Presentation of Petitioner

Google Inc.

IPR2015-00343, IPR2015-00345, IPR2015-347, IPR2015-348

U.S. Patent Nos. 8,010,988 (Ex. 1022)
8,205,237 (Ex. 1021)
8,640,179 (Ex. 1022)
8,656,441 (Ex. 1022)

Presented by:
James J. Elacqua
Skadden, Arps, Slate, Meagher & Flom LLP

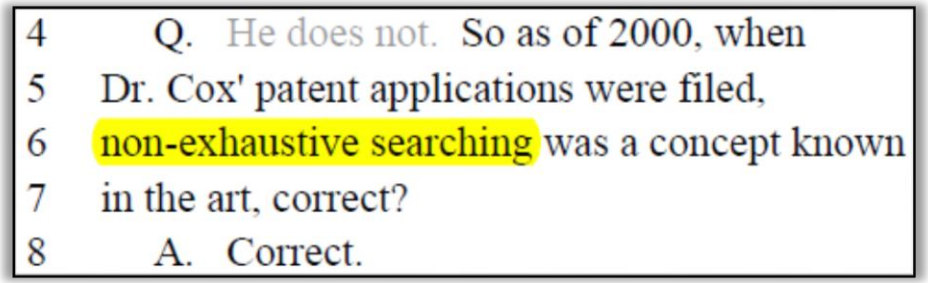
Overview

- Only three references are at issue:

Reference	Non-exhaustive search	Identifying a neighbor	Determining an action	Sublinear search
Ghias (Ex. 1010)	X	X	X	
Iwamura (Ex. 1012)	X	X		X
Conwell (Ex. 1009)	X	X		

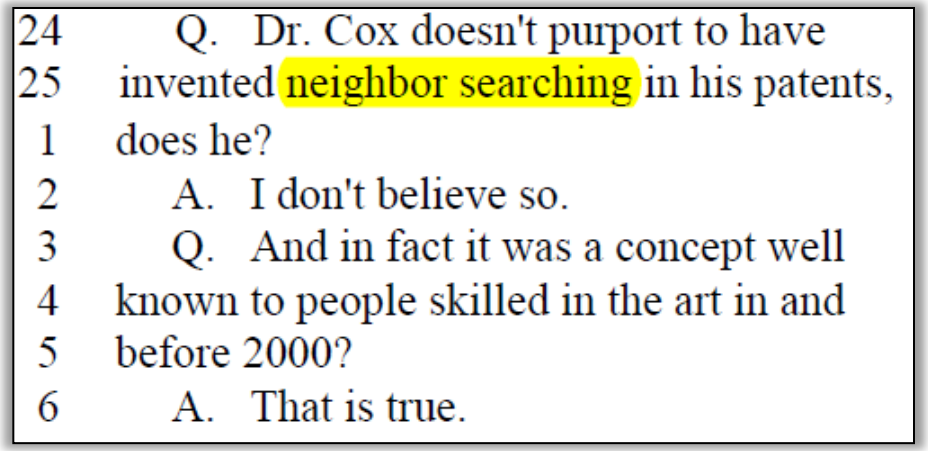
Overview

- Dr. Karypis agrees that the concepts of non-exhaustive search and neighbor search were known at the time of filing



Q. He does not. So as of 2000, when Dr. Cox' patent applications were filed, non-exhaustive searching was a concept known in the art, correct?
A. Correct.

Karypis Tr. (Ex. 1020) at 26:4-8



Q. Dr. Cox doesn't purport to have invented neighbor searching in his patents, does he?
A. I don't believe so.
Q. And in fact it was a concept well known to people skilled in the art in and before 2000?
A. That is true.

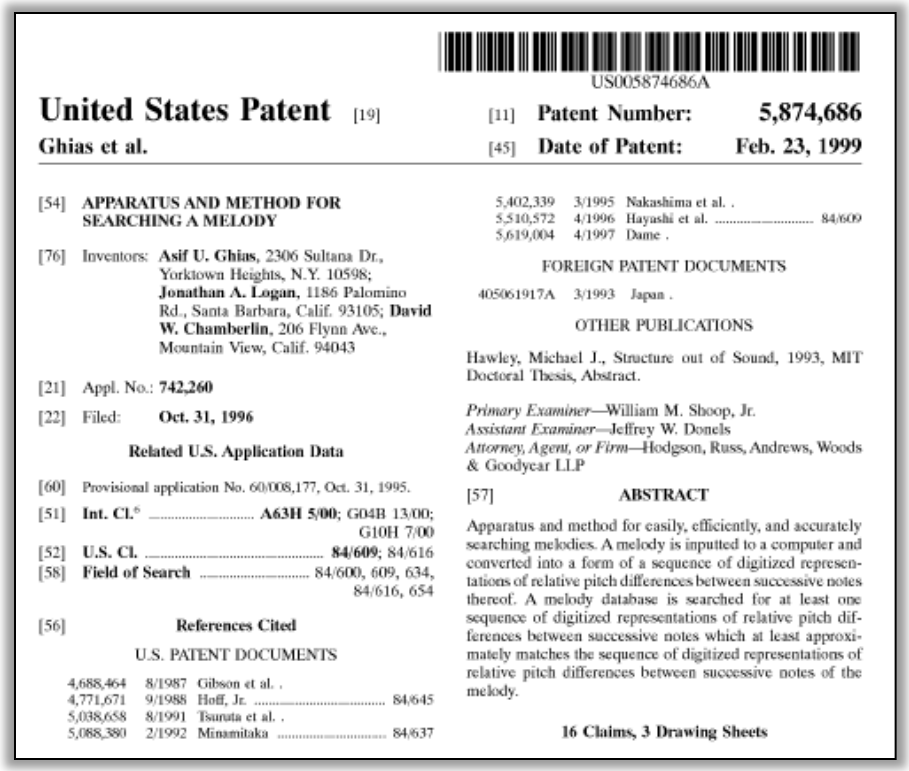
Karypis Tr. (Ex. 1020) at 78:24-79:6

Ghias – Overview

Ex. 1010

- The parties' dispute with respect to Ghias is confined to three limitations:

1. Non-exhaustive search
2. Identifying a neighbor
3. Determining an action



US005874686A

United States Patent [19]

Ghias et al.

[11] **Patent Number: 5,874,686**

[45] **Date of Patent: Feb. 23, 1999**

[54] **APPARATUS AND METHOD FOR SEARCHING A MELODY**

[76] Inventors: **Asif U. Ghias**, 2306 Sultana Dr., Yorktown Heights, N.Y. 10598; **Jonathan A. Logan**, 1186 Palomino Rd., Santa Barbara, Calif. 93105; **David W. Chamberlin**, 206 Flynn Ave., Mountain View, Calif. 94043

[21] Appl. No.: **742,260**

[22] Filed: **Oct. 31, 1996**

Related U.S. Application Data

[60] Provisional application No. 60/008,177, Oct. 31, 1995.

[51] **Int. Cl.**[6] **A63H 5/00**; G04B 13/00; G10H 7/00

[52] **U.S. Cl.** **84/609**; 84/616

[58] **Field of Search** 84/600, 609, 634, 84/616, 654

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,688,464	8/1987	Gibson et al. .	
4,771,671	9/1988	Hoff, Jr.	84/645
5,038,658	8/1991	Tsuruta et al. .	
5,088,380	2/1992	Minamitaka	84/637
5,402,339	3/1995	Nakashima et al. .	
5,510,572	4/1996	Hayashi et al.	84/609
5,619,004	4/1997	Dame .	

FOREIGN PATENT DOCUMENTS

405061917A	3/1993	Japan .

OTHER PUBLICATIONS

Hawley, Michael J., Structure out of Sound, 1993, MIT Doctoral Thesis, Abstract.

Primary Examiner—William M. Shoop, Jr.
Assistant Examiner—Jeffrey W. Donels
Attorney, Agent, or Firm—Hodgson, Russ, Andrews, Woods & Goodyear LLP

[57] **ABSTRACT**

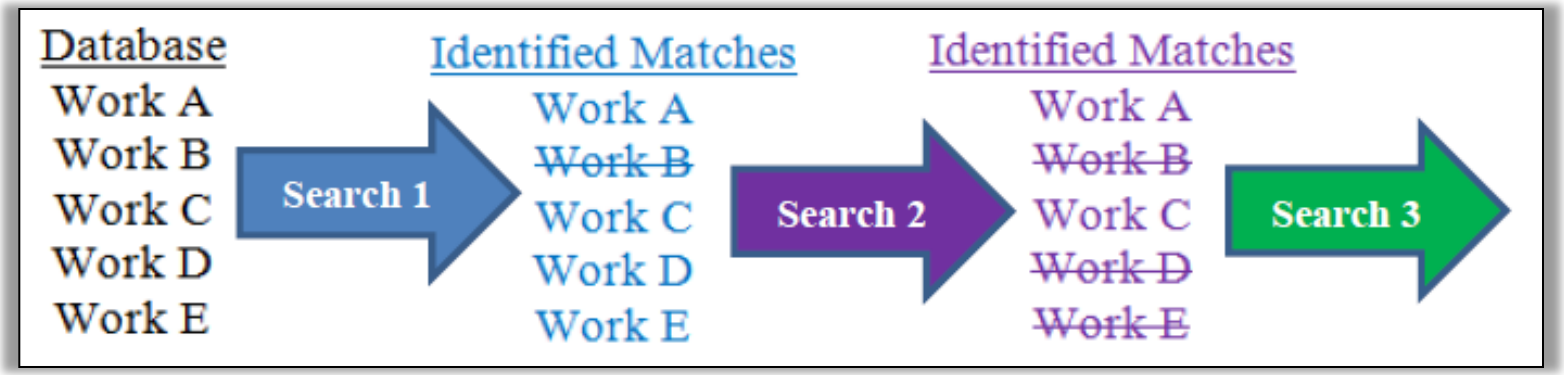
Apparatus and method for easily, efficiently, and accurately searching melodies. A melody is inputted to a computer and converted into a form of a sequence of digitized representations of relative pitch differences between successive notes thereof. A melody database is searched for at least one sequence of digitized representations of relative pitch differences between successive notes which at least approximately matches the sequence of digitized representations of relative pitch differences between successive notes of the melody.

16 Claims, 3 Drawing Sheets

Ghias

Ghias Discloses A Second Search

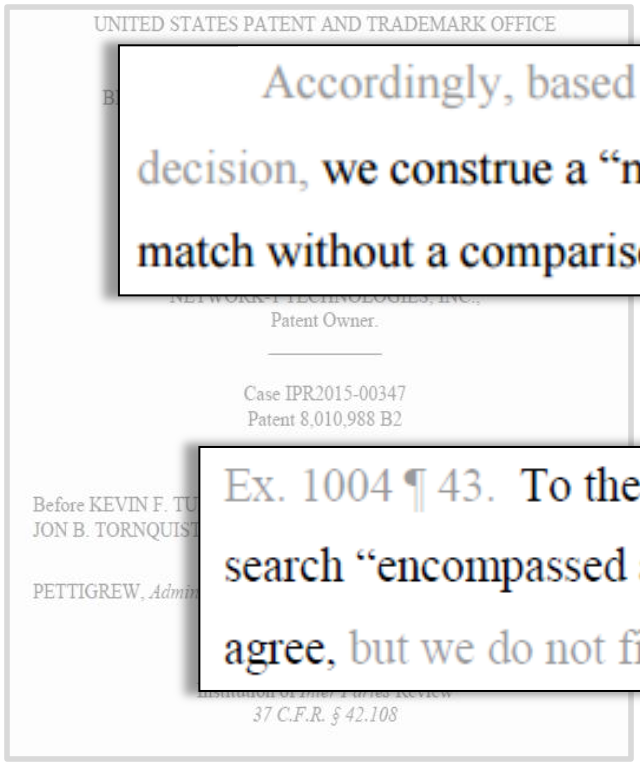
- The subsequent searches do not consider all references



'988 Google's Reply (Paper 20) at 6

Ghias – Non-Exhaustive Search

- The Board construed "non-exhaustive search"


UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner.

Case IPR2015-00347
Patent 8,010,988 B2

Before KEVIN F. TU
JON B. TORNQUIST

PETTIGREW, *Admin*

37 C.F.R. § 42.108

Accordingly, based on the instant record and for purposes of this decision, we construe a "non-exhaustive search" as "a search that locates a match without a comparison of all possible matches."

'988 Institution Decision (Paper 6) at 7

Ex. 1004 ¶ 43. To the extent Dr. Moulin testifies that a non-exhaustive search "encompassed anything other than a 'brute force' search," *id.*, we agree, but we do not find that his testimony supports the latter portion of

'988 Institution Decision (Paper 6) at 7

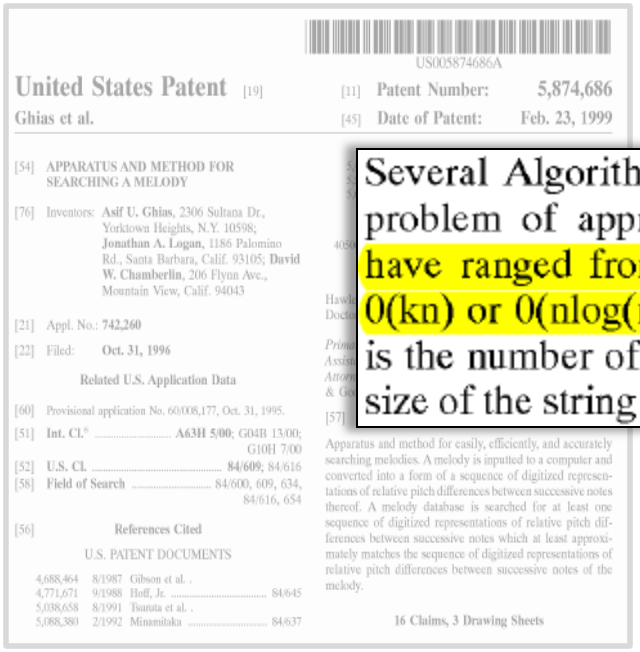
Ghias – Non-Exhaustive Search

- Ghias discloses non-exhaustive search
  - Ghias self-identifies as a different-than-brute-force (i.e., non-exhaustive) search (Ghias, Ex. 1010, at 6:23-28, 7:41-45)
  - The Board properly identified the second search taught by Ghias as a non-exhaustive search (Ghias, Ex. 1010, at 7:5-8)

Ghias – Non-Exhaustive Search

Ghias Self-Identifies Its Searches As Non-Exhaustive

- Ghias discloses search algorithms <u>different than brute force</u> search, i.e., non-exhaustive search algorithms



US005874686A

United States Patent [19]

Ghias et al.

[11] Patent Number: 5,874,686

[45] Date of Patent: Feb. 23, 1999

[54] APPARATUS AND METHOD FOR SEARCHING A MELODY

[76] Inventors: **Asif U. Ghias**, 2306 Sultana Dr., Yorktown Heights, N.Y. 10598; **Jonathan A. Logan**, 1186 Palomino Rd., Santa Barbara, Calif. 93105; **David W. Chamberlin**, 206 Flynn Ave., Mountain View, Calif. 94043

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[51] Int. Cl.[6] A63H 5/00; G04B 13/00; G10H 7/00

[52] U.S. Cl. 84/609; 84/616

[58] Field of Search 84/600, 609, 634, 84/616, 654

[56] References Cited

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4,771,671	9/1988	Hoff, Jr.	84/645
5,038,658	8/1991	Tsuruta et al. .	
5,088,380	2/1992	Minamitaka	84/637

Apparatus and method for easily, efficiently, and accurately searching melodies. A melody is inputted to a computer and converted into a form of a sequence of digitized representations of relative pitch differences between successive notes thereof. A melody database is searched for at least one sequence of digitized representations of relative pitch differences between successive notes which at least approximately matches the sequence of digitized representations of relative pitch differences between successive notes of the melody.

16 Claims, 3 Drawing Sheets

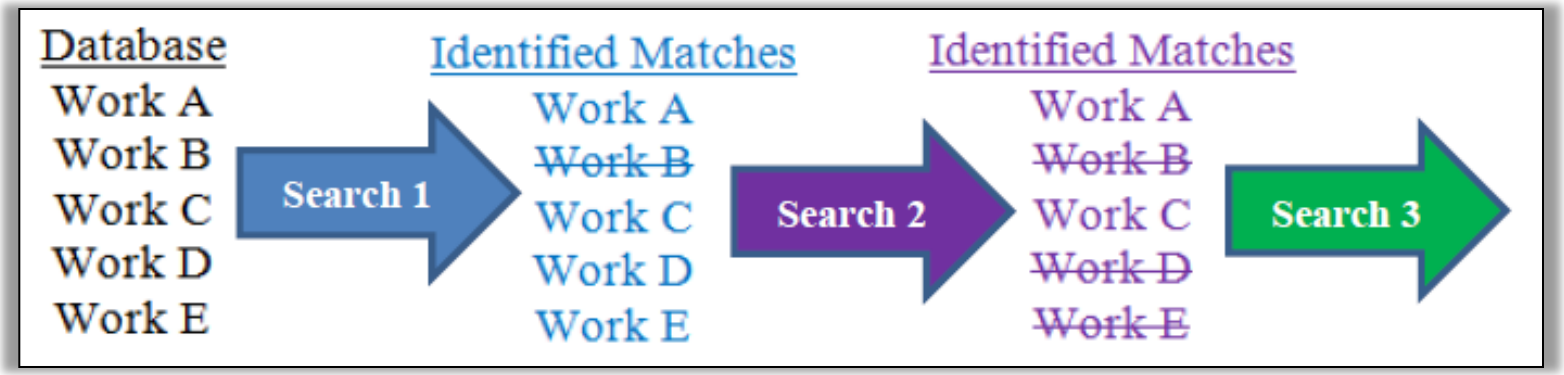
Several Algorithms have been developed that address the problem of approximate string matching. Running times have ranged from 0(mn) for the brute force algorithm to 0(kn) or 0(nlog(m), where "0" means "on the order of," m is the number of pitch differences in the query, and n is the size of the string (song). See Ricardo Baeza-Yates and G. H.

Ghias (Ex. 1010) at 6:23-28

Ghias

Ghias Discloses A Second Search

- The subsequent searches do not consider all references

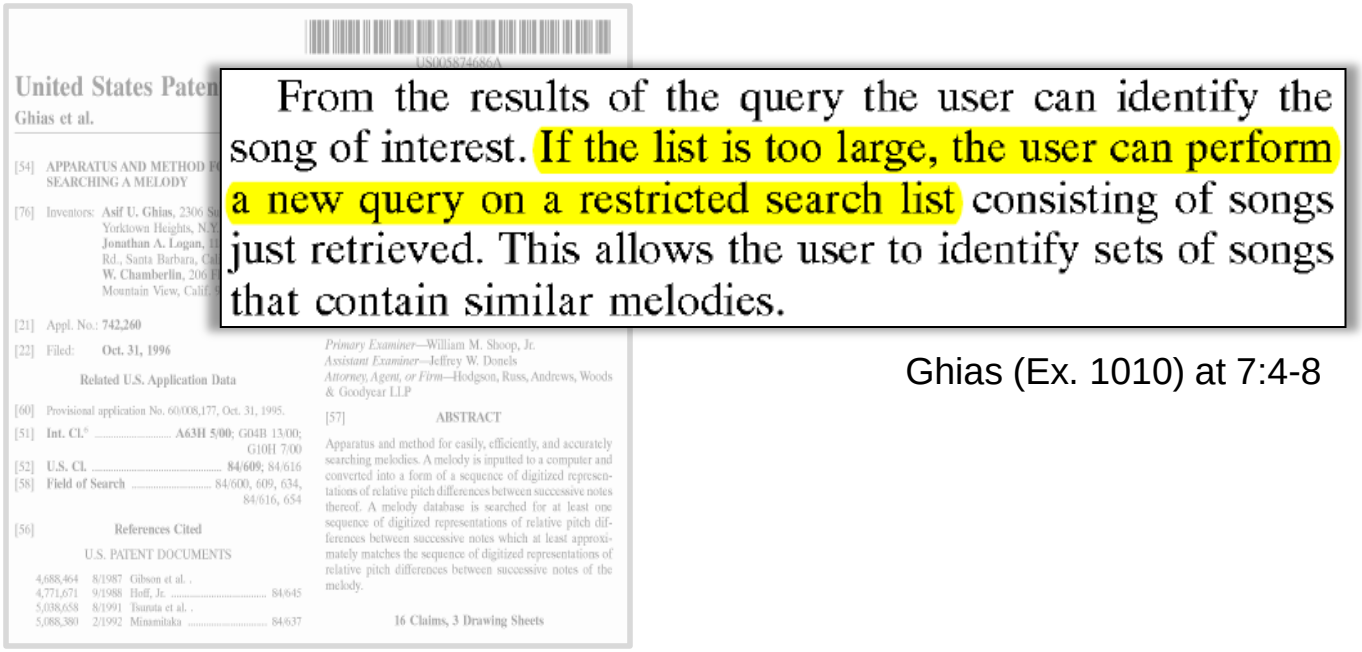


'988 Google's Reply (Paper 20) at 6

Ghias – Identifying a Neighbor / Neighbor Search

Subsequent Searches Are Non-Exhaustive

- Ghias discloses a second search that only searches the songs returned from a first search



United States Paten
Ghias et al.

[54] APPARATUS AND METHOD F
SEARCHING A MELODY

[76] Inventors: Asif U. Ghias, 2306 S
Yorktown Heights, N.Y.
Jonathan A. Logan, 1
Rd., Santa Barbara, Cal
W. Chamberlin, 206 F
Mountain View, Calif. 9

[21] Appl. No.: 742,260

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[51] Int. Cl.[6] A63H 5/00; G04B 13/00; G10H 7/00

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[58] Field of Search 84/600, 609, 634, 84/616, 654

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Primary Examiner—William M. Shoop, Jr.
Assistant Examiner—Jeffrey W. Donels
Attorney, Agent, or Firm—Hodgson, Russ, Andrews, Woods & Goodyear LLP

[57] ABSTRACT

Apparatus and method for easily, efficiently, and accurately searching melodies. A melody is inputted to a computer and converted into a form of a sequence of digitized representations of relative pitch differences between successive notes thereof. A melody database is searched for at least one sequence of digitized representations of relative pitch differences between successive notes which at least approximately matches the sequence of digitized representations of relative pitch differences between successive notes of the melody.

16 Claims, 3 Drawing Sheets

From the results of the query the user can identify the song of interest. If the list is too large, the user can perform a new query on a restricted search list consisting of songs just retrieved. This allows the user to identify sets of songs that contain similar melodies.

Ghias (Ex. 1010) at 7:4-8

Ghias – Non-Exhaustive Search

Subsequent Searches Are Non-Exhaustive

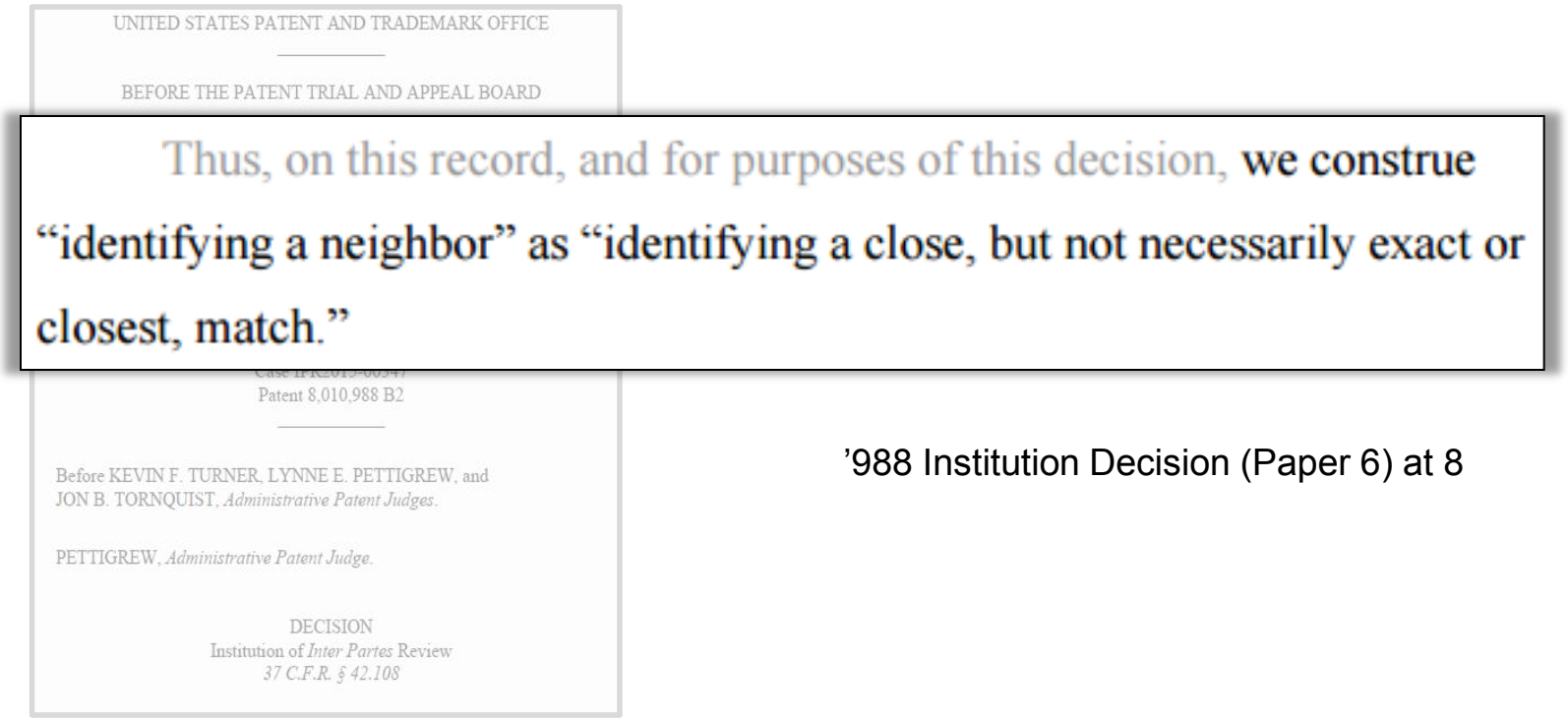
- The Board correctly identified the second search disclosed in Ghias as an example of a non-exhaustive search

the key-search." Ex. 1010, 6:63–65 (emphasis added). Ghias further provides that "the user can perform a *new query on a restricted search list consisting of songs just retrieved*. This allows the user to identify sets of songs that contain similar melodies." *Id.* at 7:5–8 (emphasis added). Thus, Ghias makes clear that the search need not be exhaustive, as Patent Owner argues, and will act to "identify[] a close, but not necessarily exact or closest, match," per our claim construction. Additionally, given the

'988 Institution Decision (Paper 6) at 12

Claim Construction – Identifying a Neighbor

- The parties agree that "identifying a neighbor" and "neighbor search" are interchangeable
- The Board construed both terms



UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Thus, on this record, and for purposes of this decision, **we construe "identifying a neighbor" as "identifying a close, but not necessarily exact or closest, match."**

Patent 8,010,988 B2

Before KEVIN F. TURNER, LYNNE E. PETTIGREW, and JON B. TORNQUIST, *Administrative Patent Judges*.

