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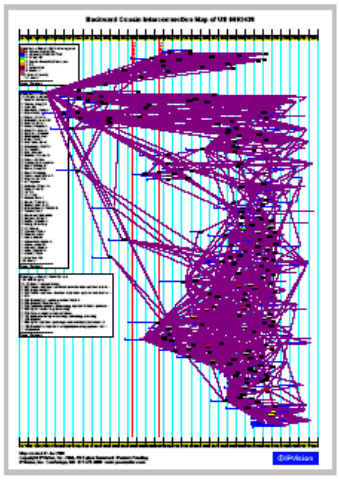
information > knowledge > wisdom

Lemelson-MIT Prize 2015

U.S. Patent Portfolio of Dr. Jay Whitacre, 2015 Lemelson-MIT Prize Winner

For: Lemelson-MIT Program



IPVision
Patent Interconnection Map

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U.S. Patent Portfolio of Dr. Jay Whitacre, 2015 Lemelson-MIT Prize Winner
For: Lemelson-MIT Program

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Important Note About Data. The analyses presented in this Report were based on data as of March 12, 2015 – i.e., the patents listed for a given company represent patents owned of record as shown at the U.S. Patent and Trademark Office databases as of that date. Patents issued to, acquired by or disposed of by such a company after March 12, 2015 will not appear in the list of patents shown in this Report or on IPVision See-The-Forest.com™. However, patents that issue after March 12, 2015 that cite a patent shown in an analysis in this Report will appear in any citation analysis run after March 12, 2015 on the information stored on IPVision See-The-Forest.com ™. In such as case there will be an inconsistency between the results presented in this Report (which is a snapshot in time) and the results shown on IPVision See-The-Forest.com ™.

1. THE LEMELSON-MIT PRIZE

"*The $500,000 Lemelson-MIT Prize recognizes individuals who translate their ideas into inventions and innovations that improve the world in which we live.*

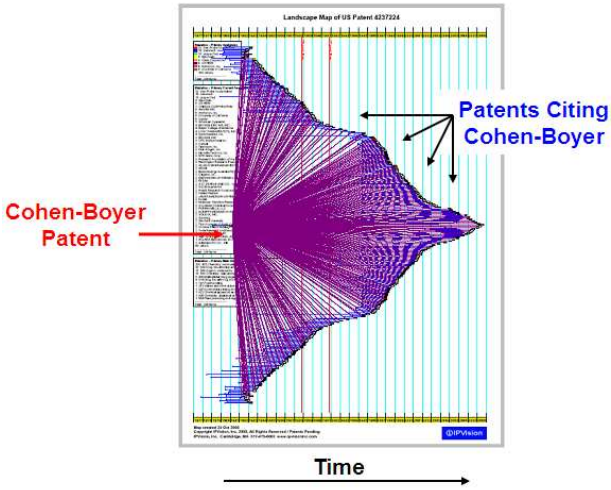
Dubbed the "Oscar for Inventors," the Lemelson-MIT Prize is awarded to outstanding mid-career inventors, who have developed a patented product or process of significant value to society, which has been adopted for practical use, or has a high probability of being adopted. By recognizing and funding younger, mid-career inventors, the prize is designed to spur inventive careers and provide role models for future generations of inventors." *Source: Lemelson-MIT Program Website*

2. OBJECTIVE MEASURES OF INNOVATION

One measure of the importance of an invention is the extent to which others in the field cite that invention in research papers. See for example, Web of Science Citation Indices.

Patents are another form of evidence of the value of an innovation and the broadness of the commercial or societal adoption of that invention. In order to obtain a patent the inventor must show that his or her invention is "novel". Relevant prior art known to the inventor must be cited in the patent examination process. A patent can become unenforceable if an applicant knowingly fails to cite relevant prior patent art of which he or she is aware. Accordingly, patent citations or the lack thereof have more specific economic consequences than citations of work in research papers

High Patent Citation is Evidence of Value. Many major innovations that have been patented have been highly cited by other patents. The IPVision Patent Landscape Map shown to the right is of the Cohen-Boyer gene splicing patent that launched the Biotech Industry. Stanley Cohen and Herbert Boyer were Co-Recipients of the Lemelson-MIT Prize in 1996. Stanford University received over $250m in revenue from the licensing of this patent. This patent U.S. 4,237,224 "*Process for producing biologically functional molecular chimeras*" had been cited over 270 times as of December 2009.



IPVision Patent Landscape Map
See Appendix A: How to Read an IPVision Map

Caveat: Although high patent citation is strong evidence of the value of an innovation, this evidence must be considered relative to the age of the technology, - i.e., the time it takes for the innovation to be recognized by others. The speed of technological development in a field must also be considered.

