

ENGINEERING THE FUTURE

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Unitary patenting draws nearer

Progress is being made on a global system to handle intellectual property, reports Clive Cookson

The world of patents is growing, as companies intensify their efforts to protect the fruits of research and development. At the same time, it is becoming more uniform, as governments try to iron out the costly inconsistencies between the world's different systems.

The World Intellectual Property Organisation (Wipo) in Geneva recorded growth of 10.7 per cent in filings under the Patent Cooperation Treaty, the closest thing to a global system. That is the biggest increase since 2005 – and in marked contrast to the decline in 2009 that reflected the economic downturn then.

Francis Gurry, Wipo director-general, says: "The recovery in international patent filings that we saw in 2010 gained strength in 2011. This underlines the important role played by [patenting] in a world where innovation is an increasingly important feature of economic strategy."

The European Patent Office (EPO) in Munich received 244,437 applications in 2011, an increase of 3.7 per cent over 2010. "This suggests that

companies are reacting differently in this difficult economic climate from the way they did in similar conditions in the past," says Benoit Battistelli, EPO president.

"Whereas European patent filings dropped 7 per cent in 2009, following the credit crunch, this time companies appear to have decided to maintain or even increase their R&D and patent investments. And, so far, 2012 has mirrored 2011."

While European and US patenting is growing at single-digit percentage rates, Asian – and above all Chinese – activity is increasing much faster.

Analysis by Thomson Reuters shows that in 2011 China overtook the US and Japan to become the world leader in patent application volume. With Chinese patent applications increasing by about 17 per cent a year, Thomson Reuters projects that China will publish 493,000 patent applications in 2015, well ahead of the US (about 380,000) and Japan (290,000).

The big difference between China and the other patenting powerhouses is that Chinese organisations still focus mainly on protection in their domestic market. They are not filing patents globally at the same level as other innovation-minded countries.

Thomson Reuters calculates that only 5.6 per cent of China's inventions are protected with global patent filings abroad, far



Joined up writing: the drive to harmonise patenting around the world has made significant progress over the past year

fewer than the US (48.8 per cent) and Japan (38.7 per cent).

Even so, a few Chinese companies have become very active on the global patent scene. Wipo says that ZTE, the Chinese telecommunications equipment manufacturer, overtook Panasonic of Japan to become the world's top applicant under the Patent Cooperation Treaty in 2011. Huawei, another Chinese telecoms company, ranks third.

Meanwhile, the drive to harmonise patenting around the world has made significant progress over the past year.

A big advance came last September with the passage of the "America Invents Act", the first thorough reform of the US patent system for 50 years and arguably the most comprehensive since the system was set up in the early 19th century.

From the international point of view, the most important feature of the act is that the traditional US "first to invent" rule is replaced with the "first to file" priority used elsewhere in the world.

David Kappos, US Patent and Trademark Office (PTO)

director, told a congressional hearing last month that passage of the act had stimulated a new drive to iron out inconsistencies between different systems for recognising intellectual property around the world.

He says: "With adoption of the act, Congress has enabled the PTO to promote a new vision of an IP world in which national and regional patent systems are co-ordinated to create an optimal environment for technological innovation globally."

"We are implementing a common patent classification sys-

tem with the US PTO," says Mr Battistelli. "This will bring a real benefit for patent searches."

The PTO is proceeding with the extensive rule making required to implement the act. The most obvious test of its success will be clearing the current patent backlog of 640,000 applications – on average it takes almost three years for an application to be reviewed.

In Europe, the long campaign to create a "unitary patent" for

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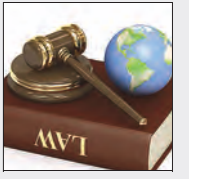
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EUROPEAN INVENTOR AWARD 2012 THE EUROPEAN PATENT OFFICE CONGRATULATES THIS YEAR'S WINNERS



INVENTORS ARE THE HEROES OF THE 21ST CENTURY ECONOMY

Innovation creates competition, dynamic markets, jobs, prosperity and growth. Ingenious inventions can improve health care, transport and communication, as well as protect our environment. Inventors are the champions of progress, refusing to accept the status quo and harnessing the forces of nature to create new products and processes.

The European Patent Office protects inventions with patents. From a field of many thousands of patentees, the European Inventor Award recognises five truly exceptional individuals or teams.

These inspirational inventors secure our future. Most of them dedicate their entire life to improving ours. We thank them for their contribution to society and the economy.

THIS YEAR'S WINNERS

INDUSTRY 1A Jan Tophølm 1B Søren Westermann
1c Svend Vitting Andersen Tailor-made hearing aid
RESEARCH 2 Gilles Gosselin A potent drug to fight hepatitis B
SMES 3 Manfred Stefener Portable fuel cell
NON EUROPEAN COUNTRIES 4A Terence Percival
4B John O'Sullivan High-speed wireless networking (Wi-Fi)
LIFETIME ACHIEVEMENT 5 Josef Bille Device for laser eye surgery



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DANISH PATENT AND TRADEMARK OFFICE

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Engineering the Future

Accolades for pioneers in world of science

An easier life for the hard of hearing

Industry
Widex

Michael Stothard profiles the inventors behind big advances in comfort and affordability

In the early 1990s, the comfort of a hearing aid was based entirely on the skill of the designer and on the kind of day he was having when he made each one.

Electronic components for the device were inserted into a hand-cut impression of the ear by a technician, which often resulted in days of terrible pain and chafing when not done perfectly.

But in 1992, Jan Tøpholm, chief executive of Widex, Søren Westermann, executive vice-president, and Svend Vitting Andersen, invented a way to computerise the process, forever making the devices cheaper and more reliably comfortable.

