Intellectual Property Office

BL O/420/17
7th September 2017

PATENTS ACT 1977

APPLICANT	Statoil Petroleum AS
ISSUE	Whether patent application GB1313173.5 complies with section 1(2)
HEARING OFFICER	H Jones

DECISION

Introduction

1 This decision is concerned with the question of whether patent application GB1313173.5 relates to excluded matter. Throughout the prosecution of the application, the examiner has maintained that the claimed invention is excluded from patentability under section 1(2) of the Patents Act 1977 ("the Act") as being a mathematical method and/or a computer program as such. Despite several rounds of argument and amendment, the examiner and the applicant have not been able to overcome the objections and a hearing was offered to resolve the matter.

2 The hearing was held at the Intellectual Property Office on 14 August 2017. The unextended period for placing the application in order (the "section 20 period") expired on 15 March 2017 but has been extended to 15 September 2017 after requests made under rules 108(2) and 108(3). The applicant was represented by Mr Julian Asquith of Marks and Clerk LLP.

The invention

3 The application is entitled "Method of predicting the response of an induction logging tool" and was filed as PCT application PCT/EP2011/051495 on 2 February 2011 with no claim to an earlier priority date. It was published as WO2012/103945 on 9 August 2012 and republished as GB2501639 on 30 October 2013 upon entry into the national phase.

4 The hearing related to the latest claims filed with skeleton arguments on 4 August 2017, which claim a method of synthesising a realistic earth model that involves a step of predicting the response of an induction logging tool along an arbitrary trajectory in a three dimensional earth model. A set of further amended claims not yet filed, including a new dependent claim 18, was also discussed at the hearing. The examiner confirmed that the amended claims filed on the 4 August 2017 are clear and supported by the application as originally filed and so can be considered: the provision of the 3D earth model, which was previously implicit, has been made explicit in the amended claims.

5 The invention is concerned with predicting the response of an induction logging tool along an arbitrary trajectory in a 3D earth model. The degree of computation involved in predicting the response of the tool can be reduced significantly without too much sacrifice by confining computations to a limited domain of the geology model surrounding the logging tool. This is said in the application to provide for “real-time” predictive computation in a way that could not be possible with computations in a “full 3D inhomogeneous and anisotropic medium with a full 3D code based on Maxwell equations”.

6 Claim 1 is the only independent claim of the set filed on 4 August 2017, which reads as follows:

> 1. A method for synthesising one or more realistic earth models comprising the steps of:
>
> providing a three-dimensional earth model;
>
> predicting the response of an induction logging tool along an arbitrary trajectory in said three dimensional earth model by confining electromagnetic field computations to a limited domain of the geology surrounding the induction logging tool;
>
> evaluating said three-dimensional earth model based upon said predicting the response of said induction logging tool;
>
> considering the magnetic field at a receiver coil of the induction logging tool to be a superposition of a primary and secondary constituent, wherein the primary constituent is due to a homogenous and isotropic background medium have an effective background conductivity which is assumed to be constant throughout said limited domain and wherein the said effective background conductivity is the average value of the conductivity around the tool domain; and
>
> based upon the preceding steps, synthesising one or more realistic earth models.

The Law

7 Section 1(1) of the Act deals with the conditions that must be met for a patent to be granted. It states that:

> *1(1). A patent may be granted only for an invention in respect of which the following conditions are satisfied, that is to say -*
>
> *(a) the invention is new;*
> *(b) it involves an inventive step;*
> *(c) it is capable of industrial application;*
> *(d) the grant of a patent for it is not excluded by subsections (2) and (3) or section 4A below;*

8 Section 1(2) lists certain categories of subject-matter which are not considered to be inventions. These categories of subject-matter are conventionally known as excluded subject matter:

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;

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.

