



25 November 2009

## **PATENTS ACT 1977**

**APPLICANT**                      Halliburton Energy Services, Inc.

**ISSUE**                            Whether patent application number  
   GB 0516638.4 complies with section 1(2)

**HEARING OFFICER**                 S. Brown

---

## **DECISION**

### **Introduction**

- 1      Patent application number GB0516638.4, entitled “Roller cone drill bits with optimized bearing structures” was filed on 12 August 2005 in the name of Halliburton Energy Services, Inc. and was published as GB2417966. The application claims priority from US patent application number US60/601,952 filed on 16 August 2004.
- 2      There were originally 8 independent claims in the application: 2 apparatus claims directed to a roller cone drill bit and 6 method claims. The examiner raised objections that the invention as defined by the method claims was excluded from patentability under section 1(2) of the Act on the basis that it was no more than either a mathematical method or a method of performing a mental act. After several rounds of correspondence and amendment the applicants and the examiner concluded that they were unable to resolve the issue and a hearing was held on 8 October 2009. The applicant was represented by Mr. Alistair Russell of Hoffmann Eitle. The examiner, Mr. David Harness, also attended.

### **The Application**

- 3      The current application contains 16 claims. The most recent set of claims were filed on 25 August 2009. There are 7 independent claims, all methods claims. The previous apparatus claims have been removed. Independent claims 1, 6 and 14 relate to a method for/of designing a roller cone drill bit, claim 10 relates to a method of designing a bearing structure configuration for a roller cone, claims 11 and 12 relate to a method of designing a bearing structure configuration and a cutting structure for a roller cone and claim 13 relates to a method of substantially minimizing the anticipated end loads on a bearing. Claim 1 reads as follows:

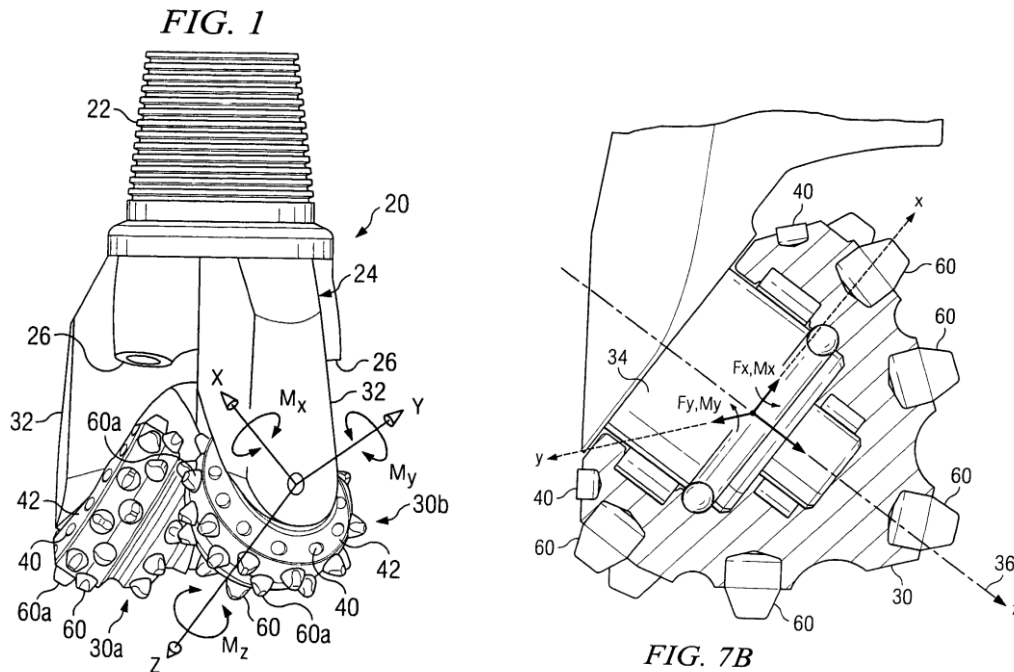
1. *A method for designing a roller cone drill bit comprising:*  
*forming a bit body with at least a first support arm, a second support arm, and a third support arm, each support arm having a spindle extending therefrom;*  
*providing a first cone assembly having a first cutting structure, a second cone assembly having a second cutting structure, and a third cone assembly having a third cutting structure;*  
*determining a first minimal moment center along a first axis of rotation of the first spindle based on the first cone assembly cutting structure;*  
*determining a second minimal moment center along a second axis of rotation of the second spindle based on the second cone assembly cutting structure;*  
*determining a third minimal moment center along a third axis of rotation of the third spindle based on the third cone assembly cutting structure;*  
*providing a first bearing assembly on the first spindle, the first bearing assembly having a center disposed proximate the first minimal moment center;*  
*providing a second bearing assembly on the second spindle, the second bearing assembly having a center disposed proximate the second minimal moment center;*  
*providing a third bearing assembly on the third spindle, the third bearing assembly having a center disposed proximate the third minimal moment center;*  
*wherein the method further comprises recording the design of the roller cone drill bit.*

