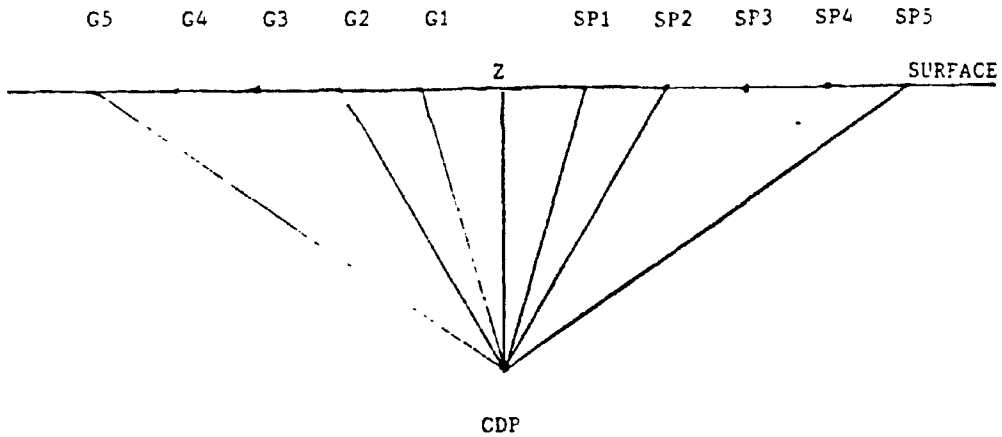
Commissioner's Decision

Computer Related, Section 2, Obviousness

The system of obtaining signals having different angles of reflectivity by apparatus which provides impulses from equidistant multiple point offsets is acceptable subject matter under Section 2. The claims did not define the apparatus over the cited art. Rejection under Section 2 withdrawn. Claims refused. Rejection modified.

This decision deals with Applicant's request for review by the Commissioner of Patents of the Final Action on application 294,139 (Class 349-20) assigned to Chevron Research Company entitled METHOD FOR INTERPRETATION OF SEISMIC RECORDS TO YIELD INDICATIONS OF GASEOUS HYDROCARBONS. The inventor is W.J. Ostrander. The Examiner in charge issued a Final Action on December 24, 1981, refusing to allow the application. A Hearing was held on October 22, 1986, at which Applicant was represented by his Patent Agent Mr. D. Cameron.

This application relates to a seismic method of obtaining for a subsurface point a series of acoustic signals having different angles of reflectivity, as shown in the drawing below. A common depth point, CDP, is selected and its surface vertical point Z located. Arranged in line on respective sides of point Z are the series of equidistant surface shot points, for example, SP1 to SP5, and the series of geophones G1 to G5 of the same equidistant surface spacing as the shot points. The shot from SP1 is received by G1, the shot from SP2 by G2, etc. The successive angling of the shots into the geological makeup of the same CDP, as in the sketch below, obtains different horizontal components of the signals received therefrom.



The method then displays for each CDP its multiple seismic reflection signals on a side by side basis as a function of the progressively changing horizontal values. By observing the horizontal increase in the values for a plurality of adjacent subsurface points, an improved understanding of the gas content in a surveyed area is obtained. Part of figure 13a is reproduced below. The increase from right to left in the peaks of the signals, as shown at the mid point of the values of the signals for the two shot points shown, is said to indicate the presence of gas in a strata.

