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PATENTS**Mind-Controlled Exoskeleton at the FIFA World Cup:
A Public Display Is a Public Disclosure**

BY GRAHAM C. PHERO

Abstract: Public disclosures can create a bar to patent rights in many countries requiring absolute novelty. Under the first-inventor-to-file system in the United States, public disclosures can also affect patent rights, even though US law provides for a limited grace period. This article analyzes the public disclosure of a mind-controlled exoskeleton as used by a paraplegic to kick a football during the opening ceremonies at the 2014 FIFA World Cup, and explains the importance of filing for patent rights before such public disclosures.

Introduction

Life changing technology is under development every day; by startups and in the labs of the biggest companies and universities around the world. Our public insight into these advances often comes from news articles that merely scratch the surface of the technologi-

Graham C. Phero is an associate at the Washington DC-based intellectual property specialty firm Sterne, Kessler, Goldstein & Fox. The views expressed herein are for purposes of discussion only and do not necessarily reflect the individual views of the author, Sterne, Kessler, Goldstein & Fox P.L.L.C., or its clients.

cal breakthroughs. But what if a technology is so remarkable that it *must* be put on display for the world to see at, say, the opening ceremonies of the biggest single-event sporting competition in the world: the FIFA World Cup?

For example, Dr. Miguel Nicholelis of Duke University and the Walk Again Project—a collaboration of several universities and over 150 researchers—equipped a 29-year-old paraplegic with a mind-controlled robotic exoskeleton to kick a football to open the 2014 FIFA World Cup. With the aid of the exoskeleton, the paraplegic man stood and kicked a football simply by *thinking* about it. Due to a network of sensors, microchips, computers, motors, and hydraulics, the exoskeleton behaved as an extension of his physical body, even though he was otherwise entirely unable to move his legs.

While the display was unquestionably amazing, exhibiting the mind-controlled exoskeleton technology on international television for the world to see has practical implications for the intellectual property rights to the technologies, particularly in countries requiring absolute novelty for patentability.

The Technology

Typically, the human brain directs the body to complete tasks through conscious and unconscious thoughts about the muscle fibers and structures that are modified and controlled at every moment. To walk, the

brain sends signals to the spinal cord and to the muscles as neurons fire and create an electrical pattern that tells the body to walk. The structures and muscles involved (legs, feet, hips, core, etc.) rely on sensory feedback for precise movement and awareness of where the various body parts are located in space. However, when nerve pathways are damaged, signals can no longer travel between the muscles and the brain. The result is the loss of muscle and limb control below the injury site. In addition, even if the person could physically move these muscles and limbs, the loss of feedback indicating position and touch would make it nearly impossible for a person with a spinal cord injury to walk effectively.

While individuals with spinal cord injuries typically rely on wheelchairs for mobility, new developments offer promising mobility alternatives and enhanced mobility freedom. The mind-controlled exoskeleton merges robotics, neuroscience, sensors, and control systems to overcome the damaged nerve pathway. The exoskeleton itself includes: a jointed outer framework with onboard computers, batteries, and hydraulic actuators to move the legs; a brain machine interface with an electroencephalogram (EEG) sensor cap to measure brain signals and electrical activity patterns and translate these signals into instructions for the exoskeleton control systems; and finally, a shirt/sleeve system embedded with sensors and haptic vibrators to provide feedback to the wearer to indicate the position of the exoskeleton foot in space and on the floor.

Each of these technologies represents years of research and development and scores of potentially patentable inventions.

The Kick

During the opening ceremonies, the mind-controlled exoskeleton was on display for approximately one minute and 30 seconds and was streamed live to millions around the globe. Video recordings were later available the same day. The opening ceremonies and the mind-controlled exoskeleton were also described in numerous articles at that time.

While this short time frame may have been insufficient to detail the device and its function in exacting detail, conceivably the demonstration could have disclosed certain patentable aspects of the technologies involved, particularly if last minute ingenuity resulted in a flash of genius to realize the final design that accomplished the fateful kick.

Patent Disclosure Basics

Utility patents are a limited monopoly granted in exchange for disclosing the workings of an invention to the public. The grant is a limited right—generally 20 years—to exclude others from making, using and selling a claimed product or process. In the United States, the requirement for patentability is that the invention be new, useful, and non-obvious over existing technologies or “prior art.” Other patents, news and journal articles, web site message boards, and even video clips can count as prior art.

As part of the America Invents Act, utility patent applications in the United States claiming inventions with an effective filing date after March 16, 2013, are examined under a first-inventor-to-file regime, meaning that patent rights are afforded to the first inventor to actually file the patent application. As such, the effective fil-

ing date is relied on for determining relevant prior art and priority of invention, while the actual date of invention is not particularly relevant. The system thus incentivizes filing patent applications as early as possible. The America Invents Act, however, also created a limited grace period, where inventors are given up to one year after a public disclosure, so long as the inventor is the first to disclose the invention publically. Thus, would-be prior art falling within the grace period window—after the inventor’s disclosure but before the application filing date—cannot be used against the patentability of the application, so long as the disclosure is proportional to the patent application claims. South Korea, Canada, Mexico, and Australia, to name a few, also provide a grace period for inventor disclosures where an inventor disclosure will not preclude patent rights so long as the utility patent application is filed within the grace period—six months for South Korea and twelve months for Canada, Mexico, and Australia. The grace period is typically not available for a disclosure by someone other than the inventor.

