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D E C I S I O N
of 21 May 1999

Case Number: T 0422/98 - 3.2.3
Application Number: 88202433.4
Publication Number: 0316985
IPC: E21B 21/08, E21B 44/00,
E21B 49/00

Language of the proceedings: EN

Title of invention:

A method of monitoring the drilling operations by analysing
the circulating drilling mud

Applicant:

Services Pétroliers Schlumberger

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 0422/98 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 21 May 1999

Appellant: Services Pétroliers Schlumberger
42, rue Saint-Dominique
75007 Paris (FR)

Representative: Mirza, Akram Karim
Intellectual Property Law Department
Schlumberger Cambridge Research
High Cross
Maddingley Road
Cambridge CB3 0EL (GB)

Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 25 November 1997
refusing European patent application
No. 88 202 433.4 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: C. T. Wilson
Members: J. B. F. Kollar
J. P. B. Seitz

Summary of Facts and Submissions

I. European patent application No. 88 202 433.4 (publication No. 0 316 985) was refused by decision of the Examining Division dated 7 August 1992. That decision was set aside by decision T 45/92 of 14 June 1995 taken by this Board because of a substantial procedural violation relating to a conflict with the requirements of Article 113(1) EPC, the matter being referred back to the first instance for further examination.

At the end of the examination proceedings performed after the aforementioned remittal the Examining Division refused the patent application by its decision dated 25 November 1997 on the ground of lack of inventive step in the sense of Article 56 EPC.

The decision was based on claim 1 filed on 22 February 1992 with letter dated 19 February 1992 (main request) and claim 1 submitted during the oral proceedings before the Examining Division on 21 October 1997 comprising a combination of claims 1, 2 and 4 of the published set of claims (auxiliary request).

Claim 1 according to the main request reads as follows:

"1. A method of monitoring drilling operations comprising analysing circulating drilling mud by periodically sampling the mud at the surface, after elimination of cuttings and analysing the samples to determine the successive values as a function of time or depth of the weight M_s of fine solids present in the mud, characterised in that the weight M_l of the liquid

phase is determined by drying to constant weight a given weight M_m of mud and in that the weight M_e of the electrolyte dissolved in the liquid phase present in a known weight M_m of mud is determined, the weight of M_s of the fine solids in the sample being determined by the expression:

$$M_s = M_m - M_l - M_e. "$$

II. The reason given for the refusal was that the subject-matter of claim 1 of the main request differed from the method for continuously monitoring the density etc. of drilling mud known from document GB-A-1 280 277 (D1) in that the weight M_l of the liquid phase and the weight M_e of the electrolyte dissolved in the liquid phase present in a known weight M_m of mud are determined, the weight M_s of the fine solids in the sample being determined by the expression: $M_s = M_m - M_l - M_e$. This difference would however be obvious since the essential parameters, including electrolyte content, are generally continuously monitored during drilling, so that the determination of soluble constituents of the mud is thus standard practice as is laid down in SI Drilling Manual, 1st edition, Canadian Association of Oilwell Drilling Contractors, section 01, pages 1 and 2, Gulf Publishing Company, Houston, London, Paris, Tokyo, 1982 (further (D2)).

The analysis of the density of the return mud in D1 is equivalent to the determination of the weight as the density is a weight per volume. In D1 it is also expressed that the resistivity of the return mud is monitored and the resistivity is a value representative of the ion content of the solution. This document hints

thus at the method to analyse the mud and by reading the value for the resistivity the overall content of soluble matter is determined and by a division the weight can be derived from the density.

Moreover, the determination of the weight of the liquid phase has been carried out for years in chemical laboratories where the soluble content of fluids is generally determined by drying to constant weight a known quantity of fluid. The difference in weight of the initial solution and the weight of the dried solids forms the weight of the fluid phase. This method of analysing the weight of constituents of a solution is a standard practice. In view of this proven standard laboratory routine the formula claimed in claim 1 is trivial. The Applicant's submissions relating to difficulties by transfer of general technical analysis to instable work conditions on rigs would not be able to replace the missing inventive step.

Furthermore, the Examining Division had mentioned document CA-A-1 222 933 but regarded this document as less relevant with respect to the method claim under consideration.

