BL O/204/05

21 July 2005

PATENTS ACT 1977

BETWEEN

Statoil ASA — Claimant

and

University of Southampton — Defendant

PROCEEDINGS

Reference under sections 12(1) and 37(1) and application under sections 13(1) and 13(3) of the Patents Act 1977 in respect of patent GB 2382875 and international patent application WO 03/048812

HEARING OFFICER P Hayward

DECISION

Introduction

1 This dispute is concerned with entitlement to a British patent, GB 2382875, and an equivalent international patent application WO 03/048812, and with the question of who should be named as the inventors. The patent and application stand in the name of the University of Southampton ('Southampton') and name Professor Martin Sinha and Dr Lucy MacGregor as the inventors. I should perhaps say that since these proceedings were launched, the international application has spawned five national applications.

2 The invention is concerned with a subsea oil exploration technique. The claimants, Statoil ASA, ('Statoil') are a Norwegian oil company. The defendants can probably fairly be described as one the three leading academic centres in the world for surveying subsea geological structures using electromagnetic techniques. To summarise the dispute in a nutshell, Statoil thought of a possible way of detecting oil reservoirs beneath the sea. To see if it worked, they needed to borrow a piece of kit that, at the time, only the University of Southampton had. Statoil and the University signed a contract which included clauses on confidentiality and ownership of intellectual property. The test went ahead and was

successful. The University then filed a patent application. Statoil say the application was for their idea. The University say no, the application was not for anything inventive that Statoil had told them but for inventions they had come up with themselves.

3 The case came before me at a hearing that extended over six days, 14th-18th February and 1st March 2005. This is long for a Patent Office hearing, but reflected the fact that the technology has proved to be commercially very valuable. Guy Burkhill QC and Tom Hinchcliffe, instructed by Messrs Lovells, appeared for the claimants. Daniel Alexander QC and Iona Berkeley, instructed by University of Southampton Legal Services, appeared for the defendants.

4 However, the parties' submissions did not finish there. At the time of the hearing, judgment was awaited from the Court of Appeal in another entitlement dispute, *Markem Corporation v Zipher Ltd.* That judgment was handed down three weeks later as [2005] EWCA Civ 267. Because it was possible it could affect the application of the law to the present case, by agreement with the parties I gave them the opportunity to make further submissions in writing on the impact of the Court of Appeal judgment in *Markem*. I had received these by 29th April, and have taken account of these as well as the submissions made at the hearing.

The technology in question

5 Investigation of the geology of the seabed is important both for academic research and for the commercial exploitation of natural resources such as hydrocarbons. Non-invasive techniques are preferable as sub-sea drilling is extremely expensive, especially in deeper waters. One technique commonly used for many years is seismic mapping in which acoustic pulses are directed into the seabed and receivers detect reflected waves. These are analysed to build up a map of the seabed structure. Whilst seismic methods work well in many contexts, they are ineffective for certain structures, eg basalt strata, because of high attenuation, and also are unable to distinguish between water-bearing and hydrocarbon bearing strata.

6 The present invention is concerned with an alternative method which relies on resistivity and involves the use of electromagnetic radiation (EM). It is particularly useful for the detection of a layer of different resistivity from the surrounding strata, for example, a hydrocarbon reservoir, which typically has a resistivity of the order of 10Om or higher, located in water-bearing shales whose resistivities are typically 2Om or less. An electric dipole through which an alternating current is passed to produce radiation is located on or just above the seabed, and one or more dipole receivers also located on or above the seabed detect the response. In order to generate an electromagnetic signal that will penetrate significant distances through the seabed, very high currents and very low frequencies are required. In choosing the frequency, a balance has to be struck, as higher frequencies have better resolution but are attenuated more rapidly. Typically frequencies below 20 Hz, and more probably something closer to 0.5 Hz, are used. The term 'Controlled Source Electromagnetic' or CSEM is used to describe this method to distinguish it from magneto-telluric (MT) methods which use natural sources of electromagnetic radiation.

7 In practice, an array of dipole receivers is located on the seabed and the horizontal dipole source is towed over the array at a fixed distance above the seabed. The response detected by a receiver varies as a function of its position relative to the source. Measurements are taken with the dipole being towed directly over the receiver ('inline', 'radial' or 'end-on') and also with the source being towed on a line offset from the receiver ('parallel', 'azimuthal' or 'broadside'). In conducting a full survey, the source is towed along a number of parallel paths in two or more directions, with source-receiver separations of the order of 0.5-20 km.

8 The inline signals are sensitive to buried resistive layers (eg a hydrocarbon reservoir located in a water-bearing shale). This may be explained in different ways, in particular in terms of waves propagating through the hydrocarbon layer which acts as a wave-guide or in terms of current passing galvanically across the boundary between the layers. To take the latter approach, the EM field produced by a horizontal electric dipole can be regarded as comprising two decoupled modes: the TE (transverse electric) mode characterised by horizontal current loops and the TM (transverse magnetic) mode. The TM mode gives rise to vertical current loops which cross the strata boundaries galvanically and will be affected by a high resistivity layer. The TE mode gives rise to horizontal current loops which couple inductively to the strata and will be largely unaffected by a high resistivity layer. The TM mode contributes significantly to the inline response but not to the broadside response, and that is why the difference between the two can be indicative of a resistive hydrocarbon layer.

9 This is a somewhat simplistic explanation of the technique. In practice there are many factors to be taken into account. The signals being detected are very small in amplitude, and therefore not easy to detect against the background noise. Moreover, radiation reaches each receiver via more than one route. At any given receiver, the detected signal will be a combination of the direct radiation from the dipole, radiation that has penetrated the seabed and been reflected or refracted back, and radiation that has travelled upwards to the water surface and been reflected or refracted back to the seabed (the "airwave"). The direct radiation can be distinguished from the signal from below the seabed when there is a hydrocarbon layer present because the radiation travels faster through the hydrocarbon than through seawater, so there will be a phase difference between the two signals for medium source-receiver separations. The airwave is more difficult. It will swamp the response from below the seabed at shallow sea depths and at larger source-receiver separations, and that puts constraints on the circumstances in which the present invention is usable.

10 Because of the potential problems associated with these extraneous signals, an essential part of the process, before a survey is conducted, is to carry out computer modelling using data from the area to be investigated in order to predict whether it would be likely that a measurable signal will be detectable. It may be necessary to make assumptions about the presence and location of a hydrocarbon reservoir or it is possible that seismic data or drilling may have confirmed the presence of a reservoir, and the EM survey is merely to determine its extent. The modelling may help to determine the optimum survey parameters such as receiver locations, towing paths for the source, and optimum signal frequencies.

The history of events

11 The dispute is not so much about the history of events as about the interpretation to be placed on those events, so in the main the history as I will now outline it is not contentious.

12 During the mid-1990s, Dr Svein Ellingsrud and Professor Terje Eidesmo were research petrologists at Statoil. They were working on a system using EM for detecting water/oil boundaries within oil reservoirs from which oil was being extracted by water injection. The EM source was located in the borehole and detected the boundary because of the higher resistivity of the oil. At a meeting in Houston in 1997 they were told of a powerful magnetic source that was capable of penetrating 2km into the ground and began to speculate whether such a source could be used on the seabed to detect buried hydrocarbon layers because of their high resistivity. They coined the term 'sea bed logging' or SBL for this technique to distinguish it from well logging where the EM source was in a borehole.

13 A project was set up under Dr Ellingsrud to investigate this method and he contracted a Norwegian research foundation NGI to carry out some initial experiments. A literature search established that the SCRIPPS Institute of Oceanography ('SCRIPPS'), Cambridge University and the University of Toronto were carrying out research in this field. NGI produced two reports in May 1999, the first relating to theoretical modelling using actual well logging data from Statoil and compared predicted responses for a hydrocarbon reservoir and a salt water reservoir. This modelling showed that for inline configurations of an electric dipole source and receiver (ie TM-mode, which NGI confusingly calls TE-mode) and at large source-receiver offsets, a hydrocarbon-filled reservoir should produce a larger response than a salt-water-filled reservoir. On the other hand, it appeared that for a parallel configuration of source and receiver, the response could not distinguish between water-filled and hydrocarbon-filled reservoirs. NGI explained the larger response by surmising that the waves entered the reservoir by refraction, and travelled along the reservoir. Because they were less attenuated in the higher resistivity reservoir, the amplitude of the waves detected by the receivers at larger offsets was greater than waves which travelled through the seawater or the overburden. Also, because the waves travelled faster through the higher resistivity reservoir, they were phase-shifted compared to waves that had not travelled through the reservoir.

14 The second report (produced in draft form in May followed by a revised version in October) gave the results of some scaled down trials in test tanks at NGI and Statoil. The NGI tank was a one-metre cube containing sand to a depth of 60 cm and filled with salt water. Buried horizontally in the sand against one side wall of the tank at a depth of 15 cm was a rectangular plate 80 cm x 40 cm and 2 cm thick made of resistive material. A pair of 15 cm long dipoles arranged inline and separated by 80 cm were located on top of the sand and could be positioned over the plate or offset therefrom. This trial showed that the responses detected by the receiver were different according to whether the dipoles were located over the plate or not. The Statoil tank measures 9 m x 6 m, is 10 metres deep and is filled with seawater. To simulate a buried layer, NGI used a submerged raft of eight waterbed mattresses filled with fresh water. A pair of inline horizontal dipoles, one acting as source and the other as receiver, were secured to a beam which could be raised and lowered within

the tank. Both tests showed what the modelling had predicted; that the wave that propagated through the buried layer (the refracted wave as Statoil saw it) was attenuated less and travelled faster than the directly transmitted wave. Thus a phase difference and an amplitude difference could indicate a buried layer.

