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**Datasheet for the decision
of 17 August 2021**

Case Number: T 1531/18 - 3.4.02

Application Number: 12799151.1

Publication Number: 2788714

IPC: G01B21/04, G05B13/00, G06F3/01,
G05B19/18, G01B11/00,
G05B19/401, G06F3/00, G06F3/03

Language of the proceedings: EN

Title of invention:
COORDINATE MEASURING MACHINE HAVING A CAMERA

Patent Proprietor:
Hexagon Technology Center GmbH

Opponent:
Carl Zeiss Industrielle Messtechnik GmbH

Relevant legal provisions:
EPC Art. 54(1), 56, 83, 100(a), 100(b), 108
EPC R. 99(2)

Keyword:

Admissibility of the appeal of the patent proprietor (yes)

Sufficiency of disclosure (yes)

Novelty (yes)

Inventive step (main and first auxiliary request: no; second
auxiliary request: yes)

Decisions cited:

J 0010/11, T 0570/07, T 0918/17



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Case Number: T 1531/18 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 17 August 2021

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
5 April 2018 concerning maintenance of the
European Patent No. 2788714 in amended form.**

Composition of the Board:

Chairman R. Bekkering
Members: F. J. Narganes-Quijano
B. Müller

Summary of Facts and Submissions

- I. The patent proprietor and the opponent lodged an appeal against the interlocutory decision of the opposition division finding European patent No. 2788714 as amended according to the second auxiliary request to meet the requirements of the EPC.

The opposition filed by the appellant against the patent as a whole was based on the grounds for opposition of insufficiency of disclosure (Article 100(b) EPC) and lack of novelty and of inventive step (Article 100(a) together with Articles 52(1), 54 and 56 EPC).

- II. The following documents considered during the first-instance opposition proceedings have been referred to by the parties during the appeal proceedings:

D6: JP 2004 093190 A

D6': English machine-generated translation of document D6 (8 pages)

E1: "Lock-in Time-of-Flight (ToF) Cameras: A Survey", S Foix *et al.*; IEEE Sensors Journal, Vol. 11, 2011; pages 1 to 11

E3: WO 2009/129916 A1

E4: "A Time-of-Flight Depth Sensor-System - Description, Issues and Solutions", S B Gokturk *et al.*; IEEE Computer Vision and Pattern Recognition Workshop, 2004; page 1 (bibliographic page) and pages 2 to 10

E5: "Exploitation of Time-of-Flight (ToF) Cameras", S Foix *et al.*; IRI Technical Report, Institut de Robòtica i Informàtica Industrial, CSIC,

- Universitat Politècnica de Catalunya, Barcelona, 2007; two bibliographic pages, and pages 1 to 20
- E6: "Hand Gesture Recognition with a novel IR Time-of-Flight Range Camera - A Pilot Study", P Breuer *et al.*; Proceedings of the 3rd International Conference on Computer Vision/Computer Graphics, Vol. 4418, 2007; pages 1 to 14
- E8: US 2011/0119025 A1
- E9: DE 10 2006 022501 A1
- E10: Extract from wikipedia, entry "Range imaging" (en.wikipedia.org/wiki/Range_imaging), retrieved from WayBackMachine (web.archive.org), 23 November 2010
- E11: "Single-Photon Image Sensors in CMOS: Picosecond Resolution for Three-Dimensional Imaging", C Niclass; Series in Microsystems, Vol. 25, 2008, Hartung-Gorre Verlag, Konstanz; 4 bibliographic pages, and pages i to viii and 1 to 7
- E12: WO 2010/130245 A1.

In its decision the opposition division held *inter alia* that

- the requirements of sufficiency of disclosure were complied with,
- the subject-matter of claim 1 as granted (main request) and of claim 1 of the first auxiliary request filed with the letter dated 21 December 2017 was new but did not involve an inventive step, and the subject-matter of claim 1 amended according to the second auxiliary request was new and involved an inventive step, and
- the subject-matter of independent claim 12 as granted (main request and first and second auxiliary requests) was new and involved an inventive step.

III. With the letter dated 21 December 2018 the patent proprietor filed claims according to auxiliary requests 3 to 8.

IV. With the letter dated 15 May 2019 the opponent filed the following document:

D6'': Certified English translation of document D6.

V. Oral proceedings were held on 17 August 2021.

The patent proprietor requested that

- the decision under appeal be set aside and the opposition be rejected (main request), or

- the decision under appeal be set aside and the patent be maintained in amended form on the basis of the claims of the first auxiliary request filed with the letter dated 21 December 2017, or

- the opponent's appeal be dismissed and the patent be maintained on the basis of the documents of the second auxiliary request underlying the decision under appeal, or

- the decision under appeal be set aside and the patent be maintained in amended form on the basis of the claims of one of the third to eighth auxiliary requests filed with the letter dated 21 December 2018.

The opponent requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

At the end of the oral proceedings the chairman announced the decision of the board.

VI. Claim 1 of the main request - with the feature labelling "[1.1]" to "[1.7]" used during the

proceedings being inserted therein by the board - reads as follows:

"[1.1] Coordinate measuring machine (1, 2) for determining at least one spatial coordinate of a measurement point of an object (15) to be measured, comprising:

- [1.2] a base (5),
- [1.3] a drive mechanism, adapted to drive a probe head (13) in a manner such that the probe head (13) is capable to move relative to the base (5) for approaching a measurement point,

- [1.4] a frame structure (7-11), to which the probe head (13) is attached, the frame structure (7-11) being movable in a horizontal (x, y) and a vertical (z) direction, and

- [1.5] a measuring volume representing a particular volume as to a design of the coordinate measuring machine (1, 2), in particular as to a provided mobility of the probe head (13), inside which the at least one spatial coordinate of the measurement point is determinable,

characterised by

- [1.6] a first range camera (3, 33) having a range image sensor with a sensor array, [1.7] wherein the range camera (3, 33) is adapted to be directed to the object for providing at least a first image as a range image of the object, and [1.8] wherein range pixels of the range image are used as image data for creating a point cloud with 3D-positions of target points of the object (15),

- [1.9] a controller, adapted to control the drive mechanism on the basis of 3D-positions of the target points."

Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the claim - with the feature labelling "[i]" used during the proceedings being inserted therein by the board - further reads as follows:

"[i], wherein the controller is adapted

- to set up a movement path of the probe head (13) on the basis of the image data and/or
- to control the movement path of the probe head (3) via the drive mechanism on the basis of the image data."

Claim 1 of the second auxiliary request - with the feature labelling "[ii]" to "[v]" used during the proceedings being inserted therein by the board - differs from claim 1 of the main request in that the term "and" at the end of feature [1.4] is replaced by the following formulation:

"[ii] the frame structure (7-11) comprising at least a first (7, 9) and a second frame member (8, 10) and a vertical rod (11), wherein the first and the second frame member (7-10) and the vertical rod (11) are arranged for being movable in at least two perpendicular directions (x, y, z) by at least two drive mechanisms, [iii] wherein the probe head (13) is attached to the vertical rod (11), and"

and in that the claim further reads as follows:

" [iv] wherein the first range camera

- is provided at the probe head (15) or in an area close to the probe head (13) at the vertical rod (11) and

- [v] adapted to be directed to the base (5) and to be moved synchronously with the probe head (13)."

Independent claim 12 of the second auxiliary request reads as follows:

"Coordinate measuring machine (1) for determining at least one spatial coordinate of a measurement point of an object (15) to be measured, comprising:

- a base (5), and
- a drive mechanism adapted to drive a probe head (13) in a manner such that the probe head (13) is capable to move relative to the base (5) for approaching a measurement point, characterised by
 - a first range camera (3, 33) having a range image sensor with a sensor array, wherein the range camera (3, 33) is adapted to be directed to a user (19) of the coordinate measuring machine (1) to take a sequence of user range images, and
 - a controller, adapted to control the drive mechanism on the basis of changes of a current user range image to one or more of preceding user range images."

The second auxiliary request also includes dependent claims 2 to 11 and 13 to 15 referring back to independent claims 1 and 12, respectively.

Reasons for the Decision

1. *Admissibility of the appeals*

- 1.1 The appeal filed by the opponent is admissible.

- 1.2 As regards the appeal filed by the patent proprietor, the opponent submitted that the arguments filed by the patent proprietor in their statement of grounds of appeal consisted of an almost literal repetition of some of the arguments already filed during the first-instance proceedings with the letter dated 14 December 2016, without actually dealing with the reasons given by the opposition division in its decision or with the pertinent passages of document D6. The opponent submitted by reference to decisions T 918/17, T 570/07 and J 10/11 that, for the mentioned reasons, the statement of grounds of appeal was not substantiated within the meaning of Article 108, third sentence, together with Rule 99(2) EPC, and that, consequently, the appeal of the patent proprietor was not admissible.
 - 1.2.1 The board notes, however, that
 - the statement of grounds of appeal filed by the patent proprietor contains a set of statements in the passage on page 2, paragraph 8, that - as acknowledged by the opponent - were not set forth in the mentioned letter filed during the first-instance proceedings;
 - the mentioned statements specifically relate to the opposition division's view that the feature of claim 1 as granted (main request) reading "a controller, adapted to control the drive mechanism on the basis of 3D-positions of the target points" was disclosed in paragraphs [0045] and [0046] of document D6, and in these statements the patent proprietor disputed the opposition division's view that the mentioned feature was disclosed as such in document D6 by emphasizing that the claimed feature specifically related to "3D-positions of the target points" [*emphasis by the patent proprietor*]; and

- the opposition division's finding of lack of inventive step of claim 1 of both the main and the first auxiliary request was based on document D6 as representing the closest state of the art and as disclosing the mentioned claimed feature.

In view of these considerations, in the board's view, the mentioned statements constitute arguments contesting in substance the reasons given by the opposition division in its decision in support of its view that the main and the first auxiliary requests were not allowable, and at least for this reason the statement of grounds of appeal of the patent proprietor is sufficiently substantiated.

1.2.2 As regards the decisions cited by the opponent, the board notes that

- decision T 918/17 (see point 2 of the reasons, together with point IV of section "Summary of Facts and Submissions", fifth paragraph) concerned a case in which the statement of grounds of appeal was, as regards the pertinent substantive issues, identical to the arguments already submitted during the first-instance proceedings;

- decision T 570/07 (see point 2.9, together with points 2.5 to 2.8, of the reasons) concerned a case in which the statement of grounds of appeal failed to address the actual reasons on which the examining division based the refusal of the application; and

- decision J 10/11 (point 2.3.2 of the reasons) concerned a case in which the statement of grounds of appeal failed to establish a clear causal relationship between the reasons given in the statement of grounds of appeal and the asserted invalidity of the findings of the decision under appeal.

Therefore, the circumstances underlying these three decisions were different from, and not comparable to, the circumstances of the present case, and none of the decisions support the opponent's submissions that the statement of grounds of appeal of the patent proprietor was not sufficiently substantiated.

1.2.3 For these reasons, the board does not find the opponent's arguments convincing. In addition, the board sees no reason to question the admissibility of the patent proprietor's appeal in any other respect (Article 108 EPC). Therefore, the appeal filed by the patent proprietor is admissible.

2. *Sufficiency of disclosure*

2.1 In its decision the opposition division held that the claimed invention, and in particular the features of the "range camera" of independent claims 1 and 12 as granted, were sufficiently disclosed. The opponent disputed some of the reasons given by the opposition division in this respect and submitted, in particular, that no discrepancy should exist between the level of skills of the skilled person assumed for the issue of sufficiency of disclosure and that assumed for the issue of inventive step.

2.1.1 The opponent, on the one hand, conceded that the skilled person would, on the basis of the disclosure of the patent specification, be in a position to select the appropriate range camera to implement the claimed coordinate measurement machines, but, on the other hand, the opponent objected that the skilled person would then have to take one of the range cameras disclosed in the technical field of range imaging, and in particular one of the cameras disclosed in documents

E1, E5, E6 and E12, because the patent specification did not contain any indication on how to implement in practice a range camera and with which specific sensor technology the range images could actually be obtained.