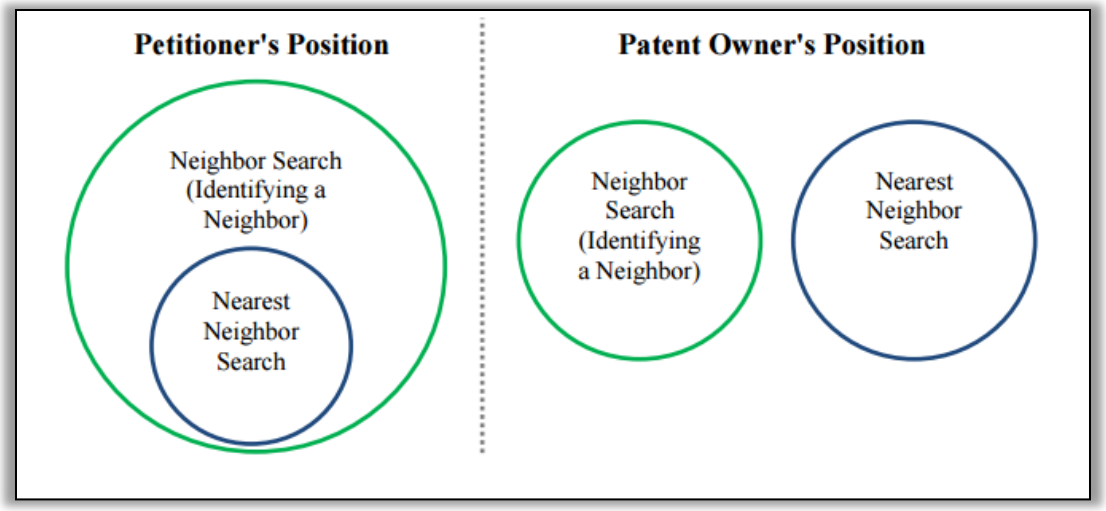
PETTIGREW, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

'988 Institution Decision (Paper 6) at 8

Claim Construction – Identifying a Neighbor

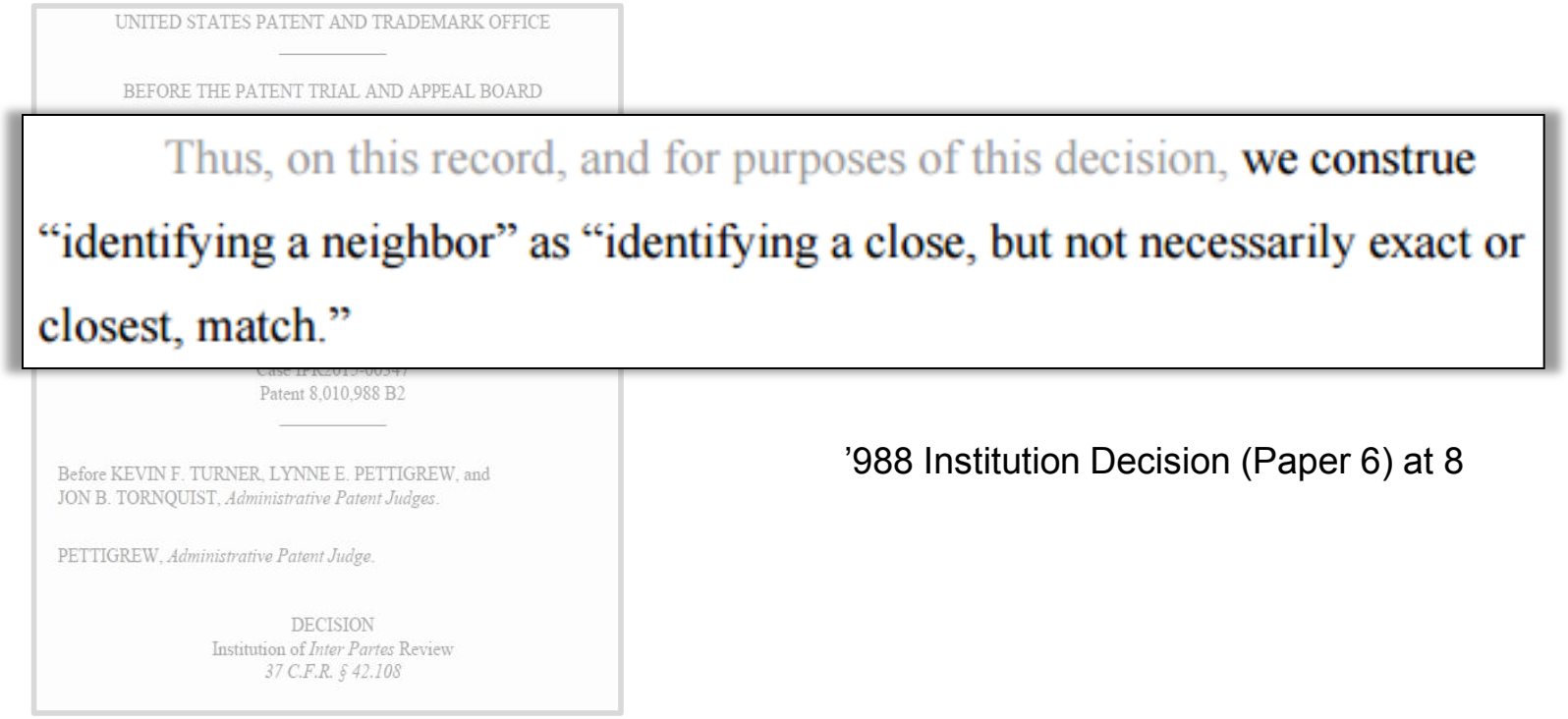
- Google's position: nearest neighbor search is a type of neighbor search
- Network-1's position: nearest neighbor search is **not** a type of neighbor search



'988 Google's Reply (Paper 20) at 4

Claim Construction – Identifying a Neighbor

- Network-1 reads the Board's language of "*not necessarily* exact or closest" as "*necessarily not* exact or closest"



UNITED STATES PATENT AND TRADEMARK OFFICE

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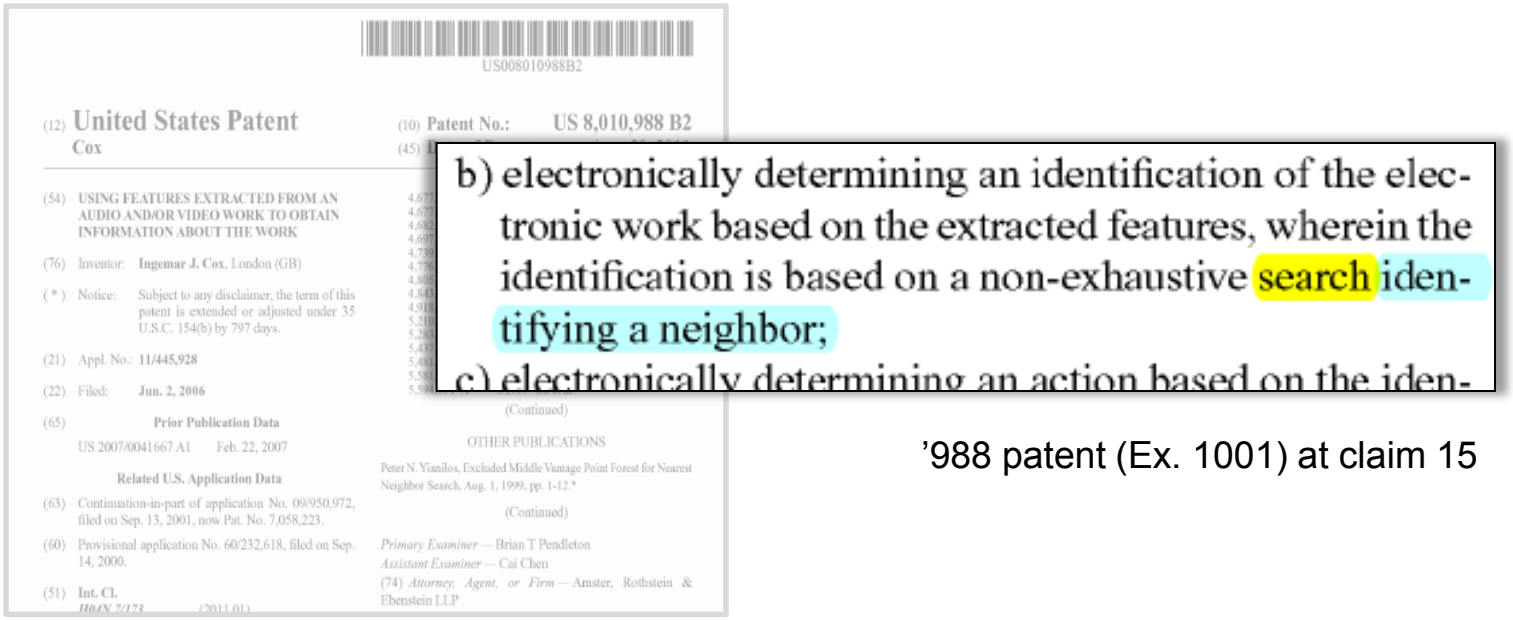
PETTIGREW, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

'988 Institution Decision (Paper 6) at 8

Claim Construction – Identifying a Neighbor

- Independent claim 15 recites a search "identifying a neighbor"



US008010988B2

(12) United States Patent
Cox

(10) Patent No.: US 8,010,988 B2

(54) USING FEATURES EXTRACTED FROM AN AUDIO AND/OR VIDEO WORK TO OBTAIN INFORMATION ABOUT THE WORK

(76) Inventor: Ingemar J. Cox, London (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 797 days.

(21) Appl. No.: 11/445,928

(22) Filed: Jun. 2, 2006

(65) Prior Publication Data

US 2007/0041667 A1 Feb. 22, 2007

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/950,972, filed on Sep. 13, 2001, now Pat. No. 7,058,223.

(60) Provisional application No. 60/232,618, filed on Sep. 14, 2000.

(51) Int. Cl.

(Continued)

OTHER PUBLICATIONS

Peter N. Yianilos, Excluded Middle Vantage Point Forest for Nearest Neighbor Search, Aug. 1, 1999, pp. 1-12.*

(Continued)

Primary Examiner — Brian T Pendleton
Assistant Examiner — Cai Chen
(74) *Attorney, Agent, or Firm* — Amster, Rothstein & Ebenstein LLP

b) electronically determining an identification of the electronic work based on the extracted features, wherein the identification is based on a non-exhaustive search identifying a neighbor;

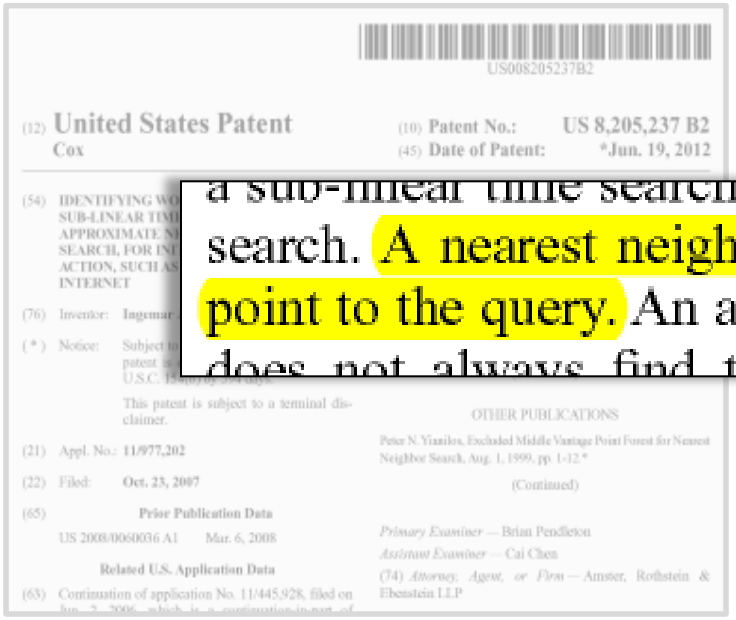
c) electronically determining an action based on the iden-

'988 patent (Ex. 1001) at claim 15

Claim Construction – Identifying a Neighbor

- The dependent claims specify that the "search **identifying a neighbor**" may be any of the following "nearest neighbor searches":
  - Claim 18 – "based on kd-trees"
  - Claim 19 – "based on vantage point trees"
  - Claim 20 – "based on excluded middle vantage point forest"
- The specification identifies each of these search algorithms as forms of "nearest neighbor search" ('988 patent at 22:1-6, 22:10-12, 22:18-19)

Claim Construction – Identifying a Neighbor


US008205237B2

(12) United States Patent
Cox

(10) Patent No.: US 8,205,237 B2
(45) Date of Patent: *Jun. 19, 2012

(54) IDENTIFYING WO... SUB-LINEAR TIM... APPROXIMATE NE... SEARCH, FOR INT... ACTION, SUCH AS... INTERNET

(76) Inventor: Ingemar...

(*) Notice: Subject to... patent is... U.S.C. 154(b)... This patent is subject to a terminal dis-claimer.

(21) Appl. No.: 11/977,202

(22) Filed: Oct. 23, 2007

(65) Prior Publication Data

US 2008/0060036 A1 Mar. 6, 2008

Related U.S. Application Data

(63) Continuation of application No. 11/445,928, filed on Jun. 2, 2006, which is a continuation-in-part of...

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Peter N. Yianilos, Excluded Middle Vantage Point Forest for Nearest Neighbor Search, Aug. 1, 1999, pp. 1-12.*

(Continued)

Primary Examiner — Brian Pendleton
Assistant Examiner — Cai Chen
(74) *Attorney, Agent, or Firm* — Amster, Rothstein & Ebenstein LLP

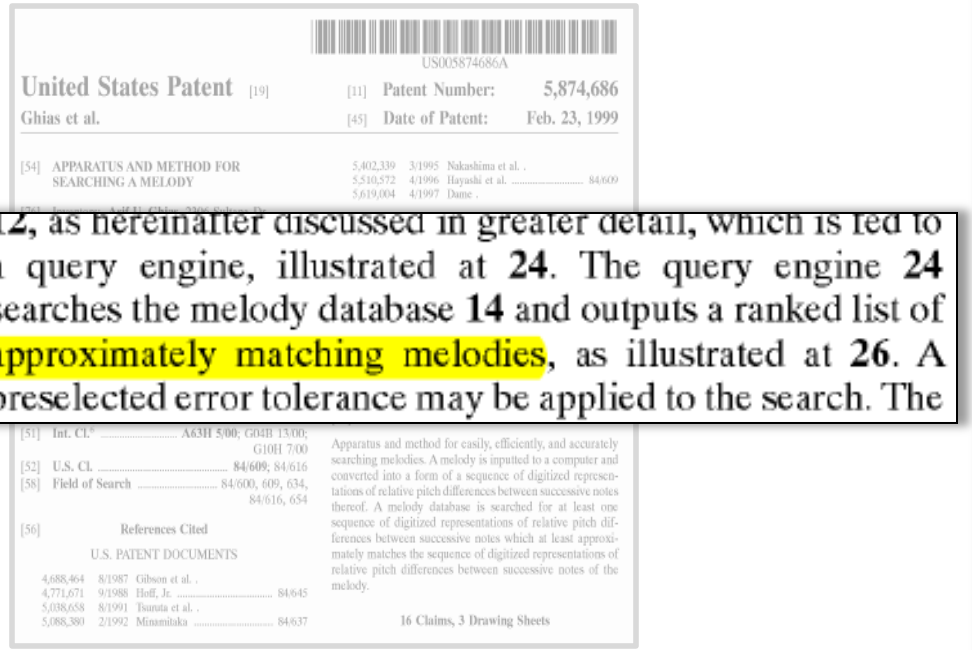
a sub-linear time search is an approximate nearest neighbor search. A nearest neighbor search always finds the closest point to the query. An approximate nearest neighbor search 15
does not always find the closest point to the query. For

’237 patent (Ex. 1021) at 9:14-15

Ghias – Identifying a Neighbor / Neighbor Search

No Dispute Ghias Discloses Finding A Close Match

- There is no dispute that Ghias identifies "approximately matching melodies"



US005874686A

United States Patent [19]
Ghias et al.

[11] Patent Number: 5,874,686
[45] Date of Patent: Feb. 23, 1999

[54] APPARATUS AND METHOD FOR SEARCHING A MELODY

5,402,339 3/1995 Nakashima et al. .
5,510,572 4/1996 Hayashi et al. 84/609
5,619,004 4/1997 Dame .

12, as hereinafter discussed in greater detail, which is fed to
50 a query engine, illustrated at **24**. The query engine **24** searches the melody database **14** and outputs a ranked list of approximately matching melodies, as illustrated at **26**. A preselected error tolerance may be applied to the search. The

[51] Int. Cl.[6] A63H 5/00; G04B 13/00; G10H 7/00
[52] U.S. Cl. 84/609; 84/616
[58] Field of Search 84/600, 609, 634, 84/616, 654

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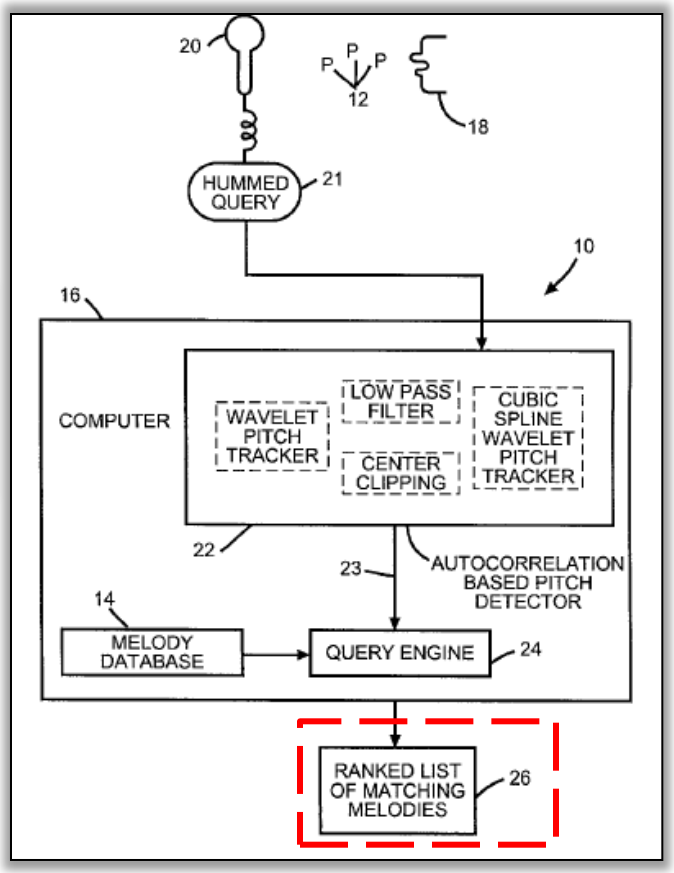
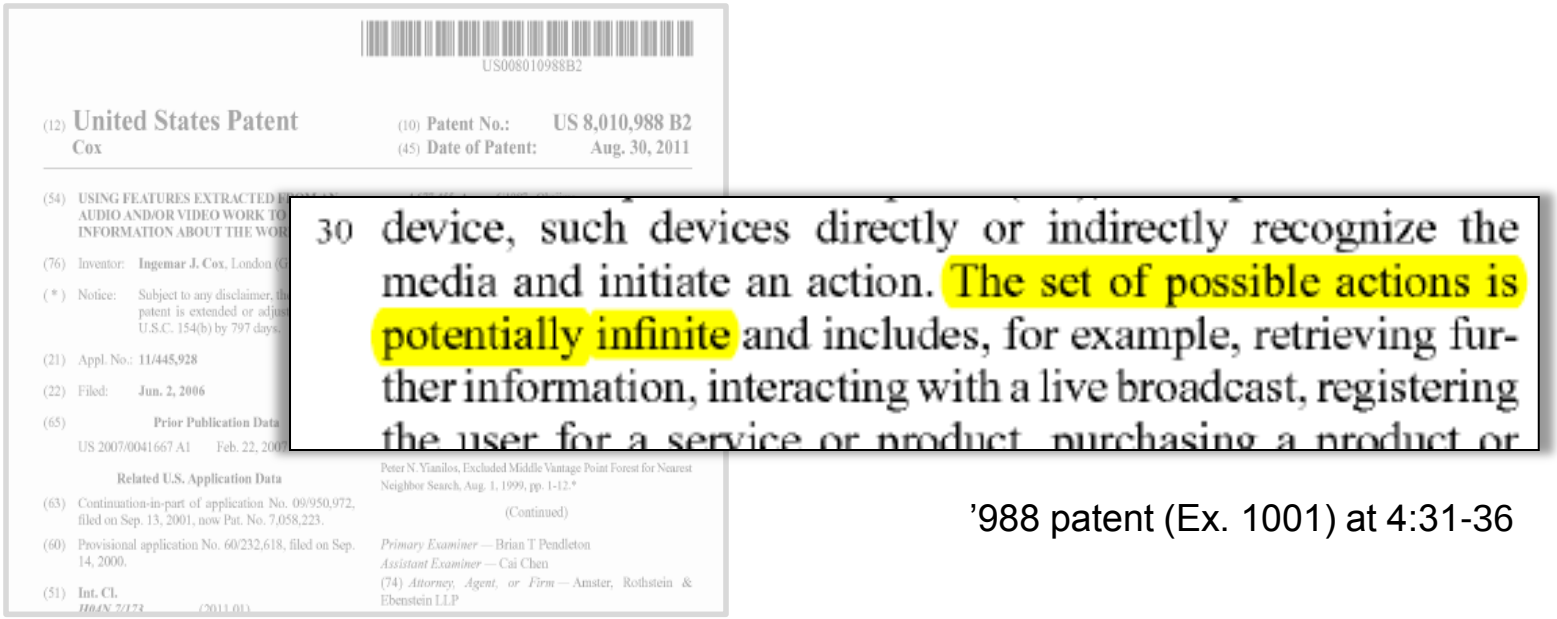
16 Claims, 3 Drawing Sheets

Ghias (Ex. 1010) at 2:50-52 & Fig. 1



Ghias – Determining an Action

- "Action" refers broadly to any act that the system executes



US008010988B2

(12) United States Patent
Cox

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(45) Date of Patent: Aug. 30, 2011

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(51) Int. Cl.
H04N 7/173 (2011.01)

Peter N. Yianilos, Excluded Middle Vantage Point Forest for Nearest Neighbor Search, Aug. 1, 1999, pp. 1-12.*

(Continued)

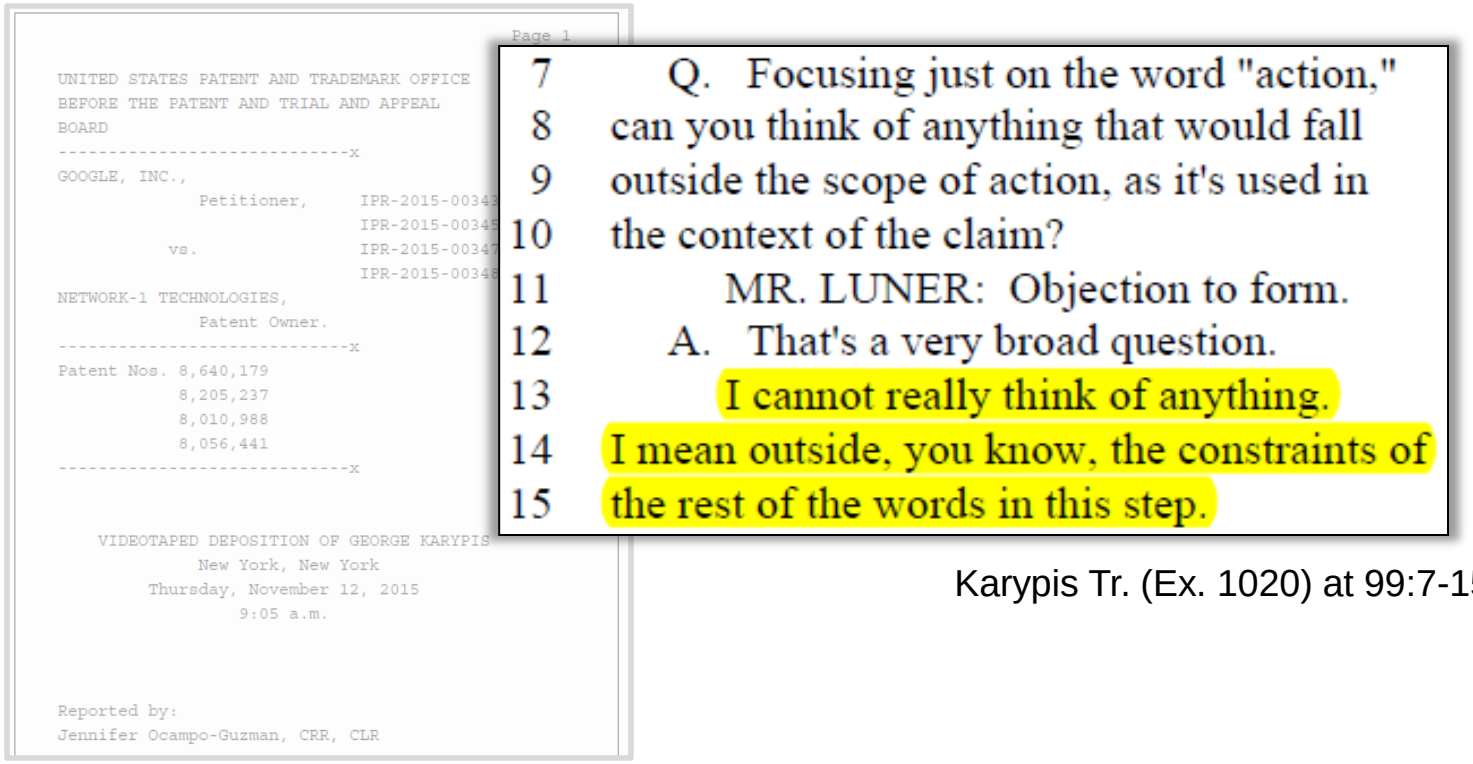
Primary Examiner — Brian T Pendleton
Assistant Examiner — Cai Chen
(74) *Attorney, Agent, or Firm* — Amster, Rothstein & Ebenstein LLP

30 device, such devices directly or indirectly recognize the media and initiate an action. The set of possible actions is potentially infinite and includes, for example, retrieving further information, interacting with a live broadcast, registering the user for a service or product, purchasing a product or

'988 patent (Ex. 1001) at 4:31-36

Ghias – Determining an Action

- Dr. Karypis agrees that the claim term is broad and practically limitless



Page 1

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT AND TRIAL AND APPEAL BOARD

GOOGLE, INC.,
Petitioner, IPR-2015-00343
IPR-2015-00345
vs. IPR-2015-00347
IPR-2015-00348

NETWORK-1 TECHNOLOGIES,
Patent Owner.

Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441

VIDEOTAPED DEPOSITION OF GEORGE KARYPIS
New York, New York
Thursday, November 12, 2015
9:05 a.m.

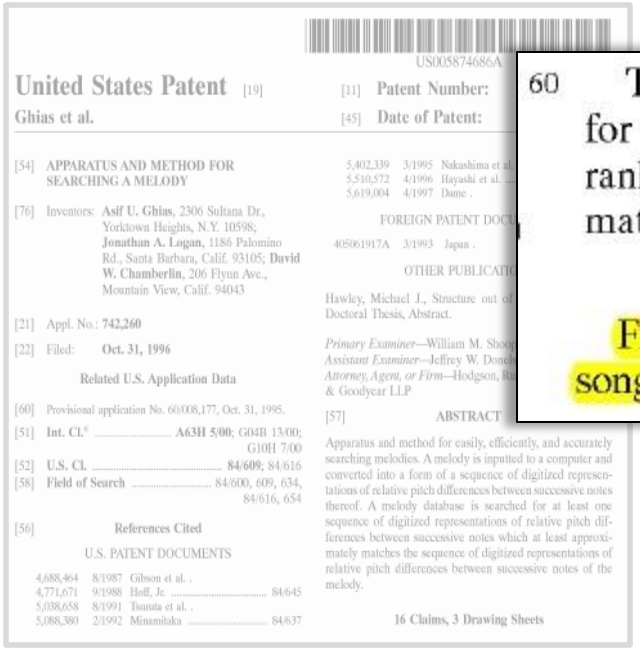
Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

7 Q. Focusing just on the word "action,"
8 can you think of anything that would fall
9 outside the scope of action, as it's used in
10 the context of the claim?
11 MR. LUNER: Objection to form.
12 A. That's a very broad question.
13 I cannot really think of anything.
14 I mean outside, you know, the constraints of
15 the rest of the words in this step.

Karypis Tr. (Ex. 1020) at 99:7-15

Ghias – Determining an Action

- Ghias displays a list of search results to the user, which would include information such as the artist and title so the user can identify the desired song



US005874686A

United States Patent [19]
Ghias et al.

[11] Patent Number:
[45] Date of Patent:

[54] APPARATUS AND METHOD FOR SEARCHING A MELODY

[76] Inventors: **Asif U. Ghias**, 2306 Sultana Dr., Yorktown Heights, N.Y. 10598; **Jonathan A. Logan**, 1186 Palomino Rd., Santa Barbara, Calif. 93105; **David W. Chamberlin**, 206 Flynn Ave., Mountain View, Calif. 94043

[21] Appl. No.: **742,260**

[22] Filed: **Oct. 31, 1996**

Related U.S. Application Data

[60] Provisional application No. 60/008,177, Oct. 31, 1995.

[51] **Int. Cl.**[6] **A63H 5/00**; G04B 13/00; G10H 7/00

[52] **U.S. Cl.** **84/609**; 84/616

[58] **Field of Search** 84/600, 609, 634, 84/616, 654

[56] References Cited

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4,771,671 9/1988 Hoff, Jr. 84/645
5,038,658 8/1991 Tsuruta et al. .
5,088,380 2/1992 Minamitaka 84/637
5,402,339 3/1995 Nakashima et al. .
5,510,572 4/1996 Hayashi et al. .
5,619,004 4/1997 Dame .

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405061917A 3/1993 Japan .

OTHER PUBLICATI

Hawley, Michael J., Structure out of Doctoral Thesis, Abstract.

Primary Examiner—William M. Shoop
Assistant Examiner—Jeffrey W. Donels
Attorney, Agent, or Firm—Hodgson, Ru & Goodyear LLP

[57] ABSTRACT

Apparatus and method for easily, efficiently, and accurately searching melodies. A melody is inputted to a computer and converted into a form of a sequence of digitized representations of relative pitch differences between successive notes thereof. A melody database is searched for at least one sequence of digitized representations of relative pitch differences between successive notes which at least approximately matches the sequence of digitized representations of relative pitch differences between successive notes of the melody.

16 Claims, 3 Drawing Sheets

60 The computer **16** may desirably be programmed so that, for a given query, the database **14** returns a list of songs ranked by how well they matched the query, not just one best match. The number of matches that the database **14** should

From the results of the query the user can identify the song of interest. If the list is too large, the user can perform 5

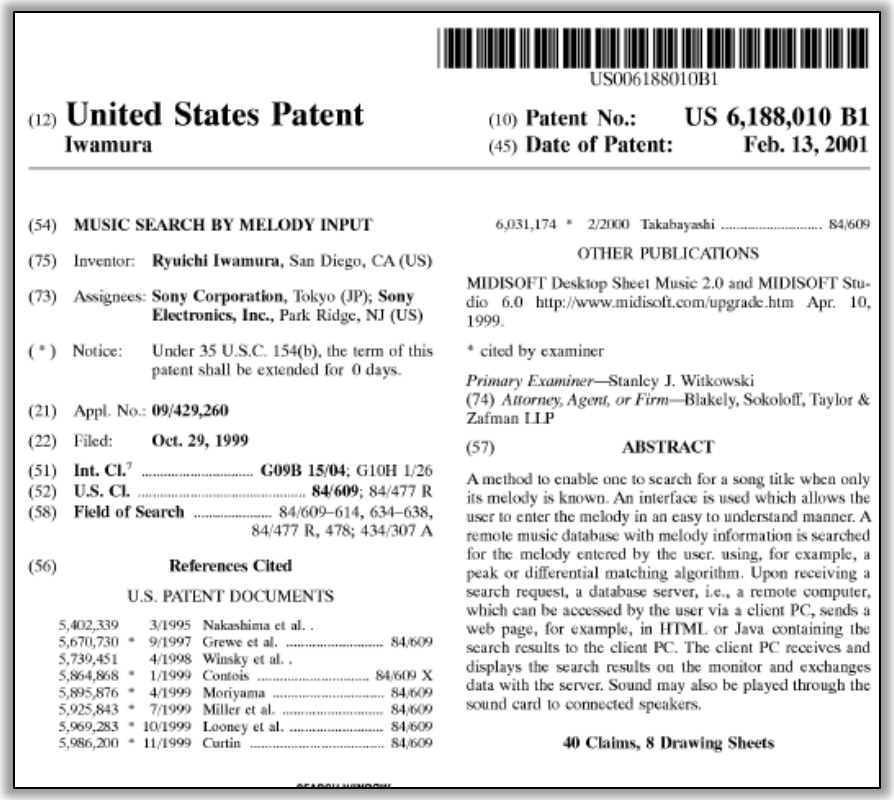
Ghias (Ex. 1010) at 6:60-7:5

Iwamura – Overview

Ex. 1012

- The parties' dispute with respect to Iwamura is confined to three limitations:

1. Non-exhaustive search
2. Identifying a neighbor
3. Sublinear search
   - Only in 2 claims of the '237 patent



US006188010B1

(12) **United States Patent**
Iwamura

(10) **Patent No.: US 6,188,010 B1**
(45) **Date of Patent: Feb. 13, 2001**

(54) **MUSIC SEARCH BY MELODY INPUT**

(75) Inventor: **Ryuichi Iwamura**, San Diego, CA (US)

(73) Assignees: **Sony Corporation**, Tokyo (JP); **Sony Electronics, Inc.**, Park Ridge, NJ (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: **09/429,260**

(22) Filed: **Oct. 29, 1999**

(51) **Int. Cl.**[7] **G09B 15/04**; G10H 1/26
(52) **U.S. Cl.** ..... **84/609**; 84/477 R
(58) **Field of Search** ..... 84/609–614, 634–638, 84/477 R, 478; 434/307 A

(56) **References Cited**

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5,670,730	*	9/1997	Grewe et al.	84/609
5,739,451		4/1998	Winsky et al. .	
5,864,868	*	1/1999	Contois	84/609 X
5,895,876	*	4/1999	Moriyama	84/609
5,925,843	*	7/1999	Miller et al.	84/609
5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609
6,031,174	*	2/2000	Takabayashi	84/609

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MIDISOFT Desktop Sheet Music 2.0 and MIDISOFT Studio 6.0 http://www.midisoft.com/upgrade.htm Apr. 10, 1999.

* cited by examiner

Primary Examiner—Stanley J. Witkowski
(74) *Attorney, Agent, or Firm*—Blakely, Sokoloff, Taylor & Zafman LLP

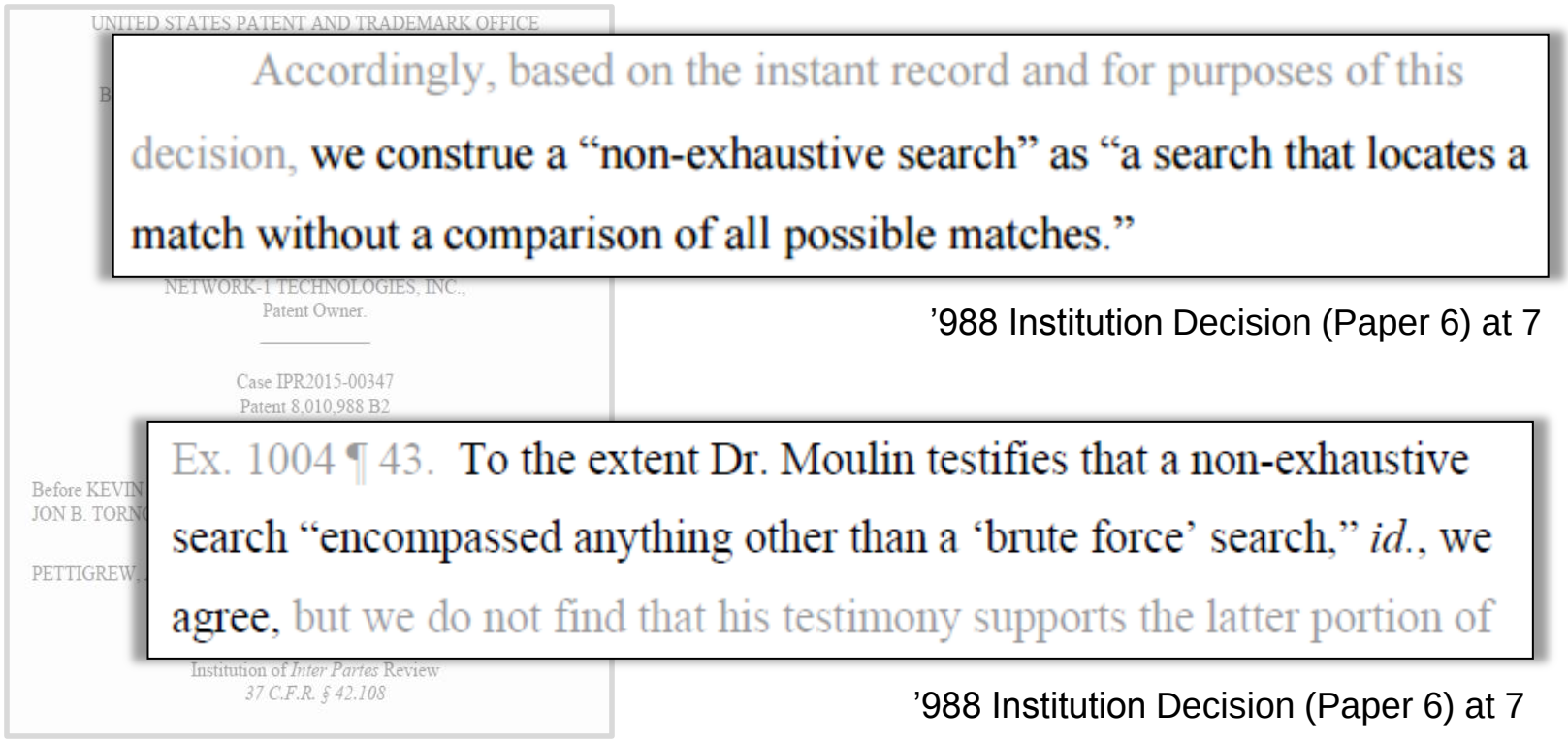
(57) **ABSTRACT**

A method to enable one to search for a song title when only its melody is known. An interface is used which allows the user to enter the melody in an easy to understand manner. A remote music database with melody information is searched for the melody entered by the user. using, for example, a peak or differential matching algorithm. Upon receiving a search request, a database server, i.e., a remote computer, which can be accessed by the user via a client PC, sends a web page, for example, in HTML or Java containing the search results to the client PC. The client PC receives and displays the search results on the monitor and exchanges data with the server. Sound may also be played through the sound card to connected speakers.

40 Claims, 8 Drawing Sheets

Iwamura – Non-Exhaustive Search

- The Board construed "non-exhaustive search"



'988 Institution Decision (Paper 6) at 7

'988 Institution Decision (Paper 6) at 7

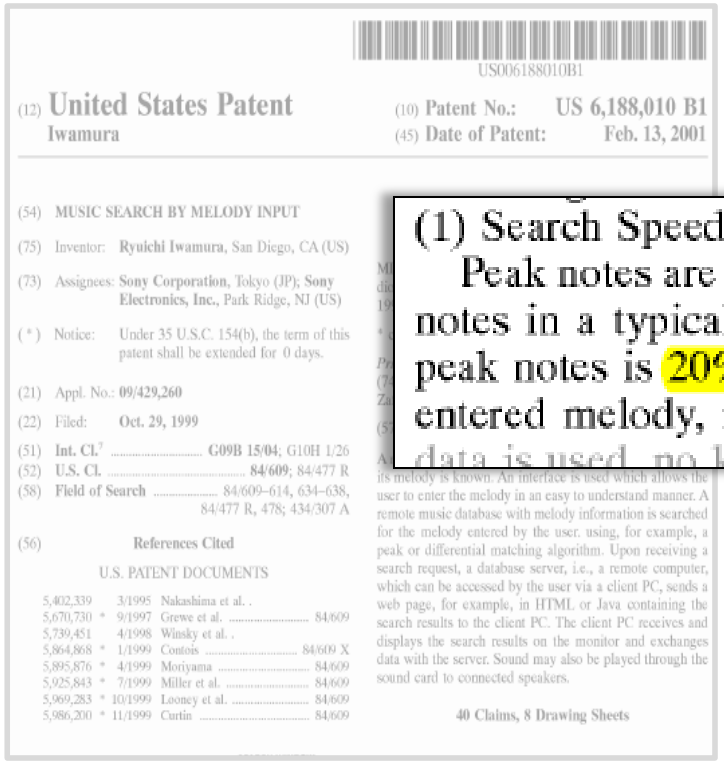
Iwamura – Non-Exhaustive Search

- Iwamura discloses non-exhaustive search in two ways
  - Iwamura self-identifies as different than a brute force (i.e., exhaustive) search (Iwamura, Ex. 1012, at 9:7-11)
  - Iwamura only performs comparisons between the query and reference when peak notes are aligned, so intermediate positions are not compared (Iwamura, Ex. 1012, at 7:52-55)
    - The “possible matches” in Iwamura are melody segments, not songs

Iwamura – Non-Exhaustive Search

Iwamura Self-Identifies as a Non-Exhaustive Search

- Iwamura identifies its search as different than a brute force (i.e., exhaustive) search



US006188010B1

(12) **United States Patent**
Iwamura

(10) Patent No.: US 6,188,010 B1
(45) Date of Patent: Feb. 13, 2001

(54) MUSIC SEARCH BY MELODY INPUT

(75) Inventor: Ryuichi Iwamura, San Diego, CA (US)

(73) Assignees: Sony Corporation, Tokyo (JP); Sony Electronics, Inc., Park Ridge, NJ (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: 09/429,260

(22) Filed: Oct. 29, 1999

(51) Int. Cl.[7] G09B 15/04; G10H 1/26

(52) U.S. Cl. ..... 84/609; 84/477 R

(58) Field of Search ..... 84/609–614, 634–638, 84/477 R, 478; 434/307 A

(56) References Cited

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5,402,339		3/1995	Nakashima et al. .	
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5,739,451		4/1998	Winsky et al. .	
5,864,868	*	1/1999	Contois	84/609 X
5,895,876	*	4/1999	Moriyama	84/609
5,925,843	*	7/1999	Miller et al.	84/609
5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609

its melody is known. An interface is used which allows the user to enter the melody in an easy to understand manner. A remote music database with melody information is searched for the melody entered by the user, using, for example, a peak or differential matching algorithm. Upon receiving a search request, a database server, i.e., a remote computer, which can be accessed by the user via a client PC, sends a web page, for example, in HTML or Java containing the search results to the client PC. The client PC receives and displays the search results on the monitor and exchanges data with the server. Sound may also be played through the sound card to connected speakers.

40 Claims, 8 Drawing Sheets

(1) Search Speed

Peak notes are approximately 20% of the total number of notes in a typical melody. That means search speed using peak notes is 20% of a brute force search which shifts the entered melody, note by note. Also because relative pitch data is used, no key-shift is required to compare with each

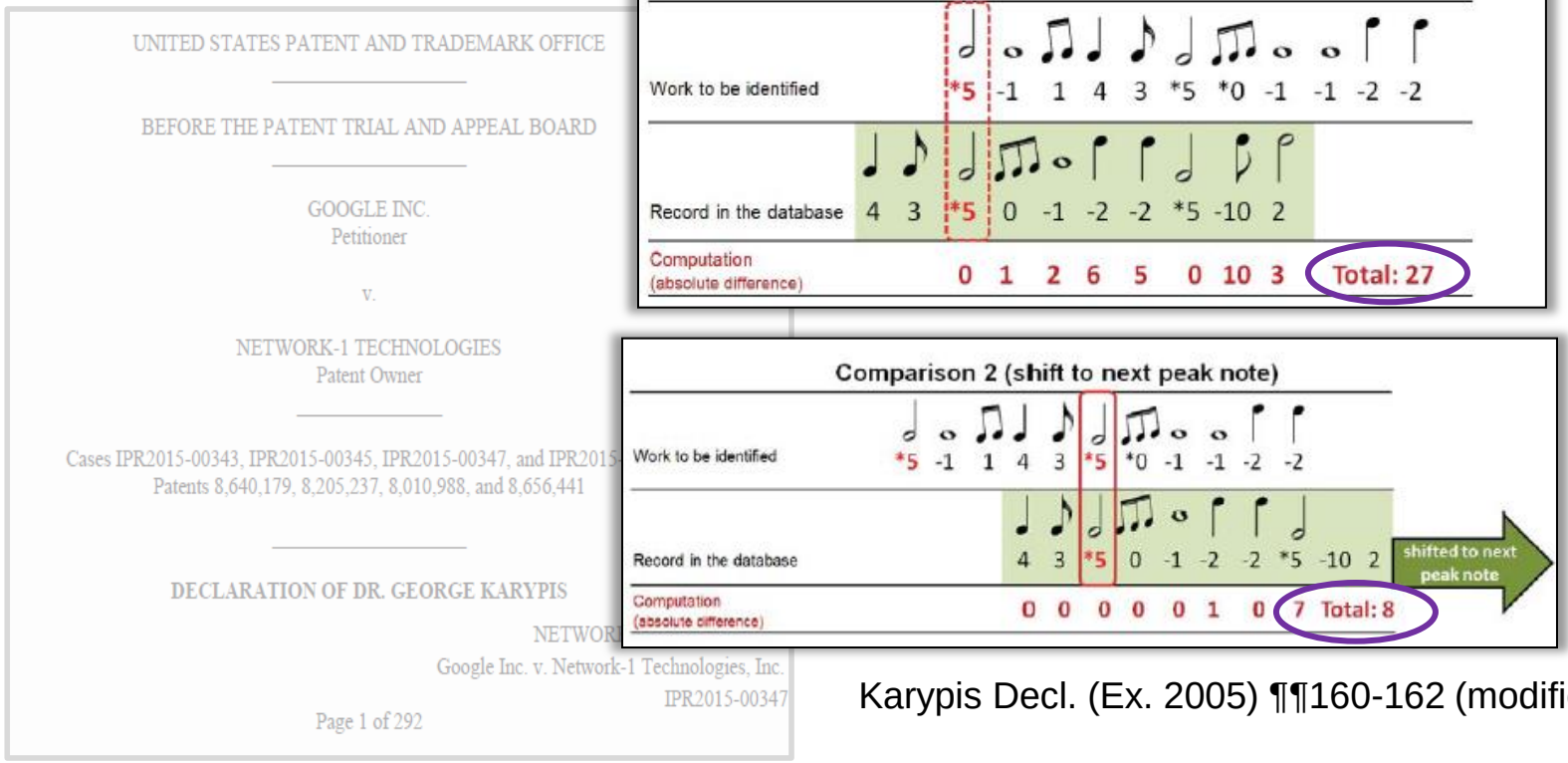
10

Iwamura (Ex. 1012) at 9:7-11

Iwamura – Non-Exhaustive Search

The "Possible Matches" Are Melody Segments, Not Songs

- Dr. Karypis illustrates the non-exhaustive nature of Iwamura's search algorithm:

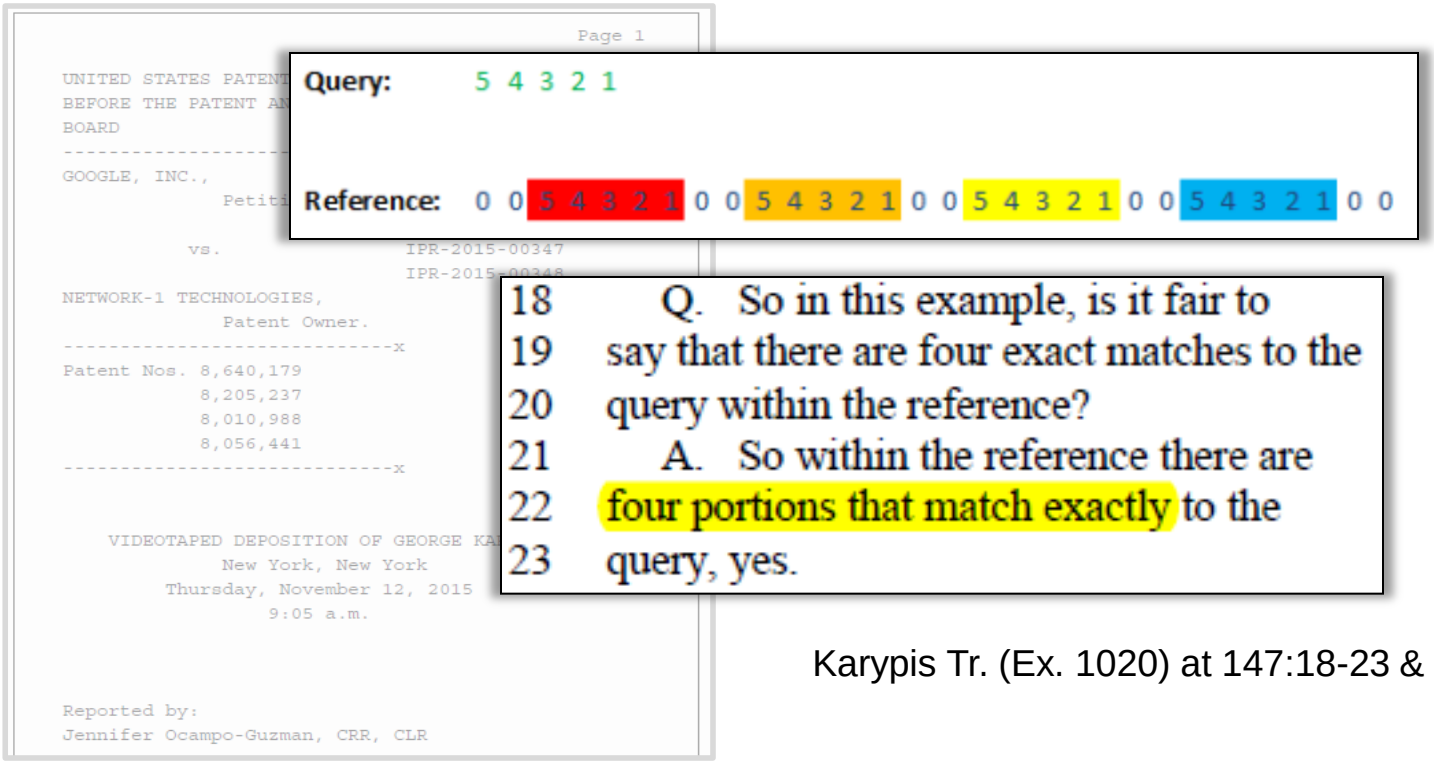


Karypis Decl. (Ex. 2005) ¶¶160-162 (modified)

Iwamura – Non-Exhaustive Search

The "Possible Matches" Are Melody Segments, Not Songs

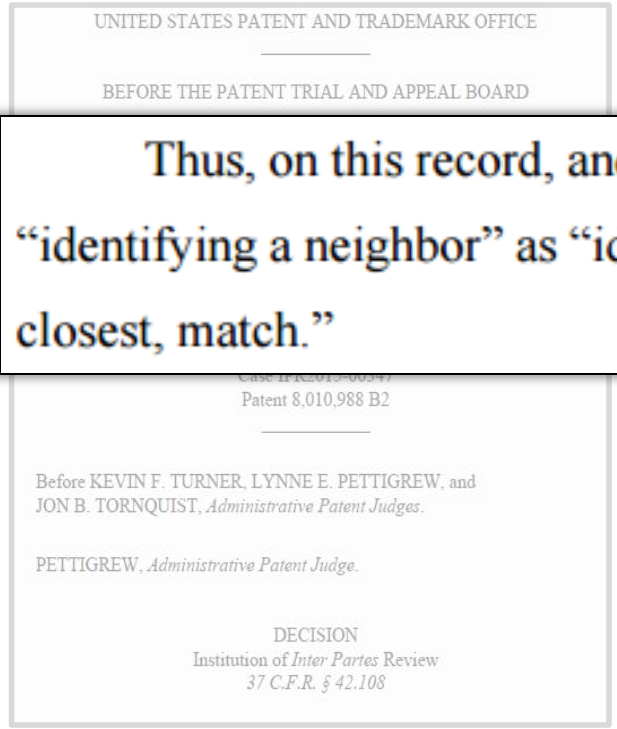
- Dr. Karypis confirmed that possible matches are melody segments



Karypis Tr. (Ex. 1020) at 147:18-23 & Ex. 9

Iwamura – Identifying a Neighbor / Neighbor Search

- The parties agree that "identifying a neighbor" and "neighbor search" are interchangeable
- The Board construed the terms


UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Patent 8,010,988 B2

Before KEVIN F. TURNER, LYNNE E. PETTIGREW, and JON B. TORNQUIST, *Administrative Patent Judges*.

