

ENGINEERING THE FUTURE

FINANCIAL TIMES SPECIAL REPORT | Friday May 20 2011

www.ft.com/engineering-future-may2011 | twitter.com/ftreports

Patent proof of rising innovation

Asia has made strides, but progress is uneven in the campaign to protect inventions, writes **Clive Cookson**

Patents are back in fashion. The World Intellectual Property Organisation (Wipo) and the European and US patent offices all reported a big increase in applications in 2010, after a decline in 2009 related to the economic downturn, and they expect to receive another record number of filings this year.

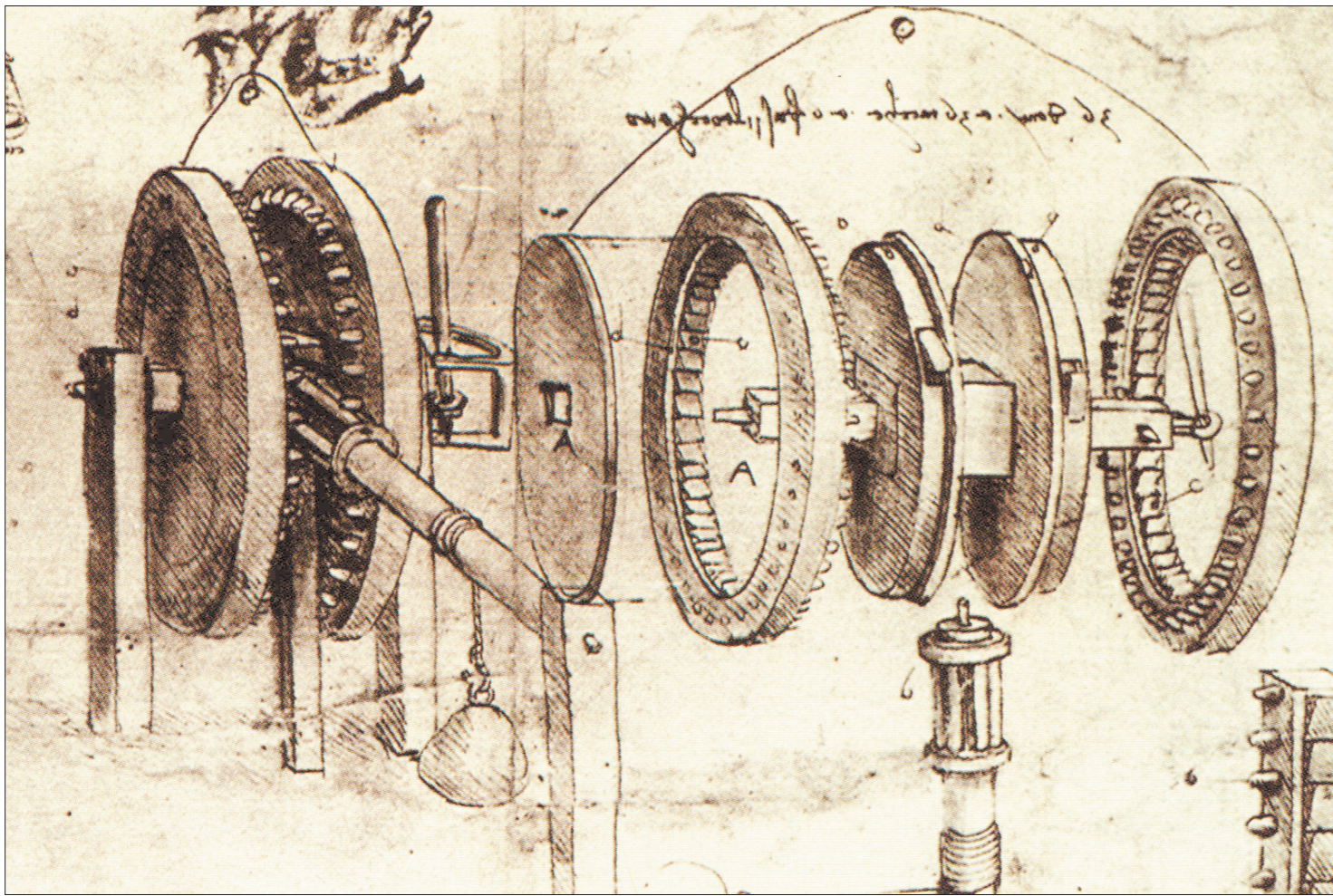
The growth should be good news for the long-term future of the global economy, given the vital role that patents play in industrial innovation – handing inventors the incentive to commercialise a product or process, by granting a 20-year monopoly in exchange for full disclosure of the invention's technical details.

But the increase in patent activity is far from evenly distributed around the world. No one who has followed the extraordinary rise in research and development spending in Asia recently will be surprised to learn that the most spectacular growth in patenting is taking place there, too.

The total volume of applications under the international Patent Co-operation Treaty rose 5.7 per cent in 2010 to reach 164,300, says Wipo, but those originating in China and India increased by 55.6 per cent and 36.6 per cent respectively.

Indeed, Asia became the biggest filing region for the first time, followed by North America and then Europe.

Historians place the origins of modern patents in 15th-century Italy, and patent laws in some form were introduced through-



Wheels of invention: modern patents have their origins in the Italy of Leonardo da Vinci

out Renaissance Europe. An internationally co-ordinated patent system began to emerge in the late 19th century.

The key moment, according to Wipo, came in 1873, when foreign exhibitors refused to attend the International Exhibition of Inventions in Vienna because they were afraid their ideas would be stolen and exploited commercially in other countries.

Subsequent negotiations led to the Paris Convention for the Protection of Industrial Prop-

erty, which came into force in 1884 to give protection beyond the country where an invention was originally patented.

Although the Paris Convention still provides the bedrock of cross-border protection and mutual recognition of patents, it has been supplemented over the past century by several other international agreements.

Most important was the establishment in the 1970s of Wipo under the auspices of the United Nations in Geneva, followed by

the Patent Co-operation Treaty, which provides a more systematic way to obtain international protection than the old Paris Convention, with less duplication of effort.

Meanwhile, also in the 1970s, Europe took a big step towards regional unification of patents through the creation of the European Patent Office in Munich. But the dreams of the EPO's founders that this would lead to a single European patent remain tantalisingly unfulfilled.

As Benoit Battistelli, EPO president, says, "a patent holder choosing to have Europe-wide protection ends up with a bundle of 40 European patents covering territories speaking 29 languages and subject to 40 court jurisdictions. . . It is much more difficult and costly for European entities to protect their innovations in their home market than for their main competitors."

