

# Patents and Innovation: Changing Methods of Search

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# Agenda

- The Rise in University Patenting
- Challenges Facing Academic Inventors
- The Changing Face of Prior Art Search-Semantic Search

# The Rise in University Patenting

# Why Patent? Reasoning Behind Invention

- Protect your products
- Increase organization value
- Defend your portfolio
- Revenue from licensing opportunities
- Market yourself and your organization
- Restrict competitors



# Why Universities Patent?

- 民國八十七年十二月由 法院通過科學技術基本法(以下簡稱科技基本法)，並於去(八十八)年一月公布施行，賦予各研究機構將國有研發成果加以運用之法源依據。
- “Universities continue to encourage and sometimes push scientists to produce transferable technology and reap income from license agreements and start-up successes”
  - -- Amy Yancey & C Neal Stewart Jr. **Are university researchers at risk for patent infringement?** Nature Biotechnology 25, 1225 - 1228 (2007)
- “高校科技成果轉移轉化工作，既要注重以技術交易、作價入股等形式向企業轉移轉化科技成果；又要加大產學研結合的力度，支援科技人員面向企業開展技術開發、技術服務、技術諮詢和技術培訓...”
  - --教育部/科技部關於加強高等學校科技成果轉移轉化工作的若干意見

# Are university researchers at risk for patent infringement?

- “Academic researchers have regularly ignored patents on key technologies as a strategy to maneuver around patent thickets and freedom-to-operate issues, but they may be more at risk than they realize.”
- “An earlier report to the National Academy of Sciences suggests ...regular infringement of patents by university researchers, which is neither a sustainable nor a desirable solution.”

— Amy Yancey & C Neal Stewart Jr. **Are university researchers at risk for patent infringement?** Nature Biotechnology 25, 1225 - 1228 (2007)

# Challenges Facing Academic Inventors

# Patenting: Not Without Drawbacks

## ■ Costs involved

- Length of time to patent
- Cost involved to get the patent
- Maintenance fees for the life of the patent

## ■ Liability

- Lawsuits could become associated with a patent
- Possibility that a granted patent might not be valid
- A competitor might try and invalidate your patent if the price to do so is reasonable
- NOTE: The patent owner is responsible for enforcing their own patents

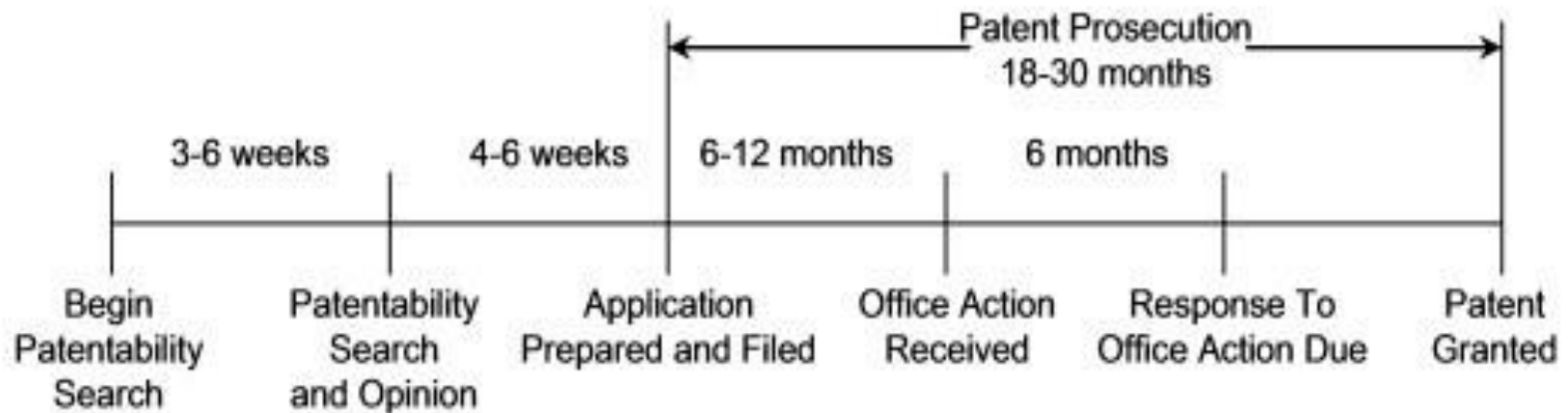




# From Idea to US Patent

## Model Patent Timeline

### Application Preparation & Prosecution Timeline



# Improving Patent Quality

- Current backlog of over 600,000 patent applications at the US Patent and Trademark Office
- Of these applications, over 40% are repeat filings
- After two years of validity reviews, 77% of patents granted are determined invalid



