Neutral Citation Number: [2010] EWCA Civ 819

Case No: A3/2009/0545

IN THE HIGH COURT OF JUSTICE
COURT OF APPEAL (CIVIL DIVISION)
ON APPEAL FROM THE HIGH COURT OF JUSTICE
CHANCERY DIVISION (PATENTS COURT)
The Hon Mr Justice Mann
HC 07 CO1084/HC 07 CO1487/HC 07 CO 1488

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 28/07/2010

Before:

THE RT HON LORD JUSTICE WALLER
THE RT HON LORD JUSTICE JACOB
and
THE RT HON LORD JUSTICE SULLIVAN

- -

Between:

Schlumberger Holdings Limited (a company incorporated in the British Virgin Islands)	**Claimant/ Respondent**
- and -	
Electromagnetic Geoservices AS (a company incorporated in Norway)	**Defendant/ Appellant**

- -
- -

Simon Thorley QC and Guy Burkill QC (instructed by Bird & Bird LLP) for the Appellant/Defendant
Michael Silverleaf QC and Hugo Cuddigan (instructed by Freshfields Bruckhaus Deringer LLP) for the Respondent/Claimant

Hearing dates: 26-30 April 2010

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Approved Judgment

Lord Justice Jacob:

1. EMGS appeals the findings of Mann J, [2009] EWHC 58 (Pat) that its EPs Nos. 1,256,019 and 1,309,887 are invalid. It does not appeal the similar finding as regards the third patent in suit, UK 2,339,640 and I need say no more about it. Also, as regards '887 in the end it was common ground that it stood or fell with 1,256,019. So the appeal is about that patent alone. I shall call it "the Patent."

General Matters

2. Mr Simon Thorley QC assisted by Mr Guy Burkill QC argued the appeal for EMGS. Mr Michael Silverleaf QC and Mr Hugo Cuddigan argued the appeal for the respondents, Schlumberger.

3. Like Mann J we had the assistance of a scientific advisor. Our advisor (who was found and agreed by the parties) was Dr Colin Brown, Director of the Ryan Institute for Environmental, Marine and Energy Research at the National University of Ireland, Galway. Prior to the hearing Dr Brown gave us an intensive two day teach-in of the technology followed by a brief non-contentious outline of the parties' respective main positions. He sat with us throughout the hearing, intervening very occasionally to clear up a technical point. Following our initial instructions to him, at no time did Dr Brown express his views of the merits of either side's arguments. Indeed even now – and even though he has been kind enough to check this judgment in draft to ensure that there are no scientific gaffes - I have no idea whether he has any or if he does what they are.

4. I would like to pay a tribute to Dr Brown for all his assistance. He is a fine teacher. In addition we greatly enjoyed his company.

The problem addressed by the Patent

5. The Judge describes the scientific and physical background and some terminology and concepts uncontroversially at [3-22]. For present purposes I think the position can be summarised in the following paragraphs.

6. Oil and gas (hydrocarbon) deposits are found in thin porous sedimentary rock. Typically a deposit will be of the order of 100m thick, though in exceptional cases a deposit can be as much as 200 or 300 metres. Generally this thickness is less than that of the layers above and below the deposit.

7. A variety of techniques has been devised over the years by exploration geophysicists to identify potentially hydrocarbon-bearing layers within sedimentary rock.

8. Of particular importance well before the date of the Patent were seismic techniques. Seismics had been well developed in the 1970s and 1980s and were serving the hydrocarbon extraction industry well. By using them it was possible to get three-dimensional (3D) information about sub-sea rock formations.

9. Seismics, however have their limitations. The Judge put it this way:

> [6] Although there have been significant improvements in modern times (including the introduction of 3D seismics in the

> 1980s), seismics do not provide a complete solution in the search for oil. They do not always give the detail and characterisation of sub-strata that an oil company would wish to have. It is sometimes useful to have a different "view" of what is down there. The more information that is available, the better. Under some conditions seismics cannot see everything that needs to be seen.

10. More particularly seismics can reveal a thin layer within sedimentary strata which might contain hydrocarbon. It can tell you its shape and size. But seismics cannot tell you that there is hydrocarbon within it, for the seismic properties of a hydrocarbon-containing layer cannot, at present, be distinguished unambiguously from those in a water- or brine- containing layer.

11. Prior to the invention of the Patent (2000), so far as under-sea exploration was concerned, once seismics had revealed an under-sea bed thin layer which potentially contained hydrocarbon, the only way to find out whether it was hydrocarbon was to drill an exploration well. This cost about US$25m per well. The success rate was only about 1 in 10. So, on average, $250m per potentially producing well.

12. Clearly it was desirable to improve on that. The problem was longstanding: hydrocarbon exploration and extraction below the sea had been carried out on a substantial scale for many years. As time went by the activities were carried out at greater and greater depth but this is no real explanation of why the invention was not made earlier.

The Patented Solution

13. The solution of the Patent can be simply stated at a general level. It is to use marine CSEM (Controlled Source Electromagnetic) surveying on a previously identified (e.g. by seismic methods) layer to find out whether it contained hydrocarbon. The method depends on the fact that hydrocarbon has high resistivity (inverse, low conductivity) whilst water or brine is the opposite (low resistivity, high conductivity). The Patent puts it this way:

> [0008] It has been appreciated by the present applicants that while the seismic properties of oil-filled strata and water-filled strata do not differ significantly, their electromagnetic resistivities (permittivities) do differ. Thus, by using an electromagnetic surveying method, these differences can be exploited and the success rate in predicting the nature of a reservoir can be increased significantly. This represents potentially an enormous cost saving.

(It was common ground that the reference to "permittivities" could be ignored).

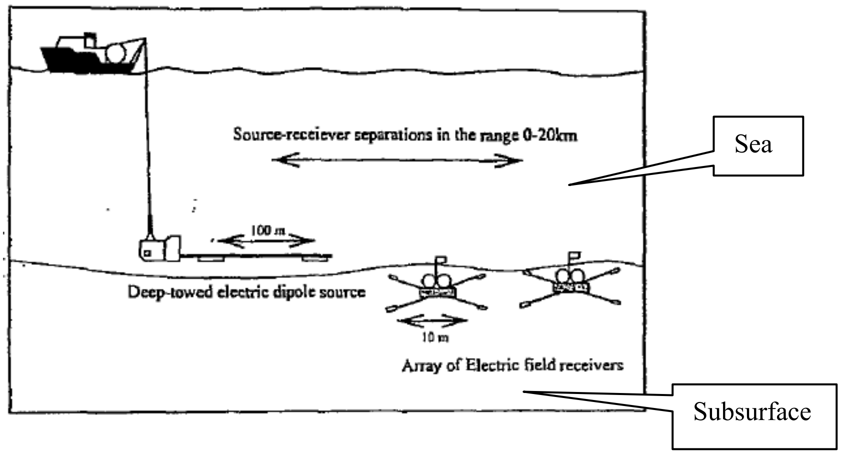
14. Claims 1 and 1A of the Patent as proposed to be amended are the only ones which now matter. They read as follows:

> 1. A method of performing a survey of subterranean strata in order to search for a hydrocarbon containing submarine

> reservoir (35), or to determining the nature of a submarine reservoir (35) whose approximate geometry and location are known, which comprises: applying a time varying electromagnetic field to the subterranean strata; detecting the electromagnetic wave field response; seeking, in the wave field response, a component representing a refracted wave (43,43C); and determining the presence and/or nature of any reservoir (35) identified based on the presence or absence of a refracted wave component (43,43C); in which the transmitted field is in the form of a wave, and in which the distance between the transmitter (37) and a receiver (38) is given by the formula
>
> $0.5\,\lambda \leq l \leq 10\,\lambda$;
>
> where λ is the wavelength of the transmission through the overburden (34) and *l* is the distance between the transmitter (37) and the receiver (38).
>
> 1A. A method of performing a survey of subterranean strata in order to determine whether a submarine reservoir (35), whose approximate geometry and location are known, contains hydrocarbons or water, which method comprises: applying a time varying electromagnetic field to the subterranean strata; detecting the electromagnetic wave field response; seeking, in the wave field response, a component representing a refracted wave (43,43C); and determining whether the reservoir (35) contains hydrocarbons or water based on the presence or absence of a refracted wave component (43,43C); in which the transmitted field is in the form of a wave, and in which the distance between the transmitter (37) and a receiver (38) is given by the formula
>
> $0.5\,\lambda \leq l \leq 10\,\lambda$;
>
> where λ is the wavelength of the transmission through the overburden (34) and *l* is the distance between the transmitter (37) and the receiver (38).

"Overburden" means the rock between the sea bottom and the subterranean strata the subject of interest (whose position and depth have been determined by seismic methods) "*l*" (the transmitter/receiver distance) is also called the "offset."

15. The apparatus for conducting a CSEM survey was known. Although not a figure of the Patent, it looks like this (a figure taken from one of the cited pieces of prior art, MacGregor):



16. An electric field is transmitted by the dipole source towed a short distance above the sea-bed. Receivers are positioned at a distance away. They can either be on the sea-bed itself or towed along with the dipole source. The method depends on the fact that the resistivity (inverse, conductivity) of different kinds of rock (and indeed of the sea water and the air above) all differ. The electric waves travel at different speeds and are attenuated differently depending on the material through which they go. The receivers pick up a composite consisting of the combined effects of these different transmission paths. That composite will be the result both of attenuation and of interference caused by phase differences between waves which have travelled at different speeds and paths.

17. The actual physics of what is going on is very complicated. But in the end the very fine detail does not matter for the purposes of this case. The Patent describes the method in these terms:

> [0009] The present invention arises from an appreciation of the fact that when an EM field is applied to subterranean strata which include a reservoir, in addition to a direct wave component and a reflected wave component from the reservoir, the detected wave field will include a 'refracted' wave component from the reservoir. The reservoir containing hydrocarbon is acting in some way as a wave guide. For the purposes of this specification, however, the wave will be referred to as a 'refracted wave', regardless of the particular mechanism which in fact pertains.
>
> [0010] Be that as it may, a refracted wave behaves differently, depending on the nature of the stratum in which it is propagated. In particular, the propagation losses in hydrocarbon stratum are much lower than in a water-bearing stratum while the speed of propagation is much higher. Thus, when an oil-bearing reservoir is present, and an EM field is applied, a strong and rapidly propagated refracted wave can be detected. This may therefore indicate the presence of the reservoir or its nature if its presence is already known. Preferably, therefore, the method according to the invention further includes the step of analyzing the effects on any detected refracted wave

component that have been caused by the reservoir in order to determine further the content of the reservoir based on the analysis.

18. The Judge explained this in his own words which were not challenged by either side:

[30] This is best explained by reference to [fig. 2 of the patent reproduced here:]

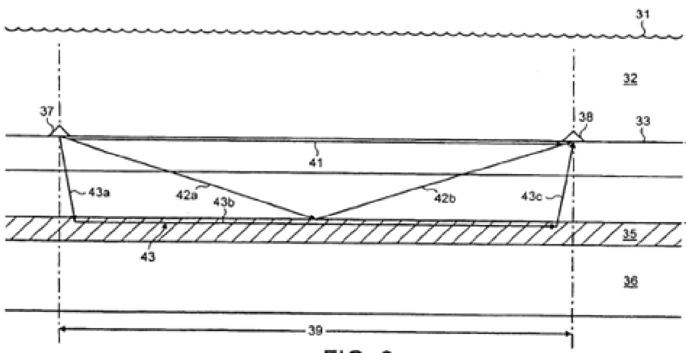


FIG. 2

37 and 38 are the transmitter and receiver respectively. 41 represents the “direct wave”, which can be considered to be the wave which passes directly through the water. Since seawater is relatively conductive (relatively less resistive) the signal or wave attenuates faster than waves passing through more resistive structures. 34 is the seabed (the top of the overburden). 35 is the target layer, supposed for these purposes to be more resistive if it contains oil than it would be if it contained water. 42a and 42b represent a supposed reflected wave, being reflected off the top of the questioned layer. 43 is the “refracted wave”. It represents a wave which is said to pass into the layer, and then to be refracted so that it can be picked up via the sort of route shown. This is the key to the invention. It depends on being able to “seek” this wave and identify it. If the layer contains water and not oil, the wave will not be present, or at least not in the same way, and the overall measured signals picked up will be different. As will appear from paragraph 0012 of the patent, it is said that the direct wave and the reflected wave, both of which will have passed through media which will have a lower resistivity than the questioned (oil-bearing) layer, will have attenuated more than the refracted wave, so that detection is facilitated; and it is said it (the refracted wave) will travel faster and with less attenuation in the more highly resistive layer, and so be detected first and more strongly. In the words of the patent:

[0035] The transmitted wave also results in a refracted wave 43. This is composed of a downward portion 43a which descends through the overburden 34, a refracted portion 43b which travels along the layer 35, and an upward portion 43c

> which travels back up through the overburden 34. Since the refracted portion 43b travels much faster through the oil-bearing layer 35 and with far less attenuation, the refracted wave 43 is detected first by the detector 38 and at a relatively high signal level, compared to the direct wave 41 and the reflected wave 42a, 42b.

The attacks on Validity

19. Schlumberger now contend that the Patent is invalid for the following reasons:

    Obviousness over Chave

    Obviousness over MacGregor

    Novelty and obviousness over Srnka

    Novelty over Yuan

    The names of the citations are those used by the parties and Judge for the purposes of this case.

20. Below there were many other points which the Judge had to deal with. The Judge's decisions about these (some in favour of one party, the others in favour of the other) are not challenged on the appeal. The points were: anticipation by Chave, anticipation or obviousness over Hördt & Strack, obviousness over Yuan, anticipation by MacGregor, invalidity of the 887 patent on grounds in addition to those raised against 019 and the whole of the validity of patent 640.

21. The Judge held the Patent obvious over each of Chave, MacGregor and Srnka. He rejected the anticipation (lack of novelty) attacks based on Srnka and Yuan. His decisions on those points are challenged by Schlumberger by way of a respondent's notice.

The Person skilled in the Art

(a) How the question arises

22. Before considering each of the remaining attacks on validity it is necessary, as the parties agreed, to consider a question of law. It arises in the following way.

23. On the facts – out in the real world – the kind of scientist who would be actively engaged by oil and gas exploration companies to find hydrocarbon reserves is called an exploration geophysicist. Such an individual would be familiar with the problems of undersea exploration and particularly the use of seismics to deal with them. He/she would know that seismics had seen considerable advances over the years, becoming more and more sophisticated and able to discern finer and finer detail of the rock structure below the sea bed. He/she would know of the problem addressed by the Patent, namely that seismics could identify a potential oil/gas containing layer or porous rock (which would be thin – maximum of about 300m thick but generally less)

but could not tell you whether it contained hydrocarbon or merely brine or water. To find out which you would have to drill. An exploration geophysicist would have but a vague knowledge of CSEM and had no apparent use for it. The Judge's finding in [57] was:

> Accordingly, looking at what actually happened in practice, those with a practical interest in this invention would not have included a CSEM specialist, especially where a marine survey was involved.

24. On the other hand there was a small, very small, group of academic geophysicists who did know a considerable amount about CSEM. The equipment for carrying it out (which we were told cost about US$1m) was far from widely available. The Judge's finding (again in [57]) was:

> There were only two sources (sets of equipment) in the world capable of carrying out marine CSEM of the sort needed, and they were in the hands of academics in Cambridge/Southampton, and at the Scripps Institute in San Diego.

25. To perform the method of the patent, you need the skills of a CSEM expert – either a CSEM expert would have to join the exploration team or the team itself would have to learn the technique including the considerable specialised mathematical methods required – in effect to become a CSEM expert. Without those skills being available, the Patent would fail to give enough instructions on how to perform the method.

26. Similarly, to determine the scope of the claims, it is common ground that you would consider them through the eyes of a notional team including both exploration and CSEM geophysicists.

27. But what about the position before the invention was made? Must the prior art be viewed through the eyes of a person (team) with both exploration geophysics and CSEM skills? In graphic terms does the law require that both sorts of expert not only be in the same room but that the exploration geophysicist says to the CSEM expert: "this is my problem, can you help?"

