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D E C I S I O N
of 26 March 1996

Case Number: T 0701/93 - 3.2.3

Application Number: 89402463.7

Publication Number: 0359642

IPC: E21B 47/00, E21B 47/04

Language of the proceedings: EN

Title of invention:
Method and apparatus for measuring subsidence

Applicant:
SCHLUMBERGER LIMITED

Opponent:
-

Headword:
Measuring subsidence

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0701/93 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 26 March 1996

Appellant: SCHLUMBERGER LIMITED
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 4 March 1993 refusing European patent application No. 89 402 463.7 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: J. B. F. Kollar
L. Mancini

Summary of Facts and Submissions

I. European patent application No. 89 402 463.7 was filed on 8 September 1989. It concerns a method and an apparatus for measuring subsidence in subsurface formations.

Independent Claims 1 and 6 read as follows:

"1. A method of measuring subsidence in subsurface formations having a borehole passing therethrough in which at least two radioactive markers have been previously implanted spaced apart along the longitudinal axis of the borehole, the method comprising the step of inserting a measuring apparatus into the borehole, said measuring apparatus comprising at least two nuclear detection assemblies spaced apart along the longitudinal axis of said apparatus, with the distance between said detection assemblies being known and substantially equal to the distance between the radioactive markers;

characterized in that each of said assemblies includes at least one position sensitive detector for performing position determination along the longitudinal axis of said apparatus;

and in that the method further comprises the steps of:

- holding said apparatus stationary in the borehole in such a manner that each of said detection assemblies is placed opposite a corresponding radioactive marker; and
- performing measurements for localizing the radioactive markers while the apparatus is held stationary."

"6. Apparatus for measuring the subsidence of subsurface formations (2), comprising:

an elongated body; and
at least two nuclear detection assemblies (10,11) which are spaced apart along the longitudinal axis of the body;
characterized in that each detection assembly includes at least one position sensitive detector for performing position determining along the longitudinal axis of the body."

II.1 In two communications according to Article 96(2) and Rule 51(2) EPC dated 25 September 1991 and 15 June 1992 respectively, the Examining Division referring to five prior art documents cited in the application as filed namely

D1: SPWLA, TENTH ANNUAL LOGGING SYMPOSIUM, Houston, Texas, 25 to 28 May 1969, pages 1 to 19; D. R. ALLEN: "Collar and radioactive bullet logging for subsidence monitoring",

D2: JAPANESE JOURNAL OF APPLIED PHYSICS, volume 23, number 12, part 2, December 1984, pages L922 to L924, Tokyo, JP; H. KAMETANI et al: "Characteristics of the self-quenching streamer mode in a gas counter",

D2': References 4 and 5 in document D2,

D3: NUCLEAR INSTRUMENTS AND METHODS, volume 165, 1979, pages 469 to 476, North-Holland Publishing Co., Amsterdam, NL; M. MATOBA et al: "One meter single-wire position sensitive proportional counter for low ionization particles", and

D3': Reference 2 and 3 in document D3

had informed the Applicant of its grounds against the grant of a patent.

II.2 The Examining Division held in its communications that the method described and shown in document D1 comprised not only all features of the preamble of Claim 1 but also the characterizing feature concerning the detection assemblies, each of which included "at least one position sensitive detector for performing...along the longitudinal axis of the (logging) apparatus" and that the subject-matter of Claim 1 was distinguished from D1 in that "said apparatus is held stationary in the borehole with said detection assemblies opposite a corresponding radioactive marker while performing the measurements". The Examining Division considered the subject-matter of Claim 1 obvious in the light of the teaching at page 7 of document D1 (see section 1 and 2 of the communication of 15 June 1992).

Objections were also raised against Claim 6 and all of the dependent Claims 2 to 5 and 7 to 15, inter alia on the ground of lack of inventive step having regard to documents D2 and D3.

III. In the submissions dated 23 January 1992 and 13 October 1992, the Applicant contested the objections to all of the claims. As to Claim 1, it was submitted that document D1 does not disclose any **position sensitive detectors**, since D1 only considers scintillation detectors which are conventional in well-logging applications. It was further submitted that the prior art, document D1 included, relevant to subsidence

monitoring only considered measurements performed by a continuously moving instrument and that there was no disclosure in the cited prior art of subsidence measurements being carried out in a stationary mode.