4 While claims 1, 6, 10-12, & 14 have slightly different scopes they are similar enough that they can be dealt with together. Claim 13 though is of a different form and will be dealt with separately. Claim 13 reads as follows:

13. *A method of substantially minimizing the anticipated end loads of a bearing, the method including determining a minimal moment center of a roller cone having a plurality of cutting elements comprising:*  
*calculating the anticipated forces acting on each cutting element under a specified drilling condition at a selected time step;*  
*projecting the forces acting on each cutting element into a cone coordinate system;*  
*calculating the forces acting on the roller cone in the cone coordinate system;*  
*simplifying the cone forces into a bearing coordinate system at a selected point located on a bearing axis;*  
*calculating the moments at that selected point and calculating the*

average moment;  
 calculating the vector sum of the moments at the selected point;  
 simplifying the cone forces into a bearing coordinate system at a second selected point on the bearing axis;  
 calculating the average moment;  
 calculating the moments at the second selected point and  
 calculating the vector sum of the moments at the second selected point on the bearing axis;  
 plotting the moment as a function of the selected points along the bearing axis; and  
 determining the minimal moment position along the bearing axis according to the plotting.

5 The invention as defined by the claims is related to the optimized design of roller cone drill bits used to form wellbores in subterranean formations. A roller cone drill bit, according to the invention, comprises three cone assemblies rotatably mounted on respective spindles via respective bearing structures. Each cone assembly has a respective cutting structure and, in use, will have a minimal moment centre located somewhere along its respective axis of rotation. This centre is where, in use, the effects of various rotational forces on the cone assembly will be a minimum. Figures 1 & 7B give a useful overview of such a drill bit:



6 The key element of the invention is that each respective bearing structure is arranged to have a centre point located proximate to its respective minimal moment center. In this way bearing load is reduced, drilling stability enhanced and the life of the bit extended. It should be noted that the location of a minimal moment centre will vary depending on various factors including the type of subterranean material being drilled through, the choice of cutting structure, and the rotational speed of the drill bit.

- 7 The examiner has argued that the invention as defined by the claims is no more than a mathematical method and/or a method of performing a mental act. He suggested to the applicants that the claims could be rendered patentable by restricting them to methods of manufacturing roller cone drill bits with a suitable manufacturing step.
- 8 It was towards this end that the applicants amended claims 1, 6, 10-12, & 14 to include a step of *recording* the bit design. This was not accepted as sufficient to confer patentability by the examiner and anyway the applicants now assert that the recording step is implicit in the method of design itself and therefore unnecessary.
- 9 The applicants have requested that I consider the claims with and without the recording step. I thus have three variations to consider in this decision. Firstly the current claims with the recording step, secondly the claims with the suggested additional manufacturing step and thirdly the claims with neither a recording nor a manufacturing step. I note that currently claim 13 does not include a recording step or a manufacturing step.

### **The law and its interpretation**

- 10 Section 1(2) reads:

*It is hereby declared that the following (among other things) are not inventions for the purposes of this Act, that is to say, anything which consists of:*

*(a) a discovery, scientific theory or mathematical method;*

*(b) a literary, dramatic, musical or artistic work or any other aesthetic creation whatsoever;*

*(c) a scheme, rule or method for performing a mental act, playing a game or doing business, or a program for a computer;*

*(d) the presentation of information;*

*but the foregoing provision shall prevent anything from being treated as an invention for the purposes of this Act only to the extent that a patent or application for a patent relates to that thing as such.*

- 11 It is not disputed that the assessment of patentability under section 1(2) is governed by the judgment of the Court of Appeal in *Aerotel Ltd v Telco Holdings Ltd* and *Macrossan's Application* [2006] EWCA Civ 1371, [2007] RPC 7 ("*Aerotel*"). In this case the court reviewed the case law on the interpretation of section 1(2) and approved a four-step test for the assessment of patentability, namely:

- 1) Properly construe the claim
- 2) Identify the actual (or alleged) contribution
- 3) Ask whether it falls solely within the excluded matter
- 4) Check whether the contribution is actually technical in nature.