# Reasoning For Prior Art Searching

- Ensure the idea is new
- Increase awareness of the product
- Prepare for legal consultation
- Reduce patent attorney and patent agent fees
- Prepare for the application process



# Examples of Prior Art



Patents  
Non-Patents

## Patents vs. Non-Patents



Valuable content is typically buried deep within complex patent and technical documents

Source: <http://wallscope.co.uk/>

# How Can Libraries Help?



- Librarians as experts of searching non-patent literature
- “In patent litigation cases, NPL can help invalidate a patent by uncovering prior work created by someone else. It can also help an inventor build on another person’s research to perfect their invention”
  - Outsell Insights, Oct 11, 2016



Figure 1 – Front Page of Patent # 5,591,372

United States Patent

5,591,372

## References Cited

### U.S. Patent Documents

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4330593	May., 1982	Shrout et al.	252/62.

### Other References

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**Ultrasonics Symposium, 1993 IEEE**, pp. 499-503. no month.

"Modeling 1-3 Composite Piezoelectrics: Thickness-Mode Oscillations", W A Smith, B A Auld,

**IEEE Trans. on Ultrasonics Ferroelectrics and Frequency Control**, vol. 38, No. 1, Jan. 1991.

"Properties of Composite Piezoelectric Materials for Ultrasonic Transducers", W A Smith, et al.,

1984 **Ultrasonics Symposium, IEEE 1984**, pp. 539-544. no month.

"The Role of Piezocomposites in Ultrasonic Transducers", W A Smith, 1989 **Ultrasonics**

**Symposium, 1989 IEEE**, pp. 755-766. no month.

"Development of 1-3 Ceramic-Air Composite Transducers", C. Oakley, et al., SPIE vol. 1733 (1992)

pp. 274-283. no month.

"Freeze-formed Silica Fibers", W. Hahler, et al., May 1980, Central Research & Development Dept.,

E.I. duPont de Nemours & Company, Wilmington, Delaware.

*Primary Examiner:* Bonner; Melissa

*Attorney, Agent or Firm:* Johnson; Noreen C., Pittman; William H.

"Freeze-formed Silica Fibers", W. Hahler, et al., May 1980, Central Research & Development Dept.,  
E.I. duPont de Nemours & Company, Wilmington, Delaware.

*Primary Examiner:* Bonner; Melissa

*Attorney, Agent or Firm:* Johnson; Noreen C., Pittman; William H.



# The Changing Role of Library in University Patenting

- Trends among university libraries in China
  - Information resource provider → Patent service provider
  - Reference librarians → Patent Specialist
  - Non-patent collections → More patent collections

Jun Feng, NaiXuan Zhao. A New Role of Chinese Academic Librarians—The Development of Embedded Patent Information Services at Nanjing Technology University Library, China. The Journal of Academic Librarianship. 41(3), May 2015, P292–300



# **The Changing Face of Prior Art Search-Semantic Search**

# Boolean Search: Traditional Prior Art Searching

Boolean search has been the mainstay of patent research for years:

- Controlled language search
- Ability to combine sets
- Can refine search set by limiters such as AND, OR & NOT
- Some databases support nesting (combining long search strings)

However, Boolean is not without its flaws:

- Requires lengthy training or expert searchers to effectively employ
- Limited to the words included in the query and variations thereof
- Lengthy search strings may be cut off by term limits in some databases

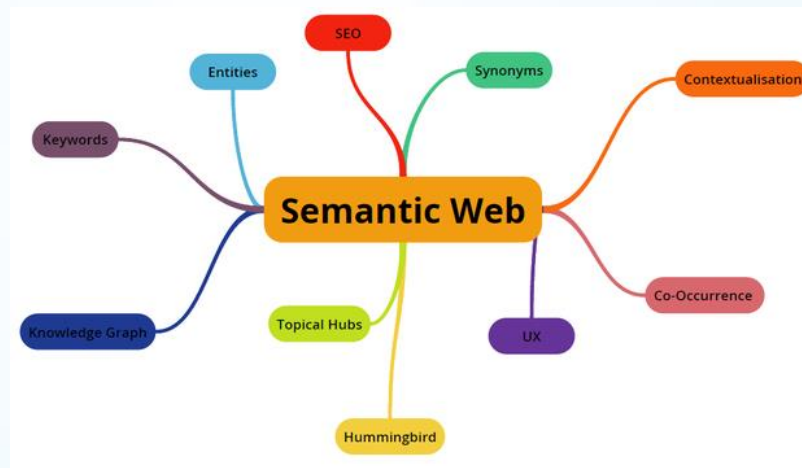
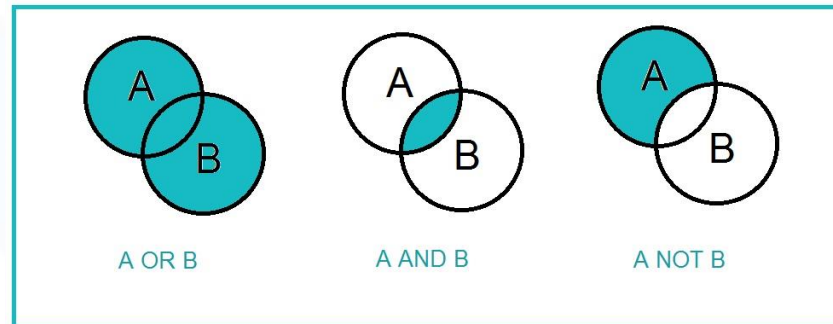
# Example of Boolean Search

