WILLIAM J. RANKIN 3

The "Person Skilled in the Art" Is Really Quite Conventional

U.S. Patent Drawings and the Persona of the Inventor, 1870–2005

Consider the drawing shown in figure 3.1. It shows a new and useful steam trap for discharging condensate from a pressurized steam system.[1] As pressurized water and steam enter from the left at C, the water fills the trap body A and eventually overspills into the cylindrical bucket E. When the bucket is heavy enough to pull the arm 9, a weight 30 rolls to the left, causing the pin 23 to be knocked forcefully enough to rotate the arm 19 around the pivot 22 and open the valve 18 at the bottom of the bucket. The pressure in the system forces water out of the right-hand pipe 13, but the valve closes before the bucket is empty, thus preventing the escape of steam. The 45-degree hatch lines indicate that this is a cross section, and that the cut is taken through metal. The thin vertical lines to the left of E show that this object is cylindrical; the shading and dashed lines of the various moving parts likewise make it clear how they interact. The overall effect is of a three-dimensional object cut and labeled to best display the complex workings of a steam trap, but it is certainly not a naturalistic view of an actual object: cutting metal does not reveal diagonal lines, and the lack of perspective distortion indicates that this view could never been seen in reality.

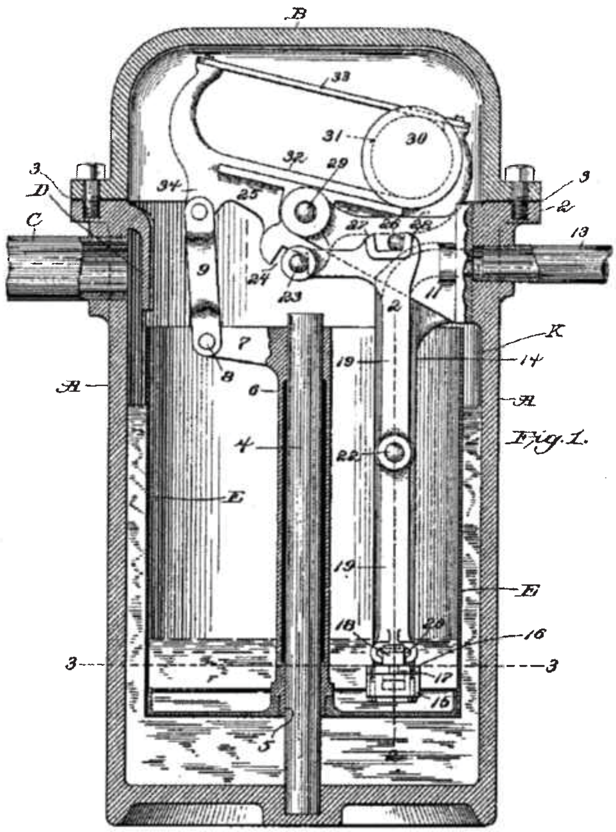

Figure 3.1. Drawing of a new and useful steam trap, from U.S. patent 583,064 (1897), granted to W. B. Mason of Boston.

The peculiar qualities of these kinds of drawings make them an important part of the patent system. They fulfill legal requirements, stabilize certain legal fictions, and even help define the idea of "invention" and the kind of person who can be an "inventor." Drawings very similar to figure 3.1 have been included with the vast majority of U.S. patents, not just for mechanical inventions like steam traps, but also for chemical, electrical, and even biological patents. Almost all these drawings, especially those issued between the early 1870s and the early 1980s, exhibit a similar tension between the abstract and the naturalistic and use conventions of light, shade, and hatch patterns quite different from standard engineering drawings. These conventions are powerful rhetorical devices that encode rather specific assumptions about intellectual property, and understanding how they work and how they change can help to reveal large-scale shifts in the patent system as a whole.

This chapter analyzes these drawings in two ways. First, patent drawings are important for reinforcing the dual status of a patent as something that both protects an idea and discloses it to the public, in line with the modern understanding of patents as a contractual exchange between inventor and society.[2] The holder of the steam-trap patent must enable others to learn from his work, but in order to guard against infringement it is in his interest to depict an invention as generically as possible so that it protects not just a particular steam trap but all steam traps that share certain characteristics. Patent drawings appear to refer to actual extant objects yet leave unanswered many questions of manufacture, assembly, or specific materials. The way this is accomplished is important for understanding the tensions inherent in the logic of modern patents.

Second, patent drawings provide great insight to the identity of the (fictional) person to whom the patent specification is addressed—the ideal "person skilled in the art" referenced in every patent act since 1790. Like the implied reader of a text, every drawing creates a rhetorical reader often quite different from its actual audience, and the selection of both conventions and content implies a viewer with a certain set of practical skills and reasons for consulting the drawing. And because in the United States the creative inventor is only defined negatively against the ordinary person who is merely skilled, analyzing the "person skilled in the art" is a useful way of analyzing the "inventor" as well.[3] For most of the twentieth century, the person skilled in the art was a self-contradictory jack-of-all-trades who had more in common with the (fictional) nineteenth-century "lone inventor" than any actual person. Patent drawings helped to stabilize the identity of this implied reader and smooth over legal contradictions.

This chapter ends by using patent drawings to examine some important shifts in the U.S. patent system from the last few decades, beginning in the late 1960s but manifest mostly since the 1980s. During that time, the traditional conventions of patent drawings were largely abandoned, and it is now relatively uncommon to find patents accompanied by drawings like the one in figure 3.1. At the same time, the patent system has changed in other ways as well: patent judges have become increasingly specialized, patent rights have been strengthened, and the criteria of patentability have been incrementally broadened to include software, biotechnology, and even "business methods." Contributing to this increasing patent-friendliness has been a legal change in the version of the "person skilled in the art" used to test for obviousness. Analyzing these changes alongside the recent shift in drawing standards helps us understand the larger stakes of these developments. Since drawings encode the ideal reader of patents—and thus the ideal inventor as well—they can be used to identify a larger shift in the idea of invention assumed by the patent system. Recent patent drawings show that both the inventor and the noninventor have become more specialized, and they now seem much more like typical corporate knowledge workers than mythical polymaths.

Reading Patent Drawings as Evidence

Nontextual material has been required in U.S. patents since the very first Patent Act in 1790. For most of the nineteenth century, patentees provided working models and color drawings, but these artifacts were often idiosyncratic, fragile, and difficult to disseminate. As a result, in the early 1870s the commissioner of patents changed official guidelines to require standardized black-and-white ink drawings reproducible using the new process of photolithography. The Patent Office shifted from being a central archive of mechanical knowledge to being more like a publishing house, with new drawings and specifications sent throughout the country on a weekly schedule.[4] Since this important change, patent drawings have remained remarkably stable, buttressed by technological momentum, bureaucratic inertia, and relative continuity in the role that they play in the patent system. Even given the changes in patent drawings (and patent law) in the last few decades, many of their most important characteristics have been unaffected. Their two major functions—disclosing a new idea to the public and guaranteeing intellectual property to a patentee—have remained the same.

