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PATENTS, AGENCY, AND ENVIRONMENT

by Richard L. Hindle

A history of innovation in physical infrastructure and large-scale complex systems.

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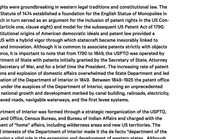
In 1850, the British architects Fletcher & Gibbs submitted a patent to protect their "invention" of a new spatial organization, improving the plans of government buildings and institutions. The patent was met with intense criticism by architects on both sides of the Atlantic who viewed it antithetical to the conventions of professional practice. Soon after, the discipline rapidly and unanimously dropped the patenting of architectural plans.[1] Over the last century, discussions on patents in architecture and landscape architecture has been scarce—other than Sigfried Giedion's canonical *Mechanization Takes Command*. OMA/AMO's potential focus patents published in *Content*, exposés of the odd construction detail that necessitates true invention, and a few recent forays into the architectural and urban effect of patent and copyright.[2,3] However, a look back into the annals of the United States' patent archive through the contemporary lens of environmental innovation and the ever-increasing complexity of environmental and infrastructural systems, reveals complex environmental systems such as rivers, coasts, and cities, historically have been used historically to incentivize innovation in physical infrastructure, develop sociotechnical environmental systems, and even provide a so-called "trick" to break government monopolies on flood control and navigable waterways. As the disciplinary boundaries of architecture and landscape architecture expand into the infrastructural, territorial, and ecosystem domains, does the continued apathy or aversion to patent rights still make sense?

PATENT DIALECTICS: DESIGN VS. UTILITY

The United States Patent and Trademark Office (USPTO) distinguishes between two major classifications of patents: design and utility. A design patent is issued for "a new, original, and ornamental design embodied in or applied to an article of manufacture," whereas a utility patent is issued by the USPTO for "the invention of a new and useful process, machine, manufacture, or composition of matter, or a new and useful improvement thereof."[4] Simply put, design patents protect the form and appearance of everyday objects, while utility patents define innovative processes, materials, modules, systems, and infrastructures. The difference between these types of patents has real implications in the built environment.

Design patents were first granted in the US as far back as 1842 to protect the ornamental appearance of manufactured items, like metal works, from domestic and foreign copycats. By safeguarding the original industrial and ornamental design of goods, early legal protection helped support American manufacturing and advance mechanized production of everyday objects. The standardization of design, and eventual loss of craft, led to what Giedion called "anonymous history."[5] Mechanization altered everything from door locks to toilets, eventually transforming the objects of modern life. Design patents became central to Giedion's argument, as they were integral to development of the machine aesthetic. Today, the legal scope of design patents remains wide—whether proactively employed to parse the difference between nearly identical industrial products, like various cell phone models, or to protect the unique formal characteristics of objects, including architectural works such as the Apple Store in NYC and a select group of ornamental lights.[6] Though these buildings remain the exception, not the rule.

Most patents issued in the USPTO have very little to do with appearance or ornamentation and are primarily concerned with the function and configuration of new inventions. To date, more than nine million utility patents have been issued in the US since the Patent Act of 1790—for outstanding the 746,000 extant design patents—and most disclose urban and landscape technologies as diverse as fire escapes, GIS Mapping Software, lawn construction methods, dredge boats, and vegetated architecture.[7,8,9,10]



The legacy of environmental innovation chronicled by the USPTO is immaculate: sponge systems and addressing a diverse array of environmental conditions. Left to right: US1000000 "Method of Cleaning Sponges" US1000001 "Sponge Attachment" US1000002 "Method of Dressing Sponges" A system to circulate clean water and remove sediment from the roots of a sponge. Right: US1000003 "Sponge Cultivation Method and Apparatus for Vivaria Establishment, Energy Generation, and Vegetation Growth" A method for cultivating sponges in a tidal environment using a floating wave energy to remediate coastal pollution US1000700 "Dredge Marine Mitigation Method" A system of capturing surface and water in desert areas to address issues of climate change. Images from USPTO.gov.