3. JAY WHITACRE'S U.S. PATENT PORTFOLIO

Jay Whitacre is Associate Professor of Materials Science and Engineering and Engineering and Public Policy at Carneige Mellon University. He holds the following academic degrees: Ph.D. and M.S.E. (Material Science and Engineering) The University of Michigan (1999 and 1997); B.A. Oberlin College (1994).

The Whitacre Research Group focus on understanding and exploiting materials properties to create efficient, long life, low cost, ionically functional technologies particularly for Electrochemical Energy Storage and Generation.

This IPVision Lemelson-MIT Prize 2015 Report investigates the U.S. patent portfolio of Dr. Jay Whitacre, the winner of the 2015 Lemelson-MIT Prize. We searched the U.S. Patent and Trademark Office databases for issued U.S. patents and published pending U.S. patent applications naming Jay Whitacre as an inventor. The following table shows (a) the number of patent properties on which Whitacre is named an inventor, (b) the number of patent citations of Whitacre's patents, (c) the Ratio/Average of Citations to Patents and (d) the Average Relative Citation Frequency Score for the patents in Whitacre's Portfolio:

Name	# Published Pending U.S. Applications	# U.S. Issued Patents	# Patent Citations of Nominee Patents	Ratio of Citations to Issued Patents	Average Relative Citation Frequency Score
Jay Whitacre	12	11	118	10.73	80.3

The number of citations of an inventor's patents by other inventors is a measure of the importance of an invention.[1] The Relative Citation Frequency for a patent is a measure of how highly cited the patent is relative to Peer Patents (patents in the same technology area of the same age) where 100 equals the most cited.[2]

3.1 LISTING OF DR. WHITACRE'S PATENTS

As of the date of this report Dr. Whitacre is listed as a named inventor on 11 issued U.S. patents and 12 published pending U.S. patent applications (the "Whitacre Patent Properties"). His 11 issued U.S. patents are:

U.S. Patents of Dr. Jay Whitacre				
Patent #	Inventors	Title	Citations By (BCs)	Citations To (FCs)
6558836	Whitacre, Jay F.; Bugga, Ratnakumar V.; West, William C.	Structure of thin-film lithium microbatteries	5	68
6764525	Whitacre, Jay F.; Bugga, Ratnakumar V.; West, William C.	Method for manufacturing thin-film lithium microbatteries	6	42
8137830	Whitacre, Jay	High voltage battery composed of anode limited electrochemical cells	56	4
8298701	Whitacre, Jay; Humphreys, Don; Yang, Wenzhuo; Lynch-Bell, Edward; Mohammad, Alex; Weber, Eric; Blackwood, David	Aqueous electrolyte energy storage device	60	3
7695849	Narayanan, Sekharipuram R.; Whitacre, Jay F.	Low Pt content direct methanol fuel cell anode catalyst: nanophase PtRuNiZr	3	1

[1] See, Jaffe, Adam B. and Trajtenberg, Manuel, *Patents, Citations & Innovations: a Window on the Knowledge Economy* (Cambridge, The MIT Press, 2002)
[2] See Appendix B for a fuller description of Relative Citation Frequency.

U.S. Patents of Dr. Jay Whitacre				
Patent #	Inventors	Title	Citations By (BCs)	Citations To (FCs)
8580422	Whitacre, Jay; Humphreys, Don; Yang, Wenzhuo; Lynch-Bell, Edward; Mohammad, Alex; Weber, Eric; Blackwood, David	Aqueous electrolyte energy storage device	66	0
8652672	Whitacre, Jay; Blackwood, David; Weber, Eric; Yang, Wenzhou; Sheen, Eric; Campbell, William; Humphreys, Don; Lynch-Bell, Edward	Large format electrochemical energy storage device housing and module	104	0
8741455	Whitacre, Jay	Sodium ion based aqueous electrolyte electrochemical secondary energy storage device	54	0
8945751	Whitacre, Jay	High voltage battery composed of anode limited electrochemical cells	57	0
8945756	Whitacre, Jay; Mohamed, Alex; Polonsky, Andrew; Shanbhag, Sneha; Carlisle, Kristen	Composite anode structure for aqueous electrolyte energy storage and device containing same	87	0
8962175	Whitacre, Jay; Humphreys, Don; Yang, Wenzhuo; Lynch-Bell, Edward; Mohamed, Alex; Weber, Eric; Blackwood, David	Aqueous electrolyte energy storage device	70	0

View Issued Patents on IPVision *See-The-Forest.com*™ ► Link to List

View Full List of Patent Properties on IPVision *See-The-Forest.com* ™ ► Link to List

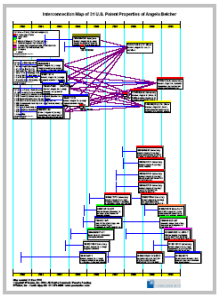
3.2 PATENT PORTFOLIO INTERCONNECTION MAP

An IPVision Patent Portfolio Interconnection Map shows all of the U.S. patents and published U.S. patent applications that comprise the patent portfolio of the Inventor. These are displayed as "patent boxes" arrayed in time from left (earliest) to right (more recent). A line connecting a later patent box to an earlier patent box shows that the later patent cited the earlier patent as "prior patent art". See, Appendix A – Reading IPVision Maps.