The board notes, however, that the skilled person in the field of coordinate measurement machines wishing to implement the claimed invention involving the use of a range camera would have recourse to the specific technical field of range imaging, and in particular - if needed, after consultation with the corresponding skilled person - the common general knowledge relating to range imaging (see, in particular, the extract from *en.wikipedia.org* shown in document E10), in order to implement the claimed invention, and would then select the appropriate range camera among the commonly available range cameras - irrespective of whether the specific range cameras disclosed in documents E1, E5, E6 and E12 fall or not within the range cameras commonly available in the technical field of range imaging. In addition, the claimed invention requires the use of a range camera which produces range images from the captured images and, for the purposes of sufficiency of disclosure, there is no need to provide the skilled person under consideration with specific technical details on how to implement a specific range camera or on how to produce range images.

2.1.2 The opponent also submitted that sufficiency of disclosure of the claimed invention would imply that the use of the range cameras of documents E1, E5, E6 and E12 in a coordinate measuring machine would - contrary to the opposition division's findings - not involve an inventive step, or that an inventive step in the use of the mentioned range cameras would imply

insufficiency of disclosure as regards the specific implementation of the mentioned range cameras.

The board, however, does not find this line of argument convincing. In particular, none of the independent claims require the use of the specific range cameras disclosed in the mentioned documents. In addition, the board concurs with the opponent that the same level of skill of the skilled person has to be applied when assessing sufficiency of disclosure and inventive step. However, the opponent's arguments are based on the identification of two different and non-equivalent issues, namely

- the issue relevant to inventive step and relating to the question of whether the skilled person working in the specific technical field of coordinate measurement machines would consider consulting the different technical field of range imaging when confronted with a problem in the technical field of coordinate measurement machines, and

- the issue relevant for sufficiency of disclosure and relating to the question of whether the skilled person working in the technical field of coordinate measurement machines and wishing to implement the claimed invention pertaining to that technical field and involving technical features pertaining to the technical field of range imaging would be in a position to implement the mentioned disclosure.

Therefore, while the answer to the first question depends on whether or not there is any indication or hint which would motivate, or suggest to, the skilled person considering consulting the technical field of range imaging for solving the problem to be solved, the answer to the second question depends on whether or not the skilled person would be in a position to implement

the claimed invention under consideration of the common general knowledge in both the technical field of coordinate measurement machines and in the technical field of range imaging.

2.2 In view of these considerations, the board sees no reason to depart from the opposition division's view that the invention is sufficiently disclosed within the meaning of Article 100(b) and 83 EPC.

3. *Main request - Claim 1 as granted - Novelty and inventive step*

3.1 Novelty - Document D6

3.1.1 In its decision the opposition division held that document D6 disclosed a coordinate measuring machine comprising features [1.1] to [1.5] and [1.9] of claim 1 as granted (*cf.* point VI above), and that the claimed coordinate measuring machine differed from that disclosed in document D6 in features [1.6] to [1.8].

The patent proprietor essentially submitted that document D6 did not disclose the use of a range camera (see part of feature [1.6]), the creation of a point cloud representing target points (see part of feature [1.8]), and the control of the coordinate measuring machine on the basis of 3D-positions of the point cloud (see feature [1.9]).

The opponent submitted that the machine disclosed in document D6 included a range camera as claimed.

3.1.2 The board notes the following:

i) The coordinate measuring machine of document D6 comprises two cameras capturing images of the object from different angles (D6', paragraph [0017]; see also the corresponding paragraph of D6''), the images then being processed in the form of three-dimensional image information of the object (D6', paragraph [0019]; see also the corresponding paragraph of D6''). There is, however, no disclosure in document D6 that these two cameras constitute a range camera as claimed. In particular, a range camera involves the production of a range image, i.e. of "2D image showing the distance to points in a scene from a specific point" (document E10, entry "Range imaging", first and second paragraphs), and although a stereoscopic imaging system of the type comprising two cameras capturing different viewing perspectives of an object can be used - in particular, by appropriately processing the stereoscopic images - to determine the distance of the points of a scene to a specific point (see document E10, page 1, entry "Range imaging", section "Stereo triangulation", first sentence: "A stereo camera system can be used for determining the depth of points [...] "*emphasis added by the board*"); see also document E11, section 1.1 on pages 2 to 6, and Fig. 1.1), such a system does - contrary to the opponent's submissions - not necessarily involve the measurement or the determination of the distance of the points of the scene being imaged to a specific point, and there is no indication in document D6 that the stereoscopic system and/or the processing of the corresponding images involve such a measurement or determination of distances - let alone that the cameras comprise a range image sensor with a sensor array as claimed.

In addition, document D6 discloses the replacement of the two cameras by an optical range or distance measurement sensor (see D6', paragraph [0061], and the corresponding paragraph of D6'''), but this sensor can be implemented in different ways - not all requiring an image sensor and/or a sensor array -, and - contrary to the opponent's submissions - there is no direct and unambiguous disclosure in document D6 of the provision of the range sensor in the specific form of a range image sensor with a sensor array as claimed.

ii) The two cameras of document D6 are arranged to capture images of the object, and therefore they are "adapted to be directed to the object for providing at least a first image" of the object as required by feature [1.7] of claim 1.

iii) The two cameras of document D6 are electronic cameras (D6', paragraph [0017]; see also the corresponding paragraph of D6''') each capturing an electronic image of the object, and the electronic images, and therefore the pixels of the images, are used as image data for creating a "rough" or approximate three-dimensional shape of the object (D6', paragraph [0018]; see also the corresponding paragraph of D6'''). Therefore, the two cameras "are used as image data for creating a point cloud with 3D-positions of target points of the object" as required in part by feature [1.8] of claim 1. It is also noted in this respect that the mentioned rough three-dimensional shape of the object created by processing the data of the two captured images is constituted by image "feature points" of the object connected by line segments (D6', paragraphs [0018] and [0019]; see also the corresponding paragraphs of D6'''), so that the resulting processed three-dimensional shape image of

the object falls - contrary to the submissions of the patent proprietor - within the generic meaning of "a point cloud with 3D-positions of target points of the object", these "target points of the object" corresponding to the "feature points" of the object disclosed in document D6.