15 Further experiments were commissioned by Statoil and were carried out in the Statoil test tank by Professors Tor Schaug Pettersen and Hans M Pedersen working for a firm called MyLab. These tests also used the waterbed mattresses and the results were presented in a report dated 5 November1999. These experiments used electric dipoles as source and receiver, and took measurements over a range of signal frequencies and a range of source-receiver separations, with the dipoles arranged inline and also in parallel. The measured results in the presence of the mattresses were compared graphically with the theoretical curves calculated without the mattresses. Other than noting a strong influence exerted by the mattresses on the responses, the report drew no conclusions from the results.

16 In September 1999 Statoil contacted Professor Steven Constable of SCRIPPS inviting him to review the work they had done to date in order to decide whether to continue with it. He duly visited Statoil in November 1999. Having seen the results of their investigations, he concluded that the method had a reasonable chance of success for sufficiently large targets and suggested that field trials should be conducted. Given this positive review, Statoil immediately began planning a full scale survey intending to carry out a trial over a known oil field. In addition they commissioned some further modelling work from Texas A&M University to establish the minimum size of buried reservoir that would be detectable. This work suggested that reservoirs of the order of 2 km width or greater should be detectable.

17 At this stage Dr Ellingsrud made contact with Professor Sinha, who was then based at Cambridge University, because he knew that Professor Sinha had a suitable EM source. An initial meeting took place in December 1999, and at this meeting Statoil's representatives, not wishing (so they say) to disclose the real reason for their interest in CSEM, said they were interested in surveying a sub-basalt layer. It was at a subsequent meeting in March 2000, after Professor Sinha had signed a confidentiality agreement, that Statoil told him of the real purpose of their survey. Negotiations between Statoil, University of Southampton (Professor Sinha moved to the University of Southampton at the end of March 2000), and SCRIPPS led to an agreement to conduct a survey over an oilfield off Angola in the autumn of 2000 financed by Statoil. The trials were conducted from the research vessel *Charles Darwin* and used Professor Sinha's source, DASI (Deep-towed Active Source Instrument), and 26 receivers provided by Southampton and SCRIPPS. The research team included Dr Ellingsrud, Harald Westerdahl from NGI, Professors Sinha and Constable and Dr Lucy MacGregor, a research associate of Professor Sinha at Southampton and previously at Cambridge.

18 For the survey, the receivers were located on the seabed in a 2-dimensional array and the DASI was towed along a series of predetermined orthogonal paths over the receivers at a height above the seabed of 30-60 metres. The tows were carried out twice, firstly with the DASI transmitting at a signal frequency of 0.25 Hz, then at 1 Hz. At the end of the survey 3 receivers could not be recovered but the remaining 23 were retrieved and the results

analysed. In brief, these showed the anticipated strong response for inline configurations of source and receiver and a weaker response for broadside configurations; in other words there was a clear split which was indicative of a buried resistive layer.

19 The final end-of-project report was completed in March 2001 and submitted to Statoil by Professor Sinha, and in May 2001 Dr MacGregor submitted an updated copy of the fully processed data. There was an agreed embargo on publication of the survey results, though Statoil disclosed them in confidence to the partners operating the Angola field surveyed in September 2001. Formal publication of the results was planned for early 2002 in the form of two articles and the three parties, Statoil, SCRIPPS and Southampton worked on preparing these articles in late 2001 and early 2002.

20 The British patent application was filed on 7 December 2001 in the names of the University of Southampton and Dr MacGregor, with Professor Sinha named as inventor. Dr MacGregor subsequently assigned her rights to Southampton and she and Professor Sinha were named as inventors. The application was published on 11 June 2003 and the patent was granted on 3 March 2004. An international application, PCT/GB02/05355, claiming priority from the British application, was filed on 28 November 2002 and published as WO 03/048812 on 12 June 2003. I should perhaps say that when these proceedings were launched there was some confusion about whether Dr MacGregor had been named as an inventor of the GB patent, but that confusion was resolved shortly before the hearing.

21 Statoil say that the inventors were not Professor Sinha and Dr MacGregor but Dr Ellingsgrud and Dr Eidesmo. As a consequence, the patent and application should, they say, be in their name, not Southampton's.

The statute law

22 The present proceedings have been brought under sections 12, 13 and 37 of the Act. These sections are well known, and for present purposes it will be sufficient if I simply outline their general provisions rather than reciting them in full.

23 Section 37 gives me the jurisdiction to determine entitlement to the GB patents. Entitlement is closely linked to inventorship because the basis on which entitlement should be decided is set out in section 7(2) as follows:

> "A patent for an invention may be granted-
>
> (a) primarily to the inventor or joint inventors;
>
> (b) in preference to the foregoing, to any person or persons who, by virtue of any enactment or rule or law or by virtue of an enforceable term of any agreement entered into with the inventor before the making of the invention, was or were at the time of the making of the invention entitled to the whole of the property in it (other than equitable interests) in the United Kingdom;

(c) in any event, to the successor or successors in title of any person or persons mentioned in paragraph (a) or (b) above..."

Section 7(3) identifies the "inventor" as the actual deviser of the invention.

24 As Mr Alexander rightly pointed out, this means that an enquiry as to ownership must start with an enquiry into who were the inventors. Indeed, that is the main issue in the present case, because as between Dr Ellingsrud and Dr Eidesmo on the one hand and Statoil on the other, there is no dispute that any invention made by Dr Ellingsrud and Dr Eidesmo belongs to Statoil. Likewise, as between Professor Sinha and Dr MacGregor on the one hand and the University of Southampton on the other, there is no dispute that any invention made by Professor Sinha and Dr MacGregor belongs to the University.

25 Section 12 gives me jurisdiction to determine entitlement to the foreign and international patent applications. Section 13 gives the inventor a right to be mentioned in the patent, and gives me the jurisdiction to issue an appropriate certificate if I find that the wrong person has been named. Section 13, as I understand it, only applies to the GB patent.

Relevant case law

26 Counsel took me to a number of precedents at the hearing, and since then they have made further submissions in the light of the Court of Appeal judgment in *Markem*. I am grateful for those submissions. The case law has a significant bearing on the present dispute, and I must therefore explain the general principles I glean from it. I will come back later to the application of those principles to the particular facts of this case.

27 In an entitlement and inventorship action, the burden of proof lies with the claimants. This is a long-established principle expressed, for example in *Viziball Ltd's Application* [1988] RPC 213, by the hearing officer and endorsed by Whitford J on appeal in the Patents Court. The burden, though, goes beyond merely showing that the claimants' inventors made the invention and that the claimants derive title from their inventors. There has to be what has sometimes been called a causal link between what the claimants and their inventors did and the patent applications in dispute. As Jacob L J put it in *Markem*:

"If A makes an invention but does not apply for a patent, and B independently comes up with the same idea and applies first, A cannot either complain or claim any part of B's patent. Like nearly all countries (save for the USA) we operate on a first to file system."

28 However, as Mr Alexander rightly submitted, the burden does not stop there. On inventorship, in the present case the claimants are seeking firstly to add additional inventors to, and secondly, to remove the existing inventors from, a patent. That was also the position in *University of Southampton's Applications* [2005] RPC 11 (which I shall call *"IDA v Southampton*" to avoid any confusion with the present case). In para 49 of his judgment Laddie J said:

> "Under the first head, all they need to prove is that, on a balance of probabilities, they made a relevant contribution to the inventive concept or one of the inventive concepts in the patent. Under the second, they need to go further. They must overcome the presumption in s.7(4) and prove not only that they devised the inventive concept or concepts but that the named inventors contributed nothing of substance to any of them."

29 Thus in the present case, to add the names of Dr Ellingsrud and Dr Eidesmo, Statoil need to prove to me that on the balance of probabilities they made relevant contributions to the inventive concept or concepts. In order to persuade me that Professor Sinha and Dr MacGregor should not be named as inventors they need to go further and show that Dr Ellingsrud and Dr Eidesmo devised the invention and that Professor Sinha and Dr MacGregor contributed nothing of substance to the inventive concept or concepts.

30 On entitlement too, the burden goes beyond merely establishing a causal link. As Jacob L J said in *Markem*:

> "What has to be shown is that A is *entitled to B's application* or part of it. In the usual run of case, such entitlement will arise by reason of the operation of some independent rule of law, such as contract, breach of confidence or the like. . . . We think it follows that, whether or not A is entitled to apply for a patent pursuant to s.7 is, as such, irrelevant to whether or not he can claim an entitlement to an application by B. For the latter he must be able to show that in some way B was not entitled to apply for the patent, either at all or alone. It follows that A must invoke some other rule of law to establish his entitlement - that which gives him title, wholly or in part, to B's application."

