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Date: 2021-12-14

TOPIC: J00 Meaning of Art

J10 Computer
Programs

SUJET: J00 Signification de
la technique

J10 Programmes
d'ordinateur

Application No. : 2,874,728

Demande n° 2 874 728

IN THE CANADIAN PATENT OFFICE

DECISION OF THE COMMISSIONER OF PATENTS

Patent application number 2,874,728, having been rejected under subsection 30(3) of the *Patent Rules* (SOR/96-423) as they read immediately before October 30, 2019 (“former *Rules*”) has consequently been reviewed in accordance with paragraph 199(3)(c) of the *Patent Rules* (SOR/2019-251) (“*Patent Rules*”). The recommendation of the Patent Appeal Board and the decision of the Commissioner are to refuse the application unless necessary amendments are made.

Agent for the Applicant:

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INTRODUCTION

- [1] This recommendation concerns the review of rejected Canadian patent application number 2,874,728 (“the instant application”), which is entitled “SYSTEM AND METHOD FOR RESERVOIR SIMULATION OPTIMIZATION” and is owned by LANDMARK GRAPHICS CORPORATION (“the Applicant”). A review of the rejected application has been conducted by the Patent Appeal Board (“the Board”) pursuant to paragraph 199(3)(c) of the *Patent Rules*. As explained in more detail below, the Board’s recommendation is that the Commissioner of Patents refuse the application unless necessary amendments are made.

BACKGROUND

The Application

- [2] The instant application was filed under the *Patent Cooperation Treaty* and has an effective filing date in Canada of May 30, 2012. It was laid open to public inspection on December 5, 2013.
- [3] The instant application relates to methods and systems for optimizing a parameter (e.g., expected oil or gas production) resulting from simulation of oil and gas reservoirs. Rather than attempting to optimize the chosen parameter for an entire group of wells in a field at once, the method and system optimize the parameter for subsets of the wells, then proceed with optimization of all the wells simultaneously. The results of the optimization may be used for the drilling parameters of the ultimate production wellbores.

Prosecution History

- [4] On August 14, 2018, a Final Action (“FA”) was written pursuant to subsection 30(4) of the former *Rules*. The FA stated that the instant application is defective on the ground that all of the claims 1-24 on file at the time of the FA (“claims on file”) encompass subject-matter that lies outside of the definition of “invention” and does not comply with section 2 of the *Patent Act*.
- [5] In a January 31, 2019 response to the FA (“R-FA”), the Applicant submitted a proposed claim set 1-24 (“proposed claims”) and submitted arguments in favor of patentability, arguments which focussed on the subject-matter of the proposed

claims.

- [6] As the Examiner considered the application not to comply with the *Patent Act*, pursuant to subsection 30(6) of the *former Rules*, the application was forwarded to the Board for review on May 6, 2019 along with an explanation outlined in a Summary of Reasons (“SOR”). The SOR set out the position that the claims on file were still considered to be defective as being directed to non-patentable subject-matter and therefore non-compliant with section 2 of the *Patent Act*. The SOR also indicated that the proposed claims did not overcome the non-patentable subject-matter defect.
- [7] In a letter dated May 9, 2019, the Board forwarded to the Applicant a copy of the SOR and requested that the Applicant confirm its continued interest in having the application reviewed.
- [8] In a response dated June 10, 2019, the Applicant indicated its desire for the Board to proceed with a review of the application.
- [9] The undersigned was assigned to review the instant application under paragraph 199(3)(c) of the *Patent Rules* and to make a recommendation to the Commissioner of Patents as to its disposition.
- [10] In a preliminary review letter (“PR letter”) dated October 21, 2021, I set out my preliminary analysis of the patentable subject-matter issue with respect to the claims on file and the proposed claims, based on the revised guidance set out in “Patentable Subject-Matter under the Patent Act” (CIPO, November 2020) [PN2020–04]. With respect to the claims on file, I was of the preliminary view that claims 1-22 on file are directed to non-patentable subject-matter, are therefore non-compliant with section 2 of the *Patent Act*, and are prohibited by subsection 27(8) of the *Patent Act*. However, I was of the preliminary view that claims 23-24 on file are directed to patentable subject-matter, are therefore compliant with section 2 of the *Patent Act*, and are not prohibited by subsection 27(8) of the *Patent Act*. With respect to the proposed claims, I was of the preliminary view that they are directed to patentable subject-matter, are therefore compliant with section 2 of the *Patent Act*, and are not prohibited by subsection 27(8) of the *Patent Act*.
- [11] The PR letter also provided the Applicant with an opportunity to make oral and/or

written submissions.