IV. The application was refused in a decision of the Examining Division dated 4 March 1993. The reason for the refusal was that the subject-matter of Claim 1 was considered to lack an inventive step (Articles 52(1) and 56 EPC).

In the decision the Examining Division reconsidered the disclosure of document D1 and accepted the delimitation of Claim 1 with respect to this document (Section 5 of the decision). It had been indicated that from document D2 "a detector and measuring apparatus is known as specified in the application's claims and particularly representing a position sensitive detector" (Section 6, first paragraph of the decision).

Having regard to the characterizing feature concerning the "position sensitive detector", and to demonstrate the general principle of operation such detector, the Examining Division introduced (see Section 6, paragraph 2 and 3 of the decision) for the first time two new documents, namely

D4: NUCLEAR INSTRUMENT AND METHODS, volume 108 (1973) page 125 to 133, H. W. FULBRIGHT et al: "Position Sensitive Particle Detectors Used in a Magnetic Spectrometer"; page 125, left column, and

D5: NUCLEAR INSTRUMENTS AND METHOD, volume 91 (1971), number 3, pages 389 to 396; G. L. MILLER et al: "A Position Sensitive Detector for a Magnetic Spectrograph", page 395, right column, lines 17 and 18).

The Examining Division was of the opinion that the application of such a sensor apparatus to the state of the art (see D1) and holding such an apparatus stationary while measuring, does not involve an inventive step and supported its reasoning substantially by the following statements:

(a) "Apparently (see D2') numerous applications and, consequently, a high degree of applicability of the said detectors are known to the skilled man. In particular note the reference D2 column 1, §1, lines 3 and 4."

(b) "The basic question is whether an inventive step is involved in seeking help from experts for the problem of selecting the most appropriate detector for detecting the position of the radioactive marker bullets, or to market a position-sensitive detector to the oil or mining industry. The answer must be negative, because it is indeed obvious to consult with a specialist physicist, who will be conversant with the apparatus described in D2 and will not require inventivity to match the apparatus with the problem."

(c) "It does, consequently, not involve an inventive step to use such apparatus to determine the position of radioactive markers, including markers placed in a borehole and to hold it stationary while taking the readings."

V. A Notice of Appeal was filed against this decision on 26 April 1993, the appeal fee being paid on the same day. The Statement of Grounds of Appeal was filed on 6 July 1993.

VI.1 The appellant (applicant) argued that the subject-matter of claims 1 and 6 was distinguished from the closest prior art according to document D1 by features which provide a clearly advantageous method and apparatus and which could not be derived in an obvious manner from the cited state of the art.

VI.2 The appellant submitted substantially the following arguments concerning the statements (a) to (c) (see supra paragraph IV) forwarded in the impugned decision:

(a) Neither document D2 nor other publications previously cited by the Examining Division contain any indication or hint pointing to application of the position-sensitive detectors in the specific area of the invention as claimed.

(b) Statement (b) is a purely abstract reasoning which has no basis in the prior art. It contains implicit assumptions, especially concerning the carrying out of measurements in a stationary mode, which belong to the claimed invention. It is thus a typical example of a hindsight reconstruction of the invention.

(c) There is no basis in the prior art for the assertion in statement (c) that it does not involve an inventive step to hold the apparatus "stationary while taking the readings".

VI.3 Referring to the facts that: (i) document D1 was published in 1969; (ii) French Patent 2 192 320 was

filed on 13 July 1972, (below document D6 - the equivalent of US-Patent 3 869 607); and (iii) US-Patent 4 396 838 was filed on 5 January 1981 (below document D7), and described the problem with measurements by the logging tools suspended from the end of the cable, the appellant made valid a long-felt need for improving the accuracy in the determination of the distance between radioactive markers implanted in a borehole.

VI.4 The appellant requested that the decision under appeal be set aside and the patent be granted with claims as originally filed.

Reasons for the Decision

1. The appeal is admissible.

2. After having examined all the documents cited during the procedure the Board has reached the conclusion that the subject-matter of the discussed claims is novel. Since novelty was acknowledged by the Examining Division there is no need to consider this matter in detail.

3. It still remains to be examined whether the requirement of inventive step is met by the claimed subject-matter.

3.1 The preamble of claim 1 is based on the disclosure of document D1. In the view of the Board this document represents the closest state of the art. Thus, claim 1 also meets the requirements of Rule 29(1)(a) and (b) EPC, since it is correctly delimited over such prior art.