The distinction between design and utility is especially salient in discussions of environmental innovation. The transformation of large-scale systems—riverine, urban, coastal—is not just a matter of aesthetics. It instead results from a complex coupling of technology and culture—what David Nye refers to as a "tandem history" in which technology and environment co-evolve.[11] Though utility patents, which operate in the realm of infrastructure, modularity, logistics, methods, and process, are often overlooked, they are particularly instrumental in contemporary discussions of environmental innovation and sociotechnical resilience.[12] In fact, they are the structures, modules, machines, materials, infrastructure, and processes that in aggregate define coastal, riverine, and urban systems. In this context, the agency of patents is not necessarily bound to any particular site, but may be distributed to define new processes that impact a particular topology or address a unique set of conditions.

FROM BRUNELLESCHI TO A DEPARTMENT OF INTERIOR

> "Patents originally represented gestures of 'largesse' on the part of sovereigns, monarchs, dukes, or lesser feudal masters, to members of their court or tenantry. They where designed to encourage thoughtful pioneering, the results of which might obviously be productive for greater wealth of feudal leaders and indirectly to their hosts of followers and subjects...When the domestic patent system was in Europe, as a result of partial emancipation of man by his artist-an-scientist devised mechanisms, the popular representatives of that time, thinking by habit in terms of feudal structure and laboring under the problem of transferring privilege of sovereignty to the populace, deemed it a wise and just act to entitle the 'letters patent' idea in their democratic constitution...The necessity of invention and growth where highly important to the building democracies, for had not invention itself forwarded man to the possibility of emergent DEMOCRACY?"
>
> - R. Buckminster Fuller, *Nine Chains to the Moon*, 1938

The world's first "true" patent for a new mechanical invention was issued to the architect Filippo Brunelleschi in 1421 for a floating vessel, later named "Il Badalone" used to transport materials to Florence for the Duomo. Brunelleschi's invention established seminal legal and architectural precedents in western patent law for the construction of the dome's novel structure. The patent protected his method for transporting heavy loads by water on the Ivore Arno, solving one of three major engineering problems associated with the dome's complex construction processes.[13] Although the patent's legalese and the dome's structure operated independently on discrete legal and structural principles, together, they formed a highly interdependent and deterministic mechanism governing the form of the built environment. In this manner, the patent—western civilization's oldest legal and institutional mechanism for incentivized innovation—has long mirrored, defined, and shaped the built environment.

Patent rights were groundbreaking in western legal traditions and constitutional law. The Venetian Statute of 1474 established a foundation for the English Statute of Monopolies in 1624, which in turn served as an argument for the inclusion of patent rights in the US Constitution (article 1, clause eight) and model for the subsequent US Patent Act of 1790. The constitutional origins of American democratic ideals and patent law provided a nascent US with a hybrid origin myth which statecraft historians have memorably linked to progress and innovation. Although it is common to associate patents etcetry with objects of commerce, it is important to note that from 1790 to 1849, the USPTO was operated by the Department of State with patents initially granted by the Secretary of State, Attorney General, Secretary of War, and for a brief time the President. The transferring of patent submissions and explosion of domestic affairs overwhelmed the State Department and led to the creation of the Department of Interior in 1849. Between 1849-1925 the patent office operated under the auspices of the Department of Interior, spanning an unprecedented period of national growth and development marked by rural settlement, railroads, electricity, sewers, paved roads, navigable waterways, and the first levee systems.

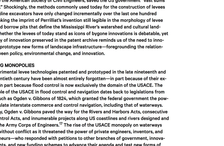
The Department of Interior was formed through a strategic reorganization of the USPTO, General Land Office, Census Bureau, and Bureau of Indian Affairs and charged with the management of "home" affairs, including wilderness areas and new US territories. The combined interests of the Department of Interior made it the de facto "department of the west," placing it at odds in the expansion and development of western states. Congressional in ambition and scope, the actual footprint of the Department of Interior was remarkably small—initially housed within the patent office before eventually moving to D.C. These two seemingly disparate offices cohabitated for six decades, until the constant flow of tourism to the building and the growing piles of patent models forced the Department of Interior to move out. Richard Andrews, an environmental policy scholar, has argued that in an ideal world, the integration of interior, patent, land, and census departments might have provided the "foundation for integrated planning and management of the nation's environment."[14]