ALL=(surgical OR curve OR segment) AND  
suture AND  
(((intervertebral OR cutting OR member OR  
arcuate OR guide)  
NEAR5 (bone OR seal)) SAME (tissure OR  
jaw\*)) AND (Instrument OR  
cannula\*1) AND DP>=(19930101) AND  
IC=(H01L 39/02 OR H01L  
39/12 OR H01F 38/14)

# Semantic Search: Less is More

A surgical cannula with curved segments used to guide a medical instrument through a curved or bowed path

# From Boolean to Semantic



# A More Comprehensive Search

## **Boolean Search:**

Autonomous vehicle

Discover deeply  
buried information!

## **Semantic Search:**

Autonomous vehicle

Car

Automobile

Driver

Truck

Robot

GPS

Transport

Satellite

Navigation

Network

Locomotive

Fuel

Transport

Route

Passenger

Brake

Engine

Accelerator

Van

Pilot

Self driving

Wheels


Tram

Train

Bus

Taxi

# A Example –from Queries to Concepts

 **Keyword Highlighting**  
Use options below to customize your highlighting settings

**Browse/Add Terms**  
Select from terms below to add to your manual list.

Query Terms

Result Concepts

*Terms generated from the query.*

bowed

cannula

curve

curve segment

guide

instrument

medical


medical instrument

path

segment

surgical

use

 **Keyword Highlighting**  
Use options below to customize your highlighting settings

**Browse/Add Terms**  
Select from terms below to add to your manual list.

Query Terms

Result Concepts

*Terms generated using our semantic algorithm.*

cannula

distal

tissue

proximal

distal end

surgery

surgeon

needle

trocar

patient

incision

lumen

proximal end

endoscope

tip

medical

endoscopic

suture

shaft

retract

guide

catheter

insertion

procedure

tube

laparoscopic

sheath

bone

seal

surgical instrument

invasion

elongate

obturator

cavity

implant

balloon

Add (80) Terms »

# A Example- Term Highlighting

Document Result #2

★ 3 < PREV NEXT >

Arcuate surgical guidance system and methods

DOCUMENT ACTIONS

Front Page Family (2) Citations Description Claims Figures (6) Pages (11) Legal

Litigation (0) Notes

What is claimed is:

1. A method of minimally-invasive tissue access, comprising: inserting an intracorporeal instrument through a cannula guide device, the cannula guide device comprising: a guide frame comprising a lower guide element having a convex upper surface and an upper guide element having a concave lower surface; and a cannula support washer moveably coupled within the guide frame between the upper guide element and lower guide element, the washer having a concave lower surface in contact with the convex upper surface of the lower guide element and having a cannula port extending through the cannula support washer wherein the lower guide element, the upper guide element and the cannula support washer each have a complementary geometry that conforms to a surface segment of a sphere; telescopically extending the instrument through the cannula port of the cannula support washer until a distal end of the instrument is positioned intracorporeally and adjacent an anatomic structure; and moving a proximal end of the instrument within the cannula port in the cannula support washer within the guide frame along the convex upper surface around a fixed point located intracorporeally near the distal end of the instrument.

2. The method of claim 1, wherein the upper guide element of the guide frame further comprises: a first opening extending through the upper guide element and the lower guide element is coupled to the upper guide element such that a space is formed between the upper and lower guide elements, and wherein the lower guide element has a second opening having a shape complementary to the first opening, and the first and second openings align to form an elongate channel.

3. The method of claim 2, wherein the central port extending through the cannula support washer is accessible via the first opening.