PETTIGREW, *Administrative Patent Judge*.

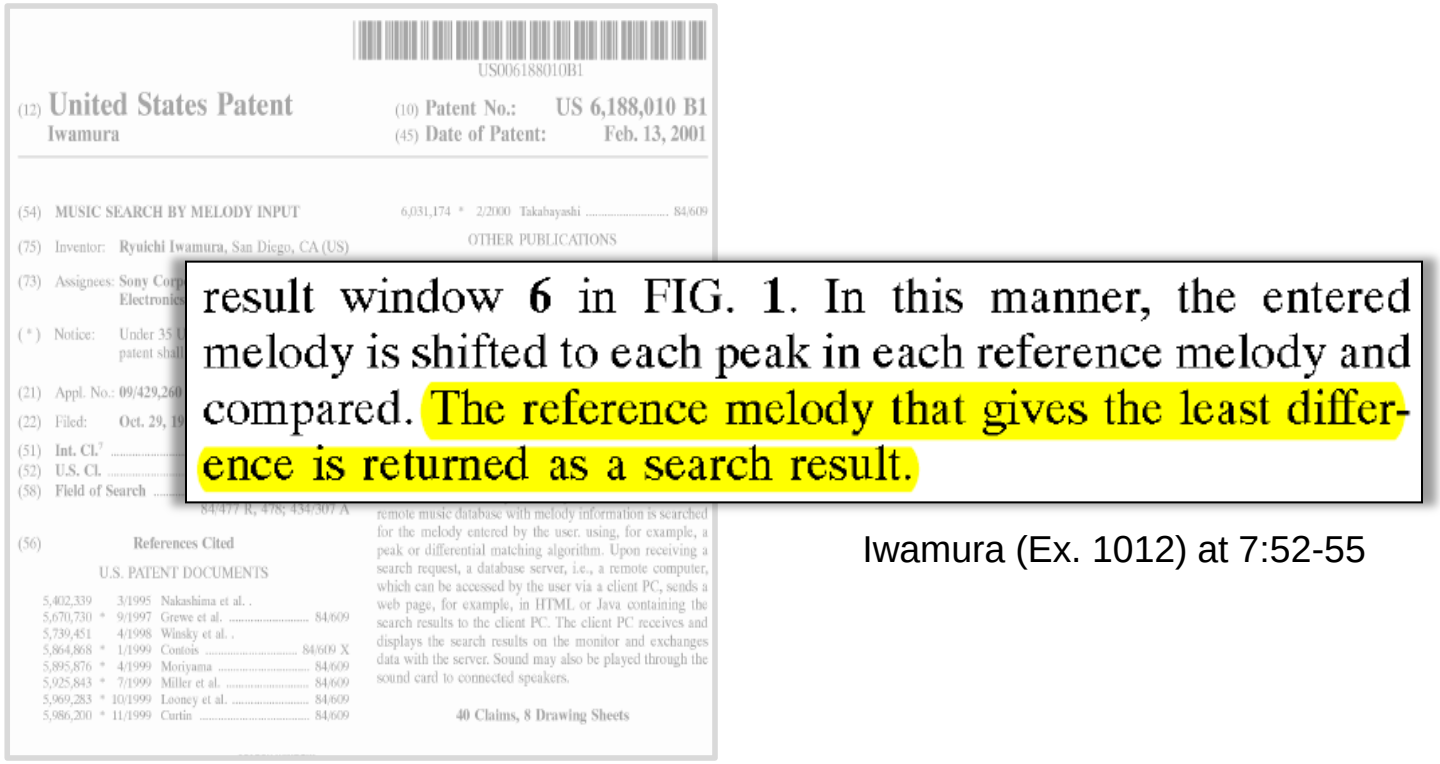
DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

Thus, on this record, and for purposes of this decision, we construe "identifying a neighbor" as "identifying a close, but not necessarily exact or closest, match."

'988 Institution Decision (Paper 6) at 8

Iwamura – Identifying a Neighbor / Neighbor Search

- Iwamura teaches identifying similar works by returning the reference melody with the least difference



US006188010B1

(12) United States Patent
Iwamura

(10) Patent No.: US 6,188,010 B1
(45) Date of Patent: Feb. 13, 2001

(54) MUSIC SEARCH BY MELODY INPUT

(75) Inventor: Ryuichi Iwamura, San Diego, CA (US)

(73) Assignees: Sony Corp... Electronics...

(*) Notice: Under 35 U... patent shall...

(21) Appl. No.: 09/429,260

(22) Filed: Oct. 29, 19...

(51) Int. Cl.[7] .....

(52) U.S. Cl. .....

(58) Field of Search ..... 84/477 R; 478; 434/307 A

(56) References Cited

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5,402,339		3/1995	Nakashima et al. .	
5,670,730	*	9/1997	Grewe et al.	84/609
5,739,451		4/1998	Winsky et al. .	
5,864,868	*	1/1999	Contois	84/609 X
5,895,876	*	4/1999	Moriyama	84/609
5,925,843	*	7/1999	Miller et al.	84/609
5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609
6,031,174	*	2/2000	Takahayashi	84/609

OTHER PUBLICATIONS

remote music database with melody information is searched for the melody entered by the user. using, for example, a peak or differential matching algorithm. Upon receiving a search request, a database server, i.e., a remote computer, which can be accessed by the user via a client PC, sends a web page, for example, in HTML or Java containing the search results to the client PC. The client PC receives and displays the search results on the monitor and exchanges data with the server. Sound may also be played through the sound card to connected speakers.

40 Claims, 8 Drawing Sheets

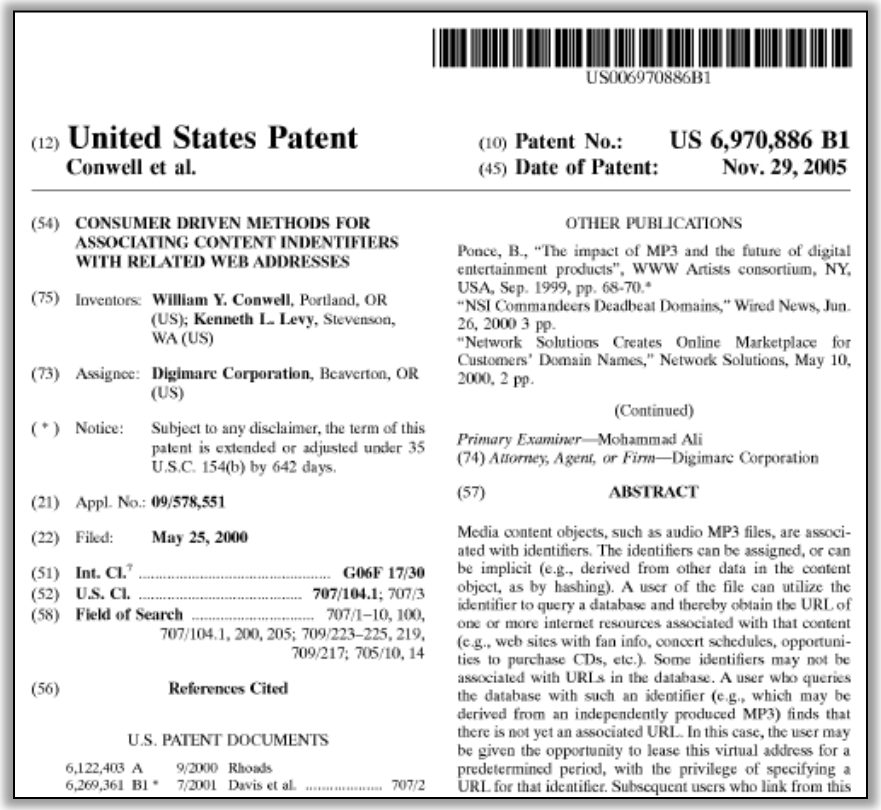
result window **6** in FIG. **1**. In this manner, the entered melody is shifted to each peak in each reference melody and compared. The reference melody that gives the least difference is returned as a search result.

Iwamura (Ex. 1012) at 7:52-55

Conwell
Ex. 1009

- The parties' dispute with respect to Conwell is confined to two limitations:

1. Identifying a neighbor
2. Non-exhaustive search



US006970886B1

(12) **United States Patent**
Conwell et al.

(10) **Patent No.: US 6,970,886 B1**
(45) **Date of Patent: Nov. 29, 2005**

(54) **CONSUMER DRIVEN METHODS FOR ASSOCIATING CONTENT INDENTIFIERS WITH RELATED WEB ADDRESSES**

(75) Inventors: **William Y. Conwell**, Portland, OR (US); **Kenneth L. Levy**, Stevenson, WA (US)

(73) Assignee: **Digimarc Corporation**, Beaverton, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 642 days.

(21) Appl. No.: **09/578,551**

(22) Filed: **May 25, 2000**

(51) **Int. Cl.**[7] **G06F 17/30**
(52) **U.S. Cl.** **707/104.1**; 707/3
(58) **Field of Search** 707/1–10, 100, 707/104.1, 200, 205; 709/223–225, 219, 709/217; 705/10, 14

(56) **References Cited**

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6,269,361 B1 * 7/2001 Davis et al. 707/2

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Ponce, B., "The impact of MP3 and the future of digital entertainment products", WWW Artists consortium, NY, USA, Sep. 1999, pp. 68-70.*
"NSI Commandeers Deadbeat Domains," Wired News, Jun. 26, 2000 3 pp.
"Network Solutions Creates Online Marketplace for Customers' Domain Names," Network Solutions, May 10, 2000, 2 pp.

(Continued)

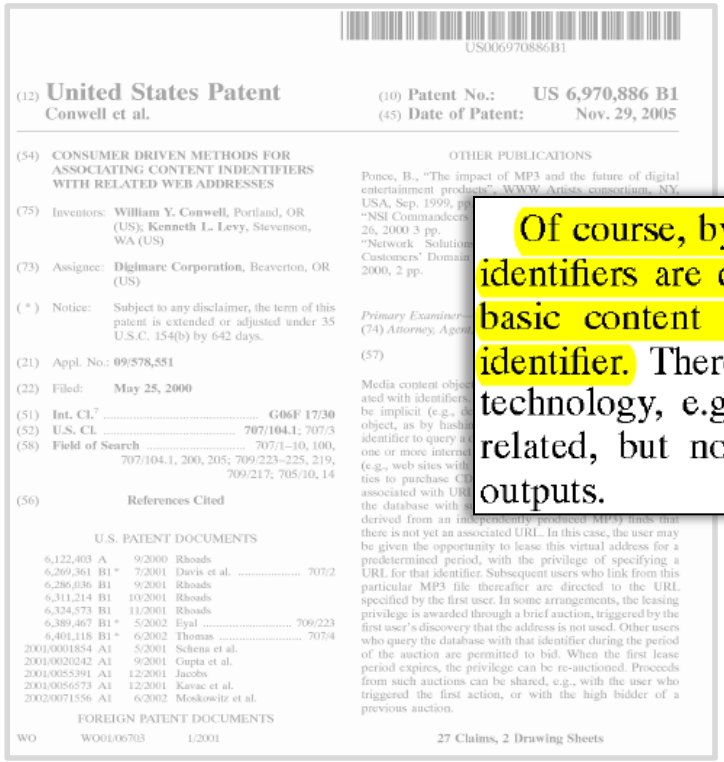
Primary Examiner—Mohammad Ali
(74) *Attorney, Agent, or Firm*—Digimarc Corporation

(57) **ABSTRACT**

Media content objects, such as audio MP3 files, are associated with identifiers. The identifiers can be assigned, or can be implicit (e.g., derived from other data in the content object, as by hashing). A user of the file can utilize the identifier to query a database and thereby obtain the URL of one or more internet resources associated with that content (e.g., web sites with fan info, concert schedules, opportunities to purchase CDs, etc.). Some identifiers may not be associated with URLs in the database. A user who queries the database with such an identifier (e.g., which may be derived from an independently produced MP3) finds that there is not yet an associated URL. In this case, the user may be given the opportunity to lease this virtual address for a predetermined period, with the privilege of specifying a URL for that identifier. Subsequent users who link from this

Conwell – Neighbor Search

- Conwell teaches identifying similar, but not exact, works by selecting from well-known hashing algorithms



US006970886B1

(12) **United States Patent**
Conwell et al.

(10) **Patent No.: US 6,970,886 B1**
(45) **Date of Patent: Nov. 29, 2005**

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(75) Inventors: **William Y. Conwell**, Portland, OR (US); **Kenneth L. Levy**, Stevenson, WA (US)

(73) Assignee: **Digimarc Corporation**, Beaverton, OR (US)

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(52) **U.S. Cl.** **707/104.1**; 707/3
(58) **Field of Search** 707/1–10, 100, 707/104.1, 200, 205; 709/223–225, 219, 709/217; 705/10, 14

(56) **References Cited**

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6,311,214	B1	10/2001	Rhoads	
6,324,573	B1	11/2001	Rhoads	
6,389,467	B1 *	5/2002	Eyal	709/223
6,401,118	B1 *	6/2002	Thomas	707/4
2001/0001854	A1	5/2001	Schena et al.	
2001/0020242	A1	9/2001	Gupta et al.	
2001/0055391	A1	12/2001	Jacobs	
2001/0056573	A1	12/2001	Kavac et al.	
2002/0071556	A1	6/2002	Moskowitz et al.	

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Ponce, B., "The impact of MP3 and the future of digital entertainment products", WWW Artists consortium, NY, USA, Sep. 1999, pp.
"NSI Commandeers Customers' Domain", 26, 2000 3 pp.
"Network Solutions Customers' Domain", 2000, 2 pp.

Primary Examiner
(74) *Attorney, Agent*

(57)

Media content object ated with identifiers be implicit (e.g., object, as by hash identifier to query a one or more interne (e.g., web sites with ties to purchase CD associated with URL the database with derived from an independently produced MP3) finds that there is not yet an associated URL. In this case, the user may be given the opportunity to lease this virtual address for a predetermined period, with the privilege of specifying a URL for that identifier. Subsequent users who link from this particular MP3 file thereafter are directed to the URL specified by the first user. In some arrangements, the leasing privilege is awarded through a brief auction, triggered by the first user's discovery that the address is not used. Other users who query the database with that identifier during the period of the auction are permitted to bid. When the first lease period expires, the privilege can be re-auctioned. Proceeds from such auctions can be shared, e.g., with the user who triggered the first action, or with the high bidder of a previous auction.

27 Claims, 2 Drawing Sheets

> Of course, by suitably designing the algorithm by which identifiers are derived, non-identical versions of the same basic content may nonetheless correspond to the same identifier. There is extensive published research on such technology, e.g., hashing algorithms by which similar or related, but non-identical, inputs map to the same hash outputs.

Conwell (Ex. 1009) at 4:64-5:3

Conwell – Neighbor Search

- Conwell teaches identifying similar, but not exact, works using a *database query*:

US006970886B1

(12) **United States Patent**
Conwell et al.

(10) **Patent No.:** US 6,970,886 B1
(45) **Date of Patent:** Nov. 29, 2005

(54) CONSUMER DRIVEN METHODS FOR ASSOCIATING CONTENT INDENTIFIERS WITH RELATED WEB ADDRESSES

(75) Inventors: **William Y. Conwell**, Portland, OR (US); **Kenneth L. Levy**, Stevenson, WA (US)

(73) Assignee: **Digimarc Corporation**, Beaverton, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 642 days.

(21) Appl. No.: **09/578,551**

(22) Filed: **May 25, 2000**

(51) **Int. Cl.**[7] **G06F 17/30**
(52) **U.S. Cl.** **707/104.1**; 707/3
(58) **Field of Search** 707/1–10, 100, 707/104.1, 200, 205; 709/223–225, 219, 709/217; 705/10, 14

(56) **References Cited**

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6,311,214	B1	10/2001	Rhoads	
6,324,573	B1	11/2001	Rhoads	
6,389,467	B1 *	5/2002	Eyal	709/223
6,401,118	B1 *	6/2002	Thomas	707/4
2001/0001854	A1	5/2001	Schena et al.	
2001/0020242	A1	9/2001	Gupta et al.	
2001/0055391	A1	12/2001	Jacobs	
2001/0056573	A1	12/2001	Kavac et al.	
2002/0071556	A1	6/2002	Moskowitz et al.	

FOREIGN PATENT DOCUMENTS

WO WO01/06703 1/2001

OTHER PUBLICATIONS

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"NSI Commandeers Deadbeat Domains," Wired News, Jun. 26, 2000 3 pp.

(57) ...

associated with URLs in the database. A user who queries the database with such an identifier (e.g., which may be derived from an independently produced MP3) finds that there is not yet an associated URL. In this case, the user may be given the opportunity to lease this virtual address for a predetermined period, with the privilege of specifying a URL for that identifier. Subsequent users who link from this particular MP3 file thereafter are directed to the URL specified by the first user. In some arrangements, the leasing privilege is awarded through a brief auction, triggered by the first user's discovery that the address is not used. Other users who query the database with that identifier during the period of the auction are permitted to bid. When the first lease period expires, the privilege can be re-auctioned. Proceeds from such auctions can be shared, e.g., with the user who triggered the first action, or with the high bidder of a previous auction.

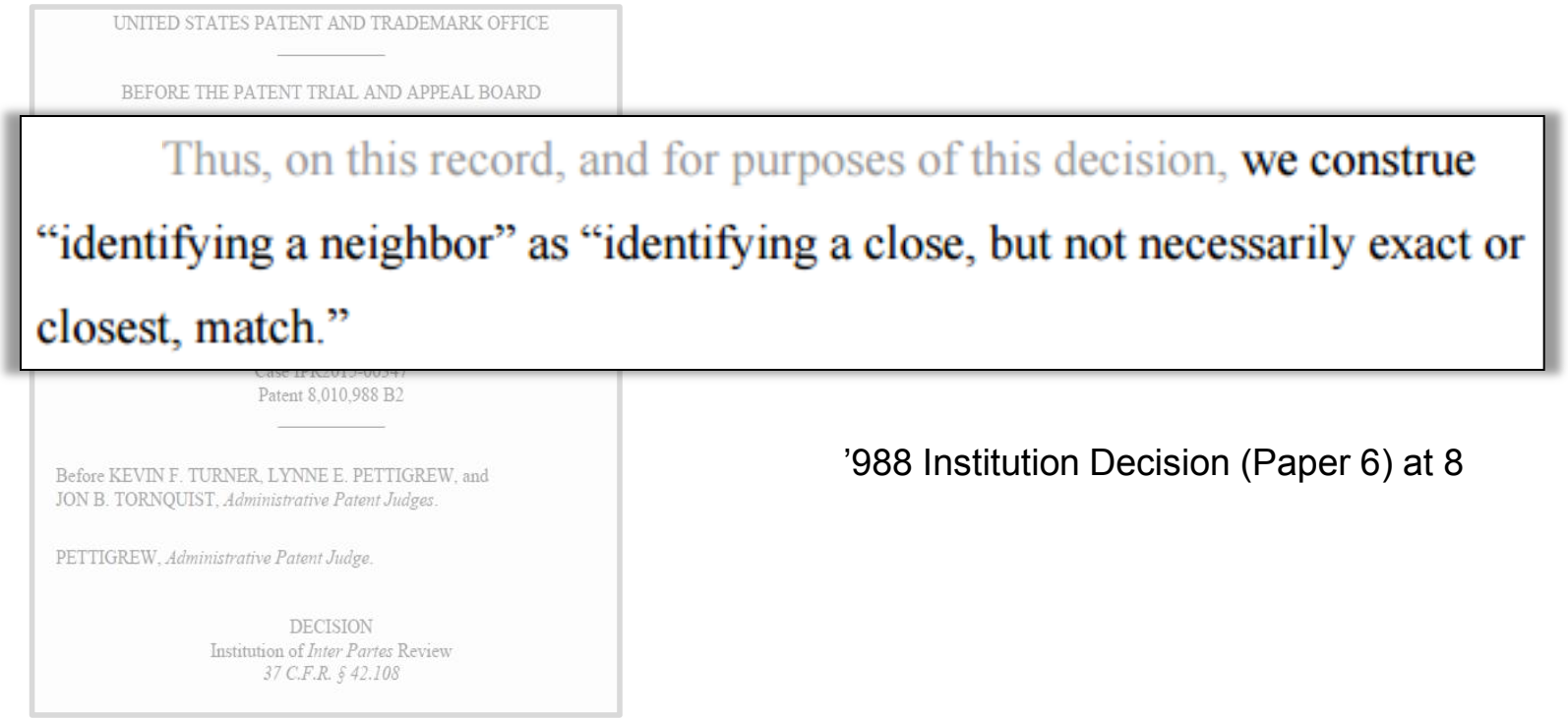
27 Claims, 2 Drawing Sheets

object, as by hashing). A user of the file can utilize the identifier to query a database and thereby obtain the URL of one or more internet resources associated with that content (e.g., web sites with fan info, concert schedules, opportunities to purchase CDs, etc.). Some identifiers may not be

Conwell (Ex. 1009) at Abstract

Claim Construction – Identifying a Neighbor

- The parties agree that "identifying a neighbor" and "neighbor search" are interchangeable
- The Board construed both terms



UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Thus, on this record, and for purposes of this decision, **we construe "identifying a neighbor" as "identifying a close, but not necessarily exact or closest, match."**

Patent 8,010,988 B2

Before KEVIN F. TURNER, LYNNE E. PETTIGREW, and JON B. TORNQUIST, *Administrative Patent Judges*.

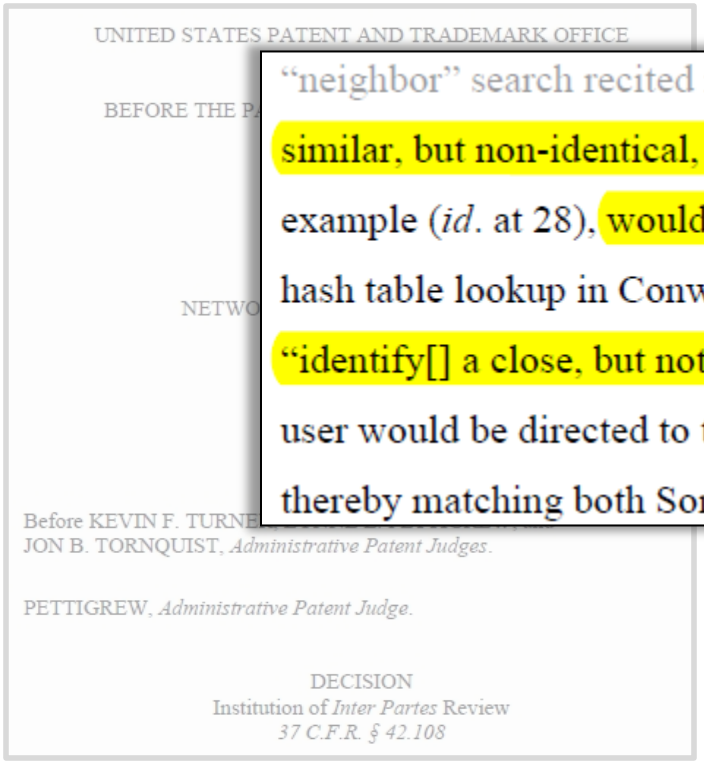
PETTIGREW, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

'988 Institution Decision (Paper 6) at 8

Conwell – Neighbor Search

- The Board correctly concluded that Conwell identifies neighboring works


UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE P

NETWO

Before KEVIN F. TURNE
JON B. TORNQUIST, *Administrative Patent Judges.*

PETTIGREW, *Administrative Patent Judge.*

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

"neighbor" search recited in the claims. We are persuaded, however, that similar, but non-identical, inputs, Song A and Song A_1, in Patent Owner's example (*id.* at 28), would be identified and the same URL provided by the hash table lookup in Conwell. In other words, the search, or lookup, would "identify[] a close, but not necessarily exact or closest, match," such that a user would be directed to the same URL for both Song A and Song A_1, thereby matching both Song A and Song A_1. Although it appears that such a

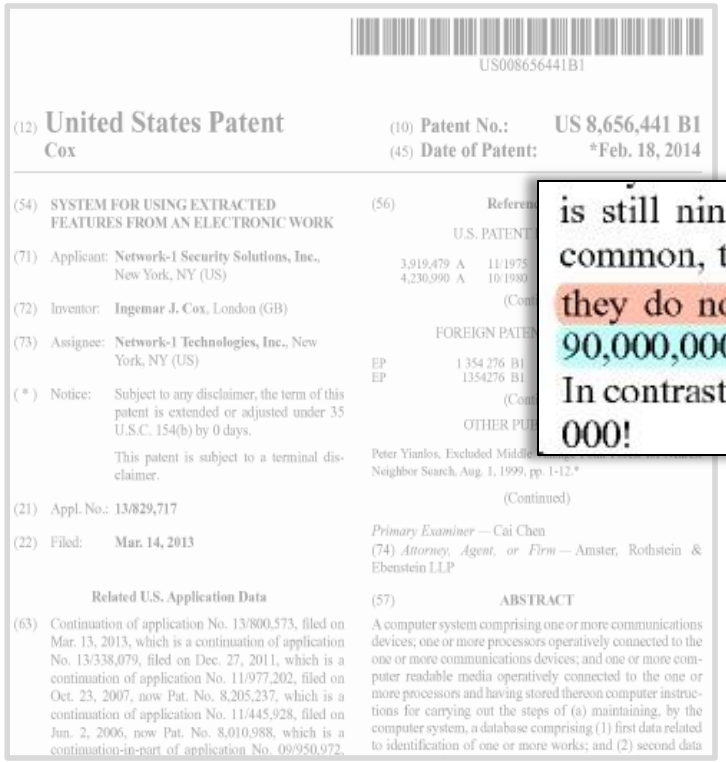
'179 Institution Decision (Paper 6) at 11

Conwell – Non-Exhaustive Search

- Conwell discloses non-exhaustive search
  - Conwell discloses a database query ("look-up table") (Conwell, Ex. 1009, at 3:43-44)
  - Database queries are non-exhaustive ('441 patent at 20:67-21:1)

Conwell – Non-Exhaustive Search

- exhaustive search = brute force search = linear search
- Patentee advised readers that database queries ran faster than a linear search (i.e., an exhaustive search)



US008656441B1

(12) **United States Patent**
Cox

(10) **Patent No.: US 8,656,441 B1**
(45) **Date of Patent: *Feb. 18, 2014**

(54) SYSTEM FOR USING EXTRACTED FEATURES FROM AN ELECTRONIC WORK

(71) Applicant: **Network-1 Security Solutions, Inc.**, New York, NY (US)

(72) Inventor: **Ingemar J. Cox**, London (GB)

(73) Assignee: **Network-1 Technologies, Inc.**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/829,717**

(22) Filed: **Mar. 14, 2013**

Related U.S. Application Data

(63) Continuation of application No. 13/800,573, filed on Mar. 13, 2013, which is a continuation of application No. 13/338,079, filed on Dec. 27, 2011, which is a continuation of application No. 11/977,202, filed on Oct. 23, 2007, now Pat. No. 8,205,237, which is a continuation of application No. 11/445,928, filed on Jun. 2, 2006, now Pat. No. 8,010,988, which is a continuation-in-part of application No. 09/950,972,

(56) Referen

U.S. PATENT

3,919,479 A 11/1975
4,230,990 A 10/1980

(Cont

FOREIGN PATEN

EP 1 354 276 B1
EP 1354276 B1

(Cont

OTHER PU

Peter Yianilos, Excluded Middle
Neighbor Search, Aug. 1, 1999, pp. 1-12.*

(Continued)

Primary Examiner — Cai Chen
(74) *Attorney, Agent, or Firm* — Amster, Rothstein & Ebenstein LLP

(57) **ABSTRACT**

A computer system comprising one or more communications devices; one or more processors operatively connected to the one or more communications devices; and one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of (a) maintaining, by the computer system, a database comprising (1) first data related to identification of one or more works; and (2) second data

is still nine million. While databases of this size are now common, they rely of efficient search to access entries, i.e., they do not perform a linear search. A binary search of a 90,000,000-item database requires less than 20 comparisons. In contrast, a linear search will require an average of 45,000,000!