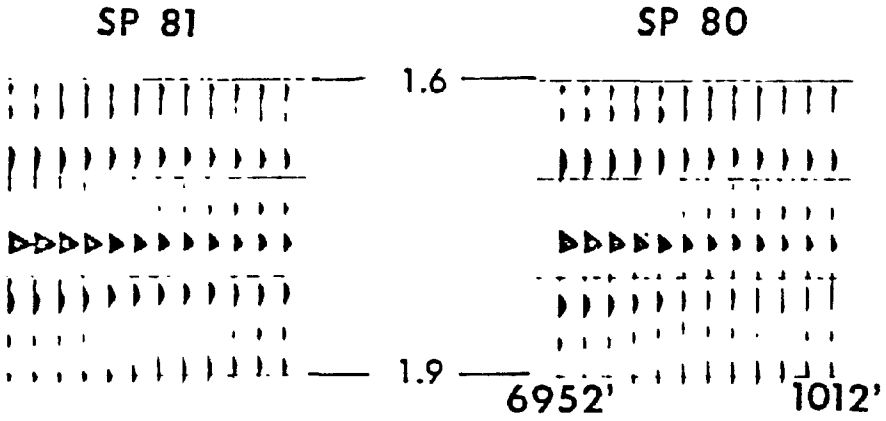


FIG. 13a

In the Final Action, the Examiner refused the claims and the application in view of the following references:

United States Patents
3,354,985 Nov. 28, 1967 Sparks
3,381,266 Apr. 30, 1968 Harris

Publication
"Seismic Signal Processing" by Wood et al, Proc IEEE, Vol. 63, No. 4, April 1975, pp. 649-661.

The Examiner assessed the references as follows:

> Sparks teaches a seismic prospecting method of locating a suspected fault.
>
> Harris describes a method of stacking seismic traces having common offset distances.
>
> The publication provides a review on data signal processing of seismic survey data.

The Examiner, in making a further rejection of the claims and the application in view of Section 2 of the Patent Act, said, in part, as follows:

> Section 28(3) of the Patent Act prohibits a patent for any mere scientific principle or abstract theorem. The process defined in the claims consists of calculations to manipulate seismic generated data to obtain more meaningful data. If the calculations were not by a computer, they would clearly consist of mental operations in solving mathematical formulae which can be characterized as a mere scientific principle or abstract theorem.
>
> To determine if the defined process is statutory subject matter within the meaning of Section 2 of the patent Act, we turn to the Patent Office guideline and the jurisprudence. The criteria on patentability of programmable inventions, commonly called computer programs, were published in the CPOR on August 1, 1978 and were later adopted by the Commissioner of Patents.
>
> The same criteria were also set forth in Commissioner's Decision no. 441 which was considered in Schlumberger v. Commissioner of Patents (F.C.A. June 15, 1981). That case was directed to a method of processing well logging data to produce output parameters representative of geological formation characteristics. The court found that the claims define the discovery that by making certain calculations according to certain formulae, useful information could be extracted from certain measurements. The court stated that if calculations are not mental operations but purely mechanical ones that constitute the various steps in the process then the use of computers to perform the calculations would have the effect of transforming into patentable subject matter what would, otherwise, clearly not be patentable. A computer used to implement a discovery does therefore, not change the nature of a discovery. The process was held not to be an invention within the meaning of Section 2.

The Applicant argues that his claims and application are allowable over the cited art, and in view of Section 2, saying in part, as follows:

> . . .
>
> Wood et al ... state as to whether or not obliqueness in the incident wave is of importance, as follows:
>
> > "Appropriate equations for oblique incidence are much more complicated [28], because mode conversion must be taken into account. Nevertheless, normal incidence coefficients are very useful and quite accurate for stacked traces in areas having simple geological structures." (Emphasis added)
>
> Hence, in effect, the Wood et al reference teaches away from Appellant's invention in that it suggests that the appropriate equations can be solved using normal reflection coefficients since such coefficients are "very useful and quite accurate" in predicting the presence of gaseous hydrocarbons, and equations for oblique incidence "are much more complicated because mode conversion must be taken into account."
>
> Furthermore, the authors state that amplitude anomalies of seismic records can also be misinterpreted so that care must be taken in their use in predicting the presence of gas in specific stratigraphic areas.

. . .

Harris relates to a method of gathering and displaying seismic data to enhance normal moveout estimation and to identify primary and multiple reflections. The key: stacking traces with a common offset, i.e., combining traces that lie along a common horizontal line in the diagrams of FIGS. 2 and 3. But note in Harris there is no teaching of de-stacking of common GATHERS of data followed by the display of the de-stacked data as a function of "common centerpoint" location to indicate the presence of events associated with gas-bearing strata, as described in claims 1-12 of record.

. . .

