RESEARCH AND ANALYSIS OF INVENTIONS IN ELECTRONICS AND NANOTECHNOLOGY

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by

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CERTIFICATE

This is certified that the thesis titled "RESEARCH AND ANALYSIS OF INVENTIONS IN ELECTRONICS AND NANOTECHNOLOGY" is being submitted by me (Deepak Kumar Singh 2K12/NST/05) towards partial fulfilment for the award of Master of Technology degree in Nanoscience & Technology in Delhi Technological University. This work is original and has not been submitted in part or fully to any other University or institute for the award of any degree or diploma.

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ABSTRACT

This thesis is based on the project work done for the patent research and analysis of the inventions. This research work has been carried out in order to predict whether an inventor(s) can be granted a patent over the said invention or not. The project has been carried out in four different phases. In each phase the research work has been done for a particular given invention and the results have been interpreted.

PHASE-I

The patent research and analysis was performed for the invalidation of the invention titled: **Providing a total battery capacity value**. This invention discloses a method and system for calculating and displaying the remaining battery capacity of a mobile phone/device. The invention includes the calculation of the battery capacity when the battery is currently in use. An exhaustive search was conducted for the patents granted worldwide over the same type of inventions and three relevant results were found which disclosed the same key features. The patents found are US5926007, US6313606, and US6495989. The detailed analysis has been done and discussed in this thesis.

PHASE-II

The invalidation search for the invention titled: **HVAC (Heating-Ventilation Air Conditioning) actuator having torque compensation.** This invention is for the air conditioning systems in which the torque of motor in the compressor is adjusted according to the surrounding temperature sensed by the sensor. A comprehensive search was conducted and one relevant result was found with patent number US6073689.

PHASE-III

The invalidation search of the invention titled: **Security Pigment** was conducted. This invention disclosed the pigment to be applied on the bank notes, bank cheques, bank drafts etc. for the authentication and security purposes. This pigment consisted of a nano-composite material consisting of a hidden forensic material inside it. The material is invisible to the

naked eyes but when exposed to the UV rays it displays a code which may be used for authentication and knowing the history of the note or document. During the search no relevant results were found which disclosed all the key features of the given invention. However two related results were found with patent number EP1597709 and US6200628, which disclosed only some of the key features.

PHASE-IV

The invalidation of the invention titled: **System for depositing microwire**. This invention disclosed a method for the deposition of a microwire on the body of the aeroplanes, rocket, spacecraft, etc. This system firstly deposits a dielectric layer on the substrate and then sandwiched the microwire between the previous dielectric layer and a covering dielectric layer. During the search no results were found which disclosed the same key features as in the given invention.

PHASE-V

The invalidation search of the invention titled: **Economizer controller plug and play system recognition with automatic user interface population** was done. This invention disclosed a system which controls the air-conditioning system in order to economize the cost of operation according to the temperature difference of the inside and outside environment. In the air conditioning system generally use the inside air refresh, cool it and again directs it inside the room but the given invention allows the system to sense the temperature of inside and outside and compare. If the temperature outside is lower than temperature inside then it allows the air conditioning system to take outside air, refresh it, cool it and direct it towards inside. After an exhaustive search two relevant results with patent numbers US20030181158 and US20020152298, were found which disclosed all the key features of the said invention.

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CHAPTER 1

INTRODUCTION

The project report presented here is based on the project work carried by me at Sagacious Research Pvt. Ltd. Sagacious Research mainly deals in Patent Research which involves the research of inventions Worldwide in the field of electronics and nanotechnology. According to the hierarchy followed in the Sagacious, I am a Patent Analyst Intern. Patent Analysis is an in-depth study of patents/publications based on the search report conducted for an invention. It is an important step carried out by the attorneys, scientists, and researchers in their quest for patent perfection, developing research and development strategy, deciding on business strategy and countering the competent companies in the market. It helps to give a clear picture of the concern IP issue [1].

Patent analysis by a patent expert enables to determine the strength of patent resources of the company in the market and also assists in identifying the loopholes in research and development. For the patent holders or small entities it finds out a way to track licensing opportunities by knowing which inventors, companies, universities, or researchers have scouted for patents in a particular domain of interest. By doing analysis, the applicant can prevent himself against any kind of anticipating patent infringement suit. It may open up new innovative R&D processes and product development priorities such as Identifying new or prospective competitors in a business area or technology. It also provides a clear map by observing patenting activity in the markets. It saves huge expenditure by taking any decisive action about whether to follow a patent, defensively publish an idea as a technical publication, or keeping the invention a trade secret [1].

Each report underlines the trends and directions in the technology domain of interest and includes the crucial information on key technology providers. Patents are ranked by their pertinence to the concerned technology or as demanded by an individual.

This gave me the opportunity to exploit the diverse technical fields. I worked on various projects from diverse fields. Every project was guided by a team lead and I had brainstorming sessions and in the process come up with new ideas. At the end of every project I had to prepare a project report for that project providing my inputs on the research conducted. The report provided by me further assisted the client to put his arguments in the court and to modify his invention in order to be successfully granted a patent [1].

A patent is a form of intellectual property. It consists of a set of exclusive rights granted by a sovereign state to an inventor or their assignee for a limited period of time, in exchange for the public disclosure of the invention. An invention is a solution to a specific technological problem, and may be a product or a process [2].

A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem. In order to be patentable, the invention must fulfil certain conditions [2]. Those are:

1. The invention has a novel part.
2. The invention has industrial application.
3. The invention is non-obvious.

The role of a Patent Analyst is to summarize the content of a patent to produce a clear and concise abstract, identifying key area of interest, such as what is new and the use and advantages of the invention. The analyst must then classify, code, and index the patent according to the subject area, which enables customers to quickly find patents of interest. The invention disclosure is provided for getting a thorough understanding. Related videos are shown for a better understanding of the invention. Projects related to “Electronics and Nanotechnology” are given to us to carry out detailed analysis and research work.

1.1. MANDATORY FIELDS IN A WELL DRAFTED PATENT:

Bibliography: The bibliography of a patent consists of the title of patent, the filing/application date, the name of inventor, the names of assignee, the family members (i.e. the patents of same document in various other countries) and the publication/patent Number and publication date, the International or European or US classification or the similar [3].

Abstract: Abstract of a patent provides a brief knowledge of invention and the field of invention.

Summary of Invention: It consist the brief summary of the whole invention without the details of all invention.

Prior Art: Prior art in a patent defines the related technology which already exists in the field in which the inventor does the improvement [3].

Description: This part of patent discloses the invention in complete details and in every aspect and with various embodiments. The description defines the complete features of project in the present invention whether be known or the novel part. The drawings are clearly described here in the disclosure.

Claims: The claims of the patent are the main part of invention on which the inventor claims to have its own novelty/invention on which the judiciary grants him the rights of a patent.

There are two types of claims in the patents:

1. **Independent claims**: Independent claims are the claims which describe the field and the novel part of invention which the inventor has created in the whole innovation and on which the inventor wants to take the claim, on the basis of which he allots licenses, sues the infringers and the other litigation roles [4].

2. **Dependent Claim**: Dependent claims are the claims which individually have no meaning but they are the supporting or branched claim of independent claim. It means the dependent claims complete the invention on adding with independent claim [4].

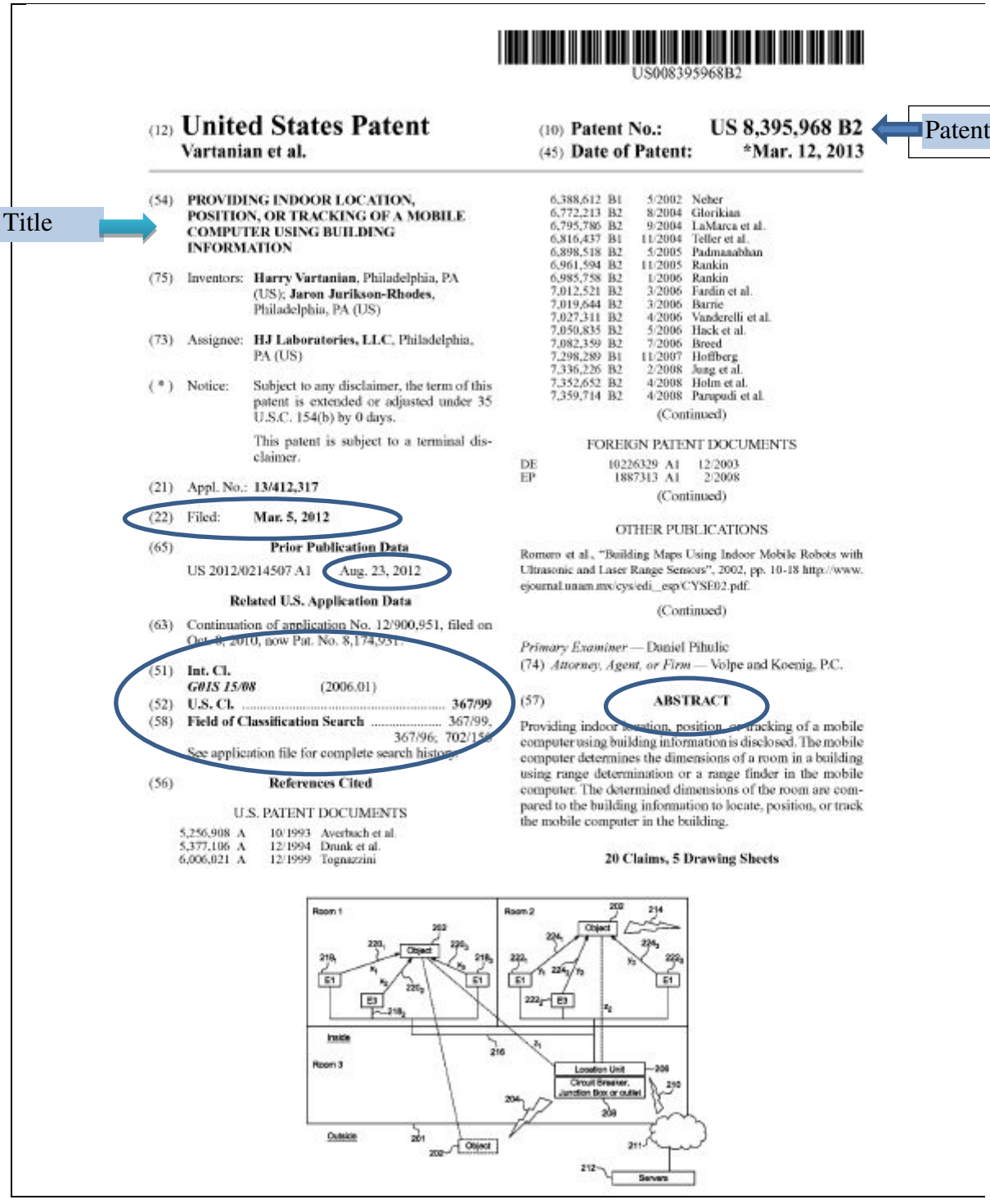
Drawings: The drawings are the most important part of patent especially in our case that is in patent related to mechanical domain/engineering domain; which most of time defines the whole invention. Sometimes it is an isometric view and sometimes these are 2-D drawings in various views as the invention demands a complete definition [5].

Patent history: patent history portfolio includes the forward and backward citations and the family members of the patent, family member are those patents which are granted for same invention but for different country [6].

1.2. OVERVIEW OF A PATENT:

In fig. 1.1 and fig. 1.2 is provided a schematic view of a patent to understand how a patent looks like [7] and also indicated its mandatory fields. The important terms in patent are marked within a circle which are:

1. **Patent No**: It is a unique number assigned to every patent after the patent has been granted for an invention.
2. **Title**: It the Title of the invention provided by the inventor over which the patent is to be granted
3. **Filing date:** It is the date when an inventor files a patent application in a particular country.
4. **Priority date:** The date on which an inventor files a first ever patent application for an invention is called a Priority date. In other words we can say that the filing date in the first country becomes the priority date [8].
5. **Publication date:** It is the date on which an applicant's patent application is published by the patent office [9].
6. **Field of Classification:** The Patent office has classified the various inventions into a number of categories/classes and then subclasses. Each classification having a classification number. So it is the classification number of the patent in which it has been classified by the patent office [10].
7. **Abstract**: Provides a brief knowledge of invention and the purpose of the said invention.
8. **Background of Invention**: It defines the related technology which already exists in the field and in which the inventor does the improvement.
9. **Summary of Invention**: It consist the brief summary of the whole invention without the full details of the invention [11].
10. **Description**: It gives the complete details and in every aspect and with various embodiments. The drawings are clearly described in this section [12].



US008395968B2

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

(10) **Patent No.: US 8,395,968 B2**
(45) **Date of Patent: *Mar. 12, 2013**

Patent No.

Title

(54) **PROVIDING INDOOR LOCATION, POSITION, OR TRACKING OF A MOBILE COMPUTER USING BUILDING INFORMATION**

(75) Inventors: **Harry Vartanian**, Philadelphia, PA (US); **Jaron Jurikson-Rhodes**, Philadelphia, PA (US)

(73) Assignee: **HJ Laboratories, LLC**, Philadelphia, PA (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.: **13/412,317**

(22) Filed: **Mar. 5, 2012**

(65) **Prior Publication Data**

US 2012/0214507 A1 Aug. 23, 2012

Related U.S. Application Data

(63) Continuation of application No. 12/900,951, filed on Oct. 8, 2010, now Pat. No. 8,174,931.

(51) **Int. Cl.**
G01S 15/08 (2006.01)

(52) **U.S. Cl.** **367/99**

(58) **Field of Classification Search** 367/99, 367/96; 702/159

See application file for complete search history.

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Primary Examiner — Daniel Pihulic
(74) *Attorney, Agent, or Firm* — Volpe and Koenig, P.C.

(57) **ABSTRACT**

Providing indoor location, position, or tracking of a mobile computer using building information is disclosed. The mobile computer determines the dimensions of a room in a building using range determination or a range finder in the mobile computer. The determined dimensions of the room are compared to the building information to locate, position, or track the mobile computer in the building.

20 Claims, 5 Drawing Sheets

Fig. 1.1: Screenshot of Front page of a Patent Document.

PROVIDING INDOOR LOCATION, POSITION, OR TRACKING OF A MOBILE COMPUTER USING BUILDING INFORMATION

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 12/900,951 filed Oct. 8, 2010, which issued as U.S. Pat. No. 8,174,931 on May 8, 2012, the contents of which is hereby incorporated by reference herein as if fully set forth. This application is related to U.S. patent application Ser. No. 13/463,538 filed May 3, 2012, which issued as U.S. Pat. No. 8,284,100 on Oct. 9, 2012.

FIELD OF INVENTION

This application relates to indoor location or position determination. In particular, it relates to providing indoor location or position determination of object devices using building information and/or powerlines.

BACKGROUND

Location determination systems, such as the global positioning system (GPS), have provided the ability to find and track location of object devices enabling new applications like location based services (LBS). Although fairly accurate outdoors, many location determination systems cannot detect when an object device is indoors, accurately track objects indoors, or determine if an object device is in a vehicle or conveyance. It is desirable to detect or track object devices indoors for applications such as safety, e-business, gaming, directions, or the like.