9 The Court of Appeal in *Symbian*[1] stated that the question of whether a computer-implemented invention is patentable has to be resolved by answering the question whether it reveals a technical contribution to the state of the art. It proceeded to answer the question with the aid of the four-step test set out in its earlier judgment in *Aerotel*[2], namely:

(1) construe the claim;
(2) identify the actual (or alleged) contribution;
(3) ask whether it falls solely within the excluded subject matter;
(4) check whether the actual or alleged contribution is actually technical in nature.

10 The fourth step of the test is to check whether the contribution is technical in nature. In paragraph 46 of *Aerotel* it is stated that applying this fourth step may not be necessary because the third step should have covered the question. This is because a contribution which consists solely of excluded matter will not count as being a "technical contribution" and thus will not, as the fourth step puts it, be "technical in nature". Similarly, a contribution which consists of more than excluded matter will be a "technical contribution" and so will be "technical in nature". In the present case, which concerns a computer-implemented invention, I think it makes sense to consider whether the contribution is excluded alongside the question of whether the contribution is technical in nature, i.e. I will consider the third and fourth *Aerotel* steps together.

11 Further guidance concerning whether a computer program makes a technical contribution was provided by Lewison LJ in *HTC/Apple*[3] in which he set out the following signposts (the so-called “AT&T signposts"):

i) whether the claimed technical effect has a technical effect on a process which is carried on outside the computer;

ii) whether the claimed technical effect operates at the level of the architecture of the computer; that is to say whether the effect is produced irrespective of the data being processed or the applications being run;

[1] Symbian Ltd. v Comptroller-General of Patents [2008] EWCA Civ 1066
[2] Aerotel Ltd v Telco Holdings Ltd and Macrossan’s Application [2006] EWCA Civ 1371
[3] HTC Europe Co Ltd v Apple Inc [2013] EWCA Civ 451, paras 148-150

iii) whether the claimed technical effect results in the computer being made to operate in a new way;

iv) whether the program makes the computer a better computer in the sense of running more efficiently and effectively as a computer;

v) whether the perceived problem is overcome by the claimed invention as opposed to merely being circumvented.

Argument & analysis

Construing the claims

12 The main point of contention in respect of claim construction turns on the meaning of the term “synthesising one or more realistic earth models” in claim 1.

13 The examiner states in his most recent examination report that the claimed invention does not define any step of using data obtained from observations in the real world which he considers necessary for the invention to be patentable. He said this in respect of a version of claim 1 that does not refer explicitly to the step of providing a three-dimensional earth model in order to synthesise a realistic earth model. He has since confirmed (following the amendment made on 4 August 2017 to introduce the step of providing a three-dimensional earth model) that he had understood such a step to be implicit in claim 1 even before the amendment was made and that his view with regard to using data from the real word remains the same.

14 Mr Asquith argued that the skilled person would well understand that any earth model used in modelling the response of a downhole logging tool would be based on all available physical measurements and that the step of providing such a model cannot be a purely abstract or theoretical step. He referred me to various paragraphs of the Office’s Manual of Patent Practice dealing with claim construction that make the point that the claims and description should be interpreted in accordance with the understanding of the skilled reader. He said that the skilled reader would be aware of documents such as "Modeling while drilling" from the Middle East and Asia Review, Number 8, 2007, which predates the priority date of the present application, which shows the manner in which the person skilled in the art would have approached and understood the patent specification. He referred specifically to the following parts of the article:

> “Directional drilling presents a range of technical challenges. Today, real-time geosteering teams can use pseudo-logs with customised applications to model downhole tool responses and anticipate lithological variations in horizontal wells while drilling. The expected tool responses can be compared with actual results and used to guide the next stage of drilling. This approach has been applied in several oil and gas fields and is becoming an established tool for many companies in the Middle East and Asia.”

> “The first step of the modelling-while drilling workflow is to create a robust and consistent earth model that incorporates all the existing data. A typical earth model includes the following datasets: seismic surveys; horizons interpreted from the seismic data; fault interpretations; a 3D earth model; 3D facies and petrophysical properties; workflows for volumetrics and uncertainty analysis; several predefined plotting windows; modelling-while drilling-workflows.”