The long drive to introduce a single European Union patent suffered two new setbacks this

year. First, Italy and Spain restated their political opposition to the language rules for the proposed unitary EU patent, which they said would unfairly favour English, French and German.

Then, more fundamentally, the European Court of Justice said an essential ingredient in the unitary system – enabling a new European Patent Court instead of national courts to rule on the validity of European patents – was incompatible with existing EU law.

But Mr Battistelli refuses to be discouraged. "I see the glass as half-full, not half-empty," he says. "I am still optimistic that it will be possible to introduce the unitary patent by the end of this year."

This could be a momentous year in the US too. The long process of reforming the American patent system and bringing it more into line with the rest of the world is expected to come to fruition, with Congress poised to pass legislation with support from both political parties and the Obama administration.

The Patent Reform Act of 2011 would simplify and streamline the US system in many ways.

Most importantly for international harmonisation, it would replace the current "first to invent" rule with the "first to file" criterion used in the rest of the world. The date of filing is far more clear-cut than the date of invention, which may be hard to pin down when there are competing claims.

However, even without big set-piece advances such as the US reform legislation, technical progress to harmonise the international patent system and make life easier for inventors is going well.

Continued on Page 3

Inside this issue

European Inventor Awards

The awards (SME category) winner Jens Dall Bentzen is pictured, (above) are a riposte to those who regard the creation and protection of intellectual property as boring



Award winners Fate has smiled on dental innovator Per-Ingvar Brånemark; gene pioneer Christine Van Broeckhoven has had to fight her corner; Ashok Gadgil and Vikas Garud are bringing clean water to the world's poorest; Ann Lambrechts gives concrete a makeover

Clean tech patents

A new way to search for patents will help policy-makers choose the best ideas

Page 3

China Beijing is looking to the nation to roll up its sleeves and surpass the west on innovation

Page 4

US Little seems to stand in the way of the most significant patents overhaul since 1952

Page 4

Europe

The EPO (Benoit Battistelli, president, right) has linked with Google to iron out translation issues

Page 4



EUROPEAN INVENTOR AWARD 2011

THE EUROPEAN PATENT OFFICE CONGRATULATES THIS YEAR'S WINNERS



FIVE INVENTORS HONORED WITH THE EUROPEAN INVENTOR AWARD

Innovation is the motor of economic growth enabling prosperity and jobs. As a result of technological progress our quality of life continues to improve. The faces behind these developments are women and men who have managed to convert an idea, an invention or a concept into technical results with an industrial application.

The European Patent Office protects such results with patents. This year, once again, we honor amongst thousands of inventors five exceptionally intelligent and creative individuals with the European Inventor Award.

With the European Inventor Award we recognize those who secure our future and not too seldom dedicate their entire life's work to improving the daily lives of others.

THIS YEAR'S WINNERS

- 1 Ashok Gadgil (not shown: Vikas Garud)** UV water disinfection device
- 2 Ann Lambrechts** Steel wire element to improve strength and stability of concrete
- 3 Jens Dall Bentzen** Highly efficient biomass furnace
- 4 Christine Van Broeckhoven** Contributions to neuropathological medicine, particularly Alzheimer's
- 5 Per-Ingvar Brånemark** Titanium fixture and anchoring device for implants



WWW.EPO.ORG

In co-operation with



Engineering the Future | European Inventor Awards

Developments that make a difference

Background

Clive Cookson sets the scene as this year's five winners are announced

The European Inventor Awards are a very visible riposte to those who regard the creation and protection of intellectual property as a boring, specialist activity of little interest to the general public.

Established by the European Patent Office in 2006, they aim to "give a face" to patents by honouring individual innovators with a prestigious prize, while raising awareness of the role of patents in promoting economic, social and technological progress.

The 15 finalists and five winners this year highlight a range of appealing developments that have made a difference to the lives of people around the world – and in the process made money for their inventors.

The winning innovations, announced in Budapest, Hungary, yesterday involve strengthening concrete (in the industry category), burning biofuels (SMEs), identifying Alzheimer's genes (research), implanting teeth (lifetime achievement) and disinfecting water (non-European). Four are profiled in separate articles below.

The awards attracted 170 entries this year, proposed both by members of the public and by specialist patent examiners at the EPO and national patent offices. These were whittled down on the basis of legal and technical criteria to a longlist of 30 entries that was put to a high-profile international jury headed by Jerzy Buzek, president of the European Parliament and former prime minister of Poland.

The selection process included a thorough economic analysis of each proposal by Technopolis, a European research consultancy. Most of the entries rely on small groups of pat-



Jens Dall Bentzen won the SME category of this year's awards for his biomass furnaces

ents, typically filed between five and 15 years ago, so that a long enough period has elapsed to judge their commercial potential.

For example, Jens Dall Bentzen, the Danish engineer who won the SME category of this year's awards, has applied since 2000 for five patents for biomass furnaces that greatly extend the range of fuels that can be burnt, while reducing associated pollution and increasing energy efficiency.

In particular his power plant can

burn biomass containing up to 60 per cent moisture, without having to dry it out first.

Having run a successful 2MW pilot plant, Mr Bentzen's company Dall Energy has completed this month an 8MW plant to demonstrate the technology on a commercial scale, for Bogense District Heating Company on the island of Funen, Denmark. Market analysis suggests a total demand in Europe for 275 such plants per year, with a total value of €370m.

As the Technopolis analysis points out, Mr Bentzen stands out in the biomass furnace industry, where the level of patenting and innovation is generally low. He gives several reasons for patenting. Besides the universal function of patents in protecting inventions and keeping competitors at a distance, they are a valuable part of a branding strategy, to indicate an innovative business to potential customers, and they help persuade investors to fund a new company.

Most other shortlisted and winning inventors have broadly similar tales to tell, even if they work in quite different industries – though of course those in the lifetime achievement category have a much longer record.

Per-Ingvar Brånemark, the winner, filed his first patent for titanium-based dental implants in 1968, nine years before EPO came into existence. Since then he has generated 57 patent "families" (patents based on the same invention but applied for in different

Bringing clean water to the world's poorest people

Non-European award Ashok Gadgil

What Ashok Gadgil learnt when working on a low-cost water purification device is that successful innovation is about more than science and technology – particularly when designing products for some of the world's poorest people.