4. The method of claim 2, wherein the cannula support washer is slidably disposed within the space between the upper guide element and the lower guide element.

5. The method of claim 4, wherein the space has a width at least as wide as a thickness of the cannula support washer.

HIDE WIDGET

Keyword Highlighting ON

Manual Terms Customize

TERMS (89)

Fr Des Cln

Click term(s) to toggle highlighting

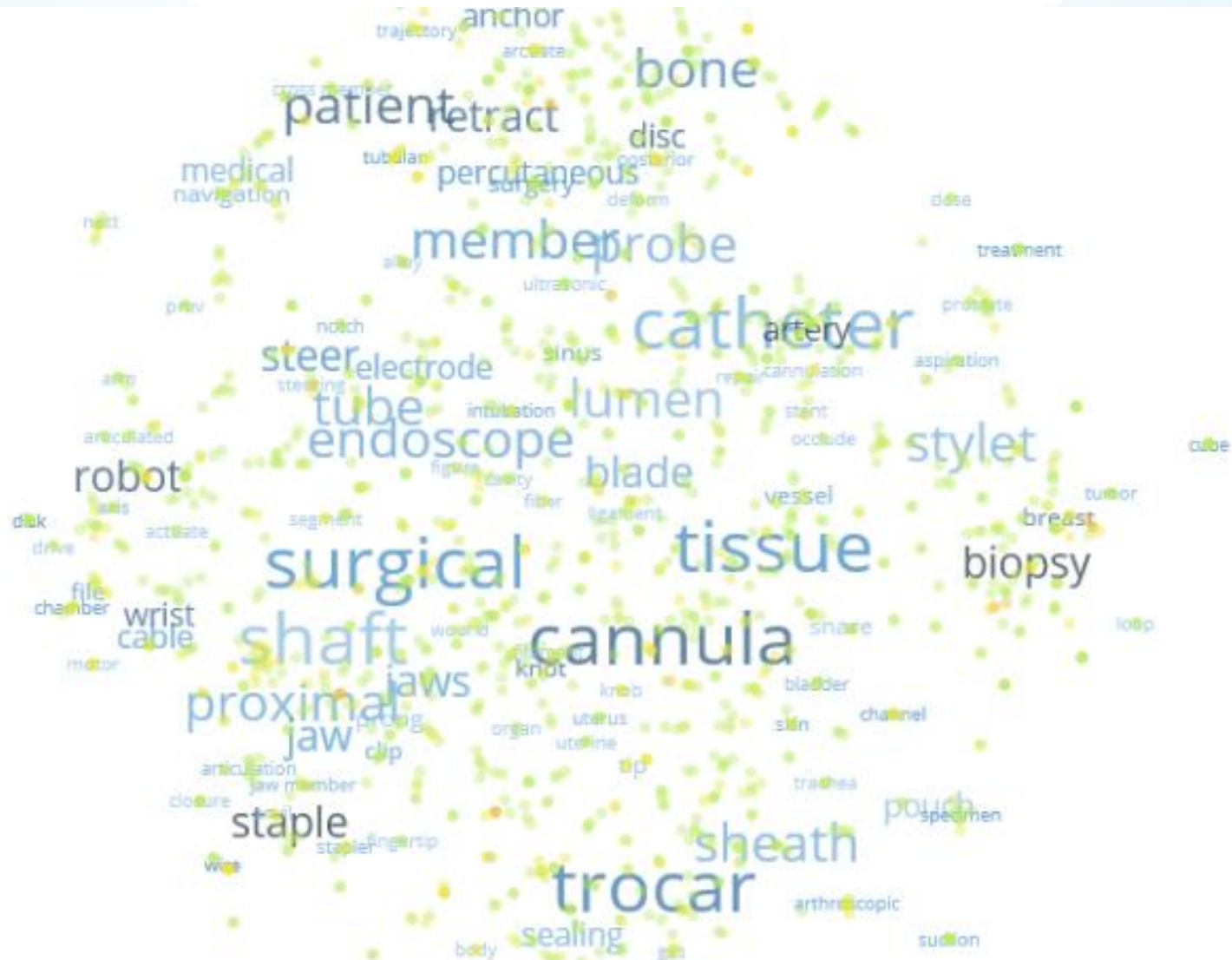
curve segment	0	0	0
distal end	0	2	4
longitudinal axis	0	0	0
medical instrument	0	1	0
minimal invasion	0	0	0
proximal end	0	1	4
surgical instrument	0	0	0
abdominal	0	0	0
advanced	0	0	0
anatomical	0	0	0
axial	0	0	1
balloon	0	0	0
biopsy	0	0	0
blood	0	0	0
bone	0	6	0
bore	0	0	0
bowed	0	0	0
cannula	3	53	17

Save Term List Highlight None

The proximity of the query terms to each other is a good indicator of applicability to the invention being searched.



