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SEARCH REPORT

Application Number

LH 38
LT 2023546

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	ULCINAS A ET AL: "Rotational scanning atomic force microscopy", NANOTECHNOLOGY, INSTITUTE OF PHYSICS PUBLISHING, BRISTOL, GB, vol. 28, no. 10, 3 February 2017 (2017-02-03), XP020314346, ISSN: 0957-4484, DOI: 10.1088/1361-6528/AA5AF7 [retrieved on 2017-02-03]	5-7	INV. G01Q10/02 G01Q10/04 G01Q10/06
A	* figures 1,2 * * paragraph [0003] *	1-4	

X,D	CUI YUGUO ET AL: "An AFM system with multi-mode scanning for large-area measurement", 5TH INTERNATIONAL SYMPOSIUM ON ADVANCED OPTICAL MANUFACTURING AND TESTING TECHNOLOGIES: DESIGN, MANUFACTURING, AND TESTING OF MICRO- AND NANO-OPTICAL DEVICES AND SYSTEMS, vol. 7657, 13 May 2010 (2010-05-13), pages 7657N-1, XP093176350, DOI: 10.1117/12.865476	5-7	TECHNICAL FIELDS SEARCHED (IPC) G01Q
A	* figures 1, 2b, 2c * * paragraph [0002] * * paragraph [03.2] * * paragraph [03.3] * * paragraph [04.2] * * paragraph [04.3] *	1-4	

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The present search report has been drawn up for all claims

Date of completion of the search	Examiner
Berlin	19 June 2024	Polesello, Paolo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

2

EPO FORM 1503 11.08 (P04C80)

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A,D	GAO ET AL: "Surface profile measurement of a sinusoidal grid using an atomic force microscope on a diamond turning machine", PRECISION ENGINEERING, ELSEVIER, AMSTERDAM, NL, vol. 31, no. 3, 15 May 2007 (2007-05-15), pages 304-309, XP022079586, ISSN: 0141-6359, DOI: 10.1016/J.PRECISIONENG.2007.01.003 * figures 1,3,4 * * paragraph [0002] - paragraph [0003] * -----	1-7	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Date of completion of the search	Examiner
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2

EPO FORM 1503 11.08 (P04C80)

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WRITTEN OPINION

File No.	Filing date *(day/month/year)*	Priority date *(day/month/year)*	Application No.
LH38	11.12.2023		LT2023546

International Patent Classification (IPC)
INV. G01Q10/02 G01Q10/04 G01Q10/06

Applicant
Fizini ir technologijos moksl centras, et al

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of the opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

	Examiner
	Polesello, Paolo

Application number

WRITTEN OPINION

LT2023546

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the application as filed.

   b. ☐ furnished subsequent to the filing date for the purposes of search,

      ☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the application as filed.

3. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the application, this opinion has been established to the extent that a meaningful opinion could be formed without a WIPO Standard ST.26 compliant sequence listing.

4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-4, 7
	No:	Claims	5, 6
Inventive step (IS)	Yes:	Claims	1-4
	No:	Claims	5-7
Industrial applicability (IA)	Yes:	Claims	1-7
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 ULCINAS A ET AL: "Rotational scanning atomic force microscopy", NANOTECHNOLOGY, INSTITUTE OF PHYSICS PUBLISHING, BRISTOL, GB,
vol. 28, no. 10, 3 February 2017 (2017-02-03), XP020314346,
ISSN: 0957-4484, DOI: 10.1088/1361-6528/AA5AF7
[retrieved on 2017-02-03]

D2 CUI YUGUO ET AL: "An AFM system with multi-mode scanning for large-area measurement",
5TH INTERNATIONAL SYMPOSIUM ON ADVANCED OPTICAL MANUFACTURING AND TESTING TECHNOLOGIES: DESIGN, MANUFACTURING, AND TESTING OF MICRO- AND NANO-OPTICAL DEVICES AND SYSTEMS,
vol. 7657, 13 May 2010 (2010-05-13), pages 7657N-1, XP093176350,
DOI: 10.1117/12.865476

D3 GAO ET AL: "Surface profile measurement of a sinusoidal grid using an atomic force microscope on a diamond turning machine", PRECISION ENGINEERING, ELSEVIER, AMSTERDAM, NL,
vol. 31, no. 3, 15 May 2007 (2007-05-15), pages 304-309, XP022079586,
ISSN: 0141-6359, DOI: 10.1016/J.PRECISIONENG.2007.01.003

2 The present application does not meet the criteria of patentability, because the subject-matter of claims 5 and 6 is not new and the subject-matter of claim 7 does not involve an inventive step.