Solutions have been proposed for locating object devices indoors involving beacons, transponders, and/powerlines. However, these systems require the installation of a plurality of devices or indoor base stations in order to work and require complicated additional hardware in the object device. It desirable to locate an object device indoors without the need for much added hardware or complexity.

SUMMARY

An apparatus and method for providing indoor detection, location, position, or track determination of object devices using building information and/or powerlines. An object device may determine the dimensions of the interior of a

FIG. **4** is a diagram of detecting, locating, positioning, or tracking an object device indoors or in a conveyance using emitted or transmitted signals; and

FIG. **5** is a process for detecting, locating, positioning, or tracking an object device indoors using emitted or transmitted signals.

DETAILED DESCRIPTION

The present invention will be described with reference to the drawing figures wherein like numerals represent like elements throughout. For the processes described below the steps recited may be performed out of sequence and sub-steps not explicitly described or shown may be performed. In addition, "coupled" or "operatively coupled" may mean that objects are linked between zero or more intermediate objects. Also, any combination of the disclosed features/elements may be used in one or more embodiments. When using referring to "A or B", it may include A, B, or A and B, which may be extended similarly to longer lists.

In the embodiments provided below, indoor location or position within a building may be determined using signals that may be received from endpoints, such as an outlet, by an object device. In addition or combination, an object device may emit signals, such as ultrasound, to determine the dimensions of a room in a building to subsequently determine indoor location or position.

FIG. **1** is a diagram of an object device **100** that may be detected, located, positioned, or tracked indoors or in a conveyance. Object device may be configured as a wireless subscriber unit, user equipment (UE), mobile station, smartphone, pager, mobile computer, cellular telephone, telephone, personal digital assistant (PDA), computing device, surface computer, tablet computer, monitor, general display, versatile device, appliance, automobile computer system, vehicle computer system, television device, a laptop, a netbook, a tablet computer, a personal computer, a wireless sensor, an Internet pad, a digital music player, a peripheral, virtual reality glasses, a media player, a video game device, or the like for mobile or fixed applications. Any of devices, controllers, displays, components, etc., in object device **100** may be combined, made integral, or separated, as desired.

Object device **100** comprises computer bus **140** that couples at least one or more processors **102**, one or more interface controllers **104**, memory **106** having software **108**, storage device **110**, power source **112**, and/or one or more displays controller **120**. One or more processors **102** may be a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a

Fig. 1.2: Screenshot of Second page of a Patent Document.

1.3. REFERENCES

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CHAPTER 2

CLASSIFICATION OF SEARCHES

There are mainly three types of patent searches:

1. Novelty search.
2. Invalidity search.
3. FTO (Freedom to Operate)

2.1. NOVELTY SEARCH: The confidential disclosure of the inventions is disclosed and the thorough understanding of the given invention is made [1]. Then a search is performed for the patents across the 92 countries, related to same field of invention. During the research a collection is made of the patent or non-patent document found which already discloses the given invention. Then a report is prepared consisting of all the relevant result documents with the detailed analysis of the results found during the research. Also the relevant text found in the result documents is mapped against all the key features of the given invention [2]. The databases used during the search are Questiel Orbit, Micropatents, Espacenet, IEEE and Science Direct, citesee and Google Patents, Google Scholar etc [3].

2.1.1. BENEFITS

1. Identifying whether the invention talked about is satisfying the basic laws of filing an invention; it is “new” as well as “non-obvious”.
2. This helps in making distinctions between what is already known (prior art) and what is new (the invention).
3. A prior-art patentability search can avoid losing the investment in a patent application if the search discovers prior references that would likely preclude patenting the invention.
4. Inventors can use State-of-the-Art searchers to see what knowledge (usually in the form of patents) already exists in the invention's scientific area.

2.1.2. METHODOLOGY FOR SEARCH/ANALYSIS

Novelty search involves reviewing the document by the client very carefully, making the keywords and searching for patents similar to the client's novelty [5]. The figure 2.1 given below shows the steps required to perform a novelty search analysis:

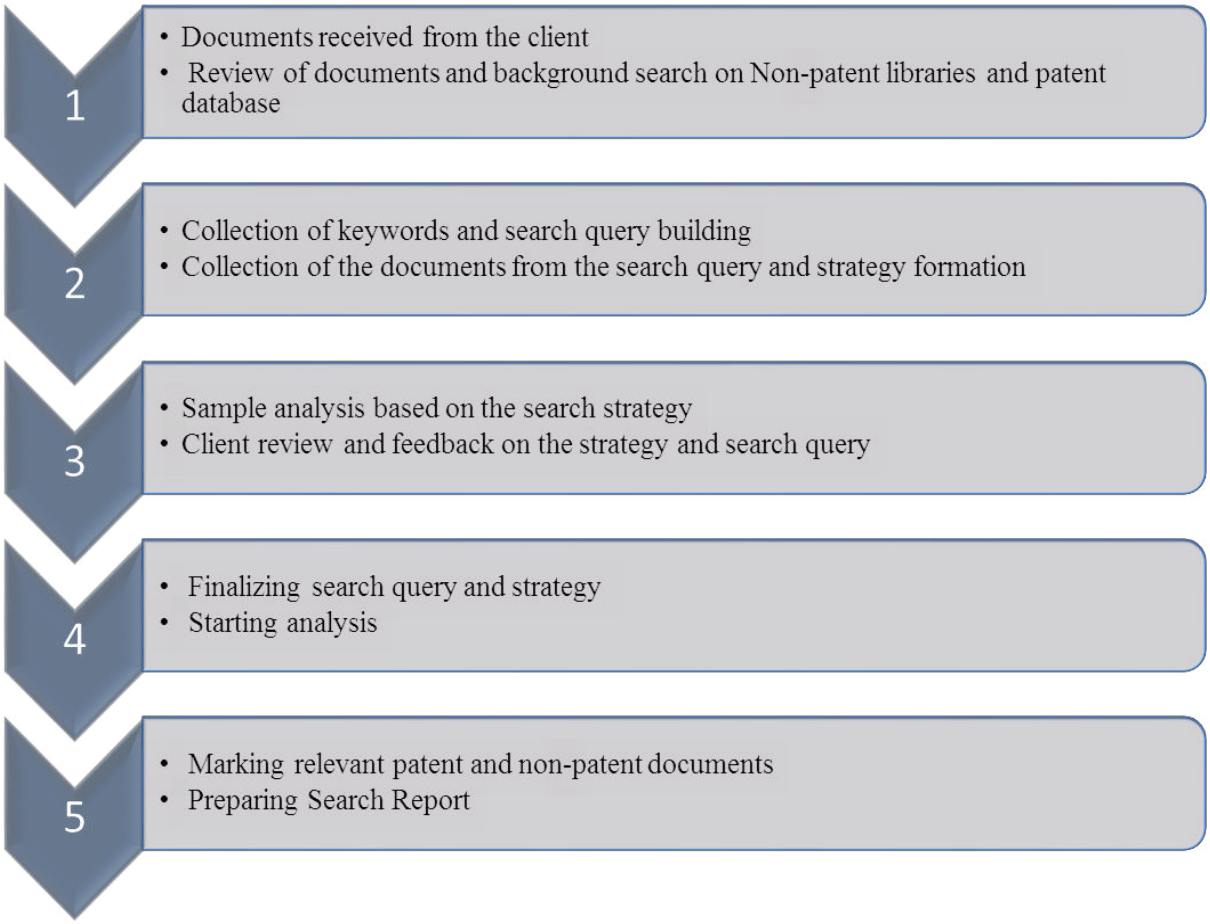

Fig 2.1: Flowchart of Methodology for Novelty Search Analysis

2.2. INVALIDITY SEARCH: In this search an already existing patent is given by the client and he wants to get the patent invalidated [4]. For this I searched for the earlier existing patents and non-patent literature in databases (Questiel Orbit, Micropatents, Espacenet), IEEE and Science Direct journals and Google Patents. If there is any concrete material or patent already existing before the filling date of that given patent then it can invalidate the given patent [5].

2.2.1. BENEFITS

Such studies are, generally, conducted:

1. To verify whether a patent, which one might be accused of infringing, is valid or not [6],
2. To check the validity of a competitor's patent deemed strong,
3. To check the strength of one's own patent,
4. To oppose the competitor's patent when in the post grant opposition period [7].

2.2.2. METHODOLOGY FOR SEARCH/ANALYSIS

For Invalidating patent claiming the patent/competitor patent coming in one's way, the independent claims of the claiming patent are looked at and a list is prepared of the key aspects claimed in the invention. Then by the keywords and their synonyms in different paid and open source database around the world are searched to find any relevant patent matching the claims of claiming patent [7]. The steps followed for performing the invalidation search are given the flowchart in fig 2.2 below.

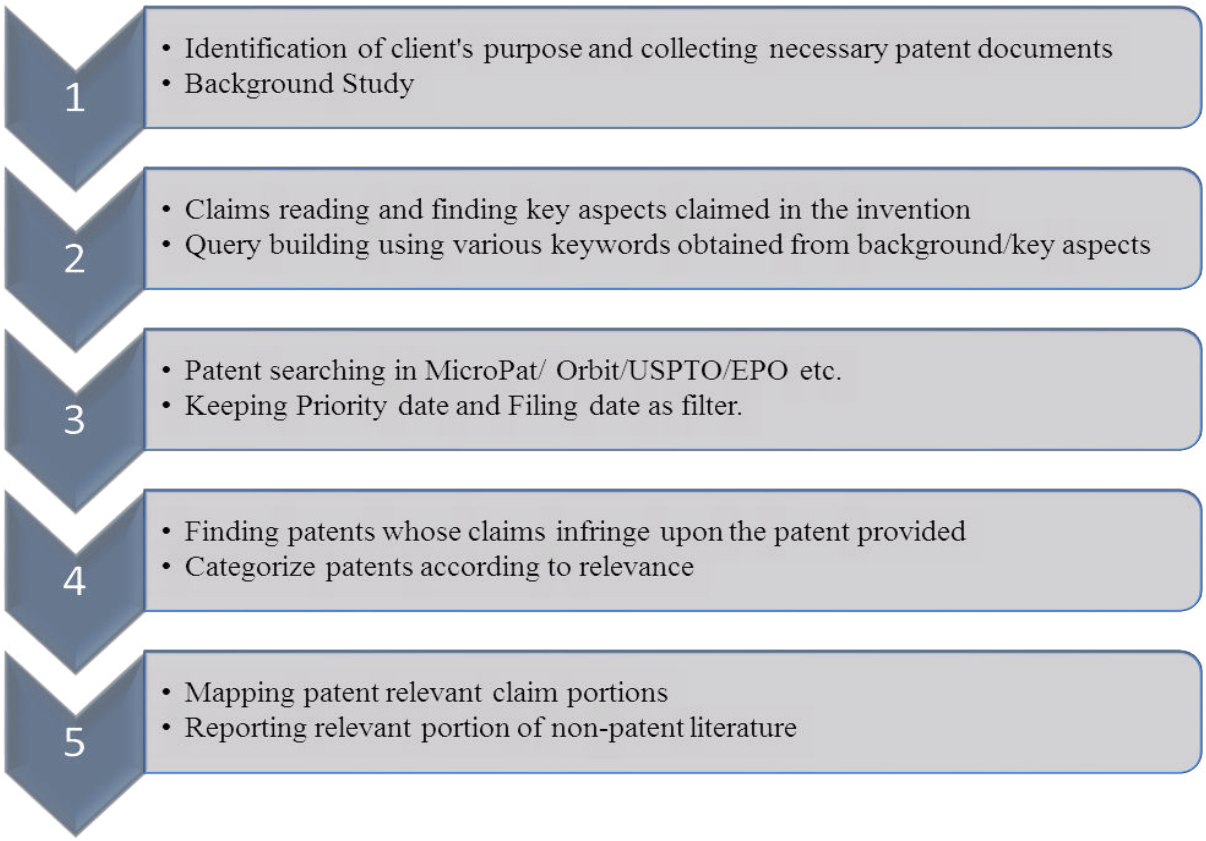

Fig. 2.2: Flowchart of Methodology for Novelty Search Analysis

2.3. FTO (FREEDOM TO OPERATE SEARCH): In this category if a client has to use some technology or method then he gets conducted the search for the particular technology to confirm that whether somebody has already got the patent over the said technology because otherwise the assignee of that patent may file a case against the client for not taking the license from him [8].

2.3.1. BENEFITS

1. Product launch by identifying infringing patent and potential losses which may happen.
2. Claims modification according to prior arts found.
3. Saving billions of dollars which can lose in potential infringement

2.3.2. METHODOLOGY FOR SEARCH/ANALYSIS

Searching for prior art from around the world using reliable patent databases and other databases. The analysis is based on the claims of the patent application and claimed aspects of the invention. Taxonomy has been prepared based on the claims of patent application and then search is carried on to find out relevant patent [9]. The steps for carrying out the freedom to operate search has been given below in the flow chart in fig 2.3

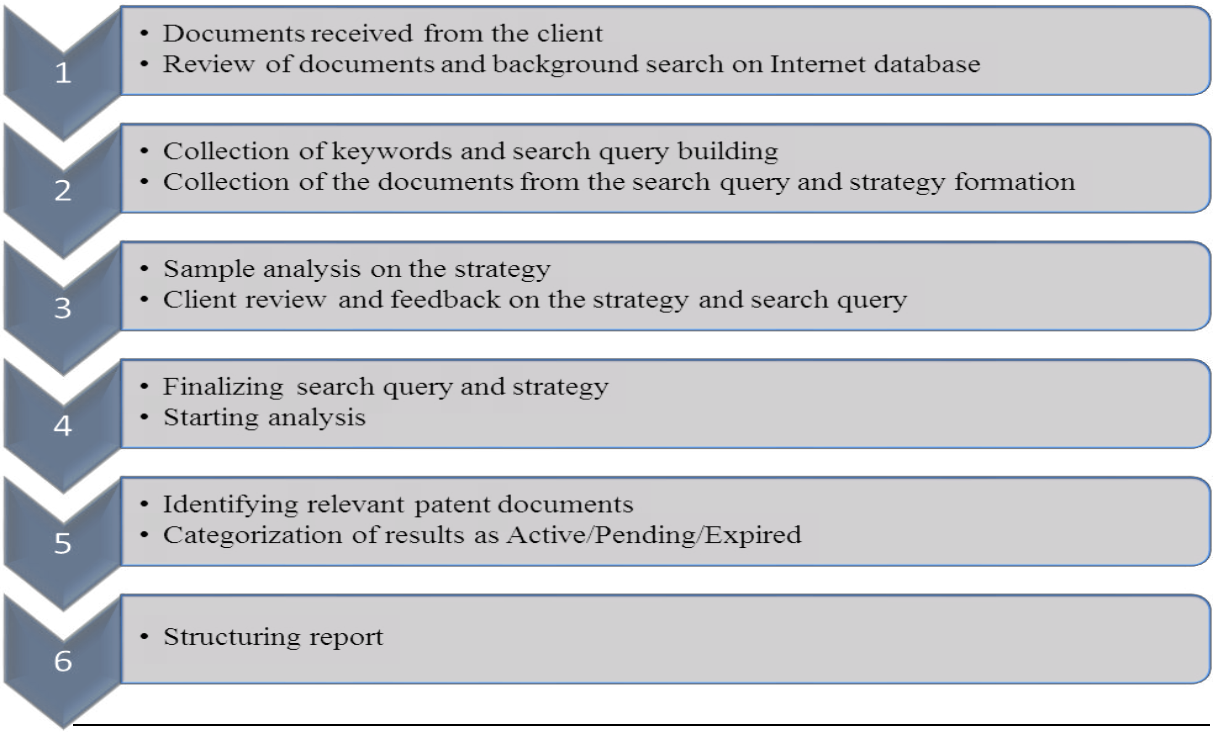

Fig 2.3: Flowchart of Methodology for Novelty Search Analysis

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CHAPTER 3

RESEARCH WORK METHODOLOGY

3.1. STEPS FOR CARRYING OUT RESEARCH WORK

For the exhaustive Research of patents Worldwide a dedicated and determined scheduled is to be followed in order make every possible effort to find out the results in a proper way without missing any document. The following steps are to be carried out during the research [1]:

1. Making a thorough understanding of the Novelty of the invention and writing it in our own words.
2. Conducting semantic searches on Google patents to get an immediate result and also collect some more keywords synonyms and also to extract a collection of classifications.
3. Comprehensive and relevant English Term Sets are prepared.
4. Relevant IPC/CPC/US classes are identified.
5. Search strings are prepared and finalized.
6. English searches are conducted on the orbit database.
7. Analysis of the patents captured by firing the search strings on the database is done.
8. Related/Interesting/Relevant patents are tagged during the analysis.
9. New terms which can be added to the Term Sets are also tagged during the analysis.
10. Iterative searches are conducted using the new terms obtained during the searches.
11. Citations Searches are conducted for relevant and related result obtained.
12. Non-patent searches are conducted on Google Patents.
13. Non-patent searches are conducted on Google Scholar.
14. Non-patent searches are conducted on Science Direct.
15. Non-patent searches are conducted on IEEE.
16. Non-patent searches are conducted on PubMed.
17. A deliverable report is prepared using also the results obtained during the searches.