31 Thus in the present case Statoil must establish that the University of Southampton were not entitled to apply because of some legal constraint on them.

32 So much for the burden on Statoil, but before I can get into the questions of inventorship and entitlement, I must identify the invention. Where, though, do I find the invention? This has become a significant issue in the present case. Section 125 of the Act says:

> *For the purposes of this Act an invention for a patent for which an application has been made or for which a patent has been granted shall, unless the context otherwise requires, be taken to be that specified in a claim of the specification of the application or patent, as the case may be, as interpreted by the description and any drawings contained in that specification . . .*

Now entitlement disputes can arise (under section 8, not section 37) before there are any claims, or at a time when the claims are in a fluid state and still subject to amendment during the pre-grant examination process. Because of this, there is a long line of authority to say that, in a pre-grant entitlement dispute, one cannot simply go to the claims to identify the invention or inventions - for the purposes of section 125, it is a situation in which "the context otherwise requires". Instead, one must look more broadly.

33 In *IDA v Southampton*, after considering the judgments in *Henry Brothers (Magherafelt) Ltd v The Ministry of Defence* [1997] RPC 693 and [1999] RPC 442, Laddie J suggested at para 39 that the approach should be as follows:

> "First, it is necessary to identify the inventive concept or concepts in the patent or application. Secondly, it is necessary to identify who came up with the inventive concept or concepts. He or they are the inventors."

In other words, for entitlement and inventorship purposes pre-grant, one is not focussed on what is claimed but on the inventive concept or concepts. The notion of "inventive concept" comes from section 14(5)(d) of the Act:

> *The claim or claims shall relate to one invention or to a group of inventions which are so linked as to form a single inventive concept.*

34 However, is the position different with a granted patent? In *Markem* at first instance, *Markem Corporation v Zipher Limited (No. 1)* [2004] RPC 10, HH Judge Fysh suggested it was, because in paragraph 51 he said:

> "Certainly in so far as granted patents are concerned, the wording of the claims may safely be regarded as being an accurate statement by the inventor/proprietor of the essence of his invention."

This led to an approach which looked at entitlement on a claim by claim basis.

35 On appeal, as Mr Alexander stressed in his further submissions, the Court of Appeal held that this was the wrong approach. As Jacob L J concluded in paragraphs 101 and 102:

> "Accordingly we think one is driven to the conclusion that s.8 is referring essentially to information in the specification rather than the form of claims. It would be handy if one could go by the claims, but one cannot. Who contributed what and what rights if any they had in it lies at the heart of the enquiry, not what monopolies were actually claimed.
>
> It is not possible to be very specific about how this is to be done. But as a general rule one will start with the specific disclosure of the patent and ask whether that involves the use of information which is really that of the applicant, wholly or in part as joint owner. . . . What one is normally looking for is "the heart" of the invention. There may be more than one "heart" but each claim is not to be considered as a separate "heart" on its own."

36 Jacob L J went on to quote with approval the following comment by Christopher Floyd QC, sitting as a Deputy Judge, in *Stanelco Fibre Optics Ltd's Applications* [2005] RPC 15 at paragraph 15A:

> "It is clear that a mechanistic, element by element approach to inventorship will not

> produce a fair result. If A discloses a new idea to B whose only suggestion is to paint it pink, B should not be a joint inventor of a patent for A's product painted pink. That is because the additional feature does not really create a new inventive concept at all. The feature is merely a claim limitation, adequate to overcome a bare novelty objection, but having no substantial bearing on the inventive concept. Patent agents will frequently suggest claim limitations, but doing so does not make them joint inventors. Some stripping of a claim of its verbiage may be necessary to determine the inventive concept, and consequently the inventor. But one must keep in mind that it is the inventive concept or concepts as put forward in the patent with which one is concerned . . ."

37 Now it is true that Jacob L J arrived at his conclusion by considering the pre-grant position under section 8, not the post grant position under section 37. However, as Mr Alexander has pointed out, *Markem* did in fact involve both section 8 and section 37, and at no point did Jacob L J suggest that he needed to apply different considerations under section 37. Indeed, there is an implicit indication that one should not do so in paragraph 100 of the Court of Appeal judgment:

> "The question of entitlement can arise before any claims exist - and must in principle remain the same whatever claims later emerge."

Taking this point to its logical conclusion, the same approach must be used under section 37 as under section 8, because otherwise one could have the absurd result that inventorship and entitlement could change at the moment of grant.

38 So, even in a granted patent I must look at the information in the specification rather than simply looking at the monopoly claimed. In my view that does not mean I mustn't look at the claims at all. That is very clear from Christopher Floyd's comments in *Stanelco*, because in talking about "stripping a claim of its verbiage" he was clearly contemplating using a claim as a starting point. Indeed, in a granted patent something would be very wrong if the main claims did not give a reasonable pointer to the "heart" of the invention. However, I cannot simply adopt them as a definition of the relevant subject matter for inventorship and entitlement purposes.

39 I should say at this point that in his further submissions, Mr Alexander argued that what *Markem* established is that an invention essentially involves information or knowledge, and that therefore my job was to ask who contributed what relevant information to the patent in question. That seems to me to be too broad a reading of the principles laid down by *Markem*. What Jacob L J said is that one must ask whether the disclosure involves the use of information "which is really that of the applicant, wholly or in part as joint owner". The relevant information, therefore, is information that has an owner. Contributing information that cannot really be said to have an owner - and that might include the knowledge of an expert - may not be sufficient to justify a claim to entitlement.

40 Before I move off this point, I must refer to another argument that was put to me at the hearing by Mr Burkhill. He referred me to the following comment by Laddie J in *Brugger*

and others v Medic-Aid Ltd [1996] RPC 635 at 656:

> "The important issue ... is to identify correctly the inventive concept which the patentee must be taken to have put forward as underpinning his monopoly. For this it is necessary to bear in mind that the relevant inventive step must apply to all embodiments falling within the claims which are said to have independent validity. It is not legitimate to define the inventive step as something narrower than the scope of the relevant claims. In particular it is not legitimate to identify a narrow sub-group of embodiments falling within the claim and which have certain technical advantages and then to define the inventive step in terms which apply to that sub-group but not the rest of the claim."

Whilst recognising this comment was made in the context of assessing inventive step, Mr Burkhill argued that it was also relevant in the present context. In determining the inventive concept of a claim for inventorship and entitlement purposes, he submitted, I must have regard to what is set out in that claim across its full breadth and not a narrower subset of the claim.

41 Mr Burkhill was making this comment before we had the benefit of the Court of Appeal judgment in *Markem*. That judgment has moved the goalposts in the sense that it moves the assessment away from an enquiry into the monopolies claimed. However, Laddie J's comment still strikes me as relevant, because the "inventive concept . . . underpinning his monopoly" seems to me to be expressing in different words Jacob L J's "heart" of the invention. Thus if the thrust of the disclosure is that the invention covers a broad area, it would be wrong to determine inventorship and entitlement solely by considering only a narrow subset of that area.

42 There is one other point. The case law I have mentioned above talks about inventive concept or concepts and the heart or hearts of the invention. That makes sense in the context of a patent application because there can clearly be more than one inventive concept, if only because an application may suffer from defects such as plurality of invention that have not yet been resolved. If there is more than one concept or heart, it has a knock-on effect on inventorship and entitlement because the different concepts or hearts could have different inventors. However, by virtue of section 14(5)(d) one might suppose that ordinarily a granted patent should only have one inventive concept. Does this mean that in a granted patent one should only be looking for a single concept or heart from which inventorship and entitlement must flow, or could there be more than one even in a granted patent?

43 This point has not been clearly addressed in any of the recent authorities. There is a hint at paragraph 25 of *Stanelco* that in this respect granted patents are different from patent applications, but it is not clearly stated and would in any case be *obiter*. It seems to me that whilst section 14(5)(d) requires there to be an inventive concept that links all the claims, it doesn't exclude the possibility of other inventive concepts being present. Accordingly, and in the absence of clear authority to the contrary, I am not going to rule out the possibility that there could, for inventorship and entitlement purposes, be more than one concept or "heart" in a granted patent. Equally, it is clear I should not be scouring the specification looking for inventive concepts in every nook and cranny.

44 Once an inventive concept has been identified, I must then address the question of who invented it. This can be a contentious issue when one person A has an idea and a second person B then takes it forward eg by developing a way of realising the idea. Whether B is the sole inventor, a co-inventor or neither will depend on the circumstances. Mr Alexander acknowledged that if B merely reduces the invention to practice, or at least fleshes out the invention so that the patent specification can be sufficient, that may not be enough. However, he submitted that if an invention consists of both an underlying idea invented by A and its means of realisation contributed by B, A and B are co-inventors.

45 The case law makes clear that merely contributing to a claim is not enough to make someone an inventor. Mr Burkhill drew my attention to *Henry Brothers (Magherafelt) Ltd v The Ministry of Defence* [1997] RPC 693 and [1999] RPC 442, in which Jacob J (as he then was) rejected the argument that anyone who contributes in a substantial way must be regarded as an inventor, saying (p706):

> "I do not think it is right to divide up the claim for an invention which consists of a combination of elements and then to seek to identify who contributed which element. I think the inquiry is more fundamental than that. One must seek to identify who in substance made the combination. Who was responsible for the inventive concept, namely the combination?"

