**Patentability considerations on Green Sustainable Design**

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**Abstract**

Environmental regulations offer designers new opportunities. Firms which can fulfill this need of sustainable designs can survive the competition compare to those who can not. Green design often starts by applying techniques such as energy-saving, material deduction or waste deduction to existing products. Patentability requires fulfill novelty and non-obviousness. Green design product improvement is not only a design change, combination or replacement. A material reduction based design would often lead to a simpler concept. Patentability would increase while green design improve product with different principle of operation.

**Keywords:**

Green design, patentability, non-obviousness

1 INTRODUCTION

Sustainability is a broad concept covering the product lifespan about consumption and the usage of resources. It comes from people's reflection and industrialization awakening. Excessive consumption and industrialization has led to great changes in our living environment, climate change, and triggered a series of environmental problems [1]. These environmental problems enforce government body and local people recognize the need to act together. There are many environmental problems (showing different aspects need of protection), thus complex regulations are introduced. As a result, consideration on sustainability has already become an important part within the design process. This paper discusses the green design-related intellectual property trends, and patentability evaluation might face during the patent litigation process.

2 PATENT APPLICATION TRENDS

2.1 Trends

Based on the analysis of the patent database from TIPO in Taiwan, patent application quantity and trend are shown in table 1 and figures 1-3.

Table 1 patent application amount according keyword

<table>
<thead>
<tr>
<th>topic</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>sustainable</td>
<td>164</td>
</tr>
<tr>
<td>green design</td>
<td>6</td>
</tr>
<tr>
<td>energy saving</td>
<td>4585</td>
</tr>
<tr>
<td>protect environment</td>
<td>8409</td>
</tr>
<tr>
<td>re-use</td>
<td>8762</td>
</tr>
</tbody>
</table>

Based on table 1, it is shown that:

- Firms often use the terms “energy-saving”, “environmental protection” and “re-use” to describe sustainability related renovations.
- The terms “sustainability” or “green design” are not used very often in the industry.
- It is most common to see applications focusing on improving aspects of the product. Fewer applications take global view or evaluation in terms of sustainability or product life-cycle.

2.2 Observations based on different technological fields

Category of energy-saving:

- H01L is the largest sector, and topped in 2000 and 2005. It however dropped considerably after 2011.
- G06F is the second largest sector, and reached the top from 2005 to 2009. It also dropped after 2011.
- B01D reached the top in 2011.

Category of environmental protection:

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F24F take the largest proportion, stabilizing after 2007 and reach the top in 2013.

The next largest sector is G06F, which reached top in 2011. It then declined after that.

F21V has been stable between 2008 and 2012.

Fig. 2 Patent trend of environment protect based on technology type and time

Category of recyclability:
- B65D was the largest sector. It has been very stable for 10 years, and reached the top in 2009.
- The next largest sector was A47D. It was stable between 2007 and 2012, and had no visible decline after 2011.
- B01D reached the top in 2008, but it is not significant compare to other sectors.

Fig. 3 Patent trend of re-use design based on technology type and time

The category code represents are indicated as following:
- A47G: household or table equipment,
- B01D: Physical or chemical processes with separation technique,
- B65D: Containers for storage or transport of articles or materials, e.g. bags, barrels, bottles, boxes, cans, cartons, crates, drums, jars, tanks, hoppers, forwarding containers; accessories, closures, or packaging elements;
- F21V: Functional features or details of lighting devices or systems thereof; Structural combinations of lighting devices with other articles,
- F24F: Air-conditioning; Air-humidification; Ventilation; Use of air currents for screening,
- G06F: Electric digital data processing,
- H01L: Semiconductor devices; Electric solid state devices not otherwise provided for.

Among those, G06F (Electric digital data processing) takes the second place in both the energy-saving and environmental protection categories, indicating that utilizing digital computer is essential in these categories. B01D: separation sits at 3rd place in recyclability/energy-saving, indicating that separation methodology using physics or chemistry has many important applications in these areas.