28. If the "person skilled in the art" for the purposes of considering obviousness is by law to be assumed to have both sets of skills, then Mr Thorley accepts that the invention is prima facie technically obvious:

> If you approach him [i.e. a CSEM expert] and say, "Can I use it for these purposes?" we are not suggesting that, in those circumstances, when the CSEM sat down and thought about it, he would say, "Sorry, it is not going to work." He would say, "It has a good enough chance of working to give it a run although we have never thought of doing this before.

29. The concession is only that the Patent would be *prima facie* obvious. Mr Thorley submits that the presumption could, and should in this case be, rebutted by so-called secondary evidence – he points to the failure to provide any good explanation why it

was not done years before coupled with the excited reactions of those with CSEM skills after the invention was made. To that secondary evidence I will return but it is first necessary to consider whether the "person skilled in the art" is by law to have the same attributes for all purposes.

(b) Same for all purposes?

30. The "person skilled in the art" is explicitly referred to three times in the European Patent Convention which is the basis of the UK Act (to which there is no point in referring). The three places are in the Protocol to Art. 69, Art 83 and Art 56.

31. The first two of these Articles are concerned with the position post-grant of the Patent. Art 69 and its Protocol are concerned with the scope of the claims – how they are to be interpreted? Art 83 is concerned with sufficiency of description - does the patent disclose the invention "in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art?" To apply either provision you must consider that patent to be in the hand of the "person skilled in the art".

32. But Article 56 is concerned with something different. The question it poses is whether there was an "inventive step". By the same Article that turns on whether, "having regard to the state of the art, it is not obvious to a person skilled in the art." So Article 56 is about the position pre-patent.

33. Now it has long been settled in general terms that the "person skilled in the art" may, where necessary, be a notional team of people having different skills. So far as English law is concerned the notion can be traced back in the context of sufficiency of description to at least *Osram v Pope* (1917) 34 RPC 369 ("I think it obvious, from the Specification itself, that directions therein contained are addressed in part to chemists and in part to skilled workmen conversant with industries which involve the formation of filaments" *per* Lord Finlay LC).

34. In the context of obviousness Graham J assumed that a team would be involved, *Olin Mathieson v Biorex* [1970] RPC 147 ("a properly qualified and instructed research organisation engaged on the problem in question", p. $184_{42\text{-}43}$ and see also his formulation of the obviousness question at 187_{43} "would the notional research group ….").

35. A full recognition that a notional team of different skills may be needed for considering novelty (and the same goes for obviousness) was provided by the Court of Appeal in *General Tire v Firestone* [1972] RPC 457 at $485_{31\text{-}35}$.

> If the art is one having a highly developed technology, the notional skilled reader to whom the document is addressed [i.e. the cited piece of prior art] may not be a single person but a team, whose combined skills would normally be employed in that art in interpreting and carrying into effect instructions such as those which are contained in the document to be construed.

36. The case law of the Boards of Appeal is to the same effect. Thus the 5th (2006) edition of *The Case Law of the Boards of Appeal of the EPO* says this:

> 7.1.2 *Competent skilled person – group of people as "skilled person"*
>
> Sometimes the "skilled person" may be a group of people, such as a research or production team. For the purposes of Art. 56 EPC the person skilled in the art is normally not assumed to be aware of patent or technical literature in a remote technical field. In appropriate circumstances, however, the knowledge of a team consisting of persons having different areas of expertise can be taken into account (T 141/87, T 99/89). This would be the case in particular if an expert in one particular field was appropriate for solving one part of the problem, while for another part one would need to look to another expert in a different area (T 986/96).
>
> Thus, the board stated, for example, in T 424/90 that in real life the semiconductor expert would consult a plasma specialist if his problem concerned providing a technical improvement to an ion-generating plasma apparatus. In T 99/89 too, the board took the view that "competent skilled person" could be taken to mean a team of two or possibly more experts from the relevant branches.
>
> In T 164/92 (OJ 1995, 305) it was observed that sometimes the average skilled person in electronics, particularly if he did not have an adequate knowledge of programming languages himself, might be expected to consult a computer programmer if a publication contained sufficient indications that further details of the facts described therein were to be found in a program listing attached as an annex thereto.

37. The point of law now in issue – whether the notional team is by law to be the same for all purposes – was not directly in point in any of these cases. What was in point, however, was the nature of the notional team for the question in issue, obviousness, novelty, sufficiency or construction. So in *Osram* the team was the addressee for carrying out the invention – sufficiency. In *Olin* it was the team seeking to find an improvement over a prior art drug, chlorpromazine – obviousness. In *General Tire* it was the team reading the prior art for the purpose of novelty. In the EPO cases it was the team to whom the invention was said to be obvious. In none of the cases was it said that there was some sort of universal rule about the nature of the team. In each case it was treated as essentially one of fact depending on the problem at hand.

38. The Judge said:

> [61] The starting point in this area of debate should be the classic formulation in *Catnic Components v Hill & Smith* [1982] RPC 183. At p 242 Lord Diplock said:
>
> > "My Lords, a patent specification is a unilateral statement by the patentee, in words of his own choosing, addressed to

> those likely to have a practical interest in the subject matter of his invention (i.e. 'skilled in the art'), by which he informs them what he claims to be the essential features of the new product or process for which the letters patent grant him a monopoly … The question in each case is: whether persons with practical knowledge and experience of the kind of work in which the invention was intended to be used, would understand that strict compliance with a particular descriptive word [etc]". (My emphasis)

I do not agree that this well-known passage is relevant at all to the point now in issue. Lord Diplock was concerned with something quite different – how the court is to determine the scope of patent claims. The notional skilled reader (which may be a team) is assumed to have the patent in hand, to have read it with his common general knowledge and to interpret the claims on that basis. (Actually the modern (post-EPC) formulation of the rules about that are to be found in *Kirin-Amgen* [2004] UKHL 46 with some refinements in later cases.) Lord Diplock was not even considering a notional team at all – which is hardly surprising given the simplicity of the mechanical invention in that case.

39. Other cases cited to us have touched on the point though in none was it directly in issue. The English cases were *Dyson v Hoover* [2002] RPC 465, *Genentech's Patent* [1989] RPC 147, *Mutoh Industry's Appn.* [1984] RPC 35, *3M v ATI Atlas* [2001] FSR 514 and *Halliburton v Smith* [2006] EWCA Civ 1715. The EPO authorities were *Luminescent Security Fibres/Jalon* T422/93 and *Plant Gene Expression/Mycogen* T/694/92.

40. I turn to some of these, bearing in mind two things. Firstly in nearly all cases the notional skilled team will on the facts be the same for all purposes (obviousness, novelty, construction and sufficiency) so the point now in issue would not arise. Secondly, what was said by the various tribunals must be read in the context of the facts of the case concerned.

41. I start with *Dyson v Hoover* relied upon by Mr Thorley. The invention was, skipping detail irrelevant here, simply a vacuum cleaner which used cyclone technology. The dust would not be collected in a bag. The actual vacuum cleaner industry had a mindset which "was bag ridden", to use Sedley LJ's phrase. No actual research team had any cyclone specialists within it. The patent was held non-obvious. Mr Thorley drew an analogy with this case. To implement the Dyson patent you would need the skills of a cyclone expert. If such a person by law was also deemed to be part of the pre-invention research team, then to that team the invention would have been obvious. But real teams did not include cyclone experts because no-one had the wit to bring one in. Doing that was the essence of the invention – was non-obvious.

42. I think one can draw from this case that the Court, in considering the skills of the notional "person skilled in the art" for the purposes of obviousness will have regard to the reality of the position at the time. What the combined skills (and mind-sets) of real research teams in the art is what matters when one is constructing the notional research team to whom the invention must be obvious if the Patent is to be found invalid on this ground.

43. Mr Silverleaf submitted that *Hoover* was not a true analogy. For in that case it was not suggested that once you were given the idea of using a cyclone, the existing research teams could not implement it. Here, however, to perform the invention of the Patent existing research teams would have to call on (or develop for themselves) a whole new expertise. I do not accept that is any real distinction. In reality a vacuum cleaner design engineer who had never used cyclones would have to develop some expertise in that field to implement the Dyson invention. In fact that would be a whole lot easier than it would be for a team of exploratory geophysicists to develop expertise in CSEM. But the difference is one of mere degree, not kind.

44. *Genentech* shows this much: that the notional team for considering obviousness may have *wider* skills than the team required for sufficiency. The target, a desirable protein called t-PA, was known. The patent was for t-PA made by recombinant DNA technology. The patentee had shown how that was to be done by taking a series of steps. The first of these was to get a sufficient sample of t-PA (it came from expression of a line of cells called Bowes melanoma). Then the skills of a protein sequencer were called in to produce some amino acid sequence data. From that, using the genetic code, what possible nucleotide sequences corresponded to the sequence data were worked out. Using that, the gene for t-PA was isolated and inserted into a suitable host cell which would then express t-PA. The protein chemist, essential at the start, had no relevant skills for anything other than finding the initial sequence data. And once the gene had been found and set out in the patent along with the protein sequence data you did not need his expertise to implement the invention.

45. On the facts the patent was held obvious. The important point to note for present purposes is that the team for obviousness included a protein chemist whereas the team for implementation (sufficiency) did not need him. Different teams for different purposes.

46. Only Mustill LJ considered the question of the "person skilled in the art" in a manner relevant here. He was actually wrestling with the problem that the person skilled in the art is supposed to have no inventive faculty whereas in reality in the field in question people were rather clever. Nonetheless he did form the view that the "person skilled in the art" was not the same for the purpose of considering obviousness as for sufficiency. He said at p.278_{51}-279_{11}:

> ….. I must draw a distinction between section 3 [= Art. 56] and section 14(3)[= Art. 83]. Each of these refers to the person skilled in the art, and it has been assumed that since the words are the same the person and his attributes must also be the same, whichever section is in play. In the case of the classical mechanical engineering patent, this is true. Whether one is asking if the addressee can read the drawings and the description, so as to be able to work the invention, or if the skilled man can proceed from the drawings and descriptions of the prior art to the new product or process without inventiveness, there is no difficulty in using the same notional skilled artificer as the touchstone. But the position here is different. Once given that we are concerned with a series of different arts practised in this complex field, it cannot be

> assumed that the arts in which the hypothetical persons are skilled will be the same whether they are addressees who start with the patent and try to make it work, or persons who start with the prior art and try to get to the patent. This is indeed obvious in the present case, since the amino acid sequencer who is a vital member of the discovering team will be redundant when the addressees are seeking to fabricate (say) the claimed expression vectors, since *ex hypothesi* they will know, not just the five or six bases which were derived en route to the discovery but the full length of the protein sequences.

47. Mr Silverleaf sought to deal with this passage by saying that this was a lone opinion, was unnecessary for the decision, and that one other member of the court (Purchas LJ) disagreed. I am not sure about the last point but he is right about the first two. However none of these is an answer to the <u>logic</u> of the opinion.

48. *Mutoh* was about whether the use of magnetic repulsion as between the moving parts of a known type of drawing device was obvious. Whitford J held not. He put it this way:

> I agree ... that the question in this case really is: Would it have been obvious to a man, who I can perhaps describe as the drawing-board man, to go to a bearing man with a view to seeing if he could get assistance on the question of reduction of frictional effect? There have of course been a number of cases where it has been rightly pointed out that it is no good just considering what might or might not have been obvious to the workman in the particular field with which the patent is concerned (in this case the drawing-board man) because very often the man working in a relatively limited field will realise that he must seek outside assistance to enable him to solve particular problems with which he may be faced, and I was referred to a number of well known authorities in which it is pointed out that nowadays in particular you do not want to consider what might be obvious to one particular individual working in one particular field because very often it is quite inevitable that a team of individuals is going to be involved and if it would be obvious to the team then that is good enough. But so far as I am aware this is not a case in which those who use apparatus of this kind were struggling desperately to get over some problems which really completely inhibited their activities; it is not a case where manufacturers of apparatus of this kind were really failing to put the apparatus on the market because they could not produce anything that was sufficiently friction-free. There is no reason why the manufacturer of apparatus of this kind, or a user of apparatus of this kind should be looking for outside assistance, though no doubt he might be thinking from time to time well, it would be nice if one could reduce the frictional effect; but there is not, so far as I am aware, any history of any specific problem. There is not

> anything pointing to this, that there would be some need for somebody within the relevant field to be looking for outside assistance. Of course, if they were, they might, I suppose, have gone to a bearing man, but they might have gone to some other sort of specialist who might be able to deal with friction problems. I think I would be prepared to accept that if once they went to the bearing man it is indeed likely that magnetic repulsion might be suggested as a possible solution to the frictional problems in this particular field.

49. Mr Thorley submitted that this case again showed that the skilled person for obviousness was not necessarily the same as the skilled person for performance. The right question was whether the drawing board expert would consider bringing in the magnetic repulsion expert. Mr Silverleaf made no express reference to this case in his argument. However his answer would clearly be the same as his answer to *Hoover*: that unlike this case where, for the Patent to be sufficient, one needs to bring in very specific skills, there was no need for such skills in that case. I have already rejected that argument as a failed attempt to elevate a question of degree into one of kind.

50. A case which does support Mr Silverleaf was *3M.* Prior to the invention the persons principally concerned with sterilisation indicators were microbiologists. The idea of the patent was to use enzymes in place of bacterial spores. That idea would have been obvious to an enzyme expert. So the question was whether such an expert should be considered as part of the notional skilled team. Pumfrey J said at [29-30]:

> 29 The question of the addressee of the specification is unusually difficult in this case. Before the date of the patent, it seems that the persons principally concerned with sterilisation indicators were, unsurprisingly, microbiologists. …. The patentees say that the inventive step lay in the discovery that some enzymes present in bacteria (or bacterial spores) commonly used to test for sterilisation can survive (in the sense of still being active after) a sterilisation cycle which kills the micro-organism. The defendants say that this is obvious to any enzymologist, [the judge spelt out why]. …. So, in essence, the defendant's position is that it is all obvious to an enzymologist …
>
> 30 It seems to me that as a matter of principle invention cannot lie in bringing into a notional team working on a particular problem a new notional member with different skills from those of the existing notional team. The specification necessarily describes the attributes of the team to which it is addressed. Here, the team consists (notionally) of a microbiologist and an enzymologist. … The addressee of a specification is the person likely to have practical interest in an invention: here, it is the maker and seller of sterilisation indicators who wishes to make an indicator following the directions of the patent, and I am satisfied that for this purpose

> he employs a microbiologist with interests in the relevant area and an enzymologist who can carry out the directions of the specification. …

Mr Thorley submitted that if read as saying there can never be invention in bringing a different skill into a team for the purpose of obviousness, this passage was wrong. If on the other hand Pumfrey J was merely saying on the facts that the notional team would include an enzymologist, there was no problem. I am bound to say I think Pumfrey J was saying the former. And if so, I do not agree. It may be possible (I say no more) to explain the actual decision on the basis that the invention was simply obvious to an enzymologist.

51. However I am not sure that even Pumfrey J was always of the same opinion. In *Horne Engineering v Reliance Water Controls* [2000] FSR 90, in the context of considering common general knowledge, he said:

> I would add that although it has to be remembered that a specification may fail to provide sufficient details for the addressee to understand and apply the invention, and so be insufficient and invalid, it is often possible to deduce the attributes which the skilled man must possess from the assumptions which the specification clearly makes about his abilities.

The fact that Pumfrey J qualified this view by the words "often possible" may indicate that he was not saying that the person skilled in the art is taken to have the same skills come into play whatever topic of patent law is under consideration.

52. Laddie J took a different view, accepting that there could be invention in the marrying of two different skills. In *Inhale Therapeutic Systems v Quadrant Healthcare* [2002] RPC 21 he said at [42]:

> In some cases a patent claim may cover a wide field so that some parts of it will be obvious to the notional skilled person in one field and other parts will be obvious to the notional skilled person in another. That is not unfair to the patentee … but [is] simply a reflection of the fact that the scope of the protection sought is wide. I accept, of course, that in some cases there will be invention in marrying together concepts from two unrelated arts, but that is not what Mr Carr is arguing for here.

53. The Judge at [65] thought this passage supported the proposition that the skilled person was an invariant for all purposes. I do not agree. What Laddie J was saying was that where an invention involves the use of more than one skill, if it is obvious to a person skilled in the art of any one of those skills, then the invention is obvious. And rightly so, for it would otherwise impede a class of person who found it obvious. So here, if the invention was obvious to a CSEM expert alone or to a geophysicist alone, then the Patent is invalid. Mr Thorley did not contend otherwise. What is important to note is that Laddie J was careful to recognise that there could be

invention in marrying together concepts from unrelated arts. A non-obvious marriage of skills is essentially what Mr Thorley is contending for here.