III. The appellant lodged an appeal against the decision on 22 January 1998, paying the appeal fee at the same time.

In the statement of grounds of appeal, dated 3 April 1998 it is requested, as a main request, to set the decision of the Examining Division aside and order the Examining Division to grant a patent on the basis of the claims filed on 22 February 1992 with the letter

dated 19 February 1992.

As an auxiliary request, it is requested to set aside the decision under appeal and order the Examining Division to grant a patent on the basis of the claims filed with the statement of grounds of appeal. In the auxiliary set of claims, claim 1 is based on claim 1 and claim 8 as originally filed.

IV. With regard to his main request the appellant argues mainly as follows:

In the contested decision D1 is regarded as the closest prior art. D1 relates to means for continuously monitoring various properties of drilling mud including its density. In its decision the Examining Division equated the density measurement of the drilling mud with a weight measurement of fine solids within the drilling mud.

The density measurement is performed to calculate the hydrostatic pressure that the mud exerts on the walls of the borehole at a given depth in order to prevent the entry of pressurized formation fluids into the borehole. The ordinary skilled person has no motivation to use the density measurement to determine the fine solids content of mud.

For density measurements the so-called "mud balance" is employed, a description of which can be found at pages 121 and 122 of the textbook "Drilling and drilling Fluid" by G. V. Chilingarian, Elsevier, Amsterdam - Oxford - New York, 1983 (D3) submitted 8 April 1998. The method of D1 appears to be a variant

of this mud balance. For solid contents measurement, the so-called "retort kit" is used. The retort method is described on page 2 of CA-A-1 222 933 (D4). Details of the method can also be found on page 147 of D3.

Based on the above statements, it becomes clear that density and solids content measurements are clearly distinguished in the art by purpose and means. Therefore, the ordinary skilled person has no motivation to use the density measurement to determine the fine solid.

The contested decision includes a further attempt to equate a measurement of resistivity with a measurement of the electrolyte content. There is no evidence that the purpose of resistivity measurements is to determine the electrolyte content. From page 163 of D3 follows that resistivity measurements are made to permit better evaluation of formation characteristics from electric logs.

The appellant concludes that major parts of the grounds for refusing the application in suit are based on *ad hoc* arguments not supported by evidence. Important elements of claim 1 are not mentioned, such as the periodical sampling of fine solids as function of time or depth and the correction for electrolyte content. He requests to cancel the appealed decision and to grant the patent on the basis of the requests specified in point III above.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 Amendments

Claim 1 is a combination of claims 1 and 2 as originally filed. Hence, the provisions of Article 123(2) are met.

The Board is also satisfied that the main claim in its present amended form meets the remaining formal requirements of the EPC.

2.2 Novelty

After examination of the cited prior art, the Board has concluded that the subject-matter of claim 1 is novel. Since novelty has not been questioned by the first instance it is not necessary to consider this matter in detail.

2.3 Inventive step

2.3.1 It is the established jurisprudence of the Boards of Appeal that the objective assessment of inventive step has to be preceded by the determination of the technical problem which the invention addresses and solves and that the technical problem is to be formulated in the light of the closest state of the art.

Therefore, in order to apply this approach for objectively assessing inventive step, it is essential

to establish the closest prior art. Generally, this requires that the claimed inventive should be compared with the art concerned with a similar use which requires the minimum of structural and functional modifications.

2.3.2 As stated in the preamble of claim 1 the subject-matter of the claimed invention relates to a method of monitoring drilling operations comprising analysing circulating drilling mud and by periodically sampling the mud at the surface, after elimination of cuttings and analysing the samples to determine the successive values as a function of time and depth of the weight M_s of the fine solids present in the mud.

2.3.3 In contrast, document D1 is concerned with means for continuously monitoring various mud properties including its density. D1 does not disclose any reference as to measuring the fine solids content of the drilling mud.

In view of this, the Board does not consider that document D1 can represent the closest prior art in the light of which the technical problem underlying the present invention should be formulated.

2.3.4 Document D4 relates, like the present invention, to improvements of accuracy in methods of determining the amount of solids in drilling fluids. Therefore in the Board's judgement, document D4 represents the closest state of the art.