Fig. 3 Patent trend of re-use design based on technology type and time

Energy-saving category has H01L (semiconductor devices) on the top, which probably means that it is closely related to technological developments. Environmental protection has F24F (air-conditioning) on the top, which shows that regulation has started to take effect in product design process. Recyclability category has B65D (containers for storage or transport) on the top, indicating packaging reuse is a common entry-point for environmental protection related work.

3 SUSTAINABLE DESIGN GUIDELINES

Sustainable Design Guidelines can be observed at different product life-cycle phases [2].

(1) Production phase
Selection assessment of appropriate materials will affect the entire life-cycle. Design and choose manufacture process by minimizing the amount of materials needed, or choosing recyclable materials

(2) Distribution phase:
Distribution phase is mainly concerned with reducing cost during transportation and distribution. Possible design considerations include: reducing product weight or volume, improve stacking efficiency, improve up-down stream collaboration of industry to reduce possible transportation cost within assemble process

(3) Use phase:
If use phase is long enough, its environmental impact due to energy inefficiency may be greater than the manufacture phase. If this is the case, the design focus can be on energy-efficiency or ease of cleaning.

(4) Disposal / recycling stage:
At this stage, the focus is on making parts reusable. If it is difficult to repair or disassemble, user may dispose the product entirely. By the concept of product modularizing,
it will be easier to disassemble during the recycle process, and reducing the waste.

4 RE-DESIGN AND PATENTABILITY

4.1 Patentability

Green design improves product in several way. Usually it is not related to technological breakthrough. In the contrast, it can be related to: Usability, Material usage, Re-use or disassembly, Reliability, Modularization [2]. Consequently, it is a collection of minor improvement in previous system. One question that often arises is “is green aspect design which improves product function in a minor scale eligible for a patent?”

Patentability requires fulfill novelty and nonobviousness. The novelty requirement is easy to satisfy. The invention must be different from what is already known to the public. The examiner must also be convinced that the invention is “nonobvious”. It would be consider unobvious to a person skilled in the prior art within technology. Nonobviousness can be shown by new and unexpected effect, when compared to prior art in the particular area the invention involved [3, 4].

Problem-solving approach provides a less arbitrary basis for evaluating whether it is obvious or not. The first step is to identify the closest prior art, then determining technical problems solved by the invention. By comparing the difference, one can evaluate whether the solution is obvious in the eyes of a skilled person.

4.2 PHOSITA

Would the skilled person solve the problem in the manner indicated on the basis of the prior art? The skilled person was first defined before 1900s. The characterization of a person having ordinary skill in the art (PHOSITA) as a tradesperson, being different to a researcher, “made it reasonably clear that the Hotchkiss mechanic and the PHOSITA were closely related if not identical.”

The prior art usually consist of [5]:
- any published writing that was made publicly available.
- any relevant invention or development existing prior to the invention
- any public or commercial use, sale items.

The skilled person can be expected to access those prior art and also look for suggestions in a general technical field. Against this background, the examiner determines the obviousness of the inventive subject matter. Also consider secondary factors such as commercial success, long-felt but unsolved need, and failure of others to come up with the invention [6].

Green design improves product based on environment protection, energy saving and waste reduced guidelines. Does it mean that the design which followed Sustainable Design Guidelines reveal receiving suggestions in this specific technical domain? If teaching or suggestions exists, this can reduce the invention’s patentability. Other issue that needs clarification is that: when green design improves existing product, can we define the PHOSITA as the previous designer (team) of that existing product? If Sustainable Design Guidelines was followed and implied the changes of product functionality or environmental impact, can these results be counted as an unexpected effect?

In Hotchkiss v. Greenwood, 52 U.S. 248(1850), the supreme Court found the patent invalid because no more “ingenuity and skill” than possessed by “an ordinary mechanic acquainted with the business.” To be patentable, an improved device had to be more than “the work of a mechanic skilled in the art.” In re Clay, two criteria have evolved for determining whether prior art is analogous: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor’s endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved [6].

