

3 July 2008

## PATENTS ACT 1977

APPLICANT                      Smith International, Inc.

ISSUE                              Whether patent application number  
GB0600581.3 complies with sections  
1(2) and 1(1)(b)

HEARING OFFICER              H Jones

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## DECISION

### Introduction

- 1 International patent application number PCT/US2004/022234, entitled “Methods for modeling, displaying, designing and optimizing fixed cutter bits”, was filed in the name of Smith International Inc on 29 July 2004. The international application claims priority from US patent application number US60/485642 filed on 9 July 2003 and entered the UK national phase as GB0600581.3. It was published by WIPO as WO2005/008022, and subsequently by the UKIPO as GB2419014.
- 2 The examiner raised objections that the application was excluded from patentability under section 1(2) on the basis that it was, in substance, no more than a computer program, a mental act, or a presentation of information, and that it lacked an inventive step in the light of GB2367853A (Smith International Inc). After several rounds of correspondence and amendment, the examiner concluded that agreement was unlikely and the matter came before me to decide at a hearing held on 25 February 2008, at which the applicant was represented by Mr. Gareth Fennell of Kilburn and Strode.
- 3 At the hearing I indicated that I was inclined to accept the applicant’s arguments on patentability. However, after the hearing was held, I became aware of certain passages in the Court of Appeal’s decision on *Fujitsu*<sup>1</sup> which I felt should be taken into account, and I therefore wrote to the Applicant on 12 March inviting him to comment on this. A response was received on 12 April.

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<sup>1</sup> *Fujitsu Limited’s Application*, [1997] RPC 608-621

- 4 Shortly after the hearing was heard, the Patents Court handed down its judgement on *Symbian*<sup>2</sup>. I invited the Applicant to make further submissions on this judgement; these were received on 15 April.

### **The application**

- 5 The application originally had a large number of claims, all relating to the design of a drill bit, but having little else in common. As a result of the amendments introduced, the invention now relates to a method for manufacturing a fixed cutter drill bit by designing the bit and then manufacturing it in accordance with at least some aspect of the design. Only the design stage is specified further in the claims: it comprises simulating the operation of the drill bit, graphically displaying at least part of the result, adjusting a parameter, and repeating the process.
- 6 The most recent set of claims was filed on the 9 January 2008. There are four independent claims (1, 35, 67, and 71), all of which relate to a method for manufacturing a fixed cutter drill bit. Claim 1 reads as follows:

*“1. A method of manufacturing a fixed cutter drill bit, comprising:*

*designing the drill bit by:*

*stimulating [sic] the fixed cutter drill bit drilling in an earth formation;*

*graphically displaying of at least a portion of the simulating;*

*adjusting a value of at least one design parameter for the fixed cutter drill bit according to the graphical display; and*

*repeating the simulation, displaying and adjusting to change a simulated performance of the fixed cutter drill bit until a performance characteristic is optimized;*

*wherein the graphically displaying comprises graphically displaying at least one of a force on blade, a total force on blade, a back rake angle of cutter against the formation, and a side rake angle, and*

*manufacturing the fixed cutter drill bit according to the designing.”*

- 7 The other claims are similar. Claim 35 specifies the parameters to be control model type parameters, drill string design parameters, drill bit / formation interface configuration parameters, or drilling operating parameters, whilst it removes from the adjusting step the requirement that adjusting is according to the graphical display. Claim 67 defines the simulating step more specifically, whilst removing the requirement for repeating. Finally claim 71 requires that a performance characteristic is obtained and displayed.

- 8 At the hearing, Mr Fennell argued the issues of patentability and inventive step separately. I will do the same in my decision.

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<sup>2</sup> Symbian Limited's application, [2008] EWHC 518(Pat)