iv) In document D6 a controller controls the corresponding drive mechanism (i.e. the path or route setting unit 22) of the coordinate measuring machine according to measuring point positions (see D6', paragraphs [0045] and [0046]; see also the corresponding paragraph of D6'') that have been corrected on the basis of correction information based on the rough three-dimensional shape of the object comprising the mentioned image "feature points" of the object, and therefore the controller is - contrary to the patent proprietor's submissions - "adapted to control the drive mechanism on the basis of 3D-positions of the target points" constituted by the mentioned image feature points. Consequently, feature [1.9] of claim 1 is - contrary to the submissions of the patent proprietor - also disclosed in document D6. It is also noted that feature [1.9] leaves open how the controller operates "on the basis of 3D-positions of the target points", and claim 1 does not exclude - and the description of the patent specification appears to describe, see paragraphs [0031] and [0033]- the comparison with a model design of the object; more particularly, claim 1 does not exclude that the drive mechanism is specifically controlled as disclosed in document D6, i.e. on the basis of the mentioned measuring point positions after their correction involving a comparison of the rough three-dimensional shape of the object and an object design (see D6', paragraphs [0045] and [0046], together with paragraphs

[0010] and [0018]; see also the corresponding paragraph of D6').

v) It is finally noted that in the assessment above the "measurement point" of the object and the point-cloud "target points" of the object defined in claim 1 have respectively been brought into correspondence with any one of the "measurement point positions" of the object (D6', paragraph [0045]; see also the corresponding paragraph of D6') and the "feature points" of the rough shape of the object (D6', paragraph [0019]; see also the corresponding paragraph of D6') disclosed in document D6, and that there is no support in claim 1 for specifically identifying the claimed "target points" with the actual measurement points - let alone as constituting "the measurement point" referred to in claim 1. This is confirmed by the description of the patent (see Fig. 3, together with column 9, lines 7 to 12 of the description) in which the "target points" correspond to points of interest of the object for creating the corresponding point cloud - as it is also the case with the "feature points" of document D6 (see D6', paragraph [0020]; see also the corresponding paragraph of D6').

- 3.1.3 Therefore, in the board's opinion the machine defined in claim 1 as granted differs from that disclosed in document D6 in that the point cloud with 3D-positions of target points of the object is not created by means of the two cameras or by means of the optical range sensor of document D6, but by means of a range camera having a range image sensor with a sensor array, the image of the object being a range image and the pixels of the image being range pixels.

- 3.1.4 In view of the considerations above, the board concludes that the subject-matter of claim 1 of the main request is new over the disclosure of document D6 (Article 100(a) together with Articles 52(1) and 54(1) EPC).
- 3.2 Inventive step - Document D6 as closest state of the art
- 3.2.1 In the decision under appeal the opposition division held that the objective problem solved by the coordinate measuring machine of claim 1 over the corresponding machine disclosed in document D6 was to be seen in finding a faster and more compact alternative to the two cameras of document D6, and that, under consideration of the disclosure of document D6 relating to the alternative use of an optical distance measurement sensor (D6', paragraph [0061]; see also the corresponding paragraph of D6''), the claimed machine was obvious in view of the disclosure of any of documents E1 and E4 relating to the use of time-of-flight (ToF) cameras.
- 3.2.2 In the board's opinion, this line of argument is still applicable when considering that the distinguishing features of the claimed machine over the machine of document D6 are specifically those mentioned in point 3.1.3 above, and the counter-arguments submitted by the patent proprietor are not found persuasive by the board. The board notes, in particular, the following:
- The patent proprietor's argument that the skilled person working in the technical field of coordinate measuring machines would not consider documents E1 and E4 pertaining to the technical field of optoelectronic distance measurement is not convincing because, as submitted by the opponent, the formulated objective

problem, together with the disclosure of document D6 relating to the alternative use of an optical distance measurement sensor, would suggest to the skilled person considering finding a solution to the objective problem in the field of optoelectronic distance measurement to which documents E1 and E4 belong.

- The arguments of the patent proprietor are essentially based on a formulation of the objective problem (a faster and more precise determination of the object to be measured) and on an assessment of the question of whether the mentioned combination of documents would result in the claimed machine. These arguments presuppose that neither the claimed feature "for creating a point cloud with 3D-positions of target points of the object" nor the claimed feature "a controller, adapted to control the drive mechanism on the basis of 3D-positions of the target points" are disclosed in document D6. However, as noted in point 3.1 above (see in particular point 3.1.2, paragraphs iii) and iv)), these two claimed features are disclosed in document D6, and for these reasons the mentioned arguments are not convincing.

3.2.3 In view of these considerations, the board is of the opinion that the subject-matter of claim 1 of the main request does not involve an inventive step over document D6 in combination with any of documents E1 and E4 (Article 100(a), together with Article 56 EPC).

4. *First auxiliary request - Claim 1 - Novelty and inventive step*

4.1 When compared with claim 1 of the main request, claim 1 of the first auxiliary request further requires that the controller is adapted as specified in the last two sub-paragraphs of claim 1, i.e. in feature [i] (*cf.*

point VI above). In its decision the opposition division held that this additional feature [i] was also disclosed in document D6 and that the subject-matter of the claim did not involve an inventive step for the same reasons as those given in respect of the subject-matter of claim 1 of the main request.

The patent proprietor did not contest that feature [i] of claim 1 of the first auxiliary request was also disclosed in document D16 and submitted that, in view of the arguments given in respect of claim 1 as granted, the subject-matter of claim 1 of the first auxiliary request also involved an inventive step.