From the point of view of the public, the primary function of a patent drawing is disclosure. For this, the law requires methodical, literal denotation, and the reader of the patent is guided by the visual analog of legalese. Usually, the multiplication of detail is commensurate with the complexity of the device, such as when an automatic card feeder requires 14 figures and 150 numerical labels (see fig. 3.2). But at times the assumed reader of a patent requires a visual prolixity that ranges from comically unnecessary to simply pathological. For example, a simple package for Camembert cheese requires three different views (fig. 3.3), while at the other extreme a 2001 patent for a pseudorandom number generator included 3,273 pages of flowcharts and circuit diagrams.[5] Long-standing legal precedent holds that drawings constitute a kind of disclosure distinct from text: intellectual property rights may not be granted to novelty which is claimed in writing but not shown in the drawing, and disclosure in a drawing can establish precedence even when not included in the text.[6] Thus drawings are often used as a final test of the claims of a patent, and if failure to draw the "plurality of separate portions of cheese" as in figure 3.3 is interpreted as lack of adequate disclosure, the patent may become worthless.

But this visual effusiveness is balanced by an ambiguity necessary for a patent's claims to be robust, and in general patent drawings do not specify

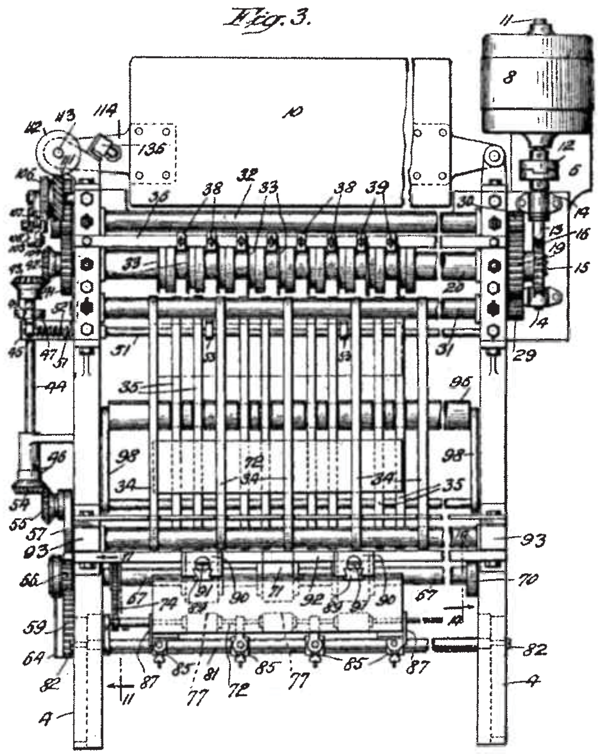

Figure 3.2. An automatic card reader (U.S. patent 1,594,883; 1923): a detailed drawing for a complex machine.

detail unless absolutely necessary. For example, in contrast to the visual redundancy required of engineering drawings, patent lawyers recommend that all duplication be avoided in patents, since inadvertent contradictions in different drawings may render all claims invalid. If the invention is a modification or improvement to an existing device, the parent object is shown dotted, and the connection between the old and the new is made clear but not explicit, lest the patent be invalidated for inaccurately depicting prior art. In order to make the broadest claims possible, verisimilitude is often completely abandoned. Monolithic parts are idealized for the sake of generality, and strict adherence to scale is not always important, especially for drawings of processes, assembly lines, or clothing (for an example, see fig. 3.4).[7] Likewise, individual parts are never shown on their own but as part of a working whole: the goal is to patent a set of relationships, not a particular object (see fig. 3.5 for an extreme case). Materials are labeled as generically as possible, often identified as simply "metal" or "wood." Dimensions, centerlines, and milling tolerances are omitted. When drafting a claim, patent lawyers begin by describing the drawing itself—what they call the "picture claim"—and then incrementally broaden

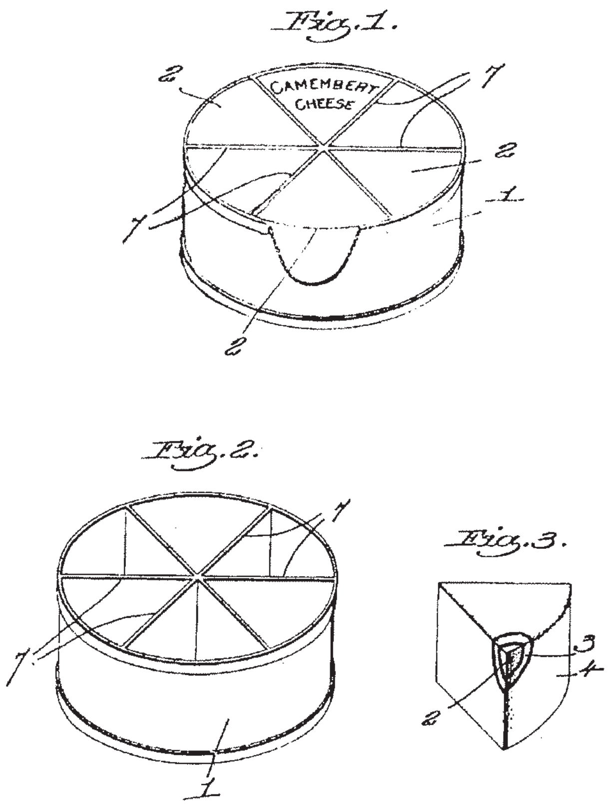

Figure 3.3. A new and useful way of storing Camembert cheese (U.S. patent 1,054,433; 1913): a detailed drawing for a cheese box.

subsequent claims to include as many similar ideas as possible. The original drawing must be ambiguous enough to allow these broader claims.[8]

The balance between prolixity and ambiguity in patent drawings is not an inherent feature of visual evidence. Most engineering drawings, for example, do not work this way: to a working engineer, no amount of ambiguity is acceptable. Likewise, these kinds of drawings are not used when patenting plants or designs, since for these patents, standards for both disclosure and protection are more narrowly circumscribed and the primary worth of the patent is to establish successful reduction to practice, as in a simple registration system (similar to copyright).[9] Not coincidentally, plants and designs are often accompanied by photographs, and photographs tend to provide only mimetic evidence; neither explanatory nor ambiguous, they are useful primarily for proving infringement.[10] Patent drawings should not be seen as just a more easily reproducible alternative to other visual sources. They are carefully calibrated to reconcile the conflicting interests of the public and the inventor.

