

6-24-2017

## From Creativity to Classification: A Logical Approach to Patent Searching

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Armour-Gemmen, Marian G., "From Creativity to Classification: A Logical Approach to Patent Searching" (2017). *Faculty & Staff Scholarship*. 1133.

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## **From Creativity to Classification: A Logical Approach to Patent Searching**

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Marian Armour-Gemmen has been the Patent & Trademark librarian at West Virginia University Libraries since 2003. In this capacity she assists inventors throughout the state of West Virginia. She is also the engineering bibliographer, with particular interest in Mechanical and Aerospace Engineering. Previously she worked as the head of the Physical Sciences Library and as an associate in the Government Documents department. She is a past president of the Patent & Trademark Resource Center Association. She holds a M.L.I.S. from the University of South Carolina, a M.A. from the University of Michigan, and a B.A. from Calvin College.

## From Creativity to Classification: A Logical Approach to Patent Searching

Engineering students and professors need to understand and search intellectual property. In the past, librarians have instructed them on using the United States Patent Classification (USPC). In 2015, after a period of transition, the United States Patent and Trademark Office phased out the USPC and began exclusively classifying in the Cooperative Patent Classification (CPC).<sup>1</sup> This adoption presented librarians a challenge of instructing students and professors in the easiest and most effective patent search. By tying patent searching to an example and presenting classification in an understandable fashion using CPC in conjunction with USPC, this writer presents a logical directed search module.

### History of Classification

Rotkin and Dood provide a history of the patent classification in the U.S.<sup>2</sup> The Patent Office was established in 1790. In 1900, a patent classification scheme was adopted. Originally consisting of 200 classes, this scheme was expanded overtime to over 700 classes. Unfortunately, the original scheme was not added onto in a systematic way. White calls the growth “organic” but it appears to be more of an ad hoc and driven by developing technologies rather than an underlying logic of firm categories.<sup>3</sup> According to Falasco, the “USPC system is based on *industrial* classification; classification by *utility*—proximate function and by product or effect produced; and *structure* classifications.”<sup>4</sup>

The Cooperative Patent Classification (CPC), developed jointly with the United States Patent & Trademark Office (USPTO) and the European Patent Office (EPO), was based on the International Patent Classification (IPC) and was an attempt at harmonization and common classification.<sup>5</sup> The IPC was formally adopted in 1971 by 61 countries in the Strasbourg Agreement. The EPO had been using the ECLA which was loosely based on the IPC because the IPC did not allow enough detail. Classification is intended to encompass “the whole body of knowledge” and is divided into eight sections: A—Human Necessities; B—Performing Operations and Transporting; C—Chemistry and Metallurgy; D—Textiles and Paper; E—Fixed Constructions; F—Mechanical Engineering and Lighting and Heating and Weapons and Blasting; G—Physics; and H—Electricity. (The CPC added an additional category “Y” for cross-referencing purposes.) These sections are divided into a hierarchical classification system which has further lower levels. When classifying an invention four specific areas of invention are considered: 1) the invention’s intrinsic nature or function; 2) the invention’s particular use or purpose; 3) the invention’s application; 4) the incorporation of an invention into a larger system. Additional guidelines are given if a place for the invention cannot initially be found such as the process, function, or field of use of the invention.<sup>6</sup> The following explains how this CPC scheme was implemented using a hierarchical or tree structure.

The tables below juxtapose USPC Class categories with the CPC classes. The USPC class categories follow the time of introduction, while the CPC sections follow a category of

knowledge; in this example, the section being “Human Necessities.” Jewelry, one observes, is a separate class in USPC, 63, but in CPC it has a section and a class within the grouping A41-A47: A44. All of the inventions that fall under the body of knowledge “Human Necessities” are under the A Section and have a class assigned to them. In the USPC however, classes jump from category to category with no real overarching category or logical grouping.

USPC Class number	USPC Class Category
056	Harvesters
057	Textiles: spinning, twisting, and twining
059	Chain, staple, and horseshoe making
060	Power plants
062	Refrigeration
063	Jewelry
065	Glass manufacturing
066	Textiles: knitting
068	Textiles: fluid treating apparatus
069	Leather manufactures
070	Locks

Table 1: Selected USPC classes.