3.2. PATENT CLASSIFICATIONS

A patent classification is a way in which the examiners of patent offices or other people arrange the documents, such as patent applications, disclosure of inventions according to the technical features of the inventions [2]. They arrange documents using a patent classification so that it becomes easy for them to quickly find out a document disclosing the invention identical or similar to the invention for which a patent is being claimed. The same document can be classified in several classes [3].

Patent classification schemes are designed and maintained by and for patent examiners and their basic purpose is to help the examiners in their work fast and effectively. While examining a patent application, the examiner needs to search for a collection of patent documents in order to identify relevant existing patent specifications and this task is facilitated by the use of a classification scheme [4].

A patent classification is fixed under an agreement among people, otherwise it is useless. The International Patent Classification (IPC) is agreed internationally [5]. The United States Patent Classification (USPC) is fixed by the United States Patent and Trademark Office (USPTO). The European Classification (ECLA) is based on the IPC but adapted by the European Patent Office (EPO) to its own requirements. [5].

In October 2010, the EPO and USPTO launched a joint project to create the Cooperative Patent Classification (CPC) in order to harmonise the patent classifications systems between the two offices [3].

3.2.1. THE INTERNATIONAL PATENT CLASSIFICATION

The International Patent Classification (IPC) is currently being used by over 70 patent authorities to classify and index the subject matter of the published patent specifications [6]. The IPC is maintained and is administered by the World Intellectual Property Organisation and was first published in 1968. The eighth edition was published in mid 2005 and came into force in January 2006 [7].

The IPC divides patentable technology into 8 key areas:

A: Human Necessities

B: Performing Operations, Transporting

C: Chemistry, Metallurgy

D: Textiles, Paper

E: Fixed Constructions

F: Mechanical Engineering, Lighting, Heating, Weapons

G: Physics

H: Electricity

Within these areas technology is divided and subdivided to a detailed level, which allows the subject matter of a patent specification to be very thoroughly classified.

3.3. PREPARATION OF SEARCH REPORT

This section covers various parts of a typical Novelty search report with brief overview and supporting snapshots.

3.3.1. OVERVIEW

This section contains details of Invention like its background and brief description. Also it covers what all jurisdictions and languages search will cover.

3.3.2. SEARCH SCOPE

This section covers Objectives of Novelty search, Assumptions made and Data Sources [Table 3.1] to be used for searches.

Objective covers the types of document required based on key features of said invention. The Assumptions in the Novelty searches are explicitly mentioned by the Analyst. Some assumptions are [8]:

1. MicroPatent and Questel Orbit databases are used for conducting Patent searches.
2. Google Scholar, Science-Direct and PubMed are used for conducting non-patent search.

The Data sources used to conduct patent and non-patent searches:

For Patent Searches	For Non-Patent Searches
MicroPatent	Google Scholar
Questel Orbit	Science-Direct
Espacenet	Scirus
USPTO	ACM Digital Library
Google Patents	PubMed

Table 3.1: Data sources used for patent and non- patent searches

3.3.3. ORBIT DATABASE

The orbit database [Fig. 3.3] for patents is provided by the company Questial which consists of the patents collection of 92 countries [9]. There are special dedicated operators [Table 3.2] for this database. This database offers patent number based search, assignee based search, keyword based search and lot many user friendly functions like highlighting of the important words which the user is searching for. There is one main account in the orbit and one subaccount for each individual patent analyst [10]. The orbit database allows making a duplicate workfile of the captured list of patents during the search. The duplicate workfile from the main account is saved to the subaccount so that one can access it according to his need [11]. The captured list firstly displays the title and abstract with the relevant figure on its right side.

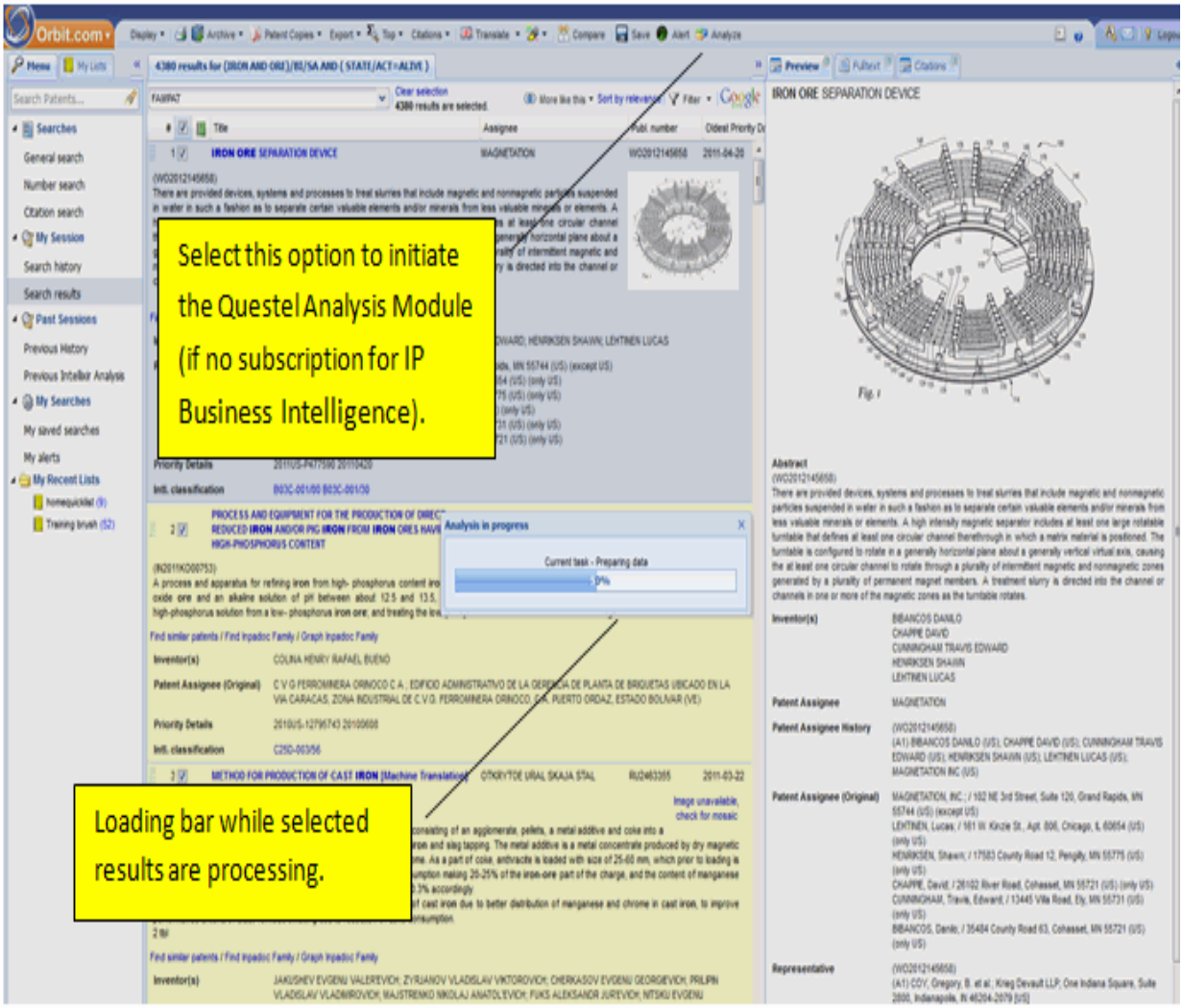


Fig. 3.1: Screenshot of Orbit Database.

In orbit database the patent can also be viewed in details by opening any particular patent [12]. It also provides the options to choose the area of jurisdiction (i.e. countries) for the search. One can restrict the search by the date, assignee or the inventor. It also provides information about the inventor and assignee, classification, the family members and the citations of a patent. The PDF of the granted patent can also be extracted/ downloaded from the orbit database. This database is mainly used for performing the comprehensive search for patents. The Search operators [table 3.2] used in the orbit database are given in the following table:

SYMBOL	DESCRIPTION	EXAMPLE
OR	Finds the references containing at least one of the words	electron OR current
AND	Captures results during the search containing all the words specified.	transmit AND receive
NOT	Captures the results during the search with the first term without the second term	signal NOT noise
F	Captures the results during the search with the terms being in the same field	charge f transfer
S	Captures the results during the search with the terms being in the same sentence	detect s temperature
P	Captures the results during the search with the terms being in the same paragraph	uplink p channel
D	Captures the results during the search with the terms adjacent being in any order	redundancy d check
nD	The terms which are adjacent, irrespective of the order, and may be separated by a maximum of n number of words	conduct 2d electric 2d adhesive
W	Captures the results during the search with the terms adjacent being in the osrder specified;	smart w card?

nW	The adjacent terms must in the order as specified and might be separated by a maximum of n number of words	friction 9w pad?
Parentheses	Parentheses is very necessary while we are combining different operators	((wireless w application w system) or was) not (frequency or modulated)

Table 3.2 Search operators for orbit database

3.3.4. MICROPATENT DATABASE

The Micropatent database [Fig 3.2] has been provided by the company Thomson Reuters. It consists of the data of the 8 jurisdictions including U.S., Europe and Japan [14]. The database is available from the year 1836 onwards. This database also employs its own set of operators [Table 3.3] for capturing the results. It offers the keyword based search, class based search, and it provides options to restrict the search by issue/publication date, priority date, filing date.

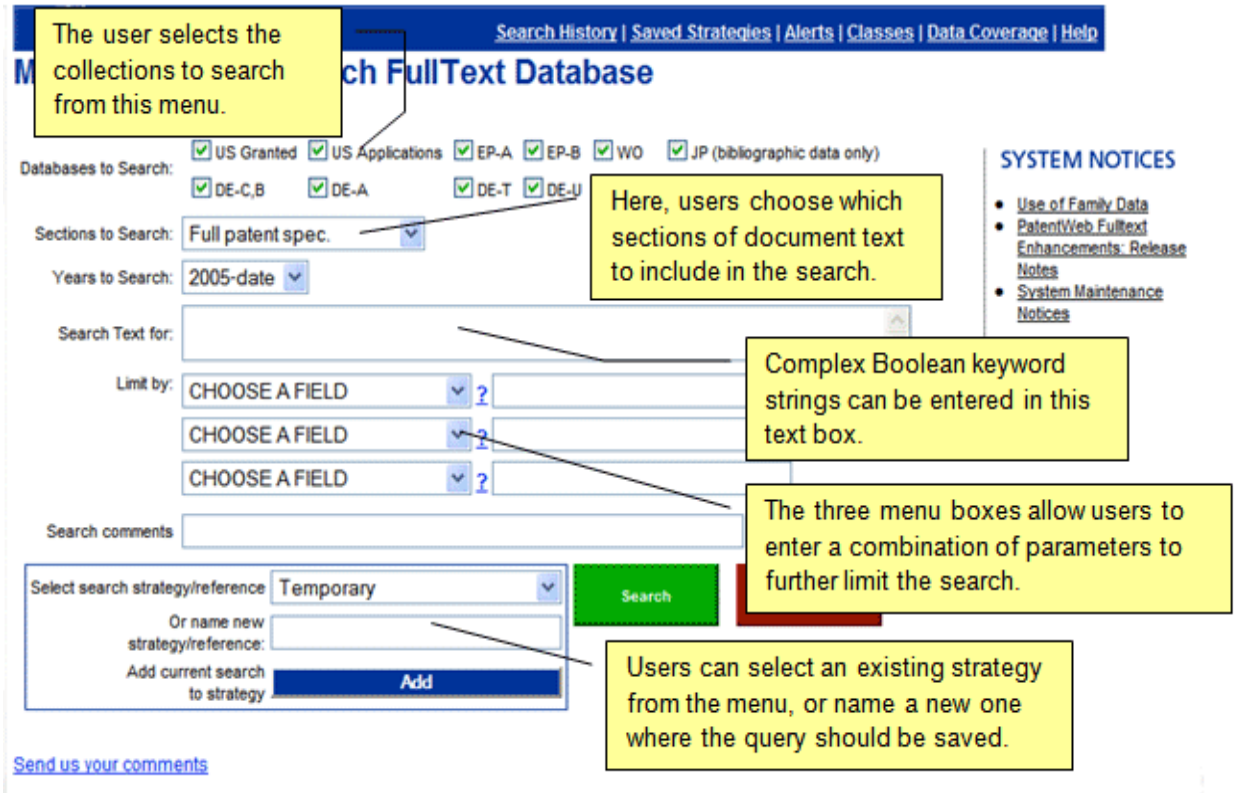


Fig. 3.2: Screenshot of Micropatent Database.