12 The operation of the test is explained at paragraphs 40-48 of the judgment. Paragraph 43 confirms that identification of the contribution is essentially a matter of determining what it is the inventor has really added to human knowledge, and involves looking at substance, not form. Paragraph 47 explains that a contribution which consists solely of excluded matter will not count as a technical contribution.

### **Application of the Aerotel test**

#### Properly construe the claim

13 I will specifically refer to claim 1 on the understanding that identical arguments apply to claims 6, 10, 11, 12 and 14. There has been no dispute regarding identifying the meaning of the claims. I construe claim 1 as a method of designing a roller cone drill bit comprising a series of steps to determine minimal moment centers along particular axes of rotation and further positioning components at those centers.

#### Identify the contribution

14 Mr. Russell argued that the contribution is to provide a design of a roller cone drill bit in which the end loads on the bearings of the roller cone drill bit will be substantially minimized resulting in significant advantages over existing drill bits. In other words, as Mr. Russell expressed at the hearing, the contribution is a design for a better drill bit. I have no dispute with this analysis.

#### Ask whether it falls solely within excluded matter

15 Mr. Russell went on to argue that the design is more than just the *potential* for a better drill bit – it is an end product in its own right. Any step of manufacturing an actual drill bit to the design would be a standard operation which would not confer any extra contributions. Thus the key contribution is present in the design itself and it is technical, i.e. non-excluded, since it relates to better drill bits. While I have some sympathy with this argument I must of course pay due notice to the relevant case law.

16 By far the closest precedent is *Halliburton Energy Services Inc. v Smith International (North Sea) Ltd.* [2005] EWHC 1623 (pat), [2006] RPC 2 (“Halliburton”). In this case Mr. Justice Pumfrey decided that claims to a method

of design of a drill bit were not patentable. Further, he considered the case to be on all fours with decision T0453/91 from the EPO Technical Board of Appeal (*IBM/Method for physical VLSI-chip design*). In this decision a claim to the design of a semiconductor chip was allowed once the additional step of “materially producing the chip so designed” was added.

17 In paragraphs 216-218 of *Halliburton Pumfrey J.* concluded:

*I have great sympathy with this approach. An untethered method claim may well cover activities which have nothing to do with industrial activity, but, if the claim is tied down to the industrial activity it becomes a valuable invention and restricted to its proper sphere. What cannot be plausibly suggested is that the method is not freighted with the technical effect that is needed for patentability: but the scope of the claim should be restricted to its technical field.*

*In the present case, claims 1 and 3, are directed purely to the intellectual content of a design process, and the criteria according to which decisions on the way to a design are made. ... They are thus firmly within the forbidden region as schemes for performing a mental act. So I think that these claims are bad because they are too broad, but an amendment of the type described in T0453/91 should dispose of the problem.*

*It might be supposed that such amendment does not affect the position ‘as a matter of substance’, but I think this is quite wrong. The objection, in my view, is to the width of claim alone when the method has potential industrial utility, that is, a potential technical effect. The objection to the claims in this case are to the form of the claim, not to the substance of the invention.*

18 Although these comments were probably *obiter* their direction is very clear. Namely, that a method of designing a drill bit should be excluded as a mental act but that tethering the design by including a manufacturing step will bring the contribution outside the exclusion.

19 Naturally, Mr. Russell disagreed with this conclusion and argued that the more recent *Aerotel* case should be followed over *Halliburton*. Certainly in *Aerotel* we are directed to assess the contribution as a matter of substance, which appears at odds with the approach taken in *Halliburton*.

20 Mr. Russell then drew an analogy with the contribution made by a computer program. He pointed out that it is standard practice to allow claims to programs themselves if they would result in a non-excluded contribution when running on an otherwise standard computer. Following *Aerotel* he argued I should also allow a claim to a method of design itself if it would result in a non-excluded contribution when manufactured. Mr. Russell argued that the issue is one of substance over form. The technical substance of the design is unchanged whether it is manufactured or not.

