patentability, document E1 discloses the software package "Holos" which runs on a computer of a coordinate measurement machine (CMM). In this apparatus deviations of measured data points from surface areas of a reference model are determined. In the example shown in Figure 10 of E1 the reference model is defined by freeform surfaces, in E1 referred to as "patches", and in the case of Figures 11 to 16 by standard analytical elements; in the case of Figure 9 both types are used. Any deviation of the measured data points of the workpiece from the reference model is a "shape deviation" in the meaning of paragraph [0002] of the patent specification. Therefore document E1 discloses an apparatus for finding shape deformations in objects comprising:

a1) an imaging device (CCM with computer) for obtaining a scanned image of the object (measured data of the workpiece);

b1) a memory (of the computer) adapted to store a reference image of the object (reference patches of the workpiece);

c1) an image register (computer memory) coupled to the imaging device and to the memory to store patch information corresponding to the reference image and the scanned image (every measured data point is allocated to a surface area or reference patch, see Figure 10; as explained before, both in the patent as well as in E1, points \mathbf{q}_i are determined by dropping a perpendicular $\vec{\mathbf{n}}$ from the model patch to the data point cloud. Therefore patch information of the corresponding reference patch for every measured data point is stored

and as a result all data points are classified as "areas" to the corresponding reference patch. These data points comprise a grid and are therefore "patches" within the extremely broad definition of paragraph [0012] of the patent);

d1) a transformation estimator coupled to the image register to provide a transform for comparing the scanned image to the reference image (the part of the program carrying out the 3D-best fit alignment);

e1) a deformation estimator coupled to the transformation estimator and to the image register to utilize the transform and the patch information to determine shape deformations of the object (the part of the program in which the deviations of the measured data fitted to the reference patches of the workpiece are determined); and

f1) wherein the transformation estimator includes a comparator arranged to compare a plurality of respective patches of selectable size and number from each of the reference image and the scanned image (fitting and alignment of the measured points allocated to the respective reference patch). With respect to the feature "selectable size and number" it is pointed out, that in feature f1), the point in time the size and number of the patches "to be compared" is scheduled, is left completely open. In the appellant's opinion this condition is also met if the size and number of the patches is variable by, for instance, a modification of the reference model of the workpiece.

It follows that the features of claim 1, insofar as these are clear and originally disclosed, by having recourse for the interpretation of the patent specification, are anticipated by the Holos system

disclosed in document E1 (Art. 52(1) and 54 EPC). Since independent claim 7 defines the same technical features as claim 1 as corresponding process steps its subject-matter is equally known from document E1.

In its decision the opposition division had argued that the apparatus of claim 1 differed from the prior art Holos system disclosed in document E1 in feature f1), because in the latter system all data points of the scanned workpiece were used for fitting and aligning with the reference patch image. Therefore, instead of comparing "a plurality of patches ...from each of the reference image and the scanned image" as defined in feature f1) of claim 1, in the Holos system "a plurality of patches ...from the reference image with all measured points of the scanned image" was compared. Since, as explained before, a plurality of measurement points defines a grid and therefore a patch, the only difference between feature f1) and the prior art is that according to this feature the number of used data points can be reduced, which may be found beneficial for a faster data reduction process. Although, as already argued, the patent specification did not address a technical problem to be solved, the objective technical problem underlying this single difference over the prior art may be seen in offering a faster fitting and alignment. Clearly, this problem is obvious and the solution, to reduce the number of used data points in the case of a very large number of such points, was known in the art. This is illustrated by reference to document E7, which discloses a very similar registration process to the Holos process. This document shows several examples in which, if desired, the number of measurement data points can be

considerably reduced (for instance, using planar section cuts and thinning out the data using a chord length deviation check, see page 252, Section 3 "Terrain Data"). In any case it is the appellant's firm belief that this idea, of thinning out the number of measurement points if this appears to be too large for an efficient data reduction or registration process, only forms part of the ordinary general knowledge of the skilled person in the field of CAD and CCMs and therefore does not require an inventive step. Hence the independent claims are not allowable (Art. 52(1) and 56 EPC).