The three inventors, two of whose fathers had founded the company in their basement in a little town in northern Denmark 40 years before, designed the first computer programme that could perfectly fit the component parts of the device into a plastic shell based on a mould of the patient's ear.

They also worked with an early 3D printer company, so the device could be manufactured by an accurate machine rather than by hand. Before their invention, the shell to hold the electronics was handmade and then fitted into the ear canal. Their process "grew" the shell in a series of layers controlled by the computer.

At the time, 3D printing was in its infancy and they had to create the software from almost nothing with the help of 3shape, a Danish company that is still in the 3D printing business. The technology was patented in 1992 and, when it matured into production a few years later, it was almost instantly adopted by Widex's competitors under licence. The patent expires this year.

Widex is among the world's six largest manufacturers of hearing aids, with a global market share of about



Sight saviour: the European Patent Office award for lifetime achievement goes to Germany's Josef Bille, who has been pushing the boundaries of eye surgery for 45 years

Prizes A way to add a human dimension to the bureaucratic world of intellectual property rights protection

Some might say that the monopoly conferred by a patent is sufficient reward for an inventor. But everyone loves a competition, and invention and innovation are increasingly being recognised by prizes and awards on top of patents.

The annual European Inventor Awards, presented yesterday in Copenhagen, have become an important date in the calendar, just six years after the European Patent Office established them to give a human face to the creation and protection of intellectual property – an activity regarded by many people as boring and bureaucratic.

Benoît Battistelli, EPO president, says: "For me these awards are a way to put flesh and blood on the economic importance of patents, which would otherwise be a theoretical or intellectual exercise. It is always more convincing to have personal examples of people who have made a difference on issues that are important for society or have been able to create real value through innovation."

The EPO devotes considerable resources

to the awards, which are based on submissions from the public and specialists at EPO and national patent offices. The selection process includes a thorough analysis of the economic impact of the 15 short-listed candidates by Technopolis, the research consultancy.

The final choice is made by an international jury headed by Jerzy Buzek, president of the European Parliament. (Peter Marsh, manufacturing editor of the FT, served on this year's jury.)

In this report, we tell the stories of the winning individuals or teams in the awards' five categories: industry; SMEs; research; non-European countries; and lifetime achievement. They cover a wide range of technologies, from hearing aids and fuel cells to pharmaceuticals and eye care.

But the other 10 short-listed entries also make impressive reading. They include:

- Jaap Haartsen and colleagues at Ericsson of Sweden, who invented the Bluetooth system for short-range wireless connection;

- Stefan Lehnert of Vector Foiltec, a German SME, who patented an architectural cladding system based on plastic cushions filled with air (seen by 100m television viewers who watched the Champions League final last month at Munich's Allianz Arena);

- Mark van Loosdrecht and colleagues at Delft University of Technology, who found a better way to purify contaminated water for drinking;

- Stanford Ovshinsky of Ovonic Battery in the US, who invented the nickel-metal hydride (NiMH) batteries that power many portable electronic devices;

- Mario Polegato, who built one of Italy's largest shoe companies – Geox – on the basis of his discovery of how to make breathable footwear that keeps feet dry by allowing sweat to evaporate.

The European Inventor Awards are all about honour and glory. There is no monetary prize, though each winner receives a trophy shaped like a sail, symbolising the pioneering spirit. Every year the sail is made from a different

material; in 2012 it is "translucent concrete".

In contrast, the top American award for invention, the Lemelson-MIT Prize, offers a huge sum – \$500,000 – to mid-career inventors who have patented a product or process of practical value to society.

The prize, endowed since 1995 by the Lemelson Foundation and run by Massachusetts Institute of Technology, will be awarded next week to Stephen Quake, professor of bioengineering and applied physics at Stanford University. At the age of 43, Prof Quake already has more than 80 patents and four bioscience companies to his credit, in drug discovery, genome analysis, and personalised medicine.

Companies (such as Siemens) and universities (such as California Institute of Technology) are increasingly recognising successful invention through award schemes – some monetary and others just offering inventors the warm glow of recognition beyond their patents.

Clive Cookson

human infection.

Telbivudine's simplicity, without the need for chemical modification, meant it had low toxicity levels and generated few side effects. It proved more potent than other experimental treatments for HBV, such as lamivudine, and had lower rates of resistance.

Idenix Pharmaceuticals – originally named Novirio – was created by Jean-Pierre Sommadossi, a professor at Alabama, to help develop the drug, initially in co-operation with CNRS. But it needed time and money to test it thoroughly in humans.

The company eventually signed an agreement with Novartis of Switzerland, which ran clinical trials and ultimately commercialised it, receiving a royalty on sales.

The medicine has been given a high price in Europe, where it has been more expensive and used less frequently than rival treatments.

He argues that the key ingredients for success are perseverance and luck. He also says patents – joint patent holders are Jean-Louis Imbach and Martin Bryant – were important, to provide rules for collaboration and generate funding for further research.

Closer to the goal of perfect vision

Lifetime Achievement
Josef Bille

James Wilson looks at the man behind revolutionary laser technology

The benefits of Josef Bille's life's work are clear to see for millions. The German scientist has for 45 years been pushing the boundaries of eye surgery with the use of lasers. Prof Bille's innovations have brought precise diagnostic and surgical techniques to ophthalmology and been the foundation of a successful entrepreneurial career.

Laser surgery is now common as a corrective treatment for sight deficiencies such as nearsightedness or astigmatism but, as Prof Bille recalls, the first laser technology started only in 1960.

He says: "I was always interested in applications and the medical field was always my favourite. Medical research is fundamentally about technology, and bringing it to the patient. If you do not get into technology, research never comes to fruition. It has to reach the patient."

