

# **DRAFTING OF A PATENT APPLICATION AS A STRATEGY FOR ENGINEERING DESIGN EDUCATION**

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## **ABSTRACT**

This article highlights the process of designing, with drafting a patent as strategy to improve the designs of new products, in academia. The patent system discourages the copy of registered technologies, and it allows the investment of resources in applied research to do new products.

Currently the patent system is not much used in engineering design education, but it is necessary to prepare future engineers towards product innovation.

In this article is explained the experience carried out in new product design and drafting patent in a free elective course entitled: *Creativity, Ecodesign and Patents*. It is commented the methodology of this process, from the election of the topic work of each group of students, to the drafting a corresponding patent. A case study of one work group of 2011-12 academic year, deals of a refrigerator redesign, in order to save energy and increase their efficiency. A patent application for this work was done and the group of students showed their interest and extra dedication to make it.

A survey conducted to students about their experience of this course is discussed and some conclusions are extracted.

Even if students do not perform patents in their future professional careers, the strategy of writing a patent is a good academic exercise to organize and improve the final design.

*Keywords: Patent drafting, engineering education, creativity, conceptual design*

## **1 INTRODUCTION**

The one definition of "patent" in Oxford Dictionaries [1] is: a government authority or licence conferring a right or title for a set period, especially the sole right to exclude others from making, using, or selling an invention.

Then, basically, a patent is a document that describes a technical invention that is new in the world, and the patent owner may produce and market the product as if it were a monopoly, for a limited period of time. Thus, the patent owner can get benefits that allow the recovery of investment in research and technological development. If the patent system did not exist, no one would invest resources in research, because everyone could copy the inventions. So the patent system allows technical developments, which ultimately, can benefit all the society.

The patent system is closely related to the engineering design. An engineer uses somehow the patent system to design new products.

In a developed economy, as in the European region, having prepared technical staff, but with expensive labour, its technological production tends to focus on design rather than manufacturing for mass production, or for produce special products. Therefore, the patent system, which is directly related to the conception and development of products, it is necessary to protect those inventions in Europe. In this case, the engineering designers need basic knowledge of the patent system and this topic could be better known and practiced in schools of engineering design.

But not all engineering designs are patentable or have an economical interest to be patented. Perhaps the patent system is too complex and long-time requiring, in general and especially for some products, for this or other reason, not all new products are finally patented. But that can change, and nowadays exist technology to unify some parts of patent process at world level and make it easier and speedier, for example it is technologically possible the world centralised search of patents and also an unified world examination for each patent.

The free elective course entitled: *Creativity, Ecodesign and Patents* [2], of 2011-12 academic year, from Technical University of Catalonia (UPC), is structured in five groups each one of five students. Their topic works were: System use multiple energy from "Bicing", of first group (G1); System utilization of the first cold water of the shower (G2); Electrical accumulation system with mechanical activation adaptable to remote control (G3); Efficient domestic refrigerator (G4); Domestic system for water reuse and of rainwater (G5).

## 2 METHODOLOGY

The enumeration of aspects of design process followed by students groups, were:

- To find an interesting topic of work that motivates the group: At the beginning of the course the groups do a list of several possible topic of work, which must be simple and fits into the lemmas of the course. After a discussion between lecturer and students, this list is reduced to three finalists topics, which are discussed again. Finally the group choose one theme of work.
- Design aspects and first sketches of product: Analysis of functions that the product must do, and first drawings of product solution.
- The use of creativity techniques: basically Brainstorming [3], and Mind Maps [4] this in concatenated form.
- Patent search to find similar issues, and also for to take some inspiration: Firstly, words search to find similar patents. When several similar patents are found, note their common International Classification code, and use it in advanced search for find a lot of similar patents.
- New sketches (this is iterative in the design process).
- Finding the design innovations of work: Some new parts or new combinations of ideas can be inventions and these must be identified as new inventions.
- Draft of a partial patent application: The writing order followed in this first draft is: drawn the figures with their numbered parts; make a list of these numbered parts with their definition; write the claims. The reflections of this drafting process can emerge new ideas or new alternatives.
- Redesign of the product: A redesign of product as results of the reflections in the process of the first drafting the patent.
- New drafting of the patent (iteration).
- Final redesign of the product (iteration).
- Final writing of the patent: Final drawings and claims. Complete with the description of the patent, and finally the summary of the patent.