CPC Section and Class	CPC Label	
A	Human Necessities	
A01	Agriculture; Forestry; Animal Husbandry; Hunting; Trapping; Fishing	
A21-A24	Foodstuffs; Tobacco	
A41-A47	Personal or Domestic Articles	A44: Haberdashery; Jewelry
A61-A63	Health; Amusement	

Table 2: CPC Section A and Classes

### Methods of Teaching Classification

The Patent & Trademark Resource Center Program had an effective 7 Step Approach which was used with USPC patent searching. This approach involved taking the inventor through 7 steps which included using print tools such as an index and a manual. Gradually, these tools came online and the index was just a hypertext equivalent of the paper index. If inventors were able to creatively imagine what terms might describe their inventions, they might have been able to establish which classifications covered their inventions through word search methods instead of

using classification. Determining the classification was fraught with difficulties. When the CPC was introduced, it was hoped that Statistical Mapping might allow looking up cross-classifications, but this too was fraught with difficulties since there were seldom one-to-one correspondences.<sup>7</sup> Figure 1 below demonstrates that there is seldom one-to-one correspondence.

**Statistical mapping of USPC to CPC for Class 63**

*Last updated 2012*

Printable Version [PDF]

View Most statistically relevant CPC Subclasses

USPC Subclass	Most statistically relevant CPC groups		
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup> - 5 <sup>th</sup>
63/1.11	A 44C 15/001	A 44C 1/00	A 44C 9/00 more...
63/1.12	A 44C 9/0053	B 43K 29/00	A 44C 1/00 more...
63/1.13	A 44C 15/0015	A 44C 25/00	G 04B 47/046 more...
63/1.14	A 44C 1/00	A 44C 5/003	A 44C 25/002 more...
63/1.15	A 44C 15/002	A 44C 25/002	A 44C 7/00 more...
63/1.16	A 44C 1/00	A 44C 15/001	A 44C 3/008 more...
63/1.17	A 44C 1/00	A 44C 15/001	A 44C 7/006 more...

Figure 1. “Statistical mapping of USPC to CPC for Class 63,” selected portion.  
<https://www.uspto.gov/web/patents/classification/cpc/html/us063tocpc.html#C063S019000>

Therefore, this Statistical Mapping demonstrated quite aptly that in using the new CPC one must learn to think differently about inventions.

**Intuitiveness of Tree Structure to Scientists**

Beginning with Aristotle, philosophers, and later, scientists, described knowledge and science by means of tree structures which branched out logically from a prior construct, organism, or thought. Famous tree structures include Ernst Haeckel’s “Family Tree of Mammals.” See also Manuel Lima’s “indented tree” which describes hierarchical levels of a computer’s file structure. Both Francis Bacon and Rene Descartes described knowledge in terms of a tree and a tree of knowledge. Charles Darwin also used the tree metaphor in *On the Origin of Species by Means of Natural Selection*.<sup>8</sup>

Thus, the CPC then appeals to an innate structure that scientists and most inventors intuitively understand. Finding a place for an invention within logical scientific or technological construct—drilling down to the exact placement—appeals to this intuition.

For example, in order to find a heat pump, an inventor would look under the Section F “Mechanical Engineering and Lighting and Heating and Weapons and Blasting Engines Or Pumps.” The inventor would then scroll through the various classes: Engines Or Pumps, Engineering in General, Lighting and Heating, Weapons and Blasting. Of these categories “Lighting and Heating” is the most obvious. Then the inventor would drill further down through the subclasses: F22: Steam Generation; F23: Combustion Apparatus and Combustion Processes; F24: Heating and Ranges and Ventilating; F25: Refrigeration Or Cooling and Combined Heating and Refrigeration Systems and Heat Pump Systems and Manufacture or Storage of Ice and Liquefaction Solidification of Gases; F26: Drying; F27: Furnaces and Kilns and Ovens and Retorts; F28: Heat Exchange in General. Of these F25 is the most obvious because it includes heat pumps. Next the subclass F25B is obvious because it is a type of

refrigeration, and heat pump is listed and finally, the group F25B30/00 because Heat Pump is a specific category. A specific subgroup could be chosen if a certain type could be specified.

Symbol	Classification and description
<input type="checkbox"/> F	MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING ENGINES OR PUMPS
<b>LIGHTING; HEATING</b>	
<input type="checkbox"/> F25	REFRIGERATION OR COOLING; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT PUMP SYSTEMS; MANUFACTURE OR STORAGE OF ICE; LIQUEFACTION SOLIDIFICATION OF GASES
<input type="checkbox"/> F25B	REFRIGERATION MACHINES, PLANTS OR SYSTEMS; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT-PUMP SYSTEMS ({{evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions <a href="#">B01B 1/005</a> }; heat-transfer, heat-exchange or heat-storage materials, e.g. refrigerants, or materials for the production of heat or cold by chemical reactions other than by combustion <a href="#">C09K 5/00</a> ; pumps, compressors <a href="#">F04</a> ; use of heat-pumps for domestic- or space-heating or for domestic hot-water supply <a href="#">F24D</a> ; air-conditioning, air-humidification <a href="#">F24F</a> ; fluid heaters using heat pumps <a href="#">F24H</a> )
<b>Machines, plant, or systems, with a single mode of operation, not covered by groups F25B 1/00 - F25B 17/00</b>	
<input type="checkbox"/> F25B 30/00	Heat pumps
<input type="checkbox"/> F25B 30/02	• of the compression type
<input type="checkbox"/> F25B 30/04	• of the sorption type
<input type="checkbox"/> F25B 30/06	• characterised by the source of low potential heat