Prof Bille reckons 60 to 80 per cent of ophthalmology equipment used worldwide stems from his innovation, or, as he puts it, "originated in my brain".

At the heart of his innovation has been his development of a technique called wavefront technology for its use of reflected beams of light to "map" the refractive properties of the retina of the eye. This allows more precise laser-guided robotic surgery upon any irregularities – as Prof Bille puts it, "eliminating the hand of the surgeon, the weakest part in this process".

Perhaps inevitably, he was an early beneficiary himself of laser eye surgery, something he says is now routine for 5m patients each year.

He has pursued his research since his master's degree in 1966, with a link for the past 35 years to the university of Heidelberg in southern Germany. He also works extensively in California.

The scientist has filed more than 100 patents associated with his research. He has also started five companies, sometimes with PhD students.

Technopolis, an Austrian consultancy that assessed the economic impact of Prof Bille's patents and research, says three of the start-ups have grown into companies that together employ 1,000 and have annual sales of €300m.

The European market for ophthalmic devices was worth €650m in 2010.

Now 67, Prof Bille's most recent big project has been in applying wavefront technology to so-called intra-ocular lens implants, which are less intrusive than corneal surgery. "We are bringing diagnostic technology to the cellular level," he says. "We are getting close to the original goal of perfect vision."

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10 per cent. Research by Companiesandmarkets.com shows the global hearing aid market was worth \$6.6bn in 2010.

This market is growing rapidly because of an ageing world population. About 700m people are expected to be suffering from moderate to severe hearing loss by 2015, up from 300m in 2011, according to Companiesandmarkets.com.

Widex is still inventing and filing patents, hoping for another big success. In 2008, it introduced the world's smallest hearing aid at just 2.1 millimetres in diameter, while in 2010 the company introduced the first hearing aid specifically designed for babies.

"It is crucially important for babies to be able to hear," says Mr Westermann, emphasising that the company needs constant innovation to push forward.

"If you cannot hear for just nine months when you are young, the speed at which you learn will be impaired forever."

First to produce methanol fuel cells

SMEs
SFC Energy

Emma Byrne considers the success of a company at the forefront of energy technology

Munich-based SFC Energy was founded in 2000 by Manfred Stefener and was the first company in the world to deliver commercially viable Direct Methanol Fuel Cells.

For the past 12 years, the company has concentrated on developing ever more compact versions of the technology and its smallest fuel cell, the Jenny, only one-fifth of the

weight of a traditional battery, is used in a range of settings from yachts to battlefields.

SFC Energy has about 190 employees and generated €15.4m in revenue in 2011. Although the company has yet to break even, it is one of the top 25 companies in the rapidly expanding sector of fuel cell technology, according to Pike Research.

It is a leading supplier of fuel cells to the leisure, surveillance and monitoring, transport and defence sectors.

What distinguishes SFC Energy from its competitors is the type of fuel cell it has developed. The Direct Methanol Fuel Cell (DMFC) is a still a relatively recent development.

While the Nasa Jet Propulsion Laboratory had already begun to develop methanol-powered fuel cells before 1997, it was Mr Stefener's PhD research into the miniaturisation of these fuel cells that made them suitable for use in difficult environments.

Methanol is cheaper, safer and easier to use than hydrogen, and the energy storage density of methanol is four times that of hydrogen, which means DMFCs are lighter and more compact than their hydrogen counterparts.

"Methanol can be directly converted into electricity," says Mr Stefener. "That makes DMFCs very easy [to use]. Every consumer can deal with methanol in a safe way, whereas for hydrogen you need a very specific infrastructure. DMFCs can be marketed and distributed far easier than hydrogen fuel cells."

However, DMFCs require much more complicated electronic and mechanical components than their hydrogen counterparts.

To address these issues, Mr Stefener has set up a company, Elcomax, which focuses on the design and development of components for the DMFCs that SFC Energy supplies.

Mr Stefener, Elcomax and SFC Energy have filed 52 patents for portable methanol fuel cell technology.

In 2010, the winning crew of the transatlantic Route du Rhum race powered their on-board navigation and telemetry systems with fuel cells based on Mr Stefener's designs.

Where maths was the simple bit

Non-European
CSIRO

Neil Hume reports on the Australian team that struggled for Wi-Fi recognition

John O'Sullivan and his team at Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) did not invent wireless networking. But they did come up with the crucial set of mathematical algorithms that have made possible high-speed wireless local area networks, or WiFi as its better known.

Today their breakthrough can be found in an estimated 3bn mobile phones, laptops and networking devices around the world, and has amassed A\$430m in royalty payments so far for CSIRO, Australia's leading scientific agency.

It has been hailed as one of country's greatest scientific achievements.

But cracking the mathematical equations was, with hindsight, the easy bit. Persuading the world's leading technology companies to recognise the CSIRO patent and pay to license the technology has been much harder.

The WLAN technology developed by Mr O'Sullivan and his team – Terry Percival, Diet Ostry, Graham Daniels and John Deane – has its roots in the equations first used in radio telescopes searching for exploding black holes.

The team decided to look at wireless networks after being challenged to find commercial applications for their research, which involved unscrambling radio waves from deep space.

An issue that scientists were grappling with in 1990 was how

to transmit large amounts of internet data without wires inside buildings, recalls Mr O'Sullivan.

He says: "What we set out to do was make a network as fast as the best wired network of the time. That was a fibre-optic network that went at 100 Mbps. That goal really stretched the sort of things that had been done before and meant we had come up with something different."

The solution the team came up with was to adapt Fourier transforms, the complex formulas that turn extremely distorted radio waves into something astronomers can recognise, for wireless networking.