In the Court of Appeal, Robert Walker LJ, although disagreeing with the judge that the invention in that case was a combination of elements, agreed with the principle. It was also followed by Laddie J in *IDA V Southampton* at paragraph 49:

> "... a person is not an inventor merely because he "contributes to a claim". His contribution must be to the formulation of the inventive concept."

and by Christopher Floyd QC in *Stanelco*:

> "But in my judgment, the crucial question is not the inventiveness (in the obviousness sense) of the second researcher's contribution, but whether the second researcher can be said in substance to be jointly responsible for devising the inventive concept."

46 So where does that leave B if his contribution is to provide enabling information or reduce the invention to practice? As Mr Burkhill pointed out, this was considered in both *Stanelco* and *IDA V Southampton*. To quote from the latter at paragraph 47:

> "Frequently, an inventive concept arises from a contribution of more than one mind, with each putting some of the pieces together and it is unrealistic to think that only one made it. On the facts it may be impossible to distinguish between the contributions of a number of individuals to a single inventive concept in which case they are all inventors. It may be, on the facts, that an invention could not have been made without the intellectual input of a number of people. If so, they may all be "responsible for the inventive concept" (to use Jacob J's words), even if some of them did not complete the

picture. This, however, does not mean .... that those whose only contribution is to supplying data for enabling disclosure thereby qualify as inventors."

47 Thus if the invention could not have been made without the intellectual contribution of both A and B, both are inventors. However, if B merely providing enabling information or reduces the invention to practice, that is not enough to make B an inventor. Of course, as Mr Alexander argued and as *Stanelco* makes clear, focussing on the inventive concept can work the other way. B may be the sole inventor if what A comes up with is merely a vague idea or pipedream and it is B who devises the invention to make that pipedream a reality.

48 Once I have reached a decision on the inventorship, then the ownership issue will be settled automatically. I say this because as I have explained above, there is no dispute that any rights arising from any contribution made by Dr Ellingsrud and Dr Eidesmo belong to Statoil, and similarly, any rights arising from any contribution by Professor Sinha and Dr MacGregor belong to the University of Southampton.

49 Finally, I must turn to the question of validity. Section 74 does not allow validity to be put in issue in inventorship and entitlement disputes. Accordingly, it has traditionally been assumed that validity cannot be questioned in such proceedings, so that one determines ownership of the invention as presented even though in truth that may not be a patentable invention. At the substantive hearing both counsel followed this line, although Mr Alexander danced carefully around the point by suggesting that there really wasn't very much in the main claims. However, the *Markem* appeal raised a big question mark over the traditional approach because Jacob L J said:

> "If the patent or part of it is clearly and unarguably invalid, then we see no reason why as a matter of convenience, the Comptroller should not take it into account in exercising his wide discretion. The sooner an obviously invalid monopoly is removed, the better from the public point of view. But we emphasise that the attack on validity should be clear and unarguable. Only when there is self-evidently no bone should the dogs be prevented from fighting over it."

50 In his supplementary submissions following the hearing, Mr Alexander seized on this to argue that claim 1 was invalid and could not therefore contribute to the inventive concept. The question is, can I properly take account of arguments like this? In my view, a closer look at *Markem* suggest there are two significant factors to take into account. First, as the above quotation makes clear, one should only take alleged invalidity into account in a clear cut case. Second, the relation between the allegation of invalidity and the case the alleger is making may also be relevant. In *Markem*, the claimant was arguing that one claim was invalid as part of its claim to be entitled to the subject matter of that claim - in short, it was trying to have its cake and eat it. Jacob L J would have none of it, saying at paragraph 90:

> "We think that if an inherent part of a claim to entitlement is also an assertion of or acceptance of invalidity, the entitlement claim must fail."

That principle, it seems to me, must apply to both parties, so that a defendant should not be

allowed to get away with pleading invalidity as an inherent part of his defence.

The witnesses

I must now say a little more about the individuals involved in this action. I will start with the defendants, because for them there are just two key players:

- Professor Martin Sinha is currently Professor in Earth Sciences at the University of Southampton. From 1982-March 2000 he was involved in research in marine geophysics at Cambridge University.

- Dr Lucy MacGregor is a physicist who is currently (from Feb 2003) Chief Scientific Officer at Offshore Hydrocarbon Mapping plc ('OHM'), a spin-off company from the University of Southampton. She previously worked with Professor Sinha at Cambridge and then Southampton.

51 There are more key players on the claimants' side:

- Dr Svein Ellingsrud is an electronics engineer currently (from Feb 2002) vice-president of research and development at ElectroMagnetic GeoServices AS ('EMGS'), an offshoot of Statoil. He was previously employed by Statoil.

- Dr Terje Eidesmo is a physicist and currently president of EMGS but previously employed by Statoil.

- Dr Per Atle Olsen is a physicist employed by Statoil.

- Ståle Johansen is a geophysicist currently employed by EMGS but from 1986-2000 he was employed by Statoil.

- Harald Westerdahl is a geophysicist working for the Norwegian Geotechnical Institute ('NGI'), a private foundation carrying out research and consulting in the geo-sciences.

- Mr Skaeveland works in Statoil's patent department.

Finally, Professor Steven Constable, who is not a witness but is mentioned in the evidence, is a geophysicist based at SCRIPPS in California.

52 With the exception of Professor Constable and Mr Skjaeveland, all the people named above supplied witness statements and were cross examined at the hearing. In addition a witness statement from Mr Skjaeveland was handed up at the hearing.

53 It is a pleasure for me to say that I found all the witnesses who were cross examined to be good witnesses. They were knowledgeable, gave considered answers, and did not speculate when taken outside their area of expertise or personal recollection. I formed the

impression that all were trying to reply honestly, and that on the whole their recollections were reliable notwithstanding the fact that the major events on which they were being questioned took place some 5 years ago. I must also commend the Norwegian witnesses for coping so well with the English language, particularly given the length of time for which some of them were cross examined.

54 Whilst all the witnesses were called as witnesses of fact, not as expert witnesses, given the importance of technical factors in this dispute they were all questioned on technical issues. They all came across as experts in one aspect or another of the technology, and I did not detect any fundamental disagreements between them on that technology. There were a few minor differences, but it was always clear to me that these simply reflected their different perspectives. For example, when Dr Ellingsrud and Dr MacGregor disagreed over whether a particular model of resistivity variations below the seabed was realistic and likely to be encountered in practice, their views were based on their different experiences in investigating seabed geological structures. Dr Ellinsgrud has only ever been concerned with structures that are of potential commercial interest, whereas Dr MacGregor, with her more-academic approach, was interested in any structures that might exist somewhere. There were also differences on terminology, but by the end of the hearing I was satisfied none of these reflected any real difference of substance.

55 I will make some brief comments on the individual witnesses. Dr Ellingsrud, in his very long session in the witness box, at times seemed to be avoiding giving straight answers to Mr Alexander's questions. However, I felt that his apparent evasiveness was partly due to his difficulty in understanding some of the complex questions which, one has to remember, were not in his native tongue and partly because many of the questions he was asked simply didn't admit of a simple, straight answer. He was certainly nervous, and I noticed he was particularly nervous when being pushed hard on one of the key questions - whether he had had the idea of using the split between the inline and broadside responses - but I felt his nervousness arose from the intensity of the cross examination, not because he was telling lies. It also transpired that he was not well and in some considerable pain for part of the time, and that will have increased the pressure he must have been feeling. Overall, I am satisfied that he was a reliable witness.

56 As for Statoil's other witnesses, Dr Eidesmo gave his evidence clearly and confidently and I am satisfied that his responses were an honest recollection of events. Mr Westerdahl came across as sound, technically-expert and very helpful in his responses, particularly when explaining the experimental work done by NGI for Statoil. I have no hesitation in accepting his evidence. Professor Johansen also came across as very sound, very knowledgeable and absolutely reliable, taking care not to stray beyond his area of expertise. Finally Dr Per Atle Olsen, who was only cross-examined very briefly, came across as sound and reliable.

57 For Southampton, Professor Sinha and Dr MacGregor were clearly very knowledgeable experts in their field. They were both concerned to demonstrate their integrity so as not to damage their academic reputations, and I felt they answered very honestly about what had occurred even though their answers may have been more helpful to Statoil than the University. However, there was one point where I felt Professor Sinha resorted to

unconvincing rationalisation to avoid admitting something. I will come back to that later.

What is the main inventive concept?

58 I can now turn to the substantive issues. In the light of the case law, I must start by identifying the inventive concept or "heart" of the invention. For convenience I will work from the GB patent, because it seems to be common ground that the international application relates to the same inventive concept or concepts. (For example, in his opening submission Mr Alexander said that the GB patent and international application were substantively the same so far as the issues in question are concerned). I also note that, at least as filed, the two share the same description.