The same applies to claim 6, which is directed to an apparatus, but contains the same technical features as claim 1 adapted to this category.

3.2 Document D1 is already directed to solving the problem of inaccuracy in the determination of the distance between markers in a borehole and to doing so by a **determination of the depth** of each peak indicating a marker. The accuracy of the technique thus depends on the accuracy of depth measurements. Although the application under appeal has acknowledged this document in its description, there must have been a need for still further improvement, because the former persists in its aim "to substantially improve the precision with which **the distance between the radioactive markers** is measured". This was, therefore, the relevant technical problem to be solved.

3.3 The technique available for determining the depth of a logging tool during its continuous motion through the borehole suffers from errors caused by the fluctuations of the displacement velocity of the logging tool suspended from the end of the cable, known as the "yo-yo effect" initiated by the elasticity of the cable. Thus the precision of the depth measurements, and consequently the precision achievable in the determination of the distance between radioactive markers was affected. These problems were also discussed at length in reference D6 (see e.g. column 1, line 47 to column 2, line 27) and also in D7 (see column 1, lines 45 to 52).

In view of the above, the Board finds it plausible that a long-felt need of improvement, made valid by the appellant in his statement (see page 8/8), existed before the filing date of the application on appeal. A solution of such need might itself be a sign of presence of inventive step.

3.4 From the prior art relevant to subsidence monitoring according to D1, D6 and D7, it follows, that the only procedure which was considered for radioactive marker detection and which was implemented was to continuously displace a scintillator-type detector(s), having a very small dimension (suggested to 9,5 mm in D1) in the direction in which positions are to be measured, along the borehole in a section encompassing the expected position of the marker, and to identify peaks in the log thus obtained.

Thus, when the prior art relating to subsidence monitoring is considered objectively i.e. taken as a whole without hindsight, there is no reason to consider any type of detector other than those which are suitable for the continuous logging mode.

3.5 Keeping in mind the problem to be solved by the present invention (cf. supra paragraph 3.2), which is quite different from the problem(s) involved in sensing individual markers referred to in the impugned decision, the Board cannot accept the reasoning of the first instance considering the problem of selecting the most appropriate detector for detecting the position of the markers as obvious, especially as none of the references cited by the Examining Division as disclosing position-sensitive detectors has suggested an

application of such detectors to the oil industry but only in the context of laboratory measurements: magnetic spectrographs (documents D4 and D5) or in ionization chambers (document (D2).

A position-sensitive detector has an elongate detecting portion, which extends over a substantial dimension. An example described in the application is about 1 meter long (compare scintillators of 9,5 mm suggested in D1).

The location of nuclear events such as gamma rays which impinge on the detecting portion can be determined with great accuracy. Even marks implanted at a distance greater than what was desired can be detected.

3.6 Moreover, in its misinterpretation of the objective problem to be solved, the first instance simply assumes a novel feature of the method of claim 1, namely the carrying out of measurements in a **stationary** mode. This is, however, a teaching which does not belong to the prior art. This teaching leads to the novel feature of performing measurements with position sensitive detectors being held stationary.

3.7 As emphasized above, the prior art related to subsidence monitoring has only considered a continuous logging mode and sensors adapted thereto. Although measurements produced with conventional scintillation detectors being continuously displaced at low speed in the borehole is admitted by the appellant to be known before the filing date (see page 7, second paragraph of D1), there is no evidence that a person skilled in the art was aware of the performance of stationary measurements for subsidence monitoring by using at least one position sensitive detector which is the common characterising feature of valid independent claims on file. For this

and above reasons it is clear that none of the improvements attained by the invention were foreseeable on the basis of the prior art.

3.8 It is, therefore, the view of the Board that the claimed invention is not rendered obvious by the available known art and hence, the required inventive step is also involved (Article 56 EPC).

Thus, claims 1 and 6 define patentable inventions within the meaning of Article 52(1) EPC.

4. Dependent claims 2 to 5 and 7 to 15 represent embodiments of the invention defined in claims 1 and 6, respectively. They are, therefore, likewise allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant a patent on the basis of the documents as originally filed.

The Registrar: The Chairman:

N. Maslin C. T. Wilson