However, the mentioned arguments relating to claim 1 as granted are not convincing (see points 3.1 and 3.2 above).

4.2 In view of these considerations, the board is of the opinion that the subject-matter of claim 1 of the first auxiliary request is new, but that it does not involve an inventive step (Article 56 EPC) for the same reasons as those given in points 3.1 and 3.2 above in respect of claim 1 of the main request.

5. *Second auxiliary request - Claim 1 - Novelty and inventive step*

5.1 Claim 1 of the second auxiliary request differs from claim 1 of the main request in the further features labelled [ii] to [v] (*cf.* point VI above). In its decision the opposition division held that features [ii] and [iii] were already disclosed in document D6, and that features [iv] and [v] were not disclosed in document D6.

None of the parties have disputed the opposition division's finding in this respect. Therefore, the board concludes that the subject-matter of claim 1 of the second auxiliary request differs from document D6 in the features mentioned in point 3.1.3 above and in features [iv] and [v].

In addition, it was undisputed that the subject-matter of claim 1 is new over the remaining documents considered during the proceedings.

The board concludes that the subject-matter of claim 1 of the second auxiliary request is new (Articles 52(1) and 54(1) EPC).

- 5.2 In its decision the opposition division held that the subject-matter of claim 1 of the second auxiliary request, in view in particular of features [iv] and [v], was not obvious, in particular over document D6 as closest state of the art, together with document E1. The opponent submitted that the two mentioned features were obvious in view of the combination of document D6 with the disclosure of document E1.
- 5.2.1 While according to the opposition division the problem solved by features [iv] and [v] was to be seen in improving the imaging of the object by the range camera, according to the opponent's written submissions the problem solved by the mentioned features was to be seen in finding the most favourable location for the range camera. During the oral proceedings the opponent submitted in this respect that the invention was directed to the avoidance of impacts or collisions of the probe head with the object to be measured (paragraphs [0015] and [0022] of the patent specification) and that this technical effect of the

claimed position of the range camera was to be taken into account when considering the technical problem solved by features [iv] and [v].

The patent proprietor submitted during the oral proceedings that features [iv] and [v] were to be read together with the remaining distinguishing features of claim 1 relating to the range camera (point 3.1.3 above), that the whole of these distinguishing features involved two modification steps of the machine of document D6 interacting with each other, namely the replacement of the stationary stereo cameras located at both sides of the machine by a range camera and then the positioning of the camera in a mobile part of the machine, and that the objective problem solved by all these distinguishing features was the same as that formulated in respect of claim 1 of the main request and was more particularly to be seen in the implementation of the measurement of the object according to the alternative mentioned in document D6 involving the use of an optical range sensor (see point 3.2.1 above).

The board adheres to the formulation of the objective problem proposed by the patent proprietor because the distinguishing features of claim 1 over document D6 identified in point 3.1.3 above and relating to the use of a range camera and the additional distinguishing features [iv] and [v] relating to the position of the range camera cannot be dissociated from each other to the extent of considering features [iv] and [v] as solving - contrary to the opponent's submissions - a problem different from, or independent of, the problem solved by the distinguishing features referred to in point 3.1.3 above.

5.2.2 As already concluded in point 3.2 above, the features mentioned in point 3.1.3 are obvious in view of documents E1 and E4.

As regards the opponent's submissions that features [iv] and [v] were also obvious in view of the teaching of document E1 relating to the advantages associated with the use of ToF range cameras such as compactness and portability, easing movement (page 9, left column, lines 1 to 8), the board first notes that the closest state of the art is constituted by the alternative embodiment disclosed in document D6 relating to the replacement of the two cameras by an optical distance measurement sensor, that there is no disclosure in document D6 that the two cameras might be positioned in a mobile part and the document is silent as to the position of the optical distance measurement sensor after replacement of the two cameras by the sensor, and that, when implementing the mentioned alternative embodiment, the skilled person would consider the possible influence of the position of the sensor on the imaging characteristics of the same and also its influence on other factors (accessibility, mechanical stability, etc.).

In addition, there are potentially multiple possible locations for the range camera including both fixed and movable positions (for instance, the claimed position, a location at any of the movable parts of the frame structure of Fig. 1 of document D6 other than the vertical rod 13, any fixed position above the object or laterally displaced with respect to the object, and close to or far from the object, a freely variable lateral position around the object to improve the imaging perspective of the same, a position at an additional movable frame the movement of which is

controlled according to the position of the probe head, etc.), and the different possible locations may present their own advantages and disadvantages in respect of the imaging characteristics (for instance, moving parts of the machine being interposed between the camera and the object), the amount of image processing data (for instance, depending on whether the position of the camera is fixed or variable with respect to the object), accessibility, mechanical stability (for instance, vibrations when the sensor or camera is located at a moving part), etc.

In this context, there is no suggestion in document D6, or in document E1, or in the combination of documents D6 and E1 that would induce the skilled person to specifically consider among all the possible locations (none of them specified in any of the mentioned documents) the location required by features [iv] and [v] of claim 1. In particular, and contrary to the opponent's submissions, none of the advantages of the use of a ToF range camera specified in document E1 such as compactness, portability and ease of movement specifically point to the claimed location - let alone to this location as the sole possible or as the straightforward position -, among other reasons because considerations of compactness and/or portability and/or ease of movement also point to different ones of the locations mentioned above. The further submissions of the opponent that the claimed positioning of the range camera was most appropriate or effective in avoiding impacts of the probe head with the object to be measured and therefore obvious cannot be followed because, as submitted by the patent proprietor, document D6 acknowledges this problem (D6', paragraph [0006]) and already solves the problem with two cameras located on the sides of the machine without them being

provided at a mobile component of the machine, let alone fixed to the vertical rod of the machine (rod 13 in Fig. 1 of document D6).

5.2.3 In view of these considerations, the board is of the opinion that the subject-matter of claim 1 of the second auxiliary request is not obvious in view of documents D6 and E1.

5.2.4 In view of these considerations, the board sees no reason to depart from the opposition division's view that the subject-matter of claim 1 of the second auxiliary request involves an inventive step (Article 56 EPC).