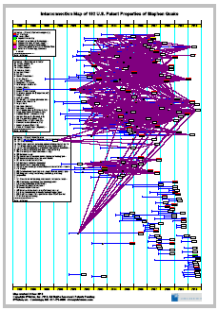
Note: A portfolio with a high degree of self citation is likely to have more commercial potential than a portfolio of individual inventions "scattered about".

Two examples of patent portfolios are shown to the right. The top portfolio is of Angela Belcher (48 patent properties), the 2013 Lemelson-MIT Prize Winner. The bottom portfolio is that of Stephen Quake (165 patent properties), the 2012 Lemelson-MIT Prize Winner. Not only does Dr. Quake have more patents, they are also more "clustered" than those of Dr. Belcher. Note: in both cases we have included published U.S. patents applications that have issued as U.S. patents.

Dr. Quake's portfolio is more clustered primarily because of the patents issued to Fluidigm, a leading microfluidics company founded by Dr. Quake.



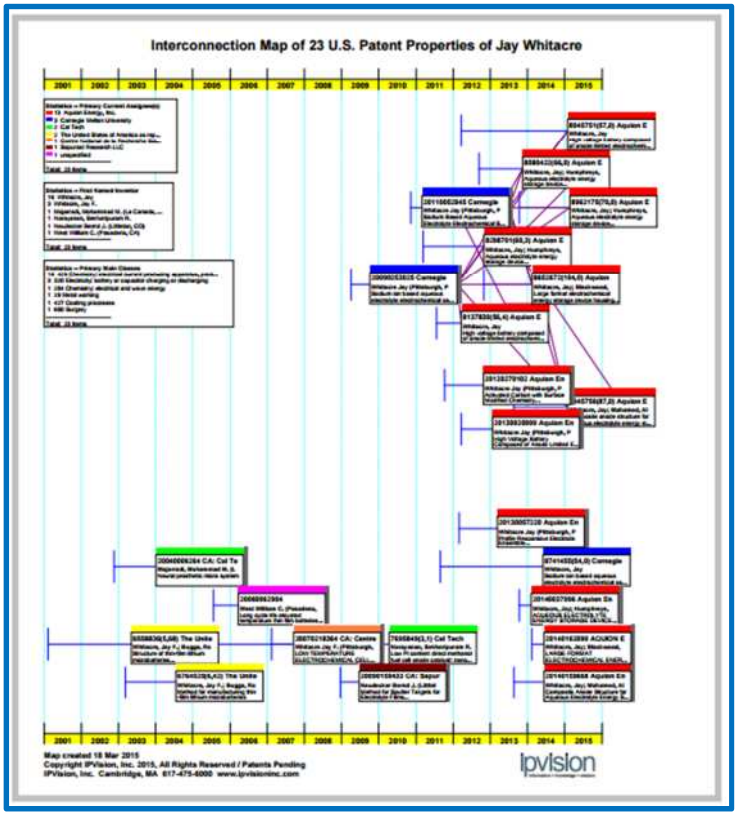
Angela Belcher – 2013 Winner



Stephen Quake – 2012 Winner

The following is an IPVision Patent Portfolio Interconnection Map™ showing the patent citation relationships among the U.S. patent properties of Jay Whtacre:

Patent Portfolio Interconnection Map™ of Jay Whitacre



Note: For information about Reading IPVision Maps, see Appendix A

Patent Portfolio Interconnection Map™: This IPVision Patent Portfolio Interconnection Map™ shows the U.S. patent properties of Jay Whitacre on a timeline from left to right. Each box is a patent or pending application with the left edge of the box aligned in time based on issue date (for patents) or publication date (for applications).

The lines connecting the boxes are citation references.

Click on the Map Image to view an interactive map online. When viewing the interactive map you can "right click" to view the underlying patent and related information.