15 Mr Asquith proceeded to set this text in the context of the present application, referring in particular to the description at page 2, line 30 of the specification as follows:

> "The invention can provide a method for real-time predictive computation of a logging response in a full 3D earth model. The method can be real-time in the sense that it can be performed contemporaneously with the taking of real-time measurements in the borehole. The logging response is the response of the tool, producing a so-called well log of the geologic formations penetrated by a borehole. This log encompasses measurements along a trajectory through a 3D anisotropic medium, for some prescribed electromagnetic frequency of operation."

16 Mr Asquith argued that the person skilled in the art would know that the initial 3D earth model of claim 1 would be based on measurements made in the real world and that the "realistic earth model" provided by the invention would be a better representation of the geological landscape surrounding a borehole. I shall return to the question of what is meant by "better" when assessing the contribution.

17 I agree with Mr Asquith that consideration of the common general knowledge of the skilled person is essential when reading and understanding a patent for the purposes of purposive construction. Mr Asquith goes on to assert that the disclosure made in the "Modeling while drilling article" forms a part of that common general knowledge and that the term "earth models" should be construed in the light of this knowledge. I am aware that the Courts have addressed the relationship between patent specifications and scientific journal publications to the common general knowledge in the past and have stated that (Sachs LJ in *General Tire*[4]):

> "..it is clear that individual patent specifications and their contents do not normally form part of the relevant common general knowledge" …."it is not sufficient to prove common general knowledge that a particular disclosure is made in an article, or series of articles, in a scientific journal";

and (Luxmoore J in *British Acoustic Films*[5]*):*

> "In my judgment it is not sufficient to prove common general knowledge that a particular disclosure is made in an article, or series of articles, in a scientific journal, no matter how wide the circulation of that journal may be, in the absence of any evidence that the disclosure is accepted generally by those who are engaged in the art to which the disclosure relates. A piece of particular knowledge as disclosed in a scientific paper does not become common general knowledge merely because it is widely read, and still less because it is widely circulated. Such a piece of knowledge only becomes general knowledge when it is generally known and accepted without question by the bulk of those who are engaged in the particular art; in other words, when it becomes part of their common stock of knowledge relating to the art".

18 The "Modeling while drilling" article was published in 2007, before the filing of the patent application, and although the article describes that models of downhole tool responses can be used by geosteering teams while physically drilling, I have seen no evidence that the disclosure is accepted generally by those who are engaged in the art to which the disclosure relates (as required in *British Acoustic Films*). Therefore, I do not consider this article to have been shown to form a part of the common general knowledge of the skilled person and cannot assume that a skilled reader would have

[4] General Tire and Rubber Company v Firestone Tyre and Rubber Company Ltd [1972] RPC 457 (pages 482-483)
[5] British Acoustic Films 53 RPC 221 at 250

regard to the contents of the article when interpreting the disclosure of the application as filed. The application as filed did not expressly refer to this article, and so it cannot be considered to form a part of the disclosure of the application either. I shall construe the claims without reference to the article.

19 The specification of the application as filed does not provide a clear description of what is meant by an earth model, stating only that it is "realistic" and can be a "full 3D" earth model (on page 2). There is also no explicit disclosure of whether the 3D earth model is based upon physical measurements. However, the application refers to an article by one of the applicants on the topic of "Optimisation Strategy for Shared Earth Modeling" (lines 26-27, page 2) and further states that "the configurations for investigation are obtained from a representative compound model from the Statoil database". Shared earth modelling is commonly understood to be a technique for combining the efforts of reservoir engineers, geophysicists, and petroleum geologists, among others, to consolidate their findings to create a fully integrated simulation of a reservoir. In practice, reservoir engineers, geophysicists, and petroleum geologists can create separate 3D simulations of a reservoir that vary depending on the technology each scientist is using. Combining the findings of these scientists in a shared earth model would generate a 3D model which was necessarily based upon some physical measurements, and the application states that it is such a compound model which is used in the method.