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

With the submission of 8 February 2008, the appellant raised for the first time in the opposition and the opposition appeal proceedings an objection under Article 123(2) EPC with respect to claims 1 and 7 as granted. This objection, forming a fresh ground of opposition, is inadmissible without the approval of the patentee in accordance with the Decisions G 9/91 and G 10/91 of the Enlarged Board of Appeal and the respondent patentee explicitly withholds such approval. Therefore it is requested that the fresh ground of opposition now raised by the opponent be dismissed.

With respect to documents E7 and E8, in the opinion of the respondent these documents should be disregarded because they have been submitted belatedly and, moreover, are of no relevance. In particular document E7 describes a so-called iterative closest point (ICP) algorithm which has nothing to do with a comparison of

patches of selectable size and number from each of the reference image and the scanned image as defined in claims 1 and 7. In particular this is illustrated by the Section VII "Conclusions" on page 253 of this publication, where it is disclosed: "if a data shape were to come in a form other than point set form, a dense set of points on the data shape can serve as the data point set". This clearly demonstrates that in document E7 only points are of interest, thus neither this document nor document E8 adds anything to the disclosures of the other documents. Hence documents E7 and E8 are not relevant for the independent claims and should consequently be disregarded.

The allegation of the appellant making reference to paragraph [0012] of the patent specification that the term "patch" would have a very broad meaning and that, if interpreted by having resort to the specification, would include individual probing points, is traversed: Claim 1 includes the following phrase: " ...to compare a plurality of patches of selectable size and number...". A single probing point does not have a selectable size, because it is a one-dimensional object and neither has a size nor an orientation. Furthermore, according to paragraph [0012] a patch is defined by "...a grid, which shall encompass a portion of the surface of the imaged object". A probing point is not a grid and, being a one-dimensional object, does not encompass a portion of the surface.

The appellant has further, by referring to paragraphs [0037] and [0043] to [0047], alleged that the patent does not disclose a comparison of patches. In paragraph [0037] it is disclosed that the registration of the

data points using low curvature patches is carried out by a Robust-Closest Patch (RCP) algorithm. From this paragraph it immediately follows that:

- the term "Robust-Closest Patch algorithm" clearly indicates that patches are used;
- RCP matches model patches to data surfaces;
- RCP uses an approximate normal distance between a patch and the data surface;
- data points are used to generate patches.

The RCP algorithm is further described in paragraphs [0044] to [0049]. Paragraph [0046] includes: "Given the approximate viewpoint, the model surface can be digitized at regular grid points on an image plane, local curvature patches retained, giving a set of regularly spaced patches. Each patch P_i is represented by its centre position \mathbf{p}_i and its outward normal $\vec{\mathbf{n}}_i$ as shown in Figure 4". In this context "centre position" means that the position of \mathbf{p}_i is in the centre of the patch. The next paragraph states that the RCP algorithm "...translates the model patches to align the model's centre of mass with that of the data". Alignment of model to data patch is therefore carried out using centre of mass. Finally the points \mathbf{p}_i and \mathbf{q}_i representing the centres of mass are not probing points. This becomes immediately apparent from paragraph [0048], the first two sentences of which read: "In step 84, RCP algorithm 80 finds for each patch P_i the matching location \mathbf{q}_i by moving a matched filter, sized to P_i , along the line \mathbf{I}_i , through \mathbf{p}_i and parallel to $\vec{\mathbf{n}}_i$ searching for the nearest significant response from current location \mathbf{p}_i , as shown in Figure 4. This estimates the piercing point of \mathbf{I}_i , with the implicit surface from which the data are measured without the expensive and noise sensitive process of estimating

surface parameters from the data". This point I_i , is the piercing point of the normal \vec{n}_i with the implicit surface of the data point, therefore the piercing point is not a probing point but a point on the implicit surface generated from the data points. Hence, on this basis it is evident that patches are compared using their centres of mass and their normals. The RCP algorithm therefore uses for the alignment patches, which are generated from the probing points and the computer model. Finally the appellant's interpretation of paragraph [0055] is disputed: points q_i cannot be found by dropping a perpendicular \vec{n} from the model patch to a "data point cloud", since in order to obtain an intersection point a surface must be present. Therefore the features of the claims, in particular concerning "patches" and "comparing ...patches" are unambiguously supported by the description of the patent specification and their interpretation for the issue of patentability is unequivocal.