6. *Second auxiliary request - Independent claim 12 - Novelty and inventive step*

The opponent contested the view of the opposition division that the subject-matter of independent claim 12 as granted was new over document E8 and involved an inventive step over each of documents E8, E9 and E3 as closest state of the art.

6.1 Novelty - Document E8

6.1.1 It is undisputed that document E8 discloses a coordinate measuring machine comprising all the features of the preamble of independent claim 12 (E8, Fig. 2 and the corresponding description, in particular paragraphs [0003] and [0004]). In addition, the machine of document E8 comprises a controller adapted to control the drive mechanism of the machine (see abstract and paragraph [0054]).

Document E8 further discloses a manipulable aid 20 comprising a probe 23 (Fig. 2 and 5) allowing a user to configure a measurement path (abstract). The manipulable aid comprises a reflective portion 21 operating in association with a LIDAR system 30 (Fig. 3) having a laser emitter 22 and a receiver 24 (Fig. 2) arranged to detect the location of the manipulable aid, and thus the position of the probe 23 with respect to the measurement volume of the measurement machine (paragraphs [0028] and [0029]). The information relating to the position of the probe 23 is then processed to create a measurement path routine (paragraphs [0026], [0030] and [0048]).

6.1.2 The board, in addition, notes the following:

A) The LIDAR system of document E8 comprises a receiver 24 and is based on the time-of-flight principle (paragraph [0029]), so that the receiver constitutes a range sensor, but there is no disclosure in document E8 that the LIDAR system is constituted by a range camera of the type required by independent claim 12, i.e. a camera having a range image sensor with a sensor array and adapted to take a sequence of range images. In addition, the document also discloses variants involving the use of one or more cameras and a laser range finder (paragraph [0041]), but - contrary to the opponent's submissions - there is no direct and unambiguous disclosure that any of these variants involve the use of a range camera having a range image sensor with a sensor array.

B) The controller of the machine of document E8 is adapted to control the drive mechanism of the machine on the basis of the measurement path determined by processing the probe position information obtained by

the LIDAR system, and there is no disclosure of controlling the drive mechanism on the basis of changes of a current user range image to one or more of preceding user ranges as required by the independent claim 12. In particular:

- There is no disclosure of range images in document E8.

- The LIDAR system of document E8 is specifically arranged to detect the reflective portion 21 of the manipulable aid and there is no disclosure in document E8 of a detection of the user and, in the event that the hand of the user is accidentally detected when detecting the manipulable aid, there is no disclosure in document E8 relating to the control of the drive mechanism on the basis of information relating to the detection of the user itself - let alone on the basis of user range images.

- There is no disclosure in document E8 of a control of the driving mechanism on the basis of changes in range measurements. In particular, the processing of the measurement path - and therefore the control of the drive mechanism - in document E8 is based on only each individual one of the instantaneous positions of the manipulable aid (paragraph [0029], lines 11 to 16) which are determined by the LIDAR system, and not on a comparison or on a relative relationship between predetermined ones of the mentioned instantaneous positions - or, as held by the opposition division, on a dynamic process in which one image is related to the previous one(s) in order to determine movement - as implied by the claimed feature "on the basis of changes of current user range image to one or more of preceding user range images". It is also noted in this respect that the claimed "changes" represent, and therefore constitute, an analysis of the dynamic movement of the user and that, although two

different instantaneous positions of the manipulable aid of document E8 detected by the LIDAR would - as submitted by the opponent - involve a change between two user's gestures, there is no disclosure in document E8 of the determination or evaluation of such a change, and the claimed feature excludes - contrary to the opponent's submissions - the control of the drive mechanism on only the basis of each of a plurality of instantaneous positions of the manipulable aid or of the corresponding positioning of the user's hand. In addition, paragraph [0118] of the patent specification referred to by the opponent is followed by paragraph [0119] which further supports the control under consideration on the basis of the changes of the range images as claimed.

The opponent also referred to the alternative manipulable aids disclosed in document E8 and comprising a touch probe associated to one or more cameras and a laser range finder (paragraph [0041]) or a pen-like object [paragraph [0042)]. However, as regards the control of the drive mechanism of the coordinate measuring machine is concerned, none of these variants go beyond the use of the manipulable aid 20 and the LIDAR system referred to above.

- 6.1.3 In view of these considerations, the board concludes that the subject-matter of independent claim 12 is new over the disclosure of document E8.
- 6.2 Inventive step - Document E8 as closest state of the art
 - 6.2.1 In its decision the opposition division held that the skilled person would consider replacing the unsafe laser-based range LIDAR system of document E8 by an

eye-safe range camera such as that disclosed in documents E1 (page 8, right column, lines 18 to 20) and E5 (page 1, fifth paragraph, last sentence), i.e. a range camera as defined in distinguishing feature A) identified in point 5.1 above, but that this replacement would not result in distinguishing feature B) referred to in point 6.1.2 above.

6.2.2 The opponent submitted that the objective problem was to find an alternative way of providing information to the controller of the drive mechanism of document E8, that document E5 disclosed the use of ToF cameras in the context of man-machine interfaces (page 1, first paragraph), that the pertinent skilled person was a mechanical engineer familiar with the field of optical sensors (see document D6) and would see in document E5 not only the use of a ToF camera as an alternative to the use of the LIDAR detection system of document E8, but also, in view of the information in document E5 relating to the use of ToF cameras in the gesture-control of machines as a new technology, a new application of the use of ToF cameras in man-machine interfaces and therefore in the machine of document E8. The application of the teaching of document E5 to document E8 would therefore result in feature B) of independent claim 12.