Figure 2: Heat Pump Classification from Espacenet

[https://worldwide.espacenet.com/classification?locale=en\\_EP#!/CPC=F25B30/00](https://worldwide.espacenet.com/classification?locale=en_EP#!/CPC=F25B30/00)

## Problems and Advantages of Tree Structure

Several problems exist with the tree structure, and a few of which are discussed here. A tree structure implies that an invention can only have one root, which is often not the case, since many of the most interesting inventions combined various technologies to create a unique device. The solution to this heterogeneity of course is to have the inventor look in all areas that the invention may fall. One must narrow the search by combining several classifications, while viewing the broad landscape as well. Exploring the gaps between classifications and technologies might assist inventors to visualize and develop new technologies otherwise not thought of or described.

## Translating CPC on USPTO Website

Although it is sometimes possible to find a class using the general searchbar at the upper righthand side of the USPTO website by typing a description of the invention (a locket) preceded by “CPC”, for example, “CPC locket.” This type of searching is not recommended because of the complexities of the CPC index on the USPTO website and its lack of hyperlinks. It is far more advisable to start on the European Patent Office’s Espacenet [<http://worldwide.espacenet.com>] which allows the exploration of the class with hyperlinks. Therefore, it is easier once the inventor has determined the starting CPC classes on Espacenet, to

then move to the USPTO's search page [http://patft.uspto.gov] and conduct a search by typing in the CPC class and selecting Current CPC from the dropdown menu.

The Espacenet website allows searching using the “/low” function, but the USPTO website does not have an exact equivalent. “/low” allows the searcher to find patents classified by a specific class and all classifications indented under that class. However, the truncation symbol “\$” can be employed on the USPTO website in a similar manner, e.g. A44C25/\$. This type of search is not a one-to-one corresponding search to A44C24/00/low on Espacenet, but it does provide some functionality. For example E03C1/00 is the CPC for Domestic Plumbing. If “E03C1/low” is searched on Espacenet everything indented under this main group would be returned. However, since some of the subgroups under this main group do not contain C1 but C2001 a search on the USPTO website using the truncation “E03C1/\$” would miss those containing “E03C2001/”. See Figure 3 below.

Symbol	Classification and description
<b>BUILDING</b>	
<input type="checkbox"/> <b>E03</b>	<b>WATER SUPPLY; SEWERAGE</b>
<input type="checkbox"/> <b>E03C</b>	<b>DOMESTIC PLUMBING INSTALLATIONS FOR FRESH WATER OR WASTE WATER</b> (not connected to either water-supply main or to waste pipe <b>A47K</b> ; devices of the kind used in the ground <b>E03B</b> , <b>E03F</b> ); <b>SINKS</b> <span style="float: right;">S D</span>
<input type="checkbox"/> <b>E03C 1/00</b>	<b>Domestic plumbing installations for fresh water or waste water; Sinks</b> {(work tops <b>A47B 77/022</b> )} <span style="float: right;">D</span>
<input type="checkbox"/> <b>E03C 2001/005</b>	•{Installations allowing recovery of heat from waste water for warming up fresh water}
<input type="checkbox"/> <b>E03C 1/01</b>	•for combinations of baths, showers, sinks, wash-basins, closets, urinals, or the like { (combinations of baths, douches, or the like, <b>A47K 4/00</b> ; cell-like units for special technical purposes <b>E04B 1/34869</b> ; panels adapted for locating conduits <b>E04C 2/52</b> ; ducts for installation lines <b>E04F 17/08</b> )} •••{with flow distribution, e.g. diverters}
<input type="checkbox"/> <b>E03C 1/02</b>	•Plumbing installations for fresh water
<input type="checkbox"/> <b>E03C 1/021</b>	••{Devices for positioning or connecting of water supply lines (connection to the tap body <b>E03C 1/0403</b> )}
<input type="checkbox"/> <b>E03C 1/023</b>	•••{with flow distribution, e.g. diverters}
<input type="checkbox"/> <b>E03C 1/025</b>	••{Water supply lines as such, e.g. shower hoses}
<input type="checkbox"/> <b>E03C 2001/026</b>	••{with flow restricting devices}
<input type="checkbox"/> <b>E03C 2001/028</b>	••{Alignment aids for plumbing installations}
<input type="checkbox"/> <b>E03C 1/04</b>	••Water-basin installations specially adapted to wash-basins or baths (valves, faucets, mixing valves, taps <b>F16K</b> )