54. The last English authority to which I find it necessary to refer is a decision of this Court in which I gave the judgment of the Court, *Halliburton.* At [22] I said:

> We would add one further comment here: there is an interrelationship between obviousness and insufficiency. At first blush one might suppose that an idea which requires masses of work to implement would be more readily rejected by, or less likely to occur to, the notional unimaginative skilled person/team who is the addressee than one which can be readily put into practice. This produces an apparent paradox: the less sufficient the description, the less is an idea likely to be obvious. The answer to the paradox is this: that if the notional skilled person/team is one that is prepared to contemplate an immense amount of work, that attribute must also be considered part of the person/team's consideration of what is obvious. Obviousness and sufficiency of description must be considered by the same person/team.

55. Mr Silverleaf relied upon the last sentence of this paragraph. I think, upon re-consideration, that although generally true and applicable in that case it is not necessarily so as a matter of law. It is not so where the invention itself is art-changing by putting together two disparate arts. Clearly the passage was not necessary for the actual decision: that was essentially that performance of the invention, if possible at all, involved far too much work and would take far too long for the person skilled in the art. In *Halliburton* there was no suggestion that the person skilled in the art for the purposes of sufficiency involved a different team from the team for the purposes of obviousness. The point did not even arise. It was a pure insufficiency case.

56. The upshot is that on balance the English authorities favour Mr Thorley though none are conclusive. What then of EPO guidance? The most relevant case is clearly *Jalon.* The other cited case, *Mycogen* assists neither side.

57. The Jalon patent was for a process for the production of security fibres containing luminescent rare earth chelates. There were two prior art citations. One disclosed the idea of using these chelates by applying them to the surface of the fibres. The other disclosed the idea of incorporating the chelates in a mass which was then extruded in a spinning process

58. In accordance with its usual practice the Board applied the "problem-solution approach" (for a discussion of this see [25-41] of *Actavis v Novartis* [2010] EWCA Civ 82). The first step is to identify the closest piece of prior art which, in *Jalon* was taken to be the prior idea of incorporating the chelates in a mass and then extruding and spinning. The patentee said its method was better in that it was useful for small quantities of fibre. The patentee's solution to the problem involved using a dyeing process. The opposition division took the view that the appropriate skilled person was a dyeing expert who would see at once that dyeing could be used to incorporate the chelates.

59. The Board said that was a wrong approach. It said:

> In the present case, however, the principle of introducing a rare earth chelate by a dyeing process quite clearly forms part of the **solution** to the technical problem to be solved (see points 3.4 and 3.5 above). The expert in dyeing cannot therefore be the skilled person who was faced with the task of solving the problem, because the very fact of choosing to **introduce** rare earth chelates by a dyeing process is the essential feature of the solution proposed. The board consequently takes the view that the skilled person faced with the task of solving the problem posed was not an expert in dyeing, but rather an expert in security materials who specialised in the marking (identification, authentication, etc.) and protection (against imitation, forgery or counterfeiting) of security documents and similar materials.
>
> …
>
> The idea of introducing rare earth chelates by a process of dyeing security fibres, etc., at a stage subsequent to their production - the process defined in claim 1 – is the essential part of the teaching of the contested invention as reflected in the solution to the problem posed. The technical problem addressed by an invention must however be so formulated as not to contain pointers to the solution, since including part of a solution offered by an invention in the statement of the problem must, when the state of the art is assessed in terms of that problem, necessarily result in an **ex post facto** view being taken of inventive step.

60. Now there is no doubt that to perform the Jalon invention you would need dyeing skills. Yet the person skilled in dyeing was rejected as being irrelevant when considering obviousness because the very invention consisted of bringing the dyer in – he was part of the solution.

61. I think this is a clear recognition that the person skilled in the art for obviousness is not necessarily the same person skilled in the art for performing the invention once it is made. Mr Silverleaf sought to distinguish *Jalon* on much the same basis as he sought to distinguish *Hoover*, namely that there was no question of the Jalon invention being insufficient without the special skills of a dyer. For the same reason as in the case of *Hoover* I think that is a distinction without a difference.

62. Mr Silverleaf says it cannot be that the same phrase when used in the EPC can have different meanings. It uses the same words in three places – by all known canons of construction they must have the same meaning in all three places.

63. I think the flaw in that is to assume that "the art" is necessarily the same both before and after the invention is made. The assumption may be correct in most cases, but some inventions are themselves art changing. If a patentee says "marry the skills of

two different arts to solve a problem," marrying may be obvious or it may not. If it is not, and doing so results in a real technical advance then the patentee deserves and ought to have, a patent. His vision is out of the ordinary.

64. This is not because a different construction is being given to the phrase "person skilled in the art" in the different Articles. It is because the phrase is being applied to different situations. Where the issue is claim construction or sufficiency one is considering a post-patent situation where the person skilled in the art has the patent in hand to tell him how to perform the invention and what the monopoly claimed is. But ex-hypothesi the person skilled in the art does not have the patent when considering obviousness and "the art" may be different if the invention of the patent itself is art changing.

65. In the case of obviousness in view of the state of the art, a key question is generally "what problem was the patentee trying to solve?" That leads one in turn to consider the art in which the problem in fact lay. It is the notional team in that art which is the relevant team making up the person skilled in the art. If it would be obvious to that team to bring in different expertise, then the invention will nonetheless be obvious. Likewise if the possessor of the "extra expertise" would himself know of the other team's problem. But if it would not be obvious to either of the notional persons or teams alone and not obvious to either sort of team to bring in the other, then the invention cannot fairly be said to be obvious. As it was put in argument before us the possessors of the different skills need to be in the same room and the team with the problem must have some reason for telling the team who could solve it what the problem is.

66. The Judge rejected EMGS's argument that the skilled person (he said "addressee") for the purposes of obviousness was <u>only</u> an exploration geophysicist. I think he was right to do so, but not entirely for the right reason. It is not because as a matter of law a CSEM man must be considered as part of the notional team for the purpose of obviousness because he is part of the team to whom the Patent is addressed. It is simply because if there is any type of person skilled in the art to whom an invention is obvious, a patent for that invention is bad.

67. At [71] the Judge said this:

> Suppose that there is a cloistered world of CSEM experts to whom the application of their marine craft to oil exploration was quite obvious, but whose views had not crossed into the realms of the actual oil explorers, and let it be supposed that the application of CSEM was in no way obvious to the latter. If Mr Burkill's submissions were correct, there would be a skilled addressee team of geophysicists, and the patent would not fail for obviousness; and the CSEM specialists would be prevented from doing something which is quite obvious to them. That seems to be wrong in principle, and that result is avoided if they are part of the team. If, next, one supposes that CSEM is not obvious to them, then their introduction to the skilled addressee team still does not render the invention obvious, and the new technique is truly inventive. Again, that is consonant

> with principle. The invention will result from marrying together two unrelated arts (to revert to what Laddie J said in *Inhale*) but that would be a correct result where the inventive concept would not be obvious to the practitioners of either. I stress that this part of the reasoning is not used to determine the constitution of the team; it is used to test the consequences of the arguments.

68. That reasoning is not quite right. You do not need to make the CSEM specialist part of a notional team also including actual explorers to ask whether the invention was obvious to a person skilled in the art of CSEM. You just ask whether it was obvious to such a person. If that person was aware of the oil explorer's particular problem and sees the answer, that is enough.

69. At [72] he accepted the "same meaning" argument saying because the Patent is addressed to a team including a geophysicist and a CSEM specialist (for some reason not a marine CSEM specialist) that was the team for testing obviousness too, see [72]. For the reasons I have tried to explain I do not agree.

70. The Judge went on to say that in the end he thought it made no difference. But it can make all the difference. It is quite right to ask whether the invention would be obvious to a person skilled in one art or the other (a CSEM person or an exploration person). But in asking those questions you must be careful to ensure that you consider just what it is that that kind of person would know. You cannot just assume that each would know what was known to the other, you need proof that it would be so.

The correct approach in this case

71. It follows that the correct approach in this case is to start with the real problem faced by exploration geophysicists. Did they appreciate they had a solvable problem? How could they determine whether a thin layer of porous rock identified by seismics as potentially hydrocarbon bearing in fact does so or is just a false positive bearing only brine or water? One then asks whether the notional exploration geophysicist who read the cited prior art would see that the answer was to use CSEM, or if not that, at least that CSEM had a sufficient prospect of being useful that it was worth asking a CSEM expert.

72. The problem must also be approached the other way round, from the point of view of the CSEM expert. Would he or she know of the exploration geophysicists' problem and, if so, would he or she appreciate that CSEM had a real prospect of being useful to solve the problem?

73. In short: was the marriage obvious to either notional partner?

74. One further approach is not necessary: that is to ask whether the notional team including both types of expert would see that CSEM would solve or stood a very good chance, of solving the problem. That is because Mr Thorley's concession provides the answer here.

75. There is danger to be avoided. There are cases where, even though you can, in retrospect, clearly see that there was a problem and articulate what it was, workers at the time did not do that. They did not say: "this is our problem. If only we had a solution to it." Instead they simply put up with things as they were. Then the essence of the invention is the insight that there was a solvable problem at all. The *Haberman* case, see below, is a good example.

The Place of Secondary Evidence

76. In answering these questions it is also important to consider the secondary evidence. I shall go to the details of this in due course, but before I do so I should say something about secondary evidence generally.

77. It generally only comes into play when one is considering the question "if it was obvious, why was it not done before?" That question itself can have many answers showing it was nothing to do with the invention, for instance that the prior art said to make the invention obvious was only published shortly before the date of the patent, or that the practical implementation of the patent required other technical developments. But once all other reasons have been discounted and the problem is shown to have been long-standing and solved by the invention, secondary evidence can and often does, play an important role. If a useful development was, in hindsight, seemingly obvious for years and the apparently straightforward technical step from the prior art simply was not taken, then there is likely to have been an invention.

78. As usual Lord Reid had something perspicacious to say on the topic. In *Technograph Printed Circuits v Mills & Rockley* [1972] RPC 346 he said at 353:

> Being wise after the event counsel for the appellants pointed out that this was really an easy problem to solve …..
>
> The whole history of this matter shows the falsity of that analysis. Dozens of inventors, and no doubt others as well, had tried and failed to find a satisfactory solution.

79. Other types of secondary evidence can also point to inventiveness. One well-known type is the commercial success of the patented product, particularly if it met a long-standing need. Again one has to be able to strip out all other possible causes of that success, such as advertising, low production costs due to factors other than the invention, good design features and so on. But if one can do that (normally it works only in the case of simple inventions), and one is left with a successful product, which, if anyone had thought of it earlier, would have met a large market earlier, there may well be an invention.

80. A particularly dramatic example of commercial success which turned a case of apparent technical obviousness into one of non-obviousness was *Haberman v Jackel* [1999] FSR 683. It was a child's trainer cup provided with a self-closing slit valve to stop leaks when it was dropped but which allowed the child to drink. The type of valve had been known for years. As had trainer cups. And for years parents had had to put up with the problem that when little Johnnie or Janet dropped the cup, it leaked. Ribena on the carpet was the order of the day. Mrs Haberman's invention stopped

that almost overnight. Her step was, in the words of Laddie J "to take the known simple valve and apply it to the known simple cup." Laddie J's non-exhaustive summary of the factors relevant when a patent is defended against a charge of obviousness by commercial success remains a masterpiece. I have no hesitation in setting it out in full:

> (a) What was the problem which the patented development addressed? Although sometimes a development may be the obvious solution to another problem, that is not frequently the case.
>
> (b) How long had that problem existed?
>
> (c) How significant was the problem seen to be? A problem which was viewed in the trade as trivial might not have generated much in the way of efforts to find a solution. So an extended period during which no solution was proposed (or proposed as a commercial proposition) would throw little light on whether, technically, it was obvious. Such an extended period of inactivity may demonstrate no more than that those in the trade did not believe that finding a solution was commercially worth the effort. The fact, if it be one, that they had miscalculated the commercial benefits to be achieved by the solution says little about its technical obviousness and it is only the latter which counts. On the other hand evidence which suggests that those in the art were aware of the problem and had been trying to find a solution will assist the patentee.
>
> (d) How widely known was the problem and how many were likely to be seeking a solution? Where the problem was widely known to many in the relevant art, the greater the prospect of it being solved quickly.
>
> (e) What prior art would have been likely to be known to all or most of those who would have been expected to be involved in finding a solution? A development may be obvious over a piece of esoteric prior art of which most in the trade would have been ignorant. If that is so, commercial success over other, less relevant, prior art will have much reduced significance.
>
> (f) What other solutions were put forward in the period leading up to the publication of the patentee's development? This overlaps with other factors. For example, it illustrates that others in the art were aware of the problem and were seeking a solution. But it is also of relevance in that it may indicate that the patentee's development was not what would have occurred to the relevant workers. This factor must be treated with care. As has been said on more than one occasion, there may be more than one obvious route round a technical problem. The existence of alternatives does not prevent each or them from

> being obvious. On the other hand where the patentee's development would have been expected to be at the forefront of solutions to be found yet it was not and other, more expensive or complex or less satisfactory, solutions were employed instead, then this may suggest that the *ex post facto* assessment that the solution was at the forefront of possibilities is wrong.
>
> (g) To what extent were there factors which would have held back the exploitation of the solution even if it was technically obvious? For example, it may be that the materials or equipment necessary to exploit the solution were only available belatedly or their cost was so high as to act as a commercial deterrent. On the other hand if the necessary materials and apparatus were readily available at reasonable cost, a lengthy period during which the solution was not proposed is a factor which is consistent with lack of obviousness.
>
> (h) How well has the patentee's development been received? Once the product or process was put into commercial operation, to what extent was it a commercial success. In looking at this, it is legitimate to have regard not only to the success indicated by exploitation by the patentee and his licensees but also to the commercial success achieved by infringers. Furthermore, the number of infringers may reflect on some of the other factors set out above. For example, if there are a large number of infringers it may be some indication of the number of members of the trade who were likely to be looking for alternative or improved products (see (iv) above [I interpolate there does not seem to be a "(iv) above", but no matter].
>
> (i) To what extent can it be shown that the whole or much of the commercial success is due to the technical merits of the development, *i.e.* because it solves the problem? Success which is largely attributable to other factors, such as the commercial power of the patentee or his license, extensive advertising focusing on features which have nothing to do with the development, branding or other technical features of the product or process, says nothing about the value of the intention.

81. Another important matter to consider is the reaction of experts at the time of the invention, both before and after. Aldous J put it this way in *Chiron v Organon Teknika (No. 3)* [1994] FSR 202 at 223:

> … it will be necessary to go back to November, 1987 [the priority date] and try to understand the attitudes and thinking of those in the art at the time. That can best be achieved by looking at what was happening and the attitudes of those concerned in the field in the 1980s. Such evidence does, I believe, enable me to decide whether the opinions of the

> witnesses are consistent with the facts or hindsight reconstructions of the type which are not persuasive.

82. Whitford J put it similarly in *Lucas v Gaedor* [1978] RPC 297, at $358_{7\text{-}9}$:

> … the question of obviousness is probably best tested, if this be possible, by the guidance given by contemporaneous events.

83. Also of clear common sense relevance (though of course not decisive) is a situation where another party has thought the development sufficiently important to apply to patent it itself. *Siddell v Vickers* (1890) 7 RPC 293 is an early example where this was given weight. One has to be a bit careful about this: even where an invention is obvious, someone has to be first to get there. And, these days, people apply for patents for all sorts of reasons, including as a precaution against attempts by others to preclude the field. But where another party has not only applied to patent the same invention but has given reasons for why it is inventive, greater weight can be given to the fact – the reasons can be compelling evidence of inventiveness. *Unilever v Chefaro* [1994] FSR 567 is an example of that. Similarly if a party demonstrates by its conduct that the rights to the invention really matter and not only gets into a fight about the ownership of the patent but in the course of the fight says things indicative of invention, that will be a matter pointing to inventiveness.