59 In their cases as originally pleaded, neither side really focussed on the inventive concept - they addressed the issues more generally in terms of the totality of the information in the patents. In his skeleton arguments for Statoil both before the hearing and in closing, Mr Burkhill argued that the inventive concept was embodied in claim 1 and that there was nothing of inventive significance in any of the other claims. Statoil have maintained that position in the additional submissions they made after the Court of Appeal judgment in *Markem*. In his skeleton arguments for the University of Southampton before the hearing, Mr Alexander argued that there were at least eight aspects to the invention, the implication being that each of them constituted an inventive concept. The first aspect he identified was what is essentially in claim 10. This can be characterised as claim 1 plus the additional step of combining two data sets to produce a results data set. The other aspects were, in essence, all adding refinements to the first aspect. In his closing and additional submissions he took much the same line, save that in his closing submissions he also contemplated the possibility that claim 1 on its own embodied an inventive concept.

60 What this boils down to is that there is disagreement about (a) whether what I shall call the main inventive concept is embodied in claim 1 or in something narrower than claim 1 and (b) whether there are also a number of additional inventive concepts. I shall concentrate on the main inventive concept at this stage and will come back to point (b) later. As I concluded when discussing the case law, to identify the main inventive concept, I must look at the information in the specification rather than focussing narrowly on the claims, although that doesn't mean I must ignore the claims.

61 The specification starts off with some background. It explains the limitations of known seismic and magneto-telluric techniques, and refers to contexts in which electromagnetic surveying of resistivity has already been used. It then has a summary of the invention which starts off:

> "The invention discloses a new approach for electromagnetic surveying to locate hydrocarbon layers. New source-detector geometries are used based upon an electromagnetic source.
>
> According to a first aspect of the invention there is provided an electromagnetic survey

method for surveying an area previously identified as potentially containing a subsea hydrocarbon reservoir, comprising:

providing an electromagnetic source having a dipole axis and first and second detectors;

obtaining first and second survey data sets by moving the electromagnetic source relative to each detector to collect data over a range of source-to-detector distances,

wherein the first survey data set is obtained with the dipole axis of the electromagnetic source aligned end-on relative to the first detector so that the first survey data set is sensitive to resistive hydrocarbon layers exploiting largely galvanic effects, and

wherein the second survey data set is obtained with the dipole axis of the electromagnetic source aligned broadside relative to the second detector so that the second survey data set is relatively insensitive to resistive hydrocarbon layers exploiting dominantly inductive effects."

62 This first aspect is identical to claim 1, and indeed for convenience I have broken it down into subparagraphs as in claim 1. I should perhaps say it is common ground that a method of electromagnetically surveying "an area previously identified as potentially containing a subsea hydrocarbon reservoir" must be construed as a reference to the direct detection of hydrocarbon reservoirs, ie distinguishing a hydrocarbon reservoir from, say, a water-filled layer.

63 The description goes on to explain the importance of looking at both end-on and broadside data in combination, and discusses a number of details which I can gloss over because they are not really in issue. It then moves on to a second aspect which is essentially identical to the first aspect save that it uses the same detector for both the end on and broadside data. This corresponds to independent claim 4. I do not see any significant difference between the inventive concept of this claim and that of claim 1 because there is nothing in the specification to suggest there is any merit in having just one or just two detectors, and indeed, neither counsel suggested I should treat claims 1 and 4 differently. The fine differences in wording are clearly just there to ensure the invention is claimed as broadly as possible.

64 Third, fourth and fifth aspects follow, corresponding to independent claim 10, 21 and 22 (although claim 10 is not truly independent). Whereas the first and second aspects are concerned with "an electromagnetic survey method", the third aspect is directed to "a method of analysing results from an electromagnetic survey", but it requires the results to have been obtained from a survey in accordance with one of the preceding aspects. What the third aspect adds to the requirements of the first two aspects is:

"combining the first and second survey data sets to obtain a results data set that represents a difference between the end-on and broadside alignments as a function of

the source-to-detector distances surveyed".

65 Like the first and second aspects, the fourth and fifth aspects differ from each other only in that one requires one detector and the other requires two. Again neither counsel suggested they embodied different inventive concepts, so I shall consider them together. They are directed to a method of planning an electromagnetic survey by creating a model of an area to be surveyed (ie establishing as many parameters of the area as possible) and then simulating the survey method of the first or second aspect.

66 There are references in the "summary of the invention" section to various preferred features, but there is certainly no suggestion that any of them constitutes the main heart of the invention. I shall come back to them later. There are also references to what purport to be further aspects but in truth are just different claim formulations (eg "a computer program product bearing machine readable instructions for implementing the method . . ."). Rightly, neither counsel took any issue on these and so I shall ignore them for present purposes.

67 In my view, all parts of this summary point clearly and unequivocally to the same inventive concept: direct detection of a hydrocarbon reservoir by moving a dipole relative to a detector to collect both broadside and in-line data over a range of source-to-detector distances, from which it is possible to deduce whether a hydrocarbon reservoir is present. That is certainly the heart of the first and second aspects (ie claims 1 and 4). It is also in my view the heart of the fourth and fifth aspects (claims 21 and 22) because the evidence from both sides clearly establishes that to be able to conduct a survey effectively and be able to interpret the results, modelling like this is an essential first step. Moreover, I can see nothing in the particular description which follows the "summary of the invention" to suggest the main heart of the invention lies anywhere else.

68 Mr Alexander, though, disagreed with this assessment of the core inventive concept. He maintained that it requires the additional step of combining the two sets of data as in the third aspect and claim 10. This submission is based on two arguments. The first, which he felt free to enunciate more clearly in his further submissions after the Court of Appeal's judgment in *Markem*, is that there is no invention in the inventive concept as I have identified it above. As he put it:

> ". . . the inventive concept cannot reside in claim 1 since there is plainly nothing inventive about it."

The second, which follows on from the first, is that it is the additional step of the third aspect and claim 10 that is clearly the significant and crucial contribution made by the disclosure to the prior art. I will start by considering the first argument.

69 The University of Southampton have made no offer or undertaking to amend the patent if ownership stays with them, so what they are in effect saying is: Statoil cannot have claim 1 because it isn't an invention, so we can keep it. This stance bears a remarkable similarity to the one that was criticised in paragraph 90 of *Markem*. The boot may be on the other foot in the sense that it is the defendant/patentee, rather than the claimant, that is making the

assertion, but it strikes me that the principle must be the same. To adapt Jacob L J's words, if an inherent part of a defence to a claim to entitlement is also an assertion of or acceptance of invalidity, the defence must fail. The University's position is all the more remarkable because claim 1 is a claim that they themselves prosecuted to grant, and the assertion of invalidity is not based on any new art of which the named inventors are alleged to have been previously unaware.

70 However, even putting that point to one side, the evidence has not in my view even begun to established that claim 1 (which for the moment I can take to represent what I have identified as the core inventive concept) is invalid through want of either novelty or inventive step. Mr Alexander argued claim 1 was manifestly obvious because use of CSEM for direct detection of hydrocarbons was known and Statoil's own witness Dr Westerdahl had confirmed that use of both broadside and inline data was standard practice. Mr Burkhill complained that this argument was contrary to the well-known case of *Technograph v Mills & Rockley* [1972] RPC 346 (which sets out the basic approach to assessing obviousness), contrary to the evidence, not a pleaded issue and not admissible by reason of section 74 because it did not pass the "clear and unarguable" test of *Markem*.

71 I agree with Mr Burkhill. Mr Alexander relied on the fact that an EPO first-instance decision has recently held that a Statoil patent application lacks novelty in the light of a patent known as Srnka, US4617518, granted in 1986. This is a rather tortuous argument. I am not interested in what effect Srnka has on the claims in Statoil's application. What matters is its relevance to the present claim 1, and as Mr Burkhill pointed out, Statoil themselves argued that the present claims were novel and inventive over Srnka during prosecution of the GB application. Moreover, it is immediately apparent that the difference between Srnka and claim 1 goes beyond the use of broadside and inline data. Srnka, for example, does not move the source relative to the detectors, so even if it is legitimate to combine Srnka and what Dr Westerdahl said, that isn't enough to establish that claim 1 is obvious. On that count alone, Mr Alexander's argument falls hopelessly short of the "clear and unarguable test". Quite apart from that, what Dr Westerdahl or, for that matter, any of the other witnesses said is not a proper basis for an obviousness argument. I would need proper evidence as to what was and was not common general knowledge at the relevant time, not simply comments made in a different context by people who were acknowledged experts.

72 Mr Burkhill is also right when he says Mr Alexander's argument is contrary to the evidence. Take, for example, the reaction of Professor Constable after Statoil had presented this inventive concept to him. If he had felt that there was nothing in the concept, his report would have been very downbeat. Instead, it was the exact opposite. To quote a few telling passages:

> "The seafloor EM method is not new . . . [but] the proposed application to direct detection of hydrocarbons is, to the best of my knowledge, novel."
>
> "In conclusion, it is my opinion that the proposed method has a reasonable chance of success for sufficiently large targets (the type being suggested)."

> "I wish Statoil every success in its endeavour; it is pleasing to see innovative research coming out of the industry sector."