"It requires going outside your comfort zone and area of expertise, and takes a lot of collaboration," says Mr Gadgil, director of the environmental energy technologies division at the Lawrence Berkeley National Laboratory, California. Mr Gadgil, who also teaches at University of California, Berkeley, has developed – with the help of Vikas Garud, a

colleague in India – a low-cost device that destroys infectious agents in water that cause cholera, typhoid, gastroenteritis and dysentery.

Water purification was not originally Mr Gadgil's area of expertise, although he had been gathering data about use of light for disinfection for some years. Then in 1993, a disastrous cholera epidemic broke out in India and spread to Bangladesh and Thailand. "Some 10,000 people died in one month," he says. "So this caused me to take note."

The purification technique he developed works in a way that is relatively simple. Ultraviolet light of a particular wavelength transmits easily through water and is readily absorbed by DNA. In the process, the DNA is modified, making the

organism non-viable.

"It's like a jammed zipper," explains Mr Gadgil. "DNA has two strands and [these] have to be unzipped for replication. If they get jammed, the organisms can't multiply and so are unable to cause disease."

Ultraviolet light purification systems did exist. However, these were expensive because they required complex pumping systems and, since they were used underwater, needed frequent cleaning.

Instead Dr Gadgil and Dr Garud designed a lamp that is placed above water tanks. The system uses gravity and hydraulics to generate a pump-free flow of water, making it extremely energy-efficient – a 40W ultraviolet light bulb can disinfect 1,000 litres of water per hour.

Its low energy consumption means that, with the aid of a car battery or solar panel, it is suitable for communities without access to grid power.

And compared with traditional purification methods, the system uses a tiny amount of energy. "When you boil water, you have to raise the temperature of all the water and most of the molecules are harmless," says Mr Gadgil. "Here, you use extremely small amounts of energy because all you're destroying is the DNA."

However, Dr Gadgil admits he made mistakes before getting the technology right. Initially, for example, the units were extremely large, made of stainless steel and designed to handle a flow of up to 50 litres per minute. "My colleague

teased me, calling it a stainless steel coffin, because it was about that size," he says.

When the team tested it in Uttar Pradesh, India, the feedback was that people wanted something much smaller, lighter, more compact and cheaper. "That was one of the lessons for me," says Dr Gadgil. "You have to pay attention to what users want."

The device now weighs just 15lb and, after WaterHealth International licensed the technology, Dr Gadgil and Dr Garud helped the India-based company refine the product for use in developing countries.

By 2010, the systems were bringing affordable clean water to more than 2m people in more than 10 countries.

Sarah Murray

Concrete gets a wiry makeover

Industry Ann Lambrechts

For the most used man-made product on earth, concrete commands a low profile among the world's inventive elite.

Discovering innovative solutions on how to improve the grey building material lacks the allure of medical science or the possible riches of technology. It sits, instead, in the pantheon of essential but unglamorous everyday products.

"Concrete is everywhere and we are talking about reinforcing it in a more efficient way," says Ann Lambrechts, a nominee for this year's Engineering the Future awards.

Ms Lambrechts' innovative steel fibres are used to boost the tensile strength of concrete structures and are, pound for pound, 32 per cent stronger than the traditional construction method of using steel mesh or reinforcing bars, or rebars.

The pieces of wire, 55mm in length, are slightly hooked at the ends and flattened in the middle. The unusual shape means that when the concrete sets it is anchored to each individual piece of wire, strengthening the core and giving more resistance to movement than rebars or mesh.

This change in design has opened up possibilities for using concrete in a new kind of architecture, where large-scale buildings with intricate designs can be fashioned from the rigid material, where in the past steel, or another easy-to-manipulate material, would be used. China Central Television's headquarters, the 44-storey, 234m skyscraper, was

constructed using Ms Lambrechts' steel wire elements.

The building was made from six horizontal and vertical sections that form a continuous loop covering 473,000 sq m of floor space. The structure, which locals have said resembles a large pair of boxer shorts, was possible only because of the high tensile strength that Ms Lambrechts' steel elements gave the concrete.

However, as well as enabling high-profile buildings, the steel wires have also become a feature of mass-market concrete use.

"You need to develop a market gradually but now the steel fibres are used in one in every three concrete floors in Europe," Ms Lambrechts says.

When she first came up with the idea for the hooked and flattened wires in 1998, Ms Lambrechts and her team at Bekaert, the Belgian building materials group, used X-ray machines to observe how the wires and concrete reacted under different stresses.

Ms Lambrechts adds that the idea of using fibres to give added strength to a wet building material can be traced back as far as the 19th century, when builders began using horsehair to strengthen plaster.

The move to use smaller wires in the concrete mix, rather than mesh and rebars, has also improved on-site safety for builders.

The wires can be poured into the wet concrete and the mix is then sprayed by robots into foundation piles, tunnel walls and floors.

In dismantling old buildings, the wires are also easier to salvage from crushed concrete than meshes and reinforcing bars.

Ed Hammond

Fate smiled on dental innovator

Lifetime achievement Per-Ingvar Brånemark

Millions of patients around the world have benefited from the scientific breakthroughs made by Per-Ingvar Brånemark, the Swedish orthopaedic surgeon.

Yet his innovations in the field of dental implants and prosthetic technology might never have happened without a twist of fate when applying for university.

Mr Brånemark put his name forward for undergraduate courses in medicine and engineering with no clear idea which field he would rather pursue.

The medical school at Lund University was first to respond with a firm offer and that was enough for Mr Brånemark to commit his future to medical science. "If the engineering department had been quicker I would probably have become an engineer," he says.

Instead, Mr Brånemark went on to become a pioneer in the development of titanium implants that can be permanently anchored in human bone – overcoming the body's usual rejection of foreign objects.

His work has paved the way for dental implants to replace damaged teeth – transforming the lives of patients who would previously have required removable dentures – and a range of bone-anchored prosthetic applications.

"I started looking into micro circulation in bone tissue and bone marrow to understand what happens inside a bone when you drill into it," he recalls. "My feeling was that you have to treat bone not as a piece of wood but as a living part of the human being."

Andrew Ward

His scientific discoveries were commercialised by a company called Nobelpharma, now Nobel Biocare, which today commands about 35 per cent of the global dental implant market.

Mr Brånemark has spent the past three decades working with surgeons in more than 100 hospitals around the world promoting his techniques.