The Supreme Court in KSR Int’l Co. v. Teleflex Inc., 550 U.S. 398, 415-421, 82 USPQ2d 1385, 1395-97 [7, 8] identified a number of rationales to support a conclusion of obviousness which are consistent with the proper “functional approach” to the determination of obviousness as Rationales laid down in Graham.

(A) Combining prior art elements according to known methods to yield predictable results;
(B) Simple substitution of one known element for another to obtain predictable results;
(C) Use of known technique to improve similar devices (methods, or products) in the same way;
(D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
(E) “Obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
(F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;

(G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention. It applied a known technique to known device [9].

Green design improves product that exist today, which indicates in Rationale D: applying a known technique (design guideline) to known device (existing product).

On the other hand, if a proposed modification of the prior art invention without changing the main principle of operation, the nonobviousness is not able to establish.
Consequently, patentability would increase if green design improve product with different principle of operation.

4.3 Patentability of Japan & Taiwan

A flow chart for inventive step assessment in Japan is shown in Figure 4, for green design product the major evaluation steps are:

- Adequate motivation for combination or replacement?
- Are there unexpected effect?
- Do the techniques of design variation belong to simple design?
- Did design change make on the basis of technical knowledge?

![Inventive Step Assessment in Japan](image1)

**Fig. 4 inventive step assessment in Japan [10]**

Green design product improvement is not only a design change, combination or replacement. It usually does not provide “unexpected functional effect”. A material reduction based design would often lead to a simpler elements or parts. According to the flow chart for inventive step assessment, simple design is usually the type that can be assessed in light of whether it generates unexpected effects.

For green design that improves existing product, there is no additional function, but patentability requires unexpected effects. Can improvements related to usability, re-use, disassembly easiness or product reliability be recognized as unexpected effects?

In 2014, the Taiwan Intellectual Property Office (IPO) received a total of 78,014 patent applications. Among those applications, 46,378 were related to inventions, 23,488 were related to utility models, and 8,148 were related to designs. In 2008, the Intellectual Property Court (IP Court) was established to hear both patent infringement and patent validity claims in civil litigation. The efficiency of the IP Court has resulted in more timely protection for patent holders. It is crucial to establish better criteria and principles for judging issues of patent infringement and validity.

A flow chart for inventive step assessment in Taiwan is shown in Figure 5. For design improvement, the factors for judgment are:

- Can be easily made by a Phosita based on prior art?
- Solving a problem which exists for a long time,
- Unpredictable effect, overcoming the technical bias,
- Commercial success.

![Inventive Step Assessment in Taiwan](image2)

**Fig. 5 inventive step assessment in Taiwan [11]**

4.4 Visions from creative design

Creativity is the ability to come up with something new or different. Although in highly competitive business environment, many creations have disappeared, creativity is even more important for keep business in competitive edge. There are some basic rules that usually applied by inventor such as : Reverse, Transfer and Combine.

TRIZ is another important systematic problem solving approach. In early stages of development, the TRIZ problem solving process consisted primarily of a contradiction table, derived from the study of inventive principles used in the patent literature. The 40 TRIZ Principles are a list of known solutions. Studying these existing solutions can inspire designer to solve new problems [12].

Both of them teach inovation based on previous rules. From this point of view, we all received teaching from somewhere. To accomplish goal, we all motivated by things or competitors around us. Consequently, it is difficult to define the scope of suggestion that KSR proposed. In Taiwan, many business are small scale, they
usually try to improve product or manufacturing process. The question arise are:

1. Can a traditional company innovate?
2. What kind of difference means unpredictable effect?

Based on PHOSITA, even traditional companies can innovate. If we put the PHOSITA or prior art in the two dimensional coordinate, if the invention appears in an open region or a sparse space, we accept it as solving a long-existing problem (the approach seldom be tried).

The effect of physical objects can be evaluated through the impact to outside world. There are many aspects of impact, if the change is significant we have confidence on having an unpredictable effect. For green design, it impacts our personal; social and business life. If it improves existing product in specific aspects, it can be viewed as commercial success or solving a long-existing problem.

