

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte FRED KOO and TING Y. LEUNG

Appeal 2008-1344
Application 10/377,896
Technology Center 2100

Decided: November 26, 2008

Before JAMES D. THOMAS, JAY P. LUCAS and
JOHN A. JEFFERY, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 1-27.¹ We have jurisdiction under 35 U.S.C. § 6(b). We reverse and enter a new ground of rejection under 37 C.F.R. § 41.50(b).

¹ We note that claims 1-27 stand rejected in this case (App. Br. 2). Although Appellants indicate that only claims 1-18 are on appeal (*Id.*), we presume that this statement is a typographical error since independent claim 19

STATEMENT OF THE CASE

Appellants invented a method of optimizing relational database queries. The method includes evaluating the query to identify when a sub-expression of the query is being joined to itself and when a predicate of the query comprises an equality test between a same column of the sub-expression. The method also includes determining when a first row set producible from a first set of references of the query to the sub-expression is subsumed by a second row set producible from a second set of references of the query of the sub-expression. Based on the evaluation and determination steps, the query may be reformed to eliminate the joining of the sub-expression to itself.² Claim 1 is illustrative:

1. A method for optimizing a query in a relational database management system, the method comprising:

evaluating the query to determine whether a sub-expression of the query is being joined to itself and whether a predicate of the query comprises an equality test between a same column of the sub-expression;

determining whether a first row set producible from a first set of references of the query to the sub-expression is subsumed by a second row set producible from a second set of references of the query to the sub-expression; and

contains commensurate limitations. Moreover, the deficiencies with the Examiner's rejection indicated in our decision apply to all independent claims. Accordingly, we presume and will proceed as if all claims are before us on appeal.

² See generally Spec. 10-11.

reforming the query to eliminate the joining of the sub-expression to itself based on evaluation of the query and determination of whether the first row set is subsumed by the second row set.

The Examiner relies on the following prior art references to show unpatentability:

Srivastava	US 6,032,144	Feb. 29, 2000
Sanders	US 6,560,595 B1	May 6, 2003 (filed Nov. 15, 1999)

Venky Harinarayan & Amish Gupta, “OPTIMIZATION USING TUPLE SUBSUMPTION” (1995) (“Gupta”).

1. The Examiner rejects claims 1, 2, 5, 8-11, 14, 17-20, 23, 26, and 27 under 35 U.S.C. § 103(a) as unpatentable over Srivastava and Gupta (Ans. 4-6).
2. The Examiner rejects claims 3, 4, 6, 7, 12, 13, 15, 16, 21, 22, 24, and 25 under 35 U.S.C. § 103(a) as unpatentable over Srivastava, Gupta, and Sanders (Ans. 7-8).

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Briefs³ and the Answer⁴ for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but did not make

³ We refer to (1) the Supplemental Appeal Brief filed November 20, 2006, and (2) the Reply Brief filed August 28, 2007, throughout this opinion.

⁴ We refer to the most recent Answer mailed March 30, 2007, throughout this opinion.

in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c) (1) (vii).

THE OBVIOUSNESS REJECTION OVER SRIVASTAVA AND GUPTA

Claims 1, 2, 5, 8-11, 14, 17-20, 23, 26, and 27

We first consider the Examiner's obviousness rejection of claims 1, 2, 5, 8-11, 14, 17-20, 23, 26, and 27 over Srivastava and Gupta (Ans. 4-6).

Regarding the independent claims,⁵ Appellants argue that the prior art fails to teach or suggest "evaluating the query to determine whether a sub-expression of a query is being joined to itself" (App. Br. 7). Appellants point out that R_1 and R_2 are not the same relation, as "the relation $R_1 (A,B)$ is the multiset of tuples $\{(1,2), (1,2), (1,4)\}$ ' and the relation ' $R_2 (C,D)$ is the [multiset of tuples] $\{(3,5), (3,6), (3,7)\}$ '" (App. Br. 8). Thus, according to Appellants, Srivastava cannot be construed as disclosing "evaluating the query to determine whether a sub-expression of the query is being joined to itself" (App. Br. 8). Appellants add that the secondary reference to Gupta fails to cure the deficiencies of Srivastava (App. Br. 10).