View Live IPVision Map™ ► Link to Map

3.3 PATENT PORTFOLIO LANDSCAPE MAP

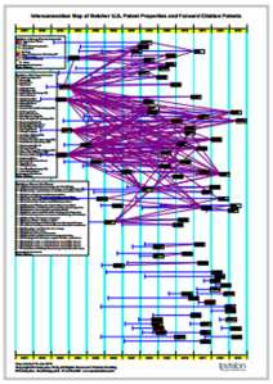
The citations by patents of prior art are often more relevant that citations in academic papers because the prior art citations have legal significance, – i.e., a patent can be invalidated if an inventor fails to cite prior art of which he or she is aware.

Patent citations also provide insights into how the invention(s) described in the patent lead to later inventions, – i.e., how those inventions "spawned" later inventions.

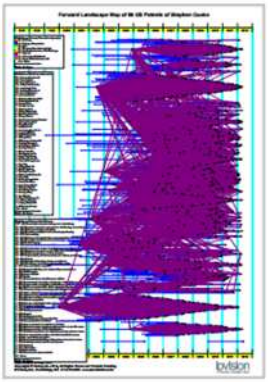
In the two examples at the right the top example shows a portfolio that has a low ratio of citations-to-patents. This is Angela Belcher (2013 Winner) (48 patents cited 37 times = 0.77 citation ratio). The bottom map shows 2012 Winner Stephen Quake's forward landscape with his 165 patents being cited 647 times = 3.92 citation ratio.

IMPORTANT CAVEAT: It can take from 3 to 5+ years from the date a patent application is filed until the patent issues – so there is a lag factor. In addition, it may take years for truly innovative inventions to be recognized by other inventors, so the relative age of the innovation is an important consideration in reviewing the patent landscape. Belcher's technology is relatively new. Quake's work has been commercialized.

(Note: Both of these maps were as of the date their prizes were awarded)



Angela Belcher – 2013 Winner
CR = 0.77



Stephen Quake – 2012 Winner
CR = 3.92

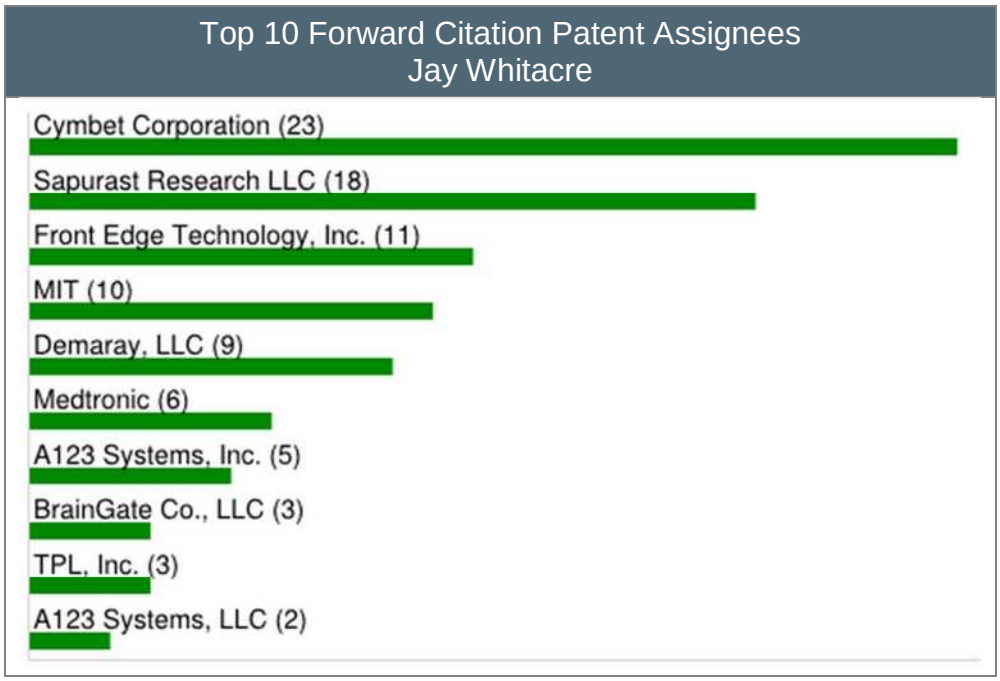
Sample Landscape Maps™

3.3.1 PATENTS CITING THE WHITACRE PATENTS

To prepare a Patent Landscape Map we identify the patents that cite the portfolio. The Whitacre Patent Properties are cited by 112 other U.S. patents as prior patent art ("Forward Citation Patents"). The Whitacre Patent Properties are cited 118 times by the Forward Citation Patents.