2.1 D1 discloses (cf. figure 2 and corresponding text, the references en parentheses relating to this document):

Scanning probe microscope for use (in the sense of "suitable for use") in method according to any previous claims, the scanning probe microscope comprising
- a probe (AFM probe in figure 2) sensitive to surface property of a sample (Sample in figure 2);

- a probe support (AFM head);
- a probe detection sensor for detection of said probe signal corresponding to said surface property (in the AFM head, cf. paragraph 3. "Experimental setup": "The AFM head signal corresponding to the probe's vertical displacement");
- a spindle (rotating part of the BLDC motor in figure 2) for rotating the sample with respect to said probe at an angular velocity (cf. paragraph 3.: "The motor is controlled by electronic drivers capable of achieving rotation speeds from 0.5 to 100 revolutions per second.");
- a rotation tracking sensor for determination of the angular position of the sample with respect to said probe (cf. paragraph 3.: "The rotation tracking signal is produced by simple home-built electronics which generate a high-to-low pulse once per every rotation.");
- a nanoscanner (XYZ piezostage, cf. paragraph 3: "3D closed-loop nanopositioning stage") and a microscanner (Manual XY stage, cf. paragraph 3: "manual micrometre translation stage") for linear translation of said probe with respect to the sample in the direction substantially parallel to the sample plane;
- means for determination of the position of the nanoscanner and the microscanner (Piezostage control and position sensing in figure 2), which alternatively may be implemented by external system such as laser interferometer;
- means (DAQ) for synchronized and simultaneous registration of the signals corresponding to said surface property, angular position of the sample with respect to the probe and linear position in the direction substantially parallel to the sample plane (cf. paragraph 3: "he rotation tracking signal is produced by simple home-built electronics which generate a high-to-low pulse once per every rotation. The AFM head signal corresponding to the probe's vertical displacement, rotation tracking and the nanopositioning stage position sensor signals is acquired using the commercial data acquistion (DAQ) instrument (NI USB- 6361, National Instruments).").

the subject-matter of claim 5 is therefore not new.

2.1.1 The subject-matter of claim 5 is also not inventive with respect to D2, cf. figure 1 and paragraph 2, wherein the air spindle is the spindle rotating the sample and the air slide in the x direction with a resolution of 0.28 nm is the nanoscanner. D2 comprises also a manual stage moving along Y-direction, which can be a microscanner with no inventive effort. Claim 5 is tehrefore not inventive with respect to D2.

2.2 Dependent claims 6 and 7 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step, the reasons being as follows:

the additional features of claim 6 are disclosed in D1, cf. figure 1 and paragraph 3;

the additional features of claim 6 are a design feature that can be applied to the device of D2 with no inventive effort;

the additional feature of a z axis micropositioner in claim 7 are a variation of the scanner in D1 which can be applied to it with no inventive effort.

the additional features of claim 7 are disclosed in D2, cf. figure 1 and paragraph 2.

2.3 D2 is considered to be the closest prior art for claim 1 and discloses, cf. paragraphs 3.2 and 3.3:

A large area, high-throughput rotational scanning method using scanning probe microscope comprising scanning a sample surface with a probe (cantilever in figure 1) along a sample plane, characterized in that scanning the sample surface with the probe comprises translating the probe linearly relative to the sample using a nanoscanner actuator (air slide in figure 1) for nanoscale resolution motion in XY axes and a microscanner (Y manual stage in figure 1) ~~for microscale resolution motion in XY axes~~, and rotating the sample in XY plane using a spindle (air spindle), for scanning surface of the sample in patterns of plurality of concentric (cf. figure 2(b)) or shifted overlapping rings in nanometer resolution concentric or spiral trajectories (cf. figure 2(c))with arbitrarily chosen step within the rings generated by the nanoscanner ~~where the translation between the rings is achieved by the microscanner.~~

2.3.1 The method of claim 1 differs from D2 in that the microscanner has microscale resolution in XY axes and the translation between the rings is achieved by the microscanner. Claim 1 is therefore new.

2.3.2 The problem to be solved is to make a large area scanning in a quicker way.

2.3.3 The solution of claim 1 is seen to be inventive for the following reason:

a microscanner having a lower resolution than a nanoscanner is quicker. Therefore passing from a ring to a one with a larger diameter or to a further step in a spiral can be performed in a quicker way.

In D2 the air slider, which is the nanoscanner, resets the probe in order to perform the scanning of another ring or of another step in the spiral. There is therefore no hint towards using the other scanner for performing the scanning of another ring or of another step in the spiral. Claim 1 is therefore inventive with respect to D2.

D1 is about performing a concentric or spiral scanning too by combination of rotational motion given by the spindle and translational motion given by the XY scanners, cf. paragraph 1 and figure 2. However, also in D1 it is not disclosed that the microscanner achieves the translation between the rings in a concentric or spiral pattern and there is no hint towards using specifically the microscanner for this purpose. Claim 1 is therefore new and inventive with respect to D1.

D3 discloses no microscanner in the XY plane. Claim 1 is therefore new and inventive with respect to D3.

2.4 Claims 2-4 are dependent on claim 1 and are as such new and inventive.

Re Item VIII

Certain observations on the application

3 Claims 1, 5 and 7 are not clear.

3.1 The wordings "nanoscanner", "nanoscale resolution", "microscanner" and "microscale resolution" in claims 1 and 5 do not define precisely the resolutions and the scanning ranges of the scanners. It is therefore suggested to insert in claims 1 and 5 the definition of claim 6, wherein it is specified that the nanoscanner (6) has at least nanometer-scale resolution and the microscanner (5) has at least micrometer-scale resolution and substantially larger travel than the nanoscanner (6).

3.2 In claim 7 mention is made of "the" Z axis nanopositioner (5) and "the" Z axis micropositioner (7). However, said Z axis nanopositioner and micorpositioner have not been defined before. These "the" should be therefore amended into "a".