Sparks relates to a seismic prospecting method for locating a suspected fault based upon "critical angle" exploration techniques. Key to operations: each stratification of the subsurface has a characteristic critical angle of reflection and critical distance determinable by well-known methods. But where such data abruptly change, the reflecting subsurface can be interpreted as being a fault zone. Hence, by plotting "critical" amplitude response as a function of horizontal distance as the array moves toward and through the fault zone, the latter can be made to stand-out on the resulting record. . . .

But note in Sparks there is no teaching of display of common gathers of data of conventional CDP collection techniques (which are below critical angles) followed by the display of such data as a function of common centerpoint location to indicate the presence of gas-bearing strata. . . .

(There's a reason why Sparks only displays maximum response values in his display of FIG. 1B. Beyond the critical angle, the phase of the received wave changes in non-hyperbolic fashion. Consequently, even in areas associated with gas sands, Sparks' method would not yield the results specified in the instant claims, that is to say, the responses associated with the common centerpoints of Sparks would not progressively change as a function of horizontal offset even if Sparks had displayed all signals. This is because the "critical angle" responses of Sparks would effectively interact with any responses due to gas sands in an unknown non-hyperbolic manner that would essentially destroy amplitude response.)

. . .

Appellant's traces are merely collected in the field using conventional CDP collection methods. From that time-frame through to the end of the last step of Appellant's method, the collected traces are not mathematically treated or enhanced in any manner. What is done is the traces are rearranged (re-formatted) and then displayed in a new arrangement as set forth in Appellant's Claims 1-12, of record.

(That is to say, if the amplitude of the event of interest progressively changes with offset IN THE DISPLAYED TRACES, then more likely than not the subsurface reflectors of the seismic energy were gas sands.)

The issue before the Board is whether or not the claims and the application are acceptable in view of Section 2 of the Patent Act, and whether or not they are obvious in view of the cited art. Claim 1 reads:

A method for increasing resolution of high-intensity amplitude events in seismic records in order to associate such events with gas-bearing strata in the earth, comprising the steps of:

(a) generating seismic data, including a record of signals from acoustic discontinuities associated with said strata of interest by positioning and employing an array of sources and detectors such that centerpoints between selected pairs of sources and detectors form a series of centerpoints along a line of survey, said recorded signals being the output of said detectors;

(b) by means of automated processing means, statically and dynamically correcting said recorded signals to form corrected traces whereby each of said corrected traces is associated with a centerpoint horizontally midway between a source-detector pair from which said each corrected trace was originally derived;

(c) by means of automated processing means, indexing said corrected traces in two dimensions whereby each of said corrected traces is identified in its relationship to neighboring traces on the basis of progressive changes in horizontal offset value versus progressive changes in common centerpoint location.

(d) displaying a series of said traces of step (c) on a side-by-side basis as a function of progressively changing horizontal offset values, said displayed traces all being associated with at least the same general common group of centerpoints;

(e) identifying progressive change in a high-density amplitude event from trace to trace of said displayed traces as a function of progressive change in horizontal offset value whereby more likely than not said event relates to reflections from acoustic impedances associated with strata containing gaseous hydrocarbons.

At the Hearing, Mr. Cameron explained that the common depth point analysis, in use prior to Applicant's invention, gathered signals together in a summing step, and presented them on a graph where they appeared as spots. He says the more pronounced spots, known as bright spots indicated formations of interest in the subsurface, and that there might be gas in such formations. He says numerous dry holes drilled in such areas point to shortcomings in the previous method. He describes Mr. Ostrander's method is, not to add the signals together, but instead to arrange them in a display so that the horizontal amplitudes of the signals obtained are visible. Further, he emphasizes Mr. Ostrander's method enables a more accurate prediction of gas in the substrata if the horizontal amplitudes increase progressively in accordance with the changing angles of reflectivity provided by the shot points spaced away from the center point overlying the common depth point.