- [12] In a response to the PR letter dated November 4, 2021 (“R-PR”), the Applicant re-submitted the proposed claims as presented with the R-FA. The Applicant did not dispute any of analysis or preliminary views expressed in the PR letter. The Applicant also indicated that an oral hearing was not required.
- [13] I have reviewed the instant application in accordance with paragraph 199(3)(c) of the *Patent Rules* and provide my analysis below.

ISSUE

- [14] The issue to be addressed by the present review is whether the claims on file are directed to patentable subject-matter.
- [15] After considering the claims on file, I review the proposed claims to determine if they are considered a necessary amendment under subsection 86(11) of the *Patent Rules*.

LEGAL PRINCIPLES AND OFFICE PRACTICE

Purposive Construction

- [16] In accordance with *Free World Trust v Électro Santé Inc*, 2000 SCC 66 and *Whirlpool Corp v Camco Inc*, 2000 SCC 67, purposive construction is performed from the point of view of the person skilled in the art in light of the relevant common general knowledge (“CGK”), considering the whole of the disclosure including the specification and drawings. In addition to interpreting the meaning of the terms of a claim, purposive construction distinguishes the essential elements of the claim from the non-essential elements. Whether or not an element is essential depends on the intent expressed in or inferred from the claim, and on whether it would have been obvious to the skilled person that a variant has a material effect upon the way the invention works.
- [17] *PN2020-04* also discusses the application of these principles, pointing out that all elements set out in a claim are presumed essential unless it is established otherwise or such presumption is contrary to the claim language.

Patentable Subject-Matter

[18] The definition of invention is set out in section 2 of the *Patent Act*:

invention means any new and useful art, process, machine, manufacture or composition of matter, or any new and useful improvement in any art, process, machine, manufacture or composition of matter.

[19] Subsection 27(8) of the *Patent Act* also prescribes that:

No patent shall be granted for any mere scientific principle or abstract theorem.

[20] *PN2020-04* describes the Patent Office's approach to determining if a claim is patentable subject matter:

To be both patentable subject-matter and not be prohibited under subsection 27(8) of the *Patent Act*, the subject-matter defined by a claim must be limited to or narrower than an actual invention that either has physical existence or manifests a discernible physical effect or change and that relates to the manual or productive arts, meaning those arts involving or concerned with applied and industrial sciences as distinguished in particular from the fine arts or works of art that are inventive only in an artistic or aesthetic sense.

ANALYSIS

Claim Construction

The person skilled in the art

[21] In the PR letter at page 4, I accepted the Applicant's characterization of the person skilled in the art with one qualification:

In the R-FA at page 1, the Applicant suggested an alternative definition of the skilled person:

The person skilled in the art is a technician or an engineer in the field of oil and gas.

While I agree that the person skilled in the art may be more specifically identified as a technician or engineer, given that the instant application is focussed on computer modelling of a hydrocarbon reservoir, in my preliminary view, the person skilled in the art must also be skilled in general purpose computer programming.

[22] The Applicant did not dispute the above in the R-PR and I adopt it for the purpose

of this review.

The relevant common general knowledge

- [23] In the PR letter at pages 4-5, I also accepted the Applicant's characterization of the relevant common general knowledge, again with one qualification:

In the R-FA at page 2, the Applicant proposed an alternative identification of the relevant CGK:

The common general knowledge of the person skilled in the art is knowledge of existing reservoir simulation systems and systems for hydrocarbon recovery.

While I agree with the Applicant's position as to what would have been part of the relevant CGK and that it encompasses most of the points set out in the FA, in my preliminary view, the skilled person would also have had knowledge of general purpose computer programming techniques that would have been used in existing reservoir simulation systems. With this addition to the Applicant's characterization, I proceed below to analyze the claims on file.