21 Again I have some sympathy with this reasoning but I believe I must follow the decision in *Halliburton* which was almost identical on the facts with this case.

While *Halliburton* predates *Aerotel* I am reassured that the former is still the correct case to follow by Pumfrey J.'s comments in paragraph 8 of *Cappellini & Bloomberg* [2007] EWHC 476 (pat). Here he said:

*The views of the Court of Appeal in Aerotel make it quite clear that, like most other problems that arise with a patent, the question of patentable subject matter is essentially a question of the scope of the claim. If the claim covers a method of arriving at a particular result by the exercise of rational processes alone, then it is, in my view, a claim to a "scheme, rule or method for performing a mental act". I adhere to the view that I expressed in Halliburton .... Such a case, in my view, can be saved by limiting it to a method of manufacture of the resulting article. ... there is no contribution lying outside excluded matter until the claim also covers the physical result of performing the claimed algorithm.*

- 22 I will not comment further on this case as Mr. Russell did not have a chance to consider it at the hearing. However, it does reassure me that the reasoning used by Pumfrey J. in *Halliburton* has not changed post-*Aerotel*.
- 23 Thus following the reasoning in *Halliburton*, I must conclude that the matter of 'claim 1 minus the recording step' is excluded under section 1(2) as a mental act. I further conclude that adding a manufacturing step to claim 1, with or without a recording step, would result in it not being so excluded.
- 24 Regarding the recording step, Mr. Russell argued that this step is implicit in the design claims. The design must be recorded in some way even if not explicitly stated. I agree with this and conclude that the recording step adds nothing significant to the claims. The contribution is a design for a better drill bit. Following *Halliburton* I have concluded that this is a mental act as such. Even recorded the contribution is still a mental act. Thus 'claim 1 with the recording step' is also excluded under section 1(2) as a mental act.

#### Check whether the contribution is actually technical in nature

- 25 As reasoned above, the contribution is a design for a better drill bit and is a mental act as such. It is thus not sufficiently technical in nature and also fails the fourth *Aerotel* step. By extension I draw the same conclusions as laid out in this paragraph, and the preceding two, with respect to claims 6, 10-12 and 14.

#### Claim 13

- 26 Turning to claim 13, this claim differs from the other method claims in that it is not a method of design but rather a method of determining a minimal moment center of a roller cone. The claim involves a number of mathematical steps to calculate and then plot the moment along a bearing axis and then determine the minimal moment position along that axis. There was no dispute regarding construing this claim.

- 27 Mr. Russell asserted that the contribution provided by this claim is to substantially minimize the anticipated end loads on a bearing when the roller cone mounted on the bearing is subjected to certain specified drilling conditions. Further, by minimizing the end loads, the operable life of the bearing structure can be enhanced. This is not in my view a fair assessment of the contribution of the claim. The claim stops short of applying the determined minimal moment positions to a roller cone in practice. I assess the contribution of claim 13 to be no more than it says, namely determining a minimal moment center of a roller cone. While this has the *potential* to substantially minimize the end loads of a bearing the claim does not specify this.
- 28 Determining a minimal moment center is clearly no more than a mathematical method or a mental act, it is not tied down to an industrial activity in any way. Claim 13 thus also lies solely within excluded matter. Similarly, the claim is not sufficiently technical in nature and therefore also fails the fourth Aerotel step.

### **Decision**

- 29 I have found that the contribution made by the invention defined in the current independent claims falls solely in subject matter excluded under section 1(2).
- 30 However, claims 1, 6, 10, 11, 12 & 14 can each be remedied by the addition of a suitable manufacturing step. Claim 13 could be rendered patentable by the inclusion of additional steps to apply the method to a roller cone in practice including manufacturing the resulting optimized structure. I thus give the applicants 2 months from the date of this decision to file an amended set of claims. If they do so the application will be remitted to the examiner for further processing. If not the application will be refused under section 18(3).

### **Appeal**

- 31 Under the Practice Direction to Part 52 of the Civil Procedure Rules, any appeal must be lodged within 28 days of the date of this decision.

### **S. Brown**

Deputy Director acting for the Comptroller