Mr. Cameron provided a comparison between the known manner of collecting data with that developed by Mr. Ostrander. For example, by looking straight into a non-glare glass surface, he noted there would not be much reflectivity. However, on moving sideways from the surface, and so changing the angle of reflectivity, the surface acts more like a mirror and provides a clearer reflection. He likened this to an optical phenomenon. He referred to Mr. Ostrander's realization that, by providing multiple shot points and receptors on each side of a strata point to obtain different angles of incidence, a contrast could be obtained in the signals, and thereby an indication whether the strata is gas containing. Part of Mr. Ostrander's technique makes use of the knowledge of how signals react in gaseous material and in hard material, for example a signal passing through a gaseous deposit will produce a different value from a signal passing through hard material.

Mr. Cameron, in referring to the decision in Schlumberger Canada Ltd. v. The Commissioner of Patents (1981) 56 C.P.R. 204, stressed that the Applicant is not attempting to monopolize an arithmetic procedure to do calculations for signal processing. He says Applicant is attempting to protect a method of detecting subsurface gas deposits. We find direction in assessing Applicant's invention in the following passages from Schlumberger:

> In order to determine whether the application discloses a patentable invention, it is first necessary to determine what, according to the application, has been discovered,

and

> I am of opinion that the fact that a computer is or should be used to implement discovery does not change the nature of that discovery. What the appellant claims as an invention here is merely the discovery that by making certain calculations according to certain formulae, useful information could be extracted from certain measurements. This is not, in my view, an invention within the meaning of s. 2.

We are aware from the disclosure and from Mr. Cameron's explanation that the signals from the shot points are subjected to certain calculations, such as are the signals produced by the common depth point analysis referred to by him. We learn from his explanation and from the description of how the apparatus is set up to emit several offset signals for each point of interest in the strata, that Applicant's features are the multiple point offset for each CDP and the different angles of reflectivity. In our view they produce the results not previously attainable by the methods of the cited art references.

We are satisfied therefore that the claims and the application are directed to patentable subject matter under Section 2 of the Act.

In reviewing the claims, we do not find any definition of the step of providing the multiple array of equidistant sources and detectors to obtain signals having progressive angles of reflectivity for each CDP. Part (a) of claim 1 does not refer to the progression of angles for the signals needed to obtain the horizontal values that Applicant contends provide the significant difference from the cited art. Part (a) merely calls for an array of sources and detectors such that centerpoints between selected pairs of sources and detectors form a series of centerpoints. As noted in the arguments to the Final Action and at the Hearing, the manner of progressively varying the angles of reflectivity obtained from the equidistant offset shot points is part of the method needed to produce the signals that provide the horizontal amplitudes. In our view, part (a) of claim 1 does no more than recite what has been argued as being known in the cited art to obtain the values for the bright spots which, as Applicant points out, have not always indicated gas bearing strata.

Part (c) of claim 1 appears to rely on automated processing means to index and correct signals to obtain the desired horizontal offset value. We do not see that this part relates the necessary equidistant placement of multiple shot points and receptors in terms that define over the arrays provided by the cited references. We find claim 1 is indefinite and does not define over the cited art.

None of the other claims, in our view, recite an arrangement of sources and detectors that define the arrangement that Applicant argues is different from the cited art. Therefore, all of the claims fail to define the step of arranging Applicant's structure to obtain the various angles of incidence that provide the reflection profiling containing indications of progressive amplitude change.

We recommend that the rejection of the application for not containing patentable subject matter be withdrawn. Concerning the refusal of the claims for not defining the invention in view of the cited art, we recommend that the rejection of the claims be maintained.

M.G. Brown
Acting Chairman
Patent Appeal Board

S.D. Kot
Member

I concur with the findings and the recommendations of the Patent Appeal Board. Therefore, I affirm the refusal of claims 1 to 12 for not defining an invention over the cited art, and I withdraw the rejection of the claims and the application for being directed to non-statutory subject matter. Accordingly, I refuse to grant a patent containing claims 1 to 12. The Applicant has six months within which to appeal my decision under the provisions of Section 44 of the Patent Act.

J.H.A. Gariépy
Commissioner of Patents

Dated at Hull, Quebec
this 10thday of June 1987

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