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File Number: T 150/90 - 3.4.1

Application No.: 85 200 868.9

Publication No.: 0 203 227

Title of invention: Method and apparatus for analysing geophones

Classification: G01V 13/00

D E C I S I O N
of 18 October 1991

Applicant: Halliburton Geophysical Services, Inc.

Headword:

EPC Article 56

Keyword: "Inventive step (yes)"

Headnote



Case Number : T 150/90 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 18 October 1991

Appellant : Halliburton Geophysical Services, Inc
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Representative : J. Keijser
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Decision under appeal : Decision of Examining Division 038 of the
European Patent Office dated 13 October 1989
refusing European patent application
No. 85 200 868.9 pursuant to Article 97(1) EPC.

Composition of the Board :

Chairman : G.D. Paterson
Members : U.G. Himmler
Y. van Henden

Summary of Facts and Submissions

- I. European patent application No. 85 200 868.9 (publication No. 0 203 227) was refused by decision of the Examining Division.
- II. The reason given for the refusal was that the subject-matter of the new Claim 8 filed with Applicant's letter dated 3 July 1989 did not meet the requirements of Articles 52(1) and 56 EPC having regard to document
- D1: J.P. Convert et al.: "System aids field testing of geophones", published in Oil and Gas Journal, Vol. 77, No. 45 (November 1979), pages 88 to 96, Tulsa, U.S.
- III. The Appellant lodged an appeal against the decision.
- With his Statement of Grounds of Appeal, the Appellant filed a new set of claims comprising method Claims 1 to 7 and apparatus Claims 8 to 13, which set formed the basis of a main request, and, subsidiarily, he requested a patent to be granted on the basis of method Claims 1 to 7 only.
- IV. In a communication pursuant to Article 11(2) of the RPBA and issued on behalf of the Board on 1 March 1991, the Rapporteur expressed the provisional view that Claims 1 and 2 according to both requests contravened the requirements of Article 123(2) EPC and that, having regard to documents (D1) and

D2: US-A-4 003 018,

the subject-matter of Claim 8 according to the main request lacked an inventive step.

V. The Appellant submitted on 18 May 1991 amended sets of claims forming the respective new bases of his main and auxiliary request.

VI. Oral proceedings were held on 13 June 1991.

VII. During the oral proceedings, the Appellant submitted amended Claims 1 to 13 and requested a patent to be granted on the basis thereof. In support of his request, he substantially argued as follows.

The geophone equipment to which document (D1) relates comprises a recorder connected to a plurality of DAs (data acquisition units), each DA being in turn connected to a plurality of geophone strings. The test is performed from the recorder and, therefore, includes a test of the DAs. The means for comparing a geophone impulse response with a reference information substantially comprise a screen for displaying the test result curve and for displaying curves showing the influence of individual parameters. The detected wave form is compared with a reference wave form. Nevertheless, no parameters are derived from the response and those parameters which are mentioned relate to complete channels extending from the recorder to the geophones through the DAs. Information on the geophone groups is consequently "buried" in the response of the complete system, thereby making it difficult to find defects in the geophones and restricting the information derived from said response to whether the system is or is not in proper operating condition.

The present invention is, however, concerned with testing geophone strings in themselves, after having disconnected them from the DAs. By deriving from the response

individual parameters of the geophones and comparing them to reference values, it makes it possible to eliminate temperature influence and gives a more complete information. The apparatus embodying the invention is, therefore, a tool for the troubleshooter.

VIII. At the end of the oral proceedings, the Chairman gave the decision that the procedure would be continued in writing on the basis of the amended claims filed during the hearing.

IX. With letter of 26 August 1991, the Appellant filed an amended text of the application and, by telex of 26 September 1991, requested that four typing mistakes be corrected in said amended text.