The team believed these equations could help with the high-speed wireless delivery of data, which experiences similar disturbances when it bounces off walls and other objects.

"We thought about the wireless network problem in many ways and decided to look at it, not in terms of sending bits more rapidly, but sending them more slowly on different frequencies. That's where Fourier transforms came in," says Mr O'Sullivan.

By transmitting data over a wider range of frequencies and processing it in a certain manner before transmission, Mr O'Sullivan and his team were able to crack the problem. Their solution is the basis for the wireless technology used in billions of devices around the world.

A US patent was granted in 1996 and, by 2000, the team had created the first successfully operational wireless chip. But it would be another nine years before the technology world recognised the patent.

CSIRO scored a big legal victory this year, when seven WiFi equipment makers agreed to pay \$220m to settle a dispute over royalties, which could top more than A\$1bn before the patents expire next year.

"CSIRO has done wonderfully well to stay the course," says Mr O'Sullivan, who in recent years has been working on the Square Kilometre Array, the world's largest radio telescope project.

"The fact that a good part of the money is being used to fund research, I find particularly gratifying," he says.

Algerian behind hepatitis medicine

Research
Telbivudine

Andrew Jack on the random series of events that led to an antiviral breakthrough

As a young scientist, Gilles Gosselin studied at the University of Oran in Algeria, where he struggled in a university often without water, let alone access to chemicals.

Three decades later, he works on secondment from the CNRS, the French national scientific research agency, at the biotech company Idenix, with resources far beyond those he could have once imagined.

Between the two periods came his pivotal role in developing the drug telbivudine (branded as Sebivo and Tyzeka) for Hepatitis B, the blood-borne infection that affects 350m people around the world, causing cancer and liver failure. He was rewarded with patents, while his colleagues established the company that produces the drug today.

When he came back to the University of Montpellier in 1979, Mr Gosselin began synthesising compounds and sending them to contacts in France, Belgium and the US to test their efficacy in tackling a range of possible diseases.

The University of Alabama found the drug had an impact on HBV, the Hepatitis B virus.

It took nearly 20 years to develop the antiviral medicine, a so-called nucleoside analogue that fools the virus into thinking it is a normal building block for DNA, and is unable to replicate on any scale.

The work involved initial tests in woodchucks, the unusual animals considered the most reliable "model" for

No end in sight for cancer gene legal saga

Biomedicine

Andrew Jack reports on a long running argument over the extent of exclusive rights

More than 20 years after scientists first made the connection between a particular gene and breast cancer, paving the way for a powerful diagnostic test, a dispute over control of the information shows no signs of resolution.

Lawyers are preparing arguments for a US legal appeal next month in the long running case over the patents involved. Some warn of the risks for the fast expanding field of personalised medicine, with its focus on genetic markers that allow doctors to identify the patients for whom particular drugs will work.

"This is the case that everybody cares about," says Robert Cook-Deegan from the Institute for Genome

Sciences & Policy and the Sanford School of Public Policy at Duke University. "Companies are trying to figure out what the law is. No one knows how this will end up."

Within three years of scientists at the University of California Berkeley identifying the cancer-causing BRCA1 gene in 1981, the US company Myriad Genetics, based in Salt Lake City, filed for patent protection. By 1986, it launched a detection kit for breast as well as ovarian cancer based on that gene and another it had also patented, BRCA2.

Mr Cook-Deegan explains: "It was not just that it had a patent, but it wanted everybody to do their testing at its laboratory in Utah: that it would enforce a monopoly and not license the technology."

While generating substantial income for the company in the US, it triggered widespread antagonism and affected its business model abroad.

In Europe, the company pulled back from aggressive

enforcement in the face of hostility from national health systems and special legislation passed in countries such as France and Belgium empowering governments to impose compulsory licences on patented technologies. In Australia and Canada, disputes have been reopened over the company's exclusive role.

In the US, where the company enforced its rights most aggressively, Myriad faced hostility from breast cancer organisations and doctors. And, since 2009, it has also received significant legal challenges launched by groups including the American Civil Liberties Union and the Public Patent Foundation.

After a federal district court overturned 15 Myriad patent claims on the two genes, arguing that naturally occurring DNA could not be patented, the US court of appeals for the Federal Circuit narrowed the findings in 2011, concluding that the company could patent isolated methods for analysing these genes. The

issue is again up for appeal.

The situation has been further confused by a separate legal ruling this year, in which a judge deemed Prometheus Laboratories' patents for treatments for immune diseases such as Crohn's were invalid, because they simply cited laws of nature and "obvious steps" for doctors to take.

The disputes seem likely run beyond the expiry in the middle of this decade of the original patents

The cases highlight the principle of gene patenting, which companies argue is essential to incentivise innovation. Mr Cook-Deegan is more sceptical, while cautioning that a monopoly on testing has not resulted in much higher costs to patients or health systems. But he argues: "I suspect some people

haven't moved into this space who would have done, if there had not been this degree of uncertainty."

He argues that "patient rights should trump patent rights" if the owner of exclusive rights does not permit basic research, obtain second opinions, and help development to make the test more comprehensive, accurate and cheap.

Peter Meldrum, Myriad's chief executive, said in a statement in the build-up to the latest legal hearings: "We are prepared to vigorously defend the patent claims granted to Myriad."

He says the company had not hindered gene research, that the cost of its test was not prohibitive and patients who have tested positive can seek external verification of their results in another laboratory.

John Iwanicki, a lawyer with Banner & Witoff, a Chicago-based firm, says that many life sciences companies are proceeding regardless of the legal uncertainties over the precise nature of patenting

that the US courts will tolerate.