20 Therefore, despite my finding that the article cited by Mr Asquith does not form a part of the common general knowledge of the person skilled in the art, I do agree with him that the 3D earth model required by claim 1 is at least partly based upon physical measurements on the basis of the disclosure contained in the application as filed. I construe the term “three-dimensional earth model” to be a numerical representation of subsurface geology derived in part from geophysical measurements.

21 Claim 1 requires that the “one or more realistic earth models” be synthesised from this three-dimensional earth model (the realistic earth models are based on the step of “providing a three-dimensional earth model”). The application as filed describes the invention in terms of a method of predicting the response of an induction logging tool in what I now construe to be a numerical representation of subsurface geology derived in part from physical measurements. The summary of invention at lines 10-20, page 2 says that the predicted response of the induction logging tool is calculated for the purpose of “analysis or synthesis of realistic earth models”, the calculations being made in such a way that “different realisations of both borehole trajectories and earth models can be evaluated effectively”. The final paragraph on page 2 explains that the method for predicting the response of an induction tool can operate in real-time, explaining further that it can be performed “contemporaneously with the taking of real-time measurements in the borehole”.

22 The application does not set out in explicit terms the way in which the realistic earth models are synthesised. One might suggest that it is implicit from the passages referred to above that the method must involve a comparison of the predicted response of the induction tool with “measurements in the borehole” in order that they can be “evaluated effectively” and used to synthesise one or more realistic models. However, the application is completely silent as to how the predicted and actual responses of the logging tool are compared and also the way in which this comparison is used to create a realistic earth model (or indeed to modify the initial

version) - the description focusses more on the calculations and approximations necessary to predict the response of the logging tool in real-time.

23 Mr Asquith did not address me on this point at the hearing. However, I note from the correspondence on file that an attempt was made in July 2016 to amend claim 1 to include the steps of evaluating the three-dimensional earth model based on actual measurements taken from a borehole and the predicted response of the induction tool, and then to produce a three-dimensional model based on this evaluation. In his examination report dated 13 July 2016, the examiner argued that this amendment added subject-matter to the application, saying that the application as filed does not clearly and unambiguously disclose the step of comparing measurements with predicted response of induction tool, adding that the most the application teaches is that the method of predicting induction tool response can be performed while measurements are taken. The applicant removed these steps from claim 1 in response to this objection, with Mr Asquith saying in his covering letter (dated 10 August 2016) that the new claim 1 being proposed at that time did not explicitly refer to comparing measurements with predicted responses.

24 In my view, the examiner was correct in his assessment that comparing the predicted response of the induction tool with “measurements in the borehole” in order to synthesise one or more realistic models, amounts to subject matter not disclosed or suggested in the application as filed. Absent this step of comparing the three-dimensional earth model with actual measurements taken from a borehole then I cannot see how the realistic earth model set out in claim 1 can provide a more accurate model (or better estimate) than the initial three-dimensional model it aims to evaluate. As a result, I do not think it is possible to construe the term “realistic earth model” as set out in the claims to be a refinement of the initial three-dimensional earth model.

25 I construe the term “synthesising one or more realistic earth models” in claim 1 to mean creating a new numerical representation of subsurface geology based on an existing numerical representation derived in part from geophysical measurements. The step of creating the new numerical representation is based on an unspecified evaluation of the predicted response of an induction tool within the numerical representation.

Identify the contribution

26 The nature of the contribution made by the invention was discussed at some length at the hearing. Guidance on how to approach this is provided at paragraph 43 of *Aerotel*:

> “How do you assess the contribution? Mr Birss submits the test is workable - it is an exercise in judgment probably involving the problem to be solved, how the invention works, what its advantages are. What has the inventor really added to human knowledge perhaps sums up the exercise. The formulation involves looking at substance not form - which is surely what the legislator intended.”