## Patentability

### The law and its interpretation

- 9 The examiner has reported that the application is excluded from patentability under section 1(2) of the Act, as relating to a mathematical method and a program for a computer as such. The relevant parts of section 1(2) read:
- 1(2) 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;*
- 10 As regards the interpretation of section 1(2), my approach will be governed by the judgment of the Court of Appeal in *Aerotel/Macrossan*<sup>3</sup> and the Practice Notice issued by the Patent Office on 2 November 2006<sup>4</sup>. In *Aerotel/Macrossan* the court reviewed the case law on the interpretation of section 1(2) and approved a new four-step test for the assessment of patentability, namely:
- 1) Properly construe the claim
  - 2) Identify the actual contribution
  - 3) Ask whether it falls solely within the excluded matter
  - 4) Check whether the actual contribution is technical in nature.
- 11 However, the fourth step of checking whether the contribution is technical in nature may not be necessary because the third step – asking whether the contribution is solely of excluded matter – should have covered that point (see paragraphs 45 – 47 of the judgment).
- 12 Finally, I note that, by virtue of section 130(7) of the Act, section 1(2) is so framed as to have, as nearly as practicable, the same effects as the corresponding provisions of the European Patent Convention. However, the reliance that I can place on decisions of the Boards of Appeal of the European Patent Office under the corresponding Article 52 of the EPC must now be limited in view of the contradictions in these noted by the Court of Appeal in *Aerotel/Macrossan* and its express refusal to follow EPO practice.

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<sup>3</sup> *Aerotel Ltd vs Telco Holdings Ltd & Macrossan's Patent Application* [2007] RPC 7

<sup>4</sup> *Patents Act 1977: Patentable subject matter* [2007] RPC 8

- 13 The remaining case law on this topic is extensive, and it is not always easy to draw a consistent message from it.
- 14 Three other precedent cases of particular relevance are *Fujitsu*<sup>5</sup>, *Halliburton*<sup>6</sup> and *Cappellini / Bloomberg*<sup>7</sup>. As is often the case they point in different directions.
- 15 In *Fujitsu*, the Court of Appeal considered claims to a method of processing two images of crystal structures to produce a third image representing a synthetic crystal structure, and held this to be unpatentable on the basis that it was no more than a computer program and a mental act as such. Of more pertinence to this application is claim 9, which related to

*A method of manufacturing a structure which is a crystalline combination of two crystal structures, the method comprising an investigation of the effects of combining the two crystal structures using a method according to any one of the preceding claims.*

- 16 Aldous LJ said of this claim at page 618:

*“Mr Birss sought to rely upon the form of the claims. He submitted that claim 10, directed as it was to a computer apparatus having a number of features and claim 9 directed to a method of manufacturing a structure could not be said to relate to an invention consisting of a computer program as such.*

*That submission cannot be right having regard to the judgment of Nicholls LJ in Gale. In that case, I held at first instance that the ROM claimed was not excluded as it was an article which had been altered during manufacture so as to perform the function of the method or program defined by the claim. The Court of Appeal decided that that was not correct and that the court should look at the claims as a matter of substance. It was both convenient and right to strip away, as a confusing irrelevance, the fact that the claim was for "hardware".*

*There is only one invention. The fact that it is claimed as a method, a way of manufacture or an apparatus having appropriate features is irrelevant. Further there is no dispute as to what the invention is. In summary it uses a computer program so that an operator can select an atom, a lattice vector and a crystal face in each of two crystal structures displayed. The computer, upon instruction and using the program, then converts data representing the physical layouts of the two crystal structures into data representing the physical layout of the structure that is obtained by combining the original two structures in such a way that the selected atoms, the selected lattice vectors and the selected faces are superposed. The resulting data are then displayed to give a picture of the resulting combined structure. Clearly the whole operation revolves around the computer program and the question for decision is whether there is a technical*

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<sup>5</sup> Fujitsu Ltd's Application [1997] RPC 608

<sup>6</sup> Halliburton Energy Services Inc v Smith International (North Sea) Ltd and others [2006] RPC 25

<sup>7</sup> Cappellini's and Bloomberg LP's Applications [2007] EWHC 476 (Pat)

*contribution so that it cannot be said that the invention consists of a computer program as such.”*

- 17 In *Halliburton*, Mr. Justice Pumfrey (as he then was) considered claims to a method of design of a drill bit, and decided, in the light of precedents which included *Fujitsu*, that such claims did not define a patentable invention. However, he then went on to consider the decision of the EPO on *IBM/Method for physical VLSI-chip design*<sup>8</sup>, where claims to “materially producing a chip” which had been designed in accordance with the (unpatentable) design of the invention were held to be allowable, and concluded at paragraphs 216 to 218:

*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.*

*... I think that these claims [1 & 3] are bad because they are too broad, but an amendment of the type described in T 0453/91 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 that this is quite wrong. The objection, in my view, is to width of claim alone when the method has potential industrial utility, that is, a potential technical effect. The objection in this case are [sic] to the form of the claim, not to the substance of the invention.*