View "List of Forward Citation Patents" on IPVision *See-The-Forest.com*™ ► Link to List

According to the U.S. Patent and Trademark Office records, the Top 10 Current Assignee/Owners of the Forward Citation Patents are:



View "Forward Citation Assignee Analysis™" on *See-The-Forest.com*™ ► Link to Analysis

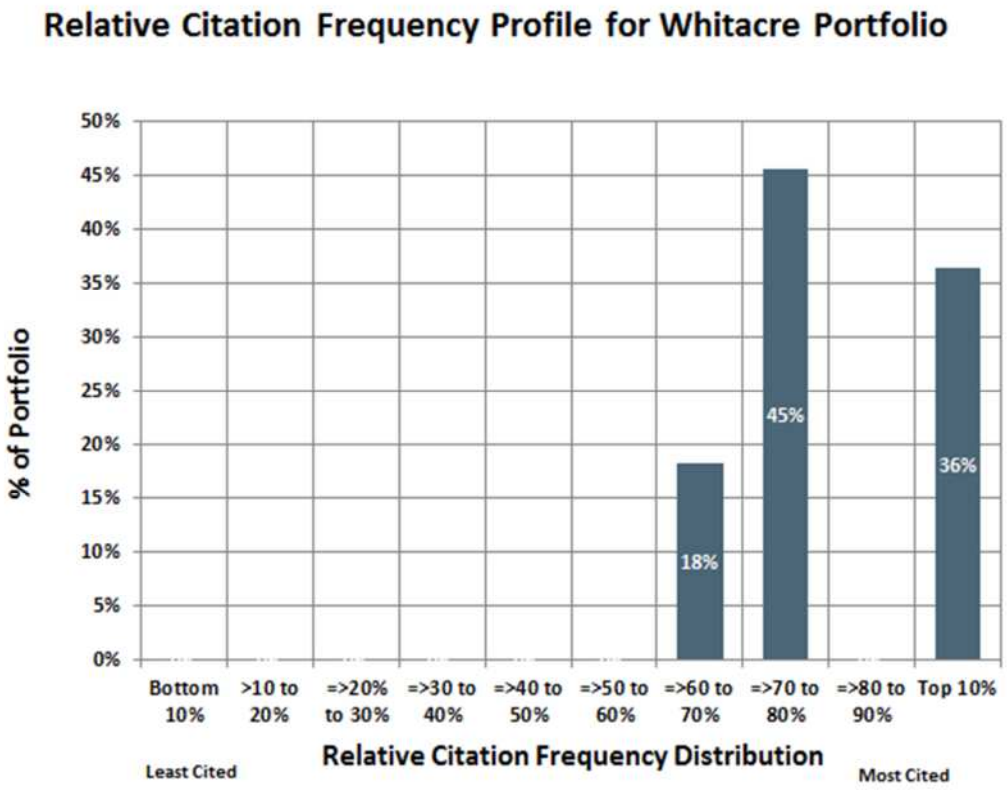
3.3.2 RELATIVE CITATION FREQUENCY

The number of patent citations to a patent is a function of the importance of the patent, the speed of patenting in the technology area and the age of the patent (the older the patent the more time it has to be cited). Accordingly, you can't tell whether a patent that is cited 50 times is "highly cited" or whether 50 citations is "average" unless you look at the number of citations relative to the patent's "peers".

IPVision has developed a Relative Citation Frequency (RCF) Score for a patent. For a given patent the RCF Score algorithm finds that patent's "Peer Patents", i.e., all patents in the same US Patent Classification System "class pair" that were issued within 6 months before or after the patent being scored. RCF then determines the relative citation frequency of the patent versus its Peer Patents.

To assess a portfolio we look at the distribution of RCF scores of the patents in the portfolio.

The Relative Citation Frequency scores distribution for the Whitacre Portfolio are:

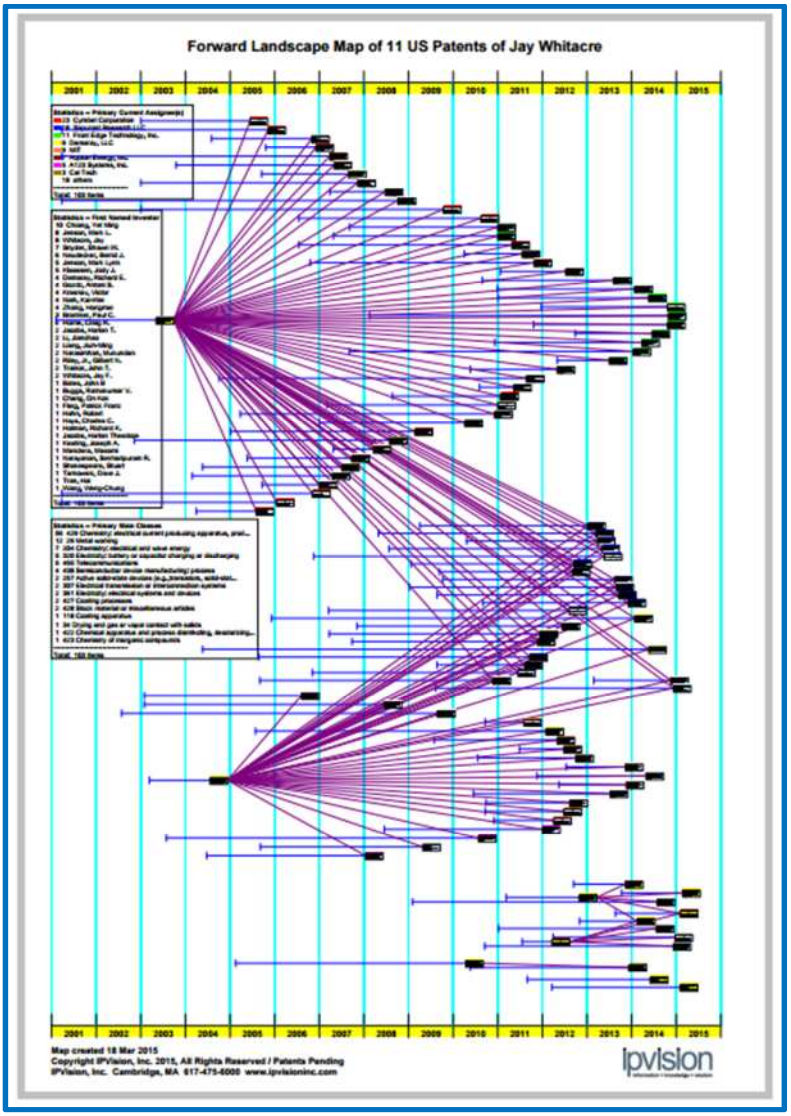


This profile shows that the Whitacre patents are highly cited relative to their Peer Patents, with 81% of the patents in the portfolio being in the 70+% most highly cited range. Mean RCF Score = 80.3; Median = 70.0 See Appendix B for a description of Relative Citation Frequency.

3.3.3 WHITACRE PATENT LANDSCAPE MAP

The following is an IPVision Forward Patent Citation Landscape Map™ showing the Whitacre Patents and the other U.S. patents that cite the Whitacre Patents ("Forward Citation Patents" or "FCs") as of the date of this report:

Forward Patent Citation Landscape Map™ of Jay Whitacre



Statistics -- Primary Current Assignee(s)

23	Cymbet Corporation
18	Sapurast Research LLC
11	Front Edge Technology, Inc.
9	Demaray, LLC
9	MIT
7	Aquion Energy, Inc.
5	A123 Systems, Inc.
3	Cal Tech
18	others

Total: 103 Items

Patent Citation Landscape Map™: This IPVision Forward Citation Patent Landscape Map™ shows the Whitacre Patents on a timeline from left to right. The Whitacre Patents are shaded in yellow. To the right of the Whitacre Patents are the Forward Citation Patents that cite the Whitacre Patents as prior patent art.

Note: For information about Reading IPVision Maps, see Appendix A

View Live IPVision Map™ ► Link to Map

There are two large “patent fans” shown on the map.

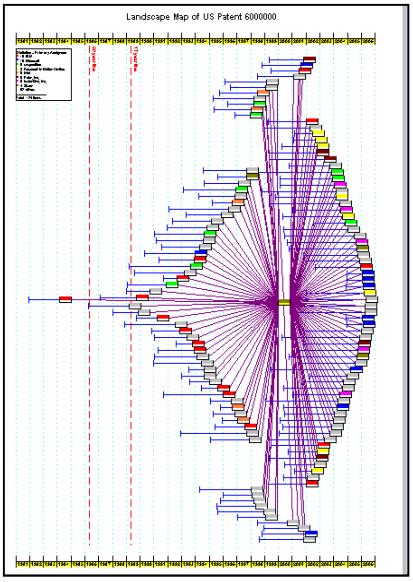
The patent fan at the top is Whitacre’s patent U.S. 6,558,836 “*Structure of thin-film lithium microbatteries*” which is cited by 68 other patents. Cymbet Corporation owns 23 of these patents. Cymbet is a privately held technology company that specializes in thin film, solid state batteries for microelectronic systems. It’s investors include Intel and Texas Instruments. The most recent citations to this patent are by Front Edge Technology.

TheThe second “fan” is around U.S. 6,764,525 “*Method for manufacturing thin-film lithium microbatteries*” which is cited by 42 patents. Sapurast Research LLC owns 18 of these patents, all of which were acquired from Infinite Power Solutions.