The Examiner argues that Srivastava discloses various examples of evaluating a query (Ans. 10-11). Specifically, the Examiner asserts that these evaluations, which include: (1) computing the "Available" view and then joining it with the "Requests" relation; (2) computing a view A1 using

⁵ Appellants' arguments are limited to independent claims 1 and 10 which each require "evaluating the query to determine whether a sub-expression of the query is being joined to itself." Claim 19 recites commensurate limitations. Accordingly, Appellants' arguments apply also to independent claim 19.

magic sets, and then joining it with the "Requests" relation; and (3) computing a view A2 using theta-semijoin transformations, and then joining it with the "Requests" relation, can be interpreted as disclosing the joining of sub-expressions (*Id.*)

Further, the Examiner contends that Srivastava discloses: (1) the multiplicity of each tuple in the result being the same as in R1, and (2) each copy of tuple $t_1 \in R_1$ being present in the relation when there exists a tuple $t_2 \in R_2$ such that the pair of tuples t_1 and t_2 satisfy the condition of the semijoin (Ans. 11). The Examiner interprets each tuple being exactly the same from one tuple to another, and each copy of tuple 1 being present in tuple 2, as corresponding to "determining whether a sub-expression of the query is being joined to itself" (Ans. 11).

ISSUE

The issue before us, then, is whether Appellants have shown that the Examiner erred in finding the collective teachings of Srivastava and Gupta teach or suggest the limitations of the independent claims. The issue turns on whether the Srivastava reference teaches or suggests "evaluating the query to determine whether a sub-expression of the query is being joined to itself."

FINDINGS OF FACT

1. Using relational techniques, a relational database management system (RDBMS) "stores, manipulates and retrieves data in the form of table-like relations typically defined by a set of columns or

attributes of data types and a set of rows, (*i.e.*, records or tuples) of data” (Spec. 1:16-18).

2. Tables are sometimes referred to as relations or sub-expressions (Spec. 1:16-18; Spec. 8:10; Srivastava, col. 2, l. 30).
3. Quantifiers range over (*i.e.* read from) base tables and correspond to the table referenced in the FROM clause of an SQL query (Spec. 4:18-20).
4. More than one quantifier may range over a common sub-expression (*e.g.*, a table) (Spec. 8:18 - 9:2).
5. Srivastava discloses a relation "Requests" (Srivastava, col. 6, ll. 14-15) and a relation "Available" (Srivastava, col. 6, l. 30). The "Requests" relation contains data about the part requested, the requested quantity and the price limit (Srivastava, col. 6, ll. 14-22), while the "Available" relation “contains information about the cost and total quantity of each part available in all of the warehouses” (Srivastava, col. 6, ll. 30-32). An objective of a query involving the "Requests" relation and the "Available" relation is “to determine which of the customer requests can be satisfied by the parts available in the warehouses” limit (Srivastava, col. 6, ll. 19-22).
6. Srivastava discloses that the relation "Available" is defined by the "PartInfo" relation and the "Warehouse" relation (Srivastava, col. 6, ll. 35-40; *see also* Srivastava col. 6, ll. 65-67).
7. Srivastava discloses a relation "Requests" joined to a relation "Available" (Srivastava, col. 6, ll. 52-53).

8. Srivastava discloses a view A1 and a view A2 (Srivastava, col. 7, ll. 14-17).
9. The view A1 is a specialized version of the Available relation (Srivastava, col. 7, ll. 14-17). Computing the view A1 involves (1) joining the "QueryAvailable" relation with the "PartInfo" relation; (2) joining the resulting intermediate result with the "Warehouse" relation; and (3) performing grouping and aggregating on the resulting relation to generate the A1 view (Srivastava, col. 7, ll. 18-24). The "QueryAvailable" relation is called a "magic" or "query" relation and is referred to as basically the "parts" of the "Requests" relation (Srivastava, col. 7, ll. 9-10).
10. Computing the view A2 involves (1) joining the "Requests" relation with the "PartInfo" relation; (2) joining the resulting intermediate result with the "Warehouse" relation; and (3) performing grouping and aggregating on the resulting relation to generate the A2 view (Srivastava, col. 7, ll. 38-44).
11. Srivastava discloses a view A1 joined to the "Requests" relation and a view A2 joined to the "Requests" relation (Srivastava, col. 6, ll. 54-57).
12. Srivastava uses the symbols R (with or without subscripts) to denote relations (Srivastava, col. 7, ll. 57-58).
13. Srivastava also discloses an example of a θ -semijoin operation (Srivastava, col. 8, ll. 1-17). In that example, the θ -semijoin operation is applied to relations R_1 and R_2 (Srivastava, col. 8, ll. 10-17).