However, as submitted by the patent proprietor, the control of the drive mechanism in document E8 is based on the measurement with the LIDAR system of a series of points selected by the user with the manipulable aid for the purpose of processing the corresponding data and determining a measurement path routine for the probe (paragraph [0030]). The skilled person working in this field and confronted with the objective problem formulated by the opponent would look for an

alternative to the way the series of selected points are measured in document E8 and would consider, as held by the opposition division in its decision, the replacement of the LIDAR system by a ToF camera as that disclosed in document E5 in view of the advantages associated with the use of ToF cameras (E5, page 1, fifth paragraph, last sentence), without however - as submitted by the patent proprietor - going beyond the measurement principle on which document E8 is based, i.e. on the measurement of the mentioned series of selected points. As mentioned by the opponent, document E5 also discloses the use of such cameras in man-machine interfaces (page 1, first paragraph, last sentence) and, more particularly, performing people tracking (page 8, section 2.3, third paragraph). The corresponding teaching is, however, general and does not specifically point to the replacement of a manipulable aid by gesture detection, let alone - as submitted by the patent proprietor - to the replacement of the detection of a manipulable aid configured to be used for the selection of points by the analysis of human gesture changes. In addition, the person skilled in the field of coordinate measuring machines is, as submitted by the opponent, familiar with the field of optical sensors in the sense that he would consult this field when searching for optical sensors to solve a particular problem relating to the sensors, but not in the sense that he would also be a skilled person in the field of optical sensors or that he would consult this field to the extent of also considering new developments in the application of optical sensors and their possible applications in the specific field of coordinate measuring machines. The board also notes that the field of optical sensors constitutes a technical field related to the field of coordinate measuring machines in the aforementioned sense, but -

as submitted by the patent proprietor and contrary to the opponent's view - not a neighbouring field within the meaning of the case law (see "Case Law of the Boards of Appeal", EPO, 9th edition 2019, section I.D. 8.2).

For these reasons, the subject-matter of independent claim 12 does not result in an obvious way from document E8 under consideration of document E5.

6.2.3 The opponent also disputed the opposition division's finding that the application of the teaching of document E1 to document E8 did not result in feature B) because this feature only related to changes between two range images of the user and it did not require a dynamic analysis of the movement of the user.

However, in the board's view the opponent's arguments are not persuasive for the following reasons:

The control of the drive mechanism in document E8 is based on the position of the probe of the manipulable aid determined by detecting the location of the reflective portion 21 of the aid and therefore the location of the aid itself, and, assuming that the skilled person would consider the replacement of the LIDAR system of document E8 by a range camera such as that disclosed in document E1, the skilled person would then arrange the range camera to detect the reflective portion of the aid or - if considered superfluous after the mentioned replacement - the aid itself. In addition, when using the mentioned range camera, the camera might, at least to a predetermined extent, accidentally capture the hand of the user operating the manipulable aid. However, the skilled person would consider any influence of an accidental imaging of the

hand of the user on the determination of the position of the manipulable aid and of the probe - and therefore on the subsequent processing of the measurement path - as spurious information that should be ignored in the imaging information of the manipulable aid because, first, an identical position of the manipulable aid and of the probe can be obtained with different spatial arrangements of the user's hand and document D8 specifically requires the detection of the position of the manipulable aid and of the probe, and, second, any consideration of imaging information relating to the user's hand would be at variance with the disclosure of document E8.

In any case, the control of the drive mechanism in document E8 is based on only each individual one of the instantaneous positions of the manipulable aid determined with the LIDAR system - or, after its replacement, with the range camera -, and there is no reason why the skilled person would consider controlling the drive mechanism on the basis of a comparison, or on the relative relationship, between predetermined ones of the mentioned instantaneous positions - or, as held by the opposition division, on a dynamic process in which one image is related to the previous one(s) in order to determine movement - as implied by the claimed feature "on the basis of changes of current user range image to one or more of preceding user range images" (see in this respect the comments in point 6.1.2 above, paragraph B)).

Therefore, in the board's view the subject-matter of independent claim 12 does not result in an obvious way from document E8 as closest state of the art and document E1.

6.3 Inventive step - Document E9 as closest state of the art

6.3.1 It is undisputed that

- document E9 discloses a coordinate measuring machine comprising all the features of the preamble of independent claim 12 (E9, Fig. 1 and the corresponding description), the machine being controlled by a controller connected to a control console including a manually operable joystick (paragraph [0059] and 34 in Fig. 1), and that

- the claimed machine differs from the machine of document E9 in the features of the characterizing part of independent claim 12, whereby the controller operates on the basis of the images taken by a range camera directed to the user as claimed.

The objective problem solved by these features is to be seen - as held by the opposition division in its decision - in the provision of an alternative to the joystick of document E9 or - as submitted by the opponent during the oral proceedings before the board - of an alternative to the interface used in document E9 for controlling the operation of the coordinate measuring machine.

The opponent submitted that the mentioned distinguishing features were rendered obvious by any of documents E5, E6 and E12.

6.3.2 Document E5 pertains to the technical field of ToF cameras (title) and discloses the use of the cameras in man-machine interfaces for face, hand and body gesture tracking (page 1, first and fifth paragraphs; page 8, section 2.3, third paragraph; and page 10, section "Hand tracking" and "Body gesture").

Document E6 cited in document E5 (see reference "[6]" on page 10 of E5, section "Hand tracking", second paragraph) also pertains to the technical field of ToF cameras (see title) and discloses the use of the cameras in hand-gesture recognition and tracking (sections 3.1 and 5.2).

Document E12 pertains to the technical field of computer-assisted recognition and tracking of the pose of the human body and/or of human gestures (title, page 1, first and second paragraphs, and page 15, last paragraph) and discloses a method (abstract and claim 1) involving the use of ToF cameras for capturing images of the body (page 4, lines 1 to 3, and page 7, first and second paragraphs) and the application of the method in the control of medical and industrial systems (claim 11, and page 16, lines 9 to 13).

As noted by the opposition division in its decision, however, documents E5, E6 and E12 are general as to the technical fields of application of the corresponding disclosure and the documents are, in particular, silent as to any application in the specific field of coordinate measuring machines. In addition, there is no indication in document E9 nor in the objective problem that would suggest to the skilled person consulting the technical field(s) to which documents E5, E6 and E12 pertain for the purpose of solving the objective problem.