The result of this course is the patent draft of each work group. These works are made with some ecological considerations and with more or less inventive solutions. Some of them are interesting areas of more exploration, others are a normal work, and others more completed can be submitted to the patent office of the University. In this case, the students are asked to do some extra work, and the lecturer finalises the drafting. Specifically, the case study below was sent to the patent office of UPC University and from them was sent it to the national patent office.

## 3 CASE STUDY

The lemmas of the course 2011-12, for the work groups were: Something that contribute to reduce the energy or water consume. The topic of the working group (number four: G4), that is show here, was an efficient domestic refrigerator.

The refrigerator is a cooled cabinet that serves to extend the life of foods. According the data of government of Catalonia the refrigerator is practically a household appliance in all houses, and is one of more electric consumption [5] in houses of this country. Several sources consulted, give about the 20% of the total electric consume in a house.

The new refrigerators are of best efficiency than older, and must show their efficiency according the European Union energy label: from the best efficient: A+++ to the worst: G [6]. A household electrical appliance renewal programme in Spain, from IDAE Institute [7], gives some grants for the renewal some appliances, refrigerator included. From country point of view, the energy savings potential of these grants is even higher when considering the useful life of more efficient equipment.

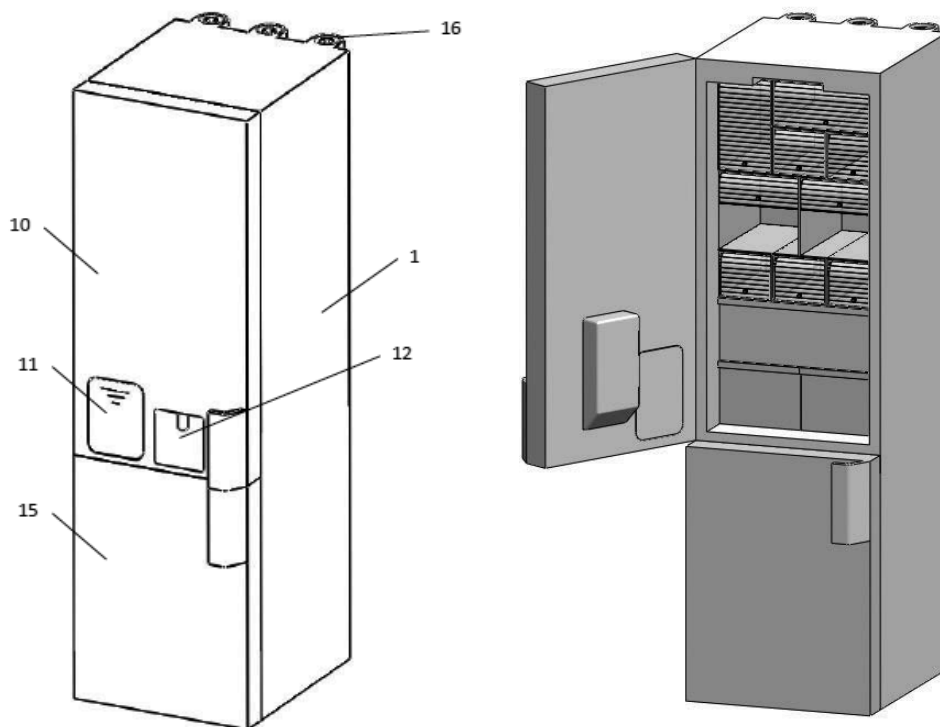
One cause of frigories lost from a refrigerator is when the main door is opened, in a normal use to take some food, because cold air falls out the refrigerator and warm air enter into it. Then the compressor-motor must work to recover cold temperature.