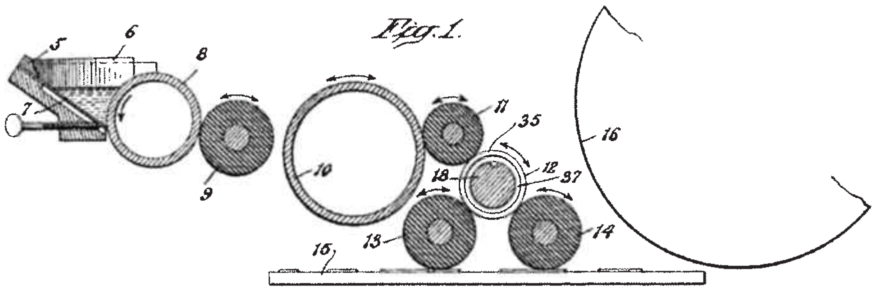

Figure 3.4. This drawing of a process for color offset printing (U.S. patent 2,189,073; 1940) shows idealized, monolithic parts: cylinders are shown floating in the air or incomplete, and a general sense of hierarchy is emphasized over precise dimensions.

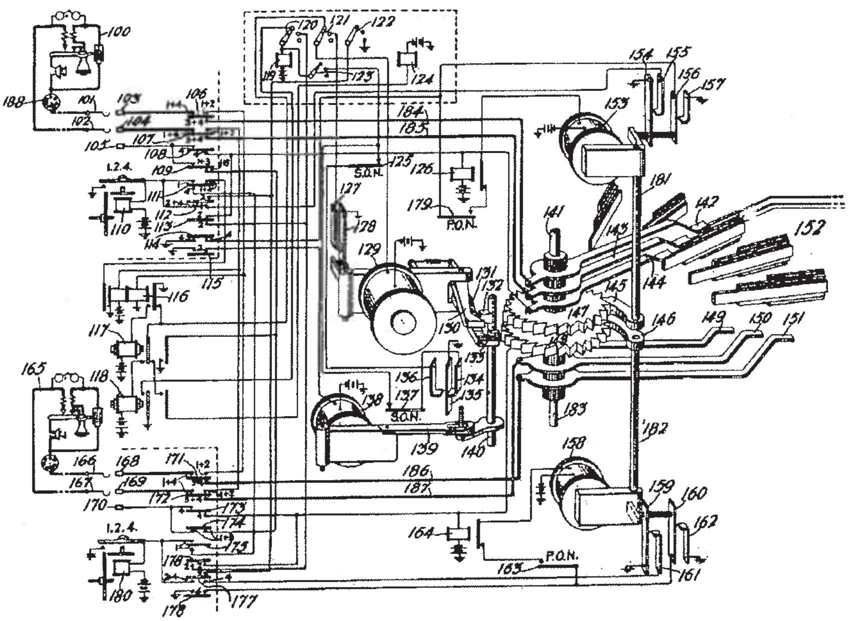

Figure 3.5. A combination of electric and axonometric drawing for a "selector switch" (U.S. patent 1,523,439; 1920). The space of the drawing does not correspond to any physical space that could be occupied by an actual object, and there are many ways that this set of relationships could be realized in practice.

Patent Drawings and the Person Skilled in the Art

Even though patent drawings fulfill legal functions that come from different sections of patent legislation and disparate judicial precedents, there are not separate drawings for different requirements. While perhaps unintentional, the reliance on a single set of drawings is a powerful device for creating a unified ideal reader—one who is not just the sum of conflicting legal requirements, but instead the stable Other against which the creative inventor is defined. Since the mid-nineteenth century, this reader—the "person skilled in the art"—has been asked to fulfill two functions: she/he must evaluate whether an invention has been adequately disclosed and, simultaneously, ensure that it is not just an "obvious" extension of the "ordinary skill in the art."[11] Until the late twentieth century, the person skilled in the art thus had a split personality, as the law defined these two roles in very different ways. A good set of patent drawings would enable him or her to replicate an invention, but in order to enforce adequate disclosure the reader was generally assumed to be thick-skulled and incapable of making inferences in unclear situations, thus requiring great prolixity and literalness. At the same time, testing for obviousness meant that she/he was also assumed to be perfectly aware of all prior art in any "analogous" field and able to understand how all past innovations might be recombined to solve a new problem. By the mid-twentieth century, this was interpreted to include literally everything that had ever been published in any language.[12] Drawing conventions were important for reconciling this apparent paradox and helped to establish the person skilled in the art as someone quite similar to the mythical lone inventor of the nineteenth century.

The distinguishing feature of patent drawings, as stressed by drawing handbooks and official guidelines, was their ability to be read "at a glance." Maintaining an easily readable at-a-glance drawing style, however, required a rather strict set of drawing conventions, which were policed by Patent Office examiners. Not only were requirements for the size and kind of paper specified exactly, but so were the margins, acceptable orientations, arrangement and labeling of figures, and the location of the inventor's and witnesses' names. In the drawing, all parts were to be called out with reference numbers no less than one-eighth-inch high and connected to the drawing with the shortest possible lead lines. Enclosing these references in quotation marks, brackets, or circles was not allowed. All characters were to be from the English alphabet, except for conventional mathematical symbols. All exploded views were to be placed in brackets, section lines shown clearly, and section-hatching drawn at 45 degrees. The patent office also published a set of standard hatch patterns for depicting materials and colors. Material could be distinguished in surface treatment and in cross-section, and guidelines were available for everything from metal and wood to cheese and human flesh. Hatch patterns were also used for the standard ROYGBV colors plus brown, black, and gray (see fig. 3.6).[13]