14. Srivastava describes relation R_1 (A,B) as the multiset of tuples $\{(1,2), (1,2) (1,4)\}$ and describes R_2 (C,D) as the multiset of tuples $\{(3,5), (3,6), (3,7)\}$ (Srivastava, col. 8, ll. 15-16).
15. Gupta is entitled "Optimization using Tuple Subsumption (Gupta, *see* title of article). Gupta states "[w]e give algorithms for deciding efficiently when a tuple subsumes another tuple for queries that use arbitrary mathematical functions" (Gupta, *see* Abstract). Further, Gupta defines subsumption as "the identification of the tuples of a database that do not 'contribute' to the result of a query" (Gupta, p.1 §1).

PRINCIPLES OF LAW

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

Discussing the question of obviousness of a patent that claims a combination of known elements, *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), explains:

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless

its actual application is beyond his or her skill. *Sakraida* [v. *AG Pro, Inc.*, 425 U.S. 273 (1976)] and *Anderson's-Black Rock[, Inc. v. Pavement Salvage Co.*, 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

KSR, 127 S. Ct. at 1740. If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that “there was an apparent reason to combine the known elements in the fashion claimed.” *Id.* at 1740-41. Such a showing requires

some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

Id. at 1741 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)) (internal quotation marks omitted).

If the Examiner’s burden is met, the burden then shifts to the Appellants to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

ANALYSIS

Based on the functionality of Srivastava noted in the Findings of Fact section above, we find error in the Examiner's position that the limitations of

the independent claims are taught by the collective teachings of Srivastava and Gupta. Claim 1, for example, requires “evaluating the query to determine whether a sub-expression of the query is being joined to itself” (App. Br. 18).

The Examiner argues that Srivastava disclosed various examples of evaluating a query (Ans. 10-11). Specifically, the Examiner asserts that these evaluations, which include: (1) computing the “Available” view and then joining it with the “Requests” relation; (2) computing a view A1 using magic sets, and then joining it with the “Requests” relation; and (3) computing a view A2 using theta-semijoin transformations, and then joining it with the “Requests” relation, can be interpreted as disclosing the joining of sub-expressions (*Id.*). We disagree.

Srivastava discloses a “Request” relation and an “Available” relation (FF 5). Srivastava further discloses that the “Available” relation is derived from the “Warehouse” and “PartInfo” relations (FF 6). Srivastava in a query, Q1, shows the Requests relation joined to an Available relation by the nomenclature “Requests.Part = Available.Part” (FF 7).

However, this nomenclature does not indicate the joining of a sub-expression (*i.e.*, relation or table) being joined to itself, as the “Requests” relation is not the same as the “Available” relation (FF 5). An objective of the query is “to determine which of the customer requests can be satisfied by the parts available in the warehouses” (*Id.*). Accordingly, the “Requests” relation contains data about the part requested, the requested quantity and the price limit, while the “Available” relation “contains information about

the cost and total quantity of each part available in all of the warehouses”
(*Id.*).

Further, the joining of a view A1 with the "Requests" relation and the joining of a view A2 with the "Requests" relation also does not disclose the joining of a sub-expression to itself. We acknowledge that the computation of A1 involves the “parts” section of the "Requests" relation and the computation of A2 involves the "Requests" relation (FF 9-10). However, the resulting views A1 and A2 are each computed based on a series of steps (*Id.*). More specifically, the resulting views A1 and A2 are the results of additional operations performed on the “parts” section of the "Requests" relation in the case of view A1, and the “Requests” relation in the case of A2 (*Id.*). While the views A1 and A2 were computed using the "Requests" relation, A1 and A2 are not the same as the "Requests" relation (*Id.*). Thus, when Srivastava references joining A1 to the "Requests" relation and A2 to the Requests relation, it is not disclosing joining a sub-expression to itself.