The main strategy of work-group G4, was to reduce the use of electricity and save energy by preserving cold air, when the main door is opened in a normal use, in reference of a current refrigerator.

And the idea was to close the food into small compartments, like boxes with a front door, inside the refrigerator. These doors are normally closed and only are opened when is need something inside them. In this manner the cold air into refrigerator is mostly preserved, and only is lost from the opened box. Also this boxes help to order the foods. In the following three figures there are detailed the main ideas of new refrigerator and especially the compartments.

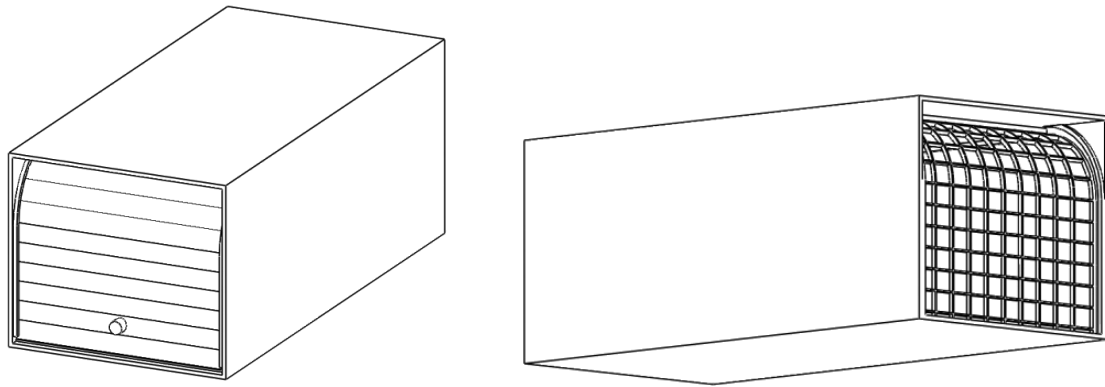
The figure 1(left) shows a household refrigerator, with an upper door to refrigerator access and a lower door to freezer access. The main door has a cold-water source (12) and a trapdoor (11) to catch some usual bottle. This main door is not necessary to open when cold water or some bottle is needed, that means the cold ambience into the refrigerator is preserved and energy is saved.

The figure 1(right) shows the proposed novelty of refrigerator with their upper door open: new compartments replace the trays into the refrigerator chamber. In this figure some compartments have their doors opened, or closed.



*Figure 1. Refrigerator with closed doors (left), and with upper main door opened showing the small compartments (right)*

In figure 2 are drawn two views of one small compartment of the refrigeration chamber. The frontal door of compartment (left) is closed and can be opened to access inside the box. The rear part of this compartment (right), is near the vertical wall of inner chamber of refrigerator, and has a grid that permits to enter cold air into the compartment and at same time prevent that the products inside the box falls out the compartment. The box door moves on the guides, and when open the box, their rear part of door is pushed and closes the rear part of the box, passing over the grid. Then, when the compartment is open in their frontal part, the rear part of this compartment is closed and only the cold air into the box falls outside. This prevents further loss of cold air from other parts of the refrigerator that can fall for this open canal, because the rear parts of the all compartments communicating with cold air of refrigerator.



*Figure 2. One small compartment, showing their front door (left), and a grid in the rear part (right)*

The figure 3 is a computer simulation of a close view of compartments assembly. In this figure the two central compartments, have their doors open.



*Figure 3. Computer design, showing small compartments into a refrigerator*

The efforts of students to express their ideas through drawings help to improve these ideas. Also write the patent claims, implies that the student reflect on the solutions, and in this way may have new ideas and alternatives of solution.

#### **4 RESULTS**

The practice of patent drafting helps to understand the system of patents and is a good way to concretize technical ideas, and to think new alternative solutions. The final work shows a basic understanding and some skills gained in patent system use.

An opinion poll was carried out among students at the end of course, and 23 answers were collected, that evidently, shows the students opinion. Each question is punctuated between 1 (totally disagree) to 5 (totally agree), and the numbers that appear into the tables were the total number of responses. The last column in the right (A) shows the average punctuation. Three tables are shown that have a relation with patents, but the survey has other questions.