27 The problem said to be solved is discussed at page 2 of the application: "the method is to predict in a reliable and computationally fast way, the response of a logging tool along an arbitrarily prescribed borehole trajectory in a full 3D earth model"; "The invention can provide a method for real-time predictive computation of a logging response in a full 3D earth model. The method can be real-time in the sense that it

can be performed contemporaneously with the taking of real-time measurements in the borehole". It can be understood from these passages that the problem to be solved relates to reducing the time taken to predict the response of a logging tool along an arbitrary borehole in a 3D earth model.

28 How the invention works may be considered in terms of what the invention does as a matter of practical reality. The prediction of the response of a logging tool along a trajectory in an earth model is stated as being used in the analysis or synthesis of realistic earth models (page 2, lines 10-12). The calculation of the predicted response is made faster by carrying out straight-line approximations of the arbitrary borehole trajectory, rotating calculation co-ordinates, reducing the size of the "window" in which the electromagnetic field response is modelled and assuming that the background medium is homogenous and isotropic. The predicted response of the well logging tool is calculated more quickly due to these mathematical approximations. As I have noted above, there are no details given of how the predicted response of the well logging tool is used to analyse or synthesise a realistic earth model and no disclosure of updating the initial 3D earth model using the calculated prediction.

29 The advantages of the invention are normally closely linked to the problem being addressed. In this case the problem was the extensive time taken to predict the response of a downhole logging tool in a 3D earth model by previous mathematical methods. It is stated at page 2, lines 29-31 that "the method can be real-time in the sense that it can be performed contemporaneously with the taking of real time measurements in the borehole". The advantages of predicting the response of a logging tool in an arbitrary borehole while taking measurements in a physical borehole are not disclosed explicitly in the application as originally filed. It is not clear whether the physical borehole has the same trajectory as the arbitrary borehole used in the prediction calculation and there is no explicit indication as to why the prediction is carried out contemporaneously with the real-time measuring. Importantly, there is no disclosure of feedback between the predicted response of the well logging tool and the physical measurements being taken and no disclosure of the controlling of any process in response to the speedy prediction of the logging response.

30 The examiner considered the contribution to be "predicting the response of an induction logging tool in an earth model for the purpose of evaluating and synthesising an earth model, characterised by reducing the computational burden in predicting the response by using an approximation which involves confining computations to a limited domain of a model and using a constant average value of the background conductivity throughout the domain." (as stated in the examination report dated 16 March 2017).

31 The applicant provided three arguments in respect of the contribution made by the claimed invention. I will analyse each in turn bearing in mind the problem to be solved, how the invention works and the advantages of the invention as set out above.

32 Mr Asquith characterised the contribution initially as "a method of synthesising realistic earth models", arguing that all such methods and improvement to such methods should, on the basis that they involve numerical representations of subsurface geology derived from geophysical measurements, be regarded as technical in nature. However, I think this represents far too general a characterisation

of the contribution made by the invention and ignores the guidance given in *Aerotel*. For instance, the application acknowledges at lines 20-23, page 2 that methods of synthesising realistic earth models are already known.

33 The problem with the known methods that is solved by the invention is the length of time taken to complete the calculations of the predicted response of the logging tool. Therefore, the reduced time taken to create the prediction of the response of the induction logging tool must be included in the contribution of the invention. Additionally, the use of the predicted response of the well logging tool to analyse or synthesise a realistic earth model is mentioned in the description, but there is no detail of how this analysis or synthesis takes place.

34 Mr Asquith's second argument in relation to contribution was that the invention provides the ability to calculate the predicted response of an induction logging tool more quickly. He argued that the improved efficiency of the prediction calculation is achieved by restricting the electromagnetic field calculations to a limited domain of the geology surrounding the induction logging tool, stating that the restriction requires many technical considerations which will be required to be decided by an engineer. The application as filed does not disclose details of the technical considerations of the geological factors, and the mathematical approximations used to quickly predict the response of the logging tool are not stated as being influenced in any way by the specific geology of the location being modelled.