73 Thus he expressly states that he thought the concept was new, and the way he speaks about it is not consistent with a view that it was obvious to him. This is not all, because we also know Professor Sinha was excited when Statoil presented the inventive concept to him - even Professor Sinha himself admits this. In cross examination he tried to rationalise this by saying that he was excited not at the concept but at the fact that an oil company were interested in it. However he then had to wriggle uncomfortably when he was asked to explain why, according to his own evidence, he went on to seek an explanation for Statoil's results so far and to speculate on what might be happening. This is the one point in Professor Sinha's testimony where I felt he was being less than convincing. I am satisfied his excitement reflected the fact that the concept had not occurred to him before.

74 If Professors Constable and Sinha were run-of-the-mill academics, these reactions might not carry much weight. However, they are two of a tiny handful of world experts in this technology. They clearly both found the concept exciting, so I do not for one moment believe they could have regarded it as obvious. If it was not obvious to two such eminent experts, it certainly cannot have been obvious to the unimaginative person skilled in the art who provides the proper legal test for obviousness. We are nowhere near the high threshold in *Markem* that "the attack on validity should be clear and unarguable".

75 However, quite apart from the question of whether claim 1 is clearly and unarguably obvious - Mr Alexander's first argument - I have difficulty with his second argument too. Mr Alexander was keen to paint the additional step of combining the two sets of data into a "results data set" as in claim 10 as a significant one, but Mr Burkhill rightly urged me to interpret it in the light of what is actually described. As Professor Sinha agreed during cross examination, the only "combining" described is plotting the first and second data sets on the same graph so that the graphs can be compared visually. Thus the "results data set" could be as trivial as a common graph. In view of this, claim 10 goes beyond claims 1 and 4 only in that it requires the broadside and inline data to be compared. As there is no reason for collecting both inline and broadside data unless one is going to compare them, I can see no difference between the inventive concept of claim 10 and that of claims 1 and 4.

76 Mr Alexander also placed a lot of emphasis on what he described as specificity as distinct from sensitivity, that is, the ability to distinguish oil-filled layers from other subsea geological structures that would also give an inline response ("false positives", as he called them). The only example we have of such a structure is the one shown in fig.4B of the patent, with five layers of successively increasing resistivity. The specification explains that this particular structure gives both an inline and a broadside response, whereas an oil layer sandwiched between lower resistivity strata gives only an inline response, so comparing the two responses distinguishes the two structures.

77 At first glance this sounds an attractive argument, but it does not stand up to close scrutiny. The fig.4B model is said to represent a submarine sedimentary basin in which resistivity increases steadily with depth due to the progressive expulsion of pore fluids by rising

overburden pressure. The model came from Dr Macgregor, and Mr Alexander argued that it was only she, not the Statoil team, who had appreciated the importance of being able to distinguish from this type of structure. However, Dr Ellingsgrud said in cross examination that this sort of structure was of academic interest only because you wouldn't find it in an area of potential commercial interest to the oil industry. I believe him, and indeed this is the point to which I referred earlier on which an apparent disagreement between the two side's witnesses in truth only reflected a difference in perspective. In any case, even if the ability to distinguish from this type of structure is significant, that does not make the recognition of this fact an invention. It is at best an unexpected advantage of an invention that had already been made.

78 Although the conclusions I have reached so far make it unnecessary for me to consider the argument advanced by Mr Burkhill on the basis of *Brugger*, I have to say that if I did, it would lead to the same conclusion. What Mr Alexander is trying to do is get me to identify as the main inventive concept something narrower than the scope of the main claims. In general that is not a legitimate approach, and there is nothing about the present case that would make it legitimate here.

79 In conclusion, I find that the main inventive concept is direct detection of a hydrocarbon reservoir by moving a dipole relative to a detector to collect both broadside and in-line data over a range of source-to-detector distances. I will come back later to the question of whether there are any other inventive concepts. First, I will consider who invented, and thus who is entitled to, this main concept.

The claimants' case on the main inventive concept

80 Statoil submit that the main inventive concept came entirely from Dr Ellingsrud and Dr Eidesmo. By November 1997, they say, Dr Ellingsrud and Dr Eidesmo had the idea of using an electromagnetic source and one or more detectors, all located on the seabed, to try to identify the presence of a thin hydrocarbon reservoir buried below the seabed between lower-resistivity strata. To support this contention, they point to the project proposal dated November 1997 presented to NGI asking them to carry out a literature study, a simulation of an electromagnetic survey over a 20 m thick oil reservoir located 1 km below the seabed, and a simple model test to verify the simulation. Additionally, they say that the first report from NGI, dated May 1999, shows that modelling was carried out to calculate the inline and broadside responses at various distances from an electric dipole source located on the seabed.

81 Statoil also draw attention to the tank experiments commissioned by them and carried out by MyLab in 1999 in which measurements were made inline and broadside with a simple dipole source and receiver using a raft of several water bed mattresses secured together to simulate a resistive layer as further evidence of their awareness of the need to take inline and broadside measurements. The results of these tests carried out over a range of signal frequencies were plotted on graphs in which the inline and parallel or broadside responses for various source-receiver separations are shown alongside the theoretical inline and

broadside responses with no mattresses. They suggest that the purpose of these tests was to establish that there was a difference in response when there was a resistive layer present.

82 In addition to the evidence mentioned above, Statoil refer also to Professor Constable's peer review of the investigations and experiments that had been carried out up to November 1999 as evidence of how far Statoil had got by that stage. As quoted earlier, Professor Constable expresses the view that the application of EM radiation for direct detection of buried hydrocarbon layers was novel, but he also said:

> "However, the work took the group [ie the Statoil team] from almost no experience in this field to having a reasonable physical insight into the method. Their conclusions are not only basically correct, but they have discovered properties of the method known only to a very few experts, (ie that the parallel/inline mode split is diagnostic of buried layers)."

This, they say, shows they fully appreciated the significance of the split at the time, and this is further demonstrated in the minutes of the so-called 'kick-off' meeting of 29 February 2000, when the possibility of filing a patent application based on the split was considered.

83 Statoil therefore argue that all the elements of the main inventive concept I have identified above had been put together by them prior to the first meeting with Professor Sinha and that all these elements were disclosed by them to Professor Sinha at the second meeting they had with him on 15 March 2000. They say they only contacted Professor Sinha because they needed an EM source and they knew that he had one. They did not contact him because they needed his expertise to develop their ideas, pointing out that if they needed such expertise, they would obviously have gone back to Professor Constable.

The defendants' case on the main inventive concept

84 Southampton defence is based primarily on an assertion that Statoil have not discharged the onus on them rather than on an alternative version of events. They argue that Statoil have not made their case since they have not shown in their evidence that (a) Dr Ellingsrud and Dr Eidesmo personally devised all the features that make up the main inventive concept and (b) Professor Sinha and Dr MacGregor made no contribution to the devising of the invention.

85 On the first point, they submit that there is no documentary evidence from Dr Ellingsrud and Dr Eidesmo prior to the meetings with Professor Sinha and Professor Constable (apart from the proposal from Dr Ellingsrud to NGI commissioning the investigations into the basic idea) relating to any aspects of the invention. They suggest that on the evidence presented it is not clear, for example, that Dr Ellingsrud and Dr Eidesmo appreciated the significance of collecting both inline and broadside data. They point out that the NGI reports give little consideration to measuring broadside data and that the MyLab report, although measuring both inline and broadside data, draws no conclusion about the need to use both sets of data. They suggest that it is not clear, because there is no supporting documentary evidence, that the MyLab tests were intended to compare inline and broadside responses. They suggest

that the initial idea of using both inline and broadside information may have come from Dr Westerdahl of NGI. Further, they say that the first clear reference to the significance of the difference between the inline and broadside data is in the peer review report by Professor Constable, and since even Dr Ellingsrud acknowledged that Professor Constable was the first person to use the term "spilt", he too may have made or at least contributed to the invention. Indeed, they say Statoil didn't even appreciate the concept of the split until the "kick-off" meeting in February 2000, when they apparently considered filing a patent application for it.

86 The conclusion that Southampton invite me to draw is this. Statoil have not discharged the onus on them to prove that Dr Ellingsrud and Dr Eidesmo were the inventors. On their own evidence, the invention could well have been made by Dr Westerdahl, Professor Constable, Dr Everett or employees at MyLab, and if it was, the claim must fail because Statoil have provided no evidence to show they have any right to inventions made by these people.

87 On the second point, they argue - as they had done in connection with the identity of the main inventive concept - that at the date of the 15 March 2000 meeting between Professor Sinha and Dr Ellingsrud and Dr Eidesmo, when Statoil disclosed that they were looking to use EM for direct detection of buried hydrocarbon layers, the idea was known, and by then it would have been obvious to someone such as Professor Sinha to gather both inline and broadside data in conducting such a survey. The implication of this is that at that meeting Professor Sinha was not given any information that he did not already possess or that was generally known. In support of this contention, they point out that Professor Sinha was an expert in the practical application of CSEM to surveying the seabed and was talking to oil companies well before this date, extolling the merits of EM surveys, using both inline and broadside data in sub-sea oil exploration.