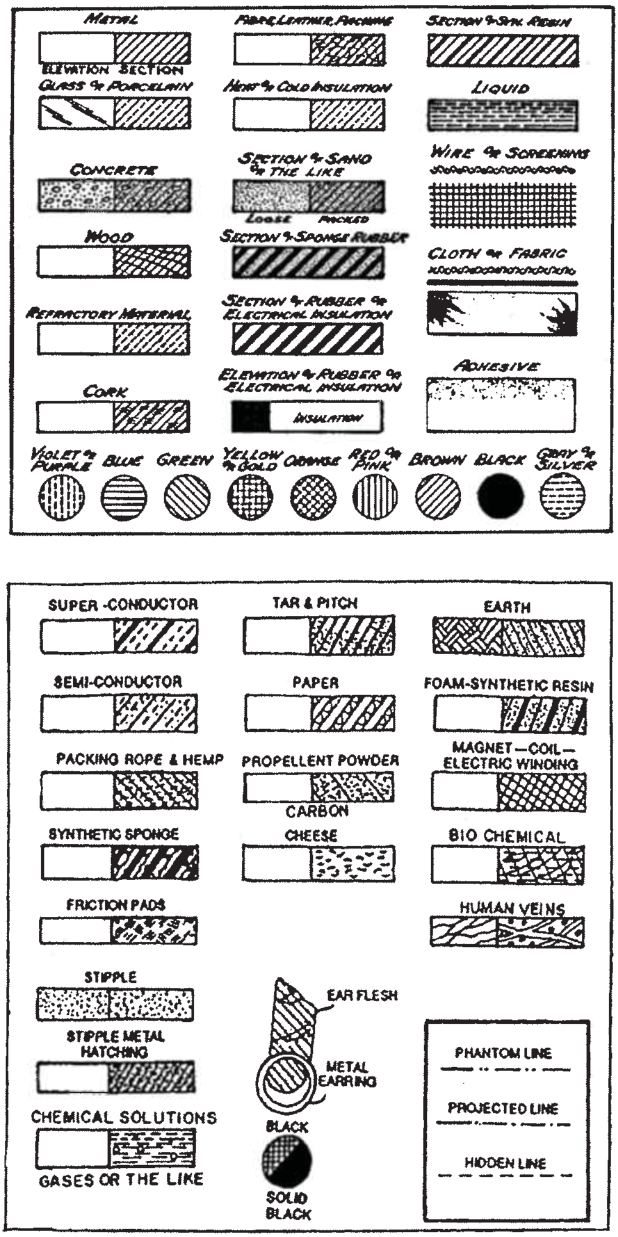

Figure 3.6. Standard hatch patterns from the Patent Office. This hatch-pattern chart has been published since at least the 1940s; these images are from the *Manual of Patent Examining Procedure* (Washington, DC: USPTO, May 2004), 600-99 and 600-100.

Perhaps the most important convention was a method for making nonperspectival orthographic drawings (such as in fig. 3.1 or 3.2) intelligible as views of three-dimensional objects. The drafter was told that "light should come from the upper left corner at an angle of forty-five degrees" to the surface of the paper.[14] Edges to the bottom and right should thus be made graphically thicker, to indicate a shadow. In combination with surface shading of curved parts, these shade lines can aid greatly in understanding an object three-dimensionally. Whereas modern engineering drawings will show an object in several standard views (front, side, top, etc.), patents will usually only show one such view, and shade lines might be the only way to differentiate between a hole and a protrusion, or a surface seam and a hard edge (see fig. 3.7 for examples; fig. 3.8 shows an actual patent drawing with shade lines). In a similar way, line weights on axonometric and perspective drawings were often used to add depth and eliminate optical gestalt shifts. Edges that point toward the viewer were made heavy, while all other lines were left light—figure 3.9 shows this convention in principle, while figure 3.10 shows it in a published patent. Together with hatch symbols and standardized reference labels, these visual effects gave patent drawings a surprisingly uniform flavor; after only a short time spent scanning the patents published in the weekly *Official Gazette of the U.S. Patent Office*, most drawings can indeed be understood (almost) at a glance.

This at-a-glance drawing style played an important rhetorical role in establishing the person skilled in the art as someone qualified to evaluate a new invention's obviousness. Having all drawings legible at a glance created a visual

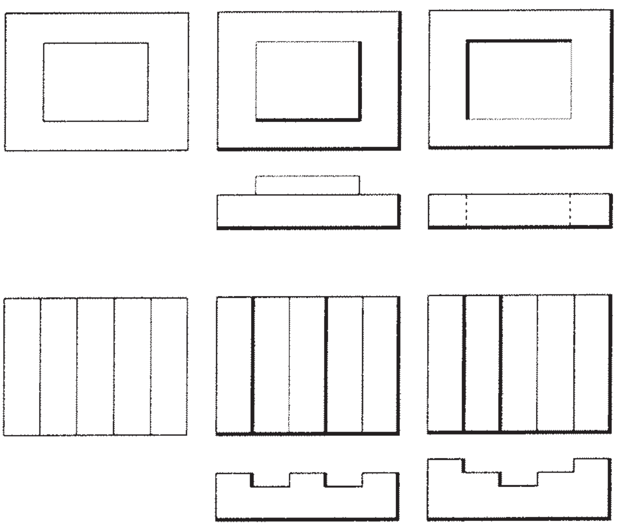

Figure 3.7. The two drawings in the left column have no shade lines. The middle and right columns show two versions of how the ambiguity of the left-hand drawings is resolved by shade lines (drawings by the author).

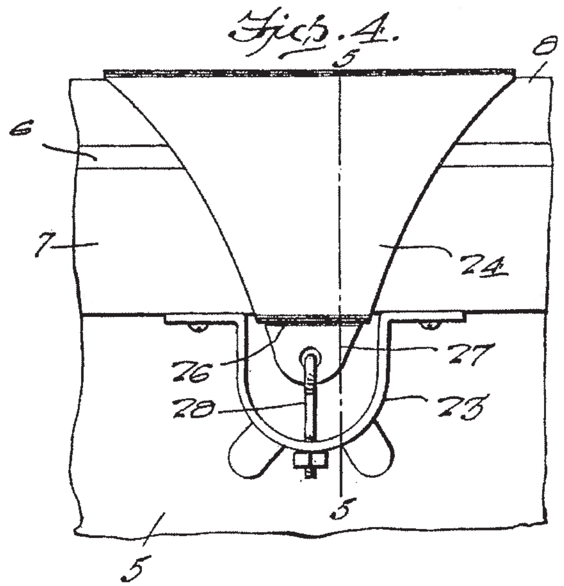

Figure 3.8. Shade lines in use on a "box wall securing means" (U.S. patent 1,523,479; 1924). The V-shaped surface is shown to protrude, while the lower half of the background surface is recessed.

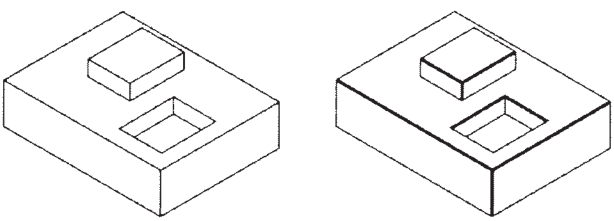

Figure 3.9. Shade lines in axonometric drawing are added to help resolve gestalt shifts (drawings by the author).