Document E1 describes two separate aspects of the Holos software. A first aspect, summarised in the first paragraph of Section 4.2 of this document, relates to the digitalization of models (for instance, prototypes), in which a computer model is generated by scanning the surface of the model to obtain a plurality of probing points and subsequently reconstructing the surface of the model by using the probing points. This can be carried out by parameterised Béziér surfaces which are determined by using the probing points as control points. Thus in the digitization process a computer model is generated for a prototype. The second aspect of the Holos software package, described in the remaining paragraphs of this Section 4.2, relates to

the best-fit alignment of a computer model with probing points obtained by scanning a workpiece. These two different aspects of the Holos software are also distinguished on page 2, second and third paragraph, of document E3, from which it clearly follows that these are separate embodiments which cannot be combined for this issue of patentability. With respect to the second aspect of Holos document E1 discloses on page 32, first paragraph, that in order to align the measured data with the computer model all probing points are used, which, according to the next sentence, is indispensable ("unverzichtbar"). In Figures 11 to 16 of E1 a best-fit alignment of objects, in this case standard analytical elements, is shown. Therefore in E1 measured probing points are compared with the surface of a computer model. Thus the method used in the Holos software package differs from the apparatus of claim 1 and the method of claim 7 of the patent, because these require [in feature c1)] the storing of patch information corresponding to the reference (i.e. the computer model) image and the scanned image (of the workpiece) and in addition [in feature f1)] comparing a plurality of respective patches of selectable size and number from each of the reference image and the scanned image. Therefore the subject-matter of the independent claim is novel.

The subject-matter of the claims also involves an inventive step because all prior art documents use discrete points for comparing the scanned image with the reference image for transforming the scanned image to provide alignment of the scanned image with the reference image. Furthermore the prior art does not disclose or suggest a selection of the size and number

of patches. Hence the claims also involve an inventive step.

Therefore it is requested to dismiss the appeal and to maintain the patent as granted.

Reasons for the Decision

1. The appeal is admissible.

2. *Formal requirements*

2.1 *Interpretation of the claims*

At the oral proceedings the appellant suggested remittal of the case to the first instance because, in its view, the independent claims lacked support by the description and therefore the interpretation of the claims, if making reference to Article 69 EPC or even the workability of the invention, was not clear. The board observes that it would have been incumbent on the appellant to raise this issue when filing the opposition and therefore sees no reason, at this very late stage of the proceedings, to conduct a debate which the opponent could have had before.

2.2 *Objection under Article 123(2) EPC*

2.2.1 In its letter of 8 February 2008 the appellant raised for the first time in the opposition proceedings an objection under Article 123(2) EPC against independent claims 1 and 7 of the patent as granted. In the respondent's response of 25 September 2008 it is

requested with reference to the Decisions G 9/91 and G 10/91 that this fresh ground of opposition be dismissed.

2.2.2 Since this Decision G 10/91, the extent of scrutiny during opposition appeal proceedings is established Case law: according to Headnote 3 of this Decision "*Fresh grounds of opposition may be considered in appeal proceedings only with the approval of the patentee*". Since in the present appeal case the patent proprietor has objected to the introduction of this new ground of opposition, the Board has no power to address this issue.

2.3 *Documents E7 and E8*

2.3.1 The appellant sought to justify the introduction of documents E7 and E8 by an unexpected change in position of the opposition division which, while in its prior communication had indicated that the subject-matter of the independent claims did not seem to be new over the disclosure of document E1, at the subsequent oral proceedings argued that this subject-matter was patentable by virtue of feature f1). Therefore documents E7 and E8 should illustrate that in any case the subject-matter of these claims did not involve an inventive step.