The first questions (table 1) were about the importance of different aspects in designing a product. The goal of innovation; the creativity; the ecology, which have similar high punctuation (4.3-4.4), nearly totally agree. The product patent was valued 3.2, near indifference point.

The second questions (table 2) were about the work motivation if the product that are designing, as an academic exercise, can become an actual solution for some problem (very high score of 4.7), or be an actual patent, or be marketed (both 3.9).

The table 3 shows the punctuation about the question of drafting a patent in the process of design. Having more clear the aspects that they want to patent, the result is a 4.3 score, that means a high score towards totally agree. The other questions: improve the product design and if they help to find some alternative solutions, the score is between indifference and reasonably agreement.

*Table 1. Questions about engineering design process*

<i>Do you consider important in designing engineering product...?</i>	1	2	3	4	5	<b>A</b>
The innovation goal			2	11	10	<b>4.4</b>
The creativity			5	6	12	<b>4.3</b>
The ecology of the product		1		12	10	<b>4.4</b>
The product patent	1	4	9	7	2	<b>3.2</b>

*Table 2. Questions about the motivation of students and the design*

<i>Motivates you to participate in the work group considering that the product that you are designing can in the future...?</i>	1	2	3	4	5	<b>A</b>
Solves some problem			1	6	16	<b>4.7</b>
Will be an actual patent		3	6	4	10	<b>3.9</b>
Be made and marketed some day		3	6	5	9	<b>3.9</b>

*Table 3. Questions around to do a draft of patent in the process of design.*

<i>Write the patent of your product, has helped you to...?</i>	1	2	3	4	5	<b>A</b>
Having more clear the aspects that you want to patent			3	10	10	<b>4.3</b>
Improve the product design	2	2	10	6	3	<b>3.3</b>
To be found some alternative solutions	2	2	6	7	6	<b>3.6</b>

Other questions in the survey were related with the group work. A question was: Would you have wanted the lecturer choose the topic? the punctuation of 1,5 clearly shows that they prefer to elect their theme of work. This is important because this motivates the group.

Another question was: Would you have wanted to work in smaller group? and the punctuation of 2,2 means that they prefer the number of five students per group rather than smaller work group. They are basically agreed as the group of work as done (4.2).

Finally, the results of this 2011-12 course, moreover the surveys, are that two works were sent to the patent office of UPC University, one of them is this case study, which was done a patent application [8] to Spanish patent office.

## **5 DISCUSSION AND CONCLUSIONS**

The possible design solutions attained in this course are limited by student experience and the total course time. The challenges to do new designs in the work groups of students, limits the possibilities to make sophisticated new products to the simple ones. The common sense determines the direction and definition of these conceptual designs.

The lecturer must know the process of writing patents, which is not usual. However, to draft a patent is not easy, specially to write the claims, which is a time class consuming, but the students leave prepared to use patents. The final patent draft is at beginner level.

Even if the patent is not realized in their professional life, the process of patent carried out in academia into the process of design, helps to specify the inventive parts and helps to find new alternative solutions. It is a good mental training. Also the interest of this process can be extended beyond the academia to the professionals who want to design something new.

The opinion of students collected by an opinion poll can be shared, or not, by the lecturer. Specifically the score of table 3: Questions around to do a draft of patent in the process of design, in the second question: Improve the product design (3.3), and the question: To be found some alternative solutions (3.6), the lecturer could consider a bit more punctuation. The rest of questions, the lecturer agrees.

The group of students that are asked to do a patent, shows an extra dedication to attain it, once the course is finished, although have other work and studies. Probably there are also interests or illusion to produce something that can be practical, and also to have a patent in their Curriculum Vitae.

Not all the students of a working group are really inventors, or work at the same level, but all contribute more or less, to improve the solutions and do the requested work. It is considered that all members of group must be in the patent application.

Finally to make a previous draft of patent in the conceptual design phase, it is a preparation for the final patent application, that is normally made when the product is designed and tested.

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