Srivastava also discloses an example of a θ -semijoin operation (FF 13). In that example, the θ -semijoin operation is applied to relations R_1 and R_2 (*Id.*). Srivastava describes relation R_1 (A,B) as the multiset of tuples $\{(1,2), (1,2) (1,4)\}$ and describes R_2 (C,D) as the multiset of tuples $\{(3,5), (3,6), (3,7)\}$ (FF 14). Thus, relations R_1 and R_2 are not the same, as their corresponding multiset of tuples differ (*Id.*). Accordingly, the joining of R_1 and R_2 , in this example of Srivastava, does not correspond to a “sub-expression of the query being joined to itself”, as required by both independent claims 1 and 10.

The Examiner argues that Srivastava discloses that "*the definition of semijoin preserves the multiset semantics, i.e., the multiplicity of each tuple in the result is exactly the same as in R_1 , each copy of tuple $t_1 \in R_1$ is present in the relation if and only if there exists a tuple $t_2 \in R_2$ such that the pair of tuples t_1 and t_2 satisfies the condition of the semijoin*" (Ans. 11). The "Examiner interprets the results of each tuple being exactly the same from one tuple to another, and each copy of tuple 1 being present in tuple 2, to correspond with the determining whether a sub-expression of the query is being joined to itself" (Ans. 11).

The example that the Examiner refers to above describes how to determine the output or result of the semijoin operation (FF 13). When the example refers to each copy of tuple $t_1 \in R_1$ is present in the relation if and only if there exists a tuple $t_2 \in R_2$ such that the pair of tuples t_1 and t_2 satisfies the condition of the semijoin, it is referring to how to determine the result of the semijoin operation, and is not indicating that the tuples are the same. Further, the tuples of R_1 are not the same as the tuples of R_2 (FF 14). Srivastava describes relation $R_1(A,B)$ as the multiset of tuples $\{(1,2), (1,2), (1,4)\}$ and describes $R_2(C,D)$ as the multiset of tuples $\{(3,5), (3,6), (3,7)\}$ (*Id.*).

Gupta is directed to optimization using table subsumption. To achieve such optimization, Gupta discloses mathematical algorithms to identify tuples in a database that do not contribute to the result of a query, for example, when a tuple is subsumed by another tuple (FF 15). As such, Gupta does not cure the deficiencies of Srivastava discussed above.

For the foregoing reasons, Appellants have persuaded us of error in the Examiner's rejection of independent 1. Independent claim 10 also requires "evaluating the query to determine whether a sub-expression of the query is being joined to itself" (App. Br. 20). Independent claim 19 recites commensurate limitations.

Therefore, for the foregoing reasons, we will not sustain the Examiner's rejection of claim 1, and dependent claims 2, 5, 8, and 9 for similar reasons. We also will not sustain the Examiner's rejection of (1) independent claim 10 and dependent claims 11, 14, 17, and 18, and (2) independent claim 19 and dependent claims 20, 23, 26, and 27 for similar reasons.

OTHER REJECTIONS

We will also reverse the Examiner's obviousness rejection of claims 3, 4, 6, 7, 12, 13, 15 and 16, over Srivastava, Gupta, and Sanders (Ans. 7-8). We find that the additional reference to Sanders does not cure the previously-noted deficiencies of Srivastava and Gupta with respect to the independent claims. Accordingly, the Examiner's obviousness rejection of claims 3, 4, 6, 7, 12, 13, 15 and 16 is also not sustained.

CONCLUSION OF LAW

Appellants have shown that the Examiner erred in rejecting claims 1-27 under § 103.