The US Government has, in the past, actively promoted innovation in physical infrastructure. Clockwise from top left: US1000004 "Method of Raising Sunken Vessels" US1000005 "Method of Dressing Lumber" Samuel M. Warren US1000421 "Method of Constructing a Dry Dock" Samuel M. Warren US1000421 "Method of Constructing a Dry Dock" Samuel M. Warren US1000422 "Method of Constructing Levees and Embankments" Alexander Mitchell US1000423 "Method of Constructing Levees and Embankments" Alexander Mitchell Clockwise from top left: Patents for methods of raising sunken vessels, methods of dressing lumber, and methods of constructing dry docks. Patents for methods of constructing levees, US1000422 "Method of Constructing Levees and Embankments" Alexander Mitchell and US1000423 "Method of Constructing Levees and Embankments" Alexander Mitchell, illustrate the ingenuity of the 19th century and the landscapes and describe the relative ease of business dealings between the federal government and private industry. Images from USPTO.gov.

By 1925, the patent office found its permanent home in the US Department of Commerce, where it remains today buried in a deluge of protectionist lawsuits and automated application processes. Ducting off old patents from this era reveals that the US government was, even prior to the advent of the Department of Interior, cognizant of the role of patents in the transformation of the built environment.[15] For example, in 1821 Congress waived the residency requirement to grant Englishman Thomas Ordey a patent for his "American Land Clearing Engine," which promised to hasten development. In 1844, while pondering interstate commerce issues, Congress passed acts to construct an experimental telegraph line from Washington to Baltimore following Samuel Morse's patent for invention. Similarly, in 1845, Congress approved the creation of a panel of experts to evaluate a proposed dredge machine, patented by J.R. Putnam, for the removal of sandbars at the mouth of the Mississippi River. By 1847, James Crutchfield was commissioned to prototype and test his experimental gaslight in the nation's Capitol, proving the viability of artificial lighting in the urban landscape.

POLICY, PATENT, LANDSCAPE

While the government has not always taken a direct role in catalyzing patent innovation in physical infrastructure, federal policies, economics, and planning have played a significant role framing areas vital to national interests, which has in turn further incentivized investment, research, and development. Take for example, the construction of levees along the Mississippi River, designed to control floods and maintain navigation. Levee construction began during French colonial era as a local effort in southern Louisiana and the environs of New Orleans in the early eighteenth century. By 1849, forty-six years after the Louisiana Purchase, the US government was preparing to unfurl a regional levee system. Congress passed the First Swamp Lands Act of 1849, granting federally owned wet and overflowed lands to the state of Louisiana in order to promote its reclamation, cultivation, and settlement. The profit from the sale and conversion of swamp-dwelling cypress into levee construction, which in turn maintained navigation along the Mississippi River by increasing water levels, stabilizing channel geometry, and protecting the newly "productive" land from inundation.



The Swamp Land Acts of 1849, 1850, and 1860 extended the legislation to Alabama, Arkansas, California, Florida, Illinois, Indiana, Iowa, Michigan, Mississippi, Missouri, Ohio, Wisconsin, Minnesota, and Oregon—with the intention of draining 64,000,000 acres of unusable swamp nationwide. The prospect of levees flanking American rivers and the promise of cheap land incentivized innovation in levee construction methods and machinery, leading to a flurry of patent submissions in the late nineteenth and early twentieth century.[16] Diverse sets of technologies were invented to aid in the construction of levees, including the first ecological, biomimetic, and biologically engineered levee system. In 1898, after a long period of trial and error, an engineer from New Orleans by the name of Arsene Perrilliat perfected and patented a technique—providing the base technology for large-scale federal levee systems constructed by the US Army Corps of Engineers (USACE). Perrilliat's patent, "Method of Building Levees and Embankments," optimized mechanical levee construction by choreographing the movement of dragline excavators and calculating the ratio of burrow pit to levee height—a system that, according to his memoir presented to the American Society of Civil Engineers, saved the US government "six tenths of money." Shockingly, the methods commonly used today for the construction of levees and other flood control structures have remained unchanged for roughly 120 years, making the imprint of Perrilliat's invention still legible in the morphology of levee berms and borrow pits that define the Mississippi River's watershed and cultural landscape. Whether the levees of today stand as icons of hubris or environmental debatable, yet the legacy of innovation preserved in the patent archive reminds us of the need to innovate and propose new forms of landscape infrastructure—foregrounding the relationship between policy, environmental change, and innovation.