'441 patent (Ex. 1001) at 20:67-21:1

CLAIM CONSTRUCTION

"Identifying a Neighbor" / "Neighbor Search"

Claim Construction – Identifying a Neighbor

- Network-1's interpretation violates the plain meaning of the Board's construction

> Thus, on this record, and for purposes of this decision, we construe "identifying a neighbor" as "identifying a close, but not necessarily exact or closest, match."

'988 Institution Decision (Paper 6) at 8

- It also runs contrary to the purpose of the patents: to identify a work

> new interactive media, such as that provided over the Internet for example. In particular, the present invention concerns identifying a work (e.g., content or an advertisement delivered via print media, or via a radio or television broadcast) without the need to modify the work.

'179 patent (Ex. 1001) at 1:37-40

CLAIM CONSTRUCTION

"Approximate Nearest Neighbor Search"

Claim Construction – Approximate Nearest Neighbor search

- The Board previously rejected Network-1's argument

> approximate nearest neighbor search" (Ex. 1001, 9:12–14), such that we are not persuaded that an "approximate nearest neighbor search," must be a sub-linear search, as that term has been construed above. As such, we are persuaded that the proper construction of "approximate nearest neighbor search" is "identifying a close match that is not necessarily the closest match."

'237 Institution Decision (Paper 6) at 9

Claim Construction – Approximate Nearest Neighbor search

- Construing "approximate nearest neighbor search" as requiring sublinearity would render the word "sublinear" superfluous

b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a sublinear approximate nearest neighbor search of reference extracted features of reference identified media works; and

'237 patent (Ex. 1001) at Claim 33

GHIAS

Overview

Ghias – Overview
Ex. 1010

- Ghias is applicable to the following patents and claims:

Patent No.	Claims
8,010,988	**15**-17, 21-26, 28, 31, 51-52
8,205,237	**9**-11, **13**-15, 23-24
8,640,179	**1**-3, 8, 10-12, **13**-14, 18-19, 21-24, **25**-27, 29, 31, 34-37
8,656,441	**1**-3, 8, 10-12, **13**-14, 18-19, 21-24, **25**-27, 29-30

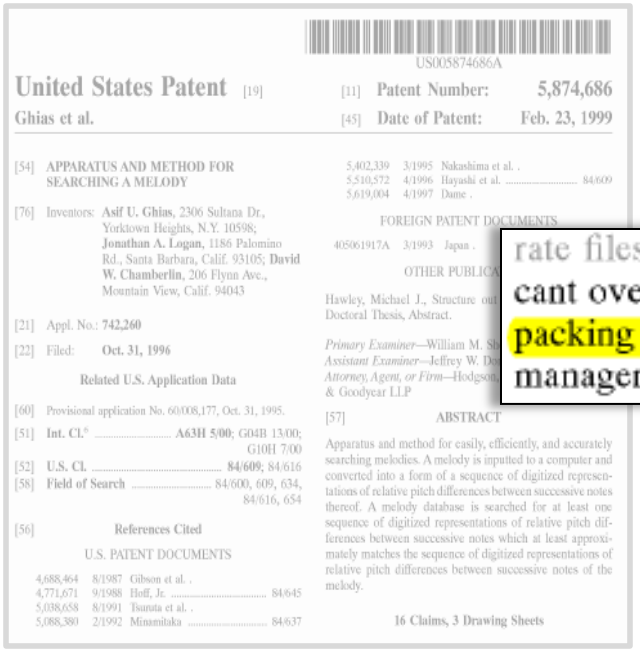
GHIAS

Non-Exhaustive Search

Ghias – Non-Exhaustive Search

Ghias Self-Identifies Its Searches As Non-Exhaustive

- Ghias also discloses combining all songs into a single reference file



US005874686A

United States Patent [19]

Ghias et al.

[11] Patent Number: 5,874,686

[45] Date of Patent: Feb. 23, 1999

[54] APPARATUS AND METHOD FOR SEARCHING A MELODY

[76] Inventors: **Asif U. Ghias**, 2306 Sultana Dr., Yorktown Heights, N.Y. 10598; **Jonathan A. Logan**, 1186 Palomino Rd., Santa Barbara, Calif. 93105; **David W. Chamberlin**, 206 Flynn Ave., Mountain View, Calif. 94043

[21] Appl. No.: 742,260

[22] Filed: Oct. 31, 1996

Related U.S. Application Data

[60] Provisional application No. 60/008,177, Oct. 31, 1995.

[51] Int. Cl.[6] A63H 5/00; G04B 13/00; G10H 7/00

[52] U.S. Cl. 84/609; 84/616

[58] Field of Search 84/600, 609, 634, 84/616, 654

[56] References Cited

U.S. PATENT DOCUMENTS

4,688,464	8/1987	Gibson et al. .	
4,771,671	9/1988	Hoff, Jr.	84/645
5,038,658	8/1991	Tsuruta et al. .	
5,088,380	2/1992	Minamitaka	84/637
5,402,339	3/1995	Nakashima et al. .	
5,510,572	4/1996	Hayashi et al.	84/609
5,619,004	4/1997	Dame .	

FOREIGN PATENT DOCUMENTS

405061917A 3/1993 Japan .

OTHER PUBLICA

Hawley, Michael J., Structure out Doctoral Thesis, Abstract.

Primary Examiner—William M. Sh
Assistant Examiner—Jeffrey W. Do
Attorney, Agent, or Firm—Hodgson & Goodyear LLP

[57] ABSTRACT

Apparatus and method for easily, efficiently, and accurately searching melodies. A melody is inputted to a computer and converted into a form of a sequence of digitized representations of relative pitch differences between successive notes thereof. A melody database is searched for at least one sequence of digitized representations of relative pitch differences between successive notes which at least approximately matches the sequence of digitized representations of relative pitch differences between successive notes of the melody.

16 Claims, 3 Drawing Sheets

rate files. Opening and closing files may become a significant overhead. Performance may therefore be improved by packing all the songs into one file, or by using a database manager. The programming code may be modernized to 45

Ghias (Ex. 1010) at 7:41-45

GHIAS

Identifying a Neighbor / Neighbor Search

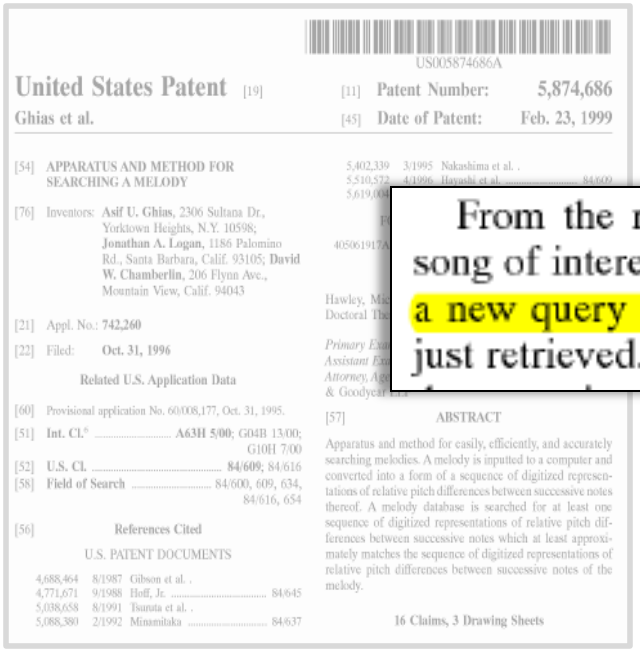
Ghias – Identifying a Neighbor / Neighbor Search

- Ghias discloses identifying a neighbor and performing a neighbor search
  - Under the Board's construction, Ghias discloses a "neighbor search" because there is no dispute that it locates near matches (Ghias, Ex. 1010, at 2:50-52)
  - Even under Network-1's interpretation, Ghias discloses a "neighbor search" because it does not always locate the closest match, because the second search does not consider all references (Ghias, Ex. 1010, at 7:5-7)

Ghias – Identifying a Neighbor / Neighbor Search

No Guarantee of the Closest Match

- Even under Network-1's interpretation, Ghias' subsequent searches do not always consider—much less identify—the closest match



US005874686A

United States Patent [19]

Ghias et al.

[11] Patent Number: 5,874,686

[45] Date of Patent: Feb. 23, 1999

[54] APPARATUS AND METHOD FOR SEARCHING A MELODY

[76] Inventors: **Asif U. Ghias**, 2306 Sultana Dr., Yorktown Heights, N.Y. 10598; **Jonathan A. Logan**, 1186 Palomino Rd., Santa Barbara, Calif. 93105; **David W. Chamberlin**, 206 Flynn Ave., Mountain View, Calif. 94043

[21] Appl. No.: 742,260

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[51] Int. Cl.[6] A63H 5/00; G04B 13/00; G10H 7/00

[52] U.S. Cl. 84/609; 84/616

[58] Field of Search 84/600, 609, 634, 84/616, 654

[56] References Cited

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4,688,464 8/1987 Gibson et al. .
4,771,671 9/1988 Hoff, Jr. 84/645
5,038,658 8/1991 Tsuruta et al. .
5,088,380 2/1992 Minamitaka 84/637
5,402,339 3/1995 Nakashima et al. .
5,510,572 4/1996 Hayashi et al. 84/609
5,619,004

[57] ABSTRACT

Apparatus and method for easily, efficiently, and accurately searching melodies. A melody is inputted to a computer and converted into a form of a sequence of digitized representations of relative pitch differences between successive notes thereof. A melody database is searched for at least one sequence of digitized representations of relative pitch differences between successive notes which at least approximately matches the sequence of digitized representations of relative pitch differences between successive notes of the melody.

16 Claims, 3 Drawing Sheets

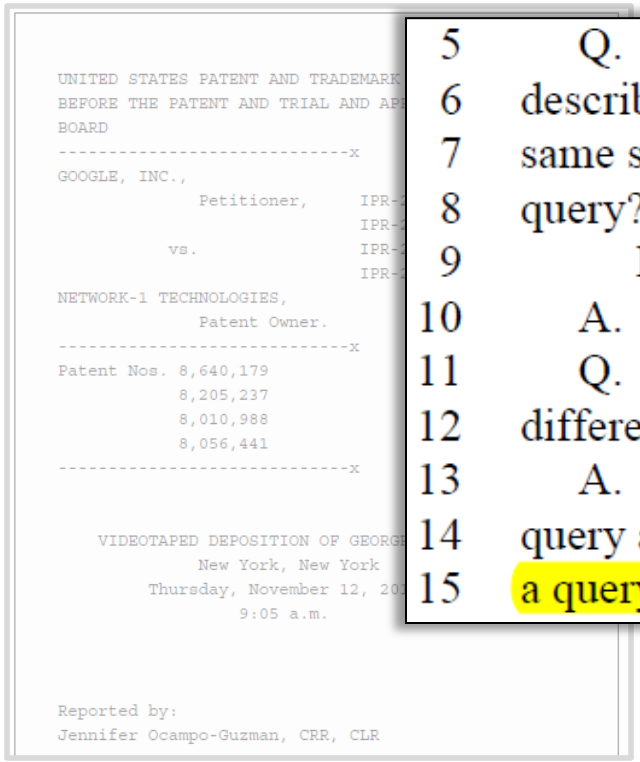
From the results of the query the user can identify the song of interest. If the list is too large, the user can perform 5 a new query on a restricted search list consisting of songs just retrieved. This allows the user to identify sets of songs

Ghias (Ex. 1010) at 7:5-7

Ghias – Non-Exhaustive Search

No Guarantee of the Closest Match

- There are no restrictions on the new query, and it can be a different part of the song or even a different song entirely


UNITED STATES PATENT AND TRADEMARK
BEFORE THE PATENT AND TRIAL AND AP
BOARD

GOOGLE, INC.,
Petitioner,
vs.
NETWORK-1 TECHNOLOGIES,
Patent Owner.

Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441

VIDEOTAPED DEPOSITION OF GEORG
New York, New York
Thursday, November 12, 20
9:05 a.m.
Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

5 Q. Could the new query that's
6 described there be a different portion of the
7 same song that was searched in the original
8 query?
9 MR. LUNER: Objection to form.
10 A. That can be a possibility.
11 Q. Could the new query be a completely
12 different song?
13 A. The segments can perform a new
14 query and puts no restrictions on the type of
15 a query.

Karypis Tr. (Ex. 1020) at 172:5-15

Ghias – Non-Exhaustive Search

No Guarantee of the Closest Match

- Dr. Karypis testifies that the new query must be different from the first query

> restricted list rather than refine the search as intended by Ghias.[32] Although the details of the new query are not disclosed, the new query (2) could theoretically be, *e.g.*, (a) a different portion of the same song, or (b) a better hummed version of the same portion of the same song.

Karypis Decl. (Ex. 2005) ¶287

Ghias – Non-Exhaustive Search

No Guarantee of the Closest Match

- The "new query" (Search 2), must be different from the original query (Search 1), and can yield entirely different search results

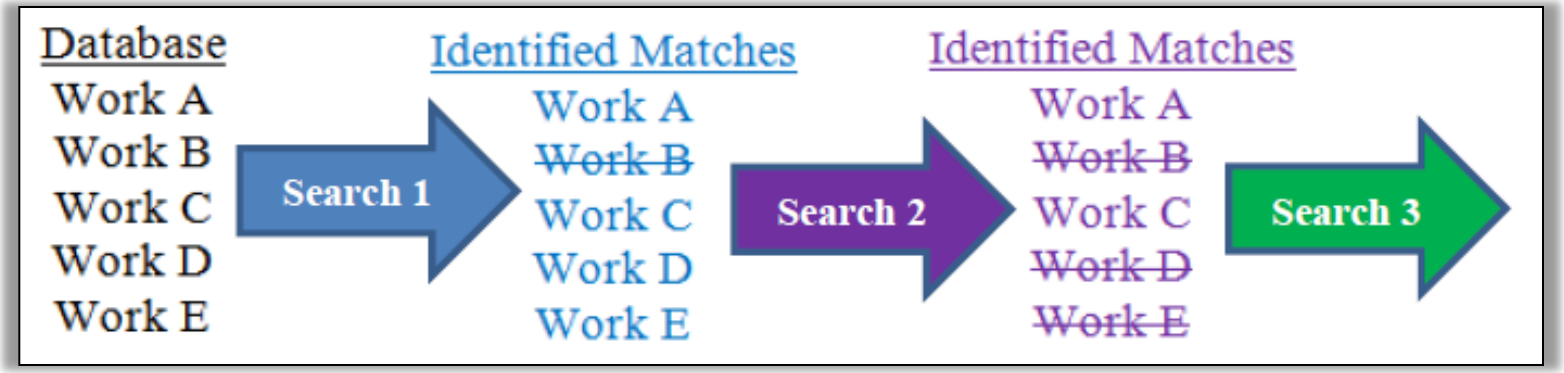
> To refine the list of potential matches, the "new query" (2) disclosed in Ghias must be different from the original query (1). This is because Ghias does not teach an alternative search algorithm for searching the restricted list. Rather, Ghias teaches

Karypis Decl. (Ex. 2005) ¶287

Ghias – Identifying a Neighbor / Neighbor Search

No Guarantee of the Closest Match

- The subsequent searches do not consider all references, and thus do not always find the "closest" match



'988 Google's Reply (Paper 20) at 6

Ghias – Identifying a Neighbor / Neighbor Search

No Guarantee of the Closest Match

- Further, Ghias cannot always identify the closest match in a group of close matches

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT AND TRIAL AND APPEAL BOARD

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Petitioner,
vs.
NETWORK-1 TECHNOLOGIES,
Patent Owner.

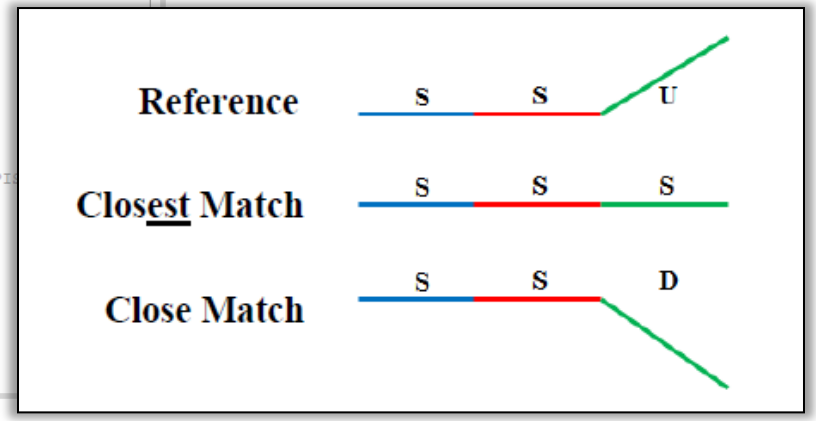
Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441

VIDEOTAPED DEPOSITION OF GEORGE KARYPI
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

9 Q. If SSU is the query and the two
10 references are SSS and SSD, will Ghias rank
11 those as equally good matches?
12 A. I believe so, the one-character
13 difference between the query and the two
14 references.

Karypis Tr. (Ex. 1020) at 165:9-14



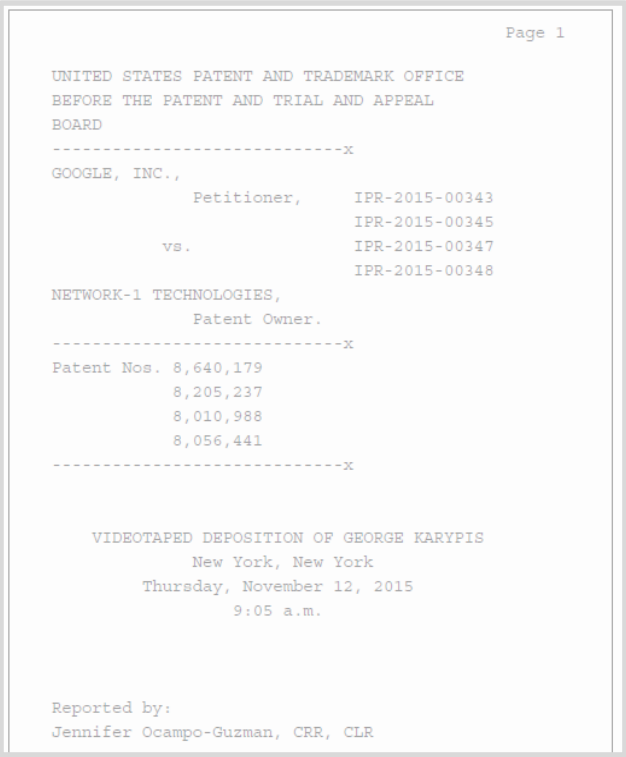
Google's Reply (Paper 20) at 10

GHIAS

Determining an Action

Ghias – Determining an Action

- Dr. Karypis agrees that Ghias' display of song titles constitutes "determining an action"



Page 1

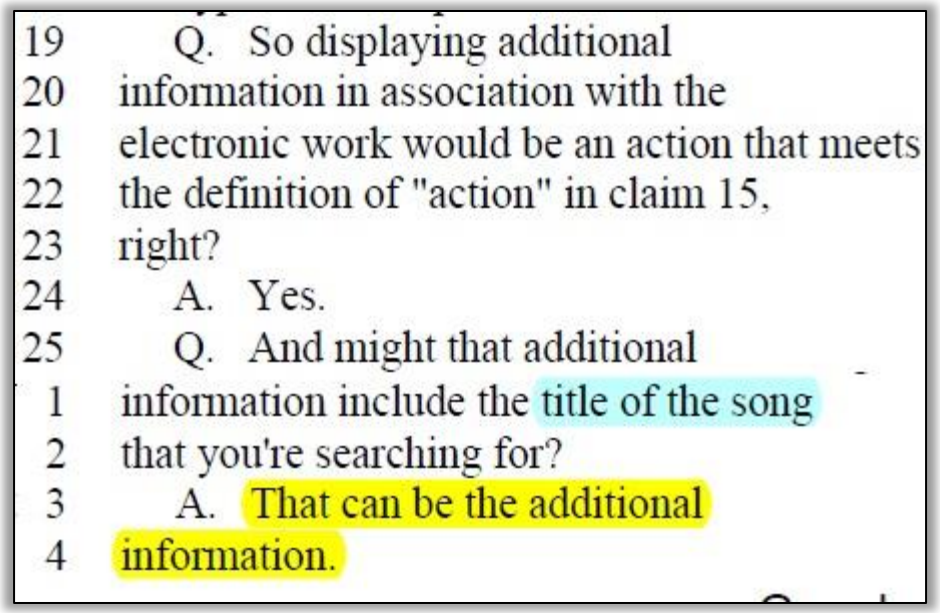
UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT AND TRIAL AND APPEAL
BOARD

GOOGLE, INC.,
Petitioner, IPR-2015-00343
IPR-2015-00345
vs. IPR-2015-00347
IPR-2015-00348
NETWORK-1 TECHNOLOGIES,
Patent Owner.

Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441

VIDEOTAPED DEPOSITION OF GEORGE KARYPIS
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

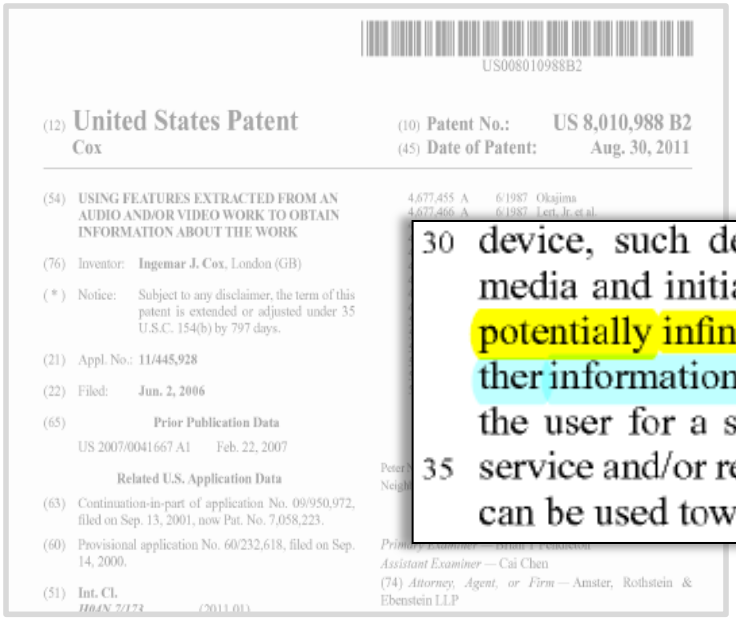


19 Q. So displaying additional
20 information in association with the
21 electronic work would be an action that meets
22 the definition of "action" in claim 15,
23 right?
24 A. Yes.
25 Q. And might that additional
1 information include the title of the song
2 that you're searching for?
3 A. That can be the additional
4 information.

Karypis Tr. (Ex. 1020) at 97:19-98:4

Ghias – Determining an Action

- The specification lists “retrieving further information” as an action


US008010988B2

(12) United States Patent
Cox

(10) Patent No.: US 8,010,988 B2
(45) Date of Patent: Aug. 30, 2011

(54) USING FEATURES EXTRACTED FROM AN AUDIO AND/OR VIDEO WORK TO OBTAIN INFORMATION ABOUT THE WORK

(76) Inventor: Ingemar J. Cox, London (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 797 days.

(21) Appl. No.: 11/445,928

(22) Filed: Jun. 2, 2006

(65) Prior Publication Data

US 2007/0041667 A1 Feb. 22, 2007

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/950,972, filed on Sep. 13, 2001, now Pat. No. 7,058,223.

(60) Provisional application No. 60/232,618, filed on Sep. 14, 2000.

(51) Int. Cl.

4,677,455 A 6/1987 Okajima
4,677,466 A 6/1987 Lert, Jr. et al.

Assistant Examiner — Cai Chen
(74) Attorney, Agent, or Firm — Amster, Rothstein & Ebenstein LLP

30 device, such devices directly or indirectly recognize the media and initiate an action. The set of possible actions is potentially infinite and includes, for example, retrieving further information, interacting with a live broadcast, registering the user for a service or product, purchasing a product or
35 service and/or receiving discount coupons or certificates that can be used towards a purchase.