APPENDICES AND EXHIBITS

APPENDIX A – HOW TO READ AN IPVISION MAP

An IPVision Map is a visual representation of the relationships between objects. The following is an example of a Landscape Map for a single U.S. Patent:

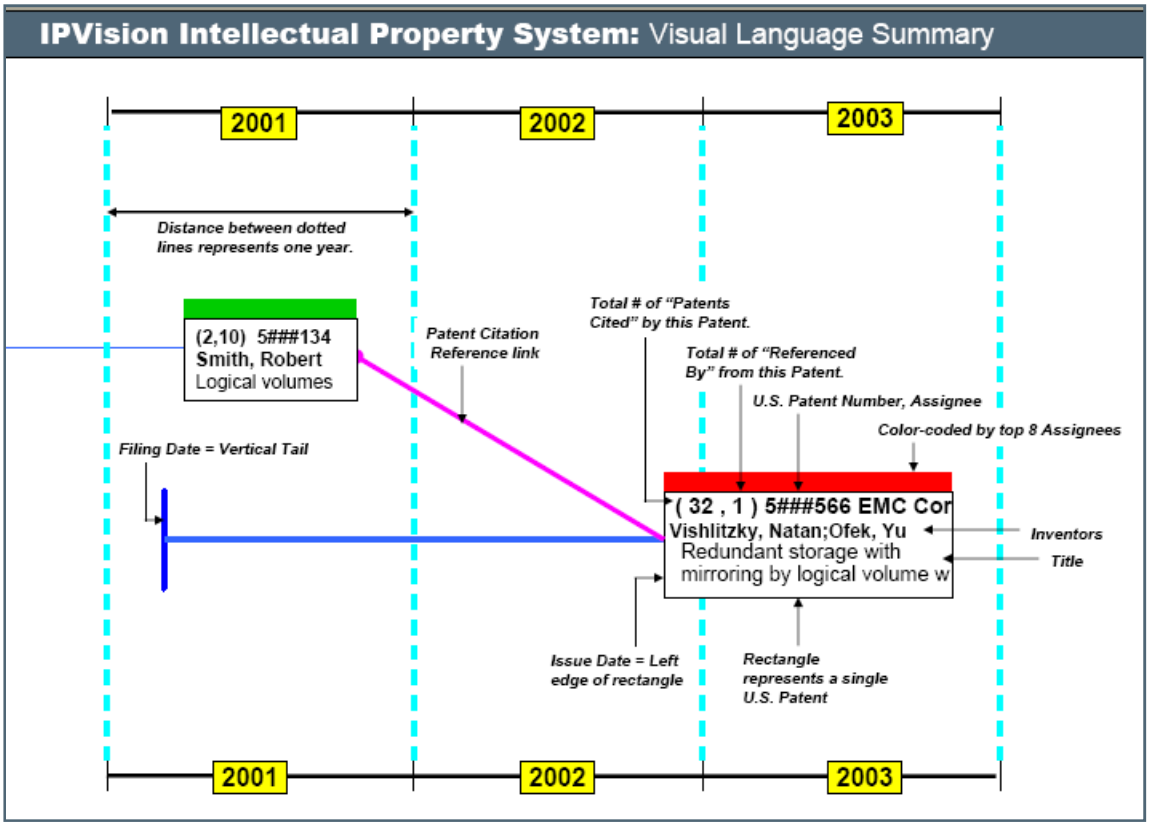


This Landscape Map is of U.S. Patent 6,000,000 entitled "Extendible method and apparatus for synchronizing multiple files on two different computer systems". It is the basic patent for the Palm Pilot software.

The horizontal X axis is "time"

Patent 6000000 is in the middle of the "fan". The lines going backward (to the left) are the patents cited by Patent 6000000 and the lines going forward (to the right) show the patents which cite Patent 6000000.