- 18 Whilst these remarks are strictly *obiter*, and the issue of the patentability of such “manufacturing” claims was not actually tested, their import is clear.
- 19 In *Cappellini / Bloomberg*, Mr. Justice Pumfrey considered the precedents of both *Aerotel* and *Fujitsu*, and concluded that

*As a matter of precedent, I am free to choose between these alternatives.*

and

*I adhere to the view that I expressed in *Halliburton v. Smith*. That case was a case of a claim to a method of design ... Such a case, in my view, can be saved by limiting it to a method of manufacture of the resulting article. I do not think that it can then be objectionable.*

- 20 Mr. Fennell has not sought to rely on *Symbian*. I do not think that this precedent advances the examiner’s arguments, so I will not consider it further.
- 21 *Halliburton* was decided before *Aerotel*, but after *Fujitsu*. *Cappellini / Bloomberg* was decided after *Aerotel*.

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<sup>8</sup> *IBM/Method for physical VLSI-chip design*, T 0453/91

## Arguments and analysis

22 The examiner analysed the claims, following the guidance given in *Aerotel*. With regard to claim 1, he construed the claims as methods of manufacturing fixed cutter drill bits in which the fixed cutter drill bit is designed in a process involving simulating drill bit / earth interaction and graphical display, and then manufactured.

23 With regard to step 2, he argued that

Paragraph 43 of the *Aerotel*/Macrossan decision explains what is meant by the contribution and sets out that it corresponds to what the invention has added to human knowledge, the problems it solves and the advantages it offers. The specification gives no instruction on any manufacturing steps, merely that manufacturing is carried out. Therefore, the manufacturing is not what the invention adds to human knowledge. Equally, the invention cannot involve solving a problem associated with manufacturing drill bits.

Turning to the issue of whether the invention has any advantages in the manufacture of drill bits, this is less straightforward. I now consider that it does not. This is because the drill bit design that comes out of the design process may be a design for a conventional drill bit, hence the manufacturing process will be unaltered. Thus, there can have been no advantages to the manufacturing process.

Thus, the manufacturing process forms no part of the contribution, which can only lie in the simulation process.

24 Applying step 3, he found that ‘simulation of drilling processes falls within the excluded categories of “mathematical method”, “computer program” and “method for performing a mental act”, and that, furthermore, it appears that the contribution to this simulation process is found in the display of information during the process, a contribution in the presentation of information.’ Step 4 was therefore unnecessary.

25 On this basis, he concluded that the invention is excluded from patent protection.

26 In response, Mr Fennell argued that whilst *Aerotel* provides a new test, it is one that is intended to produce the same results as the previous case law, in particular *Halliburton*. He pointed out that *Cappellini / Bloomberg*, decided after *Aerotel*, supports the view that nothing has changed, at least as far as design and manufacture of drill bits is concerned.

27 He also disputed the examiner’s assessment of the contribution to the art, insisting that it lay in a particular method of manufacture of the drill bit, albeit one in which the developments were in the design stage. As manufacturing is a patentable activity, he argued that his invention was patentable.

28 With regard to *Fujitsu*, Mr Fennell referred me to Mr Justice Pumfrey’s comment in *Cappellini / Bloomberg* that “as a matter of precedent, I am free to choose between these alternatives” (*Fujitsu* or *Aerotel*). Unsurprisingly, he urged me

choose *Aerotel*, although he did not explain why.