Qiagen, a German-based diagnostics group developing a number of genetic tests in conjunction with pharmaceutical companies, says it draws comfort from both the Myriad and Prometheus decisions that there will still be some patent rights tolerated on genes.

Mr Cook-Deegan says sole-provider laboratories should share data relevant to public health, contribute to public databases helping with interpretation, performance quality testing and disclose intellectual property.

He predicts a fresh front is set to open against Myriad, over access to its database and interpretation of variations in BRCA1 and BRCA2 results conducted in its laboratories.

On current showing, it seems likely that the disputes the company helped spark will run long beyond the expiry in the middle of this decade of its original patents.

Cases with high risks for all sides

Smartphones

Many think a truce is needed to avert meltdown, says **Richard Waters**

When a promising technology market emerges, it is not unusual for the patent lawsuits to fly.

New industries such as the telegraph and radio were born amid heated disputes over who owned the rights to exploit these promising inventions, points out Hector Gutierrez, Microsoft's deputy general counsel in charge of intellectual property.

Yet, even by the standards of the patent battles of the past, the war that has raged in the early years of the smartphone industry has seemed extreme.

Companies including Apple, Microsoft, Samsung, Motorola and HTC have thrown lawsuits at each other in a bewildering number of jurisdictions, each seeking to outflank their rivals by imposing legal injunctions and import bans to gain a competitive edge.

Since many of the same technologies are used in tablets and ereaders, the smartphone patent wars have spilled over.

Now, two years after the legal wrangling began, stalemate has been reached.

The claims and counter-claims have resulted in a gruelling series of court cases with high risks for all sides. Mark Lemley, a law professor at Stanford University, says: "There are so many participants in these cases, if the parties don't come to their senses, they will shut each other down."

Yet no one seems prepared yet to call a truce.

How this blizzard of legal cases will be resolved – and whether it will change the balance of power in the smartphone business – could have an important influence on the technology world's most important market since the birth of the PC.

After the first phase of legal skirmishes, an uneasy equilibrium has been reached, which may demonstrate the value in negotiated settlements.

Some companies have been found to be infringing rivals' patents, though these have so far involved fairly minor issues, and the outcomes depended on a complex series of overlapping cases. Microsoft, for instance, faces a bar on importing its Xbox games consoles and other products into Germany after losing to Motorola this year, though that ruling depends on a separate case under way in Seattle.

Apple has scored against Samsung in Germany, and won a bar on the South Korean company's Galaxy 10.1 tablet. But that is only one in more than 50 cases between the two giants in 10 countries, and a judge in San Francisco ordered both sides to hold settlement talks last month, to try to end one of the most complex of the disputes.

As some of the industry's biggest names have fought each other to a standstill in

court, they have also shored up their defences by buying patents to make up for weaknesses in their intellectual property holdings.

Last year, Apple led a consortium of tech companies, including Microsoft, in a \$4.5bn purchase of patents from Nortel, the bankrupt Canadian telecoms equipment maker. Google, which lost the bidding, responded with a \$1.5bn purchase of Motorola Mobility, giving it control of one of the mobile phone industry's biggest patent portfolios.

This patent arms race has consumed billions of dollars, including nearly \$600m in legal fees. But, according to Mr Lemley: "They're nowhere near done."

There are two schools of thought about what will happen.

Nathan Myhrvold, a former chief technology officer at Microsoft, now head of the patent licensing firm, Intellectual Ventures, thinks potential profits from smartphones and other mobile touchscreen devices are so large that rival companies have an incentive to keep fighting.

Analysts say Apple alone is heading for a trillion dollar stock market valuation, so why bury the hatchet now?

Others predict that a truce is near to hand.

David Martin, chairman of M-Cam, a patent research firm, says earlier legal wars in this market have been resolved by arriving at a



Nathan Myhrvold: future profits mean groups will keep on fighting

broad consensus, in which the main combatants agree to share.

Industry-wide truces such as these are often achieved by pooling patents, and all sides submitting any relevant intellectual property that they own, then receiving licensing fees based on how much each has contributed to the consortium.

Multilateral approaches of this kind, however, risk falling foul of antitrust regulators, warns Mr Lemley. As a result, a web of bilateral deals in which individual companies come to terms with each of their rivals separately is a more likely outcome, he says.

Like most other observers, Mr Lemley predicts that an eventual truce will leave the companies with weaker IP holdings paying royalties for the right to compete in the smartphone business – but that it will be impossible for any company to block or severely hamper a rival enough to prevent them from getting into the market.

That does not seem to be what Steve Jobs had in mind when he told his biographer, Walter Isaacson, of his plan to wage "thermonuclear war" against Google over what he claimed was its slavish copying of Apple's iPhone.

But as Microsoft's Mr Gutierrez says, however fierce the patent fights over new technology may seem, they are inevitably followed by business as usual once markets mature.

Fostering invention is not just about cash

Innovative companies

The most important thing is a culture that values creative people, says **James Shotter**

Innovation", Steve Jobs once said, "has nothing to do with how many R&D dollars you have. When Apple came up with the Mac, IBM was spending at least 100 times more on R&D."

"It's not about money. It's about the people you have, how you're led and how much you get it."

Mr Jobs certainly got it. From the Apple II to the iPad, the products that he dreamt up at Apple touched off a wave of disruption that has revolutionised the consumer electronics, mobile communications and media industries.

But is the company Mr Jobs co-founded the world's most innovative?

The answer depends, of course, on how one measures innovation. Some analysts use spending on research and development as a percentage of sales as a rough gauge of a company's innate creativity.

But as Mr Jobs well knew, this is unsatisfactory: spending lots on research does not guarantee innovative products.

On the basis of patents filed, Siemens is an obvious contender. The German industrial conglomerate holds about 53,300 patents, and for good measure filed a further 8,600 in 2011 – just under 40 per working day.