35 In his third argument on contribution, Mr Asquith argued that improving the speed of the calculations allows the realistic earth model to be synthesised more quickly, allowing the model to be created and used in real-time and ultimately allows control of apparatus while drilling is in progress. The applicant argued that the use of the words "real-time" in the description implies that there must be a connection with the real world based upon the definition of "real-time" in the Collins English Dictionary 6th Edition, which states that the term means "denoting or relating to a data processing system in which a computer receives constantly changing data, such as information relating to air traffic control, travel booking systems, etc. and processes it sufficiently rapidly to be able to control the source of the data".

36 I am aware that the use of dictionary definitions shorn of their context was cautioned against by the Court in *Kirin-Amgen Inc.*[6], where it was also stated that "if the draftsman has specifically indicated somewhere in the specification what he means by a particular expression, then that must be taken into account". The application as filed does not contain a definition of the intended meaning of real-time; it makes no reference to the control of drilling apparatus, or any other apparatus or process, based upon the prediction of the response of the logging tool in a model. Mr Asquith argued that the skilled person would be aware that control is possible as the modelling is described as being "real-time". However, the description of "real-time" in the application relates only to carrying out the prediction calculations while at the same time taking measurements down an undefined borehole. The contribution of the invention should not include advantages which are not clearly obtained by the invention.

37 In my view the contribution of the invention defined in claim 1 is predicting the response of a downhole logging tool in an arbitrary borehole within a numerical representation of subsurface geology (derived in part from geophysical

[6] Kirin-Amgen Inc. v Roche Diagnostics GmbH [2002] RPC 1

measurements), the predicted response of the logging tool being calculated more quickly by confining the electromagnetic field computations to a limited domain of the geology surrounding the induction logging tool and assuming a homogenous and isotropic background medium with a constant background conductivity, and using this predicted response to create a new numerical representation of subsurface geology.

Does the contribution fall solely within excluded subject matter; is it technical in nature?

38 I will now address the third and fourth steps in *Aerotel* together and determine whether the invention reveals a technical contribution to the state of the art.

39 In addition to the guidance provided by the "AT&T signposts", Mr Asquith has referred to the EPO Board of Appeal decision in *Vicom*[7] and the Patent Court's judgment in *Halliburton*[8] to assist my assessment. The IPO decisions in *WesternGeco Ltd's Application* [9]and *Marathon Oil's Application*[10] were discussed very briefly.

40 In *Halliburton*, a claim to a computer-implemented method of designing a drill bit was allowed even though the claim did not include the manufacture of the drill bit. The method involved improving an initial drill bit design by simulating the drilling of the earth formation by the initial drill bit and then modifying the initial drill bit design in respect of at least one parameter making up the design and then comparing the simulated performance of the modified and initial drill bit designs. Mr Asquith referred me to paragraphs 30 and 31 of the judgment:

> "..An invention which makes a contribution to the art which is technical in nature …. is patentable even if it is implemented entirely on a computer and even if the way it works is entirely as a result of a computer program operating on that computer…….
>
> Also in *Symbian…* the Court of Appeal made it clear that there was a continuous line of jurisprudence in this area following *Vicom*, including *Merrill Lynch* and *Gale* and that it should be followed today".

He also referred to paragraphs 71 and 72:

> "..Is it more than a computer program as such? The answer is plainly yes. It is a method of designing a drill bit. Such methods are not excluded from patentability by Art.52/s1(2) and the contribution does not fall solely within the excluded territory. Drill bit design is not a business method, nor a scheme for playing a game nor (as I have held) is this claim a scheme for performing a mental act."
>
> "..Although obviously some mathematics is involved, the contribution is not solely a mathematical method (on top of being a computer program) because the data on which the mathematics is performed has been specified in the claim in such a way as to represent something concrete (a drill bit design etc.). That is an important difference between the position in *Gale* and the position here. In *Gale* the claim was broadly drafted and it was nothing more than a mathematical method implemented on a computer".