- 29 He also referred me to the Mr Justice Kitchen's comments in *Crawford*<sup>9</sup>, where he held *CFPH* to be consistent with both *Halliburton* and *Fujitsu*. On this basis he argued that *Halliburton* is consistent with *Fujitsu*. He also referred me to the fact that *Aerotel* considered both *Halliburton* and *Fujitsu*, and, again, detected no inconsistency.
- 30 Mr Fennell also pointed to a number of patents that had been granted with claims similar to his, and to Office actions where examiners had indicated that amendments of the sort that he had introduced would cure an objection to unpatentable subject matter.
- 31 The examiner accepted that the manufacturing stage could provide patentability, but went on to argue that this would only be the case if the design inevitably led to a different method of manufacture or a different finished article. This was not the case here, and on this basis he felt that the contribution lay in the design method. To argue otherwise was to exalt form over substance.
- 32 I have a lot of sympathy with the examiner's argument. However, as I pointed out at the hearing, the originality of the resultant manufacturing method or the resultant product is not a factor that was considered in *Halliburton*. But the issue of form or substance was explicitly considered in *Halliburton*, and the outcome seems to me to undermine the examiner's contention fatally in this regard. And in any case, I cannot see any difference between the circumstances of *Halliburton* and those of this application.
- 33 As can be seen from the above, on the one hand, *Fujitsu* states that merely tagging on a manufacturing step to an unpatentable claim does not save it. On the other hand, *Halliburton* (confirmed by *Cappellini / Bloomberg*) states that it can.
- 34 If I were to conclude that these two decisions are inconsistent, then that would present me with a problem. On the one hand, rules of precedence would lead me to follow *Fujitsu*. On the other hand, *Halliburton* states that it takes into account *Fujitsu*, and is completely on all fours with the present application: and *generalia de specialibus non derogant*.
- 35 Fortunately, I believe that it is possible to reconcile these two decisions. The courts have consistently reminded us that decisions of this type have to be made on a case-by-case basis, taking into account all the facts of the case in question. Different cases have different facts, and different facts lead to different conclusions.
- 36 In particular, there is a dividing line between what is patentable and what is not. Some cases will be close to that dividing line. Such cases will need only a small nudge to move them over from one side of the line to the other. Other cases are further away from the dividing line. These will need a larger push to move them over the boundary, or they may be so irredeemably on the wrong side that no

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<sup>9</sup> Crawford's application, [2005] EWHC 2417

remedy will save them.

- 37 In *Halliburton*, the application related to the design of drill bits. Whilst this was correctly decided to be unpatentable, it seems to me that no-one designs a drill bit for fun or for the intellectual satisfaction of doing so. There is only one reason to design a drill bit, and that is as a prelude to making drill bits according to that design. It is thus inevitably intimately linked with the process of industrial manufacture, something that has always been at the heart of the patent system. Whilst it is not itself patentable, it is so akin to patentable subject matter that it only needs a small nudge to make it patentable. Even such a trivial step as tagging on a manufacturing step is sufficient to provide that nudge.
- 38 On the other hand, *Fujitsu* was concerned with the process of simulating novel crystal structures. This is of much wider interest. Academics in their ivory towers may well wish to engage in this sort of activity for purely intellectual reasons. An industrial process is much less likely to result. It is thus further away from the boundary between patentable and non-patentable subject matter, and the step of manufacturing is not enough on its own to drag it over the dividing line between forbidden and allowable subject matter.
- 39 In the light of this, the correct conclusion is clear. The present application, like *Halliburton*, relates to designing and then manufacturing a drill bit. Like *Halliburton*, it must be patentable.

### **Inventive step**

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

- 40 The examiner has also argued that the invention lacks an inventive step. The relevant sections of the Patents Act are

*1.-(1) A patent may be granted only for an invention in respect of which the following conditions are satisfied, that is to say -*

.....

*(b) it involves an inventive step;*

*3. An invention shall be taken to involve an inventive step if it is not obvious to a person skilled in the art, having regard to any matter which forms part of the state of the art by virtue only of section 2(2) above (and disregarding section 2(3) above).*

- 41 This is assessed on the basis of the well-known *Windsurfing*<sup>10</sup> approach, as reformulated by Jacob LJ in *Pozzoli*<sup>11</sup> (see paragraph 23 of the Court of Appeal's judgment). The four steps of the test are now:

- 1) (a) Identify the notional person skilled in the art, and  
(b) Identify the relevant common general knowledge of that person;

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<sup>10</sup> *Windsurfing International Inc v Tabur Marine (Great Britain) Ltd*

<sup>11</sup> *Pozzoli*<sup>11</sup> *SpA v BDMO SA* [2007] EWCA Civ 588



- 2) Identify the inventive concept of the claim in question or, if that cannot readily be done, construe it;
- 3) Identify what, if any, differences exist between the matter cited as forming part of the “state of the art” and the inventive concept of the claim or the claim as construed;
- 4) Viewed without any knowledge of the invention as claimed, do these differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?