It also provides the options to capture the results based on the terms being searched in title or abstract or claims or in the full text in the patents to be captured during the search [13]. The search results can also be combined with the previous results or subtracted from the previous results by using the Boolean operators like AND, NOT, OR between them. Micropat also allows to make the worksheets in which all the searched list of patents are generated on a different file and it can be saved anywhere on the user's computer. The search operators [table 3.3] used in the Micropatent database has been given in the following table [8]:

SYMBOL	DESCRIPTION	EXAMPLE
OR	At least one of the specified search terms should occur within the record.	amplify OR boost
AND	All of the specified search terms should occur within the record.	noise AND rectify
NOT	This operator locates the records in which the terms specified after NOT are absent.	amplifier NOT Mosfet
XOR	It captures the records with only any one of the search terms, but not the both.	Emitter XOR Current
*	The asterisk is used to substitute a number of characters (also including no character) within the search term.	Generat* or charg* or *electon*
*n	The asterisk is used along with a number/digit to replace 0-to-n characters.	Generat*3 or charg*3 or *5electon*2
?	The question mark can be used in order to replace exactly one (and only one, but not less than one) character within the specified search term.	Electro?deposition

<	Within the date fields, `less than' should be used to search for values. When searching for a date-range, the dates should be specified in proper ascending order.	>=20010101 <=20011231.
>	Within the date fields, `greater than' should be used in order to search for values. When searching for a date-range, the dates should be specified in proper ascending order.	>=20010101 <=20011231.
<= x	Within the date fields, 'less than or equal to' should be used in order to search for values. When searching for a date-range, the dates should be specified in the proper ascending order.	>=20010101 <=20011231.
>= x	Within the date fields, 'greater than or equal to' should be used to search for that range of values. When searching for a date-range, the dates should be specified in the proper ascending order.	>=20010101 <=20011231
Parentheses	Parentheses is necessary while we are combining different operators	((wireless adj application adj system) or was) not (frequency or modulated)

Table 3.3 Search Operators for Micropatent Database [8]

3.4. METHODOLOGY

This section [Fig 3.3] discloses various stages in Novelty search along with relevant details and expected outcomes during the search. The given invention is understood thoroughly [16]. A keyword based search is conducted on Google, further patent searching is conducted on the various databases and then a non- patent search is conducted. Further the inventor/assignee search, class based search and Forward-Backward and Backward-Forward citation analysis is done. In Forward-Backward citation analysis the backward citation analysis of the forward citation of any given patent is done [15]. In Backward-Forward analysis the citation analysis of the forward citation of the backward citation of the given invention is done. In case of Novelty search the Forward and Backward citation analysis of the closest found result found to find a more relevant result. General flowchart of Novelty search is given in the following figure 3.3:

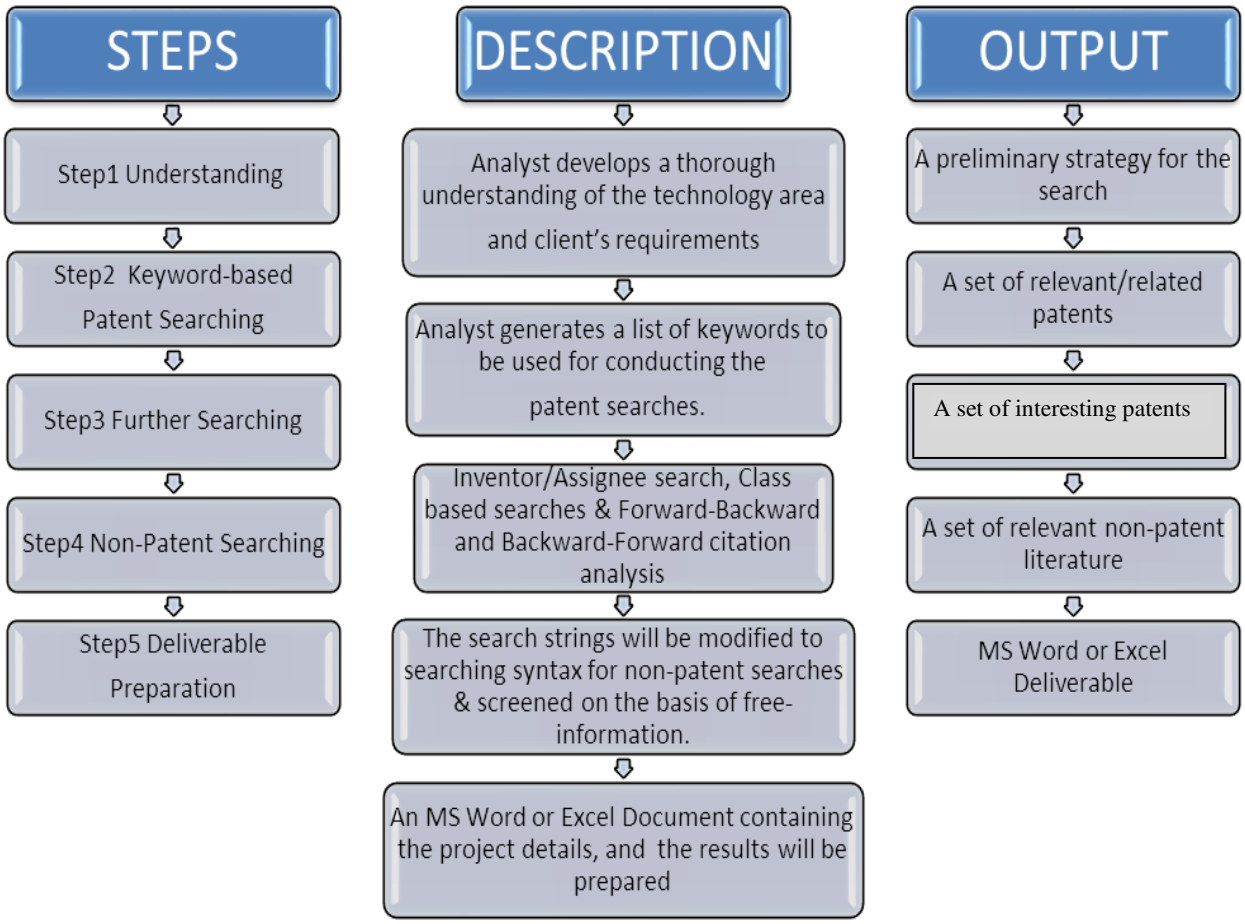


Fig.3.3 General flowchart for Novelty Search.

3.5. SEARCH STRATEGY

Search strategy as the name suggests describes various individual searches performed, Relevant Classes identified and the Term Sets.

The search strings are prepared from the various combinations of term sets, their combinations using Boolean operators (OR, AND and NOT) as well as some special operators and relevant patent classes [17].

Term Sets are collection of keywords, its synonyms, spelling variations and foreign equivalents. Classes refer to IPC or USPC classes. Similarly, syntactical variations of these strings are run on non-patent databases as well [18].

3.6. RELEVANCE CRITERIA

Documents identified from the search are manually analyzed and tagged as relevant, related and interesting.

Relevant Results

Those patent and non-patent references are considered as Relevant, in which all the key features are disclosed explicitly or at least inferentially

Related Results

Those patent and non-patent references are considered as Related, in which some of the key features are not disclosed.

Interesting Results

There are patent and non-patent references which disclose the invention within the surrounding field of the given invention. However these references do not disclose the key features of the given invention. These references appear to be potentially related, however, can't be categorized as relevant or related and these are marked as Interesting Results.

3.7. SEARCH RESULT

3.7.1. KEY FEATURES TO BE MAPPED

The key features are identified based on the claim of Patent/Invention. All the relevant and/or related results identified in the search will be mapped on these key features to properly depict their significance.

3.7.2. SUMMARY OF SEARCH RESULTS

The results of the search are mapped against key features. Then the summary is prepared exhibiting the patent and non-patent references and the availability of the text in these references against the key features of the invention.

3.7.3. DETAILED ANALYSIS OF SEARCH RESULTS

In this section the list of most relevant or related patent and non-patent references are available in the search for the given invention identified in the search.

Relevant (or Related) Patent Results:

This is the list of the most relevant patent references available in the search for the given invention. These patent references disclose all the key features of the given invention explicitly or at least inferentially.

Relevant (or Related) Non - Patent Results:

This is the list of most relevant non-patent documents available in the search for the given invention. It is to be noted that the focus is on identifying the closest references and not on identifying all the references comprehensively [19]. Accordingly, the list might not be comprehensive and there may be more documents that are similar (i.e., having the same or slightly lower relevance) to the documents listed in the results. Also, search is restricted to keywords in English, German and French and the analysis is done by using the freely available text.

3.8 REFERENCES

[1] http://ipscience.thomsonreuters.com/support/patents/dwpiref/reftools/searchtips

[2] http://www.wipo.int/export/sites/www/classifications/ipc/en/guide/guide_ipc.pdfhttp://ccd.trilateral.net/20111223.

[3] Linda Shackle."A Short Course on Patent Reference for Science and Technology Librarians"

[4] Jmornini. "An Incredible Free Patent Citation Search and Analysis Tool: The CCD" January 10, 2012

[5] Robert C. Faber, John L. Landis. "Landis on mechanics of patent claim drafting"

[6] Tony Trippe, "All Citations Are Not the Same – Exploring Examiner Citations from US Patent Documents – Part 1 – An Introduction"- 12 June 2013

[7] Breitzman Anthony and Mary Ellen Mogee. "The Many Applications of Patent Analysis". Journal of Information Science, 28 (3), 187–205. 2002.

[8] Jaffe, Adam, Manuel Trajtenberg and Michael S. Fogarty, "The Meaning of Patent Citations: Report on the NBER/Case-Western Reserve Survey of Patentees," NBER Working Paper 7631. 2000.

[9] http://orbit.com/

[10] http://www.intellogist.com/wiki/Citations

[11] http://www.sagaciousresearch.com

[12] Iwan von Wartburga, Thorsten Teicherta, Katja Rostb. "Inventive progress measured by multi-stage patent citation analysis"

[13] http://worldwide.espacenet.com

[14] http://www.ipindia.nic.in

[15] Mark P. Carpenter, Francis Narin. "Validation study: Patent citations as indicators of science and foreign dependence"

[16] http://www.wikipedia.org

[17] Xuesong Tong, J.Davidson Frame. "Measuring national technological performance with patent claims data"

[18] http://www.wipo.int/classifications/ipc/en

[19] http://www.micropat.com

CHAPTER 4

ANALYSIS OF INVENTIONS

At Sagacious Research I have worked upon the projects on Invalidity Searches which are listed below:

PROJECTS ON INVALIDITY SEARCH:

1. Providing a total battery capacity value.
2. HVAC (Heating-Ventilation Air Conditioning) actuator having torque compensation.
3. Security pigment.
4. System for depositing microwire.
5. Welding current source.

On some of the aforementioned projects I worked with my mentor and on some projects I worked independently. Of the above said projects the detailed analysis of the important projects which I handled independently is provided below:

1. Invalidity Search for patent US6630814B2: Providing a total battery capacity value.
2. Invalidity Search for patent EP2217666B1**:** Security Pigment

4.1. DETAILED ANALYSIS OF INVALIDITY SEARCH ON PATENT NO: US6630814B2, "PROVIDING A TOTAL BATTERY CAPACITY VALUE"

I have gone through the Patent "US6630814B2" and have developed the following understanding:

A method and system is disclosed for determining the total capacity of battery of an electronic device. It includes charging the electronic device and determining the net charge accepted by the battery to provide the total capacity of the battery. The system implements measurement of the voltage of the battery to determine its remaining capacity when the battery current is very

low. It monitors the remaining capacity of the battery and estimates the remaining capacity of the battery through an algorithm and updates the total capacity of the battery [1].

4.1.1. OBJECTIVE OF THE SEARCH

The objective of our search is to search for the documents that disclose:

1. A method and system to determine the total capacity of a battery during a charging process by the calculation of charge accepted by the battery. This is done by measuring the amount of current supplied to the battery for a given duration of time [1].
2. A method and system for estimating the remaining capacity of the battery by measuring the voltage at the battery terminals when the battery current is almost negligible and the chemical reactions within the battery are stabilized.
3. A method and system to update the total capacity of the battery by estimating the remaining capacity of the battery and calculating the value of charge being used simultaneously by making a call and taking the difference to update the total capacity of the battery [1].

4.1.2. TERM SETS

The term sets are prepared as shown in table 4.1; these term sets are comprehensively prepared which include the every possible term which may be used for a keyword in any of the country or any other person in their terminology. The use of Boolean operators according to search database is also implemented in preparing the term sets. The table also shows the German and French translations of the keywords [2].

Keyword Based Search			
Term Set	Keywords [English]	Keywords [German]	Keywords [French]
Battery	(Batter* OR ((Batter*) 2D (Pack* OR Cell* OR Recharg*)) OR Cell* OR Accumulat*)	(Batterie* OR (Batterie* 2D (Zelle OR Aufladen) OR Zelle* OR Akkumulator)	(Batterie* OR (Batterie* 2D Cellule) OR Cellule* OR Accumulateur)
Capacity	(Capacit* OR Voltage* OR (Back_Up) OR (Charg* 2D Stor*) OR	(Kapazität* OR Spannung* OR Sichern OR (Aufladen 2D Lagerung) OR	(Capacité* OR Tension* OR Soutenir OR

	Capabilit* OR Power*)	Leistungsfähigkeit* OR Leistung)	(Charger 2D Stockage) OR Capacité*)
Estimate	(Estimat* OR Determin* OR Calculat* OR Calibrat* OR Monitor* OR Updat* OR indicat* OR Approximat* OR Evaluat* OR Assess* OR Check* OR Observ* OR jugd* or renew* or revis*3 or amend*)	(Schätzung OR Bestimm* OR Berechn* OR Kalibrier* OR Überwachung OR Aktualisierung OR Annäher* OR Bewerten OR Überprüfen OR Beobach*)	(Détermination OR Etalonn* OR Moniteur OR Surveillance OR Evaluation OR Estimer OR Vérifier)
Charging	(Charg* OR Discharg* OR Current* OR Voltage* OR Temperatur*)	(Aufladen OR Entladung OR Spannung* OR Strom)	(Charger OR Décharge OR Tension* OR Courant OR Température*)
Remaining	(Remain* OR "available" OR "Present" OR Exist* OR Left* OR (Un_use*)) OR residual*	(Bleiben OR übrig OR vorhanden OR vorhanden OR links OR ungebraucht)	(Rester OR restant OR présent OR gauche OR Inutilisé)
Total	Total* or complet* or entir* or overall or full* or whole or gross	(gesamt OR vollständig OR insgesamt)	(compléter OR tout OR global OR ganze)

Table 4.1: Term sets for the search strategies

4.1.3. RELEVANT CLASSES IDENTIFIED

During the Google patent search and citation analysis, the following Classes [Table 4.2] were extracted from the patents of similar inventions and were used in combination with the term sets provided above [3]:

CLASS	DEFINITIONS
IPC / CPC	
H02J 7/00	Electricity >> generation, conversion, or distribution of electric power >> circuit arrangements or systems for supplying or distributing electric power; systems for storing electric energy >> circuit arrangements for charging or depolarising batteries or for supplying loads from batteries [4]
Y10S320/00	general tagging of new technological developments; general tagging of cross-sectional technologies spanning over several sections of the ipc; technical subjects covered by former uspc cross-reference art collections [xracs] and digests [5] >> technical subjects covered by former uspc cross-reference art collections [xracs] and digests >> technical subjects covered by former uspc cross-reference art collections [xracs] and digests >> electricity: battery or capacitor charging or discharging [6]
H01M 10/48	Electricity >> basic electric elements >> processes or means, e.g. batteries, for the direct conversion of chemical energy into electrical energy >> secondary cells; manufacture thereof >> accumulators combined with arrangements for measuring, testing, or indicating condition, e.g. level or density of the electrolyte [5]
G01R 19/00	Physics >> measuring; testing >> measuring electric variables; measuring magnetic variables >> arrangements for measuring currents or voltages or for indicating presence or sign thereof [5]
G01R 31/36	Physics >> measuring; testing >> measuring electric variables; measuring magnetic variables >> arrangements for testing electric properties; arrangements for locating electric faults; arrangements for electrical testing characterized by what is being tested not provided for elsewhere >> apparatus for testing electrical condition of accumulators or electric batteries, e.g. capacity or charge condition
H01M 10/44	Electricity >> basic electric elements >> processes or means, e.g. batteries,

	for the direct conversion of chemical energy into electrical energy >> secondary cells; manufacture thereof >> methods for charging or discharging
H01M 10/46	Electricity >> basic electric elements >> processes or means, e.g. batteries, for the direct conversion of chemical energy into electrical energy >> secondary cells; manufacture thereof >> accumulators structurally combined with charging apparatus [7]
USPC	
702/63	data processing: measuring, calibrating, or testing >> battery monitoring
320/157	electricity: battery or capacitor charging or discharging >> detection of current or voltage amplitude
320/114	electricity: battery or capacitor charging or discharging >> for handheld device
320/132	electricity: battery or capacitor charging or discharging >> with state-of-charge detection
340/636.12	communications: electrical >> by current and voltage
340/636.13	communications: electrical >> by current
340/636.15	communications: electrical >> by voltage
324/427	electricity: measuring and testing >> to determine ampere-hour charge capacity
320/149	electricity: battery or capacitor charging or discharging >> with detection of current or voltage integral (e.g., total charge, etc.)
324/431	electricity: measuring and testing >> with temperature compensation of measured condition

Table 4.2: Relevant classes

4.1.4. SEARCH STRATEGIES

The various search strategies [Table 4.3] were prepared using the various operators and different combinations of keywords. The term sets prepared are put into these strategies. These search strategies are used in order to capture the best possible results for analysis from the database. When these search strategies are fired on the databases a number/list of patents is generated. The total number of patents obtained by firing a string is termed as hits [8].