‘988 patent (Ex. 1001) at 4:31-36

IWAMURA

Overview

Iwamura – Overview

Ex. 1012

- Iwamura is applicable to the following patents and claims:

Patent No.	Claims
8,010,988	**15**-17, 21-26, 28, 31, 52
8,205,237	**1**, 3-**5**, 7-**9**, 11-**13**, 15-16, 21-**25**, 26-27, 29-30, **33**, 34-35, 37-38
8,640,179	N/A
8,656,441	N/A

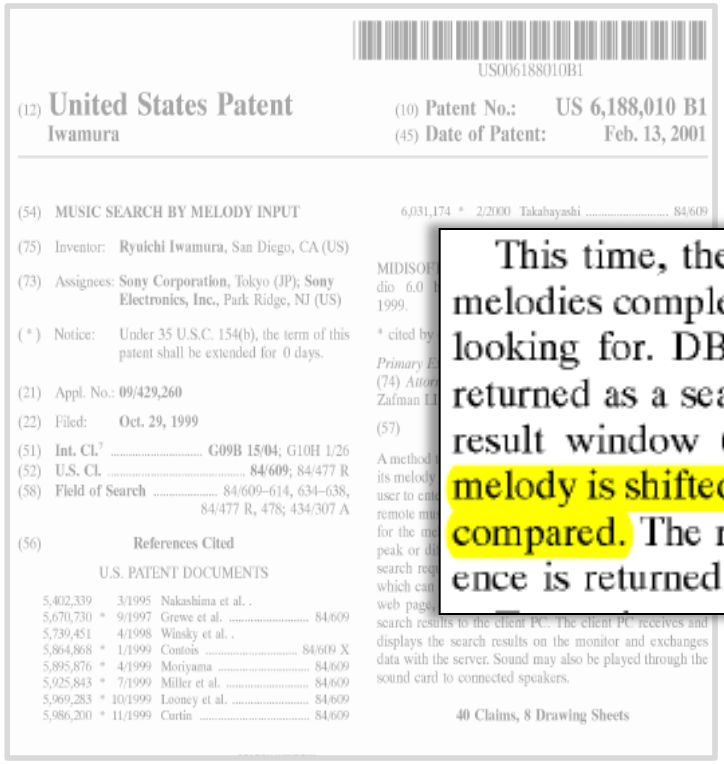
IWAMURA

Non-Exhaustive Search

Iwamura – Non-Exhaustive Search

The "Possible Matches" Are Melody Segments, Not Songs

- After calculating the absolute difference for one segment, Iwamura shifts to the next segment with aligned peak notes



US006188010B1

(12) **United States Patent**
Iwamura

(10) Patent No.: US 6,188,010 B1
(45) Date of Patent: Feb. 13, 2001

(54) MUSIC SEARCH BY MELODY INPUT

(75) Inventor: Ryuichi Iwamura, San Diego, CA (US)

(73) Assignees: Sony Corporation, Tokyo (JP); Sony Electronics, Inc., Park Ridge, NJ (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: 09/429,260

(22) Filed: Oct. 29, 1999

(51) Int. Cl.[7] G09B 15/04; G10H 1/26

(52) U.S. Cl. ..... 84/609; 84/477 R

(58) Field of Search ..... 84/609–614, 634–638, 84/477 R, 478; 434/307 A

(56) References Cited

U.S. PATENT DOCUMENTS

5,402,339		3/1995	Nakashima et al. .	
5,670,730	*	9/1997	Grewe et al.	84/609
5,739,451		4/1998	Winsky et al. .	
5,864,868	*	1/1999	Contois	84/609 X
5,895,876	*	4/1999	Moriyama	84/609
5,925,843	*	7/1999	Miller et al.	84/609
5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609
6,031,174	*	2/2000	Takahayashi	84/609

(57)

40 Claims, 8 Drawing Sheets

This time, the total absolute difference is zero. The two melodies completely match. DB[0] is the melody the user is looking for. DB[0].composer_ID and DB[0].title_ID are returned as a search result. The result is indicated in search result window **6** in FIG. **1**. In this manner, the entered melody is shifted to each peak in each reference melody and compared. The reference melody that gives the least difference is returned as a search result.

50

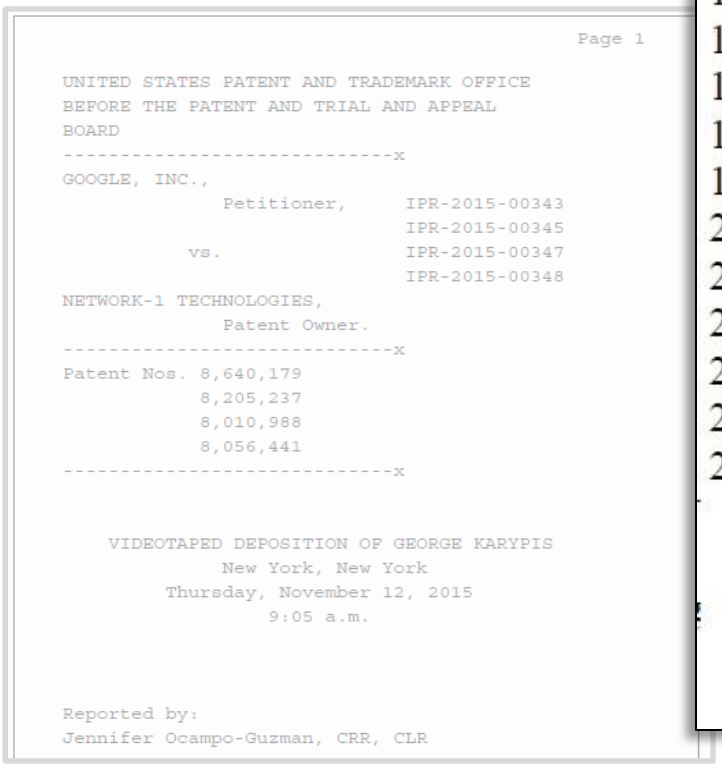
55

Iwamura (Ex. 1012) at 7:52-55

Iwamura – Non-Exhaustive Search

The "Possible Matches" Are Melody Segments, Not Songs

- Iwamura returns the subsegment with the lowest absolute difference



Page 1

UNITED STATES PATENT AND TRADEMARK OFFICE
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GOOGLE, INC.,
Petitioner, IPR-2015-00343, IPR-2015-00345, IPR-2015-00347, IPR-2015-00348

vs.

NETWORK-1 TECHNOLOGIES,
Patent Owner.

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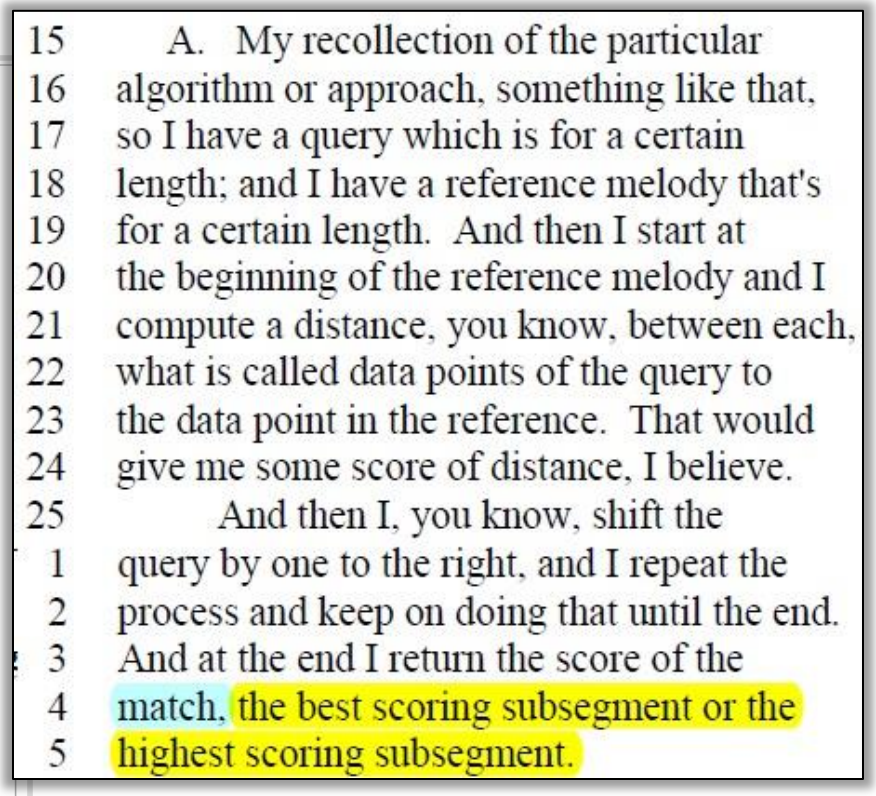
Reported by:
Jennifer Ocampo-Guzman, CRR, CLR



A. My recollection of the particular algorithm or approach, something like that, so I have a query which is for a certain length; and I have a reference melody that's for a certain length. And then I start at the beginning of the reference melody and I compute a distance, you know, between each, what is called data points of the query to the data point in the reference. That would give me some score of distance, I believe.

And then I, you know, shift the query by one to the right, and I repeat the process and keep on doing that until the end. And at the end I return the score of the match, the best scoring subsegment or the highest scoring subsegment.

Karypis Tr. (Ex. 1020) at 113:11-114:5

Iwamura – Non-Exhaustive Search

Iwamura's Peak Search Does Not Consider All Melody Segments

- Dr. Moulin testified that the "possible matches" are melody segments

Q Now, you just mentioned that it's a difference between a part of the melody; is that correct?
MR. DOVEL: Objection. Leading.
THE WITNESS: So it's difference between the user input, the melody input by the user, and the corresponding segment in the musical work.
BY MR. ELACQUA:
Q And what is the purpose of taking that difference?
A To see whether there's a match between the user query and a segment of the musical work.

Moulin Tr. (Ex. 2006) at 379:2-13

Iwamura – Non-Exhaustive Search

Iwamura's Peak Search Does Not Consider All Melody Segments

- Network-1 admits that Iwamura skips intermediate comparisons between aligned peak notes

UNITED STATES PATENT A

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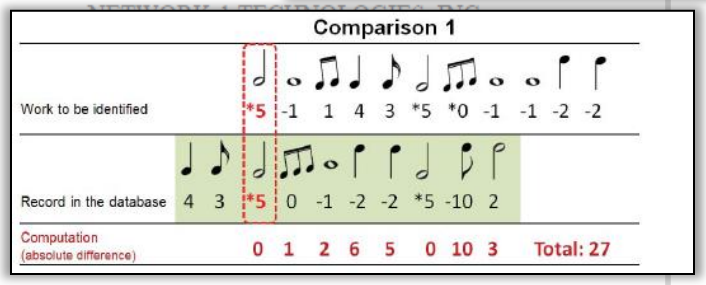
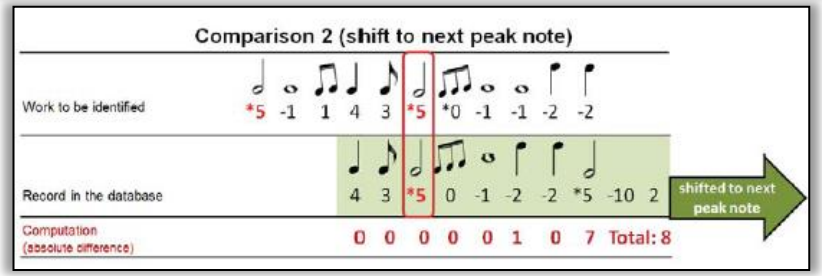
note approach taught in Iwamura. Using this peak note approach, the second comparison between the notes of the work to be identified and the notes in the record in the database is not just shifted one note to the right but is shifted to the right to align the next peek note (*i.e.*, five notes to the right), thereby skipping what would have been intermediate comparisons using the note by note approach:





PATENT OWNER'S RESPONSE PURSUANT TO 37 C.F.R. § 42.120

'988 N-1 Response (Paper 17) at 28-30

Iwamura – Non-Exhaustive Search

Iwamura's Peak Search Does Not Consider All Melody Segments

- Network-1 further admits that Iwamura's peak note search reduces the total number of comparisons

UNITED STATES PATENT AND TRADEMARK OFFICE

shifting the comparison between the work and the record "note by note" to see if there is a match, Iwamura teaches that the shifting can be done peak-note-to-peak-note, thereby reducing the number of comparisons made between the work and a specific record. Karypis Decl. ¶312; 159.

U.S. Patent 8,010,988

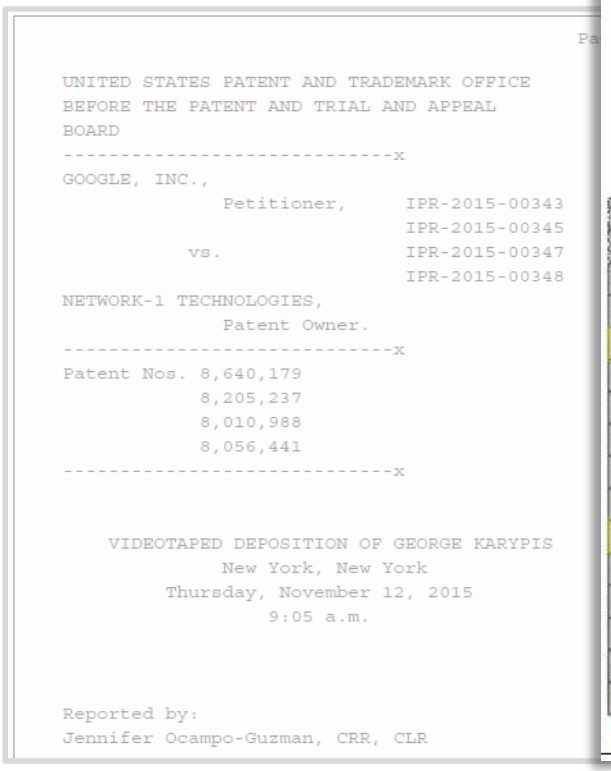
PATENT OWNER'S RESPONSE PURSUANT TO 37 C.F.R. § 42.120

'988 N-1 Response (Paper 17) at 27-28

Iwamura – Non-Exhaustive Search

Iwamura's Peak Search Does Not Consider All Melody Segments

- Iwamura increases search speed by only performing comparisons where peaks align



UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT AND TRIAL AND APPEAL BOARD

GOOGLE, INC.,
Petitioner, IPR-2015-00343, IPR-2015-00345
vs. IPR-2015-00347, IPR-2015-00348

NETWORK-1 TECHNOLOGIES,
Patent Owner.

Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441

VIDEOTAPED DEPOSITION OF GEORGE KARYPIS
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

Query: *5 4 3 2 1
Reference: *6 2 2 2 2 1 *6 5 4 3 2 1

Comparisons:

	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Total Absolute Difference
Comparison No. 1	1	-	-	-	-	-	-	-	-	-	-	-	5
Comparison No. 2	2	1	-	-	-	-	-	-	-	-	-	-	5
Comparison No. 3	3	2	1	-	-	-	-	-	-	-	-	-	4
Comparison No. 4	4	3	2	1	-	-	-	-	-	-	-	-	4
Comparison No. 5	*5	4	3	2	1	-	-	-	-	-	-	-	5
Comparison No. 6	-	*5	4	3	2	1	-	-	-	-	-	-	6
Comparison No. 7	-	-	*5	4	3	2	1	-	-	-	-	-	12
Comparison No. 8	-	-	-	*5	4	3	2	1	-	-	-	-	15
Comparison No. 9	-	-	-	-	*5	4	3	2	1	-	-	-	15
Comparison No. 10	-	-	-	-	-	*5	4	3	2	1	-	-	12
Comparison No. 11	-	-	-	-	-	-	*5	4	3	2	1	-	5
Comparison No. 12	-	-	-	-	-	-	-	*5	4	3	2	1	0
Comparison No. 13	-	-	-	-	-	-	-	-	*5	4	3	2	4
Comparison No. 14	-	-	-	-	-	-	-	-	-	*5	4	3	6
Comparison No. 15	-	-	-	-	-	-	-	-	-	-	*5	4	6
Comparison No. 16	-	-	-	-	-	-	-	-	-	-	-	*5	4
Reference →	*6	2	2	2	2	1	*6	5	4	3	2	1	

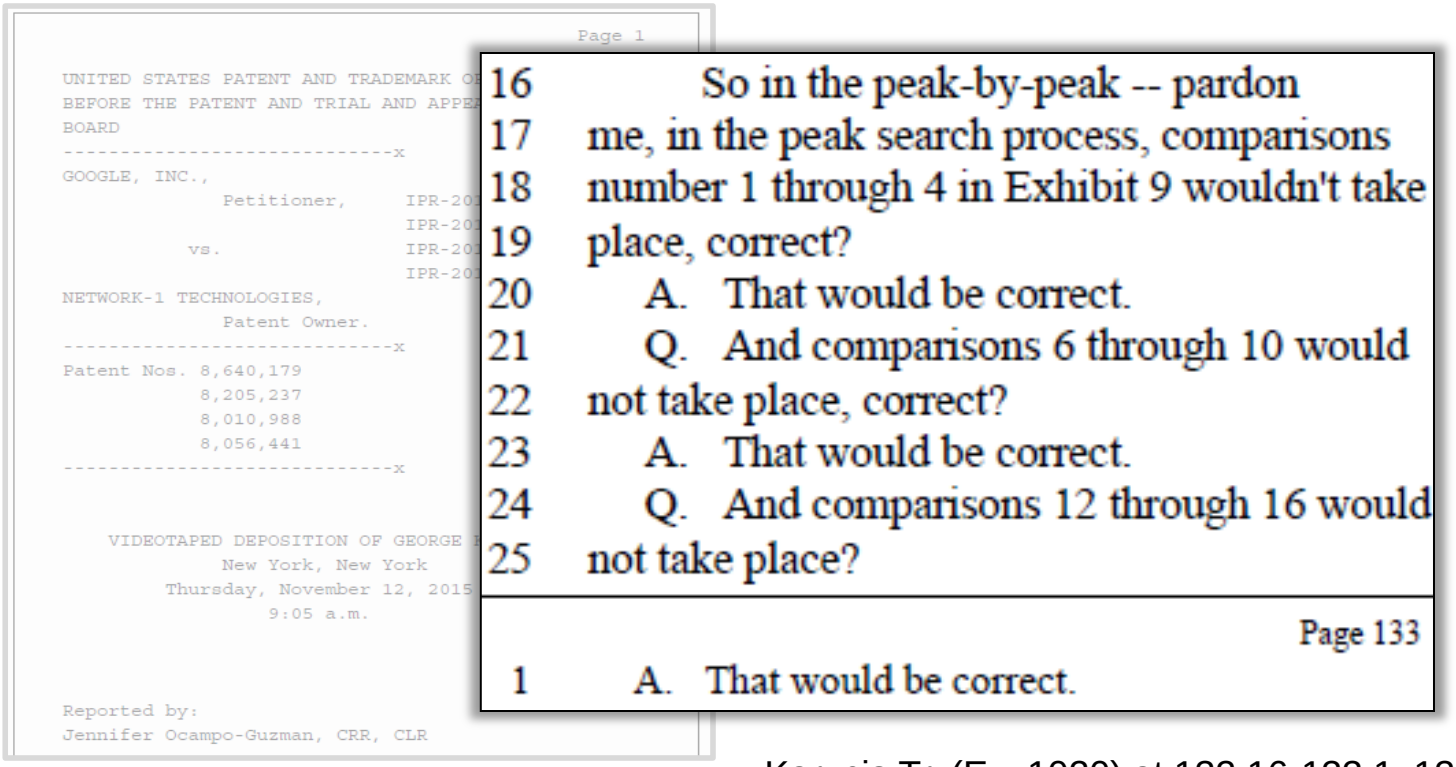
Aligning Peak Notes

Karypis Tr. (Ex. 1020) Ex. 9 (modified)

Iwamura – Non-Exhaustive Search

Iwamura's Peak Search Does Not Consider All Melody Segments

- Dr. Karypis concedes that some reference melody segments are not compared to the query



Page 1

UNITED STATES PATENT AND TRADEMARK O
BEFORE THE PATENT AND TRIAL AND APPE
BOARD
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GOOGLE, INC.,
Petitioner, IPR-20
IPR-20
vs. IPR-20
IPR-20
NETWORK-1 TECHNOLOGIES,
Patent Owner.
----------x
Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441
----------x

VIDEOTAPED DEPOSITION OF GEORGE
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

16 So in the peak-by-peak -- pardon
17 me, in the peak search process, comparisons
18 number 1 through 4 in Exhibit 9 wouldn't take
19 place, correct?
20 A. That would be correct.
21 Q. And comparisons 6 through 10 would
22 not take place, correct?
23 A. That would be correct.
24 Q. And comparisons 12 through 16 would
25 not take place?

Page 133

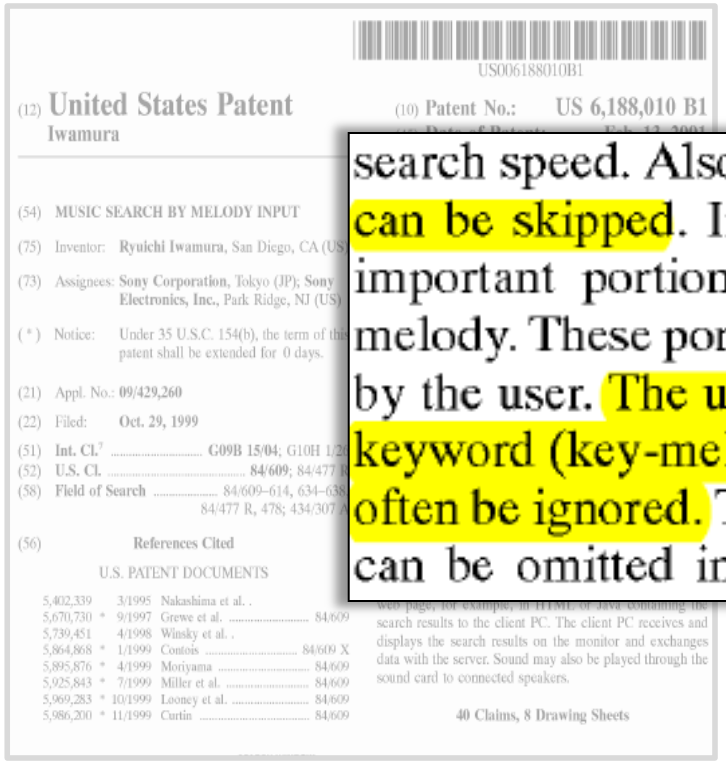
1 A. That would be correct.

Karypis Tr. (Ex. 1020) at 132:16-133:1, 134:5-135:10

Iwamura – Non-Exhaustive Search

Iwamura's Peak Search Does Not Consider All Melody Segments

- Iwamura discloses additional embodiments that skip "unimportant" segments and reduce the number of melody segments considered


US006188010B1

(12) United States Patent
Iwamura

(10) Patent No.: US 6,188,010 B1

(54) MUSIC SEARCH BY MELODY INPUT

(75) Inventor: Ryuichi Iwamura, San Diego, CA (US

(73) Assignees: Sony Corporation, Tokyo (JP); Sony Electronics, Inc., Park Ridge, NJ (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: 09/429,260

(22) Filed: Oct. 29, 1999

(51) Int. Cl.[7] G09B 15/04; G10H 1/2

(52) U.S. Cl. ..... 84/609; 84/477 R

(58) Field of Search ..... 84/609–614, 634–638, 84/477 R, 478; 434/307

(56) References Cited

U.S. PATENT DOCUMENTS

5,402,339		3/1995	Nakashima et al. .	
5,670,730	*	9/1997	Grewe et al.	84/609
5,739,451		4/1998	Winsky et al. .	
5,864,868	*	1/1999	Contois	84/609 X
5,895,876	*	4/1999	Moriyama	84/609
5,925,843	*	7/1999	Miller et al.	84/609
5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609

search results to the client PC. The client PC receives and displays the search results on the monitor and exchanges data with the server. Sound may also be played through the sound card to connected speakers.

40 Claims, 8 Drawing Sheets

search speed. Also, a peak that is in an unimportant portion can be skipped. In a long music selection, there are some important portions that are indispensable to identify the melody. These portions are well recognized and remembered by the user. The user identifies such important portions as a keyword (key-melody). The other unimportant portions can often be ignored. Therefore, peaks in an unimportant portion can be omitted in the same way as a repeated peak. This

Iwamura (Ex. 1012) at 9:36-51 & Fig. 14

IWAMURA

Identifying a Neighbor

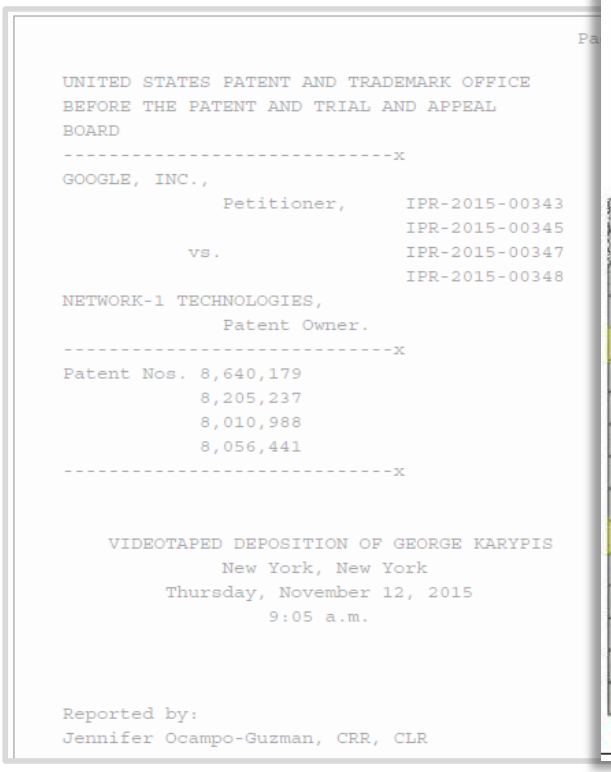
Iwamura – Identifying a Neighbor

- Iwamura discloses identifying a neighbor and performing a neighbor search
  - Under the Board's construction, Iwamura discloses "identifying a neighbor" because it locates a close match (Iwamura, Ex. 1012, at 7:54-55)
  - Even under Network-1's interpretation, Iwamura discloses "identifying a neighbor" because it does not always locate the "exact or closest" match, because not all melody segments are considered (Iwamura, Ex. 1012, at 7:52-55)

Iwamura – Identifying a Neighbor

Network-1's Interpretation

- Iwamura's peak search skips comparisons, so it does not necessarily even consider the closest match



UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT AND TRIAL AND APPEAL BOARD

GOOGLE, INC.,
Petitioner, IPR-2015-00343, IPR-2015-00345
vs. IPR-2015-00347, IPR-2015-00348

NETWORK-1 TECHNOLOGIES,
Patent Owner.

Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441

VIDEOTAPED DEPOSITION OF GEORGE KARYPIS
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

Query: *5 4 3 2 1
Reference: *6 2 2 2 2 1 *6 5 4 3 2 1

Comparisons:

	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Total Absolute Difference
Comparison No. 1	1	-	-	-	-	-	-	-	-	-	-	-	5
Comparison No. 2	2	1	-	-	-	-	-	-	-	-	-	-	5
Comparison No. 3	3	2	1	-	-	-	-	-	-	-	-	-	4
Comparison No. 4	4	3	2	1	-	-	-	-	-	-	-	-	4
Comparison No. 5	*5	4	3	2	1	-	-	-	-	-	-	-	5
Comparison No. 6	-	*5	4	3	2	1	-	-	-	-	-	-	6
Comparison No. 7	-	-	*5	4	3	2	1	-	-	-	-	-	12
Comparison No. 8	-	-	-	*5	4	3	2	1	-	-	-	-	15
Comparison No. 9	-	-	-	-	*5	4	3	2	1	-	-	-	15
Comparison No. 10	-	-	-	-	-	*5	4	3	2	1	-	-	12
Comparison No. 11	-	-	-	-	-	-	*5	4	3	2	1	-	5
Comparison No. 12	-	-	-	-	-	-	-	*5	4	3	2	1	0
Comparison No. 13	-						-	-	*5	4	3		
Comparison No. 14	-						-	-	-	*5	4		
Comparison No. 15	-						-	-	-	-	*5		
Comparison No. 16	-	-	-	-	-	-	-	-	-	-	-	*5	4
Reference →	*6	2	2	2	2	1	*6	5	4	3	2	1	

Aligning Peak Notes

Closest match

Karypis Tr. (Ex. 1020) 132:15-133:1 & Ex. 9 (modified)

Iwamura – Identifying a Neighbor

Network-1's Interpretation

- Dr. Karypis agrees that Comparison No. 12, which would identify the closest match, is never performed

24 Q. And comparisons 12 through 16 would
25 not take place?
1 A. That would be correct.

GOOGLE, INC.,
Petitioner, IPR-2015-00343
IPR-2015-00345
vs. IPR-2015-00347
IPR-2015-00348
NETWORK-1 TECHNOLOGIES,
Patent Owner.
----------x
Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441
----------x

VIDEOTAPED DEPOSITION OF GEORGE KARYPIS
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

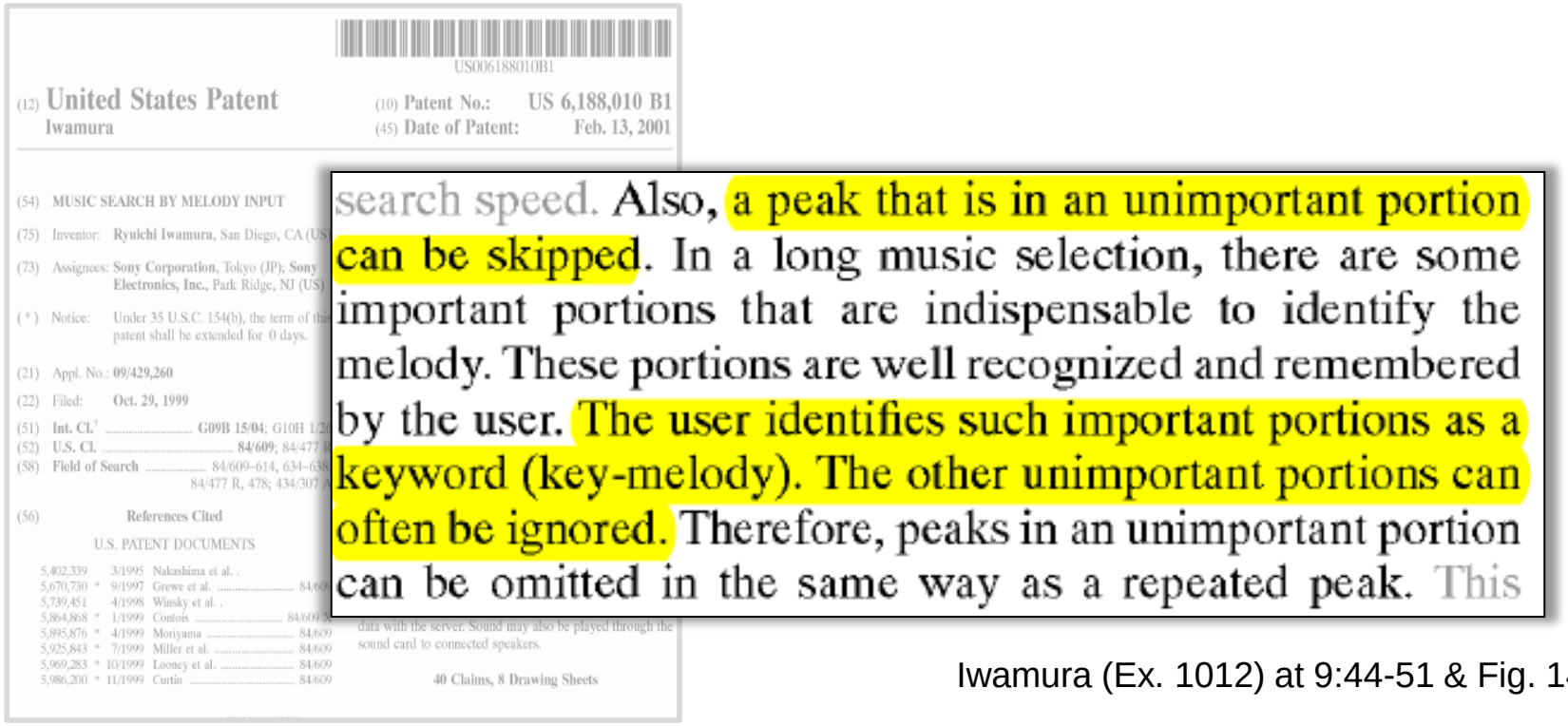
5 Q. If you take a look at comparison
6 number 12 --
7 A. Uh-huh.
8 Q. -- and compare the alignment of the
9 query to the notes in the reference work, at
10 that point, would you agree that the total
11 absolute difference sums to zero?
12 A. I do.
13 Q. And is that representative of an
14 exact match between the query and that
15 portion of reference work?
16 A. That is representative of an exact
17 match, yes.

Karypis Tr. (Ex. 1020) 132:24-133:1, 134:5-17)

Iwamura – Identifying a Neighbor

Network-1's Interpretation

- Because Iwamura skips "unimportant portions" of a reference, it does not always find the closest match



US006188010B1

(12) United States Patent
Iwamura

(10) Patent No.: US 6,188,010 B1
(45) Date of Patent: Feb. 13, 2001

(54) MUSIC SEARCH BY MELODY INPUT

(75) Inventor: Ryuichi Iwamura, San Diego, CA (US)

(73) Assignees: Sony Corporation, Tokyo (JP); Sony Electronics, Inc., Park Ridge, NJ (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: 09/429,260

(22) Filed: Oct. 29, 1999

(51) Int. Cl.[7] G09B 15/04; G10H 1/2

(52) U.S. Cl. ..... 84/609; 84/477 R

(58) Field of Search ..... 84/609–614, 634–63 84/477 R, 478; 434/307

(56) References Cited

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5,402,339		3/1995	Nakashima et al. .	
5,670,730	*	9/1997	Grewe et al.	84/60
5,739,451		4/1998	Winsky et al. .	
5,864,868	*	1/1999	Contois	84/609
5,895,876	*	4/1999	Moriyama	84/609
5,925,843	*	7/1999	Miller et al.	84/609
5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609

data with the server. Sound may also be played through the sound card to connected speakers.

40 Claims, 8 Drawing Sheets

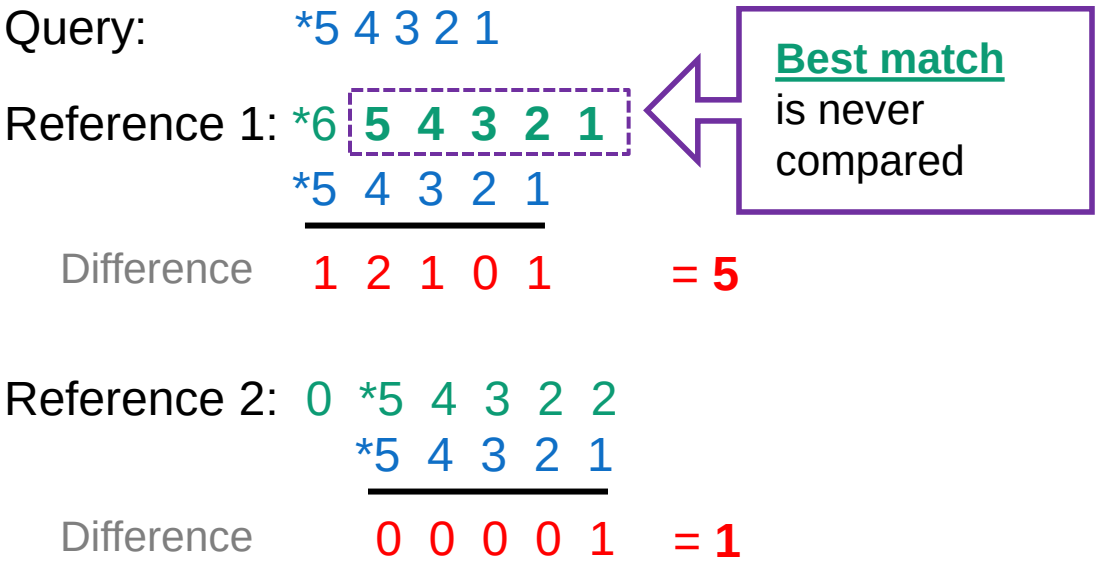
search speed. Also, a peak that is in an unimportant portion can be skipped. In a long music selection, there are some important portions that are indispensable to identify the melody. These portions are well recognized and remembered by the user. The user identifies such important portions as a keyword (key-melody). The other unimportant portions can often be ignored. Therefore, peaks in an unimportant portion can be omitted in the same way as a repeated peak. This

Iwamura (Ex. 1012) at 9:44-51 & Fig. 14

Iwamura – Identifying a Neighbor

Network-1's Interpretation

- Because Iwamura's peak note search does not always find the best segment, it also does not always find the best song



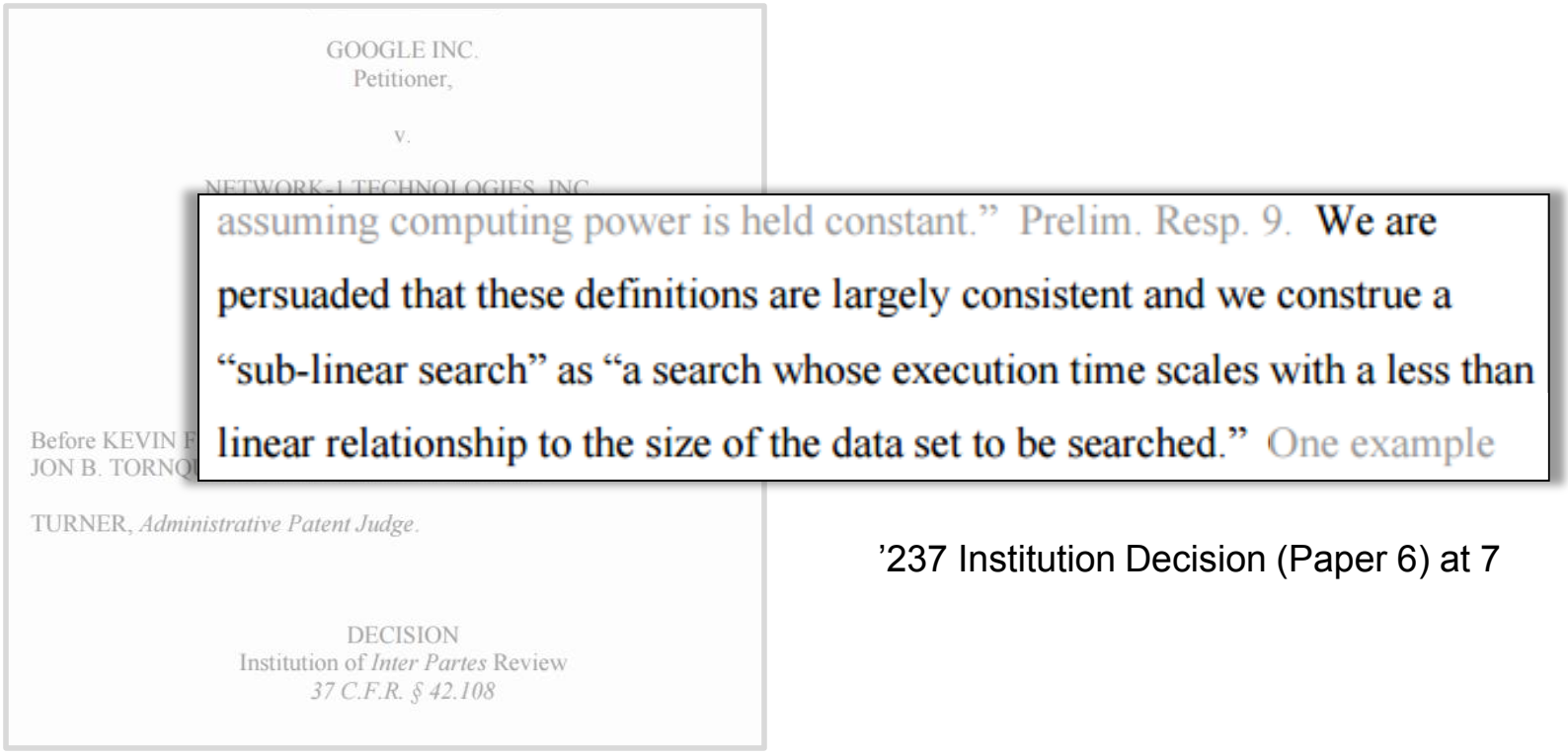
'988 Google's Reply (Paper 20) at 21-22

IWAMURA

Sublinear Search (IPR2015-00345 only)

Iwamura – Sublinear Search

- The Board's construction refers to a "less than linear relationship to the size of the data set to be searched"



GOOGLE INC.
Petitioner,

v.

NETWORK-1 TECHNOLOGIES, INC.

assuming computing power is held constant." Prelim. Resp. 9. We are persuaded that these definitions are largely consistent and we construe a "sub-linear search" as "a search whose execution time scales with a less than linear relationship to the size of the data set to be searched." One example

Before KEVIN F
JON B. TORNQ

TURNER, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

'237 Institution Decision (Paper 6) at 7

Iwamura – Sublinear Search

- The challenged patents refer to disk space when addressing the size of the database

With 9 million entries, if each vector is 1 Kbyte, then the storage requirement is 9 Gigabytes. Disk drives with this capacity are extremely cheap at this time. However, if the

’237 patent (Ex. 1001) at 21:24-25

- Dr. Karypis agrees it is an appropriate interpretation of size

Q. And you've expressed the opinion that the number of entries in the data set is the appropriate interpretation.
Why would the size on disk not be an appropriate interpretation?
A. I think that can also be an appropriate interpretation.

Karypis Tr. (Ex. 1020) at 105:25-106:6

Iwamura – Sublinear Search

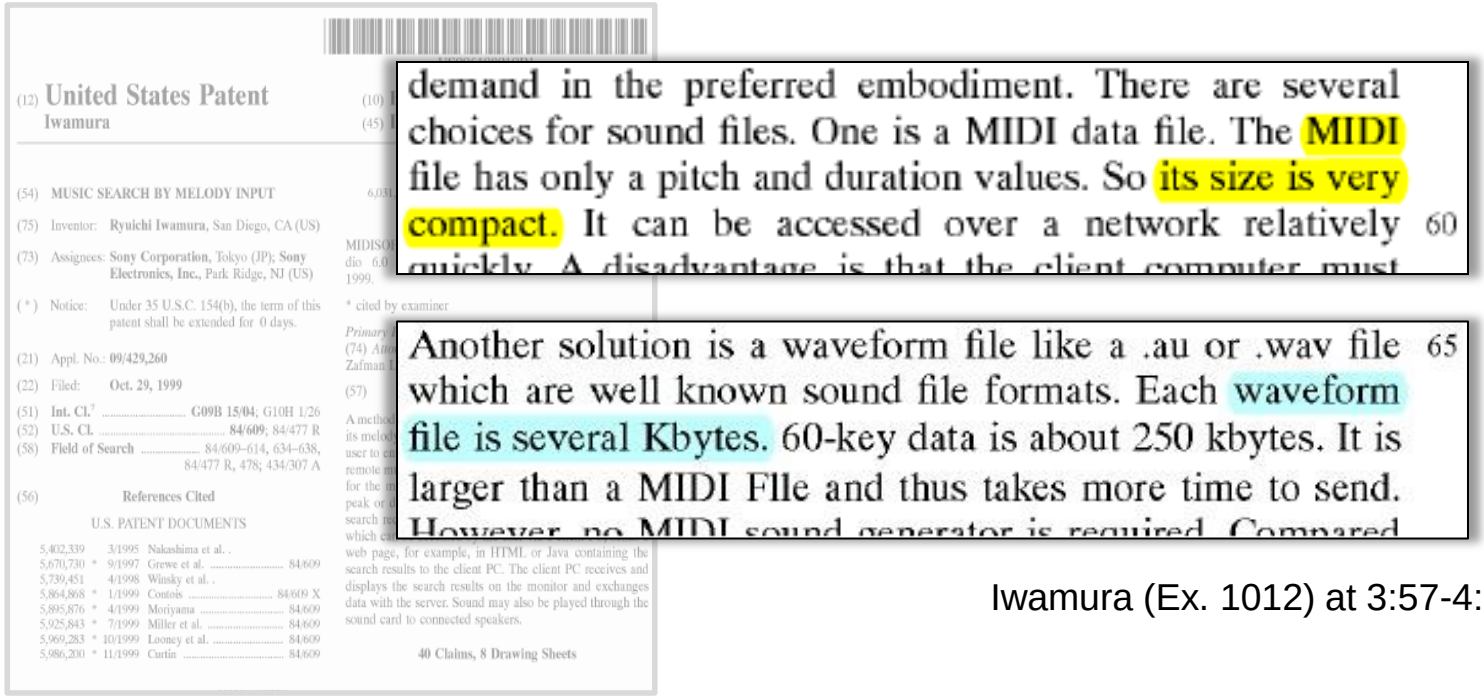
- Dr. Moulin cited the Boyer-Moore algorithm as an *example* of sublinear search disclosed in Iwamura

> 72. It is my opinion that Iwamura further teaches how this search can be sublinear. For example, Iwamura discloses that different "search algorithms may be applied to perform melody searches," (*id.* at 10:2-3), such as the "Boyer-Moore algorithm," (*id.* at 9:63). "On the average the [Boyer-Moore] algorithm has a sublinear behaviour." Ex. 1017 at 1.

'237 Moulin Decl. (Ex. 1004) ¶ 72

Iwamura – Sublinear Search

- In another example, Iwamura discloses storing reference songs in two formats: low resolution MIDI, and high resolution waveform (.wav)



(12) United States Patent
Iwamura

(54) MUSIC SEARCH BY MELODY INPUT

(75) Inventor: Ryuichi Iwamura, San Diego, CA (US)

(73) Assignees: Sony Corporation, Tokyo (JP); Sony Electronics, Inc., Park Ridge, NJ (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: 09/429,260

(22) Filed: Oct. 29, 1999

(51) Int. Cl.[7] G09B 15/04; G10H 1/26

(52) U.S. Cl. ..... 84/609; 84/477 R

(58) Field of Search ..... 84/609–614, 634–638, 84/477 R, 478; 434/307 A

(56) References Cited

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5,739,451		4/1998	Winsky et al. .	
5,864,868	*	1/1999	Contois	84/609 X
5,895,876	*	4/1999	Moriyama	84/609
5,925,843	*	7/1999	Miller et al.	84/609
5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609

* cited by examiner

(57)

web page, for example, in HTML or Java containing the search results to the client PC. The client PC receives and displays the search results on the monitor and exchanges data with the server. Sound may also be played through the sound card to connected speakers.

40 Claims, 8 Drawing Sheets

demand in the preferred embodiment. There are several choices for sound files. One is a MIDI data file. The MIDI file has only a pitch and duration values. So its size is very compact. It can be accessed over a network relatively 60 quickly. A disadvantage is that the client computer must

Another solution is a waveform file like a .au or .wav file 65 which are well known sound file formats. Each waveform file is several Kbytes. 60-key data is about 250 kbytes. It is larger than a MIDI Flle and thus takes more time to send. However, no MIDI sound generator is required. Compared

Iwamura (Ex. 1012) at 3:57-4:1

Iwamura – Sublinear Search

- Adding a .wav file to a database containing a single MIDI file will greatly increase the size of the data set, but only double the search time

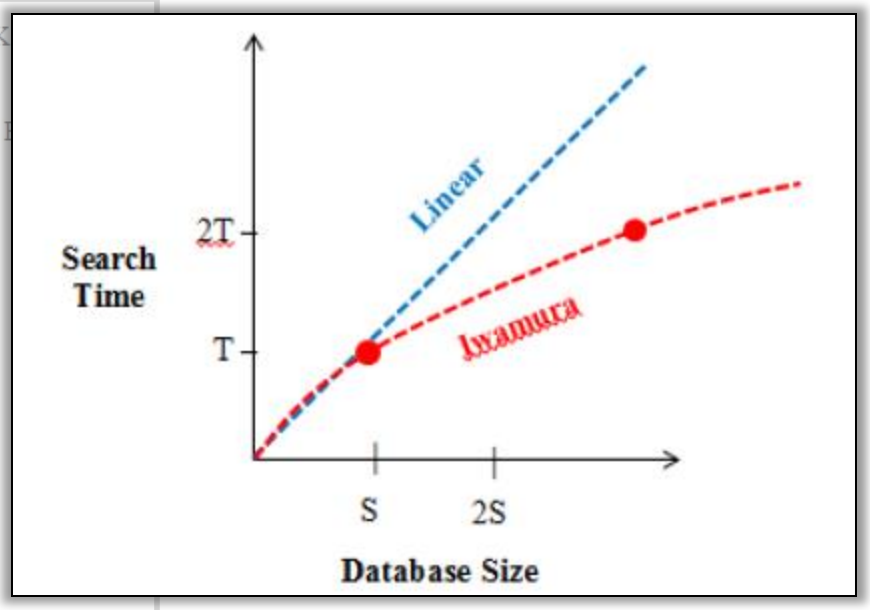
UNITED STATES PATENT AND TRADEMARK

BEFORE THE PATENT TRIAL AND APPEAL

Google Inc.
Petitioner,
v.
Network-1 Technologies, Inc.
Patent Owner.

Case IPR2015-00345
U.S. Patent 8,205,237

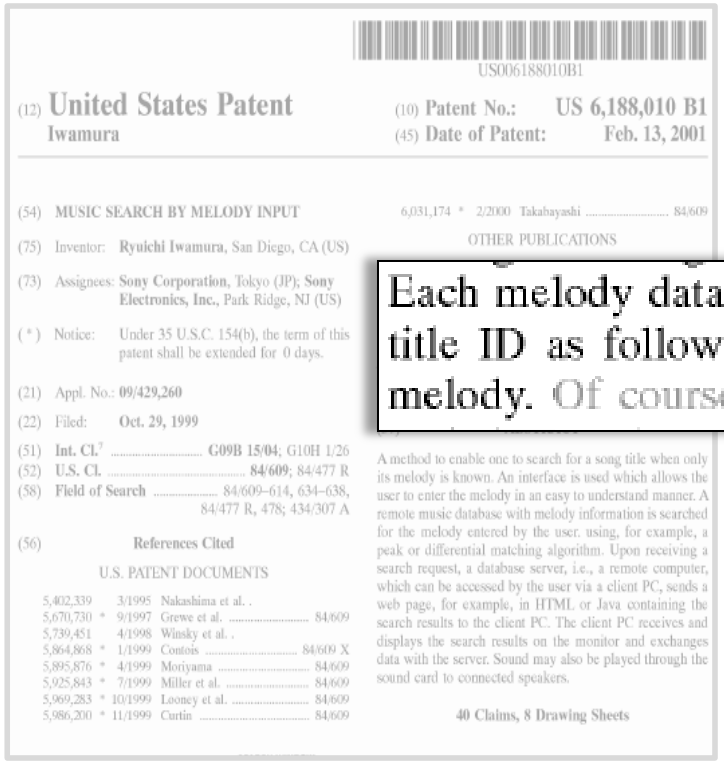
PETITIONER'S REPLY TO
PATENT OWNER'S RESPONSE TO PETITION



'237 Google's Reply (Paper 20) at 17-18

Iwamura – Sublinear Search

- Iwamura discloses an embodiment storing up to 64 notes per reference song (even if the song is longer), independent of the file type



US006188010B1

(12) **United States Patent**
Iwamura

(10) **Patent No.: US 6,188,010 B1**
(45) **Date of Patent: Feb. 13, 2001**

(54) **MUSIC SEARCH BY MELODY INPUT**

(75) Inventor: **Ryuichi Iwamura**, San Diego, CA (US)

(73) Assignees: **Sony Corporation**, Tokyo (JP); **Sony Electronics, Inc.**, Park Ridge, NJ (US)

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(52) **U.S. Cl.** ..... **84/609**; 84/477 R
(58) **Field of Search** ..... 84/609–614, 634–638, 84/477 R, 478; 434/307 A

(56) **References Cited**

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5,969,283	*	10/1999	Looney et al.	84/609
5,986,200	*	11/1999	Curtin	84/609
6,031,174	*	2/2000	Takahayashi	84/609

OTHER PUBLICATIONS

A method to enable one to search for a song title when only its melody is known. An interface is used which allows the user to enter the melody in an easy to understand manner. A remote music database with melody information is searched for the melody entered by the user, using, for example, a peak or differential matching algorithm. Upon receiving a search request, a database server, i.e., a remote computer, which can be accessed by the user via a client PC, sends a web page, for example, in HTML or Java containing the search results to the client PC. The client PC receives and displays the search results on the monitor and exchanges data with the server. Sound may also be played through the sound card to connected speakers.