### **Argument and analysis**

42 The examiner did not follow this approach explicitly in correspondence, but in his final letter he argued (in response to a discussion about selection inventions) that

I accept that GB 2367843 discloses designing an entire drilling tool assembly and not only fixed cutter drill bits. However, designing an entire drilling tool assembly per force involves designing the drill bit which is part of the drilling tool assembly so GB 2367843 discloses designing a fixed cutter drill bit; that it additionally discloses designing other features of the drilling tool assembly does not mean that it does not disclose designing the drill bit. Furthermore, your specification, in paragraphs 153 and 164 for example indicate that the designing of the fixed cutter drill bit can be done in conjunction with modelling the entire drilling tool assembly. Thus, I find the argument that GB 2367843 is not a valid starting place for inventive step not persuasive.

As is helpfully pointed out, with selection inventions it is necessary for the selection to meet the criteria laid down in *I G Farbenindustrie AG's Patent*, 47 RPC 289 at pages 322-3. These are:

- a) the selection must be based on some substantial advantage gained or some substantial disadvantage avoided,
- b) substantially all the selected members must possess the advantage in question, and
- c) the selection must be in respect of a quality of special character which can fairly be said to be peculiar to the selected group; this is not necessarily nullified if it transpires that some other members of the class from which the selection is made have this quality, but the claim may be invalid if it is found that the quality is common to many other members in addition to those selected

I also note that the advantage relied upon to justify a selection invention should be clearly disclosed if it would not otherwise be apparent to a person skilled in the art, as stated in *Glaxo Group Ltd's Patent* [2004] RPC 43.

I have considered the specification and see no clear disclose of an advantage that the particular parameters given in the claim have. If the advantages are apparent to a person skilled in the art then I cannot see

that it can be inventive to use them. Therefore, I am not persuaded by the arguments in relation to GB 2367843 and maintain the inventive step objection.

43 It is unfortunate that the examiner did not apply *Windsurfing* to this application. Had he done so, it is possible that the arguments on both sides might have been much better focussed.

44 At the hearing, Mr Fennell did not pursue the issue of selection inventions, but turned instead to inventive step.

45 His first point was that the citation relates to modelling, optimising and designing a complete drill string assembly, including the drill string, and not just a drill head. Whilst this will involve an element of design of the drill head, it will not optimise the drill head itself, only the complete drill string.

46 The examiner was of the view that this inevitably involved optimising the drill bit itself. Mr Fennell disagreed, suggesting that to optimise the whole drill string would lead to a different design for the drill bit than would arise from optimising the drill bit *per se*.

47 After some lengthy and inconclusive discussion, which did little to move the debate forward, Mr Fennell sought to distinguish his invention from the prior art in no less than nine respects:-

- i) The citation is concerned with designing a drill tool assembly *in toto*; the invention designs only the drill bit
- ii) The citation states that the simulation of the drill bit does not form part of its invention, but is known
- iii) The citation relates to roller cone bits; the invention to fixed cutter bits
- iv) The reader is required to design a fixed cutter bit
- v) The invention requires a novel design method rather than the previously known one
- vi) The invention relates to a fixed cutter bit
- vii) The graphical display relates to a drill bit
- viii) Different parameters are displayed
- ix) The invention requires that things are calculated and displayed: the citation gives no hint as to how these could be calculated.

48 There was some more inconclusive discussion.

49 I shall now apply the four tests in *Windsurfing* as reformulated in *Pozzoli*.

50 The first part of the first step is to identify the skilled person. The examiner has

suggested the skilled person is the designer of fixed cutter drill bits, and Mr. Fennell did not dispute this. Actually, it seems to me that the skilled man could be defined more widely than this, for instance as the engineer skilled in designing and manufacturing drill bits in general, or even as the engineer skilled in designing and manufacturing drilling equipment. However, I will proceed on the basis of the examiner's narrow definition.

51 The next part of the first step is to identify the common general knowledge of the skilled person. This generated considerable discussion, but I think that the outcome was that it was agreed that the skilled man will know, amongst other things, that fixed cutter drill bits have blades which are subject to substantial forces.

52 The next step requires me to construe the claim and identify the inventive concept. Construing claim 1 presents few issues:

At line 3, "stimulating" should read "simulating"

The claim requires that "a performance characteristic is optimized", but it does not clearly specify what this performance characteristic is. However, given that the claim refers to "a simulated performance of the fixed cutter drill bit" a few words earlier, I shall construe this to mean that "a characteristic of the simulated performance of the fixed cutter drill bit is optimized".

