Topology of Nanotech Patents 2007 and Discussion of IP Strategies

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ABSTRACT

An overview of some of the most interesting patents covering various nanotechnologies is provided in an interview format between a reporter and the authors. Topics covered include nanotechnology patents at large, as well as the rapidly-changing patent landscape in nano-optoelectronics and in nanotechnology as applied to biotechnology and the life sciences. Also discussed are general patent considerations and strategies that inventors and investors need to be mindful of.

Keywords: nanotechnology, patent, licensing, infringement, lawsuit

1 INTRODUCTION

Investment in nanotechnology R&D has rapidly increased in the last 10 years, and so has the number of nanotech innovations. As inventors find uses for nanotechnology in more and more applications, competition in the nanotechnology space has intensified. Businesses entering the nanotechnology space must be mindful of intellectual property issues as they proceed with research, development, marketing, manufacturing, and the sale and licensing of their technologies.

To help nanotech organizations better understand the developing topology of nanotechnology patents, the legal issues involved with nanotechnology patenting are presented in a hypothetical question-and-answer session between the authors and a nanotechnology reporter.

2 INTERVIEW

Q: Would you say that companies in the nanotechnology field have thought about intellectual property? What kinds of firms are filing for and obtaining nanotechnology patents?

A: Yes – there is significant patenting activity in the nanotechnology field. Our research shows that there are at least 6,000 distinct U.S. and international nanotechnology patent applications since 1991, with about 75% of those filed by for-profit companies, about 15% of them filed by research institutions, and the remainder filed by government labs and individuals.

Q: Are there any particular fields within nanotechnology that you have looked at?

A: We have paid particular attention to several specific areas within nanotechnology: nano-optoelectronics and the application of nanotechnology to biotechnology and the life sciences. These fields traditionally operate in very small size ranges, and nanotechnology is making things possible that were difficult to achieve only a few years ago.

But because there are so many opportunities to leverage nanotechnology into these fields and there is so much activity, both fields are becoming crowded. Thus, inventors need to consider the intellectual property ("IP") -- mainly patents -- that exists in their field of interest. From a purely IP perspective, inventors ideally should figure out ways to create broad inventions that not only are applicable across a number of technologies, but also provide a "work-around solution" to any patents that may hinder their commercialization.

Nanotechnology investors also need to be patent-savvy. The strength of an invention's patent protection may be a consideration in deciding whether or not to fund a company or to fund research.

Q: Tell me about what's "hot" in nano-optoelectronics patents.

A: Our own research into nano-optoelectronics revealed about 140 U.S. patents issued from January, 2005 through February, 2007 to 81 different assignees. Our search, which we performed in February, 2007, combined the International Patent Classification ("IPC") codes for optoelectronics with a broad set of terms commonly used in nanotechnology such as "nanoscale" and "quantum effect." The top patentees during that time period were Metrologic Instruments, Canon, Intel, Finisar, Xponent, Sumitomo, Kodak, IBM, and Fujitsu. Each of these companies had between about 10 and 20 nano-optoelectronic U.S. patents issued during this period. This may mean that the space is becoming crowded and that no single participant yet holds a

dominant position. But, because there is no dominant player, there may be opportunities for innovative companies to carve out specific niches for themselves with good inventions and strong patents.

Specific applications in nano-optoelectronics that have been active patent-wise from 2005-2007 include waveguides, vertical cavity surface emitting lasers (VCSELs), optical substrates, optical switches, display technology, and optically-based storage. For example, D Data, Inc., received a patent on a 3-D multilayer optical storage system [1], and Kodak received a patent on a display system based on ring-shaped resonators [2]. Researchers at the University of California patented a nano-scale optical switch that uses a carbon nanotube as a shaft in a nano-scale motor within the switch [3]. Canon, Intel, IBM, and other traditionally innovative companies all have recently issued nano-optoelectronic patents.

Q: What do you predict patent-wise for the nano-optoelectronic market in the future?

A: That's kind of tricky to answer, but you can look at the recently published patent applications that will likely issue within the next few years. We've found an additional 70 or so unique U.S. and PCT international patent applications that have no corresponding issued U.S. patent. It would be a little misleading to infer that the smaller numbers of patent applications means that the sector is slowing – because oftentimes two or more U.S. patents will issue from a single patent applications. Among these, we see continuing advances in waveguide technologies, optical switches, and optical circuitry devices.

Our research showed that a few companies are assembling patent portfolios covering a variety of related inventions -- Canon and Finisar are examples of this. We found about 15 VCSEL patents issued in the last two years, but only about 4 newly published patent applications. The dearth of new VCSEL patent applications could suggest that the rate of development of new innovation in the VCSEL field may be declining. More interestingly, it appears that some of the issued VCSEL patents may overlap.

Q: What happens when patents overlap?

A: Overlapping patents often arise in hot technical areas characterized by a ramp-up in R&D spending for new products arising from some new fundamental technology. Case in point is the field of carbon nanotubes - over 1000 U.S. patents since 1991 have "carbon nanotube" in the claims. A myriad of carbon nanotube inventions have been patented – from the carbon nanotubes themselves, to composite materials containing carbon nanotubes, to integrated circuits using carbon nanotubes as electrical "nanowires", to sensors and field emission displays. Remember, a patent only grants the holder the right to *exclude* others to make, use, sell or import something that embodies their *claimed* invention. This exclusionary right can be enforced by the Federal Courts (*e.g.*, a patent infringement lawsuit) to order the infringer to stop the infringing action or to pay the patent holder a reasonable royalty. Importantly, patent holders need to realize that the patent does not confer any positive right to do anything with the invention. In other words, just because you have a patent doesn't mean that you are free to practice your invention.