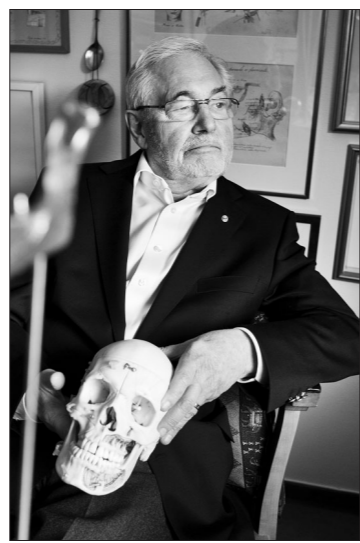
Now 82, he is no longer as active in the surgery room but continues developing his ideas, together with his son, Rickard, who is focused on advancing the use of titanium fixtures in prosthetic arms and legs.

Mr Brånemark highlights the case of a Finnish student who had two artificial limbs fused into her femur bones after losing her legs in a collision with a tram. The technology has allowed her to resume an almost normal life and to feel some of the sensations of walking – such as the different feelings of a soft carpet and a hard floor.

Looking back over his career, Mr Brånemark says his most important quality has been patience. It took 10 years from the first use of his technique on a human dental patient in 1965 to build enough evidence to publish his findings.

One of the biggest challenges, he says, has been persuading surgeons to ditch what he calls the aggressive "saw bone" style of some orthopaedic surgeons in favour of a more sensitive approach to bone tissue.

But his main advice applies equally to all medical scientists: never lose sight of how much is still not understood about the human body. "We should never start believing we know better than mother nature," he says. "We need to have some humility."



Clockwise from left: Per-Ingvar Brånemark (Lifetime achievement); Christine Van Broeckhoven (Research); Ann Lambrechts (Industry) and Ashok Gadgil (Non-European countries)



Gene pioneer who had to fight corner for her sex

Research Christine Van Broeckhoven

Christine Van Broeckhoven has dabbled in business and politics, but always for short periods in the service of her long-term passion and greatest contribution: scientific research.

A pioneer in genetics, she has received a number of European patents for her work on neurodegenerative brain diseases including Alzheimer's, some of which have been taken up by pharmaceutical companies seeking to develop innovative medicines in an important but frustratingly slow-moving field.

Ms Van Broeckhoven, director of the department of molecular genetics at the University of Antwerp, part of VIB, the Flanders-based life sciences research institution, studied for a doctorate in molecular biology. She was initially interested in metabolic diseases, but breakthroughs in the early 1980s in genetics and the link with neurology motivated her to switch tack. "It was a pioneering time," she recalls. "Instruments were becoming available to manipulate DNA in a test tube, and work began on examining genetic markers in humans. People then were convinced that senility was just due to the ageing process. There was no belief in Alzheimer's as a disease."

Studying parallels between

patients with Down's syndrome and Alzheimer's, she focused on chromosome 21, identifying a mutation causing proteins to aggregate in the brain tissue; and then highlighting the importance of progranulin as a common gene causing neurodegeneration.

Looking back on her career, during which she has accumulated awards including the American Academy of Neurology's Potamkin Prize, she recognises the challenge for women in science. "It was considered a male thing. I was protected in the beginning because I didn't realise that. I wanted to study, and was supported by my parents."

"Only later when I was confronted by science policy did I realise that I had to fight. But I'm a very good fighter. I

run a very family-friendly environment with a lot of flexibility."

She was briefly a member of the Belgian parliament, agreeing so that she could work on "the greying of society", drawing up a dementia plan. Having achieved her policy and learnt how to lobby ministers – "you have to give them something they can use directly for their own benefit to be re-elected" – she returned to research.

She has also worked for two pharmaceutical companies over the years, with mixed feelings. "I was surprised that everything went so slowly, with so much bureaucracy. It was a bit of a disappointment, although it was a pioneering time in genetics when companies were investing

before could they understand and estimate the benefits."

Ms Van Broeckhoven recognises the importance of patents to incentivise corporate research, while stressing the importance of limiting commercial secrecy to stimulate academics to co-operate fully. She remains cautious on the rapid emergence of Alzheimer's drugs, with recent clinical-trial disappointments.

"You can feel companies are reducing their investments," she says. "There is a feeling – not completely incorrect – that the neurodegenerative process is too complicated for us to understand. There is not enough investment in trying to understand a normal brain."

Andrew Jack

Information helps clear the air on renewables policy

Clean technologies

Patent classification will help politicians make right choices, says Sarah Murray

By 2050, renewables could meet almost 80 per cent of global energy demand, if supported by appropriate public policies, said the Intergovernmental Panel on Climate Change in a report released last month.

To design those policies, however, policymakers need access to relevant information on clean technology innovations. The launch of a new classification scheme for clean-tech patents therefore represents a big step forward.

Until the launch of the classification scheme – which facilitates online searches of patents databases – global climate change debates were hampered by a serious obstacle: the inability to distinguish clean-tech innovations from the millions of patents being filed every year.

“For us the question was whether it would be possible to produce data to inform the political negotiation process so we can concentrate on the real problems,” says Konstantinos Karachalios, public policy specialist at the European Patents Office and leader of the EPO’s work on the database. “If you talk about smart grids, for instance, what is a smart grid? And

what are the technologies that are patented within this context?”

Until the launch of the classification, such questions were impossible to answer. “Part of the problem was that, as these patents were recorded, they weren’t tagged in terminology that was relevant from a clean-energy perspective,” explains Benjamin Simmons, head of the trade, policy and planning unit in the economics and trade branch of the UN Environment Programme (UNEP).

Traditionally, says Mr Simmons, tracking down all the patents filed for a particular technology in the clean-tech field would have taken a specialised lawyer six to nine months. “Now someone can conduct the search in a matter of minutes,” he says.

The database was developed as part of a joint research project conducted by the EPO, the UNEP and the International Centre for Trade and Sustainable Development. It resulted in the report “Patents and clean energy: bridging the gap between evidence and policy”.

With intellectual property rights recently emerging as a particularly contentious issue in climate change debates (some countries argue that related technologies should be royalty-free since they are in the public good), the report set out to look at the role of patents in the transfer of climate change mitigation technologies.

It found that after the

signing of the Kyoto protocol in 1997, there was a surge of patenting of renewable energy inventions. “The political decisions that create frameworks that enable long-term investment make a huge difference,” says Mr Karachalios.

Governments have certainly recognised the importance of supporting the patent filing process. As part of the US government’s stimulus package, for example, the commerce department’s patent and trademark office introduced a pilot programme to accelerate the review of “green” technology patent applications. And in the UK, the government recently introduced a preferential rate on income from patents.

“There are various policies that governments use



Turning power: after the signing of the Kyoto protocol in 1997, there was a surge in renewable energy patents

Charlie Bibby

but where governments have got into difficulty is in which [clean technologies] to back and whether any of them lead to actual payback,” says Jonathan Johns, director of Climate Change Matters, a UK-based consultancy.