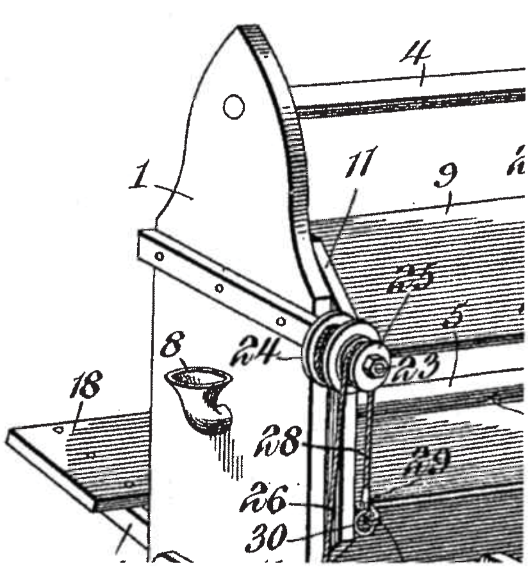

Figure 3.10. Shade lines used to show a sanitary drinking trough (detail from U.S. patent 1,054,462; 1913). In a complex drawing, thick lines can help greatly in properly reading three-dimensionality.

language that unified all patents and helped to construct the patent-drawing reader as someone who, while unable to use common sense when replicating an innovation, could nevertheless draw from ideas across all fields. The conventions of black-and-white lines, numbered figures, hatching, and reference numbers allowed atypical inventions to be understood visually in the same way as valves and engines. Even flowcharts were usually illuminated by light from the upper left (fig. 3.11).

The universality of this visual language was reinforced by the use of a limited number of drawing types. Figure 3.12 shows the relative proportion of different kinds of drawings published in the *Official Gazette*, roughly from its beginning in 1872 to the present.[15] At no point have the standard projective views (perspective, axonometric, and orthographic) accompanied fewer than 70 percent of all issued patents, and the relative popularity of different types of drawings has remained relatively stable. Even though chemical and electrical patents now outnumber general mechanical patents, most patents are still accompanied by drawings of physical objects that can be drawn in plane projection and understood in only one or two views. By using standardized conventions and relatively few drawing types to depict almost all inventions with reference to some kind of object, fields as disparate as chemistry, electrical engineering, and materials science could be united as a single discussion of machine technology.

Perhaps surprisingly, it is this same universal visual language that also establishes the person skilled in the art as the dimwitted reader who must evaluate disclosure requirements and potentially replicate an invention. This overlap can best be seen by analyzing the historical origins of patent drawings. The

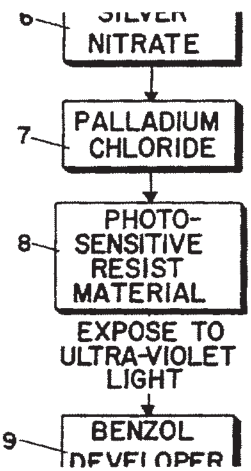

Figure 3.11. Detail of a flowchart showing a method of photo-plating electrical circuits (U.S. patent 3,006,819; 1961), with numerical labels and light from the upper left.

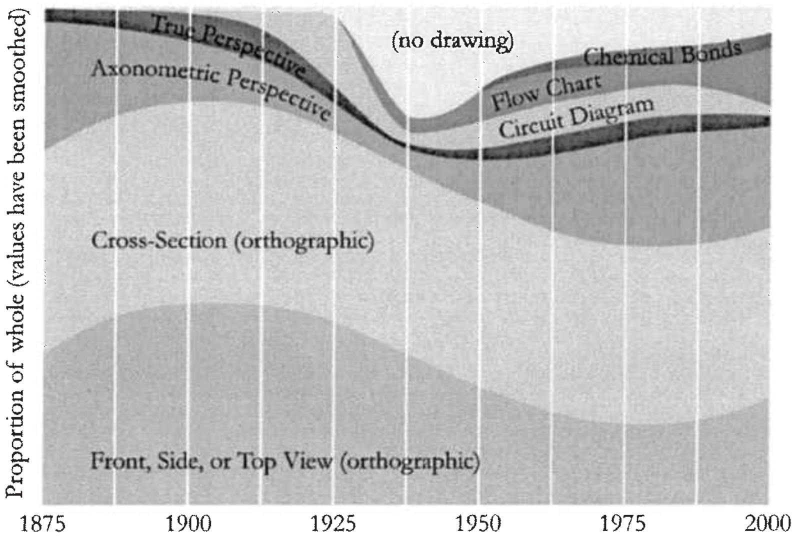

Figure 3.12. Types of patent drawings, as published in the *Official Gazette*, 1875–2000. Based on samples of 100 consecutive patents, every twelve years (1,100 patents total).

at-a-glance visual style was used throughout the nineteenth century, and for the most part, patent drawing standards can be understood as a translation of standard 1870s engineering drafting practice to the requirements of black-and-white reproduction; many of the features that today seem unique to patents are a preservation of the features of nineteenth-century drawing.[16] Nineteenth-century technical drawings were generally much less specialized than drawings today, and there was relatively little difference between the conventions used in an ideal working drawing and those used for promotional material. Three conventions typified these drawings: shade lines, shadows, and the use of color washes to differentiate between materials.[17] Before photolithography, most patent drawings used these same conventions. In the 1850s, a simple drawing of a washing machine attached to a patent application might look quite similar to a large cross-section of the Great Eastern steamship drawn to woo investors; both would show a nonperspective view, use blue coloring for steel and yellow for brass, and show light coming from the upper left.[18] In the transition to photolithography, patent drawings substituted hatch patterns for color washes, but they maintained almost all other conventions without modification.

These nineteenth-century conventions addressed problems of communication specific to a world in which engineers interacted on a daily basis more with nonspecialists than with other engineers. For example, three-dimensional shade effects had long played a role in the division of labor between engineers and unmathematical mechanics. Shade lines were used on the steam-engine drawings of inventor-engineers like James Watt and Richard Trevithick, who found that they increased a drawing's legibility for artisans, and pedagogues of technical drawing were explicit about the social role of shade and shadow. As Gaspard Monge—the patron saint of projective geometry and cofounder of the École Polytechnique—pointed out in his treatise on drafting, flattened orthographic drawings could be quite confusing to craftsmen who tended to communicate using nonprojective pictures, and the goal of shadow casting was to make precisely measured drawings look more like naturalistic views.[19] The convention of shade lines was a way to bridge both the social and epistemic gaps between tradesmen and those with mathematical training. The same logic also applied to the equally unmathematical audiences of industrialists and middle-class consumers. Nineteenth-century drawings did not differentiate between different kinds of nonspecialists, and no visual language was widely used for purely esoteric communication. The implied reader of a patent drawing which uses these conventions thus occupies a subject position similar to the various nonspecialists of the nineteenth century. Just like financiers, artisanal mechanics, and the interested public, the reader of patent drawing finds himself or herself contemplating an object which is comprehensible three-dimensionally even if she/he has had no prior exposure to its mechanical principles.