[7] T0208/84
[8] Re Halliburton Energy Services Inc. [2011] EWHC 2508 (Pat)
[9] BL O/135/07
[10] BL O/174/10

41 Mr Asquith argued that if the judgement in *Halliburton* was correct for a method of designing a drill bit then it would also be correct for a method of synthesising an earth model, given that both represent physical elements. The method of drill bit design clearly included mathematical methods to perform the simulation and the simulation was carried out by a computer, but it resulted in a better design of drill bit. He noted that the sole use of a drill bit design would be to allow the manufacture of a drill bit according to that design and so there is a direct link to the control of a process outside the computer - that process being the manufacture of the drill bit - even though the process outside of the computer does not form a part of the claim.

42 In the present case, the contribution as I have found it allows the speedy prediction of the response of a well logging tool along an arbitrary trajectory in a 3D earth model using mathematical approximations. Contrary to Mr Asquith's assertion, I am unable to find any suggestion in the application that the predicted response of the well logging tool is used for the control of any process outside the computer. Mr Asquith argued that the contribution could be seen as a method of improving the accuracy of a geological model derived initially from physical measurements and that it resulted in a system for measuring geophysical properties more accurately. However, I have already concluded that the contribution does not include the step of producing a better, more accurate representation of subsurface geology because it takes no account of measurements from a borehole in evaluating the initial geological model. Therefore, I can see no direct link between the contribution as identified and any process carried on outside the computer as Mr Asquith suggests was the case in *Halliburton*. The fact that the invention finds application in the field of geophysical measurement does not in and of itself imply that the contribution is to be regarded as technical.

43 In *Vicom,* the EPO Board of Appeal defined a mathematical method as one that "is carried out on numbers and provides a result in numerical form". A mathematical method was therefore merely an abstract concept prescribing how to operate on the numbers, and a claim directed solely to the mathematical method was excluded from patentability as a result of its abstract nature. If the invention provides a technical contribution, it may be considered patentable even though the underlying idea may reside in a mathematical method; in *Vicom*, a claim to a method of enhancing digital images by software processing that implemented a mathematical method was considered to provide such a contribution and was allowed.

44 Mr Asquith referred to page 8, paragraph 7 of the decision:

> "In contrast, "a method for digitally filtering data" remains an abstract notion not distinguished from a mathematical method so long as it is not specified what physical entity is represented by the data and forms the subject of a technical process, i.e. a process which is susceptible of industrial application."

He argued that the data that the present method works on has been specified and that it is technical data relating to geophysical earth measurements.

45 The present application does not relate to the digital filtering of image data to create new image data. The "real world" data provided in the initial 3D earth model is processed by a mathematical method to predict the response of a logging tool if it were used in the model along an arbitrary trajectory. As I have already found above, the contribution does not include the step of producing a better, more accurate

representation of subsurface geology because it takes no account of measurements from a borehole when evaluating the initial geological model against the predicted response of the induction tool. The output of the mathematical method in this case is the speedy prediction of the response of the logging tool, not an improved image or an improved earth model.

46 The presence of real data taken from a physical entity in a claim relating to a mathematical method, for example a method of modelling, simulation or prediction of a real world system, does not necessarily imply that a corresponding invention will avoid exclusion. In *WesternGeco*, I found that a method for processing real-world geophysical data by mere abstract manipulation of the data was a mathematical method as such; however, I found that aspects of the invention which related to determining one or more parameters relating to the physical properties of the earth's interior from the processed data meant that the contribution included the step of producing a better seismic image (para. 31). I have already determined that without the step of evaluating the predicted response of the logging tool with measurements from a borehole, the contribution in the present case does not result in the production of a better, more accurate representation of subsurface geology.

47 In *Marathon Oil*, the contribution was found to lie in the use of real seismic data to improve a mathematical model. The Hearing Officer refused the application on the basis that the contribution did not provide a new method of measurement. In correspondence leading up to the hearing, Mr Asquith referred to the grant of GB 2479172 in which an initial model of a subsurface is improved by inverting real measurements of seismic velocities of that subsurface to create a second subsurface model. Again, as I have already concluded above, the claimed invention does not define any step of using data obtained from observations in the real word to improve the initial earth model.