NEW GROUND OF REJECTION

Claim 1 is rejected under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter. We note that claim 1, given its broadest reasonable interpretation, does not require computer or machine implementation. Claim 1 is not directed to a machine, manufacture, or composition of matter. Accordingly, the issue is whether this claim, which covers a method for optimizing a query in a relational database management system, involves a new and useful “process,” and thus, recite patentable subject matter under 35 U.S.C. § 101. Giving the claim limitations their broadest reasonable interpretation, we conclude that claim 1 is unpatentable under section 101 because it seeks to patent an abstract idea.⁶

In view of *In re Bilski*, 2007-1130, slip op. (Fed. Cir. Oct. 30, 2008) we must consider the statutory sufficiency of the recited claims under 35 U.S.C. § 101. Under *Bilski*, “the machine-or-transformation test is the only applicable test and must be applied, in light of the guidance provided by the Supreme Court and this court, when evaluating the patent-eligibility of process claims.” (*Id.*, slip op. at 29).

Claim 1 does not recite any steps that necessarily involve machine implementation. While the preamble of claim 1 recites a "system," the "system" of claim 1 is not recited in terms of hardware or tangible structural

⁶ Specifically, the Court has held that a claim is not a patent-eligible "process" if it claims "laws of nature, natural phenomena, [or] abstract ideas." *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) (citing *Parker v. Flook*, 437 U.S. 584, 589 (1978) and *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972)).

elements. Rather, the "system" could be a software system, where the elements of claim 1 are implemented solely in software or algorithms. Thus, the nominal recitation of a "system" in the preamble does not transform claim 1 into patentable subject matter under § 101.

The method of claim 1 contains the following steps, repeated from above:

- *evaluating* the query to determine whether a sub-expression of the query is being joined to itself and whether a predicate of the query comprises an equality test between a same column of the sub-expression;
- *determining* whether a first row set producible from a first set of references of the query to the sub-expression is subsumed by a second row set producible from a second set of references of the query to the sub-expression; and
- *reforming* the query to eliminate the joining of the sub-expression to itself based on evaluation of the query and determination of whether the first row set is subsumed by the second row set.

When we read the claims broadly, as they must be read during the examination process⁷, the first step, the “*evaluating*” step, involves determining whether a query is being joined to itself and whether a predicate comprises an equality test between a same column of a sub-expression. The next step, the “*determining*” step involves an analysis of whether a first row set ... is subsumed by a second row set. Lastly, the “*reforming step*” is a

⁷ Our reviewing court states in *In re Zletz*, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989) that “claims must be interpreted as broadly as their terms reasonably allow.”

mere reference to eliminating the joining of a sub-expression to itself when the first row set is subsumed by the second row set.

Each of these steps does not call for any transformation of an article to a different state or thing, nor does it require any transformation of data or signals. Further, the claim does not recite any particular machine or apparatus to perform the recited steps and therefore does not recite a statutory process under *Bilski*.

For the foregoing reasons, claim 1 fails to recite statutory subject matter under § 101. Although we decline to reject every claim under our discretionary authority under 37 C.F.R. 41.50(b), we emphasize that our decision does not mean the remaining claims are patentable. Rather, we merely leave the patentability determination of these claims to the Examiner. *See* MPEP § 1213.02.

DECISION

We have not sustained the Examiner's rejections with respect to any claims on appeal. Therefore, the Examiner's decision rejecting claims 1-27 is reversed. Moreover, we have entered a new grounds of rejection under 37 C.F.R. § 41.50(b) for claim 1 as failing to recite statutory subject matter under 35 U.S.C. § 101.

This decision contains a new ground of rejection pursuant to 37 C.F.R. § 41.50(b). That section provides that “[a] new ground of rejection ... shall not be considered final for judicial review.”

Section 41.50(b) also provides that the Appellants, **WITHIN TWO MONTHS FROM THE DATE OF THE DECISION**, must exercise one of

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the following two options with respect to the new ground of rejection to avoid termination of the appeal as to the rejected claims:

(1) Reopen prosecution. Submit an appropriate amendment of the claims so rejected or new evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the proceeding will be remanded to the examiner....

(2) Request rehearing. Request that the proceeding be reheard under § 41.52 by the Board upon the same record....

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

REVERSED
37 C.F.R. § 41.50(b)

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