Of those, 2,235 were filed at European level, making Siemens the most enthusiastic user of the European Patent Office. Across the Atlantic at the US Patent and Trademark Office, IBM was the most successful applicant, with 6,148 patents granted in 2011.

Yet patents do not tell the whole story either. On the one hand, many businesses – especially smaller ones – do not patent all their most innovative ideas, preferring instead to keep them as trade secrets. And the reverse is also true: some companies, such as the tech giants Apple, Google, Facebook and Microsoft, are engaged in an escalating bout of legal wrangling in which possessing as many patents as possible is as much a legal hedge as a sign of innovativeness.

Moreover, points out Georges Haour, an innovation expert at the IMD Business School in Switzerland, levels of patent filing are influenced by local regulation. "In Japan, you have a lot of shotgun patents because the law encourages it," he says.

Claes Ryttoft, chief technology officer at ABB, a Swedish-Swiss multinational capital goods manufacturer, says an excessive focus on patent volumes hinders rather than fosters innovation. "We tried incentivising employees for the pure number of patents, but that didn't work out well: the quality suffered," he says.

Prof Haour suggests long-run profitability or the number of products less than five years old that a company has in circulation as alternative yardsticks. But these, he concedes, also have drawbacks: profitability depends on a multiplicity of factors; defining what constitutes a new product is more art than science.

Yet even if compiling a definitive list of the world's most innovative companies is difficult, it is still possible to identify certain traits that innovators seem to share.

The most obvious is a culture that values creative individuals. This can take various guises, ranging from providing bonuses for those who develop new ideas, to allowing employees the time to



Siemens capacitor production: the company holds 53,300 patents and filed a further 8,600 in 2011

go on training courses to develop fresh skills.

But just as important is the willingness to take risks, says Norbert Lütke-Entrup, strategy head of corporate technology at Siemens. "Innovation is about pure-risk taking. It's not as easily calculated as planning things in other parts of your business. You cannot be sure how things are going to work out," he says.

"At Siemens we make big and complex things. With projects of this nature, things can go wrong. But you have to take these risks in order to progress."

That means spending money on research for which there may be no commercial application. But it also means the willingness to commit money and resources to research programmes, even when the economy takes a turn for the worse, says Roger Stephens, of Spectris, a British company that specialises in making precision instruments.

He says: "You can't just turn research and development programmes on and off. Today's innovation may be the result of 10 to 15 years' effort in building a team and a knowledge base. You have to make R&D sacrosanct."

Another common factor, says James Utterback, professor of management and innovation at MIT, is a company's ability to tune in to the broader market for its innovation.

"[Innovators] are not necessarily or even often 'first movers' as popularly believed. Rather, they may come late to the game but deliver a superior synthesis to their customers. Apple is a much overworked example of this."

Yet perhaps the most important quality, he suggests, is the flexibility to respond to new threats. "Success is never permanent, and meeting a challenge at one juncture may or may not prepare a highly successful company to meet the next one," he says.

'Today's innovation may be the result of 10 to 15 years' effort in building a team and a knowledge base'

Invented in the UK, largely being developed elsewhere

Graphene

It is the old story of failing to exploit pure research, says **Pippa Stephens**

Mobile phones as floppy as wristwatches, early detection of genetic diseases, a green transport revolution – it is no surprise graphene is at the centre of a global patent gold rush.

Graphene was discovered in the UK eight years ago, but Britain is behind in the race to profit from its many applications.

The material, a layer of carbon a single atom thick, is stronger than diamond but stretches like rubber

and conducts electricity 1m times better than copper.

The material's possible applications are so manifold that it is difficult to foresee more than a few of them at this stage.

Hydrogen-powered cars for the energy industry, faster computer chips, flexible, transparent touch screens for mobile phones and superfast genetic readers, changing the way the biotech industry screens for diseases, to name but a few.

Graphene was discovered at Manchester University by Russian-born scientists Andre Geim and Kostya Novoselov in 2004. They won a Nobel Prize in 2010 for their discovery, which involved a roll of Scotch tape and some graphite. One forecast predicts the

graphene industry will be worth £300bn by 2022. The UK government has recognised its importance with £50m of funding for a research institute.

Europe is leading the race in academia, accounting for 36 per cent of the world's graphene publications, compared with Asia (32 per cent), and the US (25 per cent). But the UK holds only 21 of the 2,224 graphene patents filed to date. It is in sixth place behind the US (983), China (588), South Korea (236), Japan (167) and Germany (49).

Only four representatives from the UK feature in the 200 most prolific patent owners, compared with 63 in the US, 54 in China, 21 in South Korea and 23 in Japan. This disparity

between academic output and patents is known as "the European Paradox". The continent is good at producing cutting-edge scientific research, but is not so good at turning it into marketable products.

Quentin Tannock, chairman at Cambridge Intellectual Property (IP), notes a recent surge in China, where 208 patents were filed in 2010 compared with 145 in the US.

He says the patents are filed in China by national and international corporations first, which recognise it as an important market.

Mr Tannock says: "There are industry verticals, the biotech sector, aerospace industry, semiconductor industry. Graphene cuts across them. It's a horizon-

tal. There is no such thing as a graphene industry."

The exception to the rule is Samsung, which is a fully integrated company. Patents require an application so, having all the research,

The EU's Graphene Flagship Initiative aims to combine academia and industry

development and funding across different industries and in one place, may promote efficient production.

Weaker connections between academia and industry in Europe, compared with the US or Asia,

hinder the commercialisation of academic research.

Prof Geim says: "Western civilisation has no big institute that cares for a company. Maybe this is why the centre of wealth goes so far east, where advanced institutes of technology, such as Samsung, still support industrial development."