84. Now it is true that Sir Donald Nicholls in *Mölnlycke v Procter & Gamble* [1994] RPC 49 at p. 113 said:

> In applying the statutory criterion [i.e. as to whether an alleged inventive step was obvious] and making these findings [i.e. as to obviousness] the court will almost invariably require the assistance of expert evidence. The primary evidence will be that of properly qualified expert witnesses who will say whether or not in their opinions the relevant step would have been obvious to a skilled man having regard to the state of the art.

And, a little later, after describing the danger of complications which can arise about secondary evidence, he added:

> Secondary evidence of this type has its place and importance, or weight, to be attached to it will vary from case to case. However such evidence must be kept firmly in its place. It must not be permitted, by reason of its volume and complexity, to obscure the fact that it is no more than an aid in assessing the primary evidence.

85. It would be wrong to read this decision as saying that secondary evidence is always of minor importance. That would be to throw away a vast mass of jurisprudence, including many House of Lords cases, (e.g. *Siddell* and *Technograph*). It would indeed involve disregarding some of the approach actually used in *Mölnlycke.* For instance at p.123 Sir Donald had some regard to *P&G's* own reaction to the invention as shown in their discovery documents:

> These documents are treating the plaintiff's invention as both novel and inventive. They do not comment that it had been an obvious development from what had gone before. The defendants thought that the plaintiff's idea was worth copying. It was under these circumstances that the defendants chose to manufacture and market nappies incorporating the DFS system in infringement of the plaintiff's patent.

Conflicting expert opinion on obviousness

86. I should also say something about how the court should deal with the conflicting opinions of the experts on obviousness. It is not a matter to be decided by choosing between one expert who says 'tis and one who says 'tisn't. A mere assertion of opinion is of no real value. I put it in this way when at first instance in *Routestone v Minories Finance* [1997] BCC 180 in a passage I repeated with the assent of the other members of this Court in *Rockwater v Technip France* [2004] EWCA (Civ) 381:

> But just because the opinion is admissible:
>
>> it by no means follows that the court must follow it. On its own (unless uncontested) it would be "a mere bit of empty rhetoric" Wigmore, *Evidence* (Chadbourn rev) para. 1920. What really matters in most cases are the reasons given for the opinion. As a practical matter a well-constructed expert's report containing opinion evidence sets out the opinion and the reasons for it. If the reasons stand up the opinion does, if not, not.

I have no hesitation in repeating this. It cannot be emphasised enough. Reasons for the opinion are what really matter. It follows that it is generally not enough for the court to conclude that it accepts the opinion of one expert or the other. It too must descend into the reasons for the opinions.

Secondary Evidence – The Facts in this case

87. The Judge approached the secondary evidence with some scepticism. I think he was wrong to do so. And in doing so he made errors of principle. To explain why, I must recount some of the material Mr Thorley deployed in favour of inventiveness and then in the case of each piece of material examine what the Judge said about it and why I think he made errors of principle. It is necessary to consider the matter in more detail than would be usual on an appeal, for, given the errors, we have to form our own view on the materials available. Fortunately since it depends on documents rather than the assessment of oral evidence we are in as good a position to assess the materials as the judge.

(a) Why not done before?

88. First there was the fact that there was no real answer as to why no one thought earlier of using CSEM for the specific purpose envisaged by the Patent. By the date of the Patent the CSEM technique had been known for about 20 years. The Chave prior art

(accepted to be the best piece – in EPO-speak – the closest) had been around 9 years or so.

89. Various reasons had been advanced. I set them out one by one together with why each does not provide an answer:

i) CSEM is only useful in deeper water (below 500m) because in shallower water radiation through the air interfered too much (air has very low conductivity). Whilst that is correct technically, people were looking for sub-sea hydrocarbons at a depth of greater than 500m by the late 70s and well below that not so long after.

ii) CSEM requires specialist apparatus and until the Patent there were only two teams (both academics) who had it. But Dr Chave gave evidence that the apparatus cost about US$1m. That is a trivial amount to an oil company. Cost of the apparatus cannot be a reason why the technique was not used for oil exploration in the manner proposed by the earlier.

iii) Some suggested that funding was a problem (e.g. a newspaper interview with Dr Srnka in 2004). But funding would surely not have been a problem if anyone had realised just what CSEM had the potential to do. The funds were not there because the invention was missed. No other explanation fits.

iv) It was not until the technique was proved to work that there was any real excitement. What mattered was not the idea but proof it worked. Mr Silverleaf sought to emphasise this, saying the real excitement (by those who expressed it – see below) only came about when the first trial off the coast of Angola showed it did. This is to my mind hopeless. If the idea was good enough to provide a "fair expectation of success" (see *per* Lord Hoffmann in *Conor v Angiotech* [2008] UKHL 49, [2008] RPC 716 at [42]) then why was it not tried earlier remains the question.

v) There were considerable improvements in computers and mathematical methods of analysis over the years making it easier in practice to use the idea by 2000. This cannot be an explanation though it was floated faintly and with no detail by Dr Chave. The fact is the technique was actually being used by the academics from the late 1970s. No one suggested that the very apparatus could not have been used for the inventors' purpose if anyone had had the idea.

vi) Hydrocarbon exploration companies were content with the major improvements which had been made with seismics and were not ready for CSEM. The Judge thought that was a possible explanation ([129] "reasonably well served by seismic techniques and in those circumstances had not had great cause to look at (for example) CSEM"). That will not do either. It is not as though seismics and CSEM were incompatible one with the other. Improving seismics could have gone hand-in-hand with the use of CSEM if anyone had thought of it.

vii) Insufficient demand for oil to make it worth adopting the technique. That cannot be the explanation. Once the demand warranted deep water prospecting it warranted the use of CSEM as part of the exercise.

90. The plain fact is that there was no real explanation of why the idea was not taken up well before the date of the Patent. The simplest explanation – indeed the only one that fits the known facts – is that the inventors hit upon something which others had missed. Occam's razor points to invention.

91. Mr Thorley went further, suggesting that exploration geophysicists had a mind-set: thinking that CSEM was essentially an academic technique of no use to them, just as vacuum cleaner engineers were "bag-ridden" in the *Dyson v Hoover* case. I am not sure the analogy is quite perfect because in that case the invention involved doing away with something previously considered essential whereas the invention of the Patent involves doing something extra (a survey using CSEM after a seismic survey had found the target).

92. An alternative explanation from mind-set is that exploration geophysicists simply did not really articulate the problem or consider it possible it could be solved, they just accepted that once a possible target had been identified a well had to be sunk to find out whether it was hydrocarbon or brine/water.

93. I do not think it necessary to delve further into the topic of mind-set. The plain fact is that the patent is for a useful technique – one which the Judge held to be a "significant advance" [see 104] and which Mr Silverleaf concedes is useful. It could have been both proposed and used much earlier than it was. That points to invention.

94. The Judge thought nothing of this. He said:

> [108] This material does not demonstrate clearly what factors were behind the take-up of marine CSEM in the period after 2000 but they suggest what some of them may have been. They suggest that better equipment and different techniques may have been among those reasons. Lack of funding for development also affected it previously. It may have been the case that the change in demand for oil played a part in resurrecting an idea that had previously have been thought to be not worth pursuing. I can make no clear finding about it. What I do find, however, is that I cannot infer from the take-up of CSEM in that period, when it had not been taken up before, that it was providing something novel or non-obvious in patent terms. There may be other explanations that were operating consistent with want of novelty.

He must have meant non-obviousness here (and in several other places) rather than "want of novelty" for he had made no finding of lack of novelty.

95. I think the Judge fell into error here, so much so that I think it can be characterised as an error of principle. The error was in not recognising that the facts really called for a good explanation of why it was not done before. And none had been identified. So

far as he had explanations, they are covered by what I have said above. And it was not enough to say “there may be other explanations”. Nor, as he said at [129]:

> I think that the truer analysis is that the industry was being reasonably well served by seismic techniques, and in those circumstances had not had great cause to look at (for example) CSEM.

Looking with hindsight, the industry did have cause for looking at CSEM. It is a useful additional tool to seismics and would have been so years before the date of the Patent if anyone had thought of it or realised it could be used in that way.

(b) Pre- and Post- invention reactions of real skilled people.

(i) Prof. Constable

96. After the invention had been made but before it had been tried, Statoil (the predecessors in title to EMGS) wanted to know whether the idea was worth pursuing. The inventors invited Prof. Constable (a co-author of the Chave paper and one of the few academics familiar with CSEM) to Norway and showed him their own computer model. He also ran his own model. He wrote a letter setting out his opinion. The material parts (with key passages italicised) reads:

> Statoil proposes the use of seafloor electromagnetic (EM) sounding as a fluid predictor over existing prospects. The seafloor EM method is not new - it has been in development for nearly 20 years and is being carried out by universities such as Cambridge, Toronto, and Scripps Institute of Oceanography. I personally have been active in this field for 16 years. The method works by injecting EM energy of around 1 Hz into the seafloor. Measurements of attenuation as a function of range and frequency provide estimates of seafloor resistivity. *The proposed application to direct detection of hydrocarbons is, to the best of my knowledge, novel.*
>
> The conclusions of the model assessment are that if the target is not too small compared with its depth of burial, and the water depth is sufficient to suppress the air wave, then the controlled source signature of the oil-filled layer is detectable, yielding the controlled source amplitudes that are a factor of 2 to 10 different than for models without the oil layer. The signals are above the noise threshold, and the experimental parameters (frequency, range, antenna length, and power) are practicable.
>
> There are weaknesses to the study: computer models of a 3D source and 1D target could have been carried out fairly easily with publicly [sic] available code, and one of the analogue model studies used radar frequencies and wave propagation rather than the diffusive propagation necessary to detect deep targets. However, the work took the group 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 (i.e. that the parallel/inline mode split is diagnostic of buried layers).
>
> I used a 3D source/1D target code during my visit to verify Statoil's qualitative and quantitative conclusions. I would also note that the choice of controlled source EM is appropriate, as a thin resistive layer is invisible to other commonly used EM method, magnetotelluric sounding. In conclusion it is my opinion that the proposed method has a reasonable chance of success for sufficiently large targets (the type being suggested).
>
> Should Statoil continue with this program it would be appropriate to commence field trials.
>
> I wish Statoil every success in its endeavour; *it is pleasing to see innovative research coming out of the industry sector.*

97. The Judge was not impressed with this letter. I do not understand why. Firstly Prof. Constable described the proposed application of CSEM as *novel* and as involving *innovative research.* Those are not the words of someone who thought the whole thing self-evident.

98. Secondly I think the Judge overlooked the significance of the paragraph about the conclusions "if the target is not too small". He said it was "merely approving techniques." But the real significance was much more. It was saying that if you chose the parameters of the sort of target identified by seismics as potentially fruitful, you could get a meaningful difference between the signals produced by a hydrocarbon-containing layer and those produced by a similar layer without hydrocarbon. Of particular significance is that Prof. Constable did not say that had been self-evident to him in advance of trying it out with his model.

99. Moreover the very fact that Prof. Constable had never modelled this situation before speaks volumes. He had had the very means of doing so in his hands (and must have had them for years before) but had never thought to do so.

100. The Judge also observed about the "There are weaknesses …" paragraph that "it merely concludes that the work has brought the group up to speed with others." That is not an entirely accurate perspective. What Prof. Constable is saying is that the group have taught themselves a lot about CSEM. But he goes further, saying that their conclusions are "basically correct." Those conclusions were that hydrocarbons could be detected. That was something others had not said.

101. There was also other positive reaction from Prof. Constable. In the context of a negotiation about a contract between Statoil and Prof. Constable's employers, the Scripps Institute of Oceanography, a problem had arisen of some sort – a problem which required waiver of the Institute's policy. Prof. Constable said this in an email to Statoil:

> However, I explained to Nancy Wilson (my contracts officer) that (a) this was a great research project that was going to make us all famous and that Scripps really ought to be associated with it.
>
> …..
>
> I also pointed out that it was Statoil's idea and money making all this happen.

102. The Judge only quotes the part of the first sentence ending with "famous" and never comes back to this email. He overlooks the obvious enthusiasm displayed by Prof. Constable for the idea – an idea which Prof. Constable fairly says was Statoil's. This is not the reaction of a man talking about something which he thought was obvious.

103. After the successful Angola trial, Dr MacGregor, Professor Constable, Dr Sinha and others wrote a detailed scientific paper about it. Its title is "A new method for remote and direct identification of hydrocarbon filled layers in deepwater areas". Note that the method is described as "new." The opening paragraph refers to the:

> … vast saving of avoiding the costs of drilling test wells into structures that do not contain economically recoverable amounts of hydrocarbon

An important paragraph says:

> The method relies on the large resistivity contrast between hydrocarbon-saturated reservoirs, and the surrounding sedimentary layers saturated with aqueous saline fluids. Hydro-carbon reservoirs typically have a resistivity of a few tens of Ωm or higher, whereas the resistivity of the over and under-lying sediments is typically less than few Ωm. In the following sections it will be demonstrated that this resistivity contrast has a detectable influence on SBL data collected at the sea bed above the reservoir, even though the hydrocarbon bearing layers are thin compared to their depth or burial. The effect of the reservoir is detectable in SBL data at an appropriate frequency, and if the horizontal range from source to receiver is of the order of 2-5 times the depth of burial of the reservoir in typical situations.

The significance of this is the demonstration, for the first time, that resistivity contrast can be used for *thin layers of hydrocarbon*: that the effects are detectable. The authors, including some of the few experts in the world on CSEM are presenting that as new information. As Mr Thorley put it, they were saying: "look we can do it with thin layers."

104. Professor Constable published another paper in 2005. It was less detailed and rather more "populist" than the earlier paper. Its title was "Do You Need Marine EM Methods?" It contains the following passages:

In the space of just a few years a new geophysical technique has appeared on the scene – marine controlled source electromagnetic (CSEM) sounding, also known as Seabed Logging by Statoil and R3M by ExxonMobil."

…..

Actually, marine CSEM is not that new; Charles Cox of Scripps Institution of Oceanography proposed the method in the 1970s to compensate for the loss of MT signal at the deep ocean seafloor. By towing an EM transmitter close to the seafloor, EM energy couples well to seafloor rocks but, like the MT signal, gets absorbed quickly by seawater.

…

So why, if the method has been around for 30 years, has the exploration community just "discovered" CSEM? There are at least two reasons:

The first is that if the water depth is shallow compared with skin depth EM energy from the transmitter reaches the atmosphere where it becomes a true wave and propagates geometrically. This "air wave" rapidly becomes the dominant signal at the seafloor receivers and removes the sensitivity to seafloor geology that we have in deeper water. Thus until hydrocarbon exploration moved to water around 1000m deep, it was difficult to take advantage of the marine CSEM method

Second, it has long been known that the marine CSEM method is preferentially sensitive to resistive rocks (compared with MT methods, which are most sensitive to conductive rocks), and thin resistive horizons in particular. However, it was not until Statoil and ExxonMobil demonstrated that the method works with horizons as thin as oil and gas reservoirs that it became clear that marine CSEM could be used to discriminate resistive drilling targets from conductive ones. Of course, because oil and gas are resistive compared to sand and shale, this appears to provide direct detection capabilities.

Does marine CSEM work?

Undoubtedly yes, for big enough targets in relatively deep water. However, even though the method has been around for 30 years in the academic communities, the intensive application to continental shelf exploration is very new, and there is still a lot of work yet to be carried out to develop the interpretational skills and experience to get the most out of this method.

The take-home points:

> ● The marine CSEM method is not new, but the application to hydrocarbon is.

105. Clearly the article is enthusiastic about the method. And it actually tries to answer the question "why not done before?" Two reasons are offered – first that it only works in deep (he says around 1,000m but the evidence shows it works below 500m) water and second that it was not until the method had been proved to work in practice. The first falls away once one knows that deep water prospecting went back to the late 70s and the second is really no explanation at all. For once you think of the idea of using CSEM for thin hydrocarbon layers you will feed the figures into a model and see it ought to work in principle. That would lead to the test being done. The "explanation" does not explain why the idea was not tested earlier.

106. Finally so far as Prof. Constable is concerned, there were two emails of which the Judge said at [100]

> his later remarks might be thought to be less consistent with real novelty [again the Judge must have meant non-obviousness] than his first remarks might be said to be.