Figure 3. CPC Main Group E03C1/00 **Domestic plumbing installations for fresh water or waste water; Sinks**. On Espacenet

[https://worldwide.espacenet.com/classification?locale=en\\_EP#!/CPC=E03C1/00](https://worldwide.espacenet.com/classification?locale=en_EP#!/CPC=E03C1/00)

Searching on CPC on the USPTO website has several drawbacks, the biggest being that once the inventor selects a classification, a search cannot be immediately executed. Instead the inventor must go to the search pages and type in the classification.

The most notable disadvantages to searching on the USPTO website are the lack of other country's patents and the difficulty determining the classification from the website. In order to overcome these difficulties, a hybrid searching approach is recommended by this author which allows the users to initially determine the classification on the Espacenet website and then take that classification determination over to the USPTO website.

Another difficulty with the USPTO website is that the granted patents and applications reside in different databases. It is usually recommended to start in the granted patents and then move to patent application once the classification is determined.

The primary advantage searching on the USPTO website is the ability search for a keyword in combination with the CPC class throughout the entire text of the patent, not just in the title or abstract fields.

### **Teaching by Example**

Finding an example that illustrates the complexity of patent classification can aide a teacher in instructing inventors with patent classification searching. Approximately a year and a half ago this writer began using a search example that not only everyone would understand, but also that illustrates, with somewhat simplicity, the complexity of the patent search. Therefore, this search example, the locket (a type of jewelry hung from a chain, containing pictures), was chosen. In determining the CPC classification on Espacenet, the Classification page allows one to drill down through the table, observing the tree structure. Using the USPTO website allows one to demonstrate the index of the almost obsolete USPC. However, the USPC index in turn illustrates that there can also be Design patents issued as well, since U.S. Design patents are almost exclusively on the USPTO website and indexed in the USPC index.

To begin searching for the example invention "locket" the inventor should go to the Espacenet search page at <http://worldwide.espacenet.com> and click on "Classification" on the left hand side. The CPC classification should appear on the right hand side. Above the CPC classification there is a search box. Here the inventor should type in the search terms, e.g. "locket." What follows are suggestions for sections and classes and subclasses to search in. The inventor should write down relevant classes and subclasses. Taking those notes the inventor returns to the Classification Page and clicks on the letters and numbers for the classes and subclasses: A → A44 → A55C → A44C25 → A44C25/004 Here the inventor would click in the box next to the A44C25/004 and then the search will be entered on the left hand side. The inventor can then choose "Search" or add to search box. After exploring the various patents, the inventor may decide whether this is a suitable classification for the invention.

Taking this determined classification, the inventor can now go to the USPTO website [<http://patft.uspto.gov>] and input the class into the search box and add keywords as well to search the full text of patents granted after 1976. The inventor can also explore the old USPC index



[<https://www.uspto.gov/web/patents/classification/uspcindex/indextouspc.htm>] to see if there are any relevant Design Patents. (Note that neither the Design or Plant patents are covered by CPC. Those two types still use the USPC system. Such patents are not listed on the EPO website.) Once in the USPC index, the inventor would click on “L” for locket and then scroll down to “locket” on the page and find the following list:

Lockets .....	63 / 18+
Design .....	D11 / 80
Making .....	29 / 896.4

Note that if looking for the design the inventor would go back to the search page and type in “D11/80” and choose from the pulldown menu “Current USPC.” If the one wanted to explore the old USPC one would look at the Manual of Classification and see that indented under Locket 63/18 is “with hinged cover” 63/19. This class and subclass would be very similar to the CPC classification A44C25/004.

Using this example, the teacher can more easily convey the hierarchical structure of the CPC scheme to an inventor unfamiliar with it. Instead of trying to undertake a complex overview, and explaining the system from the bottom up, this search module which implements an example, allows a student to know how to use a system, and therefore automatically understand the system itself. Therefore, this search module is used in an online YouTube tutorial<sup>9</sup>, in classroom presentations, and in directed inventor training.

## Conclusion

When instructing novices on the classification scheme, it is imperative to begin the explanation in an area of comfort. By explaining classification in terms of trees and hierarchies, the engineering student and professor would have some grasp of the logic. Taking them through this logical progression will make the learning process easier. Moving from the easy-to-navigate Espacenet database to the more complex USPTO website makes the most sense.

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