By implying universal accessibility, the visual language of patent drawings—at least from the 1870s to the early 1980s—constructs the person skilled in the art as someone sharing many qualities with the hopeful loners of the nineteenth-century ideal of American inventorship. This isolated inventor, a kind of aspiring Thomas Edison, was thought to interact with the patent system mostly through published specifications instead of the workaday world of industrial laboratories and corporate patent policies. She/he would likewise gain knowledge by reading patents, not through academic or professional training, and would not be limited to one specific area of interest.[20] This mythical inventor would have seen no contradiction between disclosure and obviousness requirements—she/he was indeed ignorant but did not see the world's knowledge divided into disciplinary fiefdoms.

The association between patent drawings and nineteenth-century visual communication was often made explicit in patent-drawing handbooks, if perhaps unintentionally. In the mid-twentieth century, patent drafters were told that the conventions of shade and shadow were intended to "disclose the invention so clearly that any skilled mechanic could successfully construct the device with the use of these drawings and the specification," even though actual mechanics had come to rely increasingly on the kind of precise dimensions, tolerances, and assembly instructions eschewed in patent specifications.[21] This admonition was doubly contrived, since patent drawings were generally only seen by lawyers, patent examiners, and judges. Even though the actual audience for patent drawings did not include (nineteenth-century) mechanics, these skilled but relatively unspecialized craftsmen remained important as rhetorical readers, and the social roles encoded and reinforced by early industrial drawings remained present until the end of the twentieth century.

The Abandonment of Conventions, and a New Concept of Invention

Since the 1980s, the use of shade and shadow conventions in patent drawings has plummeted. From 1875 until the mid-1970s, roughly four-fifths of all patent drawings used conventions of shade lines or axonometric line weights, while in the year 2000 only around one-quarter of projective drawings attempted to convey three-dimensionality.[22] In the last few decades, the typical patent drawing has come to resemble the drawing shown in figure 3.13. According to the earlier guidelines, this drawing would not be legible "at a glance": it does not use shade, material codes, or even line weights. Most likely, it is easily comprehensible only to those who are already familiar with the relevant art, and it is more visually aligned with drawings used by mechanical engineers than with other patent drawings—note in particular the use of centerlines, a standard feature of engineering drawing that had long been banned from patents.

Why did this shift occur? And what significance does it have for understanding patents more generally? It might be tempting to see the abandonment of at-a-glance conventions as the result of computer-aided drafting or the general decline of drafting as a profession. After all, drafters had faced de-skilling throughout the twentieth century, and by the 1970s responsibility for technical drawing had been decisively transferred to technicians and engineers.[23] Specialized patent drafters were similarly rendered obsolete.[24] But if the Patent Office could maintain a peculiar drawing tradition separate from engineering practice for one hundred years, it seems unlikely that it could not still be maintained in a different labor environment. Computers can draw shade lines just as easily as any other kind of line, and there seems no reason why technicians or patent-preparers could not have taken on tasks previously assigned to professional drafters.

It is also clear that the retreat from traditional conventions was not due to changes in official requirements. The old rules are still published; patent lawyers have simply found that they are no longer "strictly enforced. . . . As a practical matter, all the Patent Office now wants are drawings of sufficient

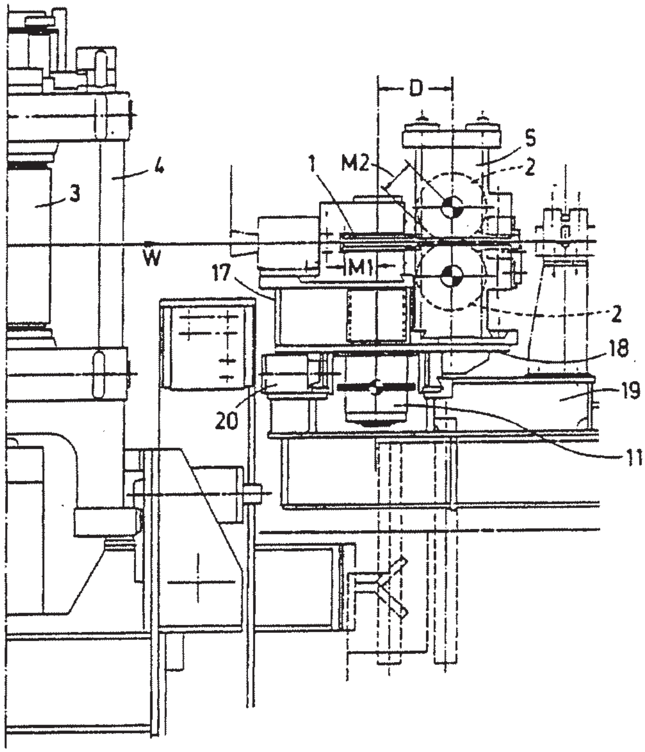

Figure 3.13. Drawing of a rolling mill train (U.S. patent 5,000,023; 1991): to the untrained eye, a jumble of lines with no shade, shadow, or hatch patterns.

quality to be . . . suitable for reproduction."[25] The Patent Office's once rigid insistence on conventions that create a universal (nineteenth-century) visual language has simply withered—gradually and silently.

Rather than looking for external causes, I would suggest that the change in drawing conventions can best be understood in relation to other changes in the patent system: if drawing standards are no longer relevant, it is because many of the assumptions codified by traditional patent drawings have themselves been challenged. On the whole, the balance between the interests of the public and those of the inventor has been increasingly tipped in favor of the inventor. This is seen most clearly in the expanding range of patentable innovations. Some newly patentable ideas—such as computer software and biotechnology—seem just to track the changing state of the art, but a 1998 decision allowing the patentability of "business methods" suggested that even transformations of data were "a useful, concrete and tangible result" deserving of protection; this included patents for new financial instruments, Amazon.com's one-click purchasing, or Priceline.com's system of reverse auctions.[26] For activists against the patentability of data and software, patent rights are looking increasingly like a way to stifle competition instead of means of disclosing novelty to the public.[27]