S. No.	Search Strategies	Number of Hits on
1	Title, Abstract and Claims: *Remaining* term set NEAR2 (*Battery* term set OR *Capacity* term set) AND Full Patent Specifications: (*Battery* term set NEAR3 (*Total* term set ADJ2 *Capacity* term set)) AND Application Date: <20001912 AND Jurisdiction: US, WO	417
2	Full Patent Specifications: Estimate term set WITH (*Battery* term set NEAR3 (*Total* term set ADJ2 *Capacity* term set)) AND *Remaining* term set NEAR2 (*Battery* term set OR *Capacity* term set) AND (G01R 31/36 OR H01M 10/44 OR H01M 10/46 OR H01M 10/48 OR G01R 19/00 OR H02J 7/00 OR Y10S320/00 OR 320/127 OR 320/128 OR 320/130 OR 320/132 OR 324/427 OR 320/149 OR 320/114 OR 702/63 OR 320/157 OR 340/636.12 OR 340/636.13 OR 340/636.15 OR 324/431) AND Application Date: <20001912 AND	372

	Jurisdiction: US, WO	
3	Title, Abstract and Claims: (*Estimate* term set NEAR3 (*Battery* term set NEAR2 *Capacity* term set)) AND (*Remaining* term set NEAR2 *Battery* term set) AND Publication Date: <20001912	321
4	Full Patent Specifications: Estimate term set WITH (*Battery* term set NEAR3 (*Total* term set ADJ2 *Capacity* term set)) AND *Remaining* term set NEAR2 (*Battery* term set OR *Capacity* term set) AND (G01R 31/36 OR H01M 10/44 OR H01M 10/46 OR H01M 10/48 OR G01R 19/00 OR H02J 7/00 OR Y10S320/00 OR 320/127 OR 320/128 OR 320/130 OR 320/132 OR 324/427 OR 320/149 OR 320/114 OR 702/63 OR 320/157 OR 340/636.12 OR 340/636.13 OR 340/636.15 OR 324/431) AND Publication Date: <20001912	456
5	Title, Abstract and Claims: (*Estimate* term set NEAR3 (*Battery* term set NEAR2 *Capacity* term set)) AND (*Remaining* term set NEAR2 *Battery* term set) AND Application Date: <20001912 AND Jurisdiction: US, WO	244
6	Title, Abstract and Claims: (*Battery* term set NEAR3 (*Total* term set ADJ2 *Capacity* term set)) AND Full Patent Specifications:	461

	Remaining term set NEAR2 (*Battery* term set OR *Capacity* term set) AND Publication Date: <20001912	

Table 4.3: Search Strategies

4.1.5. RELEVANCE CRITERIA

Documents identified from the search have been manually analysed and tagged as relevant, related, interesting and not-relevant [9]. Provided below is the description of each category

Relevant Results

Those patent and non-patent references were considered as Relevant, which disclosed the key features corresponding to any of the independent claims explicitly or at least inferentially.

Related Results

Any patents, published applications or non-patent references, will be marked as 'Related' those disclose some of the key features, but fail to disclose some other key features related to the independent claims.

Interesting Results

Those patent or non-patents references which appeared to be potentially related, however, could not be categorized as relevant or related were marked as Interesting Results.

4.1.6. SEARCH RESULTS

4.1.6.1. KEY FEATURES TO BE MAPPED

The following key features have been identified based on the claim elements. All the relevant and/or related results identified in the search are mapped on these key features to properly depict their significance.

Key Features against Claim 1 [Independent Claim]:

A method for calibrating a rechargeable battery for an electronic device comprising:

1. Charging the battery by a charging process;

2. Determining a total amount of charge accepted by the battery during the charging process; and
3. Providing a value of total battery capacity of the battery based, at least in part, on the total amount of charge accepted by the battery [9].

4.1.6.2. SUMMARY OF SEARCH RESULTS

The results of the search have been presented in the report below. The Table 4.4 provides the summary of the search results obtained during the search. The rows contain the key features of the given invention and the columns consists the patent results obtained during the search. The availability of the features has been interpreted in the summary table in form of YES or NO. The analysis below provides bibliographic details of the identified references and relevant excerpts from the identified references.

Patent Results			
S. No.	1	2	3
Patent No.	US5926007	US6313606	US6495989
Key Features against Independent Claim			
A method for calibrating a rechargeable battery for an electronic device comprising:	Yes	Yes	Yes
Key Feature 1: charging the battery by a charging process;	Yes	Yes	Yes
Key Feature 2: determining a total amount of charge accepted by the battery during the charging process;	Yes	Yes	Yes
Key Feature 3: providing a value of total battery capacity of the battery based, at least in part, on the total amount of charge accepted by the battery.	Yes	Yes	Yes

Table 4.4: Summary Table

4.1.6.3. DETAILED ANALYSIS OF SEARCH RESULTS

This is the list of most relevant patent references found during the search for the given invention identified in the search:

1. US5926007

Comments**:** The patent [Table 4.5] discloses a charging apparatus for determining the total battery capacity of a battery of an electronic device by measuring the time and current during the charging process and integrating them to provide the battery capacity. It also discloses updating the battery capacity by measuring the ratio between the measured capacity and the nominal battery capacity [10]. The figure in fig 4.1 shows the block diagram of circuit of the patent result US5926007. The detailed analysis, bibliographic data and the mapping is given in the table below [Table 4.5].In mapping the relevant text found in the search results corresponding to the key features of given invention is pasted in the right side against the corresponding key feature.

Title	Publication Date	Filing Date	Priority Date	Inventor/ Author	Assignee
BATTERY CHARGING APPARATUS WHICH DETERMINES A TIME TO COMPLETION OF CHARGING	July 20, 1999	December 15, 1997	December 17, 1996	TETSUYA OKADA	SANYO ELECTRIC CO., LTD.
Abstract:					
The battery charging apparatus is provided with a memory circuit for pre-storing correlation data between rechargeable battery charge capacity and time to completion of charging, a charge capacity measuring circuit to measure rechargeable battery charge capacity, and a calculating circuit to calculate, during charging, the time to completion of charging based on charge capacity determined by the charge capacity measuring circuit and correlation data stored in the memory circuit [10].					

A method for calibrating a rechargeable battery for an electronic device comprising:	[SUMMARY] The charging apparatus of the present invention is characterized by a provision of a memory to pre-load data describing the correlation between rechargeable battery charge capacity and time to completion of charging, a capacity measuring circuit to measure the battery charge capacity during charging, and a computation circuit to calculate, during charging, the time to completion of rechargeable battery charging based on charge capacity measured by the capacity measuring circuit and correlation data stored in memory [10].
Key Feature 1: Charging the battery by a charging process;	[SUMMARY] The charging apparatus described above pre-stores data describing the correlation between rechargeable battery charge capacity and time to completion of charging, measures battery charge capacity during charging, and calculates the time to completion of charging. Therefore, the time to completion of rechargeable battery charging can accurately be calculated during battery charging [10].
Key Feature 2: Determining a total amount of charge accepted by the battery during the charging process; and	[CLAIMS] 1. A battery charging apparatus comprising: a memory circuit to pre-store data characterizing a correlation between rechargeable battery charge capacity and time to completion of charging; a charge capacity measuring circuit to measure a rechargeable battery charge capacity during charging; and a calculating circuit to calculate, during charging, a time to completion of rechargeable battery charging based on the rechargeable battery charge capacity measured by said charge capacity measuring circuit and the correlation data stored in said memory circuit [10]. 2. A battery charging apparatus as recited in claim 1, wherein said charge capacity measuring circuit has a current sensing circuit to measure a rechargeable battery charging current, and a computation circuit to determine the rechargeable battery charge capacity, during

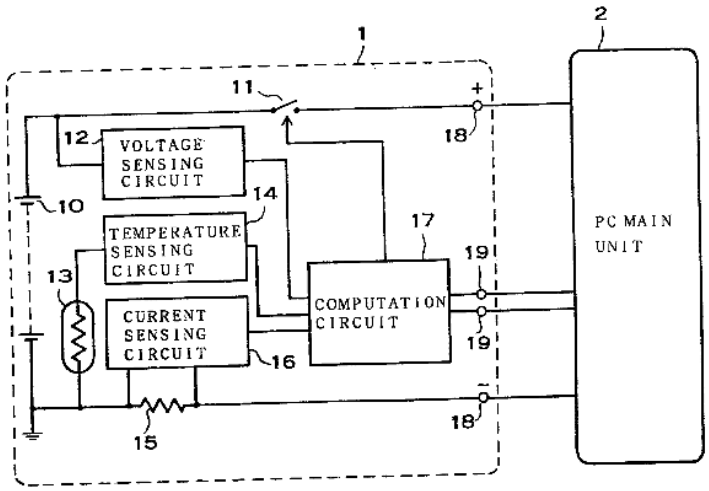
	charging, by time integration of charging current measured by said current sensing circuit [10].
Key Feature 3: Providing a value of total battery capacity of the battery based, at least in part, on the total amount of charge accepted by the battery.	[SUMMARY] Finally, for charging systems that charge rechargeable batteries with constant current and constant voltage, the present invention is characterized by a provision of a memory to pre-load a plurality of data-sets describing the correlation between rechargeable battery charge capacity and time to completion of charging for each charging current during constant current charging, a capacity measuring circuit to measure battery charge capacity during charging, and a computation circuit to calculate, during charging, the time to completion of rechargeable battery charging based on charging current during constant current charging, charge capacity measured by the capacity measuring circuit, and correlation data stored in memory [10].
Relevant Figure:	 ***Fig.4.1:***Relevant figure [10] The figure 4.1 sows the figure of the found relevant result during the search. It is the block diagram of the circuit of the invention in found patent result. The working of the circuitry is almost the same as of given invention.

Table4.5: Mapping of US5926007

2. US6313606

Comment: The patent [Table 4.6] discloses a method and apparatus for detecting battery capacity by a current integration method. Also, it provides the method of finding the residual capacity of the battery by voltage measurement of the battery terminals when the battery current is less than a threshold value. The detailed analysis, bibliographic data and the mapping is given in the table below [Table 4.5]. In mapping the relevant text found in the search results corresponding to the key features of given invention is pasted in the right side against the corresponding key feature.

Title	Publication Date	Filing Date	Priority Date	Inventor/ Author	Assignee
METHOD AND APPARATUS FOR DETECTING BATTERY CAPACITY	November 6, 2001	June 3, 1998	June 3, 1997	YASUHITO EGUCHI	SONY CORPORATION
Abstract:					
A method and apparatus for detecting the capacity of a battery wherein a voltage method of measuring the voltage of the battery, to calculate the capacity of the battery based on the correlation between the voltage and the capacity of the battery, is switched to a current integrating method of integrating the current magnitude of the battery with respect to time, to calculate the capacity of the secondary battery, and vice versa, with a pre-set current magnitude as a threshold value, in order to detect the capacity of the battery. By selectively using the voltage method and the current integrating method depending on the current magnitude of tshe battery, the capacity of the battery can be calculated with greater accuracy [11].					

Preamble: A method for calibrating a rechargeable battery for an electronic device comprising:	[SUMMARY] In view of the above-mentioned problems, an object of the present invention is to provide a battery capacity detection method, a battery pack and an electronic equipment system, in which the voltage method and the current integration method are selectively used depending on the magnitude of the current through the battery to raise the calculation accuracy of the capacity of the battery (residual capacity) [11].
Key Feature 1: charging the battery by a charging process;	[DESCRIPTION] The battery E, enclosed in the battery pack 20, includes a set of four lithium-ion-based battery cells 41 a, 41 b, 41 d and 41 d, such a battery E could be a Nicd battery as well. The +terminal of the battery E is connected via the switch 2 to a +terminal 7 of the pack (package of the battery pack 20), while its −terminal is connected via current detection circuit 3 to a −terminal 8 (GND terminal). The battery pack 20 is loaded in a battery housing section, not shown, provided in the personal computer 30, whereby the +terminal 7 of the pack side is electrically connected to the +terminal 12 of the personal computer 30 and the −terminal 8 on the pack side is electrically connected to the −terminal 13 of the personal computer 30. When the battery pack 20 is charged, the charging current also flows through the +terminal 7 and the −terminal 8 [11].
Key Feature 2: determining a total amount of charge accepted by the battery during the charging process; and	[DESCRIPTION] The current detection circuit 3, detects the current magnitude of the battery E in order to integrate the current magnitude of the battery E with respect to time to calculate the capacity of the battery E. This current detection circuit 3 includes a resistor 44 for current measurement which is connected to, for example, the minus side of the battery E and an operational amplifier 45 for detecting the voltage corresponding to the current flowing in the resistor 44. The current detection signal from the operational amplifier 45 is sent to the controller 1 where it is analog-to-digital (A/D) converted so that the

	measured current value is retrieved as a digital value in the micro-computer 11 [11]. Comment: The patent discloses measurement of current with respect to time to determine the capacity of the battery. However, charge is obtained by integrating the current over time.
Key Feature 3: Providing a value of total battery capacity of the battery based, at least in part, on the total amount of charge accepted by the battery.	[DESCRIPTION] The current detection circuit 3, detects the current magnitude of the battery E in order to integrate the current magnitude of the battery E with respect to time to calculate the capacity of the battery E. This current detection circuit 3 includes a resistor 44 for current measurement which is connected to, for example, the minus side of the battery E and an operational amplifier 45 for detecting the voltage corresponding to the current flowing in the resistor 44. The current detection signal from the operational amplifier 45 is sent to the controller 1 where it is analog-to-digital (A/D) converted so that the measured current value is retrieved as a digital value in the micro-computer 11 [11].