During the oral proceedings the opponent submitted that document E5 in particular, but also documents E6 and E12, already involved the use of a ToF camera and pertained to a neighbouring field to that of document E9, and that the skilled person would consider the

corresponding disclosures when confronted with the objective problem. However, the field of coordinate measuring machines and the technical field(s) to which documents E5, E6 and E12 pertain are not neighbouring technical fields (see point 6.2.2 above, second paragraph) and document E9 is - contrary to document D6, see point 3.1.2 above, paragraph i), second last sentence, and point 3.2.1 - silent as to the use of range or optical distance measurement sensors, and the board is unable to see a reason why the skilled person would consider the field(s) to which documents E5, E6 and E12 pertain when starting from document E9 as closest state of the art and being confronted with the objective problem formulated above. In particular, the mere fact that the skilled person is familiar with the field of optical sensors in the sense mentioned in point 6.2.2 above, second paragraph, does not justify, in the absence of any appropriate hint in document E9 and/or in the objective problem, the assumption that the skilled person would explore the field of optical sensors - let alone the possible developments of applications of optical sensors - in search of a solution to a problem of a specific coordinate measuring machine devoid of such sensors.

6.3.3 Therefore, the subject-matter of independent claim 12 does not result in an obvious way from document E9 as closest state of the art and any of documents E5, E6 and E12.

6.4 Inventive step - Document E3 as closest state of the art

6.4.1 It is undisputed that document E3 discloses a coordinate measuring machine comprising all the features of the preamble of independent claim 12 (E3,

Fig. 6, together with the paragraph bridging pages 24 and 25). In addition,

- the machine of document E3 comprises one or more cameras adapted to be directed to a user of the machine - in particular, to its hands - and to capture a sequence of user images for the purpose of tracking and detecting gestures (Fig. 1 and 4, together with page 7, third paragraph, lines 1 to 7; page 18, penultimate paragraph; page 10, third and fourth paragraphs; and page 22, last paragraph), the detected gestures then being used to select and display on a screen predetermined ones of the results of the measurements previously carried out by the machine on the object being inspected (abstract and claim 1, together with page 3, last paragraph, to page 5, second paragraph), and

- it is implicit in document E3 that the machine also comprises a controller adapted to control the drive mechanism of the machine.

Contrary to the opponent's submissions, there is no direct and unambiguous disclosure in document E3 of a camera of the range camera type. In particular, the arrangement disclosed in document E3 involving the use of more than one camera directed towards the user at different viewing angles (see Fig. 4, and page 10, penultimate paragraph) supports the opponent's submission that the arrangement operates as a stereoscopic imaging system. However, neither the use of a stereoscopic imaging system *per se* (see point 3.1.2 above, paragraph i)), nor the determination of user's gestures by means of such a system necessarily involves the measurement or determination of distances or the use of range imaging systems, let alone of a range camera.

Therefore, the claimed machine differs from that disclosed in document E3 in that

a) the camera is a range camera having a range image sensor with a sensor array, the resulting sequence of images of the user being a sequence of user range images, and

b) the controller adapted to control the drive mechanism controls the drive mechanism on the basis of changes of a current user range image to one or more of preceding user range images.

6.4.2 According to the opponent, the technical effect of the claimed machine - and in particular of distinguishing feature b) identified above - over the machine of document D3 was that the contactless control was not only applied to the selection of results of the measurements previously carried out by the machine, but also to the measurement process itself, and the claimed machine solved the objective problem of rendering the control of the machine for the measurement operation as convenient as it was for the subsequent selection of measurements.

The objective problem formulated by the opponent, however, already contains pointers to the solution, i.e. applying the gesture-controlled capability characteristics of the display system of document E3 to the measurement system disclosed in the document. In addition, as noted by the opposition division in respect of a similar objective problem formulated by the opponent during the first-instance proceedings (see reasons for the decision, points 13.4.3.4 and 13.4.3.5), the skilled person in this technical field would not consider this problem. More particularly, there is no basis in document E3 - and neither in the common general knowledge in the technical field of

coordinate measurement machines - that would motivate or suggest to the skilled person in this field to contemplate rendering the machine of document E3 more convenient in the sense considered by the opponent. The opponent's submissions in this respect are not persuasive because the objective problem solved by the claimed invention is to be formulated as submitted by the patent proprietor on the basis of the technical effects and according to objective criteria, without however containing pointers to the claimed solution.

- 6.4.3 The board notes that document E3 is silent as to how a user may command the controller adapted to control the drive mechanism of the measuring machine, and in the board's opinion features a) and b) solve the objective problem of providing means enabling a user to command the controller of the drive mechanism.

The skilled person facing the objective problem mentioned above would consider the provision of different means known in this field (see, for instance, the control console including a manually operable joystick disclosed in document E9, Fig. 1, together with paragraph [0059]) for commanding the controller of the drive mechanism, and none of the documents considered by the opponent - i.e. documents E5, E6 and E12 - render the claimed solution obvious, essentially for the reasons given by the opposition division in its decision (reasons, point 13.4.3.5, second paragraph) and for considerations similar to those already noted in point 6.3.2 above. The further argument of the opponent that the claimed solution was already obvious on the basis of document E3 alone is based on hindsight for reasons analogous to those given in point 6.4.2

above, second paragraph, in respect of the opponent's formulation of the objective problem.

6.4.4 Therefore, in the board's opinion the subject-matter of independent claim 12 does not result in an obvious way from document E3 as closest state of the art in combination with any of documents E5, E6 and E12.

6.4.5 For these reasons, the subject-matter of independent claim 12 is new and involves an inventive step over the documents considered by the opponent (Article 100(a), together with Articles 54(1) and 56 EPC).

7. The board concludes that, as held by the opposition division in its decision, the main and the first auxiliary requests are not allowable, and the second auxiliary request is allowable.

Order

For these reasons it is decided that:

The appeals of the patent proprietor and the opponent are dismissed.

The Registrar:

The Chairman:



L. Gabor

R. Bekkering

Decision electronically authenticated