Q: Overlapping patents sound like a real mess. What can be done about this?

A: We recently described a number of strategies that should be considered in addressing the issue of overlapping patents [4]. There we discussed five strategic patent options that a company should consider: (1) do nothing, especially if the financial risk is not too great and the patent rights are heavily intertwined that no party wishes to begin a conflict; (2) prepare for a patent interference to determine who was the first to invent a contested claim; (3) prepare to litigate, which involves both offensive tactics such as filing patents and in-licensing patents that target your adversaries, as well as defensive tactics such as obtaining opinions of counsel to defeat a patentee's assertion of willful infringement and reduce damages; (4) "play nice" in the industry and attempt to license needed technologies; and (5) explore the formation of a "patent pool" in which a number of companies may be able to form a consortium for cross-licensing (*i.e.*, "pooling") their rights related to a particular technology. The patent pool strategy is more common in the electronics, computer and telecommunications industries than in the biotechnology, pharmaceutical and chemical industries.

Q: What do you see happening in nano-biotechnology patents?

A: Nano-biotechnology is also progressing quickly and getting crowded. There are many R&D organizations and companies with many overlapping patents, which in turn makes strong patent protection more important for achieving a competitive advantage.

We've seen a number of issued U.S. patents on self-assembling materials and tissue engineering at the nanoscale level. Companies, investors and researchers working in those areas need to be mindful of what "IP real estate" has already been claimed.

We also see a number of new patents on nanostructured materials and compositions that are being explored in a number of biomedical applications. For example, there are over 300 issued U.S. patents covering some aspect or use of "dendrimers," many of which pertain to targeting, imaging,

and killing cancer cells. In addition to treatment and therapy applications, nanomaterials are also expected to have broad application in medical devices and disease diagnostics.

One interesting example of the use of nanomaterials in the life sciences is the use of nanoshells as a possible cancer treatment. In this treatment, nanoshells are sent to a tumor and then heated by a near-infrared laser. This in turn heats the tumor-located nanoshells and results in the destruction of the tumor as well as blood vessels that supply the tumor without damaging the surrounding, healthy tissue [4]. A number of other patents cover the use of a variety of porous or hollow nanostructures as drug delivery devices.

Q: What will be the effect of all of these nanotechnology patents?

A: The increased interest and investment in nanotechnology has catalyzed a large number of patents, like the 1000+ carbon nanotube patents we discussed earlier. This large number of patents has created a crowded -- but still attractive -- space. As we described earlier, it is critical for nanotechnology firms to understand the patent landscape of their target markets and to know exactly what's covered by other people and what's still available.

Q: What kinds of patents are the strongest, and how many patents do companies typically need?

A: Very simply, companies need to keep in mind that a patent is a business tool. Accordingly, companies should only invest in the patent protection that will further their business goals. Remember, a patent only gives the owner or its exclusive licensee the right to *exclude* others from making, using, selling, or importing the invention *as claimed.* Thus, it is critical that the *issued* claims provide its owner or licensee some type of competitive advantage or leverage in the marketplace. For example, a company in the business of selling a novel nanomaterial product should not only have at least one composition of matter claim that covers the product, but it should also have at least one claim that covers as many alternative and economically sound "copy cat" workaround compositions that are possible. Strong patent protection usually has several different type of claims to broadly protect various aspects of the inventive technology. Thus, in addition to composition of matter claims, it is also advisable to obtain device claims as well as method of manufacture and method of use claims, where applicable.

In nanotechnology and elsewhere, "device" claims, which cover things, machines, instruments, apparatuses, etc., are considered strong claims because they protect something concrete -- once you patent a particular device, nobody else can use or sell it without your permission. One aspect of device claims that makes them particularly strong is that it is comparatively easy to determine whether a device claim has been infringed – you just take the other company's device and analyze it to see if it incorporates each element, or an equivalent thereof, of your claimed invention. Composition of matter claims are thought to be the strongest because it is comparatively straight forward to determine whether an infringement has occurred.

Method claims cover processes, ways of making something, or methods of using a device or composition. Although ways of doing something are important, creative inventors can often figure out ways to circumvent these kinds of claims. For example, if a company had patented a method of identifying cells by labeling and observing them with quantum dot nanocrystals, a competitor might be able to work around that patent by identifying cells using some other method. Of course, companies should seek the advice of a patent attorney about how to work around a patent.

Q: What do you see in your crystal ball for the nanotechnology field?

A: We see more and more progress on a number of fronts -- there are so many promising technologies. But we also anticipate that more and more patent conflicts will arise – witness, for example, the recent litigation between NanoProprietary and Canon Corp. In that case, NanoProprietary entered into a license agreement with Canon relating to NanoProprietary's surface electron conduction technology, but which agreement allegedly excluded the use of electron emissions from carbon nanotubes. Canon and Toshiba formed a joint venture and announced the introduction of color TVs using surface conduction electron emitting technology. NanoProprietary then initiated a litigation, claiming the license agreement did not allow Toshiba access to NanoProprietary's technology. [6] We expect that nanotech patent litigation will accelerate as the more and more nanotech innovations are commercialized and become profitable.

Q: Could you summarize what nanotechnologists should bear in mind when it comes to patents?

A: People involved in nanotech R&D – whether they be innovators or investors – need to be mindful that patent issues can be quite complex. They need to know what kind of protection they need that will provide them a competitive advantage in the marketplace, and they need to know about the patents of others that also can limit their ability to compete at all. Finally, they should be proactive in seeking patent protection for their innovations and not view patents as an administrative waste of time. Indeed, think about this question; how many venture capitalists do you think would invest millions of dollars in a new nanotechnology company that has no patent protection? Very few VCs would invest in an unprotected technology, we suspect.

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