He says he spends 20 per cent of his time trying to collaborate with other companies, but often struggles to secure funding.

"Companies are reluctant to see beyond three or five years. I don't blame them; they are under such competitive pressure."

"The only way to bring such an enormous and disruptive technology as graphene to the UK is through small capital com-

panies, out of the universities," he says.

The EU's Graphene Flagship Initiative (GFI) offers a glimmer of hope to the UK.

It aims to combine academia and industry to come up with graphene-related products that are attractive to investors and is trying to secure €1bn from the European Commission by next January.

Jari Kinaret of the Chalmers University of Technology, Gothenburg, Sweden, co-ordinator at the GFI, says: "Our goal is to put Europe on the international stage. We are trying to find a way to involve more risk capital, more venture capital, because that's clearly how small companies will grow and get out of academia."

Harry Swan, managing director of Thomas Swan, the UK-based chemical manufacturer, took the leap in April with a four-year, £625,000 agreement with Trinity College Dublin to develop a scaleable process for producing graphene. He says it is important to focus on the long game.

"It's not just about profit, it's about seeing the collaborative research that goes on."

Mr Swan says his company had held back from investing until he could see a reliable technique to make graphene.

He adds: "Sometimes you can't rush science, it just has to take its time and have an element of trial and error, and let people catch up with that."

Engineering the Future



Wrangle over patent court site nears end

EU reform

Officials say the row can only be settled at the highest level as part of a package of trade-offs. Alex Barker reports

Almost 40 years of political wrangling over reforming Europe's sprawling network of patent systems is on the verge of conclusion, as EU leaders push for a final bargain over the new patent court's location.

At a summit in Brussels on June 29, Germany, France and the UK will try to resolve their bitter dispute over which plays host, the last obstacle to introducing a more streamlined intellectual property regime.

Moving to a single pan-European patent system is described by the European Commission as one of the most achievable and immediate steps the EU can take to support innovation, reduce costs for business and boost growth.

Most of the hardest issues that sustained this epic negotiation – which began in 1973 – are resolved, including the language and legal regime. Yet a deal seems as elusive as ever, with a fight dragging on over the relatively trivial decision on the seat of the court. "This is complete silliness," says one European diplomat. "It must be settled this month." Another senior European official marvels at the diplomatic energy being wasted on providing a home to "40 bureaucrats".

Meanwhile, the legal community is up in arms. Some warn the compromise deal is riddled with problems and will make the system for entrepreneurs worse, not better. Others fear the upheaval will strangle established legal business outside the venue of the court and Europe's patent office in Munich.

Businesses have long lamented

Europe's baffling patchwork of patent laws. They have to defend their inventions separately in each EU member state – a costly process that critics say has hurt competitiveness. According to EU estimates, it costs about €30,000 to get a bundle of national patents for all 27 member states, about 15 times the cost of a typical US patent.

For decades, EU countries have squabbled over the language rules for a single patent regime – an issue that was potentially resolved last year by 25 EU countries agreeing to move ahead with a treaty without Spain and Italy, which were implacably opposed.

But for more than six months, the row over the seat of the court has blocked progress. Those involved say it can now only be settled at the highest level as part of a package of trade-

'The current convoluted and murky constellation is a paradise for lawyers but a hell for innovators and entrepreneurs'

offs between François Hollande of France, Angela Merkel of Germany and David Cameron of the UK.

Ole Sohn, the Danish business minister who brokered the negotiations, says that "without doubt" the reforms would be a "major step forward" for competitiveness.

The haggling is playing out against increasingly loud complaints from the legal community over the proposed solution, which some see as so flawed that costs will rise and small companies will find it more difficult to protect their ideas.

Christian Gassauer-Fleissner, of the European Patent Lawyers Association, told a UK parliamentary committee: "The proposed system is burdensome and expensive, in particular from the point of view of SMEs." He gave a specific example.

"A German patent owner could sue his English competitor alleging infringement of his patent, which was drafted in German, in any participating country where the English competitor made sales. The English defendant would then have to defend himself in the language of the court chosen by the patentee."

Another worry is the proposed right of appeal to the European Court of Justice, an already overworked and short-staffed institution that could extend the process of defending patents for years.

Reform advocates dismiss the complaints as those of vested interests. "The current convoluted and murky legal constellation is a paradise for lawyers, but a hell for innovators and entrepreneurs," says one diplomat.

A decision on the location of the court will be part of a high-level political deal that will have little to do with patents.

But diplomats are nonetheless circulating papers trumpeting the virtues of each proposed city.

Three senior German ministers sent a letter praising Munich, the home of the European Patent Office, as a natural choice that is "easily reachable from anywhere in Europe via its airport".

The letter added: "Thanks to its long tradition in the field of industrial property rights in Europe, Munich offers outstanding professional infrastructure."

The UK, which diplomats see as a relative outsider in the contest, hit back with its own paean to the merits of London. They highlighted its "timely, efficient" handling of patent cases and the fact that London receives "more than twice as many flights" from other EU states than Munich.

France had hoped to host the court as a consolation for giving way on some language issues. But while it has significant backing, Berlin has so far refused to budge. If the matter is settled this month, the changes to Europe's system will be unmistakable.

Unitary patenting regime draws nearer

Continued from Page 1

the whole EU has made further progress but not yet come to fruition. Twenty-five of the 27 member states have signed up to the unitary patent – Italy and Spain are staying out because they object to the language rules that favour English, French and German over other languages.

The 25 countries have agreed to set up a new European patent court to rule on the validity of unitary patents but, as with so many decisions relating to new international institutions, the final go-ahead is waiting for its location to be decided. London, Paris and Munich are competing to host the court.