53 Claim 35 introduces a few problems of its own, which I will deal with here for completeness:

Claim 35 defines a method that comprises "selecting one or more parameters affecting performance selected from among the group consisting of control type parameters, drill string parameters, drill bit/formation interface parameters, and drill operating parameters". It is clear to me that there must be a selection step involved. However, the question arises as to whether all the parameters listed must be present, or if only one needs to be present. I construe the claim to require that, providing any one of the parameters listed is selected, this part of the claim is met. I am sure that, if the intention had been that the claim requires all the parameters to be present, then this would have been made clear.

Claim 35 refers to "control model type parameters". This term is not entirely clear. The description describes this as including cutter / formation control model, weight on bit (WOB) control model, and rate of penetration control (ROP) control model, constrained centreline model, and dynamic model. However, this is repeated in claim 42, which suggests that "control model type" is significantly broader than this.

54 I therefore construe the inventive concept in claim 1 to lie in the design of a fixed cutter drill bit, and manufacture thereof according to the design, wherein the design step includes simulating the operation of the bit, graphically displaying a simulated force on a blade or a simulated rake angle, adjusting some design parameter according to the display, and repeating the process until the

performance of the drill bit is optimised.

55 The third step requires me to identify the differences between the citation and the claim. This was rather contentious.

56 It seems to me that it is common ground that the citation discloses:

Designing a drill bit by:-

Simulating the drill bit in an earth formation

Graphically displaying at least a portion of the simulating

Adjusting at least a value of a design parameter of the drill bit until optimisation occurs

Repeating the process

57 It also appears to be common ground that the citation does not disclose:

Manufacturing

The display of a force on blade, total force on blade, back rake angle or side rake angle

58 The remaining features of claim 1 were disputed. These are:

The extent to which the citation discloses application to a fixed cutter bit

Whether a performance characteristic of the drill bit is optimised, as opposed to the drill string as a whole

The extent of the simulation or modelling

Whether or not the display is repeated

Whether the drill bit itself is optimised

59 I now turn to these.

60 Whilst the citation is primarily directed to the design of drill string assemblies as a whole, it is clear to me that the design of the drill bit forms part of this.

61 The citation is directed primarily to roller cone bits. However, it also makes it clear that the techniques disclosed there are equally applicable to fixed cutter drill bits (page 2 lines 11-13, page 11 lines 9-10, page 16 line 3, page 33 lines 1-3, page 43 line 26). Should the skilled person choose to follow this suggestion, he will clearly have to make consequential changes. The question then arises whether this is an enabling disclosure.

62 Many such changes will fall within the skills of an un inventive skilled person. The skilled man must be assumed to want to make the variant work, and to make an effort to make it work. He may be expected to design and experiment. However,

he cannot be expected to invent in order to implement a suggestion. If he needs to invent, then the suggestion is not an enabling disclosure and must be discarded.

- 63 I have read the citation. The description is in general terms and does not go into detail. The generality of the description is such that few changes would be required to make it apply to fixed cutter systems rather than roller cone systems. Such changes to the description as would be required seem to me to be rather trivial. Thus I consider that the disclosure is just as enabling for fixed cutter systems as for roller cone systems.
- 64 I therefore find that the citation does disclose application to fixed cutter bits, and that this is an enabling disclosure.
- 65 The citation discloses the display of parameters in the paragraph linking pages 31 and 32. It goes on to describe an iterative process. Mr Fennell has correctly pointed out that there is no explicit statement that the display is repeated at each stage in this iterative process. The examiner, however, believes this to be implicit. I agree with the examiner. Each iteration involves the calculations whose outcomes are shown in the display; it seems to me inevitable, or at least likely, that each of these will be displayed as they are calculated. I therefore believe that the citation shows this feature, or at least renders it highly obvious.
- 66 Claim 1 requires only that the cutter bit is simulated whilst drilling in an earth formation, and that this process is repeated iteratively as part of the optimisation loop. As noted above, it is common ground that the drill bit is simulated drilling in an earth formation. As disclosed at page 33 lines 9 to 11, the simulating is repeated at each stage in the iterative process. Therefore this aspect of the present invention is disclosed.
- 67 It is common ground that the citation optimises a drill string as a whole. Mr Fennell has suggested that this will not necessarily optimise the drill bit as a drill bit, a view with which the examiner disagreed. However, I note that all that the claim requires is that “a performance characteristic” is optimised, which I take to mean to “a simulated performance characteristic of the drill bit” as explained above. In the citation, parameters to be adjusted include the “type, size, weight, configuration, and material properties of the drill bit; and the type, size, number, location, orientation and material properties of the cutting elements on the bit.” (page 33 lines 23 to 25). Clearly the optimisation process involves parameters of the drill bit as well as the rest of the drill string.
- 68 It seems to me that optimising the performance of the drill string will inevitably optimise some performance characteristic of the drill bit, even if the optimisation is only a constrained optimisation. I therefore find that this feature of the claims is disclosed by the citation.
- 69 The feature that the adjusting is *in accordance with the graphical display* was not discussed at the hearing. This is a feature of claim 1 and 67, but not of claims 35 or 71. I cannot find it in the citation.
- 70 Consequently I find that the citation discloses, or at least strongly suggests, every