# A Example-Map of Concepts



# Ways to Start Semantic Searching

■ Anything!

## Higher Order Compensation for Converters With Constant-Voltage Output Combating Transformer

Purchase or Sign In  
to View Full Text

1  
Paper  
Citation

154  
Full  
Text Views

5

Author(s)

▼ Xiaohui Qu ; ▼ Yanyan Jing ; ▼ Hongdou Han ; ▼ S

Abstract

Authors

Figures

Re

### Abstract:

Compensation is crucial for improving performance of frequencies, an IPT converter can achieve load-independent power switches simultaneously, resulting in simplified. However, constant output voltage or current depends on converter design hard to optimize. To free the design higher order compensation circuits for IPT converters reactive power and soft switching. Detailed derivation transformer parameters. Prototypes of CC IPT config different output specifications.

Published in: IEEE Transactions on Power Electroni

## A New Method for pHEMT Noise-Parameter Determination Based on 50- $\Omega$ Noise Measurement System

Jianjun Gao, Choi Look Law, Hong Wang, Sheel Aditya, and Georg Boeck, Senior Member, IEEE

**Abstract**—A new method for determining the four noise parameters of pseudomorphic high electron-mobility transistors (pHEMT) based on 50- $\Omega$  noise measurement system without a microwave tuner is presented. The noise parameters are determined based on the noise correlation matrix technique by fitting the measured noise figure of the active device. On-water experimental verification up to 26 GHz is presented and a comparison with a tuner-based method is given. The scaling rules for noise parameters have also been determined. Good agreement is obtained between simulated and measured results for  $2 \times 20 \mu\text{m}$ ,  $2 \times 40 \mu\text{m}$ , and  $2 \times 60 \mu\text{m}$  gatewidth (number of gate fingers  $\times$  unit gatewidth) 0.25- $\mu\text{m}$  double-heterojunction 6-doped pHEMTs.

**Index Terms**—Correlation noise matrix, noise measurement, noise parameter.

### I. INTRODUCTION

THE COMPLETE characterization of the transistor in terms of noise and scattering parameters is necessary for the computer-aided design (CAD) of a low-noise amplifier. The  $S$ -parameters are measured by a vector network analyzer (VNA), whereas the noise parameters cannot be measured directly by an instrument. The full noise characterization of a pseudomorphic high electron-mobility transistor (pHEMT) requires the determination of four noise parameters, i.e., minimum noise figure  $F_{\text{min}}$ , noise resistance  $R_n$ , and optimum source reflection coefficient  $\Gamma_{\text{opt}}$  (magnitude and phase). The determination of the noise parameters is typically performed by analyzing the variation of the measured noise figure as a function of the source impedance. A minimum of four independent measurements is required. However, for increasing accuracy, more than four measurements are performed usually and curve-fitting techniques are used then to determine the noise parameters [1]–[4]. Although this method gives accurate results, it is time consuming and requires expensive automatic

broad-band microwave tuners that involves complex calibration procedures.

Some authors proposed improved methods that are using the equivalent transistor noise model to provide additional information to reduce complexity in the measurement procedure [5]–[9]. Other successful techniques are based on match source reflection 50- $\Omega$  measurements system ( $F_{50}$ ) without an automatic tuner [10]–[12]. Tasker *et al.* [10] assume no correlation between noise source and input temperature  $T_{\text{in}}$ , which is simply equal to the ambient temperature, only the unknown output temperature  $T_{\text{out}}$  must be determined to extract the noise parameters. Alternatively, the correlation coefficient  $C$  is assumed to be purely imaginary and related to  $P$ ,  $R$  by the approximate expression  $C \approx \sqrt{T_{\text{in}}/T_{\text{out}}}$  to determine noise parameters using  $F_{50}$  measurements [11]. A complex mathematical method for determining the noise matrix of active devices based on  $F_{50}$  measurements by assuming a linear frequency dependency of elements of an intrinsic noise matrix is proposed by Lazaro *et al.* [12]. The calibration procedures are very complex and need to determine the intrinsic parameter  $C_{\text{int}}$  and the whole parasitic elements.

In this paper, a new method to determine the four noise parameters of pHEMTs based on a 50- $\Omega$  measurement system ( $F_{50}$ ) without an automatic tuner is proposed. In contrast with previous publications [10]–[12], this method has the following advantages.