Likewise, the 1982 creation of the Court of Appeals for the Federal Circuit has generally been beneficial to patentees. Previously, patent cases were adjudicated by the regional circuit courts, but the increasing complexity of patentable inventions had led to long case backlogs and somewhat arbitrary decisions.[28] Designed to replace the ignorance of regional court judges with a uniform system, the Federal Circuit has effectively centralized patent law and made other courts' opinions increasingly irrelevant. In the mid-1980s one of the Federal Circuit's own judges regretted its "eagerness to pronounce legal doctrines not immediately necessary to make our decisions," a fact he found doubly distressing because the creation of the court had also "reduce[d] the number of educated, intelligent people of the caliber of federal appellate judges who are thinking and writing about [patent] law."[29] As patent law has become the purview of an increasingly specialized (and usually pro-patent-rights) court, it is not surprising to find that since 1982 the number of patent holders having their claims upheld in court has doubled, from approximately one-third to two-thirds.[30]

The superhuman "person skilled in the art" used to test for obviousness has also been largely replaced by the humbler "person having ordinary skill in the art"—and the acronym PHOSITA is increasingly used in contrast to the older, less precise moniker.[31] A 1984 Federal Circuit decision indicated that the PHOSITA is "no longer presumed to have knowledge of all material prior art," and a 1986 decision explicitly stated that obviousness would be based on the "conventional wisdom in the art," not the allegedly subjective judgment of patent examiners applying analytical hindsight.[32] Since the late 1960s, "secondary conditions" like commercial success have also been allowed as tests for nonobviousness. These changes have real effects: judges have become more inclined to find that a complex patent is addressed to multiple PHOSITAs and have come to enforce different standards of disclosure and enablement for different fields. For example, in software patents, the courts are becoming less inclined to invalidate patents for inadequate disclosure, and less of the art of programming is required to be included in specifications: standard subroutines, firmware, and even unspecified work assumed to take as much as one year of programmer labor can be omitted.[33] Completely different guidelines are used in fields like biotechnology, where requirements for disclosure remain quite stringent, but almost no patents are invalidated due to obviousness.[34]

Taken by themselves, these changes seem like a somewhat piecemeal and incremental strengthening of intellectual property rights. But like a coal miner's canary, the concomitant change in patent drawings suggests that something larger is at stake, namely, the ideal audience of patents—and thus the identity of the inventor as well. If for most of the twentieth century the "person skilled in the art" had much in common with the aspiring (and mythical) lone inventor—a combination of machinist, engineer, and member of the general public, simultaneously uncreative and incredibly knowledgeable—the pretense of general accessibility has been increasingly dropped. Nonspecialist judges are no longer expected to understand patents, and machinists are no longer used as rhetorical readers. For the most part, patent drawings do not use traditional conventions, and they are directed to a reader who is well versed in the skills and assumptions of a specific field. Their visual tendency toward unity has been eliminated: disparate fields no longer share a universal visual language, and different drawings in the same patent can be directed to different audiences.

Patent drawings are now largely illegible to the public and are instead quite similar to the drawings that engineers use on a day-to-day basis. Gone, therefore, are the perhaps admirable goals of contributing to the universal amateur knowledge of the individual inventor and addressing the general public through a visual rhetoric designed for nonspecialists. But with the new emphasis on the "ordinary" skilled person, there is now greater correspondence between the patent system and the actual practice of innovation. For decades corporations have seen research as the product of interdisciplinary teamwork and long-term investment, not exceptional individual creativity—Monsanto's iconic "no geniuses here" is a fitting slogan for the PHOSITA.[35] In this environment, the creative inventor, visually as well as legally, is increasingly addressing ordinary colleagues and competitors, not some improbable savant simultaneously ignorant of common practice yet possessing encyclopedic knowledge of all prior art.

NOTES

1. I gratefully acknowledge the close readings and helpful comments of Kara Swanson, Daniel Margocsy, Mario Biagioli, Dan Kevles, Jimena Canales, and two anonymous reviewers.

2. See Biagioli, this volume. See also Harold Dutton, *The Patent System and Inventive Activity during the Industrial Revolution, 1750–1852* (Manchester: Manchester University Press, 1984). For comparison with systems of registration, see Christine MacLeod, *Inventing the Industrial Revolution: The English Patent System, 1660–1800* (Cambridge: Cambridge University Press, 1988), 43–54; or in the United States between 1793 and 1836, Edward Walterscheid, *To Promote the Progress of Useful Arts* (Littleton, CO: Rothman, 1998), 11ff, and U.S. Patent Office Society, *Outline of the History of the United States Patent Office* (Washington, DC: Patent Office Society, 1936), 19–55.

3. This connection is made clear in court opinions that distinguish "invention" and "skill." For example, see Amos Hart, *Digest of Decisions of Law and Practice in the Patent Office . . . 1886–1898* (Chicago: Callahan, 1898), 224–227.

4. I discuss the importance of these changes to questions of disclosure and the concept of invention in a separate article, forthcoming.

5. Patent 6,314,440, apparently the longest patent ever issued. The Patent Office does prohibit excess prolixity, which may serve to obscure more than it discloses.

6. Before the 1880s, drawings could be used to revise a patent's claims after it had been issued. This is no longer true, but unclaimed novelty shown in drawings still establishes prior art. For cases since the 1880s, see Ernest Lipscomb, *Lipscomb's Walker on Patents* (Rochester, NY: Lawyers Co-Operative, 1984), vol. 1, secs. 4:9 and 4:32.

7. Harry Radzinsky, *Making Patent Drawings* (New York: Macmillan, 1945), 21–26.

8. Jeffrey Sheldon, *How to Write a Patent Application*, release 14 (New York: Practising Law Institute, 2004), 6-74 to 6-78.

9. On the peculiarities of plant patents, or patents on life more generally, see Kevles, this volume, and Sherman and Pottage, this volume. Compare to the copyright registration process described in Adrian Johns, *The Nature of the Book* (Chicago: University of Chicago Press, 1998).

10. Early plant patents—the first was issued in 1931—were accompanied by color drawings or watercolors; I am grateful to Dan Kevles for bringing these drawings to my attention. In industrial patents, photographs (usually microscopic) tend to be used in similar ways, such as when the visual disclosure of a biological or metallurgical process would not necessarily establish reduction to practice or help identify the successful use (or infringement) of the patent.

11. As first laid out in *Hotchkiss v. Greenwood* (1850), all inventions were to be nonobvious to "an ordinary mechanic acquainted with the business," but this was expanded to the broader sense above in the Patent Act of 1952. See Cyril Soans, "Some Absurd Presumptions in Patent Cases," *IDEA* 10 (1966); Michael Ebert, "Superperson and the Prior Art," *Journal of the Patent and Trademark Office Society* 67 (1985); and John Tesansky, "PHOSITA—The Ubiquitous and Enigmatic Person in Patent Law," *JPTOS* 73 (1991). For a more general discussion of patent audience, see Greg Myers, "From Discovery to Invention: The Writing and Rewriting of Two Patents," *Social Studies of Science* 25 (1995).