- [24] The Applicant did not dispute the above in the R-PR and I adopt it for the purpose of this review.

The claims on file

- [25] In the PR letter at pages 5-6, I summarized the content of the claims on file and expressed the preliminary view that the meaning and scope of the claims would have been clear to the skilled person:

The instant application contains four independent claims 1, 14, 19 and 23, directed to a computer-implemented method of solving a reservoir simulation optimization problem (claims 1 and 14), a computer-implemented reservoir simulator, (claim 19) and a method for drilling wellbores in a reservoir (claim 23). For the purposes of the analysis below, I take claim 1 as representative of claims 1-22. Claims 23-24 are considered separately. Independent claims 1 and 23 are set out below:

1. A computer-implemented method of solving a reservoir simulation optimization problem, the method comprising:
 - acquiring a plurality of spatially-dependent parameters;
 - creating an initial computer model of a well field having a plurality of wells, each well being associated with a respective spatially-dependent parameter;

- dividing the well field into first and second regions. the first region including a first subset of the plurality of wells and the second region including a second subset of the plurality of wells;

- solving for the parameters associated with the wells in the first subset to get a first set of values while holding constant the parameters associated with the wells in the second subset:

- setting the parameters associated with the wells in the first subset to the first set of values: and

- solving for the parameters associated with the wells in the second subset to get a second set of values while holding constant the parameters associated with the wells in the first subset.

23. A method for drilling wellbores in a reservoir, the method comprising:

- acquiring a plurality of spatially-dependent parameters;

- creating an initial computer model of the reservoir having a plurality of virtual well bores, each virtual well bore being associated with a respective spatially-dependent parameter;

- dividing the initial computer model into first and second regions, the first region including a first subset of the plurality of virtual wellbores and the second region including a second subset of the plurality of virtual wellbores;

- solving for the parameters associated with the virtual well bores in the first subset to get a first set of values while holding constant the parameters associated with the virtual wellbores in the second subset;

- setting the parameters associated with the virtual wellbores in the first subset to the first set of values;

- solving for the parameters associated with the virtual wellbores in the second subset to get a second set of values while holding constant the parameters associated with the virtual wellbores in the first subset;

- based on the first and second sets of values, selecting a position and trajectory for a plurality of physical well bores in the reservoir;

- preparing equipment to construct a portion of the plurality of physical well bores; and

- drilling the plurality of physical wellbores in accordance with the selected trajectory.

I note that there have been no issues raised during the prosecution of the instant application in regard to the meaning or scope of any of the terms used in the claims on file. I proceed below on the basis that the meaning and scope of the claims would have been clear to the skilled person.

[26] Again, none of the above was disputed in the R-PR and I proceed on that basis.

The essential elements

- [27] In the PR letter at page 6, I set out a preliminary view of the essential elements of the claims on file based on the revised guidance provided in *PN2020-04*:

PN2020-04 states in respect of the identification of essential/non-essential elements that:

In carrying out this identification of essential and non-essential elements, all elements set out in a claim are presumed essential, unless it is established otherwise or is contrary to the language used in the claim.

With respect to the claims on file, the person skilled in the art would understand that there is no use of language in any of the claims indicating that the elements in each claim are optional, alternatives or a preferred embodiment.

Therefore, in my preliminary view, all the elements of the claims on file are considered to be essential, including the computer implementation and computer-related components.

- [28] The above identification of the essential elements was not disputed in the R-PR and I therefore proceed on the basis that all elements of the claims on file are essential.

Patentable Subject-Matter

- [29] I set out below my assessment of patentable subject-matter in light of the essential elements identified above and the guidance as to the assessment of patentable subject-matter set out in *PN2020-04*.

- [30] At pages 6-8 of the PR letter, I presented my preliminary analysis of the patentability of claims 1-22 on file, concluding that in my preliminary view, claims 1-22 on file are directed to non-patentable subject matter:

In my preliminary view, claim 1 wholly relates to a hydrocarbon reservoir modelling algorithm processed in a well-known manner by means of a generic computer system

Claim 1 first sets out a step of “acquiring a plurality of spatially-dependent parameters.”. There is no indication that this acquisition occurs as a result of any non-generic computer input means and in fact, the discussion of an exemplary computer system at page 3 of the instant application refers to the use of generic computer input/output devices.