Table4.5: Mapping of US5926007

3. US6495989

Comments: The patent [Table 4.6] discloses residual charge determination by calculating the voltage across the terminals of the battery when the battery current is almost zero. It also updates the total battery capacity in accordance to the difference between the calculated residual battery and the residual battery stored in memory at a particular instant [12]. The detailed analysis, bibliographic data and the mapping is given in the table below [Table 4.6].In mapping the relevant text found in the search results corresponding to the key features of given invention is pasted in the right side against the corresponding key feature.

Title	Publication Date	Filing Date	Priority Date	Inventor/ Author	Assignee
BATTERY CONTROL APPARATUS AND MANAGEMENT METHOD OF BATTERY	December 17, 2002	August 14, 2000	August 18, 1999	YASUHITO EGUCHI	SONY CORPORATION

Abstract:
A battery control apparatus of this invention comprises charge detecting circuit for detecting change of charge of a battery based on current of the battery, first residual charge amount detecting circuit coupled to the charge detecting circuit for detecting a first residual charge amount of the battery by compensating a predetermined reference residual charge amount based on the detected result of the change of charge of the battery. The battery control apparatus further comprises second residual charge amount detecting circuit for detecting a second residual charge amount of the battery based on al terminal voltage of the battery and reference residual charge amount updating circuit for updating the reference residual charge amount by detected result of the second residual charge amount of the battery, wherein the second residual charge amount of the battery is detected at a predetermined timing where the current of the battery is zero or almost zero[12].

A method for calibrating a rechargeable	[DESCRIPTION] The central processing unit 3 then moves the processing to Step SP3 and detects the terminal voltage of the battery cells B1 B4 in no-load by

battery for an electronic device comprising:	controlling the operation of the switcher 2. Furthermore, the central processing unit 3 accesses the data for the terminal voltage versus charge amount stored in the memory 13, and the charging amount corresponding to this detected terminal voltage is detected. In this case the central processing unit 3 compensates the charging amount with the data for calibration stored in the memory 13 according to the temperature detected through the temperature detection element 7[12].
Key Feature 1: charging the battery by a charging process;	[DESCRIPTION] FIG. 2 shows a block diagram of a battery pack 1 in accordance with the first embodiment of this invention. This battery pack 1 is connected to a predetermined external device so as to form a current path between the battery B and the external device. In case where the battery charging apparatus is connected to the battery B as the external device, charging current is supplied from the battery charging apparatus to the battery B. In case where a personal computer or the like is connected as the external device, discharging current (operation current for the external device) is supplied from the battery B to the personal computer or the like[12].
Key Feature 2: determining a total amount of charge accepted by the battery during the charging process; and	[DESCRIPTION] The central processing unit 3 updates the full charge capacity recorded in the memory 13 in step SP 14 because of this reason. In other words in the processing routine shown in FIG. 1 the central processing unit 3 utilizes an accumulated electricity volume S%, accumulated electricity volume E% and a total integration value CC Ah respectively obtained at step SP13 and SP14 to the above expression 1 for calculating the full charge capacity FCc, where the FCc=100×CC/(S%−E%). Thereby the relation between a total current integration value CC [Ah] detected by repeating step SP6 and a full charge capacity FC [Ah] are expressed by a following formula[12]. FCx(S%=E%)/100

	Comment: The patent discloses integrating the electricity volume with respect to time which can be inferred as the charge accepted by the battery[12].
Key Feature 3: providing a value of total battery capacity of the battery based, at least in part, on the total amount of charge accepted by the battery.	[DESCRIPTION] The central processing unit 3 updates the full charge capacity recorded in the memory 13 in step SP 14 because of this reason. In other words in the processing routine shown in FIG. 1 the central processing unit 3 utilizes an accumulated electricity volume S%, accumulated electricity volume E% and a total integration value CC Ah respectively obtained at step SP13 and SP14 to the above expression 1 for calculating the full charge capacity FCc, where the FCc=100×CC/(S%−E%)[12]. Comment**:** The patent discloses calculating the full battery capacity by integrating the accumulated electricity volume with respect to time which can be inferred as charge accepted by the battery.

Table4.6: Mapping of US6313606

4.2. DETAILED ANALYSIS OF INVALIDITY SEARCH AGAINST PATENT NO: EP2217666B1, "SECURITY PIGMENT"

4.2.1. OBJECTIVE OF THE SEARCH

The objective of our search will be to capture documents that disclose:

A security pigment comprises:

1. Intrinsic hidden and/or forensic security and a transparent inorganic matrix;
2. At least one particulate material embedded in the matrix;
3. The said particulate material absorbs and/or reflects and/or emits visible light on contact with electromagnetic radiation;
4. Using the said particulate material as taggant for the pigmentation of different application media.

4.2.2. TERM SETS

The term sets are prepared as shown in [Table 4.7] these term sets are comprehensively prepared which include the every possible term which may be used for a keyword in any of the country or any other person in their terminology. The table also shows the German and French translations of the keywords [2].

Keyword Based Search			
Term Set	English Keywords	French Keywords	German Keywords
Security	(Securit+ OR Safe+ OR protect+ OR sure+ OR reliabl+ OR Forens+ OR hiding+ OR hid+ OR hidden OR Scientific+ OR Technolog+ OR Technical+ OR Legal+ OR investigat+ OR evidenc+ OR covert+)	(Assurer OR sécurité OR protéger OR sûr+ OR fiabilité OR fiable)	(Sichern+ OR Sicherheit OR Sicher OR schütz+ OR Zuverlässig+)
Pigment	(Pigment+ OR Color+ OR Colour+ OR Hue+ OR Imbue+ OR Dye+ OR Stain+ OR Tincture+ OR Paint+ OR Tint+ OR ink+ OR coat+)	(Couleur OR teint+ OR tache OR peindre OR peinture+ OR encre+ OR revêtement)	(Farb+ OR Fleck OR Tinktur+ OR malen OR Tinte+ OR Überzug)

Taggant	(Taggant+ OR Tag+ OR (Micro_scal+) OR (Micro_chip+) OR Identif+ OR Authenti+ OR Mark+ OR Label+ OR code+ OR taggent+)	(Traceur+ OR balise OR étiquette OR micro_puce OR marque+)	(Etikett OR Mikro_chip OR Beglaubigung)
Forensic	(Forens+ OR hiding+ OR "hid" OR hidden OR Scientific+ OR Technolog+ OR Technical+ OR Legal+ OR investigat+ OR evidenc+ OR covert+)	(Légal OR caché OR dissimulation OR scientifique OR technique OR enquête+ OR preuve)	(Gerichtlich OR versteckt OR wissenschaftlich OR technisch OR Untersuch+ OR Beweis OR Zeugnis)
Matrix	(Matrix OR Matric+ OR Inorganic OR arrangement+ OR Network+ OR connect+ OR Pattern+ OR Design+ OR medium+ OR media+ OR carrier+)	(Réseau+ OR relier OR raccordement OR motif OR moyen OR médias)	(Anordnung OR Netzwerk+ OR verbind+ OR Muster OR Medien)
Particulate	(Particulate+ OR aerosol+ OR "PM" OR ((Fine+ OR Tiny OR small+ OR Distinct+ OR minute) 3D (Particle+ OR particulat+ OR flake+)))	(Particule+ OR aérosol OR ((petit OR minuscule) 3D (particule+)))	(Partikel OR Sprühdose OR ((klein OR winzig OR deutlich) 3D (Teilchen OR Partikel)))
Electromagnetic Radiation	((Electromagnet+ OR Visible OR "UV" OR "IR" OR (Ultra_voilet) OR (Infra_red) OR Radio) 4D (Radiation+ OR wave+ OR frequenc+ OR light+ OR emission+ OR energ+))	((Infra_rouge) 4D (fréquenc+ OR lumière+ OR émission))	(Sichtbar OR (infra_rot)) 4D (Welle+ OR Strahlungen OR Frequenz+ OR Licht)

Table 4.7: Term sets for the search strategies

4.2.3. RELEVANT CLASSES IDENTIFIED

During the Google patent search and citation analysis, the following Classes [Table 4.8] were extracted from the patents of similar inventions and were used in combination with the term sets provided above [3]:

Class	Definitions
IPC / CPC	
G06K 19/10	physics>> computing; calculating; counting>> recognition of data; presentation of data; record carriers; handling record carriers>> record carriers for use with machines and with at least a part designed to carry digital markings>> at least one kind of marking being used for authentication, e.g. of credit or identity cards [4]
C09D 1/00	chemistry; metallurgy>> dyes; paints; polishes; natural resins; adhesives; compositions not otherwise provided for; applications of materials not otherwise provided for>> coating compositions, e.g. paints, varnishes or lacquers; filling pastes; chemical paint or ink removers; inks; correcting fluids; woodstains; pastes or solids for colouring or printing; use of materials therefor>> coating compositions, e.g. paints, varnishes or lacquers, based on inorganic substances [5]
C09K 11/00	chemistry; metallurgy>> dyes; paints; polishes; natural resins; adhesives; compositions not otherwise provided for; applications of materials not otherwise provided for>> materials for applications not otherwise provided for; applications of materials not otherwise provided for>> luminescent, e.g. electroluminescent, chemiluminescent, materials
G07D 7/00	physics>> checking-devices>> handling of coins or of paper currency or similar valuable papers, e.g. testing, sorting by denominations, counting, dispensing, changing or depositing>> testing specially adapted to determine the identity or genuineness of paper currency or similar valuable papers, e.g. for segregating those which are unacceptable or alien to a currency [7]
C09D 11/00	chemistry; metallurgy>> dyes; paints; polishes; natural resins; adhesives; compositions not otherwise provided for; applications of materials not otherwise provided for>> coating compositions, e.g. paints, varnishes or lacquers; filling pastes; chemical paint or ink removers; inks; correcting

	fluids; woodstains; pastes or solids for colouring or printing; use of materials therefor>> inks
C09D 5/00	chemistry; metallurgy>> dyes; paints; polishes; natural resins; adhesives; compositions not otherwise provided for; applications of materials not otherwise provided for>> coating compositions, e.g. paints, varnishes or lacquers; filling pastes; chemical paint or ink removers; inks; correcting fluids; woodstains; pastes or solids for colouring or printing; use of materials therefor>> coating compositions, e.g. paints, varnishes or lacquers, characterised by their physical nature or the effects produced; filling pastes [8]
G06K 19/14	physics>> computing; calculating; counting>> recognition of data; presentation of data; record carriers; handling record carriers>> record carriers for use with machines and with at least a part designed to carry digital markings>> the marking being sensed by radiation
G06K 19/06	physics>> computing; calculating; counting>> recognition of data; presentation of data; record carriers; handling record carriers>> record carriers for use with machines and with at least a part designed to carry digital markings>> characterised by the kind of the digital marking, e.g. shape, nature, code [4]
C09C 3/06	chemistry; metallurgy>> dyes; paints; polishes; natural resins; adhesives; compositions not otherwise provided for; applications of materials not otherwise provided for>> treatment of inorganic materials, other than fibrous fillers, to enhance their pigmenting or filling properties>> treatment in general of inorganic materials, other than fibrous fillers, to enhance their pigmenting or filling properties>> treatment with inorganic compounds
C09C	chemistry; metallurgy>> dyes; paints; polishes; natural resins; adhesives; miscellaneous compositions; miscellaneous applications of materials>> treatment of inorganic materials, other than fibrous fillers, to enhance their pigmenting or filling properties [7]
USPC	
283/85	printed matter >> utilizing electromagnetic radiation
436/56	chemistry: analytical and immunological testing >> tracers or tags

106/442	compositions: coating or plastic >> aluminum compound or silicon containing [5]

Table 4.8: Relevant classes

4.2.4. SEARCH STRATEGIES

The following search strings [Table 4.9], some combinations and/or some syntactical variations of them were used to conduct searches on Thomson Micropatent and Questel Orbit to extract patents for analysis or extract other relevant information to assist in searching. Similarly, syntactical variations of these strings were run on non-patent databases as well.

S. No.	Search Strategies	Number of Hits
1	Full Patent Specifications: (((*Pigment* Term Set) S (*Matrix* Term Set)) P (*Taggant* Term Set)) AND Any Classification: (C09C 3/06 OR C01P2004/00 OR C09C OR C09D 1/00 OR C09D 11/00 OR C09D 5/00 OR G06K 19/14 OR G06K 19/06 OR C09K 11/00 OR G07D 7/00 OR G06K 19/10 OR C08K 3/00 OR G01N 33/32 OR 106/442 OR 283/85 OR 436/56) AND Publication Date: <20071205	958
2	Full Patent Specifications: (((*Pigment* Term Set) S (*Matrix* Term Set)) P (*Electromagnetic Radiation* Term Set)) AND Any Classification: (C09C 3/06 OR C01P2004/00 OR C09C OR C09D 1/00 OR C09D 11/00 OR C09D 5/00 OR G06K 19/14 OR G06K 19/06 OR C09K 11/00 OR G07D 7/00 OR G06K 19/10 OR C08K 3/00 OR G01N 33/32 OR 106/442 OR 283/85 OR 436/56) AND	107

	Publication Date: <20071205	
3	Full Patent Specifications: (((*Pigment* Term Set) S (*Electromagnetic Radiation* Term Set)) AND (*Forensic/Security* Term Set)) AND Any Classification: (C09C 3/06 OR C01P2004/00 OR C09C OR C09D 1/00 OR C09D 11/00 OR C09D 5/00 OR G06K 19/14 OR G06K 19/06 OR C09K 11/00 OR G07D 7/00 OR G06K 19/10 OR C08K 3/00 OR G01N 33/32 OR 106/442 OR 283/85 OR 436/56) AND Application Date: <20071205 AND Jurisdiction: EP OR WO	131
4	Full Patent Specifications: (((*Security/Forensic* Term Set) 3D (*Pigment* Term Set)) P ((*Matrix* Term Set) S (*Particulate* Term Set))) AND Any Classification: (C09C 3/06 OR C01P2004/00 OR C09C OR C09D 1/00 OR C09D 11/00 OR C09D 5/00 OR G06K 19/14 OR G06K 19/06 OR C09K 11/00 OR G07D 7/00 OR G06K 19/10 OR C08K 3/00 OR G01N 33/32 OR 106/442 OR 283/85 OR 436/56) AND Publication Date: <20071205	426
5	Full Patent Specifications: (((*Pigment* Term Set) S (*Matrix* Term Set)) P (*Taggant* Term Set)) AND Any Classification: (C09C 3/06 OR C01P2004/00 OR C09C OR C09D 1/00 OR C09D 11/00 OR C09D 5/00 OR G06K 19/14 OR G06K 19/06 OR C09K 11/00 OR G07D 7/00 OR G06K 19/10 OR C08K 3/00 OR G01N 33/32 OR 106/442 OR 283/85 OR 436/56)	1117

	AND Application Date: <20071205 AND Jurisdiction: EP OR WO	
6	Full Patent Specifications: (((*Security/Forensic* Term Set) 3D (*Pigment* Term Set)) P ((*Matrix* Term Set) S (*Particulate* Term Set))) AND Any Classification: (C09C 3/06 OR C01P2004/00 OR C09C OR C09D 1/00 OR C09D 11/00 OR C09D 5/00 OR G06K 19/14 OR G06K 19/06 OR C09K 11/00 OR G07D 7/00 OR G06K 19/10 OR C08K 3/00 OR G01N 33/32 OR 106/442 OR 283/85 OR 436/56) AND Application Date: <20071205 AND Jurisdiction: EP OR WO	509
7	1 OR 2 OR 3 OR 4 OR 5 OR 6	1015

Table 4.9: Search Strategies

4.2.5. RELEVANCE CRITERIA

Documents identified from the search were manually analyzed and tagged as relevant, related, interesting and not-relevant. Provided below is the description of each category

Relevant Results

Any patents, published applications that disclose all the key features, explicitly or at least inferentially, will be marked as Relevant.