Mr Johns argues that the filing of patents is only one part of the process of promoting technologies that contribute to a low-carbon economy. “Yes, a lot of universities in the west are

researching into clean tech and lots of patents are being granted,” he says. “But the big issue is how to get the flow of capital to take those ideas to prototype, then to demonstration and then to commercialisation.”

A further issue, particularly for developing countries, is how easy it is to obtain licences for new technologies and how much they cost. The report found that there was surprisingly

little resistance to licensing. Some 70 per cent of respondents said they would be prepared to be more flexible when licensing to developing countries with limited ability to pay high prices.

Yet the report found that willingness to out-license was not reflected in actual volumes of licensing. Other barriers emerged, such as transaction costs, the difficulty of identifying a suitable partner and lack of sci-

entific capacity to develop the technologies.

Mr Karachalios argues that, without readily available, searchable information, policymakers cannot make decisions on where to invest to address these barriers.

“Governments need to know worldwide who is developing these technologies, what national entities are developing these technologies, where are the corporations, where there may

be bottlenecks, where they could export technologies,” he says.

“All these questions are very important.”

And while the new classification means it is now easier to identify clean-tech patents, this does not mean it is possible to tell which of those patents have been developed and are making it to market. This, says Mr Simmons, is the next step in filling the information gap.

Patent proof of rising innovation

Continued from Page 1

For example the so-called IP5 group – representing the European, US, Japanese, Chinese and Korean intellectual property offices, which handle 90 per cent of the world’s patents – is running 10 projects to reconcile their procedures, from the way patents are classified to the format required for applications.

All this is likely to drive further increases in patenting. But, as Mr Battistelli says, an efficient and growing patent system “is not a goal in itself, it is an economic tool to promote innovation”. That requires pat-

input, rather than the output.”

The real value of patents lies in the extent to which a company can commercialise them to develop new business. At worst, Mr Zentner says, “patenting can be a time-wasting distraction and a hurdle to business success.”

Sometimes a company sees trade secrecy as an alternative to patenting. But Mr Battistelli says this may be misguided. “It is as complicated to organise secrecy as to apply for a patent,” he says. “In fact, it can be more difficult to enforce secrecy right through the company, its suppliers and contacts, than to patent.”

Ideological opposition to the patent system seems to be declining, although many people still believe the scope of patents is too broad. The most contentious area is in the life sciences, as to whether biological constructs such as genes, life forms and stem cells can be patented. In general, Europe has taken a more restrictive line on such questions than the US.

For Mr Battistelli, however, the most important issue is “patent quality” – making sure that patents meet all the legal criteria, such as inventiveness, before they are granted.

Only 42 per cent of applicants to EPO end up with valid patents (and in biotechnology the granting rate is just 28 per cent).

If the world’s patent offices can ensure quality, growth in activity is almost guaranteed.



Intellectual property is a means to an end: business growth, says Larry Zentner

ent offices to do more work disseminating the technological information contained in applications.

Equally, for the inventor, obtaining a patent is just the start of the exploitation process. Patents are sometimes treated by analysts of the innovation process as an “output” of research and development spending – the industrial equivalent of the scientific papers and citations produced by academic researchers.

“Intellectual property is a means to an end: business growth,” says Larry Zentner, founding director of Inzenka, the UK-based management consultancy.

“In other words, it is an

ADVERTISEMENT

The mobility of tomorrow: With electric cars you can drive CO₂-free, store green electricity and sell any surplus back to the power grid

SERIES Part 3: The challenge of transportation

In an age of increasing mobility, megacities need fast, environmentally friendly public transport systems. The relevant technologies are already in use.

Moving on

Heavily laden carts edging their way through narrow, bumpy alleyways, merchants advertising their wares by the roadside, throngs of people everywhere. In the year 45 BC, Rome was the first city in the world to have almost one million inhabitants and certainly the first to struggle with the effects of a growing metropolis. Something had to change, thought Julius Caesar, the then ruler of Rome, and imposed the strictest traffic rules that had ever existed, prohibiting the transport of goods by cart in the city center from sunrise till late afternoon.

Passenger traffic is growing by 1.6 percent per year Foresighted, modern and visionary – almost 2050 years later, the decision-makers in megacities are taking similar action to keep traffic on the right track. Be it car-free cities, environmental zone stickers or the introduction of toll systems for city centers as in London or Milan – the aim of creative traffic rules is to eliminate the chronic congestion in the lifelines of major cities and to reduce environmental damage. After all, traffic is responsible for around 16 percent of greenhouse gas emissions. And experts expect passenger traffic to grow by around 1.6 percent per year worldwide in the period up until 2030.

This development is not only having negative effects on the population’s quality of life and the environment. If the streets and railway tracks are congested, the cities’ competitiveness suffers too. The Confederation of British Industry (CBI) estimates that the cost of traffic congestion in Great Britain is USD 32 billion per year, while in the U.S. it is a staggering USD 87 billion. This explains why the biggest infrastructural challenge that industrial and developing countries face is expanding the transportation system.

London, the city with the most congestion in Europe, has been countering the threat of gridlock for many years with cutting-edge technologies: in 2003, the megacity introduced a congestion charge. On average, 21 percent fewer vehicles drive into the city center and traffic jams have been reduced by 26 percent. In addition, the city relies on an intelligent traffic management system by Siemens that keeps a check on the bus network. Every day, the city’s buses transport around six million passengers on over 700 routes – about twice as many as the Tube.

Innovative energy-saving technologies

Timetables that are always up-to-date, buses that leave on time and subways that depart at frequent intervals create incentives for people to switch from cars to local public transportation, thereby improving the city’s carbon footprint. The full potential of this effect can only be achieved if the subways and buses themselves are as environmentally friendly as possible. The relevant technologies are already in use: since 2008, the diesel drives of the double-decker buses have been enhanced with an electric motor that makes use of the braking energy. The long term aim is to replace the drives of all 8,000 conventional buses with this Siemens innovation, which is already being used in countries such as Brazil, China and the U.S. As a result, emissions have been cut by 40 percent and fuel consumption by 30 percent. Another prime example of efficiency is the Oslo Metro, which runs on 30 percent less energy than its predecessors and can be almost completely recycled at the end of its service life.