X. The Appellant requests a European patent to be granted on the basis of the following documents:

Claims: 1 to 13 received with the Appellant's letter of 26 August 1991, with the amendments to Claim 8 requested in the Appellant's telex of 26 September 1991;

Description: pages 1 to 8 received with said letter of 26 August 1991, with the amendments to page 7 requested in said telex of 26 September 1991, to be continued with the amended text of the original description starting from line 21 of page 6, as filed with said letter of 26 August 1991;

Drawings: sheets 1/7 to 7/7 as originally filed.

Claims 1 and 8 are independent and read as follows:

"1. Method of analysing geophones, comprising sending pulses of electric currents through the geophones, measuring the output voltages and/or currents as functions of time comprising the total impulse response supplying information about the geophones, and comparing this information with reference information stored or computed, after which at least the differences between information measured and the reference information are determined for further assessment and/or processing and/or are displayed characterized in that any one or more of the following parameters:

damping, resonance frequency, sensitivity of a string of geophones which is measured are individually derived from the impulse response and are compared with corresponding reference parameters determined for a string of geophones of the same type as those tested, and with equal numbers in series and in parallel connections.

8. Apparatus for analysing geophones for performing the method according to any of Claims 1-7, comprising means for connecting a geophone or a geophone string, a pair of terminals for at least one source of voltage or current to be sent through the geophone(s), means to detect the response of the geophones(s) to voltage or current pulses sent through it (them), means to store or compute reference information, and means to enable a comparison to be made between the impulse response of a geophone or a geophone string tested and the reference information, characterized in that the apparatus is an apparatus independent of the seismic recording system and in that it comprises:

(a) means to automatically derive from the response voltage and/or current, individually and quantitatively, any of the following parameters of the geophone(s):

damping, resonance frequency, sensitivity,
 (b) means to store or compute corresponding reference parameters quantitatively,
 (c) means to compare the isolated measured parameters with the reference parameters, and
 (d) means to display the differences found in the comparison."

Claims 2 to 7 are method claims appended to Claim 1, whereas Claims 9 to 13 are apparatus claims appended to Claim 8.

Reasons for the Decision

1. The appeal is admissible.
2. Formal Requirements

The claims filed with the Appellant's letter dated 26 August 1991 exhibit a few linguistic improvements with respect to those submitted during the oral proceedings of 13 June 1991. Nevertheless, the Board is satisfied that the claims of both sets are in substance equivalent. The Board is also satisfied that the application was not amended in such a way that it contains subject-matter which extends beyond the content of the application as filed.

3. Novelty
 - 3.1 Document (D1) states that, in seismic data acquisition systems, it is common practice to test a number of geophone strings each day and that "geophone analysers" have been designed to speed up this operation - see page 88, lines 23, 24 and 32 to 34 of the right-hand column.

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According to (D1), analysers of the type designed by the Gulf Science and Technology Co. and Chevron apply a pulse or a step to a channel and observe the response - see page 89, second paragraph of the left-hand column. From later passages of (D1), it appears that said pulses are electric ones - see page 95, sentence beginning at the foot of the left-hand column; see also page 90, central column, where it is envisaged that the inputs be terminated on a resistance. It may thus be asserted that the analysers referred to in (D1) comprise "means for connecting a geophone or a geophone string, as well as a pair of terminals for at least one source of voltage or current to be sent through the geophones". Said analysers furthermore comprise means to detect the response of the geophone(s) to voltage or current pulses sent through them since they are said "to observe the response" - see page 89, lines 12 to 14; page 90, sentence bridging the left-hand and central columns; page 96, lines 18 to 24 of the right-hand column. Finally from the statement on page 96, lines 25 to 29 of the right-hand column, it can be inferred that the devices mentioned in (D1) are also provided with means to store or compute reference information, and with means for comparing said reference information to the response of the geophone or geophone string.

The Board thus takes the view that an apparatus of the kind referred to in the pre-characterising part of Claim 8 is known from (D1).

- 3.2 According to (D1), the means for testing are part of the whole seismic system and said whole system is used to acquire the field data. On page 96, it is in particular stated that the test referred to in this article "has the

advantage of checking the equipment in recording position, in the spread, without removing anything from the field - see right-hand column, lines 30 to 34. The Board, therefore, shares the Appellant's view that (D1) does not relate to an apparatus independent of the seismic recording system.