107. I do not think that can be read into either of the emails. The first reads:

> From an academic point of view, this project was an application of standard CSEM practice and represents no new techniques, just a novel target. However, I don't see any harm in introducing SBL as a terminology - I can appreciate that it looks good within Statoil, and it will probably help 'sell' the technique.

It is of course true that the invention represents the application of standard CSEM practice to a novel target. That was the very idea which had been missed for so long and which generated the enthusiasm shown by Prof Constable.

108. The second email needs some context to understand. The context was that Statoil asked Prof. Constable to treat some information as confidential. In response he wrote:

> However, as someone who has worked in marine controlled source electromagnetic sounding (CSEM, aka 'seabed logging') for nearly 20 years, it is not clear to me what intellectual property Statoil is claiming in this regard. CSEM as practised off Angola is an innovation pioneered by Scripps Institution of Oceanography over 20 years ago, and indeed your colleagues visited me and Charles Cox in late 1998 to learn more about it from us. Also, the use of CSEM for hydrocarbon exploration has been advocated for some time, see for example Hoversten … and indeed appears in my proposals for my 'Seafloor Electromagnetic Methods Consortium' since at least mid-1998.

109. Now by the date of the email (May 2002) the idea of using marine CSEM for detection of hydrocarbons was out in the open. So when Prof. Constable was asking

what intellectual property Statoil was claiming in this regard, he cannot have been asking about the idea itself. As to his suggestion that it had been advocated for some time, he refers to Hoversten – which has not even been cited as prior art in this case - and another document we have not seen.

110. By consent we were shown Hoversten though it was not shown to the Judge. It is about "Seaborne EM Sub-Salt Exploration" and is about the use of EM techniques to map the base of salts which may hamper seismic methods for oil exploration. It does not propose or suggest the use of EM methods to discover whether potentially hydrocarbon bearing layers do in fact contain hydrocarbon. To my mind, if anything, Hoversten points away from obviousness for even though some application to oil application was envisaged, the valuable one of the invention was missed.

111. Prof. Constable ended his email with a very sensible question:

> Given my considerable experience in CSEM and since Statoil's efforts to promote this field have been publicised …, it would be useful if you could be more precise as to the particular 'know-how and technology' that you are concerned about.

History does not relate what the answer was.

112. These documents (and we are in as good a position to assess them as was the Judge) clearly overall convey enthusiasm for a new and valuable idea. Coming contemporaneously from a leader in the field of CSEM they carry substantial weight in the balance which decides obvious or not.

113. The Judge discounted the effect of this evidence. Indeed he had doubts about even its admissibility. What he said was:

> [100] EMGS put much stress on Prof Constable's apparent expressions of view in his peer review and subsequently. It seems to me that the court must be careful about the weight that is put on this sort of evidence. Prof Constable would probably have been qualified to be an expert in these proceedings. To place too much reliance on his expressed views on novelty (or, I suppose, against novelty had he expressed any clear ones) would be to admit extra expert evidence without leave, and, worse still, without proper testing in cross-examination. That would be true in any case where such evidence was relied on, but it is even truer in the present case where his later remarks might be thought to be less consistent with real novelty than his first remarks might be said to be. At one level he is not saying much which turned out to be particularly controversial at the end of the day. In his two later emails he stated that nothing new was done so far as the techniques were concerned. That was not disputed by EMGS - the actual CSEM techniques were not relied on as novel as far as the 019 patent is concerned. The most that Prof Constable said was new was actually pointing those techniques at hydrocarbon layers. The most he

> seems to be saying is that that had not been done before in fact (though he did say that others had thought about it). If he was getting excited about anything in his peer review letter then it was about no more than that. The question of whether that is true as a matter of fact, and if so whether that supports novelty, is a matter to be judged by reference to all the evidence and the prior art. If he was expressing a view on novelty in his peer review, it was seriously tempered by what he said about previous advocates of the idea in his last email. I think it just as likely that he was expressing keenness and encouragement because the oil industry was at last picking up and running with a ball that he had thought had been available for play for some time. All in all, therefore, the expressed but untested attitude of Prof Constable does not assist me much.

114. I must examine these reasons. Again one must read "novelty" for "non-obviousness" throughout. First the Judge thought it was probably expert evidence. It was not and there is no doubt about its admissibility. Mr. Silverleaf properly conceded that. Expert evidence is the evidence of an expert prepared especially for the court by an expert engaged by the parties (or in the case of a court expert, appointed by the court). It will inevitably be shaped by the issues in the case. Moreover a party-expert will have been chosen by the party calling him so inevitably will have an opinion which supports that party's case. Moreover there is a risk, fortunately not too often realised in patent cases, of expert evidence being partisan.

115. Mr Silverleaf suggested that the Judge's view about the material being expert evidence really showed that he was exercising due caution about its value – after all he did admit it. But even caution about this sort of evidence (whatever "caution' may mean) is not appropriate. For the evidence of the contemporaneous real reactions of real experts in the field will not have been tailored or selected for the trial, often many years later. Moreover it involves no or little reconstruction. For that reason it has always been treated as of real value in deciding a patent case. The Judge was wrong to downgrade it.

116. The Judge's next reason was that the evidence was untested by cross-examination. So it was. But why should that matter? It is what Prof. Constable said at the time – hindsight cross-examination years later could hardly have made any difference. Mr Silverleaf did not suggest how it might have done. It could hardly have demonstrated that Prof. Constable did not mean what he wrote at the time.

117. His third reason was to rely on the last email – which for the reasons I have given I do not accept "seriously tempers" the earlier material.

(ii) Prof Sinha and Dr MacGregor

118. Both Prof. Sinha and Dr MacGregor were acknowledged experts in the esoteric world of CSEM before the Patent. They were co-authors (with Prof. Constable) of the cited Constable paper and went on the Angolan trial.

119. The Judge described the first meeting between the inventor Dr Eidesmo and Prof. Sinha:

> [90] Dr Eidesmo first met Prof Sinha on 15th March 2000. They outlined to him their proposal to use Sea Bed Logging as a direct hydrocarbon indicator. Dr Eidesmo's evidence was that at no time did Prof Sinha suggest that he had thought of this approach before; on the contrary he was excited by the presentation, and thought it would work. I have seen Prof Sinha's note of the meeting. It reflects neither excitement nor a sense of déja vu. In a subsequent email of 31st March 2000 Prof Sinha agreed with a view apparently previously expressed by Dr Eidesmo:
>
> > "'I will say that in my opinion a positive field test will change dramatically the field of active source EM (and may be MT) because of the large impact this will have for the oil industry.' I'm continuing with some modelling, but nothing I've seen yet discourages me at all."

120. The Judge does not say he rejects Dr Eidesmo's evidence about what Dr Sinha said so I think it can be accepted. As to the note, it is essentially technical only. One would not expect it to contain any reaction to the idea, positive, negative or neutral. So the fact that it reflects "neither excitement nor a sense of déja vu" is immaterial.

121. The email clearly reflects the fact that Prof. Sinha had never modelled the case of a typical hydrocarbon layer before (why not? one asks) and was finding what he thought were positive indications that the idea would work. He does not say, obviously it will work – he needed the modelling to make the prediction. Clearly he had never done it or even thought of doing it before.

122. Actually the Judge failed to notice that the last sentence of the quote are Prof. Sinha's own words – what comes before is a quotation from the inventor with which Prof. Sinha agreed.

123. I think this can only be read fairly as the reaction of one who had not before seen or realised that CSEM could well be used for searching for hydrocarbons below the sea bed. The spur to model came from the inventors.

124. The next piece of secondary evidence is remarkable. Prof. Sinha and Dr MacGregor had moved to the University of Southampton. There the University applied for a patent for what is the subject of the '887 patent, naming Prof. Sinha and Dr MacGregor as inventors. EMGS brought entitlement proceedings in the Patent Office pursuant to ss.12 and 13 of the Patents Act 1977. The hearing took six days before a very experienced hearing officer, Mr Peter Hayward. Both Prof. Sinha and Dr MacGregor were cross-examined. The hearing officer found that it was Statoil's inventors who were the true inventors and that the patent should belong to Statoil not to the University – Prof. Sinha and Dr MacGregor had got the invention from the true inventors.

125. Now the '887 patent is a refinement on the basic idea contained in '019. And part of the argument in the entitlement proceedings was about who had had that basic concept. The hearing officer made strong findings which the Judge did not set out. Here they are:

> 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."
>
> 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.
>
> 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. ….

> 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 and 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.
>
> 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, i.e. 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.
>
> 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 casual link is present.

126. To my mind these findings are a very clear indication that the invention of '019 was not obvious to Prof. Sinha or Dr. MacGregor. But the Judge gave it little weight, saying:

> [103] It is not disputed that Prof Sinha and Dr MacGregor gave evidence to the above effect. However, again this evidence has to be treated with caution. Again, putting a lot of weight on it is tantamount to admitting another two more experts without their evidence being properly tested in the context of this action. It also has to be noted, in the context of the 019 patent, that the actual invention in the Southampton patent relates to the split. There is no particular claim to the direct detection techniques, without the split, claimed in the 019 invention. There may be a number of reasons, not inconsistent with obviousness, why these two academics had not previously turned their minds to marine CSEM and hydrocarbons (if they hadn't), some of them demonstrating how clever it was and others demonstrating that they were thinking about something else. The application for the patent may demonstrate no more than their view that what was referred to was patentable, motivated by an attempt to get some financial benefit from it. Whether they are right about patentability is the question that arises in this action. They were certainly not saying the whole thing was old hat, but what else they should be taken as saying is more questionable. Accordingly, while there is material here that EMGS is entitled to rely on, it must be approached with caution. I do not, however, dismiss it from my consideration of the matter.

127. There was no good reason for treating this evidence and those findings with caution. It was not expert evidence. Moreover it was evidence that was tested by cross-examination. True it is that it was in the context of the "split" technique of '887, but the evidence and the findings clearly covered the basic idea of '019 too. As to the Judge's speculation as to why Prof. Sinha and Dr MacGregor applied for the patent for '887, it makes no real sense except in the context that people thought there was something valuable there – not only worth the filing fees of the application in many countries and associated professional fees but also the costs of a 6-day hearing with leading counsel on both sides. You are unlikely to spend that amount for an obviously hopelessly invalid patent.

(iii) Schlumberger

128. It is important to note at the outset that Schlumberger is one of the biggest companies involved in hydrocarbon exploration. Despite a clear challenge in the first report of Professor Landrø to explain why it was not done before, Schlumberger called no witness to explain why or to say what it itself knew about CSEM and its uses. The challenge read as follows:

> It is also clear to me as a scientist that this application step is not obvious. Beside the specific reasons I have given above, the most evident proof for this is that nobody actually saw this connection for almost a decade after this chapter [i.e. Chave] was written.

One is entitled to infer that Schlumberger had no real answer in the shape of one of their own employees who could explain why. Nor for that matter were they in a position to find an oil company geophysicist (whether still employed or retired) to give an answer.

129. Next there are Schlumberger's own documents or rather their non-existence. No disclosure of any pre-patent documents was given on the express basis that no-one at Schlumberger had, pre-patent, even contemplated the use of CSEM for detection of hydrocarbons. That in itself is telling.

130. As to Schlumberger's post-patent documents I can start with a paper published in November 2004 by Dave Peace then of a company called AOA Geophysics which became part of Schlumberger. Mr Peace wrote:

> **CSEM –what's All the Excitement About??**
>
> The controlled source electromagnetic (CSEM) method may be the most significant new technology for oil and gas exploration since the development of 3-D seismic 20 years ago. The promise for the technology lies in its ability to differentiate resistive, potentially oil-bearing intervals from surrounding, more conductive water-bearing units. The principle is the same as that used in well logging devices to identify hydrocarbon zones in well bores. The technique is not new but the capability to resolve relatively thin resistive intervals in the depth domain offers new promise to lower risk through direct hydrocarbon indicators in conjunction with modern seismic methods.

Although Mr Peace refers to the principle being the same as in well-logging devices, the use there is over a very short range. Dr Brown produced a note for the Court indicating that it had a range of up to 2m and was performed down an actual borehole. Neither side made any points based on the existing knowledge of this technique.

131. The next year (by which time he was a Schlumberger man) Mr Peace wrote this:

> Electro-Magnetic explorations methods have been around … as deep water marine methods since the mid-1990's when Marine MT was essentially declared a commercial exploration tool. These methods have however been rightly regarded as somewhat fringe geophysical methods of use only as regional exploration tools of low resolution and then only suitable for applications in certain more difficult geological provinces such as sub salt, sub basalts, sub carbonates etc.
>
> However with the addition of higher frequency source and a change in the basic geophysical technique, EM methods have recently undergone a metamorphosis…

Mr Peace was not called and no explanation was offered as to why not. What he says about the way CSEM was regarded prior to the Patent is clearly important – it is more or less exactly the pre-Patent status of CSEM in the minds of exploration geophysicists for which Mr Thorley contended.

132. Next there were some internal documents of Schlumberger emanating from a Dr Habashy. The Judge inferred from the documents that the invention was not obvious to Dr Habashy. Mr Silverleaf challenged that. Since it was not clear what, if anything, Dr Habashy knew about CSEM prior to the Patent or indeed after or what precisely his function was in Schlumberger I think there is no separate point to be made about these documents other than that the news of Statoil's developments not unnaturally caused some alarm at Schlumberger.

133. Mr Silverleaf also drew our attention to an email recording the views of someone called Frank Morrison who had been asked by Schlumberger to comment on "Two patent filings by …. for a new CSEM system." We were told that he is a professor at the University of Berkeley. He said the filings were a "simple non technical rephrasing of [Chave]." I am not impressed with that. 019 is not a rephrasing of Chave – indeed it is now accepted that Chave is not novelty destroying. Prof. Morrison has not appreciated that this was the first time CSEM had been proposed for such thin targets and had real potential of immense practical use.

134. In short, this single email goes nowhere near enough to displace the clear position established by all the other material showing that the real advance provided by the invention of the Patent was seen by all, including CSEM experts, as an exciting development.

Obviousness over Chave

135. This must be considered first from the point of view of the exploration geophysicist alone, then the CSEM geophysicist alone and finally one must consider whether these two notional skilled persons would get together to form a team addressing the problem.

136. Dr Chave was the lead author of three, one of the others being Professor Constable. It is entitled "Electrical Exploration Methods for the Seafloor." And was Chapter 12 of Volume 2 of a reference work for geophysicists called "Electromagnetic Methods in Applied Geophysics." It is a review article and does not purport to set out anything new.

137. It is accepted that an exploration geophysicist would probably have had this on his shelves. That is not the same thing as saying it formed part of his common general knowledge. On the other hand by and large one can say that a CSEM skilled person would already be familiar with what it says.

138. The Judge sets out the key passages:

> [132] The paper contains an introductory section which itself contains the following:
>
> > Recent developments in instrumentation and submarine geology have spawned increasing interest in the use of electromagnetic (EM) methods for seafloor exploration.

Previously, little attention had been given to their use in the marine environment, due both to the success of the seismic techniques in delineating sub-surface structure and to a pervasive belief that the high electrical conductivity of seawater precluded the application of EM principles. Marine EM exploration of the solid earth has progressed substantially in academic circles over the past two decades; the adaptation of this technology for commercial purposes is only beginning.

Over three-fifths of the Earth's surface is covered by oceans. Even though petroleum is produced from huge deposits on the relatively shallow continental shelf, the immense area of the ocean represents a largely unexplored and an exploited resource base. Until recently, little economic interest was shown in the ocean floor environment ... however, the recent discovery of intense hydrothermal activity and poly-metallic sulphide deposits of unprecedented concentration and scale on the crest of the East Pacific rise ... has aroused interest in the possibility of deep-sea mining and spurred research into the mid-ocean ridge ore genesis as an analog to terrestrial occurrences ... While [visual location is] capable of examining its surficial geology, they are not able to adequately assess the actual extent of the deposits and the nature of the geological structures in which they are found. Seafloor conductivity mapping is one of the few geophysical tools suitable for this purpose, just as the EM methods are one of the major geophysical techniques used in mineral exploration on land.

Over the past few decades, the search for petroleum reserves has been extended from the continent's off-shore into progressively deeper water, making the continental shelves a focus for geophysical exploration. The principal geophysical tool for this is the seismic method, and the success of the seismic approach is attested to by the level of offshore drilling activity and the subsequent production of oil. However, there are marine geological terranes [sic] in which the interpretation of seismic data is difficult, such as regions dominated by scattering or the high reflectivity that is characteristic of carbonate reefs, volcanic cover, and submarine permafrost. Alternative, complementary geophysical techniques are required to study these regions.

