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(54) Title: SENSOR AND SCANNING SYSTEM AND METHOD FOR RISERS AND OTHER TEST OBJECTS

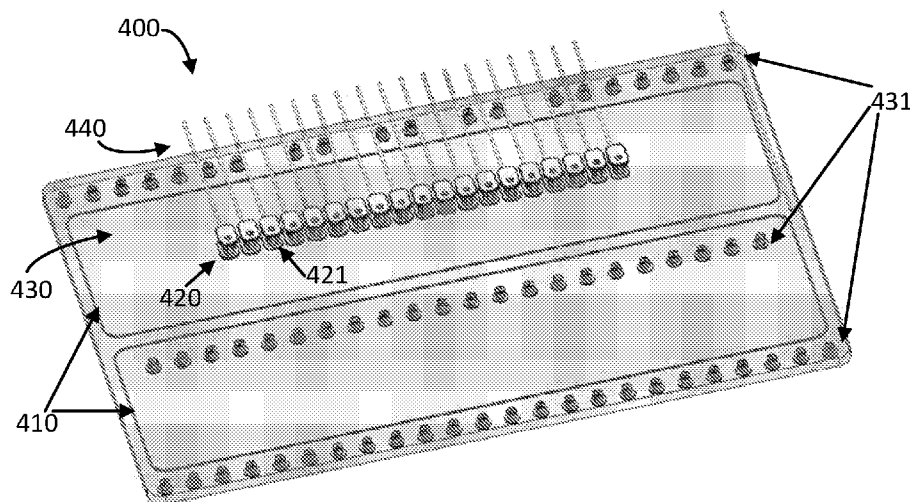


FIG. 4

(57) Abstract: A system is provided for inspecting risers and other test objects. The system may include two or more sensors and mounting arcs for holding the sensors in an arced shape. To obtain full circumferential coverage some sensors may be offset axially relative to others. In some embodiments two or more sensors have the same axial position but are shifted circumferentially so that different portions of the riser can be inspected by each sensor. The arcs and sensors may be held by a scanner with wheels for moving the scanner along the riser. Some or all of the wheels may have a suspension to provide flexibility in the structure if the surface of the object has variations such as localized changes in surface radius. A flexible version does not require rigid arcs allowing the radii of sensor curvature to change during scanning. An instrument may be provided to perform sensor measurements.



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INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. G01N 27/9013, G01N 29/265, E21B 17/01, E21B 47/10, E21B 47/007 (2024.01)

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ADD. G01N 27/82, G01N 27/9013, G01N 29/26, G01N 2291/2634, E21B 47/001

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y --- A	WO 2021/234334 A1 (SPEIR HUNTER LTD) 25 November 2021 (25.11.2021) entire document, especially FIGS. 1-4, FIGS. 4A-4B, FIG. 12, Pg. 1, ln 3-4, Pg. 1, ln 11, Pg. 12, ln 5-7, Pg. 13, ln 26-28, Pg. 15, ln 7-13, Pg. 17, ln 5-10, Pg. 27, ln 17-20; Pg. 28, ln 25-27, Pg. 30, ln 11-17, Pg. 31, ln 31-33, Pg. 32, ln 2-4	1, 2, 4, 8, 9 ----- 3, 5-7, 10-14
Y --- A	US 2021/0302382 A1 (OLYMPUS NDT CANADA INC.) 30 September 2021 (30.09.2021) entire document, especially FIG. 5, para [0003]-[0005], [0059]	1, 2, 4, 8, 9 ----- 3, 5-7, 10-14
Y --- A	US 2021/0080297 A1 (JENTEK SENSORS, INC.) 18 March 2021 (18.03.2021) entire document, especially FIG. 4A, para [0026], [0047]	2, 4 ----- 3, 5, 6
A	WO 2021/038098 A1 (NATIONAL OILWELL VARCO DENMARK I/S) 04 March 2021 (04.03.2021) entire document, especially FIG. 1, PG. 21, ln 21-Pg. 22, ln 5	11-14

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

30 September 2024

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 24/33312

Continuation of Box A.CLASSIFICATION OF SUBJECT MATTER

IPC - INV. H01F 41/06 (2024.01)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 24/33312

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I: Claims 1-14 drawn to a system and method for inspecting a cylindrical test object including a scanner.

Group II: Claim 15, drawn to a flat riser test bed including a data analysis module.

Group III: Claims 16-21, drawn to a flat riser test bed including one layer of riser wire.

--see extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-14

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 24/33312

Continuation of Box No. III – Observations where unity of invention is lacking

The inventions listed in the above-mentioned groups do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features:

Group I includes the special technical feature of a scanner, not included in the other groups.

Group II includes the special technical feature of a data analysis module, not included in the other groups.

Group III includes the special technical feature of one layer of riser wire this is long and rectangular in shape in a single plane with minimal gap between riser wires, not included in the other groups.

Common Technical Features:

The only technical feature shared by Groups I-III that would otherwise unify the groups, is inspection of cylindrical pipe including an electrically insulating layer. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by WO 2021/234334 A1 to SPEIR HUNTER LTD (hereinafter Speir).

The only additional technical feature shared by Groups I and II that would otherwise unify the groups, is a plurality of sensors and mounting arc holding the sensors. However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by Speir.

Speir discloses inspection of cylindrical pipe including an electrically insulating layer (pg 1, ln 11: inspection of insulating pipework; pg 31, ln 31-33: inspection system and method described above provide benefits in detecting corrosion under insulation) and a plurality of sensors (4, 6) and mounting arc (42A) holding the sensors (Fig 4A, 4B; pg 17, ln 7-20: mechanical support frame 10A, with five articulated frame sections 42A, supporting two sensor probes 4,6).

Accordingly, the inventions listed as the above Groups above lack unity of invention under PCT Rule 13 because they do not share a same or corresponding special technical feature providing a contribution over prior art.