12. Ebert, "Superperson," 657.

13. These guidelines have appeared in the semiperiodical *General Information Concerning Patents* (Washington, DC: USPTO) since 1922. For earlier—and similar—guidelines, starting in 1870, see E. J. Stoddard, *Annotated Rules of Practice in the United States Patent Office* (Detroit: Drake, 1920).

14. *Manual of Patent Examining Procedure* (Washington, DC: USPTO, May 2004), 600-94.

15. This graph is based on surveys of one hundred consecutive patents from the third week of January, every twelve or thirteen years, as published in the *Official Gazette of the United States Patent Office* (Washington, DC: USPTO). Before 1952, patent issues are not grouped by category, and drawing types are presumably randomly distributed. After 1952, weekly patent issues have been grouped into three categories: General and Mechanical, Chemical, and Electrical. For years since 1952, I sampled consecutive patents from these categories in proportion to the relative number of total patents in each category. Data before and after 1952 are thus not directly comparable, but given the overall continuity of this graph it seems reasonable to draw qualitative conclusions. Any residuals in post-1952 data will be consistent, and relatively small.

16. I discuss the convergence of patent and engineering drawings in a separate article, forthcoming. The later separation of patent and engineering drawing can be traced through textbooks. Compare Anson Cross, *Mechanical Drawing* (Boston: Ginn, 1898); Thomas French, *A Manual of Engineering Drawing* (New York: McGraw-Hill, 1941); and Frank Zozzora, *Engineering Drawing*

(New York: McGraw-Hill, 1958). For specialized manuals see Radzinsky, *Making Patent Drawings*; or the official *Guide for Patent Draftsmen* (Washington, DC: USPTO), published erratically between 1953 and 1989.

17. On color washes in working drawings, see M. Armengaud the Elder, *The Practical Draughtsman's Book of Industrial Design and Machinist's and Engineer's Drawing Companion*, trans. William Johnson (Philadelphia: Baird, 1871), 122.

18. For material coding in patent drawings, see "Official Rules and Directions for Proceedings in the Patent Office," reprinted in Munn & Co., *The United States Patent Law* (New York: Munn & Co., 1867), 21–34. Drawings of the Great Eastern are reproduced in Ken Baynes and Francis Pugh, *The Art of the Engineer* (Guildford, UK: Lutterworth, 1981). The ultimate reason that light comes from the left is perhaps only because most people are right-handed. In seventeenth-century Dutch studio painting, light always came from the left, since this arrangement of subject and easel allowed right-handed artists to paint without obscuring their work with their arm. The convention persisted in nonstudio painting. See Svetlana Alpers, "The Studio, the Laboratory, and the Vexations of Art," in *Picturing Science, Producing Art*, ed. Caroline A. Jones and Peter Galison (New York: Routledge, 1998).

19. For these examples, see Peter Jeffrey Booker, *A History of Engineering Drawing* (London: Chatto & Windus, 1963), 141. See also Wolfgang Lefèvre, "The Limits of Pictures," in *The Power of Images in Early Modern Science*, ed. Lefèvre, Jurge Renn, and Urs Schoepflin (Basel: Birkhäuser, 2003).

20. For the contradictions inherent in this persona with respect to text and authorship, see Swanson, this volume. This kind of inventor was explicitly the audience for the early *Official Gazette*, which might reach those without access to a large city library. See *Annual Report of the Commissioner of Patents for the Year 1871* (Washington, DC: USGPO, 1872), 10–11.

21. Radzinsky, *Making Patent Drawings*, 21.

22. Statistic based on the survey of patents described above, excluding electrical or chemical diagrams, flowcharts, and other miscellaneous drawing types.

23. Changes in textbooks make these changes especially apparent. See W. L. Healy and A. H. Rau, *Simplified Drafting Practice* (New York: Wiley, 1953); Thomas E. French and Charles J. Vierck, *Graphic Science and Design*, 3d ed. (New York: McGraw-Hill, 1970); and Frederick E. Giesecke, et al., *Technical Drawing with Computer Graphics* (New York: Macmillan, 1985).

24. Until recently the Patent Office published pamphlets like the *Guide for Patent Draftsmen*—a title which indicated that such a group existed—and maintained its own staff of drafters. The 1922 edition of *General Information Concerning Patents* states that "the office will furnish the drawings at cost, as promptly as its draftsmen can make them for applicants who can not otherwise conveniently procure them" (7). This line was omitted from the 1985 edition, and the *Guide for Patent Draftsmen* was discontinued in 1989. It has been replaced by privately published books such as Jack Lo and David Pressman, *How to Make Patent Drawings Yourself* (Berkeley, CA: Nolo Press, 1999).

25. Sheldon, *Write a Patent Application*, 5–21.

26. Computer software was held patentable in 1981 (*Diamond v. Diehr*), and guidelines were officially promulgated in 1995. Biotechnology was deemed patentable in 1980 (*Diamond v. Chakrabarty*) and business methods in 1998 (*State Street Bank & Trust Company v. Signature Financial Group, Inc.*).

27. This is a prominent theme in activists' comparisons between pending EU legislation and U.S. practice. See for example Richard Stallman, "Patent Absurdity," *Guardian*, June 20, 2005, or http://www.nosoftwarepatents.com (accessed May 2009).

28. The introduction to the "Act to Establish a United States Court of Appeals for the Federal Circuit" (April 2, 1982; 96 Stat. 25) discusses this rationale. Within the Seventh Circuit, for example,

it was said that "at the district level, patent cases would be decided by flipping a quarter. But the Appellate Court knew better—they'd use a half-dollar." (Communication of James Rankin, erstwhile Seventh-Circuit clerk, December 2004.)

29. Both quotes from Senior Circuit Judge Nichols, cited in Robert Harmon, *Patents and the Federal Circuit* (Washington, DC: Bureau of National Affairs, 1988), ix–x.

30. "Patent Wars," *Economist*, April 8–14, 2000.

31. The first use of the acronym seems to be in Soans, "Some Absurd Presumptions"; it was not in common use by 1991 (see Tesansky, "PHOSITA"), but since the mid-1990s it has become widespread.

32. Tesansky, "PHOSITA," 40–41.

33. Sheldon, *Write a Patent Application*, 7-22 to 7-27.

34. Burk and Lemley, "Policy Levers in Patent Law," *Virginia Law Review* 89 (2003): 1650, 1680.

35. Not all legal scholars see the shift in patents' implied audience—from machinists to professional researchers—as a good thing; see Jonathan Darrow, "The Neglected Dimension of Patent Law's PHOSITA Standard," *Harvard Journal of Law & Technology* 23 (Fall 2009).