- 1) It needs no complex noise deembedding techniques and calibration procedures.
- 2) No restrictions are imposed on the noise sources and noise matrix elements.
- 3) Only the determination of pad capacitances  $C_{\text{pad}}$ ,  $C_{\text{int}}$ , and  $C_{\text{tip}}$ , series inductances  $L_{\text{in}}$ ,  $L_{\text{out}}$ , and  $L_{\text{ex}}$ , and drain parasitic resistance  $R_d$  is needed, not the determination of the other extrinsic and intrinsic elements.
- 4) The whole parasitic elements are determined by using a pinch-off condition.
- 5) An improved method for determination of the initial values of the four noise parameters based on [11] is given; the iterative calculation is very fast.

### II. NOISE-PARAMETER EXTRACTION BASED ON 50- $\Omega$ MEASUREMENT SYSTEM ( $F_{50}$ )

#### A. Equivalent Noise Circuit Model

From the circuit point-of-view, the FET device can be treated as a black box of a noisy two-port. As is well known, the noise

Manuscript received December 9, 2002; revised April 11, 2003.

J. Gao was with the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore 639798. He is now with the Institute of High-Frequency and Semiconductor Systems Technologies, Technische Universität Berlin, 10587 Berlin, Germany.

C. L. Law and S. Aditya are with the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore 639798.

H. Wang is with the Microelectronics Centre, Nanyang Technological University, Singapore 639798.

G. Boeck is with the Institute of High-Frequency and Semiconductor Systems Technologies, Technische Universität Berlin, 10587 Berlin, Germany.

Digital Object Identifier 10.1109/TMTT.2003.817680

# Tips: Identifying key concepts of the invention

## ■ Patents

- Abstract and claims
- Last sentence of the abstract
- Independent claims

## ■ NPL

- Text that broadly summarizes the invention
- Text in Abstract, Introduction/Background, Results and Conclusion

(57)

### ABSTRACT

A compact optical assembly for a **laser radar system** is provided, that is configured to move as a unit with a laser radar system as the laser radar system is pointed at a target and eliminates the need for a large scanning (pointing) mirror that is moveable relative to other parts of the laser radar. The **optical assembly** comprises a light source, a lens, a scanning reflector and a fixed reflector that are oriented relative to each other such that: (i) a beam from the light source is reflected by the **scanning reflector** to the **fixed reflector**; (ii) reflected light from the fixed reflector is reflected again by the scanning reflector and directed along A line of sight through the lens; and (iii) the scanning reflector is moveable relative to the source, the lens and the fixed reflector, to adjust the focus of the beam along the line of sight.

# Ways to Refine Search

- Be mindful of synonyms
- Refine search with concept modifiers

The screenshot displays a patent search interface. At the top, there's a header with 'PAT Patents & Applications' and a 'Main Concept Text' box containing the text 'Compensation is crucial for improving performanc...'. Below this, a navigation bar shows 'Views:' with icons for list, document, and bar chart, followed by 'Sort: Relevance' and 'Relevance Filter: 3'. The main area lists search results. The first result is '8. Parallel resonant converter with zero voltage switching', which is highlighted with a red arrow. To the right of this result, a 'DOCUMENT ACTIONS' menu is open, showing options: 'Modify Query', 'Replace Main Concept', 'More Like This', 'Less Like This', 'Document', 'Preview', 'Add to Portfolio', and 'Select'. The 'Modify Query' option is highlighted in green. The background shows a list of other search results, including '1. Arcuate surgical...', '2. Guidable cutting...', '3. Apparatus and m...', and '4. Guidable cutting...'. The IEEE logo is visible in the bottom right corner.

PAT Patents & Applications

Main Concept Text  
Compensation is crucial for improving performanc...

Views: [List View] [Document View] [Bar Chart View] Sort: Relevance Relevance Filter: 3

1 - 50 Results

8. Parallel resonant converter with zero voltage switching

☐ A parallel resonant converter as disclosed having in one embodiment a variable inductance and having a cc switches of the converter under zero voltage switching conditions and under continuous conduction mode the resonant circuit...

CURRENT ASSIGNEES: LEE CHU-QUON [+2]  
US4992919 | US PATENTS | 12-FEB-1991

9. Pwm converters for three phase ac power control and ac to dc conversion, and special purpose devices using the same

PWM converters provide buck, boost, buck-boost, flyback, and Cuk configurations for three phase AC-AC p embodiment, only a single power conversion circuit is used in a configuration including a pair of series con (transistors and diodes) which are...