Long-distance travel can also be comfortable and environmentally friendly. The Velaro gets from Moscow to St. Petersburg in three-and-a-half hours and from Barcelona to Madrid in two-and-a-half, using the equivalent of a minimal 0.33 liters of fuel for every 100 km, calculated on a per-seat basis. For distances of up to 800 miles, this exceptional Siemens train clearly takes the lead over the plane and the car. Even though many commuters would switch from cars to buses or trains if the fares were at-

tractive enough, the goal is to make everyone’s favorite mode of transport more environmentally friendly, too. The solution comes from the socket: electric cars do not emit any exhaust fumes and their engines use energy about three times more efficiently than gasoline cars. In addition, they could become an important piece of the puzzle in the new era of electricity.

The electric car as a moving storage battery

The idea is as follows: environmentally friendly electricity is stored in the car’s batteries and returned to the power grid at a profit when demand is higher – the car thus becomes a moving storage battery. It is a win-win situation: The money helps the user finance the cost of the batteries, and the supply of electricity from the power grids, which is affected by the fluctuating input of wind and solar power, is more stable. Siemens covers every aspect of the process: from the drive mechanisms to quick-charge technologies and expansion of the intelligent power grids.

Switching to electric cars pays off: The European Commission is planning to halve the number of conventionally-fueled vehicles in inner cities by 2030. Electrifying the number one means of transport has thus long become an important issue, not only for environmentalists and industry.

FOR MORE INFORMATION SEE: SIEMENS.COM/COMPLETEMOBILITY



London’s red landmark: Cuts emissions by 40 percent and uses 30 percent less fuel with Siemens technology

Siemens series “The Ideal City”

TRAFFIC IS JUST one of the many challenges confronting megacities. CO₂-neutral power generation using renewable energy sources and an intelligent electricity mix is one of the main requirements for making cities more livable. However, buildings are also in need of attention: they currently account for around 40 percent of the total energy consumption and almost 20 percent of all greenhouse gas emissions. This five-part Siemens series also addresses another topic affecting everyone in the world: health care in an aging society.

Contributors

Clive Cookson
Science Editor

David Gelles
US Media and Marketing
Correspondent

Ed Hammond
UK Companies
Reporter

Kathrin Hille
Beijing Correspondent

Andrew Jack
Pharmaceuticals
Correspondent

James Politi
US Economic and
Trade Correspondent

Nikki Tait
Brussels Correspondent

Andrew Ward
Nordic Bureau Chief

Sarah Murray
FT Contributor

Andrew Baxter
Commissioning Editor

Steven Bird
Designer

Andy Mears
Picture Editor

For advertising, contact:
Liam Sweeney
Phone +44 020 7873 4148,
e-mail liam.sweeney@ft.com

Engineering the Future

Beijing looks to nation to roll up sleeves and surpass west

China

Arm-twisting of foreign companies masks big push for innovation, says Kathrin Hille

When Chinese and US officials met for their twice-a-year Strategic and Economic Dialogue in Washington last week, innovation was high on the agenda. Under pressure from US businesses, Beijing had to promise it would no longer allow policies on innovation to discriminate against foreign companies.

The way China treats intellectual property rights and their creation has

become one of the most contentious issues in Beijing's international trade relations. A wide-ranging policy programme with the catchphrase "indigenous innovation" was launched in 2006, and with it Beijing intends to catapult the country, long seen as just a base for low-cost manufacturing, into a new era.

If Beijing's vision comes true, the economy will be driven by technology-intensive industries, and Chinese companies will receive, rather than pay, patent and trademark royalties.

In a report for the US Chamber of Commerce published last year, James McGregor of Apco World-wide, the lobbying firm, called Beijing's plans "an all-hands-on-deck call to action for the Chinese

nation to roll up its sleeves and complete the mission of catching up and even surpassing the west in science and technology that began 200 years ago, when foreigners with modern weaponry and transportation technology came calling".

One way the Chinese government has tried is making ownership of local patents and brands a precondition for access to public contracts, triggering an outcry from foreign rivals against protectionism.

The government is also pressing foreign companies to set up joint ventures with local, often state-owned, enterprises. Under this scheme they must share or release proprietary technology as a precondition for wider market access – a pattern that has

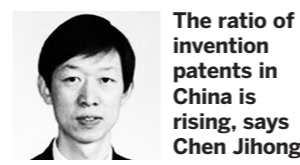
appeared in the rail sector, in nuclear power plants, the wind turbine sector and commercial aviation.

But the controversy over these arm-twisting techniques has sometimes overshadowed the fact that China has been going in leaps and bounds to becoming an innovator: at least that is what the numbers say.

China became the fourth-largest filer of patents at the World Intellectual Property Office last year. More than 1.2m patents were filed in China last year, ahead of Japan and second only to the US, which it is forecast to overtake this year. Since 2005, China has been surpassing Europe and South Korea with the numbers of patents filed.

Basic patents – those filed

first in a country as opposed to those that have been filed elsewhere before – are normally a good indicator for the strength of domestic innovation activity because local companies tend to file in their home market first.



The ratio of invention patents in China is rising, says Chen Jihong

In China, basic patents accounted for an average 38 per cent of total patents between 2003 and 2009, a much smaller ratio than the 52 per cent seen in Japan or the 46 per cent seen in the US and South Korea. Patent experts say the strong pres-

ence of foreign-controlled manufacturing in China explains this.

However, the picture is changing. China was the only leading patent application region that saw the proportion of basic patents rise, from 32.7 per cent in 2003 to 43.3 per cent in 2009, says Thomson Reuters.

Not all the growth, however, is a direct result of increased innovation. In line with Beijing's aggressive "indigenous innovation" plans, many local governments have been offering to pay companies' patent registration fees, greatly lowering the threshold for filing.

An additional incentive for more patents comes from China's patent system: It allows for registration of utility models, patents for

new technical solutions that have to do with the structure or external appearance of a product. Different from invention patents, these patents will not be scrutinised very closely, and filing fees are much lower.

"This has greatly impacted the quality of patents filed in China today," says a European Commission official specialising in Chinese patenting trends.

But in the development of China's innovation culture, utility models have their rightful place, local experts say. "Typically, the adoption of 'petty patents' such as utility models and designs is mainly based on the intention to encourage gradual innovation, which is often very important for the domestic applicants in

developing countries," says Zheng Liang, a research fellow of the China Institute for Science and Technology Policy, in a recent paper.

There are also signs that the quality problems might be receding. Until 2008, the majority of utility models in China were registered by individuals, seen as a signal of lower technology content. But that has since changed, with companies accounting for 60 per cent of utility model applications last year.

"Up to five years ago, you would have a lot of 'rubbish patents' filed in China, but now the ratio of invention patents is rising, and the extent of innovation is increasing too," says Chen Jihong, an intellectual property lawyer at Zhong Lun law firm.