... This paper emphasises the differences between seafloor and terrestrial EM applications, especially with regard to noise, resolving ability, and apparatus....Most of the existing work on seafloor EM has been motivated by solid earth problems as opposed to exploration ones. The real data discussed reflect this difference, which is principally one of scale.

[133] There is then much discussion of the theories behind EM surveying, with a reference to TM and TE modes. This discussion is accompanied by a certain amount of algebra and a number of graphs. The relevant equipment is described. At page 947 of the publication Dr Chave turns to "Controlled Source EM Methods". The technique is described. He deals with the fact that thin resistive layers are relatively insensitive to the TE mode and at page 948 he deals with the nature of the transmission. He says:

> “The choice of operating an EM system in either the frequency domain, transmitting a set of discrete frequencies one or a few at a time, or the time domain, transmitting a square or triangular step and measuring the transient response of the seafloor-ocean system, also exists. The physics of the two methods are identical, the response in one domain being the Fourier transform of the response in the other domain. Because of the finite and inexact nature of practical measurements, this transformation cannot usually be made outside the realm of theoretical studies. The choice of one system over another must be made on the basis of practical and logistical considerations."

[134] At page 950 Dr Chave turns to some modelling. His modelling seeks to demonstrate the effect of buried layers of differing resistivities on the signals generated by the sort of equipment shown in the patent.

> “It is instructive to examine the behaviour of the horizontal electric field for geometric (range-dependent) and parametric (frequency-dependent) soundings in the presence of the simplest structural complication, a buried layer. In each case a specific model consisting of a half-space of conductivity 0.05S/m containing 1 km thick layers either 10 times more or less conductive and centered at depths of 1.5 and 5.5 km is considered; these values are intended only to be illustrative. Figure 16 shows the geometric sounding curves. The low conductivity zone behaves as a lossy waveguide which traps and guides the signal, resulting in slower attenuation with range when compared to the half-space case. The deep buried layer produces a smaller effect, as expected from the diffusion nature of EM induction, and requires a larger range for the trapping to become apparent. If the buried layer has a higher conductivity than the surrounding material, greater attenuation will ultimately result at long range, but the low conductivity waveguide created between the seafloor and the layer results in an

> increase in signal strength at intermediate distances. The HED [horizontal electric dipole] method is preferentially sensitive to relatively low conductivity zones due to the presence of the TM mode. The existence of a minimum usable source-receiver spacing of 1-3 times the burial skin depth, depending on the sense of the conductivity contrast, is also apparent. Longer ranges are required to detect low conductivity material. Figure 17 shows parametric sounding curves for the same model at ranges of 5 and 10 km."

> [135] Figure 16 shows, by way of a graph, that the attenuation of the received signal, as one moves farther away than the transmitter, is less than where there is a uniform half space. The relative differences are less marked where the buried layer is deeper, but it is still shown to exist.

> [137] Then the paper sets out details of the equipment developed at Scripps for conducting marine CSEM surveys and gives some information about experiments and surveys conducted. At page 958 it refers to an experiment in the ocean with an express reference to a basalt layer. At page 959 there is a reference to another survey involving a different system:

> "The layout is based on the same frequency domain dipole-dipole system used for deep sounding, so the theory developed by Chave and Cox (1982) and Chave (1984b) is directly applicable. In particular, it may be shown that resistive features such as permafrost layers and basalt flows can be mapped using frequencies and source-receiver ranges attainable by the experimental system ..."

139. I would only add this. Chave describes a number of EM techniques: magnetotellurics, direct current resistivity, magnetometric resistivity, and self-potential, in addition to CSEM. The references, such as they are, to the search for petroleum reserves, are in the introduction. There is nothing about searching for petroleum in the CSEM section.

140. The Judge then goes on to consider and reject the allegation of anticipation by Chave. The finding is not challenged on appeal and I am not surprised. There is nothing remotely in Chave providing clear and unambiguous instructions to do something within claim 1, still less claim 1A.

141. The Judge went on to consider obviousness over Chave. He applied the *Windsurfing/Pozzoli* approach ([2007] FSR 37). He said:

> [145] The inventive concept in the relevant claims (there is no need to distinguish between them for these purposes) is the application of the CSEM techniques described in Chave to the search for, or identification of, hydrocarbon-bearing layers. The Chave paper does not go so far as to apply its techniques

> specifically to that end, but it contains all the other elements short of that. It models a marine CSEM survey and shows the anticipated result where a relatively resistive layer is sandwiched between two less resistive layers. It identifies the benefits of using a horizontal (as opposed to a vertical) electric dipole and identifies that the TM component of the signal is more sensitive to resistive layers. Where a CSEM survey is modelled in those conditions the refracted wave has the effect that one can detect the signals from the survey. The resistive layer operates as a sort of waveguide. Professor Schultz accepted that all that was present in the Chave paper. He also accepted that the authors of the paper had in mind the mapping of resistive layers. What is not present there is an express link with a search for hydrocarbon in a layer, and there is no express statement that the technique could be used for that purpose.

142. He went on to note the points made by EMGS – that there was only a limited and general reference to oil exploration, that the technique was applied to thick (about 1km) layers of basalt and the like – much thicker layers than typical hydrocarbon containing layers and so on.

143. He thought that did not matter because the Chave paper was "to inform about EM techniques generally" and did indeed refer to oil exploration in the context of EM generally. He went to say:

> [146] So the missing step is the application of those marine CSEM techniques to a search for, or identification of, hydrocarbon layers. Dr Chave's evidence was that that step would be an obvious one for the skilled addressee to take, and I accept that evidence. Even if the paper is directed to other objects in terms of exposition (permafrost, and so on), it is general in its terms, and describes general techniques. Hydrocarbon layers are, for these purposes, just other resistive layers, albeit thinner than others under consideration. I think that Dr Chave is right about this. "

> [147 I therefore find that the application of the Chave modelling technique to potentially hydrocarbon-bearing layers was obvious. That is the heart of the alleged invention. In his contemporaneous correspondence Prof Constable expressed the view that what was happening was the application of an established technique to a new target; I think that he was right. But the application to the new target was not, in patent law terms, inventive over the Chave paper.

144. If one actually looks at Dr Chave's evidence concerning obviousness it is basically just an assertion of opinion. He first asserted lack of novelty (which the Judge rejected) and then simply said:

> Even if the application of CSEM to detection of hydrocarbons is not directly disclosed in Chave (which in my opinion it is) it would have been obvious to the skilled addressee reading Chave that the marine CSEM methods it describes may be used to search for hydrocarbon-bearing subterranean reservoirs and to measure the resistivity of reservoirs whose contents are not known.

145. As I have said the mere assertion of an opinion by an expert carries little weight. What were needed were reasons for that opinion. Dr Chave does not say he knew of the problems of the exploration geophysicist, or that he had ever tried modelling for a thin layer of resistivity the same as or similar to a hydrocarbon-containing layer.

146. In the face of the compelling secondary evidence I think the Judge was wrong simply to accept Dr Chave's opinion. It was a hindsight view whereas all the contemporaneous evidence suggests otherwise. Technically, with hindsight, a CSEM skilled person, given the problem would see that the technique might work and that it would be worth modelling it in the first instance. But it is not clear that the CSEM skilled person was really aware of the problem. And such "technical obviousness" (as one might call it) is surely rebutted by the passage of time set against the value of the technique. To put it oxymoronically, the invention was "obvious" for too long for it really to have been obvious.

147. Turning to look at obviousness to a person skilled in the art of exploration geophysics gives a ready answer. Such a person, given Chave, would see the general comments about oil exploration, but will not, with his more limited understanding of CSEM, readily see that it could be applied to his specific problem. General mapping of thick layers was all he would see.

148. Finally there is the question of a team consisting of both types of geophysicist. Was it obvious to construct such a team when no such team existed in reality? Clearly no, and Chave is surely an insufficient spur to create one.

149. The problem/solution approach to obviousness readily produces the same answer considered from the point of view of an exploration geophysicist. It is, I think, common ground that Chave is the closest prior art. The problem (a real problem) is indeed that of an exploration geophysicist. Can a method be devised for determining whether a submarine reservoir contains hydrocarbons or water without the need to sink a borehole? The solution is to adapt CSEM technology in a way no one had thought of before. Does Chave suggest that solution? No, it merely shows that CSEM can be used for general mapping of thick layers. As Mr Thorley submitted, to get to the solution of the Patent you have to appreciate (a) that an oil layer will give rise to a "refracted wave", will be less attenuated than a reflected wave and will therefore be more readily detectable, (b) that a full mapping of the area of interest is not necessary, so that resolution is less of a concern than it would otherwise be, and (c) that a "refracted wave" signal indicating the presence of an oil layer will be detectable even though that layer is thin and deeply buried. Chave misses all these things.

150. Applying the PSA from the point of view of a CSEM expert is a little more complex. For in reality such a geophysicist did not have the problem. He or she was concerned with use of CSEM for mapping generally – thinking in terms of thick layers of things like basalt. To imagine the question posed to him or her is to take the inventive step itself. And it was just that step which was not taken by real CSEM people of the ability of Professor Chave, Dr MacGregor and Dr Srnka.

Obviousness over MacGregor

151. The Judge held the Patent obvious over MacGregor. I think that was rather odd, given the fact, as I have already recorded, that it was in fact not obvious to Dr MacGregor herself. Nor to either of her co-authors, Profs. Sinha and Constable. Why should the notional unimaginative person skilled in the art have seen further than the real, highly skilled authors?

152. What then does MacGregor disclose? Well it contains, as the Judge said at [156] "essentially an abbreviated account of CSEM." So no more than Chave there. It also considers resolving and mapping thick (1.5 - 2km) basalt layers close to the sea bed. Again no more than in Chave. All this is material which had been known for years.

153. What does it add which is new and which might make the invention obvious to a person skilled in the art (either a CSEM person or an exploration geophysicist)? The answer is very little and nothing directed at the real problem solved by the invention of the Patent.

154. I turn to set this out in more detail. MacGregor's introduction does indeed mention hydrocarbon exploration:

> There are numerous regions in the world where the presence of shallow high velocity layers makes the imaging of deeper structure using conventional seismic reflection techniques a difficult task. Of particular interest are continental shelf areas where potentially oil bearing sedimentary structures are obscured by layers of basalt, carbonate or salt. These high velocity layers limit the penetration of seismic waves and can cause reverberations which mask reflections from deeper sedimentary structures, leading to ambiguities in interpretation.
>
> Additional constraint on the structure can be gained by studying the electrical resistivity. The resistivity of basalt, carbonate and salt is typically in the range 100-1000 Ωm, whereas the resistivity of the surrounding sedimentary sequences are typically 1-10 Ωm. This marked contrast provides an ideal target for electromagnetic prospecting techniques. By mapping such variations in resistivity many of the ambiguities inherent in conventional seismic techniques can be resolved. In addition sediment resistivity is in itself an interesting property to measure.

155. So the problem addressed is thick layers of basalt above sedimentary layers. The basalt prevents one from identifying those layers by seismics. The paper refers to sedimentary layers below, but only considers in its modelling a layer about 1.5 - 2.4 km thick below thick layers (1km, 2km and 3km) thick of basalt.

156. This shows, to my mind, that MacGregor misses the point. Real hydrocarbon bearing layers are much thinner. There is no teaching that CSEM will work for such layers. There is no modelling of thin layers. There is no appreciation that the real, long-standing, problem (oil or water/brine?) of the exploration geophysicist can be tackled using CSEM.

157. So, would the notional exploration geophysicist see that CSEM could or might be used for his problem? Would he say: "this gives me what I want, or might well do so?" I cannot see why. As for the CSEM expert, he would learn nothing really new at all compared, for instance, with what he knew already as set out in Chave. Nothing in this paper would set him on the path to model thin layers of hydrocarbon-bearing sedimentary rock or to consider whether the technique was sensitive enough to be able to distinguish between those with high and those with low resistivity.

158. The Judge thought otherwise. In so doing I think he made the same error about the impact of the secondary evidence which I have already considered. Moreover I think he overlooked the significance of the kind of sedimentary layer being considered by MacGregor. He said:

> [166] …The focus is on resolving the extent of a highly resistive layer, which is basalt and not a hydrocarbon layer, but with the view of learning something about the layer underneath. As the introduction says, the model maps contrasts. It is finding out about the resistive layer between two less resistive layers, and also trying to find out about something underneath (including where it starts, in vertical terms). It is doing that by relying on signals that have taken a refracted route. It is obvious that that technique can be applied to layers other than basalt; and obvious that it is their comparative resistivities that are discernible. Although the relatively resistive layer in this case is not a hydrocarbon-filled layer, the application of these techniques to oil exploration is flagged by the references to "potentially oil bearing sedimentary structures" in the article itself. The technique in this paper was the utilisation of known physics, including the refracted wave through a known resistive layer. It was, in Dr Chave's view, which I accept, obvious to do it the other way round, that is to say to see if the effects of the refracted wave could be detected in order to see if it indicated a resistive layer, and to do that in the context of a sedimentary layer which was not beneath a more resistive layer.

159. "Trying to find out about something underneath" a thick layer of basalt in general is really all that MacGregor suggests. The appreciation that CSEM can be used for thin layers of sedimentary rock is missing, so also that it can be used to distinguish between those of high and those of low resistivity.

160. The upshot is that MacGregor really adds nothing of relevance to that which is in Chave. For the reasons I have given in relation to Chave I think the Judge was mistaken in holding the Patent invalid for obviousness over MacGregor.

Anticipation or obviousness over Srnka

Introduction

161. The Judge held that Srnka was not novelty-destroying but did render the invention of the Patent obvious. Mr Silverleaf attacks the former finding, Mr Thorley the latter.

162. Srnka (US Patent 4,617,518) was published in October 1986. It belonged to Exxon, a renowned large oil company. According to Dr Chave, Srnka was "widely discussed amongst the CSEM community shortly after it was issued." But nothing at all in fact came of it, either from the CSEM community or Exxon. Indeed Exxon allowed the Srnka patent to lapse in 1994, showing it thought there was nothing worthwhile there. In those circumstances one is driven to suppose that it is unlikely that Srnka actually disclosed a useful technique or made one obvious. I would add that Dr Srnka's own explanation of why nothing came of his invention, at least as reported years later (2004) in the Wall Street Journal, namely that the "project would take years, cost millions and be very risky" does not fit the facts as we know them to be. Those facts are that CSEM was a known albeit esoteric technique by the time of Chave (1991) and the apparatus cost no more than about US$1m.

Novelty – the Law

163. There was no dispute about this. The Judge summarised it accurately at [191]:

> In order to be an anticipation the disclosure must be clear and unambiguous. I repeat the classic exposition in *General Tire & Rubber Co. v. Firestone Tyre & Rubber Co. Ltd*:
>
> > "To anticipate the patentee's claim the prior publication must contain <u>clear and unmistakable directions</u> to do what the patentee claims to have invented . . ."
> >
> > "A signpost, however clear, upon the road to the patentee's invention will not suffice."
> >
> > "The prior inventor must be clearly shown to have planted his flag at the precise destination before the patentee."

164. I would add this. There are some kinds of document where the reader is compelled to find a meaning. For instance in the case of a statute, Sir Wilfred Greene MR once said:

> Every Act of Parliament must be approached with the conviction that its language is capable of a reasonable construction when carefully examined (*Bismag v Amblins* (1940) 58 RPC 209 at 232).

Items of prior art said to be novelty destroying are not of that kind. One has to consider how they would be understood on their date of publication (in this case 1986) by the notional person skilled in the art. There is no reason why such a person, just as in the case of a real person, must find a meaning. In real life there are documents which have no clear meaning, documents so obscure that one throws up one's hands saying "I have no idea what this author was really trying to say." The notional skilled reader can do likewise, and if he or she does, the document is not novelty-destroying. It is not "clear and unambiguous."

165. This position accords with a cardinal rule of patent law that one cannot monopolise that which is old. A prior document which is so obscure in meaning that it does not clearly tell the reader what to do does not make anything truly old.