The rest of claim 1 sets out steps involved in the reservoir modelling process, such as creating the initial mathematical model, dividing the well field into regions and

solving for the spatially-dependent parameters in each region while holding the parameters of the other regions constant.

Claim 1 contains no output step for the results of the modelling process.

Given that the computer-related elements of claim 1 are generic in nature, in accordance with *PN2020-04* and the illustrative examples attached to it, the question then becomes whether or not the computer forms part of the actual invention, the actual invention being the subject-matter against which patentable subject-matter is determined. As indicated in *PN2020-4*, if the processing of an algorithm on a computer improves the functioning of the computer, then the computer and the algorithm together form a single actual invention that solves a problem related to the manual or productive arts and the subject-matter defined by the claim is patentable.

In the R-FA, the Applicant asserts that as a result of individually optimizing regions of the well field for a given parameter (e.g., maximizing hydrocarbon recovery), an improved overall hydrocarbon recovery can be realized. While this may be true, it suggests an improvement in the results of the modelling algorithm, rather than an improvement in the functioning of the computer system.

In the instant application at page 1, it is suggested that in the past, solving for spatially-dependent parameters all at once across a well field “may result in computational inefficiencies and a failure to fully optimize a reservoir model.”

With respect to the optimization issue, at page 4 of the instant application, it is stated that:

In certain embodiments, after all regions have been solved for, the optimized results may be used for a final full field optimization. In this manner, reservoir simulations may more effectively solve spatially-dependent, field optimization problems.

The above passage suggests that the method of claim 1, wherein individual well field regions are optimized before a full well field optimization, leads to an improved overall optimization result, but does not suggest improvements in the computer processing itself, such as a reduction in computer resources in performing the processing.

At page 6 of the instant application, it is suggested that an optimization problem that is iteratively solved for a large number of wells is more computationally complex than that for a small number of wells. In my preliminary view, while this statement seems correct, given that according to the method of the invention the optimization is broken down into a series of smaller less complex optimization problems, it is unclear if there is any overall reduction in computer resources used to achieve the ultimate well field optimization.

At page 7 of the instant application, in discussing the division of a well field into a number of regions for the optimization, it is stated that the number of regions into which a well field should be divided will depend on the available computational power, “[t]he greater the computational power available, the greater number of wells

may be included in a regions.” In my preliminary view, this statement suggests that the optimization problem depends on the capabilities of the computer system being used and does not suggest any general improvement in computer processing. The speed of the process depends on the processing speed of the computer system, which is expected in relation to the processing of any algorithm and is not specific to the one set out in claim 1. There do not appear to be any processing advantages realized by use of the claimed algorithm. Rather the advantages appear to lie in the improved results of the modelling algorithm.

In my preliminary view, given that the computer-related elements of claim 1 on file are generic in nature, and the lack of any evidence that the steps that make up the hydrocarbon reservoir modelling algorithm improves computer functionality, the actual invention is the modelling algorithm itself. This group of steps is itself a series of abstract data manipulations and calculations. Therefore, it is my preliminary view that the actual invention of claim 1 on file is directed to subject-matter that is not “something with physical existence, or something that manifests a discernable effect or change” (*Canada (Attorney General) v Amazon.com Inc*, 2011 FCA 328 [Amazon] at paragraph 66).

The other independent claims 14 and 19 also have actual inventions that are directed to a series of abstract data manipulations and calculations, their features comprising the generic input of information to the computer system and the processing of a modelling algorithm in a well-known manner by a generic computer system.

Dependent claims 2-13, 15-18 and 20-22 all relate to further details of the hydrocarbon reservoir modelling algorithm and therefore also comprise actual inventions that are directed to a series of abstract data manipulations and calculations.

In light of the above, as the actual inventions of claims 1-22 on file are directed to a series of abstract data manipulations and calculations, claims 1-22 are directed to non-patentable subject-matter and are therefore non-compliant with section 2 of the *Patent Act*. Further, claims 1-22 on file, being directed to abstract subject-matter, are prohibited by subsection 27(8) of the *Patent Act*.