While these countries provide a grace period for pre-filing inventor disclosures, such disclosures can also destroy certain other international intellectual property rights. This is because along with a first-inventor-to-file patent system, many countries including China, Hong Kong, Singapore, Japan, the European Union, and Taiwan require “absolute novelty” for utility patent applications. This means that the patent application filing must be the *first* public invention disclosure. For example, if an inventor discloses the invention during a trade show—or at the FIFA World Cup—before filing a patent application, the disclosure will be prior art to the inventor’s patent application and preclude patent rights in the absolute novelty country.

In addition to utility patents, many countries also provide for design patent protection for novel ornamental features of a product, i.e., the way an article looks. As with utility patents, China, Hong Kong, Singapore, and Taiwan require absolute novelty for design patent applications, thus requiring that a patent application filing be the first public invention disclosure. The United States, Japan, South Korea, Canada, Mexico, and Australia, among others, provide a design patent grace period.

The Consequence

Therefore, in the absence of patent application filings before the FIFA World Cup opening ceremonies, certain aspects of the mind-controlled exoskeleton would likely now be precluded from providing the basis for patentability, especially in countries requiring absolute novelty. For example, to the extent they were otherwise patentable, the demonstration would almost certainly preclude obtaining valid utility or design patent rights for the visible hardware components of the exoskeleton, including the jointed outer framework, hydraulics, etc. The disclosure would likely not preclude obtaining valid patent rights for the visible hardware components in countries having a grace period, provided the patent application is filed within one year of the disclosure.

The mind-controlled exoskeleton also includes a number of systems and components that were not visible during the FIFA World Cup demonstration. For example, the haptic feedback system, including sensors and vibrators to provide positional feedback to the operator, was not visible. The EEG sensor cap, brain ma-

chine interface, and software to translate the brain signals to usable control instructions were also not visible. With respect to utility patent protection for these types of non-visible systems and components, potential patentability varies by country and may rest with how easy it would be for a knowledgeable person to achieve the device or system. In China and Hong Kong, for example, non-visible components are regarded as disclosed if they can be easily and directly deduced through reasonable reverse engineering based on the demonstrated device. At the European Patent Office, an earlier world-wide presentation or public event typically constitutes prior art for patent applications for novelty and inventive step. However, to challenge novelty in a patent application, the demonstration must disclose all features in question such that a person skilled in the art could learn the essence of the invention and could implement the invention. Thus, the demonstration would not defeat novelty of the non-invisible components at the EPO as long as the demonstration does not disclose all features in question allowing a person of skill to learn the essence of the invention and to implement the invention. In still other countries like the United States, the demonstration would likely not preclude obtaining valid utility patent rights for the underlying software or non-visible components and systems because they would not have been considered to be made available to the public by the demonstration.

Another aspect of the mind-controlled exoskeleton device not on display at the FIFA World Cup was the training regimen and procedures that ultimately enabled the operator to work the mind-controlled exoskeleton and complete the demonstration. For example, technology is not yet to the point where a paralyzed individual can simply strap on a mind-controlled exoskeleton and have it function as an extension of their own body. In order to work the mind-controlled exoskeleton for the FIFA World Cup demonstration, the operator had to practice for hours upon hours in a virtual reality simulator and with the exoskeleton device to train his brain based upon the principles of neuroplasticity. In essence, the operator imagined himself walking in the exoskeleton and trained his brain to generate the correct messages and signals to be interpretable by the

sensor cap, brain machine interface, and exoskeleton system as “walk” or “kick” instructions. These types of background and precursor innovations, e.g., the training regimen and virtual reality simulator, were not disclosed in the demonstration and could potentially be patentable methods, even in absolute novelty countries.

Conclusion

Prior to a public disclosure, companies must develop a comprehensive worldwide utility and design patent strategy bearing in mind the disclosure requirements for each country where protection is sought. Patent applications must be filed to avoid loss of rights in absolute novelty countries. Inventors and companies should strive to file applications as early as possible to prevent the potential loss of rights accompanying public disclosures. Such filings protect United States and international patent rights. In the United States, detailed provisional patent applications can function as a stop gap thereby allowing for evaluation of the technology in the one year prior to the non-provisional patent application filing. Provided non-provisional applications are filed at the United States Patent and Trademark Office within one year of provisional application, international intellectual property rights can be preserved.

The difficulty of such filings is of course timing and cost. It is important for companies to analyze their industry to understand the competitive forces that are driving the market and to consider the areas in which intellectual property investment will yield high returns, and other areas that will not. It simply isn't cost effective to file patent applications on every idea and iteration of a particular device, especially to capture last minute changes before a public disclosure deadline. Ultimately, a company's patent strategy should achieve its business goals while respecting its financial resources.

In the case of ideas or innovations where patent applications are not suitable, disclosures can be a defensive tool to preempt intellectual property protection of a similar innovation by a competitor. A defensive disclosure could take the form of a press release, white paper, or news article that is simply made available via the company's website.