2.3.5 In the light of this closest prior art, the technical problem underlying the present invention may be seen in

providing further improved accuracy of determining the amount of fine solids dispersed from the formation in order to make predictions as to the borehole stability (cf. second paragraph of page 9 as originally filed).

According to the invention, this technical problem is solved by the following three characterising features of claim 1:

- (i) the weight of the liquid phase is determined by drying to constant weight a given weight M_m of mud;
- (ii) the weight M_e of electrolyte in a known weight M_m of mud is determined; and
- (iii) the weight of fine solids M_s is derived from these measurements according to the equation
$$M_s = M_m - M_l - M_e.$$

In view of results obtained in the sample calculation on pages 5ff of the description as filed, the Board is satisfied that the above-defined technical problem is solved.

2.3.6 As previously mentioned, document D4 is concerned with the same technical problem as the one underlying the present invention. According to this document, it is solved by the steps of taking a sample of the drilling fluid, mixing same with a quantity of developer liquid having a specific gravity lower than the specific gravity of the weighting agent and being effectively non-immiscible with the base of the drilling fluid and in which the weighting agent is insoluble, then forcing

the weighting agent out of the drilling fluid and into the developer liquid, allowing the weighting agent to settle by gravity and then determining the amount of settled weighting agent.

The use of this method will therefore result in an accurate determination of particularly relatively high gravity solids used as weighting agents.

In the Board's judgement, the teaching of this document would not suggest to the skilled person that the problem addressed and solved in this document may be improved if the weight of dissolved electrolyte is selected from the known weight of the mud.

2.3.7 Document D1 is, as previously mentioned, concerned with means for continuously monitoring the density, flow properties, gel strength, resistivity, and pH properties of drilling mud. This document is wholly silent with regard to measuring the fine solids content of the drilling mud. In the light of this silence the skilled person, seeking a solution to the technical problem underlying the invention, would have found no motivation in D1 to determine the fine solids content to monitor the drilling operation and would have considered the document to be irrelevant.

2.3.8 In document D2 on page 2, right-hand column, the last paragraph, there is stated that "optimum solids control is very desirable for overall superior mud performance". However, from the general teaching of this document methods for measuring the fine solids content of the drilling mud are not obtainable.

2.3.9 The present invention resides in the realisation that the weight of electrolyte is significant in the determination of the weight of fine solids in a mud sample. From the afore-mentioned (point 2.3.5) sample calculation presented in the description as filed, failure to account for the weight of dissolved electrolyte can cause errors in excess of 10% in this determination. Therefore, while it may appear trivial to state that the weight of a fluid is the sum of the weights of the constituent parts of the fluid, it is not trivial to teach someone the manner in which the total must be broken down into its constituent parts.

In the present case, once it has been stated that M_e must be determined, the manner in which the invention is to be performed and the data used appears straight forward. However, this should not distract from the fact that the present invention is the first time that this particular problem has been identified and consequently the first time a solution has been offered to this problem. The prior art approach to the determination of M_s would be to dry a sample to constant weight and derive $M_s = M_m - M_1$ with the consequent error involved.

It is only when the skilled person is told that M_e is significant that the relationship $M_s = M_m - M_1 - M_e$ becomes apparent.

Referring to point 2.3.5 above characterising feature (iii) only appears trivial once the problem is identified and feature (ii) only appears obvious once feature (iii) has been determined.

2.3.10 Therefore, in the Board's judgement, the claimed solution of the technical problem underlying the present invention is not obvious.

Thus, independent claim 1 of the main request is allowable. Dependent claims 2 to 8, which relate to preferred steps of the method claimed in claim 1, are also acceptable.

3. Having allowed the appellant's main request, the Board does not need to consider the auxiliary request.

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 the patent on the basis of the following documents:

Claims: 1 to 8 filed with letter dated
19 February 1992

Description: pages 1, 3 to 11 as originally filed,
page 2 filed with letter dated
19 February 1992

Drawings: Sheets 1/4 to 4/4 as originally filed.

The Registrar:

The Chairman:

N. Maslin

C. T. Wilson