[31] The above was not disputed by the Applicant in the R-PR. I conclude that the actual inventions of claims 1-22 on file are directed to non-patentable subject-matter and are therefore non-compliant with section 2 of the *Patent Act*. Further, claims 1-22 on file, being directed to abstract subject-matter, are prohibited by subsection 27(8) of the *Patent Act*.

[32] With respect to claims 23-24 on file, I presented at pages 8-9 of the PR letter my preliminary view that these claims are directed to patentable subject-matter:

In contrast to claims 1-22 on file, claims 23 (a method of drilling wellbores) and 24 (which depends on claim 23), include the additional steps of:

based on the first and second sets of values, selecting a position and trajectory for a plurality of physical well bores in the reservoir;
preparing equipment to construct a portion of the plurality of physical well bores; and
drilling the plurality of physical wellbores in accordance with the selected trajectory.

In the case of claims 23-24 on file, the results of the hydrocarbon reservoir modelling algorithm are used to select the best drilling position and trajectory, with the wellbores ultimately drilled based on these parameters.

In my preliminary view, it is evident from the claim language and the rest of the specification that the hydrocarbon reservoir modelling algorithm and the reservoir models that it produces, cooperate with the hydrocarbon well drilling operations to effect changes in the well drilling parameters and ultimately in hydrocarbon recovery. They thus form a single actual invention that produces discernable physical effects (the ultimate drilling and hydrocarbon recovery) and “manifests a discernable effect or change” (*Amazon* at paragraph 66).

In light of the above, it is my preliminary view that the actual inventions of claims 23-24 on file relate to the manual or productive arts, are patentable subject-matter and compliant with section 2 of the *Patent Act*, and are not prohibited subject-matter under subsection 27(8) of the *Patent Act*.

[33] The above preliminary view was not disputed by the Applicant in the R-PR. I conclude that the actual inventions of claims 23-24 on file relate to the manual or productive arts, are patentable subject-matter and compliant with section 2 of the *Patent Act*, and are not prohibited subject-matter under subsection 27(8) of the *Patent Act*.

Proposed Claims

[34] As set out earlier, the proposed claims submitted with the R-PR and the R-FA are one and the same. In the PR letter at pages 9-11, I set out my preliminary view that the proposed claims are directed to patentable subject-matter:

With the R-FA, the Applicant submitted proposed claims 1-24. In proposed claim 1, for example, the Applicant added language setting out more clearly that the steps are performed “at a computer.” The Applicant also added the following additional steps at the end of proposed claim 1:

wherein the first and second set of values correspond to parameters predicted to produce a second hydrocarbon recovery that is improved over the first hydrocarbon recovery;

using the first and second set of values, generating, at a computer, a well completion plan that corresponds to the second hydrocarbon recovery; and

completing a well field according to the well completion plan.

These additional steps indicate that based on a well completion plan generated based on the hydrocarbon reservoir modelling algorithm claimed, the well field is completed according to such a plan. If “completing a well field” involves physical drilling and hydrocarbon recovery steps based on the results of the hydrocarbon reservoir modelling algorithm claimed, then the claim as a whole would be directed to patentable subject-matter.

As the language of “completing a well field” was not previously used in the claims on file, it is necessary to look to the rest of the specification in order to determine how a person skilled in the art would interpret such an expression.

At page 12, lines 9-16 of the instant application, a “well completion plan” and what that may encompass is discussed:

First a reservoir is modeled as described herein to design a well completion plan for a well. In an embodiment, the drilling well completion plan includes the selection of proposed well bores in a formation. The well completion plan may further include a fracturing plan, which may include the selection of fracture zones and their positioning, fracturing fluids, proppants and fracturing pressures. In other embodiments, the drilling well completion plan may include selecting a particular trajectory of the wellbore or selecting a desired wellbore pressure to facilitate mass transfer and fluid flow to the wellbore.

In my preliminary view, based on the above and in respect of the language of proposed claim 1, the generation of a well completion plan would have involved the selection of locations for wellbores and parameters such as wellbore trajectory, or possibly the selection of fracture zones and their positioning, if the plan involved fracturing.