The Srnka disclosure

166. The Judge helpfully sets this out. I will borrow with gratitude, noting on the way that the Judge erroneously thought that the cited references include the Chave paper cited as prior art in this case. It was not (and could not have been, having only been published in 1991). The cited reference is some other Chave paper, the details of which were not considered relevant by either side.

167. The Judge's citations are as follows:

> [175] The patent is entitled "Method and apparatus for offshore electromagnetic sounding utilising wavelength effects to determine optimum source and detector positions". The abstract reads as follows:
>
> > "An improved method and apparatus for electromagnetic surveying of a subterranean earth formation beneath a body of water. An electric dipole current source is towed from a survey vessel in a body of water substantially parallel to the surface of the body of water and separated from the floor of the body of water by a distance less than approximately one-quarter of the distance between the surface and the floor. Alternating electric current, preferably including a plurality of sinusoidal components, is caused to flow in the source. An array of electric dipole detectors is towed from the survey vessel substantially collinearly with the current source. Each electric dipole detector of the array is separated from the current source by a distance substantially equal to an integral number of wavelengths of electromagnetic radiation, of frequency equal to that of a sinusoidal component of the source current, propagating in the water. A gradient detector array is also towed by the survey vessel in a position laterally separated from, or beneath, the mid-point of the current source. Additionally, an array of three-axis magnetic field sensors mounted in controllable instrument pods are towed by the seismic vessel on the flanks of the current source. Frequency-domain and

> time-domain measurements of magnetic and electric field data are obtained and analysed to permit detection of hydrocarbons or other mineral deposits, or regions altered by their presence, within sub-floor geologic formations covered by the body of water".

[176] The section headed "background of the invention" contains, inter alia, the following:

> "Electromagnetic survey systems are being used increasingly to explore for oil and gas on land. However, at present, practical methods for exploring for oil and gas in the offshore environment are restricted to the measurement of the natural magnetic and gravitational fields at the earth's surface, of the reflection of seismic energy from subsurface structures, or the seepage of chemical substances from mineral deposits beneath the sea floor into the sea water or atmosphere. Although passive techniques such as natural-source magnetotellurics can provide useful information about the lower crust and upper mantle, electromagnetic sounding techniques employing an active source are better suited for surveying subterranean formations within five to ten kilometres beneath the sea floor. Because practical techniques for active electromagnetic sounding of earth formations beneath the sea floor have not hitherto been known, the electrical structures of continental margins and offshore basins remain largely unknown, despite the scientific and economic importance of these areas….
>
> 'Resistivity' methods using an active source of direct electric current, or very low frequency alternating current…have been proposed for determining the apparent resistivity of geologic formations beneath the sea…"

[177] At column 3 there appears a "Summary of the Invention":

> "According to the method of the invention, an electric dipole current source is towed from a survey vessel in a body of water substantially parallel to the surface of the body of water and separated from the floor by a distance less than approximately one-quarter of the distance between the surface and the floor. Alternating electric current is caused to flow in the source, said current including at least one sinusoidal frequency component. At least one electric dipole detector, including a pair of detector electrodes, is also towed from the survey vessel substantially collinear with the current source and spaced from the current source by a distance substantially equal to an integral number of wavelengths of electromagnetic radiation propagating in the

> water and having frequency equal to that of the sinusoidal component. A characteristic of the current emitted by the source and a characteristic of the potential difference between the pair of detector electrodes are measured. From these measurements, a characteristic of the "*complex mutual impedance*" of the current source and the dipole detector is determined. Preferably the current emitted by the source includes a plurality of sinusoidal components, each having a distinct frequency. Preferably, several dipole detectors are towed collinearly with the source. Measurements of the current characteristic and the potential difference characteristic should preferably be made at a plurality of frequencies for each source-detector pair…
>
> "Potential difference measurements at the electrode pairs of the gradient array and dipole array, and magnetic field measurements at the magnetic field sensors, are made while the vessel is moving or stationary, and the measurements are interpreted to permit the detection of hydrocarbons or other mineral deposits, or regions altered by their presence, within sub-floor geologic formations covered by the body of water. Frequency-domain measurements of magnetic and electric field data are analysed to construct the complex impedance spectrum of the sub-floor formation beneath each survey station…"

[178] The real difficulties start to creep in in the section entitled "Description of the Preferred Embodiment":

> "…The potential differences between [the source and transmitter electrodes] are measured and amplified, and thereafter further processed and recorded by electrical equipment…aboard [the] vessel. The measured data is interpreted in a manner to be discussed below, to permit characterisation of earth formation beneath floor of body of water and to locate regions in sub-floor formation which possess '*anomalous*' properties indicative of mineral deposits. In a particular application, the measured data is interpreted to determine the presence and depth of a buried resistive layer, such as resistive layer 25, which has a resistivity different from the average resistivity of that portion of [the formation above that layer]."

Layer 25 is a reference to one of the drawings (I have omitted other numeric cross-references to drawings). It shows a layer below the overburden similar to the layer shown in the drawing of the patent. The italicised words in the above passages are my emphasis in order to identify terms which are important to the patent and which cause problems of interpretation.

[179] The description goes on:

> "It is preferred that [the source dipole] and the electric dipole detectors be towed substantially collinearly, substantially parallel to [the] surface, and in approximately the lower quarter of the column of [the] water between [the] surface and [the] floor. As the depth below surface at which dipole current source and the dipole detectors are towed decreases to less than three-fourths the distance between the floor and the surface, the strength of the signal at the dipole detectors which is indicative of the electrical resistivity of the sub-floor formation (the '*anomaly*' signal) rapidly decreases due to masking by the water between the floor and the dipole detectors. It is additionally desirable to tow the apparatus within the lower quarter of the column of water between surface and floor because in that region, the sensitivity of the anomaly signal to the height above floor at which the apparatus is towed is sufficiently weak that fish need only control the actual tow depth to within about 5% of the desired tow depth".
>
> "If [the source electrodes] are separated by a first distance, and adjacent pairs of [detector electrodes] are also separated by substantially the first distance, then for direct detection of buried resistive layer located a second distance D, below floor, the mid-point of current source and the mid point of one of the electric dipole detectors should be separated by at least two D and preferably should be separated by at least three D. Also for detection of [the] buried layer, the output current at [the source dipole] should preferably include a sinusoidal component having frequency equal to the 'skin depth frequency' associated with [the] buried resistive layer. Such skin depth frequency [and here the patent sets out the skin depth formula referred to above]…is that frequency which makes the electromagnetic skin depth in the [overburden] equal to the depth, D, of the buried resistive layer". [This recitation omits the cross-referencing to the drawing but is sufficiently clear without it.]"
>
> "…I have found that the influence of the electromagnetic coupling directly between [the] source and each dipole detector (which coupling is independent of the characteristics of earth formation [in the overburden]) on the potential difference measurements at such dipole detector may be desirably reduced by spacing each such dipole detector from the source an integral number, n, of wavelengths λ_w, of the electromagnetic signal from [the] source. Wavelength λ_w is given by [a given expression]. If [the source and detector] are so spaced from each other, all of the changes in the phase of the signal measured at each

> detector (relative to the phase of the output current at [the] source) are due to electromagnetic signals propagating along or below [the] floor…"
>
> "If it is desired to make the surveying system particularly sensitive to a resistive layer buried at a depth D below the floor, and if the average conductivity…of [the overburden] is known to a depth just above depth D, then the separation between [the source and detector] should be chosen to be substantially equal to an integral multiple of $2\pi D(\rho_\omega\sigma)^{½}$ and the source current should be chosen so as to include a sinusoidal component having frequency substantially equal to the skin depth frequency associated with depth D".
>
> "It is desirable to generate, from the potential difference measurements made at each dipole detector, a signal indicative of the complex mutual impedance of [the source and detector]. From analysis of variations or 'anomalies' in the phase and amplitude of such complex mutual impedance signal, the presence of a buried resistive layer such as [the layer shown in the drawing] may be determined. I have found that the depth to such buried layer may be estimated by employing a plurality of detector dipoles in the electric dipole detector array and employing a variable frequency dipole source, and making potential difference measurements at each detector for each of a plurality of distinct source frequencies. In particular, it has been found that the frequency at which the phase or amplitude anomalies indicative of [the] buried layer are at a peak (or maximum) will decrease as the separation between source and detector increases, until such separation increases to a critical separation equal to three times the depth of [the] buried layer beneath [the] floor. Beyond such critical separation, the value of source frequency giving the peak signal anomalies remains substantially constant. By determining the value of such substantially constant frequency…the depth of [the] buried resistive layer may be estimated as…"

[180] Srnka relies on "complex mutual impedance". In technical terms that means:

> "the linear relationship between the EM field and a source current for a given frequency source receiver offset in geometry." (Dr Chave)

In more everyday terms it can be viewed as the strength and phase of the received signal. The complex mutual impedance instructions involve comparing the amplitude and phase of the received signal with the amplitude and phase of the source signal. They will vary in accordance with the frequency and in accordance with offset.

Novelty of the Patent over Srnka

168. It is common ground that Srnka is very difficult. A particularly acid test demonstrates this: Dr Chave himself said he had misunderstood it and prepared his initial report on that basis. Hardly a promising start for a document which, to destroy novelty, must be "clear and unambiguous" correctly contended Mr Thorley.

169. Mr Silverleaf submitted that Srnka should be read as though it was a two-part document; the first part being intelligible and falling within claim 1 and 1A. The second part he submitted was also intelligible if one tried fairly to read the document, but it did not matter if it was not – the first part was enough to anticipate.

170. More particularly Mr Silverleaf submitted that Srnka was a disclosure of *finding* a thin resistive layer (what a hydrocarbon bearing layer would be) and a disclosure of depth determination. He says you can pass over bits of the disclosure you do not need or understand.

171. To establish his case Mr Silverleaf relied upon some cross-examination in which he invited Professor Schultz to imagine he had Srnka with certain passages omitted. They were col. $6_{19\text{-}49}$ (quoted by the Judge in [179], "I have found that the influence …) and col. 6_{56}-col.7_{10} (quoted in [179]). These were the passages which Professor Schultz had identified as difficult to understand. Mr Silverleaf submitted that the Professor accepted there was anticipation on the "reduced" Srnka.

172. I am not convinced he did, but more importantly Professor Schultz did not accept the notion of cutting out the passages concerned. The transcript reads like this:

> Q. I think we have agreed that Srnka enables you without the difficult bits of the teaching to set up and carry out a marine CSEM survey looking for buried resistive layers?
>
> A. Well, by removing what I think are some of the essential bits of the teaching, you have a very generic statement of a source and a receiver and multiple frequencies that seems to be a very standard bit of practice as of 1986.
>
> Q. And it specifically tells you to do this, to go and look for hydrocarbon reservoirs which are buried resistive layers, does it not?
>
> A. Well, the patent, in its totality, tells you that. You have now asked me to remove big sections of it. Whether it would be effective in so doing by removing those sections I think is a matter of great conjecture.
>
> Q. You have just read those sections. I have not asked you to remove any of the sections which refer to hydrocarbon

> reservoirs; so that bit of the teaching is unaffected by what I asked you to do, is it not?
>
> A. Well, I mean, I do not know how to respond. It just seems a nonsense to me to even pose that; to cherry pick sections of a document whose stated aim is to do one thing, remove teaching on how to achieve big aspects of that and then ask me to conclude, "Well, it is still telling us to do it". No, it is a different document then. I must consider it in its totality.
>
> …..
>
> Q. You would agree that Srnka in its reduced form, as we just discussed, includes within it the indicator for resistive or not resistive – the indicator for hydrocarbon or not that 019 has?
>
> A. I am no longer sure what it means having excised those sections that you have asked me to pretend do not exist. All it then says is, "I am aware that there can be resistive layers. I am going to set up a generic CSEM experiment and through some method to be determined I will say something about whether the layer can be detected." That is about all it says when you take out all of the relevant bits you have asked me to take out. I really do not think it is saying anything other than that.
>
> Q. But all of which you agree was conventional at this date?
>
> A. Yes.

173. I am therefore unable to accept the submission about two parts. The division which Mr Silverleaf seeks to make is an entirely *ex post facto* analysis – seeking to create clear and unmistakeable directions by cherry-picking. It is not as though the redacted passages in the context of the document are set out as discrete matter. They are all part of a single disclosure; the notional skilled person must be supposed to take it as he finds it.

174. The Judge does not expressly consider the "reduced Srnka" case – I do not know whether it was put to him on that basis. If it was and he simply did not deal with it, I do not think he was at fault. For it seems to me so elementary that a document, including a prior art document, must be read as a whole, that the point did not really merit discussion.

175. The Judge's view about anticipation was formed on the basis of Srnka as a whole. He particularly considered what, if anything, the skilled reader could make of Srnka's "anomaly". Dr Chave had initially considered that this involved an absolute measurement of the received signal (see judgment at [186]. Prof Schultz's view was "much the same" (judgment [188]). On that basis Prof. Schultz explained that Srnka could not be made to work and so could not contain clear and unmistakable directions

to do anything within the claim. Having seen that Dr Chave changed his mind. He then suggested Srnka taught a relative measurement as set out by the Judge at [189]:

> Dr Chave's new interpretation was that "anomaly" and its derivatives meant a difference between the reading that one got on site with a buried layer and the reading one would expect to get if there were no resistive (or perhaps conductive) layer, the latter being based on a known physical reference survey or a model. He did not give reasons for his newly-expressed view. He did, however, strongly defend it in cross-examination. In doing so he is likely to have been influenced by some modelling that he did which, he said, demonstrated that "anomaly" in his sense did coincide with the results of modelling - one could see the results and effects that Srnka described.

176. It is, of course, illegitimate to construe a prior art document by conducting experiments, which is what Dr Chave's modelling amounted to. So I am not sure why the Judge indicated that Dr Chave's second view would probably as matter of construction, albeit "only just" be right. But it does not matter. For the Judge was clearly right to hold that the document did not have the "necessary clarity" to amount to an anticipation.

177. Actually there are other problems with the anticipation case too. Srnka does not mention a "refracted wave" and there are reasons to suppose that it is inconsistent with seeking such a wave. Thus it draws no distinction between the electromagnetic properties of mineral deposits (conductive) and hydrocarbons (resistive). A refracted wave could only be used for the latter for a conductive layer would attenuate EM energy rapidly. Further Srnka's "anomalies" (whatever is meant by the word) are, according to its teaching, frequency dependent. Whatever is being described in the second of the passages Mr Silverleaf suggested should be redacted is not the same as the way a refracted wave behaves. And Srnka's method depends on finding a characteristic frequency, which is not the method of the Patent.

178. Accordingly I would dismiss the cross-appeal on the question of anticipation.

Obviousness over Srnka

179. Although the Judge does not say so expressly, the question of obviousness must be considered as of the priority date of the Patent (2000). It seems the Judge approached the case on that basis (though his mistaken reference to the wrong Chave article might suggest otherwise).

180. The Judge dealt with obviousness briefly. He said:

> [209] It is obviously a problem with Srnka that its detailed teaching is somewhat unclear and obscure. If it stood by itself that lack of clarity, and that obscurity, would almost certainly stand in the way of an obviousness claim, or at least an obviousness claim based on the detailed teaching. But it does

> not stand alone for these purposes. I have already found the central teachings of Chave to be common general knowledge. This includes teaching of the refracted wave. If Mr Burkill is right that that paper does not disclose the application of the known physics to the direct detection of a hydrocarbon layer, then in my view Srnka does. Its text makes it plain that it is concerned with detecting the presence (as well as the depth) of hydrocarbon layers, even though other things are mentioned, and even though it is not plain how that is to be achieved in practice. Accordingly, if the invention is not obvious over Chave because the missing element of seeking hydrocarbon layers is not an obvious application (contrary to my primary view) it is obvious over Srnka when Srnka is placed against the permissible background of the common general knowledge elements of Chave. I accept that there was no direct evidence from Dr Chave on that particular way of putting the case, but it is a conclusion that I consider I am entitled to draw on the basis of the very extensive evidence that was given about Srnka, the Chave paper and common general knowledge. If there is a gap in between the Chave paper (embodying common general knowledge for these purposes) and the invention of the kind suggested by Mr Burkill in his description of the inventive step, then it is, in effect, filled by Srnka.