Related Results

Any patents, published applications, that disclose some of the key features explicitly or inferentially but fail to disclose all the key features as described for the relevant results, will be marked as Related.

Interesting Results

Those patent references which disclosed appeared to be potentially related, however, could not be categorized as relevant or related were marked as Interesting Results [9]. Note that this list has just been provided to give you an idea of what else exists in the art and is not meant to be comprehensive.

4.2.6. SEARCH RESULTS

Key Features to be mapped

The following pointers have been identified based on the claim elements. All the relevant and/or related results identified in the search are mapped on these key features to properly depict their significance.

A security pigment comprises:

1. Intrinsic hidden and/or forensic security;
2. A transparent inorganic matrix wherein,
   a. Thickness of the matrix lies between 0.05 µm and 10 µm;
3. At least one particulate material embedded in the matrix wherein,
   a. The said particulate material is different from the matrix;
   b. The said particulate material is a spherical/three-dimensionally regularly/irregularly shaped material; [13]
   c. The said particulate material has a particle size of 0.01 µm to 12 µm;
4. The said particulate material absorbs and/or reflects and/or emits visible light on contact with electromagnetic radiation; [13]
5. Using the said particulate material as taggant for the pigmentation of different application media.

Summary of Search Results

The results of the search have been given below [Table 4.10]. . The Table 4.10 provides the summary of the search results obtained during the search. The columns contain the key features of the given invention and the rows consists the patent results obtained during the search. The availability of the features has been interpreted in the summary table in form of YES or NO The analysis below provides bibliographic details of the identified references and relevant excerpts from the identified references.

S. No	Patent/ Publication No.	Preamble	Key Features								
			The said pigment comprises:								
		A security pigment	Key Feature 1: Intrinsic hidden and/or forensic security;	Key Feature 2: A transparent inorganic matrix wherein,	Key Feature 2 (a): Thickness of the matrix lies between 0.05 µm and 10 µm;	Key Feature 3: At least one particulate material embedded in the matrix wherein,	Key Feature 3 (a): The said particulate material is different from the matrix;	Key Feature 3 (b): The said particulate material is a spherical/three-dimensionally regularly/irregularly shaped material;	Key Feature 3 (c): The said particulate material has a particle size of 0.01 µm to 12 µm;	Key Feature 4: The said particulate material absorbs and/or reflects and/or emits visible light on contact with electromagnetic radiation;	Key Feature 5: Using the said particulate material as taggant for the pigmentation of different application media.
1	EP1597709	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
3	US6200628	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes

Table 4.10: Summary Table

Detailed Analysis of Search Results

1. **EP1597709**

Comment: This patent discloses a method for producing security markings. Pigment particles are incorporated in a matrix and form a three-dimensional random pattern. The marking also consists of a verification code which is machine readable [14]. The detailed analysis, bibliographic data and the mapping is given in the table below [Table 4.11].In mapping the relevant text found in the search results corresponding to the key features of given invention is pasted in the right side against the corresponding key feature.

Title	Publication Date	Filing Date	Priority Date	Inventor/ Author	Assignee
METHOD FOR PRODUCING SECURITY MARKINGS	November 23, 2005	February 5, 2004	February 5, 2003	NILS BIERMANN | HILMAR RAUHE	INFORMIUM AG

Abstract:
The majority of prior art security markings (barcodes, holograms, etc.) are easy to counterfeit, expensive to produce, also accessible to counterfeiters or are non-machine readable. The novel method overcomes said disadvantages. A random pattern is applied to the product or the label. It is highly important that said method is that a very large number of different patterns are produced and that one such pattern can be produced at low costs. The effort required to produce a specific pattern is obviously much higher (e.g. random distribution of effect pigments). A finger print in the form of a data set is extracted from the random input pattern, said finger print containing the individual characteristics of the pattern. Said finger print is individually stored for each security marking. The finger print is extracted again during authentication and is checked to see if it matches the stored finger print. The security marking can generally be used to protect against forgery e.g. for money, documents, water marks, vehicle number plates etc [14].

A security pigment comprises:	[DESCRIPTION] A method of the invention characterized in that the security feature of particles, for example colored particles, pigments, effect pigments, sand, dust, crystals (for example, salt crystals of different colors), ferromagnetic magnetizable permanent magnetic, fluorescent,

	phosphorescent, opalescent iridescent or radioactive particles is formed. [14].
Key Feature 1: Intrinsic hidden and/or forensic security;	[DESCRIPTION] An as yet unsolved problem is the copy protection of security markings. This allows simple visual features, barcodes, labels, etc. Just copy. Complicated security labels like holograms can not be directly copied, but adjust. To discourage copying it deviates so far typically careful to conceal the security code (eg only in the UV or IR range of visual characteristics), or encrypting information and then encrypted on the product applied (eg matrix code that his data) in an encrypted manner. Both strategies are relatively easy for counterfeiters to circumvent. In the first case leads you through a "scan" of different wavelengths and is thereby the wavelength at which the security label is readily visible. Which may then be photographed easily imitated or copied. In the second case, it is even easier. In this case .. the - encrypted - just like any other information copied the actual content of the information does not need to know the forger For this reason, work all the "lock and key" "not safety principles" within the meaning of copy protection: fits on a copied the castle authenticating the key point exactly as the original [14].
Key Feature 2: A transparent inorganic matrix wherein,	[CLAIMS] 1 A method for producing safety signs, characterized in that the security label contains a random pattern [14]. 3 A method according to claim 1, characterized in that the security mark of particles, for example colored particles, pigments, effect pigments, sand, dust, crystals (for example salt crystals of different color), ferromagnetic magnetizable permanent magnetic, fluorescent, phosphorescent, iridescent, opalescent or radioactive particles is formed [14]. 7 A method according to claim 3 or 4, characterized in that the particles are incorporated into a matrix (carrier), and the resulting mixture of such is used for the coating of objects. Suitable matrix

	paints, preferably water, solvent, powder, UV coatings, epoxy resins, plastics (eg polyethylene), ethyl acetate and similar materials, paraffins, waxes and waxy coatings (eg Flexane) [14].
a. Thickness of the matrix lies between 0.05 µm and 10 µm;	[CLAIMS] 1 A method for producing safety signs, characterized in that the security label contains a random pattern [14]. 3 A method according to claim 1, characterized in that the security mark of particles, for example colored particles, pigments, effect pigments, sand, dust, crystals (for example salt crystals of different color), ferromagnetic magnetizable permanent magnetic, fluorescent, phosphorescent, iridescent, opalescent or radioactive particles is formed [14]. 7 A method according to claim 3 or 4, characterized in that the particles are incorporated into a matrix (carrier), and the resulting mixture of such is used for the coating of objects. Suitable matrix paints, preferably water, solvent, powder, UV coatings, epoxy resins, plastics (eg polyethylene), ethyl acetate and similar materials, paraffins, waxes and waxy coatings (eg Flexane) [14]. 9 Coating is obtainable according to claim 7, characterized in that the coating thickness <= 20µm, preferably <= 10 microns, more preferably <= 5µm, most preferably <= 3 microns.
Key Feature 3: At least one particulate material embedded in the matrix wherein,	[CLAIMS] 1 A method for producing safety signs, characterized in that the security label contains a random pattern. 3 A method according to claim 1, characterized in that the security mark of particles, for example colored particles, pigments, effect pigments, sand, dust, crystals (for example salt crystals of different color), ferromagnetic magnetizable permanent magnetic, fluorescent, phosphorescent, iridescent, opalescent or radioactive particles is formed[14]. 7 A method according to claim 3 or 4, characterized in that the particles are incorporated into a matrix (carrier), and the resulting

	mixture of such is used for the coating of objects. Suitable matrix paints, preferably water, solvent, powder, UV coatings, epoxy resins, plastics (eg polyethylene), ethyl acetate and similar materials, paraffins, waxes and waxy coatings (eg Flexane) [14].
a. The said particulate material is different from the matrix;	N/A
b. The said particulate material is a spherical/three-dimensionally regularly/irregularly shaped material;	[CLAIMS] 1 A method for producing safety signs, characterized in that the security label contains a random pattern [14]. 3 A method according to claim 1, characterized in that the security mark of particles, for example colored particles, pigments, effect pigments, sand, dust, crystals (for example salt crystals of different color), ferromagnetic magnetizable permanent magnetic, fluorescent, phosphorescent, iridescent, opalescent or radioactive particles is formed [14]. 4 A method according to claim 3, characterized in that the security label of fluorescent, phosphorescent, iridescent, opalescent or reflecting particles is formed. For example, organic and inorganic, of which particularly inorganic fluorescent particles such as those of the company light Breitungen GmbH (98597 Breitungen, www.leuchtstoffwerk.com) are offered. Also suitable crystals are plate-shaped crystals, liquid crystals, reflecting pigments of at least two layers with different Refraktärindex, effect pigments (interference pigments, pearlescent and metallic luster pigments). Effect pigments are available, for example under the trade name Iriodin ® / Afflair ® and Colourstream ® from Merck KGaA, Darmstadt, Germany, under the trade name Helicone ® by the company Wacker Chemie, Burghausen. Particular preference reflective particles is the fact that they a) in contrast to fluorescent particles are subject to virtually no wear through light and b) depending on the viewing and illumination angles different random

	patterns. Such modifications occur, for example when considering the special-effect pigments, characterized in that each pigment as a microscopic mirror for light of a certain wavelength has, reflects this light in the room to its random orientation, whereby random 3-dimensional patterns [14]. [DESCRIPTION] Figure 9: The invention described particles form 3-dimensional Random pattern. During the rotation of the target object (Figure 9) by about 60 ° in the Focal plane of the random pattern changed completely. The registration marks in the image (white Crosses) show the corresponding points of the same object (Figure 9) and after (Figure 10) of the rotation [14].
c. The said particulate material has a particle size of 0.01 µm to 12 µm;	[CLAIMS] 1 A method for producing safety signs, characterized in that the security label contains a random pattern. 3 A method according to claim 1, characterized in that the security mark of particles, for example colored particles, pigments, effect pigments, sand, dust, crystals (for example salt crystals of different color), ferromagnetic magnetizable permanent magnetic, fluorescent, phosphorescent, iridescent, opalescent or radioactive particles is formed [14]. 5 A method according to claim 3 or 4, characterized in that the particles used have a diameter between 0.1 microns and 1 micron, between 1 micron and 10 microns, between 80 micron and 10 microns, between 80 micron and between 150µm and 150µm and 2000µm, and each have a thickness up to 50 microns , preferably up to 10 microns, more preferably, to 3 microns [14].
Key Feature 4: The said particulate material absorbs and/or reflects and/or emits visible light on	[DESCRIPTION] A method of the invention, characterized in that for the identification of the random pattern no coherent radiation or coherent light (laser) is required, or the radiation source must emit no coherent radiation or coherent light. Suitable radiation sources are thus, for example, but

contact with electromagnetic radiation;	not limited to, diodes, halogen lamps, UV lamps, IR lamps. A method of the invention, characterized in that the radiation source and sensor in the spectral range from x-ray, UV, visible light, infrared, microwaves, particularly preferably in the working spectral range from UV, visible light or infrared [14].
Key Feature 5: Using the said particulate material as taggant for the pigmentation of different application media.	[DESCRIPTION] This problem is solved by using the method described above as follows: a) The objects an-/aufgebracht labeling that tamper-proof (copy protected) and can be easily devalued. b) the marking consists of a random pattern (eg, a random distribution of colored particles), and a verification code corresponding thereto, which is preferably machine-readable configured (eg a barcode) (Variant C). The mark may be designed as a printing (screen printing, gravure printing, digital printing, security printing, etc.) or as a label. c) The identification works as an authentication feature, whose validity can be verified by a test set by comparing the random pattern and verification code. The random pattern acts as a copy protection that can be cracked, or only with great effort uneconomical. The check code in turn is obtained from the random pattern in which one, as described above, features extracted from the random pattern and the coded data (fingerprint). d) The labeling an-/aufgebracht any time after production of the tagged object. e) The verification of marks is done with test equipment that have a detector for the random pattern and software that extracts from the random pattern characteristics, calculates a fingerprint and compares it with the check code. f) objects without or without complete identification or without random pattern and verification code are tied match. The validation can be done in several ways, such as tearing (at design as a label), chipping, short heating (at design as a wax print) etc [14].

Table4.11: Mapping of EP1597709

2. **US6200628**

Comment: This patent relates to a method of identifying an article by tagging and adding some security features to the surface of the article. The non-stoichiometric crystal element forms an inorganic matrix and the at least two chemical elements in a predetermined known ratio contained in the particle of a non-stoichiometric crystalline compound form the particulate or taggant. The information containing particle is localized by scanning electron microscopy and then the ratio of elements is analyzed using energy or wavelength dispersive X-ray analysis [15]. The detailed analysis, bibliographic data and the mapping is given in the table below [Table 4.12].In mapping the relevant text found in the search results corresponding to the key features of given invention is pasted in the right side against the corresponding key feature.

Title	Publication Date	Filing Date	Priority Date	Inventor/ Author	Assignee
USE OF INORGANIC PARTICLES AND METHOD FOR MAKING AND IDENTIFYING A SUBSTRATE OR AN ARTICLE	March 13, 2001	October 2, 1998	December 29, 1997	Olivier Rozumek | Edgar Müller	Sicpa Holding S.A.

Abstract:

The present invention relates to inorganic particles comprising at least two chemical elements in a predefined and analytically identifiable ratio. These particles are used as a marking means incorporated into or applied onto any desired article. They provide a high security potential against counterfeiting since the analysis depend on a combination of spatial as well as of chemical information. In a first step the information containing particle has to be localized by scanning electron microscopy and in a second step the ratio of elements is analysed using energy—or wavelength—dispersive X-ray analysis (SEM/EDX) [15].