88 Southampton say that even if it was the case that Dr Ellingsrud and Dr Eidesmo had new information to impart at that meeting, Statoil have not proved that Dr Ellingsrud and Dr Eidesmo devised all the features of the invention disclosed in the patent. Southampton add that the information imparted by Dr Ellingsrud and Dr Eidesmo to Professor Sinha amounted merely to an idea (and a known or obvious one at that) but they did not have the realisation of the idea. They argue that without Professor Sinha's input, they could not have carried out a successful survey to prove the idea. and so did not have all the information needed to carry out the invention.

Assessment of these submissions

89 It seems to me to be clear from the project proposal sent by Dr Ellingsrud to NGI in November 1997 that by then he already had the idea of using an EM source and several detectors or receivers located on the seabed for direct detection of an oil reservoir buried beneath the seabed. Indeed, this evidence has not been challenged by Southampton. The computer modelling carried out by NGI suggested that for large offsets between an inline horizontal electric dipole and a receiver, a significant response would be detected by the receiver, whereas in the broadside configuration there would be little or no response. Again,

that evidence has not been challenged.

90 Having established that there should be a positive response for the inline configuration in the presence of a resistive layer in the theoretical analysis, they used this configuration in some small scale trials using tanks first at NGI and then at Statoil. It is Southampton's case that this shows Statoil failed to appreciate the importance of collecting the broadside data as well. Statoil's witnesses say no, they were testing the inline response because that was the one that needed testing, not because they hadn't realised you needed the broadside response too as a reference for comparison. I have to say I find this explanation entirely plausible, and I believe Statoil's witnesses.

91 However, I do not need to rely on that because Dr Ellingsrud commissioned further tests by MyLab and these clearly measured both inline and broadside data. Moreover, the way in which these results were presented, with the inline and broadside measurements for a range of source-detector separations in the presence of the resistive layer (the waterbed mattresses) plotted together with the corresponding calculated curves without the mattresses, suggest that it was intended that the inline and broadside responses be compared with each other and also with the respective inline and broadside responses in the absence of the resistive layer. This provides concrete support for Dr Ellingsrud's insistence that he was aware of the importance of collecting both inline and broadside data.

92 Further confirmation of this comes in the mention of the 'split' in the peer review given by Professor Steven Constable. Mr Alexander suggested that until Professor Constable mentioned the split, Statoil had not appreciated the importance of using both inline and broadside data and that the significance had been brought to their attention by Professor Constable. I find the language used by Professor Constable to be clear and unambiguous. He says the Statoil team had discovered the split. It seems very unlikely to me that he would have imparted this knowledge to Statoil and then given them credit for appreciating it themselves. I cannot accept Mr Alexander's proposition. It may well be that it was Professor Constable who introduced the term "split" to the Statoil team, but that does not mean the Statoil team were previously unaware of the concept. Dr Ellingsrud insisted that he was aware of the significance of collecting both sets of data before the review, and I believe him.

93 If that were not enough, yet further confirmation comes from the notes of the meeting on 29 February 2000. These are, admittedly, fairly cryptic, but they include the clear entry "split inline/parallel - new application", and this is, in my view, unequivocal confirmation that the Statoil team were aware of the significance of the split before they discussed this with Professor Sinha.

94 I now come to the meeting that took place between Professor Sinha and Dr Ellingsrud and Dr Eidesmo on 15 March 2000. It is Statoil's case that Dr Ellingsrud and Dr Eidesmo told Professor Sinha all the essential features of the main inventive concept at that meeting, and Dr Ellingsrud and Dr Eidesmo have given evidence to that effect. Under cross-examination, Professor Sinha eventually accepted that all the integers of the main inventive concept had indeed been told to him by Dr Ellingsrud and Dr Eidesmo. Most importantly, he expressly

conceded under cross examination that Dr Ellingsgrud and Dr Eidesmo had told him about the split:

> Mr Burkhill: The split relates to the difference in response between inline and broadside and you get a larger split if there is a hydrocarbon layer than if there is no hydrocarbon layer?
>
> Professor Sinha: That is true.
>
> Mr Burkhill: That is what Dr Ellingsgrud and Dr Eidesmo told you that they had found, is that not correct?
>
> Professor Sinha: I believe they did say that, yes.

95 This concession was reinforced by Professor Sinha's acknowledgement that Dr Ellingsgrud and Dr Eidesmo had shown him a slide at the meeting which included the line "the proposed parallel/inline antenna configuration is diagnostic for buried layers". Indeed, he also said that they had discussed the split at some length at the meeting because he wasn't initially convinced there would be one. I conclude that on the evidence, and as far as the main inventive concept is concerned, all the integers were known to Dr Ellingsgrud and Dr Eidesmo before the meeting on 15 March 2000, and those integers were told to Professor Sinha at the meeting.

96 I now need to decide whether this establishes the necessary causal link required to establish the ownership of the invention. As *Markem* made clear, to be effective in establishing ownership the causal link must involve some breach of a legal constraint.

97 If Professor Sinha had not appreciated the inventive concept before the meeting with Dr Ellingsrud and Dr Eidesmo on 15 March 2000, I would need to probe no further. It would be inconceivable that the disclosure by the Statoil team had not led to the filing of the patent application. That filing would therefore have been made mis-using information that had been given to Professor Sinha, and later Dr MacGregor, in confidence. On the basis of Professor Sinha's own admission under cross examination that the patent specification copied parts of the confidential Angola survey report, it would also have been mis-using information from that report. I regard as hopeless Mr Alexander's last ditch attempt in his further submissions to argue that Statoil had not established the relevant obligation of confidentiality. However, if it can be shown that Professor Sinha already had knowledge of these features before the meeting, in other words he had in essence devised the invention or someone else had devised the invention and told Professor Sinha about it, before the meeting, then I would need to look at the causal link more carefully.

98 Professor Sinha is clearly a leading expert in the use of CSEM in surveying the ocean floor, as for that matter is Dr MacGregor. They have provided a substantial amount of evidence revealing their involvement with research projects investigating geological structures below the seabed. This evidence shows that both of them were familiar with the way in which a CSEM survey should be conducted collecting both inline and broadside data by moving a

source relative to one or more detectors. Professor Sinha has developed a powerful electric dipole source, DASI, as well as receivers for use in conducting subsea EM surveys. Indeed, the reason, or one of the reasons, why Statoil approached Professor Sinha, was because he possessed DASI.

99 From the evidence submitted, it is clear that Professor Sinha's and Dr MacGregor's interest in the subsea structure has been directed mainly towards geologically active zones at or near boundaries in tectonic plates. Although they refer to contacts and presentations to oil industry representatives in the late 1990s, they have not produced any evidence to show that they contemplated using EM methods for the direct detection of buried hydrocarbon reservoirs. In fact, Professor Sinha says in his first witness statement at para 36, that when he was asked in 1998 by LASMO, an oil company for whom he was doing some consultancy work, whether an EM survey could be used for direct hydrocarbon detection, he concluded that it would not be possible using magneto-telluric techniques. He did not apparently even consider whether CSEM techniques would work.

100 It seems from the evidence they have presented, that what Professor Sinha and Dr MacGregor were offering oil exploration companies in the late 1990s was primarily a method of detecting sedimentary layers below basalts. Basalt is relatively opaque to conventional seismic techniques, so a method which could "see through" the basalt overburden would be of great value to those interested in finding sedimentary layers as it is the latter which may contain hydrocarbon deposits. CSEM was being offered as a technique to achieve this. As basalt has a relatively high resistivity, what was being offered was a technique to detect a thin, relatively-conductive layer in a more-resistive substrate. I can find nothing in their evidence to suggest they had contemplated using CSEM to directly detect oil reservoirs in the present context, ie to detect a thin relatively-resistive layer of hydrocarbons within more-conductive substrate. Indeed, Dr MacGregor conceded in cross examination that she had not previously even considered this problem, and Professor Sinha also effectively conceded it when he admitted that at the March 2000 meeting he had initially been doubtful about whether a split would occur.

101 From this I conclude that Professor Sinha had not considered using CSEM as a means of directly detecting buried layers of hydrocarbon at the time of the meeting on 15 March 2000. That conclusion is, of course, consistent with the excitement he showed at the meeting and with his own admission that he discuss the split at some length during the meeting because he wasn't convinced it would exist. It follows that I am satisfied the requisite causal link is present.

102 There are, however, two other issues I must consider. First, did the invention come solely from Statoil, or was the subsequent contribution from Professor Sinha and Dr MacGregor such as to make them inventors too? Second, even if the invention came solely from the Statoil side, were the inventors Dr Ellingsrud and Dr Eidesmo, as Statoil allege, or did Professor Constable and/or Mr Westerdahl devise the invention in whole or in part, as Mr Alexander suggested?

103 On the first issue, on the basis of the case law as discussed above, the test is whether the

contributions of Professor Sinha and Dr Macgregor were merely to provide enabling information and/or to reduce the invention to practice, or whether the invention could not have been made without their contribution. If one looks at the main inventive concept - and that is all I am doing at this stage - I am quite satisfied their contributions fall in the former category. That is not to belittle their contribution. There is often an immense amount of skilled work to be done in turning an invention into a marketable product or method, but those who do that work don't thereby become inventors. The main inventive concept, as an inventive concept rather than as a fully developed method, was complete by the time Statoil disclosed it to Professor Sinha. Devising the concept had not had and did not need an intellectual contribution from Professor Sinha or Dr Macgregor.