CURRENT ASSIGNEES: RSCH & DEV INST INC MONTANA STATE UNIV  
CA2200573A1 | CANADIAN APPLICATIONS | 28-MAR-1996

DOCUMENT ACTIONS

Modify Query

Replace Main Concept

More Like This

Less Like This

Document

Preview

Add to Portfolio

Select

IEEE

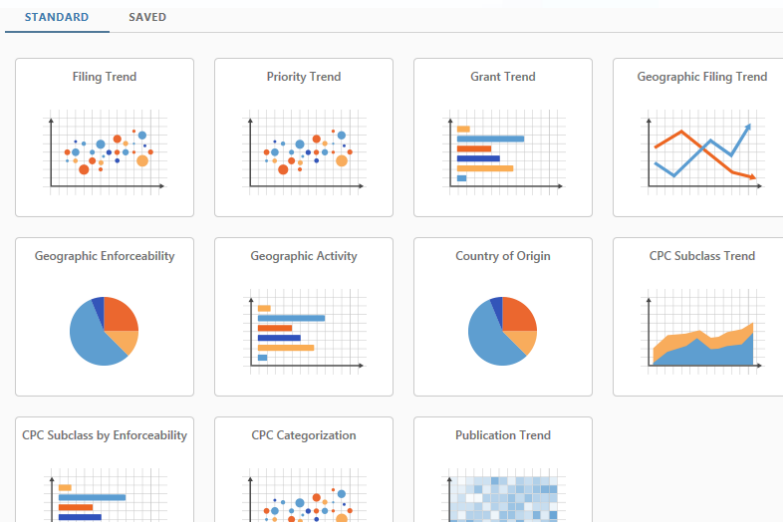
# Build a Patent Portfolio

## Technical Intelligence:

1. Knowledge of the “art” (subject matter)
2. Prior Art searching
3. Technology trends
4. Technology applications (old, current and future)

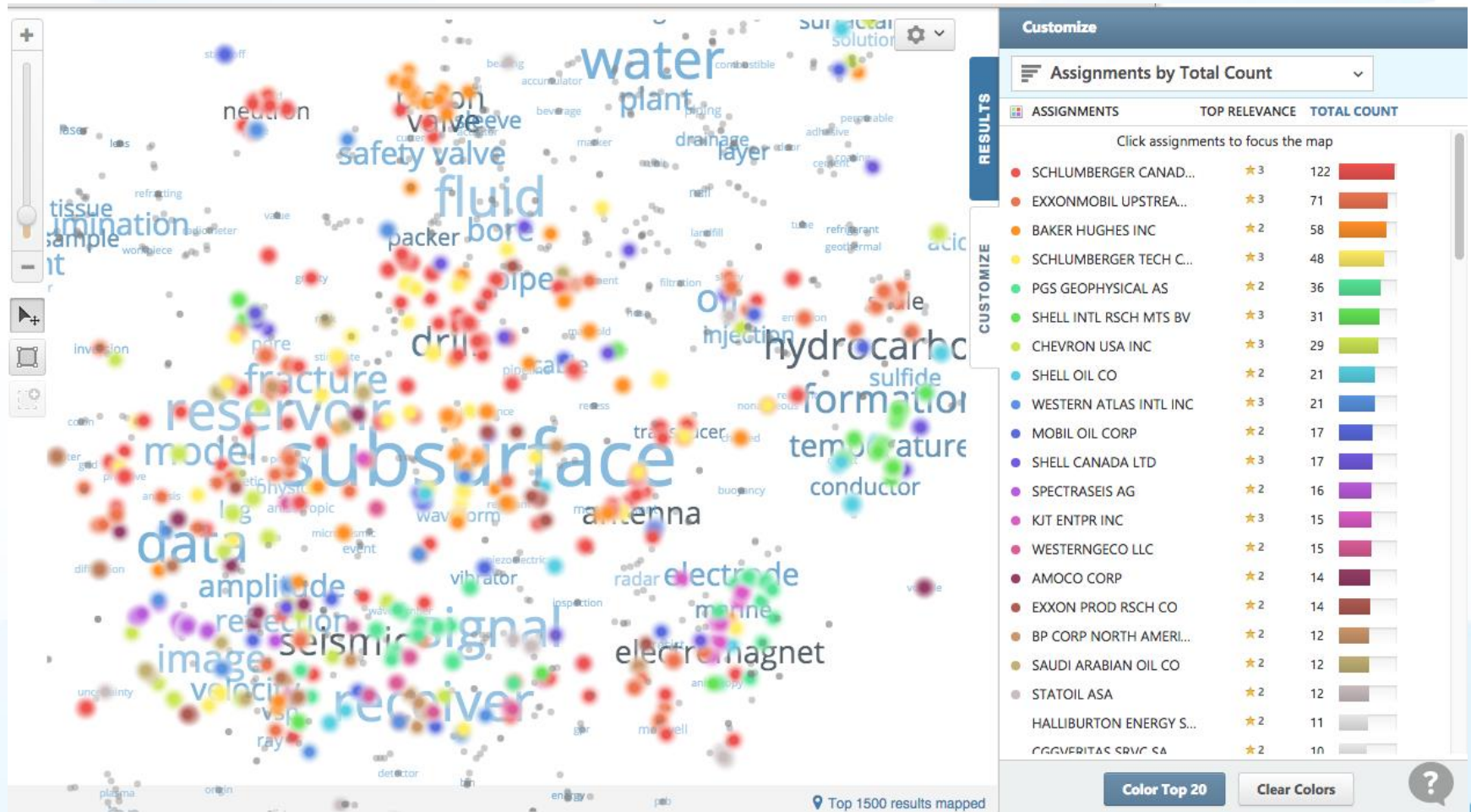
## Competitive Intelligence:

1. Who (organizations) are in this tech space? (assignee/applicant)
2. Who (people) are the professionals? (author/inventor)
3. Who are they collaborating with?
4. What are they doing?
5. How are they doing it? (patent claims)
6. How can I track these alliances or competitors? (search alerts)
7. Where are they interested in doing business?





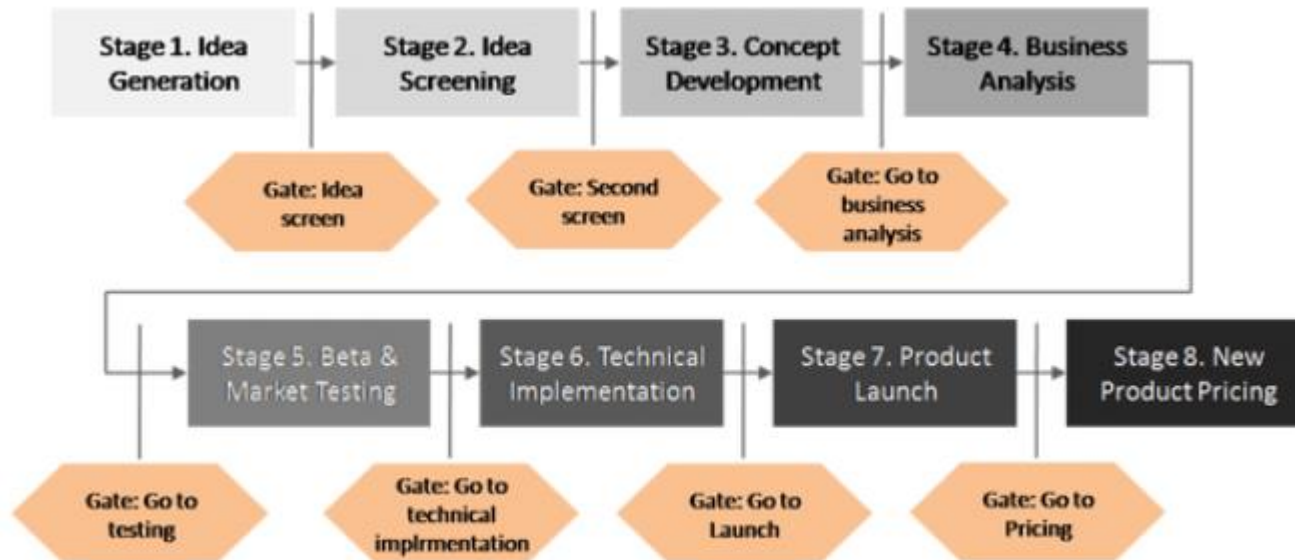
# Discover What You Don't Know



# When to Start Prior Art Search?

## The earlier, the better!

- It is important to conduct prior art searching in the early stage, instead of the final stage of idea development!



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Source: <https://www.cleverism.com/product-development-overview-idea-product/>

- InnovationQ Plus is a powerful new innovation discovery and analytics platform
  - One stop to search IEEE literature with IP.com's global patent and non-patent literature
  - Semantic search
  - Visualize concepts with the Map tool
  
- Free Trial, please contact [service@hintoninfo.com](mailto:service@hintoninfo.com)



**Librarians should play a bigger role in  
the process of university patenting!**

**Thank you!**

Any question, please contact

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[service@hintoninfo.com](mailto:service@hintoninfo.com)