48 I will now consider the "AT&T signposts" and what they may indicate in terms of whether the contribution is a technical one. The signposts were not discussed in detail during the hearing but have been referred to in correspondence between the applicant and examiner.

49 The examiner is of the view that the signposts do not help to identify a technical contribution. Mr Asquith contends that the invention results in a technical effect on a process outside the computer and specifies that the technical effect does not have to be claimed. He also contends that the invention provides an increase in computation speed.

50 I will consider the signposts in turn:

<u>i) whether the claimed technical effect has a technical effect on a process which is carried on outside the computer.</u> The prediction of the response of the logging tool resides wholly within the processing done by the computer. It is clear that this does not, in itself, have a technical effect on a process external to the computer. The applicant argues that it is possible to use the prediction of the response of the logging tool to control a process, namely drilling, but this is not considered to form a part of the contribution of the invention and is not disclosed in the application. I have already discounted the suggestion that the contribution involves improving the accuracy of a geological model derived initially from physical measurements or results in a system for measuring geophysical properties more accurately.

ii) whether the claimed technical effect operates at the level of the architecture of the computer; that is to say whether the effect is produced irrespective of the data being processed or the applications being run. And iii) whether the claimed technical effect results in the computer being made to operate in a new way. The efficient prediction of the response of the logging tool is carried out by clever approximations in the mathematical method implemented by the program. The computer itself is operating in an entirely conventional way.

iv) whether the program makes the computer a better computer in the sense of running more efficiently and effectively as a computer. The method of predicting the response of the logging tool contains mathematical approximations which allow the calculation to proceed more quickly. The result is produced more quickly due to the efficient approximations in the mathematical method and not due to a more efficient or more effective computer.

v) whether the perceived problem is overcome by the claimed invention as opposed to merely being circumvented. The method of predicting the response of the logging tool is produced more quickly than prior art methods because the complexity of the calculation has been reduced using mathematical approximations. The problem of the extensive time taken to produce a prediction by prior art methods has been circumvented by simplifying the mathematical calculations used to produce the prediction.

51 Based on my assessment of the contribution set out in paragraph 36 above, I am satisfied that the contribution made by the invention is not technical and that it resides wholly within excluded matter. The invention is a mathematical method and a program for a computer and, as such, it fails steps three and four of the *Aerotel* test. As I have noted above, I construe the term “synthesising one or more realistic earth models” to mean creating a new numerical representation of subsurface geology based on an existing numerical representation derived in part from geophysical measurements. The step of creating the new numerical representation is based on an unspecified evaluation of the predicted response of an induction tool within the numerical representation, in which the predicted response of the induction tool is derived in less time than known methods due to mathematical approximations. What has been improved by the claimed invention is the speed by which the predicted response on the induction logging tool is determined (through shrewd choice of mathematical approximations) and not the accuracy of the numerical representation of subsurface geology. In my view, this contribution is not technical.

Potential amendments

52 A potential set of amended claims presented at the hearing included an additional dependent claim 18, which was dependent upon claim 17, as follows:

> Claim 17: A method as claimed in any preceding claim wherein said method is real-time and is performed contemporaneously with the taking of real-time measurements in said borehole.
>
> Claim 18: A method as claimed in claim 17, wherein said step of predicting the response of an induction logging tool comprising performing a real-time prediction of the response of the induction logging tool.

53 In my view, the proposed amended claims do not alter the contribution as previously identified and so are also considered to relate to a mathematical method and a program for a computer as such – the contribution made by the invention would remain as an improvement in the speed of calculating induction tool response through mathematical approximation.

Conclusion

54 I conclude that the claimed invention is excluded from patentability under section 1(2)(a) because it consists of a mathematical method and under section 1(2)(c) because it is no more than a program for a computer. The amendments proposed by the applicant at the hearing do not alter my conclusion. I therefore refuse the application under section 18(3) for failure to comply with sections 1(2)(a) and 1(2)(c).

Appeal

55 Any appeal must be lodged within 28 days after the date of this decision.

H JONES
Deputy Director, acting for the Comptroller