- 3.3 Document (D1) mentions only two parameters of a geophone equipment that are taken into account for deriving an information from the pulse response, namely the distortion of the response and the impedance of the geophone group - see from the right-hand column of page 90, line 16, to the right-hand column of page 95, line 17. Damping, resonance frequency and sensitivity being not mentioned in (D1), the Board takes the view that, as a consequence thereof, the system known from this document does not comprise means to automatically derive from the response voltage and/or current, individually and quantitatively, any of these parameters, and that said system does not comprise means to store or compute corresponding reference parameters quantitatively, means to compare the isolated measured damping, resonance frequency and sensitivity with the corresponding reference parameters and means to display the difference found in the comparison either.

The Board, therefore, takes the view that, having regard to the state of the art disclosed in (D1), the subject-matter of Claim 8 is new.

- 3.4 For the reasons already explained in above section 3.3 of the present decision, the method carried out by the system known from (D1) does not comprise the step of individually deriving from the impulse response of a string of geophones which is measured any one or more of the parameters comprising damping, resonance frequency and sensitivity of said string of geophones, and it does not

comprise the step of comparing the measured values of said parameters with corresponding reference parameters determined for a string of geophones either. Furthermore, whether the reference information is or is not determined for a string of geophones with equal numbers in series and in parallel connections is not stated in (D1).

With regard thereto, the Board also takes the view that the subject-matter of Claim 1 is new with respect to the disclosure of (D1).

- 3.5 Document (D2) relates to a method and apparatus for testing geophones for both their activity and their distortion and noise level - see column 1, lines 6 to 9 - whereby no comparison of measured parameter values with stored or computed reference information is performed. The state of the art disclosed in (D2) is, therefore, more remote from the invention than the one known from (D1).

The remaining documents cited in the European search report are still less relevant for the assessment of novelty.

4. Inventive Step

The prior art documents lay stress on the consideration of distortion and, consequently, do not prompt the skilled person to investigate whether useful information can be derived from the consideration of alternative parameters, in particularly those recited in the characterising clauses of Claims 1 and 8. As shown by the formulas (5) to (7) given on page 10 of the application as originally filed, damping, resonance frequency and sensitivity of a geophone or geophone string can easily be derived from the measure of (T), i.e. the half pseudoperiod of the damped oscillations, and that of the first two extreme value

(A₁, A₂) of the geophone or string output, only. With regard thereto, the Board is satisfied that the invention provides improved method and apparatus for testing geophones or geophone strings.

In spite of the fact that the skilled man was aware of the disadvantage of the equipment known from (D1), that this known equipment could not distinguish whether there was a defect in the string of geophones or in the electronic equipment or in both (cf. in (D1) page 90, right hand column, lines 11 to 13 with the stress on "network"; the whole of page 96, in particular line 16 "... instruments and geophones." and page 96, paragraphs 7 and 8) there was no solution of this problem proposed for more than five years (the publication date of (D1) is November 1979) and the priority date of the present application is May 1985). This may be considered as at least some circumstantial evidence of an inventive step. Another indication that said method and said apparatus according to Claims 1 and 8 respectively, involve an inventive step is the advantage that according to the subject-matter of these claims the information derived from the response signal is a quantitative one, whereas according to (D1) the response signal can only be a qualitative one, because two curves have to be compared visually and no numerical values are derived which can be evaluated automatically as provided by the subject-matter of such claims.

In the absence of any suggestion in any cited document of the above practical advantages to be gained from a comparison of the parameters as now claimed, in the Board's judgment Claims 1 and 8 involve an inventive step, and accordingly Article 56 EPC is satisfied.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to grant a European patent on the basis of the text set out in paragraph X above, with the correction of the spelling mistake affecting the adverb "quantitatively" in lines 11 and 15 of the new page 7 of preamble to the description and in Claim 8, lines 30 and 34 of the new second page of claims.

The Registrar:

The Chairman:

M. Beer

G.D. Paterson