Although European heads of government said in January that a final decision on the court would be made by the end of this month, this may slip. "Whatever decision it is, it is important that a decision is made quickly," says Mr Bat-

tistelli. "We need to have this improvement in the European system."

Under the current system, once a European patent is granted by the EPO, it has to be validated in each EPO member state for which the inventor seeks patent protection. For this purpose, the majority of states require a full translation of the patent in their official language(s) – a hugely expensive business.

The future unitary patent will be valid automatically throughout the participating countries in the language in which it was granted. For a typical applicant, this will cut costs by 70 per cent compared with the present system, according to Mr Battistelli.

Translation is a big issue for the patent world – but technology is coming to the rescue. Last year, the EPO signed a partnership with Google to set up a machine translation service for patents. The service, called Patent Translate, was

launched four months ago.

Patent Translate is designed not to provide precise, legal quality translations but to be a public information service for users who want to search for patents in different languages without having to employ a human translator.

Being a technical transla-

'The grammar is sometimes a bit strange but you understand the content'

tion service, it is of far higher quality than the translations offered to users of Google's general search engine, which often produce incomprehensible linguistic manglings.

Mr Battistelli asks people to judge Patent Translate on its own merits, without preconceptions about the quality of machine transla-

tion. "The grammar is sometimes a bit strange, but you understand the content," he says.

At present, Patent Translate offers translation from and into English for six languages: French, German, Italian, Portuguese, Spanish and Swedish. The EPO aims to extend coverage to all 28 languages of its member states, plus Chinese, Japanese, Korean and Russian by the end of 2014.

Mr Battistelli says Patent Translate and other machine translation systems, combined with online access to global patent data, represent "huge progress" for the whole world of intellectual property.

Soon, inventors will for the first time be able to search the world's "prior art" thoroughly and check that their application really does describe something new – which should raise the quality of patents and reduce the number of overlapping claims that can trigger patent disputes.

Overhaul 'fails to address system's weaknesses'

US reform

Richard Waters reports on the flaws in badly needed legislation

After a legislative effort dating back to the middle of the last decade, the US Congress succeeded last year in passing the first reform to the country's patent system for more than 50 years.

Yet, while there was general agreement that an overhaul was badly needed, the law that was eventually passed did little to fix what is widely seen as the current system's chief weakness: that it leads to the issuing of too many patents that lack real innovation and that clog up the legal system once their holders seek to enforce them against alleged infringers.

That has contributed to the rise of a class of legal opportunists, known as patent "trolls", that acquire patents wholesale, often using them to win out-of-court settlements from large tech companies that prefer not to risk the sort of large damages awards that have come from other jury trials.

The chief feature of the America Invents Act, in fact, had little direct bearing on the main issues that had led Congress to attempt reform in the first place.

A new provision that grants priority to the first person to file for a patent on an invention when there are competing claims – rather than an earlier "first to invent" principle – brings the US into line with the rest of the world.

Critics object that it is likely to favour big companies with active patent departments at the expense of lone inventors, who may not be as quick to seek formal recognition for their ideas.

The law's effectiveness in improving the quality of patents and reducing litigation rests on two main provisions.

One makes it possible for opponents to have patents overturned after they have been issued, provided they can show that the patents should not have been granted either because they did not represent any real advance or because the ideas they embodied were obvious.

But, while that creates an avenue for weeding out weak patents, it relies on the public to police the system, says David Martin, chairman of M-Cam, a patent licensing company. It does nothing to make sure only high-quality patents are issued in the first place.

A fee system under which the US Patent and Trademark Office collects maintenance fees on patents after they have been issued gives it an incentive to issue far more low-quality patents than it should, he says.

The number of patent cases filed against multiple defendants jumped just before the act was passed

The act has also put an end to a favourite tactic of plaintiffs' attorneys in patent cases: naming multiple defendants when filing a single claim.

That approach made it cheap and easy to drag many companies into the same case, greatly increasing the payouts for litigants and leading to the filing of more cases.

The tactic has helped fuel the caseload of the federal court system in the Eastern District of Texas in particular, where juries have historically proved most sympathetic to plaintiffs in patent cases.

It is now only a matter of time before the Texas court returns to being a backwater of the US legal system, says Mr Martin.

That could take a number of years, however.

The number of patent cases filed against multiple defendants jumped in the weeks

before the act was passed, guaranteeing a steady caseload for some time to come, according to RPX, a patent licensing company.

With Congress having largely failed to address what critics argue are the weaknesses in the current system, any hope of deeper reform in patent practices now rests with the courts.

On that score, at least, companies that often find themselves on the receiving end of patent suits may have reason to hope.

The ability of plaintiffs to win injunctions that bar companies from shipping products found to infringe their patents – the most feared weapon in the patent trolls' arsenal – was limited by a recent Supreme Court ruling involving eBay and rival MercExchange.

A number of cases that are still in progress could also limit the scope of what is considered patentable in the first place, says Mark Lemley, a law professor at Stanford University.

This year, for instance, the Supreme Court ordered a US appeals court to reconsider its decision that Myriad Genetics should have been able to patent two genes thought to have a bearing on breast and ovarian cancer.

Yet, even if the courts weed out some of the perceived abuses in the US patent system, the rich American companies that most often get hit by patent claims may soon have other reasons to worry.

A recent patenting boom in China has led to many of the same weaknesses seen before in the US, with patents too often issued on ideas that are not truly original, says M-Cam's Mr Martin.

Western companies that have complained for years about the theft of intellectual property in China could soon find the boot on the other foot, should the country's courts one day be asked to uphold these rights against importers seeking to break into one of the world's most enticing markets.

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