181. I am unable to accept this for a number of reasons:

(a) The very fact that Srnka is so obscure in meaning as not really to have one is a very telling factor against obviousness. Even read with the knowledge of the CSEM technique (which a CSEM expert would have had in 2000, and indeed would have had years earlier) the most one could get would be a suggestion that some unintelligible technique might be useful for "detection of hydrocarbons." I do not see that as telling anyone, including a CSEM person, that the standard CSEM method could differentiate between identified thin layers which might contain hydrocarbon or might contain water/brine.

(b) It entirely overlooks the fact that although Srnka had belonged to and been abandoned by a mighty oil company and had been widely discussed by CSEM experts, nothing had come of it. It is not as though Srnka was an obscurely published document. In its time it was before the very eyes of all the sorts of people to whom it is said it would have made the invention obvious. The position had not changed over the years.

(c) A case of obviousness by a combination of Chave and Srnka overlooks the fact that whatever Srnka is talking about is *not* conventional CSEM and is inconsistent with it. To say that the unimaginative skilled person (whether CSEM expert or exploration geophysicist) would have the wit to ignore the core Srnka teaching is going too far.

Anticipation by Yuan?

182. There is no dispute as to the legal test, most recently summarised by Lord Hoffmann in *Synthon* [2006] RPC 10 at [22]:

> … the matter relied upon as prior art must disclose subject-matter which, if performed, would necessarily result in an infringement of the patent. …. it follows that, whether or not it would be apparent to anyone at the time, whenever subject-matter described in the prior disclosure is capable of being performed and is such that, if performed, it must result in the patent being infringed, the disclosure condition is satisfied. The flag has been planted, even though the author or maker of the prior art was not aware that he was doing so.

183. For Yuan to anticipate it must be enabling and must "plant the flag": supposing Yuan to be performed now, would it necessarily fall within claims 1 or 1A as proposed to be amended? EMGS contends not for five reasons. If any of these are correct, there is no anticipation.

184. EMGS's reasons are:

(a) Yuan is not concerned with a "hydrocarbon containing submarine reservoir" within the meaning of the claims in dispute (1 and 1A as proposed to be amended).

(b) Yuan is not concerned with:

(i) "searching for a hydrocarbon containing submarine reservoir" within the meaning of claim 1;

(ii) "determining the nature of a submarine reservoir" within the meaning of claim 1;

(iii) "performing a survey .. to determine whether a submarine reservoir … contains hydrocarbon or water," within the meaning of claim 1A.

(c) Yuan is not enabling.

(d) Yuan does not make her determination "based on the presence or absence of a refracted wave component."

(e) Yuan does not necessarily involve operating within the parameters l (transmitter/receiver distance) and λ (wavelength) of claim 1.

185. The Judge was with EMGS on all these points save for (a). In its response to the respondent's notice, EMGS challenges that point.

The Disclosure of Yuan

186. The Judge's description of and citation from, Yuan, was not challenged by either side so I can borrow it with gratitude:

> [237] This is a "poster presentation" given at the American Geophysical Union meeting in San Francisco in December 1998. A "poster presentation" is in effect a paper which is "delivered" by its being placed on a large board so that those interested can read it and, if they think fit, copy it. It is entitled "Electromagnetic assessment of offshore methane hydrate deposits in the Cascadia margin" and it is by J Yuan, G Cairns and R N Edwards. …
>
> [238] Methane hydrate is an ice-like white solid. It is, as its name suggests, a form of methane in a sort of ice-like form. Technically, it is a "clathrate" i.e. gas molecules encased in water molecules. It is perhaps, in the future, a potential source of methane, though at the moment no-one knows how to extract it economically and practically. At present it is a nuisance to drilling. It occurs in sedimentary layers. Technically it is a hydro-carbon.
>
> [239] Yuan contains the following. It starts with a section entitled "Importance of Assessment" and says:
>
> > "The assessment of off-shore methane hydrate is relevant because the deposits are expected to become a very important natural energy resource…."
>
> Under the problem of "assessment", she says:
>
> > "It is difficult to assess the total mass of hydrates from conventional geophysical remote sensing. While the base of hydrate deposits stands out clearly on seismic sections as the Bottom Simulating Reflector (BSR), the diffuse upper boundary is not well delineated.
> >
> > ….
> >
> > "Our group is developing a number of complementary geophysical techniques, one of which, the use of an electromagnetic method, is described here."
>
> [240] Next is a section entitled "Refraction electromagnetics":
>
> > "Marine sediment conducts electrical current ionically through saline fluid present in interconnected pores and fractures. Methane hydrate, like ice, is electrically insulating. Deposits of hydrate in sediment replace the conductive pore water, restrict the flow of electric current and thereby increase the bulk resistivity of the rock.

> Refraction electromagnetic data are obtained by measuring the analogue of the time taken for an electrical disturbance generated in a sea floor transmitter to diffuse through the sediment to a sea floor receiver (Edwards 1997). The travel time is related linearly to the resistivity: the higher the resistivity the shorter the travel time. The analog used is the phase difference between the transmitted and received signals viewed as a function of frequency. In simple terms, a linear variation in phase difference with frequency between the transmitted and received signals corresponds with a simple time delay and may be converted to an apparent resistivity."

[241] Next there is a section entitled "Electrical conductivity of hydrate" which I do not need to quote save for the last sentence:

> "The amount of hydrate present can be directly related to conductivity."

[242] Under "apparatus" Yuan sketches a conventional marine CSEM setup and refers to the prior art Chave paper. The diagram shows one transmitter and two receivers.

[243] Yuan apparently conducted a 10 day experiment on board ship in 1998 off Canada's west coast.

[244] The paper then goes on to show the result of some modelling, demonstrating apparent resistivity and phase differences for a transmitter/receiver separation of 500 metres. Details of the survey are then given and there is shown "apparent resistivity computed using the phase difference method for transmitter receiver separations of 85, 185, 200 and 300 metres…." The actual results are then graphed. The first graph (fig.9) is entitled: "Recorded stacked transient signals on the sea floor and in the water column". The data analysis section declares that:

> "Using this scheme we inverted all data in frequency domain with half space models."

[245] Fig.10 is:

> "A plot of the difference in phase measured at a given site and the phase of the signal in the water column against corresponding theoretical models having a variable sea floor conductivity."

[246] The conclusions include the following:

> "1. We have designed and constructed a marine sea floor transient electric dipole-dipole apparatus suitable for assessing offshore methane hydrate.
>
> 2. The apparatus has been tested successfully over known hydrate deposits west of Vancouver Island.
>
> 3. Estimates of apparent electrical resistivity of the sea floor have been obtained with an experimental accuracy of better than one per cent for a wide range of transmitter-receiver separation using a differential phase analysis method.
>
> 4. Preliminary results reveal that the resistivity of the sea floor is remarkably uniform at about 1.15 ohm.metres to a depth of in excess of 100 metres. There is some evidence for higher resistivity values near [a relevant site] which may indicate the presence of hydrate."

(a) The meaning of "hydrocarbon containing reservoir" (I leave out *submarine* which adds nothing in this debate)

187. It is not suggested that either *hydrocarbon* or *reservoir* or the phrase as a whole has a specific technical meaning to be determined as a matter of evidence from experts. Its meaning is a question of construction for the court. That is to be decided by the well-known *Kirin-Amgen* approach:

> The question is always what the person skilled in the art would have understood the patentee to be using the language of the claim to mean (*per* Lord Hoffmann in *Kirin-Amgen* [2004] UKHL 46 at [46].

188. Although not a technical term, both sides' experts opined on the meaning. There is no harm in experts doing that provided they give their reasons and it is not used as a basis for extensive cross-examination. There is a danger if they do of a descent into a debate about the acontextual meaning of the term. These days, fortunately, the patent judges are generally strong enough to stop that.

189. The Judge's task is not to decide which expert's evidence about the meaning is accepted but to construe the meaning by working out how a skilled reader would understand the word as used in the context of the patent as whole.

190. Mann J decided that the sedimentary rock containing methane hydrate which Yuan was examining was indeed a "reservoir." He said at [251]:

> It merely has to be <u>capable</u> of containing something (namely fluids). A reservoir can be an empty reservoir. I think that it is used in that sense in the 019 patent - see the opening sentence, which uses the word broadly.

And at [252]:

> It is a reservoir because of its porosity, which is capable of holding a fluid. The methane hydrate is a hydrocarbon, literally speaking. So sediment containing methane hydrate in its pores is literally a reservoir which contains a literal hydrocarbon.

191. The Judge then went on to reason thus: since the rock is a reservoir, the only question which remains is whether it contains a hydrocarbon. As a matter of chemistry methane hydrate is a hydrocarbon. So Yuan was concerned with a "hydrocarbon-containing reservoir" within the meaning of the claims.

192. I do not accept this reasoning. I think the skilled team (which for this purpose includes both exploration and CSEM geophysicists – see above) would not regard a layer of sedimentary rock containing methane hydrate as a "reservoir" of the hydrate. The Patent is about searching for <u>extractable</u> hydrocarbon such as oil or gas. The *hydrocarbon-containing reservoir* of the claim is a "reserve" from which the contained hydrocarbon can be drawn. I do not consider the skilled team would regard porous rock containing the solid methane hydrate which has no current use as the sort of *reservoir* the patentee had in mind when he used the phrase *hydrocarbon-containing reservoir.* The fact that there may be in the far distant future a possible use for methane hydrate (as Yuan mentioned) does not change this conclusion.

193. So for that reason alone, Yuan does not anticipate.

(b) Was Yuan "searching" or "determining the nature of"?

194. Unlike the Patent, Yuan was not about prospecting for rock containing hydrocarbon: what Yuan reported was using CSEM to investigate an already known sedimentary rock which it was known did contain methane hydrate. She wanted to find out how much methane hydrate was there. The target was already known. Yuan was neither "searching for a hydrocarbon containing reservoir" (claim 1) nor determining "whether a reservoir … contains hydrocarbons or water" (claim 1A).

195. The Judge so concluded at [253]. Mr Silverleaf contended that he was wrong. The submission was that measurement of the quantity of a substance necessarily includes also measuring whether it is there at all. I do not accept this metaphysical way of considering the point. As a practical matter Yuan was doing something different from that covered by the claims. She was not trying to find hydrocarbon or trying to differentiate between hydrocarbon and water or brine using CSEM. What she was doing would not fall within the claims for that reason too. The Judge was right.

(c) Is Yuan enabling?

196. Next there is the question of enablement. There is no dispute that to be anticipatory a prior disclosure must be enabling. The Judge held Yuan was not at [254]. He relied upon (i) Dr Chave's description of the Yuan experiment as "inconclusive", (ii) the tentative nature of Yuan's conclusion: "here is some evidence for higher resistivity values near ODP site 889B which may indicate the presence of hydrates," and (iii) that Yuan sought to measure a model with a buried layer but failed to do so. The Judge said "all that lacks the flag-pointing clarity required for anticipation."

197. Mr Silverleaf challenged that. He submitted that the Judge wrongly considered only the results of the survey whereas Yuan also disclosed a theoretical computer model along with the apparatus necessary to do the actual measurements. This, he suggested amounted to a complete disclosure of using CSEM to measure methane hydrate deposits in porous rock. The skilled team was thus enabled to carry out Yuan's method and that was enough.

198. I do not accept that analysis. Yuan would be read as a whole. If even the authors could do no better than get an inconclusive result in practice, I do not see why the addition of what is no more than a computer model transforms the disclosure into that which would enable the skilled person to make it work. The Judge was entitled to reach the conclusion he did.

Does Yuan base her determination on the refracted wave component?

199. There is yet another reason why the Judge found Yuan to differ from the claims. The latter call for:

> seeking, in the wave field response, a component representing a refracted wave, and determining
>
> > [claim 1] the presence and/or nature of any reservoir identified based on the presence or absence of a refracted wave component
> >
> > [claim 1A] whether the reservoir contains hydrocarbons or water based on the presence or absence of a refracted wave component.

200. The question is whether Yuan clearly and unambiguously discloses the use of the "refracted wave" feature of the claims in the manner claimed. Mr Silverleaf says it does so explicitly as well as being inherent in Yuan's method.

201. As far as explicit disclosure is concerned he relied on the passage of Yuan quoted by the Judge at his [240] – see above. Mr Silverleaf said that it was a complete description of what is in fact going on when you get the channelled or refracted wave of the patented method.

202. As far as implicit disclosure is concerned, Mr Silverleaf submits that Yuan must in fact have been using the refracted wave for her detection and so, there is no difference from the claims in this respect.

203. I am not convinced. It is not sufficiently clear from the terse disclosure of Yuan precisely what she was actually doing by way of detection. The Judge said:

> [255] So far as using the refracted wave is concerned, it is not plain that Yuan was using that either. It is true that there is a section of the paper called "Refraction Electromagnetics"; it is true that one of the physical aspects of refracted waves, namely the quicker transmission of signals, is relied on, and it is true that the refracted wave is always there (in terms of

> physics, as Dr Chave pointed out) but it is not clearly exploited in the manner in which the 019 patent seeks to exploit it. This paper is much more focussed on measuring bulk resistivity and modelling results. Again, therefore, the paper does not anticipate.

I accept that entirely.

(e) Does Yuan disclose working within parameters of the claims?

204. The Judge had one more reason as to why there was no anticipation. It was not shown that Yuan in fact operated within the parameters of the formula in claims 1 and 1A – so there was no clear flag-planting or inevitable result. Mr Silverleaf contended otherwise. He accepted that so far as Yuan reported actual experiments you could not tell whether she worked within the parameters of the claims. But so far as the computer models were concerned there was an overlap between what was disclosed and those parameters.

205. For the purposes of considering this point I will assume in Mr Silverleaf's favour (without deciding) that a mere computer model could provide clear and unmistakeable directions to do something, even though just constructing and running such a model would not itself fall within the claim and if done post-patent would not infringe.

206. The Judge said [256];

> She shows a model in accordance with various frequencies, but her actual frequencies are not used. Her modelled frequencies, when "plugged into" the relevant formulae, show a wavelength range of 575 to 32,000m. When those wavelengths are applied to the offset formula in integer 10 of claim 1, this would give a range of offsets from 288m to 320 Km. There is a slight overlap between the top of Yuan's actual ranges and the bottom of the ranges generated with integer 10.

"Integer 10" is the formula at the end of claims 1 and 1A: $0.5\,\lambda \leq l \leq 10\,\lambda$.

207. Mr Silverleaf submits that the judge made an error of law. Once there is an overlap of a range specified in a patent with a range specified in the prior art, to the extent there is an overlap there is anticipation. The flag is planted by Yuan within the offset range of the formula. So, he submitted, Yuan's computer model anticipates.

208. Mr Thorley accepted the general proposition but said Mr Silverleaf was misunderstanding what the Judge meant by an "overlap." We are not concerned with comparing two simple linear ranges to see whether there was a simple overlap (e.g. $10\text{-}60^0$C compared with $40\text{-}70^0$C). Two parameters are involved. Yuan mentions a range of frequencies (which can be translated into wavelengths) and a range of offsets. There is some overlap with the integers of the claim in the ranges specified by Yuan. But the claim specifies a relationship between the two as set out in the formula. Although Yuan's ranges <u>could</u> be individually chosen so as to fit the formula, there is nothing in Yuan, even in the model, which necessarily requires this. So the flag was not planted.

209. Indeed there is another technical reason why Yuan does not fall within the claims in this regard. Unlike the patented method, Yuan seeks to use transient signals (see fig. 9). This, as Dr Chave accepted, meant that λ had to be long in relation to the offset because you have to allow for the transients to die out before each measurement is taken. He accepted that λ had to be at least 5 times the offset (Day 8 $1034_{2\text{-}5}$). That takes Yuan outside the claims: for they only allow λ to be two offsets as a maximum.

210. I accept Mr Thorley's argument on this point too. Yuan does not teach clearly and unambiguously working within the formula of the claims.

Conclusion on Yuan

211. Accordingly, for no less than five reasons Yuan does not anticipate. Mr Silverleaf did not advance any separate obviousness case based on Yuan, accepting realistically that if his other cases of obviousness failed, obviousness over Yuan would not succeed.

Overall Conclusion

212. The appeal should be allowed. I hope the consequential order can be agreed. If not the parties should prepare a composite draft order showing the rival versions and provide written skeleton arguments about the point(s) in dispute.

Lord Justice Sullivan:

213. I agree.

Lord Justice Waller:

214. I also agree.