2.3.2 Documents E7 and E8 have been submitted with the grounds of appeal and are therefore late-filed. At the oral proceedings before the board the appellant did not deny that these documents (document E7 relating to a publication a known scientific journal from the same technical field, document E8 being a published patent

document) had been available at the filing date of the opposition. The board also observes that the claims of the patent under attack at the appeal proceedings are identical to those at the filing date of the opposition. Since it is a matter of discretion under Article 114(2) EPC whether such late-filed material should be considered by the board, a commonly used criterion applied by the boards in this respect is the relevance of the late-filed material, i.e. of the probability that their admission into the appeal proceedings might change the outcome of the case. It is added that under such conditions it might be deemed necessary to remit the case to the first instance, which would give rise to further delay and questions of legal security for all parties. Therefore such late-filed documents should only be admitted under very restricted conditions.

- 2.3.3 For the reasons given in point 3.1.8 below, the board is not convinced that documents E7 and E8 disclose more relevant information than the documents filed with the notice of opposition, therefore these documents are not admitted.

3. *Patentability*

3.1 *Novelty*

- 3.1.1 Document E1 discloses a software package "Holos" combinable with a CCM (see page 24, Section 2) which can be used for finding shape deformations in an object (see page 33, last paragraph: "Auswertung und Darstellung von Meßabweichungen"). This device comprises an imaging device for obtaining a scanned image of the object (see page 24, CCM) and a memory (in

the computer) adapted to store a reference image of the object. Furthermore the device comprises an image register coupled to the memory to store patch information of the object (see page 33 and Figure 10, where the deviations of single measurement points to reference patches are displayed).

3.1.2 Contrary to the opposition division, which in point 3.1 of its decision had argued that the apparatus of E1 "...also comprises an image register coupled to said imaging device and to said memory device to store patch information corresponding to said reference image and said scanned image" (emphasis added) this feature cannot be identified in E1, at least not in the part of this document disclosing the evaluation of deviations between a workpiece scanned point-wise on a CCM and a pre-stored reference image in the related computer: the conversion of measured data points by parameterised Béziér surfaces to patches described in the first paragraph of Section 4.2 of E1 is only discussed within the scope of a digitisation process of model structures, in particular for car bodies or prototypes, for which no prior computer model exists. This embodiment is separate from the comparison of scanned data points of a workpiece with a reference model stored in the computer, which is the subject of the disclosure in pages 32 to 38 of E1. Indeed, according to E1, page 32, first paragraph, for the registration process the Holo software comprises amongst others the best fit of the workpiece with respect to all scanned data points. This is furthermore shown in Figure 10 and page 33, first paragraph, according to which arbitrary single points can be scanned and their deviations from the reference surface (shown as reference patches) are displayed.

With respect to the term "patches" document E1 defines these on page 31, penultimate paragraph as "parameterised surface areas" ("parametrisierte Flächenstücke"). The board observes that this definition appears to conform to the definition in paragraph [0012] of the patent specification, which reads "a patch is defined to be a grid on the reference surface which grid encompasses at least a portion of the surface of the imaged object".

3.1.3 Therefore the subject-matter of claim 1 differs from the Holos package at least in the feature c1) that in an image register patch information corresponding to the scanned image is stored, whereas in the Holos system the individual scanned points are stored. Furthermore in the apparatus defined in claim 1 a plurality of respective patches of selectable size and number from each of the reference image and the scanned image are compared, whereas in the Holos system the measured points are compared with the (patches of) the reference image. Therefore the respective evaluation algorithms (defined in feature f1)) also differ.