feature of claim 1 other than manufacture, display of a force on blade, total force on blade, back rake angle or side rake angle, and adjusting in accordance with the graphical display.

- 71 Having completed the third step of *Windsurfing / Pozzoli*, I now move on to the final question: do these differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention? In so doing I must be careful to avoid falling into the trap of using hindsight, and I must take into account that I am already aware of the present invention and suppress this awareness.
- 72 As I noted above, the citation does not disclose a manufacturing step. However, as I noted with reference to patentability, drill bits are designed with only a single object in view, namely to manufacture them. Thus I do not consider that this step is inventive.
- 73 The citation discloses the display of bit forces, cone forces, cutting element forces, ... etc., or a time history of the dynamic WOB or the wear of cutting elements. It is clear that this list is not exhaustive, and that any other suitable parameter could also be displayed. Given that the force on a blade will be the sum of the forces on the cutting elements, I do not think that the step of displaying the force a blade, or a total force on a blade, would be inventive: it is no more than a summary of what is already disclosed as being displayed. This view is confirmed by the disclosure in the citation at page 43 final line to page 44 line 2 that the force distribution on the blades or among the blades may be optimised when the invention is applied to fixed cutter bits: since the optimisation is on the basis of the display, it seems to me that it is implicit that such forces will have to be displayed.
- 74 The final feature of claim 1 that is not in the citation is that the adjusting is in accordance with the graphical display. The citation states that adjustment may be "by reading in a new value from a data file, data input from an operator, or calculating adjustment values based on evaluation of responses corresponding to previous values, for example" (page 42 lines 13 to 16). The first and third of these suggest an automatic process; the second does not indicate the basis on which the operator inputs data, and there is no reason that I can see to suppose that it will be on the basis of the graphical display. I do not think that it is an obvious step that would readily occur to the skilled by un inventive person.
- 75 I therefore find that claim 1 is inventive. Claims 67 and 71 are inventive for the same reason.
- 76 I now turn to claim 35. This lacks the feature that I held to be inventive in the other independent claims, namely that a parameter is adjusted in accordance with the graphical display. Instead it requires that the simulation is on the basis of at least one of control model type parameters, drill string parameters, drill bit/formation interface configuration parameters, or drilling operating parameters, that one of these is selected, and that the display shows a simulated performance characteristic as well as one of the design parameters of claim 1.
- 77 The citation discloses (at page 13 lines 13 to 17) the selection of parameters that

include drilling tool assembly parameters, initial drilling environment parameters, drilling operating parameters, and drilling tool assembly / drilling environment interaction parameters. Drilling tool assembly / drilling environment interaction includes drill bit / formation interaction (page 13 lines 5 and 6). Thus drill bit/formation interface configuration parameters and drilling operating parameters are disclosed, and drill string parameters are strongly suggested. Furthermore, the citation states (in the paragraph linking pages 17 and 18) that the drilling tool assembly / drilling environment interaction parameters can include cutting element / earth formation interaction models; as the term “control model type parameters” includes “cutter / formation control models”, it also seems to me to be likely that this feature is also disclosed by the citation, although given the obscurity of the term it is difficult to be sure. In any event, given my construction of claim 35, the citation discloses the first two extra features of claim 35.