Preamble: A security pigment comprises:	[CLAIMS] 1. A method of marking and authenticating an item, said method comprising steps of applying to said item a marking comprising at least one particle of a

	non-stoichiometric crystalline compound containing at least two chemical elements in a predetermined known ratio, and subsequently authenticating the item by [15]. locating said particle on said item, and then analyzing the particle to determine whether it contains said elements, in said predetermined ratio [15]. [DESCRIPTION] It is therefore an object of the present invention to provide marking means which do not show the drawbacks of the prior art and which are particularly suitable for application on security documents [15] It is a further object of the invention to provide a reliable forensic tool for marking articles against counterfeiting or improper use. Another object of the invention is to provide marking means which are compatible with the existing security systems, especially those which are in use on security documents and which serve for their automated machine recognition.
Key Feature 1: Intrinsic hidden and/or forensic security;	[DESCRIPTION] It is therefore an object of the present invention to provide marking means which do not show the drawbacks of the prior art and which are particularly suitable for application on security documents. It is a further object of the invention to provide a reliable forensic tool for marking articles against counterfeiting or improper use. Another object of the invention is to provide marking means which are compatible with the existing security systems, especially those which are in use on security documents and which serve for their automated machine recognition [15].
Key Feature 2: A transparent inorganic matrix wherein,	[DESCRIPTION] One embodiment of the present invention is that the information containing particle consists of superposed layers which comprise the chemical elements in non-stoichiometric or stoichiometric form. The inorganic particles can be of any shape, including irregularly

	formed as well as regularly formed particles. The size of said particles is substantially in a range of between 0.1 to 30 micrometers, preferably in a range of between 0.5 to 10 micrometers and even more preferably in a range of between 1 to 5 micrometers. Substantially means that 80% or more of the total weight of the material falls within the range. The volume of the individual particles is substantially comprised within the range between 0.01 μm3 to 10000 μm3, preferably within the range of between 0.1 μm3 to 1000 μm 3, more preferably within the range of between 1 μm3 to 100 μm3 [15]. The inorganic particles of the present invention can be blended into any carrier medium which is able to form stable dispersions of said particles and to hold the particles in place for localization and analysis. Preferably those particles are blended into any kind of coating composition and printing ink which are applied onto any kind of substrate to be marked. In a preferred embodiment, if the coding has to remain invisible to the human eye, the film forming carrier medium is chosen to be transparent in the visible range of the electromagnetic spectrum. In a further application mode, the particles are incorporated into bulk materials which thereafter will obtain their desired form by extrusion, casting, injection moulding, rolling, etc.. Coating compositions or printing inks comprising said particles can be applied to the underlying substrate by any of the known techniques. These include spraying, brushing, dipping, printing. Printing can be performed e.g. by intaglio, gravure, offset, silkscreen, letterpress, flexography and related techniques [15]. [CLAIMS] 1. A method of marking and authenticating an item, said method comprising steps of applying to said item a marking comprising at least one particle of a non-stoichiometric crystalline compound containing at least two chemical elements in a predetermined known ratio, and subsequently authenticating the item by [15]. Locating said particle on said item, and then analyzing the particle to

	determine whether it contains said elements, in said predetermined ratio. 2. The method of claim 1, wherein the particle is located using back scattered electron detection. 3. The method of claim 1, wherein the particle is incorporated in a coating composition before being applied to said item. 4. The method of claim 3, further comprising a step of adding at least one camouflaging compound to said coating, said camouflaging compound containing at least one of said chemical elements. 5. The method of claim 1, wherein said crystalline compound has a garnet structure. 6. The method of claim 1, wherein said crystalline compound has a spinel structure. 7. The method of claim 1, wherein said crystalline compound has a perovskite structure. 8. The method of claim 1, wherein said crystalline compound has a zircon structure. 9. The method of claim 1, wherein the crystalline compound is selected from the group consisting of oxysulfides of rare-earth elements and oxysulfides of yttrium, and combinations thereof. Comment**:** The non- stoichiometric form of chemical elements may be inferred to have a matrix type structure.
a. Thickness of the matrix lies between 0.05 µm and 10 µm;	[DESCRIPTION] The inorganic particles can be of any shape, including irregularly formed as well as regularly formed particles. The size of said particles is substantially in a range of between 0.1 to 30 micrometers, preferably in a range of between 0.5 to 10 micrometers and even more preferably in a range of between 1 to 5 micrometers. Substantially means that 80% or more of the total weight of the material falls within the range. The volume of the individual particles is substantially comprised within the range between 0.01 µm3 to 10000 µm3, preferably within the range of between 0.1 µm3 to 1000 µm 3, more preferably within the range of between 1 µm3 to 100 µm3 [15].

	Comment**:** The group of inorganic particles here may be inferred as the matrix.
Key Feature 3: At least one particulate material embedded in the matrix wherein,	[CLAIMS] 1. A method of marking and authenticating an item, said method comprising steps of applying to said item a marking comprising at least one particle of a non-stoichiometric crystalline compound containing at least two chemical elements in a predetermined known ratio, and subsequently authenticating the item by locating said particle on said item, and then analyzing the particle to determine whether it contains said elements, in said predetermined ratio [15]. 2. The method of claim 1, wherein the particle is located using back scattered electron detection. 3. The method of claim 1, wherein the particle is incorporated in a coating composition before being applied to said item. 4. The method of claim 3, further comprising a step of adding at least one camouflaging compound to said coating, said camouflaging compound containing at least one of said chemical elements. 5. The method of claim 1, wherein said crystalline compound has a garnet structure. 6. The method of claim 1, wherein said crystalline compound has a spinel structure. 7. The method of claim 1, wherein said crystalline compound has a perovskite structure. 8. The method of claim 1, wherein said crystalline compound has a zircon structure. 9. The method of claim 1, wherein the crystalline compound is selected from the group consisting of oxysulfides of rare-earth elements and oxysulfides of yttrium, and combinations thereof [15]. Comment: Here the said two chemical elements contained inside the particle of a non-stoichiometric crystalline compound may be inferred as the particulate material**.**
a. The said particulate material	[DESCRIPTION] The encoding compounds used in the present invention are preferably

is different from the matrix;	chosen among the non-stoichiometric crystalline compounds or among the different types of glasses. Not with quite the same security potential, however satisfying for selected applications, are stoichiometric crystalline compounds. Stoichiometric compounds are such which do only exist in a defined elemental ratio. Calcium carbonate (CaCO3) Quartz (SiO2), Baryte (BaSO4), etc. are examples of stoichiometric compounds [15]. Non-stoichiometric crystals are solids with a microscopically ordered structure, i.e. the atoms are arranged in a regular fashion, called the crystal structure. Certain crystal structures are quite tolerant towards replacement of one type of atom by another without the need for changes in their microscopic order, given that certain general rules like atom sizes and charge neutrality are respected. Examples of such structure types are the spinels (AB2O4) the garnets (A3B2C3O12 or A3B5O12), the perovskites (ABO3), the lanthanide oxysulphides (Y,Ln)2O2S, the zircones (ABO4) etc. Here A,B,C stand for the different types of sites encountered in the crystal structure; these sites must be occupied by corresponding metal ions. Ln stands for the lanthanide series, i.e. elements 57 to 71. A given site in all these structures may be occupied either by a single type of metal ion, or by a mixture of different types of chemically similar metal ions. For example, the compounds Fe3O4,znFe2O4, (ZnxCo1-x)Fe2O4 and Co(Fe2-xAlx)O4 all posess the spinel structure. The parameter x in certain of these formulas may be freely chosen, i.e. one or more concentration ratios exist which are not prescribed by stoichiometry. The present invention relies heavily on the existence of this type of compounds for the realization of suitable information containing particles [15]. Comment: Here the non-stoichiometric crystal solids may be inferred as the matrix. [DESCRIPTION] The enhanced coding capacity of this type of marking according to the

	present invention, as well as its resistance to perturbing elements and to reverse-engineering attempts, will be illustrated with the help of the following examples: EXAMPLE; Encoding particles P1: (Y1.6Nd0.2Gd0.2)O2S Encoding particles P2: (Y1.0Gd0.6Yb0.4)O2S Encoding particles P3: (Y1.3Nd0.1Gd0.4Yb0.2)O2S Camouflaging material C1: La2O3 Camouflaging material C2: Gd2O3 An encoding realised with a 1:1 mixture of P1 and P2 can be distinguished, according to the present invention, from an encoding realised with P3. U.S. Pat. No. 5,670,239 would not distinguish between both cases. This illustrates the higher coding capacity of the marking means according to the present invention [15]. An encoding realised with an 1:1 mixture of P1 and the camouflaging material Cl is easily decoded, according to the present invention, as having the element ratio (Y1.6Nd0.2Gd2.0); it is indeed sufficient to localize one crystal of the (Y1.6Nd0.2Gd0.2)O2S particle and to analyse it. Since U.S. Pat. No. 5,670,239 would additionally consider the La2O3, it would conclude to an overall element ratio of (La1.0Y0.8Nd0.1Gd0.1) in this case. This would also be the compositional ratio obtained with classical elementary analysis, X-ray fluorescence, Laser-Ablation-ICP-MS, etc.) which illustrates the higher resistance against reverse-engineering of a marking means according to the present invention [15]. Comment: Here the mixture of P1 and P2 may be inferred as the chemical element i.e. the particulate material.
b. The said particulate material is a spherical/three-dimensionally regularly/irregularly shaped material;	N/A

c. The said particulate material has a particle size of 0.01 µm to 12 µm;	N/A
Key Feature 4: The said particulate material absorbs and/or reflects and/or emits visible light on contact with electromagnetic radiation;	[DESCRIPTION] The protection against counterfeiting is enhanced when said particles additionally have luminescence-, magnetism-, IRabsorption-, radio frequency- and/or microwave resonance-properties. Coating compositions and/or printing inks can be applied to any security document to prevent counterfeiting or unauthorized trade and use of said document.
Key Feature 5: Using the said particulate material as taggant for the pigmentation of different application media.	[DESCRIPTION] This invention relates to the use of inorganic particles which comprise at least two chemical elements in a predefined and analytically identifiable ratio, a method for tagging a substrate and to a method of tagging and identifying a substrate and/or an article. Encoded micro-particles whose code is represented by at least three visually distinguishable coloured layers of organic resins and their use as tag and/or security feature in order to prevent counterfeiting of articles have already been described in DE 26 51 528 and U.S. Pat. No. 4,329,393. Originally, these particles have been developed to allow tracing of explosives from production to detonation. These tags are sold under the trade name Microtaggant or Microtrace [15].

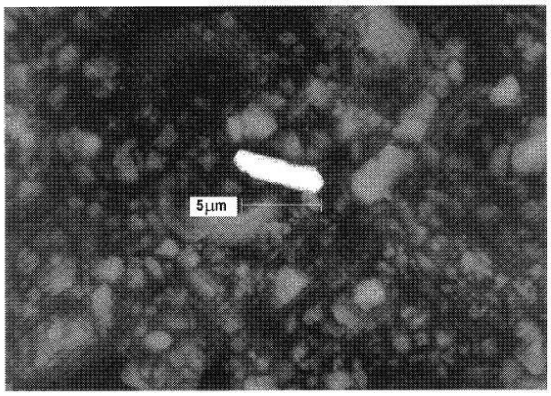
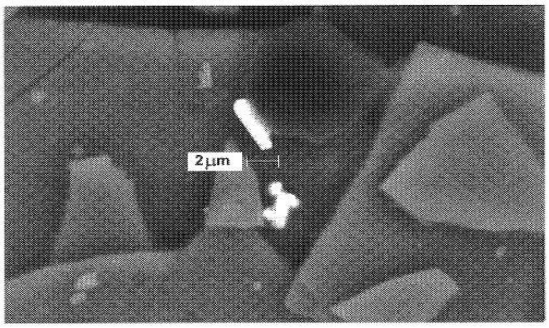
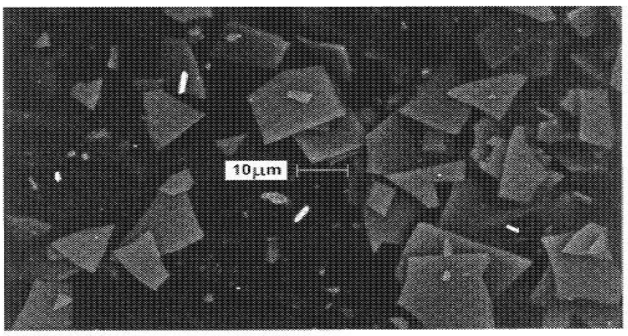
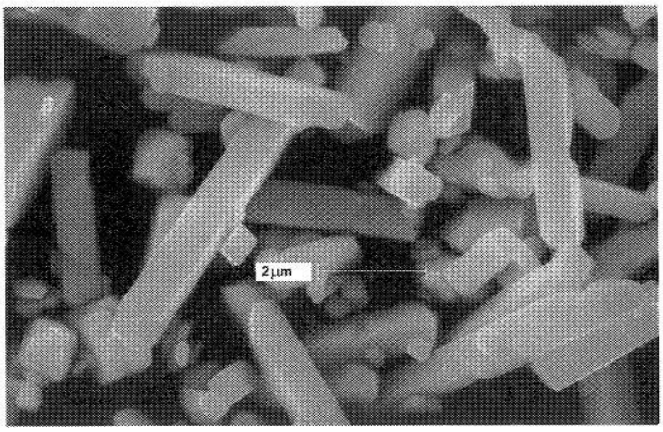
Relevant Figure: ***Fig 1:*** SEM picture of a crystalline non-stoichiometric inorganic information containing particle of the present invention, incorporated in a printed intaglio ink, under backscattered electron detection. ***Fig 2:*** SEM picture of several crystalline non-stoichiometric inorganic information containing particles of the present invention in a printed optically variable silk screen ink. ***Fig 3:*** SEM picture of the same particles as in FIG. 2 in a printed optically variable intaglio ink.	FIG. 1   FIG. 2  FIG. 3 FIG. 4 

Table 4.11: Mapping of US6200628

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CHAPTER 5

CONCLUSION, PERSPECTIVE & FUTURE RESEARCH

5.1 THE OUTCOME

The projects mentioned above provided an insightful knowledge about the field of Intellectual Property Research [IPR], the challenges lying within as well as the strategic approaches employed by companies to progress in the fields of Research & Development whilst constantly monitoring their competitors through prior-art and patentability searches.

The projects also enabled me to develop a thorough understanding of the existing latest technologies in various fields in the IPR field and its progressive development through innovation and research.

Analysing and more fundamentally, reading between the lines was extremely important and crucial to the projects since many of the terms, claims and novelties of the patents were quite esoteric and involved an in-depth understanding of the field as well as the technology to conduct a better search and segregate qualitatively sharpened results. Overall, it was an enriching and a learning experience and I am highly grateful to the authorities for giving me this rare opportunity.

The research work on the all Novelty Searches and some of the Invalidity searches proved to be very useful for getting acquainted with the technical knowledge of how the inventions work by practically implementing them into devices.

As in the invalidity search of the patent US6630814B2, “PROVIDING A TOTAL BATTERY CAPACITY VALUE” while making the understanding of the invention I got to know that how the measurement of charge can be implemented to find out the stored capacity

of the battery and how we can practically measure the remaining capacity of the battery while someone is simultaneously using the battery by talking to somebody on phone.

In the invalidity search of the patent EP2217666B1, "SECURITY PIGMENT" I got acquainted with how the nanocomposites can be practically implemented for security purposes and got to know the importance of the crystalline non-stoichiometric inorganic information containing forensic particles embedded in it.

5.2 SCOPE FOR FUTURE WORK

I realized the future potential as well as the importance that this field of IPR holds. Students who are interested in research will be benefited the most. Reading various inventions would give a different perspective towards academics and helps in intellectual stimulating. One may come up with a better idea and also patent the same. Also the IPR field forms an indispensable part of R & D department in various companies.

While doing the research work over patents I got many ideas in my mind for the future research on the project I handled. In the method/ system disclosed by the patent US6630814B2, "PROVIDING A TOTAL BATTERY CAPACITY VALUE" it uses the measurement circuitry which also consumes a little amount of the battery capacity, thereby reducing the battery backup by a small amount. But if we use a voltage sampler which periodically measures the voltage at the battery terminals within short intervals, the power can be saved to a great extent. Hence the efficiency of the battery will be least effected by the battery capacity measuring circuit.