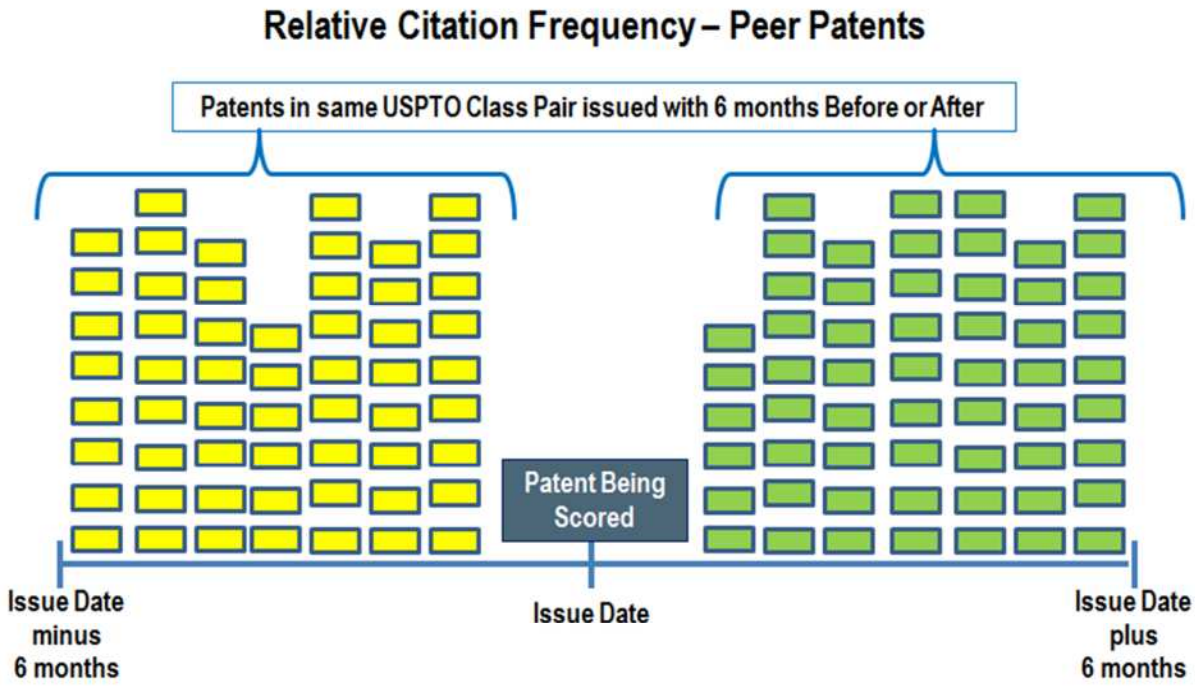
The details of an IPVision Map are explained in more detail below. See also a Guide To Reading IPVision Patent Maps.



APPENDIX B - RELATIVE CITATION FREQUENCY EXPLAINED

The number of patent citations to a patent is a function of the importance of the patent, the speed of patenting in the technology area and the age of the patent (the older the patent the more time it has to be cited). Accordingly, one can not tell whether a patent that is cited 50 times is "highly cited" or whether 50 citations is "average" unless you look at the number of citations relative to the patent's "peers".

IPVision has developed a Relative Citation Frequency (RCF) Score for a patent. For a given patent the RCF Score algorithm finds that patent's "Peer Patents", i.e., all patents in the same US Patent Classification System "class pair" that were issued within 6 months before or after the patent being scored. RCF then determines the relative citation frequency of the patent versus its Peer Patents.

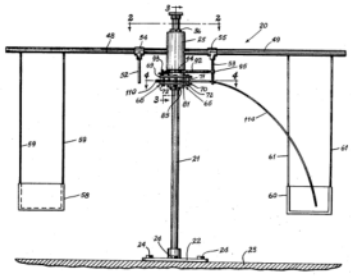


What is a Patent Classification? This is how the U.S. Patent and Trademark Office describes a Patent Classification:

> "*A Patent Classification is a code which provides a method for categorizing the invention. Classifications are typically expressed as "482/1". The first number, 482, represents the class of invention. The number following the slash is the subclass of invention within the class. There are about 450 Classes of invention and about 150,000 subclasses of invention in the USPC.*
>
> *Classes and subclasses have titles which provide a short description of the class or subclass. Classes and subclasses also have definitions which provide a more detailed explanation. Many Classes and subclasses have explicitly defined relationships to one another….*
>
> *A patent classification also represents a searchable collection of patents grouped together according to similarly claimed subject matter.*
>
> *A classification is used both as a tool for finding patents (patentability searches), and for assisting in the assignment of patent applications to examiners for examination purposes.….. Classifications have hierarchical relationships to one another.*"

What is a Class Hierarchy? The USPTO Classification System sets up a hierarchy of classes to describe areas of technology and invention. The following Class Hierarchy for "playground equipment" illustrates how a hierarchy is set up:

Example: Class Hierarchy for "Playground Equipment"



This is the drawing of the invention described in a patent entitled "Occupant-Propelled Roundabout Swing Set". A rider sitting in one of the swings can pull on a cable which causes the swings to rotate around the poll.

The USPTO placed this invention in Class 472/122: Amusement Devices/Swing/Having a hand operator/Cable grasp. This Hierarchy is illustrated as follows:

US Patent Class 472 - Amusement Devices		
106	SEESAW	
	107	Motor Operated
	108	Foot, hand or seat operated
	109	Having a safety feature
	etc	
116	BODY SLIDE	
	117	Water Slide
118	SWING	
	119	Motor operated
	120	Having hand and foot operator
	121	Having hand operator
	122	Cable grasp
	124	Having foot operator with separate suspender