In the same paragraph at page 12 of the instant application, last sentence, it is stated that:

Based on the optimized model, a drilling plan may be implemented and physical wellbores drilled in accordance with the plan.

In my preliminary view, the language “drilling plan”, which was not used previously in this paragraph, is used to convey the same meaning as “well completion plan”, both involving a plan to physically drill a wellbore and recover hydrocarbons.

In light of the above, it is my preliminary view that “completing a well field according to the well completion plan”, as set out in proposed claim 1, would be interpreted by the person skilled in the art as the physical execution of the completion plan, which would have involved the drilling of a wellbore and recovery of hydrocarbons according to the results from the hydrocarbon reservoir modelling algorithm. As such, the subject-matter of proposed claim 1 as a whole would form a single actual invention that produces discernable physical effects and “manifests a discernable effect or change” (*Amazon* at paragraph 66).

As proposed independent claims 14 and 19 contain the same generation of a well completion plan and completion of a well field according to that plan, these proposed claims would also form a single actual invention that produces discernable physical effects and “manifests a discernable effect or change” (*Amazon* at paragraph 66).

Further, as proposed dependent claims 2-13, 15-18 and 20-22 depend directly or indirectly on proposed independent claims 1, 14 or 19, these too would form a single actual invention that produces discernable physical effects and “manifests a discernable effect or change” (*Amazon* at paragraph 66).

Proposed claims 23-24 are substantially the same as claims 23-24 on file, the only changes being that language has been added to clarify that the steps are performed “at a computer.” As such, proposed claims 23-24 would also be directed to a single actual invention that produces discernable physical effects and “manifests a discernable effect or change” (*Amazon* at paragraph 66).

In light of the above, it is my preliminary view that the actual inventions of proposed claims 1-24 relate to the manual or productive arts, are patentable subject-matter and compliant with section 2 of the *Patent Act*, and are not prohibited subject-matter under subsection 27(8) of the *Patent Act*.

[35] In response to the above analysis, the Applicant proposed amending the claims on file to correspond to the proposed claims.

[36] I conclude that the proposed claims relate to the manual or productive arts, are patentable subject-matter and compliant with section 2 of the *Patent Act*, and are not prohibited subject-matter under subsection 27(8) of the *Patent Act*.

[37] Further, since the claims on file as a whole are not patentable, it is my view that the deletion of the claims on file and the entry of the proposed claims is considered a “necessary” amendment for compliance with the *Patent Act* and *Patent Rules*, as required by subsection 86(11) of the *Patent Rules*.

CONCLUSIONS

- [38] I have determined that claims 1-22 on file are directed to non-patentable subject-matter, are non-compliant with section 2 of the *Patent Act* and are prohibited subject-matter under subsection 27(8) of the *Patent Act*.
- [39] I have also determined that claims 23-24 on file are directed to patentable subject-matter, are compliant with section 2 of the *Patent Act* and are not prohibited subject-matter under subsection 27(8) of the *Patent Act*.
- [40] In my view, the proposed claims submitted with the R-PR are considered “necessary” amendments for compliance with the *Patent Act* and *Patent Rules* as required by subsection 86(11) of the *Patent Rules*.

RECOMMENDATION OF THE BOARD

[41] In view of the above, the undersigned recommends that the Applicant be notified, in accordance with subsection 86(11) of the *Patent Rules*, that specific amendments are “necessary” for compliance with the *Patent Act* and *Patent Rules*, namely:

- The deletion of the claims on file; and
- The entry of the proposed claims submitted by the Applicant on November 4, 2021.

Stephen MacNeil

Member

DECISION OF THE COMMISSIONER

[42] I concur with the conclusions and recommendation of the Board. In accordance with subsection 86(11) of the *Patent Rules*, I hereby notify the Applicant that the following amendments, and only these amendments, must be made in accordance with paragraph 200(b) of the *Patent Rules* within (3) months of the date of this decision, failing which I intend to refuse the application:

- The deletion of the claims on file; and
- The entry of the proposed claims submitted by the Applicant on November 4, 2021.

Virginie Ethier
Assistant Commissioner of Patents

Dated at Gatineau, Quebec

this 14th day of December, 2021