Officials push ahead on single EU regime

European patents

Language poses hurdle to bloc-wide reform, writes Nikki Tait

Top European Union officials were subdued last month when they finally unveiled the draft rules that will create a single EU patent.

At face value, this should have been a cause for celebration. The idea that companies or inventors should, in one fell swoop, be able to get patent protection across Europe, rather than apply for such protection in each country separately, has been a goal for decades. It would mean substantial cost savings for companies large and small, and could help to bolster innovation in the EU bloc.

But there are problems. On the one hand, Italy and Spain are opposed to the latest proposals, claiming that the proposed language regime for the new EU patent unfairly focuses on English, French and German. This means that the legislation is being introduced via a cumbersome Brussels procedure known as "enhanced co-operation", and the single EU patent is likely to cover only 25 of the 27 EU countries.

On the other, there is the potentially bigger problem of a ruling from the European Union's top court, which earlier this year stymied moves to create a more unified litigation system for hearing and ruling on patent disputes in Europe.

Without that, holders of a single EU patent could be exposed to separate country-by-country litigation in all the national jurisdictions the new IP right covers.

So until this is sorted out, many lawyers think the commercial appeal of the single EU patent will be limited.

"The introduction of a European patents court is seen by many as an essential ingredient to the introduction of a unitary European patent," says Alasdair Poore, president of the Chartered Institute of Patent Attorneys and partner at the Mills & Reeve law firm.

"In the absence of a single well-respected court, businesses might find that their patent protection had been invalidated by a national court with almost no experience of patents. Will they therefore be willing to risk all the their investment in Europe depending on such a decision?"

But these obstacles notwithstanding, EU officials are still pushing ahead with the creation of the single EU patent. The draft rules could be formally approved during 2011 and will allow businesses and inventors to apply at the European Patent Office for unitary patent protection covering at least 25 countries.

Under the new system, patent applications can be made in any language. However, the EPO will continue to focus on its three existing official languages of English, French and German.

So if an application is made in a non-official language – Estonian, say – a translation will have to be done into one of the official languages, although the cost will be compensated. Once the patent is granted, its core claims will then have to be translated into the other two official languages.

For a transitional period of up to 12 years, EU patents granted in French or German will need to be translated into English, and ones granted in English will also need to be translated into another official EPO language. But officials hope that high-quality machine translations (see article below) will steadily take over from the costly manual work. (Last year more than 60 per cent of all patent filings from businesses in the EU came from the UK, France or Germany – with the last leading the field by a large margin.)

All this, officials estimate, should mean that the new EU patents will be available for less than €2,500 (\$3,570), and eventually – as manual translation work diminishes – for well under €1,000.

That compares with about €32,000 at present if an inventor wants a basket of national patents covering all 27 EU countries, of which €23,000 comes from the necessary translation costs alone. (On top of this, there is also the burden of annual renewal fees in



Michel Barnier: aim is to make innovation cheaper and easier

AFF

each country where the patent has been validated).

By contrast, a patent covering all the US costs about €1,850 on average.

"The purpose of unitary patent protection is to make innovation cheaper and easier for businesses and inventors everywhere in Europe," says Michel Barnier, EU internal market commissioner. "It

EU officials privately hope Italy, at least, may eventually join the new proposed arrangements

is my deeply held conviction there is no sustainable economic growth without innovation – and no innovation without efficient intellectual property protection."

EU officials privately hope Italy, at least, may eventually join the new proposed arrangements.

It is, after all, a country with a significant industrial base, and firms there could be disadvan-

taged if they have the added cost of having to seek separate protection in their domestic market as well as protection elsewhere in the EU through the new EU patent.

But Spanish disquiet over the proposed language and translation arrangements appears to be deep-rooted. In Brussels, its diplomats have threatened to bring a legal challenge in the EU courts against the use of the "enhanced co-operation" procedure – which is designed to allow a group of member states to proceed with certain measures even if all 27 do not join in.

Spain argues that, if the sole objective is cost savings, a regime based on English alone would be more appropriate. But if other languages are to be included, Spanish – which, officials point out, counts several hundred million speakers worldwide – should be included.

EU officials, in reply, stress that every effort has been made to persuade Spain and Italy to join, and that adjustments were introduced to make the regime more palata-

ble for non-official language countries. They are confident that all the requirements of the enhanced co-operation procedure have been complied with.

Their bigger legal headache is the European Court of Justice's March ruling on the proposed patent litigation reform. In this, the Luxembourg-based ECJ clearly stated that the creation of a European and Community Patent Court was not compatible with EU law – partly because, if the court erred, there would be no way of putting this right. In short, its creation would "alter the essential character of the powers conferred on the institutions of the EU and the member states, which are indispensable to the preservation of the very nature of EU law".

Back in Brussels, EU officials, determined to make the new single EU patent a practical reality as well as a legal one, insist they are actively looking at ways around this fundamental constitutional problem. But coming up with a solution may take some time.

Capitol Hill shows unity on innovation

US patent reform

Law to change to 'first-inventor-to-file' system, writes James Politi

With political tensions running high between Republicans and Democrats in recent months, particularly on fiscal and budgetary policy, few pieces of legislation have managed to make their way through the US Congress with bipartisan support.

But there is one notable exception: a new patent reform bill that represents – according to some – the most significant overhaul of the way inventions and inventors are treated in the US since 1952.

In March, the US Senate approved by an overwhelming 95 to 5 margin the America Invents Act, and the House of Representatives judiciary committee last month advanced a similar bill, also with a near-unanimous vote.

Now, little appears to stand in the way of it being agreed by the full House, and being enacted into law by President Barack Obama – who supports the bill – this year.

Patrick Leahy, the Democratic Vermont senator and chairman of the Senate judiciary committee and one of the architects of the legislation, has not hesitated to make grand statements about its importance, saying it would keep the US at the "pinnacle of innovation".

"American ingenuity and innovation have been a cornerstone of the American economy from the time Thomas Jefferson examined the first patent to today," Mr Leahy said in March, as the bill was nearing its final Senate vote.

"If we are to maintain our position at the forefront of the world's economy, if we are to continue to lead the globe in innovation and production, if we are to continue to enjoy the fruits of the most creative citizens, then we must have a patent system that produces high-quality patents, that limits counter-productive litigation over those patents, and that makes the entire system more streamlined and efficient," he added.