5 CASES:

5.1 Re-usable bag for shopping or packaging use: (IP Court patent decision No #103-99) [13]

The container bag’s inner layer is made out of Polypropylene. Its outer layer is made out of Bi-axial Oriented Polypropylene. The two layers are fused by applying lamination and then heated together. The bag’s folding lines were also done during this heat press process. This ensures the connecting parts stay sealed, thus becoming stronger and water resistant.

![Fig. 6 Re-usable bag for shopping](image)

Evidence 2 shows a structural improvement to the bag body, consisting of inner layer, outer layer, connecting part and bottom part. The inner layer is made out of Polypropylene. The outer layer is made out of BOPP. The two layers form a fabric using lamination and heat pressing. The fabric’s two sides are cross folded and then fused using heat again. This connecting section can be rolled and then sewed to fixate.

Though application is about the overlapping section being fused using head-press process, evidence 2 is using lamination material to heat-press and fuse. The two fusing processes are different but results in the same effect (fusing connected section together). Both of them belong to existing knowledge of fusing processes, so in the eyes of PHOSITA, this belongs to a general knowledge.

However evidence 2 shows that “the inner part is made of PP”, “the outer part is made of BOPP”, “The two layers form a fabric using lamination and heat pressing” and “the bag is folded inwards to be able to contain stuffs”. This is the same as “container bag composition”, and should have the functionality of “moisture and water resistance”.

Evidence 2 uses heat-melting process to fuse the inner and outer layer together (to form the fabric). The fabric is then sealed to become a bag structure. This means the bag manufacturing used two techniques to complete. Evidence 4 Graph 1~6 all reveal the bag has inward concave folding on the two sides. Hence, the feature belongs to existing known techniques.

5.2 Flood stopping structure (IP Court patent decision No #103-99) [14]

The flood wall gate board sealing device can be installed at different heights, providing pressure to all kinds of board layers. The board can be easily installed or disassembled. One can adjust the pressing unit’s arm to change the required sealing pressure. The green design factors are:

1. Simplifying pressure unit by providing slot for variable height settings.
2. Adjustable and controllable using pressing unit
3. Multipurpose and can form many combinations

![Fig. 7 flood stopping structure](image)

Evidence 4: Prior application #97216931 is “Improvement of pressing unit in flood control gate”. The flood wall includes side slot pole, middle pole, bottom slot and
multiple boards. The slot includes a pressing frame, and comes with a control handle. The handle contains a presser, which and push the boards at the bottom in order to ensure they fit together tightly.

A pressure rack (60) is installed on top of retaining tank (evidence #4) so the pressure block (64) right below it can be closely bound to steel gratings (40). The purpose is to prevent leaking and to solve problem involving complex structures of steel gratings. There is no suggestion or teaching that inserting slots be installed on either side of the retaining wall column to achieve the effect that pressure is provided to steel gratings and that this pressuring gadget can be easily assembled and disassembled from the standing columns [11].

Evidence# 5: the pressing unit and the top cover are connected by slot. So the defendant’s proclamation fails to convince that the two slots and pressing unit’s two footer being combined together. Evidence #2, #3 and #4 are not compatible; therefore, the claim is non-obvious.

There are clear differences between the problems raised by evidence #4 and the patent in dispute. There is no motivation for PHOSITA to easily make the claimed invention by the reference of evidence #4.

6 SUMMARY

Environmental regulations offer designers new opportunities. Sustainable requirements ask the designer to tackle the problem from a new viewpoint. Firms which can fulfill this need of sustainable designs can survive the competition compare to those who can not.

Green design’s core concept and values are not widely known. By observing Taiwan’s green design related intellectual property application trend, it is shown that many innovations were introduced. Green design often starts by applying techniques such as energy-saving, material deduction or waste deduction to existing products. How this can be linked to inventive steps and nonobviousness needs more attention.

REFERENCES