BREAKING MONOPOLIES

The experimental levee technologies patented and prototyped in the late nineteenth and early twentieth century have been almost entirely forgotten—in part because of their expiry and in part because flood control is now exclusively the domain of the USACE. The central role of the USACE in flood control and navigation dates back to legislations from rulings such as Gibbons v. Ogdens of 1824, which granted the federal government the power to regulate interstate commerce and control navigation, including that of waterways. Subsequent Rivers and Harbors Acts of 1824, 1827, and 1852 established the Mississippi Flood Control Acts, and innumerable projects along US coastlines and rivers designed and built by the Army Corps of Engineers.[17] The rise of the USACE monopoly on waterways was not without conflict as it threatened the power of private engineers, inventors, and entrepreneurs—who responded with petitions to other branches of government, innovative patents, and new funding schemes to advance their agenda and test new forms of infrastructure.

Patents have been used as a "stick" to break government monopolies and promote innovation in physical infrastructure. James Buchanan Eads' prominent "Patent Jetties" in New Orleans, Louisiana, were constructed in 1875 to "scour" a new ship channel for the Mississippi River against the will of the USACE. Engineers instituted Eads patent dock and patented experimental technologies, including the new jetty systems such as Eads' "Patent Jetties." Eads' experimental technologies forced the hand of the Army Corps of Engineers to adopt the Jetties. Image from USPTO.gov.

One of the best documented examples of this pushback occurred at the Mississippi River's South Pass, where the self-taught engineer James Buchanan Eads built and tested his soon-to-be famous jetties. In 1874, Eads petitioned Congress with a plan to construct parallel jetties at South Pass using a novel construction technique to maintain navigable channels in one of the world's most dynamic deltaic landscapes. The patented system involved the fabrication of a floating jetty that would be positioned, anchored, and eventually encased in sediment to define channel geometry. While Eads' jetty system was entirely untested in North America at the time, it promised to be cheaper and more efficient than competing plans from the Army Corps of Engineers. The government agreed to a fee structure based on the annual performance of his prototypes, with the initial cost of construction covered by Eads and his partners.[18]

The process of prototyping Eads' jetties began in 1875 and lasted until 1879. It proved that his jetties could maintain navigable depths and earned Eads millions of dollars and worldwide recognition for saving the port of New Orleans.[19] The competition between Eads and the USACE also led to the creation of the Mississippi River Commission in 1879, which institutionalized the use of experimental and patented technologies to "improve and control the navigable waterways." Eads' victory established precedent for challenging the monopoly of government engineers and agencies under the principle "No Cure, No Pay," which declared that new technologies had to be tested and evaluated with limited risk.[20] Although short-lived, private engineers heralded the idea as a way to break the "monopoly in the hands the Engineer Corps."[21] In essence, the patent became a tool to challenge government hegemony and advance innovation in physical infrastructure.[22] New jetties and coastal armoring technologies implemented during this era still span the Gulf and Atlantic coasts—their legacy remain important touchstones in the history of environmental innovation and the ongoing struggle to reinvent the built environment.

CONCLUSION

The patent is western civilizations oldest legal and institutional mechanism for incentivized innovation. It is often associated with commerce and objects of manufacturing, but, today, intellectual property is also instrumental in the large-scale and complex shaping of environments. Patents, in the form of innovative processes, have been instrumental in realms of socio-ecological innovation, the conversation of parts and the whole. A strategic revivalism of patent rights may help advance disciplines agenda beyond discrete site and building envelopes and facilitate the positive transformation of our rivers, coasts, and cities.

Richard L. Hindle is an assistant professor of landscape architecture at UC Berkeley. His research focuses on role of technology in landscape architecture with an emphasis on material processes, innovation, and patents. His current work explores patent innovation across a range of scales, from facade details to rivers and coasts.

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