- 78 The citation discloses at page 31 lines 15 to 23 the output of bit forces, cone forces, cutting element forces, impact forces, friction forces, dynamic WOB, resulting bottomhole geometry, etc. This output information may be presented in the form of a visual presentation. Although this is not stated explicitly, I take this to mean that all this could be output as part of the visual presentation or display (Fig. 7D). Calculated bottomhole geometry seems to me to fall within the ambit of “simulated performance characteristic”, and I have already held that blade forces are an obvious alternative to the various forces listed. Thus I find that the final extra feature of claim 35 is obvious.
- 79 Therefore I find that claim 35 lacks an inventive step.
- 80 A graphical display of the parameters is disclosed in the citation in the paragraph linking pages 31 and 32. Thus claim 36 falls with claim 35.
- 81 The citation discloses the specific matter of claim 37, 45, 46 and 64, for instance in the first full paragraph of page 14. Therefore claims 37, 45, 46 and 64 fall with claim 35.
- 82 The citation discloses parameters that include cutter / formation models (page 17 line 20), dynamic weight on bit (page 31 line 19), rate of penetration (page 34 line 6) and constraining to a centreline (paragraph linking pages 21 and 22). Thus claim 38 falls with claim 35.
- 83 I can find no reference to adjusting the nodal division of components, PDC table thickness, or anisotropic strength, or to a three-dimensional graphical depiction, or to displaying the number of cutters in contact with the earth formation in the citation, and I can think of no reason why it would be obvious to incorporate any of these into the citation. Claims 39, 40, 41, 50, 51, 52, 57 to 61, 63, 65 and 66 are therefore inventive.
- 84 Many of the features of claim 42 are disclosed by the citation: I have already alluded to weight on bit. Thus claim 42 falls with claim 35.
- 85 I have already held that forces on blades are obvious. As this is one option in claims 43, 44 and 48, claims 43, 44 and 48 must fall with claim 35.

- 86 The implication of the paragraph linking pages 31 and 32 is that the display repeats as the information is recalculated at successive increments of rotation. Thus claim 47 is also obvious.
- 87 The citation does not disclose claims 49 or 62, and I do not believe that it is obvious to introduce the features that these claims define.
- 88 Claims 53 to 56 depend on claim 52, which I have found to be inventive. They are also inventive.
- 89 For completeness, I will briefly confirm that I have considered all nine distinctions from the prior art that Mr Fennell sought to draw:-

“The citation is concerned with designing a drill tool assembly *in toto*; the invention designs only the drill bit.” I have concluded that designing the drill tool will inevitably involve designing the drill bit.

“The citation states that the simulation of the drill bit does not form part of its invention, but is known.” Nevertheless, it is disclosed (albeit indirectly) by the citation: this is the test that I must apply.

“The citation relates to roller cone bits; the invention to fixed cutter bits.” The citation also discloses application to fixed cutter bits.

“The reader is required to design a fixed cutter bit.” This is true. But he is given enough information to so in combination with his specialist common general knowledge.

“The invention requires a novel design method rather than the previously known one.” I accept that the invention is novel. The issue here is inventive step.

“The invention relates to a fixed cutter bit”. The citation discloses the design of fixed cutter bits.

“The graphical display relates to a drill bit”. The citation discloses the display of a variety of features of the drill bit in the paragraph linking pages 31 and 32.

“Different parameters are displayed.” This is inevitable when the disclosed ‘fixed cutter’ alternative is pursued. Any other differences that go beyond this lack an inventive step.

“The invention requires that things are calculated and displayed: the citation gives no hint as to how these could be calculated.” It also gives little indication how they could be calculated and displayed for roller cutters, because this is within the remit of the skilled man.

## **Conclusion**

- 90 I therefore conclude that the invention is not excluded under section 1(2). It relates to a manufacturing process, and not to a mathematical method, a



program for a computer or a mental act as such.

- 91 I have also concluded that claims 1 to 34, 39 to 41, 49 to 63, and 65 to 75 involve an inventive step, and therefore satisfy the requirements of section 1(1)(b).
- 92 Finally, I have concluded that claims 35 to 38, 42 to 48 and 64 do not involve an inventive step, contrary to section 1(1)(b).

### **Further procedure**

- 93 The application has not yet reached the end of the extended compliance period, and there are various possible amendments to claim 35 that would cause it to meet the requirements of the Act. I therefore remit the application to the examiner to see if he can agree a form of amendment with the applicant that will meet the requirements of section 1(1)(b).
- 94 The extended compliance period for acceptance of this application ends on July 7. However, further extensions are possible at the comptroller's discretion, and I would be minded to grant a further extension if this were to be applied for.
- 95 I would point out that the claims that I have found to be inventive have a number of very different inventive features. When amending, it will be necessary to ensure that all the claims include the same inventive feature.

### **Appeal**

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

**H JONES**

Deputy Director acting for the Comptroller