3.1.4 At the oral proceedings before the opposition division the opponent in its argumentation pertaining to lack of novelty had used the argument that, referring to Art. 69 EPC and using the description of the patent in order to interpret the claims, "a patch is defined as being a grid i.e. an arbitrary group of points or even a single point" (see page 1, point 6 first paragraph, of the Minutes of the oral proceedings with the date 11 August 2006). As already set-out, such a definition of a patch consisting of "arbitrary points" or even a "single point" is not consistent with the accepted definition

given both in document E1 and in paragraph [0012] of the patent. Rather, although a grid may be defined by a number of points, such points only define a grid if at the same time the information is provided that these points have a predetermined interrelation between them in order to span a vector space for defining the grid. Therefore, without such information being disclosed, individual points do not define a grid or even a patch.

3.1.5 The considerations by the appellant on the interpretation of the term "patch" and "comparing patches" are apparently promoted by what the appellant believes to be a discrepancy between the description of the patent and the wording of the independent claims. The board, however, was unable to identify such a discrepancy: rather it finds that the technical features of the apparatus of claim 1 do correspond to features shown in the apparatus in Figure 1, which for instance shows "patch determining devices" 32 and 34 coupled to the imaging device 20 and to the reference image device 30, and which are programmed to portion these images into a plurality of surfaces (see paragraph [0028]). Figure 1 further shows a transformation estimator 26 in which the respective patches are compared, see paragraph [0032]. Finally the board finds the position of the respondent persuasive that the employed evaluation algorithm, the so-called Robust-Closest Patch algorithm, indeed matches model patches to data surfaces, which is enumerated in paragraph [0037].

3.1.6 Therefore the apparatus of claim 1, the method of claim 7 and the encoded storage medium of claim 20 differ from the Holos system and software package

disclosed in document E1 in the evaluation of the workpiece measured data for the registration process in the form of patches, whereas in E1 all single scanned points are used.

- 3.1.7 The further documents are not more relevant: as pointed out by the respondent, document E3, page 2, distinguishes between the first task of HoloS "measuring of deviations in shape between freeform-objects (reference geometry) and the workpieces (actual shape)" and the second task of "digitisation of models for which no numerical shape exists, so that after digitisation such models can be handled in a CAD-system". This supports the assessment of the contents of E1 in point 3.1.2 *supra*.
- 3.1.8 Late-filed documents E7 and E8 also relate to methods of registration of 3-dimensional shapes wherein a comparison is made between points and surfaces. As noted by the respondent, document E7 is based on the "closest point algorithm", which includes a procedure to find the closest point on a geometric entity to a given point (see Abstract). Therefore this document (and document E8, to which was no further reference was made at the oral proceedings by the appellant) does not disclose relevant subject-matter. For this reason the board decided not to admit these late-filed documents.
- 3.1.9 The subject-matter of these claims is therefore novel (Art.52(1) and 54 EPC).

3.2 *Inventive step*

3.2.1 The objective technical problem underlying the differences between the apparatus of claim 1 and the method of claim 7 and the closest prior art disclosed in document E1 (see point 3.1.6) could be defined as providing a faster or more efficient way of finding shape deformations in scanned images when these are compared to reference models. It is a general aim of the skilled person to make such evaluation systems and their data reduction more efficient, therefore the formulation of this technical problem as such does not require an inventive activity. However, the solution defined in the independent claims is not obtainable from the prior art in an obvious way. In document E1 the comparison of the scanned image with the stored reference image is always carried out using the single measurement points and calculating the deviations to the reference image (see Figure 10). There is no suggestion in this document, or in the other cited literature, to store patch information based on the scanned image points and to carry out the evaluation of the measured workpiece by comparing these patches with the stored reference patches as defined in the independent claims.

3.2.2 Therefore in the opinion of the board the subject-matter of the independent claims 1 and 7 involves an inventive step (Art.52(1) and 56 EPC).

3.2.3 Claims 2 to 6 and 8 to 19 are appended to claims 1 and 7, respectively, and equally involve an inventive step. Claim 20 defines a storage medium encoded with a

computer code program code for performing the method of claim 7 and also defines patentable subject-matter.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Kiehl

A. G. Klein