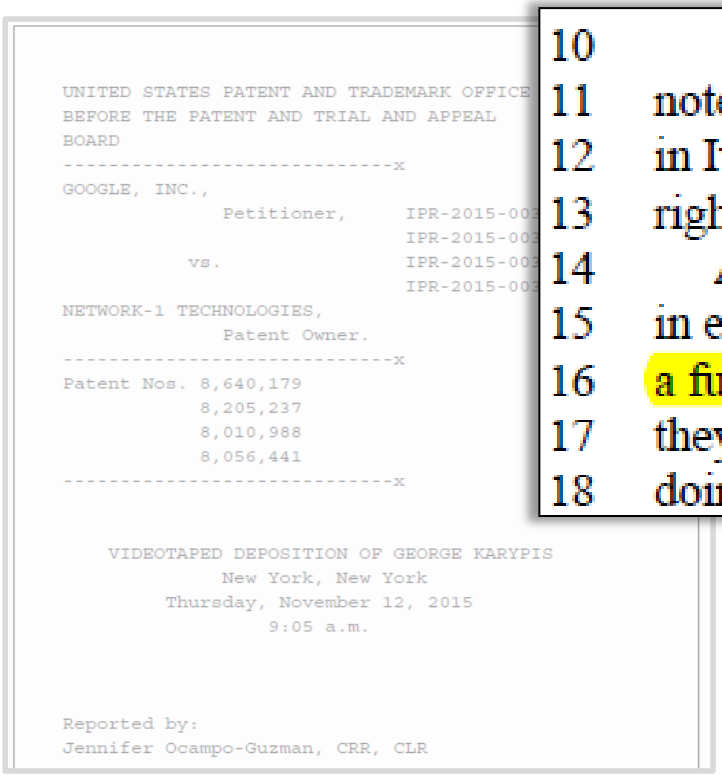
40 Claims, 8 Drawing Sheets

Each melody data is grouped with its composer ID and its title ID as follows. Here, up to 64 notes are stored for a melody. Of course, the size of the array used to store the 30

Iwamura (Ex. 1012) at 5:29-30

Iwamura – Sublinear Search

- The distance between peak notes would be a function of the music, not the file type, so the search time is independent of file type



UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT AND TRIAL AND APPEAL BOARD

GOOGLE, INC.,
Petitioner,
vs.
NETWORK-1 TECHNOLOGIES,
Patent Owner.

Patent Nos. 8,640,179
8,205,237
8,010,988
8,056,441

VIDEOTAPED DEPOSITION OF GEORGE KARYPIS
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

10 Would distance between the peak
11 notes in either a query or a reference item
12 in Iwamura would be a function of the music,
13 right?
14 A. The distance between the peak notes
15 in either the query or the reference would be
16 a function of the music and a function of how
17 they're, whether or not they're, how they're
18 doing the centering.

Karypis Tr. (Ex. 1020) at 126:10-18

CONWELL

Overview

Conwell
Ex. 1009

- Conwell is applicable to the following patents and claims:

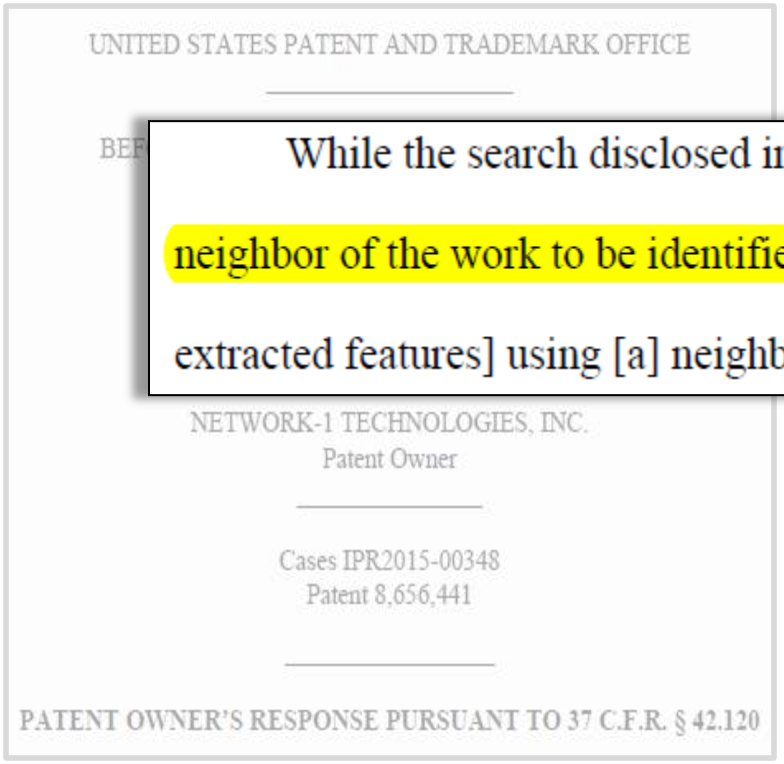
Patent No.	Claims
8,010,988	N/A
8,205,237	N/A
8,640,179	**1**-3, 6, 8-12, **13**-14, 19, 21-24, **25**-26, 30-31, 34-37
8,656,441	**1**-3, 6, 8-12, **13**-14, 19, 21-24, **25**-26, 30

CONWELL

Neighbor Search

Conwell – Neighbor Search

- Network-1 does not dispute that Conwell discloses identifying a neighbor of the query work


UNITED STATES PATENT AND TRADEMARK OFFICE

BEF

NETWORK-1 TECHNOLOGIES, INC.
Patent Owner

Cases IPR2015-00348
Patent 8,656,441

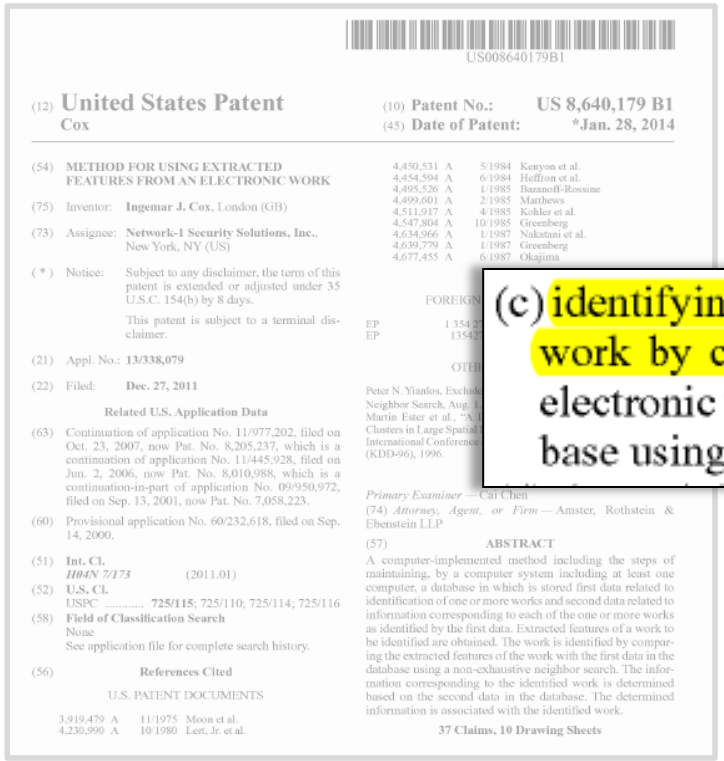
PATENT OWNER'S RESPONSE PURSUANT TO 37 C.F.R. § 42.120

While the search disclosed in Conwell may have the result of identifying a neighbor of the work to be identified, it does not do so by "comparing [the extracted features] using [a] neighbor search" as required by the '441 claims.

'179 N-1 Response (Paper 17) at 17

Conwell – Neighbor Search

- The claim language recites identifying an electronic work, and does not exclude exactly matching features



US008640179B1

(12) **United States Patent**
Cox

(10) **Patent No.: US 8,640,179 B1**
(45) **Date of Patent: *Jan. 28, 2014**

(54) **METHOD FOR USING EXTRACTED FEATURES FROM AN ELECTRONIC WORK**

(75) Inventor: **Ingemar J. Cox**, London (GB)

(73) Assignee: **Network-1 Security Solutions, Inc.**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 8 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/338,079**

(22) Filed: **Dec. 27, 2011**

Related U.S. Application Data

(63) Continuation of application No. 11/977,202, filed on Oct. 23, 2007, now Pat. No. 8,205,237, which is a continuation of application No. 11/445,928, filed on Jun. 2, 2006, now Pat. No. 8,010,988, which is a continuation-in-part of application No. 09/950,972, filed on Sep. 13, 2001, now Pat. No. 7,058,223.

(60) Provisional application No. 60/232,618, filed on Sep. 14, 2000.

(51) **Int. Cl.**
H04N 7/173 (2011.01)

(52) **U.S. Cl.**
USPC **725/115**; 725/110; 725/114; 725/116

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

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Clusters in Large Spatial
International Conference
(KDD-96), 1996.

Primary Examiner — Cai Chen
(74) *Attorney, Agent, or Firm* — Amster, Rothstein & Ebenstein LLP

(57) **ABSTRACT**

A computer-implemented method including the steps of maintaining, by a computer system including at least one computer, a database in which is stored first data related to identification of one or more works and second data related to information corresponding to each of the one or more works as identified by the first data. Extracted features of a work to be identified are obtained. The work is identified by comparing the extracted features of the work with the first data in the database using a non-exhaustive neighbor search. The information corresponding to the identified work is determined based on the second data in the database. The determined information is associated with the identified work.

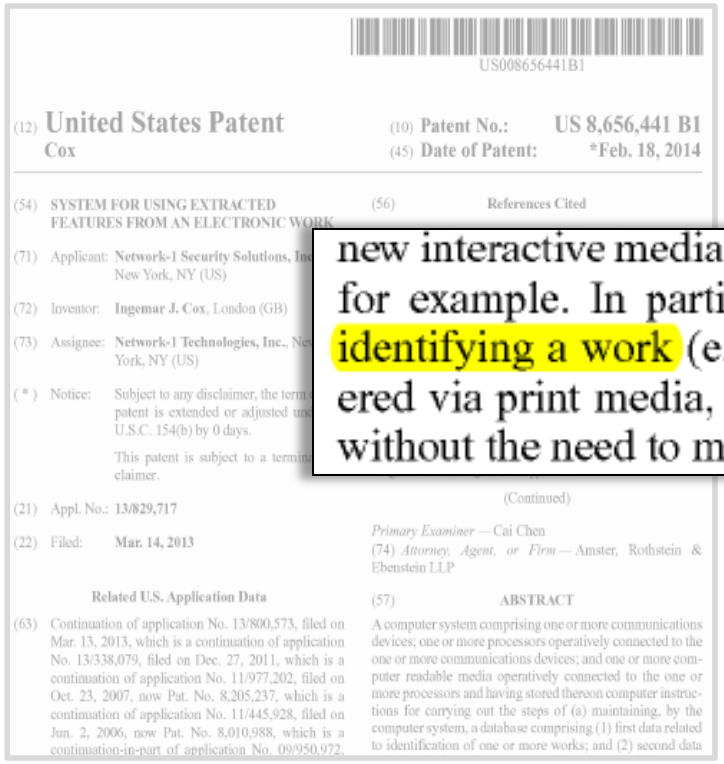
37 Claims, 10 Drawing Sheets

(c) identifying, by the computer system, the first electronic work by comparing the extracted features of the first electronic work with the first electronic data in the database using a non-exhaustive neighbor search;

'179 patent (Ex. 1001) at Claim 1

Conwell – Neighbor Search

- The specification makes clear that the purpose of the invention is to identify a *work*



US008656441B1

(12) **United States Patent**
Cox

(10) **Patent No.: US 8,656,441 B1**
(45) **Date of Patent: *Feb. 18, 2014**

(54) **SYSTEM FOR USING EXTRACTED FEATURES FROM AN ELECTRONIC WORK**

(56) **References Cited**

(71) Applicant: **Network-1 Security Solutions, Inc.**, New York, NY (US)

(72) Inventor: **Ingemar J. Cox**, London (GB)

(73) Assignee: **Network-1 Technologies, Inc.**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/829,717**

(22) Filed: **Mar. 14, 2013**

Related U.S. Application Data

(63) Continuation of application No. 13/800,573, filed on Mar. 13, 2013, which is a continuation of application No. 13/338,079, filed on Dec. 27, 2011, which is a continuation of application No. 11/977,202, filed on Oct. 23, 2007, now Pat. No. 8,205,237, which is a continuation of application No. 11/445,928, filed on Jun. 2, 2006, now Pat. No. 8,010,988, which is a continuation-in-part of application No. 09/950,972,

(Continued)

Primary Examiner — Cai Chen
(74) *Attorney, Agent, or Firm* — Amster, Rothstein & Ebenstein LLP

(57) **ABSTRACT**

A computer system comprising one or more communications devices; one or more processors operatively connected to the one or more communications devices; and one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of (a) maintaining, by the computer system, a database comprising (1) first data related to identification of one or more works; and (2) second data

new interactive media, such as that provided over the Internet for example. In particular, the present invention concerns identifying a work (e.g., content or an advertisement delivered via print media, or via a radio or television broadcast) without the need to modify the work. 40

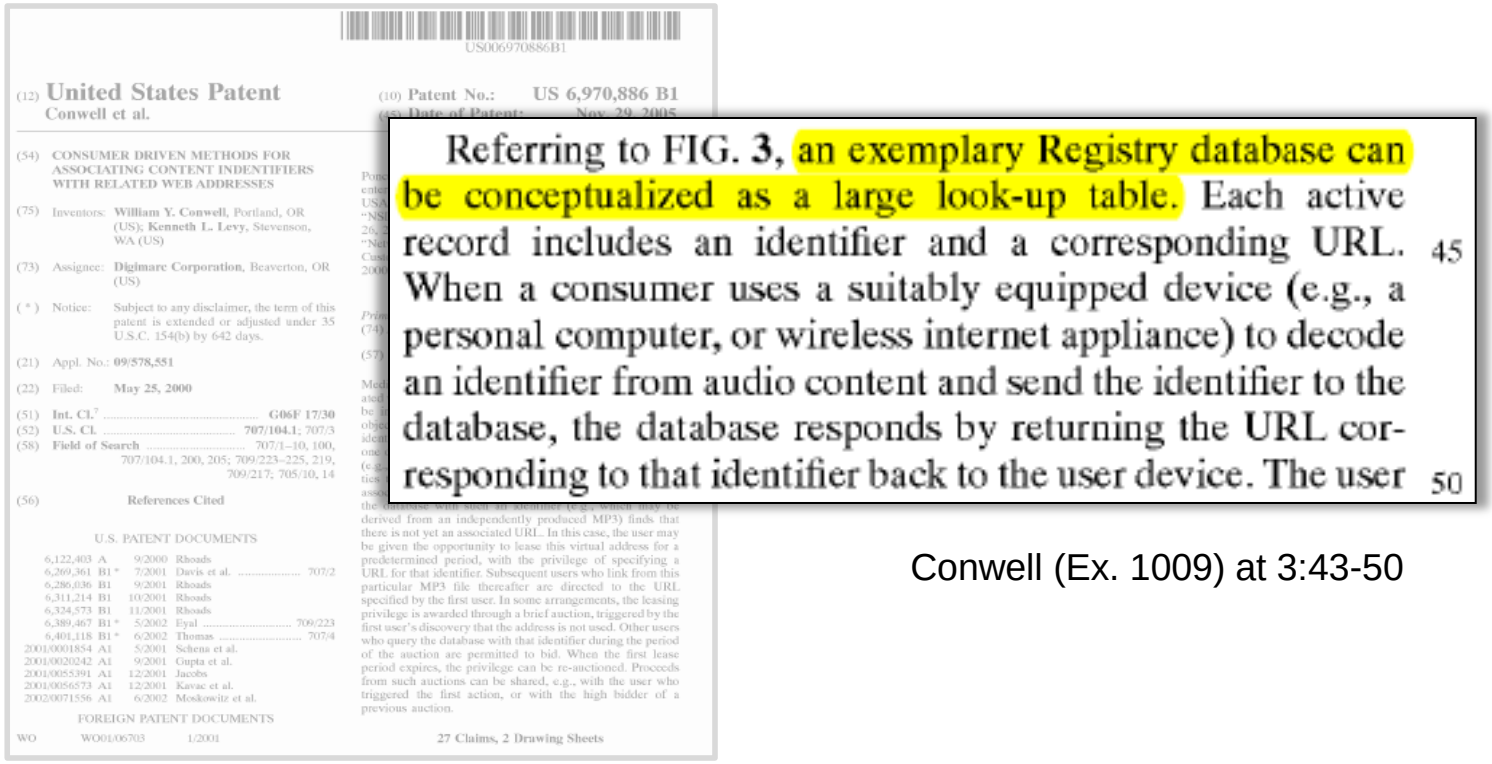
'179 patent (Ex. 1001) at 1:37-38

CONWELL

Non-Exhaustive Search

Conwell – Non-Exhaustive Search

- Conwell discloses a database (look-up table) that returns the URL corresponding to an identifier



US006970886B1

(12) **United States Patent**
Conwell et al.

(10) Patent No.: US 6,970,886 B1

(54) CONSUMER DRIVEN METHODS FOR ASSOCIATING CONTENT INDENTIFIERS WITH RELATED WEB ADDRESSES

(75) Inventors: William Y. Conwell, Portland, OR (US); Kenneth L. Levy, Stevenson, WA (US)

(73) Assignee: Digimarc Corporation, Beaverton, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 642 days.

(21) Appl. No.: 09/578,551

(22) Filed: May 25, 2000

(51) Int. Cl.[7] G06F 17/30

(52) U.S. Cl. 707/104.1; 707/3

(58) Field of Search 707/1–10, 100, 707/104.1, 200, 205; 709/223–225, 219, 709/217; 705/10, 14

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2001/0001854	A1	5/2001	Schena et al.	
2001/0020242	A1	9/2001	Gupta et al.	
2001/0055391	A1	12/2001	Jacobs	
2001/0056573	A1	12/2001	Kovac et al.	
2002/0071556	A1	6/2002	Moskowitz et al.	

FOREIGN PATENT DOCUMENTS

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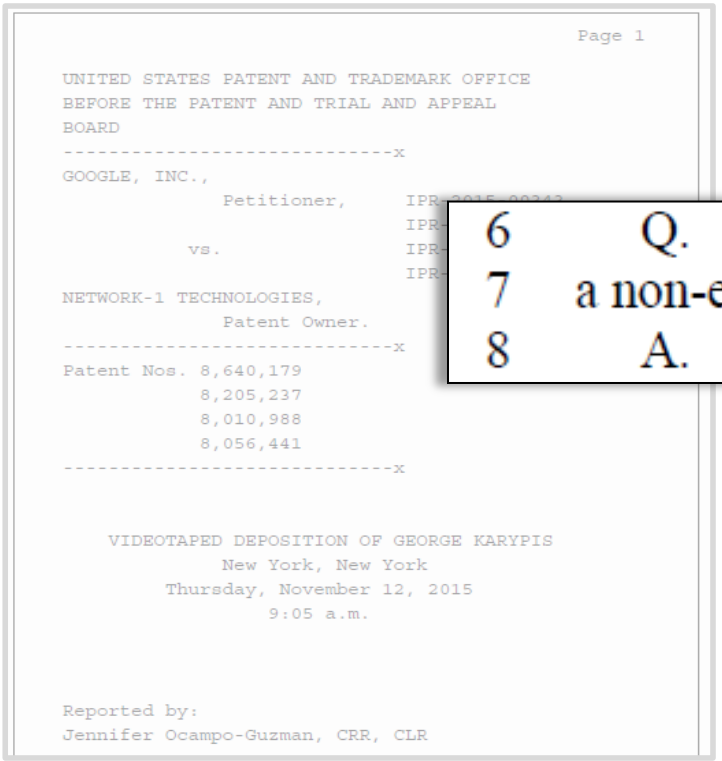
27 Claims, 2 Drawing Sheets

Referring to FIG. 3, an exemplary Registry database can be conceptualized as a large look-up table. Each active record includes an identifier and a corresponding URL. When a consumer uses a suitably equipped device (e.g., a personal computer, or wireless internet appliance) to decode an identifier from audio content and send the identifier to the database, the database responds by returning the URL corresponding to that identifier back to the user device. The user

Conwell (Ex. 1009) at 3:43-50

Conwell – Non-Exhaustive Search

- Dr. Karypis concedes that a “binary search” is a type of non-exhaustive search



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8,056,441

VIDEOTAPED DEPOSITION OF GEORGE KARYPIS
New York, New York
Thursday, November 12, 2015
9:05 a.m.

Reported by:
Jennifer Ocampo-Guzman, CRR, CLR

6 Q. A binary search being an example of
7 a non-exhaustive search, correct?
8 A. That is correct.

Karypis Tr. (Ex. 1020) at 186:6-8

Exemplary Claims

- ’988 patent (IPR2015-00347)

15. A method for associating an electronic work with an action, the electronic work comprising at least one of audio and video, the method comprising:

a) electronically extracting features from the electronic work;

b) electronically determining an identification of the electronic work based on the extracted features, wherein the identification is based on a non-exhaustive search identifying a neighbor;

c) electronically determining an action based on the identification of the electronic work; and

d) electronically performing the action.

Exemplary Claims

- ’237 patent (IPR2015-00345)

1. A computer-implemented method comprising:

a) receiving, by a computer system including at least one computer, features that were extracted from a media work by a client device;

b) determining, by the computer system, an identification of the media work using the received features extracted from the media work to perform a sub-linear time search of extracted features of identified media works to identify a neighbor; and

c) transmitting, by the computer system, information about the identified media work to the client device.

Exemplary Claims

- ’179 patent (IPR2015-00343)

1. A computer-implemented method comprising:
(a) maintaining, by a computer system including at least one computer, a database comprising:
(1) first electronic data related to identification of one or more reference electronic works; and
(2) second electronic data related to action information comprising an action to perform corresponding to each of the one or more reference electronic works;
(b) obtaining, by the computer system, extracted features of a first electronic work;
(c) identifying, by the computer system, the first electronic work by comparing the extracted features of the first electronic work with the first electronic data in the database using a non-exhaustive neighbor search;
(d) determining, by the computer system, the action information corresponding to the identified first electronic work based on the second electronic data in the database; and
(e) associating, by the computer system, the determined action information with the identified first electronic work.

Exemplary Claims

- ’441 patent (IPR2015-00348)

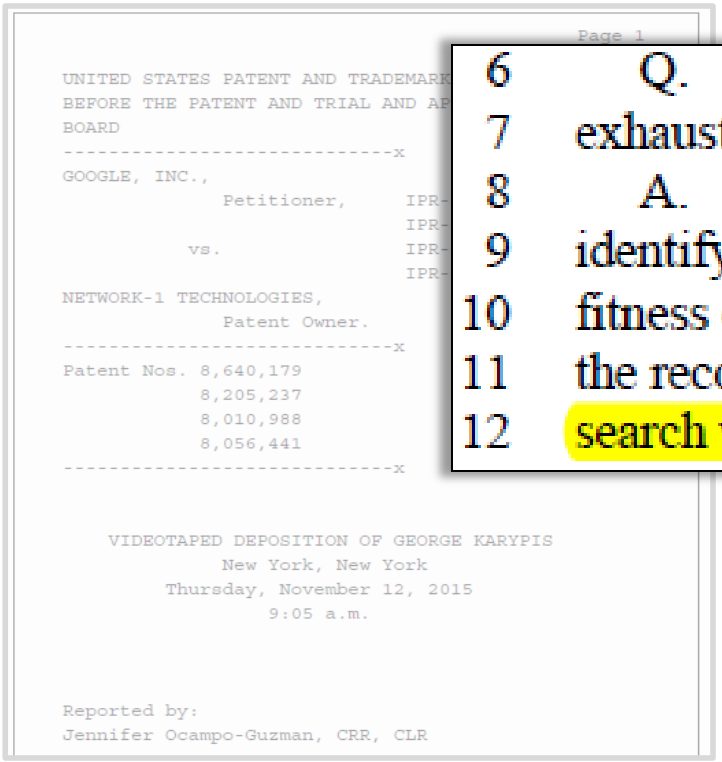
1. A computer system comprising:
one or more electronic communications devices;
one or more processors operatively connected to the one or more electronic communications devices; and
one or more computer readable media operatively connected to the one or more processors and having stored thereon computer instructions for carrying out the steps of:
(a) maintaining, by the computer system, a database comprising:
(1) first electronic data related to identification of one or more reference electronic works; and
(2) second electronic data related to action information comprising an action to perform corresponding to each of the one or more reference electronic works;
(b) obtaining, by the computer system, extracted features of a first electronic work;
(c) identifying, by the computer system, the first electronic work by comparing the extracted features of the first electronic work with the first electronic data in the database using a non-exhaustive neighbor search;
(d) determining, by the computer system, the action information corresponding to the identified first electronic work based on the second electronic data in the database; and
(e) associating, by the computer system, the determined action information with the identified first electronic work.

- Brute Force Search = Exhaustive Search

82. If there are 100 records in the database, an "exhaustive" search does not narrow the potential matches but instead systematically compares the work with each record to determine a match (if there is one). Systematically comparing the work to be identified with each potential match until a match is identified rather than using intelligence to narrow the search candidates is also referred to as using "brute force." Moulin Decl. ('988) ¶44 ("a brute force search conducts a comparison of every item in a search database"); Ex. 2001.

Karypis Decl. (Ex. 2005) ¶82

- Linear Search = Exhaustive Search



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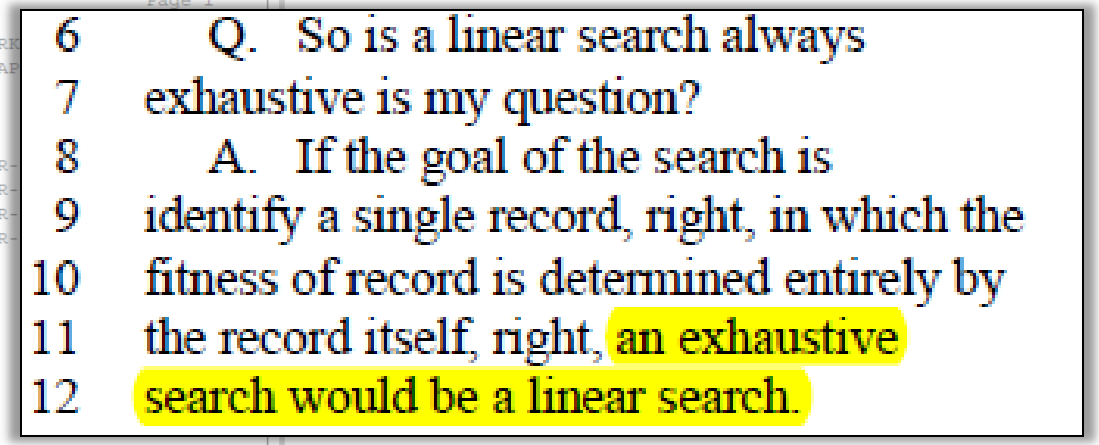

Q. So is a linear search always exhaustive is my question?
A. If the goal of the search is identify a single record, right, in which the fitness of record is determined entirely by the record itself, right, an exhaustive search would be a linear search.

Karypis Tr. (Ex. 1020) at 66:6-12, 69:22-70:20