104 On the second point, Mr Alexander put it to me that a person is not a deviser if he or she merely asks someone else to devise something, or merely understands what someone else has done or proposed. Similarly a person is not a deviser if they only communicate what a third party has devised or is a part of a group working on a project and a different member of the group comes up with the inventive concept. I agree with these general statements - they are consistent with the legal principles I discussed earlier. Applying these statements to the present case, Mr Alexander suggested that the evidence left open the possibility that it was Mr Westerdahl of NGI who, through his modelling work, predicted a difference between the inline and broadside responses in the presence of a buried resistive layer and was thus the originator of the inventive concept. Alternatively or additionally, the evidence also left open the possibility that the originator may have been someone from MyLab in the tank tests they carried out, or possibly Professor Constable himself. The gist of Mr Alexander's case on this point was that because Statoil had not provided enough evidence to rule out these possibilities, they had not discharged the onus on them to show that it was Dr Ellingsrud and Dr Eidesmo who devised the invention.

105 I disagree with what I can only describe as this somewhat desperate argument. I am satisfied Statoil have discharged the onus on them to show that, on the balance of probabilities, their inventors devised the inventive concept and Southampton's inventors did not. The whole thrust of their evidence goes to showing that the invention came from Dr Ellingsrud and Dr Eidesmo personally, not merely that it came from people on Statoil's side, and as Mr Burkhill rightly pointed out, if they have satisfied me that Dr Ellingsgrud and Dr Eidesmo were inventors and Professor Sinha and Dr MacGregor were not, they have done enough. They do not also have to prove that there were no other inventors on Statoil's side.

106 In any case, the evidence does not in my view appear to point towards a probability that Mr Westerdahl and/or Professor Constable contributed anything of substance to the inventive concept. As far as Mr Westerdahl is concerned, he appeared as a witness for Statoil and was thus clearly aware of the case they were making. He was also clearly aware of the concept of joint inventorship because he says in his evidence that he is mentioned as an inventor on a number of patents that Statoil obtained based on other research. Despite this, at no stage has he given the slightest hint that he feels his contribution to the development of the present invention was such as to make him even a joint inventor, let alone sole inventor. That seriously undermines Mr Alexander's argument in respect of him. As for Professor Constable, I am at a loss to see how his own acknowledgement that the Statoil team had

come up with the idea points to the possibility that Professor Constable himself was the inventor or an inventor.

107 In conclusion, I find that Dr Ellingsrud and Dr Eidesmo were the inventors of the main inventive concept, and that Professor Sinha and Dr MacGregor were not inventors of this concept. It follows that this concept belongs to Statoil, not the University of Southampton.

Are there other inventive concepts?

108 That is not the end of the matter, because I now need to go on and consider whether there are any other inventive concepts. However, as I concluded when I considered the case law, it would be wrong to go searching for additional inventive concepts in every subordinate claim and every feature described.

109 Statoil say there are no additional inventive concepts disclosed. The defendants' position is less clear. In his closing submissions, Mr Alexander identified eight inventive concepts (plus an undefined catch-all which I feel I can safely ignore). Three of these - which for convenience I will identify as claims 1, 10 and 21 - I have already dealt with because I have already ruled that they are simply different expressions of the main inventive concept, but that still leaves five others. Mr Alexander identified them by reference to various subordinate claims. However, in his further submissions following *Markem*, whilst Mr Alexander acknowledged that the claims could not be regarded as determinative of the inventive concepts, he glossed over the question of how many inventive concepts there were, leaving me unsure whether he was still maintaining that there are five further inventive concepts. I will have to proceed on the assumption that he is maintaining this.

110 The five alleged additional inventive concepts are as follows. I have given them the letters used by Mr Alexander, the missing letters being the three that I have said are embraced by the main inventive concept.

C. Normalising the data sets
D. Visually representing the results data set on a 2D plot
E. Use of polarisation ellipse parameters
G. Modelling using a number of frequencies to find the best
H. Modelling taking account of the air wave

111 None of these is a free-standing feature. They are all additions to or developments of the main inventive concept. The question is, are those additions and developments inventive concepts in their own right? I have looked carefully at the evidence, and I am satisfied that none of them are. Rather, they are well-known, if not routine, techniques in this general field which have simply been applied to the main inventive concept. That does not mean to say that the application to the main inventive concept required no intellectual effort, but merely that the nature of the intellectual effort was not such as to elevate the application to the level of an invention.

112 I do not think it is necessary for me to go through every one of these five features to explain in detail why I feel the evidence leads to this conclusion, but I will pick on a couple as examples. I will take normalisation as my first example. Even Mr Alexander acknowledged that normalisation was a generally-applicable, and often routine, technique. One of the exhibits to which Mr Burkhill drew my attention, for example, is a conference paper presented in June 1999 by Dr MacGregor, Professor Sinha and Professor Constable which refers to normalising the inline and broadside responses by the field of a uniform resistivity structure in a way that implies it was a perfectly ordinary thing to do. However, Mr Alexander argued that the particular way the normalisation was done was important. I agree - the evidence of Professor Sinha makes that clear - but although it might require skill to select an appropriate normalisation technique, that is not the same as requiring invention to do so. In theory it could involve invention, but the wording of the description in the patent specification clearly suggests it did not do so in the present case. The description explains why it is convenient to normalise, suggests one simple model that could be used, then suggests that in some circumstances a more complex model could be used, then says one could normalise by phases rather than amplitudes, and finally concludes by suggesting yet another basis for normalisation. This is clearly not describing something that was perceived as inventive, but merely explaining that a number of routine options might work. In short, even if it were true that the concept of normalisation were introduced by Professor Sinha and/or Dr MacGregor, that does not make them inventors.

113 Similar considerations apply to all the other four features. As with normalisation, there is nothing in the description to suggest that visually representing the results on a 2D plot and using polarisation ellipses involve a shred of invention or were perceived as inventive. On the contrary, the evidence establishes that they are both routine techniques. The same applies to modelling. It is not presented as inventive, and it is clearly recognised as an essential prerequisite before any survey can be undertaken. Indeed, Statoil's own activities demonstrate this. When they first came up with the idea of direct hydrocarbon detection, they didn't rush off to the nearest bit of sea with a detector. Rather, they spent a long time modelling and testing the concept before even contemplating a real survey. Any modelling, of course, will try to replicate real survey conditions as closely as possible and determine optimum parameters, so there is nothing clever about using modelling to determine the best frequency or about taking account of the airwave.

114 In short, I find that there are no other inventive concepts, besides the main inventive concept, which qualify Professor Sinha or Dr MacGregor to be named as inventors. It follows that there is nothing that entitles the defendants to any rights in the patent.

Conclusion and next steps

115 I have found that Dr Ellingsgrud and Dr Eidesmo should be named as inventors of the GB patent, that Professor Sinha and Dr MacGregor should not be named as inventors, and that the patent should belong to Statoil ASA, not the University of Southampton. If that were all I had to deal with, the order would be straightforward and I could make it now, save for the question of costs.

116 However, I also have to deal with the international application, and that is less straightforward. Although Statoil had asked Southampton about the fate of the international application two weeks before the hearing, the University did not tell them that it had spawned five national applications until the last working day before the hearing. It is true that Statoil had already discovered some of these national applications from its own researches, but it didn't know about all of them and so had not had an opportunity to deal properly with the implications of the foreign applications.

117 In closing, Mr Alexander argued that I could not make any order in respect of the foreign applications because Statoil had failed to provide any evidence of the relevant foreign law. Such evidence was, he said, necessary following *Norris' Patent* [1988] RPC 159 at p169. In the circumstances, I think it would be wholly inequitable to take that line. Southampton have never suggested that the international application or the resulting foreign applications embody an inventive concept different from that of the British application, so my finding on inventorship in respect of the latter must apply to all the applications. The only possible questions are, first, whether there are any quirks of local law that affect the connection between inventorship and ownership in this case - and I have to say, I would be surprised if there were - and second, whether there are any local provisions that affect the form of order that would be appropriate.

118 I am going to give the parties an opportunity to deal with these points. The patent profession is well used to dealing with foreign patent laws, so I do not expect to be receiving masses of evidence. Indeed, I shall be disappointed if the parties can't agree the implications of any relevant local provisions between them and come up with an appropriate form of order. Mr Burkhill did, in fact, offer a form of order at paragraph 164 of his closing skeleton. Subject to any unexpected details of local law, this looks to me to be broadly OK, so I would recommend that the parties use this as their starting point. As agreed at the hearing, I am also going to give the parties an opportunity to make submissions on costs.

119 Accordingly, I allow the parties two weeks to make submissions on the form of order and on costs. What I hope to get at the end of that two weeks is a form of order that is largely, if not wholly, agreed. If it is not wholly agreed, the parties should confine their submissions and any evidence to the areas of disagreement, and they will then have one week thereafter to comment on the other side's submissions in respect of the points of disagreement. If there are problems in getting necessary information about local laws within this timescale, either side is at liberty to come back to me to seek an extension, though I very much hope that will not be necessary.

Appeal

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

P HAYWARD
Divisional Director acting for the Comptroller