One of the cornerstones of the reform legislation is a switch away from the current "first-to-invent" system, in which the fate of a patent application is determined based on the date of invention. Replacing would be a "first-inventor-to-file" system, which is what most of the world uses, in which the filing date is the most important reference.

"Unlike the objective date of filing, the date someone invents something is often uncertain, and, when disputed, typically requires corroborating evidence," according to a Senate judiciary committee summary of the bill. "In the first-to-invent system, a lengthy and costly administrative proceeding must be conducted at the US Patent and Trademark Office (PTO) to determine who actually invented first," it added.

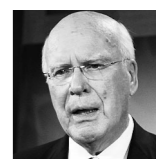
The new bill would also

change the way the PTO, which is under the umbrella of the commerce department, would be funded, turning it into a more independent agency. In a blog in March, David Kappos, director of patent office and undersecretary of commerce for intellectual property, said the legislation would allow it to set its fees and be essentially self-funded.

"By providing our agency with adequate resources, delays will be minimised and high-quality examinations will be completed in a shorter amount of time," Mr Kappos said. "This will help to clear the patent backlog and allow innovators to move ideas to the marketplace more quickly."

A third main element of the proposal would allow third parties to submit evidence – known as "prior art" – as an application is being processed, which proponents argue will help prevent bad patents from being awarded. In addition, the new law expands the system for challenging a patent's solidity within the patent office without resorting to going to court.

Given the broad bipartisan support that developed in support of the bill, it is not surprising that the largest companies in Silicon Valley and the US technology industry have been backing the legislation and are satisfied with the changes. "On the scale of 1 to 10, in terms of importance, this is an 11," says



Patrick Leahy: reform will keep the US at the 'pinnacle of innovation'

Dean Garfield, president of the Information Technology Industry Council, which represents the sector's giants, from Microsoft, Google and Cisco to Oracle, Ebay and Hewlett-Packard.

"An issue that has been lingering will now be resolved ... so we can focus on inventing," Mr Garfield adds. "The last thing you want is for the patent system to be creating a time delay between an idea and improving people's lives."

And yet the bill still has some opponents, and the primary objection has been that the reform could damage fledgling entrepreneurs and some universities. According to the National Small Business Association, the legislation "would put innovative small firms and start-up businesses at greater risk than the current system and would result in a US patent system strongly tilted in favour of large incumbent corporations".

But passage of patent reform seems to be inevitable at this point, even though some differences between the House and Senate version will still need to be ironed out. When he signs the bill, President Obama is likely to frame patent reform as a step towards the innovation agenda he sought to lay out in his January State of the Union address – one of many measures intended to make the US more competitive in the global economy.

Lost in translation Tie-up with Google offers hope for cheaper patent filing

While the pan-European patent offers myriad benefits for those who win protection, it may also put hurdles in the way of those seeking to apply for one.

In particular, for inventors seeking a pan-European patent, the onus will be on them to make sure similar work has not already been protected by others in other countries.

In an attempt to ease this cumbersome task, the European Patent Office, which is in charge of granting patents, has partnered with an unlikely ally: Google.

With a new feature called Patent Search, the California-based internet company has developed advanced language translation software that will be employed to help inventors ensure their work is not too similar to existing patents in other European countries.

Patent Search will translate patents into 28 European languages, as well as Chinese, Japanese and Korean.

So, for example, if a Romanian inventor hopes to patent a new type of ballpoint pen head, he would be able to search for a related term in the EPO's database, and Google's software would instantly comb through thousands of existing patents to find and translate any potentially relevant ones.

"Translation is expensive work. This will lower the barrier," says Rainer Osterwalder, spokesman for the EPO, noting that translations for individual patents can cost about €1,500.

"Google will allow inventors to spot existing similar patents and streamline the process." The programme is set to be in place by the end of 2014, and the EPO is also using translation software by other providers.

"The ramifications of that are potentially huge," says Matthew Lambrinos, an attorney with FAI Patents. "At the moment, if I'm going

to file a patent application in Spanish, I have to search abstracts in English, or search in multiple languages."

Extensive use of Patent Search by inventors applying for pan-European patents will make those patents that do get approved that much stronger. "There's a lot of prior art out there," says Mr Lambrinos, using the technical term for pre-existing patents. "The more prior art you can have, the stronger the patents will be."

For Google, which is seeking to improve its language translation software, the partnership gives it unique access to reams of documents both technical and multilingual. In exchange for access to Google's translation software, the EPO will offer Google access to patents that are already translated, which will help Google improve its software.

So-called "machine translation" works by comparing translated texts in multiple languages, and using a predictive algorithm to produce new translations. Because patent documents all employ similar styles and formats, their predictable structures make ideal targets for Google Translate.

"Machine translation helps to overcome language barriers and make information contained in patents globally accessible and

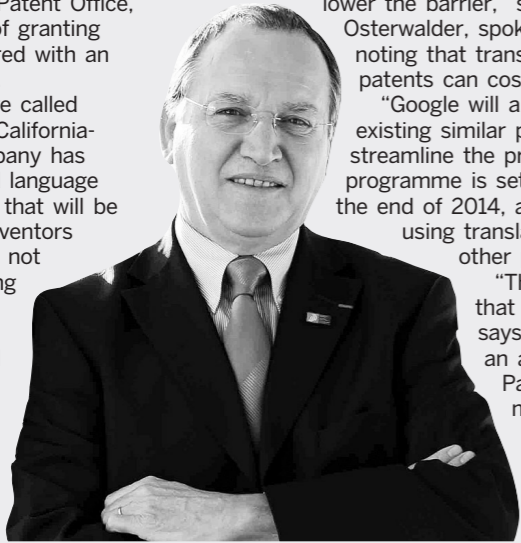
available," says Benoit Battistelli, the EPO's president. "The new translation tool is a further stepping-stone to improving innovation in Europe, and enabling European businesses to play level with their competitors in other regions. Moreover, I am convinced it will facilitate development of the unitary patent."

Google, with its vague techno-altruism, is keen to improve access to patents around the world, believing that easy discovery of patents will strengthen intellectual property regimes around the continent. Public-private partnerships are also being pursued by Google in an effort to find collaborative solutions to complex technical problems.

"This project will be of huge benefit to inventors, scientists and innovators across Europe – enabling them to speed up R&D efforts with searches in their own language, across the entire EPO corpus of European, Asian and Russian patents," says Antoine Aubert, head of public policy at Google Brussels.

"Google Translate was created to help break down language barriers, and this collaboration with the EPO will do exactly that, for all Europeans in all languages."

David Gelles



Benoit Battistelli: hails link with Google

Getty